FINAL TECHNICAL REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigator:
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Project Period:
October 1, 2009 through December 31, 2013

Final Report Submission Date:
May 27, 2014

DOE Award Number: DE-EE0001108

Name of Recipient: University of Illinois at Chicago

Project Title: Midwest Clean Energy Application Center

Project Director/Principal Investigator: John Cuttica, Cliff Haefke

Consortium/Teaming Members: Avalon Consulting, ETC Group, Go Sustainable Energy, Power Equipment Associates, Scott Energy Technologies,

Executive Summary:

The Midwest Clean Energy Application Center (CEAC) was one of eight regional centers that promoted and assisted in transforming the market for combined heat and power (CHP), waste heat to power (WHP), and district energy (DE) technologies and concepts throughout the United States between October 1, 2009 and December 31, 2013. The key services the CEACs provided included:

- Market Opportunity Analyses – Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors.

- Education and Outreach – Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations and others. Information was shared on the Midwest CEAC website: www.midwestcleanenergy.org.

- Technical Assistance – Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy with CHP in their facility and to help them through the project development process from initial CHP screening to installation.

The Midwest CEAC provided services to the Midwest Region that included the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

Program Summary, Project Objectives and Accomplishments

OBJECTIVE 1

Develop technology application knowledge and educational infrastructure necessary to foster CHP, District Energy, and Waste Heat Recovery (clean energy) technologies as a viable energy option in the Midwest and reduce any perceived/real risks associated with their implementation.

Accomplishment 1.1: Development of State Industrial EE/CHP Strategy Plans: State Industrial Energy Efficiency (EE) and Combined Heat and Power (CHP) strategy plans were developed and presented to the Illinois and Iowa Governor Offices in June 2013. This work was sponsored by the National Governors Association (NGA) Policy Academy program. The Midwest CEAC assisted the Illinois Governor's office in submitting their proposal which was selected as one of the four states to participate in the NGA CHP Policy Academy. The Midwest CEAC was engaged with the Illinois and Iowa state teams from October 2012 through June 2013 in developing their strategic plans.

Strategic Importance: These State Industrial EE/CHP plans provide a framework within each state to organize CHP related efforts and activities focused on increasing the implementation of industrial energy efficiency and CHP programs and projects. These state plans also provide documentation on how to bring similar efforts to other Midwest states.

Accomplishment 1.2: CEAC Presentations – The Midwest CEAC presented at a number of workshops during the contract period. Please see the Appendix for a list of presentations.

Strategic Importance: Presentations to stakeholders at various meetings, conferences, workshops, etc. on the benefits, barriers, and approaches to implementing CHP projects, specifically approaching individual target market sectors has been a critical activity for the CEACs.

OBJECTIVE 2

Provide market research, technical assistance, and performance evaluations to identify high impact sustainable clean energy technology applications and pursue their implementation.

Accomplishment 2.1: Strategic Development of Healthcare Market Sector Plan: The Midwest CEAC focused on the strategic development of the Healthcare Market Sector Plan to assemble a package of materials that will enable the CEACs to more effectively target and educate the healthcare market sector. The Midwest CEAC developed and assembled the following items:

- Co-developed CHP 101 Presentation w/ Pacific CEAC (April 2013)
- Co-developed CHP Market Sector Handout w/ Northeast CEAC (July 2013)
- Developed CHP Resource Guide for Hospitals (pre-FY2013)
- Developed Project Profile for Gundersen Lutheran Health System (Dec 2012)
- Assembled Series of 18 CHP Project Profiles (pre-FY2013)
- Manned Exhibit Booth and Attended Presentations at American Society of Healthcare Engineering's (ASHE) Annual Conference in Atlanta, GA (July 2013) – ASHE is the primary trade association for healthcare engineers
    - Midwest CEAC established greater understanding of current industry status relating to energy efficiency and distributed generation developments
    - Midwest CEAC established contacts with 40+ hospitals to discuss CHP screenings
    - Midwest CEAC met with Regional Midwest ASHE Director to discuss opportunities and develop strategies to more effectively target Midwest healthcare sector

Strategic Importance: The CEACs historically have undertaken a target market approach when promoting CHP concepts and technologies to further the development of the CHP installation status in the various regions. This approach in FY2013 has made an attempt to bring together all the materials needed to understand the market more effectively and to better communicate with those in the target market industry. The development and gathering of these materials will also provide a template to develop the required materials in other CHP target market sectors.

Accomplishment 2.2: DOE Boiler MACT Technical Assistance Program: The Midwest CEAC was tasked with contacting 280 facilities in the Midwest, Intermountain, Northwest, and Pacific regions to offer complimentary technical assistance offered by the U.S. DOE through the CEACs. The technical assistance is focused on helping facilities evaluate the options to come under compliance with the new Boiler MACT regulations that were passed in January 2013. The Midwest CEAC was able to contact all 280 facilities and provide support to those interested in CHP by the end of December 2013.

Strategic Importance: The DOE Boiler MACT technical assistance program provided an opportune time for the CEACs to contact large industrial and institutional facilities with coal and oil boilers that were being faced to come under compliance with the EPA Boiler MACT ruling that would result in large capital investments by these facilities. In the discussions and analyses with these facilities, the CEACs presented CHP as one of the alternative options to come under appliance that would result not only in a cost to comply but as an option with a more favorable rate of return and with a return on investment (ROI). Numerous facilities considered CHP in their evaluation process and several sites are moving forward with new CHP installations. By engaging in this highly visible technical assistance outreach effort, the Midwest CEAC was able to increase their relations with various entities in the Midwest region that were interested in this program that included State Energy Offices (SEOs), state EPA agencies, Non-Government Organizations (NGOs), and others.

Accomplishment 2.3: Increase in Number of CHP Projects Being Installed: Several CHP projects were installed in FY2013 in the Midwest Region with several more on the watch list. This increase in activity is a significant improvement over the past several years. Below are a list of installed projects and those projects that the Midwest CEAC is aware of. Known CHP projects installed in FY2013:

- 100 MW – Lansing Board of Water & Light (BWL), Lansing, MI
- 50 MW – Domtar, Rothschild, WI
- 2 MW – Potawatomi Bingo and Casion, Milwaukee, OH
- 1.2 MW – Northern Michigan University (NMU), Marquette, MI
- 1.2 MW – Duck Farm, Middlebury, IN
- 500 kW – Gundersen Lutheran, LaCrosse, WI
- 210 kW – Brighton Tru-Edge Heads, Cincinnati, OH
- 150 kW – Danville WWTF, Danville, IL
- 130 kW – ProMedica Wildwood Orthopedic and Spine Hospital, Toledo, OH

Strategic Importance: The Midwest CEAC has been engaged with a number of projects from one-on-one technical assistance to a site, to information shared with CHP project developers, to engaging with discussion with utilities, and more. With an increase in CHP development activity, these projects will provide more sites to visit, more case studies and lessons learned, and more familiarity with permitting, interconnecting, and financing of these projects in the Midwest.

Accomplishment 2.4: Illinois Biogas CHP Program Resulted in Over 1,300 kW Installed (increasing the number of biogas CHP projects in Illinois by 63%): The Midwest CEAC has worked closely for the last several years with both the Illinois State Energy Office (DCEO) and the Association of Illinois Energy Cooperatives to increase anaerobic digester biogas CHP projects in Illinois. This past year the Midwest CEAC co-sponsored three workshops with the AIEC, identified several potential project sites, worked with Illinois and Region V EPA on a potential Community Digester CHP Project, and convinced DCEO to continue its incentive program for Biogas/Biomass CHP projects. Five (5) specific sites are proceeding in Illinois that if successfully installed will result in over 1,300 kW of new CHP generating capacity fueled by biogas.

Strategic Importance: The partnership of the Utility Coops, the EPA, and the Illinois DCEO sends a definite positive message to the potential end users (food processing plants, WWTF, livestock facilities etc.) that utility and state support is available for them. Opportunity fueled CHP is an important strategic element in the implementation of CHP in the Midwest where traditionally spark spreads between electricity and natural gas have not been favorable.

OBJECTIVE 3

Provide feedback to U.S. DOE, industry, and local government entities on technical, market, and policy needs to assist in their program planning.

Accomplishment 3.1: CHP/WHP Submitted for inclusion in IL EEPS: The Midwest CEAC developed the CHP/WHP incentive program for the Illinois public sector that was submitted by the Illinois Department of Commerce and Economic Opportunity (DCEO) under the next three (3) year plan of the Illinois Energy Efficiency Portfolio Standard (EEPS). The program plan was submitted to the Illinois Commerce Commission (ICC) on August 28, 2013 with approval anticipated in December 2013. Once approved, the Midwest CEAC will assist DCEO in marketing the incentive program along with developing an RFP to solicit future CHP projects to qualify for the EE incentives. If approved by the ICC, the project incentives will become available June 2014.

Strategic Importance: The inclusion of CHP in the Illinois EEPS program will provide incentives for CHP projects in the public sector lowering their overall first costs and improving the overall project economics. The inclusion of CHP in the EEPS program was developed with experience and lessons learned from the recent activities in Ohio, that the Midwest CEAC was actively involved in, when CHP was signed into law in 2012 as a qualifying technology under the Ohio EEPS program. The activities in Illinois were also streamlined through the NGA Policy Academy process. 25% of the state's energy efficiency funds are managed by DCEO and allocated to the public sector and low income housing. Although the Illinois electric utilities (ComEd and Ameren) elected not to include CHP as a specific program under their 3 year plans. The intent of the Midwest CEAC is to utilize the DCEO filing and CHP program as leverage to have the utilities initiate pilot CHP efforts in 2014/2015.

Accomplishment 3.2: Positive Changes Favoring CHP in Minnesota and Iowa Policies: The Midwest CEAC participated in several activities during the contract period that have led to favorable outcomes in state legislation and regulations.

- Improvements in MidAmerican Standby Rates (Iowa) – MidAmerican filed new standby rates with the Iowa Utilities Board (IUB). This is a direct result of the two previous studies the Midwest CEAC authored concerning standby rates in Iowa. The hearing for this rate filing is set to begin November 2013.
- Waste Heat to Power (WHP) submitted in Iowa Utility Plans – The Iowa Investor Owned Utilities (IOUs) of Alliant Energy and MidAmerican Energy both submitted their five (5) year energy efficiency portfolio plans in FY2013 that included waste heat to power (WHP). The Midwest CEAC authored a paper examining the barriers to CHP in Iowa in FY2012. Additionally, the Midwest CEAC provided testimony in

FY2013 to the IUB in support of WHP in these portfolios. The IUB's final decision concerning WHP is due in December 2013.

- Improvements in Xcel Energy Standby Rates (Minnesota) – Xcel significantly revised their standby rate. The previous rate created avoided rates as low as 70% of the retail rate while the new standby rate helps customers avoid 90% of the retail rate. The Midwest CEAC brought the issue of standby rates in front of the Minnesota Department of Commerce in a September 2011 presentation and at a January 2012 workshop.
- Standby Rate Exemption for Minnesota Net Metering Customers – Minnesota passed HF 729 in FY2013 which included an exemption from standby rates for net metering DG up to 1 MW in generating capacity. MN utilities recently filed their revised tariffs with the PUC. The Midwest CEAC along with the Midwest Cogeneration Association is planning to file comments providing information on the benefits associated with the standby exemption for all DG customers with a capacity up to 1 MW. The Midwest CEAC participated in public workshops in Minnesota over the past several years covering topics of DG and CHP.
- Definition of Waste Heat Recovery Expanded in Minnesota Law – The definition of "waste heat recovery" was expanded by adding "waste heat recovered and used as thermal energy" in HF 729 during FY2013. The Minnesota legislature opened the door for the recovery and reuse of waste heat from existing machinery, buildings or industrial processes, including CHP. The expanded recovery and reuse of otherwise wasted heat to reduce demand side energy usage will now be eligible to participate in a utility's conservation improvement programs and the resulting energy savings will be eligible towards a utility's natural gas or electric energy savings goals. The Midwest CEAC participated in public workshops in Minnesota over the past couple years covering topics of DG and CHP.

Strategic Importance: The improvements in state policies towards CHP are critical to reducing the barriers of CHP implementation. Two barriers identified in several Midwest states are standby rates and lack of incentives. The work of the Midwest CEAC over the past couple of years that have led to these positive changes in policies are being shared with other states as lessons learned and sample templates to continue educating stakeholders in other states.

Accomplishment 3.3: Ohio Energy Legislation Passed and Signed into Law: In June of 2012, Governor Kasich signed into law SB 315, an energy plan that included CHP and WER as a recognized technology in the State Energy Efficiency Portfolio Standard (EEPS) and included Waste Energy Recovery (WER, also known as Waste Heat to Power) as a recognized technology under the State Renewable Portfolio Standard (RPS). This is a major accomplishment for not only the Midwest CEAC, but all our partners that have been working on this for the past 2½ years.

Strategic Importance: In the winter of 2010, the Midwest CEAC identified Ohio as a state that ranked 25th in installed CHP (approx. 750 MW), but ranked 8th in CHP technical potential (over 9,000 MW). Ohio was identified as one of the six (6) states designated by DOE for targeted emphasis by the CEACs to reform state policy to increase the implementation of CHP. The Midwest CEAC has worked diligently: 1) helping form an OHIO CHP Coalition that has brought together both the industrial and environmental sectors to promote favorable CHP policies; 2) to become recognized by all stakeholders in the state as an unbiased expert in CHP; and 3) made ourselves available to provide market assessments, education/outreach, and tech assistance to the coalition, the Ohio PUCO, the Governor's Office, and the utilities.

- SB 315 now puts in place the mechanism by which CHP/WER can become integral parts of the utilities' EEPS and RPS plans. The work is not yet complete as the law passing only accomplishes the first phase. Starting in the fall of 2012, phase two will include the PUCO starting the regulatory process to implement SB 315 in the State. Our strategic direction is now focused on making sure the implementation rules are such that the utilities will indeed incorporate these technologies into their plans in a fair and reasonable manner.
- The passing of SB 315 and the implementation rules development will enhance the development process of CHP in the State of Ohio making it a more favorable state to develop CHP projects, ultimately leading to Ohio contributing more GW of CHP installations to the SEE Action goal of 40 GW. The passing of this law is a major accomplishment for not only the Midwest CEAC, but all our partners that have been working on this for the past 2 ½ years."

Accomplishment 3.4: Development of the Ohio CHP Coalition: The CEAC provided technical and educational support to the coalition. We assisted in bringing together both the industrial manufacturing community and the environmental community to proceed as a unified coalition to address both the opportunities and barriers facing CHP/WER in Ohio. This consisted of numerous meetings, conference calls, preparing educational material, organizing workshops and webinars, and being available to answer questions on CHP/WER in general and specifically how other states were addressing similar issues in their state.

Strategic Purpose: The formation of the coalition was the mechanism to affect state policy in regards to CHP/WER. A united front (partnership) between the industrial and environmental communities would get the attention of the regulators and legislators who in turn would be able to get the attention of the utilities.

Products Developed

Conference papers published by the Midwest CEAC are listed and presented in the Appendix.

Information from the Midwest CEAC can be found at www.midwestcleanenerg.org

Quarterly Reports for the Midwest CEAC between FY2010 and FY2013 are listed in the Appendix.

APPENDIX

CEAC Presentations

#	Presentation	Conference	Location	Date	Sponsor
1	How Can Utilities Engage Industrials for Greater Savings?	2013 Midwest Energy Solutions Conference	Chicago, IL	1/17/2013	MEEA
2	Panel Discussion: Post Hurricane Sandy – The Resiliency Benefits of CHP	NASEO & ASERTTI Energy Outlook Conference	Washingt on DC	2/5/2013	NASEO & ASERTTI
3	National Governors Association Policy Academy – Illinois Participation	Stakeholder Advisory Group	Chicago, IL	3/19/2013	SAG
4	Combined Heat and Power (CHP) – An Opportunity for Illinois Policy	Utility Regulation: The Good, the Bad, and the Efficient	Springfie ld, IL	4/18/2013	Institute for Regulatory Policy Studies
5	Combined Heat & Power (CHP)	2013 CenterPoint Energy Efficiency and Technology Conference	Minneap olis, MN	5/21/2013	CenterPoint Energy
6	Taking Advantage of Combined Heat and Power (CHP)	2013 RE AMP Annual Meeting: Getting Clean Energy Built	Chicago, IL	6/19/2013	RE AMP
7	CHP, an Opportunity for Midwest State Policy	2013 NASEO Midwest Regional Meeting	Ann Arbor, MI	5/7/2013	NASEO
8	DOE CEACs, CHP Market Drivers, & CHP Applications	Iowa Combined Heat and Power Worshop	Des Moines, IA	6/28/2013	Iowa Eonomic Development Authority
9	Taking Advantage of CHP	OMA Energy Efficiency & CHP Work Group	Webinar	7/17/2013	Ohio Manufacturing Association
10	CHP and Critical Infrastructure	State of Illinois Energy Assurance Workshop for Municipalities	Springfie ld, IL	7/22/2013	Illinois Department of Commerce and Economic 7Opportunity
11	CHP and Critical Infrastructure	State of Illinois Energy Assurance Workshop for Municipalities	Glen Ellyn, IL	7/23/2013	Illinois Department of Commerce and Economic Opportunity
12	Combined Heat and Power (CHP) Update on Security and Resiliency	NASEO Annual Meeting	Denver, CO	9/5/2013	NASEO
13	Examining CHP Technologies	Half Moon Seminars	Middlebu rg Heights, OH	6/2/2011	Half Moon Seminars

14	Snapshot of the Cogeneration / CHP Market and Industry Trends	MCA Annual Conference	Elgin, IL	10/11/2011	Midwest Cogeneration Association
15	Waste Heat Recovery Opportunities	World Energy Engineering Congress Conference	Chicago, IL	10/14/2011	WEEC
16	Industrial Cogeneration / CHP	American Institute of Chemical Engineers (AIChE) 2011 Midwest Regional Conference	Chicago, IL	11/11/2011	American Institute of Chemical Engineers (AIChE)
17	Combined Heat & Power (CHP) in the Food Processing Industry: When Does It Make Sense?	American Institute of Chemical Engineers (AIChE) 2011 Midwest Regional Conference	Chicago, IL	11/11/2011	American Institute of Chemical Engineers (AIChE)
18	Introduction to CHP and WHR Technologies	Congressional Education Briefing	Washingt on DC	11/17/2011	NASEO and ASERTTI
19	CHP Using Biogas & Biomass Fuels	Illinois 25x'25 Renewable Energy Forum's Distributed Electricity and Renewable Electricity Panel	Chicago, IL	11/18/2011	Illinois 25x'25 Renewable Energy
20	Industrial / Commercial / Institutional Boiler MACT Combined Heat and Power: A Technical & Economic Compliance Option		Online Webinar	1/17/2012	PUCO/DOE
21	Introductory Presentation	Biogas Renewable Energy CHP Projects for Clinton County Electric Coop Dairy Farmers: Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line	Breese, IL	2/3/2012	AIEC, EPA, CEAC
22	Introductions to Combined Heat & Power (CHP)	2012 NARUC Winter Meetings	Washingt on DC	2/6/2012	NARUC
23	Strategic States and SEE Action Network for Industrial EE & CHP	IDEA Business Development Workshop	Washingt on DC	2/6/2012	IDEA
24	Industrial Energy Efficiency: A look at Illinois and the Midwest	Industrial Efficiency and Advanced Manufacturing Roundtable	Washingt on DC	2/8/2012	NASEO / ASERTTI

25	Introductory Presentation	Biogas Renewable Energy CHP Projects for West-Central Illinois Livestock Producers: Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line	Effingham, IL	2/9/2012	AIEC, EPA, CEAC
26	Introductory Presentation Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line	Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers: Understanding Issues, Evaluating Combined Heat & Power	Macomb, IL	2/10/2012	AIEC, EPA, CEAC
27	CHP & WHR Technology Briefing and Environmental Benefits		Online Webinar	2/14/2012	
28	U.S. Department of Energy Boiler MACT Technical Assistance Pilot Program	Public Utilities Commission of Ohio (PUCO) Educational Forum	Columbus, OH	3/9/2012	PUCO
29	Market Opportunities for Biogas Utilization	AW&WMA Lake Michigan States Section's Waste Not Conference	Oakbrook Terrace, IL	5/15/2012	AW&WMA Lake Michigan States Section
30	Panel: Advancing Pro-CHP Policy in Ohio	USCHPA Spring Forum	Washington DC	5/16/2012	USCHPA
31	CHP Opportunities and DOE's Regional Clean Energy Application Centers	Indiana District Energy Seminars	Indianapolis, IN	6/14/2012	Bingham Greenbaum Doll
32	Combined Heat and Power 101	Public Utility Commission of Ohio's Combined Heat and Power Case Studies: Voices of Experience	Columbus, OH	6/20/2012	PUCO
33	Session 2: "Opportunities and Potential for Industrial CHP"	Industrial Energy Efficiency & CHP Dialogue (US DOE Regional Meeting - Midwest)	Columbus, OH	6/21/2012	US DOE
34	CHP Project Costs Screening	PUCO CHP: Financial Tools Workshop	Columbus, OH	8/2/2012	PUCO
35	Combined Heat & Power (CHP) and Waste Energy Recovery (WER)	7th Annual Northern Ohio Energy Management Conference	Toledo, OH	9/25/2012	Manufacturer’s Education Council

	Opportunities for Ohio Industries				
36	Natural Gas Key Account Reps Training for CHP	Natural Gas Key Account Reps Training for CHP	Columbus, OH	12/7/2012	PUCO

How Can Utilities Engage Industrials for Greater Savings? (CHP Option)

2013 Midwest Energy Solutions Conference
MEEA, January 17th, 2013

Panelist
John J. Cuttica
Energy Resources Center
University of Illinois at Chicago

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **CHP, District Energy, and Waste Heat to Power** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

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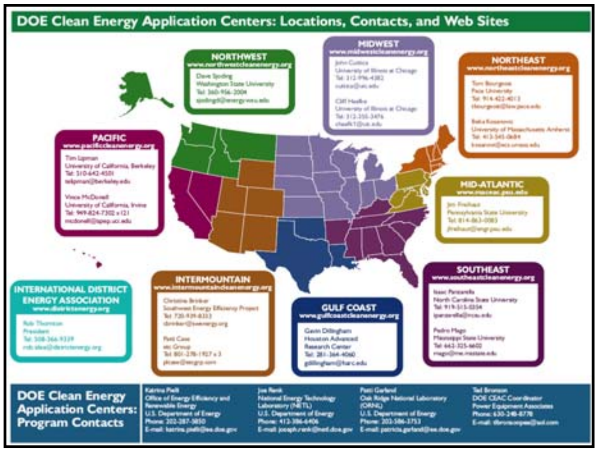
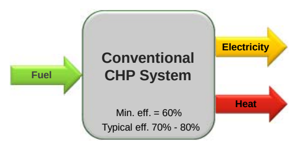
U.S. Department of Energy
Midwest Clean Energy Application Center



Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



- Simultaneous generation of heat and electricity
- **Fuel is combusted/burned for the purpose of generating heat and electricity**
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

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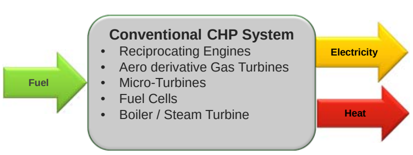

Defining Combined Heat & Power (CHP)

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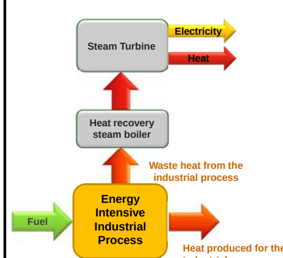
Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Normally requires high temperature (> 800°F) *(low hanging fruit in industrial plants)*

Defining Combined Heat & Power (CHP)

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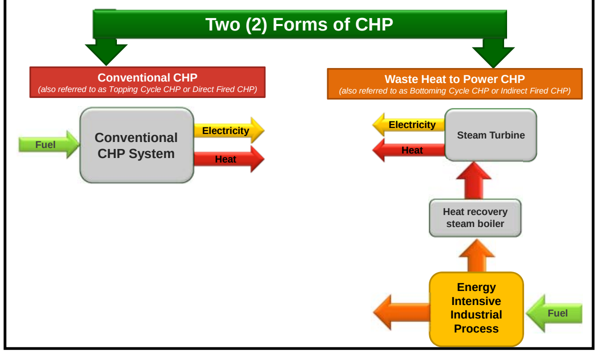
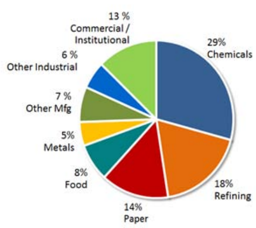


CHP Is Used at the Point of Demand

Source: ICF International

Existing CHP Capacity

- ~ 8% US generating capacity
- ~ 12% total annual MWh generated
- **Industrial applications represent 87% of existing capacity**
- Commercial/institutional applications represent 13% of existing capacity:
  - Hospitals, Schools, University Campuses, Hotels, Nursing Homes, Office Buildings, Apartment Complexes, Data Centers, Fitness Centers



Source: ICF International

Why U.S. Businesses Invest in CHP
(> 3,800 installations & ~ 82 GW installed capacity)

- Reduces energy costs for the end-user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability (Hurricanes Katrina & Sandy; 2004 Blackout)
- Provides stability in the face of uncertain electricity prices
- Used as compliance strategy for emission regulations (Boiler MACT & Reduced Carbon Footprint)

Why More Businesses Do Not Invest in CHP

- Economics not right (long payback periods)
  - Spark Spread not favorable
  - Capital Cost
- Competing for tight capital budgets
- Too much of a hassle
  - Utilities not always helpful (seen as impediment)
- Lack of accurate knowledge & lack of resources to investigate
- To lesser degree, financing and permitting

How Can Utilities Help

- Utilities have to want to assist
  - Recognize as benefit not liability (regulatory fairness)
- Include CHP in Utility programs:
  - Waste Heat to Power ….. RPS
  - Conv. CHP & Waste Heat to Power …. EEPS
  - Ohio, Maryland, Connecticut, Massachusetts, California, Arizona, and growing
- Encourage CHP in grid congested areas (CHP Zones)
- Re-look at Standby Rates, Net Metering Regs, and Interconnection Costs
- Include in demand response programs

Midwest Industrial Initiative (MI2)

MIDWEST INDUSTRIAL INITIATIVE
a MEEA resource
www.midwestindustrial.org

MEEA has created the MI2 in order to:

- Provide information on electric and natural gas utility energy efficiency rebates and programs
- List national and local energy efficiency best practices and technology information
- Offer catalog of case studies of successful energy efficiency implementation

The Source On Energy Efficiency
MEEA

www.midwestindustrial.org

The Source On Energy Efficiency
MEEA

Upcoming Dates

- January 30, 2013: **Combined Heat and Power as a Boiler MACT Compliance Strategy Webinar**
- February 6, 2013: **Quarterly Industrial Utility Coordination Call**

The Source On Energy Efficiency
MEEA

Questions

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

A program at
UIC Energy Resources Center

A program sponsored by
U.S. Department of Energy — Energy Efficiency & Renewable Energy

Panel Discussion
Post Hurricane Sandy – The Resiliency Benefits of Combined Heat & Power

NASEO & ASERTTI
Energy Outlook Conference
Wednesday, Feb. 5th, 2013

Panel Moderator: John J. Cuttica, Energy Resources Center, Univ. of Illinois at Chicago

Panelists:

Edward "Ted" Borer, PE; Energy Plant Manager, Princeton Univ.

Peter Douglas; Director of End-Use Application & Innovation, New York State Energy Research & Development Authority

Electricity Availability Taken for Granted

- When we lose the electric grid, it affects:
  - Water & waste water facilities
  - Oil & gas pipelines
  - Communication systems
  - Transportation systems
  - Buildings of all types, sizes, and occupancy levels
  - Businesses (Industrial/Commercial)
  - Health & emergency systems

2

Losing Electricity Goes Beyond Inconvenience

- National Security
- Life Endangerment
- Significant Costs

Industry	Avg. Cost of Downtime
Cellular Communications	$41,000 per hour
Telephone Ticket Sales	$72,000 per hour
Airline Reservations	$90,000 per hour
Credit Card Operations	$2,580,000 per hour
Brokerage Operations	$6,480,000 per hour

CHP and Energy Assurance Planning

- NASEO/DOE – State Energy Assurance Guidelines …. Jeff Pillon and Alice Lippert
- Texas HB 1831 & HB 4409: Consider CHP before construction and/or major renovations for gov't owned facilities identified as critical in emergency situations
- Louisiana Resolution No. 171: Requests the DNR and PSC establish guidelines to evaluate CHP feasibility in critical government facilities

CHP and Energy Assurance Planning

- New York: NYSERDA strategic partnership with N.Y. State Office of Emergency Management
- **Coming Soon**: U.S. DOE SEEAction Document --- "Guide to the Successful Implementation of State CHP Policies" .. Chapter 6 on Critical Infrastructure Applications
- **Coming Soon**: NASEO Paper: "Combined Heat and Power – A Resource Guide for State Energy Officials and Policymakers"

Numerous Examples of CHP in Energy Emergency Situations

- Today's Panel --- Super Storm Sandy
- Previous Examples:
  - Northeast Blackout ….. 2003
  - Hurricane Katrina ……. 2005
  - Hurricane Ike ………… 2008
  - Hurricane Irene ………. 2011

6

Super Storm Sandy

- One of the most expensive natural disasters in U.S history:
  - ~ 2.1 million facilities w/o power … New York State
  - ~ 2.6 million facilities w/o power ….New Jersey
  - ~ 0.6 million facilities w/o power ….Connecticut
  - $ lost due to production/sales downtime, lost inventory, spoiled goods?
  - N.Y. and N.J. alone requested a combination $82 Billion in federal support

7

Today's Panelists

- Edward "Ted" Borer:
  - Advanced Planning for Electric Reliability In Princeton University Campus Microgrid

January 28th, 2013
New Jersey Governor's Annual
Environmental Excellence Awards

- Princeton one of 11 winners
- Clean Air Category
- CHP System key to award

8

Today's Panelists

- Peter Douglas
  - NYSERDA Support of CHP for the Last 10 Years

9

National Governors Association Policy Academy – Illinois Participation

Presentation to SAG

Tuesday, March 19th, 2013

John Cuttica, UIC/ERC

Eric Heineman, Governor's Office

Agnes Mrozowski, Illinois DCEO

Presentation Outline

- Introduce NGA Policy Academy Project
- Introduce the Concept of CHP as an Allowable Technology Under EEPS (initial reactions)
- Next Steps
  - SAG input to NGA project
  - What needs to be done to continue the process of CHP incorporated into EEPS

National Governors Association (NGA) Policy Academy

- NGA Policy Academy
  - A targeted technical assistance program offered by NGA and its expert national faculty
  - Work with selected states to identify and develop long-term policy and program changes to positively impact specified areas of interest
  - Illinois is one of five states selected under a competitive procurement to participate in the NGA Policy Academy entitled:

" Enhancing Industry Through Energy Efficiency and Combined Heat &Power"

Illinois Team

- State Team :
  - Governor's Office --- Eric Heineman
  - DCEO --- Agnes Mrozowski (David Baker, Byron Lloyd)
  - ICC --- Jon Feipel (Torsten Clausen, Jim Zoinierek)
  - Illinois EPA --- Kevin Greene
  - ERC (tech advisors) --- John Cuttica / Cliff Haefke
  - NGA Coordinator --- Sue Gander
- Utilities Contacted:
  - NICOR --- Jim Jerozal
  - Peoples --- Patrick Michalkiewicz
  - ComEd --- Tim Melloch
  - Ameren --- Keith Goers
- MEEA --- Jay Wrobel

Develop an Implementable Action Plan for the Governor by April 30th, 2013

- Role EE and CHP can play in assisting Illinois public sector/industries
- Analyze barriers to greater investment & implementation of these technologies (EE and CHP) by the industrial sector
- Recommend policy and program changes to enhance their effectiveness, including but not limited to:
  - Regulatory & financial incentives
  - Education & outreach activities
  - Technical assistance
  - Partnerships/collaborative approaches

Activities to Date

- Brief utility sector representatives (Nov. 28)
  - Identified challenges for group to address
- Consult with IL EPA on Boiler MACT outreach (Feb 14)
  - Working UIC/ERC to roll out tech. assistance program
- Brief Stakeholder Advisory Group for the IL EEPS (March 19)
  - Will present ideas on incorporating CHP into EEPS 3yr plan
- Brief manufacturing sector representatives (Mid-March)
  - Will explore partnering on outreach and education with trade associations, assisting efforts on Boiler MACT compliance through CHP, discuss key strategies
- Two Policy Academy Mtgs:
  - Portland …. October, 2012
  - Philadelphia …. March, 2013

6

Premise for Illinois Participation in the Policy Academy

- State EEPS Program (administered by the investor owned utilities) is the single largest opportunity within the state for increased Industrial EE
- EEPS annual efficiency targets becoming much more difficult to meet
- Greater industrial sector participation is one of the keys to the future success of EEPS
- How can we increase industrial participation in EEPS through policy and program changes (can CHP be a contributor)?

Goal 1: Identify mechanisms to increase industrial sector participation and investment in EEPS.

Strategies:

- **Enhance industry education & outreach** to increase participation in EEPS programs (Governor Recognition Award; Case studies/success stories)
- **Add CHP to EEPS** program (not currently included)
- **Examine EM&V modifications** to facilitate greater participation in EEPS programs (e.g. consistent protocols, credit for behavioral programs, treatment of targeted programs)
- **Help advance larger projects and/or aggregation of projects** that better address industrial needs (process not facility oriented)

Goal 2: Identify mechanisms to advance the use of CHP in the industrial & large institutional sectors

Strategies:

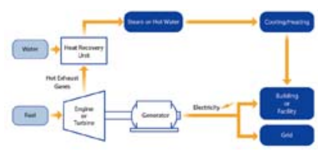
- **Add CHP to EEPS** program and **WHP/CHP to RPS** program
- Provide greater **education for industry on benefits & application of CHP** (e.g. webinar series)
- Participate in **implementation of DOE Boiler MACT Technical Assistance Program** in Illinois
- **Explore CHP "permit by rule"** (streamline process)
- Integrate CHP into **critical infrastructure planning**

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP

(also referred to as Topping Cycle CHP or Direct Fired CHP)



Separate Energy Delivery: 45% to 55%
- **Electric generation – 33%**
- **Thermal generation - 80%**

CHP Energy Delivery: 70% to 85%

- Simultaneous generation of heat and electricity
- **Fuel is combusted/burned for the purpose of generating heat and electricity**
- Normally sized for thermal load to max. efficiency – 70% to >85%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Some Questions for Including CHP in EEPS:

- Must pass TRC Test!!
- Should Incentives be on Electric Side, Gas Side, or shared?
- How do you Calculate Energy Savings?
- Estimated versus Actual Savings?
- Can CHP Significantly Assist in Meeting Targets?
- How do you control size of CHP incentives?
- Is it Fuel Switching and How do you Handle that?
- What Have Other States Done?

Add CHP to Illinois EEPS Program??

- Over 20 states specifically call out CHP in either their RPS, EEPS, or AEPS.
- Arizona, Maryland, Massachusetts, Rhode Island, Connecticut, Ohio all have conventional CHP under their EEPS program
- Most other states include WHP/CHP as part of their RPS and/or EEPS
- Under EEPS Programs, the CHP systems are incentivized as electric energy efficiency measures.

Calculating Savings

$$S_{fuel\ CHP} = F_{grid} + F_{thermal} - F_{CHP\ Total}$$

EPA Emissions Calculator can be utilized to calculate $S_{fuel\ CHP}$
http://epa.gov/chp/basic/calculator.html

$$S_{elec\ CHP} = S_{fuel\ CHP} / H$$

S = Savings
F = Fuel
H = Heat Rate – MMBtu/Mwh (grid, CHP system, or standard conversion

- Depending on value used for H, provides very favorable, very conservative, more realistic values.
- Based on the above, we came up with what we are recommending to Ohio – Threshold/Tiered approach

Threshold/Tier Approach (proposed Ohio)

Efficiency (%, LHV)	Portion of MWh output considered savings
< 60	0%
60-65	60%
65-70	70%
70-77.5	80%
> 77.5	100%

- **Does not pick technology winners**
- **Encourages project developers to design higher-efficiency installations, regardless of the prime mover technology**
- **Is based on the performance of real CHP systems, of various sizes, configurations and technologies**
- **Is simple to administer and implement**
- **Neither under-estimates nor over-estimates savings**

Example – based on actual site

- 6.3 MW Turbine with HRSG (has duct firing)
- Operates 8760 hrs @ 96% availability (50,793,170 kWh)
- Unfired Thermal Output (no duct firing):
  - 2,638,916 Therms; produces 37% of steam load; CHP system efficiency is 80.4% (LHV)
- With Duct Firing:
  - 6,126,695 Therms; produces 85% of steam load; CHP system efficiency is 87.9% (LHV) --- remaining 15% provided by 82% efficient boiler.
- With threshold/Tiered Approach:
  - 50.8 million kWh allowed as savings
  - At $0.07/kWh – could get up to $3,555,522 in incentive
  - BG&E limits incentive to $2M --- this case would be $0.039/kWh
  - Cost of this type project vary greatly ($9.5M to > $20M)

Summary & Next Steps (CHP):

- Several states (AZ, MD, MA, RI, CT, OH) have conventional CHP as part of EEPS
- CHP can provide significant energy savings towards target goals
- CHP as part of EEPS – many questions to be evaluated further
- CHP next steps:
  - Should we move forward in evaluating CHP as EEPS option? And how?
  - Perhaps Task Force (Envir, CHP Industry, Industrials, State Agency, Utilities)
  - UIC/ERC can provide some assistance as we did in Ohio.

Questions/Discussion

Combined Heat and Power (CHP), An Opportunity for Illinois Policy

Presentation to:
The Institute for Regulatory Policy Studies Conference
"Utility Regulation: The Good, the Bad, and the Efficient"
Thursday April 18th, 2013
John Cuttica and Cliff Haefke
University of Illinois at Chicago
Energy Resources Center

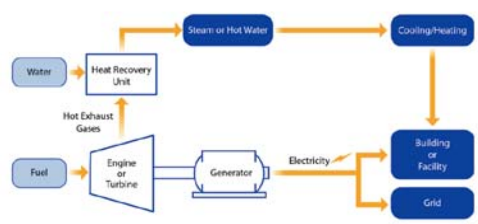
Presentation Outline

- Combined Heat & Power (CHP) – What is it & Why should I be interested
- CHP Opportunities in Illinois
  - Portfolio Standards (EEPS / RPS)
  - EPA Boiler MACT Rule
  - Critical Infrastructure Support
  - Utility Participation in CHP Markets

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



Separate Energy Delivery:
- **Electric generation – 33%**
- **Thermal generation - 80%**
- **Combined efficiency – 45% to 55%**

CHP Energy Efficiency (combined heat and power) 70% to 85%

Defining Combined Heat & Power (CHP)

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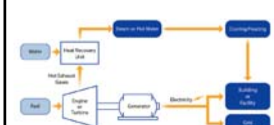

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- Normally non export of electricity
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Defining Combined Heat & Power (CHP)

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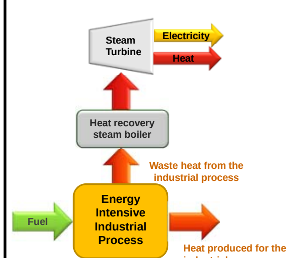
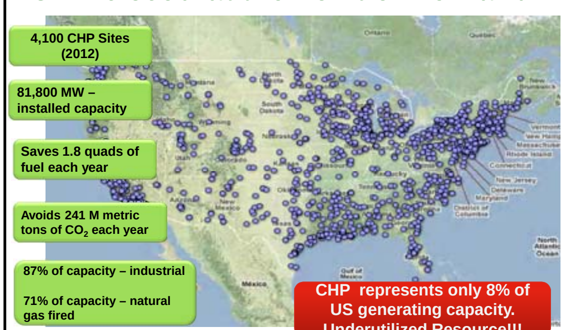
Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

CHP Is Used at the Point of Demand



Source: ICF International

CHP in Illinois

- 1,330 MW installed at ≈ 137 sites
- Represents ≈ 2.7% of generating capacity
- Technical potential ≈ 8,200 MW
- Ranks 19th among states in CHP adoption
- Ranks 5th among states in tech. potential

CHP Value Proposition

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2	N/A
Capital Cost	$24 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

Growing State Policy Support for CHP

- 24 states recognize CHP/WHP in some manner in state Renewable or Energy Efficiency Portfolio Standards
- Massachusetts – CHP a critical part of Advanced Energy Portfolio Standard and Utility Energy Efficiency Programs
- Ohio – include CHP/WHP in Portfolio Standards; Boiler MACT pilot program
- Maryland – CHP pilot program as part of EmPOWER Maryland energy efficiency program
- California – Feed in tariff for excess generation systems under 20 MW – long term power purchase agreements
- Louisiana, Texas, New York, New Jersey – CHP as part of critical infrastructure activities
- Texas – Permit by Rule for CHP systems ≤ 15MW

CHP and Illinois Policies

- Portfolio Standards (EEPS / RPS)
- Boiler MACT Compliance Strategies
- Critical Infrastructure Support
- Utility Participation in CHP Markets

Illinois EEPS Program

- State EEPS Program (administered by the investor owned utilities) is the single largest opportunity within the state for increased large customer EE
- EEPS annual efficiency targets becoming much more difficult to meet within budget caps
- Greater industrial, large commercial, institutional sector participation is one of the keys to the future success of EEPS
- How can we increase large customer participation in EEPS?

Can CHP be a Contributor

Some Thoughts for Including CHP in EEPS:

- Projects must pass cost effectiveness test (TRC).
- Should incentives be on electric side, gas side, or shared?
- How do you calculate allowable energy savings?
- Should incentives be tied to measured performance?
- Can CHP significantly assist in meeting targets?
- How do you control size of CHP incentives?
- What have other states done? (16 states include)

Next Three Year Programs Due September 2013

EPA's Boiler MACT Rule (CHP Role)

- ICI Boiler MACT - Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters
  - Final rule December 2012 – Compliance by January 31, 2016
- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units, replacements for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	360	84,197
Heavy Liquid	64	9,936
Light Liquid	58	5,375
Total	**482**	**99,508**

Includes industrial, commercial and institutional boilers only

Affected Coal and Oil Boilers in the Midwest by Market Sector

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	46	92	21,460
Paper	28	55	13,433
Petroleum and Coal	5	13	3,219
Chemicals	29	65	10,452
Plastics and Rubber	6	17	1,488
Primary Metals	9	22	9,011
Fabricated Metals	2	5	664
Machinery	5	14	5,276
Transportation Equip.	18	80	12,036
Educational Services	18	44	8,753
Other Applications	29	75	13,717
Total	**195**	**482**	**99,508**

Affected Coal and Oil Boilers in the Midwest

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
Illinois	**23**	**36**	**2**	**7**	**10,241**
Indiana	22	37	14	14	14,986
Kansas	2	1	4	0	685
Michigan	29	72	7	0	18,630
Minnesota	15	16	12	7	4,955
Missouri	8	22	0	8	3,442
North Dakota	6	6	3	1	3,838
Nebraska	6	6	4	0	2,554
Ohio	37	77	3	10	14,179
South Dakota	1	5	0	0	1,651
Wisconsin	28	43	12	6	9,131
Total	195	360	64	58	99,508

DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
Illinois Program Just Getting Underway

CHP - Part of Critical Infrastructure

- Most critical infrastructure facilities are dependent on availability & resiliency of the electric grid
- Grid is subject to terrorist attack & natural disasters
- If electricity grid is impaired, a properly configured CHP system can continue to operate, ensuring an uninterruptable supply of electricity and thermal energy *(hospitals, universities, waste water treatment facilities, financial institutions, placed of refuge, etc)*

Numerous examples – Northeast Blackout 2003, Hurricane Katrina 2005, Super-storm Sandy 2012, Various winter and summer blackouts/brownouts

Infrastructure Design

- Include CHP in critical infrastructure facilities as a priority in state and local emergency planning activities
- Some states require consideration of CHP in design and major retrofit of “critical” state facilities (Texas and Louisiana)
- Encouraging the incorporation of “black start” capability in appropriate CHP installations
- Recognition of the differences between emergency generators and CHP systems

Utility Participation in CHP Markets

- Can a utility build and own CHP facilities?
- Can a utility negotiate a package of services to support a CHP customer?
- Can a utility include CHP as part of their energy efficiency incentive programs (EEPS)?
- Perhaps CHP Zones where grid congestion exists or impractical to upgrade or install new lines?

Summary

- CHP is not the “silver bullet” to answer all energy issues
- CHP can be a highly effective tool in state energy related programs
- CHP not a technology issue
- CHP normally an economic and/or policy issue

The concepts presented this morning are intended to encourage discussion

Thank You for Your Attention

Contact Information:

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312/355-3476
chaefk1@uic.edu

John Cuttica
312/996-4382
cuttica@uic.edu

For more information:

www.midwestcleanenergy.org

http://www1.eere.energy.gov/seeaction/chp_policies_guide.html

http://www.epa.gov/chp/documents/ps_paper.pdf

Combined Heat & Power (CHP)

2013 Energy Efficiency and Technology Conference
Track 2: Industrial Energy Efficiency

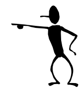
May 21, 2013
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

What technology can…

- Increase overall energy efficiency and reduce utility bill expenditures?
- Reduce carbon emissions?
- Increase energy reliability, decrease reliance on the grid, and support grid T&D?
- Show more energy savings and reduce more emissions than comparably sized PV and wind technologies?
- Support nation's energy goals and is commercially available today?

The Answer? CHP



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U.S. Department of Energy Clean Energy Application Centers

Presentation Outline

- Overview of Combined Heat and Power (CHP)
- Industries and applications where this technology makes sense
- Factors to consider when planning a CHP project
- Example CHP Case Studies

3

U.S. Department of Energy Clean Energy Application Centers

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

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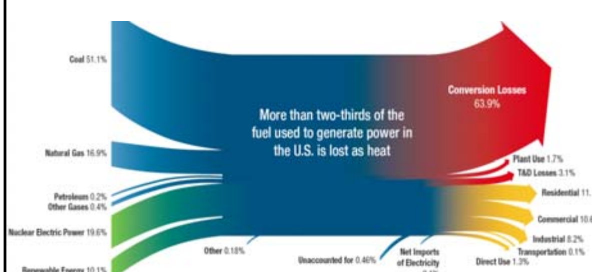
(See Slides 37 & 38 for more information)

U.S. Department of Energy Clean Energy Application Centers

Fuel Utilization by U.S. Utility Sector



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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U.S. Department of Energy Clean Energy Application Centers

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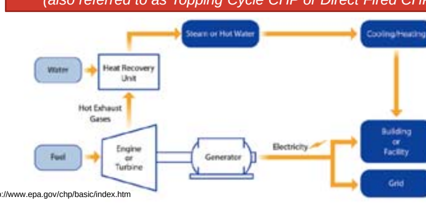

Source: http://www.epa.gov/chp/basic/index.htm

- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating heat and electricity
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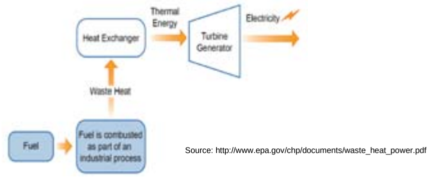

Source: http://www.epa.gov/chp/documents/waste_heat_power.pdf

- Fuel first applied to produce useful thermal energy for the process
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- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
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Defining Combined Heat & Power (CHP)

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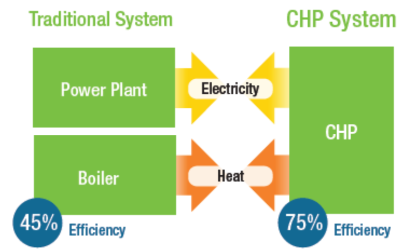
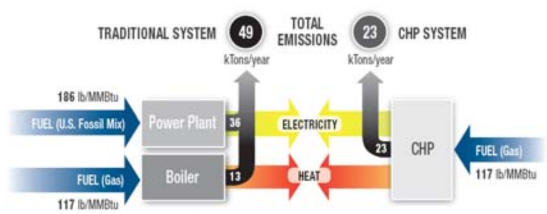


CHP provides efficient, clean, reliable, affordable energy – today and for the future.

8 U.S. Department of Energy Midwest Clean Energy Application Center

CHP Role in Our Environmental Future

Impact on Carbon Emissions

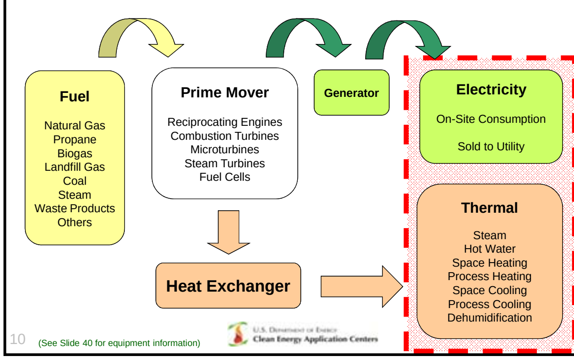


Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

9 U.S. Department of Energy Clean Energy Application Centers

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

CHP Technology Components (Topping Cycle)



10 (See Slide 40 for equipment information) U.S. Department of Energy Clean Energy Application Centers

CHP Is Used at the Point of Demand

- **4,100 CHP Sites (2012)**
- **81,800 MW – installed capacity**
- **Saves 1.8 quads of fuel each year**
- **Avoids 241 M metric tons of CO_2 each year**
- **87% of capacity – industrial**
- **71% of capacity – natural gas fired**

Source: ICF International

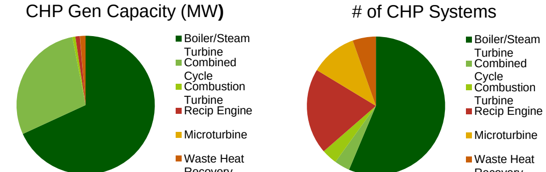
11 U.S. Department of Energy Clean Energy Application Centers

MN CHP Installation Summary

State CHP Generating Capacity:	918 MW
Number of CHP Systems:	55
CHP as % of State Gen Capacity:	6.1%
CHP Technical Potential:*	2,409 MW

** Technical Potential for commercial and industrial facilities only, non-export only*

Installation Status by Prime Mover Type



12 (See Slide 39 for list of MN installations) U.S. Department of Energy Clean Energy Application Centers

Source: ICF CHP Installation Database

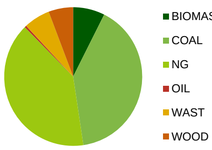
MN CHP Installation Summary

- State CHP Generating Capacity: 918 MW
- Number of CHP Systems: 55
- CHP as % of State Gen Capacity: 6.1%
- CHP Technical Potential:* 2,409 MW

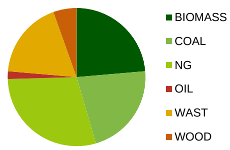
** Technical Potential for commercial and industrial facilities only, non-export only*

Installation Status by Fuel Type

CHP Gen Capacity (MW)



\# of CHP Systems



13

(See Slide 39 for list of MN installations)

Source: ICF CHP Installation Database

Attractive CHP Markets




Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

14

Favorable Characteristics for CHP Applications

- Concern about energy costs
- Concern about power reliability
- Concern about sustainability and environmental impacts
- Long hours of operation
- Existing thermal loads
- Central heating and cooling plant
- Future central plant replacement and/or upgrades
- Future facility expansion or new construction projects
- EE measures already implemented
- Access to fuel
- Facility energy champion

15

CHP Value Proposition

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2	N/A
Capital Cost	$24 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

16

Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

Emerging Drivers for CHP

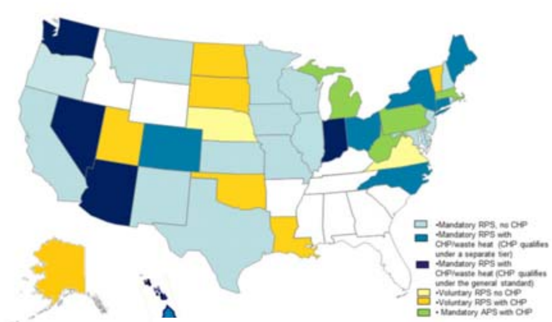
- Benefits of CHP recognized by policymakers
  - President Obama signed an Executive Order to accelerate investments in industrial EE and CHP on 8/30/12 that sets national goal of 40 GW of new CHP installation over the next decade
  - State Portfolio Standards (RPS, EERS, Tax Incentives, Grants, standby rates, etc.
- Favorable outlook for natural gas supply and price in North America
- Opportunities created by environmental drivers

DOE / EPA CHP Report (8/2012)

Executive Order: http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency
Report: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

17

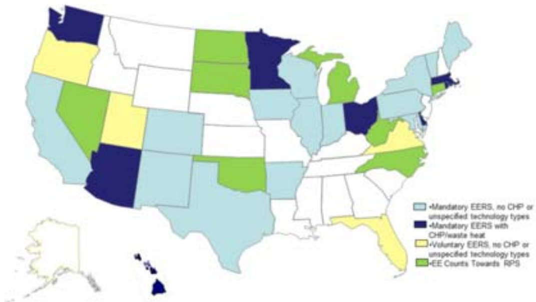
States with RPS, CES, and APS Requirements for CHP



18

Source: http://www.epa.gov/chp/documents/ps_paper.pdf

States with EERS Programs for CHP



19

Source: http://www.epa.gov/chp/documents/ps_paper.pdf

U.S. Shale Gas Resources

20

U.S. Department of Energy
Clean Energy Application Centers

Source: http://www.eia.gov/analysis/studies/usshalegas

EPA's Boiler MACT Rule (CHP Role)

- ICI Boiler MACT - Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters
  - Final rule December 2012 – Compliance by January 31, 2016
- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units, replacements for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

21

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	360	84,197
Heavy Liquid	64	9,936
Light Liquid	58	5,375
Total	**482**	**99,508**

Includes industrial, commercial and institutional boilers only

22

U.S. Department of Energy
Clean Energy Application Centers

Affected Coal and Oil Boilers in the Midwest by Market Sector

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	46	92	21,460
Paper	28	55	13,433
Petroleum and Coal	5	13	3,219
Chemicals	29	65	10,452
Plastics and Rubber	6	17	1,488
Primary Metals	9	22	9,011
Fabricated Metals	2	5	664
Machinery	5	14	5,276
Transportation Equip.	18	80	12,036
Educational Services	18	44	8,753
Other Applications	29	75	13,717
Total	**195**	**482**	**99,508**

23

U.S. Department of Energy
Clean Energy Application Centers

Affected Coal and Oil Boilers in the Midwest

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
Illinois	23	36	2	7	10,241
Indiana	22	37	14	14	14,986
Kansas	2	1	4	0	685
Michigan	29	72	7	0	18,630
Minnesota	**15**	**16**	**12**	**7**	**4,955**
Missouri	8	22	0	8	3,442
North Dakota	6	6	3	1	3,838
Nebraska	6	6	4	0	2,554
Ohio	37	77	3	10	14,179
South Dakota	1	5	0	0	1,651
Wisconsin	28	43	12	6	9,131
Total	195	360	64	58	99,508

24

(See Slide 41 for list of MN facilities)

U.S. Department of Energy
Clean Energy Application Centers

DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of natural gas CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
www.midwestcleanenergy.org

Impact of Pending EPA Utility Regulations

- Utility Regulations
  - Mercury and Air Toxics Standards (MATS)
  - Cross-State Air Pollution Rule (CSAPR), formerly "Transport Rule" – (Vacated by the Court)
- Will require compliance investments and/or may contribute to closings of some coal capacity
  - Estimates of shutdown coal capacity range from 20 to 50 GW
- Price impacts will be regional
- Closings could result in localized reliability concerns providing opportunities for CHP

CHP Case Studies

- CHP is not always sold on economics alone
- Other drivers exist for CHP projects
- Case study series explores other drivers
- Case Studies (Project Profiles) located at http://www1.eere.energy.gov/manufacturing/distributedenergy/projects_sector.html#healthcare

Case Studies:
Addressing Coal Emissions

Kent State University
Kent, OH

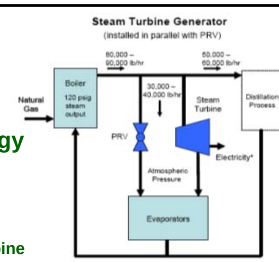
Capacity: **12 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb. Turbines (1 x 5MW and 1 x 7MW)**
Installed: **2003, 2005**

Case Studies:
Reliability / Multi-Fuel

Bay View Wastewater Treatment Plant
Toledo, OH

Capacity: **10 MW**
Fuel: **Biogas / LFG / NG**
Prime Mover: **Comb. Turbine**
Installed: **2010**

Case Studies:
Replacing Pressure Reducing Valve



East Kansas Agri-Energy
Garnet, KS

Capacity: **1.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Backpressure Turbine**
Installed: 2005

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/EastKansas.pdf

Case Studies:
Multiple Heat Recovery Applications

Broshco Fabricated Products
Mansfield, OH

Capacity: **4.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Reciprocating Engines**
Installed: **2000, 2005**
Heat Recovery: **Process tanks, Boiler Heat, Make Up Heat for Plant Operations**

Waukesha 7100 GSI Engine Units

Control Room Switchgear

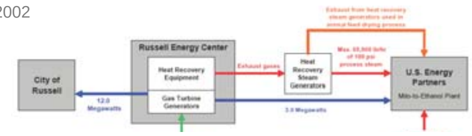
31

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/BroshcoProducts.pdf

Case Studies:
Partnership w/ Municipality

U.S. Energy Partners, LLC & City of Russell
Russell, KS

Capacity: **15 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb Turbine**
Installed: 2002



32

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/USEnergyPartners.pdf

Case Studies:
Partnership with Utility

Detroit Thermal Energy (Cristal Global)*
Ashtabula, OH

Capacity: **28 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb. Turbines and Steam Turbines owned by DTE**
Thermal: **Steam delivered to Cristal Global**
Installed: **2001**

* Former Duke Energy CHP Plant that delivered steam to Millennium Inorganic Chemicals

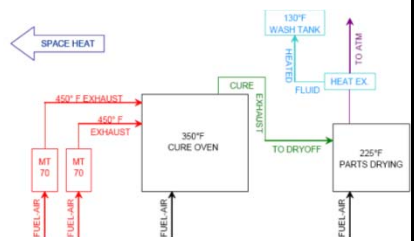
33

U.S. Department of Energy Clean Energy Application Centers

Case Studies:
Multiple Waste Heat Recovery Streams

Vestil Manufacturing
Angola, IN

Capacity: **140 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2005**



34

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/VestilManufacturing.pdf

Case Studies:
Industrial Dehumidification

Utilimaster Corporation
Wakarusa, IN

Capacity: **70 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2004**

35

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/Utilimaster.pdf

Questions

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

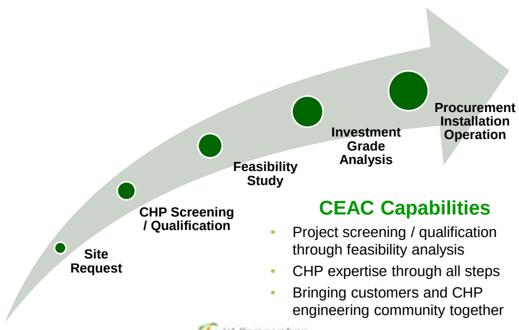
A program at
UIC Energy Resources Center

A program sponsored by
U.S. Department of Energy — Energy Efficiency & Renewable Energy

36

U.S. Department of Energy Clean Energy Application Centers

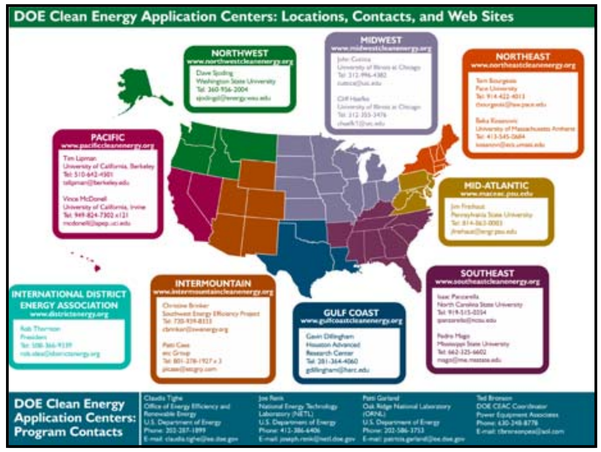
CHP Assistance from CEACs



CEAC Capabilities

- Project screening / qualification through feasibility analysis
- CHP expertise through all steps
- Bringing customers and CHP engineering community together

U.S. Department of Energy Clean Energy Application Centers



Minnesota CHP Installations

- Albert Lea Wastewater Treatment Plant (Albert Lea)
- Pope-Douglas Resource Recovery Facility (Alexandria)
- Plant Site On Highway 2, Potlatch Corp (Bemidji)
- National Sports Center Schwan's Super Rink (Blaine)
- Potlatch Corporation (Brainerd)
- Jer-Lindy Farms (Brooten)
- CenterPoint Station (Burnsville)
- Fairview Ridges Hospital (Burnsville)
- Macdonald Oil Processing Plant (Clontarf)
- Sappi Fine Papers, Potlatch Corporation (Cloquet)
- Fond du Lac Tribal and Community College (Cloquet)
- YMCA Coon Rapids (Coon Rapids)
- 3M Plant (Cottage Grove)
- ACS Crookston (Crookston)
- Lake Superior Paper Co, Duluth Paper Mill (Duluth)
- American Crystal Sugar Company (East Grand Forks)
- Northern Border Pipeline Compressor Station (CS-12) (Garvin)
- Northern Border Pipeline Compressor Station (CS-13) (Garvin)
- Rapids Energy Center / Blandin Paper Mill (Grand Rapids)
- District 45 Dairy (Hancock)
- Hibbing (Hibbing)
- Boise Cascade Corporation (International Falls)
- Poet Biorefining - Ethanol (Lake Crystal)
- Little Falls Plant (Little Falls)
- Archer Daniels Midland Co., Mankato (Mankato)
- Ramsey County Correctional Facility (Maplewood)
- FMC (Minneapolis)
- U.S. Navy / FMC (Minneapolis)
- University Of Minnesota Plant Upgrade (Minneapolis)
- American Crystal Sugar Company (Moorhead)
- Riverview Farms (site #1) (Morris)
- Riverview Farms (site #2) (Morris)
- New Ulm (New Ulm)
- Minnegasco/Arkla, Inc. (Ottawa)
- Tuffy's Pet Foods (Perham)
- Haubenschild Dairy (Princeton)
- Franklin Heating Station (Rochester)
- Olmsted Waste-To-Energy Facility (Rochester)
- Southern Minnesota Beet Sugar (Rochester)
- Saint Marys Hospital Power Plant (Rochester)
- Mayo Clinic (Rochester)
- Wastewater Treatment Plant (Rochester)
- Sartell Pulp & Paper Mill (Sartell)
- Koda Energy (Shakopee)
- Liberty Paper (Sherburne)
- Northshore Mining Corporation (Silver Bay)
- Spring Valley (Spring Valley)
- District Energy St. Paul (St. Paul)
- Metro Plant (St. Paul)
- Rock Tenn St. Paul Facility (St. Paul)
- St. Paul Cogneration Plant (St. Paul)
- Northern Plains Dairy (St. Peter)
- City of Virgina (Virginia)
- Willmar (Willmar)
- Winona Wastewater Treatment Facility (Winona)

Source: http://www.eea-inc.com/chpdata/States/MN.html

Table III: Summary Table of Typical Cost and Performance Characteristics by CHP Technology*

Technology	Steam Turbine[1]	Recip. Engine	Gas Turbine	Microturbine	Fuel Cell
Power efficiency (HHV)	15-38%	22-40%	22-36%	18-27%	30-63%
Overall efficiency (HHV)	80%	70-80%	70-75%	65-75%	55-80%
Effective electrical efficiency	75%	70-80%	50-70%	50-70%	55-80%
Typical capacity (MW_e)	0.5-250	0..01-5	0.5-250	0.03-0.25	0.005-2
Typical power to heat ratio	0.1-0.3	0.5-1	0.5-2	0.4-0.7	1-2
Part-load	ok	ok	poor	ok	good
CHP Installed costs ($/kW_e$)	430-1,100	1,100-2,200	970-1,300 (5-40 MW)	2,400-3,000	5,000-6,500
O&M costs ($/kWh_e$)	<0.005	0.009-0.022	0.004-0.011	0.012-0.025	0.032-0.038
Availability	near 100%	92-97%	90-98%	90-98%	>95%
Hours to overhauls	>50,000	25,000-50,000	25,000-50,000	20,000-40,000	32,000-64,000
Start-up time	1 hr - 1 day	10 sec	10 min - 1 hr	60 sec	3 hrs - 2 days
Fuel pressure (psig)	n/a	1-45	100-500 (compressor)	50-80 (compressor)	0.5-45
Fuels	all	natural gas, biogas, propane, landfill gas	natural gas, biogas, propane, oil	natural gas, biogas, propane, oil	hydrogen, natural gas, propane, methanol
Noise	high	high	moderate	moderate	low
Uses for thermal output	LP-HP steam	hot water, LP steam	heat, hot water, LP-HP steam	heat, hot water, LP steam	hot water, LP-HP steam
Power Density (kW/m^2)	>100	35-50	20-500	5-70	5-20
NO_x (lb/MMBtu) (not including SCR)	Gas 0.1-.2 Wood 0.2-.5 Coal 0.3-1.2	0.013 rich burn 3-way cat. 0.17 lean burn	0.036-0.05	0.015-0.036	0.0025-.0040
$lb/MWh_{TotalOutput}$ (not including SCR)	Gas 0.4-0.8 Wood 0.9-1.4 Coal 1.2-5.0.	0.06 rich burn 3-way cat. 0.8 lean burn	0.17-0.25	0.08-0.20	0.011-0.016

* Data are illustrative values for typically available systems; All costs are in 2007$

[1]For steam turbine, not entire boiler package

Source: http://www.epa.gov/chp/documents/catalog_chptech_intro.pdf

Boiler MACT Affected Facilities

Site	City
3M Center	Maplewood
3M Hutchinson	Hutchinson
ADM Corn Division - Marshall Facility	Marshall
American Crystal Sugar - Moorhead	Moorhead
American Crystal Sugar Company - Crookston	Crookston
Archer Daniels Midland Co	Red Wing
Archer Daniels Midland Co.- Mankato 225/284	Mankato
Georgia-Pacific Duluth Hardboard	Duluth
Minnesota Soybean Processors - Brewster	Brewster
Northshore Mining Company	Silver Bay
S. B. Foot Tanning Company	Red Wing
Southern Minnesota Beet Sugar Cooperative	Renville
United Taconite, LLC - Cleveland Cliffs	Forbes
Verso Paper Corp. - Sartell Mill	Sartell
Wausau Paper Printing & Writing, LLC	Brainerd

Source: EPA ICR Database

U.S. Department of Energy Clean Energy Application Centers

Acronyms

- APS – Alternative Portfolio Standard
- CES – Clean Energy Standard
- EERS – Energy Efficiency Resource Standard
- MACT – Maximum Achievable Control Technology
- RPS – Renewable Portfolio Standard

U.S. Department of Energy Clean Energy Application Centers

Taking Advantage of Combined Heat and Power (CHP)

2013 RE AMP Annual Meeting
Getting Clean Energy Built Workshop

Presented by:
John Cuttica
Energy Resources Center
University of Illinois at Chicago

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

What technology can...

- Increase overall energy efficiency and reduce utility bill expenditures?
- Reduce carbon emissions?
- Increase energy reliability, decrease reliance on the grid, and support grid T&D?
- Show more energy savings and reduce more emissions than comparably sized PV and wind technologies?
- Support nation's energy goals and is commercially available today?

The Answer? CHP

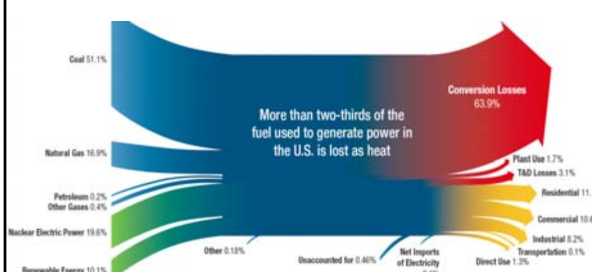
Presentation Outline

- Overview of Combined Heat and Power (CHP)
- CHP Market and Market Drivers
- Favorable CHP Policies
- Market Potential

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Centers** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **Conventional CHP, Waste Heat to Power CHP and District Energy** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

Fuel Utilization by U.S. Utility Sector



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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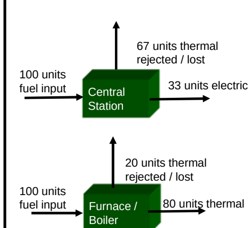
Conventional Energy System

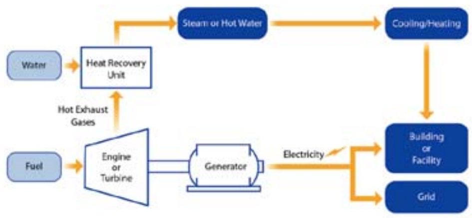


- **Customer purchases power from grid (central station)**
  - Power plant economy of scale
  - 100 units input = 33 units of power
  - Remainder of energy lost (heat)
- **On-site generation of steam/hot water (boilers/furnaces)**
  - 100 units input = 60 to 80 units of heat
- **Typical grid power + onsite heat**
  - Efficiency depends on heat/power ratio
  - 45% to 55% combined efficiency is common

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



Separate Energy Delivery:
- Electric generation – 33%
- Thermal generation - 80%
- Combined efficiency – 45% to 55%

CHP Energy Efficiency (combined heat and power) 70% to 85%

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

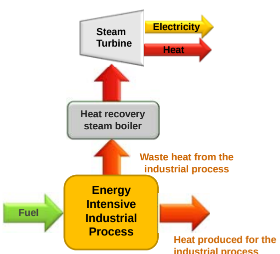
Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

- Simultaneous generation of heat and electricity
- **Fuel is combusted/burned for the purpose of generating heat and electricity**
- Normally sized for thermal load to max. efficiency – 70% to >85%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

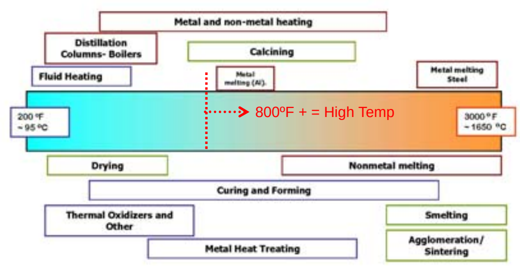
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



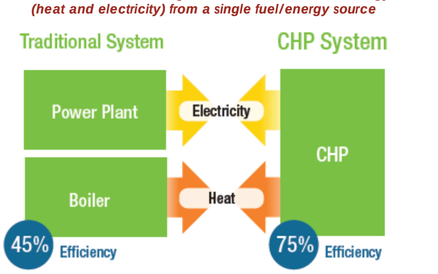
- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*

Industrial Waste Heat Recovery Opportunities



Defining Combined Heat & Power (CHP)

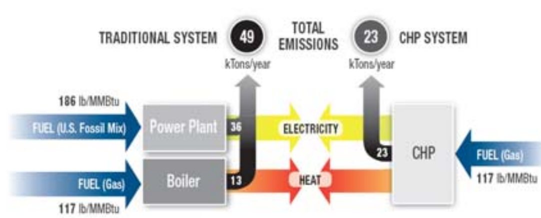
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

CHP Role in Our Environmental Future

Impact on Carbon Emissions



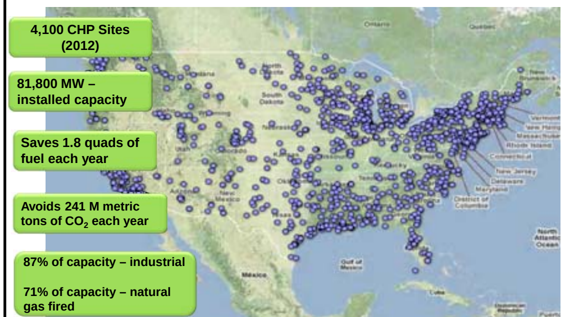
Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

Source: http://www.chpcenternw.org/pdfs/ORNL_Report_Dec2008.pdf

What Are the Benefits of CHP?

- CHP is *more efficient* than separate generation of electricity and heat
- Higher efficiency translates to *lower operating cost,* (but requires capital investment)
- Higher efficiency *reduces emissions of all pollutants*
- CHP can also *increase energy reliability and enhance power quality*
- On-site electric generation *reduces grid congestion and avoids distribution costs*

CHP Is Used at the Point of Demand



Source: ICF International

Attractive CHP Markets



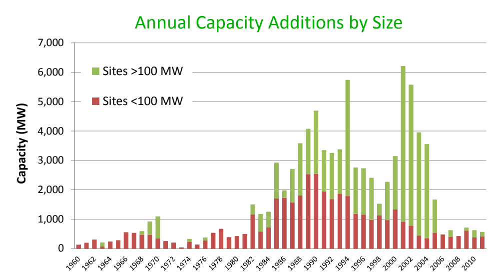

Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

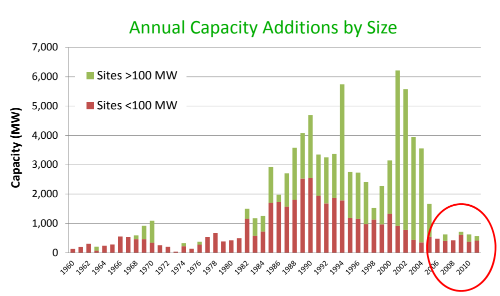
Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Annual Additions



Source: ICF CHP Installation Database

CHP Annual Additions



Source: ICF CHP Installation Database

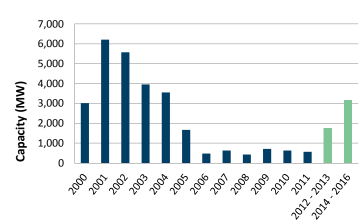
Market Drivers

Benefits recognized by policymakers at the federal and state levels

Favorable outlook for natural gas supply in North America enhances economics

Opportunities created by environmental pressures on the power sector and industrial/institutional users

Growing interest in power reliability and critical infrastructure support



Over 4,500 MW announced/under construction

CHP Value Proposition

Category	10 MW CHP	10 MW WHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW)
Annual Capacity Factor	85%	85%	25%	34%	67%
Annual Electricity	74,446 MWh	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None	None
Capital Cost	$24 million	$30 million	$45 million	$24 million	$10 million
Annual Energy Savings	343,747 MMBtu	767,176 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	68,864 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	91.1 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

Recent CHP Policies

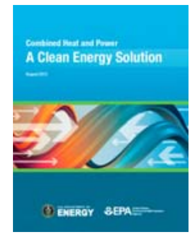
President Obama signed an executive order to accelerate industrial energy efficiency and CHP in August, 2012 that sets a national goal of 40 GW of new CHP installations by 2020.

24 states recognize CHP in some manner in state Renewable and/or Energy Efficiency Resource Standards

Re-evaluating standby rates, interconnect standards, tax incentives, feed-in-tariffs, permit by rule, grants & financing programs

DOE - SEEAction "Guide to the Successful Implementation of State CHP Policies" – www.seeaction.energy.gov

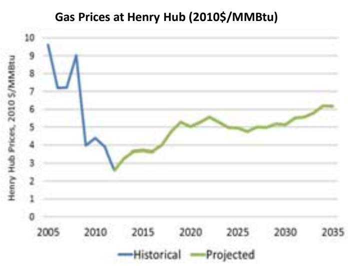
DOE / EPA CHP Report (8/2012)



Executive Order: http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency
Report: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

Gas Availability and Price likely to be Key Driver

- Broad consensus that Henry Hub natural gas prices will average between $4 and $6 per MMBtu well beyond 2025.
- Natural gas outlook will drive manufacturing investment and technology choice.
- $4 to $6 gas prices are sufficient to support the levels of supply development in the projection, but not so high as to discourage market growth.



Source: ICF Estimates, 2013

Environmental Drivers for CHP

ICI Boiler MACT – standards for hazardous air pollutants from major sources – coal & oil boilers affected by rule should consider CHP in their compliance strategy

Affected Midwest Sites

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
Illinois	23	36	2	7	10,241
Indiana	22	37	14	14	14,986
Kansas	2	1	4	0	685
Michigan	29	72	7	0	18,630
Minnesota	15	16	12	7	4,955
Missouri	8	22	0	8	3,442
North Dakota	6	6	3	1	3,838
Nebraska	6	6	4	0	2,554
Ohio	37	77	3	10	14,179
South Dakota	1	5	0	0	1,651
Wisconsin	28	43	12	6	9,131
Total	195	360	64	58	99,508

DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of natural gas CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
www.midwestcleanenergy.org

Impact of Pending EPA Utility Regulations

- Utility Regulations
  - Mercury and Air Toxics Standards (MATS)
  - Cross-State Air Pollution Rule (CSAPR), formerly "Transport Rule" – (Vacated by the Court)
- Will require compliance investments and/or drive closings of some coal capacity
  - Estimates of shutdown coal capacity range from 20 to 50 GW
- Price impacts will be regional
- Closings could result in localized reliability concerns providing opportunities for CHP

Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

Applications:

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

U.S. Department of Energy Midwest Clean Energy Application Center

CHP - Part of Critical Infrastructure

- Most critical infrastructure facilities are dependent on availability & resiliency of the electric grid
- Grid is subject to terrorist attack & natural disasters
- If electricity grid is impaired, a properly configured CHP system can continue to operate, ensuring an uninterruptable supply of electricity and thermal energy

Numerous examples – Northeast Blackout 2003, Hurricane Katrina 2005, Super-storm Sandy 2012, Various winter and summer blackouts/brownouts

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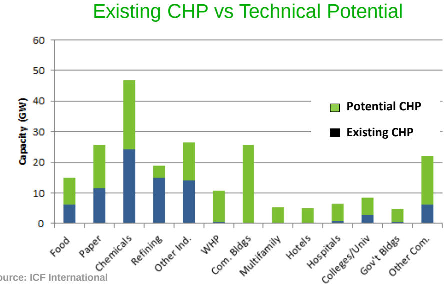
CHP Kept Critical Facilities Running During Sandy

- South Oaks Hospital - Amityville, NY, 1.25 MW recip. engine
- Greenwich Hospital - Greenwich, CT, 2.5 MW recip. engine
- Christian Health Care Center - Wyckoff, NJ, 260 kW microturbine
- Princeton University - Princeton, NJ, 15 MW gas turbine
- The College of New Jersey - Ewing, NJ, 5.2 MW gas turbine
- Salem Comm. College - Carney's Point, NJ, 300 kW microturbine
- Public Interest Data Center - New York, NY, 65 kW microturbine
- Co-op City - The Bronx, NY, 40 MW combined cycle
- Nassau Energy Corp – Garden City, NY, 57 MW combined cycle
- Bergen Wastewater Plant – Little Ferry, NJ, 2.8 MW recip. engine
- New York University – New York, NY, 14.4 MW gas turbine
- Sikorsky Aircraft Corporation – Stratford, CT, 10.7 MW gas turbine

U.S. Department of Energy Clean Energy Application Centers

Technical Potential of 140,000 MW



Source: ICF International

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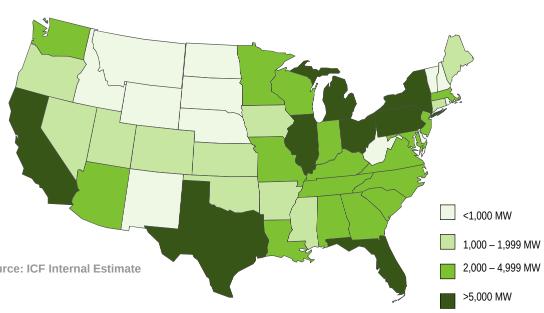
CHP Technical Potential

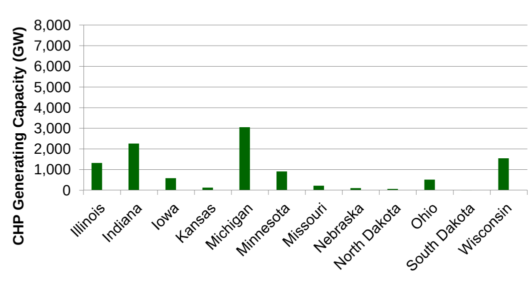


Source: ICF Internal Estimate

U.S. Department of Energy Clean Energy Application Centers

Midwest CHP Generating Capacity

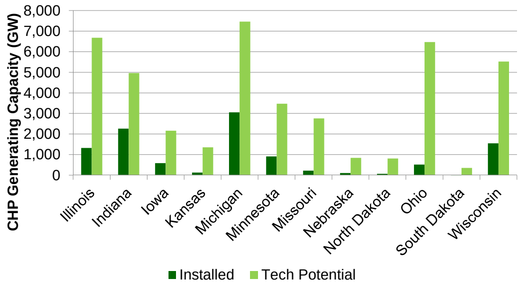
Installed Capacity



U.S. Department of Energy Clean Energy Application Centers

Midwest CHP Generating Capacity

*Installed vs Total Technical Potential**

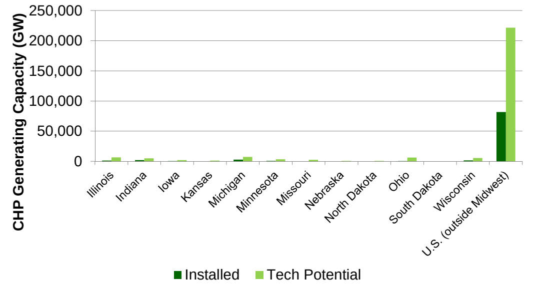


* Technical Potential also includes existing CHP

U.S. Department of Energy Clean Energy Application Centers

Midwest CHP Generating Capacity

Installed vs Total Technical Potential (including U.S.)

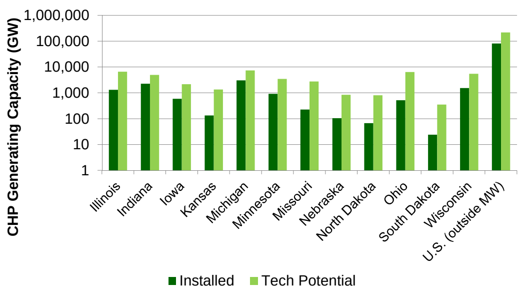


* Technical Potential also includes existing CHP

U.S. Department of Energy Clean Energy Application Centers

Midwest States CHP Generating Capacity

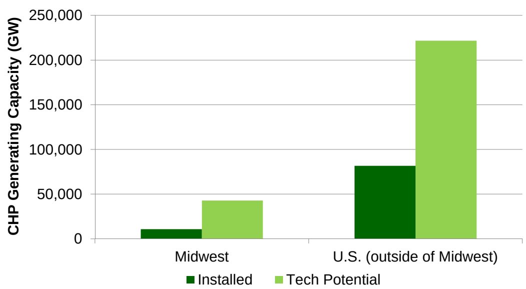
Installed vs Total Technical Potential



U.S. Department of Energy Clean Energy Application Centers

CHP Generating Capacity

Installed vs Total Technical Potential



* Technical Potential also includes existing CHP

U.S. Department of Energy Clean Energy Application Centers

Questions

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cuttica@uic.edu

www.midwestcleanenergy.org

U.S. Department of Energy Midwest Clean Energy Application Center

A program at UIC Energy Resources Center

A program sponsored by U.S. Department of Energy Energy Efficiency & Renewable Energy

35

U.S. Department of Energy Clean Energy Application Centers

Combined Heat and Power (CHP), An Opportunity for Midwest State Policy

Presentation to:
2013 NASEO Midwest Regional Meeting
Tuesday, May 7th, 2013

John Cuttica
University of Illinois at Chicago
Energy Resources Center

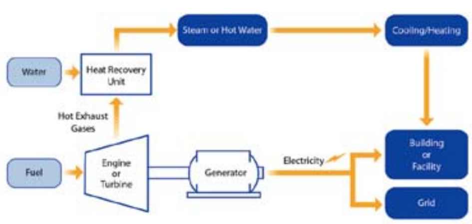
Presentation Outline

- Combined Heat & Power (CHP) – What is it & Why should I be interested
- CHP Opportunities in Midwest
  - Portfolio Standards (EEPS / RPS)
  - EPA Boiler MACT Rule
  - Critical Infrastructure Support
  - Utility Participation in CHP Markets

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



Separate Energy Delivery:
- **Electric generation – 33%**
- **Thermal generation - 80%**
- **Combined efficiency – 45% to 55%**

CHP Energy Efficiency (combined heat and power) 70% to 85%

Defining Combined Heat & Power (CHP)

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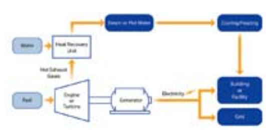
(also referred to as Topping Cycle CHP or Direct Fired CHP)

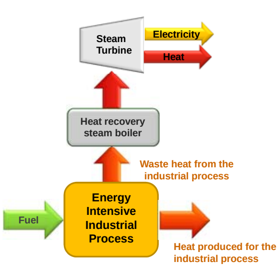


- Simultaneous generation of heat and electricity
- **Fuel is combusted/burned for the purpose of generating heat and electricity**
- Normally sized for thermal load to max. efficiency – 70% to >85%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

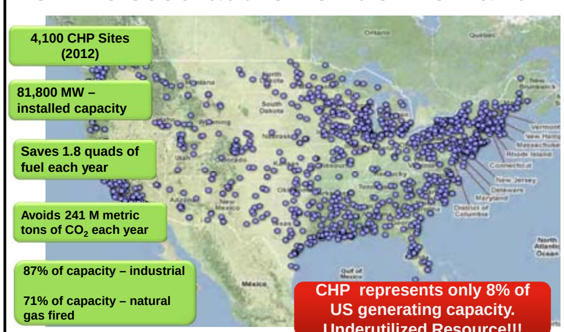
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

CHP Is Used at the Point of Demand



Source: ICF International

CHP Value Proposition

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2	N/A
Capital Cost	$24 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

Growing State Policy Support for CHP

- 24 states recognize CHP/WHP in some manner in state Renewable or Energy Efficiency Portfolio Standards
- Massachusetts – CHP a critical part of Advanced Energy Portfolio Standard and Utility Energy Efficiency Programs
- Ohio – include CHP/WHP in Portfolio Standards; Boiler MACT pilot program
- Maryland – CHP pilot program as part of EmPOWER Maryland energy efficiency program
- California – Feed in tariff for excess generation systems under 20 MW – long term power purchase agreements
- Louisiana, Texas, New York, New Jersey – CHP as part of critical infrastructure activities
- Texas – Permit by Rule for CHP systems $\leq$ 15MW

CHP and State Policies

- Portfolio Standards (EEPS / RPS)
- Boiler MACT Compliance Strategies
- Critical Infrastructure Support
- Utility Participation in CHP Markets

State EEPS Programs

- State EEPS Program (administered by the investor owned utilities) usually the single largest opportunity within a state for increased large customer EE
- EEPS annual efficiency targets becoming much more difficult to meet within budget caps
- Greater industrial, large commercial, institutional sector participation is one of the keys to the future success of state EEPS programs
- How can we increase large customer participation in EEPS?

Can CHP be a Contributor

Some Thoughts for Including CHP in EEPS:

- Projects must pass cost effectiveness test (TRC).
- Should incentives be on electric side, gas side, or shared?
- How do you calculate allowable energy savings?
- Should incentives be tied to measured performance?
- Can CHP significantly assist in meeting targets?
- How do you control size of CHP incentives?
- What have other states done? (16 states include)

EPA's Boiler MACT Rule (CHP Role)

- ICI Boiler MACT - Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters
  - Final rule December 2012 – Compliance by January 31, 2016
- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units, replacements for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	360	84,197
Heavy Liquid	64	9,936
Light Liquid	58	5,375
Total	**482**	**99,508**

Includes industrial, commercial and institutional boilers only

Affected Coal and Oil Boilers in the Midwest by Market Sector

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	46	92	21,460
Paper	28	55	13,433
Petroleum and Coal	5	13	3,219
Chemicals	29	65	10,452
Plastics and Rubber	6	17	1,488
Primary Metals	9	22	9,011
Fabricated Metals	2	5	664
Machinery	5	14	5,276
Transportation Equip.	18	80	12,036
Educational Services	18	44	8,753
Other Applications	29	75	13,717
Total	**195**	**482**	**99,508**

Affected Coal and Oil Boilers in the Midwest

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
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Missouri	8	22	0	8	3,442
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DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
Illinois Program Just Getting Underway

CHP - Part of Critical Infrastructure

- Most critical infrastructure facilities are dependent on availability & resiliency of the electric grid
- Grid is subject to terrorist attack & natural disasters
- If electricity grid is impaired, a properly configured CHP system can continue to operate, ensuring an uninterruptable supply of electricity and thermal energy *(hospitals, universities, waste water treatment facilities, financial institutions, placed of refuge, etc)*

Numerous examples – Northeast Blackout 2003, Hurricane Katrina 2005, Super-storm Sandy 2012, Various winter and summer blackouts/brownouts

Infrastructure Design

- Include CHP in critical infrastructure facilities as a priority in state and local emergency planning activities
- Some states require consideration of CHP in design and major retrofit of "critical" state facilities (Texas and Louisiana)
- Encouraging the incorporation of "black start" capability in appropriate CHP installations
- Recognition of the differences between emergency generators and CHP systems

Utility Participation in CHP Markets

- Can a utility build and own CHP facilities?
- Can a utility negotiate a package of services to support a CHP customer?
- Can a utility include CHP as part of their energy efficiency incentive programs (EEPS)?
- Perhaps CHP Zones where grid congestion exists or impractical to upgrade or install new lines?

Summary

- CHP is not the "silver bullet" to answer all energy issues
- CHP can be a highly effective tool in state energy related programs
- CHP not a technology issue
- CHP normally an economic and/or policy issue

The concepts presented this morning are intended to encourage discussion

Thank You for Your Attention

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John Cuttica
312/996-4382
cuttica@uic.edu

For more information:

www.midwestcleanenergy.org

http://www1.eere.energy.gov/seeaction/chp_policies_guide.html

http://www.epa.gov/chp/documents/ps_paper.pdf

http://www.naseo.org/data/sites/1/documents/publications/CHP-for-State-Energy-Officials.pdf

DOE CEACs, CHP Market Drivers, & CHP Applications

Combined Heat and Power Workshop

Sponsored by National Governors Association

Hosted by Iowa Economic Development Authority

June 28, 2013

Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

What technology can...

- Increase overall energy efficiency and reduce utility bill expenditures?
- Reduce carbon emissions?
- Increase energy reliability, decrease reliance on the grid, and support grid T&D?
- Show more energy savings and reduce more emissions than comparably sized PV and wind technologies?
- Support nation's energy goals and is commercially available today?

The Answer? CHP

2 U.S. Department of Energy Clean Energy Application Centers

Presentation Outline

- DOE's Clean Energy Application Centers (CEACs)
- CHP Market Drivers
- Example CHP Applications

3 U.S. Department of Energy Clean Energy Application Centers

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- The CEACs promote the use of **CHP, Waste Heat to Power, and District Energy** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

4 (See Slides 37 & 38 for more information) U.S. Department of Energy Clean Energy Application Centers

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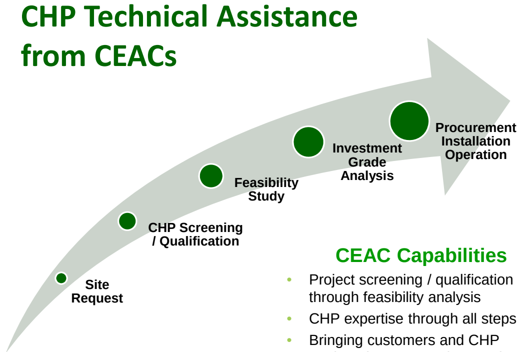
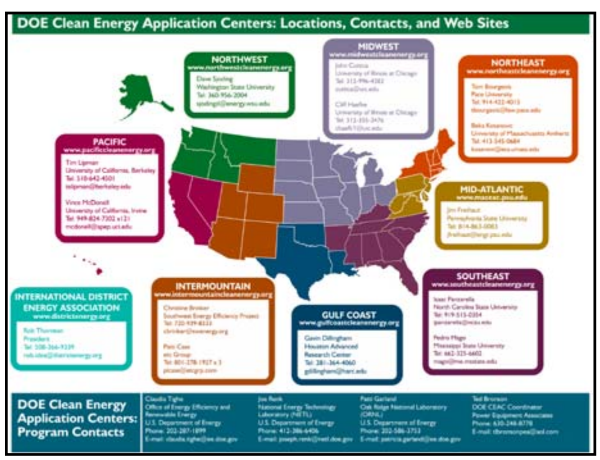
CHP Technical Assistance from CEACs



CEAC Capabilities

- Project screening / qualification through feasibility analysis
- CHP expertise through all steps
- Bringing customers and CHP engineering community together

5 U.S. Department of Energy Clean Energy Application Centers



CHP Market Drivers and Outlook

- Benefits recognized by policymakers at the federal and state levels
- Favorable outlook for natural gas supply in North America enhances economics
- Opportunities created by environmental pressures on the power sector and industrial/institutional users
- Growing interest in power reliability and critical infrastructure support

Over 4,000 MW announced/under construction

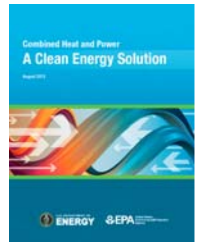
Source: ICF International

U.S. Department of Energy Clean Energy Application Centers

White House Executive Order

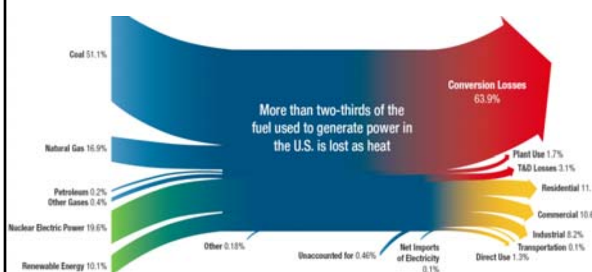
- President Obama signed an Executive Order to accelerate investments in industrial EE and CHP (8/30/12)
- Sets national goal of 40 GW of new CHP installation over the next decade
- Directs agencies to foster a national dialogue
- Directs US DOE, US DOC, USDA, and US EPA to coordinate actions at the Federal level

New DOE / EPA CHP Report (8/2012)



Executive Order: http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency
Report: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

Fuel Utilization by U.S. Utility Sector



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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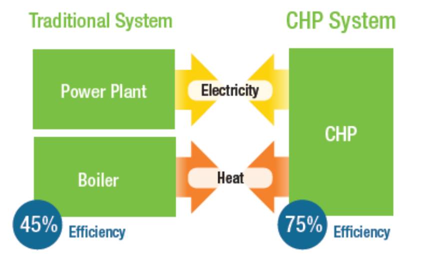
U.S. Department of Energy Clean Energy Application Centers

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

U.S. Department of Energy Midwest Clean Energy Application Center

CHP Value Proposition

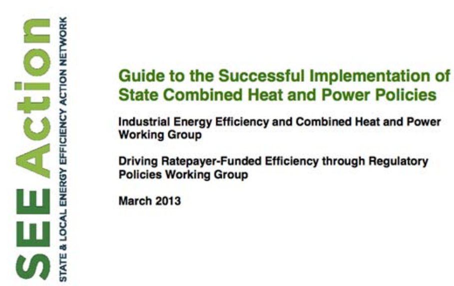
Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	25%	34%	67%
Annual Electricity	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2	N/A
Capital Cost	$24 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	343,747 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) - 9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

11

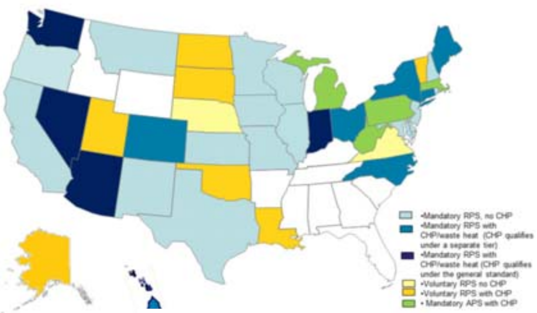
Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

Supportive State Policies are Key



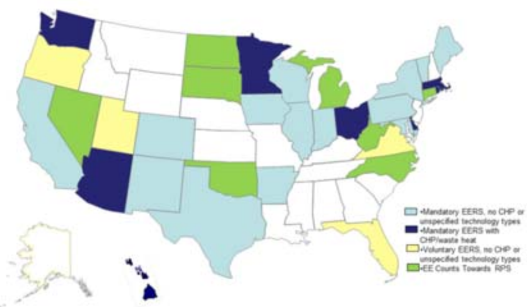
U.S. Department of Energy Clean Energy Application Centers

States with Clean Energy Portfolio Standards Requirements for CHP



Source: http://www.epa.gov/chp/documents/ps_paper.pdf

States with EERS Programs for CHP



Source: http://www.epa.gov/chp/documents/ps_paper.pdf

U.S. Shale Gas Resources

U.S. Department of Energy Clean Energy Application Centers

Source: http://www.eia.gov/analysis/studies/usshalegas

EPA's Boiler MACT Rule (CHP Role)

- ICI Boiler MACT - Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters
  - Final rule December 2012 – Compliance by January 31, 2016
- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units, replacements for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	360	84,197
Heavy Liquid	64	9,936
Light Liquid	58	5,375
Total	**482**	**99,508**

Includes industrial, commercial and institutional boilers only

U.S. Department of Energy Clean Energy Application Centers

Affected Coal and Oil Boilers in the Midwest by Market Sector

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	46	92	21,460
Paper	28	55	13,433
Petroleum and Coal	5	13	3,219
Chemicals	29	65	10,452
Plastics and Rubber	6	17	1,488
Primary Metals	9	22	9,011
Fabricated Metals	2	5	664
Machinery	5	14	5,276
Transportation Equip.	18	80	12,036
Educational Services	18	44	8,753
Other Applications	29	75	13,717
Total	**195**	**482**	**99,508**

U.S. Department of Energy Clean Energy Application Centers

Affected Coal and Oil Boilers in the Midwest

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
Illinois	23	36	2	7	10,241
Indiana	22	37	14	14	14,986
Kansas	2	1	4	0	685
Michigan	29	72	7	0	18,630
Minnesota	15	16	12	7	4,955
Missouri	8	22	0	8	3,442
North Dakota	6	6	3	1	3,838
Nebraska	6	6	4	0	2,554
Ohio	37	77	3	10	14,179
South Dakota	1	5	0	0	1,651
Wisconsin	28	43	12	6	9,131
Total	195	360	64	58	99,508

Iowa Boiler MACT Affected Facilities
(identified in EPA ICR Database)

Site	City
3M Knoxville	Knoxville
ADM Corn Processing CR	Cedar Rapids
Ag Processing Inc	Eagle Grove
Archer Daniels Midland Co. - Des Moines	Des Moines
Archer Daniels Midland Company - Corn Processing Plant - Clinton	Clinton
Cargill Corn Milling - Eddyville	Eddyville
Cargill, Inc. - Sioux City	Sioux City
Grain Processing Corporation	Muscatine
Iowa State University Power Plant	Ames
John Deere Dubuque Works	Dubuque
Roquette America, INC	Keokuk
The University of Iowa	Iowa City
University of Northern Iowa	Cedar Falls

Source: EPA ICR Database

DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of natural gas CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
www.midwestcleanenergy.org

Impact of Pending EPA Utility Regulations

- Utility Regulations
  - Mercury and Air Toxics Standards (MATS)
  - Cross-State Air Pollution Rule (CSAPR), formerly "Transport Rule" – (for more information: http://www.washingtonpost.com/blogs/post-politics/wp/2013/06/24/supreme-court-agrees-to-review-controversial-epa-air-rule/)
- Will require compliance investments and/or may contribute to closings of some coal capacity
  - Estimates of shutdown coal capacity range from 20 to 50 GW
- Price impacts will be regional
- Closings could result in localized reliability concerns providing opportunities for CHP

CHP and Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

Applicable Market Sectors

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

Resource:: Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities, http://info.ornl.gov/sites/publications/Files/Pub41761.pdf

CHP and Critical Infrastructure

- Most critical infrastructure facilities are dependent on availability & resiliency of the electric grid
- Grid is subject to terrorist attack & natural disasters
- If electricity grid is impaired, a properly configured CHP system can continue to operate, ensuring an uninterruptable supply of electricity and thermal energy

Numerous examples – Northeast Blackout 2003, Hurricane Katrina 2005, Super-storm Sandy 2012, Various winter and summer blackouts/brownouts

Resource:: Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities, http://info.ornl.gov/sites/publications/Files/Pub41761.pdf

Favorable Characteristics for CHP Applications

- Concern about energy costs
- Concern about power reliability
- Concern about sustainability and environmental impacts
- Long hours of operation
- Existing thermal loads
- Central heating and cooling plant
- Future central plant replacement and/or upgrades
- Future facility expansion or new construction projects
- EE measures already implemented
- Access to fuel
- Facility energy champion

Attractive CHP Markets




Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

Example CHP Applications

- CHP is not always sold on economics alone; other drivers exist for CHP projects
- CHP systems are implemented in various market sectors, facility sizes, and via different prime mover technologies and generation capacities
- Example installations explore other drivers and various applications
- CEAC Developed Project Profiles located at: http://www1.eere.energy.gov/manufacturing/distributedenergy/chp_projects.html

CHP Applications:
Addressing Coal Emissions

Kent State University
Kent, OH

Capacity: **12 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb. Turbines (1 x 5MW and 1 x 7MW)**
Installed: **2003, 2005**


CHP Applications:
Addressing Instantaneous Power Interruptions

Lake Forest Hospital
Lake Forest, IL

Capacity: **3.2 MW**
Fuel: **Natural Gas**
Prime Mover: **Recip. Engines**
Installed: **1997**

Annual Instantaneous Power Interruptions were reduced from 50 down to 2 due to CHP installation

CHP Applications:
CHP Serving as Emergency Generators

Beloit Memorial Hospital
Beloit, WI

Capacity: **3.0 MW**
Fuel: **Natural Gas & Diesel**
Prime Mover: **Recip. Engines**
Installed: **2000**

CHP system serves both day-to-day and emergency power:
- *Meets 10 sec start up time requirement*
- *Meets on-site fuel requirement*

CHP Applications:
Facility Utilities Expansion

Northwest Community Hospital
Arlington Heights, IL

Capacity: **4.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Recip. Engines**
Installed: **1997 / 2005**

"We said, 'Well, if we're going to centralize it all, doesn't it make sense to do a CHP—and generate our own electricity, to reduce our demand load, and then capture the heat of those engines and utilize all that for heating and/or cooling?' "
Charlie Stevenson, Director of Plant Operations
Northwest Community Hospital

"The beauty of this CHP to him was not simply the return for the cogen system, but the fact that these savings would pay for the central energy plant too."
Joe Sinclair, Ballard Engineering

CHP Applications:
LEED Platinum

Dell Children's Medical Center of Central Texas
Austin, TX

Capacity: **4.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **2009**

First healthcare facility in the world to achieve a LEED Platinum certification by the U.S. Green Building Council (USGBC)

U.S. Department of Energy
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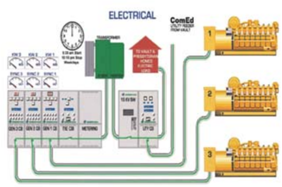
CHP Applications:
Addressing Extended Power Outages

Presbyterian Homes
Evanston, IL



Capacity: **2.4 MW**
Fuel: **Natural Gas**
Prime Mover: **Recip. Engines**
Installed: **2001**

Ice storm in winter of 1998 knocked out power for 9 hours.
- *600 senior residents were transferred to safety*
- *CHP installed to avoid future outages*

"The environment we provide to elderly adults had everything to do with our decision to pursue power generation. Loss of power isn't an option. Lives depend on it."
- Keith Stohlgren, V/P Operations

"We had no power for nine hours one cold, winter day during an ice storm. The loss of power forced us to take immediate, aggressive measures to ensure the comfort and safety of our residents."
– Nancy Heald Tolan, Director of Facilities Management

Clean Energy Application Centers

CHP Applications:
Disaster Relief, Hurricane Katrina

Mississippi Baptist Medical Center
Jackson, MS

Capacity: **4.2 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **1991**

The independence provided by the CHP system allowed MBMC to continue operation relatively unaffected during Hurricane Katrina in 2005. As soon as power reliability became a factor MBMC performed a load shed, switched off of the power grid, and continued operation in turbine-only mode. MBMC was the only hospital in the Jackson metro area to remain nearly 100% operational. After approximately 50 hours, the power reliability issue was addressed and MBMC connected to the power grid and returned to normal operation.

Source: *http://www.southeastcleanenergy.org/resources/reports/CHP-MBMC.pdf*

CHP Applications:
Disaster Relief, Hurricane Sandy

Danbury Hospital
Danbury, CT

Capacity: **4.5 MW / 3 MW standby**
Fuel: **natural gas / diesel**
Prime Mover: **Combustion Turbine / Recip backups**
Installed: **2011**

Danbury Hospital is a 371 bed comprehensive regional medical center

During the storm, the facility operated without any loss of power and, despite most of the businesses in the surrounding area being without power for several days, Danbury Hospital still had lights and heat. The CHP facility enabled the hospital to be fully functional during the storm and continued conducting business and providing the critical and necessary health care for patients.

CHP Applications:
Mission Critical Power System

University of Toledo Data Center
Toledo, OH

Capacity: **260 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2012**

Microturbine CHP system installed in University of Toledo's Green Data Center. The system will be capable of providing 100 percent of the data center's critical electric and cooling needs.

36

Source: http://www.capstoneturbine.com/_docs/CS_CAP345_University_Toledo_lowres.pdf

CHP Applications:
Reliability / Multi-Fuel

Bay View Wastewater Treatment Plant
Toledo, OH

Capacity: **10 MW**
Fuel: **Biogas / LFG / NG**
Prime Mover: **Comb. Turbine**
Installed: **2010**



CHP Applications:
Green Energy & Energy Savings

Lima Wastewater Treatment Plant
Lima, OH

WWTP Size: **14 MGD**
CHP Capacity: **65 kW**
Fuel: **Biogas**
Installed: **2002**
Prime Mover: **Microturbine**
(plans for 2nd MT)



Gas Compression

Gas Refrigeration

Static Filter (siloxane)

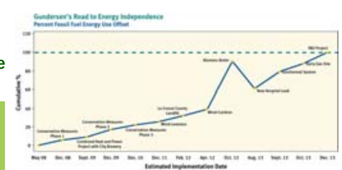
Microturbine

CHP Applications:
Energy Independence & Unique Partnerships

Gundersen Lutheran & City Brewery
La Crosse, WI

Capacity: **633 kW**
Fuel: **Biogas**
Prime Mover: **Recip. Engine**
Installed: **2009**

Hospital owns CHP system at local brewery. Heat from CHP system used to heat digester, electricity is sold to utility, electric sales/credit go to hospital.

CHP Applications:
Public & Private Partnerships

Gundersen Lutheran & County Landfill
Onalaska, WI

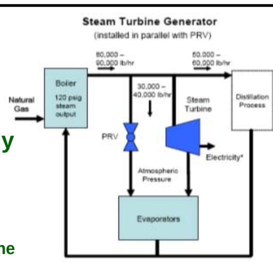
Capacity: **1.2 MW**
Fuel: **Landfill Gas**
Prime Mover: **Recip. Engine**
Installed: **2011**

Instead of simply generating electricity at landfill, landfill gas is piped 2 miles to hospital where CHP system provides all required electricity and thermal energy. Claim to be first energy independent hospital in U.S.


CHP Applications:
Replacing Pressure Reducing Valve

East Kansas Agri-Energy
Garnet, KS

Capacity: **1.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Backpressure Turbine**
Installed: 2005



Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/EastKansas.pdf

CHP Applications:
Multiple Heat Recovery Applications

Broshco Fabricated Products
Mansfield, OH

Capacity: **4.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Reciprocating Engines**
Installed: **2000, 2005**
Heat Recovery: **Process tanks, Boiler Heat, Make Up Heat for Plant Operations**


Waukesha 7100 GSI Engine Units

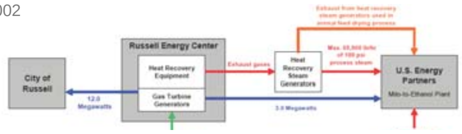
Control Room Switchgear

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/BroshcoProducts.pdf

CHP Applications:
Partnership w/ Municipality

U.S. Energy Partners, LLC & City of Russell
Russell, KS

Capacity: **15 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb Turbine**
Installed: 2002

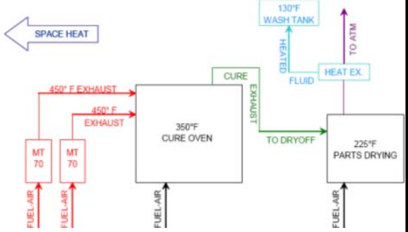


Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/USEnergyPartners.pdf

CHP Applications:
Multiple Waste Heat Recovery Streams

Vestil Manufacturing
Angola, IN

Capacity: **140 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2005**



Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/VestilManufacturing.pdf

CHP Applications:
Industrial Dehumidification

Utilimaster Corporation
Wakarusa, IN

Capacity: **70 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2004**

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/Utilimaster.pdf

Questions

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

A program at

UIC Energy Resources Center

A program sponsored by

U.S. Department of Energy — Energy Efficiency & Renewable Energy

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Iowa CHP Installations

- Amana Farms, Inc. / GHD, Inc. (Amana)
- Iowa State University (Ames)
- United States Department of Agriculture (USDA) (Ames)
- Otter Creek Ethanol (Ashton)
- Alcoa / Midamerican Riverside (Bettendorf)
- Jacobs Energy Corporation (Bettendorf)
- University Of Northern Iowa (Cedar Falls)
- Archer Daniels Midland Company (Cedar Rapids)
- Archer Daniels Midland Company (Clinton)
- Southwest Iowa Renewable Energy (Council Bluffs)
- Mercy Hospital (Council Bluffs)
- Oscar Mayer Foods Corporation (Davenport)
- City of Davenport (Davenport)
- Archer Daniels Midland Company (Des Moines)
- Des Moines Metro WRF (Des Moines)
- Heather Manor (Des Moines)
- Iowa Methodist Medical Center (Des Moines)
- John Deere Corporation (Dubuque)
- Mercy Health Center (Dyersville)
- AG Processing Inc. (Eagle Grove)
- Cargill, Inc. (Eddyville)
- Kendrick Forest Products (Edgewood)
- City of Forest City (Forest City)
- University Of Iowa (Iowa City)
- Delaware County Memorial Hospital (Manchester)
- Good Neighbor Home (Manchester)
- Bio-Energy Partners (Mitchellville)
- City of Muscatine / Muscatine Power and Water (Muscatine)
- University of Iowa (Oakdale)
- City of Rockford (Rockford)
- Packaging Corporation of America (Tama)
- Bertch Cabinet Manufacturing (Waterloo)
- John Deere Corporation (Waterloo)
- Top Deck Holsteins (Westgate)

Source: http://www.eea-inc.com/chpdata/States/IA.html

Taking Advantage of Combined Heat and Power (CHP)

OMA Energy Efficiency & CHP Work Group
July 17th, 2013

Presented by:
John Cuttica
Energy Resources Center
University of Illinois at Chicago

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

What technology can…

- Increase overall energy efficiency and reduce utility bill expenditures?
- Reduce carbon emissions?
- Increase energy reliability, decrease reliance on the grid, and support grid T&D?
- Show more energy savings and reduce more emissions than comparably sized PV and wind technologies?
- Support nation's energy goals and is commercially available today?

The Answer? CHP

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Presentation Outline

- Overview of Combined Heat and Power (CHP)
- CHP Market and Market Drivers
- Favorable CHP Policies
- Market Potential

3 U.S. Department of Energy Clean Energy Application Centers

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Centers** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **Conventional CHP, Waste Heat to Power CHP and District Energy** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

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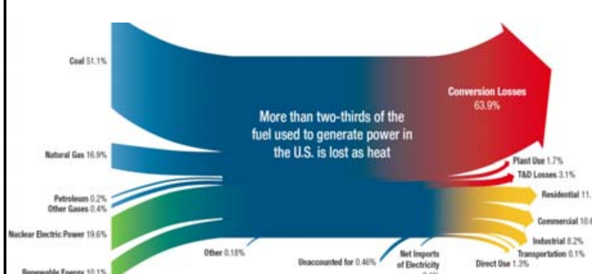
Fuel Utilization by U.S. Utility Sector



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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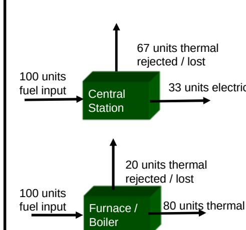
Conventional Energy System



- **Customer purchases power from grid (central station)**
  - Power plant economy of scale
  - 100 units input = 33 units of power
  - Remainder of energy lost (heat)
- **On-site generation of steam/hot water (boilers/furnaces)**
  - 100 units input = 60 to 80 units of heat
- **Typical grid power + onsite heat**
  - Efficiency depends on heat/power ratio
  - 45% to 55% combined efficiency is common

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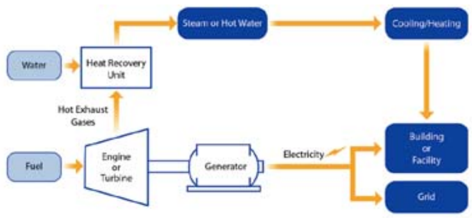
Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



Separate Energy Delivery:
- Electric generation – 33%
- Thermal generation - 80%
- Combined efficiency – 45% to 55%

CHP Energy Efficiency (combined heat and power) 70% to 85%

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Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

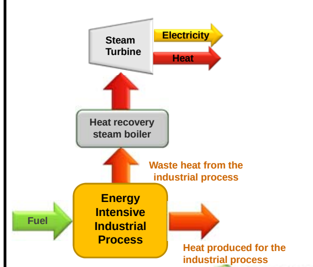
- Simultaneous generation of heat and electricity
- **Fuel is combusted/burned for the purpose of generating heat and electricity**
- Normally sized for thermal load to max. efficiency – 70% to >85%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

U.S. Department of Energy Midwest Clean Energy Application Center

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Waste Heat to Power CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*

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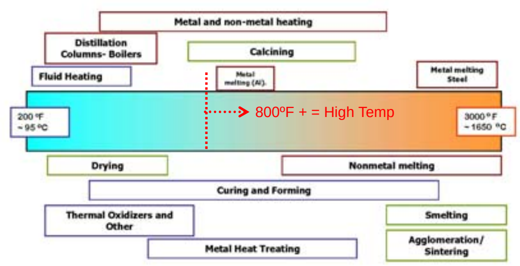
Industrial Waste Heat Recovery Opportunities



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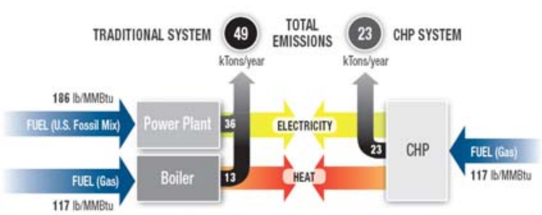
CHP Role in Our Environmental Future

Impact on Carbon Emissions



Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

U.S. Department of Energy Clean Energy Application Centers

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

What Are the Benefits of CHP?

- CHP is *more efficient* than separate generation of electricity and heat
- Higher efficiency translates to *lower operating cost,* (but requires capital investment)
- Higher efficiency *reduces emissions of all pollutants*
- CHP can also *increase energy reliability and enhance power quality*
- On-site electric generation *reduces grid congestion and avoids distribution costs*

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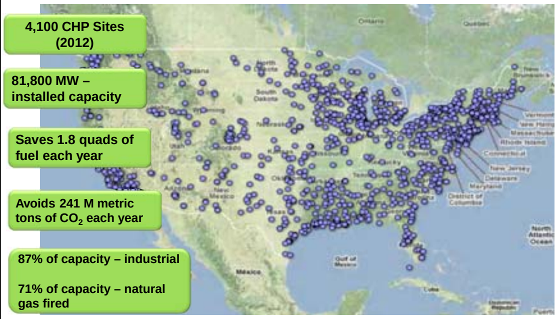
CHP Is Used at the Point of Demand



Source: ICF International

Attractive CHP Markets



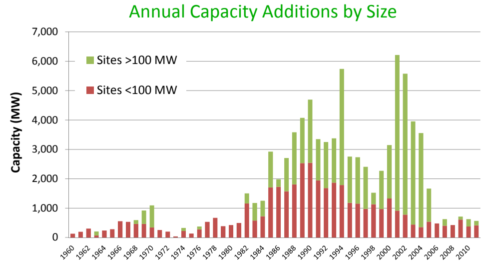

Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

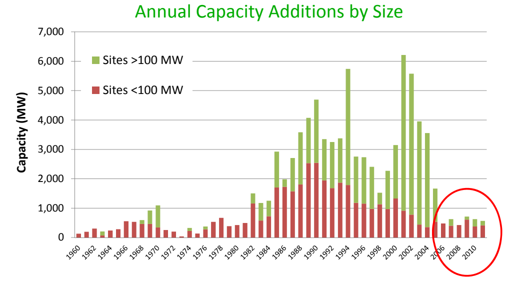
Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Annual Additions



Source: ICF CHP Installation Database

CHP Annual Additions



Source: ICF CHP Installation Database

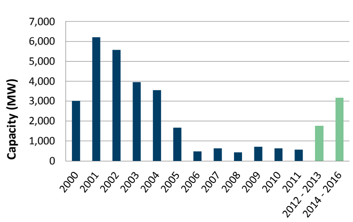
Market Drivers

Benefits recognized by policymakers at the federal and state levels

Favorable outlook for natural gas supply in North America enhances economics

Opportunities created by environmental pressures on the power sector and industrial/institutional users

Growing interest in power reliability and critical infrastructure support



Over 4,500 MW announced/under construction

CHP Value Proposition

Category	10 MW CHP	10 MW WHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW)
Annual Capacity Factor	85%	85%	25%	34%	67%
Annual Electricity	74,446 MWh	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	None	None	None	None
Capital Cost	$24 million	$30 million	$45 million	$24 million	$10 million
Annual Energy Savings	343,747 MMBtu	767,176 MMBtu	225,640 MMBtu	306,871 MMBtu	156,708 MMBtu
Annual CO_2 Savings	44,114 Tons	68,864 Tons	20,254 Tons	27,546 Tons	27,023 Tons
Annual NOx Savings	86.9 Tons	91.1 Tons	26.8 Tons	36.4 Tons	59.2 Tons

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

Recent CHP Policies

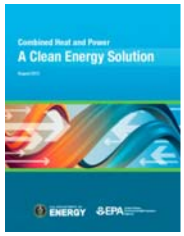
President Obama signed an executive order to accelerate industrial energy efficiency and CHP in August, 2012 that sets a national goal of 40 GW of new CHP installations by 2020.

24 states recognize CHP in some manner in state Renewable and/or Energy Efficiency Resource Standards

Re-evaluating standby rates, interconnect standards, tax incentives, feed-in-tariffs, permit by rule, grants & financing programs

DOE - SEEAction "Guide to the Successful Implementation of State CHP Policies" – www.seeaction.energy.gov

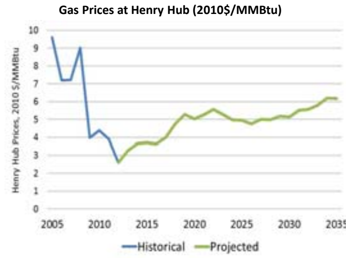
DOE / EPA CHP Report (8/2012)



Executive Order: http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency
Report:
http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

Gas Availability and Price likely to be Key Driver

- Broad consensus that Henry Hub natural gas prices will average between $4 and $6 per MMBtu well beyond 2025.
- Natural gas outlook will drive manufacturing investment and technology choice.
- $4 to $6 gas prices are sufficient to support the levels of supply development in the projection, but not so high as to discourage market growth.



Source: ICF Estimates, 2013

Environmental Drivers for CHP

ICI Boiler MACT – standards for hazardous air pollutants from major sources – coal & oil boilers affected by rule should consider CHP in their compliance strategy

Affected Midwest Sites

State	# Facilities	# Coal Units	# Heavy Oil Units	# Light Oil Units	Total Capacity (MMBtu/hr)
Iowa	18	39	3	5	15,217
Illinois	23	36	2	7	10,241
Indiana	22	37	14	14	14,986
Kansas	2	1	4	0	685
Michigan	29	72	7	0	18,630
Minnesota	15	16	12	7	4,955
Missouri	8	22	0	8	3,442
North Dakota	6	6	3	1	3,838
Nebraska	6	6	4	0	2,554
Ohio	37	77	3	10	14,179
South Dakota	1	5	0	0	1,651
Wisconsin	28	43	12	6	9,131
Total	195	360	64	58	99,508

DOE Boiler MACT Technical Assistance Program (Midwest)

- Providing site specific technical and cost information to the 195+ major source facilities (~ 480 boilers) in 12 states currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss "Clean Energy Compliance Strategies" including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of natural gas CHP as a compliance strategy

Program Offered Through The
U.S. DOE Midwest Clean Energy Application Center
University of Illinois at Chicago
www.midwestcleanenergy.org

Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

Applications:
- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

CHP - Part of Critical Infrastructure

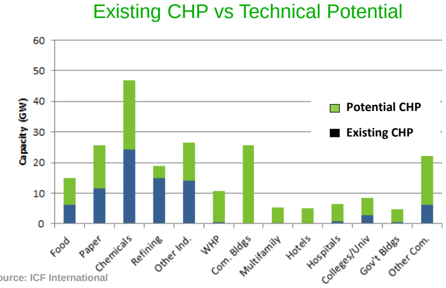
- Most critical infrastructure facilities are dependent on availability & resiliency of the electric grid
- Grid is subject to terrorist attack & natural disasters
- If electricity grid is impaired, a properly configured CHP system can continue to operate, ensuring an uninterruptable supply of electricity and thermal energy

Numerous examples – Northeast Blackout 2003, Hurricane Katrina 2005, Super-storm Sandy 2012, Various winter and summer blackouts/brownouts

CHP Kept Critical Facilities Running During Sandy

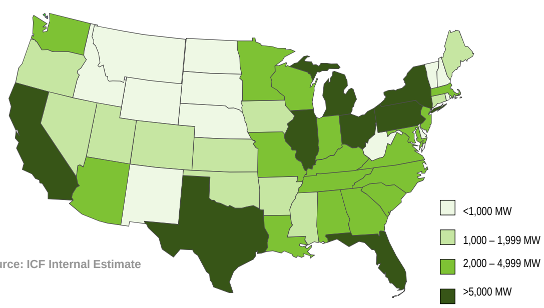
- South Oaks Hospital - Amityville, NY, 1.25 MW recip. engine
- Greenwich Hospital - Greenwich, CT, 2.5 MW recip. engine
- Christian Health Care Center - Wyckoff, NJ, 260 kW microturbine
- Princeton University - Princeton, NJ, 15 MW gas turbine
- The College of New Jersey - Ewing, NJ, 5.2 MW gas turbine
- Salem Comm. College - Carney's Point, NJ, 300 kW microturbine
- Public Interest Data Center - New York, NY, 65 kW microturbine
- Co-op City - The Bronx, NY, 40 MW combined cycle
- Nassau Energy Corp – Garden City, NY, 57 MW combined cycle
- Bergen Wastewater Plant – Little Ferry, NJ, 2.8 MW recip. engine
- New York University – New York, NY, 14.4 MW gas turbine
- Sikorsky Aircraft Corporation – Stratford, CT, 10.7 MW gas turbine

Technical Potential of 140,000 MW



Source: ICF International

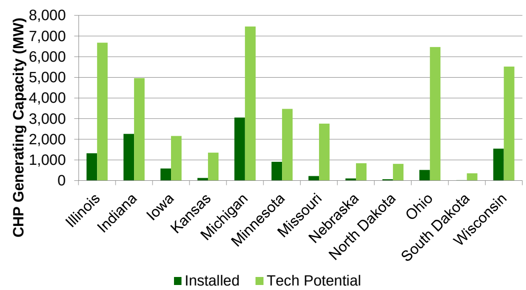
CHP Technical Potential



Source: ICF Internal Estimate

Midwest CHP Generating Capacity

*Installed vs Total Technical Potential**



** Technical Potential also includes existing CHP*

CHP Generating Capacity

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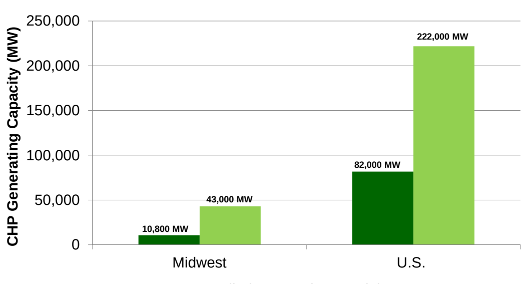

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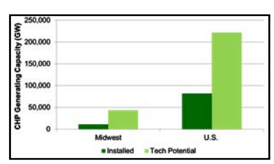
??Economic Potential??



What Defines Economic Potential

- 2 year paybacks, 4 year paybacks, 8 year paybacks??
- Financial analysis can't be done with average utility rates.
- Average site data is unacceptable (operating hours, cost of system, level of heat recovery, etc)
- How do you account for such benefits as reliability, power quality, resiliency, environment, etc
- The economic potential lies somewhere between the two bars

** Technical Potential also includes existing CHP*

Questions

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

A program at

UIC Energy Resources Center

A program sponsored by

U.S. Department of Energy
Energy Efficiency & Renewable Energy

CHP and Critical Infrastructure

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Graeme Miller

US DOE Midwest Clean Energy Application Center

July 22, 2013

U.S. Department of Energy
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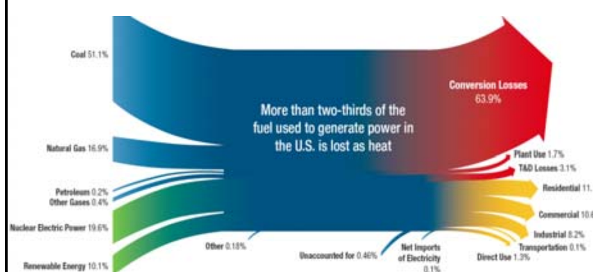

Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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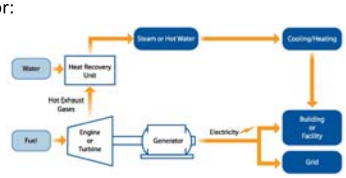
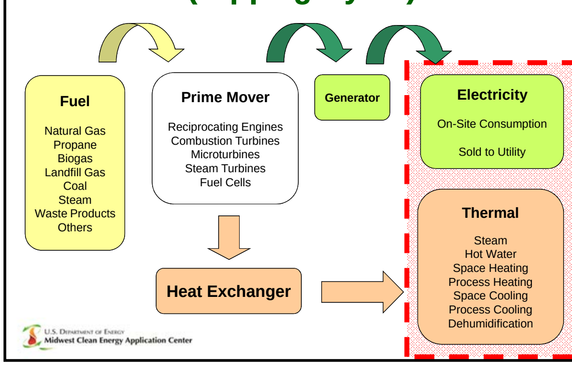
- Can utilize a variety of technologies and fuels

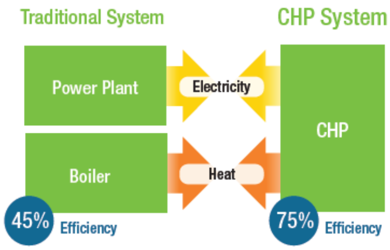


CHP Technology Components (Topping Cycle)



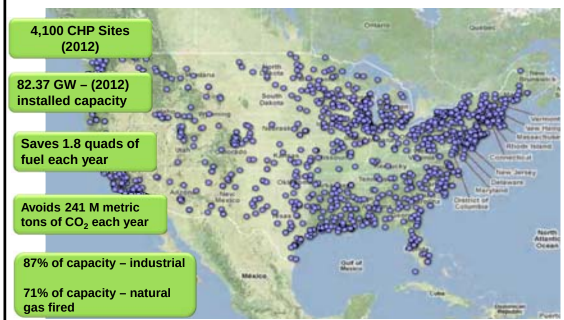
Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

CHP Is Used at the Point of Demand



Source: ICF International

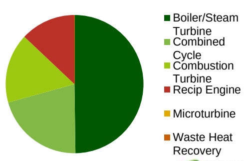
Illinois CHP Installation Summary (2012)

- State CHP Generating Capacity: 1,243 MW
- Number of CHP Systems: 132
- CHP as % of State Gen Capacity: 2.5%
- CHP Technical Potential:* 5,430 MW

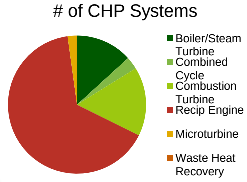
** Technical Potential for commercial and industrial facilities only, non-export only*

Installation Status by Prime Mover Type

CHP Gen Capacity (MW)



# of CHP Systems



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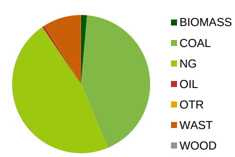

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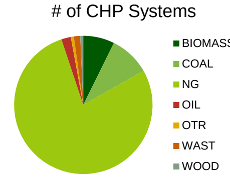


Source: ICF CHP Installation Database

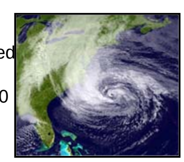
Favorable Characteristics for CHP Applications

- Concern about energy costs
- Concern about power reliability
- Concern about sustainability and environmental impacts
- Long hours of operation
- Existing thermal loads
- Central heating and cooling plant
- Future central plant replacement and/or upgrades
- Future facility expansion or new construction projects
- EE measures already implemented
- Access to fuel
- Facility energy champion

Power Outage Cost Estimates

Superstorm Sandy

- Nearly $20 billion in losses from suspended business activity
- Total losses estimated between $30 to $50 billion
- Two-day shutdown of the NY Stock Exchange, costing an estimated $7 billion from halted trading
- Rutgers estimates economic losses of $11.7 billion for New Jersey GDP



SOURCE: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_enabling_resilient_energy_infrastructure.pdf

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Patriot Act of 2001 Section 1016 (e)

Applications:

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

Designing for Reliability

- CHP systems designed for reliability will incur additional costs ($45 - $170/kW depending on complexity of system)
- These additional costs however provide important reliability benefits to the site, and to the community at large
- One estimate states that over $150 billion per year is lost by U.S. industries due to electric network reliability problems

SOURCE: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_enabling_resilient_energy_infrastructure.pdf

Uninterrupted Operation Requirements

- **Black start capability**
  - allows the system to start up independently from the grid
- **Generators capable of independent operation**
  - the system must be able to operate without the grid power signal
- **Ample carrying capacity**
  - system size must match critical loads
- **Parallel utility interconnection and switchgear controls**
  - the system must be able to disconnect from the grid, support critical loads, and reconnect after an event

CHP versus Backup Generation

- CHP provides continuous benefits to host facilities, rather than just during emergencies
- CHP can result in daily operating cost savings
- CHP offsets capital costs associated with investments in traditional backup power

CHP versus Backup Generation

	CHP	Backup Generation
System Performance	• Designed and maintained to run continuously • Improved performance reliability	• Only used during emergencies
Fuel Supply	• Natural gas infrastructure typically not impacted by severe weather	• Limited by on-site storage
Transition from Grid Power	• May be configured for "flicker-free" transfer from grid connection to "island mode"	• Lag time may impact critical system performance
Energy Supply	• Electricity • Thermal (heating, cooling, hot/chilled water)	• Electricity
Emissions	• Typically natural gas fueled • Achieve greater system efficiencies (80%) • Lower emissions	• Commonly burn diesel fuel

US DOE's Clean Energy Application Center's Role

- In February 2012, the US DOE's Clean Energy Application Centers formed a working group on CHP in Critical Infrastructure
- The working group and ICF International prepared a report, published in April 2013, on CHP and Critical Infrastructure for the US DOE, Oak Ridge National Lab
  http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_critical_facilities.pdf
- US DOE conducted a webinar on April 3, 2013 on the topic of CHP's Role in Critical Infrastructure support

Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/

Critical Infrastructure CHP: Texas and Louisiana

- **CHP Requirements:**
  - Deemed feasible if it can provide a facility with 100% of its critical electricity needs; primary source of thermal energy;
  - Can sustain emergency operations for at least 14 days;
  - Meets a minimum efficiency of 60%;
  - Energy savings must exceed installation, operating and maintenance costs over a 20-year period;
  - CHP must be on-site.

Learn more at: http://www.txsecurepower.org/ or at http://legiscan.com/LA/text/SR171/id/649813/Louisiana-2012-SR171-Introduced.pdf

Critical Infrastructure CHP: New York

- **Eligibility:**
  - 50 kW to 1.3 MW systems;
  - **ONLY** Fund CHP systems that can continue operations during grid outages;
  - Only systems installed at sites that pay the System Benefits Charge;
    - All Investor Owned Utilities in New York pay the Systems Benefits Charge
  - Flood zone applicants must meet a "high and dry" requirement*; providing extra level of reliability in major storm events
  - First-come, first-serve basis through December 31, 2016

Learn more at: http://www.nyserda.ny.gov/PON2568

*Lesson learned and new requirement added after Superstorm Sandy.

Critical Infrastructure CHP: New Jersey

- 2008 NJ Energy Master Plan calls for 1,500 MW of CHP in NJ by 2020*.
  - Reduce energy costs & capacity requirements
  - Reduce emissions & improve grid reliability

*Post Superstorm Sandy, the programs have been amended to emphasize grid resiliency benefits by awarding additional merit points for being able to:
- operate in grid island mode; and
- act as a place of refuge in a long-term grid outage.

CT9

Example CHP Installations

- Other drivers exist for CHP projects than straight economics
- Example CHP installations explore other drivers (CHP serving critical loads)
- Case Studies (Project Profiles) located at http://www1.eere.energy.gov/manufacturing/distributedenergy/chp_database/Default.aspx

CHP Applications:
Disaster Relief, Superstorm Sandy

New York Presbyterian Hospital
Manhattan, NY

Capacity: **7.5 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **2009**

New York City's first hospital with grid-independent operating capability

Maintained full service while the surrounding grid was shut down

Due to its CHP system, New York Presbyterian not only cared for its own patients during the Superstorm Sandy blackout, but was able to admit patients from nearby hospitals that had lost power during the storm.

Source: http://cdhnrgy1.user.openhosting.com/Fact%20Sheets/New%20York%20Presbyterian%20Hospital%20Fact%20Sheet.pdf

CHP Applications:
Disaster Relief, Hurricane Katrina

Mississippi Baptist Medical Center
Jackson, MS

Capacity: **4.2 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **1991**

The independence provided by the CHP system allowed MBMC to continue operation relatively unaffected during Hurricane Katrina in 2005. As soon as power reliability became a factor MBMC performed a load shed, switched off of the power grid, and continued operation in turbine-only mode. MBMC was the only hospital in the Jackson metro area to remain nearly 100% operational. After approximately 50 hours, the power reliability issue was addressed and MBMC connected to the power grid and returned to normal operation.

Source: http://www.southeastcleanenergy.org/resources/reports/CHP-MBMC.pdf

Slide 21

CT9 just wanted to clarify that points provided for either and/or both, right?
Claudia Tighe, 7/18/2013

CHP Applications:
Mission Critical Power System

University of Toledo Data Center
Toledo, OH

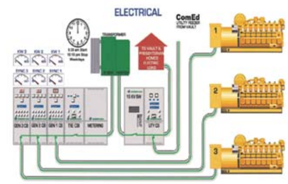
Capacity: **260 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2012**

Microturbine CHP system installed in University of Toledo's Green Data Center. The system will be capable of providing 100 percent of the data center's critical electric and cooling needs.

25

Source: http://www.capstoneturbine.com/_docs/CS_CAP345_University_Toledo_lowres.pdf

CHP Applications:
Addressing Extended Power Outages



Presbyterian Homes
Evanston, IL

Capacity: **2.4 MW**
Fuel: **Natural Gas**
Prime Mover: **Recip. Engines**
Installed: **2001**

Ice storm in winter of 1998 knocked out power for 9 hours.

- *600 senior residents were transferred to safety*
- *CHP installed to avoid future outages*

"The environment we provide to elderly adults had everything to do with our decision to pursue power generation. Loss of power isn't an option. Lives depend on it."
- Keith Stohlgren, V/P Operations

"We had no power for nine hours one cold, winter day during an ice storm. The loss of power forced us to take immediate, aggressive measures to ensure the comfort and safety of our residents."
– Nancy Heald Tolan, Director of Facilities Management

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/PresbyterianHomes.pdf

Questions?

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US DOE Midwest Clean Energy Application Center
www.midwestcleanenergy.org

27

U.S. Department of Energy Clean Energy Application Centers

CHP and Critical Infrastructure

State of Illinois Energy Assurance Workshops for Municipalities

Graeme Miller

US DOE Midwest Clean Energy Application Center

July 23, 2013

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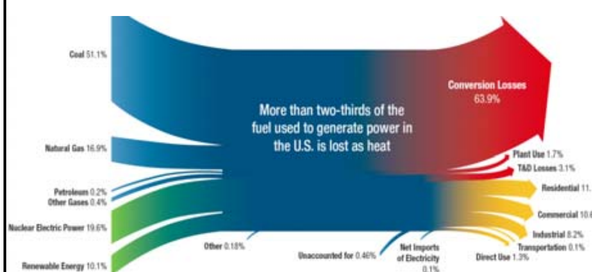

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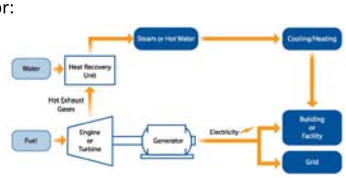


CHP Technology Components (Topping Cycle)

Fuel
Natural Gas
Propane
Biogas
Landfill Gas
Coal
Steam
Waste Products
Others

Prime Mover
Reciprocating Engines
Combustion Turbines
Microturbines
Steam Turbines
Fuel Cells

Generator

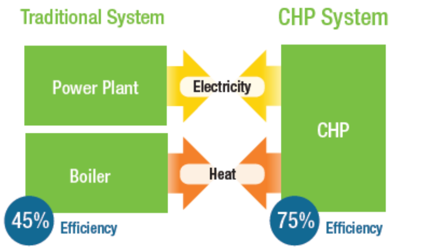
Electricity
On-Site Consumption
Sold to Utility

Heat Exchanger

Thermal
Steam
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification

Defining Combined Heat & Power (CHP)

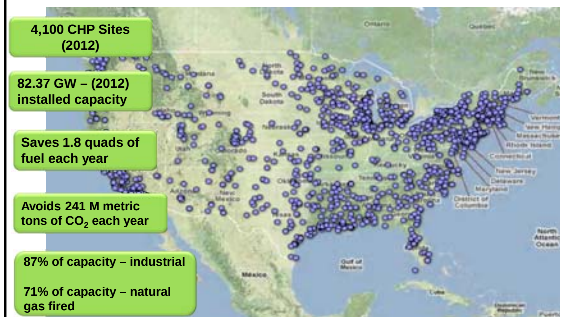
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

U.S. Department of Energy Midwest Clean Energy Application Center

CHP Is Used at the Point of Demand



Source: ICF International

U.S. Department of Energy Midwest Clean Energy Application Center

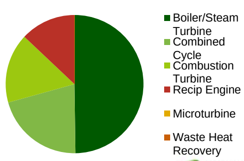
Illinois CHP Installation Summary (2012)

- State CHP Generating Capacity: 1,243 MW
- Number of CHP Systems: 132
- CHP as % of State Gen Capacity: 2.5%
- CHP Technical Potential:* 5,430 MW

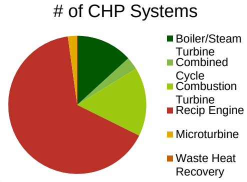
** Technical Potential for commercial and industrial facilities only, non-export only*

Installation Status by Prime Mover Type

CHP Gen Capacity (MW)



\# of CHP Systems



U.S. Department of Energy Midwest Clean Energy Application Center

Source: ICF CHP Installation Database

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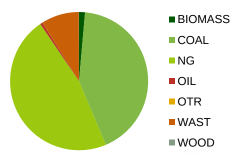
CHP Gen Capacity (MW)



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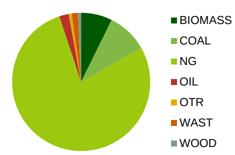

U.S. Department of Energy Midwest Clean Energy Application Center

Source: ICF CHP Installation Database

Favorable Characteristics for CHP Applications

- Concern about energy costs
- Concern about power reliability
- Concern about sustainability and environmental impacts
- Long hours of operation
- Existing thermal loads
- Central heating and cooling plant
- Future central plant replacement and/or upgrades
- Future facility expansion or new construction projects
- EE measures already implemented
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- Facility energy champion

U.S. Department of Energy Midwest Clean Energy Application Center

Power Outage Cost Estimates

Superstorm Sandy

- Nearly $20 billion in losses from suspended business activity
- Total losses estimated between $30 to $50 billion
- Two-day shutdown of the NY Stock Exchange, costing an estimated $7 billion from halted trading
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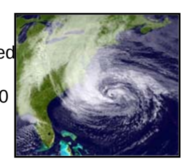

SOURCE: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_enabling_resilient_energy_infrastructure.pdf

U.S. Department of Energy Midwest Clean Energy Application Center

Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

Applications:

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

U.S. Department of Energy
Midwest Clean Energy Application Center

Designing for Reliability

- CHP systems designed for reliability will incur additional costs ($45 - $170/kW depending on complexity of system)
- These additional costs however provide important reliability benefits to the site, and to the community at large
- One estimate states that over $150 billion per year is lost by U.S. industries due to electric network reliability problems

SOURCE: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_enabling_resilient_energy_infrastructure.pdf

U.S. Department of Energy
Midwest Clean Energy Application Center

Uninterrupted Operation Requirements

- **Black start capability**
  - allows the system to start up independently from the grid
- **Generators capable of independent operation**
  - the system must be able to operate without the grid power signal
- **Ample carrying capacity**
  - system size must match critical loads
- **Parallel utility interconnection and switchgear controls**
  - the system must be able to disconnect from the grid, support critical loads, and reconnect after an event

U.S. Department of Energy
Midwest Clean Energy Application Center

CHP versus Backup Generation

- CHP provides continuous benefits to host facilities, rather than just during emergencies
- CHP can result in daily operating cost savings
- CHP offsets capital costs associated with investments in traditional backup power

U.S. Department of Energy
Midwest Clean Energy Application Center

CHP versus Backup Generation

	CHP	Backup Generation
System Performance	• Designed and maintained to run continuously • Improved performance reliability	• Only used during emergencies
Fuel Supply	• Natural gas infrastructure typically not impacted by severe weather	• Limited by on-site storage
Transition from Grid Power	• May be configured for "flicker-free" transfer from grid connection to "island mode"	• Lag time may impact critical system performance
Energy Supply	• Electricity • Thermal (heating, cooling, hot/chilled water)	• Electricity
Emissions	• Typically natural gas fueled • Achieve greater system efficiencies (80%) • Lower emissions	• Commonly burn diesel fuel

U.S. Department of Energy
Midwest Clean Energy Application Center

US DOE's Clean Energy Application Center's Role

- In February 2012, the US DOE's Clean Energy Application Centers formed a working group on CHP in Critical Infrastructure
- The working group and ICF International prepared a report, published in April 2013, on CHP and Critical Infrastructure for the US DOE, Oak Ridge National Lab
  http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_critical_facilities.pdf
- US DOE conducted a webinar on April 3, 2013 on the topic of CHP's Role in Critical Infrastructure support

Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/

U.S. Department of Energy
Midwest Clean Energy Application Center

Critical Infrastructure CHP: Texas and Louisiana

- **CHP Requirements:**
  - Deemed feasible if it can provide a facility with 100% of its critical electricity needs; primary source of thermal energy;
  - Can sustain emergency operations for at least 14 days;
  - Meets a minimum efficiency of 60%;
  - Energy savings must exceed installation, operating and maintenance costs over a 20-year period;
  - CHP must be on-site.

Learn more at: http://www.txsecurepower.org/ or at http://legiscan.com/LA/text/SR171/id/649813/Louisiana-2012-SR171-Introduced.pdf

U.S. Department of Energy Midwest Clean Energy Application Center

19

Critical Infrastructure CHP: New York

- **Eligibility:**
  - 50 kW to 1.3 MW systems;
  - **ONLY** Fund CHP systems that can continue operations during grid outages;
  - Only systems installed at sites that pay the System Benefits Charge;
    - All Investor Owned Utilities in New York pay the Systems Benefits Charge
  - Flood zone applicants must meet a "high and dry" requirement*; providing extra level of reliability in major storm events
  - First-come, first-serve basis through December 31, 2016

Learn more at: http://www.nyserda.ny.gov/PON2568

*Lesson learned and new requirement added after Superstorm Sandy.

U.S. Department of Energy Midwest Clean Energy Application Center

20

Critical Infrastructure CHP: New Jersey

- 2008 NJ Energy Master Plan calls for 1,500 MW of CHP in NJ by 2020*.
  - Reduce energy costs & capacity requirements
  - Reduce emissions & improve grid reliability

*Post Superstorm Sandy, the programs have been amended to emphasize grid resiliency benefits by awarding additional merit points for being able to:
- operate in grid island mode; and
- act as a place of refuge in a long-term grid outage.

CT9

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21

Example CHP Installations

- Other drivers exist for CHP projects than straight economics
- Example CHP installations explore other drivers (CHP serving critical loads)
- Case Studies (Project Profiles) located at http://www1.eere.energy.gov/manufacturing/distributedenergy/chp_database/Default.aspx

U.S. Department of Energy Gulf Coast Clean Energy Applica

U.S. Department of Energy Midwest Clean Energy Application Center

CHP Applications:

Disaster Relief, Superstorm Sandy

New York Presbyterian Hospital

Manhattan, NY

Capacity: **7.5 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **2009**

New York City's first hospital with grid-independent operating capability

Maintained full service while the surrounding grid was shut down

Due to its CHP system, New York Presbyterian not only cared for its own patients during the Superstorm Sandy blackout, but was able to admit patients from nearby hospitals that had lost power during the storm.

Source: http://cdhnrgy1.user.openhosting.com/Fact%20Sheets/New%20York%20Presbyterian%20Hospital%20Fact%20Sheet.pdf

CHP Applications:

Disaster Relief, Hurricane Katrina

Mississippi Baptist Medical Center

Jackson, MS

Capacity: **4.2 MW**
Fuel: **Natural Gas**
Prime Mover: **Combustion Turbines**
Installed: **1991**

The independence provided by the CHP system allowed MBMC to continue operation relatively unaffected during Hurricane Katrina in 2005. As soon as power reliability became a factor MBMC performed a load shed, switched off of the power grid, and continued operation in turbine-only mode. MBMC was the only hospital in the Jackson metro area to remain nearly 100% operational. After approximately 50 hours, the power reliability issue was addressed and MBMC connected to the power grid and returned to normal operation.

Source: http://www.southeastcleanenergy.org/resources/reports/CHP-MBMC.pdf

CHP Applications:
Mission Critical Power System

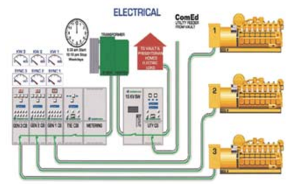
University of Toledo Data Center
Toledo, OH

Capacity: **260 kW**
Fuel: **Natural Gas**
Prime Mover: **Microturbine**
Installed: **2012**

Microturbine CHP system installed in University of Toledo's Green Data Center. The system will be capable of providing 100 percent of the data center's critical electric and cooling needs.

Source: http://www.capstoneturbine.com/_docs/CS_CAP345_University_Toledo_lowres.pdf

CHP Applications:
Addressing Extended Power Outages



Presbyterian Homes
Evanston, IL

Capacity: **2.4 MW**
Fuel: **Natural Gas**
Prime Mover: **Recip. Engines**
Installed: **2001**

Ice storm in winter of 1998 knocked out power for 9 hours.
- *600 senior residents were transferred to safety*
- *CHP installed to avoid future outages*

"The environment we provide to elderly adults had everything to do with our decision to pursue power generation. Loss of power isn't an option. Lives depend on it."
- Keith Stohlgren, V/P Operations

"We had no power for nine hours one cold, winter day during an ice storm. The loss of power forced us to take immediate, aggressive measures to ensure the comfort and safety of our residents."
– Nancy Heald Tolan, Director of Facilities Management

Source: http://www.midwestcleanenergy.org/profiles/ProjectProfiles/PresbyterianHomes.pdf

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US DOE Midwest Clean Energy Application Center
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U.S. Department of Energy
Clean Energy Application Centers

Combined Heat and Power (CHP) Update on Security and Resiliency

Presentation to:
Energy Security Committee
NASEO Annual Meeting
September 5th, 2013

John Cuttica
Energy Resources Center, University of Illinois at Chicago
&
U.S. DOE Midwest Clean Energy Application Center

Presentation Outline

- CHP 101
- CHP and Critical Infrastructure
- CHP in Critical Infrastructure State Policies
- CHP Case Studies

Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

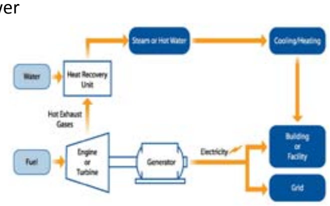
Applications:
- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telecom and data centers

Infrastructure Resiliency

- A key principle of disaster preparedness
- Ability to maintain operation despite a devastating event
- CHP (if properly configured):
  - Offers the opportunity to improve CI resiliency
  - Can continue to operate, providing uninterrupted supply of electricity and heating/cooling to the host facility

What Is Combined Heat and Power?

CHP is an *integrated energy system* that:
- Is located at or near a factory or building
- Generates electrical power
- Recovers waste heat for:
  - heating,
  - cooling or
  - dehumidification
- Can utilize a variety of technologies and fuels



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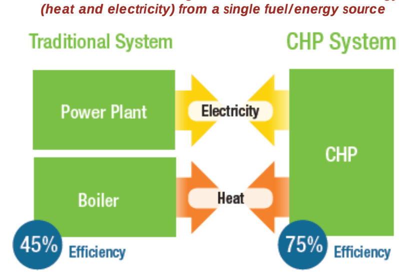

CHP provides efficient, clean, reliable, affordable energy – today and for the future.

CHP versus Backup Generation

	Backup Generator	CHP
System Performance	• Only used during emergencies	• Designed and maintained to run continuously • Improved performance reliability
Fuel Supply	• Limited by on-site storage	• Natural gas infrastructure typically not impacted by severe weather
Transition from Grid Power	• Lag time may impact critical system performance	• May be configured for "flicker-free" transfer from grid connection to "island mode"
Energy Supply	• Electricity	• Electricity • Thermal (heating, cooling, hot/chilled water)
Emissions	• Commonly burn diesel fuel	• Typically natural gas fueled • Achieve greater system efficiencies (80%) • Lower emissions

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Superstorm Sandy

- Nearly $20 billion in losses from suspended business activity
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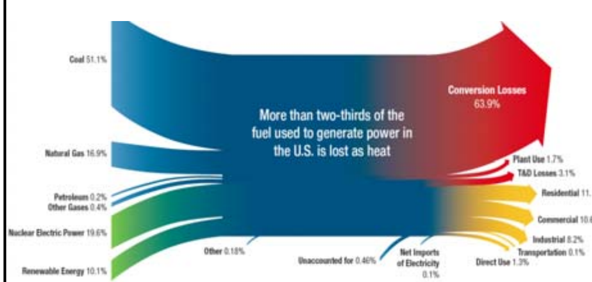
US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **CHP, District Energy, and Waste Heat-to-Power** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

11

Fuel Utilization by U.S. Utility Sector



Source: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf

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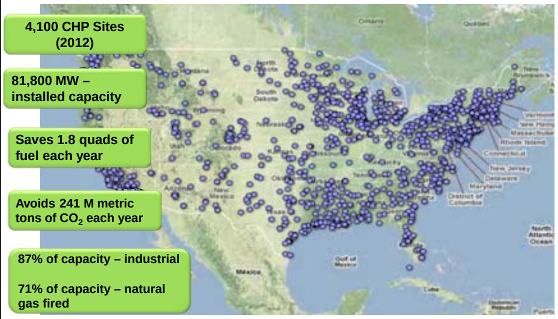

Source: ICF International

U.S. Department of Energy Midwest Clean Energy Application Center

Favorable Characteristics for CHP Applications

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U.S. Department of Energy Midwest Clean Energy Application Center

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U.S. Department of Energy Midwest Clean Energy Application Center

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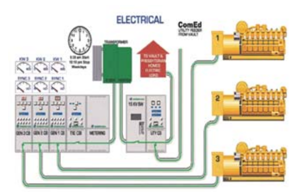

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- *600 senior residents were transferred to safety*
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Questions?

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U.S. Department of Energy
Clean Energy Application Centers

Examining CHP Technologies

John Cuttica
Cliff Haefke
U.S. DOE Midwest Clean Energy Application Center
Univ. of Illinois at Chicago

Half Moon Seminars
Middleburg Heights, Ohio
June 2, 2011

UIC Energy Resources Center, College of Engineering — U.S. Department of Energy Clean Energy Application Center, Midwest

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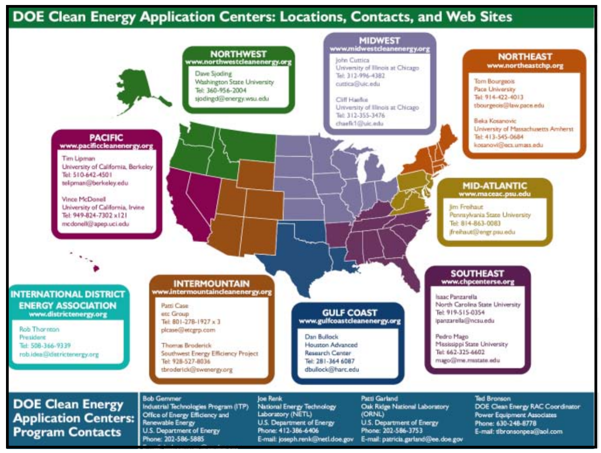
U.S. DOE Clean Energy Regional Application Centers (RAC)

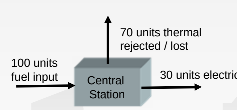
Who are we?

- **U.S. DOE Midwest Clean Energy Application Center**
- Originally established in 2001 by US DOE to support DOE CHP Challenge
- Today the center promotes the use of CHP, District Energy, and Waste Heat Recovery Technologies
- Strategy: Provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Targeted education and outreach**
  - **Policy education**
  - **Project support**
- www.midwestcleanenergy.org



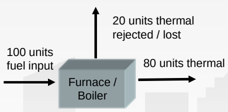
Quick Recap of CHP Concept

Conventional Energy System

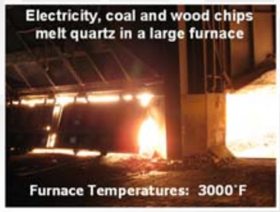


- **Customer purchases power from grid (central station)**
  - Power plant economy of scale
  - 100 units input = 30 units of power
  - Remainder of energy lost (heat)

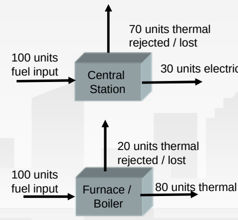
Conventional Energy System



- On-site generation of steam/hot water/hot air (boilers/furnaces)
  - 100 units input = 60 to 80 units of heat



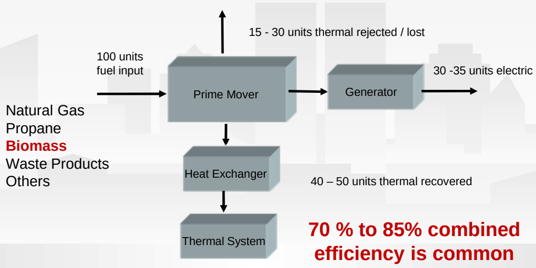
Conventional Energy System



- Customer purchases power from grid (central station)
  - Power plant economy of scale
  - 100 units input = 30 units of power
  - Remainder of energy lost (heat)
- On-site generation of steam/hot water (boilers/furnaces)
  - 100 units input = 60 to 80 units of heat
- Typical grid power + onsite heat
  - Efficiency depends on heat/power ratio
  - 40% to 55% combined efficiency is common

CHP System

Produce the power on-site and recycle the waste heat from the prime mover

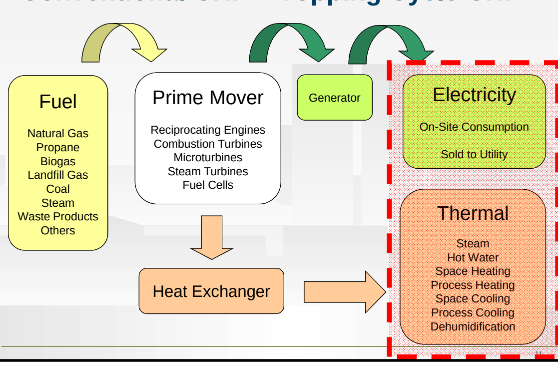


70 % to 85% combined efficiency is common

Combined Heat and Power Concepts

Conventional CHP	Waste Heat to Power	District Energy CHP
		
The sequential production of useful electric and thermal power from a single dedicated fuel source	Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power. These systems may or may not produce additional thermal energy	Central heating & cooling plants that incorporate electricity generation along with thermal distribution piping networks for multiple buildings (campus / downtown area)

Conventional CHP – Topping Cycle CHP



Conventional CHP – Topping Cycle CHP

- What drives system efficiency in a conventional CHP system??

Ability to utilize as much of the thermal energy as possible + coincidence between electric and thermal loads

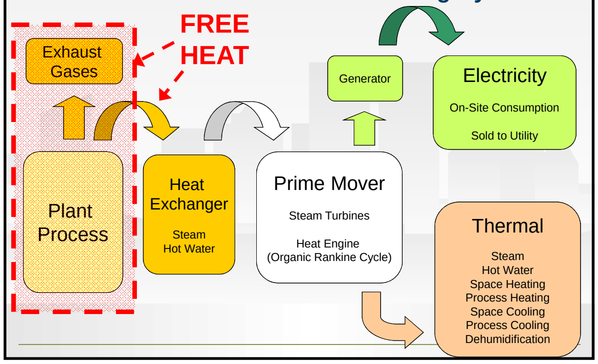
- To ensure high system efficiency, how would you size a conventional CHP system??

Size for thermal load and generate electricity when operating to meet the thermal load

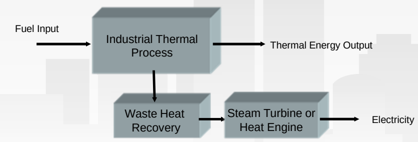
- What maximizes the effectiveness of a conventional CHP system??

Long operating hours + max efficiency = max savings/effectiveness

Waste Heat to Power CHP – Bottoming Cycle CHP

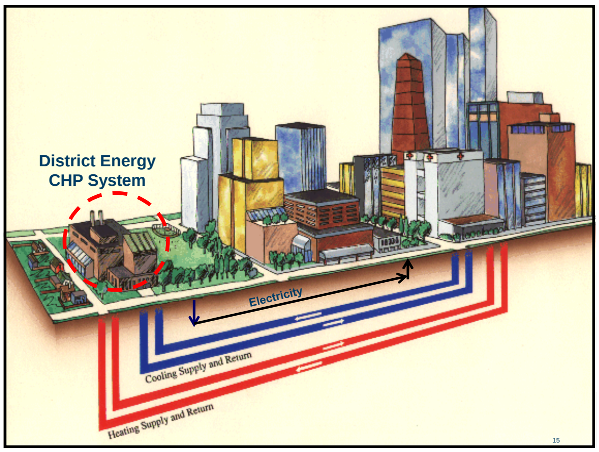


Waste Heat to Power – Bottoming Cycle CHP



- No Additional Fuel Consumed
- No Additional On-Site Emissions
- May or May Not Generate Additional Thermal Energy

14



CHP System Configuration

Normal CHP Configuration

- CHP Systems are Normally Installed in Parallel with the Electric Grid (CHP does not replace the grid)
- Both the CHP and Grid Supply Electricity to the Customer
- Recycled Heat From the Prime Mover Used for:
  - Space Heating (Steam or Hot Water Loop)
  - Space Cooling (Absorption Chiller)
  - Process Heating and/or Cooling
  - Dehumidification (Desiccant Regeneration)

What Makes A Good CHP Application?

- Good Coincidence Between Electric and Thermal Loads
- Large Cost Differential Between Electricity (Grid) and CHP Fuel --- "Spark Spread"
- Long Operating Hours
- Economic Value of Power Reliability is High
- Installed Cost Differential Between a Conventional and a CHP System (*smaller is better*)

18

Candidate Applications for CHP

- Hospitals
- Colleges / Universities
- High Schools
- **Residential Confinement**
- High Rise Hotels
- Fitness Centers

- Food Processing Waste
- Farm Livestock Waste
- Waste Water Treatment
- Landfill Sites
- Pulp & Paper Mills
- Ethanol / Biodiesel Plants
- Industrial Manufacturing (chemicals, metals, non-metals) – conventional and waste heat to power systems

Anaerobic Digesters

Other Biomass

19

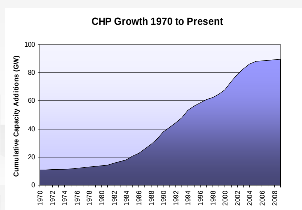
CHP System Sizes (Terminology)

System Designation	Size Range	Comments
Mega	50 to 100+ MWe	Very Large Industrial Usually Multiple Smaller Units Custom Engineered Systems
Large	10's of MWe	Industrial & Large Commercial Usually Multiple Smaller Units Custom Engineered Systems
Mid	10's of kWe to Several MWe	Commercial & Light Industrial Single to Multiple Units Potential Packaged Units
Micro	<60 kWe	Small Commercial & Residential Appliance Like

20

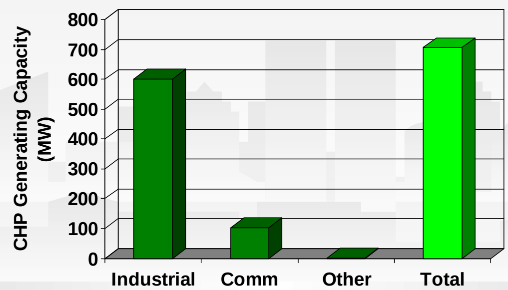
Installed CHP - 2009

- 85,000 MW at approx. 3,600 sites (Nationally)
- Represents approx. 9% of total US generating capacity
- Reduces Annual Energy Consumption ~ 1.9Quads
- Eliminates over 248 MMT of CO_2 emissions annually

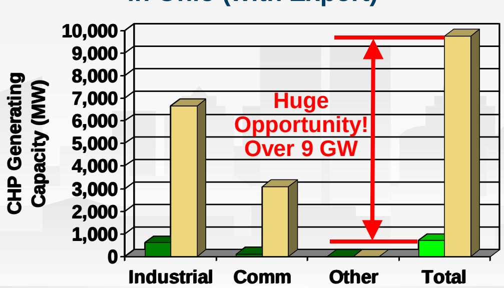


21

Existing CHP Installations in Ohio



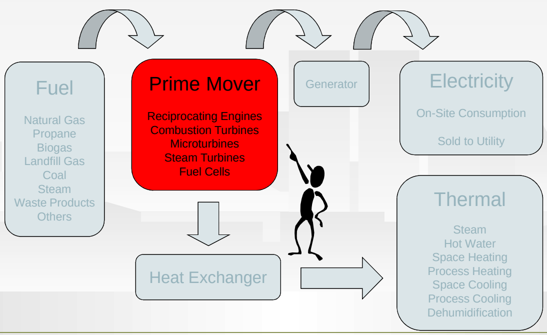
Looking at the Technical CHP Potential in Ohio (with Export)



Basic CHP Components

- **Prime Mover** that generates mechanical energy
  - Reciprocating Engine
  - Turbine (Gas, Micro, Steam)
  - Fuel Cell
- **Generator** converts the mechanical energy into electrical energy
- **Waste Heat Recovery** is one or more heat exchangers that capture and recycle the heat from the prime mover
- **Thermal Utilization** equipment converts the recycled heat into useful heating, cooling, and/or dehumidification
- **Operating Control Systems** insure the CHP components function properly together

24



25

Reciprocating Engines

Picture Courtesy of Caterpillar

Two Types of Reciprocating Internal Combustion Engines

- Spark Ignited – Otto Cycle Engines
  - Utilizes Gaseous or Easily Vaporized Liquid Fuels
- Self Ignited – Compression Ignited – Diesel Cycle Engines
  - Utilizes the Full Range of Liquid Petroleum Fuels
  - (Distillate through Residual)

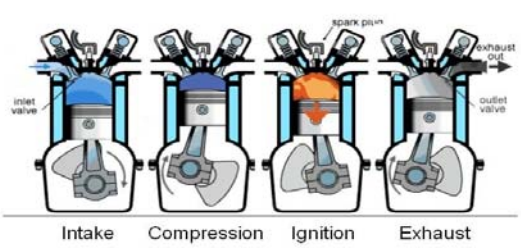
27

Spark Ignited - Four Stroke Reciprocating Engine

- Power Generated Thru a Series of 4 Combustion Stages
  - Air / Fuel Intake
  - Compression
  - Ignite / Power
  - Exhaust
- Two Crankshaft Revolutions to Complete Power Cycle

28

Reciprocating Engines - Spark Ignited Four-Stroke Engine



Source: GTI Textbook (Natural Gas-Fueled Cooling Technologies and Economics)

29

Reciprocating Engine Characteristics

- Advantages
  - Low Capital Cost
  - Good Electrical Efficiencies (30% to over 40% LHV)
  - Quick Startup
  - Excellent Load Following & Good Part Load Efficiencies
  - Proven Reliability
  - Significant Heat Recovery Potential
  - Typical Range 5 kW – 10 MW
- Disadvantages
  - Atmospheric Emissions
  - Noisy / Vibrations
  - Frequent Maintenance Intervals (annual maintenance costs -- .007 to .015 $/kWh

30

Recip. Engine Emissions Control

- Two Methods of Emission Control
  - Reduction via Control of Combustion in Combustion Chamber
    - Lean burn
  - Reduction via After-Treatment of Exhaust Gas
    - Catalytic converters (3-way, oxidation, SCR)
    - Thermal reactors (oxidize CO, HC)

For More Information

- Caterpillar
- Waukesha
- Cummins
- Wartzila
- Jenbacher
- Fairbanks-Morse

Wartzila


Waukesha

Caterpillar
Jenbacher


Fairbanks-Morse

32

Combustion Turbines

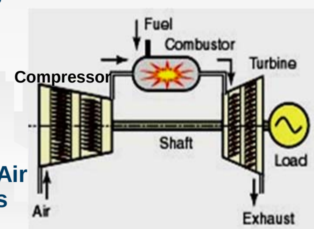

Industrial Turbine

Solar Turbine 7 MW – 2ft Diameter


Capstone Micro-Turbine 30 KW

How a Gas Turbine Works (5 steps)

1. **Intake Air – working fluid (Atmospheric)**
2. **Compress Air**
3. **Heat Up the Air by Burning Fuel - Combustor**
4. **Re-Expand the Hot Air Over Turbine Blades**
5. **Exhaust Temperature**



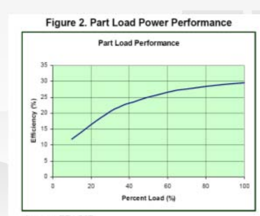
34

Industrial Gas Turbine

- Available Size Range: 500 kW - Hundreds of MW
- Typical for CHP: Several MWs to Tens of MWs
- Efficiency Range: 25% to 40% LHV (Simple Cycle)
- Typically 3 Configurations:
  - Simple Cycle (Most Common in CHP)
  - Recuperated
  - Combined Cycle
- Thermal (Recoverable) Energy:
  - Exhaust Gas @ 900 °F to 1100 °F
  - Excellent for High Grade Steam @ 150 psig and Higher

What Effects Gas Turbine Performance

- Part Load Performance -- disadvantage

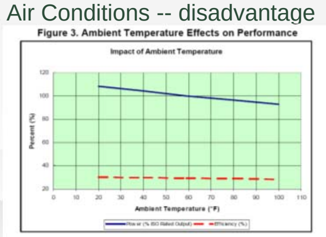


36

What Effects Gas Turbine Performance

- Ambient Air Conditions -- disadvantage

Chart compares to operation at ISO conditions of sea level and 59^0F



Power decreases due to decreased air flow mass rate (density of air declines as temperature increases)

Efficiency decreases because the compressor requires more power to compress higher temperature air

37

Small Packages

Power = Torque X Speed
15,000 to 20,000 rpm

38

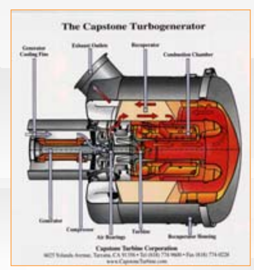
Summary

- Combustion Turbines are small and light-weight
- Main Components: Compressor, Combustor, Expansion Turbine
- Performance is greatly affected by altitude, ambient temperature, turbine load, cycle operation
- Various emissions control technologies exist (ie. burner modifications and exhaust gas treatments)

39

Microturbine Basics

- Consist of a compressor, combustor, turbine and recuperator



Microturbines

- Small Turbines with Recuperation
- Capacity Range: 25 kW to 500 kW
- Efficiency Range: 25% to 30% LHV
- Recoverable Heat:
  - Gas Exhaust @ Approximately 500 °F
- Variety of Fuels:
  - Natural Gas
  - Propane
  - Bio-derived Gas (landfill, sewage treatment, animal waste)
- Low Emissions: < 0.49 lbs/MWh or 9ppm

Picture Courtesy of Capstone

Adding Heat Recovery

- Most equipment compatible for use with heat recovery

Microturbine Examples

- Capstone Turbine Corporation
  - 30 kW & 65 kW, 200 kW
  - Special biogas capable models available
- Ingersoll Rand Energy Systems
  - 250 kW
  - Uses gaseous fuels with wide range of energy content (350 to 2500 Btu/scf)
- Elliott Energy Systems
  - 80 kW
- Bowman Power Systems
  - 80 kW
- Turbec
  - 100 kW

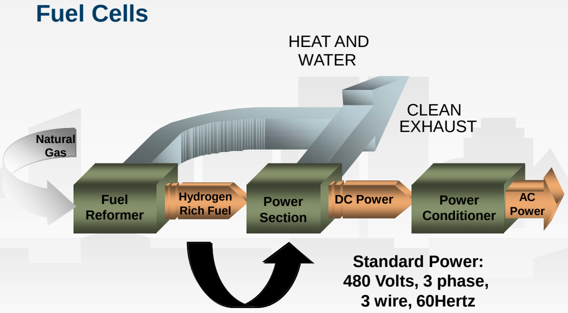
43

Fuel Cells

- Electrochemical Process (no direct combustion of fuel)
- Hydrogen and Oxygen Ions thru an electrolyte to generate electricity (DC) and heat
- Similar to a battery in operating principal but can continue to operate provided the availability of a continuous fuel source.

44

Fuel Cells

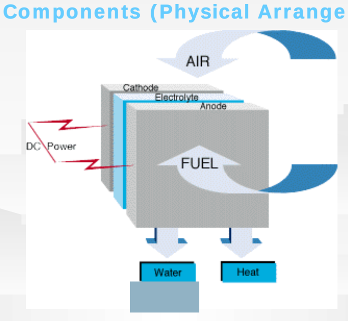


Source: Midwest CHP Application Center

45

Fuel Cells

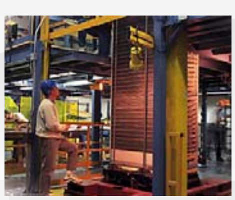
Key Components (Physical Arrangement)



Source: DOD Website: www.dodfuelcell.com

46

Fuel Cell Stack



Internal fuel cell stack (similar in most systems)
Individual fuel cells comprise a fuel cell stack

47

Fuel Cells

Types and Attributes

	PEMFC	PAFC	MCFC	SOFC
	Proton Exchange Membrane	Phosphoric Acid	Molten Carbonate	Solid Oxide
Electrolyte	Sulfonic acid in polymer	Orthophosphoric acid	Lithium and potassium carbonates	Yttrium-stabilized zirconia
Charge Carrier	H^+	H^+	$CO_3^=$	$O^=$
Operating Temperature	175 F Warm Water	390 F Hot Water	1,200 F High-Pressure Steam	1,300 – 2,000 F High-Pressure Steam
Cogeneration Heat	Minimal	Modest	High	High
Efficiency (LHV)	< 40%	35 - 45%	45 – 60%	45 – 60%
Reforming	External	External	Internal or external	Internal or external

Source: GTI

48

Which Prime Mover to Use

- Recip. Engine --- Hot Water / Low Pressure Steam
- Combustion Gas Turbines --- High Pressure Steam, Usually over 3 to 4 MW in Capacity
- Micro-Turbines --- Fuel Flexibility, Relatively Small Capacities
- Steam Turbines --- Large Industrials with Waste Streams, Large Pressure Drop Requirements
- Fuel Cells --- Extremely Clean, Very Expensive

49

Fuel
Natural Gas
Propane
Biogas
Landfill Gas
Coal
Steam
Waste Products
Others

Prime Mover
Reciprocating Engines
Combustion Turbines
Microturbines
Steam Turbines
Fuel Cells

Generator

Electricity
On-Site Consumption
Sold to Utility

Heat Exchanger

Thermal
Steam
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification

50

Two Types of Generators

Induction

- Requires External Power Source to Operate (Grid)
- Contributes to Poor PF
- When Grid Goes Down, CHP System Goes Down
- Less Complicated & Less Costly to Interconnect
- Preferred by Utilities

Synchronous

- Self Excited (Does Not Need Grid to Operate)
- Can Assist in PF Correction
- CHP System can Continue to Operate thru Grid Outages
- More Complicated & Costly to Interconnect (Safety)
- Preferred by CHP Customers

51

Fuel
Natural Gas
Propane
Biogas
Landfill Gas
Coal
Steam
Waste Products
Others

Prime Mover
Reciprocating Engines
Combustion Turbines
Microturbines
Steam Turbines
Fuel Cells

Generator

Electricity
On-Site Consumption
Sold to Utility

Heat Exchanger

Thermal
Steam
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification

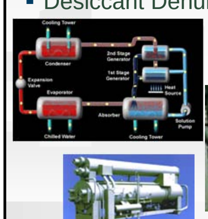
52

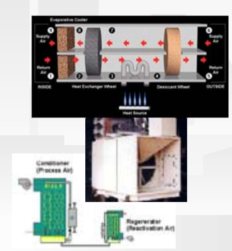
Heat Recovery (Recycled Energy)

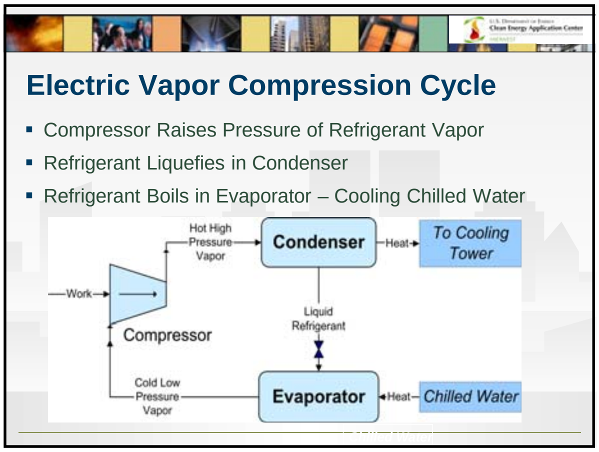
- Steam and Hot Water
- Exhaust Gases

Thermally Activated Technologies

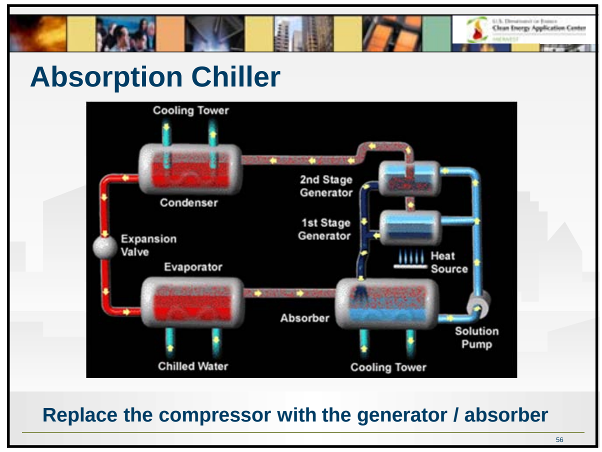
- Steam or Hot Water Heating Loops
- Absorption Chillers
- Desiccant Dehumidification



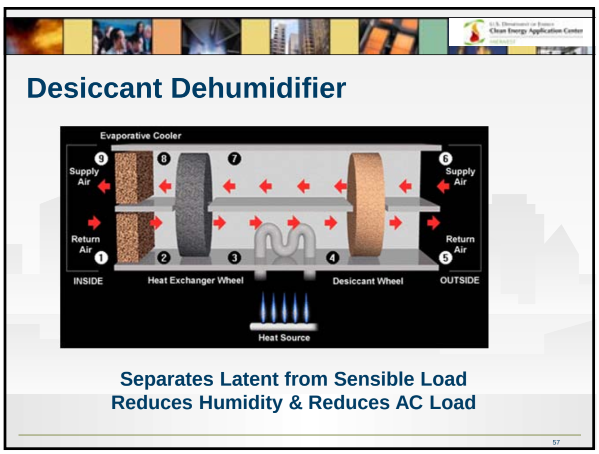




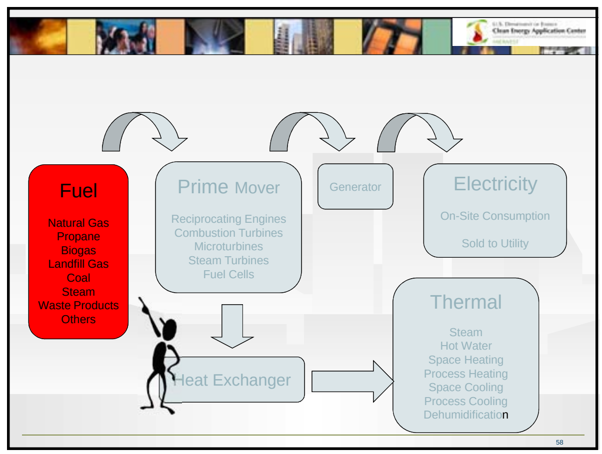
Electric Vapor Compression Cycle
Compressor Raises Pressure of Refrigerant Vapor
Refrigerant Liquefies in Condenser
Refrigerant Boils in Evaporator – Cooling Chilled Water
Hot High Pressure Vapor
Condenser
Heat
To Cooling Tower
Work
Compressor
Liquid Refrigerant
Cold Low Pressure Vapor
Evaporator
Heat
Chilled Water



Absorption Chiller
Cooling Tower
2nd Stage Generator
Condenser
1st Stage Generator
Expansion Valve
Evaporator
Heat Source
Absorber
Solution Pump
Chilled Water
Cooling Tower
Replace the compressor with the generator / absorber
56



Desiccant Dehumidifier
Evaporative Cooler
Supply Air
Return Air
INSIDE
Heat Exchanger Wheel
Desiccant Wheel
OUTSIDE
Heat Source
Separates Latent from Sensible Load
Reduces Humidity & Reduces AC Load
57



Fuel
Natural Gas
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Waste Products
Others
Prime Mover
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Microturbines
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Electricity
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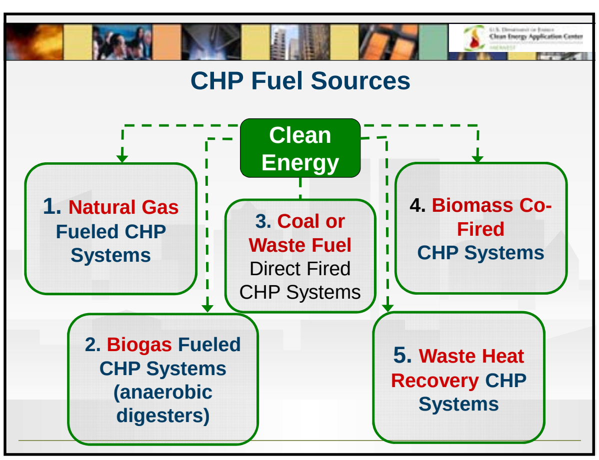
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification
Heat Exchanger
58



CHP Fuel Sources
Clean Energy
1. Natural Gas Fueled CHP Systems
2. Biogas Fueled CHP Systems (anaerobic digesters)
3. Coal or Waste Fuel Direct Fired CHP Systems
4. Biomass Co-Fired CHP Systems
5. Waste Heat Recovery CHP Systems

CHP Is A Low Technical Risk
Utilize Proven Technologies
Employ Standard Design Practices
Incorporate Good Maintenance Practices
CHP Is More a Financial and Regulatory Risk

CHP Regulatory Requirements

- Grid Interconnection --- Lack of Standards
- Utility Standby / Backup Rates
- Environmental Permitting (over 1 MW)
  - Air Permitting
  - Water Permitting
- Other Permitting Requirements
  - Local Codes
  - OSHA

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U.S. DOE Midwest Clean Energy Application Center
www.midwestcleanenergy.org

62

Case Studies

www.midwestcleanenergy.org

Project Profiles

63

Lake Forest Hospital – 3.2 MW

- Campus Operation – District Energy System
- 4 – 820 kW Recip Engines
- Natural Gas Fueled
- Recaptures 3,600 Lbs/hr – 65 psi steam
- 525 tons of Absorption Cooling
- **Annual Instantaneous Power Outages – reduced from 50 to 2**

Beloit Memorial Hospital – 3.0 MW

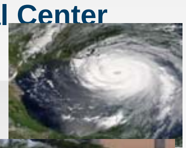
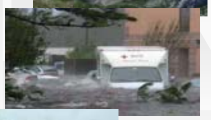
- Campus Operation – District Energy System
- 2 – 1.5 MW Recip Engines
- Dual Fueled (diesel & natural gas)
- 434 tons of Absorption Cooling
- **CHP system serves both day-to-day and emergency power**

Dell Children's Medical Center of Central Texas

- Solar Mercury 50 Combustion Turbine (4.6 MW)
- Thermal applications: steam, double-effect absorption chiller, thermal storage
- First healthcare facility in the world to achieve a **LEED Platinum certification** by the U.S. Green Building Council (USGBC)… early 2009

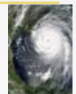
Mississippi Baptist Medical Center

- Jackson, MS
- 1 - 4.0 MW NG-fired turbine
- Hurricane Katrina
  - 302,000 homes destroyed
  - Approximately $125-250B in damages
  - 1,323 deaths
  - 2.7M customers without power


MBMC Response

August 29, 2005
Hurricane Katrina
Hits Jackson, MS



-MPG Restored, but Unstable
-Load Shed Performed (1.2 MW Disconnected)
-Pumping Trucks Supply Water to Physical Plant

- Connection to MPG Restored

1 hr — 3 hr — 5 hr — 57 hr

-Main Power Grid (MPG) Failed
-Alternate Power Grid Enabled
-City Water Lost

- 52 hrs of 100% operation on CHP
- Only Hospital in the Jackson Metro Area to be Nearly 100% Operational!!

-Power Reliability Problems
-Switched to CHP Operation Only
-Elevators on Emergency Generators
-Restricted Use of MRI Equipment

Value of CHP at MBMC

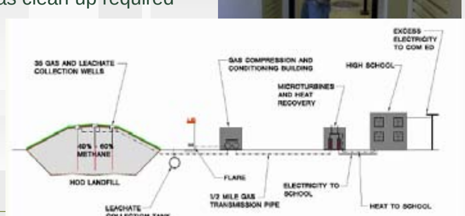
- Remained open and treated a high volume of patients
- Provided clothing, food, and housing for displaced patients during the first night of the disaster
- Opened a round-the-clock day care to allow employees to focus on patient care

Broshco Fabricated Products – 4.55MW

- Auto Seat Frame Mfgr.
- 4 – 1.1MW Recip Engines
- 8MMBtu/hr Hot Water
  - Process tanks
  - Boiler Heat
  - Make Up Heat for Plant Operations
- Natural Gas Fueled

Antioch Community High School – 360 kW

- Landfill ½ mile away supplies fuel
- 12 – 30 kW microturbines
- Gas clean up required



Hunter Haven Farm – 260kW

- 800 Cow Dairy
- 2 – 130kW Recip Engines
- 1.5 MMBtu/hr Hot Water
- Anaerobic Digester – Biogas
- Solid Digestate – Cow Bedding
- Liquid Digestate – Fertilizer
- Use Wet DGS from Ethanol Plant for Cow Feed

Snapshot of the Cogeneration/CHP Market and Industry Trends

2011 MCA Conference

October 11, 2011

Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

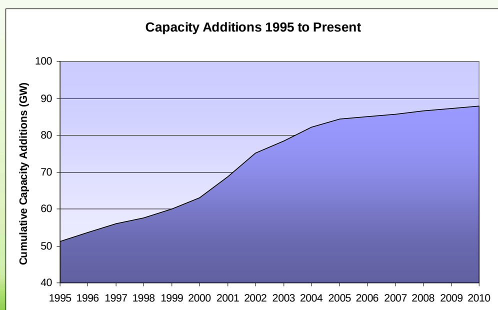
www.midwestcleanenergy.org

Acknowledgements

Based on work supported by:

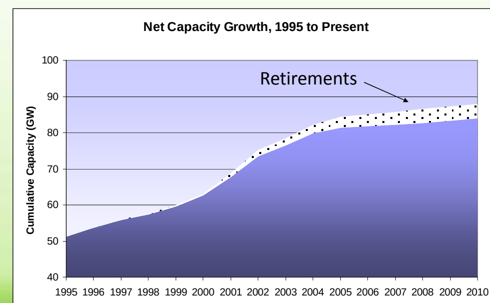
- DOE's Industrial Technology Program
- EPA's Combined Heat and Power Partnership
- ICF International

Over 35 GW of New CHP Capacity Has Been Installed Since 1995



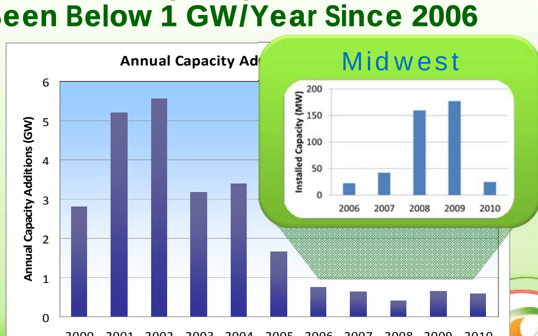
Source: ICF CHP Database

But CHP Growth Has Slowed Since 2005



Source: ICF CHP Database

New CHP Capacity Additions Have Been Below 1 GW/Year Since 2006

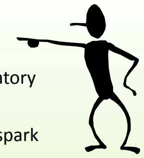


Source: ICF CHP Database

Why the Downturn in the CHP Market?

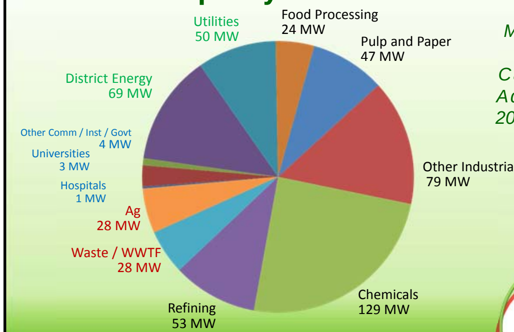
- Excess generation capacity in many regions
- Changes in wholesale power market rules
- Lingering effect of volatile natural gas prices
- Price (spark spread) uncertainty
- Financial crisis

Current Market Conditions



- Most activity in states with favorable regulatory treatment and/or specific incentives
- Natural gas CHP in areas with supportable spark spread (Northeast, Texas, California)
- Biomass and opportunity fuels in Southeast, Midwest and Mountain
- "Hot" applications: universities, hospitals, waste water treatment, other institutional applications
- Growing interest in waste heat to power applications
- Can Smart Grid provide opportunities
- Project inquiries increasing

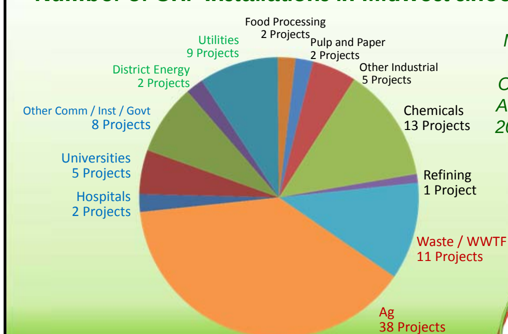
Industrial Type Users Represent 63% of New CHP Capacity in Midwest since 2005



Midwest CHP Capacity Additions: 2005-2011

Source: ICF CHP Database

Agriculture & Waste Represent 50% of New Number of CHP Installations in Midwest since 2005



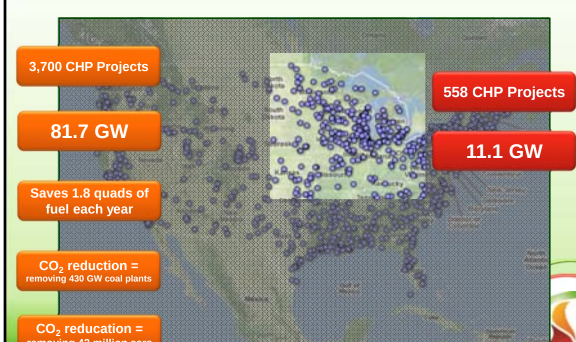
Midwest CHP Capacity Additions: 2005-2011

Source: ICF CHP Database

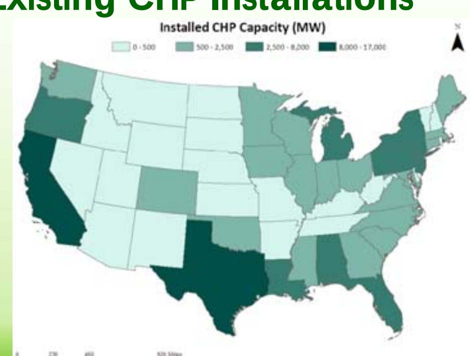
Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Upward pressure on electricity prices
- Favorable natural gas outlook
- Others

CHP Is Used at the Point of Demand

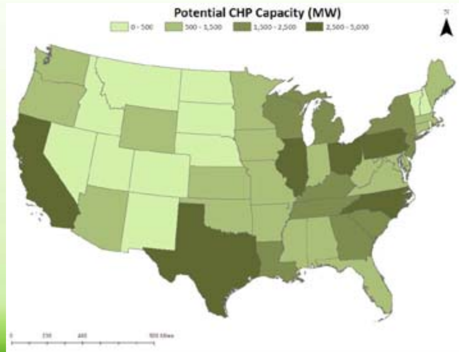


Existing CHP Installations



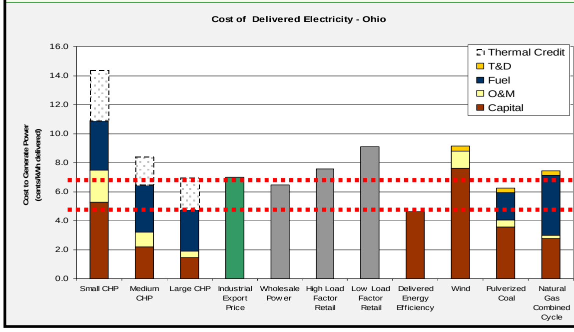
Source: CHP/DHC Country Scorecard: United States (International Energy Agency)

Technical CHP Potential



Source: CHP/DHC Country Scorecard: United States (International Energy Agency)

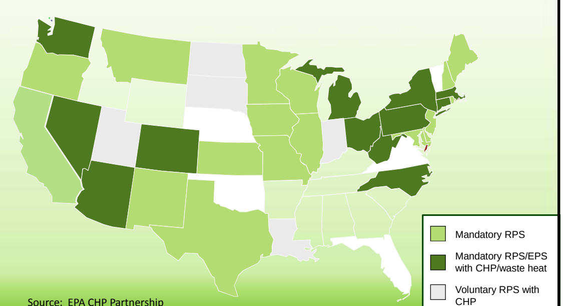
CHP Is a Cost-Effective Source of New Power (example shown for Ohio)



Policy Issues and Trends

- Growing recognition of CHP benefits by state and federal policymakers
- Pending Federal Initiatives
  - Modifying existing 10% CHP ITC
  - Promote rate-basing of behind the meter energy efficiency investments through increased tax incentives
- State Initiatives
  - Seventeen (17) states include CHP or waste energy recovery in portfolio standards

States that Include CHP/WHP in Portfolio Standards



Source: EPA CHP Partnership

16

Pending Regulation/Legislation

- New criteria pollutant emission standards could increase electricity prices and impact non-utility boilers
  - Utility Boiler MACT
  - Other utility rules
  - ICI Boiler MACT
- EPA is proceeding with greenhouse gas emission standards
  - CHP recognized as an efficiency measure
- Energy legislation
  - How will CHP be treated in a national Clean Energy Standard?

Pending Emission Regulations

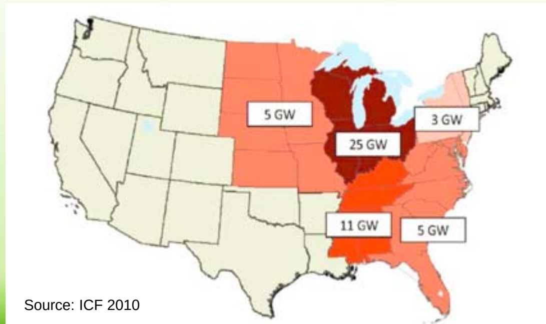
- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40,000 MW of coal-fired electric generation
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)

18

Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

Rules Effecting Utility Sector

("at risk" coal generation by region)



Source: ICF 2010

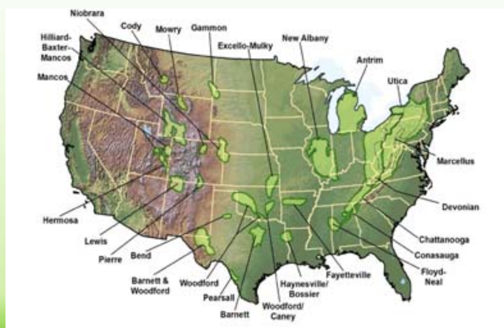
Other Electric Industry Market Indicators

- Supply margins are declining and as demand is recovering
  - Need significant infrastructure investment
  - Estimates at $750 – 900 Billion: exceeds current capitalization
  - Major baseload generation & transmission will be needed
- Transmission congestion is increasing
- Aging transmission infrastructure
  - 70% of transmission lines are 25 years or older
  - 70% of power transformers are 25 years or older
  - 60% of circuit breakers are more than 30 years old

Sources: NERC Transmission Loading Relief Procedure Logs &
"Rising Utility Construction Costs: Sources & Impacts" Edison Foundation/Brattle Group

20

U.S. Shale Gas Resources



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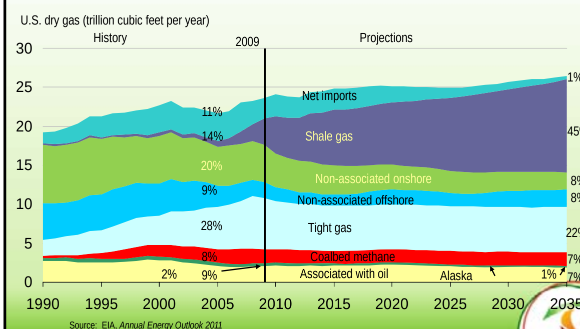
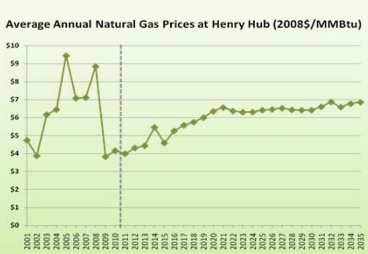
Shale Gas Offsets Declines in Other Resources

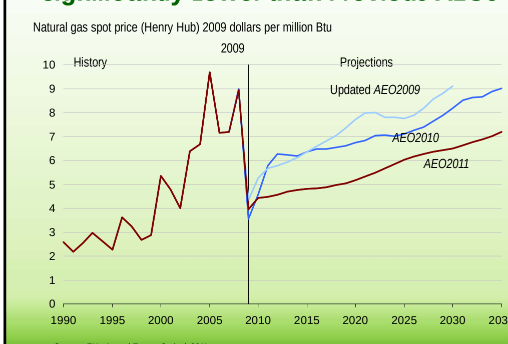


Henry Hub Gas Prices Will Average Between $5 and $7 per MMBtu

- We have more than doubled the U.S. and Canada shale resource to 1,900 Tcf over the prior level of 825 Tcf.
- With 1,500 Tcf of gas in the supply curves at or below $5.00, the current U.S and Canada natural gas consumption level of 27 Tcf per year, could be met for another 55 years at attractive prices.
- The full potential of natural gas from unconventional formations (including shale) will subject to environmental concerns, land access restrictions, and drilling constraints



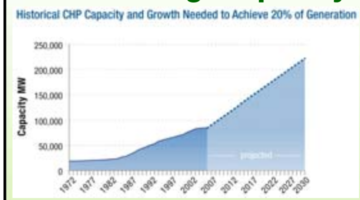
EIA's Projections for Natural Gas Prices are Significantly Lower than Previous AEOs



Re-emphasizing Positive Impacts and Benefits

- **Enhance U.S. energy security** by reducing our national energy requirements and help businesses weather energy price volatility and supply disruptions
- **Advance U.S. climate change and environmental goals** by reducing emissions of CO2 and other pollutants
- **Improve business competitiveness** by increasing energy efficiency and managing costs
- **Increase resiliency of U.S. energy infrastructure** by limiting congestion and offsetting transmission losses
- **Diversify energy supply** by enabling further integration of domestically produced and renewable fuels
- **Improve energy efficiency** by capturing heat that is normally wasted

What if CHP Represented 20% of US Generating Capacity in 2030?



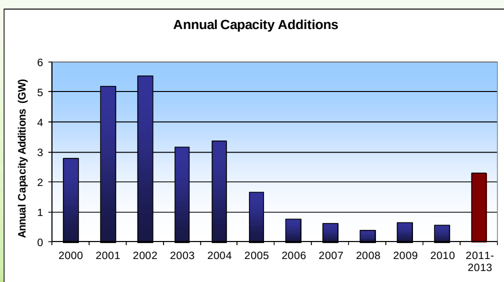
	2006	2030
CHP Capacity	85 GW	241 GW
Annual Fuel Savings	1.9 quads	5.3 quads
Total Annual CO_2 Reduction	248 MMT	848 MMT
Cars Taken off Road (Equivalent)	45 million	154 million

Source: ORNL 2008

- **$234 billion private sector investment**
- **Nearly 1 million new jobs**
- **Reduces fuel use and CO_2 emissions**

Source: ORNL 2008

2,400 MW of Additional CHP Capacity Is in the Pipeline



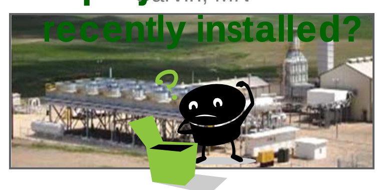
Source: ICF CHP Database

Based on projects under construction or in design phase

What projects have been recently installed?

Northern Border Pipeline Compressor Station (CS-13)

Garvin, MN



5.5 MW WHR CHP System

Installed: 2010

Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

A program at

UIC Energy Resources Center
College of Engineering

A program sponsored by

U.S. Department of Energy
Energy Efficiency & Renewable Energy

CHP Applications: The Ultimate in Energy & Carbon Management (Market Perspective)

John Cuttica
U.S. DOE Midwest Clean Energy Application Center
Univ. of Illinois at Chicago

2011 World Energy Engineering Congress
Friday, October 14, 2011
Session N4 – CHP/Power Generation

UIC Energy Resources Center, College of Engineering
U.S. Department of Energy Clean Energy Application Center Midwest

Combined Heat and Power Concepts

Conventional CHP

The sequential production of useful electric and thermal power from a single dedicated fuel source

Conventional CHP – Topping Cycle CHP

Fuel
Natural Gas
Propane
Biogas
Landfill Gas
Coal
Steam
Waste Products
Others

Prime Mover
Reciprocating Engines
Combustion Turbines
Microturbines
Steam Turbines
Fuel Cells

Generator

Electricity
On-Site Consumption
Sold to Utility

Heat Exchanger

Thermal
Steam
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification

Combined Heat and Power Concepts

Conventional CHP

The sequential production of useful electric and thermal power from a single dedicated fuel source

Waste Heat to Power

Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power. These systems may or may not produce additional thermal energy

Waste Heat to Power CHP – Bottoming Cycle CHP

FREE HEAT

Exhaust Gases

Plant Process

Heat Exchanger
Steam
Hot Water

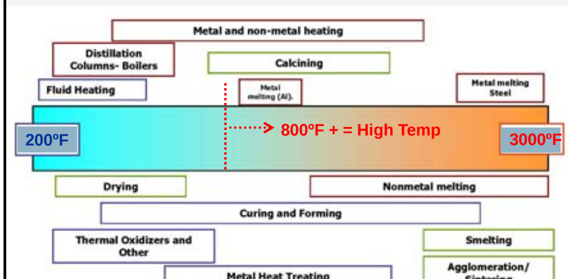
Prime Mover
Steam Turbines
Heat Engine
(Organic Rankine Cycle)

Generator

Electricity
On-Site Consumption
Sold to Utility

Thermal
Steam
Hot Water
Space Heating
Process Heating
Space Cooling
Process Cooling
Dehumidification

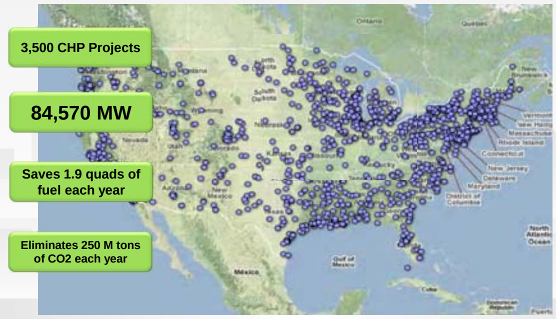
Industrial Heat Recovery Opportunities



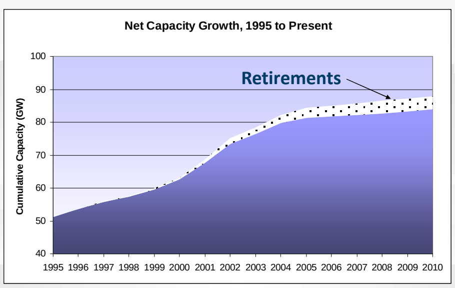
Waste Heat to Power Drivers

- WHP = No fossil fuel (capturing waste energy)
- WHP = No incremental emissions
- Like conventional CHP, power generated at load (DG)
- Base load generation – industrials operate 24/7
- Conventional equipment, little technical risk
- High temp WHP (> 800ºF) is low hanging fruit industrial
- WHP qualifies under RPS in 11 states

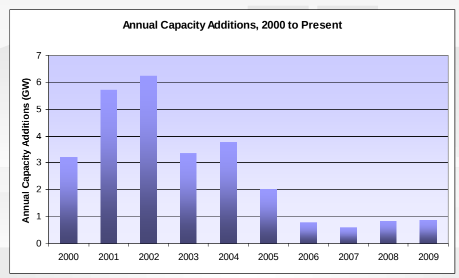
CHP Is Used at the Point of Demand



Over 35 GW of New CHP Capacity Has Been Installed Since 1995



New CHP Capacity Additions Have Been Below 1 GW/Year Since 2006



Why the Downturn in the CHP Market?

- Excess generation capacity in many regions
- Changes in wholesale power market rules
- Lingering effect of volatile natural gas prices
- Price (spark spread) uncertainty
- Financial crisis

Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Upward pressure on electricity prices
- Favorable natural gas outlook
- Others

Federal Support for CHP

- Investment Tax Credit
  - 10% on first 15 MW
  - 5 year depreciation
- Option to claim ITC through a grant program (ARRA)
- House and Senate Proposals
  - ITC eligibility from 15 to 25 MW
  - 30% ITC (high efficiency projects)

Pending Emission Regulations

- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40,000 MW of coal-fired electric generation
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)

Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

14

Recent State Policies

- **Massachusetts:** Alternative Portfolio Standard requires CHP to be 4% of utility sales by 2018;
- **New Jersey:** Right of Way Law: Sell thermal, have right to wheel power
- **North Carolina:** CHP eligible for 35% renewable investment tax credit up to $2.5M
- **Wisconsin:** Favorable biogas CHP selling rates to utilities (i.e. WE Energies 15.5¢/kWh on-peak)

RPS

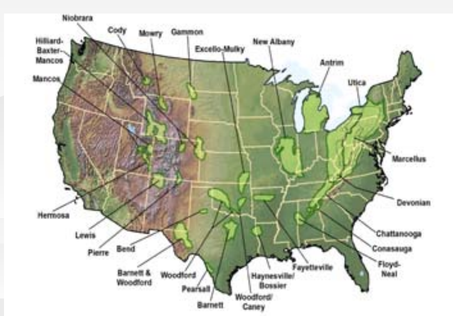
- 11 states include WHP as an eligible technology in their state renewable portfolio standard

Recent State Policies

- **California:** enacted a CHP Feed-in-Tariff (FIT) for systems less than 20 MW and with excess power (AB 1613)
  - Add 4 GW of CHP by 2020 (Global Warming Solutions Act)
- **Connecticut:** (2006-2009) Incentive of $450/kW, capital cost grants
  - Minimum of 50% energy efficiency
  - State to avoid federally mandated congestion charges
- **Texas:** CHP feasibility study required for all critical government infrastructures prior to construction or major renovation (HB 1831, HB 4409)
- **Arizona:** CHP is included in new Electric Utility EERS (20% savings by 2020) AND in Gas Utility Energy Efficiency Rule and Standard (6% savings by 2020)

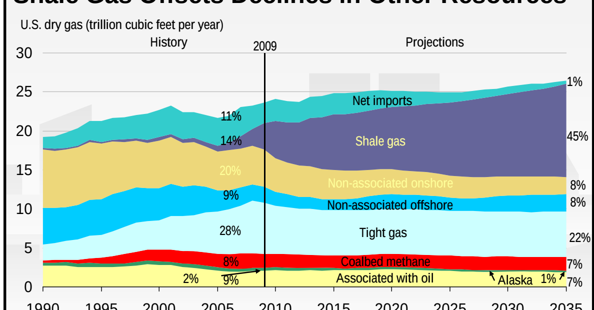
16

U.S. Shale Gas Resources



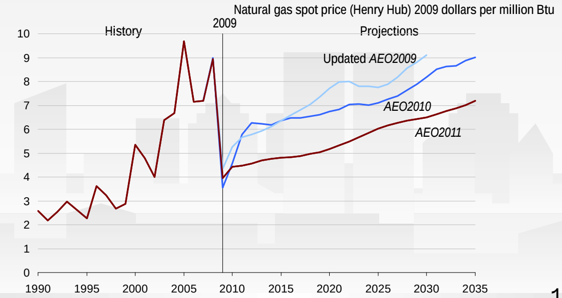
17

Shale Gas Offsets Declines in Other Resources



Source: EIA, *Annual Energy Outlook 2011*

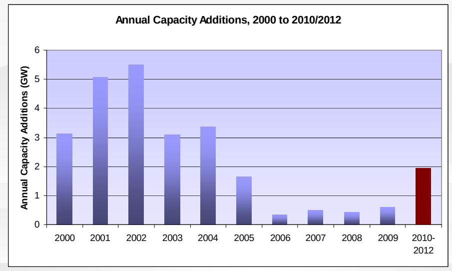
EIA's Projections for Natural Gas Prices are Significantly Lower than Previous AEOs



Source: EIA, *Annual Energy Outlook 2011*

19

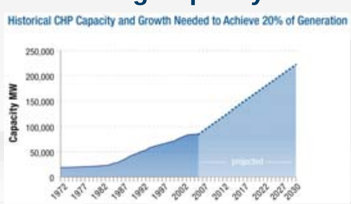
Almost 2,000 MW of Additional CHP Capacity Is Expected by 2012



Source: ICF CHP Database

Based on projects under construction or in design phase

What if CHP Represented 20% of US Generating Capacity in 2030?



- $234 billion private sector investment
- Nearly 1 million new jobs
- Reduces fuel use and CO_2 emissions

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CHP Capacity	85 GW	241 GW
Annual Fuel Savings	1.9 quads	5.3 quads
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Source: ORNL 2008

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22

Industrial Cogeneration / CHP

AIChE
2011 Midwest Regional Conference

November 11, 2011
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

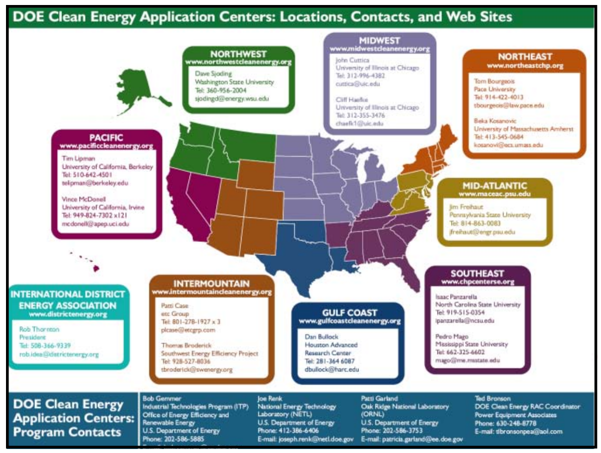
Regional Clean Energy Application Centers (RACs)

- **U.S. DOE Midwest Clean Energy Application Center**
- Originally established in 2001 by DOE to support DOE CHP Challenge
- Today the center promotes the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Targeted education and outreach**
  - **Policy education**
  - **Project support**

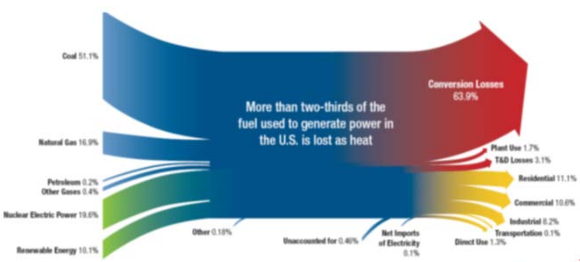
"Clean Energy" Technologies

Conventional CHP	Waste Heat Recovery	District Energy CHP
		
The sequential production of useful electric and thermal power from a single dedicated fuel source	Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power. These systems may or may not produce additional thermal energy	Central heating & cooling plants that incorporate electricity generation along with thermal distribution piping networks for multiple buildings (campus / downtown area)

3

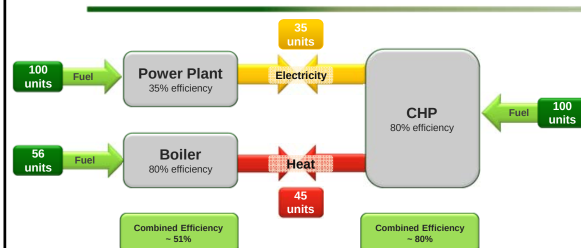


Fuel Utilization by U.S. Utility Sector



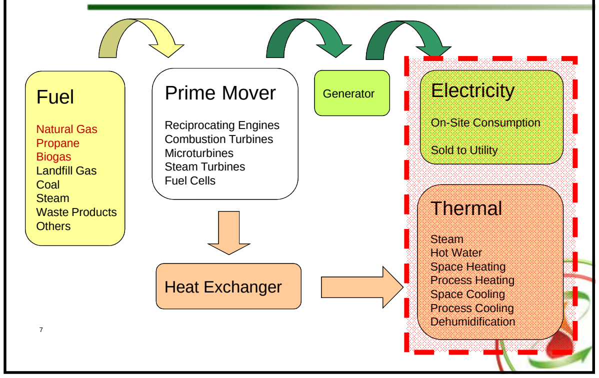
The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

CHP Role in Our Energy Future

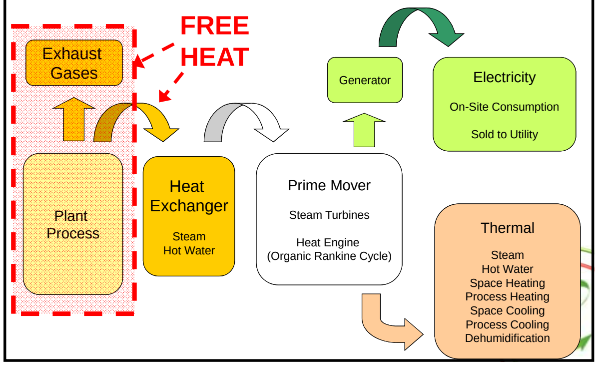


CHP provides efficient, clean, reliable, affordable energy – today and for the future.

“Conventional CHP” Diagram
(i.e. topping cycle CHP)



Waste Heat Recovery CHP
(i.e. bottoming cycle CHP)



What Makes A Good CHP Application?

- Good Coincidence Between Electric and Thermal Loads
- Central Heating/Cooling System
- Large Cost Differential Between Electricity (Grid) and CHP Fuel --- “Spark Spread”
- Long Operating Hours
- Economic Value of Power Reliability is High
- Installed Cost Differential Between a Conventional and a CHP System (*smaller is better*)
- Renovation and/or expansion of existing facilities

Attractive CHP Markets

Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutions
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agriculture
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

Industrial CHP

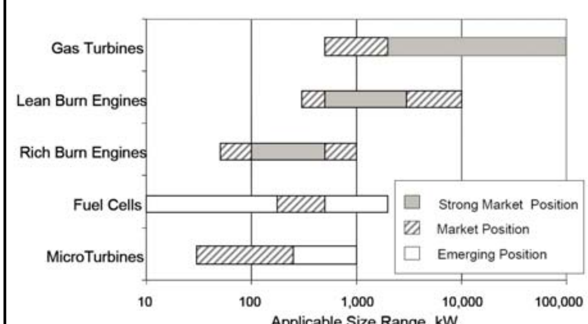
> Industrial applications of CHP generally consist of electricity and heat production with minimal cooling

> Systems much larger than commercial applications

> Fuels may be natural gas, coal, or some industrial waste product

> Gas is often used as supplementary fuel, particularly for industrial waste systems

CHP Technology Size Coverage



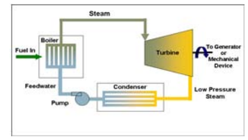
Gas Combustion Turbines

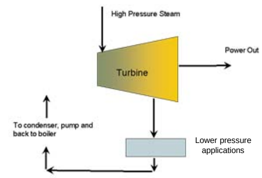
– Similar to a jet engine as a stream of inlet air is compressed, heat is added and then the high pressure outlet stream turns a reaction turbine at high speed which in turn drives a generator
– Generally used for larger applications (>4MW)
– Good when high pressure steam is required

Source: Industrial Turbine by Siemens Westinghouse
www.siemenswestinghouse.com

Steam Turbine

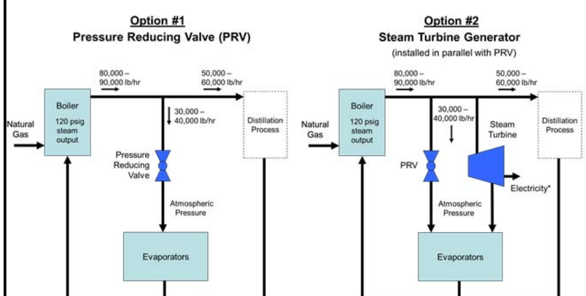
- One of the oldest prime mover technologies still in use
- Steam turbines extract heat from steam and transform it into mechanical work by expanding the steam from high pressure to low pressure
- Size range: <1 MW to >500 MW
- Two types of steam turbines: condensing and backpressure



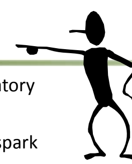


Backpressure Turbine Example

East Kansas Agri-Energy, LLC



Current Market Conditions



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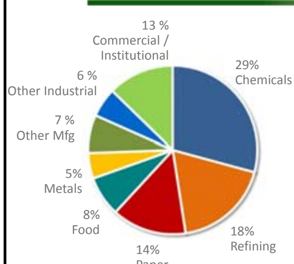
- Biomass and opportunity fuels in Southeast, Midwest and Mountain
- "Hot" applications: universities, hospitals, waste water treatment, manufacturing, other institutional applications
- Growing interest in waste heat to power applications
- Can Smart Grid provide opportunities
- Project inquiries increasing

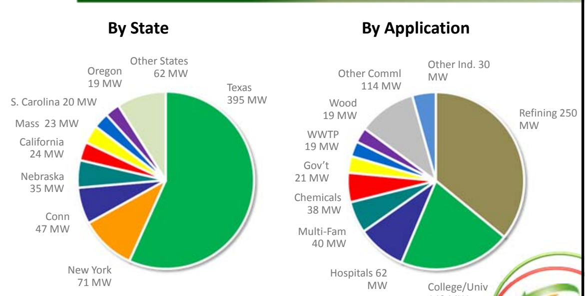
Existing CHP Capacity Is Now at 82 GW



- 81.7 GW of installed CHP at 3,700 industrial and commercial facilities (2011)
- Avoids **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **240 million metric tons of CO_2** per year
- CO_2 reduction equivalent to removing **42 million cars** from the road
- CO_2 reduction equivalent to eliminating **43 1,000 MW coal power plants**

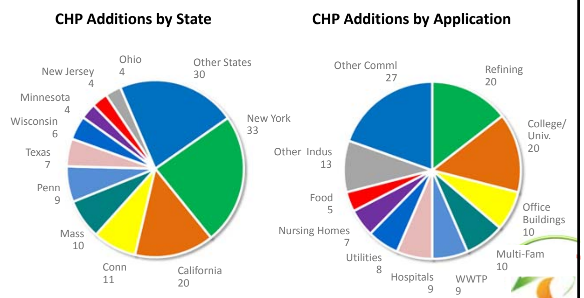
Source: ICF CHP Database

CHP Additions 2010-2011 (696 MW)



Source: ICF CHP Database

CHP Additions 2010-2011 (138 Sites)



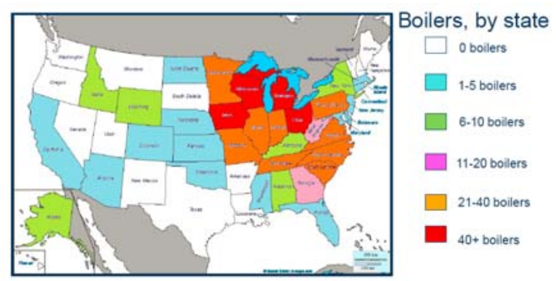
Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Upward pressure on electricity prices
- Favorable natural gas outlook
- Others

Pending Regulation/Legislation

- New criteria pollutant emission standards could increase electricity prices and impact non-utility boilers
  - Utility Boiler MACT
  - Other utility rules
  - ICI Boiler MACT
- EPA is proceeding with greenhouse gas emission standards
  - CHP recognized as an efficiency measure
- Energy legislation
  - How will CHP be treated in a national Clean Energy Standard?

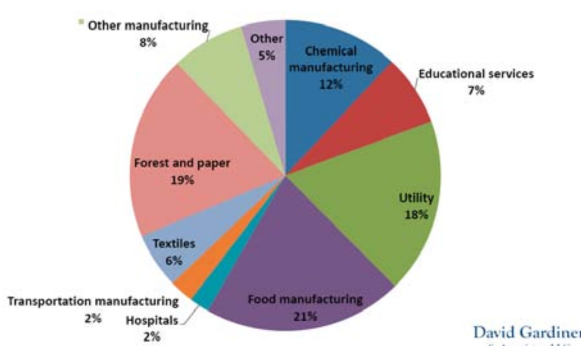
Coal-Fired Industrial Boiler Locations (540 total)



22

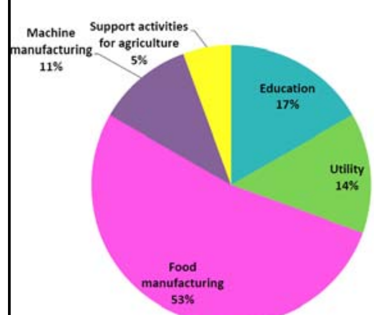
Source: EPA, "Emissions Database for Boilers and Process Heaters"

Economy-Wide Industrial Breakdown of Coal Fired Boilers



David Gardiner & Associates, LLC

Example Breakdown By Industry, Iowa (n=36)



If each of these 36 boilers switched to natural-gas-fired CHP, there would be statewide savings of roughly 752 MW

David Gardiner & Associates, LLC

Pending Emission Regulations

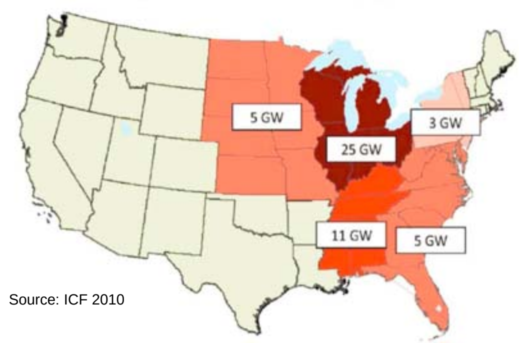
- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40 GW of coal-fired elec gen
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)
- **Other factors impacting electric utilities**
  - supply margins and declining as demand is recovering
  - aging transmission infrastructure

25

Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

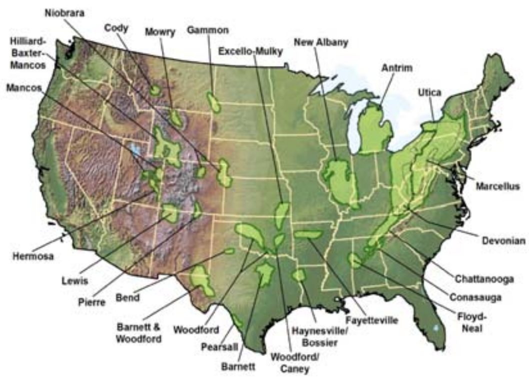
Rules Effecting Utility Sector

(“at risk” coal generation by region)

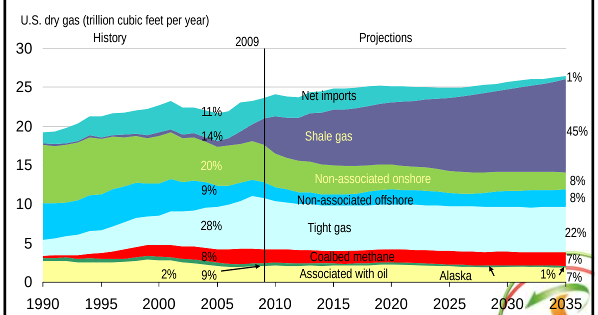


Source: ICF 2010

U.S. Shale Gas Resources



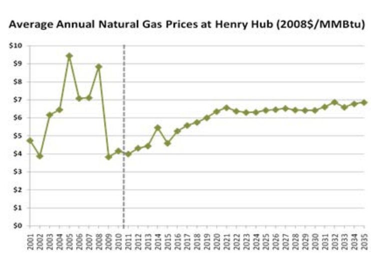
Shale Gas Offsets Declines in Other Resources



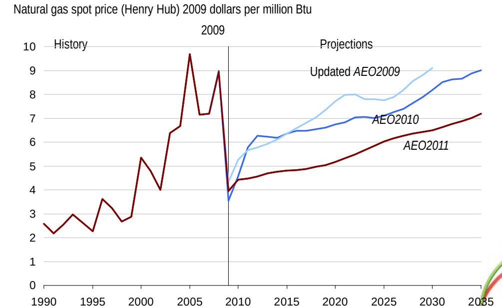
Source: EIA, *Annual Energy Outlook 2011*

Henry Hub Gas Prices Will Average Between $5 and $7 per MMBtu

- We have more than doubled the U.S. and Canada shale resource to 1,900 Tcf over the prior level of 825 Tcf.
- With 1,500 Tcf of gas in the supply curves at or below $5.00, the current U.S and Canada natural gas consumption level of 27 Tcf per year, could be met for another 55 years at attractive prices.
- The full potential of natural gas from unconventional formations (including shale) will subject to environmental concerns, land access restrictions, and drilling constraints



EIA’s Projections for Natural Gas Prices are Significantly Lower than Previous AEOs



Source: EIA, *Annual Energy Outlook 2011*

Positive Impacts and Benefits

- **Enhance U.S. energy security** by reducing our national energy requirements and help businesses weather energy price volatility and supply disruptions
- **Advance U.S. climate change and environmental goals** by reducing emissions of CO_2 and other pollutants
- **Improve business competitiveness** by increasing energy efficiency and managing costs
- **Increase resiliency of U.S. energy infrastructure** by limiting congestion and offsetting transmission losses
- **Diversify energy supply** by enabling further integration of domestically produced and renewable fuels
- **Improve energy efficiency** by capturing heat that is normally wasted

Thank You

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Promoting CHP, District Energy, and Waste Heat Recovery

A program at

UIC Energy Resources Center
College of Engineering

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Energy Efficiency & Renewable Energy

Combined Heat & Power (CHP)
In the Food Processing Industry

When Does It Make Sense?

AIChE
2011 Midwest Regional
Conference

November 11, 2011
John Cuttica

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

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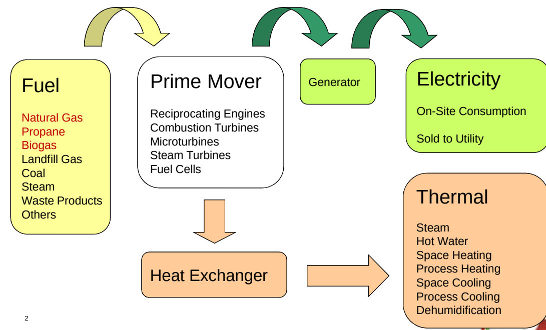
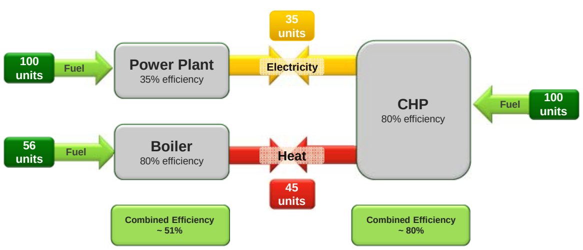
Combined Heat and Power (CHP) Diagram



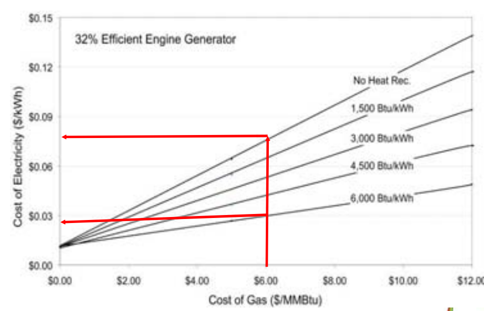
2

CHP Role in Our Energy Future



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

Financial Impact of CHP Heat Recovery

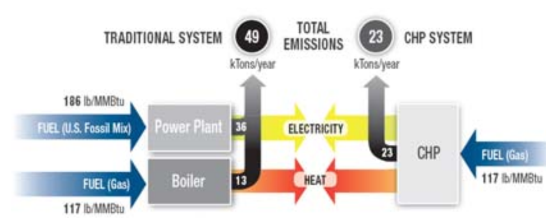


Best Practices for CHP

- What drives system efficiency in a CHP system??
  - Ability to utilize as much of the thermal energy as possible + coincidence between electric and thermal loads
- To ensure high system efficiency, how would you size a CHP system??
  - Size for thermal load and generate electricity when operating to meet the thermal load
- What maximizes the effectiveness of a CHP system??
  - Long operating hours + max efficiency = max savings/effectiveness

5

CHP Role in Our Environmental Future
Impact on Carbon Emissions



Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

6

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

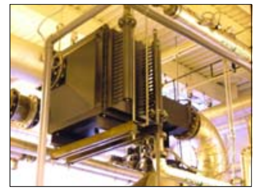
Normal CHP Configuration

- CHP Systems are Normally Installed in Parallel with the Electric Grid
  (CHP does not replace the grid)
- Both the CHP and Grid Supply Electricity to the Customer

What are the Customer Benefits of CHP?

CHP does not make sense in all applications, but where it does make technical and economic sense, it will provide:

- **Lower Energy Costs**
- **Reduced Energy Consumption**
- **Increased Electric Reliability**
- **Standby Power**
- **Improved Environmental Quality**
- **Public Relations Benefits**



Food Processing Industry

- One of the largest mfgr. sectors in North America
- Over 10,000 facilities in the U.S.
- 5th largest Industrial user of energy
- Approx. 13th in mfgr. output in the U.S.
- Over $200 Billion industry
- U.S. Industry accounts for approx. 26% of the world output

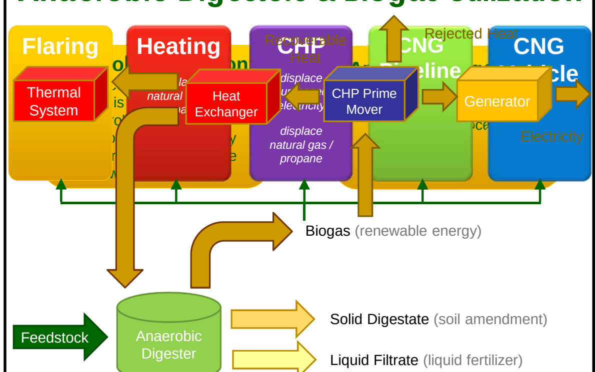
9

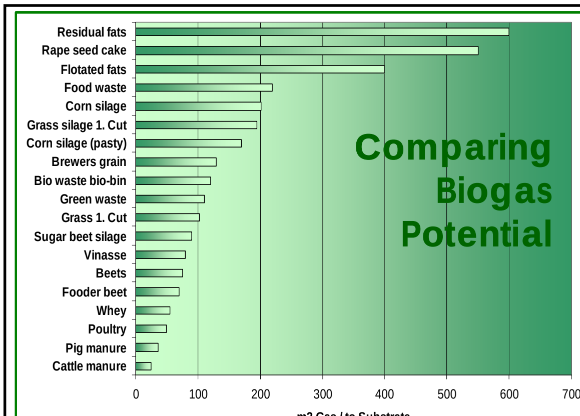
CHP Drivers for Food Processing

- Energy Intense Industry
- Food Safety --- large thermal energy needs
- Power Reliability --- sustainability, avoid power loss costs
- More Efficient Water Usage --- waste water management
- Environmental Stewardship --- good neighbor
- Year Round Operation

10

Anaerobic Digesters & Biogas Utilization





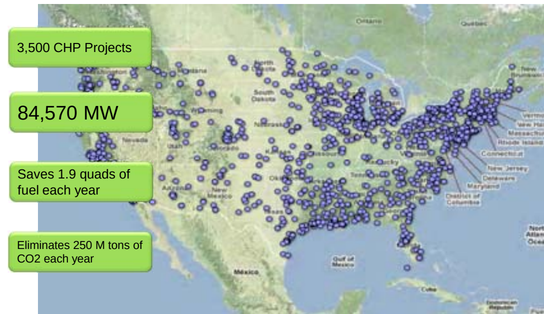
Source: Engineered Storage Products Inc.

Co-Digesting (Mixing Feedstocks)

- Co-digesting different organic wastes can increase biogas production, but care must be taken to understand the characteristics of the combined feedstock.
  - Can effect the quality of the effluents
  - Can impact permitting requirements
  - Is the feedstock you expected the feedstock you actually received
  - Not understanding the characteristics and/or volume added can severely damage the digester

13

CHP Is Used at the Point of Demand



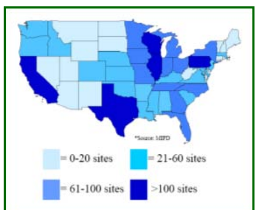
CHP in the Food Industry

235 existing sites – 6.3 GW

Existing Applications

Sector	Gen. (MW)	Sites
Fruits & Vegetables	2,731	30
Grain & Corn Processing	969	26
Sugar, Candy, Gum, Nuts	707	43
Seafood, Ice, Prepared Foods	509	15
Beverages	434	30
Dairy Products	149	
Oils	122	16
Meat	94	10
Bakery	27	16

Technical Potential



Frito-Lay Killingly

4.5 MW Natural Gas Fired Combustion Turbine

- Solar Centaur 50 gas turbine with HRSG
- Produces 325 psig steam up to 60,000 lbs/hr
- NOx levels < 2.5 ppm
- Can operate independent of grid
- Provides about 90% of electrical demand and 80% of the steam load
- Plant processes > 250,000 lbs/day corn & potatoes for snack foods

16

MillerCoors Brewery

20 MW Steam Fired Turbines

- Three GE extraction steam turbines, 800psig in – 400psig steam refrigeration and 50psig process
- 20 MW base and 20 MW peaking
- Brewery produces 1.5 million gallons of beer per day
- Half the pollution of conventional electric power plant

17

New Belgium Brewery

290 kW Anaerobic Digester Biogas CHP System

- On site waste water treatment with anaerobic digestion
- CHP starts when biogas storage nears 100% capacity and turns off at about 20% capacity (10 to 15 hours per day)
- Waste heat used to heat the digester (summer heat is rejected)
- Justified on: City waste water cost reduction; renewable energy production; energy cost savings; environmental sustainability

18

W2E Organic Power

Community Digester CHP System

- **Location:** Columbia, SC
- **Feedstocks:** 48,000 tons/yr food waste (70%), grease solids and liquids (25%); yard trimmings (5%)
- **Status:** long term feedstock contracts secured, permitted site, PPA's in place, construction underway
- **Digester Partner:** Eisenmann
- **Total Project Cost:** $25M
- **Start Up:** Fall 2012

Source: Eisenmann

Thank You

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A program at

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A program sponsored by

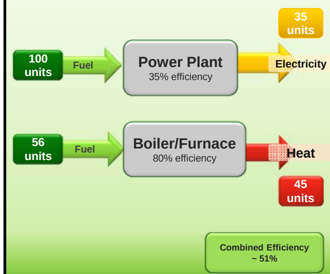
U.S. Department of Energy
Energy Efficiency & Renewable Energy

Introduction to Combined Heat & Power (CHP) and Waste Heat Recovery (WHR) Technologies

Congressional Educational Briefing
November 17th, 2011

John Cuttica
Energy Resources Center
University of Illinois at Chicago

Traditional Energy Systems



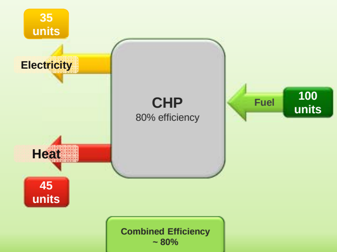
Combined Heat and Power

Conventional CHP

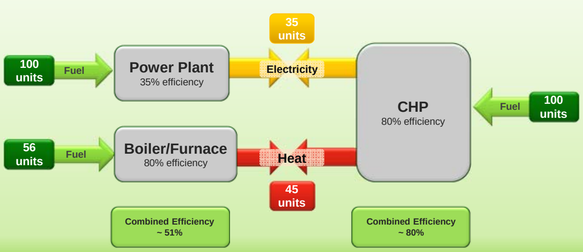
The onsite sequential production of useful electric and thermal power from a single dedicated fuel source

3

Conventional CHP System



Traditional Energy System vs. Conventional CHP System



Combined Heat and Power

Conventional CHP

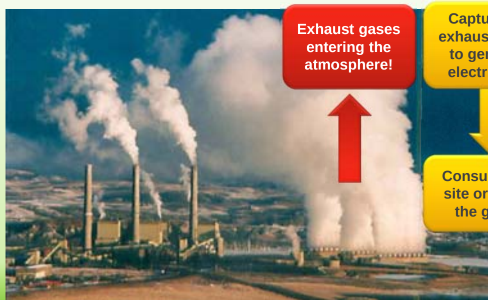
The sequential production of useful electric and thermal power from a single dedicated fuel source

Waste Heat Recovery

Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power.

6

Another Form of CHP = Waste Heat Recovery



Exhaust gases entering the atmosphere!

Capture the exhaust gases to generate electricity!!!

Consume on-site or sell to the grid…

Positive Impacts and Benefits

- **Enhance U.S. energy security** by reducing our national energy requirements and help businesses weather energy price volatility and supply disruptions
- **Improve business competitiveness** by increasing energy efficiency and managing costs (maintain jobs)
- **Increase resiliency of U.S. energy infrastructure** by limiting congestion and offsetting transmission losses
- **Diversify energy supply** by enabling further integration of domestically produced and renewable fuels
- **Improve energy efficiency** by capturing heat that is normally wasted

CHP Is Used at the Point of Demand

3,700 CHP Projects

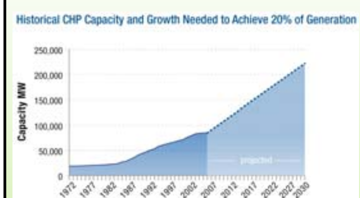
81,700 MW

Saves 1.8 quads of fuel each year

Eliminates 240 M tons of CO2 each year

CHP/WHR is an Underutilized Resource!!!

What if CHP Represented 20% of US Generating Capacity in 2030?



- $234 billion private sector investment
- Nearly 1 million new jobs
- Reduces fuel use and CO_2 emissions

	2010	2030
CHP Capacity	81.7 GW	241 GW
Annual Fuel Savings	1.8 quads	5.3 quads
Total Annual CO2 Reduction	240 MMT	848 MMT
Cars Taken off Road (Equivalent)	42 million	154 million

Source: ORNL 2008

Getting to 20% by 2030

- Good Federal Policies
- Favorable Recognition at the State Level
- Accepted (Tolerated) by Electric Utilities
- Educating End Users & Federal/State Representatives
- Technology Advancements

Thank You

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UIC UNIVERSITY OF ILLINOIS AT CHICAGO Energy Resources Center COLLEGE OF ENGINEERING

CHP using Biogas & Biomass Fuels

Distributed Electricity and Renewable Electricity Panel

Illinois 25x'25
Renewable Energy Forum

November 18, 2011
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

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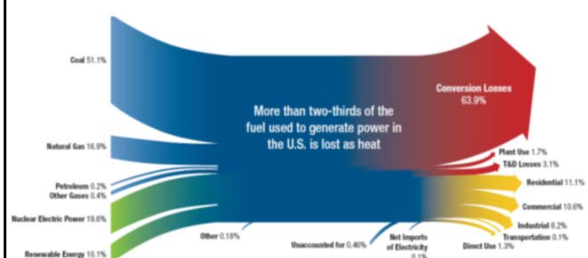
Regional Clean Energy Application Centers (RACs)

- **U.S. DOE Midwest Clean Energy Application Center**
- Originally established in 2001 by DOE to support DOE CHP Challenge
- Today the center promotes the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Targeted education and outreach**
  - **Policy education**
  - **Project support**

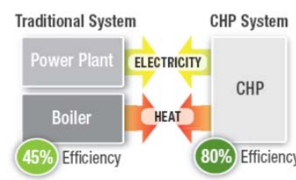
Fuel Utilization by U.S. Utility Sector



The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

Key Part of Our Energy Future is CHP

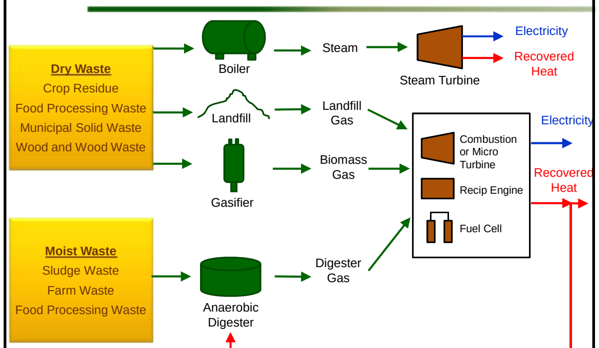
- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- Recycles the thermal energy for
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

CHP Using Biomass/Biogas Fuels



Source: Combined Heat and Power Market Potential for Opportunity Fuels

Positive Impacts and Benefits

- **Enhance U.S. energy security** by reducing our national energy requirements and help businesses weather energy price volatility and supply disruptions
- **Advance U.S. climate change and environmental goals** by reducing emissions of CO2 and other pollutants
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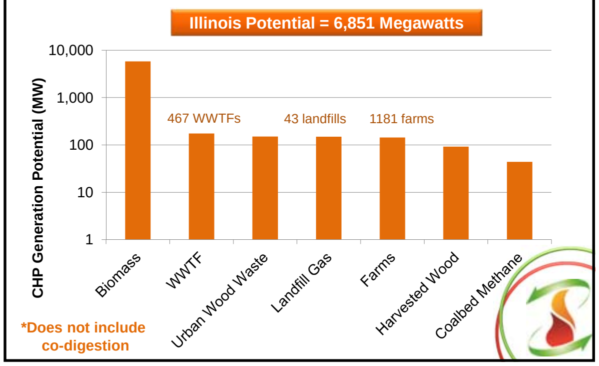
Illinois Biogas/Biomass Potential (MW)



*Does not include co-digestion

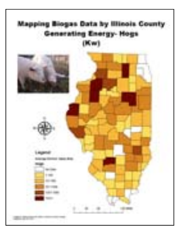
Illinois DCEO Biogas/Biomass Program

- DCEO Program managed by UIC/ERC
  - Six (6) projects awarded totaling $580K
  - Feasibility Studies: $2,500
  - Biogas to Energy Systems: $225,000 (up to 50%)
  - Biomass to Energy Systems: $500,000 (up to 50%)

Funded Projects
1. Agriculture Watershed Institute (AWI)
2. Hunter Haven Farms
3. John Deere Harvester Works
4. Packer Engineering
5. Village of Fox Lake - WWTF
6. WWTF(contract pending)

Illinois Activity Development

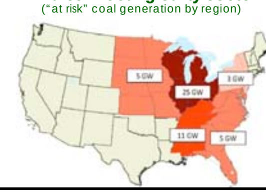
- Illinois Electric Cooperatives showing interest in biogas CHP applications (AIEC)
  - 2009 Workshop (Springfield)
  - 2010 Workshop (Onarga)
  - 2011 Biogas Feedstock Study
  - 2012 Workshops Planned (Effingham, Macomb)
- EPA Region 5 Interest in Illinois Community Digester



Market Development – Emerging Drivers

- Growing recognition of biogas, biomass, & CHP benefits by state and federal policymakers
- Upward pressure on electricity prices
- Emissions regulations impacting non-utility boilers
- Favorable natural gas outlook
- Others

Rules Effecting Utility Sector
("at risk" coal generation by region)



Thoughts on Biogas/Biomass CHP Policy Barriers

- Federal policy activities
  - Renewable ITC going away (applications due 12/31/11)
  - Protecting Farm Bill Section 9007 (REAP)
- Potential state policy actions
  - Property tax exemptions (ex: Wisconsin)
  - Streamline interconnection policies
  - Long term Power Purchase Agreements
  - Greater recognition in RPS

Thank You

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Industrial/Commercial/Institutional Boiler MACT

Combined Heat and Power
A Technical & Economic Compliance Strategy

January 17, 2012
John Cuttica, Midwest Clean Energy Application Center
Bruce Hedman, ICF International

ICI Boiler MACT

- Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters (excludes any unit combusting *solid waste*)
- Major source is a facility that emits:
  - 10 tpy or more of any single Hazardous Air Pollutant, or 25 tpy or more of total HAPs
- Emissions limits applicable to new and existing units > 10 MMBtu/hr
  - Mercury (Hg)
  - Particulate Matter (PM) as a surrogate for non-mercury metals (alternative limits for total selective metals (TSM))
  - Hydrogen Chloride (HCl) as a surrogate for acid gases
  - Carbon Monoxide (CO) as a surrogate for non-dioxin organics)

Impacts of the Boiler MACT

- Compliance straight forward for natural gas fired units (tune-ups)
- Rule significantly impacts oil, coal and biomass boilers and process heaters
- Controls are potentially required for Hg, PM, HCl and CO
- Emissions limits must be met at all times except for start-up and shutdown periods
- Also includes monitoring and reporting requirements
- Limits are economically challenging for oil and coal units

Compliance Options

- The specific emissions limits depend on fuel type and combustor design, but all pollutants within a group (Hg, PM, HCl, CO) can be controlled with the same measures
- Required compliance measures for any unit depend on current emissions levels and control equipment already in place
- Fabric filters and activated carbon injection are the primary control devices for Hg
- Electrostatic precipitators may be required for units that need additional control for PM or TSM
- Wet scrubbers or fabric filters with dry injection are primary controls for HCl
- Tune-ups, replacement burners, combustion controls and oxidation catalysts for CO and organic HAPs control

Potential Opportunity for CHP?

- Compliance with MACT limits will be expensive for many coal and oil units - some users will consider switching to natural gas
- Potential opportunity to move to natural gas CHP
  - Trade off of benefits and additional costs
  - Economics now based on incremental investment over compliance costs
- Affected units (EPA ICR Database – all facilities)
  - 616 coal units ($2.7 Billion capital cost)
  - 903 liquid fuel units ($1.7 Billion capital cost)
  - 508 biomass units ($0.6 Billion capital cost)

Affected Industrial/Commercial/Institutional Boilers

	EPA ICR Data	
Number of Facilities	652	
Fuel Class	# Units	Capacity (MMBtu/hr)
Coal	495	131,526
Heavy Liquid	287	38,020
Light Liquid	202	19,926
Biomass	442	97,131
Process Gas	78	21,146
Total	**1,504**	**307,749**

Excludes non-continental liquid, Gas 1 (NG/RG) and limited use units

Facilities with Affected Boilers by Region

Region	Number of Facilities	Number of Coal Units	Number of Oil Units	Number of Biomass Units	Number of Process Gas Units
Midwest	**187**	**242**	**114**	**55**	**53**
Southeast	**270**	**153**	**200**	**248**	**7**
Mid-Atlantic	56	68	58	14	18
North East	37	11	58	16	0
Mountain	8	10	7	0	0
Northwest	45	7	20	55	0
Gulf Coast	39	3	13	46	0
Pacific	10	1	19	8	0
Total	**652**	**495**	**489**	**442**	**78**

Includes only Industrial/Commercial/Institutional units

Affected Coal, Oil, and Process Gas Boilers by Industry (drops biomass boilers)

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)
Mining (except Oil and Gas)	7	14	4,767
Food Manufacturing	64	134	27,745
Textiles	13	28	1,851
Wood and Furniture	18	27	2,508
Paper Manufacturing	87	149	48,566
Petroleum Refining	19	65	10,491
Chemical Manufacturing	74	199	34,347
Plastics and Rubber Manufacturing	22	54	4,500
Primary Metal Manufacturing	20	107	35,048
Transportation Equip. Manufacturing	23	80	11,151
Other Industrial	11	28	8,877
Educational Services	26	68	10,400
National Security and Int'l Affairs	9	64	4,695
Other Institutional	17	45	5,673
Total	410	1062	210,618

Includes only industrial, commercial and institutional boilers

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	242	62,071
Heavy Liquid	63	10,351
Light Liquid	51	4,461
Process Gas	53	14,820
Total	**409**	**91,705**

Includes only coal, oil, and process gas industrial, commercial and institutional boilers (drops out biomass boilers)

Affected Coal, Oil, and Process Gas Boilers in the Midwest

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)	Existing CHP Sites	Existing CHP Capacity (MW)
Mining and Agriculture	5	14	4,397	2	134
Food Processing	**42**	**89**	**20,299**	**19**	**676**
Wood Products	4	8	421	0	0
Paper Products	**29**	**55**	**13,716**	**19**	**739**
Refining	5	10	857	1	40
Chemicals	**21**	**48**	**7,135**	**2**	**6**
Plastic and Rubber Products	5	13	781	0	0
Primary Metals	**9**	**64**	**23,529**	**5**	**547**
Transportation Equipment	**12**	**40**	**6,840**	**1**	**3**
Other Industrial	11	27	6,787	2	24
Colleges/Universities	13	34	6,294	9	268
Hospitals	1	3	191	1	1
Other Institutional	2	4	456	0	0
Total	159	409	91,705	61	2,439

Affected Boilers in the Southeast

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	153	39,353
Heavy Liquid	110	11,716
Light Liquid	90	7,422
Process Gas	7	1,322
Total	**360**	**59,814**

Includes only coal, oil, and process gas industrial, commercial and institutional boilers (drops out biomass boilers)

Affected Coal, Oil, and Process Gas Boilers in the Southeast

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)	Existing CHP Sites	Existing CHP Capacity (MW)
Food Processing	10	16	2,258	2	31
Beverage and Tobacco	3	5	1,123	2	25
Textile Mills	8	16	1,387	0	0
Wood Products	8	10	412	0	0
Paper Products	**36**	**60**	**24,612**	**25**	**1,706**
Chemicals	**31**	**102**	**17,028**	**6**	**301**
Plastics and Rubber Products	**11**	**30**	**2,354**	**0**	**0**
Transportation Equipment	4	16	1,794	0	0
Other Industrial	8	24	2,801	1	40
Colleges and Universities	6	12	1,511	3	44
National Security and Int'l Affairs	6	56	3,623	0	6
Other Institutional	5	13	910	0	0
Total	136	360	59,813	39	2,152

CHP as a Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler

Example – Affected Facility in Pennsylvania

- Four existing coal boilers at the site

Boiler Capacity	Fuel	Annual Hours	Existing Controls
10.2 MMBtu/hr	Coal	8000	Cyclone
17.0 MMBtu/hr	Coal	8000	Cyclone
20.4 MMBtu/hr	Coal	8000	Cyclone
20.4 MMBtu/hr	Coal	4000	Cyclone

  - Average steam demand of 40 MMBtu/hr
  - Pays $0.08/kWh for power and $3.10 MMBtu for coal
- Projected compliance costs
  - Additional controls required for PM, HCl and CO
  - $4,100,000 Capital cost
  - $723,000 annual operating and maintenance costs

Comparative Steam Costs

	Existing Coal Boilers	New Natural Gas Boilers	Natural Gas CHP
Steam Capacity, MMBtu/hr	60	60	60
Avg Steam Demand, MMBtu/hr	40	40	40
Boiler Efficiency	76%	80%	N/A
CHP Capacity, MW	0	0	8
CHP Electric Efficiency	N/A	N/A	29%
Fuel Use, MMBtu/year	416,842	396,000	752,993
Annual Fuel Cost	$1,292,211	$2,772,000	$4,901,985
Annual O&M Cost	$1,242,189	$502,920	$1,154,664
Annual Compliance O&M	$723,000		
Annual Electric Savings			($4,692,557)
Annual Steam Operating Costs	$3,257,400	$3,274,920	$1,364,092

Based on delivered coal price of $3.10/MMBtu, natural gas price of $7.00/MMBtu, and industrial electricity price of $0.08/kWh (CHP avoids 90% of retail rate)

CHP Paybacks

		Existing Coal Boilers	Natural Gas Boilers	Natural Gas CHP
1	Annual Steam Operating Costs	$3,257,400	$3,274,920	$1,364,092
2	Annual Operating Savings (coal compliance)			$1,893,308
3	Annual Operating Savings (gas boiler)			$1,910,828
4	Installed Costs	$4,103,000	$2,643,750	$16,000,000
5				
6	CHP Incremental costs (coal compliance)			$12,000,000
7	CHP Payback (coal compliance)			6.3 years
8				
9	CHP Incremental costs (gas boiler)			$13,355,000
10	CHP Payback (gas boiler)			7.0 years

CHP Benefits

- Compliance with MACT
- Investment versus Operating Cost
- Payback between 6 and 7 years
- Increase Electric Service Reliability
- Enhance Economic Competitiveness
- Reduce Carbon Emissions

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	227	495	131,526	13,155
Heavy Liquid	120	287	38,020	3,803
Light Liquid	91	202	19,926	1,993
Process Gas	14	78	21,146	2,115
Total	452*	1062	210,618	21,065

*Some facilities are listed in multiple categories due to multiple fuel types; there are 410 affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

Boiler MACT Assistance Available

- List of available state incentives for emissions controls, energy efficiency measures, boiler replacements/tune-ups, CHP, and energy assessments (DOE)
  - http://www1.eere.energy.gov/industry/states/pdfs/incentives_boiler_mact.pdf
  - Will be updated when final reconsidered rule signed
- Extensive assistance materials for Area Source rule available from EPA
  - Tune-up guidance, fast facts, brochure, table of requirements, small entity compliance guide, etc.
  - www.epa.gov/ttn/atw/boiler/boilerpg.html
- DOE technical assistance for Major Source rule (when final reconsidered rule signed)
  - Site-specific technical and cost information for evaluation of clean energy compliance options for facilities with coal/oil-fired boilers through Regional Clean Energy Application Centers. Includes site visits.

Thank You!

Biogas Renewable Energy
CHP Projects for Clinton County
Electric Coop Dairy Farmers:

Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line

Knotty Pine Restaurant • Breese, Illinois

February 3, 2012

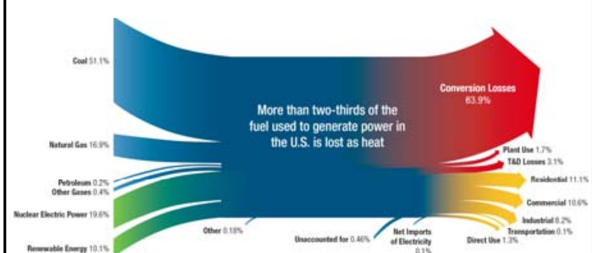
Thank You to All our Sponsors!

Today's Workshop Agenda

- Regulations impacting operations
- Implementing an anaerobic digester (AD) project
- Investigating digester outputs
- Real life on-farm case study
- Connecting to the grid
- Available funding
- Lunch
- Q&A

Why is the U.S. DOE interested in clean and renewable on-site power generation?

Look at our Current Efficiency in the Power Generation Sector



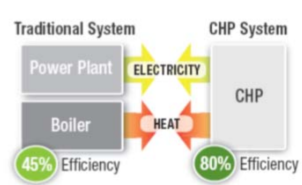
Source: DOE/ORNL

Is there a more efficient way?

CHP: A Key Part of our Energy Future

What is Combined Heat and Power (CHP)?

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building or facility
- Provides at least a portion of the electrical load and
- Recycles the thermal energy for
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification
  - Additional generation

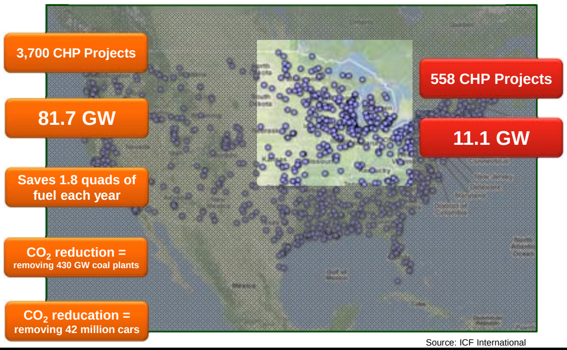


Source: DOE/ORNL

CHP provides efficient, clean, reliable, affordable energy – today and for the future.

40 more Gigawatts of CHP by 2020?

Snapshot of Existing U.S. CHP Installations



Source: ICF International

What are the benefits of CHP and when does it make sense?

CHP does not make sense in all applications, but where it does make technical and economic sense, it will provide:

- Lower energy costs
- Reduced energy consumption
- Increased electric reliability
- Standby power
- Improved environmental quality
- Public relations benefits

Making sense when…

- Good coincidence between electric and thermal loads
- Central heating/cooling system
- Large "Spark Spread" - cost differential between electricity (grid) and CHP fuel
- Long operating hours
- Energy concerns (current/future costs, power reliability, facility efficiency/conservation, etc.)
- Environmental concerns
- Renovation and/or expansion of existing facilities
- Access to on-site or nearby biomass/biogas resources

Why CHP and Anaerobic Digesters?

AD / CHP projects can help meet compliance issues with a ROI

Where are farm AD projects located?

161 farm scale projects
15 regional/centralized or multiple-farm projects

Source: EPA AgStar www.epa.gov/agstar

Enjoy the workshop!

- Ask questions…
- Get engaged…
- Network…
- Don't forget to complete the survey…

Industrial Energy Efficiency
A look at Illinois and the Midwest

Presentation to:
Industrial Efficiency and Advanced Manufacturing Roundtable
NASEO/ASERTTI
Energy Policy & Technology Outlook Conference
February 8th, 2012

Presentation by:
John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago

Energy Resources Center (ERC)
University of Illinois at Chicago

- Interdisciplinary Public Service, Research, and Special Project Organization Dedicated to Improving Energy and Environmental Sustainability (non teaching – grant funded energy/environmental extension service)
- Report to the Dean, College of Engineering
- ERC Role in Industrial Energy Efficiency

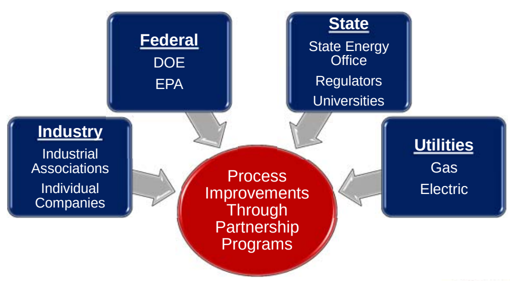
Provide Technical Expertise in the Transfer / Deployment of Energy Efficient Advanced Technologies & Concepts to the Midwest Manufacturing Sector

Targeted Education
Unbiased Information
Technical Assistance

2

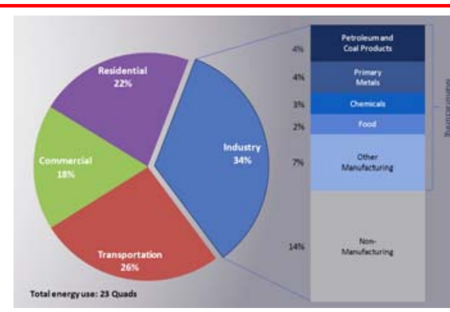
Implementation

-------Education/Information/Technical Assistance-------



3

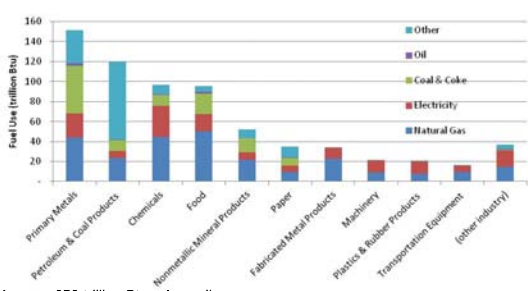
Midwest Total Energy Use by Sector



Sources: EIA, *MECS*; U.S. Census, *ASM*; EIA, *State Energy Data System* 2006 Data and World Resources Institute - Midwest Industrial Energy Efficiency Summit
http://www.wri.org/event/2012/01/size-prize-midwest-industrial-energy-efficiency-summit

4

Fuel Use by Illinois Manufacturing



Approx. 650 trillion Btus Annually

Sources: EIA, MECS; US Census, ASM 2006 Data and World Resources Institute - Midwest Industrial Energy Efficiency Summit
http://www.wri.org/event/2012/01/size-prize-midwest-industrial-energy-efficiency-summit

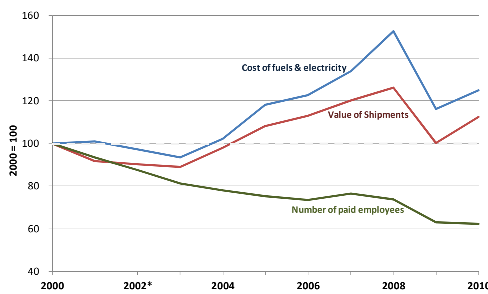
5

Illinois Manufacturing

Sources: US Census (ASM), World Resources Institute
**Derived from national-level data

6

Index of Manufacturing Energy Costs, Value of Shipments, and Employment



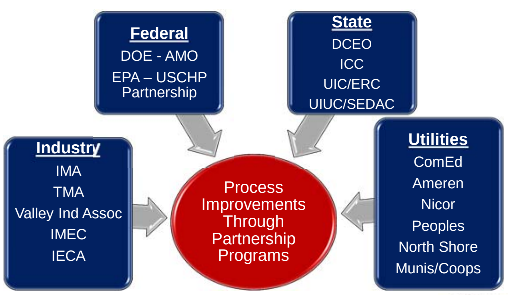
Sources: EIA, MECS; US Census, ASM.
* 2002 values were linearly interpolated due to a gap in the published data.

Why Don't Industrials Invest More in EE & CHP?

- Not aware of the total value of EE and CHP on ROI
- Energy costs typically < 5% of operating costs (non energy intensive industries)
- Complain about energy costs but viewed as cost of doing business – not a variable cost they can easily control
- Often do not link process improvements to EE and therefore EE investments often viewed as non-essential, discretionary
- Capital constraints & competing priorities
- Often times require short payback periods < 2 years
- Ability to "opt out" of state-level policies
- Lack of dedicated & trained staff (energy) – Small/Mid Size Co

Illinois

-------Education/Information/Technical Assistance-------



ERC --- Illinois Industrial Activities

- DOE Midwest Clean Energy Application Center (CEAC) – 12 Midwest States
- Student Energy Assessment Center -- 10 to 15 students trained each year in energy engineering *(modeled after DOE IACs but with no federal funds)*
- Active member of the SEEAction Industrial EE & CHP Working Group *(blueprint development / deployment implementation)*
- Superior Energy Performance (ISO- 50001) – Worked with DOE and Midwest States to develop the Midwest Pilot – 9 companies in the process of completing certifications by March, 2012

ERC --- Illinois Industrial Activities

- Save Energy Now (forerunner to Better Buildings, Better Plants)
  - major energy industrial forums in Illinois *(also Iowa, Minnesota, Michigan, Missouri, Indiana, and Ohio)*
  - Identified over 200 SEN partnerships
- Implementer, DCEO Large Energy User Program
  - 13 major capital investment projects (> 13 million therms in annual savings) …Total Investment $35M ---ARRA funds $14M
- Active member – Illinois Energy Efficiency Stakeholder Advisory Group *(provide guidance and support - utility efficiency programs)*

Commonwealth Edison – Smart Ideas Program

June, 2008 thru May 2011 - C&I Prescriptive & Custom Program

Building Type	Project Count		kWh Savings		Incentive	Percent
Grocery	429	5.9%	21,688,272	3.3%	$ 1,400,284	2.8%
Heavy Industry	**357**	**4.9%**	**99,203,958**	**15.2%**	**$ 7,227,463**	**14.5%**
Hotel / Motel	62	0.8%	12,818,802	2.0%	$ 745,077	1.5%
Light Industry	**889**	**12.2%**	**144,097,493**	**22.0%**	**$ 10,915,244**	**21.9%**
Medical	192	2.6%	44,981,590	6.9%	$ 2,727,119	5.5%
Miscellaneous	728	10.0%	56,652,649	8.7%	$ 4,215,616	8.4%
Office	985	13.5%	59,008,587	9.0%	$ 7,136,975	14.3%
Restaurant	117	1.6%	2,165,790	0.3%	$ 127,186	0.3%
Retail/Service	2862	39.2%	87,448,631	13.4%	$ 6,274,215	12.6%
School/College	128	1.8%	6,283,078	1.0%	$ 797,163	1.6%
WareHouse	546	7.5%	119,414,069	18.3%	$ 8,332,065	16.7%
Grand Total	7295	100.0%	653,762,919	100.0%	$ 49,898,407	100.0%

Strategic States and SEE-Action Network for Industrial EE & CHP

Presentation to:
IDEA Business Development Workshop
February 6th, 2012

Presentation by:
John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

U.S. Department of Energy
Midwest Clean Energy Application Center

Presentation Outline

- Description of the State Energy Efficiency (SEE) Action Network
  - Industrial EE and CHP Working Group
  - First Year Activities
- Examples of ongoing Clean Energy Application Center (CEAC) State Policy Efforts
- CHP as a Boiler MACT Compliance Strategy

The State and Local Energy Efficiency Action Network (SEE-Action)

The Opportunity

1. Energy efficiency represents one of our nation's largest untapped energy resources
2. Investing in cost-effective energy efficiency improvements could save hundreds of billions of dollars nationally over the next 10–15 years*
3. State and local programs and policies are critical to capturing the benefits of efficiency:
   - Job creation and economic development
   - Reduced demand and need for new transmission and distribution investments; improved system reliability
   - Reduction in fossil fuel use; significant public health and environmental benefits

What is SEE Action?

- A state- and local-led effort facilitated by US DOE and US EPA to take energy efficiency to scale that builds on the National Action Plan for Energy Efficiency.**
- SEE Action offers best practice recommendations and technical assistance to state and local decision makers as they seek to advance energy efficiency in their jurisdictions

Goal: to achieve all cost effective energy efficiency by 2020

*McKinsey Global Energy and Materials (2009), *Unlocking Energy Efficiency in the U.S. Economy*
**For more information visit www.epa.gov/eeactionplan

Decision Maker Action

SEE Action supports individuals and organizations seeking to reap the benefits of energy efficiency through policies and programs:

- **Utility Regulators and their utility partners** who can utilize efficiency as an energy resource to ensure reliable, affordable energy for ratepayers
- **State and Local Policymakers** including governors, legislators, and mayors, who can implement effective energy efficiency policies and programs for their communities
- **State Energy and Air Officials** who can develop and implement cost-effective energy efficiency programs to realize energy, cost, and emissions savings among other benefits
- **State and Local Partners,** including utilities and other energy efficiency program administrators, financial institutions, energy services companies, industrial facility and commercial building owners, and many others

SEE Action Network Structure

SEE Action's Eight Working Groups:

Executive Group Members:
Leadership/strategic direction and vision of SEE Action Network

Working Group Chairs:
Leadership of 8 priority issue areas.

DOE/EPA Staff Leads:
Support/coordination of Working Groups and Executive Group.

Who is the Network?

Over 200 leaders from state and local government, associations, business & industry, NGOs, and others who provide visionary leadership, strategic direction, and drive to reach the goal.

Membership lists at www.seeaction.energy.gov

SEE Action Working Group Priorities

+ Driving Ratepayer-Funded Efficiency Through Regulatory Policies
Increase investments in energy efficiency through ratepayer-funded programs.

+ Building Energy Codes
Increase the adoption of model and stretch building energy codes, and increase compliance with adopted codes for new and renovated buildings.

+ Existing Commercial Buildings
Improve energy efficiency in commercial-scale public and private buildings by promoting solutions for whole-building improvements such as retro-commissioning and high performance leasing.

+ Residential Retrofit
Increase the number and effectiveness of moderate income residential energy efficiency programs nationwide, and support development of a thriving home energy upgrade industry.

+ Customer Information and Behavior
Decrease residential energy consumption through behavior change, information, and feedback.

+ Evaluation, Measurement, and Verification
Transform EM&V to yield more accurate, credible, and timely results that accelerate deployment and improve management of energy efficiency.

+ Financing Solutions
Increase and improve energy efficiency financing instruments and mechanisms in the residential and commercial sectors.

+ Industrial Energy Efficiency and Combined Heat and Power (CHP)
Improve energy efficiency in the U.S. manufacturing sector though programs and policies that support industrial efficiency and implementation of CHP.

SEE Action IEE/CHP Working Group

- Chairs: Todd Currier, WA Energy Office & Greg White, Commissioner – Michigan PSC
- DOE/EPA staff leads: IEE (Sandy Glatt-DOE, Betsy Dutrow-EPA) and CHP (Katrina Pielli-DOE, Neeharika Naik-Dhungel-EPA)
- Members include: ACEEE, ASE, NRDC, NYSERDA, SoCal Gas, MW CEAC, Saint Gobain
- Blueprint has Four Focus Areas:
  - Demand for Industrial Energy Efficiency & CHP
  - Build the Workforce
  - Promote Efficient Operations & Investment
  - Move the Market

7

IEE / CHP Working Group Scope

- IEE / CHP Working Group addresses:
  - Industrial sector/manufacturing:
    - Large-, medium-, and small-sized industries
    - Varying levels of energy intensity
  - Energy efficiency of systems and processes in terms of:
    - Energy intensity (as a measure of efficiency)
    - Combined Heat and Power (CHP)

Energy Intensity – energy consumption per unit of GDP. Chosen over solely BTUs consumed because it does not include energy efficiency savings that might occur due to industrial downsizing or other market events.

CHP – the simultaneous production of useful thermal and electric energy from a single fuel source (dedicated fuel or waste heat recovered from industrial equipment or processes).

8

IEE / CHP Working Group Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Note: The working group recognizes that the reduction may not be an annual 2.5% achievement, but a cumulative effort over time that equates to a 2.5% annual reduction, on average, over the next 10 years.

9

Building Blocks to Meet the Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Drive Demand for IEE & CHP	Build the Workforce	Promote Efficient Operations & Investment	Move the Market

10

Key Solutions & Actions to Achieve the Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Drive Demand for IEE & CHP	Build the Workforce	Promote Efficient Operations & Investment	Move the Market
1. State, Local, & Utility Programs for Industry Programs that better meet the needs of industry	**5. Education & Workforce Development** Identify industry's needs and workforce needs; develop new programs to address needs	**8. Financing Innovation** Loan guarantees, energy service companies (ESCOs), etc.	**12. Technology Demonstration** Adoption of existing technologies
2. State Policy Models Broader adoption of model policies	**6. Develop Training & Academic Curricula** From the plant floor to the corporate level	**9. Financial Incentives** Address industry ROI and refit cycles	**13. Regulatory Recommendations to Support CHP** Offer comprehensive CHP policies
3. National Energy Efficiency Policy Enhance national policy with regard to industrial energy efficiency and CHP	**7. Licensing & Certification Protocols** Certified Energy Manager (CEM); DOE Qualified Specialists; Continuous Energy Improvement, etc.	**10. Technical Solutions** Improve availability of energy efficiency and CHP information and tools for industry	**14. Reduce Uncertainty Related to State Interconnection** Harmonization across broad regions and states
4. Education & Outreach Build corporate culture; foster greater understanding of the economic value of industrial energy efficiency and CHP		**11. Energy Management Programs/Continuous Energy Improvement** Ex: ISO 50001, Superior Energy Performance (SEP), ENERGY STAR, and others	**15. Financing Reform** Depreciation rules and Sarbanes-Oxley Act

Red = IEE and CHP solution
Purple = CHP only solution

11

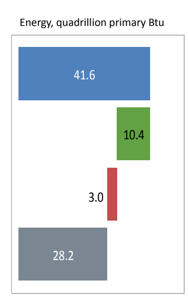
Impact of IEE / CHP WG Goals

Where We Are Today: According to the Energy Information Administration, gross domestic product (GDP) growth estimates with fixed energy intensity, the industrial sector will consume 41.6* quads of primary energy in the year 2020 (Business as Usual).

Working Group Goals: Based on the McKinsey report, 13.4 quads of potential industrial Btu savings by 2020 exist.** The working group's goals to reduce industrial energy intensity by 2.5% annually through 2020 and install 40 GW of new, cost-effective CHP by 2020 will achieve a reduction of 10.4 quads.***

Scope: Reaching goals would capture 78% of the potential energy efficiency in the industrial sector, leaving 3.0 quads to address through other activities.

Resulting 2020 Energy Use if all potential is addressed:



* Total industrial sector energy consumption includes refining-related efforts.
** The McKinsey non-transportation industrial estimates were used to calculate the potential for the full industrial sector.
*** 2020 efficiency potential is based on an estimated 25.2% growth in GDP by 2020 (Annual Energy Outlook 2008) and a fixed industrial energy intensity (energy consumption per value of shipments) through 2020.

IEE/CHP Working Group – First Year Activities

- 2012 Webinar Series (http://www1.eere.energy.gov/seeaction/iee.chp.webinars.html)
  - EPA Regulations and CHP (held January 17th)
  - Showcasing Model Utility IEE Programs (Feb 7th)
  - Elevating IEE Regulatory Issues for Commissioners (March 6th)
  - Successful State CHP Policies (Summer, 2012) – see below
- Developing "Guide to Implementing Successful State CHP Policies" & "IEE Model Programs & Policies Guide"
- Regional (MW & SE) Utility/Industry Workshops
  - Overcoming IEE and CHP Barriers ….. Spring/Summer 2012
- Engage Utility Regulators on Successful State Policies (IEE and CHP)

U.S. DOE Clean Energy Application Centers (CEACs)

- **Market Assessments:** Supporting analyses of CHP/WHR market potential
- **Education and Outreach:** Information on benefits and application to state and local policy makers, regulators, energy end-users, utilities, others
- **Technical Assistance:** Providing technical information, site assessments, feasibility studies, technical & financial analyses

Pacific CEAC --- California

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Self-Generation Incentive Program (SGIP) Extension	Economic analysis of benefits to state contributed to $250 M extension
Treatment of CHP under CA Cap-and-Trade	Initiated technical paper on CHP and GHG reduction to ensure "fair" treatment under cap-and-trade policies
Support for Governor's 6.5GW CHP Installation Goal	Completing CHP jobs creation/economic impact analysis
Garner Support for Balanced CA Energy Portfolio	Work to demonstrate how CHP, energy efficiency, & renewable can work together to move away from centralized fossil generation – CA 33% RPS

South East CEAC --- North Carolina

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Parity for CHP with Renewable Resources – Tax incentive – Portfolio Standard	Fostered understanding among renewable & policymakers: – 35% tax credit in place – Renewable & EE Std. incl. CHP
Revise public IOUs business model to recognize CHP as viable new generation capacity	Part of utility/industry team investigating the feasibility of pilot program fostering utility/industry partnership (Duke Energy – potential docket 2012)
Third Party CHP Investment	Efforts Include: – Collaboration ESCO, SEO, NCState, Fort Bragg – Projects underway, – Tech. analysis on HB 906 – Third Party Sale of Electricity –Biomass CHP

Midwest CEAC --- Ohio

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
New interested Gov and Ohio PUC Chairman – Energy Summit highlights CHP	Education and technical support of environmental & industrial coalition. Strong policy recommendations:
More favorable inclusion of CHP/WHR in the State Advanced Energy Resource Standard – SB 221	– WHR as an eligible technology in RPS – Conventional CHP benchmark in advanced technology section
CHP as First Option Considered in New Generation Capacity Building	– AEP Energy Security Plan stipulates 350 MW of CHP
Access to low interest financing	– Integration into existing OAQDA program or similar agency to administer a loan program

Northeast CEAC --- New York

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Preserve/expand resources dedicated to CHP in 2012-2015 (5yr) SBC IV Plan	Extensive education & support efforts turned $0 allocation to $75M for CHP acquisitions under SBC IV
Engage IOUs on recognizing benefits of CHP as an alternative to distribution system capital investments	Collaborative with: – National Grid to create "Principles Document" on non wires alternatives & pilot 2012 project. – Con Ed on "CHP Zones" that would create significant system benefits, exploring new incentive designs.
Promote realization of 800MW CHP goal – PlaNYC	Asked to partner with Mayor's Office to assist in implementation – work starts in Feb 2012
Innovative Financing	Working with DASNY – hospitals/universities

CHP as a Boiler MACT Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Retrofitting old boilers (pre mid 1970s) very difficult
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler

19

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20

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	227	495	131,526	13,155
Heavy Liquid	120	287	38,020	3,803
Light Liquid	91	202	19,926	1,993
Process Gas	14	78	21,146	2,115
Total	452*	1062	210,618	21,065

*Some facilities are listed in multiple categories due to multiple fuel types; there are 410 affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

21

CHP Compliance Option – Potential Benefits

- Compliance with MACT
- Investment versus compliance cost/expenditure
- More Favorable Paybacks
- Increase electric service reliability
- Enhance economic competitiveness (higher efficiency plant)
- Reduce Carbon Emissions
- Potential partnership with Utilities facing EPA power plant emission regulations

Thank You

John Cuttica
(312) 996-4382
cuttica@uic.edu

www.midwestcleanenergy.org

U.S. Department of Energy Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

A program at
UIC Energy Resources Center

A program sponsored by
U.S. Department of Energy – Energy Efficiency & Renewable Energy

Industrial Energy Efficiency
A look at Illinois and the Midwest

Presentation to:
Industrial Efficiency and Advanced Manufacturing Roundtable
NASEO/ASERTTI
Energy Policy & Technology Outlook Conference
February 8th, 2012

Presentation by:
John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago

Energy Resources Center (ERC)
University of Illinois at Chicago

- Interdisciplinary Public Service, Research, and Special Project Organization Dedicated to Improving Energy and Environmental Sustainability (non teaching – grant funded energy/environmental extension service)
- Report to the Dean, College of Engineering
- ERC Role in Industrial Energy Efficiency

Provide Technical Expertise in the Transfer / Deployment of Energy Efficient Advanced Technologies & Concepts to the Midwest Manufacturing Sector

Targeted Education
Unbiased Information
Technical Assistance

Implementation

-------Education/Information/Technical Assistance-------

Federal
DOE
EPA

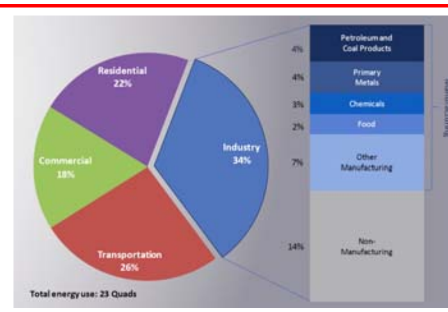
State
State Energy Office
Regulators
Universities

Industry
Industrial Associations
Individual Companies

Utilities
Gas
Electric

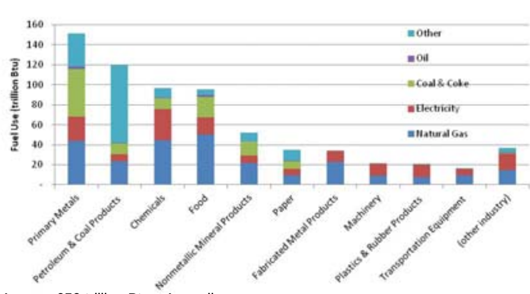
Process Improvements Through Partnership Programs

Midwest Total Energy Use by Sector



Sources: EIA, *MECS*; U.S. Census, *ASM*; EIA, *State Energy Data System* 2006 Data and World Resources Institute - Midwest Industrial Energy Efficiency Summit
http://www.wri.org/event/2012/01/size-prize-midwest-industrial-energy-efficiency-summit

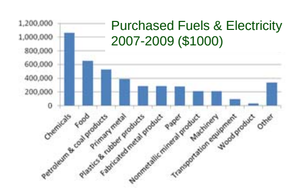
Fuel Use by Illinois Manufacturing

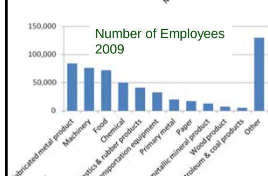


Approx. 650 trillion Btus Annually

Sources: EIA, MECS; US Census, ASM 2006 Data and World Resources Institute - Midwest Industrial Energy Efficiency Summit
http://www.wri.org/event/2012/01/size-prize-midwest-industrial-energy-efficiency-summit

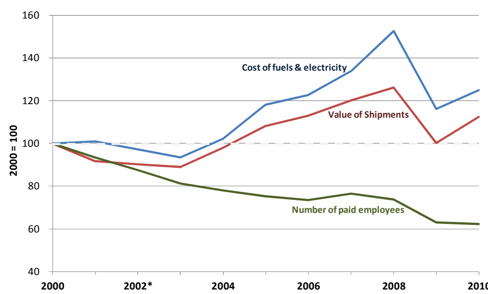
Illinois Manufacturing





Sources: US Census (ASM), World Resources Institute
**Derived from national-level data

Index of Manufacturing Energy Costs, Value of Shipments, and Employment



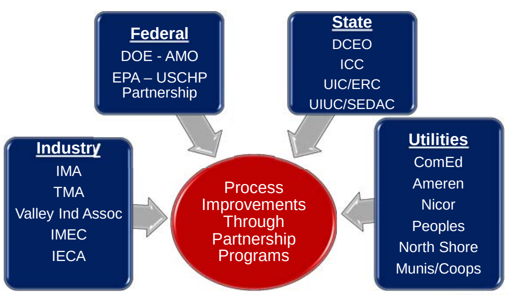
7 Sources: EIA, MECS; US Census, ASM.
* 2002 values were linearly interpolated due to a gap in the published data.

Why Don't Industrials Invest More in EE & CHP?

- Not aware of the total value of EE and CHP on ROI
- Energy costs typically < 5% of operating costs (non energy intensive industries)
- Complain about energy costs but viewed as cost of doing business – not a variable cost they can easily control
- Often do not link process improvements to EE and therefore EE investments often viewed as non-essential, discretionary
- Capital constraints & competing priorities
- Often times require short payback periods < 2 years
- Ability to "opt out" of state-level policies
- Lack of dedicated & trained staff (energy) – Small/Mid Size Co

Illinois

-------Education/Information/Technical Assistance-------



9

ERC --- Illinois Industrial Activities

- DOE Midwest Clean Energy Application Center (CEAC) – 12 Midwest States
- Student Energy Assessment Center -- 10 to 15 students trained each year in energy engineering *(modeled after DOE IACs but with no federal funds)*
- Active member of the SEEAction Industrial EE & CHP Working Group *(blueprint development / deployment implementation)*
- Superior Energy Performance (ISO- 50001) – Worked with DOE and Midwest States to develop the Midwest Pilot – 9 companies in the process of completing certifications by March, 2012

10

ERC --- Illinois Industrial Activities

- Save Energy Now (forerunner to Better Buildings, Better Plants)
  - major energy industrial forums in Illinois *(also Iowa, Minnesota, Michigan, Missouri, Indiana, and Ohio)*
  - Identified over 200 SEN partnerships
- Implementer, DCEO Large Energy User Program
  - 13 major capital investment projects (> 13 million therms in annual savings) …Total Investment $35M ---ARRA funds $14M
- Active member – Illinois Energy Efficiency Stakeholder Advisory Group *(provide guidance and support - utility efficiency programs)*

11

Commonwealth Edison – Smart Ideas Program

June, 2008 thru May 2011 - C&I Prescriptive & Custom Program

Building Type	Project Count		kWh Savings		Incentive	Percent
Grocery	429	5.9%	21,688,272	3.3%	$ 1,400,284	2.8%
Heavy Industry	**357**	**4.9%**	**99,203,958**	**15.2%**	**$ 7,227,463**	**14.5%**
Hotel / Motel	62	0.8%	12,818,802	2.0%	$ 745,077	1.5%
Light Industry	**889**	**12.2%**	**144,097,493**	**22.0%**	**$ 10,915,244**	**21.9%**
Medical	192	2.6%	44,981,590	6.9%	$ 2,727,119	5.5%
Miscellaneous	728	10.0%	56,652,649	8.7%	$ 4,215,616	8.4%
Office	985	13.5%	59,008,587	9.0%	$ 7,136,975	14.3%
Restaurant	117	1.6%	2,165,790	0.3%	$ 127,186	0.3%
Retail/Service	2862	39.2%	87,448,631	13.4%	$ 6,274,215	12.6%
School/College	128	1.8%	6,283,078	1.0%	$ 797,163	1.6%
WareHouse	546	7.5%	119,414,069	18.3%	$ 8,332,065	16.7%
Grand Total	7295	100.0%	653,762,919	100.0%	$ 49,898,407	100.0%

12

Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers:

Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line

Keller Convention Center • Effingham, Illinois

February 9, 2012

Thank You to All our Sponsors!

Association of Illinois Electric Cooperatives

UIC Energy Resources Center

U.S. Department of Energy Midwest Clean Energy Application Center

Prairie Power, Inc.

Norris Electric Cooperative

Shelby Electric Cooperative

Coles-Moultrie

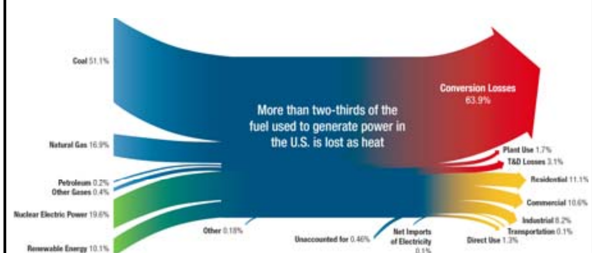
Clay Electric Co-operative, Inc.

Today's Workshop Agenda

- Regulations impacting operations
- Implementing an anaerobic digester (AD) project
- Investigating digester outputs
- Real life on-farm case study
- Connecting to the grid
- Available funding
- Lunch
- Q&A

Why is the U.S. DOE interested in clean and renewable on-site power generation?

Look at our Current Efficiency in the Power Generation Sector



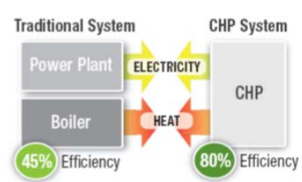
Source: DOE/ORNL

Is there a more efficient way?

CHP: A Key Part of our Energy Future

What is Combined Heat and Power (CHP)?

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building or facility
- Provides at least a portion of the electrical load and
- Recycles the thermal energy for
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification
  - Additional generation

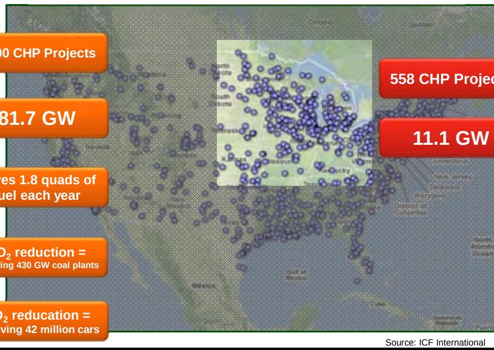


Source: DOE/ORNL

CHP provides efficient, clean, reliable, affordable energy – today and for the future.

40 more Gigawatts of CHP by 2020?

Snapshot of Existing U.S. CHP Installations



3,700 CHP Projects

81.7 GW

Saves 1.8 quads of fuel each year

CO_2 reduction = removing 430 GW coal plants

CO_2 reducation = removing 42 million cars

558 CHP Projects

11.1 GW

Source: ICF International

What are the benefits of CHP and when does it make sense?

CHP does not make sense in all applications, but where it does make technical and economic sense, it will provide:

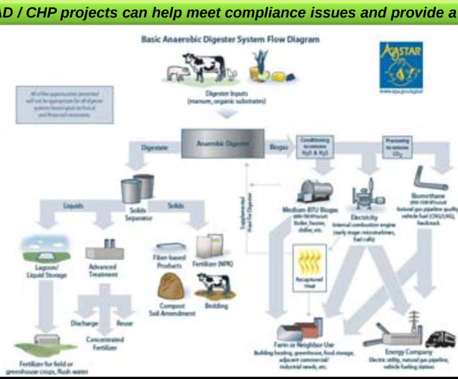
- Lower energy costs
- Reduced energy consumption
- Increased electric reliability
- Standby power
- Improved environmental quality
- Public relations benefits

Making sense when…

- Good coincidence between electric and thermal loads
- Central heating/cooling system
- Large "Spark Spread" - cost differential between electricity (grid) and CHP fuel
- Long operating hours
- Energy concerns (current/future costs, power reliability, facility efficiency/conservation, etc.)
- Environmental concerns
- Renovation and/or expansion of existing facilities
- Access to on-site or nearby biomass/biogas resources

Why CHP and Anaerobic Digesters?

AD / CHP projects can help meet compliance issues and provide a ROI



Where are farm AD projects located?

Source: EPA AgStar www.epa.gov/agstar

161 farm scale projects
15 regional/centralized or multiple-farm projects

US DOE Regional Clean Energy Application Centers (CEACs)

- **US DOE Midwest Clean Energy Application Center**
- **www.midwestcleanenergy.org**
- DOE goal of 40 GW of CHP by 2020
- Today the center promotes the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market Assessments**
  - **Education and Outreach**
  - **Technical Assistance**

U.S. Department of Energy Midwest Clean Energy Application Center

Enjoy the workshop!

- Ask questions and get engaged…
- Network and utilize the available resources…
- Don't forget to complete the survey…

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Spoon River College Community Outreach Center

February 10, 2012 • Macomb, Illinois

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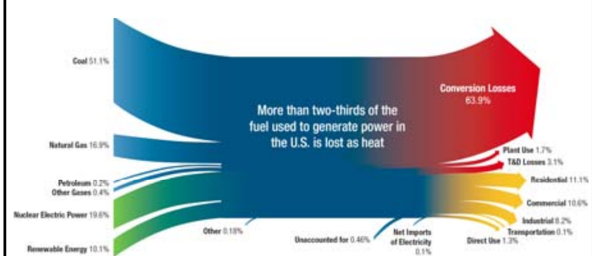

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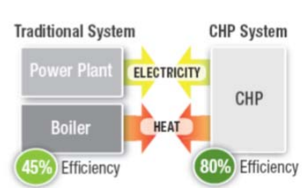

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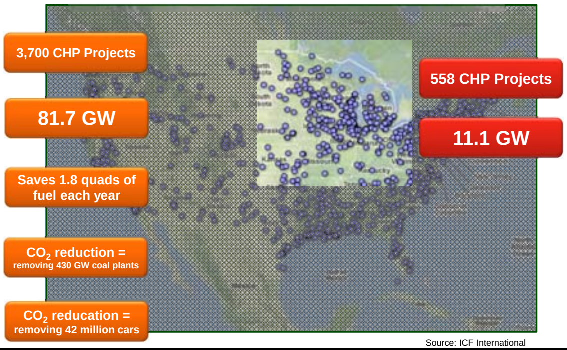

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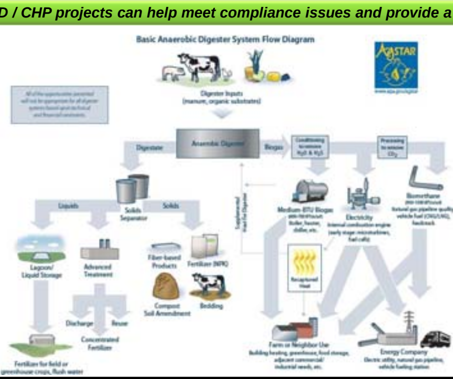

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PRAIRIE POWER, INC.
Menard Electric Cooperative
Association of Illinois Electric Cooperatives
UIC Energy Resources Center
dceo
SPOON RIVER ELECTRIC COOPERATIVE
Adams Electric Cooperative, Inc.
Western Illinois Electrical Coop.
Illinois Rural Electric Cooperative

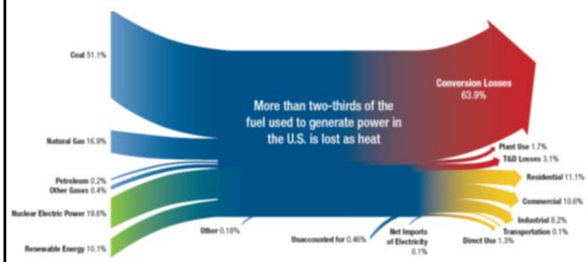
CHP & WHR Technology Briefing and Environmental Benefits

Tuesday, February 14, 2012

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

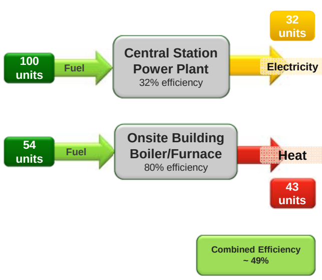
U.S. Department of Energy
Midwest Clean Energy Application Center

Fuel Utilization by U.S. Utility Sector



The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

Traditional Energy Systems

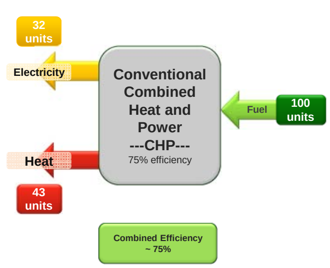


Combined Heat and Power

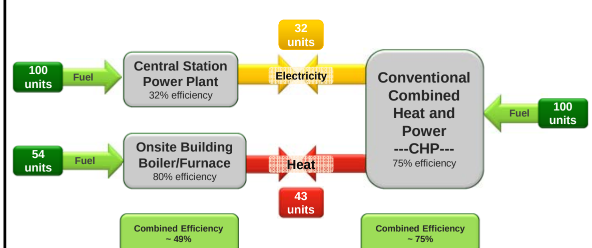
Conventional CHP
Topping Cycle CHP

The sequential production of useful electric and thermal power from a single **dedicated** fuel source

Conventional CHP System (Topping Cycle)



Traditional Energy System vs. Conventional CHP System



CHP provides efficient, clean, reliable, affordable energy – today and for the future

Conventional CHP

- What drives system efficiency in a conventional CHP system?

Ability to utilize as much of the thermal energy as possible + coincidence between thermal and electric loads

- To ensure high system efficiency, how would you size a conventional CHP system?

Size for thermal base-load and generate electricity when operating to meet the thermal load

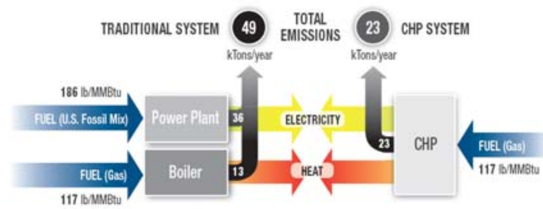
- What maximizes the effectiveness of a conventional CHP system?

Long operating hours + max efficiency = max savings/effectiveness

7

CHP Role in Our Environmental Future

Impact on Carbon Emissions



Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

8

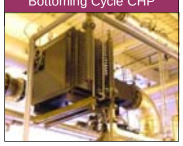
Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

Combined Heat and Power

Conventional CHP
Topping Cycle CHP

The sequential production of useful electric and thermal power from a single **dedicated** fuel source

Waste Heat Recovery CHP
Bottoming Cycle CHP



Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power.

9

Waste Heat Recovery CHP

Waste Heat Recovery CHP

- No additional fossil fuel (capturing waste heat as the fuel)
- No incremental emissions
- Like conventional CHP, power generated at site (DG)
- Base load generation – industrials operate 24/7
- High temp (> 800ºF) is low hanging fruit industrial

CHP Nomenclature

- Conventional CHP
- Topping Cycle CHP
- Traditional CHP
- Natural Gas CHP

- Waste Heat Recovery CHP (WHR)
- Bottoming Cycle CHP
- Waste Energy Recovery CHP (WER)
- Waste Heat to Power CHP (WHP)

12

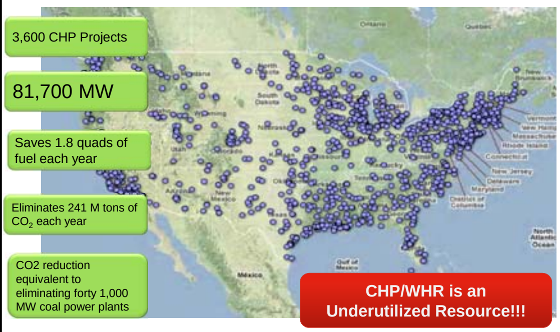
Positive Impacts and Benefits (U.S. Businesses)

- Reduces energy costs for the end-user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability
- Provides stability in the face of uncertain electricity prices

Positive Impacts and Benefits (Nation)

- Provides immediate path to increased energy efficiency and reduced GHG emissions
- Offers low cost approach to new electricity generation capacity and lessens the need for new T&D
- Uses abundant, domestic energy sources
- Uses highly skilled local labor & American technologies

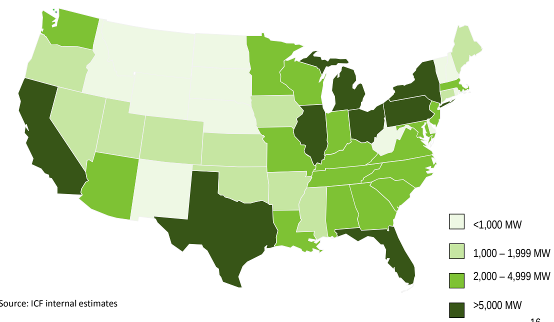
CHP Is Used at the Point of Demand



Source: ICF International

CHP Onsite Technical Potential Market

Existing CHP (82 GW)
CHP Potential W/O Export (+132 GW)



Source: ICF internal estimates

16

Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	**766.6 MW**	9,800 MW
CHP % of Total Ohio Electric Generation	**2.3%**	29.4%
Nationally, CHP % of Total Generation	*8.0%*	-

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	**9,800**

CHP Technical Potential

Attractive CHP Markets

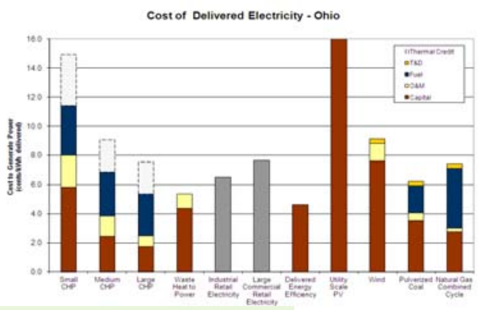
Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

CHP as a Boiler MACT Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP (gas turbine system)
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler
  - Investment rather than control cost

20

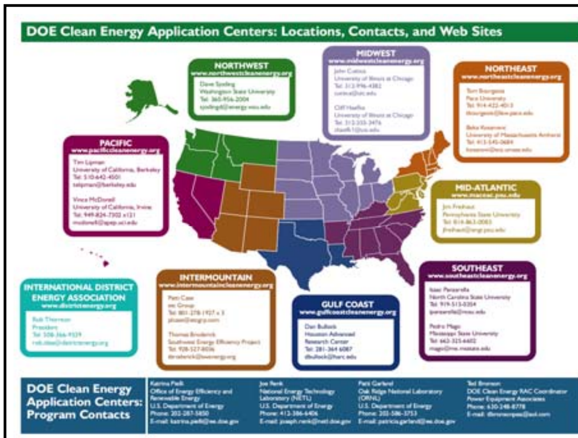
MACT Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	398	84,495
Heavy Liquid	82	11,760
Light Liquid	79	6,487
Biomass	67	8,705
Process Gas	71	18,892
Total	**697**	**130,339**

Includes industrial, commercial and institutional boilers only

What's Needed to Increase Market Share

- Removal of state policy barriers (interconnection, standby rates, etc)
- Clear value proposition for electric utilities
- Increased awareness of CHP benefits by end-users, state decision makers, & policy makers
- Supportive federal policies
- Technology advancements



Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy Midwest Clean Energy Application Center

A program at UIC Energy Resources Center

A program sponsored by U.S. Department of Energy, Energy Efficiency & Renewable Energy

U.S. Department of Energy Boiler MACT Technical Assistance Pilot Program

Public Utilities Commission of Ohio (PUCO) Educational Forum

March 9, 2012

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

Presentation Outline

- What is Combined Heat and Power (CHP)
- Status and Opportunity of CHP in the US and Ohio
- Boiler MACT and CHP as a Control Strategy
- U.S. DOE Boiler MACT Technical Assistance Pilot Program
- U.S. DOE Clean Energy Application Centers

DOE Boiler MACT Technical Assistance Team

- Katrina Pielli --- DOE Headquarters
- Patti Garland --- Oak Ridge National Laboratory
- Bruce Hedman & Ann Hampson --- ICF International
- John Cuttica & Cliff Haefke --- Midwest CEAC
- Jim Freihaut --- Mid Atlantic CEAC
- Tom Bourgeois --- Northeast CEAC
- Isaac Panzarella --- Southeast CEAC

Presentation Message / Take Away

- Combined Heat & Power (CHP) is an important energy resource that provides
  - Benefits for U.S. Industry
    - Reduces energy costs for the user
    - Reduces risk of electric grid disruptions
    - Provides stability in the face of uncertain electricity prices
  - Benefits for the Nation
    - Provides immediate path to increased energy efficiency and reduced GHG emissions
    - Offers a low-cost approach to new electricity generation capacity and lessens need for new T&D infrastructure
    - Enhances grid security
    - Enhances U.S. manufacturing competitiveness
    - Uses abundant, domestic energy sources
    - Uses highly skilled local labor and American technology

Presentation Message / Take Away

- Ohio has significant CHP potential – 9,800 MW
  - Today, Ohio has only 766 MW of CHP installed
- Current circumstances have highlighted the role additional CHP can play in the energy resource mix & achieve above benefits
  - Coal power plant retirement announcements
  - Boiler MACT opportunity for new CHP
  - Focus on maintaining and increasing manufacturing in the US
- DOE currently provides technical information and assistance, market development, and education on CHP, Waste Heat Recovery, and District Energy options through its 8 regional Clean Energy Application Centers (CEACs)

Presentation Message / Take Away

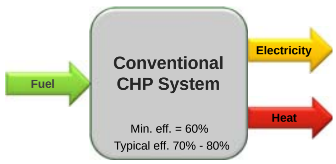
- DOE, through the CEACs, is supplementing this ongoing effort by providing site-specific technical and cost information on clean energy compliance strategies to those major source facilities affected by the Boiler MACT rule currently burning coal or oil.
  - These facilities may have opportunities to develop compliance strategies, such as CHP, that are cleaner, more energy efficient, and that can have a positive economic return for the plant over time
- DOE Boiler MACT Technical Assistance program is being piloted in Ohio now, and will be rolled out nationally when the EPA rule reconsideration process is complete (Spring 2012)

http://www1.eere.energy.gov/manufacturing/distributedenergy/boilermact.html

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

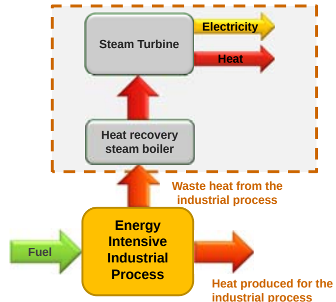


- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating heat and electricity
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

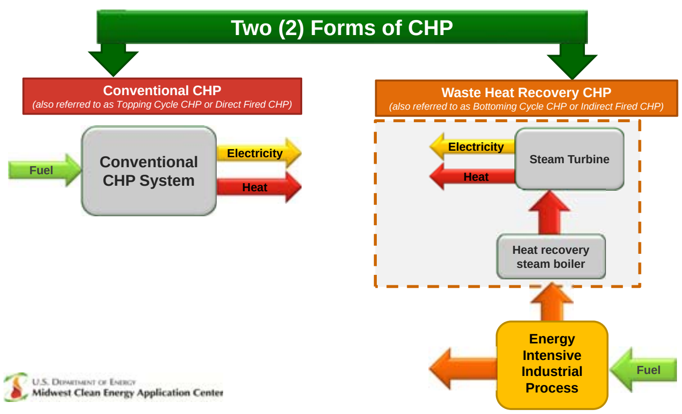
Waste Heat Recovery CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



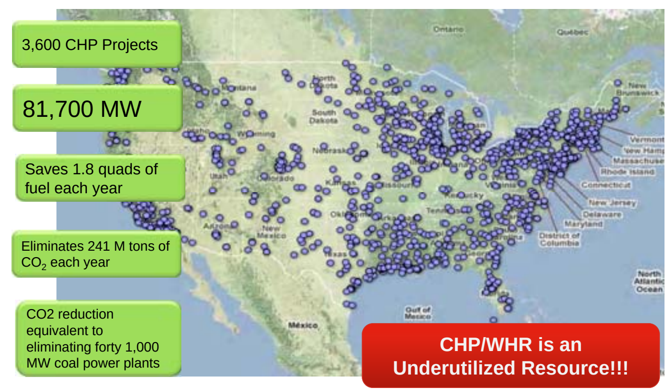
- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



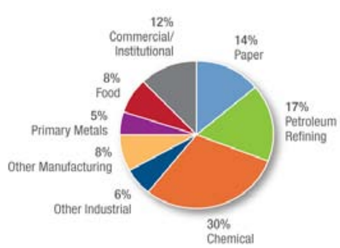
CHP Is Used at the Point of Demand



Source: ICF International

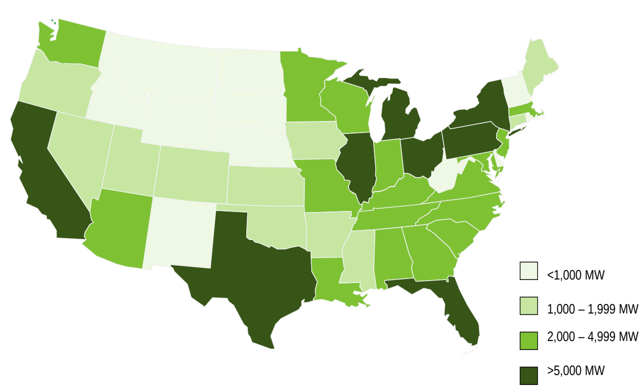
Existing CHP Capacity

- ~ 8% US generating capacity
- ~ 12% total annual MWh generated
- Industrial applications represent 88% of existing capacity
- Commercial/institutional applications represent 12% of existing capacity:
  - Hospitals, Schools, University Campuses, Hotels, Nursing Homes, Office Buildings, Apartment Complexes, Data Centers, Fitness Centers



Source: ICF International

CHP Onsite Technical Potential Market



Source: ICF internal estimates

Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	**766.6 MW**	9,800 MW
CHP % of Total Ohio Electric Generation	**2.3%**	29.4%
Nationally, CHP % of Total Generation	*8.0%*	-

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	**9,800**

CHP Technical Potential

Attractive CHP Markets

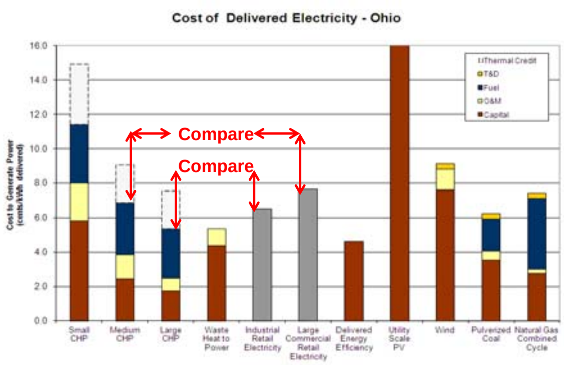
Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

EPA ICI Boiler MACT

- Three rules. DOE effort focused on Major Source Boiler MACT
- Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters (excludes any unit combusting *solid waste*)
- Major source is a facility that emits:
  - 10 tpy or more of any single Hazardous Air Pollutant, or 25 tpy or more of total Hazardous Air Pollutants (HAPs)
- Emissions limits applicable to new and existing units > 10 MMBtu/hr
  - Mercury (Hg)
  - Particulate Matter (PM) as a surrogate for non-mercury metals (alternative limits for total selective metals (TSM))
  - Hydrogen Chloride (HCl) as a surrogate for acid gases
  - Carbon Monoxide (CO) as a surrogate for non-dioxin organics

Impacts of the Boiler MACT

- Compliance straight forward for natural gas fired units (tune-ups in lieu of more rigorous control options)
  - Refinery and blast furnace gases are treated as natural gas
- Rule significantly impacts oil, coal, biomass, and process gas boilers
  - Emissions limits must be met at all times except for start-up and shutdown periods
  - Controls are potentially required for Hg, PM, HCl and CO
  - Also includes monitoring and reporting requirements
  - Limits are difficult (technically and economically) for oil and coal boilers (especially older units)

Standard Compliance Measures

- Mercury (Hg): Fabric filters and activated carbon injection are the primary control devices
- Particulate Matter (PM): Electrostatic precipitators may be required for units to meet emission levels
- Hydrogen Chloride (HCl): Wet scrubbers or fabric filters with dry injection are the primary control technologies
- Carbon Monoxide (CO): Tune-ups, replacement burners, combustion controls and oxidation catalysts are the preferred control technologies

Required compliance measures for any unit depend on current emissions levels from the units and the control equipment already in place

Affected Facilities by CEAC Region

CEAC Region	Number of Facilities	Number of Coal Units	Number of Oil Units	Number of Biomass Units	Number of Process Gas Units
Gulf Coast	46	10	11	48	8
Intermountain	16	19	11	0	0
Mid-Atlantic	133	126	152	32	23
Midwest	264	378	159	64	59
Northeast	85	23	149	23	6
Northwest	78	20	30	89	0
Pacific	23	5	16	32	0
Southeast	326	179	224	317	15
Total	**971**	**760**	**752**	**605**	**111**

The data in this chart is still being refined

- This table includes only industrial/commercial/institutional boilers
- There are 217 affected utility facilities not included in this table

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	378	80,902
Heavy Liquid	82	11,760
Light Liquid	77	6,427
Biomass	64	8,128
Process Gas	59	15,292
Total	**660**	**122,509**

The data in this chart is still being refined

Includes industrial, commercial and institutional boilers only

Affected Boilers in Ohio

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	76	12,202
Heavy Liquid	5	563
Light Liquid	10	1,579
Biomass	6	1,106
Process Gas	13	4,114
Total	**110**	**19,565**

The data in this chart is still being refined

Includes industrial, commercial and institutional boilers only

Affected Coal and Oil Boilers in Ohio

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	5	9	1,150
Paper	7	15	2,195
Petroleum and Coal	1	2	108
Chemicals	10	21	2,856
Plastics and Rubber	2	5	740
Primary Metals	2	3	1,347
Fabricated Metals	3	7	716
Machinery	1	4	400
Transportation Equip.	5	16	3,383
Educational Services	4	9	1,450
Total	**40**	**91**	**14,345**

The data in this chart is still being refined

CHP as a Compliance Strategy

- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units
  - New boilers for most coal units?
- May consider moving to natural gas fueled "Conventional CHP" (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	333	760	177,435	17,746
Heavy Liquid	194	422	52,358	5,237
Light Liquid	145	330	29,495	2,950
Total	**672***	**1,512**	**259,288**	**25,933**

The data on this chart is still being refined

*Some facilities are listed in multiple categories due to multiple fuel types; there are 621 ICI affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

DOE Boiler MACT Technical Assistance Program (Ohio Pilot)

The U.S. DOE Midwest CEAC will supplement its normal CHP services by:

- Providing site specific technical and cost information to the 40+ major source facilities (~ 90 to 100 boilers) in Ohio currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss “Clean Energy Compliance Strategies” including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of CHP as a compliance strategy

DOE Boiler MACT Technical Assistance Program

- Site specific “Decision Trees” will include:
  - Facility Info
  - Site Financial Data
  - Contact Info
  - Boiler Unit Data
  - Compliance Control Requirements
  - CHP as an Alternative Compliance Option
  - Comparative Cost of Compliance Options
  - CHP Payback
  - Available Financial Options

Decision Tree Analysis Example XXXX Co. (Ohio)

- Existing Boilers

Total Capacity MMBtu/hr	Primary Fuel	Annual Hours	Year Installed	Existing Controls
156	Coal	8,400	1,960	Electrostatic Precipitator
245	Coal	8,539	1,968	Electrostatic Precipitator

  - Average steam demand of 240 MMBtu/hr
  - Pays $0.07/kWh for power and $2.50 MMBtu for coal
- Projected compliance costs
  - Additional controls required for PM and CO
  - $17,921,813 Capital cost
  - $3,111,500 annual operating and maintenance costs of controls

Comparative Costs

	Existing Coal Boilers	New Natural Gas Boilers	Natural Gas CHP
Steam Capacity, MMBtu/hr input	400	400	
Avg Steam Demand, MMBtu/hr	240	240	240
Boiler Efficiency	75%	80%	N/A
CHP Capacity, MW	0	0	25*
CHP Electric Efficiency	N/A	N/A	32%
Fuel Use, MMBtu/year	2,720,000	2,550,000	3,404,334
Annual Fuel Cost	$5,984,000	$15,300,000	$20,426,003
Annual O&M Cost	$8,105,600	$3,238,500	$4,990,500
Annual Compliance O&M	$3,111,500		
Annual Electric Savings			($12,622,500)
Annual Steam Operating Costs	$17,201,100	$18,538,500	$12,794,003
Capital Costs	$17,921,500	$14,800,000	$35,000,000

Calculations based on delivered coal price of $2.50/MMBtu, natural gas price of $6.00/MMBtu, and industrial electricity price of $0.07/kWh (CHP avoids 90% of retail rate)

* Steam demand could support 50 to 55 MW CHP system; system designed to meet the facility electric load of 25 MW (non-export mode)

CHP Paybacks

	Existing Coal Boilers	Natural Gas Boilers	Natural Gas CHP
Annual Steam Operating Costs	$17,201,100	$18,538,500	$12,794,003
Annual Operating Savings (coal compliance)			$4,407,097
Annual Operating Savings (gas boiler)			$5,744,497
Installed Costs	$17,921,500	$14,800,000	$35,000,000
CHP Incremental costs (coal compliance)			$17,078,500
CHP Payback (coal compliance)			**3.9 years**
CHP Incremental costs (gas boiler)			$20,200,000
CHP Payback (gas boiler)			**3.5 years**

Frequently Asked Questions

- How accurate is the Decision Tree Analysis results?

The results are only as good as the assumptions utilized. We expect the facilities will update the assumptions after the one-on-one meetings.

- What are the sources of the facility and unit data assumptions?

ICR – Survey data on boilers, process heater and other combustion units, submitted to EPA (facility & unit level data)

ECHO – EPA Enforcement & Compliance History Online database (facility level data on major source polluters)

REPIS – NREL Renewable Electric Plant Info System database (facility and unit level data for biomass facilities)

MIPD – Major Industrial Plant database (facility data for large industrial plants

LBDB – Large Boiler database (facility & unit level data – boilers > 250 MMBtu/hr

ELECUTIL – ICF Electric Utility database (facility & unit level data for utility boilers

Frequently Asked Questions

- What is the value of an option that has such a significantly larger first cost?

Investment (with payback) versus a cost - higher efficiencies & lower emissions – potential for lower steam costs

- As a "rule of thumb," which boilers are most favorable for a CHP control strategy?

Older coal and oil boilers where installing standard control technologies and/or converting the existing boiler to natural gas is very expensive.

- If the facility wants to further explore CHP, what specific services can the CEAC provide?

Assist in scoping the project (level 1 sizing, costs, design options); assist in securing needed engineering, financial and installation support

Next Steps – Ohio

- Midwest CEAC will send letters to all affected Ohio facilities explaining the pilot program, providing contact info, and urging them to contact the Midwest CEAC (March)
- Midwest CEAC will call all major sources that use coal or oil to set-up one-on-one meetings (March)
  - Site visits will be made to those interested major source facilities that use coal or oil to meet and discuss their "Decision Tree" and CHP opportunity (ASAP starting immediately)
- Continue technical assistance as appropriate
- Want to work with in-state trade associations, utilities and others to spread word

DOE Boiler MACT Technical Assistance information:

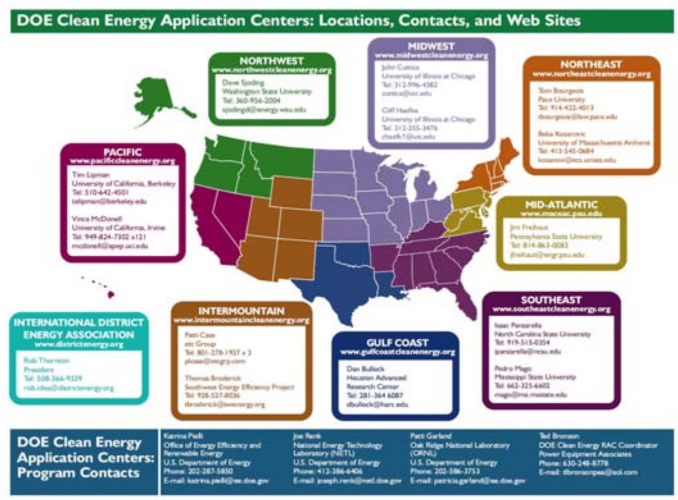
http://www1.eere.energy.gov/manufacturing/distributedenergy/boilermact.html

CEAC Mission and Focus

- **CEAC Mission:** Develop technology application knowledge and the educational infrastructure necessary to promote "clean energy" technologies as viable energy options and reduce any perceived risks associated with their implementation.

CEAC Focus: Assist in transforming the market for CHP, WHR, and DE technologies and concepts throughout the United States by providing:

- Market Analysis & Evaluation
- Education & Outreach
- Technical Assistance



DOE & Midwest CEAC Contacts

DOE Headquarters

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U.S. Department of Energy
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http://www1.eere.energy.gov/manufacturing/distributedenergy/ceacs.html

Midwest CEAC

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Associate Director / Lead Engineer: Cliff Haefke; 312/355-3476; chaefk1@uic.edu

www.midwestcleanenergy.org

States Covered: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin

Market Opportunities for Biogas Utilization

A&WMA Lake Michigan States Section's Waste Not Conference

Oakbrook Terrace, IL
May 15, 2012

Cliff Haefke

UIC Energy Resources Center
UNIVERSITY OF ILLINOIS AT CHICAGO
COLLEGE OF ENGINEERING

1

Energy Resources Center (ERC)

- Located at the University of Illinois at Chicago (UIC)
- Reports to Dean of College of Engineering
- Over 30 years of service
- Technical knowledge and hands on ability to provide forward looking solutions for today's complex energy environment
- Areas of expertise include energy efficiency, distributed generation, bioenergy and climate, utilities management

UIC Energy Resources Center
University of Illinois at Chicago

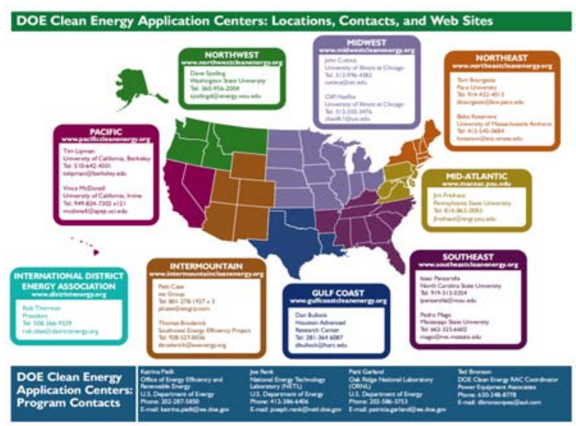
US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center**
- Originally established in 2001 by U.S. DOE to support DOE CHP Challenge
- Today the center promotes the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**

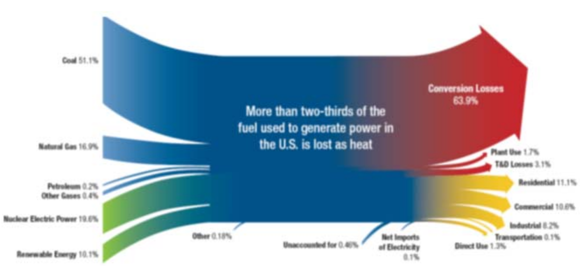
U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

UIC Energy Resources Center



Fuel Utilization by U.S. Utility Sector



The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

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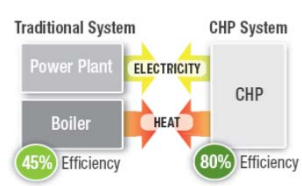
Key Part of Our Energy Future is CHP

- **Form of Distributed Generation (DG)**
- **An integrated system**
- Located at or near a building / facility
- Provides at least a portion the electrical load and
- **Recycles the thermal energy for**
  - **Space Heating / Cooling**
  - **Process Heating / Cooling**
  - **Dehumidification**

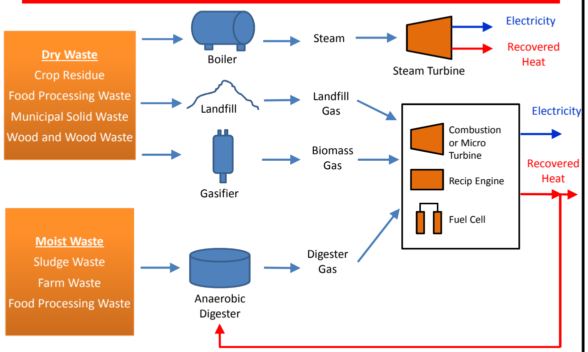


CHP provides efficient, clean, reliable, affordable energy – today and for the future.

UIC Energy Resources Center

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

CHP Technologies Utilizing Biomass/Biogas



Market Development – Emerging Drivers

- Growing recognition of biogas, biomass, & CHP benefits by state and federal policymakers
- Co-digestion / multiple feedstocks / urban farms
- Upward pressure on electricity prices
- Emissions regulations impacting coal-fired power plants and non-utility plants
- Favorable natural gas outlook
- Other…

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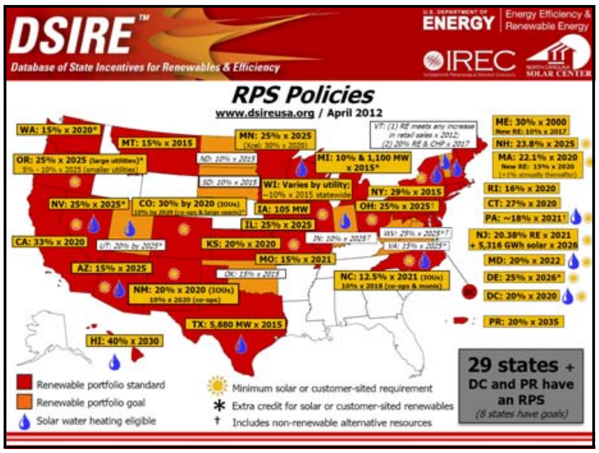
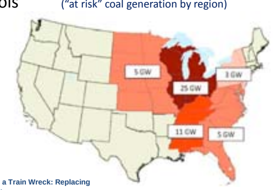


Market Development – Pending Emission Regulations affecting Utility Sector

- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40,000 MW of coal-fired electric generation
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)

Rules Effecting Utility Sector
("at risk" coal generation by region)



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Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

Market Development – Other Electric Industry Market Indicators

- Supply margins are declining and as demand is recovering
  - Need significant infrastructure investment
  - Estimates at $750 – 900 Billion: exceeds current capitalization
  - Major baseload generation & transmission will be needed
- Transmission congestion is increasing
- Aging transmission infrastructure
  - 70% of transmission lines are 25 years or older
  - 70% of power transformers are 25 years or older
  - 60% of circuit breakers are more than 30 years old

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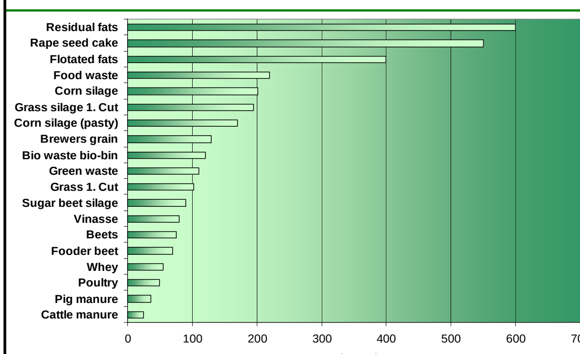
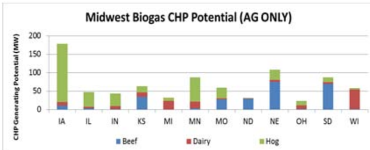
Sources: NERC Transmission Loading Relief Procedure Logs & "Rising Utility Construction Costs: Sources & Impacts" Edison Foundation/Brattle Group

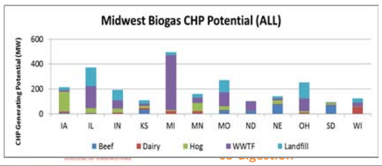
Co-Digestion & Comparing Biogas Potential



Midwest Biogas Potential (MW)

Midwest Potential = 2,528 Megawatts

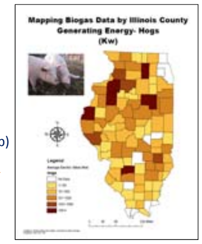




Waste Category	# of Projects	CHP Potential (MW)
Beef	9,360	255
Dairy	2,112	153
Hog	9,464	410
WWTF	2,468	1,087
Landfill	445	623
Total	23,849	2,528

Illinois Activity Development

- Illinois electric cooperatives and Association of Illinois Electric Cooperatives (AIEC) expressing interest in biogas CHP development:
  - 5 Workshops between 2009 and 2012 (Springfield, Onarga, Breese, Effingham, Macomb)
  - Biogas Feedstock Study
  - RE-AP Grant Program
- EPA Region 5 Interest in Illinois Community Digester



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Illinois DCEO Biogas/Biomass Program

- DCEO Program managed by UIC/ERC
  - Six (6) projects awarded totaling **$780K**
  - Feasibility Studies: **$2,500**
  - Biogas to Energy Systems: **$225,000 (up to 50%)**
  - Biomass to Energy Systems: **$400,000 (up to 50%)**
  - Deadline: **April 30, 2012** (likely to be renewed for 2013)

Funded Projects
1. Agriculture Watershed Institute (AWI)
2. Hunter Haven Farms
3. John Deere Harvester Works
4. Packer Engineering
5. Village of Fox Lake - WWTF
6. City of Danville – WWTF

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Recent Biogas CHP Developments

- **Gundersen Lutheran Health System (WI)**
  - 100% Energy Independence Goal
  - 1 MW LFG CHP Project w/ Landfill
  - 633 kW AD/CHP Project w/ Brewery

- **Janesville WWTP (WI)**
  - 460 kW AD/CHP
  - CNG Vehicle Fueling Station

Capstone Microturbine

ANGI Compressor

ANGI Fuel Dispenser

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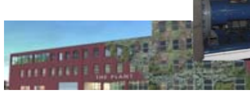
Recent Biogas CHP Developments

- **Bayview WWTP (OH)**
  - 10 MW dual-fueled CHP system
  - Landfill Gas & Anaerobic Digester Gas

- **The Plant (IL)**
  - Vertical farm and home to a number of sustainable food and beverage businesses
  - 500 kW retrofitted jet engine CHP system



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17

Thank You

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www.midwestcleanenergy.org

UIC Energy Resources Center
University of Illinois at Chicago
College of Engineering

Panel: Advancing Pro-CHP Policy in Ohio

USCHPA Spring Forum

May 16, 2012

Cliff Haefke, Associate Director
US DOE Midwest Clean Energy Application Center

Trish (Lanahan) Demeter, Director of Clean Energy Campaigns
Ohio Environmental Council

Kevin Schmidt, Director of Energy Services
Ohio Manufacturers Association

Dylan Sullivan, Staff Scientist
NRDC-Midwest Office

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the centers promote the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
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  - **Education & outreach**
  - **Technical assistance**
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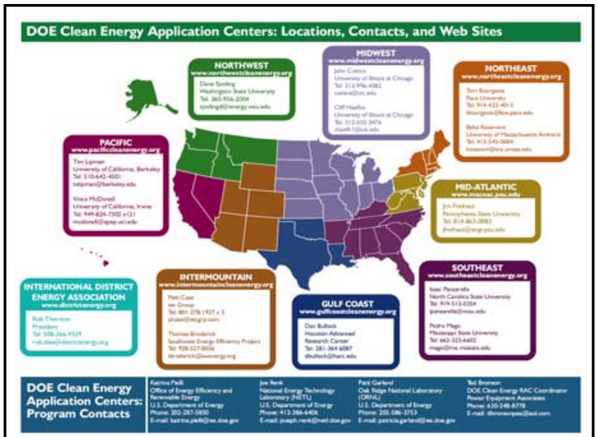

Snapshot of Ohio CHP Market

	Current	Tech Potential
CHP Implementation in Ohio	566.6 MW	9,800 MW
CHP % of Total Ohio Electric Generation	1.7%	29.4%
Nationally, CHP % of Total Generation	*8.0%*	*-*

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	9,800

Why the GAP between installed CHP and the technical potential of CHP?

- ***PAST…***
  - Poor spark spread (high natural gas prices, low electric prices)
  - Policies unfavorable towards CHP (SB 221, standby rates, etc.)
- ***NOW…***
  - Natural gas prices lower/stabilizing
  - Electric prices increasing (EPA regulations, aging electric infrastructure, etc.)
  - Interest by Governor / PUCO / SEO / Industry / Environmental Community

The Beginning of the Ohio CHP/WHR Discussions

- Benefits of large CHP/WHR potential recognized by environmental community 2 years ago
- CHP interaction between ***Environmental*** community and ***Industrial*** community kicked off at December 2010 workshop in Columbus, OH
- Opportunity for CEAC to assist educating Environmental and Industrial stakeholders

Now 2 years later…

- Where are we at?
- How did we get where we are at?
- Who are the interested stakeholders?
- What's next?
- Here is our panel:
  - **Trish (Lanahan) Demeter**, Director of Clean Energy Campaigns, Ohio Environmental Council
  - **Kevin Schmidt**, Director of Energy Services, Ohio Manufacturers Association
  - **Dylan Sullivan**, Staff Scientist, NRDC-Midwest Office

Follow PUCO Activities (in-person or online)

- (Feb 23, 2012) Public Utility Commission of Ohio (PUCO) announced partnership with US DOE to launch a pilot program to offer technical assistance to industrial boiler operators who invest in CHP
  - http://www.puco.ohio.gov/puco/index.cfm/media-room/media-releases/puco-announces-offer-of-technical-assistance-for-combined-heat-and-power-conversions/
- **2012 PUCO CHP Workshops**
  - US DOE Pilot Program for CHP – Friday, March 9, 2012
    - http://www.puco.ohio.gov/apps/Webcast/index.cfm
  - CHP Success Stories - Wednesday, June 20, 2012
  - CHP Financial Tools - Thursday, August 2, 2012
  - CHP Stand-by Power Issues - Thursday, September 13, 2012

Thank You

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U.S. Department of Energy Midwest Clean Energy Application Center

A program at UIC Energy Resources Center

A program sponsored by U.S. Department of Energy Energy Efficiency & Renewable Energy

CHP Opportunities and DOE's Regional Clean Energy Application Centers

June 14, 2012
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

Outline

- DOE's Clean Energy Application Centers
- CHP Markets and Opportunities
- DOE's Interest in CHP
- Available CEAC Technical Assistance

2

US DOE Regional Clean Energy Application Centers (CEACs)

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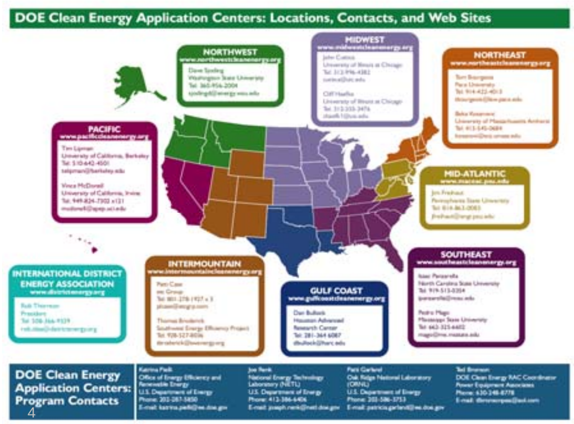

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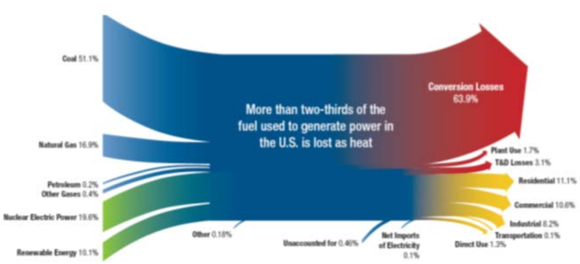
Fuel Utilization by U.S. Utility Sector

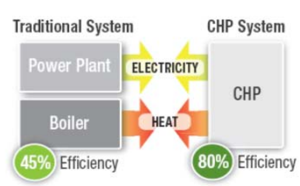


The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

5

Key Part of Our Energy Future is CHP

- **Form of Distributed Generation (DG)**
- **An integrated system**
- Located at or near a building / facility
- Provides at least a portion of the electrical load and
- **Recycles the thermal energy for**
  - **Space Heating / Cooling**
  - **Process Heating / Cooling**
  - **Dehumidification**

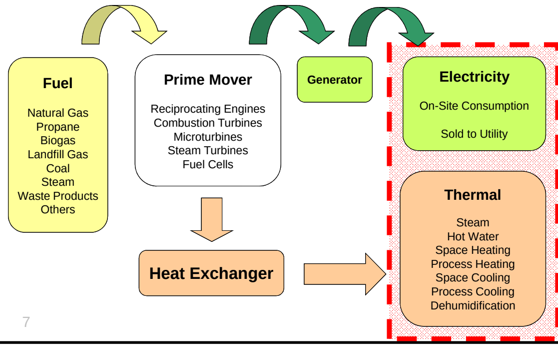


CHP provides efficient, clean, reliable, affordable energy – today and for the future.

6

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

CHP Technology Components (Topping Cycle)



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Attractive CHP Markets

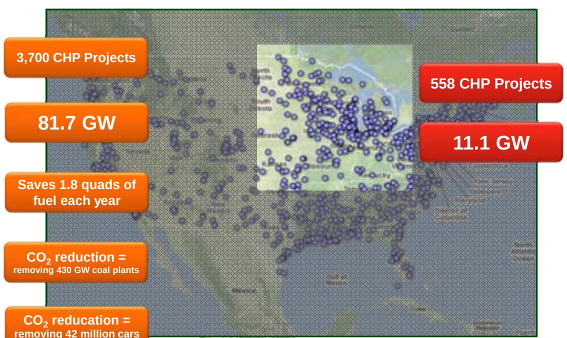
Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Is Used at the Point of Demand



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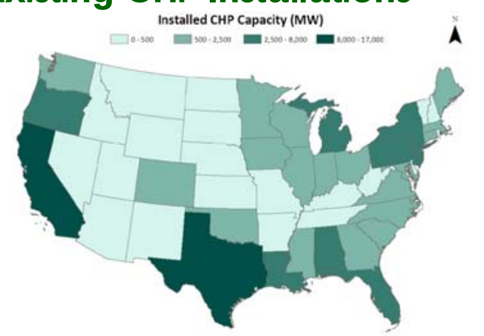
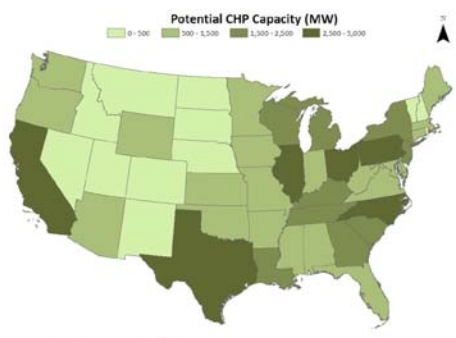
Existing CHP Installations



Source: CHP/DHC Country Scorecard: United States (International Energy Agency)

10

Technical CHP Potential



Scorecard: United States (International Energy Agency)

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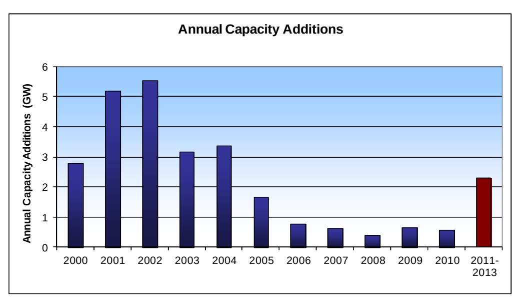
2,400 MW of Additional CHP Capacity Is in the Pipeline

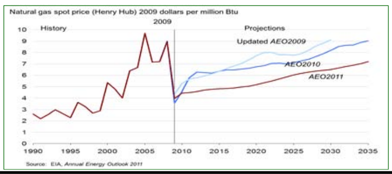


Source: ICF CHP Database

Based on projects under construction or in design phase

CHP Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Emissions regulations impacting non-utility boilers
- Upward pressure on electricity prices
- Favorable natural gas outlook



CHP Market Development – Pending Emission Regulations affecting Utility Sector

- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40,000 MW of coal-fired electric generation
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)

Rules Effecting Utility Sector
("at risk" coal generation by region)

Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

CHP Market Development – Other Electric Industry Market Indicators

- Supply margins are declining and as demand is recovering
  - Need significant infrastructure investment
  - Estimates at $750 – 900 Billion: exceeds current capitalization
  - Major baseload generation & transmission will be needed
- Transmission congestion is increasing
- Aging transmission infrastructure
  - 70% of transmission lines are 25 years or older
  - 70% of power transformers are 25 years or older
  - 60% of circuit breakers are more than 30 years old

Sources: NERC Transmission Loading Relief Procedure Logs & "Rising Utility Construction Costs: Sources & Impacts" Edison Foundation/Brattle Group

CHP is a Key Component of Distributed Energy within DOE's Advanced Manufacturing Office (AMO)

Accelerated CHP has proven its effectiveness and holds promise for the future—as an:

- **Environmental Solution** – Significantly reducing CO_2 emissions through greater energy efficiency
- **Competitive Business Solution** – Increasing efficiency, reducing business costs, and creating green-collar jobs
- **Local Energy Solution** – Deployable throughout the U.S.
- **Infrastructure Modernization Solution** – Relieving grid congestion and improving energy security.

DOE Secretary Chu visited TECO CHP Plant (2/2/2012)

Goal: achieve all cost-effective energy efficiency by 2020

- State- and local-led initiative facilitated by federal government to take energy efficiency to scale through state and local policies and programs
- Information resources to support state and local decision makers
  - Decision-grade guides on time-tested best practices
  - State/local approaches to new and emerging issues
  - Technical assistance from national experts
- Successor to the National Action Plan for Energy Efficiency

SEE Action Network Structure

Executive Group Members

A diverse group of state policy makers, business leaders, utilities, NGOs, associations, and others provide vision and strategic guidance

Working Group Chairs

State & local leaders co-chair SEE Action's 8 priority issue areas

Staff Leads

DOE and EPA staff provide support and coordination

What SEE Action Does

Working Groups develop decision-grade best practice guides based on state & local experience →

Working Groups educate and engage with state and local decision makers through Network connections

Working Groups support decision maker action with expert technical assistance and peer exchanges →

IEE / CHP Working Group Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Drive Demand for IEE & CHP	Build the Workforce	Promote Efficient Operations & Investment	Move the Market
1. State, Local, & Utility Programs for Industry Programs that better meet the needs of industry **2. State Policy Models** Broader adoption of model policies **3. National Energy Efficiency Policy** Enhance national policy with regard to industrial energy efficiency and CHP **4. Education & Outreach** Build corporate culture; foster greater understanding of the economic value of industrial energy efficiency and CHP	**5. Education & Workforce Development** Identify industry's needs and workforce needs; develop new programs to address needs **6. Develop Training & Academic Curricula** From the plant floor to the corporate level **7. Licensing & Certification Protocols** Certified Energy Manager (CEM); DOE Qualified Specialists; Continuous Energy Improvement, etc.	**8. Financing Innovation** Loan guarantees, energy service companies (ESCOs), etc. **9. Financial Incentives** Address industry ROI and refit cycles **10. Technical Solutions** Improve availability of energy efficiency and CHP information and tools for industry **11. Energy Management Programs/Continuous Energy Improvement** Ex: ISO 50001, Superior Energy Performance (SEP), ENERGY STAR, and others	**12. Technology Demonstration** Adoption of existing technologies **13. Regulatory Recommendations to Support CHP** Offer comprehensive CHP policies **14. Reduce Uncertainty Related to State Interconnection** Harmonization across broad regions and states **15. Financing Reform** Depreciation rules and Sarbanes-Oxley Act

Green = IEE **and** CHP solution
Purple = CHP only solution

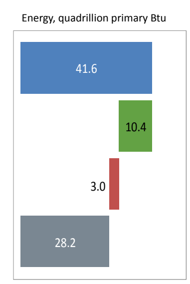
Impact of IEE/CHP WG Goals

Where We Are Today: According to the Energy Information Administration, gross domestic product (GDP) growth estimates with fixed energy intensity, the industrial sector will consume 41.6* quads of primary energy in the year 2020 (Business as Usual).

Working Group Goals: Based on the McKinsey report, 13.4 quads of potential industrial Btu savings by 2020 exist.** The working group's goals to <u>reduce industrial energy intensity by 2.5%</u> annually through 2020 <u>and install 40 GW of new, cost-effective CHP</u> by 2020 will achieve a reduction of 10.4 quads.***

Scope: Reaching goals would capture 78% of the potential energy efficiency in the industrial sector, leaving 3.0 quads to address through other activities.

Resulting 2020 Energy Use if all potential is addressed:



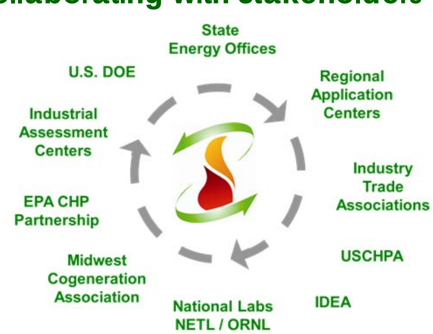
* Total industrial sector energy consumption includes refining-related efforts.
** The McKinsey non-transportation industrial estimates were used to calculate the potential for the full industrial sector.
*** 2020 efficiency potential is based on an estimated 25.2% growth in GDP by 2020 (Annual Energy Outlook 2008) and a fixed industrial energy intensity (energy consumption per value of shipments) through 2020.

Estimated Potential Impacts of New 40 GW of CHP by 2020*

- Increased CHP capacity by nearly 50%
- Annually save 0.8 quads of fuel
- Reduce annual CO2 emissions by 233 MT
- Remove the annual equivalent of 35 million cars off the road
- Realize $60 million in private sector investment and 250,000 new jobs

** Impact values calculated based on ORNL's 2008 "Combined Heat and Power Effective Energy Solutions for a Sustainable Future"*

Collaborating with Stakeholders



CEAC Technical Assistance – CHP, WHR, District Energy

Feasibility Steps

- Phone and Meeting Inquiries
- Site Data Collection
- Qualification Screening Analysis
- Feasibility Analysis
- Investment Grade Analysis
- Procurement / Installation / Operation

CEAC Capabilities

- Analysis Performance thru Feasibility Analysis
- Consulting Expertise thru all Steps
- Bringing customers and CHP engineering community together

CEAC Project Support

- Over 225 assessments & 700 tech support activities
- Represents over 1.5 GW installed or in development

25

Questions

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Combined Heat and Power 101

Public Utility Commission of Ohio

Combined Heat and Power Case Studies:
Voices of Experience

June 20, 2012
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

Outline

- DOE's Clean Energy Application Centers (CEACs)
- CHP Overview (Concept, Technology, Markets, Opportunities, etc.)
- Available DOE CEAC Technical Assistance

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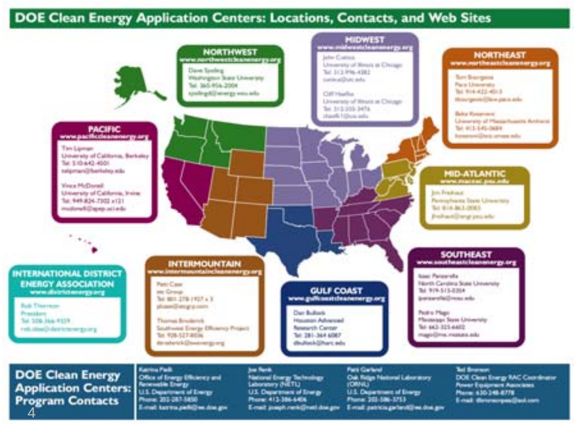
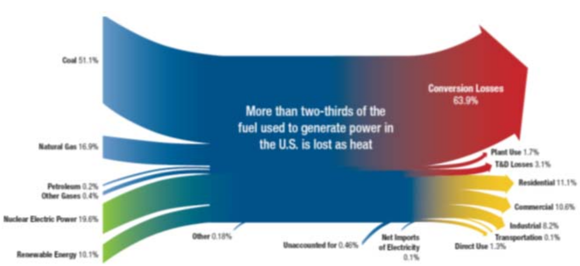


Fuel Utilization by U.S. Utility Sector



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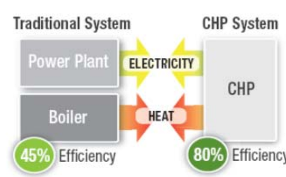


CHP provides efficient, clean, reliable, affordable energy – today and for the future.

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

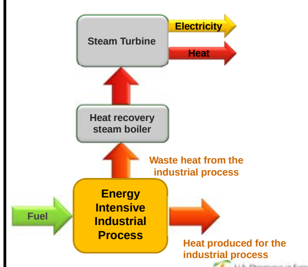
Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating heat and electricity
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

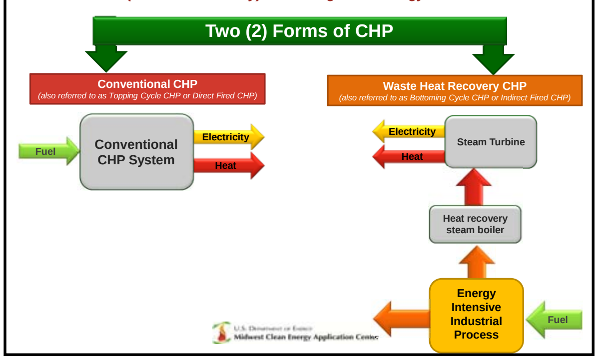
Waste Heat Recovery CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature *(low hanging fruit in industrial plants)*

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

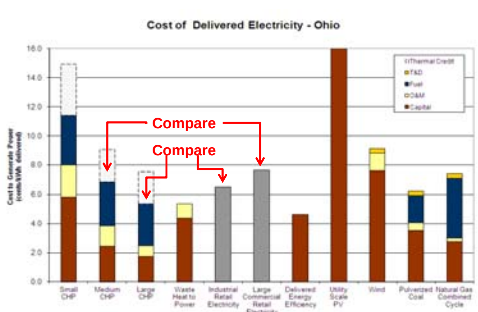


CHP Integrated Technologies / Components

- **Prime Movers**
  - Turbines (Combustion, Steam, Micro)
  - Reciprocating Engines
  - Fuel Cells
  - ORC
- **Thermal Technologies**
  - Heat Exchangers
  - Absorption Chillers
  - Desiccants
- **Controls**
- **Fuels**
  - Natural Gas
  - Biogas / Biomass
  - Landfill Gas
  - Waste Products
  - Exhaust Gases
  - Other
- **Generators**
  - Synchronous
  - Induction
  - Inverters

10

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

Attractive CHP Markets



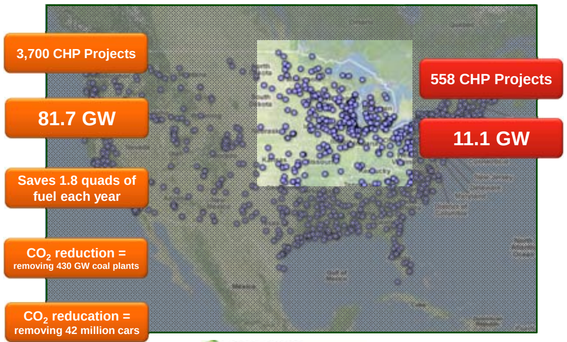

Industrial
- **Chemical manufacturing**
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- **Refining**
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- **Hospitals**
- **Landfills**
- Universities & colleges
- **Wastewater treatment**
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Is Used at the Point of Demand



U.S. Department of Energy Midwest Clean Energy Application Center

13

Snapshot of Ohio CHP Market

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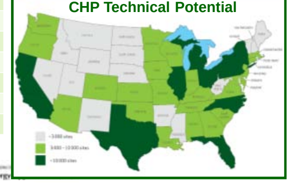
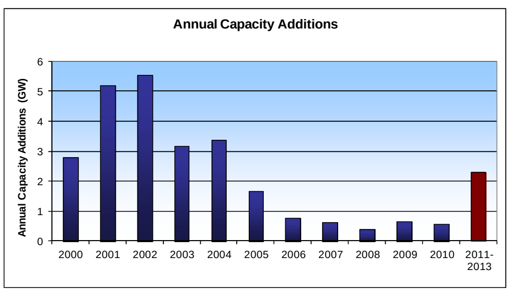
CHP Technical Potential



U.S. Department of Energy Midwest Clean Energy Application Center

Market Trend of U.S. CHP Installation Capacity



Source: ICF CHP Database

Based on projects under construction or in design phase

U.S. Department of Energy Midwest Clean Energy Application Center

CHP Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Emissions regulations impacting non-utility boilers
- Upward pressure on electricity prices
- Favorable natural gas outlook

16

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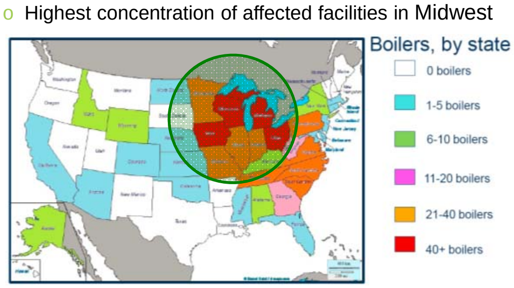
CHP Potential in Boiler MACT Affected Facilities

- Highest concentration of affected facilities in Midwest

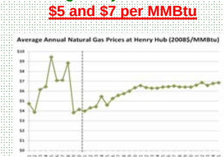


U.S. Department of Energy Midwest Clean Energy Application Center

Midwest "Spark Spread" Improving

Favorable Natural Gas Outlook

Henry Hub Gas Prices Will Average Projected Between $5 and $7 per MMBtu



Upward Pressure on Electricity Prices

30 GW of Midwest Coal Fired Utility Power Plants impacted by EPA regulations

Source: ICF International

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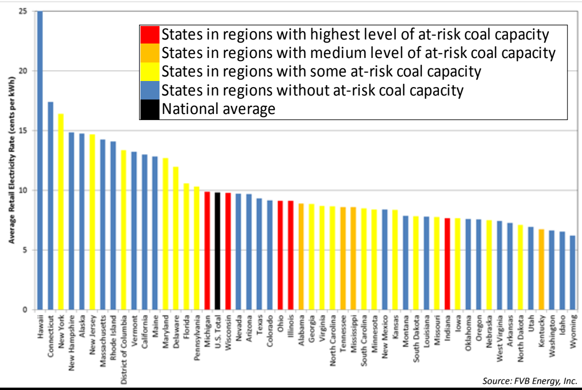
Ave. Electric Price & At-Risk Coal Capacity



CHP is a Key Component of Distributed Energy within DOE's Advanced Manufacturing Office (AMO)

Accelerated CHP has proven its effectiveness and holds promise for the future—as an:

- **Environmental Solution** – Significantly reducing CO2 emissions through greater energy efficiency
- **Competitive Business Solution** – Increasing efficiency, reducing business costs, and creating green-collar jobs
- **Local Energy Solution** – Deployable throughout the U.S.
- **Infrastructure Modernization Solution** – Relieving grid congestion and improving energy security.

IEE/CHP SEE Action Working Group Goals:
Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

DOE CEAC CHP Technical Assistance

Feasibility Steps

- Phone and Meeting Inquiries
- Site Data Collection
- Qualification Screening Analysis
- Feasibility Analysis
- Investment Grade Analysis
- Procurement / Installation / Operation

CEAC Capabilities

- Analysis Performance thru Feasibility Analysis
- Consulting Expertise thru all Steps
- Bringing customers and CHP engineering community together

CEAC Project Support

- Over 225 assessments & 700 tech support activities
- Represents over 1.5 GW installed or in development

U.S. Department of Energy
Midwest Clean Energy Application Center

Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

A program at

UIC Energy Resources Center
College of Engineering

A program sponsored by

U.S. Department of Energy
Energy Efficiency & Renewable Energy

Session 2
"Opportunities and Potential for Industrial CHP"

Panel Moderator:
John Cuttica: Director Energy Resources Center – Univ. of Illinois @ Chicago

Panelists:
Edward Mardiat: Director of On-Site Energy & Power Project Development, Burns & McDonnell

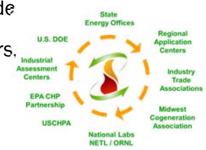
Kevin Bright: Managing Director, Non-Residential Products & Strategy, Duke Energy

Steve Caminati: Director, Advanced Energy Economy Ohio

Industrial Energy Efficiency & CHP Dialogue
U.S. DOE Regional Meting - Midwest
June 21, 2012

U.S. DOE Midwest Clean Energy Application Center

- Mission: Promote and assist in transforming the market for combined heat and power, waste heat recovery, and district energy technologies and concepts throughout the 12 State Midwest Region
- Regional Strategy (Focus): Provide an outreach and technology deployment program to end users, policy, utility, & industry stakeholders aimed at:
  - Education and Outreach
  - Market Assessments
  - Technical Assistance (project support)



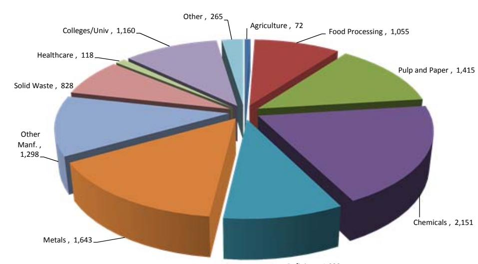
Evolving Midwest CHP Landscape

2001 - 2004
- Focus on specific markets *(healthcare, colleges/universities, industrial manufacturers, ethanol plants)*
- Focus on NG fueled topping cycle CHP
- Main efforts were education and project support

2004 - 2009
- Sharp increase in NG prices *(terrible spark spreads)*
- Focus shifted to opportunity fueled topping cycle CHP and WHR/bottoming cycle CHP
- Top priority - anaerobic digester applications *(livestock manure, food processing, wastewater treatment facilities)*
- Increase in policy related work *(interconnect standards, net metering,)*

2010 - 2012
- NG prices fall and long term price projections look good
- Upward pressure on electric prices *(pending EPA regs including Boiler MACT)*
- Industrial sector starts to rebound
- Result: Focus on anaerobic digester and WHR applications expanded to once again include natural gas topping cycle CHP applications *(emphasis on industrial market)*
- Policy efforts increase with State RPS/ EEPS, DOE Six State Effort, SEEAction, Changes in State Administrations, Renewed State Interest in CHP/WHR,

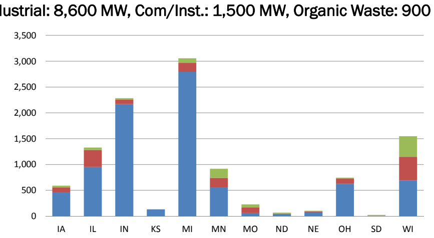
Snapshot Midwest
Midwest Installed CHP Generation Capacity by Market Sector (11,000 MW)



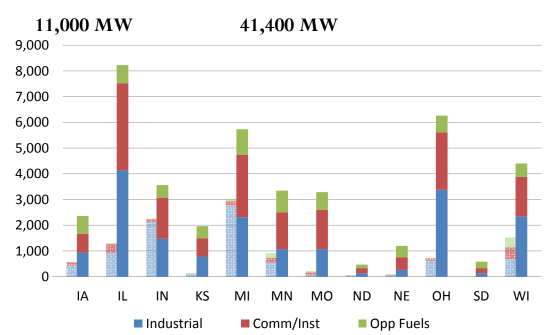
Snapshot Midwest
Midwest Installed CHP Capacity

Total: 11,000 MW

Industrial: 8,600 MW, Com/Inst.: 1,500 MW, Organic Waste: 900 MW



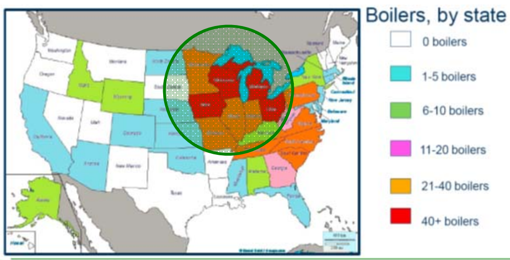
Snapshot Midwest
Installed vs. Technical Potential



Snapshot Midwest

CHP Potential in Boiler MACT Affected Facilities

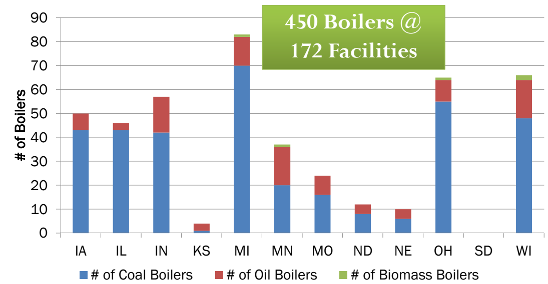
- Highest concentration of affected facilities in Midwest



U.S. Department of Energy
Clean Energy Application Centers

Snapshot Midwest

Boiler MACT Affected Boilers



U.S. Department of Energy
Clean Energy Application Centers

CHP Investment Considerations

- Energy Costs (electric, gas, standby rates, demand charges)
- Value Proposition for the Customer (reduce energy costs, increase reliability, emission compliancy, power quality – impact on bottom line)
- Value Proposition for the Utility (why should they be interested?)
- State Policies have a Large Impact (interconnect standards, permitting, portfolio standards, financing, rate structures)
- Developers follow the path of least resistance

U.S. Department of Energy
Clean Energy Application Centers

Today's Panelists

Edward Mardiat: Director of On-Site Energy & Power Project Development, Burns & McDonnell

Kevin Bright: Managing Director, Non-Residential Products & Strategy, Duke Energy

Steve Caminati: Director, Advanced Energy Economy Ohio

U.S. Department of Energy
Clean Energy Application Centers

CHP Project Costs Screening

Public Utility Commission of Ohio

Combined Heat and Power: Financial Tools Workshop
Columbus, OH

August 2, 2012
Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

Outline

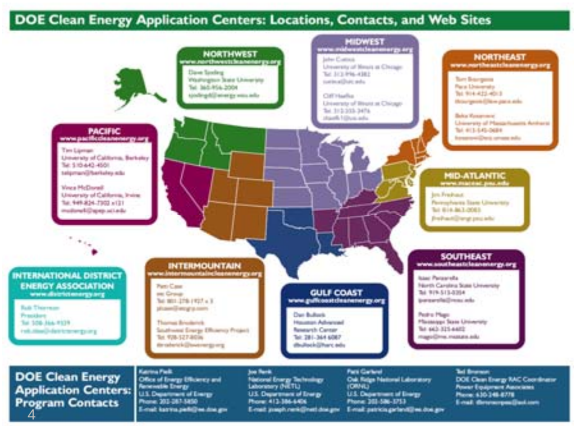
- CHP project development process
- Qualifying a CHP system
- CEAC technical assistance

2

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

3



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Advantages & Benefits of CHP

- Remember… **CHP does not make sense in every application**, but when it does, it can provide the following benefits
  - Lower energy costs
  - Reduced energy consumption
  - Increased electric reliability
  - Standby power
  - Improved environmental quality
  - Good public relations
  - And more…

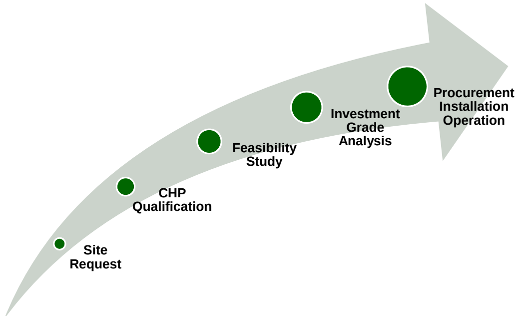
5

Evaluating Facilities on an Individual Basis

- All buildings and market sectors are not identical in terms of
  - Energy consumption
  - Energy demands
  - Operating schedules
  - Size of facilities
  - Geographic location
  - Electric and natural gas utilities
  - Environmental concerns
- Therefore… **it's important to evaluate facilities individually!**

6

CHP Process Development Steps



12

CHP Qualification Questions

- Do you pay more than $.06/kWh on average for electricity (including generation, transmission and distribution)?
- Are you concerned about the impact of current or future energy costs on your business?
- Are you concerned about power reliability? Is there a substantial financial impact to your business if the power goes out for 1 hour? For 5 minutes?

8

CHP Qualification Questions (2)

- Does your facility operate for more than 5000 hours per year?
- Do you have thermal loads throughout the year (including steam, hot water, chilled water, hot air, etc.)?
- Does your facility have an existing central plant?

9

CHP Qualification Questions (3)

- Do you expect to replace, upgrade, or retrofit central plant equipment within the next 3-5 years?
- Do you anticipate a facility expansion or new construction project within the next 3-5 years?
- Have you already implemented energy efficiency measures and still have high energy costs?

10

CHP Qualification Questions (4)

- Are you interested in reducing your facility's impact on the environment?
- Do you have access to on-site or nearby biomass resources (i.e. landfill gas, farm manure, food processing waste, etc.?

11

Attractive CHP Markets




Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

Collecting Site Information for a CHP Evaluation

- Facility data and industry information
- Facility motivation for CHP
- Electric/thermal loads, needs, and costs
- Major HVAC, electric, and thermal (heating & cooling) equipment

Example Screening Calculation *Loads & Assumptions*

Site Characteristics	Value
Facility Type	Hospital
Annual Hours of Operation, hrs	8,520
Average Power Demand, MW	10.4
Average Thermal Demand, MMBtu/hr	50.0
Thermal Fuel Costs, $/MMBtu	6.00
CHP Fuel Costs, $/MMBtu	6.00
Average Electricity Costs, $/kWh	0.08
Percent Electric Price Avoided*	90%

** Typically 70-95%*

Example Screening Calculation (2) *CHP System Assumptions*

CHP System	Values
Net CHP Power, MW (based on thermal match)	10.2
CHP Electric Efficiency, % (HHV)	29.1%
CHP Thermal Output, Btu/kWh	4,922
CHP Availability, %	96%
Incremental O&M Costs, $/kWh	0.009
Displaced Thermal Efficiency, %	80.0%
CHP Thermal Utilization	100.0%

Example Screening Calculation (3) *Annual Energy Results*

	Base Case	CHP Case
Purchased Electricity, kWh	88,250,160	5,534,150
Generated Electricity, kWh	0	82,716,010
On-Site Thermal, MMBtu	426,000	18,872
CHP Thermal, MMBtu	0	407,128
Boiler Fuel, MMBtu	532,500	23,590
CHP Fuel, MMBtu	0	969,845
Total Fuel, MMBtu	**532,500**	**993,435**

Example Screening Calculation (4) *Annual Operating Costs & Simple Payback*

Annual Operating Costs	Base Case	CHP Case
Purchased Electricity, $	$7,060,013	$1,104,460
On-Site Thermal Fuel, $	$3,195,000	$141,539
CHP Fuel, $	$0	$5,819,071
Incremental O&M, $	$0	$744,444
Total Operating Costs, $	**$10,255,013**	**$7,809,514**

Simple Payback Calculations	
Annual Operating Savings, $	$2,445,499
Total Installed Costs, $/kW	$1,400
Total Installed Costs, $	$14,221,861
Simple Payback, Years	**5.8**

CHP Market Development – Emerging Drivers

- **Growing recognition of CHP benefits by state and federal policymakers**
- Emissions regulations impacting non-utility boilers
- Upward pressure on electricity prices
- Favorable natural gas outlook

OH Governor Kasich signing energy Senate Bill 315
Source: Akron Beacon Journal Online, 07/2012

CHP Market Development – Emerging Drivers

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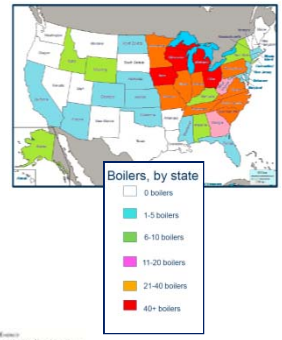

CHP Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
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- **Upward pressure on electricity prices**
- Favorable natural gas outlook

Upward Pressure on Electricity Prices

45+ GW of Coal Fired Utility Power Plants impacted by EPA regulations

Source: ICF International

CHP Market Development – Emerging Drivers

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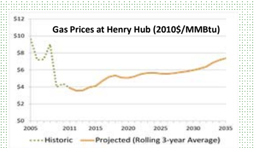
Favorable Natural Gas Outlook

Henry Hub Gas Prices Will Average Projected Between $5 and $6 per MMBtu

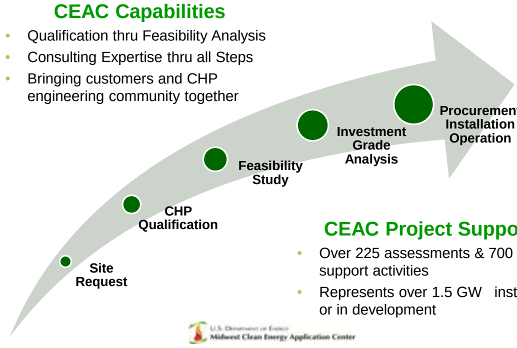


Source: ICF International

CHP Assistance from CEACs

CEAC Capabilities

- Qualification thru Feasibility Analysis
- Consulting Expertise thru all Steps
- Bringing customers and CHP engineering community together



CEAC Project Support

- Over 225 assessments & 700 tech support activities
- Represents over 1.5 GW installed or in development

Thank You

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A program at
UIC Energy Resources Center, University of Illinois at Chicago, College of Engineering

A program sponsored by
U.S. Department of Energy – Energy Efficiency & Renewable Energy

Combined Heat & Power (CHP) and Waste Energy Recovery (WER) Opportunities for Ohio Industries

Tuesday, September 25, 2012

7th Annual Northern Ohio Energy Management Conference

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

U.S. Department of Energy Midwest Clean Energy Application Center

www.midwestcleanenergy.org

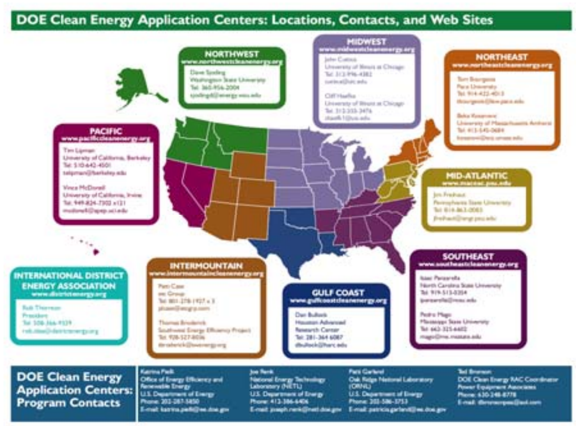
U.S. Clean Energy Application Centers (CEACS)

CEAC Mission and Focus

- **CEAC Mission:** Develop technology application knowledge and the educational infrastructure necessary to promote "clean energy" technologies as viable energy options and reduce any perceived risks associated with their implementation.

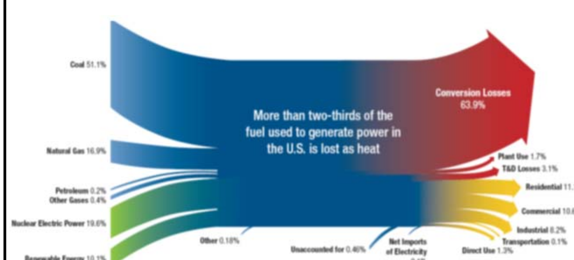
CEAC Focus: Assist in transforming the market for CHP, WER, and DE technologies and concepts throughout the United States by providing:

- Market Analysis & Evaluation
- Education & Outreach
- Technical Assistance



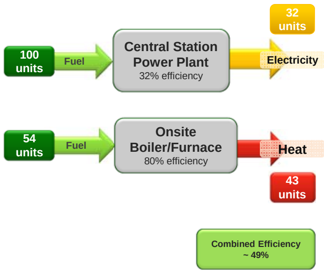
Traditional Energy Systems vs. CHP System Concept

Fuel Utilization by U.S. Utility Sector



The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

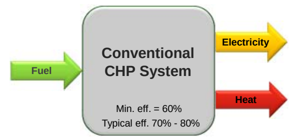
Traditional Energy Systems



Defining Combined Heat & Power (CHP)

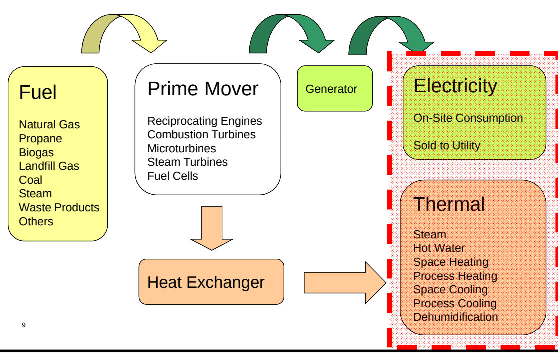
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)



- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating electricity and heat
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Conventional CHP – Topping Cycle CHP



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Conventional CHP

- What drives system efficiency in a conventional CHP system?

Ability to utilize as much of the thermal energy as possible + coincidence between thermal and electric loads

- To ensure high system efficiency, how would you size a conventional CHP system?

Size for thermal base-load and generate electricity when operating to meet the thermal load

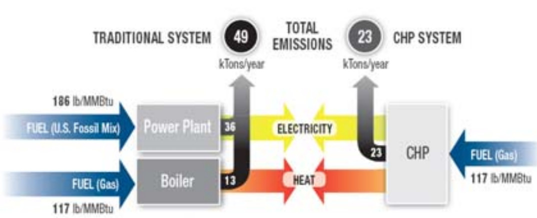
- What maximizes the effectiveness of a conventional CHP system?

Long operating hours + max efficiency = max savings/effectiveness

10

CHP Role in Our Environmental Future

Impact on Carbon Emissions



Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

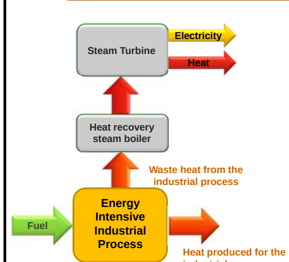
11

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

Defining Combined Heat & Power (CHP)

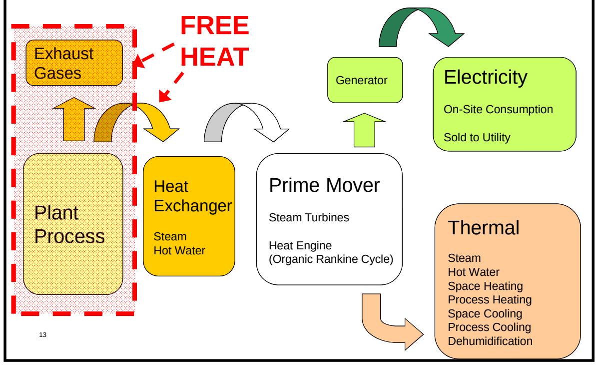
The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Waste Energy Recovery CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of electricity and heat
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

Waste Energy Recovery CHP – Bottoming Cycle CHP

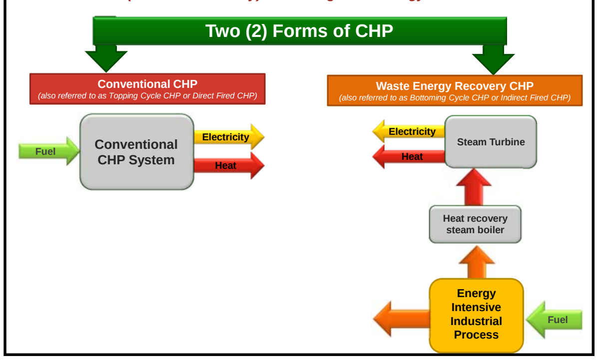


Waste Energy Recovery CHP

- No additional fossil fuel (capturing waste heat as the fuel)
- No incremental emissions
- Like conventional CHP, power generated at site (DG)
- Base load generation – industrials operate 24/7
- High temp (> 800ºF) is low hanging fruit industrial

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



CHP Nomenclature

- Conventional CHP
- Topping Cycle CHP
- Traditional CHP
- Natural Gas CHP

- Waste Heat Recovery CHP (WHR)
- Bottoming Cycle CHP
- Waste Energy Recovery CHP (WER)
- Waste Heat to Power CHP (WHP)

16

Positive Impacts and Benefits (U.S. Businesses)

- Reduces energy costs for the end-user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability
- Provides stability in the face of uncertain electricity prices

Positive Impacts and Benefits (Nation)

- Provides immediate path to increased energy efficiency and reduced GHG emissions
- Offers low cost approach to new electricity generation capacity and lessens the need for new T&D
- Uses abundant, domestic energy sources
- Uses highly skilled local labor & American technologies

CHP System Configuration

Normal CHP Configuration

- CHP Systems are Normally Installed in Parallel with the Electric Grid (CHP does not replace the grid)
- Both the CHP and Grid Supply Electricity to the Customer
- Recycled Heat From the Prime Mover Used for:
  - Space Heating (Steam or Hot Water Loop)
  - Space Cooling (Absorption Chiller)
  - Process Heating and/or Cooling
  - Dehumidification (Desiccant Regeneration)

CHP Is Used at the Point of Demand

3,600 CHP Projects

81,700 MW

Saves 1.8 quads of fuel each year

Eliminates 241 M tons of CO_2 each year

CO2 reduction equivalent to eliminating forty 1,000 MW coal power plants

CHP/WHR is an Underutilized Resource!!!

Source: ICF International

What Makes A Good CHP Application?

- Good Coincidence Between Electric and Thermal Loads
- Large Cost Differential Between Electricity (Grid) and CHP Fuel --- "Spark Spread"
- Long Operating Hours
- Economic Value of Power Reliability is High
- Installed Cost Differential Between a Conventional and a CHP System (*smaller is better*)

22

Attractive CHP Applications




Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

White House Executive Order

- President Obama signed an Executive Order to accelerate investments in industrial EE and CHP (8/30/12)
- Sets national goal of 40 GW of new CHP installation over the next decade
- Directs agencies to foster a national dialogue
- Directs US DOE, US DOC, USDA, and US EPA to coordinate actions at the Federal level

New DOE / EPA CHP Report (8/2012)

Executive Order: http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency
Report: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf

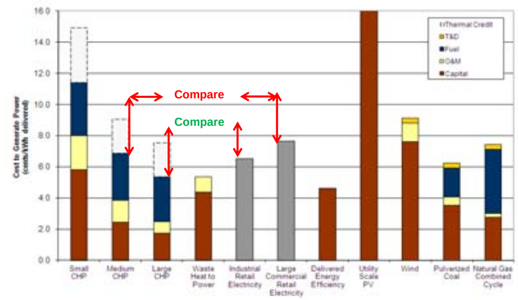
Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	766.6 MW	9,800 MW
CHP % of Total Ohio Electric Generation	2.3%	29.4%
Nationally, CHP % of Total Generation	*8.0%*	*-*

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	9,800

CHP Technical Potential

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

CHP as a Boiler MACT Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP (gas turbine system)
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler
  - Investment rather than control cost

27

MACT Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	398	84,495
Heavy Liquid	82	11,760
Light Liquid	79	6,487
Biomass	67	8,705
Process Gas	71	18,892
Total	**697**	**130,339**

Includes industrial, commercial and institutional boilers only

Ohio's 21st Century Energy Plan

SB 315 Becomes Law

Material for this part of the presentation provided by the Ohio Environmental Council – Trish Demeter

Overview – Ohio's Renewable & Efficiency Standards

- 2008 – SB 221 established Renewable Portfolio Standard (RPS) and Energy Efficiency Resource Standard (EERS)
  - RPS = 12.5% Renewable Energy by 2025
  - EERS = 22% Cumulative Energy Savings by 2025
  - Penalties for non-compliance associated with annual % benchmarks
  - CHP mentioned in Tier 2 Advanced Energy Resources provision (no requirements, no enforcement, ineffective)

Senate Bill 315

- Introduced in March, 2012 as result of Gov. Kasich's "21st Century Energy Plan"
- Includes amendments to SB 221's RPS and EERS provisions
- Signed into law, June 11th, 2012

CHP and WER Definitions in SB 315

"Waste Energy Recovery System"

- a facility that generates electricity through the conversion of energy from either:
  - exhaust heat from engines or manufacturing, industrial commercial, or institutional sites, except for exhaust heat from a facility whose primary purpose is the generation of electricity; or
  - reduction of pressure in gas pipelines before gas is distributed through the pipeline, provided that the conversion of energy to electricity is achieved without using additional fossil fuels.

CHP and WER Definitions in SB 315

"Combined Heat and Power System"

- Defined as:
  - the coproduction of electricity and useful thermal energy from the same fuel source designed to achieve thermal efficiency levels of at least 60% with at least 20% of the system's total useful energy in the form of thermal energy.

SB 315 Changes

- Waste Energy Recovery Systems will be able to qualify as a renewable energy under the RPS
  - Project owner will be able to obtain renewable energy credits (RECs) for each MW produced. Utilities may procure or own WER projects

SB 315 Changes

- WER and CHP will qualify as an energy efficiency measure under the EERS
  - Energy savings from a WER or CHP system will be able to be applied to a utility's efficiency targets
  - Savings claimed by a utility from CHP and WER systems cannot exceed the percentage ratio of total industrial customer load relative to total load
  - WER system owners must qualify their projects as either renewable or efficiency; one project cannot qualify as both.

SB 315 Next Steps

- Effective Date of Legislation: September 10, 2012
- Public Utilities Commission of Ohio (PUCO) will develop rules pertaining to their sections of the bill.
- Rules will be filed with the Joint Committee of Agency Rule Review (JCARR) after the effective date of the legislation
  - Public hearing schedule over 90 days
  - Public comments will be accepted

SB 315 Rules

- As it pertains to EERS, PUCO rules will likely determine:
  - How energy savings are calculated for CHP and WER systems, as it pertains to the EERS
  - The "life of the measure"
  - Measurement and Verification of savings
  - Cost – Benefit or Total Resource Cost mechanism

Utility Efficiency Programs

- As it pertains to CHP and WER as an energy efficiency measure, individual utility programs will likely determine:
  - Revenue mechanisms for savings-per-kilo/megawatt-hour – rebates, performance payments, subsidize equipment, etc.

More Information on CHP and WER Happenings in Ohio

- **Ohio Coalition for Combined Heat and Power**
  - www.midwestcleanenergy.org/ohiochp
- **Public Utility Commission of Ohio**
  - www.puc.state.oh.us/puco/

CHP / WER Opportunities for Ohio

- Large technical potential for CHP/WER
- Low natural gas price outlook
- Upward pressure on electric prices (coal power plant closings)
- Industrial Boiler MACT rules
- SB 315 presents RPS/EERS options
- State Energy Loan Fund (ODOD)
- Joint PUCO/DOE efforts
- Ohio Coalition for CHP

Case Studies

Case Studies: OH CHP Projects

Bay View Wastewater Treatment Plant
Toledo, OH

Capacity: **10 MW**
Fuel: **Biogas / LFG / NG**
Prime Mover: **Comb. Turbine**
Installed: **2010**

Case Studies: Ohio CHP Projects

Kent State University
Kent, OH

Capacity: **12 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb. Turbines (1 x 5MW and 1 x 7MW)**
Installed: **2003, 2005**



Case Studies: Ohio CHP Projects

Broshco Fabricated Products
Mansfield, OH

Capacity: **4.6 MW**
Fuel: **Natural Gas**
Prime Mover: **Reciprocating Engines**
Installed: **2000, 2005**


Waukesha 7100 GSI Engine Units


Control Room Switchgear


Waukesha APG 1800 rpm ARES Test Engine

Case Studies: OH CHP Projects

Millenium Inorganic Chemicals
Ashtabula, OH

Capacity: **28 MW**
Fuel: **Natural Gas**
Prime Mover: **Comb. Turbines and Steam Turbines**
Thermal: **Steam delivered to MIC**
Installed: **2001**

Millennium Inorganic Chemicals
A Cristal Company

Duke Energy®
Generation Services

Case Studies: OH CHP Projects

SunCoke Energy
Middleton, OH

Facility: **100 ovens**
Capacity: **48 MW**
Fuel: **Waste**
Prime Mover: **Steam Turbines**
Installed: **2011**

Case Studies: OH CHP Projects

Lima Wastewater Treatment Plant
Lima, OH

WWTP Size: **14 MGD**
CHP Capacity: **65 kW**
Fuel: **Biogas**
Installed: **2002**
Prime Mover: **Microturbine (plans for 2nd MT)**


Gas Compression


Gas Refrigeration


Static Filter (siloxane)


Microturbine

Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

A program at
UIC Energy Resources Center

A program sponsored by
U.S. Department of Energy
Energy Efficiency & Renewable Energy

Natural Gas Key Account Reps Training for Combined Heat and Power (CHP)

Public Utility Commission of Ohio
Columbus, Ohio

December 7, 2012
John Cuttica / Cliff Haefke

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

www.midwestcleanenergy.org

Natural Gas Key Accounts Training for Combined Heat and Power (CHP)

- Purpose:
  - Understand fundamentals of CHP
  - Understand the types of CHP
  - Present why CHP can bring value to your customers
  - Be able to identify where CHP might make technical and economic sense
  - Where to find assistance once a CHP potential site is identified
  - Not to become CHP experts in one workshop

2

U.S. Department of Energy
Midwest Clean Energy Application Center

Outline

1. CHP Value/Impact to NG Suppliers and Current Industry Drivers
2. CHP Technologies
3. Where Does CHP make sense?
4. Screening a facility for CHP potential

3

U.S. Department of Energy
Midwest Clean Energy Application Center

US DOE Regional Clean Energy Application Centers (CEACs)

- **U.S. DOE Midwest Clean Application Center** originally established in 2001 by U.S. DOE and ORNL to support DOE CHP Challenge
- Today the **8 Centers** promote the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market analysis & evaluation**
  - **Education & outreach**
  - **Technical assistance**
- Midwest Website: www.midwestcleanenergy.org

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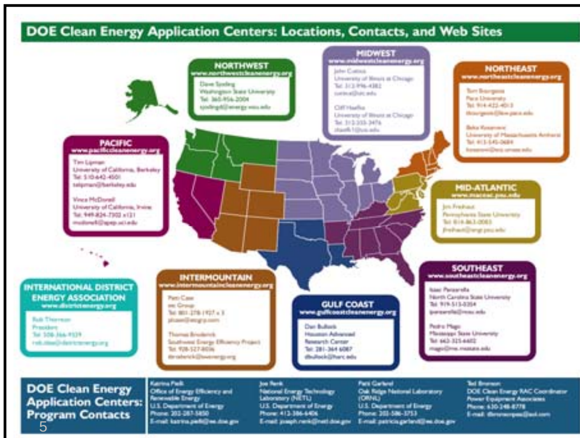
Midwest Clean Energy Application Center



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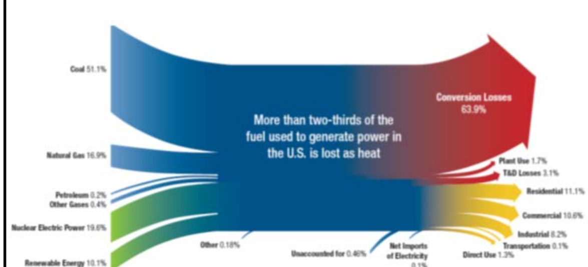
Fuel Utilization by U.S. Utility Sector



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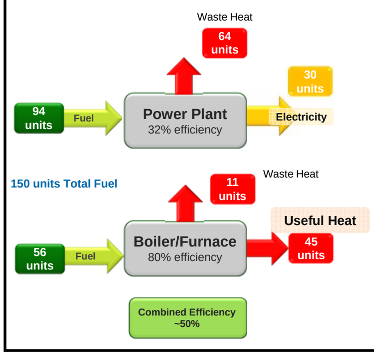
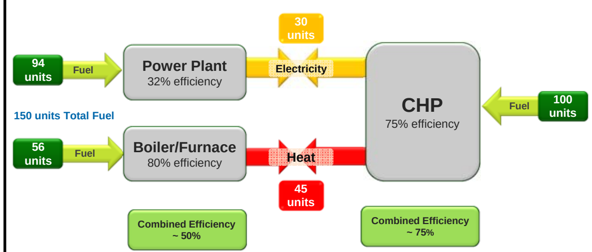
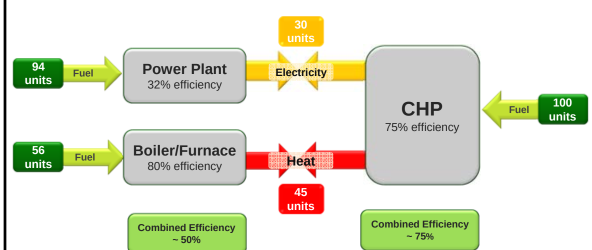
Conventional Delivery of Heat & Power



CHP Recaptures Much of that Heat, Increasing Overall Efficiency of Energy Services.....



.... and Reduces Greenhouse Gas Emissions

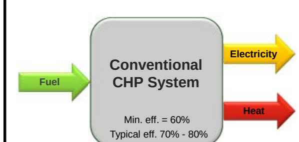


30 to 55% less greenhouse gas emissions

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

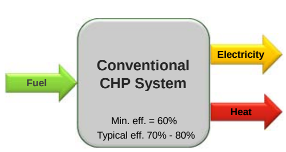


- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating heat and electricity
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

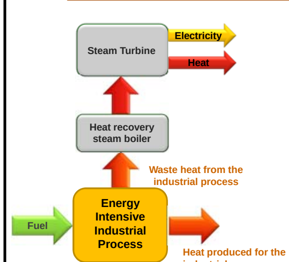


- Reciprocating Engine
- Aero derivative Gas Turbine
- Micro turbine
- Fuel Cell
- Boiler Steam Turbine

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

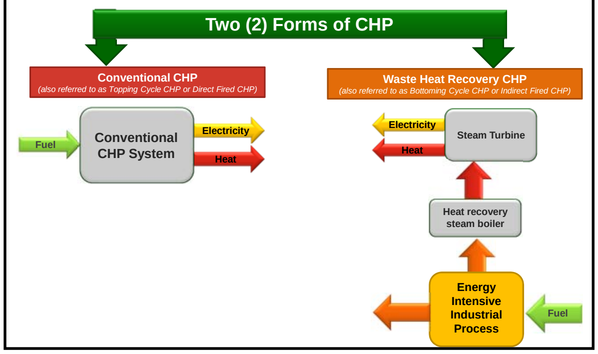
Waste Heat Recovery CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

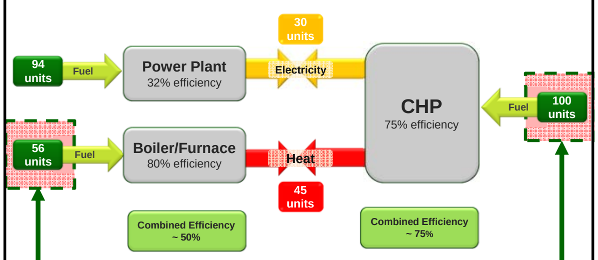


1.) CHP Value/Impact to NG Suppliers and Current Industry Drivers

CHP Value to NG Suppliers

- Building gas load
- Increasing the value you bring to your customers

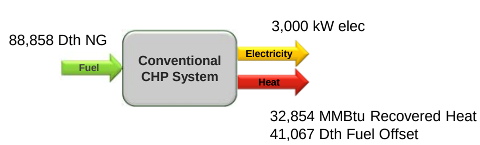
Building Customer Gas Load



- Baseline Fuel Consumption = 56 units
- CHP Case Fuel Consumption = 100 units
- On-Site Fuel Increase of 44 units (i.e. 79% increased load)

Example: Determining Increased Gas Load for 3,000 kW CHP System

- 3,000 kW CHP system operating 3,120 hours per year (i.e. 12 hrs/day, 5 days/wk)
- CHP Effic. @ 73% -- Elec. Conversion Effic. @ 36% HHV



Example: Determining Increased Gas Load for 3,000 kW CHP System

800 kW CHP System	Operating 12/5
Gross CHP Fuel Consumption	88,858 Dth

Example: Determining Increased Gas Load for 3,000 kW CHP System

800 kW CHP System	Operating 12/5
Gross CHP Fuel Consumption	88,858 Dth
Heat Recovery Fuel Offset*	41,067 Dth

Example: Determining Increased Gas Load for 3,000 kW CHP System

800 kW CHP System	Operating 12/5
Gross CHP Fuel Consumption	88,858 Dth
Heat Recovery Fuel Offset*	41,067 Dth
Net CHP Fuel Consumption	47,791 Dth

* Fuel that would have been consumed by boiler in baseline case.

- CHP system operating 12/5 (3,120 hr/yr) with margins of $1/Dth would profit $47.8K

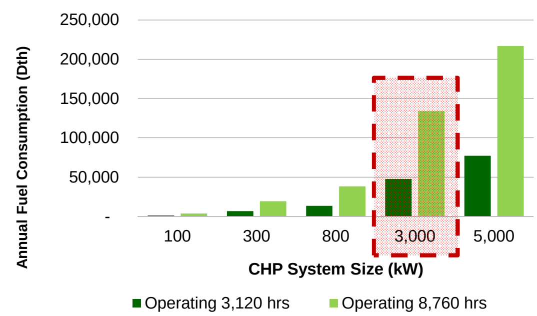
Example: Determining Increased Gas Load for 3,000 kW CHP System

800 kW CHP System	Operating 12/5	Operating 24/7
Gross CHP Fuel Consumption	88,858 Dth	249,485 Dth
Heat Recovery Fuel Offset*	41,067 Dth	115,304 Dth
Net CHP Fuel Consumption	47,791 Dth	134,181 Dth

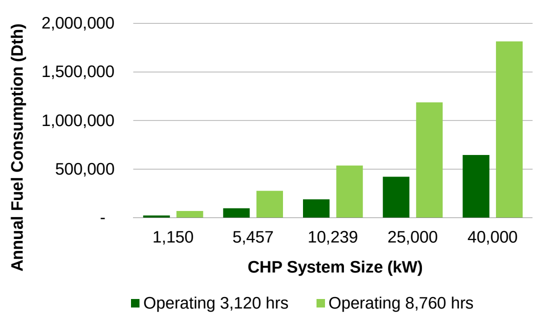
* Fuel that would have been consumed by boiler in baseline case.

- CHP system operating 12/5 (3,120 hr/yr) with margins of $1/Dth would profit $47.8K
- CHP system operating 24/7 (8,760 hr/yr) with margins of $1/Dth would profit $134.2K

Increasing On-Site Gas Load with CHP Systems (reciprocating engines)



Increasing On-Site Gas Load with Larger CHP Systems (gas turbines)



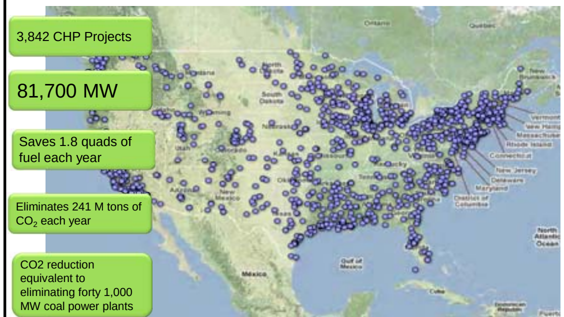
Increasing Value to Your Natural Gas Customers

- Looking out for customer's overall interests and energy needs
  - not just NG consumption
- Bringing non-standard energy technology concepts to customer
- Building credibility for future projects
  - Irrelevant to whether CHP project development moves forward or not

CHP Market Development – Emerging Drivers

- Growing recognition of CHP benefits by state and federal policymakers
- Upward pressure on electricity prices
- Favorable outlook for natural gas supply and price in North America
- Opportunities created by environmental drivers
- Others

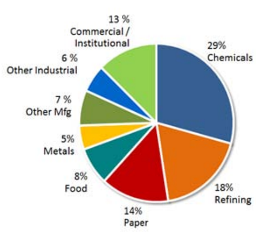
CHP Is Used at the Point of Demand



Source: ICF International

Existing CHP Capacity

- ~ 8% US generating capacity
- ~ 12% total annual MWh generated
- Industrial applications represent 87% of existing capacity
- Commercial/institutional applications represent 13% of existing capacity:
  - Hospitals, Schools, University Campuses, Hotels, Nursing Homes, Office Buildings, Apartment Complexes, Data Centers, Fitness Centers



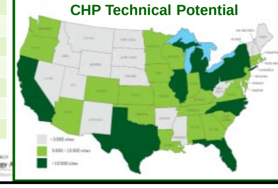
Source: ICF International

Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	530 MW	9,800 MW
CHP % of Total Ohio Electric Generation	2%	29.4%
Nationally, CHP % of Total Generation	*8.0%*	*-*

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	9,800

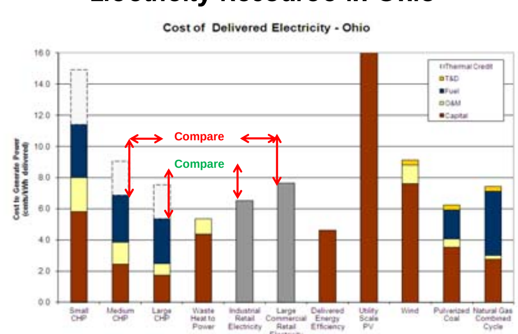
CHP Technical Potential



Ohio CHP Facilities

1. Goodyear Tire & Rubber (Akron)
2. Diamond Crystal Salt Company (Akron)
3. City of Akron, OH Department of Public Services Composting Facility (Akron)
4. Sauder Woodworks Plant (Archbold)
5. Millennium Inorganic Chemicals (Ashtabula)
6. Bygen Corporation (Ashtabula)
7. Radisson Beachwood Inn (Beachwood)
8. Glatfelter Research (Chillicothe)
9. University of Cincinnati (Cincinnati)
10. Ivorydale (Cincinnati)
11. Clarke Gm Diesel (Cincinnati)
12. LTV Steel Cleveland Works (Cleveland)
13. Empire Industries (Cleveland)
14. Deaconess Hospital (Cleveland)
15. Synthetic Products Company (Cleveland)
16. CERTS Microgrid Test Bed (Columbus)
17. Stone Container Corporation (Coshocton)
18. Wright Patterson AFB (Fairborn)
19. Wenning Poultry Farm (Ft Recovery)
20. City Building (Hamilton)
21. Haverhill Facility (Haverhill)
22. Kent State University (Kent)
23. Lima Wastewater Treatment Plant (Lima)
24. Broshco Fabricated Products (Mansfield)
25. Jay Plastics (Mansfield)
26. Mansfield YMCA (Mansfield)
27. Warmington Road Facility (Massillon)
28. SunCoke Middletown (Middletown)
29. Wheeling-Pittsburgh Steel (Mingo Junction)
30. Bridgewater Dairy, LLC (Montpelier)
31. Oberlin College (Oberlin)
32. Toledo (Oregon)
33. Residential Project (Paris)
34. Morton Salt (Rittman)
35. Bay View Wastewater Treatment Plant (Toledo)
36. Medical College Of Ohio (Toledo)
37. Toledo Wastewater Treatment Plant (Toledo)
38. St. Charles Hospital (Toledo)
39. Toledo Art Museum (Toledo)
40. SeaGate Convention Centre (Toledo)
41. University of Toledo Data Center (Toledo)
42. Huntington Center (Toledo)
43. Toledo Art Museum - Glass Pavillion (Toledo)
44. University of Toledo, Center for Visual Arts (Toledo)
45. MillerCoors (Trenton)
46. Warren Consolidated (Warren)
47. Mills Pride (Waverly)
48. The Ohio State University - Ohio Agricultural Research and Development Center (Wooster)
49. College of Wooster (Wooster)
50. City of Wooster (Wooster)
51. Quasar Energy Group - Zanesville Project (Zanesville)

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

CHP Value Proposition

Category	10 MW CHP	10 MW WHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	85%	25%	34%	67%
Annual Electricity	74,446 MWh	74,446 MWh	21,900 MWh	29,784 MWh	58,692 MWh
Annual Useful Heat	103,417 MWh_t	0	0	0	0
Footprint Required	6,000 ft^2	6,000 ft^2	1,740,000 ft^2	76,000 ft^2t	N/A
Capital Cost	$24 million	$30 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	**343,747 MMBtu**	**767,176 MMBtu**	**225,640 MMBtu**	**306,871 MMBtu**	**156,708 MMBtu**
Annual CO_2 Savings	**44,114 Tons**	**68,864 Tons**	**20,254 Tons**	**27,546 Tons**	**27,023 Tons**
Annual NOx Savings	**86.9 Tons**	**91.1 Tons**	**26.8 Tons**	**36.4 Tons**	**59.2 Tons**

Based on: 10 MW Gas Turbine CHP - 30% electric efficiency, 70% total efficiency, 15 PPM NOx
Electricity displaces National All Fossil Average Generation (eGRID 2010) -
9,720 Btu/kWh, 1,745 lbs CO_2/MWh, 2.3078 lbs NOx/MWH, 6% T&D losses
Thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions

CHP Positive Impacts and Benefits (U.S. Businesses)

- Reduces energy costs for the end-user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability
- Provides stability in the face of uncertain electricity prices

CHP Positive Impacts and Benefits (Nation)

- Provides immediate path to increased energy efficiency and reduced GHG emissions
- Offers low cost approach to new electricity generation capacity and lessens the need for new T&D
- Uses abundant, domestic energy sources
- Uses highly skilled local labor & American technologies

State Support for CHP

- Eighteen states include CHP or waste energy recovery in portfolio standards
- Specific incentives for CHP (tax credits, streamlined permitting, capital incentives)
  - New York
  - California
  - Massachusetts
  - New Jersey
  - Maryland
  - Texas
  - Ohio
  - Others in response to Executive Order

State Support for CHP - Ohio

- Support by Governor's Office and Utility Commission
- Coalition of industrial users and environmental groups
- SB 315 signed into law – June 2012
  - WHR included in RPS
  - Conventional CHP and WHR included in EEPS
- Boiler MACT Tech Assistance Pilot program

> "Because of coal plant retirements, educating consumers on combined heat power is of particular interest to the PUCO. A facility's decision to invest in CHP may constitute a rational market response that not only benefits the facility but which also supports grid reliability in Ohio."
> - Public Utilities Commission of Ohio Chairman Todd Snitchler, Feb 23, 2012

http://www.puco.ohio.gov/puco/index.cfm/industry-information/industry-topics/combined-heat-and-power-in-ohio/

SB 315 (CHP/WHR) Implementation

- WHR allowable under RPS --- apply like any other renewable technology
- CHP & WHR under EEPS??
  - Considered an electric energy efficiency measure
  - Included in Electric Utility Program (incentives similar to other EE measures) – meet cost effectiveness tests (TRC)
  - How do you calculate the allowable electricity savings?

How to Calculate Electricity Savings

- Step #1: Calculate Fuel Savings from Utilizing the CHP System
  - $S_{fuel\ CHP}$ = Fuel Savings from CHP
  - F_{grid} = Fuel would have used to generate electricity output of CHP system from local grid
  - $F_{thermal}$ = Fuel would have been used on-site to provide thermal output of CHP from a boiler (80%)
  - $F_{CHP\ Total}$ = Total fuel consumed by CHP system

$$S_{fuel\ CHP} = F_{grid} + F_{thermal} - F_{CHP\ Total}$$

How to Calculate Electricity Savings

- Step #2: Convert Fuel Savings to Electricity savings
  - $S_{elec\ CHP}$ = Allowed electricity savings from the CHP (MWh)
  - $S_{fuel\ CHP}$ = Fuel Savings calculated in step 1 (MMBtus)
  - H = Appropriate Heat Rate (MMBtu/MWh)

$$S_{elec\ CHP} = S_{fuel\ CHP} / H$$

Value of H?

- Direct Conversion --- 3,212 MMBtu/MWh
- Heat Rate of the Grid --- approx. 9,800 MMBtu/MWh
- Heat Rate of the CHP System --- 4,000 to 7,500 MMBtu/MWh

Federal Support for CHP

- Executive Order: "coordinate and strongly encourage efforts to achieve a national goal of deploying 40 gigawatts of new, cost effective industrial CHP in the United States by the end of 2020"
- DOE focuses technology deployment support for CHP - CEACs and SEEAction – Regional meetings planned in support of Executive Order
- EPA recognizes CHP as an efficiency measure under developing greenhouse gas emission standards and promoting output-based options that recognize CHP benefits (ICI Boiler MACT and Utility MACT (MATS))

ICI Boiler MACT

- Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters (excludes any unit combusting *solid waste*)
- Major source is a facility that emits:
  - 10 tpy or more of any single Hazardous Air Pollutant, or 25 tpy or more of total HAPs
- Emissions limits applicable to new and existing units > 10 MMBtu/hr
  - Mercury (Hg)
  - Particulate Matter (PM) as a surrogate for non-mercury metals (alternative limits for total selective metals (TSM))
  - Hydrogen Chloride (HCl) as a surrogate for acid gases
  - Carbon Monoxide (CO) as a surrogate for non-dioxin organics)

Impacts of the Boiler MACT

- Compliance straight forward for natural gas fired units (tune-ups)
- Rule significantly impacts oil, coal and biomass boilers and process heaters
- Controls are potentially required for Hg, PM, HCl and CO
- Emissions limits must be met at all times except for start-up and shutdown periods
- Also includes monitoring and reporting requirements
- Limits are economically challenging for oil and coal units

Compliance Options

- The specific emissions limits depend on fuel type and combustor design, but all pollutants within a group (Hg, PM, HCl, CO) can be controlled with the same measures
- Required compliance measures for any unit depend on current emissions levels and control equipment already in place
- Fabric filters and activated carbon injection are the primary control devices for Hg
- Electrostatic precipitators may be required for units that need additional control for PM or TSM
- Wet scrubbers or fabric filters with dry injection are primary controls for HCl
- Tune-ups, replacement burners, combustion controls and oxidation catalysts for CO and organic HAPs control

Potential Opportunity for CHP

- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units
  - New boilers for coal units?
- May consider moving to natural gas fueled CHP (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Potential Opportunity for CHP (cont'd)

- CHP Configuration (conventional CHP system)
  - Gas turbine with heat recovery steam boiler (HRSG)
  - HRSG has duct burners with outside air (operates if turbine is down)
  - HRSG provides steam requirements
    - Waste heat from turbine
    - Waste heat from turbine plus duct burners
    - Duct burners with no turbine waste heat
  - Turbine provides electricity for site
  - If needed existing boiler used as back-up (less than 800 hours per year)

Effected Boiler MACT Facilities

ICI Boiler MACT - Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)	CO_2 Emissions Savings (MMT)
Coal	332	751	180,525	18,055	114.2
Heavy Liquid	170	367	48,296	4,830	22.9
Light Liquid	109	241	22,133	2,214	10.5
Total	**611***	**1,359**	**250,954**	**25,099**	**147.6**

The data on this chart is still being refined

*Some facilities are listed in multiple categories due to multiple fuel types; there are 567 ICI affected facilities

- CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)
- GHG emissions savings based on 8000 operating hours for coal and 6000 hours for oil, with a CHP electric efficiency of 32%, and displacing average fossil fuel central station generation

Boiler MACT Pilot Tech Assistance Program in Ohio

- Over 50 companies contacted
- 12 feel they are already in compliance
- 6 no longer in business
- Analyses for 15 in various stages
- All companies are now aware of how CHP can assist in a compliance strategy (on their radar)
- All How many will proceed?????

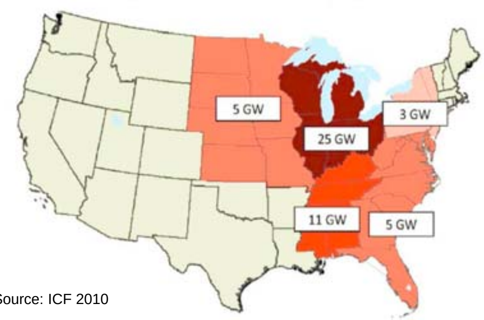
Pending Emission Regulations

- EPA proposing updates to at least 6 regulations affecting coal-fired power plants – compliance deadlines in next 7 yrs
- Could impact as much as 40,000 MW of coal-fired electric generation
  - Forced retirements / replacements
  - Investment in compliance controls
- Result will be significant investment by Utilities and upward pressure on electric prices (20% projected in some affected markets)

http://www.brakeyenergy.com/wp-content/Brakey_Energy_FirstEnergy_Capacity_White_Paper.pdf

Source: ACEEE White Paper Avoiding a Train Wreck: Replacing Old Coal Plants with Energy Efficiency

Rules Effecting Utility Sector
(“at risk” coal generation by region)



Source: ICF 2010

Other Electric Industry Market Indicators

- Supply margins are declining and as demand is recovering
  - Need significant infrastructure investment
  - Estimates at $750 – 900 Billion: exceeds current capitalization
  - Major baseload generation & transmission will be needed
- Transmission congestion is increasing
- Aging transmission infrastructure
  - 70% of transmission lines are 25 years or older
  - 70% of power transformers are 25 years or older
  - 60% of circuit breakers are more than 30 years old

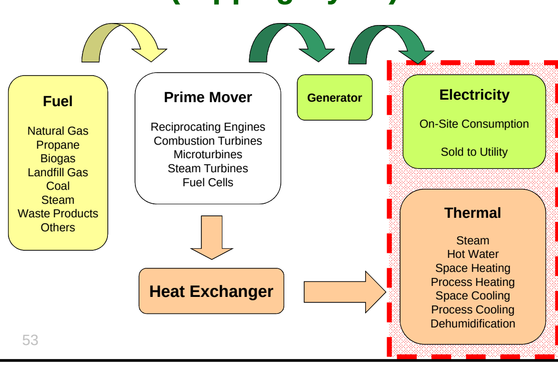
Sources: NERC Transmission Loading Relief Procedure Logs & “Rising Utility Construction Costs: Sources & Impacts” Edison Foundation/Brattle Group

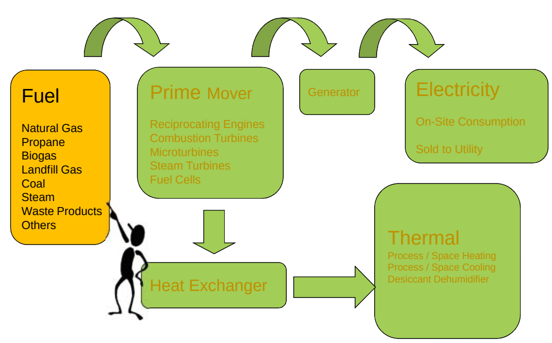
Summary Market Conditions

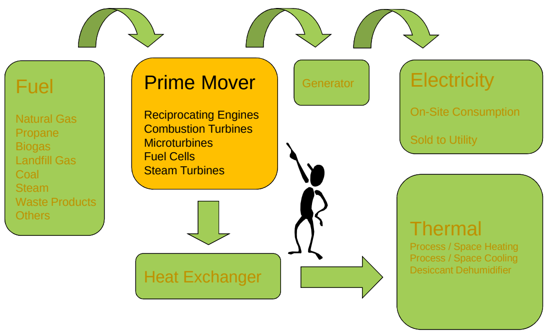
- Upward pressure on electric prices
  - Pending EPA Regulations
  - Aging Infrastructure and congestion
- Low and hopefully stable natural gas prices
  - Shale Gas
- Renewed interest at State level
  - CHP in EEPS and RPS
  - EPA Industrial Boiler MACT
  - Energy Emergency/Assurance Plans
- Continued Federal Interest

2.) CHP Technologies

CHP Technology Components
(Topping Cycle)







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Technologies

PRIME MOVER

Reciprocating Engines

- 5 kW – 10 MW
- Excellent part-load operation
- Waste heat recovered from engine exhaust, engine jacket and oil coolant
- Low set-up cost, fast start-up
- Emissions signature has improved significantly
  - Lean-burn engines
  - Selective catalytic reduction (SCR)

Technologies

PRIME MOVER

Combustion Gas Turbines

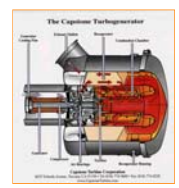
- 5 MW - 250 MW
- Same technology as a jet engine
- Best suited for base-load (24/7) operations
- Typically fueled by natural gas
- Produce high quality heat from exhaust

Technologies

PRIME MOVER

Micro-Turbines

- Small turbines with recuperation
- 25 kW to 500 kW
- Efficiency range: 25% to 30% LHV
- Recoverable heat: gas exhaust @ approx. 500ºF
- Fuel flexible
- Low emissions <0.49lbs/MWh or 9ppm



Technologies

PRIME MOVER

Fuel Cells

- 5 kW – several MWs
- Generates power and heat through electrochemical reactions
- Very quiet, no combustion or shaft movement
- Environmentally cleanest CHP technology
- Different kinds:
  - Phosphoric acid
  - Solid oxide
  - Molten carbonate
  - Proton exchange membrane

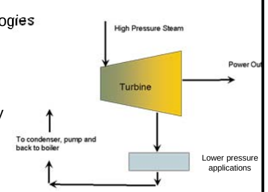
Source: www.eere.energy.gov

Technologies

Prime Mover

Steam Turbines

- 1MW – 500 MW
- Among oldest prime mover technologies still in use
- Converts pressure drop in steam to electricity through turbine blades
- Long working life and high reliability
- Two types:
  - Extraction
  - Backpressure



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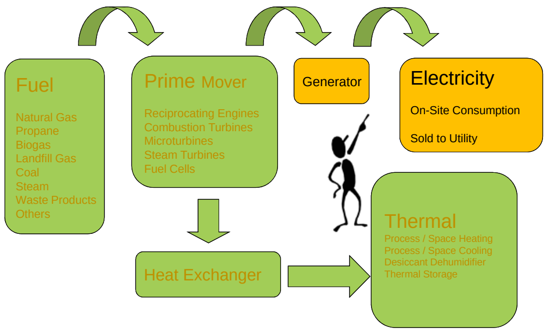


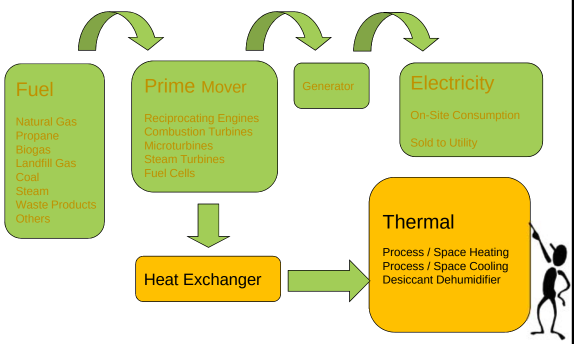
Two Types of Generators

Induction

- Requires External Power Source to Operate (Grid)
- Contributes to Poor PF
- When Grid Goes Down, CHP System Goes Down
- Less Complicated & Less Costly to Interconnect
- Preferred by Utilities

Synchronous

- Self Excited (Does Not Need Grid to Operate)
- Can Assist in PF Correction
- CHP System can Continue to Operate thru Grid Outages
- More Complicated & Costly to Interconnect (Safety)
- Preferred by CHP Customers



Technologies

HEAT CAPTURE | CONVERT HEAT INTO WORK

Heat Exchangers

- Recover exhaust gas generated by:
  - Gas turbine
  - Industrial processes
- Transfers exhaust gas into useful heat (e.g. steam) for downstream applications
- Heat recovery steam generator (HRSG) the most common

Heat Recovery Steam Generator (HRSG)

Technologies

HEAT CAPTURE | CONVERT HEAT INTO WORK

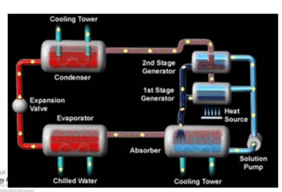
Heat-Driven Chillers (Absorption)

- Use "waste" heat to chill water for A/C, cooling machinery
- More efficient, fewer emissions vis-à-vis electric chillers

ABSORPTION CHILLERS

Use exhaust gas, hot water, or steam via thermal compressor to boil water vapor out of lithium bromide/ water solution and compress refrigerant to higher pressure; avoids CFCs/HCFCs

Range: 10-3,000 tons

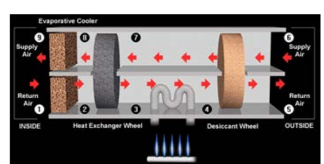


Technologies

HEAT CAPTURE | CONVERT HEAT INTO WORK

Desiccant Dehumidifiers

- Separates Latent from Sensible Load
- Reduces Humidity and Reduces AC Load



PROGRESS REPORT

U.S. DOE Midwest Clean Energy Application Center

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigator:
John Cuttica, (312) 355-3476, cuttica@uic.edu

Reporting Period:
October 1, 2009 through December 31, 2010

Submission Date:
January 31, 2010

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

Dear Mr. Renk,

Please find the attached Progress Report for the 4th quarter 2009 (Q4.09) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $92,589.75 for Q4.09:

- Oct. 2009: $1,616.00
- Nov. 2009: $40,708.84
- Dec. 2009: $50,264.91

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q4.09. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: Will be submitted Q1.10.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Activity:

- Target Market Workshop: The Midwest RAC organized and co-sponsored a target market workshop on anaerobic digester and combined heat and power (AD/CHP) applications for the Illinois electric cooperatives titled "Waste to Energy Workshop for the Illinois Electric Cooperatives." The workshop was conducted October 20, 2009, in Springfield, Illinois. The main partner for this event was the Association of Illinois Electric Cooperatives (AIEC). For more information: http://www.chpcentermw.org/11-01_news.html#091103.
- Graduate Level CHP Course: The Midwest RAC will be teaching a Spring 2010 semester graduate course for the Energy Engineering Masters program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management." The semester course will begin January 11th and conclude the week of May 3rd.
- Other Workshops/Conferences:
    - Biogas: Scaling up biogas production in North America, October 1-2, 2009, San Francisco, CA – the Midwest RAC presented "Using Biogas for Heat Recovery," http://www.chpcentermw.org/pdfs/091001_Haefke.pdf.
    - USCHPA Annual Conference, October 7-9, 2009, Washington, D.C. – the Midwest RAC attended the annual conference.
    - Waste to Energy Workshop for the Illinois Electric Cooperatives, Oct. 20, 2009, Springfield, IL – the Midwest RAC presented "CHP the Concept," http://www.chpcentermw.org/pdfs/091020_IL/091020_Haefke1.pdf
    - CRC Workshop on Life Cycle Analysis of Biofuels Argonne National Laboratory, October 21, 2009, Argonne, IL – the Midwest RAC presented "Emerging Technologies Impact Corn Ethanol's Energy and Environmental Profile."
    - ARES Ignition Systems Research – Roundtable U.S. DOE Industrial Technologies Program (ITP), November 17-18, 2009, Argonne, IL – the Midwest RAC presented "Reciprocating Engines in the CHP Market Place."
    - Midwest Cogeneration Association Board Meeting, October 22, 2009, Oakbrook Terrace, IL – the Midwest RAC attended the MCA board meeting.
    - Midwest Cogeneration Association Dinner Meeting, October 22, 2009, Oakbrook Terrace, IL – the Midwest RAC attended and co-organized the event.

- Wright State College Technical Course, November 5th and 12th, 2009 – the Midwest provided a part CHP session two consecutive weeks on the "Fundamentals of Combined Heat and Power (CHP)."
- 2009 Great Plains Energy Expo, November 10, 2009, Chicago, IL – the Midwest RAC presented Combined heat and Power (CHP) Opportunity to be Explored & Exploited in North Dakota."
- CHP Training for the Midwest IACs - November 17, 2009, Ames, IA – the Midwest RAC presented "The Fundamentals of Combined Heat and Power (CHP)" to the Iowa State University Industrial Assessment Center (IAC).
- Midwest Clean Tech 2009, November 24, 2009, Chicago, IL – the Midwest RAC presented "Combined Heat and Power (CHP) Today's Opportunity."

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.CHPCenterMW.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory Workshop: The workshop was not in planning phase during Q4.09.
- Policy Student: the Midwest RAC is in the process of interviewing and hiring a policy graduate student from College of Urban Planning and Public Affairs (University of Illinois at Chicago).
- Other Policy/Regulatory Activities:
  - City of Oak Park: the Midwest RAC met with the City of Oak Park, IL and members of the Galvin Electric Initiative on December 18, 2009 to discuss future sustainability activities for the city (including grid infrastructure, smart grids, perfect power, and required policy changes to accommodate Oak Park's initiatives).
  - State of Missouri: The Midwest RAC has been working with both the Missouri State Energy Office and an environmental group to provide input on proposed legislation to make the State of Missouri a more favorable market for "clean energy" applications. One key issue the Midwest RAC is promoting is Feed-In Tariffs (FITs).
  - State of Ohio: The Midwest RAC has been working with the Ohio environmental groups and Ohio industrial partners to provide input on proposed legislation to make the State of Ohio a more favorable market

for "clean energy" applications. One key issue the Midwest RAC is promoting is Feed-In Tariffs (FITs).
    - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP projects in the State of Illinois and to identify the barriers (including policy and regulatory issues) associated with the implementation of these types of projects.
    - Galvin Electricity Initiative: the Midwest RAC is working with the Galvin Electricity Initiative to identify favorable policy reforms for the Midwest states. Illinois will most likely be the first state to target with the GEI.
    - College of Urban Planning and Public Affairs (CUPPA): the Midwest RAC provided information on recent municipal activities with WWTFs that the Midwest RAC has participated in to Martin Jaffe (CUPPA-UIC) as information for municipal policy planning.
    - U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been extensively working on the redevelopment of the RAC websites during Q4.09. Cliff Haefke is serving as co-chair with Christine Brinker (Intermountain RAC) for the RAC Logo/Website Team. The initiatives of the team are to create a new logo and graphic for the RACs and to develop a coordinated effort in converting the RAC websites from "CHP" to "clean energy." See Appendix A for a copy of the "Report and Recommendations from the RAC Website/Logo Working Group."

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- The RAC provided metrics to ORNL for Fiscal Year 2009 during Q4.10.
- The semi-annual report will be submitted following Q1.10.

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity: Three project profiles were developed and completed during Q4.10. The project profiles can be found at: http://www.chpcentermw.org/15-00_profiles.html

- Crave Brothers Farms, Waterloo, WI, 633 kW

- SC Johnson, Racine, WI, 6.4 MW (developed under previous contract)
- First National Bank of Omaha, Omaha, NE, 840 kW (developed under previous contract)

Deliverable: 8 Task: 4

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:
- See Activity #5 for a description of the website activity during Q3.09.

Deliverable: 9 Task: 4

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:
- Three separate technical studies are being investigated to fund during fiscal year 2010:
    - Lessons Learned for Biogas CHP Projects
    - Energy Savings Partnership – Integration of an Ethanol Plant and Dairy Farm Facility
    - County-by-County Biogas CHP Potential for the State of Illinois
- National Survey of Energy Systems at Ethanol Plants (Q4.09)
    - Leveraged funds with Illinois Corn Marketing Board
    - Includes evaluation of CHP technologies
    - Measures what energy efficiency measures were implemented at ethanol facilities
- Assistance Provided to Other Technical Documents
    - The Midwest RAC provided a review and technical guidance for the Michigan Digester Handbook during December 2009 (specifically the biogas recovery and use section for CHP technologies).

Deliverable: 10 Task: 4

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: The Midwest RAC sent out requests to its Midwest partners in November 2009 to collect data on clean energy installations in the Midwest for the DOE database. This information was forwarded on to Anne Hampson of ICF International.

Deliverable: 11 Task: 5

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- VA Medical Centers Feasibility Study Reviews for ORNL – the Midwest RAC participated in extensive review process for ORNL to review seven Veterans Affair (VA) facilities. Two other RACs (Northeast and Southeast) were also involved in this process. The seven sites reviewed by the Midwest RAC were:
  - Dwight D Eisenhower
  - VAMC Chillicothe
  - Marion VA Medical Center
  - VA Illiana HCS
  - Battle Creek VA Medical Center
  - Tomah VA Medical Center
  - Edward Hines Jr. VA Hospital
- Harrison Steel, Attica, IN – the Midwest RAC has been collecting data and information to provide a Level 1 Feasibility to investigate both CHP and waste heat recovery opportunities.
- Schreiber Foods, Shippensburg, PA – the Midwest RAC provided jobs creation estimates using RIMS II data software from the Bureau of Economics.
- Upland Brewery, Bloomington, IN – initial contacts with Midwest RAC
- SunnyRidge Farms, Illinois – initial discussion with a hog farmer
- Dublin VA Medical Center, Dublin, GA – provided technical assistance to GDS Associates to develop load profiles for a CHP feasibility analysis.
- Pathway Communications, Ontario, Canada – provided technical information towards the investigation of CHP and adsorption technologies in data centers.
- Egan WRP, Schaumburg, IL – continued providing technical information and serving as a technical resource for the Metropolitan Water Reclamation District of Greater Chicago to investigate biogas CHP opportunities at their Egan WRP.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
  - Green Industry Business Development Program for Organic Waste Processing Facility (partners: Gas Environmental, Global Water & Energy (GW&E), Growing Power) – food waste processing, composting, and AD/CHP to power greenhouses to grow more food product (1-2 MW)
  - Packer Engineering, gasifier (crop residue and corn stover) looking to site CHP system (15 kW), Naperville, IL
  - Agricultural Watershed Institute, for a mobile biomass briquetter and distribute biomass briquettes to other biomass CHP projects, partners include John Deere, Packer Engineering, and Archer Daniels Midland
  - Parkland College, 25 kW CHP project on campus using biogas
- Engineering Firms that the Midwest RAC met with and/or provided assistance to:
  - New Loop Energy
  - Johnson Controls
  - Kraft Power
  - Endurant Energy
  - Air Cogen

- Galvin Electric Initiative
- Midwest Cogeneration Association
- SEN Leader Program
- Midwest Cogeneration Association (MCA) – the Midwest RAC has two active members of the MCA. One of the Midwest RAC members is VP of the MCA.

Deliverable: 12	**Task: 5**

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity: The Midwest RAC met at the Iowa State University IAC on November 17th, 2009 and provided a ½ day of training on the concepts and technologies of CHP for evaluation at Midwest industrial facilities.

Deliverable: 13	**Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for Q4.09.
- Also see Quarterly Website Report in Appendix B for Midwest RAC website activities.

Deliverable: 14	**Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: The Midwest RAC submitted the metrics for the Midwest on 11.25.09 to Martin Schweitzer (ORNL).

Appendix A

REPORT AND RECOMMENDATIONS FROM THE RAC WEBSITE/LOGO WORKING GROUP

Christine Brinker, Rhett Graves, Cliff Haefke, Elaine Kulawiak, Pauline Jensen, Maureen Quinlan, Ross Tomlin
November 24, 2009

EXECUTIVE SUMMARY

At the last RAC Face-to-Face meeting on Oct 7, 2009 in Washington DC, the RAC Directors discussed the need to develop a better-coordinated plan to educate regional stakeholders while further emphasizing the U.S. DOE's role in creating and supporting the RACs. The RAC Directors designated a Website/Logo Working Group to investigate updating the RAC websites to increase collaboration and strengthen U.S. DOE RAC brand recognition. This report provides details on the recommendations listed below for the RAC Directors to consider as collective group in moving forward as U.S. DOE Clean Energy Application Centers.

- UPDATED RAC LOGO: The Working Group is working with Bob Gemmer and the DOE Graphics Department to receive permission to use the DOE graphic within the RAC logo. To increase recognition of the RACs as a DOE program, the Working Group believes this is the most effective logo strategy.
- WEBSITE STRUCTURE: After reviewing all existing RAC websites, the Working Group has identified eight website categories/tabs to form the main structure of each updated RAC website. Maintaining a common website structure amongst all RACs will help provide uniformity within the DOE RAC program, will provide easier navigation from one RAC website to another, and will allow ease of transferring common web material and text from one RAC website to another. Each RAC website will have content, however, that is customized to reflect the needs of each individual region.
- GETTING IT DONE (IMPLEMENTATION): The Working Group has determined that a mock-up of one RAC website will initially be developed (goal of late January 2010), and after being reviewed by all RACs Directors and other interested RAC personnel, it will serve as the template for all eight RACs websites. During this time, all eight RACs will provide assistance in developing the various website sections that are common amongst all RACs, and protocols/templates for website sections that are region-dependent. The coding for the entire website design will be shared amongst all RACs for easier implementation and reduced costs.
- WEBMASTERS: The Working Group has determined that during the initial year of the four year contract, each RAC will continue to work with their respective webmaster to develop, implement, and maintain their regional RAC website following the design of the RAC website template. After the first year of operation, the RACs will re-evaluate whether one webmaster or eight separate webmasters should be used to maintain and update the websites.
- WEBSITE DESIGN: The Working Group has developed a list of Website Best Practices that will ensure modern/new website techniques are used when developing the regional RAC websites to help the DOE RAC program maintain an up-to-date look and feel.
- INTERFACE WITH THE NATIONAL DOE CHP SITE: The Working Group has coordinated efforts with the National DOE RAC web page team to ensure the two groups develop consistent and relevant material strengthening the collaboration between the RACs and DOE headquarters.
- BUDGET ISSUES: The Working Group has recognized that the website redevelopment task for the "Clean Energy" centers may require additional financial resources than the RACs initially allocated in their original "Clean Energy" center proposals. The Working Group has identified some of the related budgetary issues and proposed an action plan.
- PROTOCOLS FOR OTHER DOCUMENTS/EDUCATIONAL RESOURCES: The Working Group has determined that several RAC-produced documents and other materials should also have templates and protocols to increase RAC uniformity and recognition, and this task should include revisiting earlier templates and protocols.

The Working Group is pleased to pass on these recommendations to the RAC Directors. The Working Group suggests that a Web Conference Call be scheduled shortly to: 1) walk the RAC Directors through the Working Group's recommendations; 2) answer any questions that the RAC Directors may have; and 3) facilitate discussion amongst the RAC Directors to begin implementation of the recommended efforts.

BACKGROUND – RAC WEBSITE / LOGO WORKING GROUP

At the last RAC Face-to-Face meeting (Oct 7, 2009 in Washington DC), the RAC Directors and other attendees discussed the need to develop a better-coordinated plan to educate regional stakeholders while building the U.S. DOE brand. While this encompassed a broader discussion of education and outreach approach and information sharing between RACs, the discussion turned to the RAC websites as a focal point for information distribution and "brand" recognition. It was determined that all of the RAC websites needs to be updated and upgraded to:

1) Have a more consistent look and feel between RAC websites
2) Highlight more prominently the U.S. DOE's role in the RACs
3) Reflect the change from CHP Centers to Clean Energy Application Centers
4) Modernize the content presentation and design
5) Devise a better strategy for updating/maintaining existing content, so it does not get so out-of-date
6) Minimizing duplication of efforts between regions by standardizing some of the similar content
7) Explore the interface between the national DOE CHP website (currently under development by Energetics) and the RAC sites

A sub-group of seven RAC staff was formed to explore these issues, and make recommendations to the RAC Directors on the preferred approach. The identified Working Group consisted of Christine Brinker, Rhett Graves, Cliff Haefke, Elaine Kulawiak, Pauline Jensen, Maureen Quinlan, and Ross Tomlin. The group was advised by Patti Garland, Bob Gemmer, Ted Bronson, and John Cuttica. Discussion of a revised logo was also included in the group's charter.

RAC LOGO

GOAL: Develop an effective logo for the newly established U.S. DOE Clean Energy Application Centers, reflecting the RACs' increasing role as a technology and educational outreach arm for DOE.

BACKGROUND: The opinions of RAC personnel on the existing "snowflake/sun/lightning bolt" logo range from neutral to extreme distaste. Thus, the Working Group is in agreement that a new logo is in order. The two options identified by the Working Group are:

- Using the DOE graphic, with customized text (examples shown below in Figure 1)
- Designing a new logo with a non-DOE graphic

To support the wishes expressed by Doug Kaempf, Isaac Chan, Bob Gemmer, and Patti Garland at the RAC Face-to-Face meeting, the RACs are to serve as the primary education and outreach arm for DOE for combined heat and power, waste heat recovery, and district energy. Therefore, the Working Group believes the DOE graphic should be incorporated into the RAC logo to ensure that any materials and/or works published with the RAC logo cannot be mistaken with any other entity and/or organization other than DOE.

> Note: The law states the "Application Centers" are to be referred as "Clean Energy Application Centers," and not "Clean Energy Regional Application Centers." (This is reflected in the example logos shown in Figure 1.) Bob Gemmer clarified that in text format, the "Application Centers" should be referred to as the name of the region followed by the acronym RAC (i.e. Midwest RAC, Gulf Coast RAC, etc.).

NEXT STEPS: DOE requires a written request (preferably by a federal employee) to reproduce the DOE graphic for external use. Bob Gemmer is working with the draft RAC logos (shown below) developed by the Working Group and is seeking authorization through the DOE Graphics Department. The timeframe for authorizing use of the DOE graphic in the RAC logo is unknown; the Working Group is therefore recommending the current RAC graphic be utilized as the temporary logo until the proposed logo has been accepted/denied by the DOE Graphics Department.

Should permission to incorporate the DOE graphic into the RAC logo be denied, then at this point a new graphic will be designed:
- Internally by the Working Group;
- Working with a top Mississippi State University graphic arts student ($200-300); or
- Working with a graphic artist recommended by Patti Garland (Kristina).

U.S. DEPARTMENT OF ENERGY
MIDWEST
Clean Energy Application Center

Promoting CHP, District Energy, and Waste Energy Recovery Technologies

U.S. DEPARTMENT OF ENERGY
MIDWEST CLEAN ENERGY
Application Center

Promoting CHP, District Energy, and Waste Energy Recovery Technologies

U.S. DEPARTMENT OF ENERGY
Clean Energy Application Center

MIDWEST REGION

FIGURE 1: EXAMPLE RAC LOGOS INCORPORATING DOE GRAPHIC

U.S. DEPARTMENT OF ENERGY
MIDWEST
Clean Energy Application Center

Promoting CHP, District Energy, and Waste Energy Recovery Technologies

U.S. DEPARTMENT OF ENERGY
MIDWEST CLEAN ENERGY
Application Center

Promoting CHP, District Energy, and Waste Energy Recovery Technologies

U.S. DEPARTMENT OF ENERGY
Clean Energy Application Center

MIDWEST REGION

FIGURE 2: EXAMPLE RAC LOGO INCORPORATING EXISTING RAC GRAPHIC

WEBSITE STRUCTURE

GOALS: Minimize duplication of efforts between regions, while maintaining flexibility to meet individual region needs. Create a format/structure in common between all RACs, so that the RAC websites resemble one another, are recognized as a coordinated DOE program, and allow visitors going from one RAC site to another to know where to find similar information.

BACKGROUND: Many RAC web pages have very similar information from region to region, but updating the information requires the same work to be done eight times. All of the RACs, to differing degrees, have had difficulty keeping web pages up to date. At the RAC Face-to-Face meeting, it was suggested that the common information could be standardized so that it would only need to be changed once instead of eight times. Ideas presented at the Face-to-Face included having one centralized "master website," increased linking to other RACs, or keeping the eight separate websites as they are.

NEXT STEPS: The Working Group recommends that certain pages and sections be standardized among all RACs, while other pages remain unique/customizable to the individual region. For the standardized pages, the Working Group understands that it is technically feasible for content to be hosted by one site, and then automatically and seamlessly "fed" to the other sites. When a change/update is made to the original website, the change/update would show up on all of the websites copying information from the original website. From the visitor's perspective, one would thus stay on the original page he/she started on, without being bounced to a different RAC site or even realizing the info is coming from another place. While none of the Working Group understands web coding, the Working Group was told by several web experts that this approach could work.

The Working Group analyzed all eight RAC websites to determine information in common among all RACs versus information that would need to remain region-specific. The Working Group identified subject headings (tabs) that should be found on each RAC website and discussed the material and text that would be found under each subject heading.

The eight main headings identified by the Working Group that would cover all the material found in the RAC websites are:

- About Clean Energy
- Getting Started
- Market Sectors
- States & Region
- Policy & Incentives
- Case Studies
- News & Events
- Library & Resources

Figure 3 provides an example of the subject headings for each RAC. Note that further detail on the content belonging under each heading, and in some cases, page layout, can be found in the appendix.

FIGURE 3: EXAMPLE TEMPLATE FOR RAC WEBSITES SHOWING SUBJECT HEADINGS (TECHNOLOGY & CONCEPT)

A section of smaller headings would be located at the top right corner of the websites, covering material on the RAC websites that is more organizational, logistical, and/or programmatic. This is common in many website designs; an example for the RAC websites is shown in Figure 4.

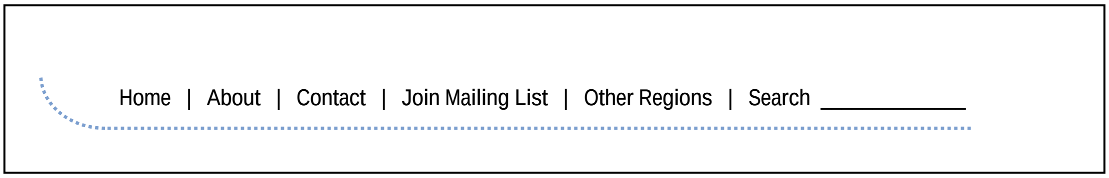


FIGURE 4: EXAMPLE TEMPLATE FOR RAC WEBSITES SHOWING SUBJECT HEADINGS (ORGANIZATIONAL/LOGISTICAL/PROGRAMMATIC)

Note that the categories identified in Figures 3 and 4 do not reflect *design* decisions in terms of color, font, layout, etc., only structure and content.

GETTING IT DONE (IMPLEMENTATION)

GOAL: Complete the website revisions/updates in a timely and efficient manner, in a coordinated effort between all RACs. The Working Group recommends a more specific goal of developing the Midwest RAC website as a mock-up, with the majority of the content filled in by the end of January to coincide with the unveiling date of the DOE's national RAC website.

NEXT STEPS: The Working Group recommends a coordinated approach to develop the newly designed RAC websites. This approach involves two main components:

- One RAC will develop the mock-up of the new "Clean Energy" website design and structure, taking into consideration the recommendations contained elsewhere in this report.
- In parallel to developing the mock-up, each RAC will be responsible for providing the text and material for one or two of the tabs (revising and combining the information already available on the RAC websites, and drafting new content where necessary for the standardized pages; or creating templates/protocols for the region-specific pages). The Working Group suggests that two RACs pair up to develop the assigned pages ("the buddy system"). This was identified to be a successful method to accomplishing tasks within the Working Group as the RACs continue their collaborative and coordinated efforts.

Once most of the content and design is ready, the Working Group suggests that one RAC (perhaps the Midwest) put up a non-live version of the website, which can then be reviewed by all of the RAC personnel. When the mock-up has met the approval by all RAC Directors and is ready to go live, the other RACs can use the same coding for their own websites.

A conference call between our different webmasters may be warranted to make sure the coding and standardized pages are easily sharable.

WEBMASTERS

GOAL: Determine whether the RACs should continue to use the services of eight separate webmasters, or if it would be better for 1-2 webmasters to maintain and update all eight RAC websites.

BACKGROUND: The Working Group surveyed each RAC about how they add content, update, and maintain their website. The Working Group learned that each RAC has a different approach—updates are handled by RAC staff, a university affiliate, a private consultant, or a combination thereof. The Working Group also surveyed about the cost and payment structure and learned that some RACs pay per hour, some pay per project, some have an annual contract, and some have other arrangements.

The Working Group then discussed whether it would be best for all RACs to use the same webmaster, or continue with their existing arrangements.

- The main advantage to having a single webmaster between all RACs is increased consistency between the RAC sites. Some RACs may also realize speedier updates to their websites in this approach when compared to their past/current webmaster arrangements.
- The two most notable disadvantages are 1) that one webmaster could be over-extended working on all eight RAC websites (in particular if it involved launching the redesigned sites), and 2) that it is easiest (at least in the short term) for each RAC to stay in the current arrangements with which they are already familiar.

It was not possible to compare the two options based on cost, given the differing cost structures in place.

NEXT STEPS: After considering all of the above, the Working Group has determined that during the initial year of the four year contract, each RAC will work with their respective webmaster to develop, implement, and maintain their regional RAC website, following the design on the RAC website template and borrowing the coding. After the first year of operation, the RACs will re-evaluate whether one webmaster or eight separate webmasters should be utilized to maintain and update the websites. RACs that currently utilize shared staff among inter-organization departments may need to re-evaluate their webmaster situation to accommodate updated websites in a timely manner.

WEBSITE DESIGN

GOAL: Ensure that modern/new website techniques are used when developing the regional RAC sites, to help the DOE RAC program project a modern and up-to-date look and feel.

BACKGROUND: The Working Group is working on finalizing a set of design Best Practices to use in the updated website design. Some of the design protocols the Working Group has developed so far are as follows:

- While all the RAC sites will have the same basic structure, layout, and tabs, each RAC can choose their own color scheme, assuming this is technically feasible for page/content sharing. The example was given of the Major League Soccer pages at www.mlsnet.com, where each team's page follows the same structure but has individual team colors.

- The main menu tabs will go horizontally across the top or top-middle, instead of vertically on the left. Where sub-menus are necessary, they may go vertically on the left. A smaller menu of logistical items can go at the top right corner.

- While each RAC's main page will be individual and will contain the information and news most important to that region, we recommend that each main page contain a front-and-center rotating feature of 3-5 items. These could include a photo and 2-3 sentence description of a successful clean energy project in the region (linking to the full project profile), an announcement of a recent report or application guide, with a graphic of the report cover, or other important items. After 4-5 seconds, it would rotate to the next item. This is common in website design—see, for example, www.nationalgeographic.com.

- Each RAC's site should have an RSS feed so visitors can subscribe to get news updates (this is different from an e-mail newsletter, which will also remain).

- Sites with movable frames (Gulf Coast & Intermountain) seem much more attractive than those with fixed frames (Southeast, Midwest, Northwest). The difference is that a movable frame allows the website to conform to the viewer's monitor settings, re-aligning the text to fit the available space. The fixed frame sites appear to be jammed to one side or stuck in the center with large expanses of color on the sides when viewed on a large monitor.

NEXT STEPS: The Working Group will have a GoToMeeting in the near future to further share design best practices, and pass those on to the group working on the mock-up of the identified RAC website.

INTERFACE WITH THE NATIONAL DOE CHP SITE

GOAL: Coordinate between the National DOE RAC web page team (Energetics) and the RAC Working Group to ensure the two ventures work together and do not develop inconsistent material.

BACKGROUND: DOE (via their contractor, Energetics) is currently revising, updating, and rearranging its CHP pages. DOE will have two new pages focused on the RACs. The first will provide a map of the U.S., whereby a visitor can hover their mouse over a specific state or region and see the contact information and website link to the corresponding RAC. The second page, titled "CHP Projects," will have another map that links to RAC-created project profiles; the project profiles will also be searchable by market sector.

These national DOE RAC web pages are expected to be launched by late January 2010.

NEXT STEPS: The Working Group will continue to work with the National DOE RAC web page team in coordination with Patti Garland.

BUDGET ISSUES

GOAL: Ensure each RAC has allocated financial resources in their budgets to redevelop the RAC websites.

BACKGROUND: Some of the RACs have budgeted for a redesign of their website, while others only budgeted for regular, ongoing maintenance similar to the level they had been doing. This is an issue that will have to be discussed by the RAC Directors along with Bob Gemmer, Patti Garland, Ted Bronson, and John Cuttica.

The Working Group is putting forth the effort to keep the costs at a minimum for each RAC, by combining resources and expertise, by doing most of the design work internal amongst our RAC personnel, and by ensuring it is possible for RAC webmasters to copy the coding of the model site rather than write it from scratch. The Working Group does not yet have an estimate of what coding of the model site would cost, nor what copying the coding would cost, since this is dependent on the webmaster and time involved.

NEXT STEPS: The RAC Directors should verify the individual budgets allocated to the RAC website redevelopment. If there is an issue with reallocating the budget towards the RAC websites, a meeting should be arranged with Bob Gemmer, Patti Garland, and Ted Bronson to discuss these budget issues.

PROTOCOLS FOR OTHER DOCUMENTS/EDUCATIONAL RESOURCES

GOAL: Utilize similar protocols and templates of certain documents to increase the RAC/DOE branding campaign.

BACKGROUND: Related RAC educational materials including report covers, power points, and boilerplate feasibility studies are also part of the branding process. As such, they must be coordinated between RACs. It was mentioned at the RAC Face-to-Face meeting, "Every time you view an EPA CHP Partnership document or see a presentation, you recognize right away it's from the EPA CHP Partnership," and it was further mentioned that RACs deserved the same viewer-familiarity.

RACs will be more likely to use these protocols/templates if they are content with their design; therefore a group process will be best to develop these, as with the website.

NEXT STEPS: The Working Group (or another identified group among RAC personnel) should revisit the concept of protocols. This effort should include re-examining the protocols originally developed by the Midwest RAC when the RACs were first established in 2001, and also identifying what other documents should have templates and common protocols (i.e. PPT presentation slides, feasibility studies, etc.).

APPENDIX

The Appendix identifies the eight Website Categories/Tabs and the content to be developed within each Category/Tab that will utilized by all eight RAC websites.

WEBSITE CATEGORIES/TABS

ABOUT CLEAN ENERGY

- Combined Heat and Power (CHP)
- Waste Heat Recovery
- District Energy

This page and its sub-pages should be standardized between RACs. They will contain basics on clean energy and benefits.

GETTING STARTED

This page lays out, from an end user perspective, how to go about evaluating if CHP, waste heat recovery, or district energy is right for their application. It will show the evaluation steps, starting with a Level 1 feasibility screening and progressing to more detailed studies (see www.epa.gov/chp/project-development for an example graphic, which would modified for RAC use); explain how RACs can help with screenings; and present the tools and resources that can help end users in various steps of project development.

The tab will most likely have a sub-menu, but we did not develop this yet.

MARKET SECTORS
COMMERCIAL
- data centers
- health clubs
- high-rise offices
- hotels
- casinos
- supermarkets
- retail stores
- restaurants
- theaters
- ice arenas
- laundries
- laboratories
- green buildings
INDUSTRIAL
- chemicals
- food processing
- refrig. warehouses
- breweries
- ethanol plants
- manufacturing
- petrochemicals
- pulp and paper / forest products
- rubber and plastics
- utilities
INSTITUTIONAL
- hospitals
- nursing homes & assisted living
- k-12 schools
- universities
- museums
- wastewater treatment
- naval stations
- army bases
- police departments
- correctional
AGRICULTURAL
- animal and dairy farms
OTHER

Most RACs have a page with specific market sectors where CHP makes sense. The actual markets are different from RAC to RAC, based on regional market conditions as well as RAC time and resources for actually developing the market-sector pages. We agreed that the market sector information can be standardized. We looked at each of the eight RAC sites and made a list of market sectors where we have already developed content. Five main market sector groups were identified, and specific market sectors were placed into each category. The four groups identified are commercial, industrial, institutional, agricultural, and other.

The market sectors can be categorized in different ways (i.e. wastewater treatment could be called industrial, etc.) and we determined that this could be further discussed and finalized at a later time—perhaps after the pages are more developed.

We also developed a layout for the main market sector page: A square commercial photo, a square industrial photo, a square institutional photo, and a square agricultural photo lined up horizontally across the page, each labeled at the top or inside, and each listing the specific market sub-sectors below the photo (with the words linked to those pages).

STATES & REGION

- Alaska
- Idaho
- Montana
- Oregon
- Washington
- Regional info
- Other regions

This section will remain region-specific, but we will develop a protocol for the content.

The “Regional info” tab is optional.

The “Other regions” will explain that there are RACs for each region of the country, and will have DOE/ORNL’s color-coded map showing the RACs and their contact info.

POLICY & INCENTIVES

This section will also remain region-specific, and will be the most customizable in terms of content and layout. Regions may want to show policy work in progress, policy changes needs, or existing policies in place.

This section will also include incentives for CHP, waste heat recovery, and district energy available in the region, and we discussed several ways to do this. Our preferred approach is that taken by the Southeast RAC. Since the Southeast RAC and the DSIRE database are both run from the NCSU Solar Center, a Southeast RAC webpage has a direct feed from the DSIRE database, showing CHP-specific incentives for each state. See http://www.chpcenterse.org/incentives.htm. Most of the other RACs just link to the DSIRE database, but the Southeast’s approach has the dual advantages of keeping visitors on their page and narrowing the database to just CHP incentives in just the relevant states, saving visitors’ the time of extra searching.

However, setting up the other RACs with a similar feed is not free. The DSIRE people quoted a price of $3,500 for the initial set-up for each RAC plus $1,000 per year for each RAC. They would offer a discount if multiple RACs if more than one RAC would request this service. However, the Working Group agrees the price is too steep.

NEXT STEPS: We will ask Patti Garland to check if the RACs could get a more affordable price. ORNL provided funding for the DSIRE database for a number of years, so they have more of an established relationship than the other RACs. DOE/ORNL may be looking into somehow using or linking to the DSIRE database for the new national CHP section currently being developed by Energetics, or they may develop a new national database similar to that of the ITP State Incentives and Resource Programs Database run by Sandy Glatt’s group (http://www1.eere.energy.gov/industry/about/state_activities/incentive_search.asp), or they may use that database directly and include CHP incentives within it – this is still being decided.

If the RACs are not able to secure a DSIRE feed like the Southeast RAC does, then alternatively:

- We can link to the DSIRE database, and/or
- We can link to the ITP database

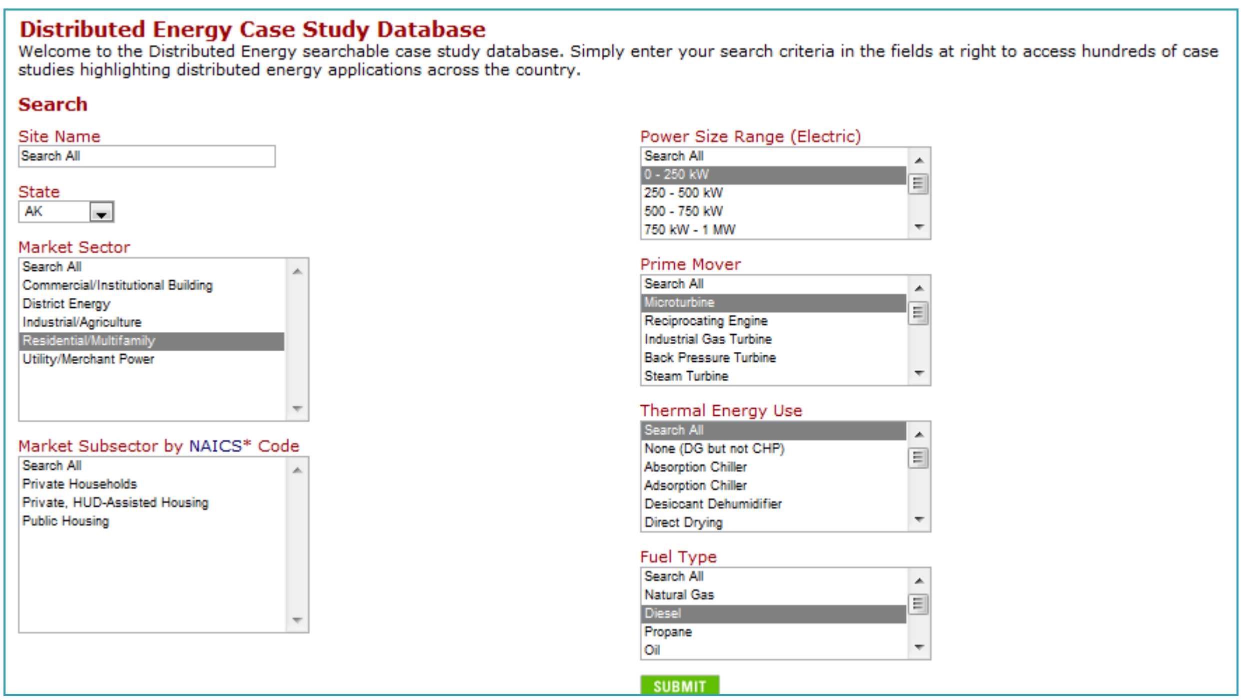
CASE STUDIES

We titled this tab “Case Studies” rather than “Project Profiles,” because case studies is more commonly-used lingo and will be more apparent to our target audience of end users. Elsewhere on the page, we may choose to refer to Project Profiles.

This page should be standardized because, for instance, a hospital in the northwest may be interested in seeing case studies of hospitals in the northeast. In addition, it will serve as a useful repository for all RAC project profiles so we can find them and send them on to potentially interested end users in our region. However, we are blessed by a large and growing number of project profiles, and thus navigating through a simple list of all of them will quickly become unwieldy. The best solution is to resurrect the DOE Case Study Database developed by Sentech (see www.sentech.org/CaseStudy/). This database is a wonderful resource. You can search by site name, state, market sector, market subsector and NAICS code, size range, prime mover, thermal energy use, or fuel type—or a combination of any of the above. For instance, “Are there any examples of microturbines running on diesel in Alaska? Are there any reciprocating engines running desiccant dehumidification? Is there any CHP at multifamily housing in New York?

We spoke with Patti Garland and learned that the reason this database was taken off of the DOE website was because it linked to external web pages, many of which then got moved or removed, so the site contained too many “dead links.” We suggested that this database be revived and re-populated with only RAC project profiles, to ensure no dead links. In the future, if we decide we want to add external non-RAC case studies, we could turn them into PDFs and host them on our own site, rather than linking to them.

We will also most likely have a link to ICF’s CHP Installation Database.



Patti Garland confirmed that the coding of this database belonged to DOE and that are welcome to use it. (It is most likely a Microsoft Access database that Sentech sent on a CD to Energetics.)

QUESTION: Can this remain a national resource rather than have to be maintained by an individual RAC?

NOTE: One of DOE’s new CHP pages will include the ability to search for RAC project profiles either by state (via a U.S. map) or by market sector.

QUESTION: If this case study database is revived and re-populated with RAC project profiles, maybe DOE should consider using it on their new CHP site, either instead of or in addition to the map/market sector approach. This would cover both state and market sector, but offer users other searchable options too—making it a more complete and usable tool. Furthermore, it would be a better use of time to have one repository, instead of having to send new RAC project profiles to this case study database and to the maintainers of the DOE site.

NEWS & EVENTS
Upcoming Workshops & Events
Recent Workshops & Events
News

Some RACs keep News and Events separate, while others combine them. We think it is best to combine them, to save website "real estate." They will be region-specific.

The most important news and events for each region will also be listed on the RAC's main page.

This page will include a sidebar or box that says, for example:
Members of the Media: The GCAC staff is available to respond to journalists' inquiries and requests. Please contact Dan Bullock by phone (281) 364-6087 or by email at dbullock@harc.edu.

We suggest that the best way to organize the rest of this section is as follows (not including font/color/design etc.):

Upcoming Workshops & Events

- List as many as you have, up to max of ~ 6?
- List the event title, date, and place. The title links to a page with info on just that event (registration, agenda, etc.). If only date/place is known, no need to link to a separate page.
- This section is mainly for RAC events or select events where RAC personnel are giving presentations. National events can be listed, or not.
- To make certain that we don't list events as "upcoming" that are actually in the distant past, we recommend that we somehow give each item an "expiration date": i.e. when posting an item, tell the webmaster to remove it when the data passes, or put a reminder on your calendar to move it (and at the same time, post the presentations if applicable).

Recent Workshops & Events

Archive

- List max of ~ 2? (Older events get archived)
- List the event title, date, and place. The title links to a page with the workshop presentations PDF'd.

News

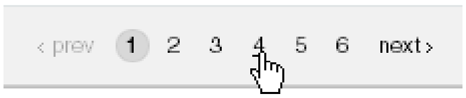
RSS | **Email Updates** | **Archive**

- List max of… 8? Nothing more than 1.5 years old? (Older news gets archived)
- Putting a cap on the number of new items listed and/or a date range will make certain that we don't list news from the distant past. In addition, we recommend that we give each item an "expiration date": i.e. when posting an item, tell the webmaster to remove it after a certain date, or put a reminder on your calendar.

LIBRARY & RESOURCES

This section will be modeled after the Resource Library section of the Gulf Coast: www.gulfcoastchp.org/Library/. We did not finalize the layout and content, but we are leaning towards suggesting that it include:

1) An All-RAC "catch-all" library that lists perhaps 10-12 documents on the first page and then have pagination at the bottom to see others; for example:



… or…

QUESTION: List alphabetically or by most recent?

We do not yet know the logistics of how this catch-all would be maintained.

2) A RAC-specific section
3) A national resources section with a handful of the best non-RAC tools, databases, magazines, or related organizations – not comprehensive.
4) Other items from the Gulf Coast Resources Library page, TBD. Note that the Case Studies link would go to our other Case Studies page.

NEXT STEPS: The Working Group will continue to research ways to organize the library and resources section and to provide input to the mock-up website.

Appendix B

The MAC Website Traffic Report: October through December 2009

- Website traffic during the period was over 351,150 hits[1] and a total of over 1.5 million hits[1] for the calendar year 2009. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Website in April 2002, now exceeds 7.24 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Website during the period exceeded 173,600 and a total of over 784,400 for the calendar year 2009. Since launching the Website over 2.65 million PDF documents have been viewed / downloaded from the Website. The annual and cumulative data for the PDF documents downloaded are shown in Figures 4 and 5, respectively.
- During the period, the number of distinct computers that logged on to the Website at least once during the period was as high as 6,356 per month as shown in Figure 6 and averaged over 6,000 per month. The statistics of the distinct computers logged on for the calendar year 2009 are as high as over 10,300 per month and averaged over 6,600 per month.
- Data transferred by the Website visitors during the period was as high as 22.9 per month as shown in Figure 7 and totaled 67 Gigabytes. These statistics for the calendar year 2009 are as high as 87.2 Gigabytes per month and 310 Gigabytes for the whole year. Since launching the Website, over 1,051 Gigabytes of data have been transferred from the Website as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded are shown in Exhibits 1 and 2. These include the following:
  - *Project Profiles*: Nearly 18,700 during the period (including over 9,300 of those developed by other RACs) and a total of over 82,600 for the calendar year 2009 (including over 40,900 of those developed by other RACs)
  - *CHP Resource Guide:* Over 9,900 during the period and a total of over 37,100 for the calendar year 2009
  - *CHP Resource Guide for Hospitals*: Over 6,600 during the period and a total of over 27,400 for the calendar year 2009
  - *Illinois Permitting Guidebooks (Volumes A, B and Calculator): Over* 1,520 during the period and a total of over 154,200 for the calendar year 2009 (This includes unusually high number of downloads of 149,000 recoded by the server for April 2009. If we use an average number of 477 downloads during April, the total for 2009 will be 5,728)
  - *Report on* "*Potential Use of IL Coal in Dry-Mill Ethanol Plants*: 250 during the period and a total of nearly 1,070 for the calendar year 2009
  - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:* Over 260 during the period and a total of over 1,700 for the calendar year 2009
  - *Report on "Global Warming Impact of Corn Ethanol Production:"* Over 472 during the period and a total of over 1,320 for the calendar year 2009
  - *Report on "CHP Application in Ethanol Plants:"* Over 420 during the period and a total of nearly 1,270 for the calendar year 2009

- *Presentations made at the Workshop on "Waste to Energy: Advances and Opportunities for Ohio's Livestock & Food Processing Industries,"* (Held in Wooster, OH on April 7, 2009): Over 8,600 during the period and over 28,800 total in 2009
- *Presentations made at the Workshop on "Energy Saving Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP,"* (Held in Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively): Over 7,540 during the period and over 33,500 total in 2009
- *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies," (Held in Lansing, MI on January 15, 2008): Over 2,100 during the period and over 10,900 total in 2009*

- *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste," (Held in Richmond, IN on May 31, 2007): Over 2,960 during the period and over 13,300 total in 2009*

- *Presentations made at the Workshop on "Waste-to-Energy from the Ohio Livestock & Food Processing Industries," (Held in Wooster, OH on January 31, 2007): Over 3,800 during the period and over 15,600 total in 2009*

- *Presentations made at the Workshop on "Waste-to-Energy Workshop for Indiana's Farm, Food Processing and Wood Industries,"* (Held in Jasper, IN on December 11, 2006): Over 2,500 during the period and 10,100 total in 2009

1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes).

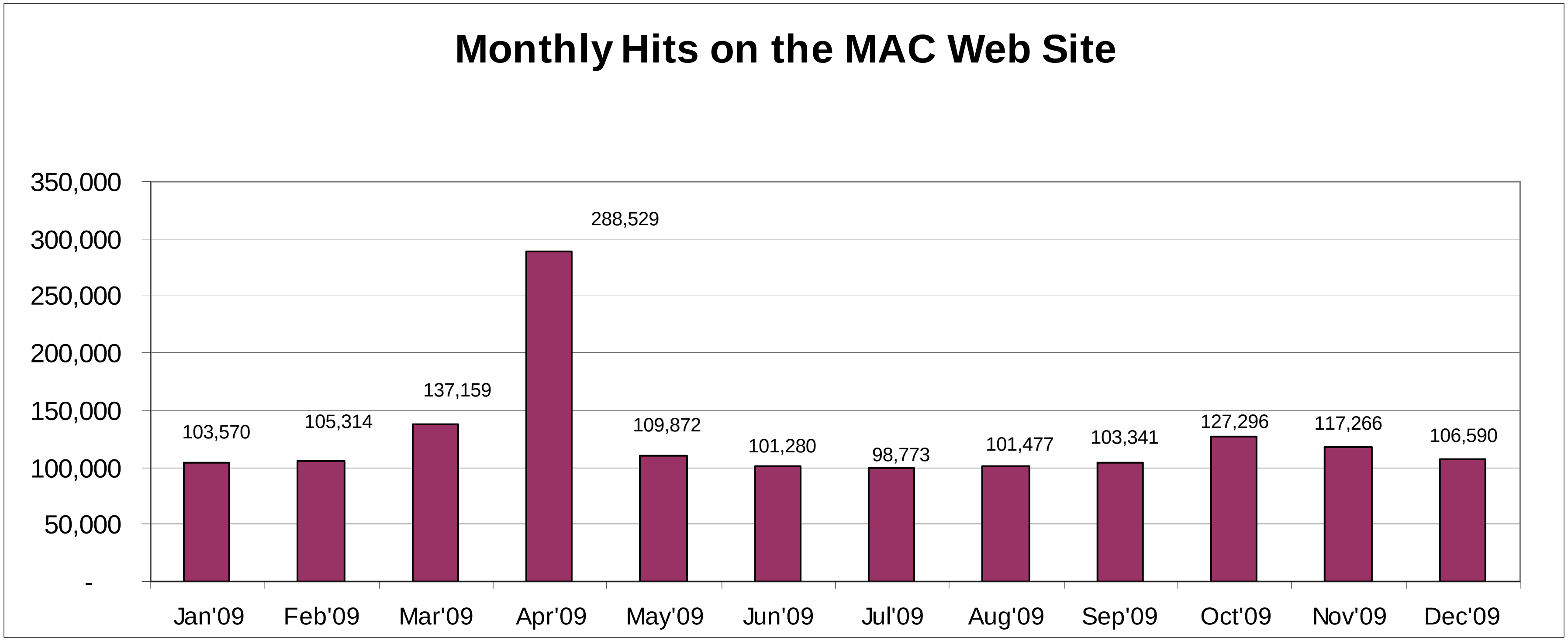


Figure 1 Monthly Hits on the MAC Website

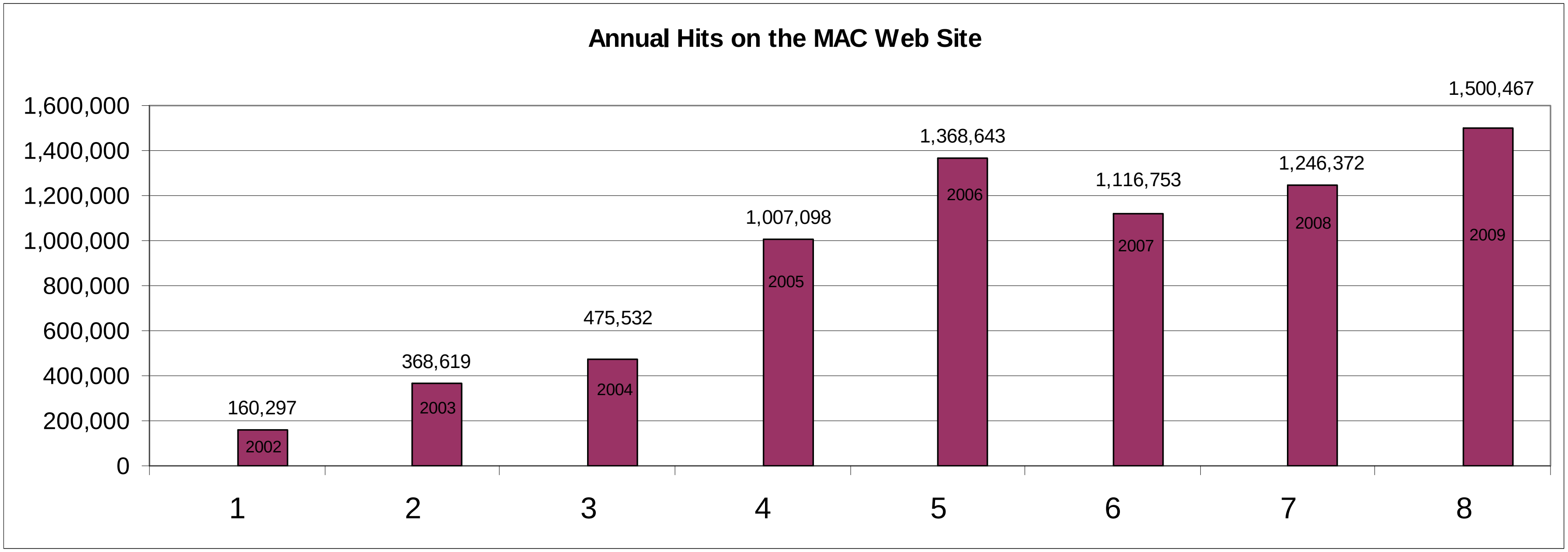


Figure 2 Annual MAC Website Hits through December 2009

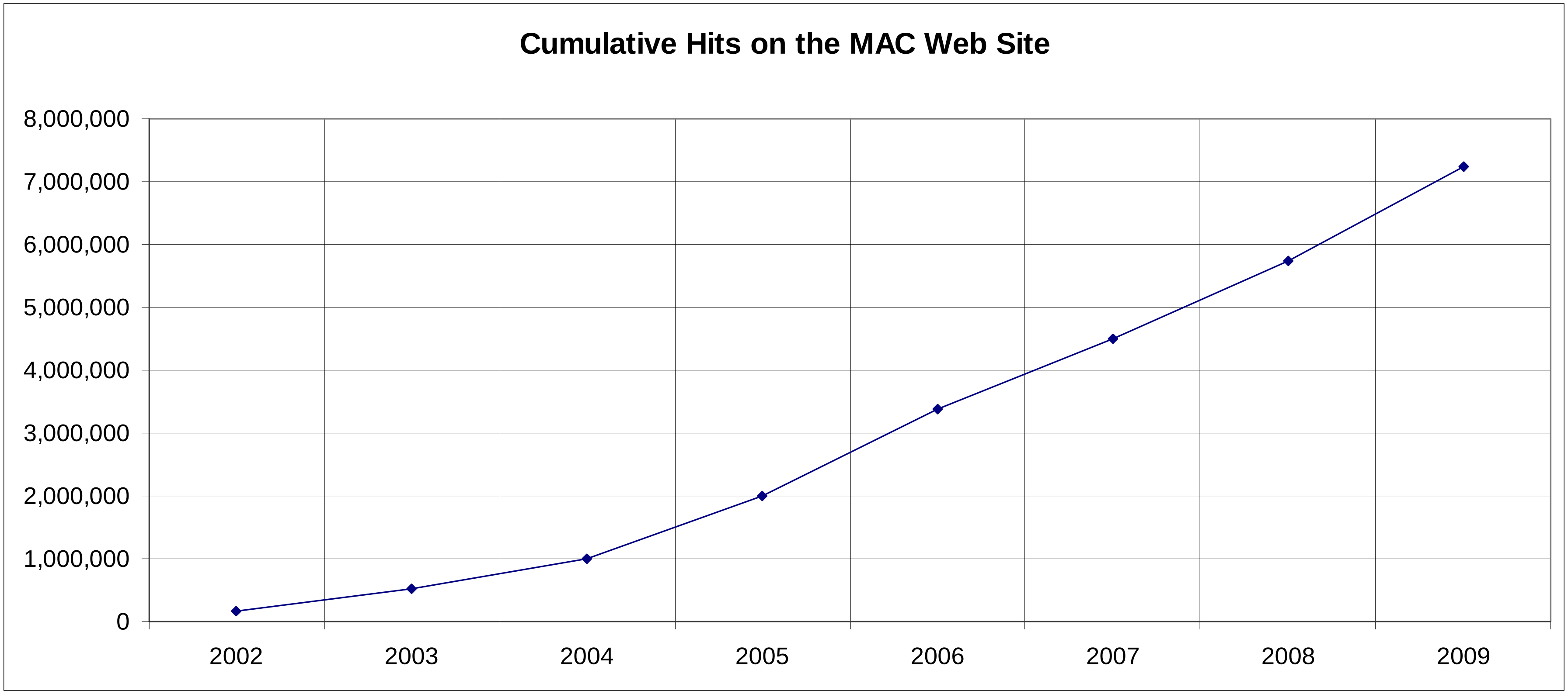


Figure 3 Cumulative MAC Website Hits through December 2009

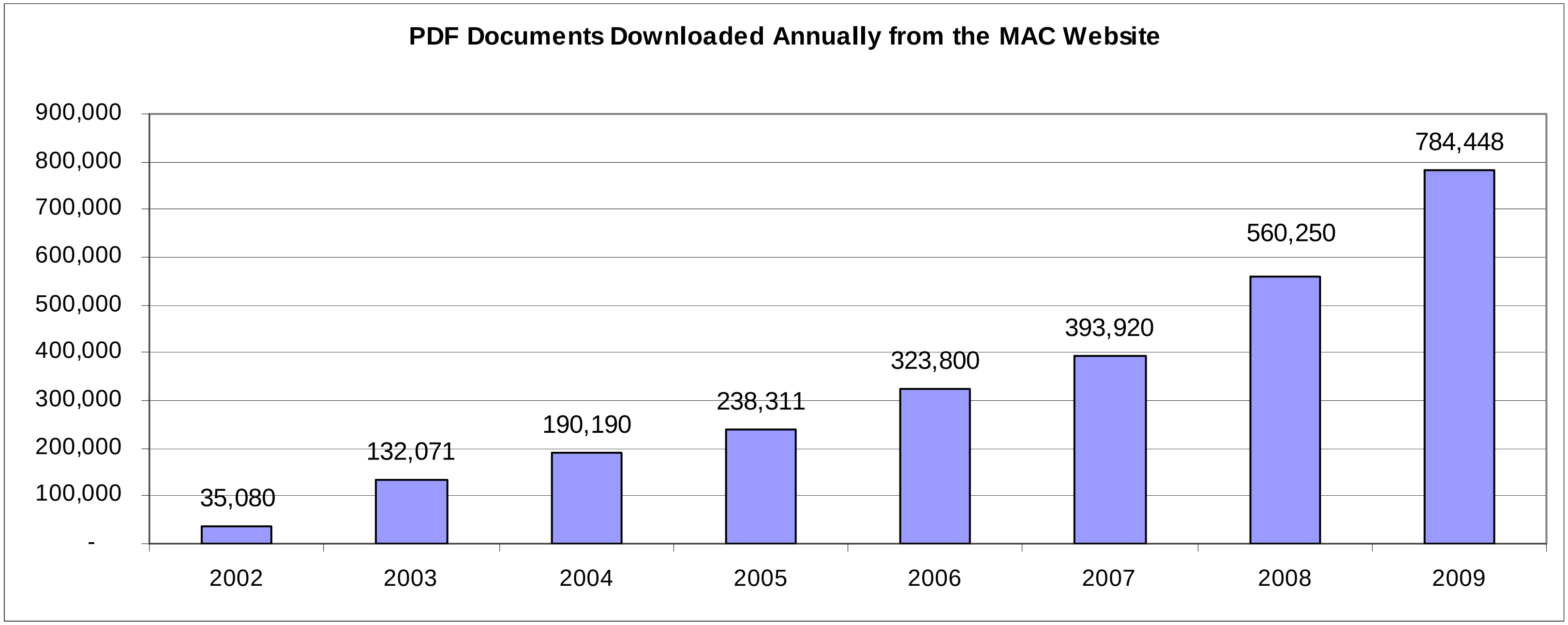


Figure 4 Number of PDF Documents Annually Downloaded from the MAC Website

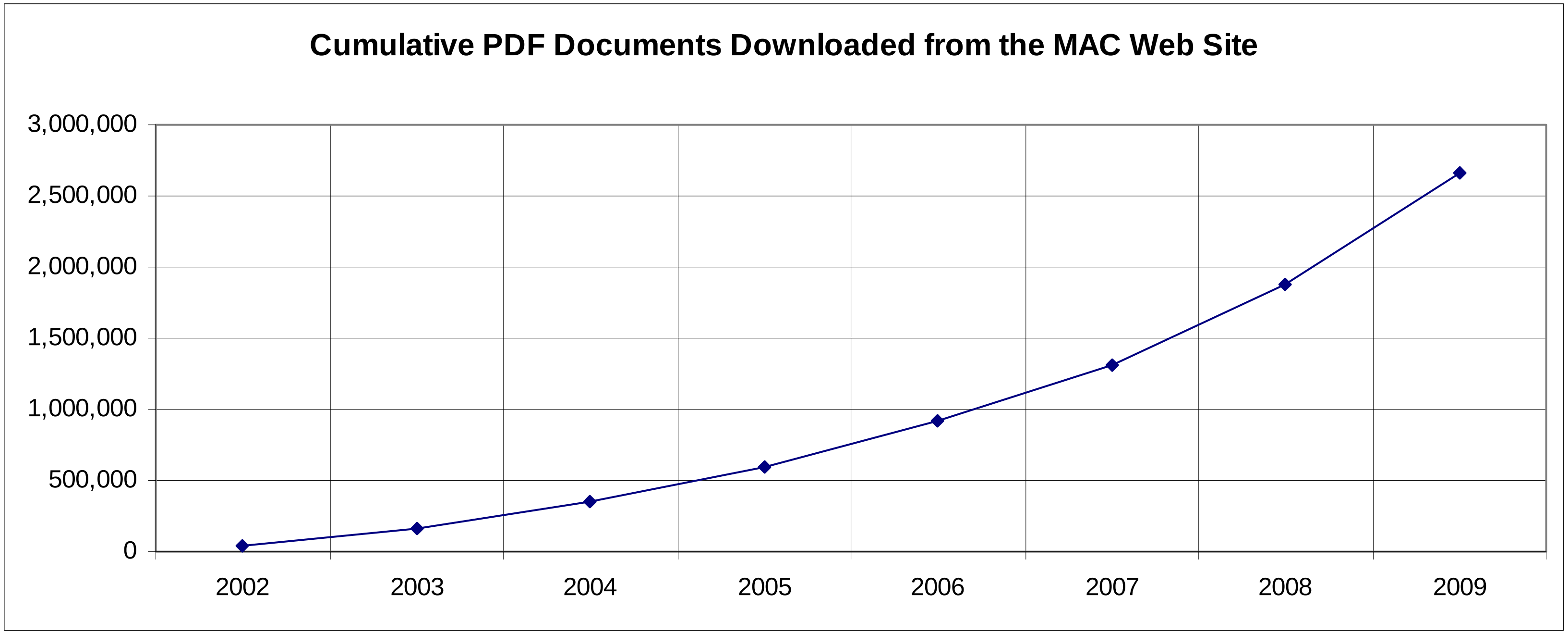


Figure 5 Cumulative Total of PDF Documents Downloaded through December 2009

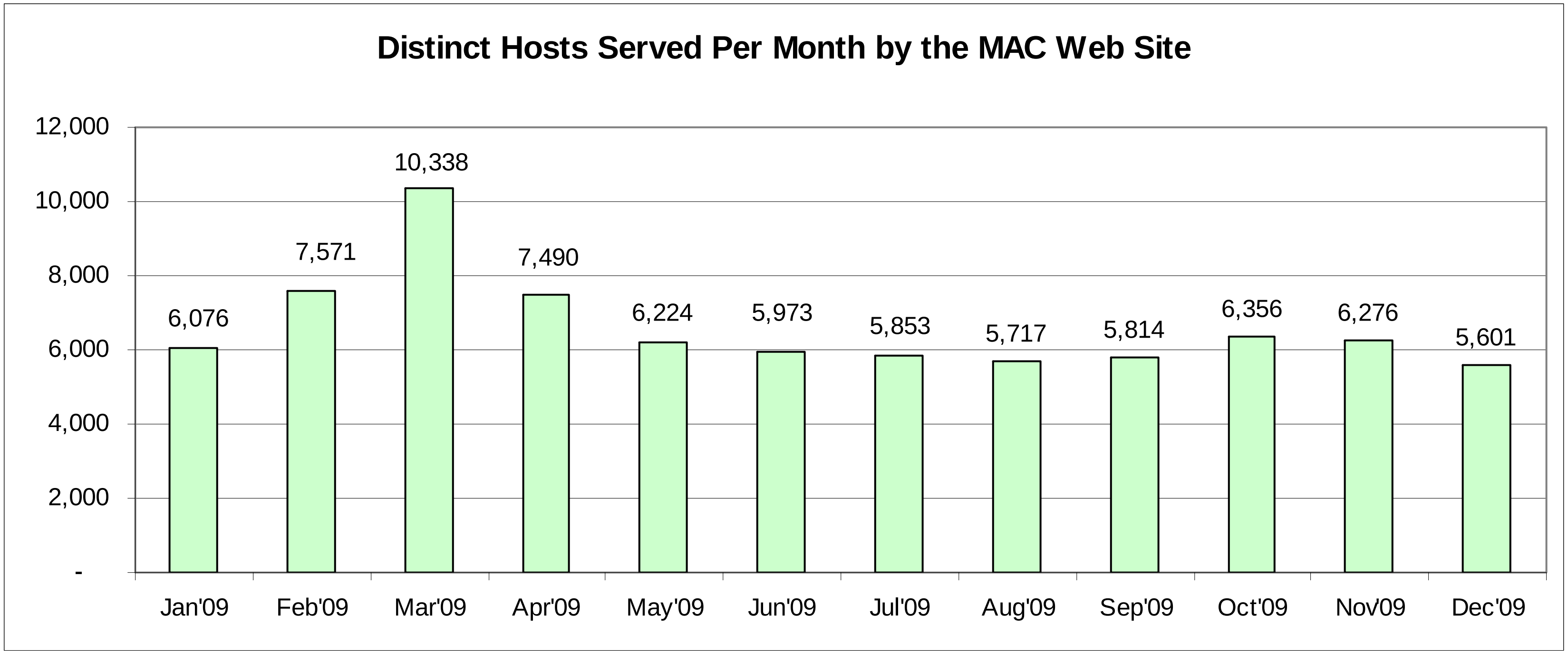


Figure 6 **Distinct Computers Accessing the MAC Website At Least Once**

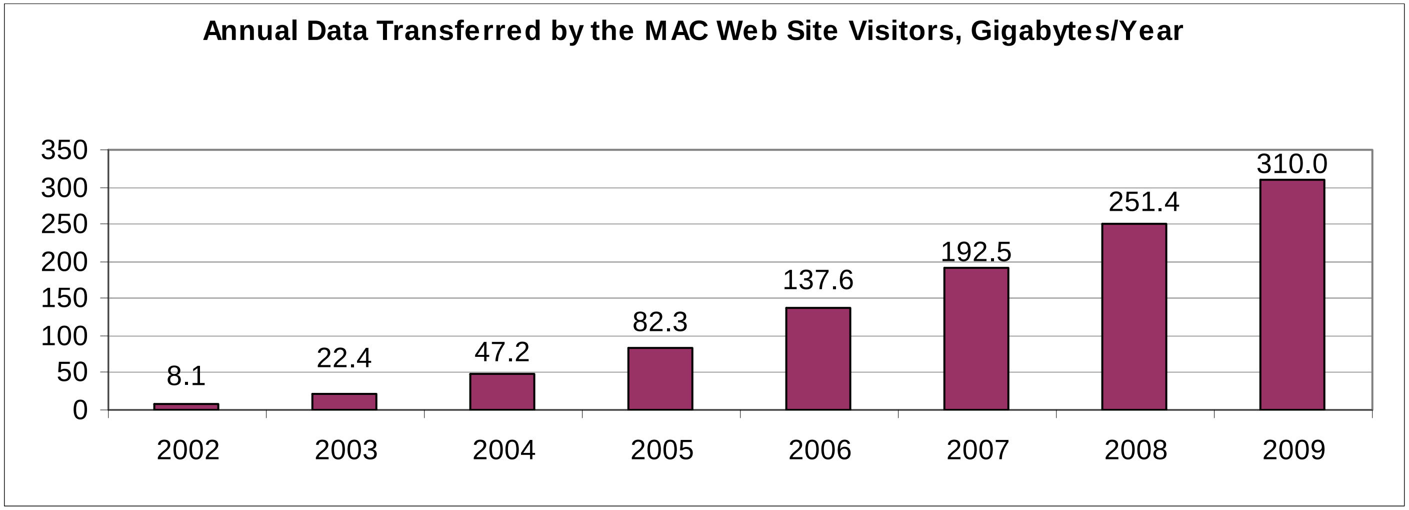


Figure 7 Annual Data Transferred by the MAC Website Visitors

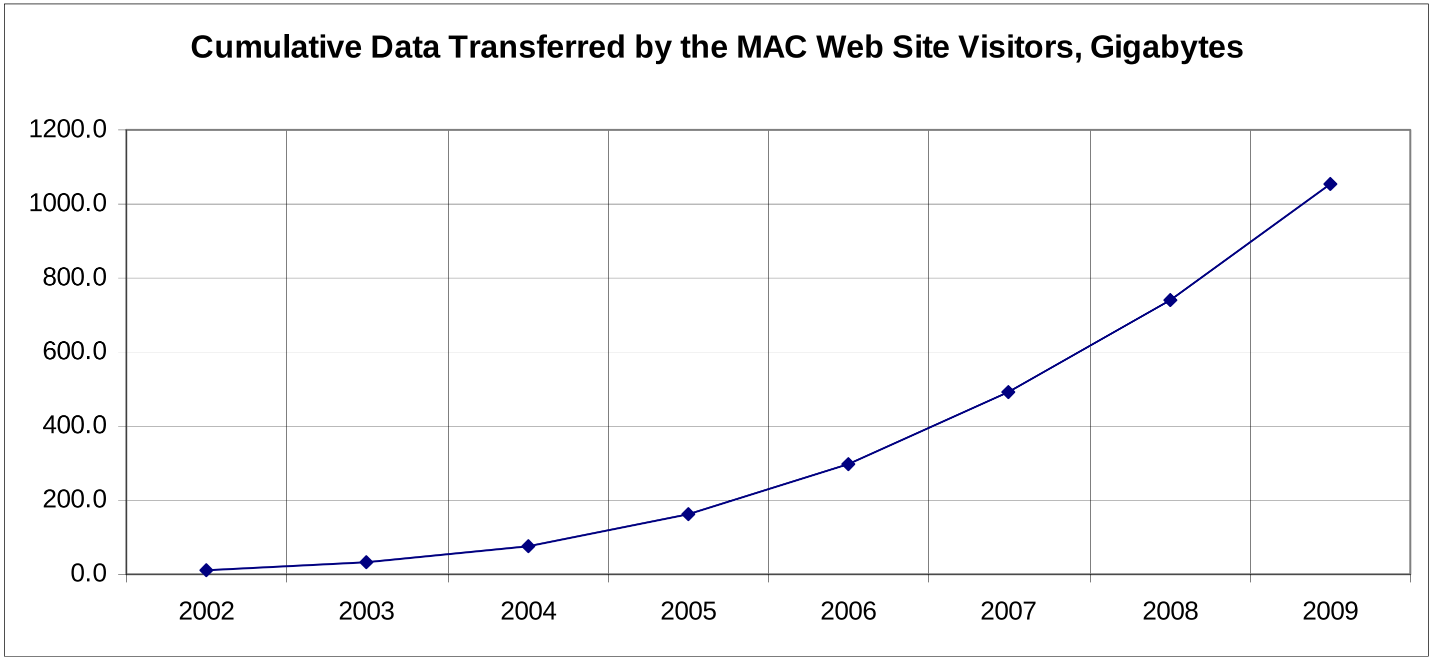


Figure 8 Cumulative Data Transferred by the MAC Website Visitors through December 2009

Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2009

	2009												YTD 2009		
	Jan'09	Feb'09	Mar'09	Apr'09	May'09	Jun'09	Jul'09	Aug'09	Sep'09	Oct'09	Nov'09	Dec'09	Total	Avg. PM	Max. PM
Project Profiles															
Adkins Energy	61	42	52	58	45	48	37	49		28	30		450	50	61
Advocate South Suburban Hospital	45	39	52	66	66		54	46	24	42	32	20	486	54	66
Afxantiou Farm	47	40	49	51	40		38	42	29	43	26		405	45	51
Albert Lea Wastewater Treatment Facility	107	111	145		178	105	101	111	128	147	136	113	1,382	154	178
Antioch Community High School	73	73	102	128	66	92	60	61	51	69			775	86	128
Barham Farms	44	43	61	54	51	59	42	55	28	36	29		502	56	61
Beloit Memorial Hospital	55	39	52	58	57	54	64	31	26	35	34		505	56	64
Breeden YMCA	49	38	62	44	37		42	34	22	35	28		391	43	62
Broshco Fabricating Products	102	106	145	114	121	104	81	86	79	95	100	86	1,219	135	145
Clover Hill Dairy								55	134	157	176	132	654	73	
Dakota Station		41	61	44	53	45	44	29	37	50			404	45	61
East Kansas Agri-Energy	346		106	183	167	124	165	78	140	94	217	108	1,728	192	346
Eastern Michigan University														-	
Elgin Community College	67	69	97	85	74	73	58	55	61	72	63	76	850	94	97
Elkhart Hospital	114	34	63	121	106	106	335	77	41	42	47		1,086	121	335
Evanston High School	40	36	44	73	76	64	66	69	69	44	41		621	69	76
Franciscan Sisters	59	53	81	71	66	81	56	54	49	38	31	26	665	74	81
Franklin Heating Station	44	39	49	64	54		80	42	28	29	26		455	51	80
Holiday Inn	55	39	52	49	48	41	27	26	21	23			381	42	55
Holsum Dairy								42	104	109	154	132	541	60	
Holsum Elm Dairy								36	56	104	53	58	307	34	
Hunter Haven Farms	79	71	113	77	85	96	117	90	77		96	65	966	107	117
Janesville Wastewater Treatment Facility				69	90	70	57	58	103	66	76	61	650	72	103
Jesse Brown VA Medical Center	148	123	124	101	94	110	113	127	111	150	119	98	1,418	158	150
Laclede Gas Building		32	42	72	59	75	60			36	61	23	460	51	75
Lake Forest Hospital	58	60	93	180	161	134	169	99	65	55	58	23	1,155	128	180
Little Company of Mary Hospital		33	41	45	62	73	52	39		36	23		403	45	73
Lorin Industries	35	31	41	36			29	23	21			20		-	
Maine South High School	72	70	70	90	90	151	57	79	109		168	110	1,066	118	168
Manchester Tanks	158	131	216	202	158	179	150	141	169	209	346	224	2,283	254	346
Museum of Science	43	33	44	60	58	82	52	76	38	44	30		560	62	82
National Animal Disease Center	83	65	78	98	80	84	100	87	73	109	81	112	1,050	117	112
Naval Station Great Lakes	118	149	121	182	147	155	147	169	129	159	179	150	1,805	201	182
Northeast Missouri Grain	80	69	61	84	95	99	82	54	25	37	31		717	80	99
Northwest Community Hospital	158	153	56	62	58	195	218	301	267	282	26	164	1,940	216	301
Norwiss Farms	104	106	112	112	119	122	83	85	89	109	86	86	1,213	135	122
Onyx Seven Mile Creek Landfill	111	104	212	265	283	219	249	157	196	208	236	114	2,354	262	283
Pasadena City College	34	38	45	40	36		36	27	22	29				-	
Presbyterian Homes	67	83	83	70	84	83	58	32	32	55		21	668	74	84
Resurrection Hospital	55	51	39	60	75	63	96	69	30	54	26	22	640	71	96
Rochester Wastewater Treatment Plant	74	79	96	112	89	83	117	85	89	95	121	75	1,115	124	121
SmithField Foods	40	38	50	49			30	39	24	29	22		321	36	50
St Francis Hospital	57	48	62	78	91		90	41	63	72	61	26	689	77	91
St. Mary's Hospital, MN	39	34	39	87	89	93	112	43	29	32	21		618	69	112
St. Mary's Hospital, WI	48	42	43	48	44		64	49	44	51	33		466	52	64
Spectrum Health														-	
U.S. Energy Partners	44	38	44	49	47	46	44	32		32	30		406	45	49
UIC- East Campus	63	50	46	91	73	70	126	68	21	47	30		685	76	126
UIC-West Campus	41	34	53	43	46	49	58	57	40	31	22		474	53	58
University of Iowa	78	90	108	92	91	61	70	81	94	86	82	88	1,021	113	108
University of Michigan														-	
Utilimaster Corporation	103	78	134	113	88	87	66	86	88				843	94	134
Vestil Manufacturing	64	69	76	99	62	68	65	68	73	71	63	73	851	95	99
Winnenago County Sheriff's Office	90	97	87	97	86	95	74	82	94	81	89	77	1,049	117	97
Total Project Profiles Total	**3452**	**2940**	**3702**	**4126**	**3945**	**3638**	**4191**	**3522**	**3342**	**3556**	**3439**	**2383**	**41,693**	**4,633**	**4,191**
Other RACs															
Alaska Village Electric Coop Anvik	62	44	67	46	42	47	52	45	47	45	36	46	579	64	67
Alaska Village Electric Coop Grayling	52	46	66	46	42	51	58	54	48		40	50	553	61	66
BMW											2	51			
Bristle-Myers Squibb	53	47	65	50	49	45	47	43	40	43	35	42	559	62	65
Central Connecticut State University	96	83	101	70	59	69	36	43	45	41	46	44	733	81	101
Chambers County	150	123	172	157	96	68	180	146	102	80	154	91	1,519	169	180
Colby College	73	56	72	63	50	40	56	49	38	50	41	40	628	70	73
Columbia Energy											2	60			
Colorado Pork	53	92	108	86	79	40	98	71	63	67	39	39	835	93	108
Cooper Tire											2				
Corn Products											3	56			
COX Interior											7	61			
East Bay Municipal Utilby District	161	132	130	126	158	116	157	87	77	122	133		1,399	155	161
Encore Landfill											6	119			
Essex Junction Waterwater Treatment Facility	53	64	83	65	45	45	37	45	44	41	33	186	741	82	186
Fort Bragg											7	84			
Golovin City	74	67	84	72	44	68	52	48	48	66	43	45	711	79	84
Green Mountain Coffee Roasters	80	90	102	84	75	79	51	60	51	38	41	55	806	90	102
Herbec Plastics	66	49	81	73	41	44	51	61	59	60	42	43	670	74	81
Homan Lumber											13				
Ina Road Water Pollution Control Facility	48	60	76	67	45	43	47	52	42	47	34	47	608	68	76
Johnson & Johnson	68	52	108	148	130	121	118	116	121	115	167	174	1,438	160	174
Joseph Gallo Farms	296	246	316	327	303	426	296	283	196	349	254	326	3,618	402	426
Kokhanok City	55	50	77	64	44	39	42	50	40	49	39	49	598	66	77
Kongiganak City	53	40	47	50	44	46	42	42	41	58	44	47	554	62	58
Kwigillingok	62	56	57	62	43	46	63	43	47	45	44	52	620	69	63
LaFarge Gypsum											5	63			
McShan Lumber											7				
Network Appliance Data Center	98	197	113	113	122	56	111	148	86	109	131	118	1,402	156	197
Nevada Hotel Casino	70	84	75	78	70	74	76	67	59	87	61	55	856	95	87
New Belgium Brewery	77	63	64	54	54	57	187	81	85	85	58	67	932	104	187
Notre Dame Long Term Care	57	57	85	63	43	46	49	47	40	40	36	41	604	67	85
One Market Plaza	100	79	120	142	83	89	84	113	75	58	61	67	1,071	119	142
Ritz Carlton	56	61	75	67	57	55	49	49	56	58	72	85	740	82	85
Santa Margarita Wastewater Treatment Plant	53	52	71	53	81	49	43	48	43	55	36	47	631	70	81
Santa Rita Jail	253	236	222	277	138	118	167	210	211	139	172	198	2,341	260	277
Sierra Nevada Brewery	78	94	102	113	77	61	90	89	62	75	124	125	1,090	121	125
Shands Hospital	3										3	54			
South Oaks Hospital	61	60	79	59	49	50	46	40	42	48	35	39	608	68	79
South Mississippi Correctional Facility											1				
SP Newsprint											1	49			
Stevens Village Council	69	43	79	50	46	40	53	62	41	47	47	48	625	69	79
Tesoro Petroleum	104	90	99	105	48	59	62	51	46	60	35	48	807	90	105
The Inside Passage Electric Coop (Angoon)	67	66	83	90	48	66	54	80	61	72	156	104	946	105	156
University of California, Berkeley			52	32	5	3	1	3	6	3	2	2	109	12	52
University of Montana	87	58	162	138	56	52	97	99	63	83	98	88	1,081	120	162
University of North Carolina											11	94			
University of California, San Diego			49	33	4	3	1	3	2	2		1	98	11	49
Utah State University	63	72	84	65	43	45	51	39	42	43	36	43	626	70	84
Valley Medical Center	57	43	67	48	40	45	46	41	40	48	34	38	547	61	67
Vander Haak Dairy	84	84	119	130	75	123	125	112	90	106	97	87	1,232	137	130
Vinyard 29	95	79	93	135	98	80	113	93	60	64	56	87	1,053	117	135
Wadeland Dairy	69	71	71	78	46	42	54	46	44	46	35	42	644	72	78
Waldbaum's Supermarket	585	476	568	647	317	442	429	292	315	49	199	92	4,401	489	647
William College	54	48	68	53	53	43	53	40	40	45	33	42	572	64	68
Total Project Profiles of Other RACs	**3,795**	**3,509**	**4,402**	**4,279**	**3,042**	**3,131**	**3,524**	**3,191**	**2,758**	**2,738**	**2,949**	**3,631**	**40,949**	**4,550**	**4,402**
Grand Total of All Project Profiles (MAC + Others)	**7,247**	**6,449**	**8,104**	**8,405**	**6,987**	**6,769**	**7,715**	**6,713**	**6,100**	**6,294**	**6,388**	**6,014**	**82,642**	**9,182**	**8,593**
Resource Guide														-	
2003	1,366	1,007	1,654	1,518	581	750	995	583	789	820	979	683	11,725	1,303	1,654
2005	1,870	1,864	1,910	1,989	2,001	2,143	2,531	1,658	1997	2,587	2,665	2,185	25,380	2,820	2,655
Total	**3,236**	**2,861**	**3,564**	**3,507**	**2,582**	**2,893**	**3,526**	**2,241**	**2,786**	**3,407**	**3,634**	**2,868**	**37,105**	**4,123**	**3,634**
Hospitals Resource Guide	**2,354**	**2,200**	**3,262**	**2,623**	**2,026**	**1,468**	**2,332**	**2,594**	**1,944**	**2,318**	**2,075**	**2,267**	**27,463**	**3,051**	**3,262**
IL Premitting Guidebooks														-	
A	172	424	142	138	175	179	560	146	150	206	149	221	2,662	296	560
B	76	147	81	148,754	127	90	126	68	98	187	139	169	150,062	16,674	148,754
Calculator	108	106	133	114	95	99	118	164	142	194	134	126	1,533	170	194
Total	**356**	**677**	**356**	**149,006**	**397**	**368**	**804**	**378**	**390**	**587**	**422**	**516**	**154,257**	**17,140**	**149,006**
Energy Use in Future Dry-Mill Ethanol Plants	**89**	**81**	**108**	**69**	**98**	**83**	**72**	**82**	**137**	**86**	**88**	**76**	**1,069**	**119**	**137**
Global Warming Impact of Corn Ethanol Production	**77**	**87**	**94**	**113**	**99**	**69**	**90**	**88**	**136**	**148**	**138**	**186**	**1,325**	**147**	**186**
Potential Use of IL Coal in Dry-Mill Ethanol Plants	**159**	**217**	**182**	**120**	**203**	**170**	**135**	**144**	**116**	**99**	**90**	**74**	**1,709**	**190**	**217**
CHP Application in Ethanol Plants	**122**	**109**	**132**	**164**	**84**	**67**	**65**	**65**	**40**	**130**	**145**	**146**	**1,269**	**141**	**164**
Others															
Mich. Water Env. Asso. Biosolids Wksh. (090303_Haefke)			1	298	300	175	243	393	172	218	337	238	**2,375**	**264**	**393**
Dubuque Iowa Biomass Conf															
080717 Haefke 1	225	193	332	311	195	225	196	262	187	169	386	199	**2,880**	**320**	**386**
080717 Haefke 2	184	159	419	449	154	227	243	234	106	178	286	198	**2,837**	**315**	**449**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2009

													--------YTD 2009 ----------		
	Jan'09	Feb'09	Mar'09	Apr'09	May'09	Jun'09	Jul'09	Aug'09	Sep'09	Oct'09	Nov'09	Dec'09	Total	Avg. PM	Max. PM
Waste-to-Energy Workshop (Wooster, OH; 4/7/09)															
Schanbacher				1,347	1501	1221	733	1220	1113	1399	1527	839	10,900	1,211	1,527
Dvorak				336	346	267	84	226	267	385	421	297	2,629	292	421
McDonald				295	227	110	76	86	124	85	62	65	1,130	126	295
Kasper				220	103	57	39	65	62	55	41	35	657	73	220
Brown				265	211	100	141	202	141	124	165	147	1,496	166	265
Weaver				584	296	99	94	72	34	140	30	52	1,401	156	584
O'Loughlin				229	91	61	34	35	36	41	63	66	656	73	229
Berlekamp				160	116	49	38	38	40	73	57	47	618	69	160
Maringer				351	159	200	113	202	300	145	101	179	1,750	194	351
Kurtz				414	195	172	74	127	106	57	73	47	1,265	141	414
Arnold				206	88	48	29	29	68	36	30	46	580	64	206
Goodge				68	55	51	35	57	45	53	95	95	554	62	95
Sutor				53	52	48	34	38	36	40	29	34	364	40	53
Monhemius				243	265	323	187	166	202	306	231	146	2,069	230	323
Speakers Contact Info				56	97	101	88	108	95	78	79	93	795	88	108
Agenda				275	144	68	77	83	75	72	54	59	907	101	275
Brochure				403	88	74	81	71	83	98	68	75	1,041	116	403
Directions													-	-	-
Total				**5,505**	**4,034**	**3,049**	**1,957**	**2,815**	**2,817**	**3,187**	**3,126**	**2,322**	**28,812**	**3,201**	**5,505**
														0	
WWTF Workshop (Indianapolis, IN; 05/19/08)															
Downey	44	70	44	41	61	56	56	58	40	58	33	36	597	66	70
Scott	153	90	160	134	134	74	151	186	93	180	137	76	1,568	174	186
Welle	74	86	111	68	91	77	117	83	84	96	69	42	998	111	117
Haefke	126	490	493	1090	150	158	84	174	117	89	56	37	3,064	340	1,090
Griffin	143	60	63	52	97	54	111	59	66	85	80	63	933	104	143
Karafa	127	135	222	252	171	141	168	109	97	165	94	150	1,831	203	252
Totzke	160	148	344	290	210	220	187	169	263	184	174	32	2,381	265	344
Robin	157	239	190	189	125	65	229	95	82	138	204	38	1,751	195	239
Jan Scott	612	861	946	940	726	852	628	767	862	685	919	777	9,575	1,064	946
Dvorak	48	49	54	48	48	34	42	39	34	45	37	34	512	57	54
Cummings	87	145	102	97	58	91	116	87	101	77	56	84	1,101	122	145
Parker	93	62	144	99	128	69	75	66	107	78	78	74	1,073	119	144
Speakers Contact Info	69	62	86	65	61	56	55	49	47	48	68	80	746	83	86
Agenda	52	41	56	94	43	85	77	101	35	92	76	79	831	92	101
Brochure								11		5			16	2	11
Directions								192		251			443	49	251
Total	**1,945**	**2,538**	**3,015**	**3,459**	**2,103**	**2,032**	**2,096**	**2,245**	**2,028**	**2,276**	**2,081**	**1,602**	**27,420**	**4,570**	**3,459**
														-	
WWTF Workshop (Elkhart, IN; 05/21/08)															
Downey	88	50	158	130	208	145	136	75	61	183	214	84	1,532	170	214
Kline	52	45	63	68	39	81	111	61	34	57	44	39	694	77	111
Totzke	46	50	80	67	51	56	82	72	53	70	59	81	767	85	82
Wishart	90	60	114	51	117	141	140	79	131	68	69	89	1,149	128	141
Bayer	51	52	49	59	68	88	47	53	52	58	47	46	670	74	88
Speakers Contact Info	47	31	50	42	41	46	40	48	47	51	55	63	561	62	63
Agenda	55	49	51	97	44	40	36	107	47	93	77	40	736	82	107
Total	**429**	**337**	**565**	**514**	**568**	**597**	**592**	**495**	**425**	**580**	**565**	**442**	**6,109**	**1,018**	**597**
														-	
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)															
Gould	138	221	169	173	258	129	138	97	92	143	188	117	1,863	207	258
Safferman	75	176	175	144	95	107	121	72	75	94	56	84	1,274	142	176
Cuttica	107	118	348	182	133	104	97	61	63	75	66	50	1,404	156	348
Stanton	93	82	118	88	57	62	48	45	34	44	70	60	801	89	118
Urban	65	51	57	79	64	46	60	37	45	48	42	35	629	70	79
Ruswick	48	49	55	50	44	38	39	36	31	39	34	31	494	55	55
Parker	100	82	74	98	128	80	49	54	51	61	54	108	939	104	128
Fortune	90	271	127	197	150	95	90	75	110	52	93	56	1,406	156	271
Agenda	164	70	75	131	140	131	98	107	89	101	72	74	1,252	139	164
Speakers Bio	100	109	94	77	85	69	70	60	53	57	53	51	878	98	109
Flyer													-	-	-
Total	**980**	**1,229**	**1,292**	**1,219**	**1,154**	**861**	**810**	**644**	**643**	**714**	**728**	**666**	**10,940**	**1,823**	**1,292**
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)															
Westerfield	59	57	47	60	50	43		37	34	51	40	34	512	57	60
Ileleji	79	74	42	67	92	47		75	62	56	65	56	715	79	92
Cuttica	40	87	49	60	83	47		49	45	51	30	43	584	65	87
Dvorak	213	181	357	223	258	254		174	165	237	162	171	2,395	266	357
Larsen	104	95	95	110	65	100		44	45	68	59	43	828	92	110
McDonald	63	63	64	68	105	66		35	46	51	32	52	645	72	105
Snodgrass	179	539	356	292	224	187	143	184	170	226	119	99	2,718	302	539
Saum	40	42	40	41	39	36	33	35	33	36	29	32	436	48	42
Wagoner	41	48	49	52	53	35	51	36	32	40	37	54	528	59	54
Norrick	49	45	46	46	46	46	53	38	33	55	38	47	542	60	55
Corso	50	66	81	59	48	58	59	47	47	45	59	38	657	73	81
Hay	48	40	52	42	58	38	50	39	38	43	38	39	525	58	58
Agenda	45	131	47	113	129	127	88	106	108	132	97	110	1,233	137	132
Speaker Bios	49	43	51	43	46	38	31	41	37	38	38	43	498	55	51
Flyer	53	46	45	42	48	40	37	45	36	47	39	46	524	58	53
Total	**1112**	**1,557**	**1,421**	**1,318**	**1,344**	**1,162**	**545**	**985**	**931**	**1,176**	**882**	**907**	**13,340**	**2,223**	**1,557**
														-	
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 01/31/07)															
Ward	42	36	41	38	46	36	29	36	32	40	61	57	494	55	61
Elder	37	41	36	54	44	34	38	34	31	39	32	38	458	51	54
Schanbacher	279	382	491	258	388	277	398	468	203	320	575	203	4,242	471	575
Cuttica	45	97	35	71	88	52	60	55	50	57	67	92	769	85	97
Dvorak	84	62	89	90	62	64	57	50	48	36	36	42	720	80	90
Moser	46	43	47	41	49	52	40	38	37	40	51	63	547	61	63
Mills	44	47	69	46	53	59	53	49	57	44	57	70	648	72	70
Arnold	40	32	34	43	43	32	32	34	33	41	38	33	435	48	43
O'Loughlin	46	40	47	44	43	36	34	37	35	42	34	35	473	53	47
Maringer	182	213	210	156	156	164	190	210	213	205	46	41	1,986	221	213
Kasper	64	71	61	63	72	68	50	47	82	73	40	53	744	83	82
Dreve	42	41	46	40	38	36	37	38	33	41	35	35	462	51	46
Eschmeyer	34	30	36	35	44	35	30	38	40	38	36	38	434	48	44
Gwin	53	33	49	41	48	37	33	36	35	42	34	37	478	53	53
Monhemius	43	35	48	46	40	35	36	34	32	40	28	39	456	51	48
Zuber	36	38	42	36	38	33	31	38	35	36	28	34	425	47	42
Agenda	99	96	52	105	102	98	92	102	107	127	103	96	1,179	131	127
Flyer							38			36	32	34	140	16	38
Speakers Bio	49	47	57	46	39	39		83	45	44	57	60	566	63	83
Total	**1,265**	**1,384**	**1,490**	**1253**	**1393**	**1187**	**1278**	**1427**	**1148**	**1341**	**1390**	**1100**	**15,656**	**2,609**	**1,490**
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries															
(Jasper, IN,12/11/06)															
Book	39	33	44	38	43	36	29	37	39	39	36	32	445	49	44
Brown	39	34	55	43	49	51	34	35	44	52	34	35	505	56	55
Corso	40	34	49	42	38	34	32	41	34	35	33	32	444	49	49
Cuttica	35	34	51	50	67	58	53	65	60	51	45	35	604	67	67
Hay	38	33	36	37	41	32	30	38	34	35	36	34	424	47	41
Jones	38	35	53	42	51	65	56	56	57	43	32	32	560	62	65
McGolden	37	35	40	39	44	36	38	38	55	42	30	36	470	52	55
Moser	50	37	44	40	40	41	33	36	40	39	31	44	475	53	50
Roger	49	35	47	47	47	49	38	47	35	42	36	38	510	57	49
Sievertsen	63	85	64	101	112	98	58	73	96	100	73	80	1,003	111	112
Stinchfield	36	33	39	38	39	34	28	34	31	36	36	33	417	46	39
Stwalley	73	63	102	158	125	122	157	130	136	90	50	55	1,261	140	158
Tietz	45	33	55	41	48	44	35	43	43	49	205	41	682	76	205
Toenges	40	33	44	35	36	37	31	38	46	35	35	33	443	49	46
Walmsley	36	34	57	63	94	70	62	84	76	81	86	67	810	90	94
Speakers Contact Information	45	41	53	38	40	36	34	40	40	45	33	38	483	54	53
Agenda	47	47	51	49	43	44	39	55	44	55	40	38	552	61	55
Flyer									13	36	31		80	9	36
Total	**750**	**679**	**884**	**901**	**957**	**887**	**787**	**890**	**923**	**905**	**902**	**703**	**10,168**	**1,695**	**957**

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigator:
John Cuttica, (312) 355-3476, cuttica@uic.edu

Reporting Period:
January 1, 2010 through March 31, 2010

Submission Date:
April 30, 2010

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

Dear Mr. Renk,

Please find the attached Progress Report for the 1st quarter 2010 (Q1.10) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $112,399.17 for Q1.10:

- Jan. 2010: $37,272.20
- Feb. 2010: $32,481.27
- Mar. 2010: $42,645.70

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q4.09. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: The Midwest RAC discussed the Project Management Plan (PMP) with the RAC Project Manager Joe Renk and understands the PMP is a working document and can be updated throughout the year as the Midwest RAC sees their efforts alter focus. No update to the PMP was submitted during Q1.10.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Activity:

- Target Market Workshop: No target market workshops hosted during Q1,10.
- Graduate Level CHP Course: The Midwest RAC is in the midst of teaching a Spring 2010 semester graduate course for the Energy Engineering Masters program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management." The semester course began January 11th and will conclude the week of May 3rd.
    - Module 1 – What is CHP (01/11/10)
    - Module 2 – CHP Fuels (01/11/10)
    - Module 3 – Prime Movers 1: Internal Combustion Engines (01/25/10)
    - Module 4 – Prime Movers 2: Combustion Turbines (01/25/10)
    - Module 5 – Prime Movers 3: Steam Turbines and Fuel Cells (02/01/10)
    - Module 6 – Generators & Electrical Interconnection (02/01/10)
    - Module 7 – Thermal Distribution Systems (02/08/10)
    - Module 8 – Desiccant Dehumidifiers (02/08/10)
    - Module 9 – CHP Evaluations (02/15/10)
    - Module 10 – CHP Market Sectors (02/15/10)
    - Module 11 – CHP Software Model Training (02/22/10)
    - Module 12 – CHP Financial Analysis (03/01/10)
    - Module 13 – CHP Environmental Considerations (03/08/10)
    - Module 14 – DG/CHP Air Permitting (03/08/10)
    - Module 15 – Waste Heat Recovery Applications (03/29/10)
    - Module 16 – Landfill Gas Applications (03/29/10)
- Other Workshops/Conferences/Presentations:
    - CHP Opportunities in Eastern Illini Electric Cooperative, January 21, 2010, Paxton, IL – the Midwest RAC presented "Biogas Energy Opportunities for Eastern Illini Electric Cooperatives"
    - Ohio Chemical Technology Council Board of Directors Meeting, January 28, 2010, Columbus, OH – the Midwest RAC co-presented "Ohio: CHP/Waste Heat Recovery & Feed-in Tariff Policy"
    - ACEEE "Profitability and Environmental Sustainability in the Dairy Industry" Conference, February 7, 2010, Madison, WI – the Midwest RAC presented "Rural Synergies: Combined Heat and Power Systems at Dairy Farms and Ethanol Plants."

- IDEA Annual Campus Energy Conference, February 9, 2010, Reno, Nevada – the Midwest RAC presented "U.S. DOE Clean Energy Applications"
- Combined Heat and Power (CHP): Creating Interconnection Standards in the 2010 Missouri Legislation, March 1, 2010, Jefferson City, MO – the Midwest RAC presented Combined Heat and Power (CHP): An Opportunity to be Explored and Exploited in Missouri"
- Biomass CHP and Thermal Systems Short Course, March 17, 2010, Penn State University, University Park, PA – the Midwest RAC presented "Anaerobic Digester CHP."
- CHP Opportunities and Project Development Strategies: Part 1 "Capturing New CHP Opportunities – Maybe in Your Own Backyard," March 18, 2010, Online Webinar – the Midwest RAC presented "U.S. DOE Clean Energy Application Centers."

- Upcoming (or under consideration) Workshops/Conference :
  - Illinois Save Energy Now (SEN) Industrial Energy Efficiency Forum, April 21, 2010, Chicago, IL
  - Anaerobic Digester (AD) / CHP Workshop, August 2010, Eastern Illini Service Territory (under consideration)
  - Combined Heat and Power for Toledo Industry Workshop (under consideration)
  - District Energy Webinar Series for 2nd Tier Colleges/Universities (under consideration)
  - Waste Heat to Power Workshop, September 29-30, 2010, Chicago, IL

Deliverable: 3 **Task: 2**

Description: *All educational material developed and utilized in deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4 **Task: 3**

Description: *1 regulatory workshop*

Activity:

- Target Policy States: The Midwest RAC has been heavily involved in developing an action plan for the State of Ohio titled "State of Ohio Clean Energy Policy Opportunity Document." This activity has been a highlighted focus for the Midwest RAC and several other RACs working closely with DOE during Q1.10.
- Regulatory Workshop: A ½ day regulatory focused workshop is being coordinated in conjunction with the Waste Heat to Power workshop that will be hosted in Chicago, Illinois, in the September timeframe. The second day of this workshop will be focused on the past, current, and future regulatory and policy

related activities impacting CHP and WHR technologies. This workshop's planning efforts are being coordinated with the Northwest RAC, the Pacific RAC, and the Gulf Coast RAC.

- Policy Student: the Midwest RAC hired a policy graduate student from College of Urban Planning and Public Affairs (University of Illinois at Chicago) who began working with the Midwest RAC in January 2010. This policy student will likely be granted a internship with the Environmental Law & Policy Center (ELPC), which is one of the policy/regulatory partners of the Midwest RAC (50% time for ELPC and 50% time for the Midwest RAC).
- Other Policy/Regulatory Activities:
    - State of Ohio: The Midwest RAC has been working with the Ohio environmental groups and Ohio industrial partners to provide input on proposed legislation to make the State of Ohio a more favorable market for "clean energy" applications. One key issue the Midwest RAC is promoting is Feed-In Tariffs (FITs). The Midwest RAC co-presented to the Ohio Chemical Technology Council Board of Directors on CHP and policy changes on January 28, 2010 (see more info in Deliverable #2). A coalition is actively being formed in Ohio to promote required policy changes to open up the CHP market in Ohio.
    - State of Missouri: The Midwest RAC has been working with both the Missouri State Energy Office and an environmental group to provide input on proposed legislation to make the State of Missouri a more favorable market for "clean energy" applications. One key issue the Midwest RAC is promoting is legislation similar to Feed-In Tariffs (FITs). The Midwest RAC made several trips to Missouri during Q1.10:
        - 03/01/10 – Co-presented with Recycled Energy Development at the Missouri Capitol on CHP and the needed CHP policy changes
        - 03/19/10 – Met with Missouri Utilities and Missouri Public Utility Commission to discuss benefits of added CHP and required CHP policy changes
        - 3/22/10 – Testified in the Missouri House of Representatives in favor of HB2311: Missouri CHP Bill.
    - Illinois Electric Cooperatives: the Midwest RAC working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois and to identify the related barriers. The AIEC and Midwest RAC met with the Eastern Illini Electric Cooperative on January 21, 2010.
    - City of Oak Park: the Midwest RAC is waiting for information from the City of Oak Park to begin preliminary studies for city buildings for CHP feasibility as part of their future sustainability activities (including grid infrastructure, smart grids, perfect power, and required policy changes to accommodate Oak Park's initiatives).
    - Galvin Electricity Initiative: the Midwest RAC is working with the Galvin Electricity Initiative to identify favorable policy reforms for the Midwest states. Illinois will most likely be the first state to target with the GEI.

- College of Urban Planning and Public Affairs (CUPPA): the Midwest RAC hired a policy student from CUPPA and is providing municipal policy related activities to Martin Jaffe (CUPPA-UIC) as information for municipal policy planning.
- Chicago Climate Action Plan – the Midwest RAC has continued to support the CCAP in promoting CHP for the City of Chicago.
- U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been extensively working on the redevelopment of the RAC websites during Q1.10. Cliff Haefke is serving as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. The initiatives of the team are to create a new logo and graphic for the RACs and to develop a coordinated effort in converting the RAC websites from "CHP" to "clean energy."
  - Working with the Gulf Coast RAC, a new graphic and logo was developed and presented at the RAC Face-to-Face meeting in February in Reno, NV. The RAC logo was approved and is now being utilized by all of the 8 RACs. Below are the example logos for the Midwest RAC.
  - A prototype of the website (developed by the Gulf Coast RAC) will be made available for comment in late April 2010.
  - The RAC Website and Logo Working Group provided the following:
    - Presentation Update to the RAC Directors, 2/8/10 (see Appendix A)
    - Presentation to RAC Webmasters, 3/5/10 (see Appendix B)
    - Notes from RAC Webmaster Meeting, 3/8/10 (see Appendix C)

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Midwest Clean Energy Application Center

Figure 1 - Midwest RAC Logo (no tag line)

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Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Figure 2 - Midwest RAC Logo (with tagline)

Figure 3 - Midwest RAC (vertical)

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- The RAC provided metrics to ORNL for Fiscal Year 2009 during Q4.09.
- The semi-annual report will be submitted during Q2.10.

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group has been working with Energetics to develop a searchable database tool
- Project Profiles in development: four project profiles were in development during Q1.10:
  - Caterpillar Aurora, Aurora, IL, 15 MW
  - Qualcomm, San Diego, CA, 11.4 MW
  - Basin Electric, North Dakota, 5.5 MW
  - Sietsema Farm Feeds, Howard City, MI, 500 kW

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during Q1.10.
- The Midwest RAC has secured the rights to use www.midwestcleanenergy.org as their new url. Both the old and new urls will be available to access the U.S. DOE Midwest Clean Energy Application Center website.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
  - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected May 2010)
  - National Survey of Energy Systems at Ethanol Plants (Q1.10)
    - Leveraged funds with Illinois Corn Marketing Board
    - Includes evaluation of CHP technologies
    - Measures what energy efficiency measures were implemented at ethanol facilities
    - The survey found that 22% of surveyed ethanol plants (17 plants out of 76 responding plants) utilize CHP technologies.
- Three separate technical studies are being investigated and under consideration to fund during fiscal year 2010:
  - Lessons Learned for Biogas CHP Projects
  - Energy Savings Partnership – Integration of an Ethanol Plant and Dairy Farm Facility
  - Update to the 2005 CHP Resource Guide
  - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10 **Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: No activity during Q1.10. Requests to the Midwest RAC partners will be sent out Q2.10 to collect data on clean energy installations in the Midwest for the DOE database. This information will be forwarded on to Anne Hampson of ICF International.

Deliverable: 11 **Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- Harrison Steel, Attica, IN – the Midwest RAC has been collecting data and information to provide a Level 1 Feasibility to investigate both CHP and waste heat recovery opportunities. The Midwest RAC met with Harrison Steel staff and toured the facility in February 2010.
- Gundersen Lutheran Hospital, Lacrosse, WI – the Midwest RAC was contacted by Gundersen Lutheran to perform a Level 1 Analysis of a LFG/CHP project. Gundersen Lutheran may move forward with an RFP in which the Midwest RAC would assist GL in writing the RFP and assisting GL in selecting a qualified engineering firm.

- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
    - Green Industry Business Development Program for Organic Waste Processing Facility (partners: Gas Environmental, Global Water & Energy (GW&E), Growing Power) – food waste processing, composting, and AD/CHP to power greenhouses to grow more food product (1-2 MW)
    - Packer Engineering, gasifier (crop residue and corn stover) looking to site CHP system (15 kW), Naperville, IL
    - Agricultural Watershed Institute, for a mobile biomass briquetter and distribute biomass briquettes to other biomass CHP projects, partners include John Deere, Packer Engineering, and Archer Daniels Midland
    - Fox Lake Wastewater Treatment Facility, for a 100 kW CHP project utilizing biogas from the anaerobic digester that was otherwise being wasted and flared.
    - Parkland College, 25 kW CHP project on campus using biogas
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that involved in the Clean Energy community in the Midwest region.
- Midwest Cogeneration Association (MCA)
    - Cliff Haefke of the Midwest RAC was voted in as Vice President of the Midwest Cogeneration Association (MCA) in January 2010.
    - John Cuttica participates in the MCA as a Board Member.
    - The Midwest RAC is assisting in the development of a monthly newsletter for the MCA members and cogeneration/CHP industry that will be issued in April.
    - The Midwest RAC staff attended three MCA Board meetings during Q1.10.

Deliverable: 12 Task: 5

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity:

- The Midwest RAC has organized a site tour of a CHP plant for the University of Illinois at Chicago on April 12th, 2010.
- The Midwest RAC will be coordinating activities with the Midwest IACs to attend the September 2010 Waste Heat to Power Workshop.

Deliverable: 13 Task: 6

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for Q1.10.
- Also see Quarterly Website Report in Appendix D for Midwest RAC website activities.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: No activity during Q1.10.

Appendix A

U.S. Department of Energy
Clean Energy Application Centers

RAC Logo/Website Team Update

RAC Face-to-Face Meeting

February 8, 2010

Reno, NV

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Topics

- Purpose
- Team Members
- Activities
- Accomplishments-to-Date
- Next Steps

Purpose

- Assemble RAC sub-committee
- Develop new RAC logo
- Coordinate and brand new/modified RAC web sites focused on **"clean energy"** technologies
- Continue other RAC branding initiatives

Team Members

- Christine Brinker – IM (co-chair)
- Cliff Haefke – MW (co-chair)
- Maureen Quinlan – SE
- Pauline Jensen – NW
- Rhett Graves – SE
- Elaine Kulawiak – MW

Activities

- Began teleconferences/webcasts in Oct. '09
- Presented "RAC Logo/Website Recommendations Report" to RAC Directors on Dec. 8th
- Website Phase I began Jan. 14th *(completed Feb. 5th)*
- New RAC logo *temporary* approval Feb. 1st
- RAC Face-to-Face Meeting *(Feb. 8th)*
- Website Phase II begins week of Feb. 8th

New RAC Logo

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MIDWEST
Promoting CHP, District Energy, and Waste Energy Recovery

MIDWEST
U.S. DOE
Clean Energy Application Center

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Website Development: Phases I & II

- Phase I *(complete by 02/05/10)*
  - Initial website template design
  - Develop initial round of shared website content *(assigned 01/14/10)*
- Phase II (various completion stages)
  - RAC Directors discuss website template *(week of 02/08/10)*
  - Conference call with RAC webmasters to agree on website coding language *(conference call week of 02/15/10)*
  - Develop remaining shared website content *(assigned week of 02/08/10, complete by 02/26/10)*
  - Develop initial RAC website for review *(complete 03/08/10)*
  - Launch first RAC website *(03/15/10)*

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Shared Website Content Assignments

- Website Template Design *(GC-Tomlin)*
- News and Events *(IM-Brinker, MW-Haefke)*
- About Clean Energy *(NE-Gerrish, SE-Quinlan)*
- Getting Started/Evaluation Tools *(NE-Gerrish, MA-Freihart)*
- Market Sectors *(P-McDonnell, NW-Jenson)*
- States *(P-McDonnell, NW-Jenson)*
- Policy & Incentives *(IM-Brinker, MW-Haefke)*
- Project Profiles *(IM-Brinker, MW-Haefke)*
- Library & Links *(Graves-SE, Quinlan-SE, Kulawiak-MW)*

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Discussion & Next Steps

- Revised RAC Logo
- Phase II approach appropriate?
  - Launch one initial web site vs. all 8 web sites?
- Price of DSIRE web feed
- Other Branding Team efforts?
  - PPT templates, report templates, project profiles, etc.

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Appendix B

RAC Webmaster Coordination Call

March 5, 2010

Introductions

RAC	Webmaster
Gulf Coast	Ross Tomlin, rtomlin@harc.edu, 281-363-7922
Intermountain	Randy Martin, randy@rlmartin.com, 970-219-2605
Mid-Atlantic	Deb Simpson, dys11@outreeach.psu.edu, (814) 865-9972
Midwest	Don Punwani, dpunwani@avalonconsulting.com, 630-983-0883
Northeast	Outside contractor TBD
Northwest	Michael Bradley, bradleym@energy.wsu, 360-956-2099
Pacific	Cecila
Southeast	Maria Fellicelli, maria@me.msstate.edu, 662-325-7321

Agenda

- Introductions
- Background / Approach
- Design Preview
- Design Considerations
- Coding Discussion
- Discussion of Tracking Web Statistics
- Other?

Background

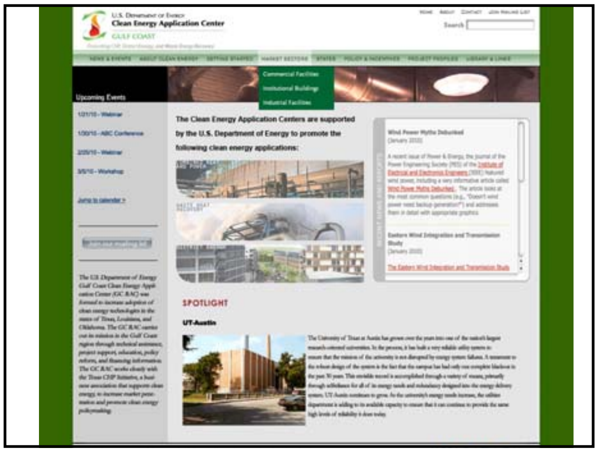
- Expanded scope (CHP, district energy, waste heat recovery)
- RAC Website & Logo Working Group
- New, modern, and consistent look-and-feel for all 8 RAC websites (coordinated effort)

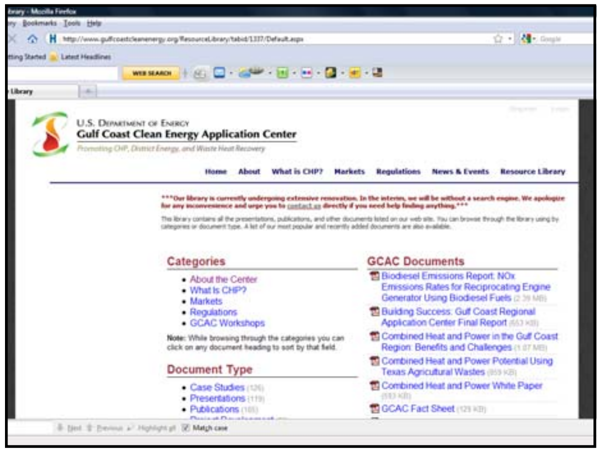
Approach

1) The Gulf Coast RAC will pilot the first site
   - www.gulfcoastcleanenergy.org
   - Ross Tomlin, rtomlin@harc.edu, 281-363-7922
2) Comments and revisions from RAC Directors and others
3) All other RACs copy the site for their own region
   - Some content is more-or-less standardized, other content is region-specific

Design Consistency

The RAC Directors have expressed that all 8 RAC websites should have a consistent look and feel .





Design Considerations

- Full screen/adjustable-width pages rather than fixed-width pages *(Rhett Graves)*
- News box with vertical scroll bar *(Ross Tomlin)*
- Rotating pictures on Home Page
- A searchable database common to all RAC websites
  - Help us figure out a way that visitors could view and search the database from their own RAC website rather than being redirected to another
- Pull down paragraphs (see next slide)

Design Considerations *(cont'd)*

- Pull-down paragraphs

Open Discussion

- Other design considerations?
- Other website techniques?
- More new/modern techniques?
- What makes websites today more attractive and user-friendly than other websites?

Discussion/Agreement on Coding Language

Discussion of Tracking Web Statistics

- DOE has asked all RACs to use the same method of tracking hits, page views, downloads, etc to maintain consistency
- Switch to Google Analytics? *(Randy Martin)*
  - Free and robust

Recap/Action Items/Final Comments

Thank You

- RAC Website and Logo Working Group:
  - Cliff Haefke – MW (co-chair)
  - Christine Brinker – IM (co-chair)
  - Maureen Quinlan – SE
  - Pauline Jensen – NW
  - Rhett Graves – SE
  - Elaine Kulawiak – MW

Appendix C

Notes from RAC Webmasters Conference Call

1:00PM (CST), Friday, March 5, 2010
Moderators: Christine Brinker, Cliff Haefke

ATTENDEES:

RAC	RAC Working Group	RAC Webmasters
Gulf Coast	Ross Tomlin	Krist Bender, GJ Snyder
Intermountain	Christine Brinker	Randy Martin, Jonathan Martin
Mid-Atlantic		Deb Simpson
Midwest	Cliff Haefke	Dharam Punwani
Pacific	Vince McDonnell	Cecilia Ruiz-Smith
Northeast		
Northwest		Michael Bradley
Southeast	Rhett Graves, Maureen Quinlan	Maria Felicelli

ACTION ITEMS:

Action Item	Responsible Party	Proposed Deadline
Identify pros/cons of a national CHP library/database versus a locally-hosted library/database	ALL	Email Brinker & Haefke by 3/12/10
Identify whether or not your RAC will be changing your region's RAC web address / URL and pass along new web address *- Midwest is changing to www.midwestcleanenergy.org* *- Intermountain is changing to www.intermountaincleanenergy.org* *- Gulf Coast is changing to www.gulfcoastcleanenergy.org* *- Mid-Atlantic is changing to www.maceac.psu.edu*	ALL	Email Brinker & Haefke by 3/12/10
Share "other" modern web site design considerations and/or web techniques not discussed on call	ALL	Email Brinker & Haefke by 3/12/10
Discuss logistics of existing CHP database located at ORNL	Brinker, Graves, Haefke, Punwani	Schedule Conference Call during week of 3/12/10 following input from RAC webmasters
Verify with DOE sponsors what website reporting content is required *(results will aid in identifying and selecting website tracking program)*	Haefke	Schedule Conference Call during week of 3/08/10
Development of initial prototype website	Tomlin	Develop draft prototype website by 3/15/10 (pending receiving developed material from RAC Website/Logo Working Group)

NOTES:

- See attached presentation for all discussion topics
- National library/database versus locally-hosted library/database
  - Existing CHP database in existence at ORNL uses Cold Fusion – could/should this be expanded for all RACs?
  - Need to further discuss logistics with Working Group and Webmasters
  - Need to verify with RAC Directors
  - Need to verify with DOE sponsors
  - This web library is not to be confused with an internal RAC resource/working documents library
- CHP Project Profile Database can be located on Energetics website and viewed on individual RAC websites by using iframes

- The Gulf Coast will develop the initial prototype site in HTML using DotNetNuke, and will transfer the website coding to other RACs via HTML files, layered Photoshop replicas, and/or DotNetNuke files (whatever is necessary for each RAC)
- Best practices / design considerations
  - Use standard HTML coding technique and cascading style sheets (especially for initial prototype)
  - Avoid text in images for the initial prototype (hard to revise)
  - Avoid Flash little widgets for the initial prototype (hard to revise)
  - Text in “accordion control” may not come up when you try to search within the page (but still comes up in site-wide searched and Google searches). As long as the headings are clear, this should not be a major problem.
- Website tracking program
  - Need to determine what type of information DOE sponsors require of the RACs when reporting and then make sure Google Analytics can meet the requirements of the DOE sponsors
  - Webmasters in agreement to move towards same tracking program
  - If Google Analytics can not meet the reporting requirements of DOE sponsors, then a new website tracking program must be identified

Appendix D

<u>**The MAC Web Site Traffic Report: January through March 2010**</u>

- Web site traffic during the period was over 363,000.hits[1]. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 7.6 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 182,100. Since launching the Web site over 2.84 million PDF documents have been viewed / downloaded from the Web site. Figures 4 and 5 show monthly and annual download data, respectively of the PDF documents.
- During the period, the number of distinct computers that logged on to the Web site at least once during the period was as high as 6,900 per month as shown in Figure 6 and average about 6,300 per month.
- Data transferred by the Web site visitors during the period was as high as 25.4 Gigabytes per month and totaled 69 Gigabytes as shown in Figure 7. Since launching the Web site, over 1,120 Gigabytes of data have been transferred from the Web site as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded during the period are shown in Exhibits 1 and 2. These include the following:
  - *Project Profiles*: Over 27,500 (including over 13,400 of those developed by other RACs)
  - *CHP Resource Guide:* 9,707
  - *CHP Resource Guide for Hospitals* (Published in March 2008): 8,334
  - Illinois Permitting Guidebooks (Volumes A, B and Calculator: 1,510
  - Report on "Potential Use of IL Coal in Dry-Mill Ethanol Plants:" 522
  - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:"* 423
  - Report on "Global Warming Impact of Corn Ethanol Production:" 285
  - *Report on "CHP Application in Ethanol Plants:"* 146
  - *Presentation made by Cliff Haefke at the "Biosolids Workshop of the Michigan Water and Environmental Association (3/3/09)": 792*
  - *Presentations made by Cliff Haefke at the "Biomass Conference (Dubuque, IA; 7/17/08)": 1,081*
  - *Presentations made at the Workshop on "Waste to Energy for the Illinois Electric Cooperatives (Springfield, IL; 10/20/09)": 3,157*
  - *Presentations made at the Workshop on "Waste to Energy (Wooster, OH; 4/7/09)": 9,364*
  - *Presentations made at the Workshop on "Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP* (Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively)": 7,098
  - *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 1/15/08)": 2,029*
  - *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 5/31/07)": 2,767*

- *Presentations made at the Workshop on “Waste-to-Energy from the Ohio Livestock & Food Processing Industries (Wooster, OH; 1/31/07)”: 3,327*

- *Presentations made at the Workshop on “Waste-to-Energy Workshop for Indiana’s Farm, Food Processing and Wood Industries* (Jasper, IN; 12/11/06)”: 2,220

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1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes)

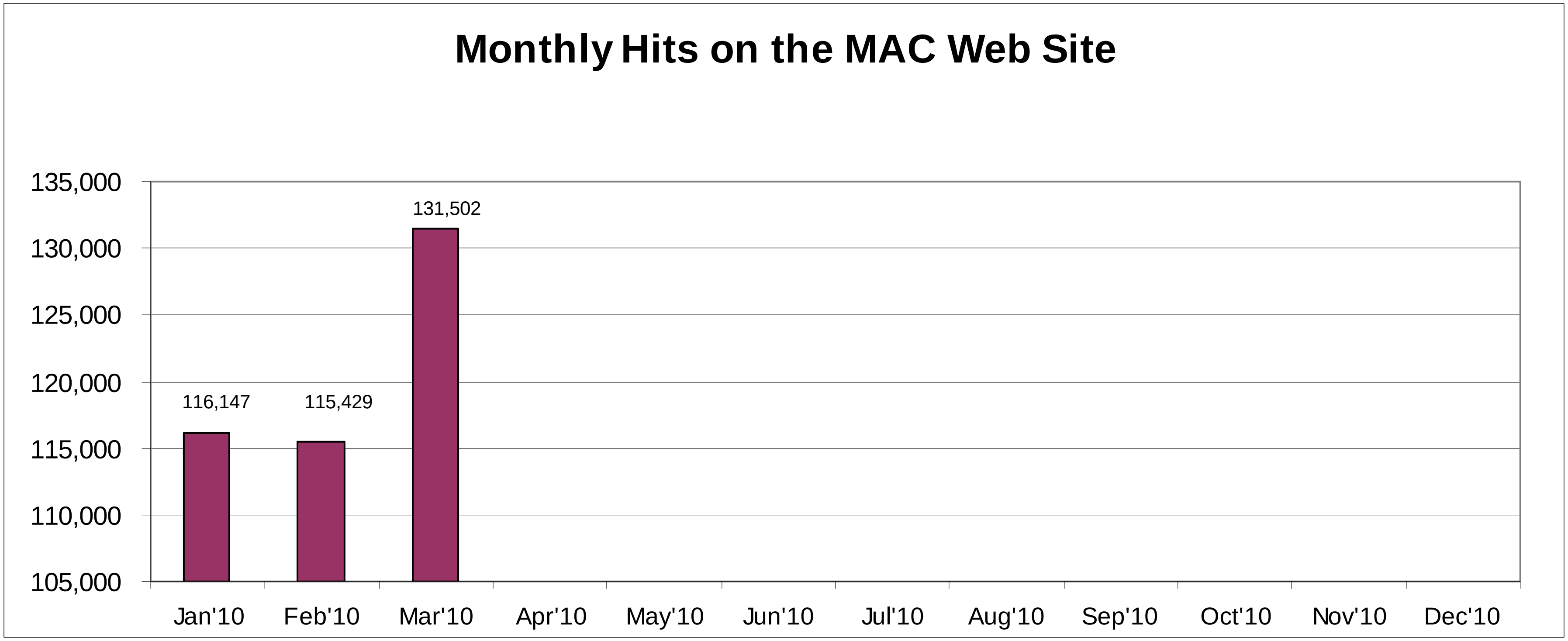

Figure 1: Monthly Hits on the MAC Web Site During 2010

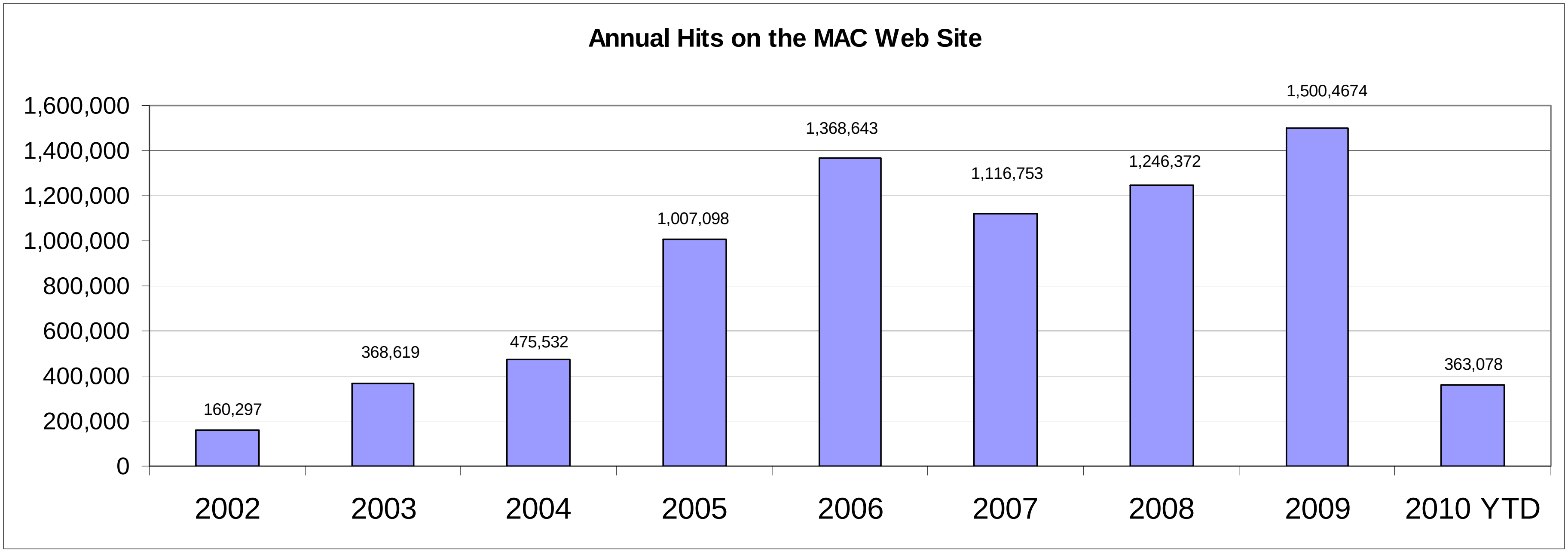

Figure 2: Annual MAC Web Site Hits

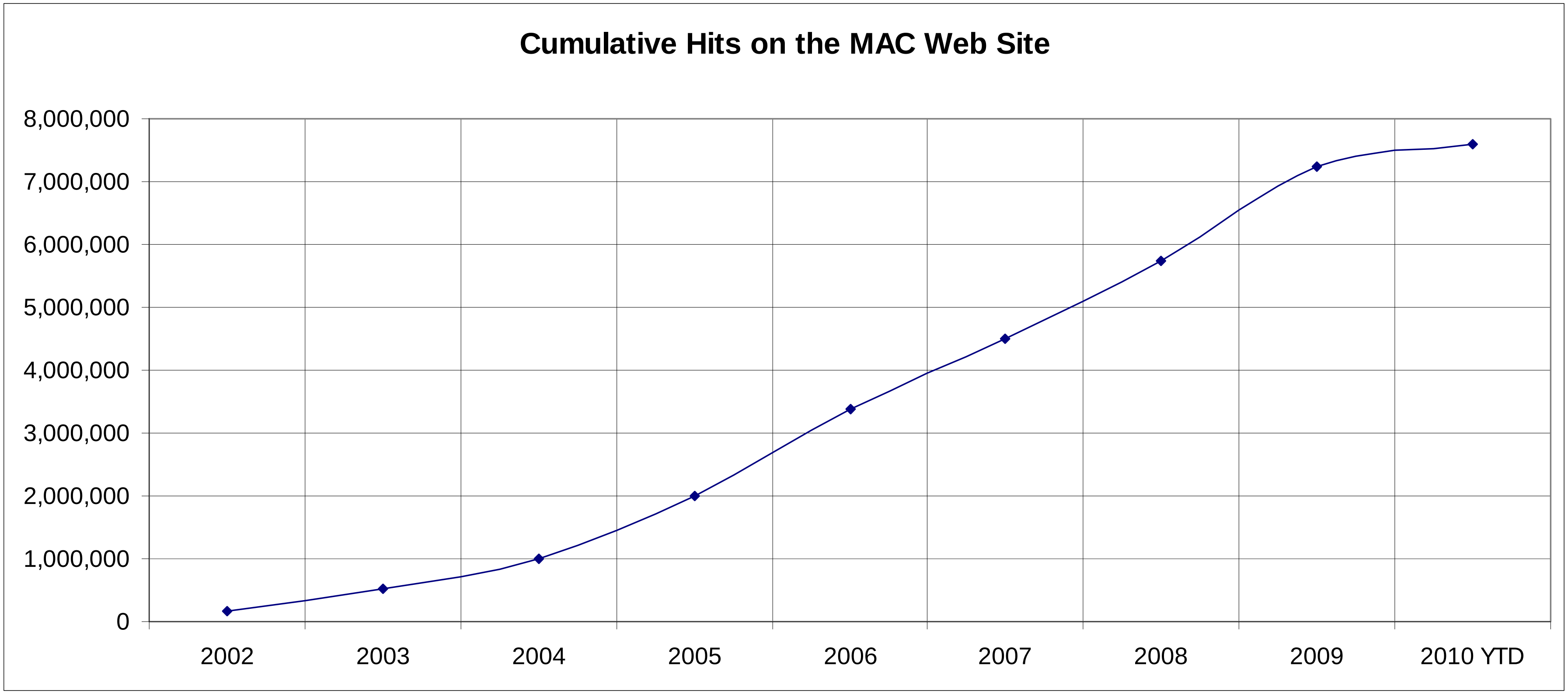

Figure 3: Cumulative MAC Web Site Hits through March 2010

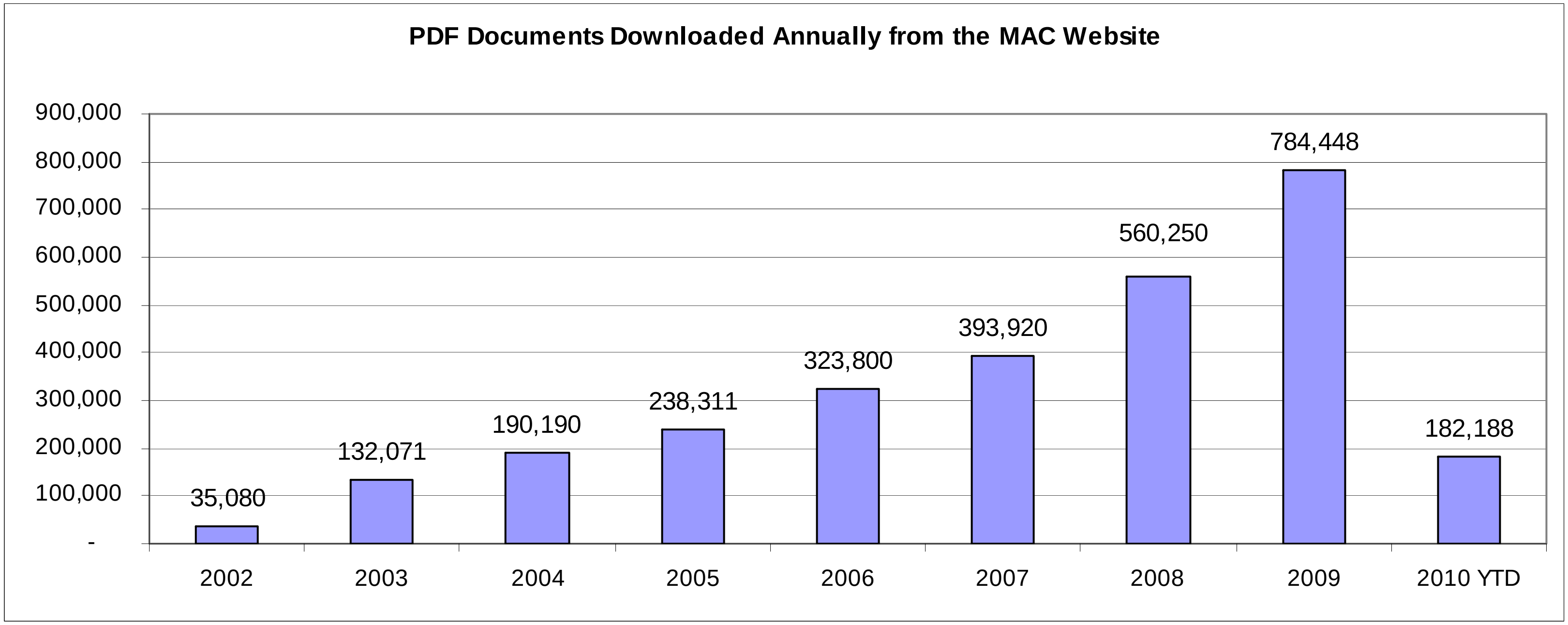

Figure 4: Number of PDF Documents Annually Downloaded from the MAC Web site

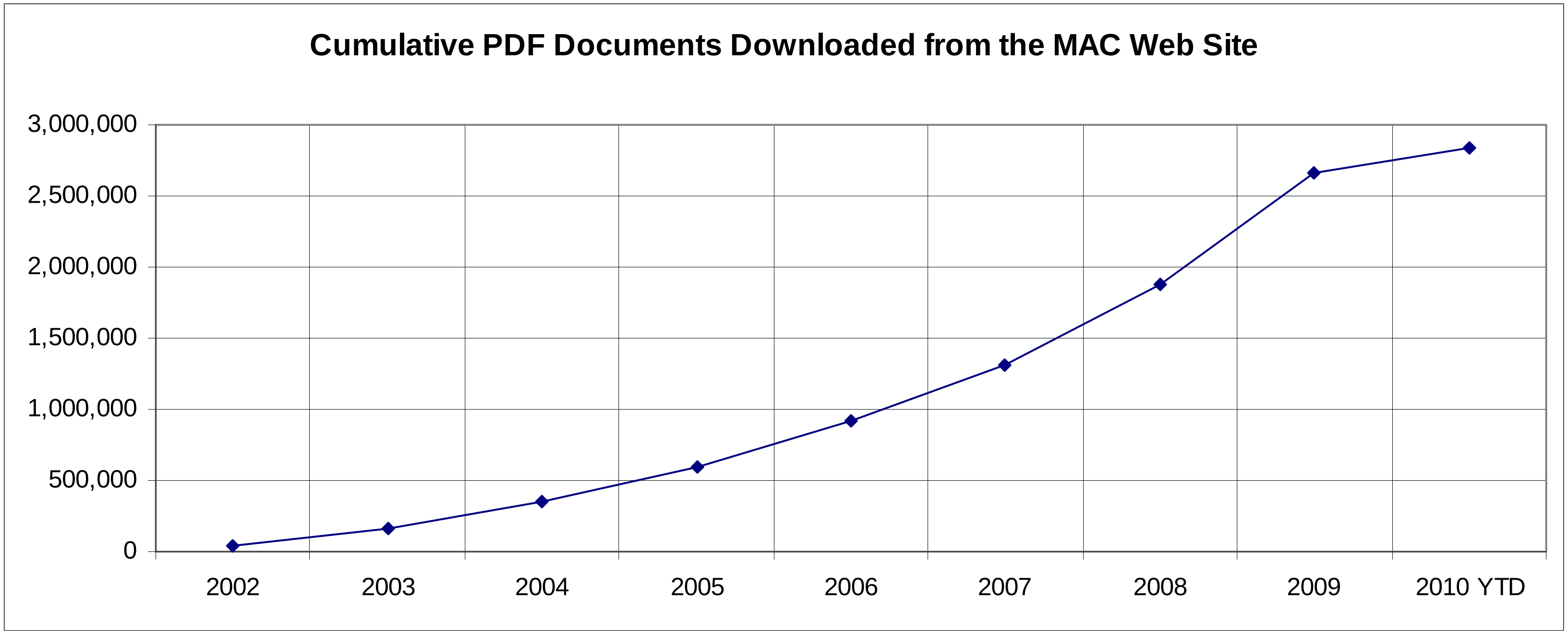

Figure 5: Cumulative Total of PDF Documents Downloaded through March 2010

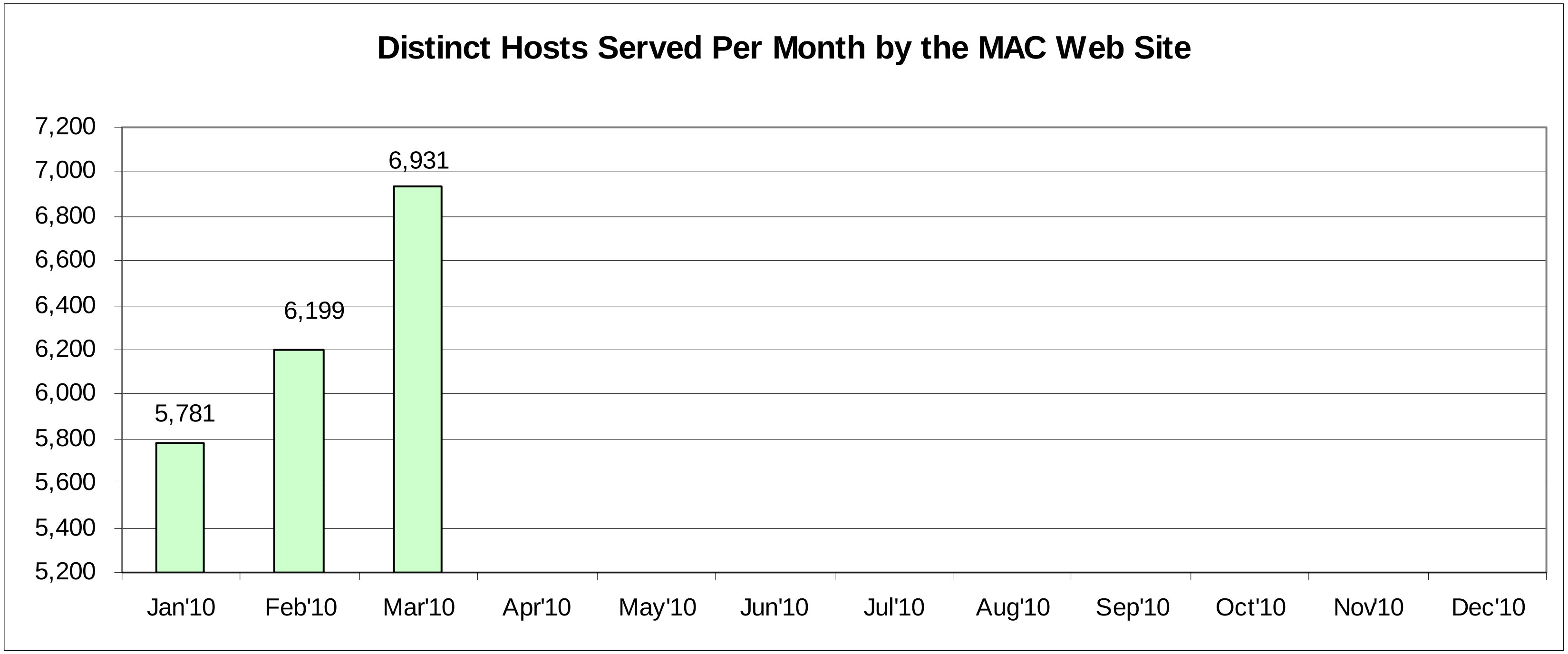

Figure 6: Distinct Computers Accessing the MAC Web Site At Least Once

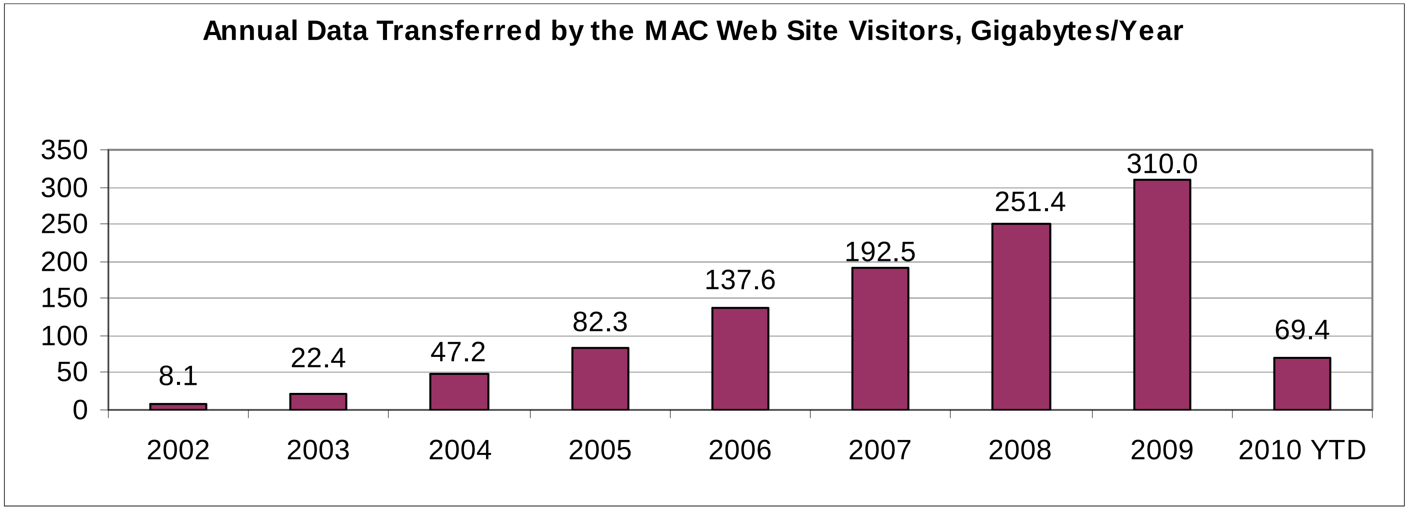

Figure 7: Annual Data Transferred by the MAC Web Site Visitors

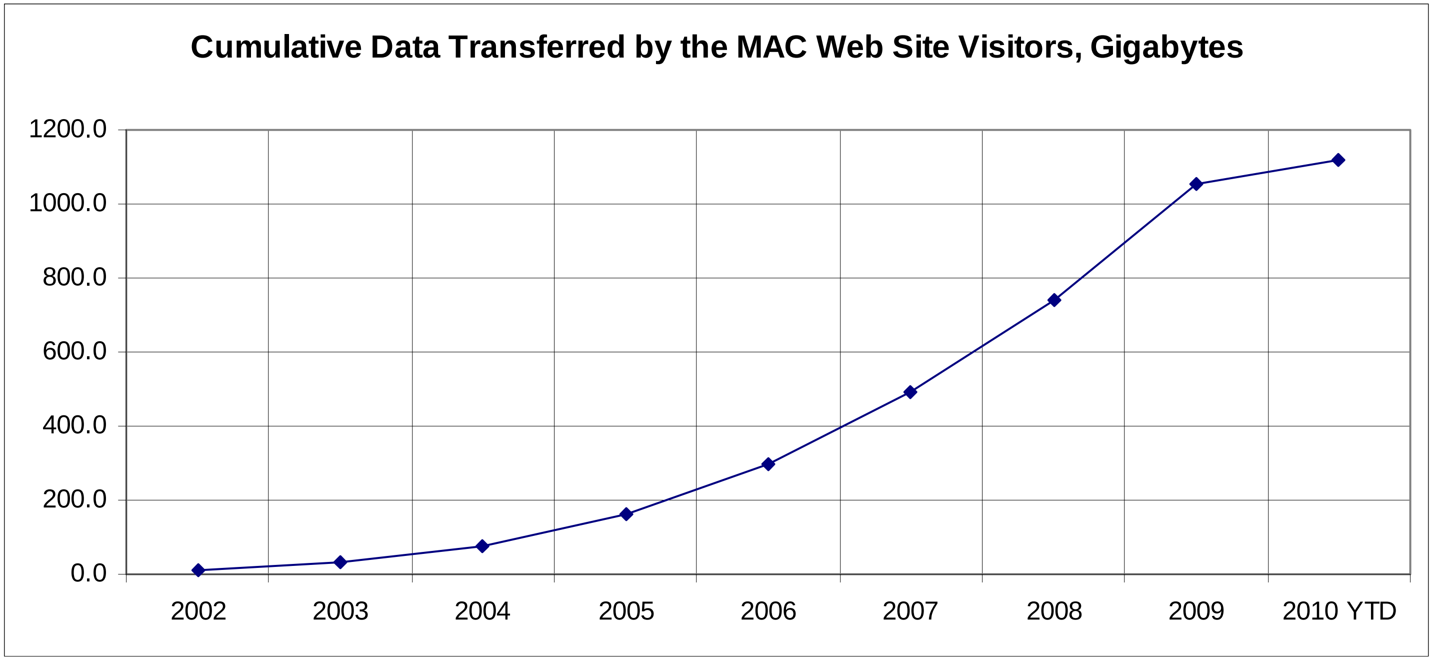

Figure 8: Cumulative Data Transferred by the MAC Web Site Visitors through March 2010

Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2010

	2010												
	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Project Profiles													
Adkins Energy	41	33	89										163
Advocate South Suburban Hospital	57	46	105										208
Afxantiou Farm	22	31											53
Albert Lea Wastewater Treatment Facility	121	198	234										553
Antioch Community High School	79	119	115										313
Barham Farms	40	33	86										159
Beloit Memorial Hospital	45	50	111										206
Breeden YMCA	34	43	62										139
Broshco Fabricating Products	142	87	139										368
Clover Hill Dairy	178	135	243										556
Crave Brothers		97	59										
Dakota Station	46	27	73										146
East Kansas Agri-Energy	116		154										270
Eastern Michigan University													
Elgin Community College	104	82	124										310
Elkhart Hospital	138	190	289										617
Evanston High School	81	122	163										366
Franciscan Sisters	60	31	167										258
Franklin Heating Station	30	39	61										130
Holiday Inn	52	27	29										108
Holsum Dairy	137	131	202										470
Holsum Elm Dairy	87	75	108										270
Hunter Haven Farms	93	85	107										285
Janesville Wastewater Treatment Facility	94	61	132										287
Jesse Brown VA Medical Center	103	95	131										329
Laclede Gas Building		87	242										329
Lake Forest Hospital	41	28	232										301
Little Company of Mary Hospital	36	38	81										155
Lorin Industries	22	20	24										66
Maine South High School	118	81	120										319
Manchester Tanks	277	148	186										611
Museum of Science	57	58	164										279
National Animal Disease Center	106	83	137										326
Naval Station Great Lakes	185	130	156										471
Northeast Missouri Grain	95	105	103										303
Northwest Community Hospital	240	185	228										653
Norwiss Farms	105	99	135										339
Onyx Seven Mile Creek Landfill	152	178	284										614
Pasadena City College	23	28	30										81
Presbyterian Homes	63	51	113										227
Resurrection Hospital	55	47	115										217
Rochester Wastewater Treatment Plant	113	77	146										336
S. C. Johnson		59	80										
SmithField Foods	37	29	66										132
St Francis Hospital	63	51	84										198
St. Mary's Hospital, MN	46	45	91										182
St. Mary's Hospital, WI	47	27	78										152
Spectrum Health													
U.S. Energy Partners	31	28	57										116
UIC- East Campus	57	77	121										255
UIC-West Campus	37	39	73										149
University of Iowa	75	84	125										284
University of Michigan													
Utilimaster Corporation													-
Vestil Manufacturing	97	79	112										288
Winnenago County Sheriff's Office		58	108										166
Total Project Profiles Total	**4,078**	**3,856**	**6,474**	-	-	-	-	-	-	-	-	-	**14,113**
Other RACs													
Alaska Village Electric Coop Anvik	50	46	69										165
Alaska Village Electric Coop Grayling	56	48	62										166
BMW	57	82	99										
Bristle-Myers Squibb	53	43	62										158
Central Connecticut State University	56	51	67										174
Chambers County	162	183	173										518
Colby College	47	57	70										174
Columbia Energy	71	58	88										217
Colorado Pork	74	57	72										203
Cooper Tire													
Corn Products	55	61	96										
COX Interior	84	57	117										
East Bay Municipal Utiltiy District	168	90	129										387
Encore Landfill	107	59	123										
Essex Junction Waterwater Treatment Facility	44	33	45										122
Fort Bragg	64	72	140										
Golovin City		58	55										113
Green Mountain Coffee Roasters	60	97	117										274
Herbec Plastics	60	43	57										160
Homan Lumber													
Ina Road Water Pollution Control Facility	48	72	78										198
Johnson & Johnson	201	112	204										517
Joseph Gallo Farms	395	276	395										1,066
Kokhanok City	56	51	47										154
Kongiganak City	69	38	51										158
Kwigillingok	69	47	54										170
LaFarge Gypsum	68	64	96										228
McShan Lumber													
Network Appliance Data Center	76	62	109										247
Nevada Hotel Casino	68	67	61										196
New Belgium Brewery	66		92										158
Notre Dame Long Term Care	48	42	54										144
One Market Plaza	54	58	89										201
Ritz Carlton	79	57	61										197
Santa Margarita Wastewater Treatment Plant	48	42	66										156
Santa Rita Jail	170	141	197										508
Sierra Nevada Brewery	132	150	141										423
Shands Hospital	60	60	99										219
South Oaks Hospital	50	42	67										159
South Mississippi Correctional Facility													
SP Newsprint	66	78	104										
Stevens Village Council	51	46	63										160
Tesoro Petroleum	93	66	59										218
The Inside Passage Electric Coop (Angoon)	82	114	99										295
University of California, Berkeley			1										1
University of Montana	128	70	72										270
University of North Carolina	77	58	115										250
University of California, San Diego													-
Utah State University	58	65	43										166
Valley Medical Center	48	36	45										129
Vander Haak Dairy	115	83	108										306
Vinyard 29	81	96	105										282
Wadeland Dairy	84	74	45										203
Waldbaum's Supermarket	323	351	930										1,604
William College	49	44	48										141
Total Project Profiles of Other RACs	**4,280**	**3,757**	**5,439**	-	-	-	-	-	-	-	-	-	**13,476**
Grand Total of All Project Profiles (MAC + Others)	**8,358**	**7,613**	**11,913**	-	-	-	-	-	-	-	-	-	**27,589**
Resource Guide													
2,003	599	456	719										
2,005	2,215	2,389	3,329										
Total	**2,814**	**2,845**	**4,048**	-	-	-	-	-	-	-	-	-	**9,707**
Hospitals Resource Guide	**2,108**	**3,011**	**3,215**										**8,334**
IL Premitting Guidebooks													
A	205	136	320										
B	157	87	183										
Calculator	149	127	146										
Total	**511**	**350**	**649**	-	-	-	-	-	-	-	-	-	**1,510**
Energy Use in Future Dry-Mill Ethanol Plants	**151**	**214**	**157**										**522**
Global Warming Impact of Corn Ethanol Production	**134**	**129**	**160**										**423**
Potential Use of IL Coal in Dry-Mill Ethanol Plants	**70**	**97**	**118**										**285**
CHP Application in Ethanol Plants	**40**	**35**	**71**										**146**
Others													
Mich. Water Env. Asso. Biosolids Wksh. (090303_Haefke)	**230**	**256**	**306**										**792**
Dubuque Iowa Biomass Conf													
080717 Haefke 1	**137**	**130**	**257**										**524**
080717 Haefke 2	**164**	**222**	**171**										**557**
Total													**1,081**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2010

	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Waste to Energy Workshop for the Illinois Electric Cooperatives (Springfield, IL; 10/20/09)													
Haefke 1	61	52	80										193
Haefke 2	45	32	43										120
Hammond	59	158	43										260
Hartel	41	41	41										123
Kennebck	103	80	52										235
O'Neil 1	61	59	49										169
O'Neil 2	343	462	434										1,239
Solomon	85	33	127										245
Andreson	64	57	71										192
Brochure	15	36	42										93
Agenda	38	44	42										124
Speakers Bio	56	48	60										164
Total	**971**	**1102**	**1084**										**3,157**
Waste-to-Energy Workshop (Wooster, OH; 4/7/09)													
Schanbacher	1554	1199	1654										4,407
Dvorak	300	352	402										1,054
McDonald	111	75	65										251
Kasper	51	38	53										142
Brown	134	191	597										922
Weaver	46	30	100										176
O'Loughlin	35	32	39										106
Berlekamp	38	63	39										140
Maringer	102	88	125										315
Kurtz	45	66	44										155
Arnold	41	31	63										135
Goodge	72	45	52										169
Sutor	42	32	35										109
Monhemius	136	139	169										444
Speakers Contact Info	105	96	127										328
Agenda	92	65	73										230
Brochure	86	97	98										281
Directions													-
Total	**2,990**	**2,639**	**3,735**	-	-	-	-	-	-	-	-	-	**9,364**
WWTF Workshop (Indianapolis, IN; 05/19/08)													
Downey	45	36	36										117
Scott	109	68	108										285
Welle	82	45	106										233
Haefke	77	85	72										234
Griffin	108	66	60										234
Karafa	75	215	168										458
Totzke	143	116	108										367
Robin	97	77	34										208
Jan Scott	876	774	1082										2,732
Dvorak	43	33	35										111
Cummings	85	31	42										158
Parker	74	133	65										272
Speakers Contact Info	53	47	56										156
Agenda	43	29	86										158
Brochure	8	10	12										30
Directions													-
Total	**1,918**	**1,765**	**2,070**	-	-	-	-	-	-	-	-	-	**5,753**
WWTF Workshop (Elkhart, IN; 05/21/08)													
Downey	136	84	199										419
Kline	48	46	34										128
Totzke	73	43	35										151
Wishart	75	93	84										252
Bayer	59	47	48										154
Speakers Contact Info	53	35	42										130
Agenda	42	31	38										111
Total	**486**	**379**	**480**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,345**
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)													
Gould	122	192	108										422
Safferman	108	115	68										291
Cuttica	54	48	37										139
Stanton	55	37	42										134
Urban	54	44	54										152
Ruswick	40	36	34										110
Parker	58	50	78										186
Fortune	70	57	58										185
Agenda	47	79	90										216
Speakers Bio	69	57	68										194
Flyer													-
Total	**677**	**715**	**637**	-	-	-	-	-	-	-	-	-	**2,029**
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)													
Westerfield	53	44	36										133
Ilelaji	53	28	46										127
Cuttica	48	29	42										119
Dvorak	226	215	157										598
Larsen	48	84	36										168
McDonald	53	46	47										146
Snodgrass	95	108	131										334
Saum	38	30	35										103
Wagoner	41	36	49										126
Norrick	49	31	32										112
Corso	57	31	37										125
Hay	45	54	34										133
Agenda	111	90	104										305
Speaker Bios	43	37	38										118
Flyer	41	33	46										120
Total	**1001**	**896**	**870**	-	-	-	-	-	-	-	-	-	**2,767**
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 01/31/07)													
Ward	47	29	40										116
Elder	49	32	35										116
Schanbacher	180	199	316										695
Cuttica	66	36	51										153
Dvorak	47	41	60										148
Moser	65	32	45										142
Mills	67	43	60										170
Arnold	39	30	38										107
O'Loughlin	43	31	43										117
Maringer	57	75	128										260
Kasper	57	32	47										136
Dreve	42	32	40										114
Eschmeyer	49	41	38										128
Gwin	43	32	35										110
Monhemius	47	34	36										117
Zuber	46	33	48										127
Agenda	108	89	97										294
Flyer	46	43	48										137
Speakers Bio	66	32	42										140
Total	**1,164**	**916**	**1,247**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,327**
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries													
(Jasper, IN;12/11/06)													-
Book	44	32	33										109
Brown	42	35	36										113
Corso	39	33	36										108
Cuttica	50	35	40										125
Hay	46	33	38										117
Jones	42	35	36										113
McGolden	42	36	39										117
Moser	41	31	33										105
Roger	44	39	33										116
Sievertsen	60	51	31										142
Stinchfield	37	29	31										97
Stwalley	58	52	72										182
Tietz	57	75	37										169
Toenges	39	34	33										106
Walmsley	68	45	45										158
Speakers Contact Information	46	34	38										118
Agenda	40	40	44										124
Flyer	24	38	39										101
Total	**819**	**707**	**694**	-	-	-	-	-	-	-	-	-	**2,220**

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigator:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2010 – 3rd Quarter
April 1, 2010 through June 30, 2010

Submission Date:
July 30, 2010

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

July 30, 2010

Dear Mr. Renk,

Please find the attached Progress Report for the 3rd Quarter of Fiscal Year 2010 (FY2010.Q3) for award number DE-EE0001108 – “Midwest Region Clean Energy Application Center.”

The center has invoiced $170,878.80 for FY2010.Q3:

- April 2010: $76,412.89
- May 2010: $40,014.47
- June 2010: $54,451.44

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q2.10. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: The Midwest RAC discussed the Project Management Plan (PMP) with the RAC Project Manager Joe Renk and understands the PMP is a working document and can be updated throughout the year as the Midwest RAC sees their efforts alter focus. No update to the PMP was submitted during FY2010.Q3.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q2.10 Activity:

- Target Market Workshops and Webinars: No target market workshops hosted during Q2,10.
- Graduate Level CHP Course: The Midwest RAC completed teaching a Spring 2010 semester graduate course for the Energy Engineering Masters program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management." The semester course began January 11th and concluded the week of May 3rd.
    - Module 17 – Biogas CHP Applications (04/05/10)
    - Module 18 – Biomass CHP Applications (04/12/10)
    - Module 19 – Special Topics (04/19/10)
- Other Workshops/Conferences/Presentations:
    - UIC East Campus Site Tour, April 12, 2010, Chicago, IL – the Midwest RAC organized a joint site tour for the UIC Energy Engineering Masters Students and the Student Interns of the UIC Industrial Assessment Center.
    - Midwest Cogeneration Association Board Meeting, April 15, 2010 – conference call
    - US DOE Clean Energy Application Centers, April 21, 2010, Chicago, IL – the Midwest RAC presented at the "Illinois Save Energy Now (SEN) Industrial Energy Efficiency Forum"
    - CHP Software Tool: Building Energy Analyzer (BEA), May 5, 2010, Online Webinar – the Midwest RAC presented to the RAC Project Assessment Working Group
    - U.S Department of Energy Regional Application Centers, IDEA 101st Annual Conference & Trade Show: Creating an Efficient Energy Future, June 15, 2010, Indianapolis, IN – the Midwest RAC co-presented with Ted Bronson (PEA)
    - How are the "Chicago Climate Action Plan" and other State Regulatory & Policy Activities Impacting the Illinois DG / CHP Market Place? (MCA Dinner Meeting), June 16, 2010, Oakbrook Terrace, IL – the Midwest RAC coordinated the MCA Dinner Meeting (Dinner Meeting postponed to undetermined date in August)
- Upcoming (or under consideration) Workshops/Conference :

- Anaerobic Digester (AD) / CHP Workshop, Fall 2010, Eastern Illini Service Territory (under consideration)
- Ohio Policy Considerations for Combined Heat and Power Workshop, Columbus, OH (Sept/Oct 2010)
- District Energy Webinar Series for 2nd Tier Colleges/Universities (tentatively scheduled for Nov. 2010)
- Waste Heat Recovery for Power and Heat Workshop, September 29-30, 2010, Chicago, IL
- Combined Heat and Power Projects, Advancing Renewables in the Midwest, July 15, 2010, Columbia, MO
- MAC will be presenting at the October 2010 BioCycle Conference in Iowa

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Target Policy States: The Midwest RAC has been heavily involved in developing an action plan for the State of Ohio titled "State of Ohio Clean Energy Policy Opportunity Document." **This activity has been a highlighted focus for the Midwest RAC and several other RACs working closely with DOE during FY 2010.** The Midwest RAC has been working with several individuals in the State of Ohio forming an Ohio CHP Coalition to promote required policy changes to open up the CHP market in Ohio. Weekly conference calls were begun in late June.
- Regulatory Workshop:
  - In conjunction with the State of Ohio policy activities, a workshop for the Sept/Oct timeframe is being planned for the Columbus, Ohio area.
  - A ½ day regulatory focused workshop is being coordinated in conjunction with the Waste Heat to Power workshop that will be hosted in Chicago, Illinois, in the September timeframe. The second day of this workshop will be focused on the past, current, and future regulatory and policy related activities impacting CHP and WHR technologies. This workshop's planning efforts are being coordinated with the Northwest RAC, the Pacific RAC, and the Gulf Coast RAC.
  - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP

in the State of Illinois and to identify the related barriers. A workshop is being planned for the August/September timeframe for the Eastern Illini Electric Cooperative service territory.

- City of Oak Park: the Midwest RAC is waiting for information from the City of Oak Park to begin preliminary studies for city buildings for CHP feasibility as part of their future sustainability activities (including grid infrastructure, smart grids, perfect power, and required policy changes to accommodate Oak Park's initiatives).
- Galvin Electricity Initiative: the Midwest RAC is working with the Galvin Electricity Initiative to identify favorable policy reforms for the Midwest states. Illinois will most likely be the first state to target with the GTI.
- Chicago Climate Action Plan – the Midwest RAC has continued to support the CCAP in promoting CHP for the City of Chicago.
  - The Midwest RAC attended planning meetings for the Chicago Climate Action Plan.
  - The Midwest RAC coordinated a dinner meeting and presentation topic for the Midwest Cogeneration Association on June 16, 2010 to help educate the trade association's membership on the Chicago Climate Action Plan – How are the "Chicago Climate Action Plan" and other State Regulatory & Policy Activities Impacting the Illinois DG / CHP Market Place? (the dinner meeting was rescheduled to an undetermined date in the Fall 2010)
- U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC is serving on the board of directors for the USCHPA.

Deliverable: 5	**Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been extensively working on the redevelopment of the RAC websites during FY2010.Q3. Cliff Haefke is serving as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. The initiatives of the team are to create a new logo and graphic for the RACs and to develop a coordinated effort in converting the RAC websites from "CHP" to "clean energy."
- A prototype of the website (developed by the Gulf Coast RAC) was made available for comment in May 2010.
- The co-chairs have been meeting and discussing next steps. The Gulf Coast RAC website should be finalized in August 2010. At this time, web files will be shared with the other seven RACs.

Deliverable: 6	**Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2010.Q3 Midwest RAC Website Traffic Report.

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group has been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites.
- Cliff Haefke (Midwest RAC) and Christine Brinker (Intermountain RAC) will be working with the RAC Website/Logo working group to develop the new Project Profile template during FY2010.Q4.
- Project Profiles in development: four project profiles were in development during FY2010.Q3:
    - Caterpillar Aurora, Aurora, IL, 15 MW
    - Qualcomm, San Diego, CA, 11.4 MW
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2010.Q3.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Completed
    - Michigan On-farm Anaerobic Digester Operator Handbook – the Midwest RAC assisted in the development of Chapter 13 – Combined Heat and

Power System management Utilizing Biogas. The handbook is only available in hard copy format at this time.

- Technical Studies Under Development
  - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected August 2010)
  - CHP Casebook for Food Processing Facilities (co-sponsored study with Energy Center of Wisconsin)
  - An Analysis of Electricity Generated from Combined Heat and Power Systems at Dry Grind Corn Ethanol Plants (White Paper)
- Four separate technical studies are being investigated and under consideration to fund during FY 2010:
  - Lessons Learned for Biogas CHP Projects
  - Energy Savings Partnership – Integration of an Ethanol Plant and Dairy Farm Facility
  - Update to the 2005 CHP Resource Guide
  - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10 **Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: No activity during FY2010.Q3. Requests to the Midwest RAC partners will be sent out to collect data when ICF International submits the formal request. This information will then be forwarded on to Anne Hampson of ICF International to incorporate into the DOE database.

Deliverable: 11 **Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- Harrison Steel, Attica, IN – the Midwest RAC has been collecting data and information to provide a Level 1 Feasibility to investigate both CHP and waste heat recovery opportunities. The Midwest RAC met with Harrison Steel staff and toured the facility in February 2010.
- Gundersen Lutheran Hospital, Lacrosse, WI – the Midwest RAC was contacted by Gundersen Lutheran to perform a Level 1 Analysis of a LFG/CHP project during Q1.10. Gundersen Lutheran moved forward with an RFP in Q2.10 in which the Midwest RAC assisted GL in writing the RFP and is in the process of assisting GL in selecting a qualified engineering firm.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.

- Green Industry Business Development Program for Organic Waste Processing Facility (partners: Gas Environmental, Global Water & Energy (GW&E), Growing Power) – food waste processing, composting, and AD/CHP to power greenhouses to grow more food product (1-2 MW)
    - Packer Engineering, gasifier (crop residue and corn stover) looking to site CHP system (15 kW), Naperville, IL
    - Agricultural Watershed Institute, for a mobile biomass briquetter and distribute biomass briquettes to other biomass CHP projects, partners include John Deere, Packer Engineering, and Archer Daniels Midland
    - Fox Lake Wastewater Treatment Facility, for a 100 kW CHP project utilizing biogas from the anaerobic digester that was otherwise being wasted and flared.
    - Parkland College, 25 kW CHP project on campus using biogas
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that involved in the Clean Energy community in the Midwest region.
- Future technical analyses for FY2010.Q4 include:
    - RenTech, Illinois
    - Gundersen Lutheran, Wisconsin (new hospital wing)
    - Denison University, Ohio
    - Bell's Brewery, Michigan
- Midwest Cogeneration Association (MCA)
    - Cliff Haefke of the Midwest RAC has been serving as Vice President of the Midwest Cogeneration Association (MCA) in January 2010.
    - John Cuttica participates in the MCA as a Board Member.
    - The Midwest RAC is assisting in the development of a newsletter for the MCA members and cogeneration/CHP industry. Two issues were sent out during FY2010.Q3 in the months of April and May.
    - The Midwest RAC staff attended one MCA Board meeting during FY2010.Q3.

Deliverable: 12	**Task: 5**

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity:

- The Midwest RAC organized a site tour of a CHP plant for the University of Illinois at Chicago on April 12th, 2010.
- The Midwest RAC will be coordinating activities with the Midwest IACs to attend the September 29-30, 2010 Waste Heat Recovery for Power and Heat Workshop in Chicago, IL.

Deliverable: 13	**Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for FY2010.Q3.
- Also see Quarterly Website Report in the Appendix for Midwest RAC website activities.

Deliverable: 14	**Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: No activity during FY2010.Q3.

Appendix

The MAC Web Site Traffic Report: April through June 2010

- Web site traffic during the period was about 366,000.hits[1]. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Web site in April 2002, now is nearly 8 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 181,900. Since launching the Web site over 3.02 million PDF documents have been viewed / downloaded from the Web site. Figures 4 and 5 show monthly and annual download data, respectively of the PDF documents.
- During the period, the number of distinct computers that logged on to the Web site at least once during the period was as high as 7,300 per month as shown in Figure 6 and average about 6,950.
- Data transferred by the Web site visitors during the period was as high as 23.6 Gigabytes per month and totaled 66 Gigabytes as shown in Figure 7. Since launching the Web site, over 1,152 Gigabytes of data have been transferred from the Web site as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded are shown in Exhibits 1 and 2. These include the following:
    - Project Profiles: Over 29,200 during the period (including over 13,600 of those developed by other RACs) and over 57,100 YTD
    - *CHP Resource Guide:* Over 11,700 during the period and over 21,400 YTD
    - *CHP Resource Guide for Hospitals* (Published in March 2008): Over 4,800 during the period and 13,100 YTD
    - *Illinois Permitting Guidebooks (Volumes A, B and Calculator:* Over 1,200 during the period and over 2,700 YTD
    - *Report on* "*Potential Use of IL Coal in Dry-Mill Ethanol Plants*:" 150 during the period and 435 YTD
    - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:" Over* 360 during the period and over 880 YTD
    - *Report on "CHP Application in Ethanol Plants:"* Over 160 during the period and over 310 YTD
    - *Presentations made at the Workshop on "Waste to Energy Workshop for the Illinois Electric Cooperatives," (held in Springfield, IL on October 20, 2009*): Over 1,950. during the period and over 5,100 YTD

- *Presentations made at the Workshop on "Waste-to-Energy Workshop," (Held in Wooster, OH on April 7, 2009*): Over 6,400 during the period and over 15,800 YTD

- *Presentations made at the Workshop on "Energy Saving Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP,"* (Held in Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively): Over 5,900 during the period and over 13,000 YTD

- *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies," (Held in Lansing, MI on January 15, 2008): Over 1,600 during the period and over 3,600 YTD*

- *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste," (Held in Richmond, IN on May 31, 2007): Over 2,500 during the period and over 5,300 YTD*

- *Presentations made at the Workshop on "Waste-to-Energy from the Ohio Livestock & Food Processing Industries," (Held in Wooster, OH on January 31, 2007): Over 2,800 during the period and 6,100 YTD*

- *Presentations made at the Workshop on "Waste-to-Energy Workshop for Indiana's Farm, Food Processing and Wood Industries,"* (Held in Jasper, IN on December 11, 2006): Over 2,400 during the period and 4,600 YTD

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1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes).

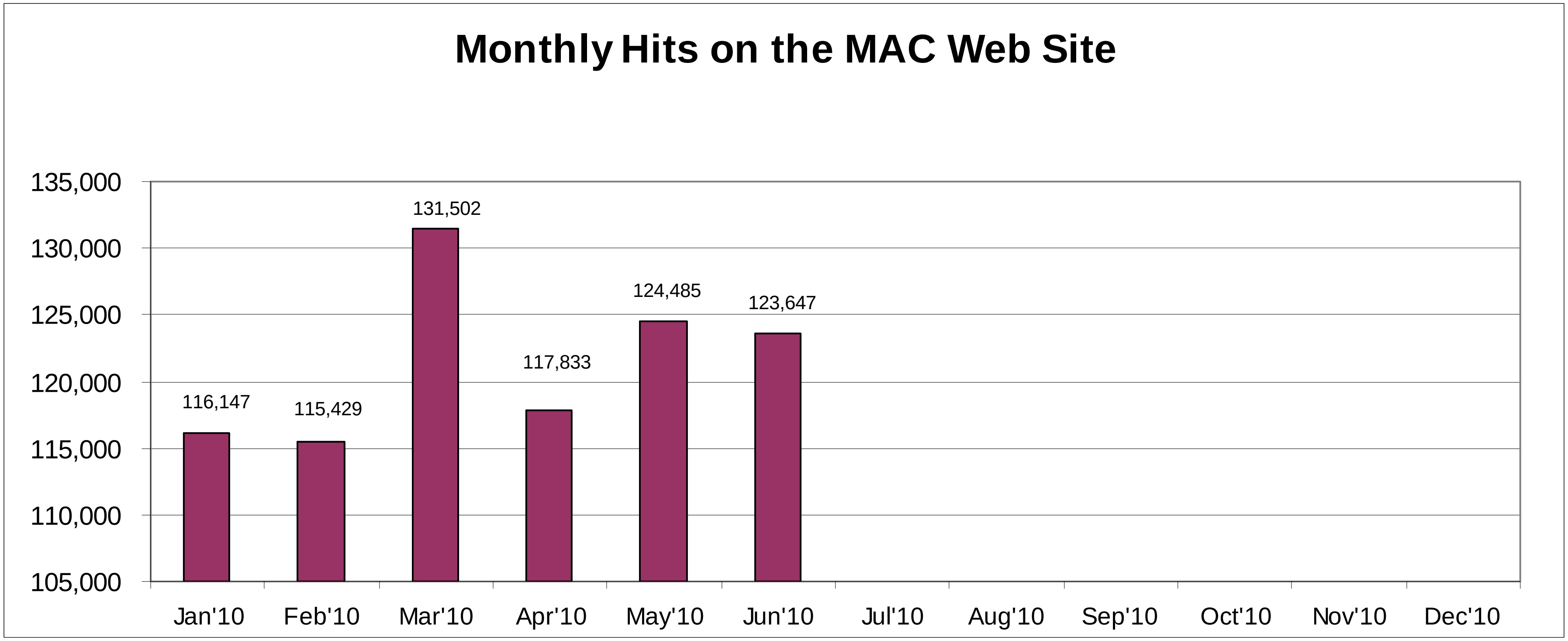

Figure 1: Monthly Hits on the MAC Web Site During 2010

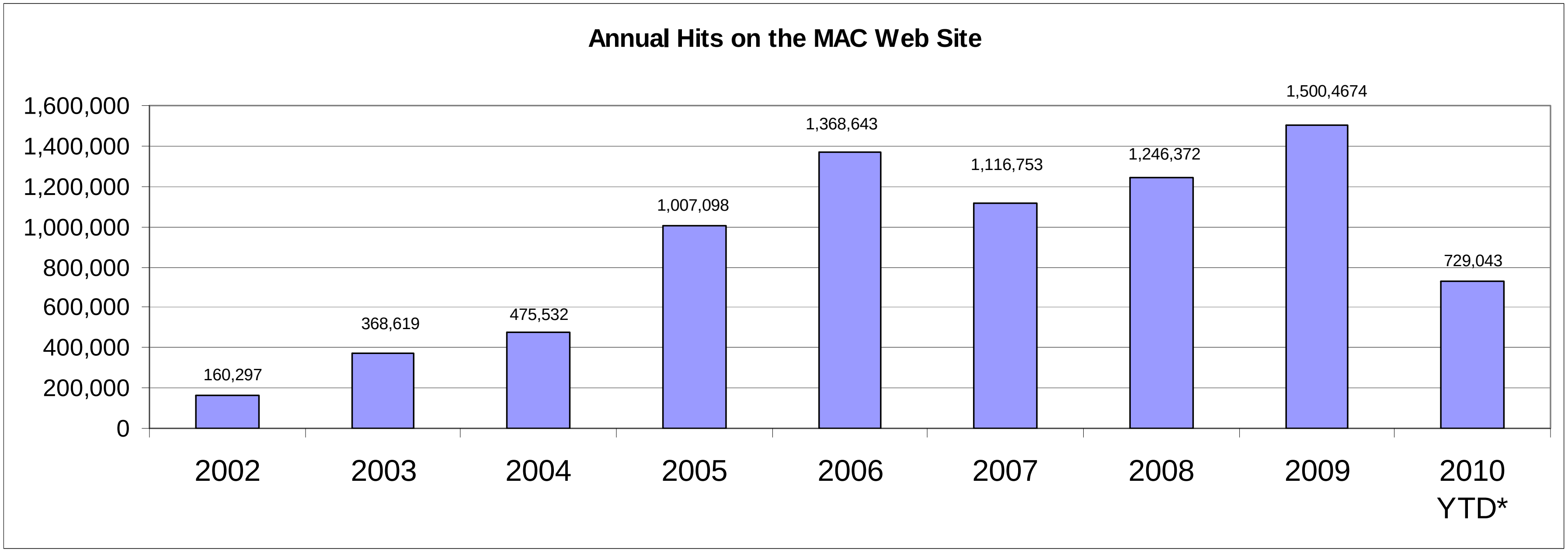

Figure 2: Annual MAC Web Site Hits

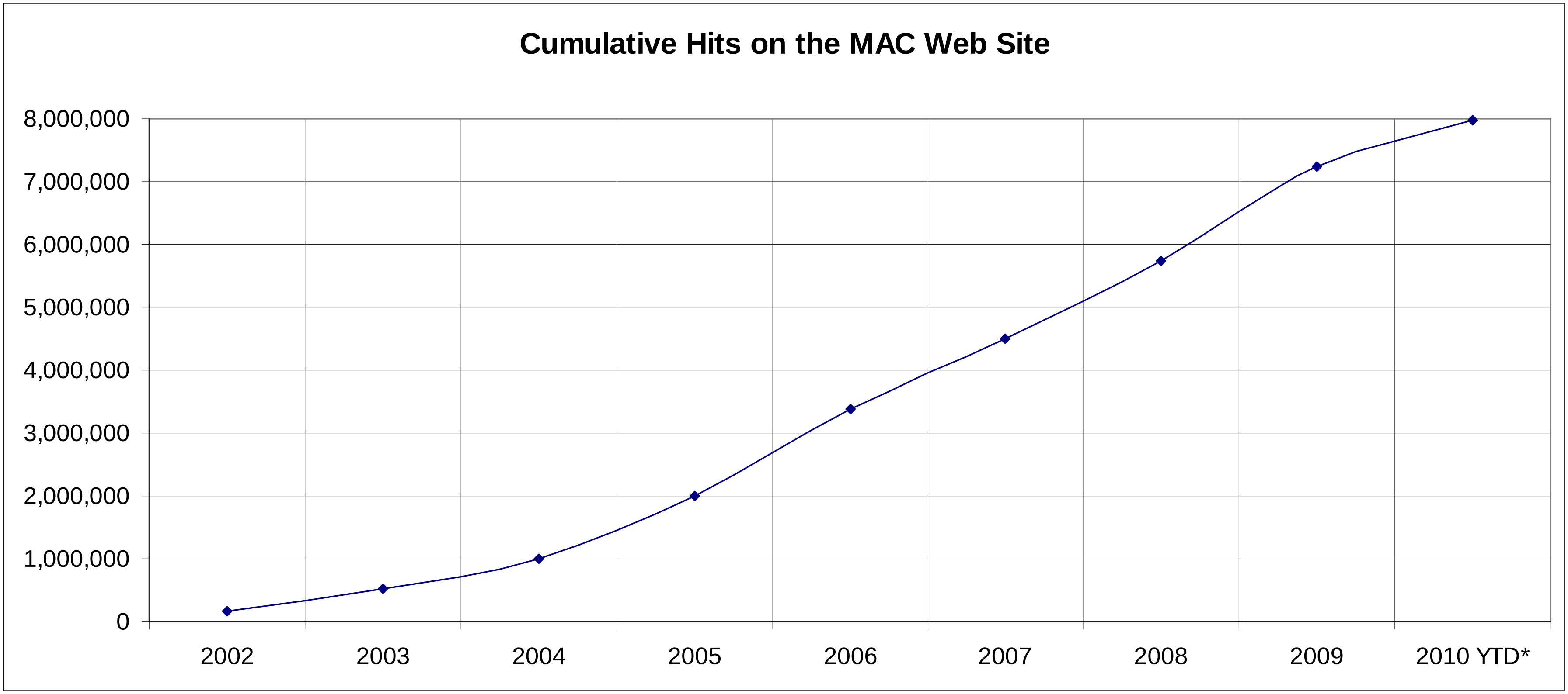

Figure 3: Cumulative MAC Web Site Hits through March 2010

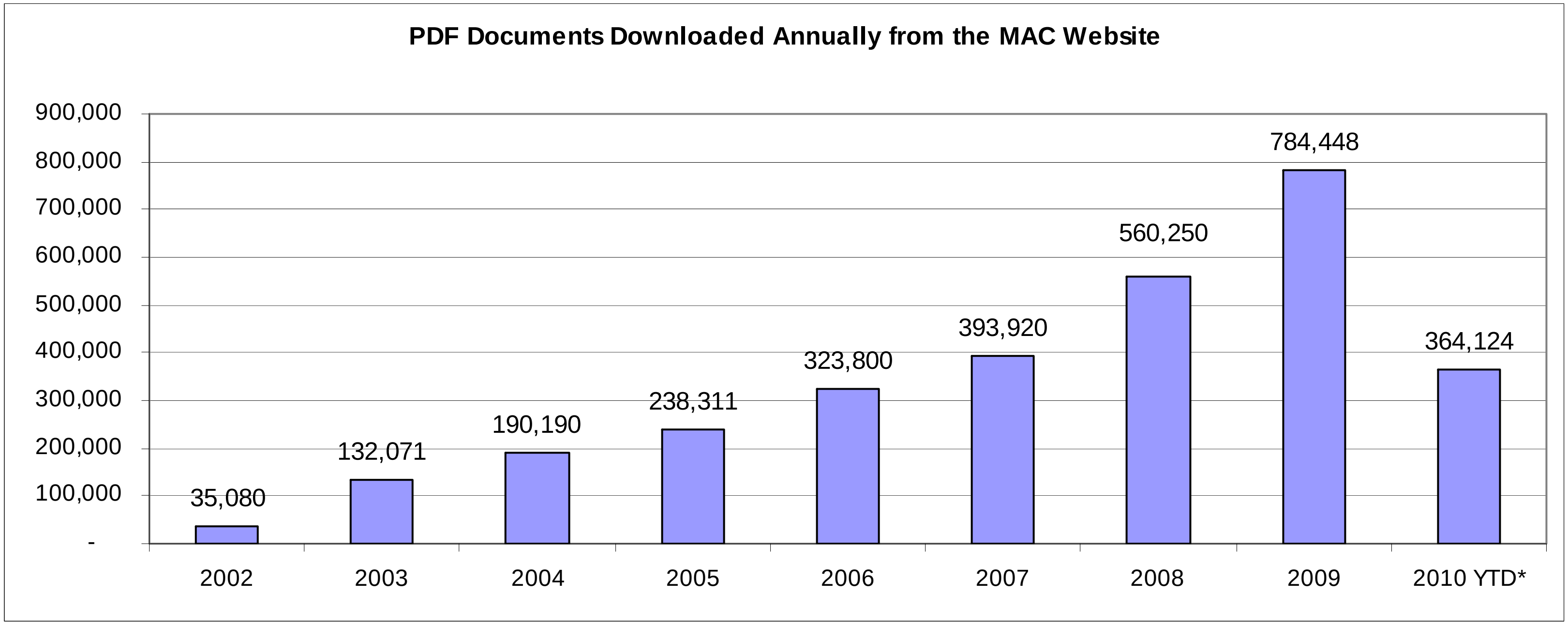

Figure 4: Number of PDF Documents Annually Downloaded from the MAC Web site

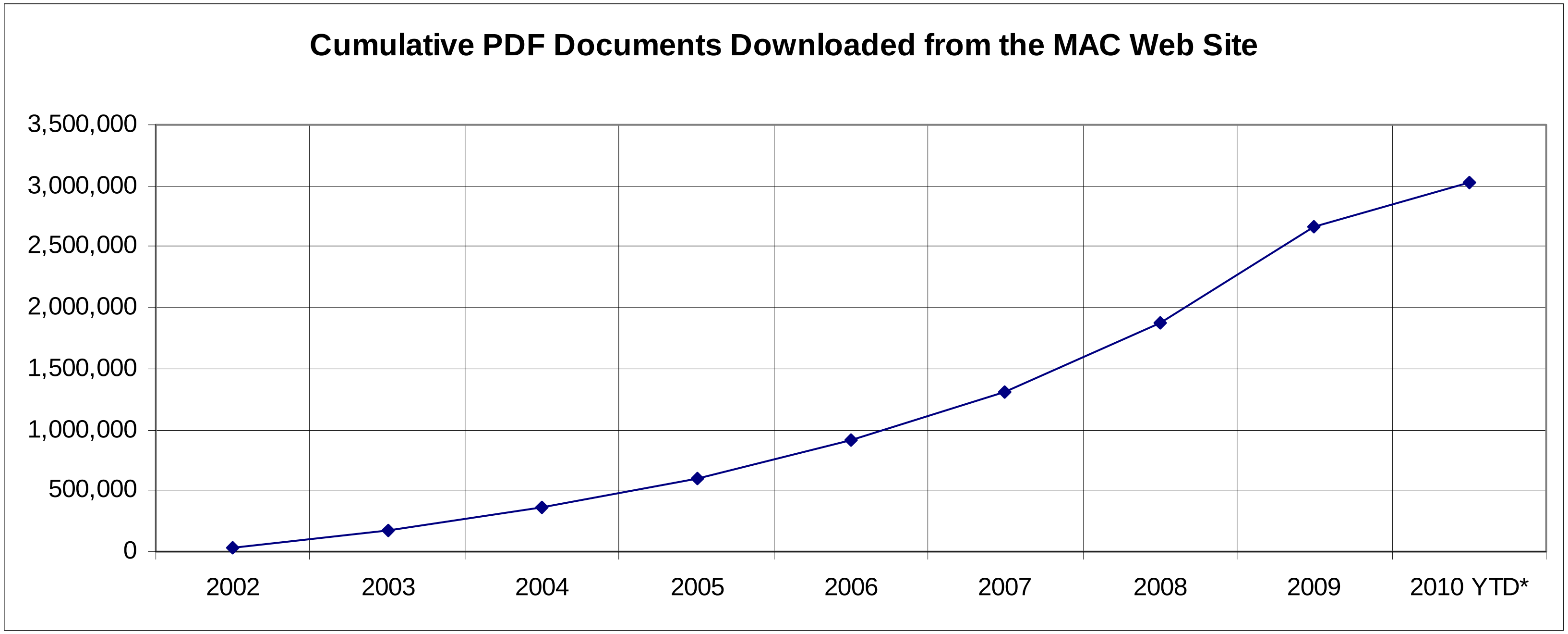

Figure 5: Cumulative Total of PDF Documents Downloaded through March 2010

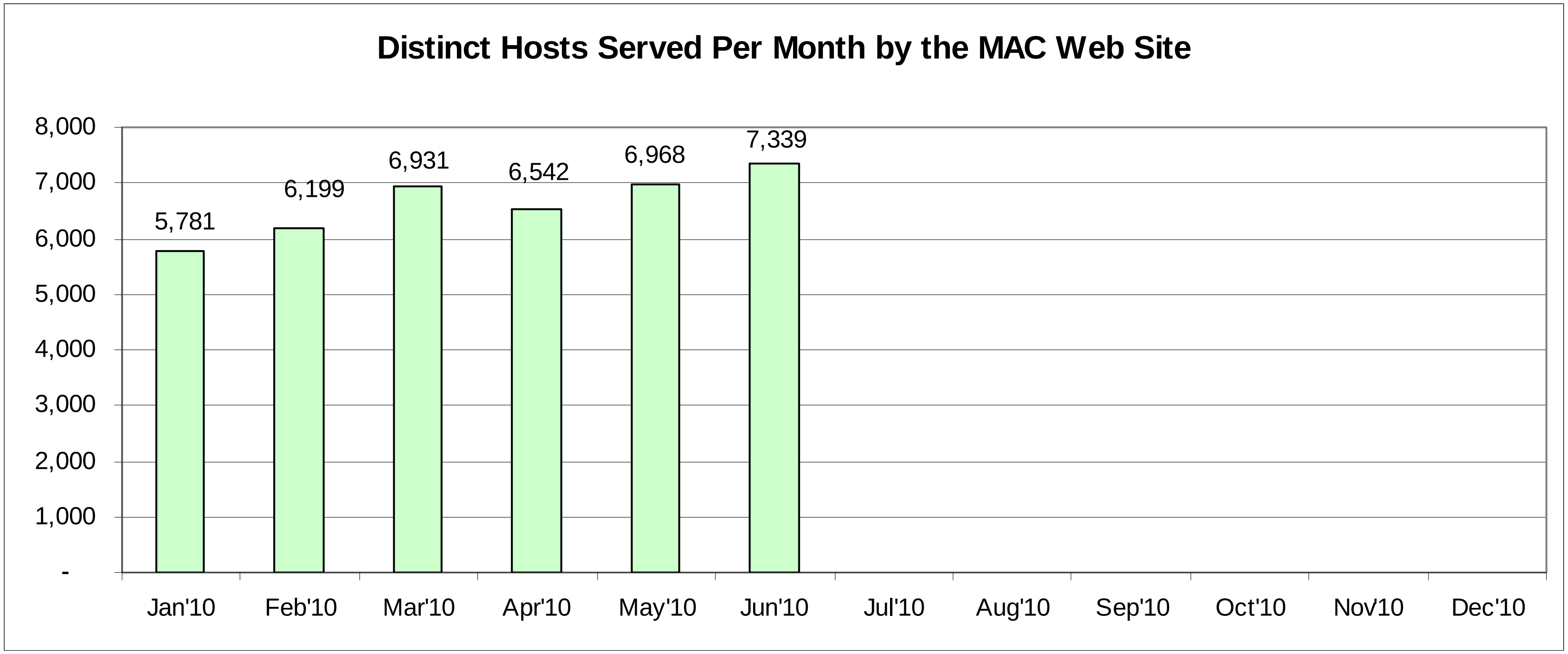

Figure 6: Distinct Computers Accessing the MAC Web Site At Least Once

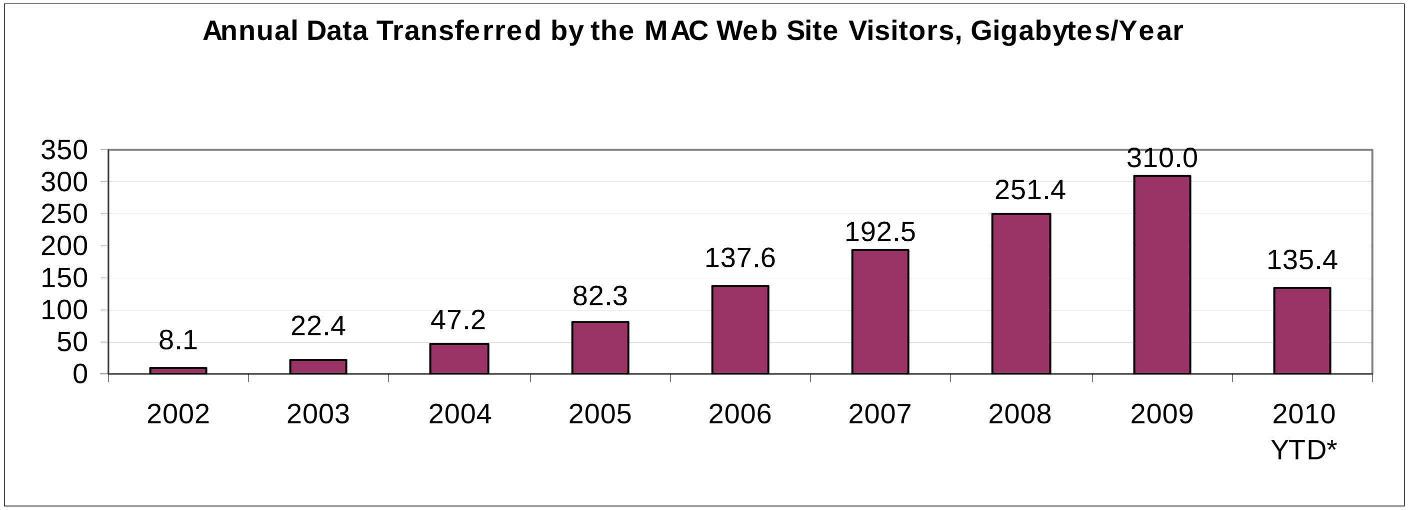

Figure 7: Annual Data Transferred by the MAC Web Site Visitors

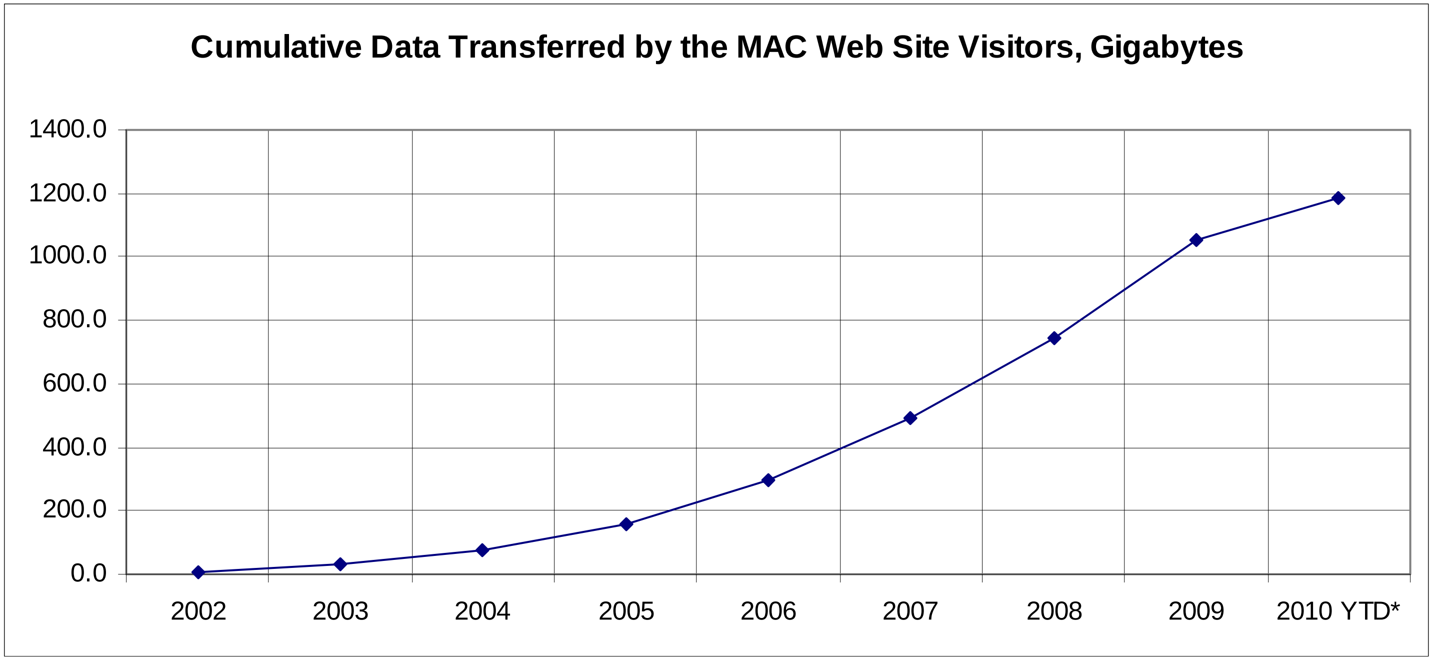

Figure 8. Cumulative Data Transferred by the MAC Web Site Visitors through March 2010

Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2010

	2010												
	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Project Profiles													
Adkins Energy	41	33	89	49	38	41							291
Advocate South Suburban Hospital	57	46	105	71	78	56							413
Afcantiou Farm	22	31		28	36	31							148
Albert Lea Wastewater Treatment Facility	121	198	234	155	213	243							1,164
Antioch Community High School	79	119	115	71	140	33							557
Barham Farms	40	33	86	46	64	62							331
Beloit Memorial Hospital	45	50	111	99	86	99							490
Breeden YMCA	34	43	62	81	88	121							429
Broshco Fabricating Products	142	87	139	112	108	104							692
Clover Hill Dairy	178	135	243	248	178	210							1,192
Crave Brothers		97	59	49	51	51							307
Dakota Station	46	27	73	42	60	50							298
East Kansas Agri-Energy	116		154	170	122	162							724
Eastern Michigan University													
Elgin Community College	104	82	124	107	147	104							668
Elkhart Hospital	138	190	289	210	167	151							1,145
Evanston High School	81	122	163	84	94	77							621
Franciscan Sisters	60	31	167	108	88	86							540
Franklin Heating Station	30	39	61	41	83	55							309
Holiday Inn	52	27	29	29	29	24							190
Holsum Dairy	137	131	202	211	174	140							995
Holsum Elm Dairy	87	75	108	82	93	74							519
Hunter Haven Farms	93	85	107	91	105	91							572
Janesville Wastewater Treatment Facility	94	61	132	81	84	70							522
Jesse Brown VA Medical Center	103	95	131	114	146	143							732
Laclede Gas Building		87	242	121	96	120							666
Lake Forest Hospital	41	28	232	113	167	162							743
Little Company of Mary Hospital	36	38	81	41	56	38							290
Lorin Industries	22	20	24		22								88
Maine South High School	118	81	120	93	120	87							619
Manchester Tanks	277	148	186	207	194	272							1,284
Museum of Science	57	58	164	135	93	123							630
National Animal Disease Center	106	83	137	102	116	142							686
Naval Station Great Lakes	185	130	156	166	135	215							987
Northeast Missouri Grain	95	105	103	104	83	74							564
Northwest Community Hospital	240	185	228	248	214	236							1,351
Norwiss Farms	105	99	135	142	189	152							822
Onyx Seven Mile Creek Landfill	152	178	284	255	245	307							1,421
Pasadena City College	23	28	30	22	26								129
Presbyterian Homes	63	51	113	58	53	59							397
Resurrection Hospital	55	47	115	121	92	71							501
Rochester Wastewater Treatment Plant	113	77	146	99	106	139							680
S. C. Johnson		59	80	80	68	79							366
SmithField Foods	37	29	66	44	48	30							254
St Francis Hospital	63	51	84	47	72	78							395
St. Mary's Hospital, MN	46	45	91	66	73	56							377
St. Mary's Hospital, WI	47	27	78	75	59	37							323
Spectrum Health													
U.S. Energy Partners	31	28	57	33	35	33							217
UIC- East Campus	57	77	121	71	40	57							423
UIC-West Campus	37	39	73	57	34	53							293
University of Iowa	75	84	125	122	101	124							631
University of Michigan													
Utilimaster Corporation													-
Vestil Manufacturing	97	79	112	91	110	122							611
Winnenago County Sheriffs Office		58	108	71	94	81							412
Total Project Profiles Total	**4,078**	**3,856**	**6,474**	**5,163**	**5,213**	**5,225**	-	-	-	-	-	-	**30,009**
Other RACs													
Alaska Village Electric Coop Anvik	50	46	69	43	52	35							295
Alaska Village Electric Coop Grayling	56	48	62	48	59	42							315
BMW	57	82	99	53	57	59							407
Bristle-Myers Squibb	53	43	62	42	47	38							285
Central Connecticut State University	56	51	67	73	117	59							423
Chambers County	162	183	173	267	139	113							1,037
Colby College	47	57	70	73	116	61							424
Columbia Energy	71	58	88	50	54	53							374
Colorado Pork	74	57	72	62	69	30							364
Cooper Tire													
Corn Products	55	61	96	53	62	76							403
COX Interior	84	57	117	53	76	80							467
East Bay Municipal Utitiy District	168	90	129	151	108	62							708
Encore Landfill	107	59	123	65	117	103							574
Essex Junction Waterwater Treatment Facility	44	33	45	38	45	25							230
Fort Bragg	64	72	140	74	84	122							556
Golovin City		58	55	61	69	45							288
Green Mountain Coffee Roasters	60	97	117	137	122	101							634
Herbec Plastics	60	43	57	55	76	38							329
Homan Lumber													
Ina Road Water Pollution Control Facility	48	72	78	68	88	71							425
Johnson & Johnson	201	112	204	274	180	167							1,138
Joseph Gallo Farms	395	276	395	435	364	598							2,463
Kokhanok City	56	51	47	46	58	39							297
Kongiganak City	69	38	51	47	61	33							299
Kwigillingok	69	47	54	50	68	34							322
LaFarge Gypsum	68	64	96	51	60	49							388
McShan Lumber													
Network Appliance Data Center	76	62	109	77	140	125							589
Nevada Hotel Casino	68	67	61	62	92	58							408
New Belgium Brewery	66		92	90	91	102							441
Notre Dame Long Term Care	48	42	54	51	48	46							289
One Market Plaza	54	58	89	71	124	119							515
Ritz Carlton	79	57	61	72	93	55							417
Santa Margarita Wastewater Treatment Plant	48	42	66	62	61	43							322
Santa Rita Jail	170	141	197	126	235	237							1,106
Sierra Nevada Brewery	132	150	141	147	105	173							848
Shands Hospital	60	60	99	59	57	50							385
South Oaks Hospital	50	42	67	71	67	56							353
South Mississippi Correctional Facility													
SP Newsprint	66	78	104	48	71	90							
Stevens Village Council	51	46	63										160
Tesoro Petroleum	93	66	59	66	110	62							456
The Inside Passage Electric Coop (Angoon)	82	114	99	100	114	66							575
University of California, Berkeley			1										1
University of Montana	128	70	72	107	107	194							678
University of North Carolina	77	58	115	66	72	93							481
University of California, San Diego													
Utah State University	58	65	43	42	54	37							299
Valley Medical Center	48	36	45	41	46	63							279
Vander Haak Dairy	115	83	108	106	85	58							555
Vinyard 29	81	96	105	56	116	123							577
Wadeland Dairy	84	74	45	50	61	75							389
Waldbaum's Supermarket	323	351	930	693	290	244							2,831
William College	49	44	48	54	63	40							298
Total Project Profiles of Other RACs	**4,280**	**3,757**	**5,439**	**4,686**	**4,650**	**4,342**	-	-	-	-	-	-	**27,154**
Grand Total of All Project Profiles (MAC + Others)	**8,358**	**7,613**	**11,913**	**9,849**	**9,863**	**9,567**	-	-	-	-	-	-	**57,163**
Resource Guide													
2,003	599	456	719	890	673	828							
2,005	2,215	2,389	3,329	3,322	3,020	3,023							
Total	**2,814**	**2,845**	**4,048**	**4,212**	**3,693**	**3,851**	-	-	-	-	-	-	**21,463**
Hospitals Resource Guide	**2,108**	**3,011**	**3,215**	**2,673**	**1,793**	**341**							**13,141**
IL Premitting Guidebooks													
A	205	136	320	174	211	224							
B	157	87	183	118	107	64							
Calculator	149	127	146	94	112	102							
Total	**511**	**350**	**649**	**386**	**430**	**390**	-	-	-	-	-	-	**2,716**
Energy Use in Future Dry-Mill Ethanol Plants	**151**	**214**	**157**	**172**	**116**	**76**							**886**
Global Warming Impact of Corn Ethanol Production	**134**	**129**	**160**	**142**	**188**	**120**							**873**
Potential Use of IL Coal in Dry-Mill Ethanol Plants	**70**	**97**	**118**	**53**	**49**	**48**							**435**
CHP Application in Ethanol Plants	**40**	**35**	**71**	**64**	**69**	**34**							**313**
Others													
Mich. Water Env. Asso. Biosolids Wksh. (090303_Haefke)	**230**	**256**	**306**	**321**	**272**	235							**1,620**
Dubuque Iowa Biomass Conf													
080717 Haefke 1	137	130	257	217	192	116							**1,049**
080717 Haefke 2	164	222	171	165	136	279							**1,137**
Total	**301**	**352**	**428**	**382**	**328**	**395**							**2,186**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2010

	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Waste to Energy Workshop for the Illinois Electric Cooperatives (Springfield, IL; 10/20/09)													
Haefke 1	61	52	80	59	36	73							361
Haefke 2	45	32	43	33	44	33							230
Hammond	59	158	43	38	61	41							400
Hartel	41	41	41	30	37	24							214
Kennebck	103	80	52	31	43	37							346
O'Neil 1	61	59	49	35	46	36							286
O'Neil 2	343	462	434	132	134	254							1,759
Solomon	85	33	127	35	40	108							428
Andreson	64	57	71	36	44	51							323
Brochure	15	36	42	37	44	28							202
Agenda	38	44	42	46	53	36							259
Speakers Bio	56	48	60	46	60	37							307
Total	**971**	**1,102**	**1,084**	**558**	**642**	**758**							**5,115**
Waste-to-Energy Workshop (Wooster, OH; 4/7/09)													
Schanbacher	1554	1199	1654	980	1012	779							7,178
Dvorak	300	352	402	549	391	224							2,218
McDonald	111	75	65	36	35	29							351
Kasper	51	38	53	37	48	30							257
Brown	134	191	597	118	89	45							1,174
Weaver	46	30	100	37	36	28							277
O'Loughlin	35	32	39	33	48	27							214
Berlekamp	38	63	39	39	53	29							261
Maringer	102	88	125	56	41	30							442
Kurtz	45	66	44	38	95	28							316
Arnold	41	31	63	35	47	30							247
Goodge	72	45	52	56	72	67							364
Sutor	42	32	35	37	39	28							213
Monhemius	136	139	169	109	73	120							746
Speakers Contact Info	105	96	127	81	139	101							649
Agenda	92	65	73	65	64	50							409
Brochure	86	97	98	58	65	82							486
Directions													-
Total	**2,990**	**2,639**	**3,735**	**2,364**	**2,347**	**1,727**	-	-	-	-	-	-	**15,802**
WWTF Workshop (Indianapolis, IN; 05/19/08)													
Downey	45	36	36	30	37	70							254
Scott	109	68	108	66	94	68							513
Welle	82	45	106	43	39	34							349
Haefke	77	85	72	37	34	29							334
Griffin	108	66	60	54	40	25							353
Karafa	75	215	168	140	118	102							818
Totzke	143	116	108	121	175	158							821
Robin	97	77	34	71	124	38							441
Jan Scott	876	774	1082	688	807	721							4,948
Dvorak	43	33	35	35	37	24							207
Cummings	85	31	42	77	38	34							307
Parker	74	133	65	57	59	46							434
Speakers Contact Info	53	47	56	56	76	50							338
Agenda	43	29	86	32	100	23							313
Brochure	8	10	12	11	11	10							62
Directions													-
Total	**1,918**	**1,765**	**2,070**	**1,518**	**1,789**	**1,432**	-	-	-	-	-	-	**10,492**
WWTF Workshop (Elkhart, IN; 05/21/08)													
Downey	136	84	199	133	136	183							871
Kline	48	46	34	32	42	41							243
Totzke	73	43	35	31	31	23							236
Wishart	75	93	84	52	39	39							382
Bayer	59	47	48	35	32	26							247
Speakers Contact Info	53	35	42	34	46	23							233
Agenda	42	31	38	38	94	55							298
Total	**486**	**379**	**480**	**355**	**420**	**390**	**0**	**0**	**0**	**0**	**0**	**0**	**2,510**
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)													
Gould	122	192	108	109	117	102							750
Safferman	108	115	68	35	44	24							394
Cuttica	54	48	37	39	55	37							270
Stanton	55	37	42	47	36	24							241
Urban	54	44	54	35	38	34							259
Ruswick	40	36	34	31	32	24							197
Parker	58	50	78	34	37	35							292
Fortune	70	57	58	42	98	77							402
Agenda	47	79	90	85	100	60							461
Speakers Bio	69	57	68	64	67	39							364
Flyer													-
Total	**677**	**715**	**637**	**521**	**624**	**456**	-	-	-	-	-	-	**3,630**
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)													
Westerfield	53	44	36	56	36	28							253
Ilelaji	53	28	46	63	65	73							328
Cuttica	48	29	42	30	48	22							219
Dvorak	226	215	157	153	167	187							1,105
Larsen	48	84	36	37	50	22							277
McDonald	53	46	47	64	38	42							290
Snodgrass	95	108	131	76	130	181							721
Saum	38	30	35	30	32	24							189
Wagoner	41	36	49	41	46	31							244
Norrick	49	31	32	34	31	33							210
Corso	57	31	37	50	47	21							243
Hay	45	54	34	31	39	23							226
Agenda	111	90	104	90	96	66							557
Speaker Bios	43	37	38	41	42	23							224
Flyer	41	33	46	41	41	55							257
Total	**1001**	**896**	**870**	**837**	**908**	**831**	-	-	-	-	-	-	**5,343**
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 01/31/07)													
Ward	47	29	40	32	35	21							204
Elder	49	32	35	38	40	23							217
Schanbacher	180	199	316	166	277	198							1,336
Cuttica	66	36	51	50	35	34							272
Dvorak	47	41	60	56	57	32							293
Moser	65	32	45	38	49	24							253
Mills	67	43	60	48	45	46							309
Arnold	39	30	38	37	37	23							204
O'Loughlin	43	31	43	44	39	25							225
Maringer	57	75	128	55	66	50							431
Kasper	57	32	47	43	49	26							254
Dreve	42	32	40	31	40	27							212
Eschmeyer	49	41	38	32	42	27							229
Gwin	43	32	35	42	38	34							224
Monhemius	47	34	36	34	37	25							213
Zuber	46	33	48	35	41	24							227
Agenda	108	89	97	92	112	71							569
Flyer	46	43	48	35	41	25							238
Speakers Bio	66	32	42	39	50	31							260
Total	**1,164**	**916**	**1,247**	**947**	**1130**	**766**	**0**	**0**	**0**	**0**	**0**	**0**	**6,170**
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries													
(Jasper, IN;12/11/06)													-
Book	44	32	33	31	32	22							194
Brown	42	35	36	32	37	25							207
Corso	39	33	36	32	38	22							200
Cuttica	50	35	40	33	50	40							248
Hay	46	33	38	36	42	25							220
Jones	42	35	36	51	41	27							232
McGolden	42	36	39	35	40	24							216
Moser	41	31	33	28	36	28							197
Roger	44	39	33	37	43	26							222
Sievertsen	60	51	31	51	67	52							312
Stinchfield	37	29	31	32	37	32							198
Stwalley	58	52	72	99	65	93							439
Tietz	57	75	37	35	31	22							257
Toenges	39	34	33	29	33	19							187
Walmsley	68	45	45	40	386	58							642
Speakers Contact Information	46	34	38	43	37	33							231
Agenda	40	40	44	46	53	37							260
Flyer	24	38	39	37	38	23							199
Total	**819**	**707**	**694**	**727**	**1,106**	**608**	-	-	-	-	-	-	**4,661**

PROGRESS REPORT

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigator:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2010 – 4th Quarter
July 1, 2010 through September 30, 2010

Submission Date:
November 5, 2010

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

July 30, 2010

Dear Mr. Renk,

Please find the attached Progress Report for the 4th Quarter of Fiscal Year 2010 (FY2010.Q4) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $170,878.80 for FY2010.Q$:

- July 2010: $20,424.04
- August 2010: $53,637.82
- September 2010: $19,759.95

The total amount invoiced for FY2010 equals $469,689.53.

- FY2010.Q1 $92,589.75
- FY2010.Q2 $112,399.17
- FY2010.Q3 $170,878.80
- FY2010:Q4 $93,821.81

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q4.10. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during FY2010.Q4.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q2.10 Activity:

- Target Market Workshops and Webinars:
  - Waste Heat Recovery for Power and Heat Workshop, September 28-30, 2010, Chicago, IL – the Midwest RAC was the lead RAC in organizing this workshop with the Gulf Coast, Intermountain, and Pacific RACs. 115+ in attendance with prospective end-users representing 20-25% of the total attending. More information on the workshop can be found at: http://www.chpcentermw.org/wasteheat2010/index.html

- Other Workshops/Conferences/Presentations:
  - Combined Heat and Power: An Opportunity to be Explored and Exploited in Missouri, July 15, 2010, Columbia, MO – the Midwest RAC presented at the Advancing Renewables in the Midwest Conference.
  - U.S. DOE Midwest Clean Energy Application Center, August 8, 2010, Indiana – the Midwest RAC presented at the Indiana Save Energy Now (SEN) Industrial Energy Efficiency Forum
  - CHP Technologies & Applicable Market Sectors, September 2, 2010, Chicago, IL – the Midwest RAC provided a brown bag lunch presentation to the Environmental Law & Policy Center (ELPC)
  - Federal Actions Impacting State Policies: EPA Greenhouse Gases Tailoring Rule & Output-based Regulations, September 30, 2010, Chicago, IL – the Midwest RAC presented at the Waste Heat Recovery for Power and Heat Workshop

- Upcoming Workshops/Conferences/Presentations :
  - District Energy and Combined Heat & Power: Increasing Energy Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals, November 18, 2010, St. Paul, Minnesota – Midwest RAC co-sponsored / co-organized workshop with International District Energy Association (IDEA) and Minnesota Office of Energy Security. More information available at: http://www.chpcentermw.org/minnesotaDECHP2010/index.html#agenda
  - Renewable Biogas Energy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency, and Improving Your Bottom Line, November 23, 2010, Ornega, IL – Midwest RAC co-organized / co-sponsored workshop with Eastern Illini Electric Cooperative, and Association of Illinois Electric Cooperatives (AIEC).

More information available at: http://www.chpcentermw.org/easternillinibiogas2010/index.html#agenda

- o Ohio CHP/WHR Policy Workshop co-organized with Industrial Energy Consumers of America (IECA), December 14, 2010, Columbus, OH.
- o Midwest RAC will be presenting to the Energy Committee of the Ohio Manufacturing Association on November 3, 2010 in Columbus, OH regarding CHP/WHR policy education.
- o The Midwest RAC will be presenting two presentations at the 10th Annual BioCycle Conference in Des Moines, Iowa on October 19, 2010.
  - Evolution of Biogas CHP Industry: Gas Engines, Microturbines, CHP System Evolution
  - Biogas-to-Energy Potential in Illinois
- o The Midwest RAC will be presenting at the Anaerobic Digester Operator Training Program in Lansing, Michigan on October 28, 2010. The presentation will cover CHP System Management Utilizing Biogas, a chapter of the Michigan On-farm Anaerobic Digester Operator Handbook, in which the Midwest RAC helped co-author.

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- RAC Policy Meetings: The Midwest RAC participated and presented at the following RAC Policy Meetings focused on the Target Policy States:
  - o July 21, 2010
  - o August 25, 2010
  - o August 25, 2010
  - o September 15, 2010

- Target Policy States: The Midwest RAC has been heavily involved in developing an action plan for the State of Ohio titled "State of Ohio Clean Energy Policy Opportunity Document." **This activity has been a highlighted focus for the Midwest RAC and several other RACs working closely with DOE during FY 2010.** The Midwest RAC has been working with several individuals in the State of Ohio helping build an Ohio CHP/WHR Coalition to educate on needed policy and regulatory reform for the CHP / WHR market in Ohio. Weekly conference calls began in late June and seven (7) conference calls were conducted during FY2010.Q4:

- Friday, July 9, 2010
- Friday, July 16, 2010
- Friday, July 23, 2010
- Friday, July 30, 2010
- Friday, August 20, 2010
- Friday, September 3, 2010
- Friday, September 17, 2010

- Other States: The Midwest RAC has been working with Renew Missouri environmental group and the Missouri SEO in promoting CHP and WHR in Missouri. The Midwest RAC presented at the Advancing Renewables in the Midwest Conference in Columbus, Missouri with efforts to promoting CHP in the State of Missouri.

- Regulatory Workshop:
  - Day 2 of the Midwest RAC sponsored Waste Heat Recovery for Power and Heat Workshop targeted policy and regulatory activities impacting the implementation of the Waste Heat Recovery projects.
  - In conjunction with the State of Ohio policy activities, the Midwest RAC has been in conversation with the Industrial Energy Consumers of America (IECA) during FY2010.Q4 to schedule and coordinate an appropriate workshop targeting Ohio CHP/WHR policy and regulatory activities. This workshop has been scheduled for December 14, 2010 in Columbus, Ohio with the target audience being the Ohio industrials to bring the coalition participants together that have been contacted on a one-on-one basis during the past year. The goal will be to bring a unified front to the Ohio industrial representatives when addressing policy and regulatory reform.

- Other Activities:
  - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors. The Midwest RAC participated on two conference calls during FY2010.Q4.
  - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers. A hog dister CHP workshop is being planned for the service territory of the Eastern Illini Electric Cooperative for November 23, 2010.
  - Chicago Climate Action Plan (CCAP) – the CCAP began its implementation in September 2010. The Midwest RAC played a key role in the integration of CHP and WHR into the plan. CHP and WHR

represent the largest contributor of all energy efficiency and renewable energy measures in the plan. The Midwest RAC will be assisting the City of Chicago in the education and promotion of these clean energy technologies.

- Illinois State EEPS Program: the Midwest RAC presented the role of CHP to the Illinois Department of Commerce and Economic Opportuntiy (DCEO) for the state technology breakthrough program during FY2010.Q4.
- U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC is serving on the board of directors for the USCHPA.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been working on the redevelopment of the RAC websites during FY2010.Q4. Cliff Haefke is serving as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. The current initiative of the team is to develop a coordinated effort in converting the RAC websites from "CHP" to "clean energy."
- The RAC websites (developed by the Gulf Coast RAC and the Intermountain RAC) were finalized and distributed amongst the RAC Directors and RAC Web Developers in August. Christine Brinker (IM), Ross Tomlin (IM), and Cliff Haefke (MW) will be working with the RAC Directors and RAC web developers in implementing all eight RAC websites during FY2011.Q1.

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2010.Q4 Midwest RAC Website Traffic Report.

Website Highlights:

- Web site traffic during the period was over 354,700 hits.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 8.3 million hits.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 149,000. Since launching the Web site over 3.17 million PDF documents have been viewed / downloaded from the Web site.

- During FY2010.Q4, the number of distinct computers that logged on to the Web site at least once during the period was as high as 6,900 per month and averaged over 6,700.
- Data transferred by the Web site visitors during the period was as high as 23 Gigabytes per month and totaled 63 Gigabytes. Since launching the Web site, over 1,250 Gigabytes of data have been transferred from the Web site.

Deliverable: 7	**Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group has been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites (expected website launch in December 2010)
    - Cliff Haefke (Midwest RAC) and Christine Brinker (Intermountain RAC) have been working with the RAC Website/Logo working group to develop the new Project Profile template during FY2010.Q4. The RAC Website and Logo Working group developed and finalized a template for Project Profiles which was completed July 2010 and is available on the RAC Sharepoint site.

- Project Profiles in development: eight project profiles were in development during FY2010.Q4:
    - Caterpillar Aurora, Aurora, IL, 15 MW
    - Qualcomm, San Diego, CA, 11.4 MW
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW

Deliverable: 8	**Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2010.Q4.

Deliverable: 9	**Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
    - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected FY2011.Q1). A presentation of this analysis will be given by the Midwest RAC at the Annual BioCycle Conference in Iowa during the month of October 2010.
    - CHP Casebook for Food Processing Facilities (co-sponsored study with Energy Center of Wisconsin with completion expected in December 2010)
    - An Analysis of Electricity Generated from Combined Heat and Power Systems at Dry Grind Corn Ethanol Plants (White Paper)
    - Ohio CHP Utility Barriers (in conjunction with the Target Policy States)
- Three additional technical studies are being investigated and under consideration to fund during FY 2011:
    - Energy Savings Partnership – Integration of an Ethanol Plant and Dairy Farm Facility
    - Update to the 2005 CHP Resource Guide
    - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10	**Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: The Midwest RAC has been collecting installation data and information for ICF International during FY2010.Q4.

Deliverable: 11	**Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- <u>Harrison Steel</u>, Attica, IN – the Midwest RAC completed a Level 1 Feasibility to investigate both CHP and waste heat recovery opportunities. The Midwest RAC presented the results in July to Harrison Steel personnel. Harrison Steel staff attended the Midwest RAC sponsored Waste Heat Recovery workshop in Chicago in September.
- <u>Gundersen Lutheran Hospital, Lacrosse, WI</u> – the Midwest RAC was contacted by Gundersen Lutheran to perform a Level 1 Analysis of a LFG/CHP project during FY2010Q2.10. Gundersen Lutheran moved forward with an RFP in FY201.Q3 in which the Midwest RAC assisted GL in writing the RFP and is in the process of assisting GL in selecting a qualified engineering firm. The Midwest RAC reviewed the submitted proposals from the project bidders and served as a technical reviewer in FY2010.Q4 to Gundersen Lutheren in the selection process. Construction is to begin before December 31, 2010.

- Gudersen Lutheran Hospital, Lacrosse, WI (Phase II) – the Midwest RAC is assisting GL in analyzing CHP for a future hospital expansion, in particular, identifying whether or not, CHP is technical feasible and in addition if the natural gas-fired CHP system can serve as the emergency backup generation to the hospital (similar to the Beloit Memorial Hospital CHP application).
- Bell's Brewery, Galesburg, MI – the Midwest RAC is performing a Level 1 CHP analysis for a natural gas-fired CHP system.
- Continental Plaza Office Building, Columbus, OH – the Midwest RAC is performing a Level 1 CHP analysis for a natural gas-fired CHP system as part of a larger Energy Efficiency audit.
- Denison University, Granville, OH – the Midwest RAC is performing a Level 1 CHP analysis as a replacement to their current coal-fired boiler.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
    - Green Industry Business Development Program for Organic Waste Processing Facility (partners: Gas Environmental, Global Water & Energy (GW&E), Growing Power) – food waste processing, composting, and AD/CHP to power greenhouses to grow more food product (1-2 MW)
    - Packer Engineering, gasifier (crop residue and corn stover) looking to site CHP system (15 kW), Naperville, IL
    - Agricultural Watershed Institute, for a mobile biomass briquetter and distribute biomass briquettes to other biomass CHP projects, partners include John Deere, Packer Engineering, and Archer Daniels Midland
    - Fox Lake Wastewater Treatment Facility, for a 100 kW CHP project utilizing biogas from the anaerobic digester that was otherwise being wasted and flared.
    - Parkland College, 25 kW CHP project on campus using biogas
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that involved in the Clean Energy community in the Midwest region.
- Midwest Cogeneration Association (MCA)
    - Cliff Haefke of the Midwest RAC has been serving as Vice President of the Midwest Cogeneration Association (MCA) since January 2010.
    - John Cuttica participates in the MCA as a Board Member.
    - The Midwest RAC staff attended one MCA Board meeting during FY2010.Q4 and attended the Annual MCA Meeting.

Deliverable: 12 **Task: 5**

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity:

- The Midwest RAC extended invitations to the Midwest IACs to the Waste Heat Recovery for Power and Heat Workshop in September in Chicago to provide training on the concepts of waste heat recovery in industrial facilities. Assistance for travel/lodging accommodations was also personally extended to each of the sixe RACs.
- The Midwest RAC will be assembling and mailing the presentation materials and tools from the Waste Heat Recovery workshop to be used as training manuals for the Midwest IACs during FY2011.Q1.

Deliverable: 13 **Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for FY2010.Q4.
- Also see Quarterly Website Report in the Appendix for Midwest RAC website activities.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: No activity during FY2010.Q4.

Appendix

The MAC Web Site Traffic Report: July through September 2010

- Web site traffic during the period was over 354,700.hits[1]. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 8.3 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 149,000. Since launching the Web site over 3.17 million PDF documents have been viewed / downloaded from the Web site. Figures 4 and 5 show monthly and annual download data, respectively of the PDF documents.
- During the period, the number of distinct computers that logged on to the Web site at least once during the period was as high as 6,900 per month as shown in Figure 6 and average over 6,700.
- Data transferred by the Web site visitors during the period was as high as 23 Gigabytes per month and totaled 63 Gigabytes as shown in Figure 7. Since launching the Web site, over 1,250 Gigabytes of data have been transferred from the Web site as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded are shown in Exhibits 1 and 2. These include the following:
  - *Project Profiles*: Over 25,140 during the period (including over 11,800 of those developed by other RACs) and over 82,300 YTD (including over 38,900 of those developed by other RACs)
  - *CHP Resource Guide:* Over 9,690 during the period and 31,100 YTD
  - *CHP Resource Guide for Hospitals* (Published in March 2008): Over 1,520 during the period and over 14,600 YTD
  - *Illinois Permitting Guidebooks (Volumes A, B and Calculator:* Nearly 1,100 during the period and over 3,800 YTD
  - *Report on* "*Potential Use of IL Coal in Dry-Mill Ethanol Plants*:" Over 110 during the period and over 540 YTD
  - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:"* Over 410 during the period and over 1,300 YTD
  - *Report on "Global Warming Impact of Corn Ethanol Plants:"* Over 310 during the period and over 1,180 YTD
  - *Report on "CHP Application in Ethanol Plants:"* Over 120 during the period and over 430 YTD.

- *Presentations made at the "Waste to Energy Workshop for the Illinois Electric Cooperatives,"* (Held in Springfield, IL on October 20, 2009): Over 1,550 during the period and over 6,660 YTD

- *Presentations made at the "Waste-to-Energy Workshop,"* (Held in Wooster, OH on April 7, 2009): Over 5,030 during the period and over 20,800 YTD

- *Presentations made at the Workshop on "Energy Saving Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP,"* (Held in Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively): Over 6,120 during the period and 19,100 YTD

- *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies," (Held in Lansing, MI on January 15, 2008): Over 1,540 during the period and over 5,170 YTD*

- *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste," (Held in Richmond, IN on May 31, 2007): Over 2,800. during the period and 8,100 YTD*

- *Presentations made at the Workshop on "Waste-to-Energy from the Ohio Livestock & Food Processing Industries," (Held in Wooster, OH on January 31, 2007): Over 2,510 during the period and over 8,680.YTD*

- *Presentations made at the Workshop on "Waste-to-Energy Workshop for Indiana's Farm, Food Processing and Wood Industries,"* (Held in Jasper, IN on December 11, 2006): Over 1,940 during the period and 6,600 YTD

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1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes).

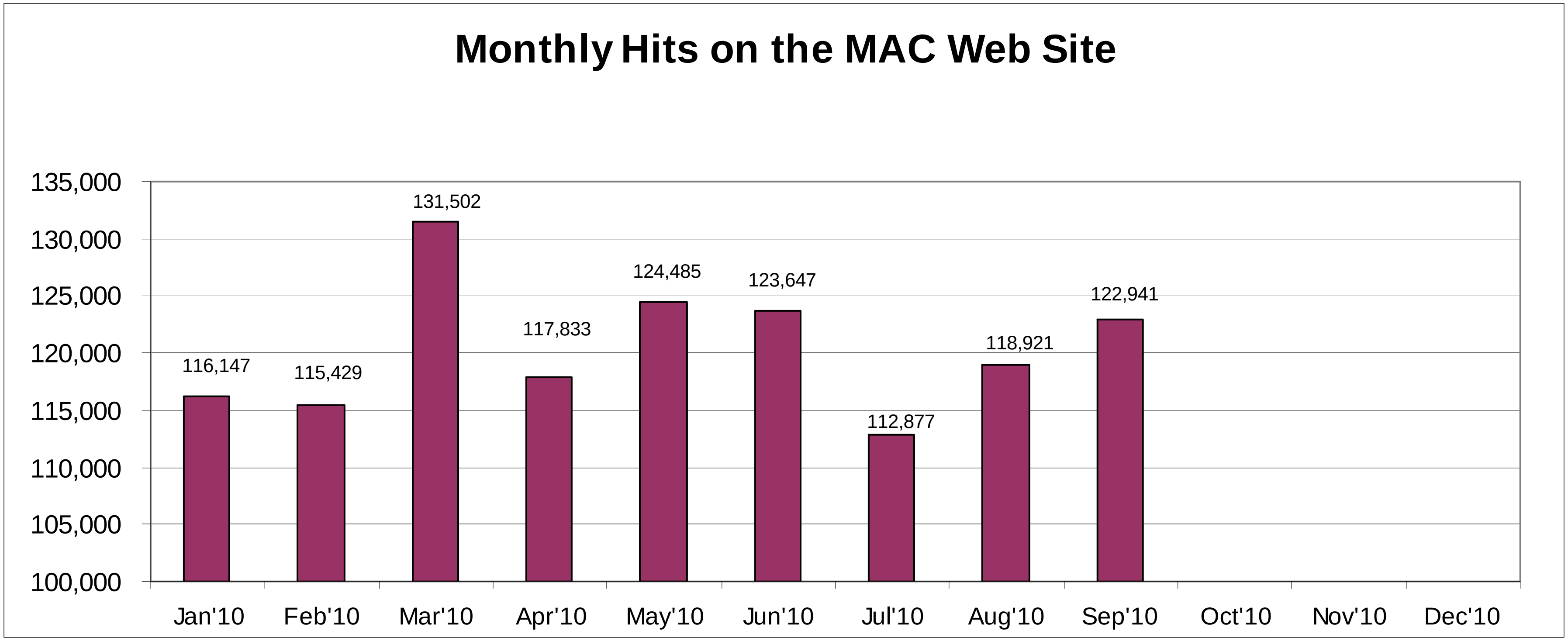

Figure 1: Monthly Hits on the MAC Web Site During 2010

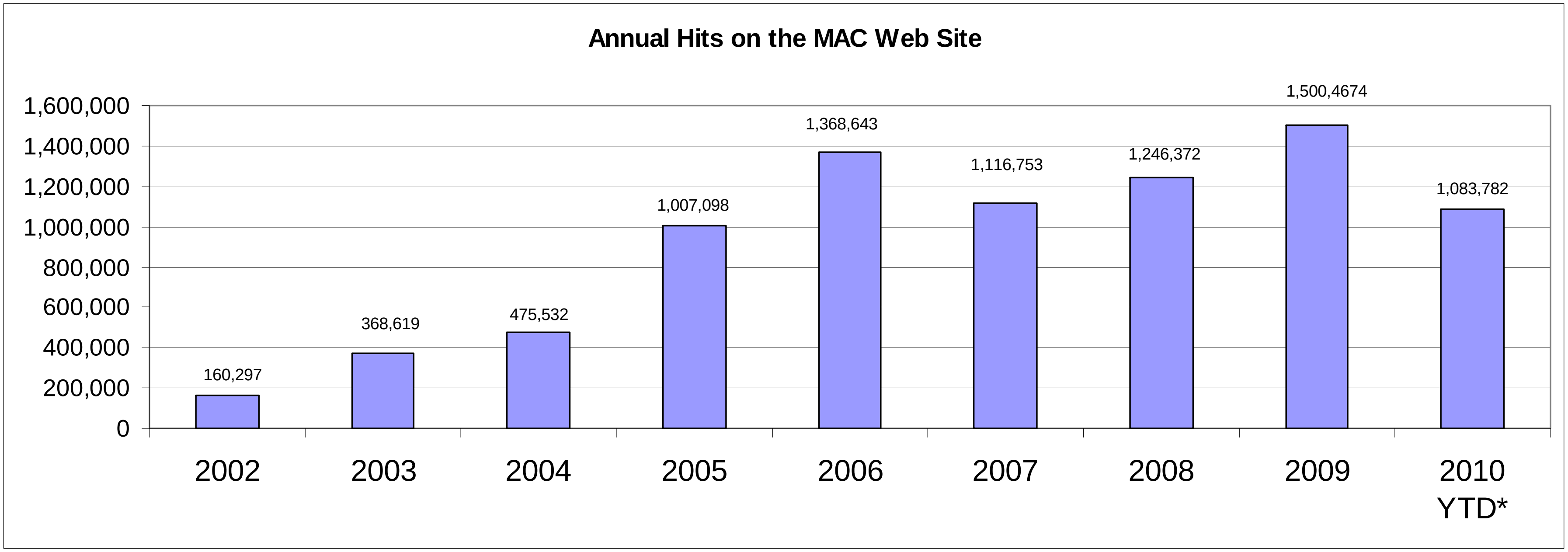

Figure 2: Annual MAC Web Site Hits

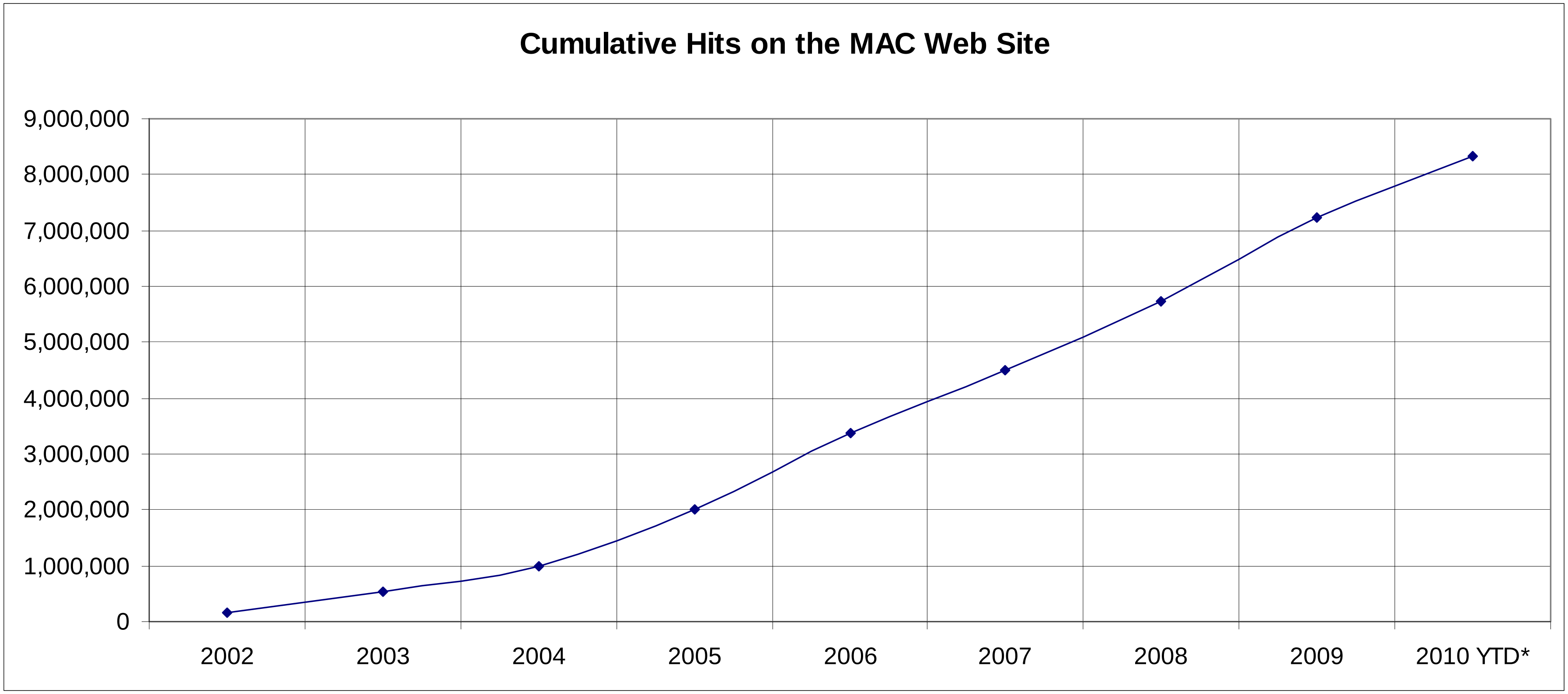

Figure 3: Cumulative MAC Web Site Hits through March 2010

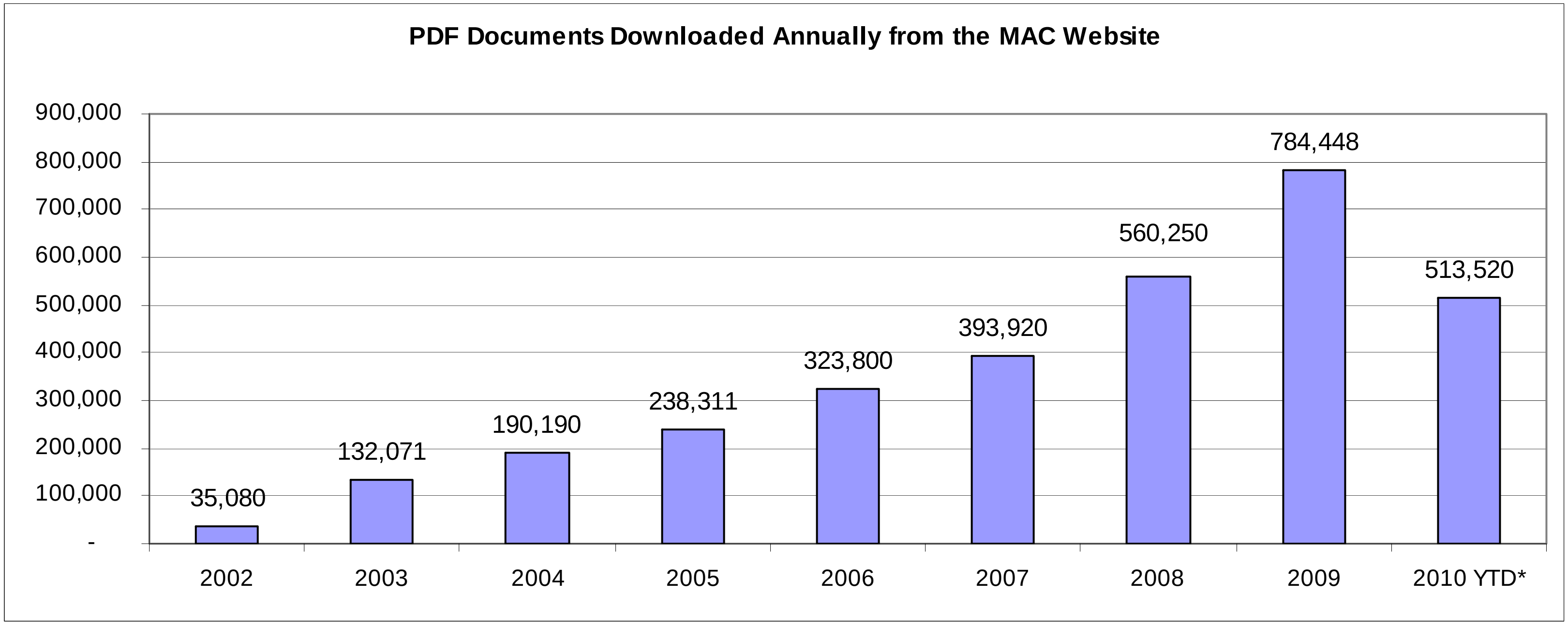

Figure 4: Number of PDF Documents Annually Downloaded from the MAC Web site

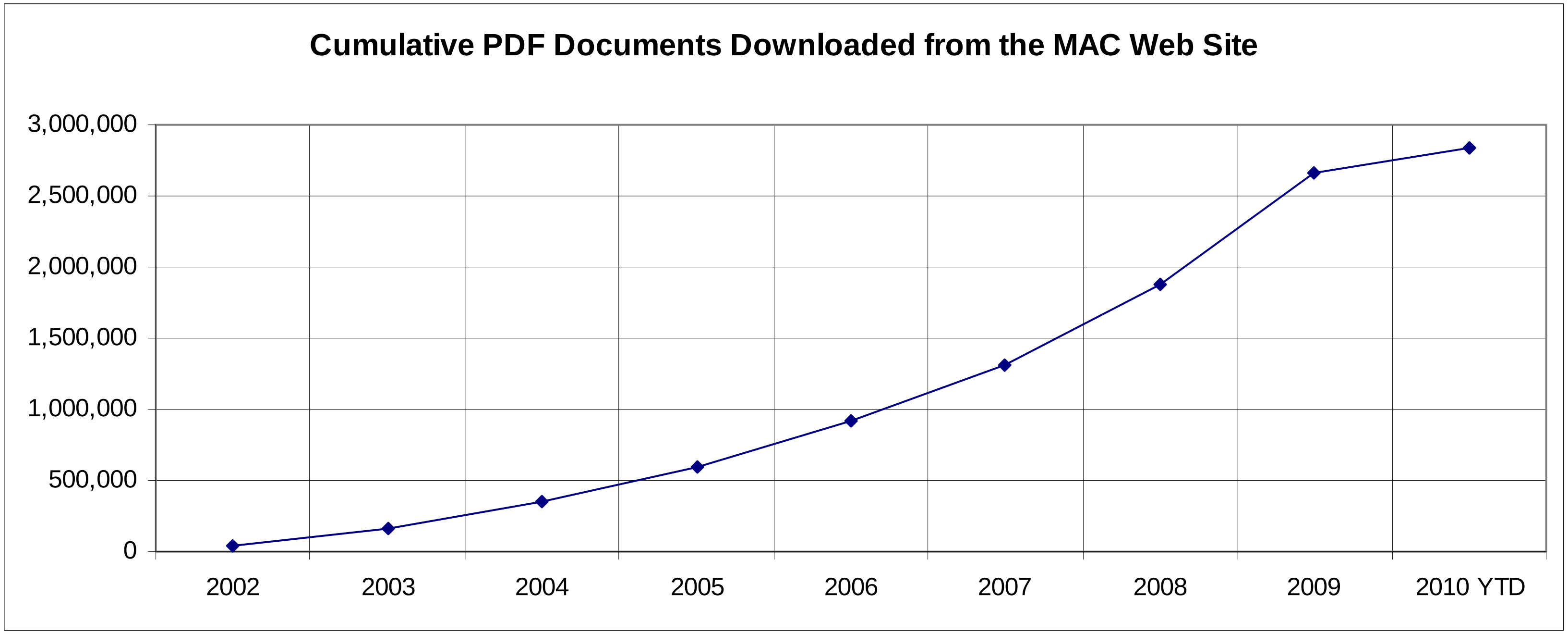

Figure 5: Cumulative Total of PDF Documents Downloaded through March 2010

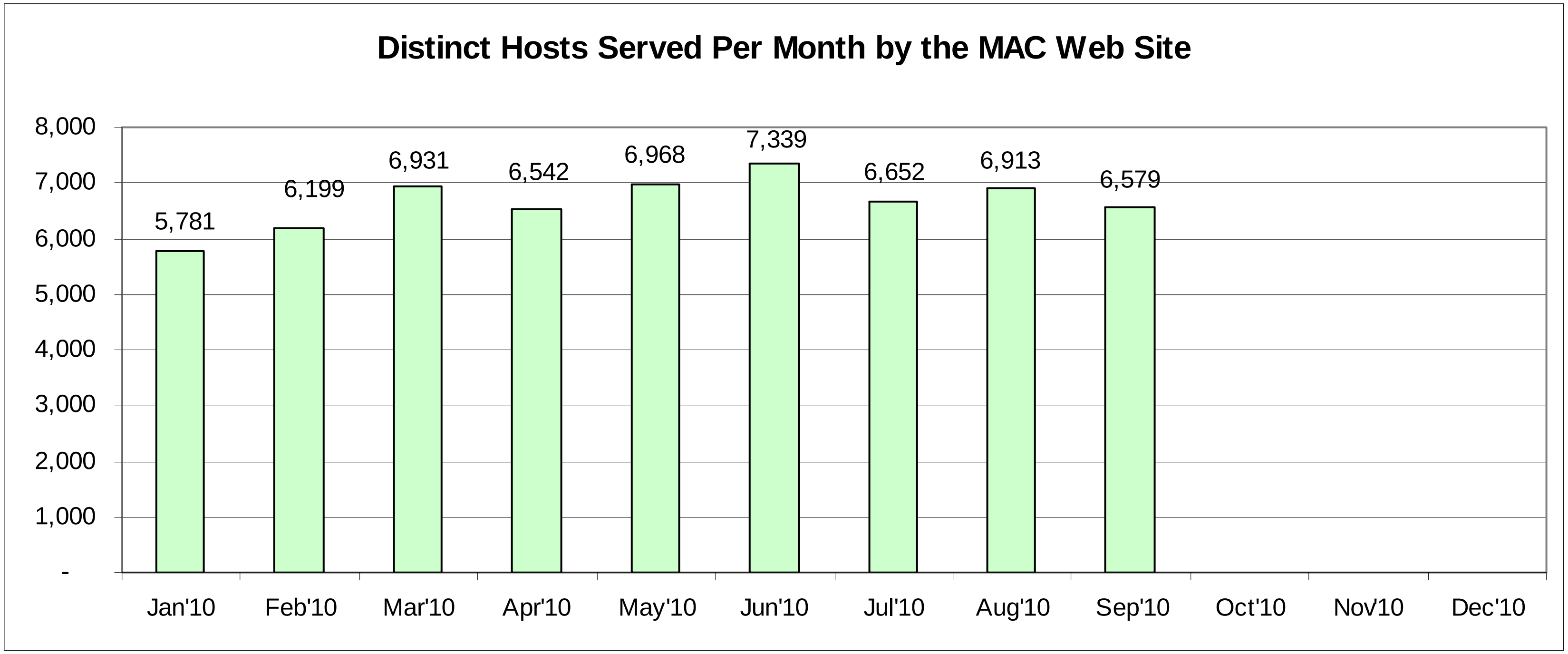

Figure 6: Distinct Computers Accessing the MAC Web Site At Least Once

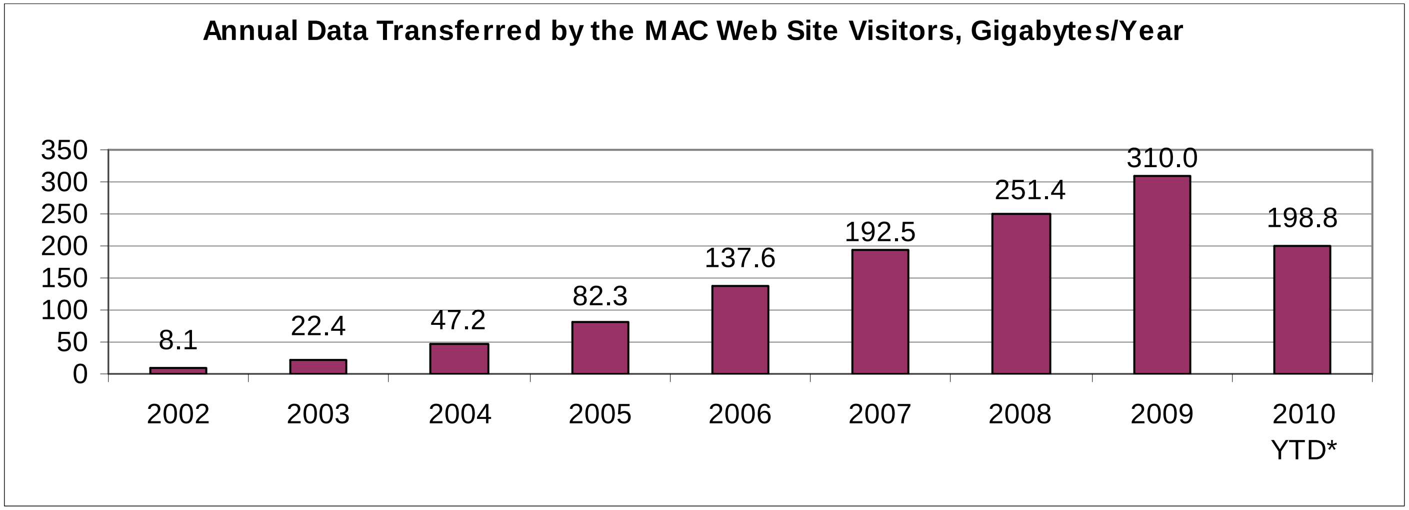

Figure 7: Annual Data Transferred by the MAC Web Site Visitors

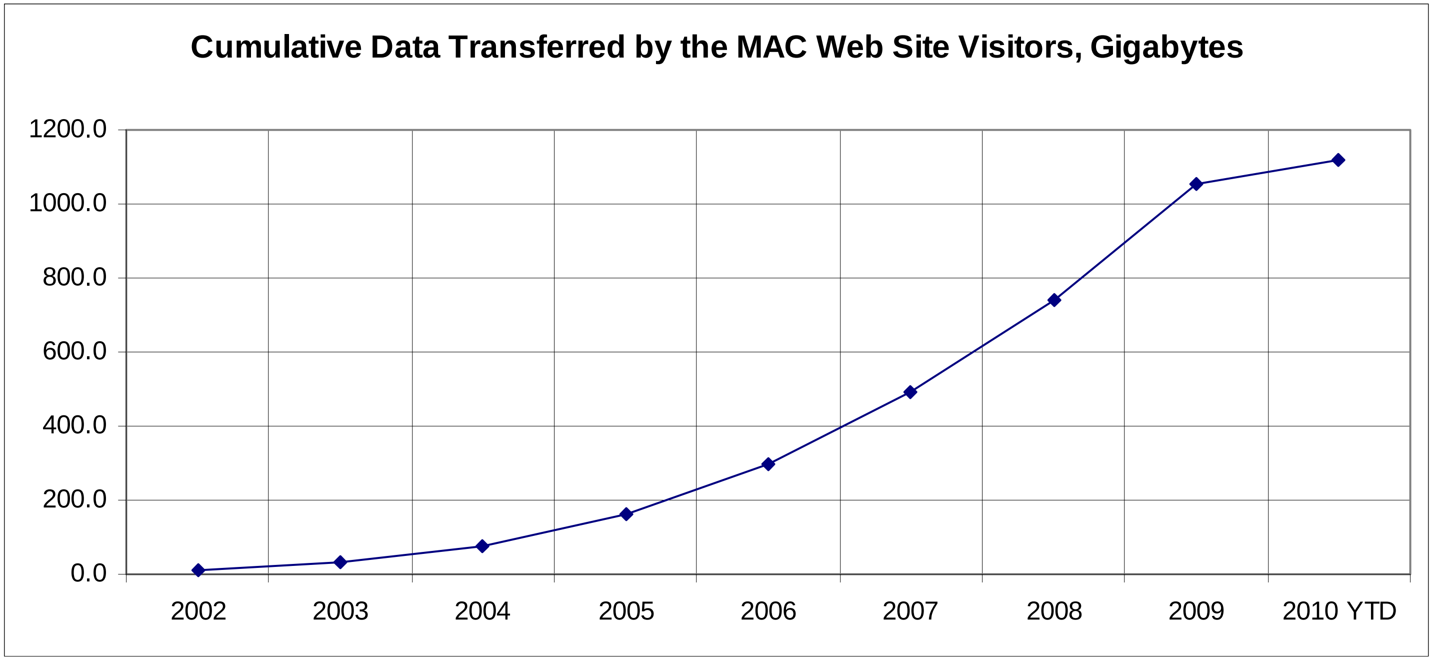

Figure 8. Cumulative Data Transferred by the MAC Web Site Visitors through March 2010

Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2010

	2010												
	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Project Profiles													
Adkins Energy	41	33	89	49	38	41	39	26	25				381
Advocate South Suburban Hospital	57	46	105	71	78	56	70		74				557
Afcantiou Farm	22	31		28	36	31	41	33					222
Albert Lea Wastewater Treatment Facility	121	198	234	155	213	243	190	159	154				1,667
Antioch Community High School	79	119	115	71	140	33	49	68	81				755
Barham Farms	40	33	86	46	64	62	72	33	53				489
Beloit Memorial Hospital	45	50	111	99	86	99	152	78	59				779
Breeden YMCA	34	43	62	81	88	121	164	93	89				775
Broshco Fabricating Products	142	87	139	112	108	104	97	110	79				978
Clover Hill Dairy	178	135	243	248	178	210	152	114	106				1,564
Crave Brothers		97	59	49	51	51	38	52	48				445
Dakota Station	46	27	73	42	60	50	48	46	67				459
East Kansas Agri-Energy	116		154	170	122	162	134	156	201				1,215
Eastern Michigan University													
Elgin Community College	104	82	124	107	147	104	64	66	58				856
Elkhart Hospital	138	190	289	210	167	151	145	134	151				1,575
Evanston High School	81	122	163	84	94	77	236	78	52				986
Franciscan Sisters	60	31	167	108	88	86	83	41	34				698
Franklin Heating Station	30	39	61	41	83	55	51	59	53				472
Holiday Inn	52	27	29	29	29	24		36	28				254
Holsum Dairy	137	131	202	211	174	140	177	209	159				1,540
Holsum Elm Dairy	87	75	108	82	93	74	104	64	74				761
Hunter Haven Farms	93	85	107	91	105	91	72	88	73				805
Janesville Wastewater Treatment Facility	94	61	132	81	84	70	45	62	80				709
Jesse Brown VA Medical Center	103	95	131	114	146	143	134	108	114				1,088
Laclede Gas Building		87	242	121	96	120	150	100	86				1,002
Lake Forest Hospital	41	28	232	113	167	162	220	163	156				1,282
Little Company of Mary Hospital	36	38	81	41	56	38	53	35	33				411
Lorin Industries	22	20	24		22								88
Maine South High School	118	81	120	93	120	87	74	76	66				835
Manchester Tanks	277	148	186	207	194	272	221	224	326				2,055
Museum of Science	57	58	164	135	93	123	57	32	45				764
National Animal Disease Center	106	83	137	102	116	142	110	123	94				1,013
Naval Station Great Lakes	185	130	156	166	135	215	148	127	174				1,436
Northeast Missouri Grain	95	105	103	104	83	74	80	54	35				733
Northwest Community Hospital	240	185	228	248	214	236	205	213	281				2,050
Norwiss Farms	105	99	135	142	189	152	148	104	129				1,203
Onyx Seven Mile Creek Landfill	152	178	284	255	245	307	227	226	249				2,123
Pasadena City College	23	28	30	22	26								129
Presbyterian Homes	63	51	113	58	53	59	50	41	42				530
Resurrection Hospital	55	47	115	121	92	71	75	43	42				661
Rochester Wastewater Treatment Plant	113	77	146	99	106	139	80	77					837
S. C. Johnson		59	80	80	68	79	70	57	70				563
SmithField Foods	37	29	66	44	48	30	43	37	34				368
St Francis Hospital	63	51	84	47	72	78	42	22	36				495
St. Mary's Hospital, MN	46	45	91	66	73	56	50	48	52				527
St. Mary's Hospital, WI	47	27	78	75	59	37	31	27	44				425
Spectrum Health													
U.S. Energy Partners	31	28	57	33	35	33	24	21	34				296
UIC- East Campus	57	77	121	71	40	57	52	38	38				551
UIC-West Campus	37	39	73	57	34	53	28	31	65				417
University of Iowa	75	84	125	122	101	124	98	95	94				918
University of Michigan													
Utilimaster Corporation													-
Vestil Manufacturing	97	79	112	91	110	122	153	106	99				969
Winnenago County Sheriff's Office		58	108	71	94	81	98	60	61				631
Total Project Profiles Total	**4,078**	**3,856**	**6,474**	**5,163**	**5,213**	**5,225**	**4,943**	**4,093**	**4,297**	-	-	-	**43,342**
Other RACs													
Alaska Village Electric Coop Anvik	50	46	69	43	52	35	33	31	29				388
Alaska Village Electric Coop Grayling	56	48	62	48	59	42	44	40	50				449
BMW	57	82	99	53	57	59	66	92	46				611
Bristle-Myers Squibb	53	43	62	42	47	38	31	34	31				381
Central Connecticut State University	56	51	67	73	117	59	64	81	41				609
Chambers County	162	183	173	267	139	113	216	167	161				1,581
Colby College	47	57	70	73	116	61	49	79	38				590
Columbia Energy	71	58	88	50	54	53	41	35	49				499
Colorado Pork	74	57	72	62	69	30	30	28	32				454
Cooper Tire													
Corn Products	55	61	96	53	62	76	49	37	58				547
COX Interior	84	57	117	53	76	80	64	60	50				641
East Bay Municipal Utiltiy District	168	90	129	151	108	62	90	109	115				1,022
Encore Landfill	107	59	123	65	117	103	70	59	78				781
Essex Junction Waterwater Treatment Facility	44	33	45	38	45	25	26	25	30				311
Fort Bragg	64	72	140	74	84	122	64	75	89				784
Golovin City		58	55	61	69	45	34	35	35				392
Green Mountain Coffee Roasters	60	97	117	137	122	101	67	89	127				917
Herbec Plastics	60	43	57	55	76	38	39	39	58				465
Homan Lumber													
Ina Road Water Pollution Control Facility	48	72	78	68	88	71	123	115	40				703
Johnson & Johnson	201	112	204	274	180	167	176	35	37				1,386
Joseph Gallo Farms	395	276	395	435	364	598	351						2,814
Kokhanok City	56	51	47	46	58	39	37	39	45				418
Kongiganak City	69	38	51	47	61	33	32	39	37				407
Kwigillingok	69	47	54	50	68	34	26	44	35				427
LaFarge Gypsum	68	64	96	51	60	49	49	82	72				591
McShan Lumber													
Network Appliance Data Center	76	62	109	77	140	125	70	164	123				946
Nevada Hotel Casino	68	67	61	62	92	58	51	61	74				594
New Belgium Brewery	66		92	90	91	102	75	61	80				657
Notre Dame Long Term Care	48	42	54	51	48	46	39	35	40				403
One Market Plaza	54	58	89	71	124	119	62	46	36				659
Ritz Carlton	79	57	61	72	93	55	57	72	89				635
Santa Margarita Wastewater Treatment Plant	48	42	66	62	61	43	41	41	42				446
Santa Rita Jail	170	141	197	126	235	237	255	214	201				1,776
Sierra Nevada Brewery	132	150	141	147	105	173	122	85	77				1,132
Shands Hospital	60	60	99	59	57	50	39	36	47				507
South Oaks Hospital	50	42	67	71	67	56	45	37	46				481
South Mississippi Correctional Facility													
SP Newsprint	66	78	104	48	71	90	60	72					
Stevens Village Council	51	46	63				33	38	34				265
Tesoro Petroleum	93	66	59	66	110	62	52	60	64				632
The Inside Passage Electric Coop (Angoon)	82	114	99	100	114	66	112	76	52				815
University of California, Berkeley			1										1
University of Montana	128	70	72	107	107	194	158	222	140				1,198
University of North Carolina	77	58	115	66	72	93	73	84	66				704
University of California, San Diego													
Utah State University	58	65	43	42	54	37	29	27	41				396
Valley Medical Center	48	36	45	41	46	63	103	31	29				442
Vander Haak Dairy	115	83	108	106	85	58	84	71	75				785
Vinyard 29	81	96	105	56	116	123	85	84	73				819
Wadeland Dairy	84	74	45	50	61	75	52	53	51				545
Waldbaum's Supermarket	323	351	930	693	290	244	849	666	602				4,948
William College	49	44	48	54	63	40	29	66	28				421
Total Project Profiles of Other RACs	**4,280**	**3,757**	**5,439**	**4,686**	**4,650**	**4,342**	**4,446**	**3,871**	**3,493**	-	-	-	**38,964**
							4,446	**3,871**	**3,493**	11,810			
Grand Total of All Project Profiles (MAC + Others)	**8,358**	**7,613**	**11,913**	**9,849**	**9,863**	**9,567**	**9,389**	**7,964**	**7,790**	-	-	-	**82,306**
Resource Guide													
2,003	599	456	719	890	673	828	555	642	458				
2,005	2,215	2,389	3,329	3,322	3,020	3,023	2,437	2,878	2,726				
Total	**2,814**	**2,845**	**4,048**	**4,212**	**3,693**	**3,851**	**2,992**	**3,520**	**3,184**	-	-	-	**31,159**
Hospitals Resource Guide	**2,108**	**3,011**	**3,215**	**2,673**	**1,793**	**341**	**723**	**426**	**380**				**14,670**
IL Premitting Guidebooks													
A	205	136	320	174	211	224	250	180	229				
B	157	87	183	118	107	64	65	53	71				
Calculator	149	127	146	94	112	102	64	91	96				
Total	**511**	**350**	**649**	**386**	**430**	**390**	**379**	**324**	**396**	-	-	-	**3,815**
Energy Use in Future Dry-Mill Ethanol Plants	**151**	**214**	**157**	**172**	**116**	**76**	**132**	**153**	**130**				**1,301**
Global Warming Impact of Corn Ethanol Production	**134**	**129**	**160**	**142**	**188**	**120**	**111**	**110**	**93**				**1,187**
Potential Use of IL Coal in Dry-Mill Ethanol Plants	**70**	**97**	**118**	**53**	**49**	**48**	**26**	**30**	**55**				**546**
CHP Application in Ethanol Plants	**40**	**35**	**71**	**64**	**69**	**34**	**31**	**63**	**32**				**439**
Others													
Mich. Water Env. Asso. Biosolids Wksh. (090303_Haefke)	**230**	**256**	**306**	**321**	**272**	235	164	202	183				**2,169**
Dubuque Iowa Biomass Conf													
080717 Haefke 1	137	130	257	217	192	116	85	62	66				**1,262**
080717 Haefke 2	164	222	171	165	136	279	111	95	82				**1,425**
Total	**301**	**352**	**428**	**382**	**328**	**395**	**196**	**157**	**148**				**2,687**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2010

	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Waste to Energy Workshop for the Illinois Electric Cooperatives (Springfield, IL; 10/20/09)													
Haefke 1	61	52	80	59	36	73	27	25	40				453
Haefke 2	45	32	43	33	44	33	27	25	24				306
Hammond	59	158	43	38	61	41	49	29	28				506
Hartel	41	41	41	30	37	24	25	26	20				285
Kennebck	103	80	52	31	43	37	22	26	37				431
O'Neil 1	61	59	49	35	46	36	26	39	29				380
O'Neil 2	343	462	434	132	134	254	110	207	139				2,215
Solomon	85	33	127	35	40	108	19	21	33				501
Andreson	64	57	71	36	44	51	25	33	64				445
Brochure	15	36	42	37	44	28	34	33	33				302
Agenda	38	44	42	46	53	36	55	43	41				398
Speakers Bio	56	48	60	46	60	37	52	51	36				446
Total	**971**	**1,102**	**1,084**	**558**	**642**	**758**	**471**	**558**	**524**				**6,668**
Waste-to-Energy Workshop (Wooster, OH; 4/7/09)													
Schanbacher	1554	1199	1654	980	1012	779	618	726	661				9,183
Dvorak	300	352	402	549	391	224	189	218	232				2,857
McDonald	111	75	65	36	35	29	52	29	32				464
Kasper	51	38	53	37	48	30	26	31	25				339
Brown	134	191	597	118	89	45	92	139	114				1,519
Weaver	46	30	100	37	36	28	29	24	27				357
O'Loughlin	35	32	39	33	48	27	27	33	53				327
Berlekamp	38	63	39	39	53	29	25	40	28				354
Maringer	102	88	125	56	41	30	58	69	59				628
Kurtz	45	66	44	38	95	28	46	144	48				554
Arnold	41	31	63	35	47	30	28	30	25				330
Goodge	72	45	52	56	72	67	41	51	65				521
Sutor	42	32	35	37	39	28	28	29	33				303
Monhemius	136	139	169	109	73	120	47	41	41				875
Speakers Bio	105	96	127	81	139	101	116	100	98				963
Agenda	92	65	73	65	64	50	70	61	58				598
Brochure	86	97	98	58	65	82	66	55	60				667
Directions													-
Total	**2,990**	**2,639**	**3,735**	**2,364**	**2,347**	**1,727**	**1,558**	**1,820**	**1,659**	-	-	-	**20,839**
WWTF Workshop (Indianapolis, IN; 05/19/08)													
Downey	45	36	36	30	37	70	21	23	21				319
Scott	109	68	108	66	94	68	24	27	57				621
Welle	82	45	106	43	39	34	49	43	29				470
Haefke	77	85	72	37	34	29	51	39	59				483
Griffin	108	66	60	54	40	25	27	106	31				517
Karafa	75	215	168	140	118	102	58	106	75				1,057
Totzke	143	116	108	121	175	158	136	194	114				1,265
Robin	97	77	34	71	124	38	28	29	30				528
Jan Scott	876	774	1082	688	807	721	869	875	932				7,624
Dvorak	43	33	35	35	37	24	21	26	33				287
Cummings	85	31	42	77	38	34	22	71	30				430
Parker	74	133	65	57	59	46	50	30	53				567
Speakers Contact Info	53	47	56	56	76	50	45	51	83				517
Agenda	43	29	86	32	100	23	65	69	28				475
Brochure	8	10	12	11	11	10							62
Directions													-
Total	**1,918**	**1,765**	**2,070**	**1,518**	**1,789**	**1,432**	**1,466**	**1,689**	**1,575**	-	-	-	**15,222**
WWTF Workshop (Elkhart, IN; 05/21/08)													
Downey	136	84	199	133	136	183	103	152	253				1,379
Kline	48	46	34	32	42	41	24	27	35				329
Totzke	73	43	35	31	31	23	55	38	69				398
Wishart	75	93	84	52	39	39	66	62	121				631
Bayer	59	47	48	35	32	26	27	28	36				338
Speakers Contact Info	53	35	42	34	46	23	24	34	55				346
Agenda	42	31	38	38	94	55	39	68	77				482
Total	**486**	**379**	**480**	**355**	**420**	**390**	**338**	**409**	**646**				**3,903**
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)													
Gould	122	192	108	109	117	102	67	108	98				1,023
Safferman	108	115	68	35	44	24	36	70	25				525
Cuttica	54	48	37	39	55	37	46	27	28				371
Stanton	55	37	42	47	36	24	25	27	52				345
Urban	54	44	54	35	38	34	25	26	24				334
Ruswick	40	36	34	31	32	24	23	21	22				263
Parker	58	50	78	34	37	36	53	44	48				437
Fortune	70	57	58	42	98	77	89	42	125				658
Agenda	47	79	90	85	100	60	72	70	74				677
Speakers Bio	69	57	68	64	67	39	63	62	53				542
Flyer													-
Total	**677**	**715**	**637**	**521**	**624**	**456**	**499**	**497**	**549**	-	-	-	**5,175**
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)													
Westerfield	53	44	36	56	36	28	34	47	51				385
Ileleji	53	28	46	63	65	73	39	88	45				500
Cuttica	48	29	42	30	48	22	227	24	24				494
Dvorak	226	215	157	153	167	187	227	167	185				1,684
Larsen	48	84	36	37	50	22	62	75	279				693
McDonald	53	46	47	64	38	42	22	37	66				415
Snodgrass	95	108	131	76	130	181	152	27	67				967
Saum	38	30	35	30	32	24	26	26	25				266
Wagoner	41	36	49	41	46	31	26	60	28				358
Norrick	49	31	32	34	31	33	27	25	25				287
Corso	57	31	37	50	47	21	22	29	26				320
Hay	45	54	34	31	39	23	23	47	23				319
Agenda	111	90	104	90	96	66	89	77	76				799
Speaker Bios	43	37	38	41	42	23	25	29	30				308
Flyer	41	33	46	41	41	55	32	37	29				355
Total	**1001**	**896**	**870**	**837**	**908**	**831**	**1,033**	**795**	**979**	-	-	-	**8,150**
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 01/31/07)													
Ward	47	29	40	32	35	21	24	26	49				303
Elder	49	32	35	38	40	23	25	26	25				293
Schanbacher	180	199	316	166	277	198	160	150	240				1,886
Cuttica	66	36	51	50	35	34	31	47	51				401
Dvorak	47	41	60	56	57	32	43	40	42				418
Moser	65	32	45	38	49	24	23	34	68				378
Mills	67	43	60	48	45	46	41	40	61				451
Arnold	39	30	38	37	37	23	22	25	27				278
O'Loughlin	43	31	43	44	39	25	21	29	25				300
Maringer	57	75	128	55	66	50	48	39	40				558
Kasper	57	32	47	43	49	26	89	33	36				412
Dreve	42	32	40	31	40	27	22	27	26				287
Eschmeyer	49	41	38	32	42	27	21	25	26				301
Gwin	43	32	36	42	38	34	25	32	22				303
Monhemius	47	34	36	34	37	25	25	32	28				298
Zuber	46	33	48	35	41	24	28	27	24				306
Agenda	108	89	97	92	112	71	82	81	75				807
Flyer	46	43	48	35	41	25	31		31				300
Speakers Bio	66	32	42	39	50	31	37	39	68				404
Total	**1,164**	**916**	**1,247**	**947**	**1130**	**766**	**798**	**752**	**964**				**8,684**
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries (Jasper, IN;12/11/06)													-
Book	44	32	33	31	32	22	23	28	23				268
Brown	42	35	36	32	37	25	24	21	24				276
Corso	39	33	36	32	38	22	21	20	21				262
Cuttica	50	35	40	33	50	40	45	53	54				400
Hay	46	33	38	36	42	25	25	23	27				295
Jones	42	35	36	51	41	27	24	30	33				319
McGolden	42	36	39	35	40	24	26	22	22				286
Moser	41	31	33	28	36	28	26	29	28				280
Roger	44	39	33	37	43	26	23	26	34				305
Sievertsen	60	51	31	51	67	52	46	44	35				437
Stinchfield	37	29	31	32	37	32	23	22	18				261
Stwalley	58	52	72	99	65	93	132	121	114				806
Tietz	67	75	37	35	31	22	24	21	20				322
Toenges	39	34	33	29	33	19	29	22	25				263
Walmsley	68	45	45	40	386	58	69	39	66				816
Speakers Contact Information	46	34	38	43	37	33	33	30	34				328
Agenda	40	40	44	46	53	37	51	42	46				399
Flyer	24	38	39	37	38	23	32	25	30				286
Total	**819**	**707**	**694**	**727**	**1,106**	**608**	**676**	**618**	**654**	-	-	-	**6,609**

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY

Midwest Clean Energy Application Center

Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2011 – 1st Quarter
October 31, 2010 through December 31, 2010

Submission Date:
January 31, 2010

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

January 31, 2010

Dear Mr. Renk,

Please find the attached Progress Report for the 1st Quarter of Fiscal Year 2011 (FY2011.Q1) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $117,268.36 for FY2011.Q1:

- October 2010: $52,855.26
- November 2010: $21,775.02
- December 2010: $42,638.08

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q1.11. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during FY2011.Q1.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q1.11 Activity:

- Target Market Workshops and Webinars:
  - Renewable Biogas Energy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency, and Improving Your Bottom Line, November 23, 2010, Onarga, IL – the Midwest RAC co-hosted and co-sponsored a target market workshop for hog farmers and rural electric cooperatives. Over 50% of attendees were target market end users. More info on the workshop can be found at: http://www.chpcentermw.org/11-01_news.html#2010nov23
  - District Energy and Combined Heat & Power: Increasing Energy Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals, November 18, 2010, St. Paul, MN – the Midwest RAC co-hosted and co-sponsored a target market CHP/DE workshop for hospitals, colleges, and communities with IDEA and the MN State Energy Office (nearly 100 in attendance). More info on the workshop can be found at: http://www.chpcentermw.org/11-01_news.html#2010nov18

- Other Workshops/Conferences/Presentations:
  - Clean Energy State Policy Panel, October 6, 2010, Washington DC – the Midwest RAC moderated a panel discussion on state policy at the Annual USCHPA Conference
  - Evolution of Biogas CHP Industry: Gas Engines, Microturbines, CHP System Evolution, October 19, 2010, Des Moines, Iowa – the Midwest presented at the 10th Annual BioCycle Conference.
  - Biogas-to-Energy Potential in Illinois, October 19, 2010, Des Moines, Iowa – the Midwest presented at the 10th Annual BioCycle Conference.
  - Michigan On-farm Anaerobic Digester Operator Handbook – Chapter 13: Combined Heat and Power System Management utilizing Biogas, October 28, 2010, Lansing Michigan – the Midwest RAC presented at Anaerobic Digester Operator Training Program.
  - Combined Heat and Power (CHP) Waste Heat Recovery (WHR) Building a Coalition, November 9, 2010, Conference Call – the MAC presented to the Ohio Manufacturers Association
  - Combined Heat and Power (CHP): Concepts & Technologies, November 18, 2010, St. Paul, MN – the MAC presented at the District Energy and CHP: Increasing Energy Efficiency and Cutting Carbon Emissions in Communities, Colleges, and Hospitals

- Next Steps: How can the RAC assist?, November 18, 2010, St. Paul, MN – the MAC presented at the District Energy and CHP: Increasing Energy Efficiency and Cutting Carbon Emissions in Communities, Colleges, and Hospitals
- Anaerobic Digestion and Biogas Recovery Concepts and Technolgoies Overview, November 23, 2010, Onarga, IL – the MAC presented at "Renewable Biogas Energy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency, and Improving Your Bottom Line"
- Role of DOE Clean Energy Application Centers, December 14, 2010, Columbia, MO – the Midwest RAC presented at the Ohio Manufacturing Competitiveness Workshop: "The Role of Combined Heat & Power and Waste Heat to Energy"
- Illinois CHP Potential, December 14, 2010, Springfield, Illinois – the Midwest RAC presented at the Illinois Energy Assurance Planning Workshop.
- Anaerobic Digesters and Combined Heat & Power (AD/CHP), December 16, 2010, Wheaton, IL – the Midwest RAC presented at the Exploring Waste-to-Energy Technologies Seminar (Halfmoon Seminars)
- Missouri Combined Heat and Power (CHP), December 16, 2010, Columbia, MO – the MAC presented at the Interconnection Symposium: Creating Strong Interconnection Standards in the 2011 Legislature

- Booth Displays:
  - Annual USCHPA Conference
  - District Energy and CHP: Increasing Energy Efficiency and Cutting Carbon Emissions in Communities, Colleges, and Hospitals
  - Renewable Biogas Energy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency, and Improving Your Bottom Line

Deliverable: 3 **Task: 2**

Description: *All educational material developed and utilized in Deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4 **Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory/Policy Workshop:

- In conjunction with the State of Ohio policy activities, the Midwest RAC was the co-sponsor for December 14th workshop hosted by the Industrial Energy Consumers of America (IECA) in Columbus, Ohio. The MAC worked very closely with IECA to develop the program, agenda, and recruit the target audience of Ohio industrials.
- The presentations are available at the IECA website. The presentations will be made available shortly on the Midwest RAC website.
- The Midwest RAC will be providing a follow-up conference call to assist in the organization of a OH CHP Coalition/Initiative during FY2011.Q2.

- RAC Policy Meetings: The Midwest RAC participated and presented at the following RAC Policy Meetings focused on the Target Policy States:
  - October 20, 2010
  - November 19, 2010
  - December 15, 2010

- Target Policy States: The Midwest RAC has been heavily involved in developing an action plan for the State of Ohio titled "State of Ohio Clean Energy Policy Opportunity Document." **This activity has been a highlighted focus for the Midwest RAC and several other RACs working closely with DOE during FY 2010.** The Midwest RAC has been working with several individuals in the State of Ohio helping build an Ohio CHP/WHR Coalition to educate on needed policy and regulatory reform for the CHP / WHR market in Ohio. Four (4) conference calls were conducted during FY2011.Q1:
  - October 15, 2010
  - November 5, 2010
  - December 6, 2010
  - December 22, 2010

- Other States: The Midwest RAC has been working with Renew Missouri environmental group and the Missouri SEO in promoting CHP and WHR in Missouri. The Midwest RAC presented at the Interconnection Symposium: Creating Strong Interconnection Standards in the 2011 Legislature in Columbus, Missouri with efforts to promoting CHP in the State of Missouri.

- Other Activities:
  - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors.
  - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers.
  - U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.

- Midwest Cogeneration Association (MCA) – the Midwest RAC serves on the board of directors for the MAC.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been working on the redevelopment of the RAC websites during FY2011.Q1. Cliff Haefke serves as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. The current initiative of the team is to develop a coordinated effort in converting the RAC websites from "CHP" to "clean energy." All 8 RACs now have updated "clean energy" websites.
- The Intermountain RAC developed templates for RAC documents (i.e. reports, presentations, etc.) in which the RACs provided comments on.

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2011.Q1 Midwest RAC Website Traffic Report.

Website Highlights:

- Web site traffic during the period was over 410,800 hits.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 8.73 million hits.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 196,600. Since launching the Web site over 3.36 million PDF documents have been viewed / downloaded from the Web site.
- During FY2011.Q1, the number of distinct computers that logged on to the Web site at least once during the period was as high as 7,040 per month and averaged over 6,620.
- Data transferred by the Web site visitors during the period was as high as 26 Gigabytes per month and totaled 76 Gigabytes. Since launching the Web site, over 1,325 Gigabytes of data have been transferred from the Web site.

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group have been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites (expected website launch in December 2010)

- Project Profiles in development: eight project profiles were in development during FY2011.Q1:
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2011.Q1.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
    - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected FY2011.Q1). A presentation of this analysis was given by the Midwest RAC at the Annual BioCycle Conference in Des Moines, Iowa on October 19, 2010.
    - CHP Casebook for Food Processing Facilities (co-sponsored study with Energy Center of Wisconsin). To be completed and published in FY2011.Q2.
    - Ohio CHP Utility Barriers (in conjunction with the Target Policy States). To be published FY2011.Q2.
- Three additional technical studies are being investigated and under consideration to fund during FY 2011:
    - Energy Savings Partnership – Integration of an Ethanol Plant and Dairy Farm Facility

- Update to the 2005 CHP Resource Guide
- CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10 **Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: The Midwest RAC has been collecting installation data and information for ICF International during FY2011.Q1.

Deliverable: 11 **Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- Gundersen Lutheran Hospital, Lacrosse, WI (Phase II) – the Midwest RAC is assisting GL in analyzing CHP for a future hospital expansion, in particular, identifying whether or not, CHP is technical feasible and in addition if the natural gas-fired CHP system can serve as the emergency backup generation to the hospital (similar to the Beloit Memorial Hospital CHP application).
- Bell's Brewery, Galesburg, MI – the Midwest RAC performed a Level 1 CHP analysis for a natural gas-fired CHP system.
- Continental Plaza Office Building, Columbus, OH – the Midwest RAC performed a Level 1 CHP analysis for a natural gas-fired CHP system (part of a larger Energy Efficiency audit).
- Denison University, Granville, OH – the Midwest RAC is performing a Level 1 CHP analysis as a replacement to their current coal-fired boiler.
- Turano Bakery, Chicago, IL – the Midwest RAC was contacted by Turano Bakery to investigate WHR project opportunities.
- Clow Water Systems, Coshocton, OH – the Midwest RAC was contacted by Clow Water Systems to investigate WHR opportunities.
- Rentech, Inc., East Dubuque, IL – the Midwest RAC was contacted by Rentech to investigate CHP opportunities.
- Illinois State University, Normal, IL – the Midwest RAC was contacted by ISU to investigate AD/CHP opportunities.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
  - Green Industry Business Development Program for Organic Waste Processing Facility (partners: Gas Environmental, Global Water & Energy (GW&E), Growing Power) – food waste processing, composting, and AD/CHP to power greenhouses to grow more food product (1-2 MW)

- Packer Engineering, gasifier (crop residue and corn stover) looking to site CHP system (15 kW), Naperville, IL
    - Agricultural Watershed Institute, for a mobile biomass briquetter and distribute biomass briquettes to other biomass CHP projects, partners include John Deere, Packer Engineering, and Archer Daniels Midland
    - Fox Lake Wastewater Treatment Facility, for a 100 kW CHP project utilizing biogas from the anaerobic digester that was otherwise being wasted and flared.
    - Parkland College, 25 kW CHP project on campus using biogas
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that involved in the Clean Energy community in the Midwest region.
- Midwest Cogeneration Association (MCA)
    - Cliff Haefke of the Midwest RAC has been serving as Vice President of the Midwest Cogeneration Association (MCA) since January 2010.
    - John Cuttica participates in the MCA as a Board Member.
    - The Midwest RAC staff attended two MCA Board meetings during FY2011.Q1.

Deliverable: 12 **Task: 5**

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity:

- The Midwest RAC assembled Training Manuals for the six (6) Midwest IACs to assist them with future waste heat recovery future energy audits. These training manuals will be mailed in FY2011.Q2.

Deliverable: 13 **Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for FY2011.Q1.
- See Quarterly Website Report in the Appendix for Midwest RAC website activities.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: The FY2010 RAC Metrics will be completed in FY2011.Q2.

Appendix

The MAC Web Site Traffic Report: October through December 2010

- Web site traffic during the period was over 410,800.hits[1]. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 8.73 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 196,600. Since launching the Web site over 3.36 million PDF documents have been viewed / downloaded from the Web site. Figures 4 and 5 show monthly and annual download data, respectively of the PDF documents.
- During the period, the number of distinct computers that logged on to the Web site at least once during the period was as high as 7,040 per month as shown in Figure 6 and average over 6,620.
- Data transferred by the Web site visitors during the period was as high as 26 Gigabytes per month and totaled 76 Gigabytes as shown in Figure 7. Since launching the Web site, over 1,325 Gigabytes of data have been transferred from the Web site as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded are shown in Exhibits 1 and 2. These include the following:
  - *Project Profiles*: Nearly 20,900 during the period (including over 9,400 of those developed by other RACs)
  - *CHP Resource Guide:* Over 9,600 during the period and over 40,800 YTD
  - *CHP Resource Guide for Hospitals* (Published in March 2008): Over 3,170 during the period and 17,800 YTD
  - *Illinois Permitting Guidebooks (Volumes A, B and Calculator:* Over 1,100 during the period and over 4,900 YTD
  - *Report on* "*Potential Use of IL Coal in Dry-Mill Ethanol Plants*:" 217 during the period and over 760 YTD
  - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:"* 375 during the period and over 1,670 YTD
  - *Report on "CHP Application in Ethanol Plants:"* 52 during the period and 490 YTD
  - *Presentations made at the Workshop on "Renewable Bioenergy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency and Improving Your Bottom Line"* (Held in Onagra, IL on November 23, 2010): Nearly 3,400 during the period and 3,400 YTD

- *Presentations made at the Workshop on "District Energy and Combined Heat & Power: Increasing Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals"* (Held in St. Paul, MN on November 18, 2010): Over 2,740 during the period and 2,740 YTD

- *Presentations made at the Workshop on "Waste Heat Recovery for Electricity and Heat"* (Held in Chicago, IL on September 29-30, 2010): Over 23,800 during the period and 23,800. YTD

- *Presentations made at the Workshop on "Waste to Energy Workshop for the Illinois Electric Cooperatives"* (Held in Springfield, IL on October 20, 2009): Over 2,700 during the period and over 9,300 YTD

- *Presentations made at the Workshop on "Waste-to-Energy Workshop"* (Held in Wooster, OH on April 7, 2009) Over 6,600 during the period and over 27,500 YTD

- *Presentations made at the Workshop on "Energy Saving Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP,"* (Held in Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively): Over 6,300 during the period and 25,400 YTD

- *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies," (Held in Lansing, MI on January 15, 2008): Over 2,000 during the period and nearly 7,200 YTD*

- *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste," (Held in Richmond, IN on May 31, 2007): Nearly 2,800 during the period and over10,900 YTD*

- *Presentations made at the Workshop on "Waste-to-Energy from the Ohio Livestock & Food Processing Industries," (Held in Wooster, OH on January 31, 2007): Over 2,750 during the period and over 11,400.YTD*

- *Presentations made at the Workshop on "Waste-to-Energy Workshop for Indiana's Farm, Food Processing and Wood Industries,"* (Held in Jasper, IN on December 11, 2006): Over 1,940 during the period and over 8,500 YTD

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1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes).

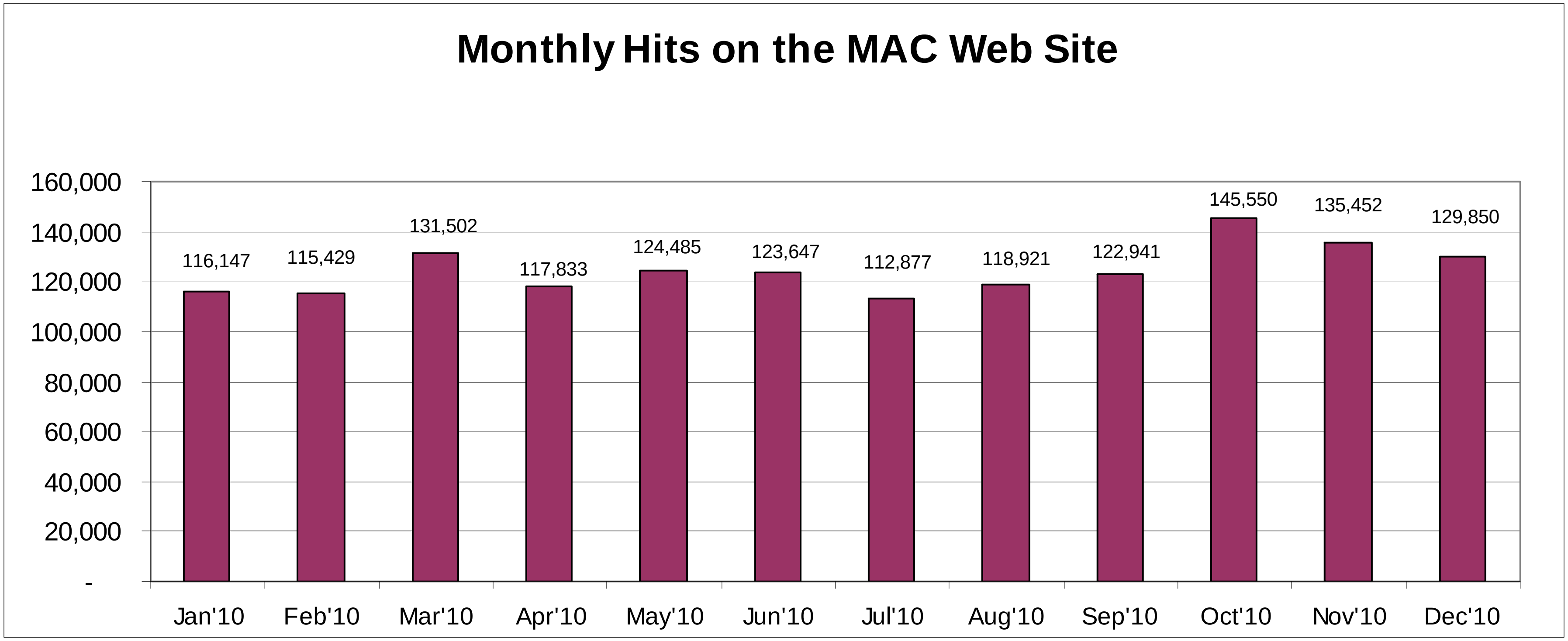

Figure 1: Monthly Hits on the MAC Web Site During 2010

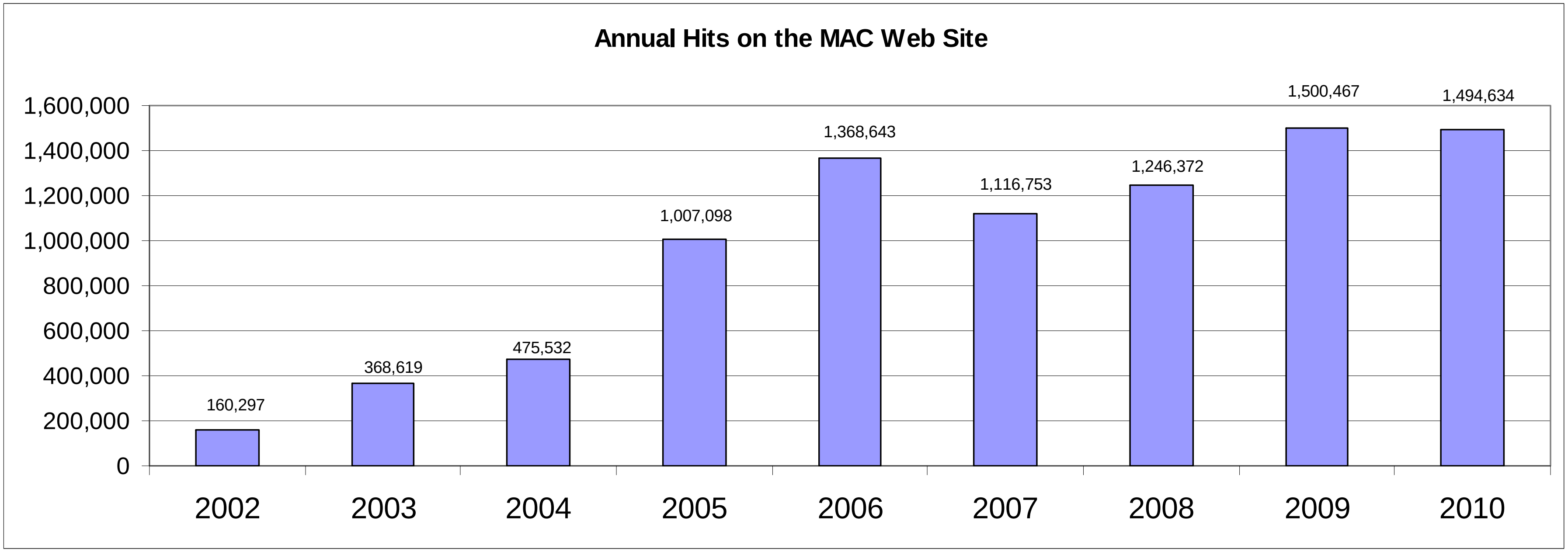

Figure 2: Annual MAC Web Site Hits

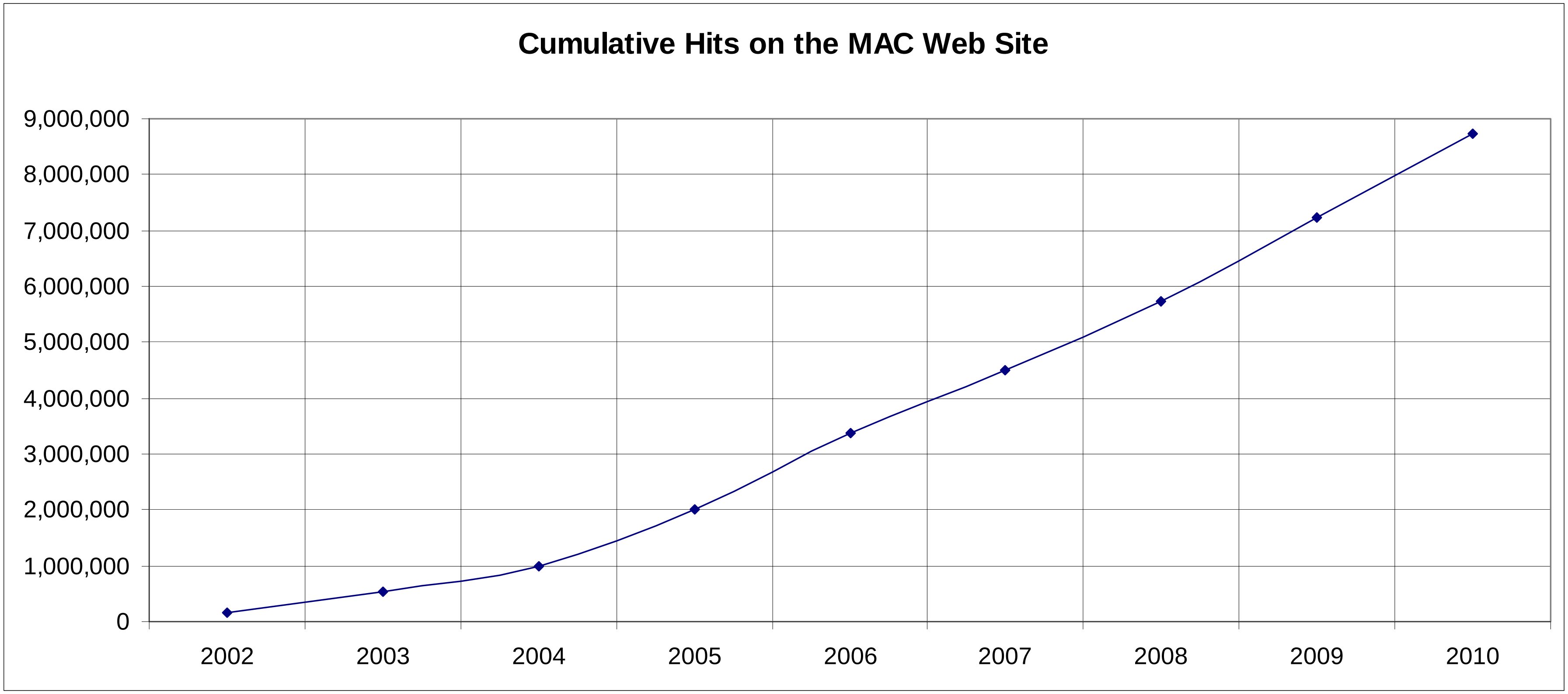

Figure 3: Cumulative MAC Web Site Hits through March 2010

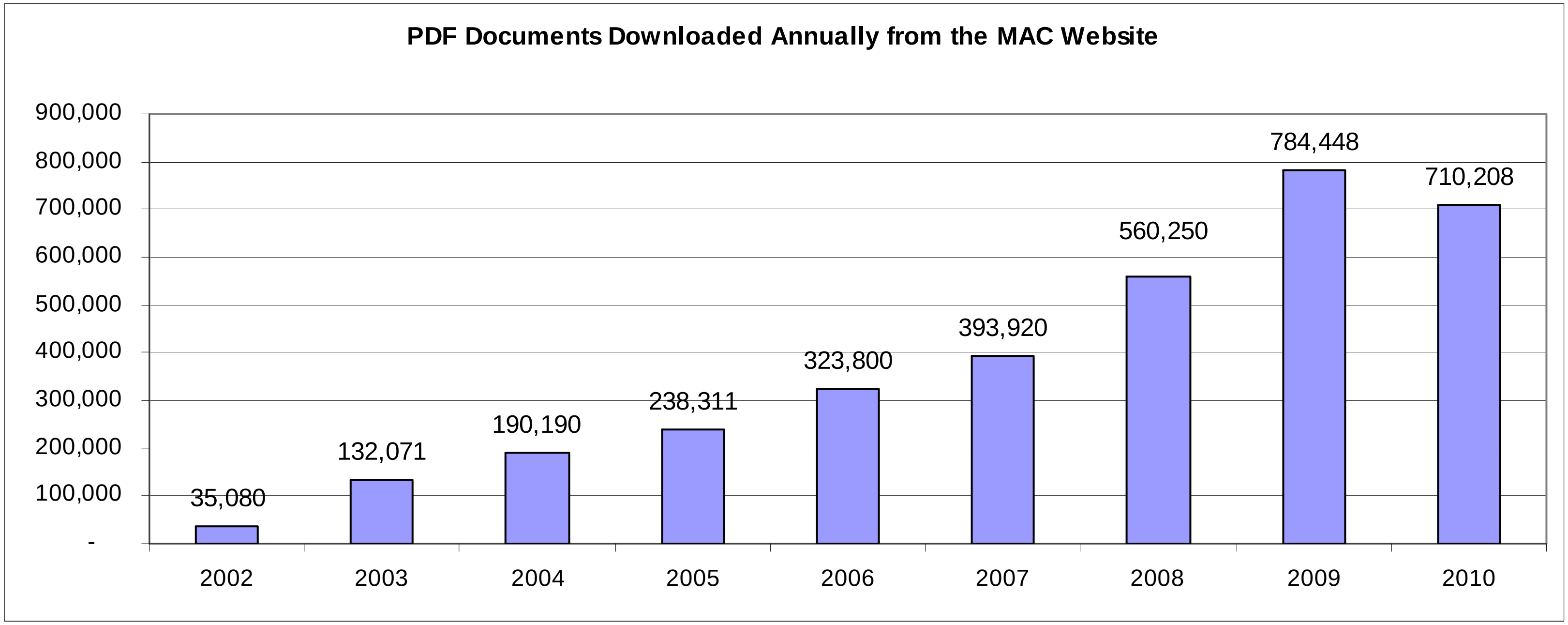

Figure 4: Number of PDF Documents Annually Downloaded from the MAC Web site

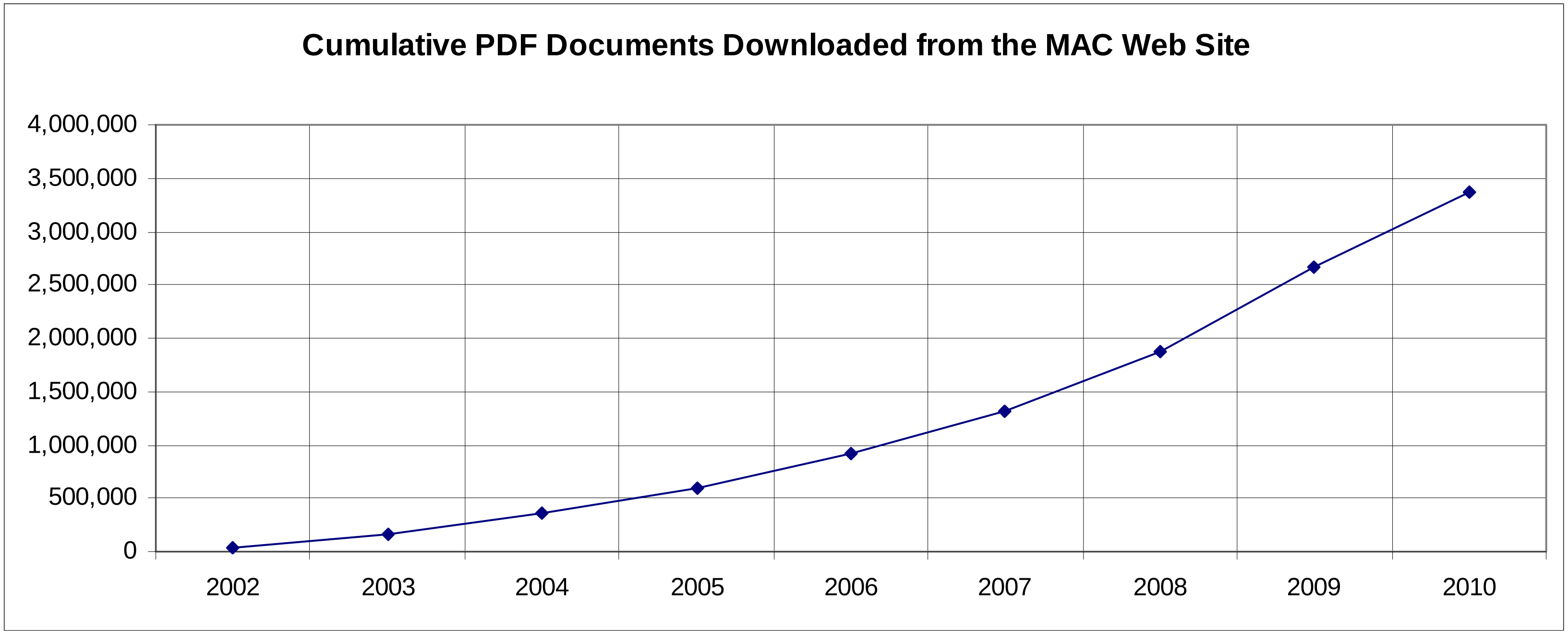

Figure 5: Cumulative Total of PDF Documents Downloaded through March 2010

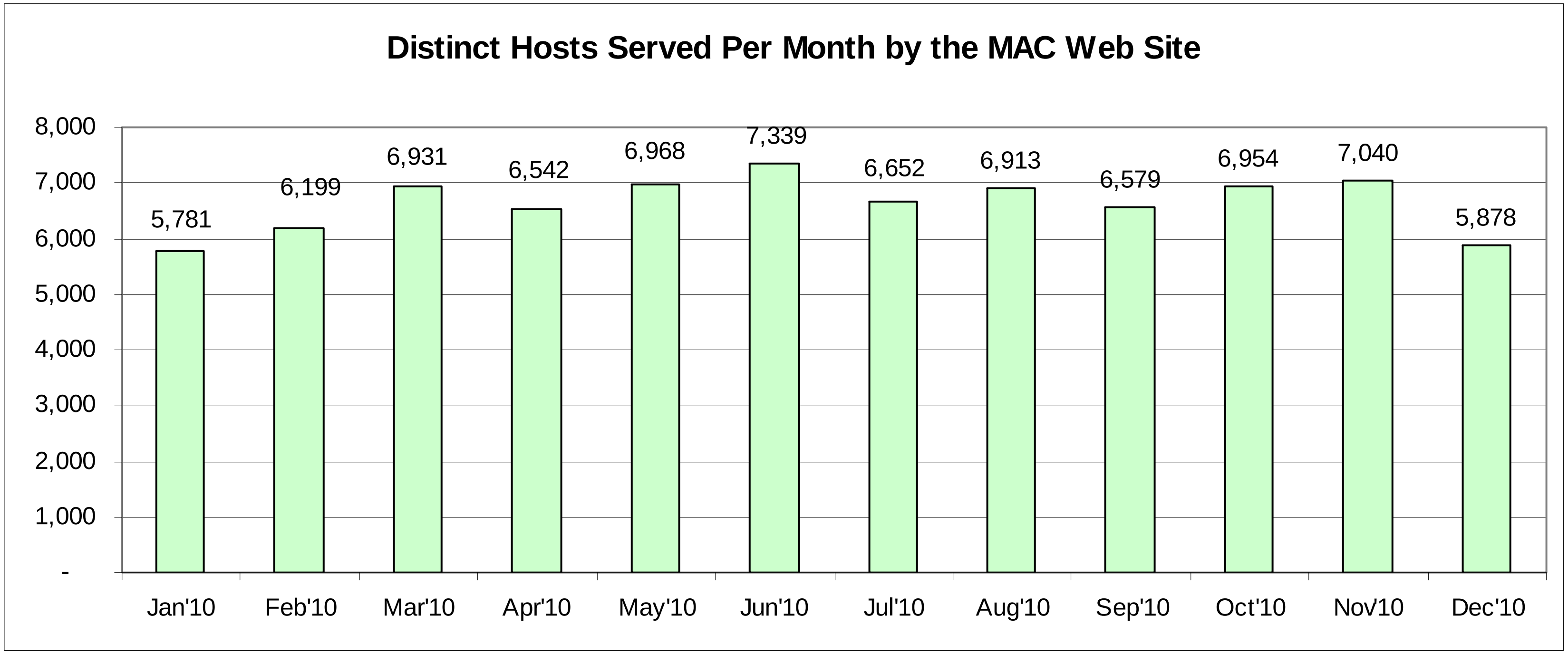

Figure 6: Distinct Computers Accessing the MAC Web Site At Least Once

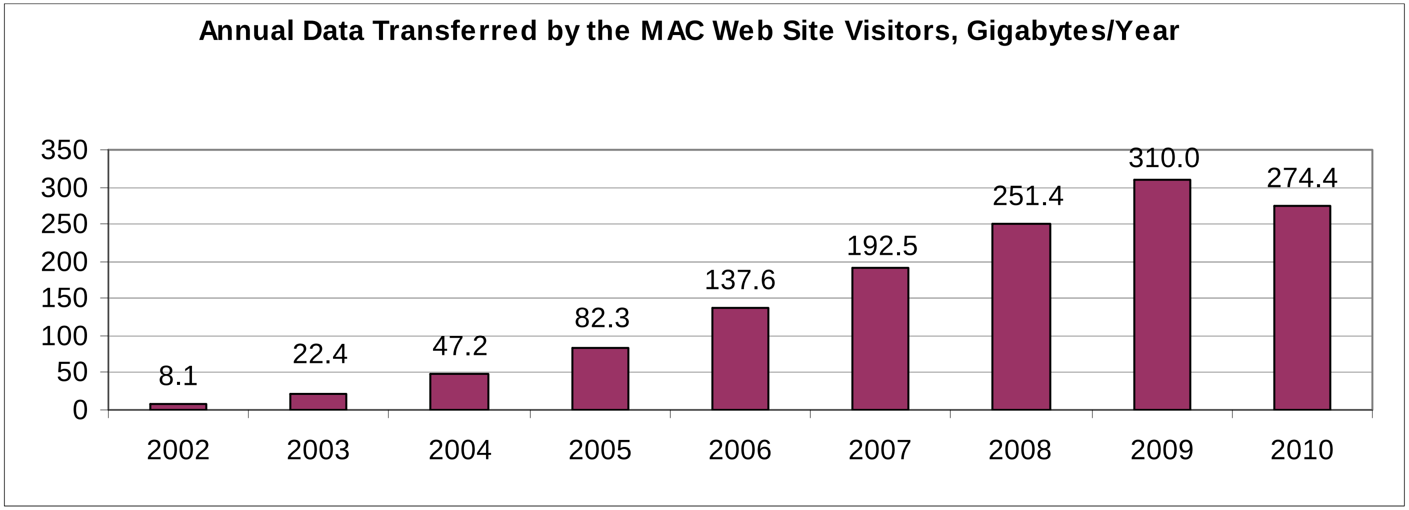

Figure 7: Annual Data Transferred by the MAC Web Site Visitors

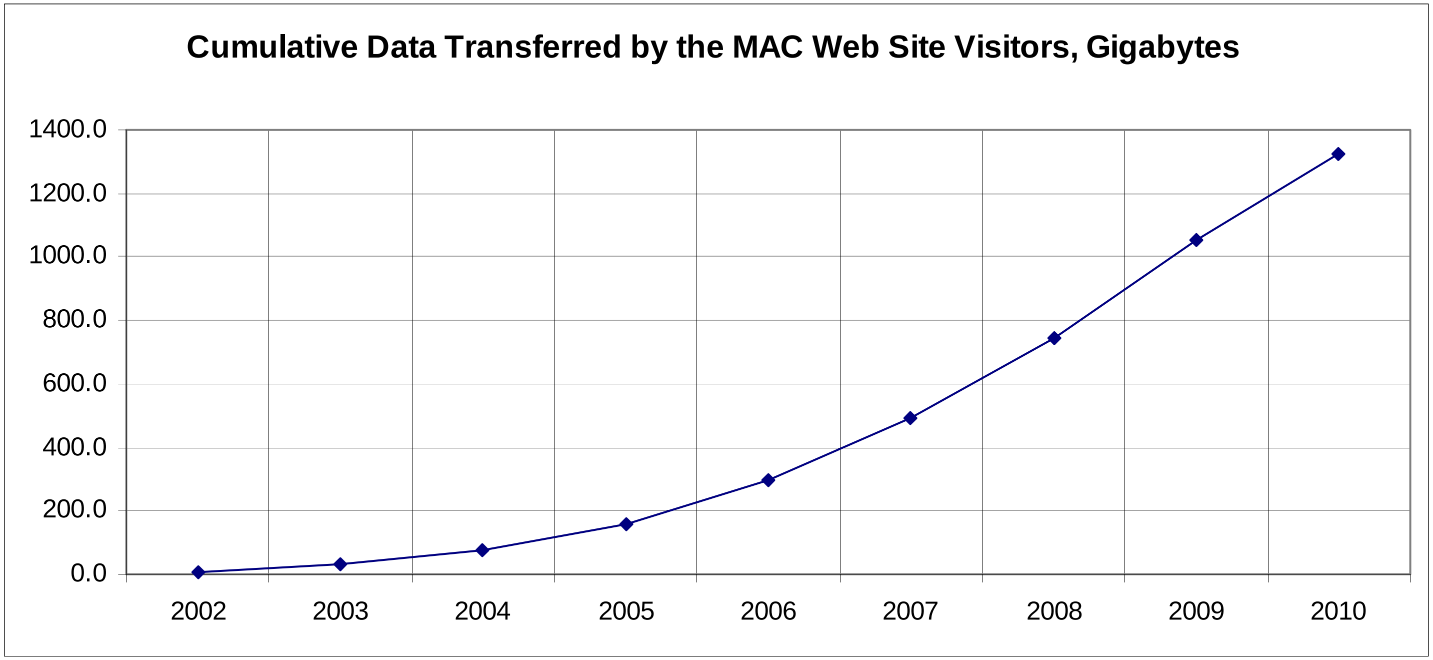

Figure 8. Cumulative Data Transferred by the MAC Web Site Visitors

Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2010

	2010												
	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Project Profiles													
Adkins Energy	41	33	89	49	38	41	39	26	25	43	27		451
Advocate South Suburban Hospital	57	46	105	71	78	56	70		74	62	32		651
Afxantiou Farm	22	31		28	36	31	41	33		28			250
Albert Lea Wastewater Treatment Facility	121	198	234	155	213	243	190	159	154	171	158	146	2,142
Antioch Community High School	79	119	115	71	140	33	49	68	81	90	40	75	960
Barham Farms	40	33	86	46	64	62	72	33	53	47	25		561
Beloit Memorial Hospital	45	50	111	99	86	99	152	78	59	48	36	33	896
Breeden YMCA	34	43	62	81	88	121	164	93	89	52	34		861
Broshco Fabricating Products	142	87	139	112	108	104	97	110	79	100	97	92	1,267
Clover Hill Dairy	178	135	243	248	178	210	152	114	106	190	120	142	2,016
Crave Brothers		97	59	49	51	51	38	52	48	72	97	92	706
Dakota Station	46	27	73	42	60	50	48	46	67	46	21	20	546
East Kansas Agri-Energy	116		154	170	122	162	134	156	201	182	133	100	1,630
Eastern Michigan University													
Elgin Community College	104	82	124	107	147	104	64	66	58	73	74	70	1,073
Elkhart Hospital	138	190	289	210	167	151	145	134	151	92	48	49	1,764
Evanston High School	81	122	163	84	94	77	235	78	52	66	33	59	1,144
Franciscan Sisters	60	31	167	108	88	86	83	41	34	49	49	33	829
Franklin Heating Station	30	39	61	41	83	55	51	59	53	33	44		549
Holiday Inn	52	27	29	29	29	24		36	28	30	44		328
Holsum Dairy	137	131	202	211	174	140	177	209	159	139	148	177	2,004
Holsum Elm Dairy	87	75	108	82	93	74	104	64	74	73	76	93	1,003
Hunter Haven Farms	93	85	107	91	105	91	72	88	73	85	88	88	1,066
Janesville Wastewater Treatment Facility	94	61	132	81	84	70	45	62	80	73	58	80	920
Jesse Brown VA Medical Center	103	95	131	114	146	143	134	108	114	105	124	95	1,412
Laclede Gas Building		87	242	121	96	120	150	100	86	46	34	24	1,106
Lake Forest Hospital	41	28	232	113	167	162	220	163	156	66	45	32	1,425
Little Company of Mary Hospital	36	38	81	41	56	38	53	35	33	41	28		480
Lorin Industries	22	20	24		22								88
Maine South High School	118	81	120	93	120	87	74	76	66	113	92	116	1,156
Manchester Tanks	277	148	186	207	194	272	221	224	326	356	248	156	2,815
Museum of Science	57	58	164	135	93	123	57	32	45	52	27	45	888
National Animal Disease Center	106	83	137	102	116	142	110	123	94	171	119	78	1,381
Naval Station Great Lakes	185	130	156	166	135	215	148	127	174	179	169	162	1,946
Northeast Missouri Grain	95	105	103	104	83	74	80	54	35	46	28	27	834
Northwest Community Hospital	240	185	228	248	214	236	205	213	281	454	32	233	2,769
Norwiss Farms	105	99	136	142	189	152	148	104	129	159	91	111	1,564
Onyx Seven Mile Creek Landfill	152	178	284	255	245	307	227	226	249	278	155	155	2,711
Pasadena City College	23	28	30	22	26								129
Presbyterian Homes	63	51	113	58	53	59	50	41	42	85	43	26	684
Resurrection Hospital	55	47	115	121	92	71	75	43	42	52	33	25	771
Rochester Wastewater Treatment Plant	113	77	146	99	106	139	80	77		80	114	93	1,124
S. C. Johnson		59	80	80	68	79	70	57	70	104	112	87	866
SmithField Foods	37	29	66	44	48	30	43	37	34	47	40		455
St Francis Hospital	63	51	84	47	72	78	42	22	36	39	55		589
St. Mary's Hospital, MN	46	45	91	66	73	56	50	48	31	31	26		563
St. Mary's Hospital, WI	47	27	78	75	59	37	31	27	44	35	32	39	531
Spectrum Health													
U.S. Energy Partners	31	28	57	33	35	33	24	21	34	29	22		347
UIC- East Campus	57	77	121	71	40	57	52	38	38	70	50	36	707
UIC-West Campus	37	39	73	57	34	53	28	31	65	27	30		474
University of Iowa	75	84	125	122	101	124	98	95	94	93	100	80	1,191
University of Michigan													
Utilimaster Corporation													-
Vestil Manufacturing	97	79	112	91	110	122	153	106	99	114	96	84	1,263
Winnenago County Sheriff's Office		58	108	71	94	81	98	60	61	85	108	81	905
Total Project Profiles Total	**4,078**	**3,856**	**6,474**	**5,163**	**5,213**	**5,225**	**4,943**	**4,093**	**4,276**	**4,801**	**3,535**	**3,134**	**54,791**
Other RACs													
Alaska Village Electric Coop Anvik	50	46	69	43	52	35	33	31	29	38	37	28	491
Alaska Village Electric Coop Grayling	56	48	62	48	59	42	44	40	50	41		41	531
BMW	57	82	99	53	57	59	66	92	46	51	52	50	764
Bristle-Myers Squibb	53	43	62	42	47	38	31	34	31	39	29	33	482
Central Connecticut State University	56	51	67	73	117	59	64	81	41	53	42	35	739
Chambers County	162	183	173	267	139	113	216	167	161	110	91	85	1,867
Colby College	47	57	70	73	116	61	49	79	38	49	56	37	732
Columbia Energy	71	58	88	50	54	53	41	35	49	51	51	58	659
Colorado Pork	74	57	72	62	69	30	30	28	32	40	34	34	562
Cooper Tire													
Corn Products	55	61	96	53	62	76	49	37	58	46	47	51	691
COX Interior	84	57	117	53	76	80	64	60	50	77	56	68	842
East Bay Municipal Utiltiy District	168	90	129	151	108	62	90	109	115	150	147	115	1,434
Encore Landfill	107	59	123	65	117	103	70	59	78	71	101	71	1,024
Essex Junction Waterwater Treatment Facility	44	33	45	38	45	25	26	25	30	33	29	39	412
Fort Bragg	64	72	140	74	84	122	64	75	89	78	79	92	1,033
Golovin City		58	55	61	69	45	34	35	35		33	36	461
Green Mountain Coffee Roasters	60	97	117	137	122	101	67	89	127	172	37	45	1,171
Herbec Plastics	60	43	57	55	76	38	39	39	58	50	34	30	579
Homan Lumber													
Ina Road Water Pollution Control Facility	48	72	78	68	88	71	123	115	40	40	41	35	819
Johnson & Johnson	201	112	204	274	180	167	176	35	37	142	154	106	1,788
Joseph Gallo Farms	395	276	395	435	364	598	351	329	402	222	322	201	4,290
Kokhanok City	56	51	47	46	58	39	37	39	45	42	33	36	529
Kongiganak City	69	38	51	47	61	33	32	39	37	42	39	33	521
Kwigillingok	69	47	54	50	68	34	26	44	35	36	36	39	538
LaFarge Gypsum	68	64	96	51	60	49	49	82	72	53	54	49	747
McShan Lumber													
Network Appliance Data Center	76	62	109	77	140	125	70	164	123	81	49	43	1,119
Nevada Hotel Casino	68	67	61	62	92	58	51	61	74	82	83	60	819
New Belgium Brewery	66		92	90	91	102	75	61	80	92	140	84	973
Notre Dame Long Term Care	48	42	54	51	48	46	39	35	40	56	31	28	518
One Market Plaza	54	58	89	71	124	119	62	46	36	81	46	38	824
Ritz Carlton	79	57	61	72	93	55	57	72	89	74	58	33	800
Santa Margarita Wastewater Treatment Plant	48	42	66	62	61	43	41	41	42	48	42	36	572
Santa Rita Jail	170	141	197	126	235	237	255	214	201	203	179	63	2,221
Sierra Nevada Brewery	132	150	141	147	105	173	122	85	77	118	118	119	1,487
Shands Hospital	60	60	99	59	57	50	39	36	47	50	49	52	658
South Oaks Hospital	50	42	67	71	67	56	45	37	46	87	30	27	625
South Mississippi Correctional Facility													
SP Newsprint	66	78	104	48	71	90	60	72		62	66	59	
Stevens Village Council	51	46	63				33	38	34	37	34	33	369
Tesoro Petroleum	93	66	59	66	110	62	52	60	64	71	64	58	825
The Inside Passage Electric Coop (Angoon)	82	114	99	100	114	66	112	76	52	39	38	43	935
University of California, Berkeley			1								1		2
University of Montana	128	70	72	107	107	194	158	222	140	69	49	37	1,353
University of North Carolina	77	58	115	66	72	93	73	84	66	82	113	107	1,006
University of California, San Diego													
Utah State University	58	65	43	42	54	37	29	27	41	57	32	35	520
Valley Medical Center	48	36	45	41	46	63	103	31	29	38	34	31	545
Vander Haak Dairy	115	83	108	106	85	58	84	71	75	79	41	47	952
Vinyard 29	81	96	105	56	116	123	85	84	73	87	39	38	983
Wadeland Dairy	84	74	45	50	61	75	52	53	51	48	86	38	717
Waldbaum's Supermarket	323	351	930	693	290	244	849	666	602	162	48	145	5,303
William College	49	44	48	54	63	40	29	66	28	35	32	28	516
Total Project Profiles of Other RACs	**4,280**	**3,757**	**5,439**	**4,686**	**4,650**	**4,342**	**4,446**	**4,200**	**3,895**	**3,564**	**3,136**	**2,729**	**49,124**
Grand Total of All Project Profiles (MAC + Others)	**8,358**	**7,613**	**11,913**	**9,849**	**9,863**	**9,567**	**9,389**	**8,293**	**8,171**	**8,365**	**6,671**	**5,863**	**103,915**
Resource Guide													
2,003	599	456	719	890	673	828	555	642	458	693	482	578	
2,005	2,215	2,389	3,329	3,322	3,020	3,023	2,437	2,878	2,726	3,145	2,403	2,364	
Total	**2,814**	**2,845**	**4,048**	**4,212**	**3,693**	**3,851**	**2,992**	**3,520**	**3,184**	**3,838**	**2,885**	**2,942**	**40,824**
Hospitals Resource Guide	**2,108**	**3,011**	**3,215**	**2,673**	**1,793**	**341**	**723**	**426**	**380**	**280**	**1,118**	**1,773**	**17,841**
IL Premitting Guidebooks													
A	205	136	320	174	211	224	250	180	229	278	250	87	
B	157	87	183	118	107	64	65	53	71	77	82	70	
Calculator	149	127	146	94	112	102	64	91	96	92	77	96	
Total	**511**	**350**	**649**	**386**	**430**	**390**	**379**	**324**	**396**	**447**	**409**	**253**	**4,924**
Energy Use in Future Dry-Mill Ethanol Plants	**151**	**214**	**157**	**172**	**116**	**76**	**132**	**153**	**130**	**126**	**142**	**107**	**1,676**
Global Warming Impact of Corn Ethanol Production	**134**	**129**	**160**	**142**	**188**	**120**	**111**	**110**	**93**	**169**	**93**	**55**	**1,504**
Potential Use of IL Coal in Dry-Mill Ethanol Plants	**70**	**97**	**118**	**53**	**49**	**48**	**26**	**30**	**55**	**48**	**35**	**134**	**763**
CHP Application in Ethanol Plants	**40**	**35**	**71**	**64**	**69**	**34**	**31**	**63**	**32**		**28**	**24**	**491**
Others													
Mich. Water Env. Asso. Biosolids Wksh. (090303_Haefke)	**230**	**256**	**306**	**321**	**272**	235	164	202	183	292	344	144	**2,949**
										292	344	144	780
Dubuque Iowa Biomass Conf													
080717 Haefke 1	137	130	257	217	192	116	85	62	66	113	66	49	**1,490**
080717 Haefke 2	164	222	171	165	136	279	111	95	82	134	242	58	**1,859**
Total	**301**	**352**	**428**	**382**	**328**	**395**	**196**	**157**	**148**	**247**	**308**	**107**	**3,349**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2010													
	Jan'10	Feb'10	Mar'10	Apr'10	May'10	Jun'10	Jul'10	Aug'10	Sep'10	Oct'10	Nov'10	Dec'10	Total
Renewable Bioenergy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency and Improving Your Bottom Line (Onagra, IL; 11/23/2010)													
Haefke_1												77	77
Haefke_2												290	290
Tegen												365	365
Austin												1,818	1,818
Bastos												355	355
Dalton												128	128
Agenda											115	177	292
Speaker Bios												71	71
Flyer													
Total											115	3,281	3,396
District Energy and Combined Heat & Power: Increasing Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals (St. Paul, MN; 11/10/2010)													
McCollum												26	26
Haefke_1												106	106
Haefke_2												103	103
Thornton												214	214
Spurr												61	61
Haase												54	54
Grant												48	48
Bronson												52	52
Smith												144	144
Malmquist_1												144	144
Malmquist_2												151	151
Pittman												435	435
DeBoer												234	234
Rasmussen												110	110
Burns												105	105
Leoni													
McNary												97	97
Quast												108	108
Walle												94	94
Thomas												36	36
Sohail												38	38
Agenda											113	179	292
Speaker Bios												91	91
Flyer													0
Total											113	2,630	2,743
Waste Heat Recovery for Electricity and Heat (Chicago, IL; 9/29-30/2010)													
Cuttica										440	249	384	1,078
Casten										1,098	651	426	2,175
Sjoding_1										613	1,309	1,178	3,100
Sjoding_2										34	36	31	101
Darrow										376	240	319	935
Mueller										342	229	346	917
Miller										664	1,410	739	2,813
Duncan										567	297	372	1,236
Bullock_1										102	121	133	356
Bullock_2										132	198	96	426
Deyse										272	315	288	875
Hilberg										162	71	60	293
Schaddel										128	180	66	374
Scholz										679	203	155	1,037
Chudnovsky										660	533	599	1,692
Weil										62	109	160	331
Bautista										268	49	126	443
McNeil										41	44	41	126
Thornton										228	146	132	506
McDonell										60	77	49	186
Nix										273	99	122	494
Gemmer/Hedman										965	431	804	2,200
Walker										58	81	46	185
Agenda										151	71	231	453
Speaker Bios										36	86	78	200
Flyer										136	567	639	1,342
Total										8,452	7,802	7,620	23,874
Waste to Energy Workshop for the Illinois Electric Cooperatives (Springfield, IL; 10/20/09)													
Haefke 1	61	52	80	59	36	73	27	25	40	34	27	113	627
Haefke 2	45	32	43	33	44	33	27	25	24	32	32	63	433
Hammond	59	158	43	38	61	41	49	29	28	28	36	36	606
Hartel	41	41	41	30	37	24	25	26	20	29	25	25	364
Kennebeck	103	80	52	31	43	37	22	26	37	34	30	83	579
O'Neil 1	61	59	49	35	46	36	26	39	29	34	31	69	514
O'Neil 2	343	462	434	132	134	254	110	207	139	374	459	392	3,440
Solomon	85	33	127	35	40	108	19	21	33	44	74	101	720
Andreson	64	57	71	36	44	51	25	33	64	56	46	48	595
Brochure	75	36	42	37	44	28	34	33	33	36	32	31	491
Agenda	38	44	42	46	53	36	55	43	41	50	37	35	520
Speakers Bio	56	48	60	46	60	37	52	51	36	46	38	41	571
Total	971	1,102	1,084	558	642	758	471	558	524	797	867	1,057	9,369
Waste-to-Energy Workshop (Wooster, OH; 4/7/09)													
Schanbacher	1,554	1,199	1,654	980	1,012	779	618	726	661	906	1,099	1,039	12,227
Dvorak	300	352	402	549	391	224	189	218	232	442	324	328	3,951
McDonald	111	75	65	36	35	29	52	29	32	46	56	29	595
Kasper	51	38	53	37	48	30	26	31	25	32	41	29	441
Brown	134	191	597	118	89	45	92	139	114	12	124	60	1,715
Weaver	46	30	100	37	36	28	29	24	27	32	30	45	464
O'Loughlin	35	32	39	33	48	27	27	33	53	78	44	37	484
Berlekamp	38	63	39	39	53	29	25	40	28	34	28	26	442
Maringer	102	88	125	56	41	30	58	69	59	36	46	116	826
Kurtz	45	66	44	38	95	28	46	144	48	50	83	30	717
Arnold	41	31	63	35	47	30	28	30	25	31	37	26	424
Goodge	72	45	52	56	72	67	41	51	65	64	59	34	678
Sutor	42	32	35	37	39	28	28	29	33	34	32	28	397
Monhemius	136	139	169	109	73	120	47	41	41	53	185	49	1,162
Speakers Bio	105	96	127	81	139	101	116	100	98	119	105	87	1,274
Agenda	92	65	73	65	64	50	70	61	58	65	60	63	796
Brochure	86	97	98	58	65	82	66	56	60	61	96	121	935
Directions													0
Total	2,990	2,639	3,735	2,364	2,347	1,727	1,558	1,820	1,659	2,883	2,449	2,147	27,518
WWTF Workshop (Indianapolis, IN; 05/19/08)													
Downey	45	36	36	30	37	70	21	23	21	26	36	20	401
Scott	109	68	108	66	94	68	24	27	57	72	54	26	773
Wells	82	45	106	43	39	34	49	43	29	36	42	39	587
Haefka	77	86	72	37	34	29	51	39	59	59	56	26	624
Griffin	108	66	60	54	40	25	27	106	31	34	49	27	627
Karafa	75	215	168	140	118	102	58	106	75	58	64	58	1,237
Tetzlaw	143	116	108	121	175	158	136	194	114	165	148	64	1,642
Robin	97	77	34	71	124	38	28	29	30	33	99	38	698
Jan Scott	876	774	1,082	688	807	721	869	875	932	949	1,065	779	10,417
Dvorak	43	33	35	36	37	24	21	26	33	37	36	24	384
Cummings	85	31	42	77	38	34	22	71	30	36	65	28	559
Parker	74	133	65	57	59	46	50	30	53	57	54	26	704
Speakers Contact Info	53	47	56	56	76	50	45	51	83	68	74	61	720
Agenda	43	29	86	32	100	23	65	69	28	92	30	56	653
Brochure	8	10	12	11	11	10	9	13	18	10	12	21	145
Directions													
Total	1,918	1,765	2,070	1,518	1,789	1,432	1,475	1,702	1,593	1,732	1,884	1,293	20,171
										1,732	1,884	1,293	4,909
WWTF Workshop (Elkhart, IN; 05/21/08)													
Downey	136	84	199	133	136	183	103	152	253	142	309	107	1,937
Kline	48	46	34	32	42	41	24	27	35	49	30	28	436
Tetzlaw	73	43	35	31	31	23	65	38	69	47	56	39	540
Wishart	75	93	84	52	39	39	66	62	121	77	113	60	881
Bayer	59	47	48	35	32	26	27	28	36		50	30	418
Speakers Contact Info	53	35	42	34	46	23	24	34	55	55	43	20	464
Agenda	42	31	38	38	94	55	39	68	77	97	66	34	679
Total	406	379	400	355	420	390	338	409	646	467	667	318	5,355
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)													
Gould	122	192	108	109	117	102	67	108	98	118	219	237	1,597
Safferman	108	116	68	35	44	24	36	79	25	100	114	27	766
Cuttica	54	48	37	39	55	37	46	27	28	42	81	43	537
Stanton	55	37	42	47	36	24	25	27	52	54	41	23	463
Urban	54	44	54	35	38	34	25	26	24	37	28	24	423
Rusewick	40	36	34	21	32	24	23	21	22	26	25	20	334
Parker	58	58	78	34	37	35	53	44	48	57	41	26	561
Fortune	70	57	58	42	98	77	89	42	125	118	87	25	888
Agenda	47	79	90	85	100	60	72	70	74	93	72	68	910
Speakers Bio	69	57	68	64	67	39	63	62	53	64	65	45	716
Flyer													0
Total	677	715	637	521	624	456	499	497	549	709	773	538	7,195
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)													
Westerfield	53	44	36	56	36	28	34	47	51	68	41	32	526
Ileley	53	28	46	63	65	73	39	88	45	46	31	41	618
Cuttica	48	29	42	30	48	22	227	24	24	36	28	28	586
Dvorak	226	215	167	153	167	187	227	167	185	127	324	186	2,321
Larsen	48	84	36	37	50	22	62	75	279	269	141	136	1,238
McDonald	53	46	47	64	38	42	22	37	66	97	52	31	595
Snodgrass	95	108	131	76	130	181	152	27	67	116	65	44	1,192
Saum	38	38	35	30	32	24	25	25	25	30	27	25	348
Wagoner	41	36	49	41	46	31	26	60	28	32	27	29	446
Norrick	49	31	32	34	31	33	27	26	25	33	28	29	377
Corso	57	31	37	50	47	21	22	29	26	35	30	30	415
Hay	45	54	34	31	39	23	23	47	23	32	29	25	405
Agenda	111	90	104	90	96	66	89	77	76	92	73	63	1,027
Speaker Bios	43	37	38	41	42	23	25	29	30	36	29	21	394
Flyer	41	33	46	41	41	55	32	37	29	38	36	32	481
Total	1,001	896	870	837	908	831	1,033	795	979	1,087	961	751	10,949
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 05/31/07)													
Ward	47	29	40	32	35	21	24	26	49	57	39	26	425
Elder	49	32	35	38	40	23	25	26	25	32	28	30	383
Schanbacher	180	199	316	166	277	198	160	150	240	210	237	165	2,498
Cuttica	66	36	51	50	35	34	31	47	51	54	66	29	550
Dvorak	47	41	60	56	57	32	43	40	42	55	50	33	556
Moser	65	32	45	38	49	24	23	34	68	61	47	29	515
Mills	67	43	60	48	45	46	41	40	61	58	54	32	595
Arnold	39	30	38	37	37	23	22	25	27	32	33	25	368
O'Loughlin	43	31	43	44	39	25	21	29	25	34	31	30	395
Maringer	57	75	128	55	66	50	48	39	40	42	57	37	694
Kasper	57	32	47	43	49	26	89	33	36	40	38	37	527
Drew	42	32	40	31	40	27	22	27	26	32	30	20	369
Eschmeyer	49	41	38	32	42	27	21	25	26	26	21	22	370
Gwin	43	32	36	42	38	34	25	32	22	34	37	28	402
Monhemius	47	34	36	34	37	25	25	32	28	34	28	27	387
Zuber	46	33	48	35	41	24	28	27	24	51	27	27	411
Agenda	108	89	97	92	112	71	82	81	75	93	71	67	1,038
Flyer	46	43	48	35	41	25	31		31	93		23	416
Speakers Bio	66	32	42	39	59	31	37	39	68	59	46	29	537
Total	1,164	916	1,247	947	1,130	766	798	752	964	1,096	940	716	11,436
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries													
(Jasper, IN 12/11/06)													0
Book	44	32	33	31	32	22	23	28	23	30	25	22	345
Brown	42	35	36	32	37	25	24	21	24	34	26	21	357
Corso	39	33	36	32	38	22	21	20	21	28	24	26	340
Cuttica	50	35	40	33	50	40	45	53	54	59	49	25	533
Hay	46	33	38	36	42	25	25	23	27	30	24	18	367
Jones	42	35	36	51	41	27	24	30	33	42	24	22	407
McGoldan	42	36	39	35	40	24	26	22	22	28	24	21	359
Moser	41	31	33	28	36	28	26	29	28	33	30	25	368
Roger	44	39	33	37	43	26	23	26	34	35	30	26	396
Sievertsen	60	51	31	51	67	52	46	44	35	71	38	33	579
Stinchfield	37	29	31	32	37	32	23	22	18	27	22	19	329
Stoafley	58	52	72	99	65	93	132	121	114	249	122	83	1,260
Tietz	57	75	37	35	31	22	24	21	26	20	22	20	390
Toenges	39	34	33	29	33	19	29	22	25	30	29	24	346
Walmsley	68	45	45	40	386	58	69	39	66	62	47	26	951
Speakers Contact Information	46	34	38	43	37	33	33	30	34		34	27	389
Agenda	40	40	44	46	53	37	51	42	46	60	42	36	537
Flyer	24	38	39	37	38	23	32	25	30			21	307
Total	819	707	694	727	1,106	608	676	618	660	838	612	495	8,560

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2011 – 2nd Quarter
January 1, 2011 through March 31, 2010

Submission Date:
May 3, 2011

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940

May 3, 2011

Dear Mr. Renk,

Please find the attached Progress Report for the 2nd Quarter of Fiscal Year 2011 (FY2011.Q2) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $108,621.39 for FY2011.Q2:

- January 2011: $31,719.95
- February 2011: $43,024.73
- March 2011: $33,876.71

Below you will find a brief synopsis of our activities (deliverables and tasks) for FY2011.Q2. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during FY2011.Q2.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q1.11 Activity:

- Target Market Workshops and Webinars:
    - The Midwest RAC has been working with the Minnesota Office of Energy Security (MN SEO) to develop the "Waste-to-Energy Workshop for the Minnesota Food Processing & Livestock Industries: Exploring CHP Opportunities" that will be held on May 24th, 2011 in Brooklyn Center, Minnesota. Target Markets = Food Processors and Farmers. More information can be found at: http://www.midwestcleanenergycenter.org/minnesotaCHPfoodprocessing2011/index.html
    - The Midwest RAC has in the beginning stages of identifying a target market for the State of Indiana to hold a workshop in the summer/fall 2011 time period.
    - The Midwest RAC is working with the Midwest Cogeneration Association (regional trade association for cogeneration/CHP) to develop a webinar series titled "Sustaining Operational Efficiency and Effective O&M Strategies for Existing Cogeneration/CHP Applications." This webinar also gained large interest from the DOE Technical Account Managers (TAMs).

- Graduate Level CHP Course: The Midwest RAC is in the midst of teaching a Spring 2011 semester graduate course for the Energy Engineering Masters program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management." The semester course began January 11th and will conclude the week of May 2nd.
    - Module 1 – CHP the Concept (01/11/10)
    - Module 2 – CHP Fuels (01/18/10)
    - Module 3 – Prime Movers 1: Internal Combustion Engines (01/18/10)
    - Module 4 – Prime Movers 2: Gas Turbines and Microturbines (01/18/10)
    - Module 5 – Prime Movers 3: Steam Turbines and Fuel Cells (02/01/10)
    - Module 6 – Generators & Electrical Interconnection (01/25/10)
    - Module 7 – CHP Evaluations (02/22/11)
    - Module 8 – CHP Market Sectors (02/22/11)
    - Module 9 – Desiccant Dehumidifiers (02/08/11)
    - Module 10 – Thermal Distribution Systems and Absorption Chillers (02/08/11)
    - Module 11 – CHP Software Modeling Training (03/01/11)

- Module 12 – Financial and Economic Analysis (02/15/11)
- Module 13 – Global Warming and Carbon Footprinting of Energy Systems (03/08/11)
- Module 14 – CHP Emissions Considerations (03/29/11)
- Module 15 – Biogas Applications – Farm, Food, WWTF (03/15/11)
- Module 18 – Biomass and Fluidized Bed Technologies (03/29/11)

- Other Workshops/Webinars/Conferences/Presentations:
  - CHP Technology for LEADER Plants, March 2nd, 2011, Online Webinar – the Midwest RAC Coordinator Ted Bronson (PEA) presented to the TAM Leaders.
  - MCA Freedom Field Tour, March 31st, 2011, Rockford, IL – the Midwest RAC assisted the Midwest Cogeneration Association (MCA) to host a tour of the "Freedom Field" project.

- Booth Displays:
  - The Midwest RAC developed and manned the booth display for the RACs at the International District Energy Association's 24th Annual Campus Energy Conference on February 22-25, 2011 in Miami, FL.

- Other Activities:
  - The Midwest RAC assisted the Mid-Atlantic RAC identifying and developing target market CHP materials for schools in January 2011.

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in Deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory/Policy Workshop/Webinar:
  - The Midwest RAC conducted a follow-on webinar on February 17th to the December 14th workshop hosted by the Industrial Energy Consumers of America (IECA) in Columbus, Ohio.
  - The Midwest RAC completed follow-up call to assist in the organization of the OH CHP Coalition/Initiative during FY2011.Q2.

- RAC Policy Meetings: The Midwest RAC assisted in the organization and participation of the January 26th RAC Policy Meeting call focused on the Target Policy States.

    - Target Policy States: The Midwest RAC has been heavily involved in developing an action plan for the State of Ohio titled "State of Ohio Clean Energy Policy Opportunity Document." **This activity has been a highlighted focus for the Midwest RAC and several other RACs working closely with DOE during FY2010 and FY2011.** The Midwest RAC has been working with several individuals in the State of Ohio helping build an Ohio CHP/WHR Coalition to educate on needed policy and regulatory reform for the CHP / WHR market in Ohio. The Midwest RAC met numerous times via individual and group conference calls with key stakeholders of the OH CHP Coalition/Initiative.

- Other States:
    - Missouri – The Midwest RAC has been working with Renew Missouri environmental group and the Missouri SEO in promoting CHP and WHR in Missouri. The Midwest RAC commented on Interconnection language that was drafted in January 2011 and submitted February 2011.
    - Indiana – The Midwest provided technical information in relation to Indiana's proposed Feed-In Tariff for renewable energy projects that includes biogas CHP projects.

- Other Activities:
    - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors.
    - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers.
    - U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.
    - Midwest Cogeneration Association (MCA) – the Midwest RAC serves on the board of directors for the MAC and Cliff Haefke serves as Vice President of the MCA.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The Midwest RAC has been working on the redevelopment of the RAC websites during FY2011.Q2. Cliff Haefke serves as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. During FY2011.Q2, the DSIRE database feed and the searchable project profile database was under development.
- The Midwest RAC launched their updated RAC website in January 2011 (www.midwestcleanenergy.org).

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- The MAC was contacted by DOE sponsors in Washington DC to analyze web tracking software for all of the RACs. The Midwest RAC will be working with Avalon Consulting and using the Midwest RAC as the test RAC website.
- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2011.Q2 Midwest RAC Website Traffic Report.

Website Highlights:

- Web site traffic during the period was over 477,000 hits.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 9.2 million hits.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 165,100. Since launching the Web site over 3.53 million PDF documents have been viewed / downloaded from the Web site.
- During FY2011.Q2, the number of distinct computers that logged on to the Web site at least once during the period was as high as 8,539 per month and averaged over 7,620.
- Data transferred by the Web site visitors during the period was as high as 28.2 Gigabytes per month and totaled 82 Gigabytes. Since launching the Web site, over 1,408 Gigabytes of data have been transferred from the Web site.

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group have been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites. The test searchable database was launched in FY2011.Q2 at the Intermountain RAC website.

- Project Profiles in development: eight project profiles were in development during FY2011.Q1:
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2011.Q2.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
    - The Midwest RAC co-sponsored the "Great Lakes Region Food Industry Biogas Casebook" that was published in March 2011 and was developed by the Energy Center of Wisconsin (ECW). The Casebook shares how biogas-to-energy projects present energy cost savings opportunities for food processing facilities. Readers will learn why food and beverage producers have been using anaerobic treatment of their production wastewaters for decades to produce biogas. 12 facilities utilizing anaerobic digesters are profiled in the Casebook with two utilizing the concepts and technologies of CHP. The document can be viewed and downloaded at: http://www.midwestcleanenergycenter.org/events/EventRelated/PDF/FoodIndus_Casebook.pdf.
    - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected FY2011.Q3).

  - Ohio CHP Utility Barriers (in conjunction with the Target Policy States). To be published FY2011.Q3.
  - "Gundersen Lutheran Health System's path to energy independence" – the Midwest RAC is writing an article for the Cogeneration & On-Site Power Production (COSPP) magazine that will be submitted in FY2011.Q3.
- Two additional technical studies are being investigated and under consideration to fund during FY 2011:
  - Update to the 2005 CHP Resource Guide
  - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10	**Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity: The Midwest RAC has been collecting installation data and information for ICF International during FY2011.Q2.

Deliverable: 11	**Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

- City of Monmouth, Monmouth, IL – the Midwest RAC met with the City of Monmouth and submitted a proposal in January 2011 to assist the City in developing and issuing an RFP to develop a biogas CHP project.
- Gundersen Lutheran Hospital, Lacrosse, WI (Phase II) – the Midwest RAC is assisting GL in analyzing CHP for a future hospital expansion, in particular, identifying whether or not, CHP is technical feasible and in addition if a natural gas-diesel dual-fired CHP system can serve as the emergency backup generation to the hospital (similar to the Beloit Memorial Hospital CHP application).
- Denison University, Granville, OH – the Midwest RAC completed a Level 1 CHP analysis investigating the replacement to their current coal-fired boiler (ensuing Boiler MACT regulations).
- Turano Bakery, Chicago, IL – the Midwest RAC was contacted by Turano Bakery in FY2011.Q1 to investigate WHR project opportunities. The analysis has been put on hold until FY2011.Q3.
- Clow Water Systems, Coshocton, OH – the Midwest RAC worked with Clow Water Systems to investigate several WHR opportunities at their facility. The Midwest RAC assisted Clow Water Systems in contacting several turnkey engineering firms.
- Illinois State University, Normal, IL – the Midwest RAC was contacted by ISU in FY2011.Q1 to investigate AD/CHP opportunities. The Midwest RAC had further discussions with ISU during FY2011.Q2 and will assist ISU in issuing an RFI in FY2011.Q3.

- Oberweiss Dairy, North Aurora, IL – the Midwest RAC discussed CHP opportunities with staff at Oberweiss Dairy during FY2011.Q2.
- Met with Six Convert to discuss AD/CHP opportunities and identify potential test facilities.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that are involved in the Clean Energy community in the Midwest region.
- Midwest Cogeneration Association (MCA)
  - Cliff Haefke of the Midwest RAC has been serving as Vice President of the Midwest Cogeneration Association (MCA) since January 2010.
  - John Cuttica participates in the MCA as a Board Member.
  - The Midwest RAC staff attended two MCA Board meetings during FY2011.Q2.
- The Midwest RAC attended the PAWG webinar focused on absorption cooling systems on February 4th, 2011.
- The Midwest RAC has been working with the Association of Illinois Electric Cooperatives (AIEC) on the newly established RenewE program for Illinois coop members interested in investigating the biogas CHP opportunities in 2011 and 2012. The Midwest RAC will be serving as the prime technical advisor in investigating the technical feasibility studies.
- The Midwest RAC has had several conversations with DOE headquarters regarding future technical assistance in relation to the ensuing Boiler MACT ruling.

Deliverable: 12 **Task: 5**

Description: *Provide clean energy technology support to Midwest IACs – one day educational sessions.*

Activity:

- No activity in FY2011.Q2.

Deliverable: 13 **Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL).
- See this quarterly report for FY2011.Q2.

- See Quarterly Website Report in the Appendix for Midwest RAC website activities.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity: The FY2010 RAC Metrics were completed and submitted to Marty Schweitzer of Oak Ridge National Laboratory (ORNL) on February 24th.

Appendix

The MAC Web Site Traffic Report: January through March 2011

- Web site traffic during the period was over 477,000.hits. Figures 1 and 2 show monthly and annual traffic, respectively.
- Cumulative traffic, since launching the Web site in April 2002, now exceeds 9.2 million hits as shown in Figure 3.
- Total number of PDF documents (project profiles, reports, and presentations etc.) viewed/downloaded from the Web site during the period exceeded 165,100. Since launching the Web site over 3.53 million PDF documents have been viewed / downloaded from the Web site. Figures 4 and 5 show the number of PDF documents downloaded monthly and annually, respectively.
- The number of distinct computers that logged on to the Web site at least once during the period was as high as 8,539 per month as shown in Figure 6 and average 7,620.
- Data transferred by the Web site visitors during the period was as high as 28.2 Gigabytes per month and totaled over 82 Gigabytes as shown in Figure 7. Since launching the Web site, over 1,408 Gigabytes of data have been transferred from the Web site as shown in Figure 8.
- Major documents and their number of copies viewed/downloaded are shown in Exhibits 1 and 2. These include the following:
  - *Project Profiles*: Over 20,200[2] during the period (including over 10,900 of those developed by other RACs)

  - *CHP Resource Guide:* Over 7,500 during the period and over 7500.YTD (same as during the period because it is the first quarter of 2011)

  - *CHP Resource Guide for Hospitals* (Published in March 2008): Over 9,500 during the period and 9,500 YTD

  - *Illinois Permitting Guidebooks (Volumes A, B and Calculator:* Over 1,580 during the period and over 1,580 YTD

  - *Report on* "*Potential Use of IL Coal in Dry-Mill Ethanol Plants*:" Nearly 230 during the period and 230 YTD

  - *Report on "Energy Use in Future Dry-Mill Ethanol Plants:"* Nearly 370 during the period and 370 YTD

  - *Report on "CHP Application in Ethanol Plants:"* Over 110 during the period and over 110 YTD.

  - *Presentations made at the Workshop on "Renewable Bioenergy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency and Improving Your Bottom Line"* (Held in Onagra, IL on November 23, 2010): Over 4,800 during the period and over 4,800 YTD

- *Presentations made at the Workshop on "District Energy and Combined Heat & Power: Increasing Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals"* (Held in St. Paul, MN on November 18, 2010): Over 7,490 during the period and 7,490 YTD

- *Presentations made at the Workshop on "Waste Heat Recovery for Electricity and Heat"* (Held in Chicago, IL on September 29-30, 2010): Over 37,500 during the period and over 37,500. YTD

- *Presentations made at the Workshop on "Waste to Energy Workshop for the Illinois Electric Cooperatives"* (Held in Springfield, IL on October 20, 2009): Over 2,780 during the period and over 2,780 YTD

- *Presentations made at the Workshop on "Waste-to-Energy Workshop"* (Held in Wooster, OH on April 7, 2009) Over 7,100 during the period and over 7,100 YTD

- *Presentations made at the Workshop on "Energy Saving Opportunities for Wastewater Treatment Facilities: Energy Efficiency and CHP,"* (Held in Indianapolis, IN and Elkhart, IN on May 19 and 21, 2008, respectively): Over 6,4800 during the period and over 6,480 YTD

- *Presentations made at the Workshop on "Bio-Energy Production through Anaerobic Digester Technologies," (Held in Lansing, MI on January 15, 2008): Over 2,830 during the period and over 2,830 YTD*

- *Presentations made at the Workshop on "Methane Recovery from Farm & Food Processing Waste," (Held in Richmond, IN on May 31, 2007): Over 3,500 during the period and over 3,500 YTD*

- *Presentations made at the Workshop on "Waste-to-Energy from the Ohio Livestock & Food Processing Industries," (Held in Wooster, OH on January 31, 2007): Over 2,450 during the period and over 2,450.YTD*

- *Presentations made at the Workshop on "Waste-to-Energy Workshop for Indiana's Farm, Food Processing and Wood Industries,"* (Held in Jasper, IN on December 11, 2006): Over 1,760 during the period and over 1,760 YTD

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1. ALL Hits (Cannot determine the number of visitors that stayed on the Website for >5 minutes).
2. Does not include those downloaded/viewed from one of the ORNL servers (Not currently available because of a cyber attack)

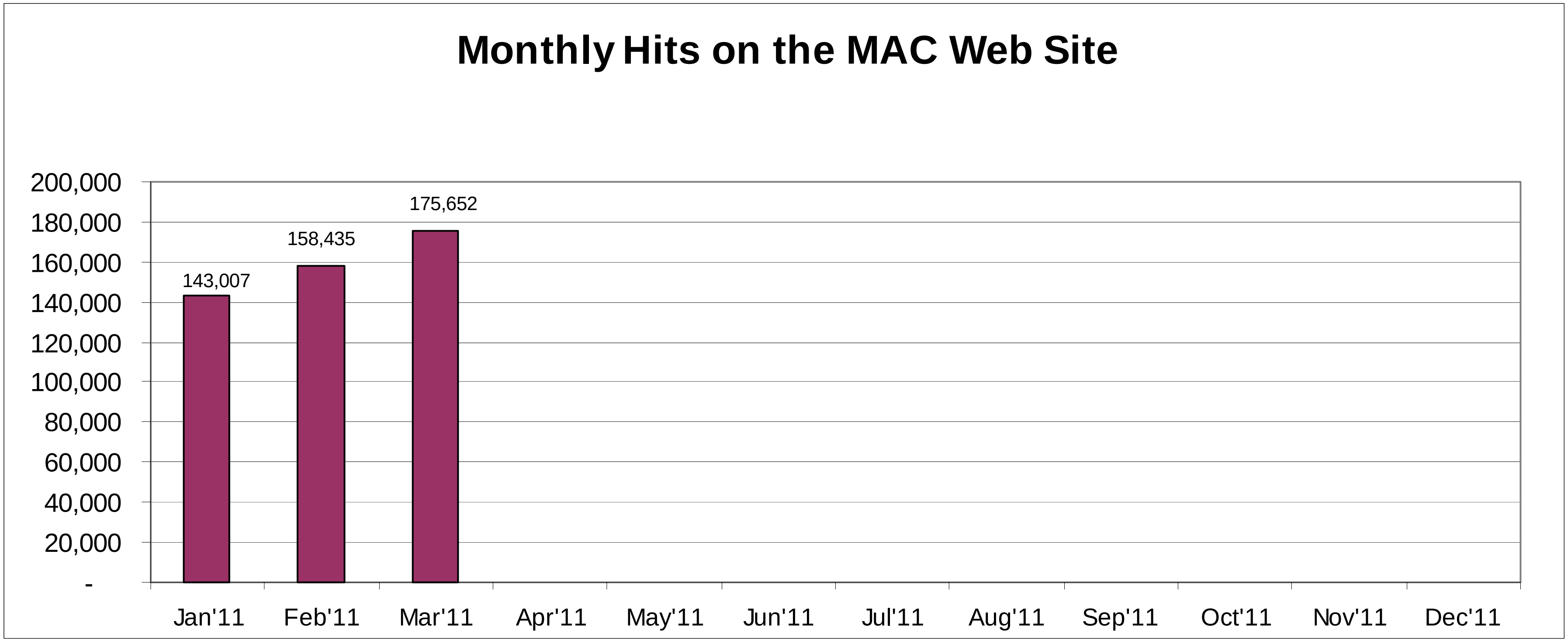


Figure 1: Monthly Hits on the MAC Web Site During 2011

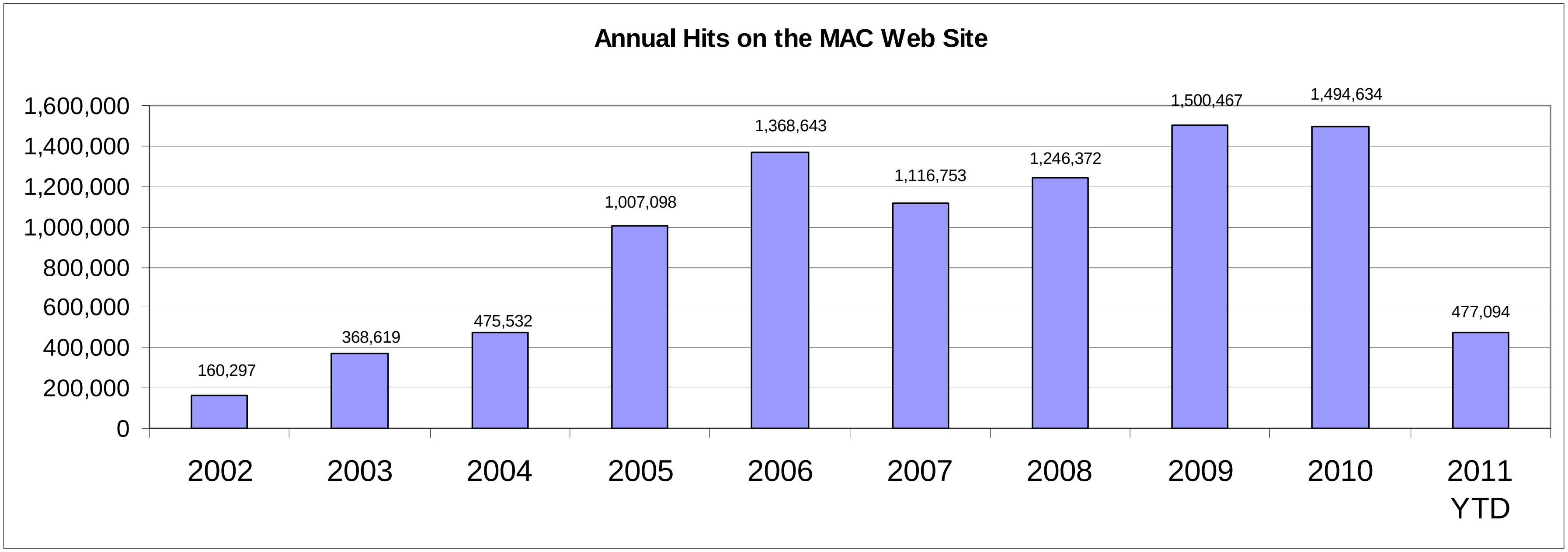


Figure 2: Annual MAC Web Site Hits

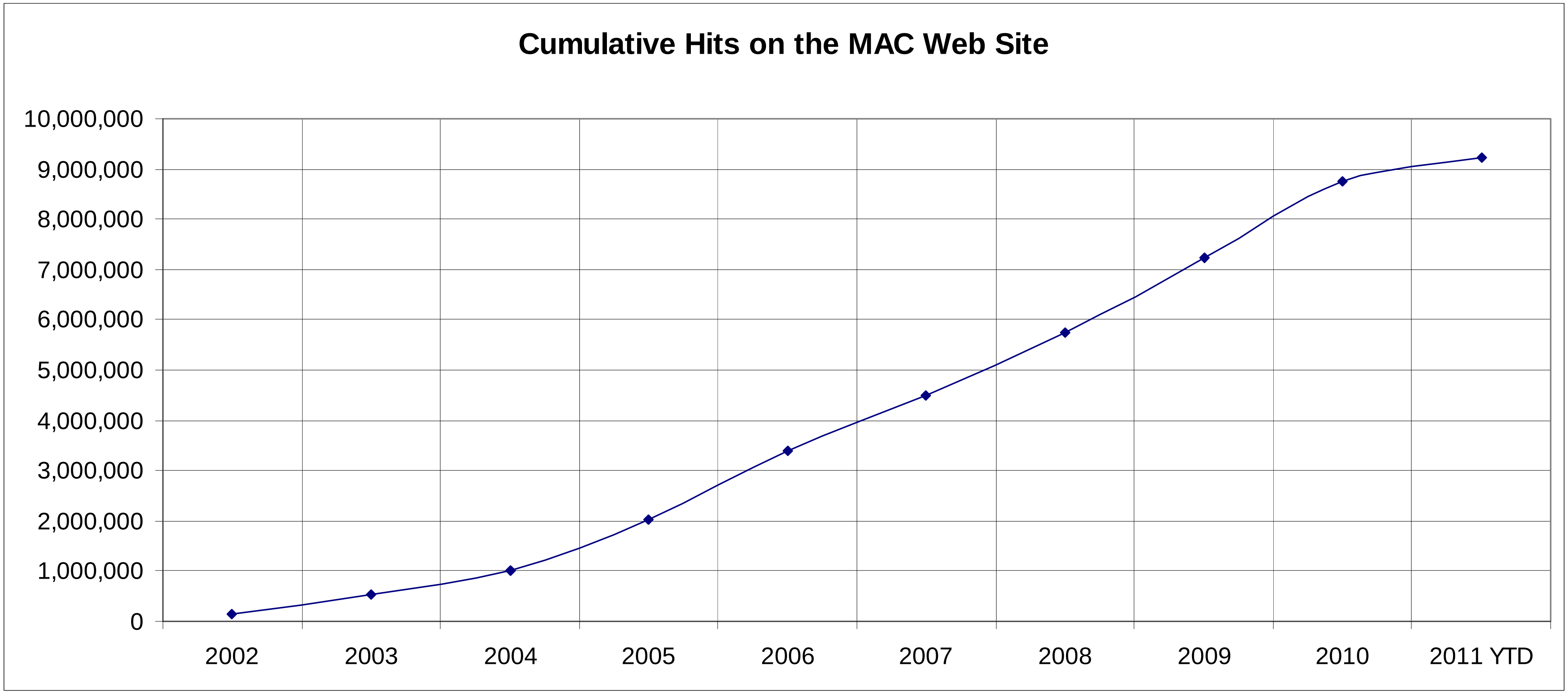


Figure 3: Cumulative MAC Web Site Hits since Launching through YTD 2011

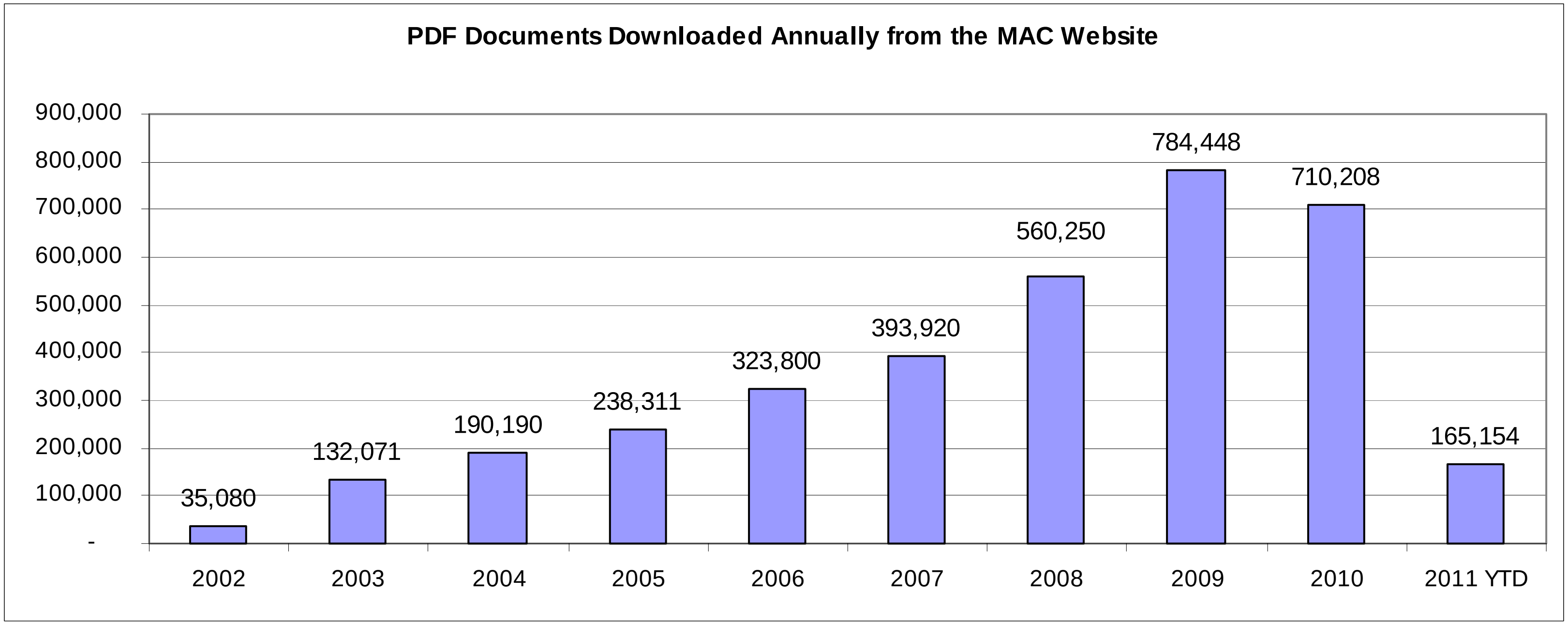


Figure 4: Number of PDF Documents Annually Downloaded from the MAC Web Site

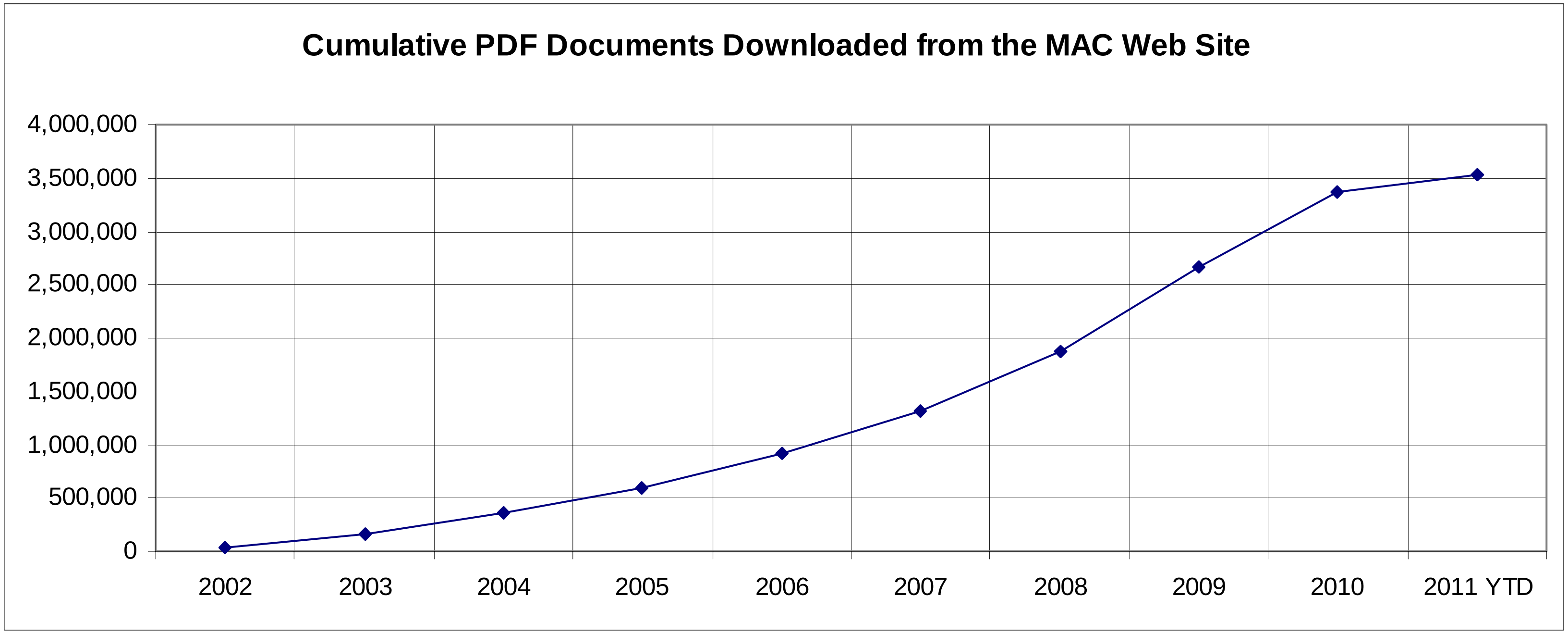


Figure 5: Cumulative Total of PDF Documents Downloaded Since Launching through YTD 2011

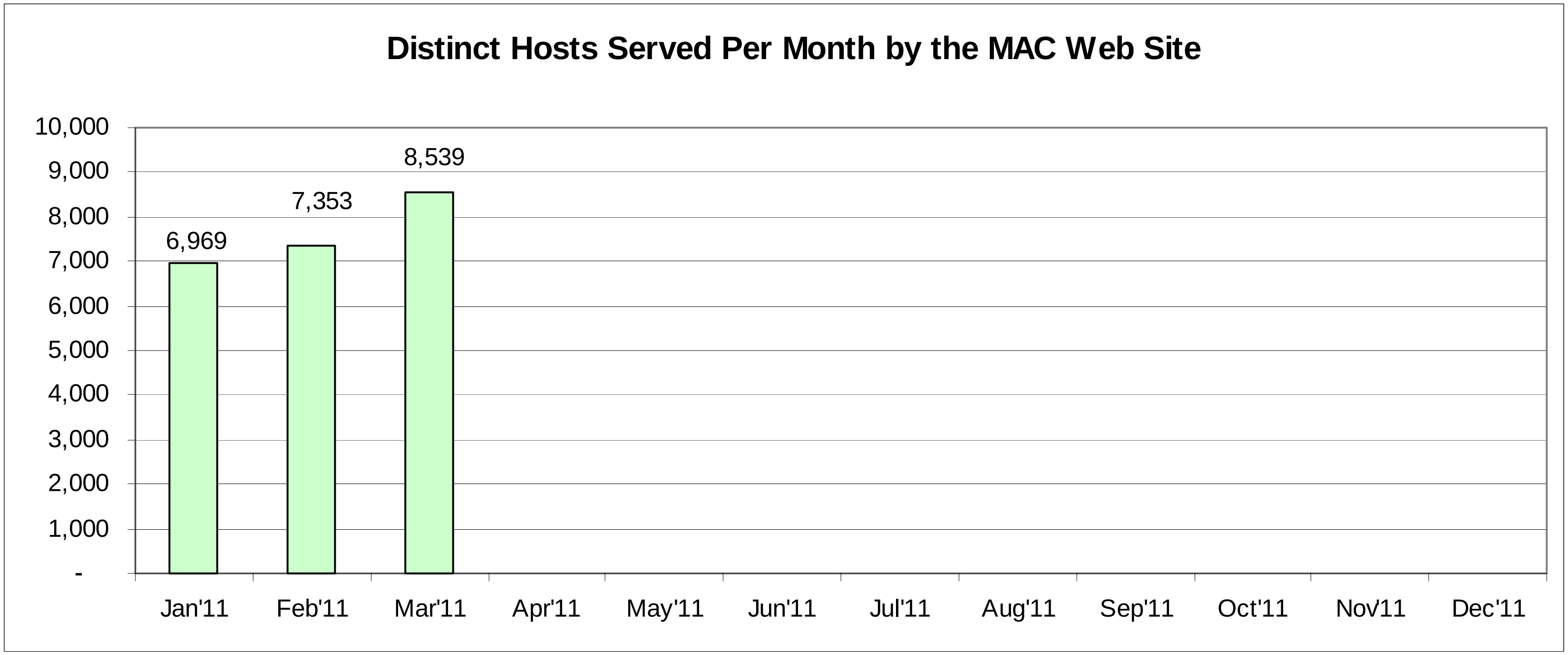


Figure 6: Distinct Computers Accessing the MAC Web Site At Least Once

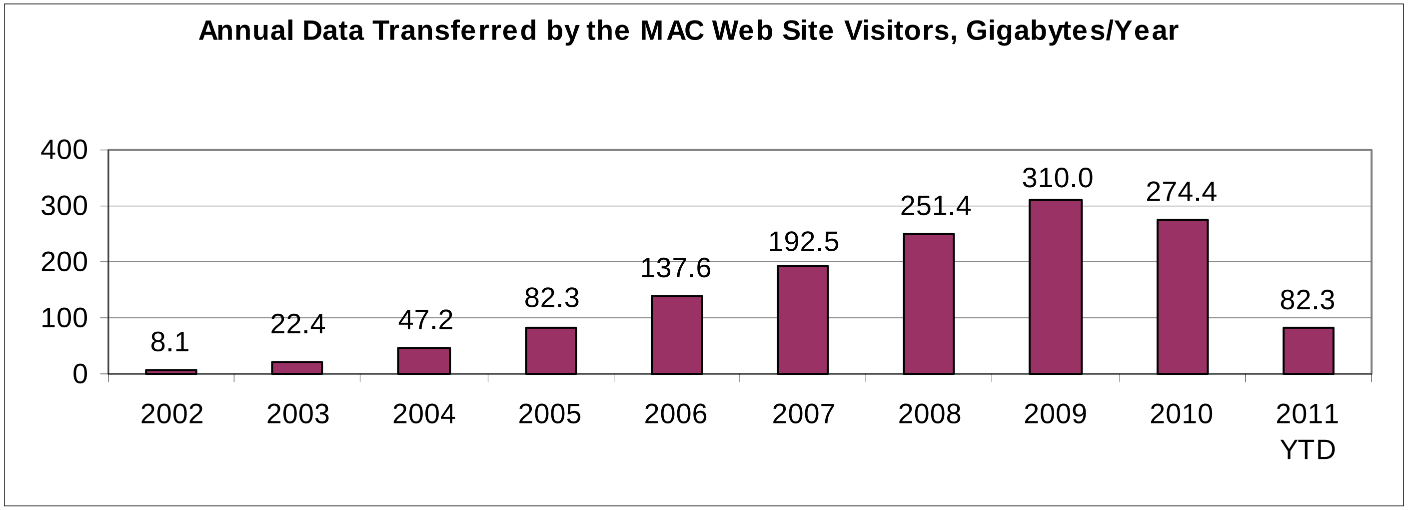


Figure 7: Annual Data Transferred by the MAC Web Site Visitors

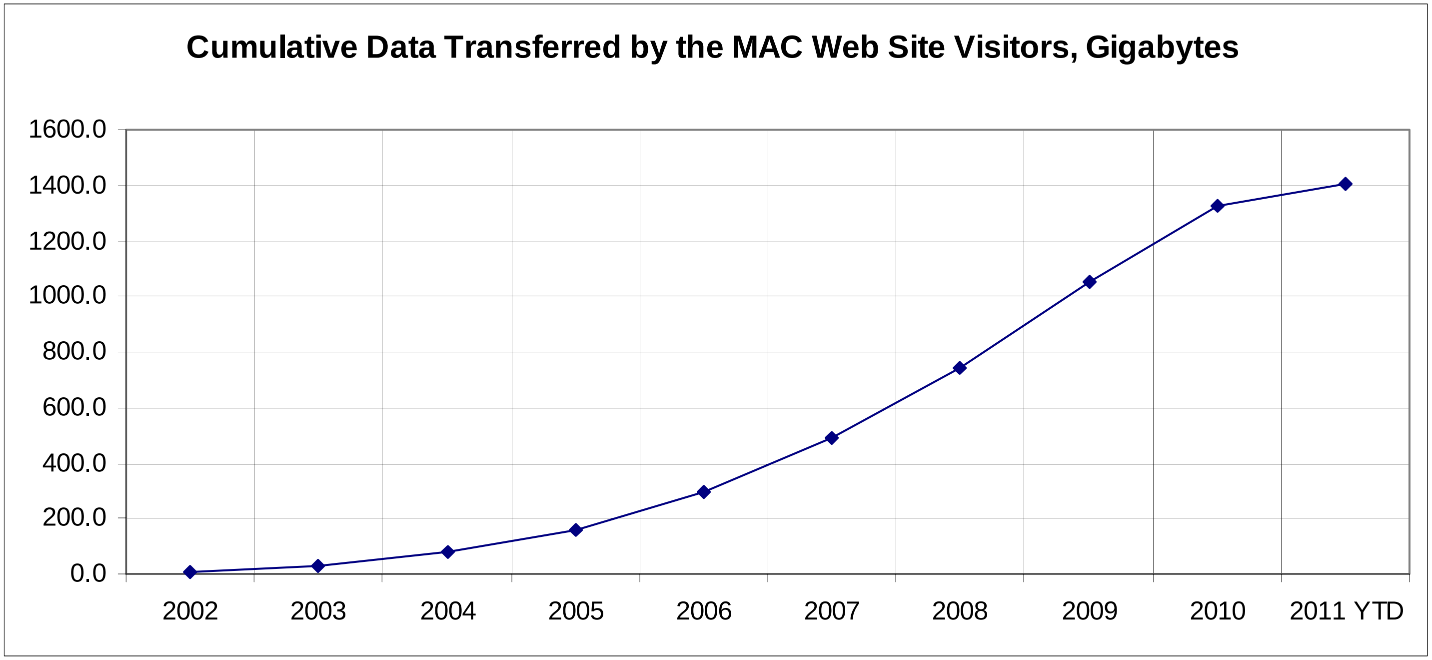


Figure 8: Cumulative Data Transferred by the MAC Web Site Visitors Since Launching through YTD 2011

	Exhibit 1: Project Profiles, Guidebooks and Ethanol Reports Downloaded in 2010												
	---------- 2010 ----------												
	Jan'11	Feb'11	Mar'11	Apr'11	May'11	Jun'11	Jul'11	Aug'11	Sep'11	Oct'11	Nov'11	Dec'11	Total
Project Profiles													
Adkins Energy													-
Advocate South Suburban Hospital													-
Afxantiou Farm													-
Albert Lea Wastewater Treatment Facility	176	186	232										594
Antioch Community High School													-
Barham Farms													-
Beloit Memorial Hospital													-
Breeden YMCA													-
Broshco Fabricating Products	111	105	202										418
Clover Hill Dairy	162	137	228										527
Crave Brothers	134	93	121										348
Dakota Station													-
East Kansas Agri-Energy	130	117	181										428
Eastern Michigan University													
Elgin Community College	62	62	111										235
Elkhart Hospital													-
Evanston High School													-
Franciscan Sisters													-
Franklin Heating Station													-
Holiday Inn													-
Holsum Dairy	171	229	225										625
Holsum Elm Dairy	100	87	122										309
Hunter Haven Farms	95	68	165										328
Janesville Wastewater Treatment Facility	70	108	114										292
Jesse Brown VA Medical Center	91	97	123										311
Laclede Gas Building													-
Lake Forest Hospital													-
Little Company of Mary Hospital													-
Lorin Industries													-
Maine South High School	100	95	118										313
Manchester Tanks	268	182	162										612
Museum of Science													-
National Animal Disease Center	67	110	117										294
Naval Station Great Lakes	167	177	201										545
Northeast Missouri Grain													-
Northwest Community Hospital	195	176	252										623
Norwiss Farms	108	141	171										420
Onyx Seven Mile Creek Landfill	139	166	249										554
Pasadena City College													-
Presbyterian Homes													-
Resurrection Hospital													-
Rochester Wastewater Treatment Plant	87	77	121										285
S. C. Johnson	104	101	105										310
SmithField Foods	87												87
St Francis Hospital													-
St. Mary's Hospital, MN													-
St. Mary's Hospital, WI													-
Spectrum Health													
U.S. Energy Partners													-
UIC- East Campus													-
UIC-West Campus													-
University of Iowa	91	122	122										335
University of Michigan													
Utilimaster Corporation													-
Vestil Manufacturing	88	82	121										291
Winnenago County Sheriff's Office	63	58	86										207
Total Project Profiles Total	**2,866**	**2,776**	**3,649**	-	-	-	-	-	-	-	-	-	**9,291**

Exhibit 2: Workshop/Conference Presentations Downloaded from or Viewed at the MAC Website in 2010

	Jan'11	Feb'11	Mar'11	Apr'11	May'11	Jun'11	Jul'11	Aug'11	Sep'11	Oct'11	Nov'11	Dec'11	Total
Renewable Bioenergy Projects for Swine Producers: Meeting Permitting Requirements, Increasing Energy Efficiency and Improving Your Bottom Line (Onagra, IL; 11/23/2010)													
Haefke_1	23	36	35										108
Haefke_2	79	91	113										283
Hammond	29	40	39										
Tegen	191	310	277										778
Austin	464	54	1932										2,450
Bastra	65	79	123										267
Dalton	44	47	50										141
Agenda	105	96	36										237
Speaker Bios	59	82	70										211
Flyer	89	83	97										269
Total	1,157	918	2,771										4,859
District Energy and Combined Heat & Power: Increasing Efficiency and Cutting Carbon Emissions in Communities, Colleges and Hospitals (St. Paul, MN; 11/18/2010)													
McCollum	18	21	22										61
Haefke_1	61	51	50										162
Haefke_2	60	33	33										126
Thornton	177	85	312										574
Spurr	33	33	35										101
Hasse	33	34	36										103
Grant	34	34	33										101
Branson	37	44	32										113
Smith	313	206	148										667
Malmquist_1	110	42	134										286
Malmquist_2	103	79	88										270
Pittman	344	220	245										809
DeBaet	880	371	902										2,153
Rasmussen	34	39	32										105
Burns	59	77	46										182
McNary	64	113	56										233
Quant	67	46	128										241
Watts	27	41	48										116
Thomas	34	39	38										111
Schall	30	46	60										136
Agenda	38	142	121										301
Speaker Bios	77	91	79										247
Flyer	121	115	77										313
Total	2,754	2,082	2,737								0	0	7,453
Waste Heat Recovery for Electricity and Heat (Chicago, IL; 9/29-30/2010)													
Cuttica	72	167	160										397
Caster	180	493	800										1,473
Sjoding_1	1,913	1,607	1,820										5,340
Sjoding_2	38	29	30										97
Darrow	361	416	250										1,027
Mueller	245	186	287										718
Miller	822	2,275	2,189										5,286
Duncan	744	496	695										1,935
Bullock_1	527	310	357										1,194
Bullock_2	54	86	41										181
Deyoe	228	278	963										1,469
Hilberg	97	59	68										224
Schadder	70	83	117										270
Scholz	217	534	464										1,215
Chudnovsky	1,374	888	2,211										4,473
Weil	155	168	228										551
Bautista	78	21	165										264
McNeil	40	69	55										164
Thornton	251	135	243										629
McDonell	64	52	49										165
Nix	147	52	41										240
Gemmer/Heidman	366	535	520										1,421
Walker	75	62	68										205
Tour Info	747	1,097	1,517										
Agenda	65	1,229	1886										3,180
Speaker Bios	139	85	66										290
Flyer	1,840	236	299										2,375
Total	10,958	11,622	14,970							0	0	0	37,550
Waste to Energy Workshop for the Illinois Electric Cooperatives (Springfield, IL; 10/2009)													
Haefke 1	52	33	33										118
Haefke 2	29	29	29										87
Hammond	29	30	30										89
Hartel	27	35	32										94
Kennelock	29	57	34										120
O'Neil 1	42	29	34										105
O'Neil 2	157	353	787										1,297
Solomon	46	277	67										390
Andresson	34	36	31										101
Brochure	39	39	38										116
Agenda	34	35	40										109
Speakers Bio	50	46	50										146
Total	578	999	1,205	0	0	0	0	0	0	0	0	0	2,782
Waste to Energy Workshop (Wooster, OH; 4/7/09)													
Scharnbacher	420	1107	1068										2,595
Dvorak	404	379	909										1,702
McDonald	35	32	37										104
Kasper	32	36	35										103
Brown	112	82	36										230
Weaver	34	31	36										101
O'Loughlin	35	55	54										144
Berlekamp	27	30	34										91
Maringer	166	154	129										449
Kurtz	72	67	36										175
Arnold	32	29	27										88
Goodge	54	96	90										240
Sutor	32	31	36										99
Montemurro	103	44	52										255
Speakers Bio	88	88	80										256
Agenda	57	72	69										198
Brochure	135	78	64										277
Directions													0
Total	2,098	2,491	2,516	0	0	0	0	0	0	0	0	0	7,105
WWTF Workshop (Indianapolis, IN; 05/19/08)													
Downey	22	27	122										171
Scott	45	68	80										183
Watts	39	58	35										132
Haefke	48	99	83										230
Griffin	38	30	79										147
Karafa	85	44	94										223
Tatsche	164	398	87										649
Robin	27	26	33										86
Jan Scott	394	1019	763										2,176
Dvorak	32	29	34										95
Cummings	34	30	35										99
Parker	35	63	55										153
Speakers Contact Info	61	76	65										202
Agenda	33	28	38										99
Brochure													0
Directions													
Total	1,057	1,985	1,603	0	0	0	0	0	0	0	0	0	4,645
										0	0	0	0
WWTF Workshop (Elkhart, IN; 05/21/08)													
Downey	425	349	154										928
Kline	47	43	43										133
Tatsche	36	47	54										137
Wishart	91	157	111										359
Bayer	38	32	32										102
Speakers Contact Info	25	33	30										88
Agenda	32	25	36										93
Total	694	686	460	0	0	0	0	0	0	0	0	0	1,840
Conference on Bio-Energy Production through Anaerobic Digester Technologies (Lansing, MI; 01/15/08)													
Gould	259	217	236										712
Safferman	59	40	31										130
Cuttica	35	54	59										149
Stanton	33	54	55										142
Urban	26	30	32										88
Rysewick	22	23	30										75
Parker	31	56	87										174
Fortune	186	477	340										1,003
Agenda	34	34	37										105
Speakers Bio	48	61	58										169
Flyer													0
Total	733	1,046	1,056	0	0	0	0	0	0	0	0	0	2,837
Methane Recovery from Farm & Food Processing Waste (Richmond, IN; 05/31/07)													
Westerfield	43	48	57										148
Ilaley	33	28	60										121
Cuttica	41	27	52										120
Dvorak	209	381	294										884
Larsen	70	74	487										631
McDonald	284	63	52										399
Snodgrass	40	42	297										379
Baum	29	28	30										87
Wagoner	29	26	32										87
Nemick	35	25	32										92
Coros	22	27	28										77
Hay	30	31	30										91
Agenda	69	76	78										223
Speaker Bios	31	27	35										93
Flyer	36	40	41										117
Total	1,001	943	1,605	0	0	0	0	0	0	0	0	0	3,549
Waste-to-Energy for the Ohio Livestock & Food Processing Industries (Wooster, OH; 01/31/07)													
Ward	21	47	53										121
Elder	30	28	32										90
Scharnbacher	124	140	129										393
Cuttica	32	63	64										159
Dvorak	47	41	42										130
Moser	36	49	49										134
Mills	36	63	57										156
Arnold	37	32	35										104
O'Loughlin	30	32	34										96
Maringer	40	34	41										115
Kasper	30	28	42										100
Drew	27	31	32										90
Eschmeyer	24	25	26										75
Gwin	32	34	33										99
Montemurro	28	28	28										84
Zuber	27	32	33										92
Agenda	75	73	86										234
Flyer													0
Speakers Bio	46	62	62										170
Total	737	842	878	0	0	0	0	0	0	0	0	0	2,457
Waste-to-Energy Workshop for Indiana's Farm, Food Processing & Wood Industries													
Jasper, IN 12/11/06													0
Bock	24	27	27										78
Brown	29	27	30										86
Coros	24	26	27										77
Cuttica	32	47	51										130
Hay	22	21	24										67
Jones	22	24	27										73
McGolden	36	27	30										87
Moser	32	27	34										93
Roger	30	30	29										89
Severtsen	45	37	42										128
Stonchfield	23	25	25										73
Stoaltey	102	73	71										246
Tietz	21	27	26										74
Tsengas	25	28	34										87
Walmsley	32	60	54										146
Speakers Contact Information	32	30	39										101
Agenda	42	43	44										129
Flyer													0
Total	571	579	614	0	0	0	0	0	0	0	0	0	1,764

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2011 – 3rd Quarter
April 1, 2011 through June 30, 2011

Submission Date:
July 29, 2011

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
July 29, 2011

Dear Mr. Renk,

Please find the attached Progress Report for the 3rd Quarter of Fiscal Year 2011 (FY2011.Q2) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $152,420.00 for FY2011.Q3:

- April 2011: $34,645.03
- May 2011: $38,300.99
- June 2011: $79,473.98

Below you will find a brief synopsis of our activities (deliverables and tasks) for FY2011.Q2. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during FY2011.Q3.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q2.11 Activity:

- Target Market Workshops and Webinars:
    - The Midwest RAC co-sponsored the Waste-to-Energy Workshop for the Minnesota Food Processing & Livestock Industries: Exploring CHP Opportunities with the Minnesota Office of Energy Security (MN SEO). Nearly 100 participants attended the workshop that was held on May 24th, 2011 in Brooklyn Center, Minnesota. Senator Al Franklin provided recorded opening remarks. More information can be found at: http://www.midwestcleanenergy.org/events/default.aspx?News=ExploringCHPOpportunitie
    - The Midwest RAC met several times via phone and in person with Indiana CHP stakeholders (developers, industrial end users, state energy office) focused on conducting a webinar and a workshop revolving around near term activities that could positively impact the implementation rate of CHP, WHR, and DE applications in the state of Indiana (i.e. Boiler MACT, tailoring rule, energy rates, industrial cash flow, etc.). The webinar is tentatively scheduled for FY2011.Q3 with a follow on workshop scheduled at a later date and time.
    - The Midwest RAC has been working with the Midwest Cogeneration Association (regional trade association for cogeneration/CHP) to develop a monthly webinar series titled "Sustaining Operational Efficiency and Effective O&M Strategies for Existing Cogeneration/CHP Applications." This webinar also gained large interest from the DOE Technical Account Managers (TAMs), stemming from a meeting between PEA, the Midwest RAC, and ORNL back in FY2011.Q2, and will be advertised with the TAMs. The first two webinars scheduled include:
        - Webinar #1 scheduled for July 28th – Generating Operation Strategies in Real Time Energy Markets
        - Webinar #2 scheduled for August 25th – Turbine Inlet Cooling Options and Technologies

- Graduate Level CHP Course: The Midwest RAC completed teaching the Spring 2011 semester graduate course for the Energy Engineering Masters program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management."
    - Course summary information:
        - Semester began January 11th and concluded week of May 2nd.

- Modules 1 – 15 and 18 were taught during FY2011.Q2.
    - Modules 16, 17, 20, 21 were taught during weeks FY2011.Q3.
    - The Midwest RAC coordinated a site-tour of the UIC East Campus CHP plant for the DOE Industrial Assessment Center and the Energy Engineering Masters students, both of the University of Illinois at Chicago, on April 26th, 2011.
    - Design project sessions were conducted during weeks 4/19, 4/26, and 5/3.
  - Listing of Modules presented in FY2011.Q3 (Module titles for FY2011.Q2 can be found be in FY2011.Q2 Quarterly Report):
    - Module 16 – Waste Heat Recovery Applications (04/05/11)
    - Module 17 – Landfill Gas CHP Applications (04/05/11)
    - Module 20 – Regulatory Related CHP Activities (04/12/11)
    - Module 21 – Operations, Maintenance, and Sustaining Operational Efficiency (04/12/11)

- Presentations:
  - Current CHP/WHR Scenario in Ohio, May 2nd, 2011, Online Webinar – Midwest RAC presented at the Interactive Webinar Identifying & Prioritizing CHP/WHR Barriers in Ohio
  - Combined Heat and Power (CHP) Concepts & Technologies, May 24th, 2011, Brooklyn Center, Minnesota – the Midwest RAC presented at the Waste-to-Energy Workshop for the Minnesota Food Processing & Livestock Industries: Exploring CHP Opportunities.
  - Next Steps and Resources, May 24th, 2011, Brooklyn Center, Minnesota – the Midwest RAC presented at the Waste-to-Energy Workshop for the Minnesota Food Processing & Livestock Industries: Exploring CHP Opportunities.
  - CHP Technology Overview, May 25th, 2011, Online Webinar – the Midwest RAC presented at the Biomass Thermal Energy Council's (BTEC) Webinar titled "Large-Scale Biomass Thermal – District Energy and Combined Heat & Power."
  - Examining CHP Technologies, June 2nd, 2011, Middleburg Heights, OH – the Midwest RAC presented at the Halfmoon Seminar titled "Using Combined Heat and Power"AD Biogas Opportunities in the Midwest, June 22nd, 2011, Chicago, Illinois – the Midwest RAC presented at the Biogas East & Midwest Conference.

- Booth Displays:
  - Waste-to-Energy Workshop for the Minnesota Food Processing & Livestock Industries: Exploring CHP Opportunities, May 24th, 2011, Brooklyn Center, Minnesota

- Other Activities:
    - The Midwest RAC is working closely with the Midwest Cogeneration Association (MCA) in developing the conference material the Midwest Region's Cogeneration Conference. Development activities include: agenda, sponsorships, marketing, conference website, payment logistics, speakers, etc. The conference was originally scheduled for August 11th, but was postponed in late June to October 11th.

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in Deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory/Policy Workshop/Webinar:
    - The Midwest RAC co-sponsored and organized an interactive webinar with the Ohio Coalition of Combined Heat and Power on May 2nd (read below for more information).

- RAC Policy Meetings:
    - The Midwest RAC assisted in the organization, coordination, and participation of the two RAC Policy Meetings during FY2011.Q3 working closely with Eric Wong of ICF. Meetings were conducted on April 13th and June 8th.
    - The Midwest RAC met with Jamie Link (DOE) on May 3rd to discuss the role of the RACs.

- Target Policy State: As part of DOE's RAC highlighted policy efforts, the Midwest RAC has focused their attention on the State of Ohio and been actively involved in developing an action plan for the State of Ohio, working with the Ohio Coalition for Combined Heat and Power. The Midwest RAC was one of the founding members of the coalition and serves as one of the key technical support entities for the coalition.
    - During FY2011.Q3, the Midwest RAC submitted milestones, goals, updates, and reports to Eric Wong (RAC Policy Coordinator) per Eric's request to keep DOE headquarters abreast of Ohio's CHP Policy activities.
    - The Midwest RAC developed the webpage for the Ohio Coalition for Combined Heat and Power during FY2011.Q3. The webpage will be launched FY2011.Q4 in July.

- The Midwest RAC is developing a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets in Ohio. The three IOUs being investigated are Duke, AEP, and First Energy. The report will be published in FY2011.Q4.
- White Paper developed for OCCHP titled: "Ohio Electric Utility Rate Impacts toward On-Site Generation"… completed in June 2011.
- The Midwest RAC, as part of the Ohio Coalition for Combined Heat and Power, conducted a webinar on May 2nd titled "Interactive Webinar Identifying and Prioritizing CHP/WHR Barriers in Ohio." This webinar was the first in the series for Ohio stakeholders to investigate the potential barriers to CHP/WHR implementation in Ohio. An interactive survey was implemented during the live webinar. A follow up identical survey was also issued to gain additional input into identifying and prioritizing the barriers. For more information on the webinar visit: http://www.midwestcleanenergy.org/events/default.aspx?News=WebinarCHPWHRBarriersInOhio The first "solutions" webinar is tentatively scheduled for early August.
- The Midwest RAC met with industry experts, government staff, and other individuals and groups during FY2011.Q3 to discuss Ohio's CHP and Clean Energy efforts. Some of these meetings include:
    - April 19th, 2011 – met with Ohio Environmental Council
    - April 22nd, 2011 – met with GE Energy
    - April 27th, 2011 – attended the University Clean Energy Alliance of Ohio conference in Columbus, OH
    - April 27th, 2011 – attended an "invitation only" meeting with former Michigan Governor Granholm and the PEW Charitable Trusts to discuss energy policy needs in the state of Ohio (Columbus, Ohio)
    - June 2nd, 2011 – met with OEC and Policy Matters Ohio in Cleveland, Ohio.
    - June 10th, 2011 – met with OCCHP via conference call
    - June 21st, 2011 – met with OEC via phone
    - June 23rd, 2011 – met with OCCHP via conference call
    - June 30th, 2011 - met with NRDC and RED in Chicago, IL.
- The Midwest RAC was asked to comment on the agenda for the Ohio Governor's Fall Energy Summit.

- Other States:
    - Missouri – Worked with Renew Missouri in reviewing HB 877.in April 2011.
    - Indiana – Indiana issued a clean energy standard during FY2011.Q2 with low-medium support for CHP/WHR technologies.
    - Iowa - the Midwest RAC developed a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets by Iowa utilities in conjunction with the Environmental Law & Policy Center.

- Other Activities and Organizations:
  - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors.
    - The Midwest RAC attended a SEE Action conference call on April 26th, 2011.
    - The Midwest RAC attended a SEE Action conference call on May 31st, 2011.
    - The Midwest RAC presented results of SEE Action to the Midwest Governors Association on June 7/8th, 2011.
  - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers.
  - U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.
    - The Midwest RAC attended a USCHPA team meeting on April 14th, 2011 in Washington DC.
    - The Midwest RAC participated in the USCHPA Stratgy Meeting on April 15th, 2011 in Washington DC.
    - The Midwest RAC participated at the Spring USCHPA Meeting in Washington DC on May 5-6th, 2011.
  - Midwest Cogeneration Association (MCA) – the Midwest RAC serves on the board of directors for the MAC and Cliff Haefke serves as Vice President of the MCA.
    - Midwest RAC met with MCA President and Treasurer on April 19th to discuss region activities and coordinated efforts
    - The Midwest RAC attended an MCA Board Meeting, Thursday, May 5th, Oakbrook Terrace, Illinois
    - Midwest RAC met with various MCA members on June 23rd to discuss Midwest region efforts in Westmont, Illinois.
    - The Midwest RAC attended an MCA Board Meeting, Thursday, June 30th, Oakbrook Terrace, Illinois.
  - Midwest Governors Association
    - The Midwest RAC attended a Midwest Governors Association planning call on April 27th.
    - The Midwest RAC attended a meeting in Columbus, Ohio, on June 7/8th, to present the status and results for SEE Action, that will be included in the Midwest Industrial Activities
  - Midwest Energy Efficiency Alliance (MEEA)
    - The Midwest RAC met with MEEA Industrial and CHP Coordinator on May 11th to discuss coordination of activities in the Midwest region.

- PEW Charitable Trusts and ELPC
    - The Midwest RAC attended a meeting presentation titled "Legal Implications of Environmental Issues" given by Howard Lerner of ELPC on May 12th, 2011.
    - Midwest RAC attended an event at ELPC offices in Chicago, Illinois, in which former Michigan Governor Granholm spoke about energy policy needs in the U.S. and Illinois on June 29th, 2011.

Deliverable: 5	**Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The initial activity of incorporating district energy and waste heat recovery technology material into the website was completed in FY2011.Q2.
- Cliff Haefke serves as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. During FY2011.Q3, the DSIRE database feed and the searchable project profile database were under development. The searchable database was test launched on the Intermountain RAC website.

Deliverable: 6	**Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- The Midwest RAC worked with Martin Schweitzer (ORNL) during April and May to provide additional data and clarification to the Midwest Region's RAC metrics.
- Avalon Consulting is working with the Midwest RAC and using the Midwest RAC website as the test RAC website to analyze web tracking software.
- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2011.Q3 Midwest RAC Website Traffic Report. FY2011.Q3 is the first quarter that the Midwest RAC has begun using Google Analytics.

Website Highlights:

- Over 2,270 pages were viewed
- Over 930 visits
- Number of unique visitors per month ranged from 168 to 300

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group have been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites. The test searchable database was launched in FY2011.Q3 at the Intermountain RAC website and coding will be shared with the other RACs in FY2011.Q4.

- Project Profiles in development: seven project profiles were in development during FY2011.Q3:
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW
    - Toledo WWTF, Toledo, OH

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2011.Q3.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
    - "Gundersen Lutheran Health System's path to energy independence" – the Midwest RAC is co-wrote an article for the Cogeneration & On-Site Power Production (COSPP) magazine that was published in the May/June issue of COSPP.
    - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected FY2011.Q4).
    - Ohio CHP Utility Barriers (in conjunction with the Target Policy States). To be published FY2011.Q3.
    - The Midwest RAC developed a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets under Iowa utilities in conjunction with the Environmental Law & Policy Center.

    - The Midwest RAC is working on a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets under Ohio utilities. The report will be published FY2011.Q4.
- Two additional technical studies are being investigated and under consideration to fund during FY 2011/2012:
    - Update to the 2005 CHP Resource Guide
    - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10	**Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity:

- The Midwest RAC submitted updated installation data and information for the Midwest Region to Anne Hampson (ICF International) on June 17, 2011.

Deliverable: 11	**Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

Technical Analysis

- The Plant, Chicago, IL – the Midwest RAC toured the facility that will be implementing an AD/CHP project. The facility is based on vertical indoor farming. The RAC toured the facility and supplied names of AD/CHP industry contacts in June.
- City of Valparaiso, Indiana – the Midwest RAC assisted the City of Valparaiso in
- Youngstown State University – preliminary discussions regarding CHP on their university campus and Boiler MACT issues.
- Verso Paper, Michigan – the Midwest RAC began discussions in May and June with Verso Paper (Michigan) in investigating waste heat recovery opportunities and their industrial facility and greenhouse. The project inquiry stemmed from a meeting with the ORNL/DOE Technical Account Managers (TAMs) meeting in FY2011.Q2.
- Illinois State University – the Midwest RAC has been working with the ISU in developing a digester-biogas-CHP project at their campus. The Midwest RAC met ISU at a RAC sponsored workshop in October 2010. RAC supported activities during FY2011.Q3 included reviewing an RFI, providing technical support, providing regional equipment vendor and engineering contacts.
- Gundersen Lutheran Hospital, Lacrosse, WI (Phase II):
    - The Midwest RAC is assisting GL in analyzing CHP for a future hospital expansion, in particular, identifying whether or not, CHP is technical feasible and in addition if a natural gas-diesel dual-fired CHP system can

    - serve as the emergency backup generation to the hospital (similar to the Beloit Memorial Hospital CHP application).
    - The Midwest RAC began discussions with GL on implementing a biomass CHP project. Further discussions to occur in FY2011.Q4.
- Denison University, Granville, OH – the Midwest RAC completed a Level 1 CHP analysis in FY2011.Q2 and met with DU staff to discuss results and next steps on April 4th, 2011. DU is concerned about Boiler MACT issues. A follow up conference call was held on April 18th, 2011 to discuss funding opportunities, turnkey engineering firms, etc.
- Hog Farm, Illinois – early discussions stages for AD/CHP project
- Turano Bakery, Chicago, IL – the Midwest RAC was contacted by Turano Bakery in FY2011.Q1 to investigate WHR project opportunities. The analysis was put on hold indefinitely, the Midwest RAC will be back in touch with Turano Bakery in FY2011.Q4.
- Confluence Solar Inc. – the Midwest RAC provided technical assistance in terms of waste heat recovery applications.
- Clow Water Systems, Coshocton, OH – the Midwest RAC worked with Clow Water Systems to investigate several WHR opportunities at their facility. The Midwest RAC assisted Clow Water Systems in contacting several turnkey engineering firms.
- Middough – the Midwest RAC assisted engineering firm with four potential projects in April/May:
    - Chemical Plant, Iowa – understanding emissions regulations
    - LFG CHP Plant, Maryland – understanding transit fees and working with RECs
    - Healthcare campus, Ohio – helped organize a site tour of an existing CHP application in Illinois
    - University Campus, Illinois – identifying industry experts in smart grid
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas CHP Program.
- The Midwest RAC has continued to maintain relations with and establish new contacts with a number of Engineering Firms that are involved in the Clean Energy community in the Midwest region. Some of the meetings and dicussions are listed here:
    - Energy Center of Wisconsin, June 16th, 2011
    - Met with GE Energy on April 19th, 2011
    - Met with Eisenmann on April 5th, 2011
    - Attended "Biogas…What Is Its Future?" in Madison, WI, on April 7, 2011
    - Met on June 14th with Innovation Center with U.S. Dairy
    - Assisted Westinghouse Co. on June 15th with market information for petro chemical facilities.
- The Midwest RAC has been working with the Association of Illinois Electric Cooperatives (AIEC) on the newly established RenewE program for Illinois coop members interested in investigating the biogas CHP opportunities in 2011 and

2012. The Midwest RAC will be serving as the prime technical advisor in investigating the technical feasibility studies.
- The Midwest RAC has had several conversations with DOE headquarters regarding future technical assistance in relation to the ensuing Boiler MACT ruling.

Deliverable: 12	**Task: 5**

Description: *Provide clean energy technology support to Midwest IACs.*

Activity:
- The Midwest RAC coordinated a site-tour of the UIC East Campus CHP plant for the DOE Industrial Assessment Center and the Energy Engineering Masters students, both of the University of Illinois at Chicago, on April 26^{th}, 2011.
- The Midwest RAC began working with the US DOE Save Energy Now (SEN) Midwest to develop an abbreviated webinar series for training the Midwest IACs to be broadcast during FY2011.Q3 (tentatively scheduled for September 2011).

Deliverable: 13	**Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:
- The Quarterly Report was submitted to Joe Renk (DOE/NETL) and Elmer Fleischman (DOE/NETL).
- The Quarterly Report was submitted to the DOE EERE Management Center website at https://www.eere-pmc.energy.gov/SubmitReports.aspx.

Deliverable: 14	**Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity:
- The Midwest RAC worked with Martin Schweitzer (ORNL) during April and May to provide additional data and clarification to the Midwest Region's RAC metrics.

Appendix

U.S. Midwest Clean Energy Application Center

Website Traffic Report: April through June 2011

(Source: Google Analytics)

- Over 2,270 pages were viewed during over 930 visits and the number of unique visitors per month ranged from 168 to 300. Figures 1 through 3 show the monthly pages viewed, visits and unique visitors, respectively; and cumulative pages viewed and visits are shown in Figures 4 and 5, respectively.
- The tiles of the pages viewed and the total number of time these pages were viewed during the quarter are shown in Exhibit 1.

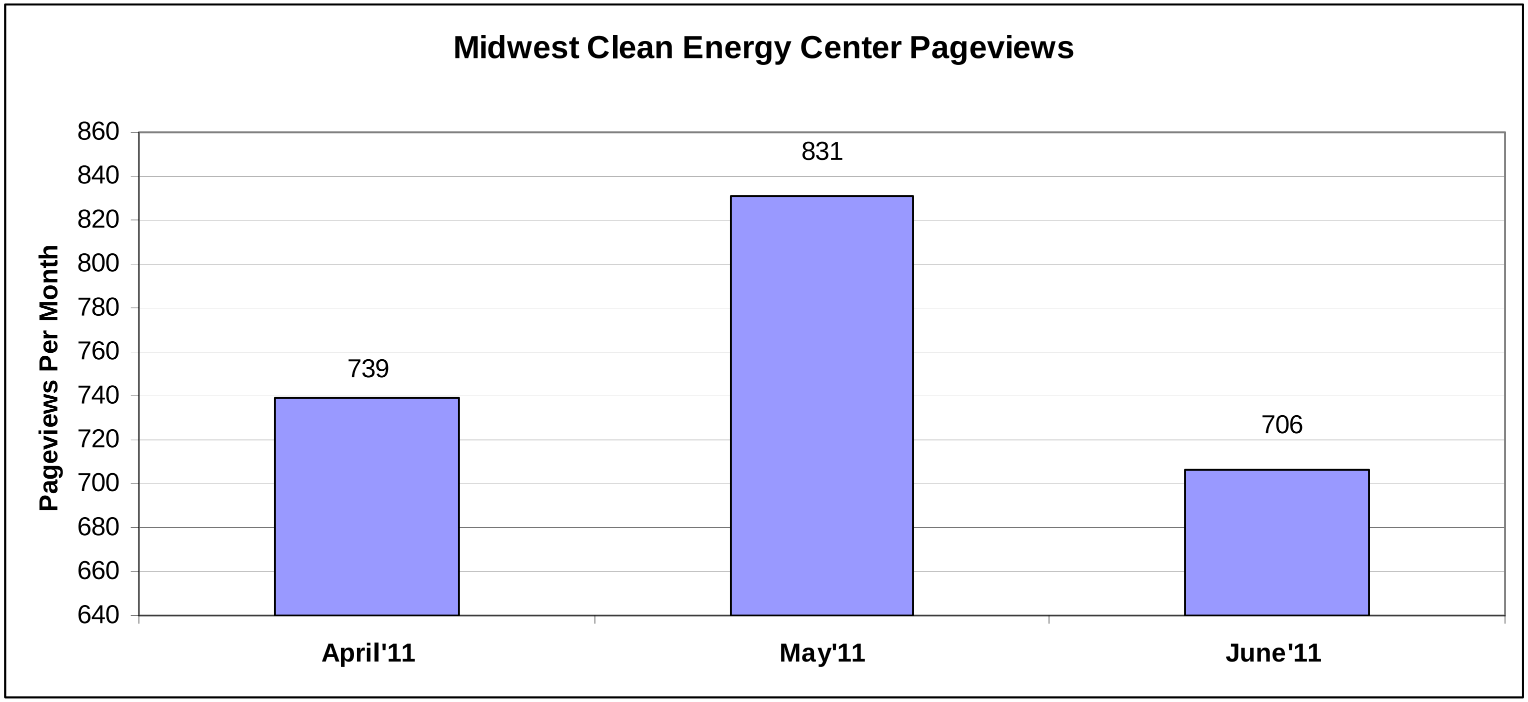


Figure 1: Monthly Pages Viewed on the Midwest RAC Website

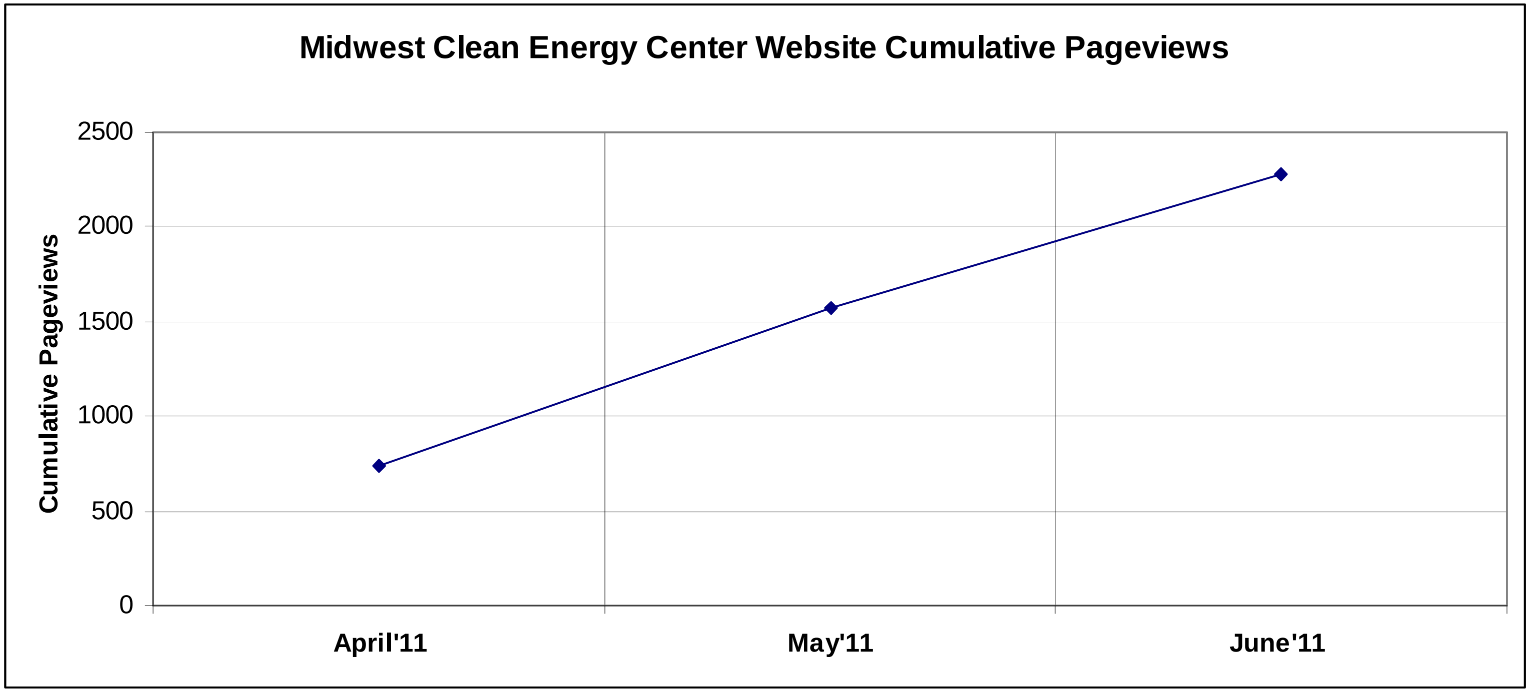


Figure 2: Cumulative Pages Viewed on the Midwest RAC Website

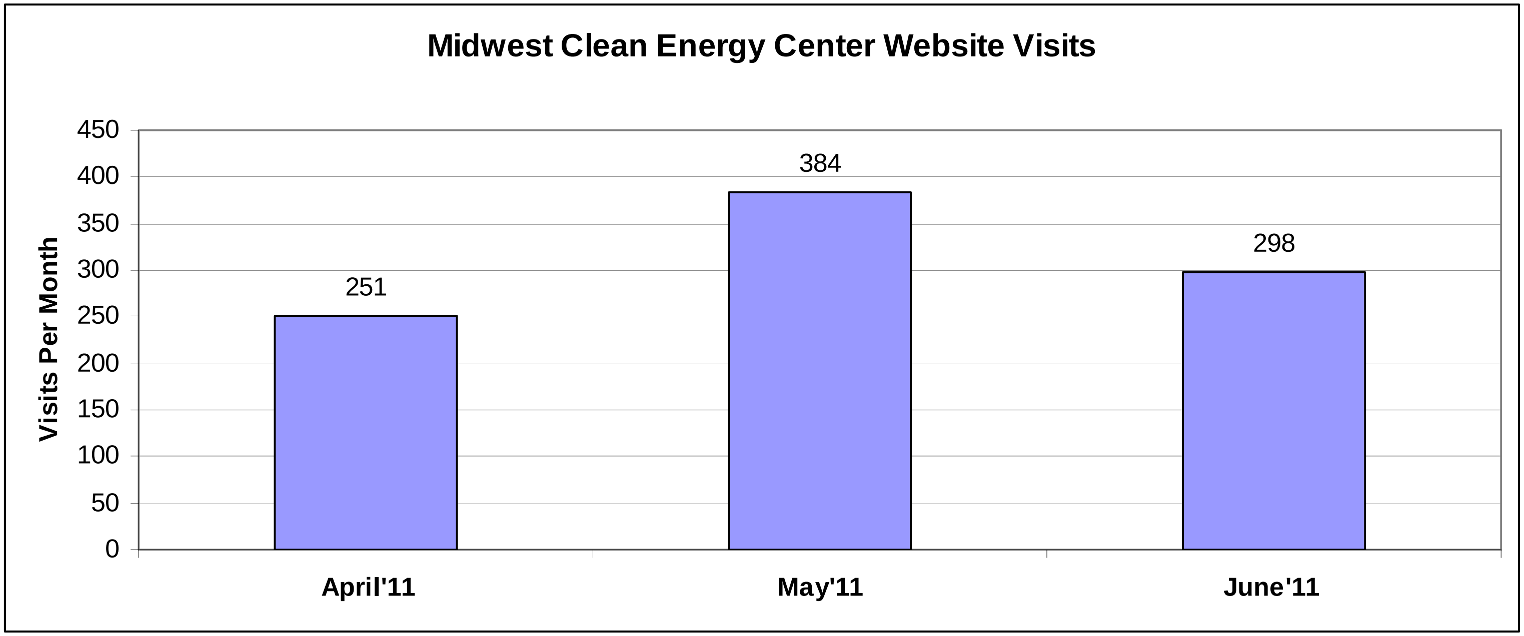


Figure 3: Monthly Number of Visitors at the Midwest RAC Website

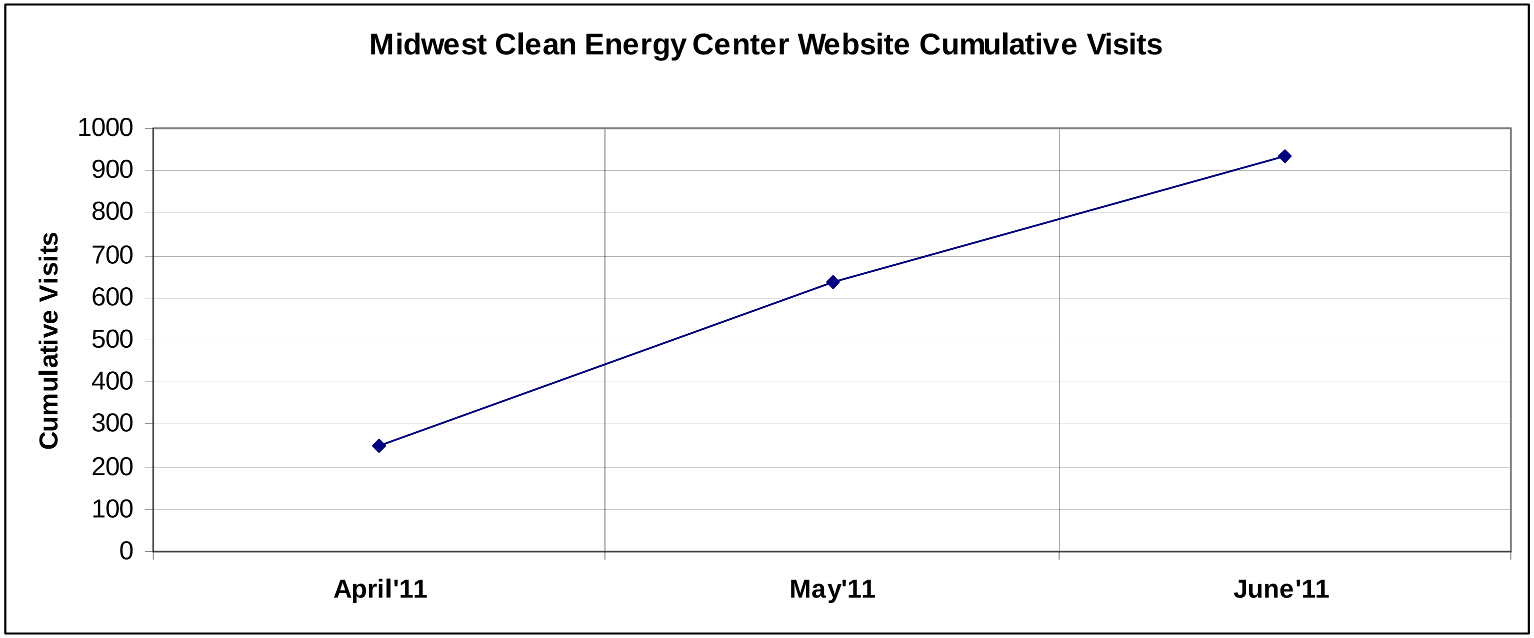


Figure 4: Cumulative Numbers of Visitors at the Midwest RAC Website

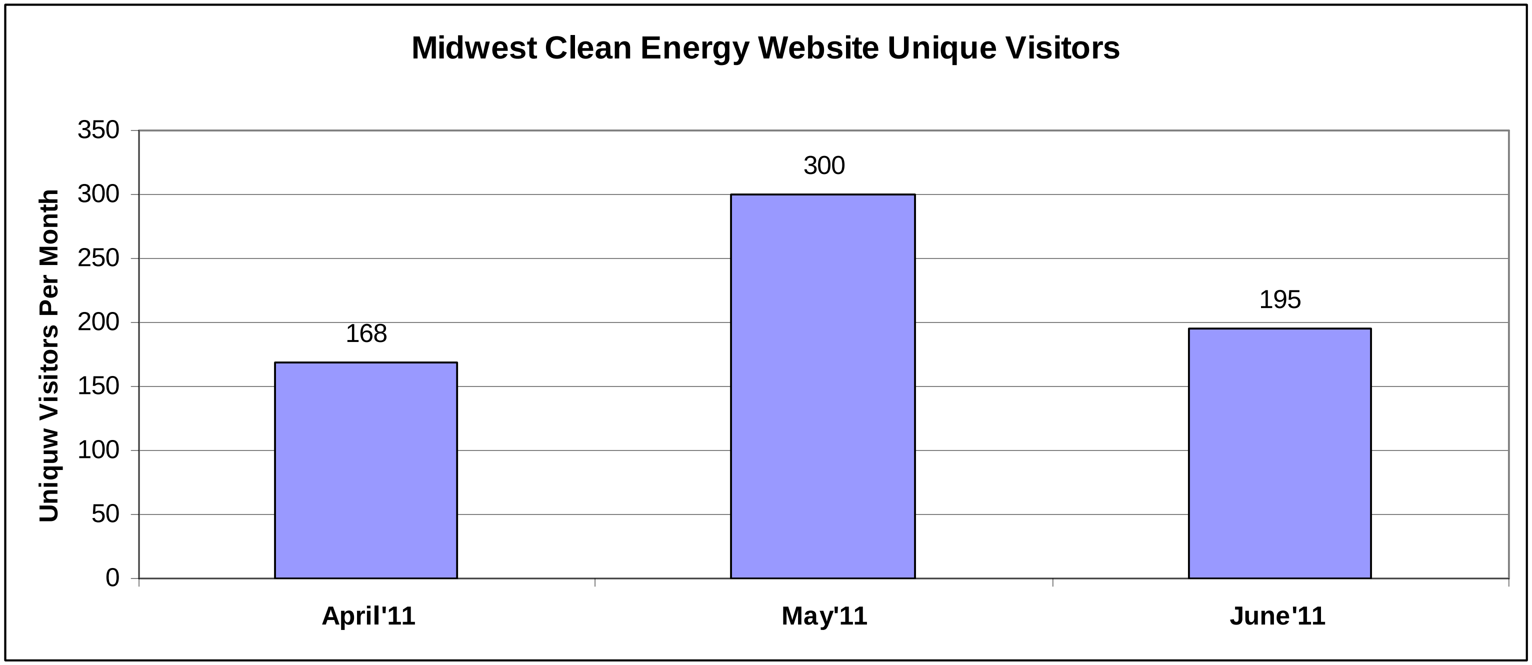


Figure 5: Monthly Numbers of Unique Visitors at the Midwest RAC Website

Exhibit 1: Titles of the Pages Viewed at the Midwest RAC Website

Page Title	Pageviews
Midwest Clean Energy Application Center	520
Midwest Clean Energy Application Center || News & Event	226
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery || Heat-to-Power Technologies	93
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery || Recover & Use of Waste Heat	79
Midwest Clean Energy Application Center || Project Profiles	71
Midwest Clean Energy Application Center || Resources	70
Midwest Clean Energy Application Center || States	70
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || Prime Mover Technologies	67
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery	67
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP)	63
Midwest Clean Energy Application Center || Markets || Industrial	56
Ohio Clean Energy || Register	56
Midwest Clean Energy Application Center || States || Ohio	46
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery || Factors Affecting Feasibility	40
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery || Importance to Industry	38
Midwest Clean Energy Application Center || Contact Us	38
Midwest Clean Energy Application Center || IECA Workshop Summary - December 14, 2010	38
Midwest Clean Energy Application Center || About Us	37
Midwest Clean Energy Application Center || About Clean Energy || District Energy	36
Midwest Clean Energy Application Center || About Clean Energy || Waste Heat Recovery || Sources of Waste Heat	32
Midwest Clean Energy Application Center || States || Illinois	31
Midwest Clean Energy Application Center || States || Minnesota	28
Midwest Clean Energy Application Center || About Clean Energy || District Energy || Who Uses District Energy?	27
Midwest Clean Energy Application Center || Policy & Initiatives	26
Midwest Clean Energy Application Center || About Clean Energy || Benefits & Barriers	23
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || History	23
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || What a CHP System Produces	23
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || CHP Thermal Technologies	22
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || Emissions	22
Midwest Clean Energy Application Center || E-NEWSLETTER	21
Midwest Clean Energy Application Center || About Clean Energy || Combined Heat & Power (CHP) || Fuels for CHP	19
Midwest Clean Energy Application Center || About Clean Energy || District Energy || Fuels for District Energy	19
Midwest Clean Energy Application Center || About Clean Energy || District Energy || History	19
Midwest Clean Energy Application Center || Markets	19
Midwest Clean Energy Application Center || States || Wisconsin	19
Midwest Clean Energy Application Center || Project Start-up || Pre-Screen / Site Qualification	18
Midwest Clean Energy Application Center || About Clean Energy	17
Midwest Clean Energy Application Center || About Clean Energy || Economics	16
Midwest Clean Energy Application Center || Project Start-up || Procurement, Operation, & Maintenance	14
Midwest Clean Energy Application Center || States || Michigan	14
Midwest Clean Energy Application Center || IECA Workshop - December 14, 2010	13
Midwest Clean Energy Application Center || Project Start-up || Level 2 Conceptual & Financial Analysis	13
Midwest Clean Energy Application Center || Project Start-up || Level 1 Screening Analysis	12
Midwest Clean Energy Application Center || Project Start-up || Level 3 Investment-Grade Analysis	12
Midwest Clean Energy Application Center || States || Missouri	12
Midwest Clean Energy Application Center || News & Event Archive	11
Midwest Clean Energy Application Center || States || Indiana	10
Midwest Clean Energy Application Center || About Clean Energy || District Energy || Why District Energy?	9
Midwest Clean Energy Application Center || About Clean Energy || District Energy || Electric Generation Technologies for District Energy	6
Midwest Clean Energy Application Center || States || North Dakota	5
Midwest Clean Energy Application Center || States || Other Regions	5
Midwest Clean Energy Application Center || Project Start-up || Financing	2
Midwest Clean Energy Application Center || States || Iowa	1
Midwest Clean Energy Application Center || States || Kansas	1
Midwest Чистота центр Применение энергии | | О чистой энергии | | утилизации тепла | | Восстановление и использование отработанного тепла	1
Total	2,276

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2011 – 4th Quarter
July 1, 2011 through September 30, 2011

Submission Date:
October 28, 2011

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
July 29, 2011

Dear Mr. Renk,

Please find the attached Progress Report for the 4th Quarter of Fiscal Year 2011 (FY2011.Q4) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $71,815.03for FY2011.Q4:

- July 2011: $15,759.38
- August 2011: $27,652.40
- September 2011: $28,403.25

Below you will find a brief synopsis of our activities (deliverables and tasks) for FY2011.Q2. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during FY2011.Q4.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q4.11 Activity:

- Target Market Workshops and Webinars:
    - The Midwest RAC has been working with the Midwest Cogeneration Association (regional trade association for cogeneration/CHP) on a monthly webinar series titled "Sustaining Operational Efficiency and Effective O&M Strategies for Existing Cogeneration/CHP Applications" targeting engineers, developers, and existing/potential end users. Two webinars were hosted in FY2011.Q4 with two in planning phase for FY2012.Q1.
        - Webinar #1: Generating Operation Strategies in Real Time Energy Markets, July 28, 2011
        - Webinar #2: Turbine Inlet Cooling Options and Technologies, August 25, 2011
    - UPCOMING EVENT: The Midwest RAC is planning with Indiana CHP stakeholders (developers, industrial end users, state energy office) an education outreach effort that would include a target market workshop and a webinar series towards users of medium to larger sized boilers: industrial, healthcare, and higher education facilities. This effort would surround the ensuing emissions regulations, forecasted natural gas prices, projected energy rate increases, and industrial cash flow. Activities have been postponed to beginning of 2012.
    - UPCOMING EVENT: The Midwest RAC is in planning efforts with the Association of Illinois Electric Cooperatives (AIEC) to conduct three target market workshops in the Illinois rural cooperative service territories during the Jan/Feb 2012 timeframe towards biogas CHP workshops in the agriculture and food processing sectors.

- Presentations:
    - Introduction and Overview of Combined Heat and Power, Online Webinar #1: Generating Operation Strategies in Real Time Energy Markets, July 28, 2011.
    - Introduction and Overview of Combined Heat and Power, Online Webinar #2: Turbine Inlet Cooling Options and Technologies, August 25, 2011.
    - Introduction to CHP and WHR Technologies, Online Hill Staff Webinar for Ohio, Potential for Combined Heat and Power (CHP) to increase Ohio's Competitiveness ,September 1, 2011

- Combined Heat & Power Policies and Projects, An Overview of Distributed Generation Resources (sponsored by the Division of Energy Resources Minnesota Department of Commerce), St. Paul, MN, September 29th, 2011.
- UPCOMING EVENT: Snapshot of the Midwest CHP/Cogeneration Market, 2011 Midwest Cogeneration Conference, Elgin, Illinois, October 11, 2011.

- Booth Displays:
  - UPCOMING EVENT: 2011 USCHPA Annual Conference, October 6-7, 2011, Washington DC.

- Other Activities:
  - UPCOMING EVENT: The Midwest RAC has scheduled an invite-only webinar for the Midwest State Energy Offices on October 12th geared towards planning RAC activities for FY2012 in conjunction with the Midwest SEOs.
  - UPCOMING EVENT: The Midwest RAC is working closely with the Midwest Cogeneration Association (MCA) in developing the conference material for the Midwest Region's Cogeneration/CHP Conference on October 11th in Elgin, Illinois. Development activities include: agenda, sponsorships, marketing, conference website, payment logistics, speakers, etc.

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in Deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory/Policy Workshop/Webinar:
  - The Midwest RAC co-sponsored and organized a webinar with the Ohio Coalition of Combined Heat and Power and PEW Environment Group for the Ohio Hill Staff on September 1st titled "Hill Staff Webinar – Potential for Combined Heat and Power (CHP) to increase Ohio's Competitiveness."
  - The Midwest RAC, as part of the Ohio Coalition of Combined Heat and Power, co-sponsored and co-organized an interactive webinar for Ohio

CHP stakeholders titled “Potential Policy Recommendations for Implementing CHP/WHR Projects in Ohio” on August 4, 2011.

- RAC Policy Meetings:
    - The Midwest RAC assisted in the organization, coordination, and participation of the two RAC Policy Meetings during FY2011.Q4 working closely with Eric Wong of ICF. Meetings were conducted on July 20th and September 7th.
    - The Midwest RAC met with Jamie Link (DOE) on August 24th to discuss Midwest CHP policy efforts.

- Target Policy State: As part of DOE’s RAC highlighted policy efforts, the Midwest RAC has focused their attention on the State of Ohio and been actively involved in developing an CHP action plan for the new Governor Kasich, working with the Ohio Coalition for Combined Heat and Power. The Midwest RAC was one of the founding members of the coalition and serves as one of the key technical support entities for the coalition.
    - During FY2011.Q4, the Midwest RAC continued to work on milestones, goals, updates, and reports due to DOE requests.
    - The Midwest RAC launchedwebpage for the Ohio Coalition for Combined Heat and Power during FY2011.Q4. www.midwestcleanenergy.org/ohiochp
    - The Midwest RAC is developing a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets in Ohio. The three IOUs being investigated are Duke, AEP, and First Energy. The report will be published in FY2011.Q4.
    - The Midwest RAC co-sponsored and organized a webinar with the Ohio Coalition of Combined Heat and Power and PEW Environment Group for the Ohio Hill Staff on September 1st titled “Hill Staff Webinar – Potential for Combined Heat and Power (CHP) to increase Ohio's Competitiveness.”
    - The Midwest RAC, as part of the Ohio Coalition of Combined Heat and Power, co-sponsored and co-organized an interactive webinar for Ohio CHP stakeholders titled “Potential Policy Recommendations for Implementing CHP/WHR Projects in Ohio” on August 4, 2011.
    - The Midwest RAC met with industry experts, government staff, and other individuals and groups during FY2011.Q4 to discuss Ohio’s CHP and Clean Energy efforts. Some of these meetings included:
        - July 12th, 2011 – conference call with Ohio Coalition for Combined Heat and Power (OCCHP)
        - July 28th, 2011 - conference call with OCCHP
        - August 9th, 2011 – conference call with OCCHP
        - August 16th, 2011 – conference call with OCCHP
        - September 12th, 2011 – conference call with OCCHP
    - The Midwest RAC attended Governor Kasich’s Ohio Energy Summit (invitation only event) on September 21st, 2011.

- Other States:
    - Iowa - the Midwest RAC developed a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets by Iowa utilities in conjunction with the Environmental Law & Policy Center. The Midwest RAC is working with several Iowa entities to flush out and review the report before publication.
    - Minnesota – The Midwest RAC was asked to participate at the first of four Minnesota Distributed Generation Policy Workshops on September 29th, 2011: "Combined Heat and Power Policies and Projects." The Midwest RAC is planning to attend the fourth workshop on November 8th – Forum on Next Steps.
    - Michigan – the Midwest RAC met with the Michigan Environmental Council to discuss CHP opportunities and barriers for tri-county region on July 25th, 2011.
- Other Activities and Organizations:
    - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors.
        - The Midwest RAC presented on a RAC Conference Call on July 5th the activities of SEE Action.
        - The Midwest RAC attended a SEE Action conference call on August 30th, , 2011.
    - Midwest Governors Association: the Midwest RAC has been participating in MGA meetings and planning activities.
        - Midwest RAC presented on August 5th, 2011 to the MGA Industrial Committee (i.e. bringing CHP and SEE Action activities to MGA)
        - Midwest RAC attended MGA Industrial Group Meeting on August 31st and September 1st.
    - Illinois Electric Cooperatives: the Midwest RAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers.
    - U.S. Clean Heat and Power Association (USCHPA) – the Midwest RAC serves on the board of directors for the USCHPA.
        - The Midwest RAC attended a USCHPA team conference call on August 4th.
        - The Midwest RAC participated in a USCHPA Board Meeting conference call on September 20th.
        - The Midwest RAC will be participating at the 2011 Annual USCHPA Meeting in in Washington DC on October 6-7th, 2011.
    - Midwest Cogeneration Association (MCA) – the Midwest RAC serves on the board of directors for the MAC and Cliff Haefke serves as Vice President of the MCA.

            - Midwest RAC attended MCA Board Meeting on Thursday, June 30th, 2011 in Oakbrook Terrace, Illinois.
            - Midwest RAC participated in a July 7th MCA Board Meeting conference call.
            - Midwest RAC participated in a September 26th MCA Board Meeting conference call.
            - Midwest RAC is assisting the MCA in developing the 2011 MCA Cogeneration/CHP Conference for October 11th in Elgin, IL.
        - <u>Midwest Energy Efficiency Alliance (MEEA)</u>
            - The Midwest RAC attended the MEEA Conference and presented on the CHP/Industrial activities of SEE Action and MGA on August 2nd and 3rd.
        - <u>PEW Charitable Trusts and ELPC</u>
            - The Midwest RAC attended a meeting presentation on August 11th.
            - The Midwest RAC co-sponsored and organized a webinar with the Ohio Coalition of Combined Heat and Power and PEW Environment Group for the Ohio Hill Staff on September 1st titled "Hill Staff Webinar – Potential for Combined Heat and Power (CHP) to increase Ohio's Competitiveness."

Deliverable: 5	**Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- Cliff Haefke serves as co-chair with Christine Brinker (Intermountain RAC) for the RAC Website and Logo Working Group. During FY2011.Q4, the DSIRE database feed and the searchable project profile database were under development. The searchable database was test launched on the Intermountain RAC website and information to download to other RAC websites was shared in FY2011.Q4

Deliverable: 6	**Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- Avalon Consulting is working with the Midwest RAC and using the Midwest RAC website as the test RAC website to analyze web tracking software.
- Reporting on website activities, usage, and metrics has been completed on a quarterly basis. Please see the Appendix for the FY2011.Q4 Midwest RAC Website Traffic Report. FY2011.Q4 is the second quarter that the Midwest RAC has begun using Google Analytics.

Website Highlights:

- Over 6,470 pages were viewed

- Over 2,200 visits
- Number of unique visitors per month ranged from 197 to 381

Deliverable: 7 **Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

- Searchable Project Profile Database: the RAC Logo and Website Working Group have been working with Energetics to develop a searchable database tool for the DOE RAC website and the individual RAC websites. The test searchable database was launched in FY2011.Q3 at the Intermountain RAC website and coding was shared with the other RACs in FY2011.Q4.

- Project Profiles in development: seven project profiles were in development during FY2011.Q4:
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - Sietsema Farm Feeds, Howard City, MI, 500 kW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - City Brewing Co., LaCrosse, WI, 633 kW
    - St. Paul Cogeneration Plant, St. Paul, MN, 32 MW
    - Toledo WWTF, Toledo, OH

Deliverable: 8 **Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- See Activity #5 for a description of the website activity during FY2011.Q4.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
    - County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected FY2012.Q1).
    - The Midwest RAC developed a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets under Iowa utilities in conjunction with the Environmental Law & Policy Center (under review during FY2011.Q4)

    - The Midwest RAC is working on a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets under Ohio utilities. The report will be published FY2012.Q1.
- Two additional technical studies are being investigated and under consideration to fund during FY2012:
    - Update to the 2005 CHP Resource Guide
    - CHP Policy and Regulatory Activities in the Midwest

Deliverable: 10	**Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity:

- No activity in FY2011.Q4.

Deliverable: 11	**Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

Technical Analysis

- The Plant, Chicago, IL – the Midwest RAC toured the facility that will be implementing an AD/CHP project. The facility is based on vertical indoor farming. The RAC toured the facility and supplied names of AD/CHP industry contacts in June.
- Illinois State University – the Midwest RAC has been working with the ISU in developing a digester-biogas-CHP project at their campus. The Midwest RAC met ISU at a RAC sponsored workshop in October 2010. RAC supported development of RFP..
- Gundersen Lutheran Hospital, Lacrosse, WI (Phase II):
    - The Midwest RAC is providing technical assistance in the development of a CHP biomass project at the Gundersen Lutheran La Crosse campus. The Midwest RAC developed an RFP for GL and reviewed submitted proposals.
- Black Hills Bronze, Inc. – the Midwest RAC is providing technical assistance towards the feasibility evaluation of CHP for Black Hills Bronze located in South Dakota.
- Quaker Foods & Snacks a Division of PepsiCo – the Midwest RAC has been contacted to investigate CHP opportunities for their facilities.
- Superior Fibers LLC – the Midwest RAC was contact to provide a CHP feasibility evaluation in Bremen, Ohio.
- Technical Assistance to Illinois Biogas CHP Projects: the Midwest RAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. The UIC/ERC has leveraged funds with the IL DCEO to

serve as the contract manager for the Illinois Biogas CHP Program. The Midwest RAC reviewed and approved funding for Danville WWTF.

- The Midwest RAC has been working with the Association of Illinois Electric Cooperatives (AIEC) on the newly established RenewE program for Illinois coop members interested in investigating the biogas CHP opportunities in 2011 and 2012. The Midwest RAC will be serving as the prime technical advisor in investigating the technical feasibility studies.
- The Midwest RAC met with EPA Region 5 and Illinois EPA to discuss project identification and developments for a community based digester CHP project in Illinois.
    - Conference Call – July 6th, 2011
    - Meeting – September 15th, 2011 (EPA Region 5, Illinois EPA, Association of Illinois Electric Cooperatives, Illinois Clean Energy Foundation)

Deliverable: 12 **Task: 5**

Description: *Provide clean energy technology support to Midwest IACs.*

Activity:

- No activity in FY2011.Q4.

Deliverable: 13 **Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL) and Elmer Fleischman (DOE/NETL).
- The Quarterly Report was submitted to the DOE EERE Management Center website at https://www.eere-pmc.energy.gov/SubmitReports.aspx.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity:

- No activity in FY2011.Q4.

Appendix

U.S. Midwest Clean Energy Application Center

Website Traffic Report: July through September 2011

(Source: Google Analytics)

- Over 6,470 pages were viewed during over 2,200 visits and the number of unique visitors per month ranged from 197 to 381. Figures 1 through 3 show the monthly pages viewed, visits and unique visitors, respectively; and cumulative pages viewed and visits are shown in Figures 4 and 5, respectively.
- The tiles of the pages viewed and the total number of time these pages were viewed during the quarter are shown in Exhibit 1.

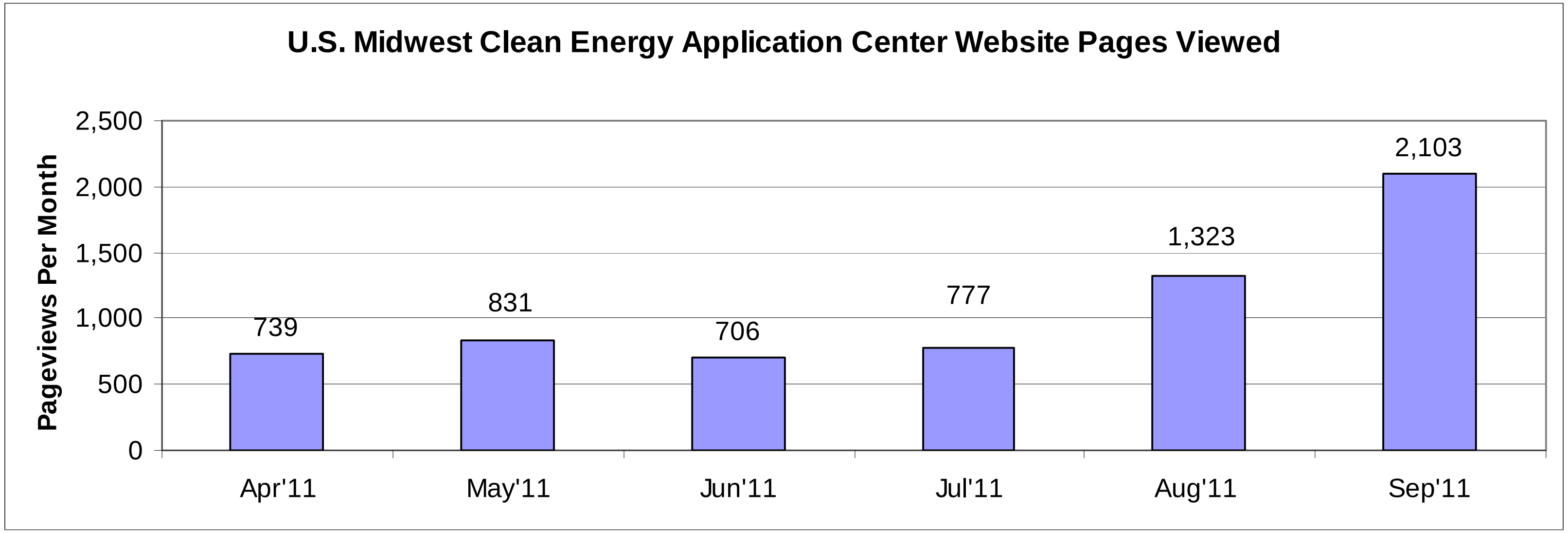


Figure 1: Monthly Total Pages Viewed

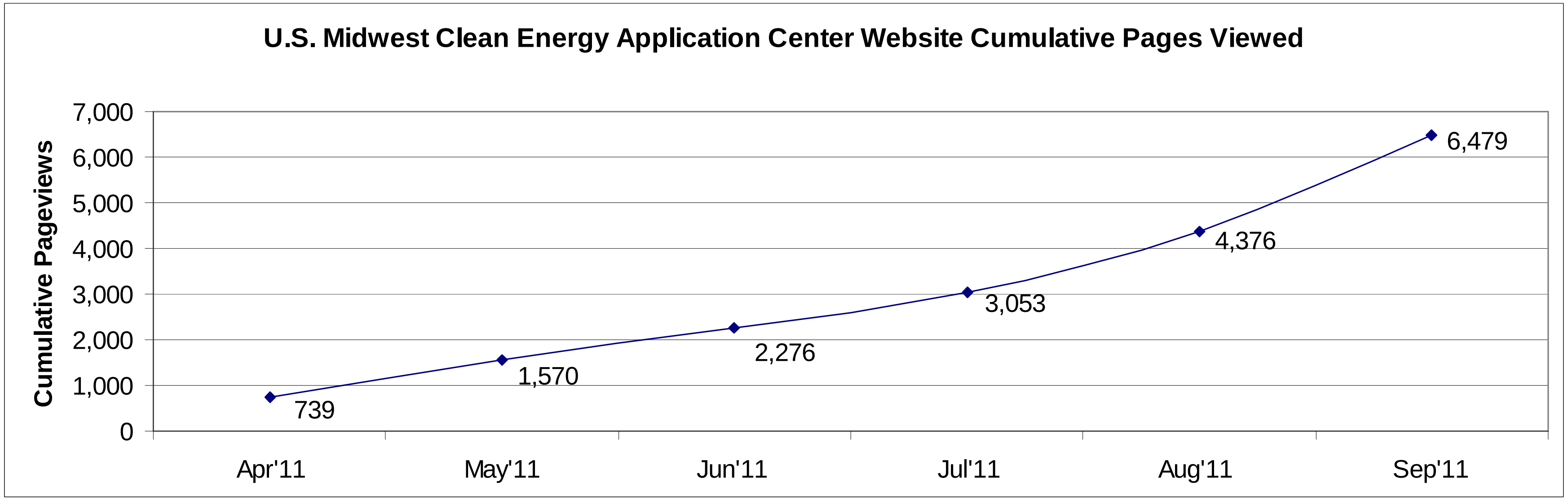


Figure 2: Cumulative Pages Viewed

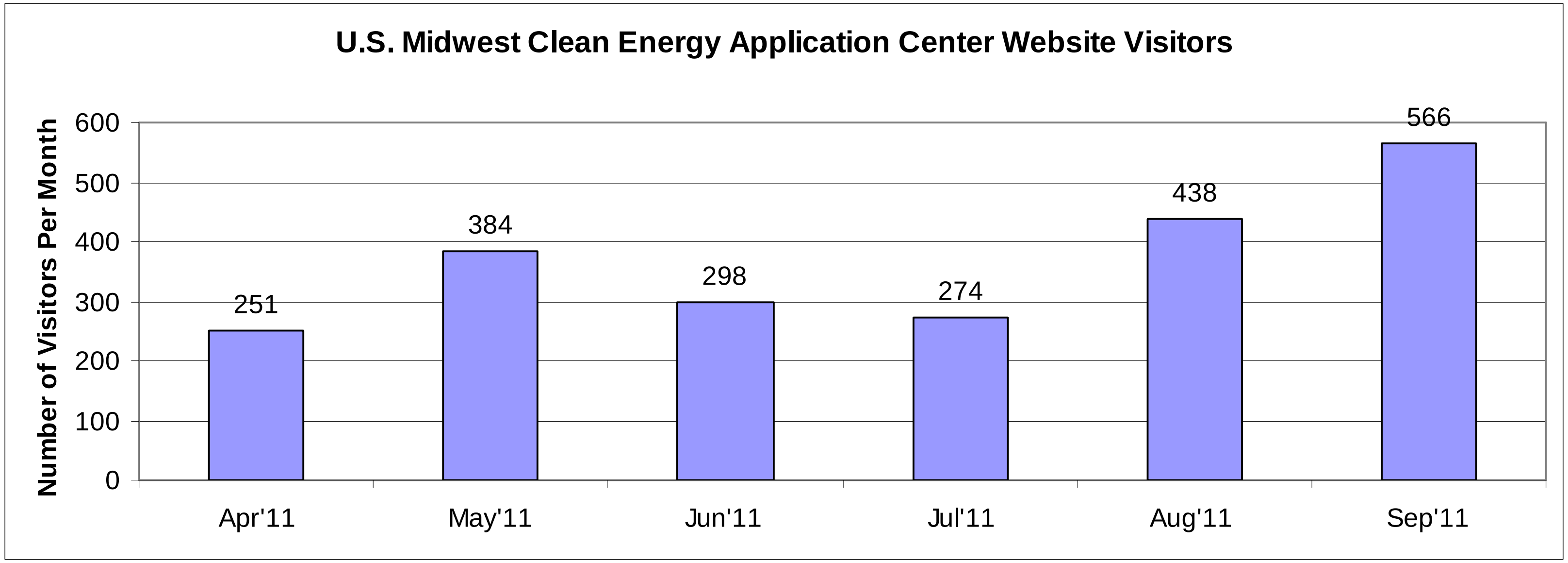


Figure 3: Monthly Number of Visitors

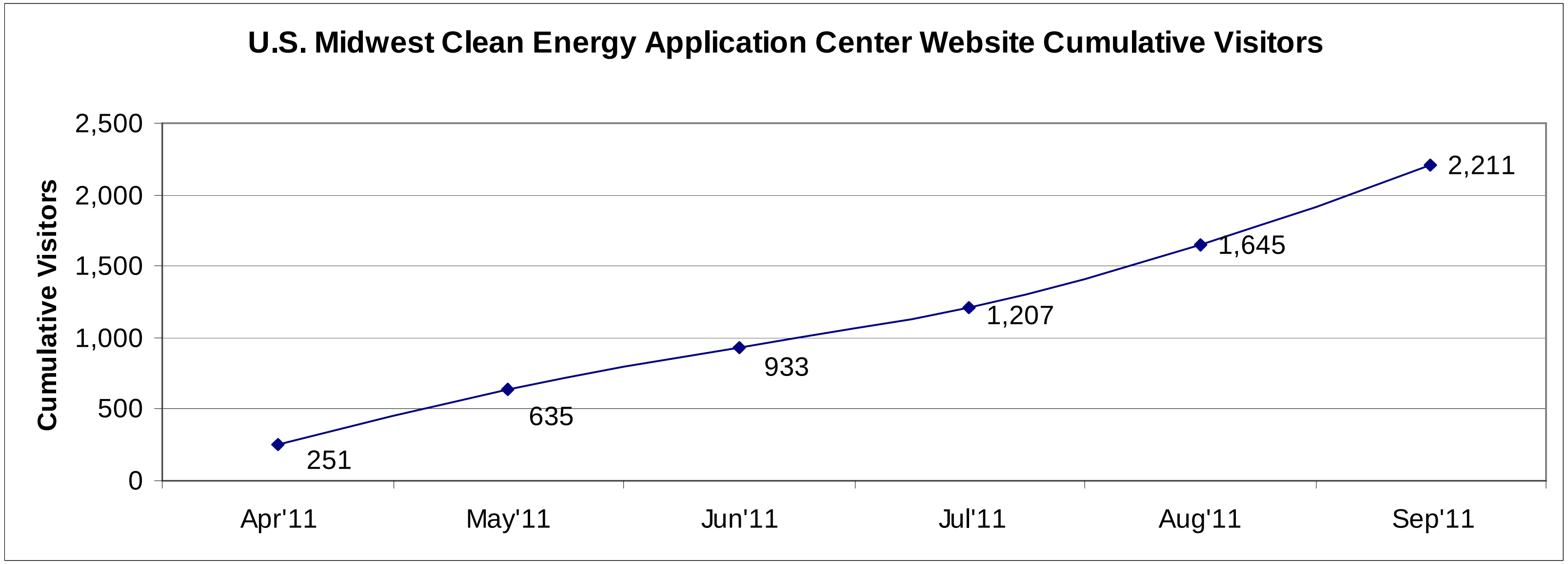


Figure 4: Cumulative Numbers of Visitors at the Midwest RAC Website

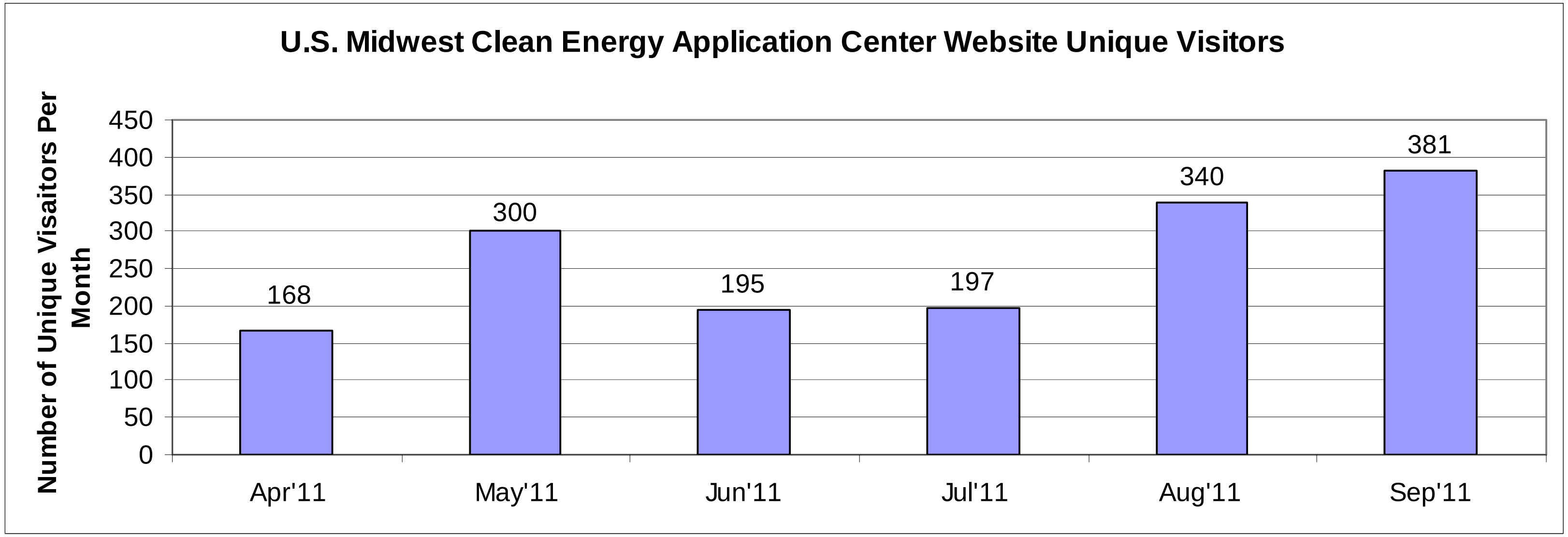


Figure 5: Monthly Numbers of Unique Visitors at the Midwest RAC Website

Exhibit 1: Titles of the Pages Viewed at the U.S. DOE Midwest RAC Website

Page Title	Pageviews
Home	968
News & Event	476
Project Profiles	289
Resources	275
About Clean Energy || Combined Heat & Power (CHP)	156
States	99
About Clean Energy || Waste Heat Recovery	91
About Clean Energy || Combined Heat & Power (CHP) || Prime Mover Technologies	90
Contact Us	89
Policy & Initiatives	78
Markets	75
About Clean Energy || Waste Heat Recovery || Heat-to-Power Technologies	74
Markets || Industrial	73
Project Start-up || Pre-Screen / Site Qualification	70
Project Start-up || Level 1 Screening Analysis	68
About Clean Energy || Waste Heat Recovery || Importance to Industry	65
About Clean Energy || Waste Heat Recovery || Recover & Use of Waste Heat	65
About Clean Energy || Combined Heat & Power (CHP) || CHP Thermal Technologies	64
States || Ohio	62
About Us	59
Project Start-up || Level 2 Conceptual & Financial Analysis	55
States || Illinois	55
About Clean Energy || Combined Heat & Power (CHP) || What a CHP System Produces	54
About Clean Energy || Waste Heat Recovery || Sources of Waste Heat	52
About Clean Energy || Waste Heat Recovery || Factors Affecting Feasibility	44
About Clean Energy || Combined Heat & Power (CHP) || Emissions	43
About Clean Energy || Benefits & Barriers	40
About Clean Energy || Combined Heat & Power (CHP) || Fuels for CHP	40
States || Minnesota	36
About Clean Energy	35
Project Start-up || Level 3 Investment-Grade Analysis	31
About Clean Energy || District Energy	28
E-NEWSLETTER	27
IECA Workshop Summary - December 14, 2010	25
States || Nebraska	25
States || Wisconsin	25
Webinars	24
Project Start-up || Procurement, Operation, & Maintenance	23
About Clean Energy || Combined Heat & Power (CHP) || History	22
About Clean Energy || District Energy || Who Uses District Energy?	22
About Clean Energy || District Energy || Fuels for District Energy	21
States || Other Regions	20
About Clean Energy || Economics	18
IECA Workshop - December 14, 2010	16
States || Indiana	16
About Clean Energy || District Energy || Electric Generation Technologies for District Energy	14
States || Iowa	13
States || Missouri	12
States || North Dakota	12
About Clean Energy || District Energy || History	11
States || Michigan	11
About Clean Energy || District Energy || Why District Energy?	9
Ohio Clean Energy || Register	9
States || Kansas	8
Project Start-up || Financing	4
MCA-MidwestRAC_Webinars	3
Markets || Commercial	3
States || South Dakota	3
Markets || Agricultural	2
Home Page_""Ohio Coalition fro Combined Heat and Power""	1
Total	**4,198**

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY

Midwest Clean Energy Application Center

Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2012 – 1st Quarter
October 1, 2011 through December 31, 2011

Submission Date:
February 1, 2012

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
February 1, 2012

Dear Mr. Renk,

Please find the attached Progress Report for the 3rd Quarter of Fiscal Year 2012 (Q1.FY2012) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $105,002.61 for Q1.FY2012:

- October 2012: $23,849.41
- November 2012: $49,184.97
- December 2012: $31,968.23

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q1.FY2012. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Deliverable: 1 **Task: 1**

Description: *Updated Project Management Plan*

Activity: No update to the PMP was submitted during Q1.FY2012.

Deliverable: 2 **Task: 2**

Description: *Minimum 5 workshops/webinars*

Q2.11 Activity:

- Target Market Workshops and Webinars:
    - The MW CEAC co-sponsored the Implementing Winning Cogeneration/CHP Projects conference with the Midwest Cogeneration Association on October 11th, 2011 in Elgin, Illinois. More information can be found at: http://www.cogeneration.org/111011Conf/index.html
    - Midwest State Opportunities Webinar for CHP, District Energy, & Waste Heat Recovery, October 12th, 2011, Online Webinar, the MW CEAC coordinated a webinar for the Midwest SEOs. 8 of the 12 SEOs participated in the event.
    - Following the 10/12 webinar, the MW CEAC met with the Wisconsin SEO on 10/28 to discuss CHP opportunities in Wisconsin. The WI SEO and MW CEAC identified the target market sectors of breweries, food processing facilities, and waste water treatment facilities as sectors to pursue in FY2012 for workshops and/or webinars.
    - The MW CEAC has been meetingwith Indiana CHP stakeholders (developers, industrial end users, SEO personnel) focused on conducting a webinar and a workshop series revolving around near term activities that could positively impact the implementation rate of CHP, WHR, and DE applications in the state of Indiana (i.e. utility and non-utility regulations, energy rates, industrial cash flow, etc.). The webinar/workshop series is tentatively scheduled for Q2.FY2012.

- Graduate Level CHP Course: The MW CEAC will be teaching a Spring 2012 semester graduate engineering course for the Energy Engineering Masters Program at the University of Illinois at Chicago titled "Combined Heat and Power, Design, and Management." The MW CEAC was preparing coursework in Q1.FY2012 for this class.

- Presentations:
    - Snapshot of the Cogeneration/CHP Market and Industry Trends, October 11th, 2011, Elgin, IL – MW CEAC presented at the MCA Conference.
    - Midwest State Opportunities Webinar for CHP, District Energy, & Waste Heat Recovery, October 12th, 2011, Online Webinar, the MW CEAC presented a coordinated a webinar for the Midwest SEOs (8 of the 12 SEOs attended the webinar).

- Waste Heat Recovery Opportunities, October 14th, Chicago, Illinois – the MW CEAC presented at the World Energy Engineering Congress (WEEC) conference.
- CHP using Biogas & Biomass Fuels, November 18th , 2011, Chicago, IL – the MW CEAC presented at the Illinois 25x'25 Renewable Energy Forum's Distributed Electricity and Renewable Electricity Panel.
- Industrial Cogeneration / CHP, November 11, 2011, Chicago, IL, – the MW CEAC presented at the American Institute of Chemical Engineers (AIChE) 2011 Midwest Regional Conference
- Combined Heat & Power (CHP) In the Food Processing Industry : When Does It Make Sense? November 11, 2011, Chicago, IL – the MW CEAC presented at the American Institute of Chemical Engineers (AIChE) 2011 Midwest Regional Conference
- Introduction to CHP and WHR Technologies, November 17th, 2011, Washington DC – MW CEAC presented at the Congressional Education Briefing sponsored by NASEO and ASERTTI
- Combined Heat & Power (CHP) and Waste Heat Recovery (WHR) Briefing Waste Heat Recovery, November 22nd, 2011, Columbus, OH – the MW CEAC presented to the PUCO commissioners and staff.

- Booth Displays:
  - Implementing Winning Cogeneration/CHP Projects: Midwest Cogeneration Association Conference, October 11th, 2011 in Elgin, IL
  - USCHPA Annual Meeting, October 4-6, 2011, Washington DC.

- Other Activities:
  - The MW CEAC is working closely with the Midwest Cogeneration Association (MCA) in implementing a monthly webinar series titled "Sustaining Operational Efficiency and Effective O&M Strategies for Existing Cogeneration/CHP Applications." The first webinar of FY2012.Q2 will be scheduled for February 2012.

Deliverable: 3	**Task: 2**

Description: *All educational material developed and utilized in Deliverable 2 posted on the website*

Activity: See the U.S. DOE Midwest Clean Energy Application Center website at www.midwestcleanenergy.org.

Deliverable: 4	**Task: 3**

Description: *1 regulatory workshop*

Activity:

- Regulatory/Policy Workshop/Webinar:
  - No workshops/webinars were scheduled during Q1.FY2012.
  - The MW CEAC is working closely with the Midwest Governors Association (MGA), the Ohio Coalition for CHP, the Ohio Governor's Office, and other key stakeholders in planning a workshop for Q2.FY2012.

- RAC Policy Meetings:
  - The MW CEAC assisted in the organization, coordination, and participation of the CEAC Policy Meeting on November 16th working closely with Eric Wong of ICF.

- Target Policy State: As part of DOE's CEAC highlighted policy efforts, the MW CEAC has continued their focus and attention on the State of Ohio and has been actively involved in developing an action plan for the State of Ohio, working with the Ohio Coalition for Combined Heat and Power. The MW CEAC isone of the founding members of the coalition and serves as one of the key technical support entities for the coalition.
  - The Ohio Coalition for Combined Heat and Power (OCCHP) submitted CHP/WHR policy recommendations to Governor Kasich's office on 10/25/11. The MW CEAC reviewed and provided recommendations to the draft version of the policy recommendations.
  - The MW CEAC presented to the commissioners and staff of the the Public Utility Commissioner of Ohio on November 22, 2012.
  - Stemming from actions that took place in Q4.FY2011, that included the MW CEAC providing requested technical assistance and information, the Ohio PUC ruled in favor of the 350 MW outlined in AEP's 3 year energy security plan.
  - The Ohio Coalition for Combined Heat and Power and the MW CEAC met various times (in-person meetings, conference calls, one-on-one calls) with the Governor's staff, legislative staff, PUCO staff, and other government staff throughout Q1.FY2012.
  - The MW CEAC is developing a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets in Ohio. The three IOUs being investigated are Duke, AEP, and First Energy. The report is expected to be published in Q3.2012.
  - The MW CEAC attended bi-weekly meetings (conference calls) and other meetings with representatives from the Ohio Coalition for Combined Heat and Power during Q1.FY2012.

- Other States:

- Missouri – the MW CEAC met with Missouri SEO staff on 12/12/2011.
- Wisconsin – the MW CEAC met with Wisconsin SEO staff on 10/28/2011.
- Iowa – the MW CEAC met with Iowa SEO staff on 12/8/2011.

- Other Activities and Organizations:
  - State Energy Efficiency Action Network (SEE Action): the Midwest RAC has been serving on the Industrial and CHP sub-committee identifying the strategies to better meet DOE's overall energy goals within the industrial and CHP market sectors and attended SEEAction meetings during Q1.FY2012.
  - Illinois Electric Cooperatives: the MW CEAC is working closely with Association of Illinois Electric Cooperatives (AIEC) to promote AD/CHP in the State of Illinois through the Illinois electric cooperatives and to identify the related barriers.
  - U.S. Clean Heat and Power Association (USCHPA) – the MW CEAC serves on the board of directors for the USCHPA and attended various team meetings/calls during Q1.FY2012.
  - Midwest Cogeneration Association (MCA) – the MW CEAC serves on the board of directors for the MCA and Cliff Haefke serves as Vice President of the MCA and attended conference calls and planning meetings for the October cogeneration conference.
  - Midwest Governors Association – the MW CEAC has been meeting with the MGA to plan a CHP/WHR policy workshop in Ohio scheduled for Q2.FY2012.
  - Midwest Energy Efficiency Alliance (MEEA) - the MW CEAC serves on the board of MEEA and attended various meetings during Q1.FY2012.

Deliverable: 5 **Task: 4**

Description: *Incorporate district energy and waste heat recovery technology material into the website.*

Activity:

- The initial activity of incorporating district energy and waste heat recovery technology material into the website was completed in FY2011.Q2.
- Cliff Haefke serves as co-chair with Christine Brinker (IM CEAC) for the CEAC Website and Logo Working Group.
- During Q1.FY2012, the DSIRE database feed were under development.
- The Working Group is coordinating the Target Market Sector website page development (see Deliverable 8 for more information).

Deliverable: 6 **Task: 4**

Description: *Provide semi-annual report on website activities, usage, and metrics.*

Activity:

- The MW CEAC worked with Martin Schweitzer (ORNL) during Q1.FY2012provide additional data and clarification to the Midwest Region's CEAC metrics.
- Avalon Consulting is working with the MW CEAC and using the Midwest RAC website as the test CEAC website to analyze web tracking software.
- Reporting on website activities, usage, and metrics is completed on a quarterly basis. Please see the Appendix for the Q1.FY2012 Midwest CEAC Website Traffic Report.

Website Highlights:

- Over 5,700 pages were viewed
- Over 1,850 visits
- Number of unique visitors per month ranged from 473 to 502

Deliverable: 7	**Task: 4**

Description: *Develop a minimum of 9 project profiles.*

Activity:

-
- Several Project Profiles were in development in Q1.FY2012, includingthe following:
    - Northern Border Pipeline, North Dakota, 5.5 MW
    - University of Missouri, Columbia, MO, 83.5 MW
    - CokeEnergy, East Chicago, IN, 94 MW
    - Gundersen Lutheran, LaCrosse, WI
    - Bayview WWTF, Toledo, OH

Deliverable: 8	**Task: 4**

Description: *Develop and launch at least 1 market sector page on the website.*

Activity:

- Cliff Haefke (MW CEAC) and Christine Brinker (IM CEAC) are co-chairs for the CEAC Website Working Group.
- Cliff and Christine are working with the 8 CEACs in developing the Target Market Sector web pages for the CEACs.
- The 8 CEACs plus IDEA are all tasked to complete a draft of one Market Sector write-up each by 1/31/2012 that will be submitted to Cliff and Christine.
- The goal is to publish these initial market sector write-ups on the CEAC websites by 2/29/2012.

Deliverable: 9 **Task: 4**

Description: *Technical studies (topics TBD during the course of the year). Reports posted on the website and provided as deliverable.*

Activity:

- Technical Studies Under Development
  - The MW CEAC is working with the Association of Illinois Electric Cooperatives on developing a County-by-County Biogas Feedstock CHP Potential for the State of Illinois (completion expected Q2.FY2012).
  - The MW CEAC developed a draft report studying the impacts and potential barriers of standby rates toward CHP and other generating assets under Iowa utilities in conjunction with the Environmental Law & Policy Center and the Iowa Environmental Council. This report will be published in Q2.FY2012 and presented to the Iowa investor owned utilities
  - The MW CEAC is working on a report studying the impacts and potential barriers of standby rates toward CHP and other generating assets within Ohio utilities. The report is expected to be published Q3.FY2012.
  - The MW CEAC will be updating the 2005 CHP Resource Guide during FY2012. A planning meeting was organized in December 2011. Work on this guide is expected to begin in Q2.FY2012.

Deliverable: 10 **Task: 4**

Description: *Semi-annual reporting of changes in clean energy installations in the Midwest to DOE database.*

Activity:

- The MW CEAC submitted updates on installation data and information for the Midwest Region to Anne Hampson (ICF International) during Q1.FY2012.

Deliverable: 11 **Task: 5**

Description: *Up to 10 technical site evaluations on an as required basis.*

Activity:

Technical Analysis

- <u>The Plant, Chicago,</u> IL – the MW CEAC provided project assistance to THE PLANT providing funding, loans, and incentive assistance.The facility is based on vertical indoor farming and is implementing an AD/CHP project.
- <u>Thilmany Papers</u>, Kaukauna, WI – the MW CEAC met with Thilmany Papers to discuss future CHP operations/modifications and their efficiency issues in their existing steam turbines. The MW CEAC is developing a paper on low isentropic efficiency issues in steam turbines as part of the first steps of reviewing their

plant, expected completion FY2012.Q2. The MW CEAC was introduced to Thilmany Papers by Paul Lemar, DOE Technical Account Manager (TAM).

- Gundersen Lutheran Hospital, Lacrosse, WI (Phase II): the Midwest CEAC is providing technical assistance to GL on their biomass CHP project (operations expected in late 2012).
- Technical Assistance to Illinois Biogas CHP Projects: the MW CEAC serves as the technical resource arm for the Illinois DCEO (state energy office) on the technologies of CHP. UIC/ERC has leveraged funds with the IL DCEO to serve as the contract manager for the Illinois Biogas/Biomass CHP Program.
- The MW CEAC continues to maintain relations with and establish new contacts with industry stakeholders of the CHP/WHR/DE industry.
- The MW CEAC has been working with the Association of Illinois Electric Cooperatives (AIEC) on the RenewE program for Illinois coop members interested in investigating the biogas CHP opportunities.. The MW CEAC is serving as the prime technical advisor in investigating the technical feasibility studies.
- The MW CEAC is working with DOE headquarters and ICF on the upcoming technical assistance work in relation to the ensuing Boiler MACT ruling.

Deliverable: 12 **Task: 5**

Description: *Provide clean energy technology support to Midwest IACs.*

Activity:

- No activity in Q1.FY2012.

Deliverable: 13 **Task: 6**

Description: *Quarterly status reports activities, deliverables, etc. in accordance with NETL/DOE instructions.*

Activity:

- The Quarterly Report was submitted to Joe Renk (DOE/NETL) and Elmer Fleischman (DOE/NETL).
- The Quarterly Report was submitted to the DOE EERE Management Center website at https://www.eere-pmc.energy.gov/SubmitReports.aspx.

Deliverable: 14 **Task: 6**

Description: *Support DOE metrics of Centers as required.*

Activity:

- The MW CEAC worked with Martin Schweitzer (ORNL) during Q1.FY2012 to provide additional data and clarification to the MW CEAC’s metrics.

Appendix

U.S. Midwest Clean Energy Application Center

Website Traffic Report: October through December 2011

(Source: Google Analytics)

- Over 5,610 pages were viewed by over 1,850 visits and the number of unique visitors per month ranged from 473 to 502. Figures 1 through 4 show the monthly number of pages viewed, number of visitors, number of unique visitors and number of PDF files downloaded/viewed, respectively; and cumulative number of pages viewed, visitors and PDF files downloaded/viewed are shown in Figures 5 and 7, respectively. Please note that the counting of PDF downloaded files recorded by Google did not start until October 2011.
- The tiles of the pages viewed and the total number of time these pages were viewed during the quarter are shown in Exhibit 1.

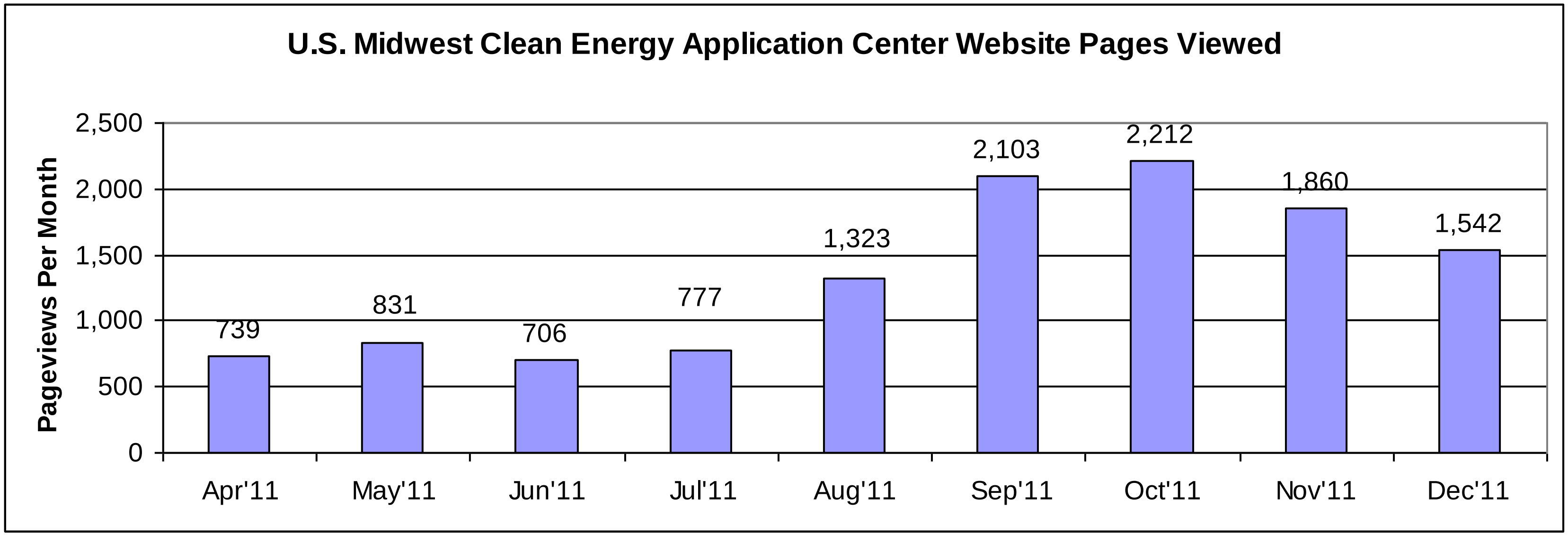


Figure 1: Monthly Total Pages Viewed

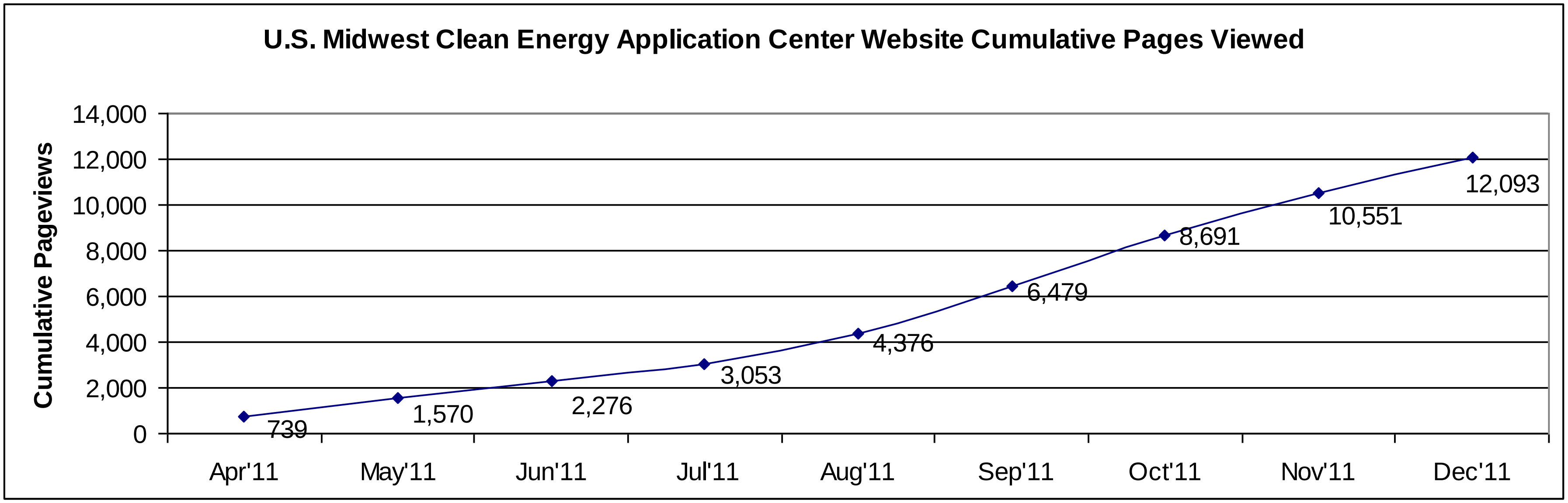


Figure 2: Cumulative Pages Viewed

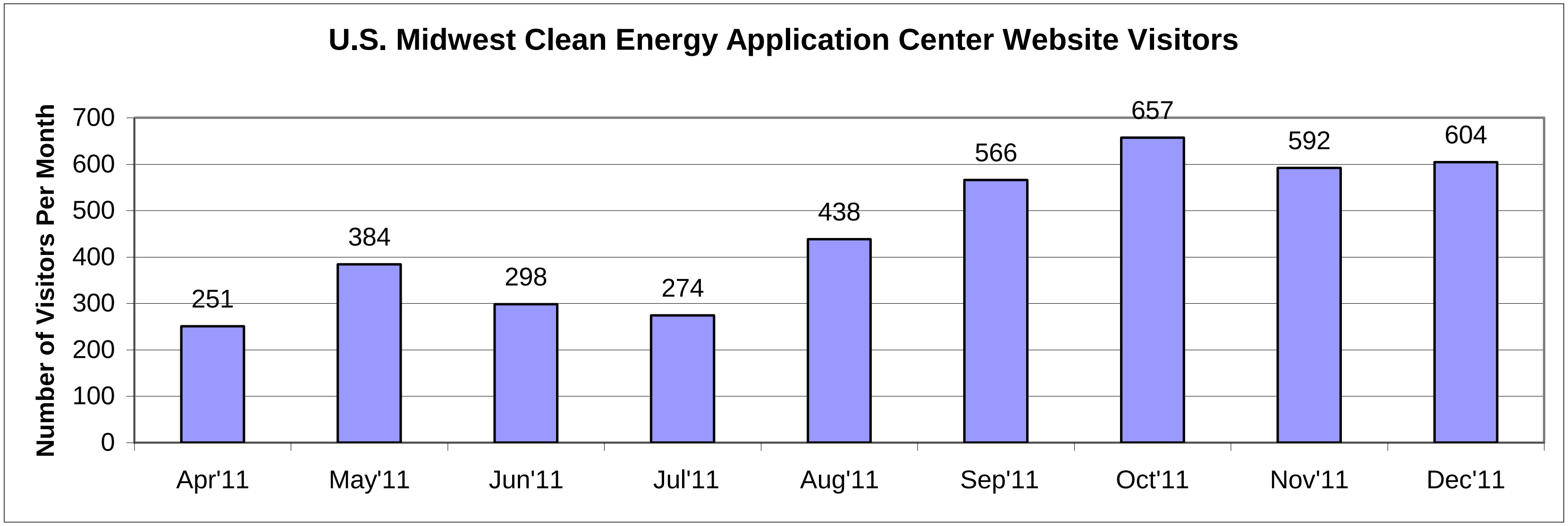


Figure 3: Monthly Number of Visitors

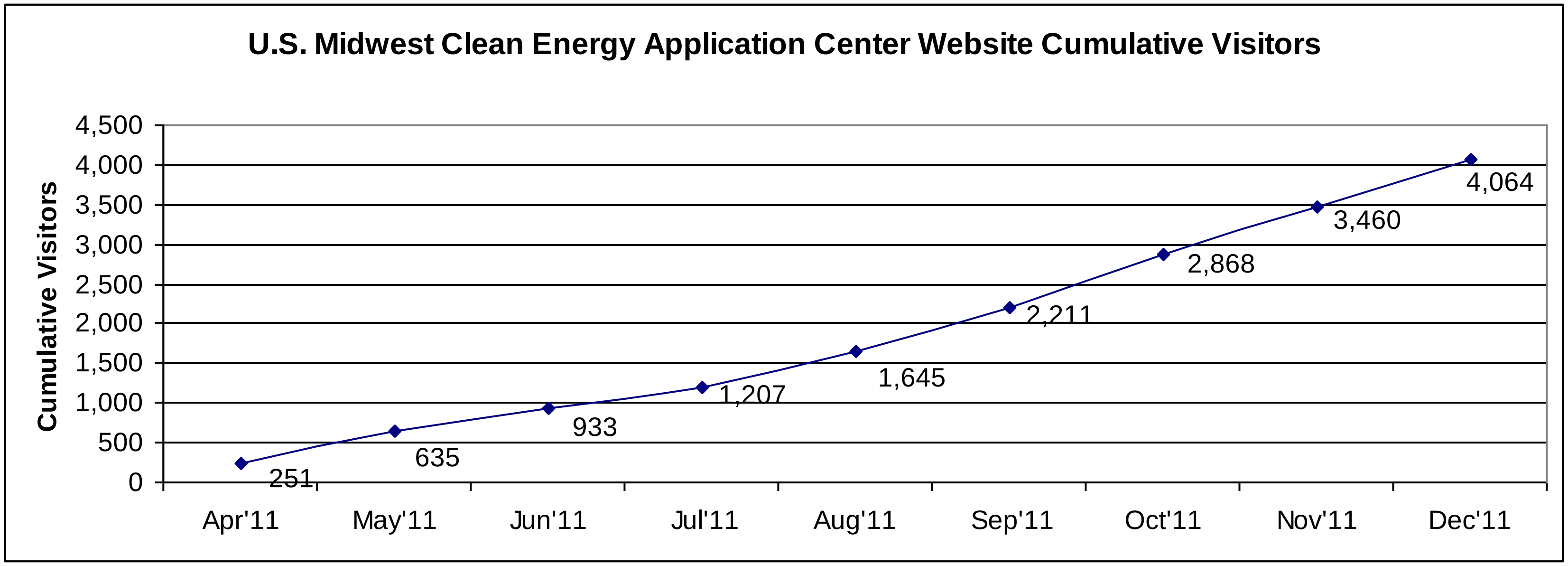


Figure 4: Cumulative Numbers of Visitors at the Midwest RAC Website

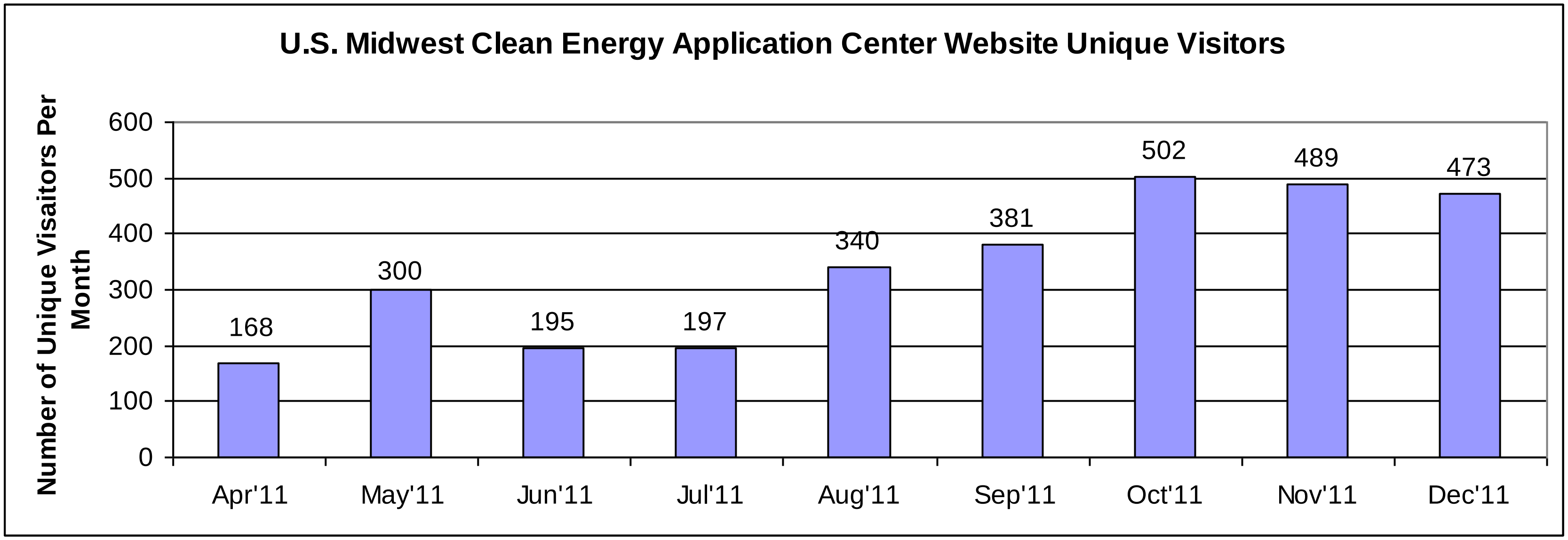


Figure 5: Monthly Numbers of Unique Visitors at the Midwest RAC Website

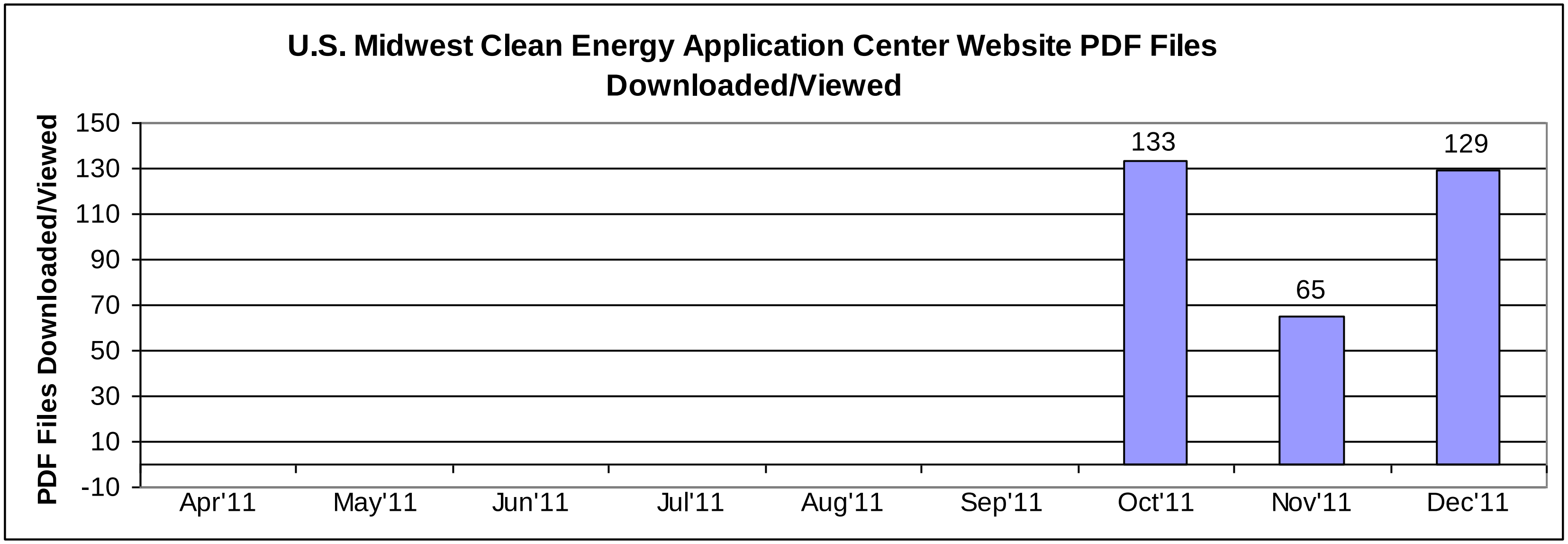


Figure 6: Monthly Numbers of PDF Files Downloaded from the Midwest RAC Website

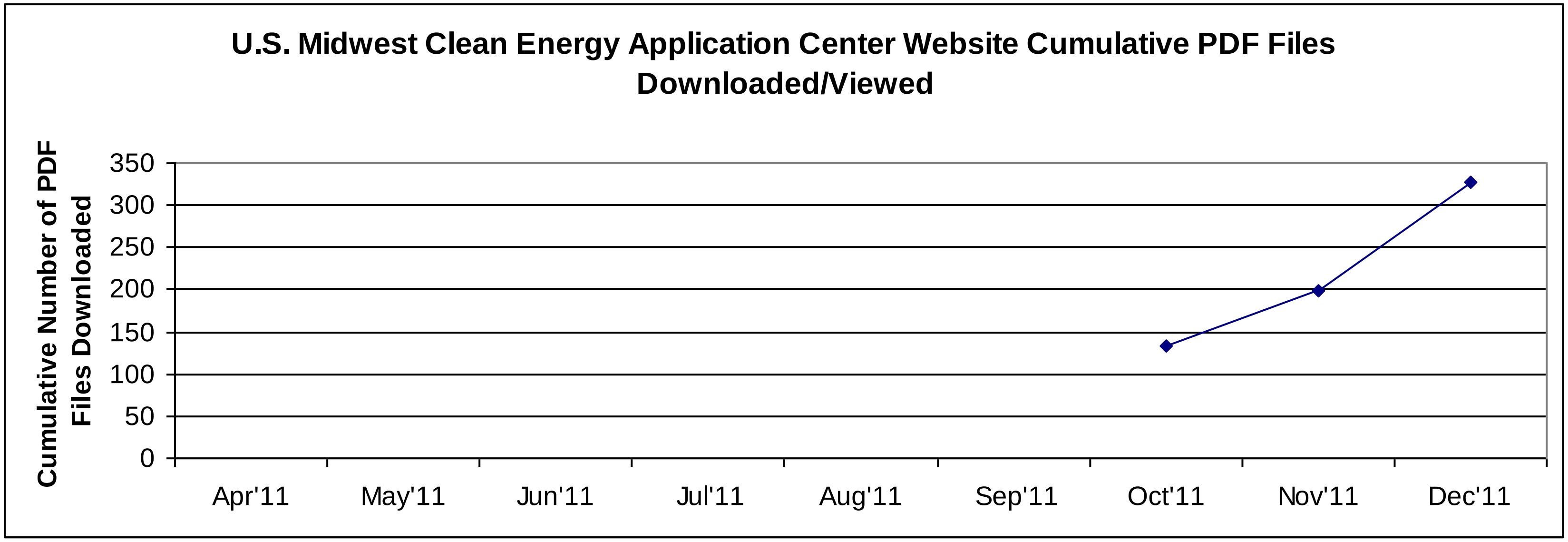


Figure 7: Cumulative Numbers of PDF Files Downloaded from the Midwest RAC Website

Exhibit 1: Titles of the Pages Viewed at the U.S. DOE Midwest RAC Website

Page Title	Pageviews
/	1,267
/resources/	356
/PDFPages/	327
/states/	320
/profiles/	301
/cleanenergy/chp/	283
/events/	172
/cleanenergy/chp/technologies.aspx	171
/cleanenergy/chp/technologies-thermal.aspx	128
/cleanenergy/whr/	128
/cleanenergy/whr/heat-to-power.aspx	112
/cleanenergy/whr/recovery.aspx	110
/cleanenergy/chp/products.aspx	106
/events/webinars/index.html	93
/cleanenergy/chp/fuels.aspx	78
/cleanenergy/chp/emissions.aspx	76
/support/level1.aspx	73
/policy/	71
/cleanenergy/benefits/	68
/support/	62
/Contact.aspx	58
/markets/industrial/naturalgas.aspx	57
/markets/	56
/cleanenergy/whr/feasibility.aspx	54
/cleanenergy/whr/sources.aspx	52
/cleanenergy/chp/history.aspx	51
/cleanenergy/whr/industry.aspx	51
/ohiochp/	49
/support/level2.aspx	49
/states/oh/	43
/cleanenergy/district/	35
/about/	33
/states/mi/	33
/cleanenergy/chp/default.aspx	32
/states/regions.aspx	32
/support/level3.aspx	32
/cleanenergy/whr/resources.aspx	29
/cleanenergy/economics.aspx	27
/cleanenergy/	26
/events/EventRelated/Content/WorkshopSummary_IECA_2010Dec14.asp	26
/cleanenergy/district/generation.aspx	25
/states/ia/	24
/states/il/	24
/states/mn/	23
/cleanenergy/district/who.aspx	22
/events/EventRelated/Content/Agenda_IECA_2010Dec14.aspx	19
/cleanenergy/whr/default.aspx	18
/cleanenergy/district/history.aspx	17
/events/ENewsletter/default.aspx	17
/support/default.aspx	17
/support/procurement.aspx	17
/cleanenergy/district/why.aspx	14
/events/ENewsletter/	14
/cleanenergy/district/economics.aspx	13
/cleanenergy/district/fuels.aspx	12
/PDFViews/2007CornEethanolEnergySys.pdf	12
/states/in/	12
/states/mo/	12
/events/default.aspx?News=ExploringCHPOpportunities	11
/contact.aspx	10
/ohiochp/index.html	10
/default.aspx	9
/XLSPages/	9
/cleanenergy/district/default.aspx	8
/ohiochp/register.aspx	7
/states/wi/	7
/cleanenergy/default.aspx	6
/states/ks/	6
/states/nd/	6
/events/default.aspx?News=SwineProducers	5
/states/sd/	5
/midwestwebinar/	4
/states/ia/default.aspx	4
/states/il/default.aspx	4
/states/sd/default.aspx	4
/HospitalGuide/	3
/markets/institutional/	3
/states/mi/default.aspx	3
/states/oh/default.aspx	3
/translate_c?hl=de&prev=/search?q=combined+heat+and+power+mid+we	3
/cleanenergy/benefits/default.aspx	2
/events/default.aspx?News=CleanHeatPowerAssociation	2
/events/default.aspx?News=IndustrialEnergyStrategies	2
/events/default.aspx?News=WebinarCHPWHRBarriersInOhio	2
/events/webinars/	2
/markets/commercial/	2
/markets/industrial/	2
/search?hl=en&gs_sm=e&gs_upl=4140l6015l0l6390l10l10l0l9l0l0l141l141	2
/states/mn/default.aspx	2
/states/nd/default.aspx	2
/states/ne/	2
/events/default.aspx?News=AnnualOhioEnergyManagement	1
/events/default.aspx?News=ID	1
/events/default.aspx?News=IDEA24thAnnualCampusEnergyConference	1
/PDFViews/040130-ILinterconnect-AppendixA.pdf	1
/PDFViews/040805_Roadmap_Final.pdf	1
/PDFViews/EthanolStudyReport_Nov2007.pdf	1
/PDFViews/IA_Baseline_Report_Final_102405.pdf	1
/PDFViews/icci_coal_ethanol_final_report_pub.pdf	1
/PDFViews/USHospitalGuidebook_111907.pdf	1

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2012 – 2nd Quarter
January 1, 2012 through March 31, 2012

Submission Date:
April 30, 2012

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
April 30, 2012

Dear Mr. Renk,

Please find the attached Progress Report for the 2nd Quarter of Fiscal Year 2012 (FY2012.Q2) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $70,872.37 for FY2012.Q2:

- January 2012: $9,192.17
- February: $31,666.19
- March: $30,014.01

Below you will find a brief synopsis of our activities (deliverables and tasks) for FY2012.Q2. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 4/30/2012
b. Reporting Period: January 1, 2012 through March 31, 2012

Sections 4,5, 7: Quarterly Accomplishments & Schedule Status (see Appendix)

Section 6: Cost Status – The center invoiced $70,872.37 for FY2012.Q2.

- January 2012: $9,192.17
- February: $31,666.19
- March: $30,014.01

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed in the Appendix.

    i. **1/17 – Industrial/Commercial/Institutional Boiler MACT Combined Heat and Power: A Technical & Economic Compliance Option**, DOE SEE Action Webinar (see attached)

    ii. **2/3 – Welcome Presentation** @ Biogas Renewable Energy CHP Projects for Clinton County Electric Coop Dairy Farmers: Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line, Breese, IL. (see attached)

iii. **2/6 – Introduction to Combined Heat & Power (CHP)** @ 2012 NARUC Winter Meetings, Washington DC (see attached).

iv. **2/6 - Strategic States and SEE-Action Network for Industrial EE & CHP** @ IDEA Business Development Workshop, Washington DC. (see attached)

v. **2/9 – Welcome Presentation** @ Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers: Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line, Effingham, IL. (see attached)

vi. **2/10 – Welcome Presentation** @ Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers: Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line, Macomb, IL. (see attached)

vii. **2/14 – CHP & WHR Technology Briefing and Environmental Benefits**, Ohio Webinar (see attached).

viii. **3/9 – U.S. Department of Energy Boiler MACT Technical Assistance Pilot Program** @ Public Utilities Commission of Ohio (PUCO) Educational Forum, Columbus, OH (see attached).

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

Appendix

CEAC Goals and Milestones from January Presentations and Project Management Plan

CEAC	Goals	Activities	Outcomes	Milestones	Status (as of 3/31)
Midwest	Ohio		• Inclusion of CHP /WHR as a specified & recognized technology with an installed capacity target in the new Governor's energy plans , Ohio energy regulations, Ohio energy legislation. • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Participate Workshop(s) (energy summit follow-up) PUCO…Feb. 2012 • Develop consensus on the policy direction (Ohio CHP Coalition) ….Spring ,2012 • Policy reform introduced from Gov Office to Legislature and/or PUCO…. Spring 2012 • Provide educational and technical support to the Coalition (biweekly conference calls, white paper(s) identifying issues and suggested actions to be considered: rate structures /jobs ..Ongoing • Initiate Boiler MACT activities with PUCO …. Winter 2012 • Complete Policy Options Paper (standby rates)..Spring2012	• COMPLETED Q2: March Workshop hosted 3/9, more being planned • Ongoing (undetermined consensus amongst coalition, testimony to be heard by state senate in April on SB 315 • COMPLETED Q2: Gov. Kasich introduced energy plan (SB 315) on 3/22 • Ongoing • Initiated March, additional milestones being set • Ongoing (to be published in May 2012)
	Illinois		• Initiate the implementation of a minimum of two biogas CHP projects with the Association of Illinois Electric Cooperatives securing their commitment to biogas CHP within the state and expanding biogas CHP within the state • Bring the Ohio model to Illinois (ELPC, IEC, NRDC, others) • Expand educational activities to identify new CHP avenues within the state: • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Partnership with AIEC, identification of 2 CHP sites & initiation of engineering studies (includes 3 planned workshops)…..Fall 2012 • Successful start-up of minimum 2 additional CHP biogas sites…Fall 2012 • Illinois Power Authority commitment to WHR as approved technology for RPS (long term contracts)….Spring 2012 • IDEA workshop on Community Energy Development Guide…(Chicago) --- District Energy/CHP as redevelopment tool ….June, 2012 • Develop plan for bringing Ohio model to Illinois … Fall 2012	• Ongoing (Working with Iron Street Farms & Downstate Community Digester Ag Project, 3 workshops co-sponsored on 2/3, 2/9, 2/10) • Ongoing (working with Fox River Grove WWTF (100 kW) and Danville WWTF (100 kW)) • Ongoing • Ongoing • Not yet started
	Wisconsin		• Re-engage the SEO, include CHP in their energy programs. • Continue technical support on high visibility CHP/WHR projects (target markets remain biogas and pulp/paper) • Inclusion of CHP as a viable approach to meet Boiler MACT Regs •	• Identify and implement outreach activities with SEO and targeted markets (Breweries, Food Processing, Livestock, WWTF).. Ongoing efforts with potential webinars by spring/summer 2012 • Min 2 project profiles from tech assistance efforts … ongoing	• Workshops delayed till fall • Initiated work on one project profile (March), Gundersen Lutheran Health System in Onalska, WI (completion expected May 2012)
	Iowa		• IEC & ELPC introducing utility rate reform to PUC • SEO/Industry sponsored education webinars • CHP as a viable approach to meet Boiler MACT Regs	• Rate study analysis completed (best practices).. Spring 2012 • CHP Market Impact Analysis .. Summer 2012 • Settlement agreement meeting ..Summer 2012 • IEC & ELPC submittal of reform request to PUC … Fall 2012 • 1 Targeted webinar .. Summer/Fall	• COMPLETED: submitted Feb • Ongoing • COMPLETED: first meeting held 3/7 in Des Moines • Ongoing • Not yet started
	Minnesota		• Inclusion of CHP/WHR in SEO programs and recommendation to PUC for DG policy reform • CHP as a viable approach to meet Boiler MACT Regs	• Rate study / net metering paper(s) for SEO.. Summer 2012 • Reform recommendations to PUC .. Fall 2012	• Not yet started • Not yet started

	Indiana	▪	NIPSCO initiate pilot FIT for CHP similar to existing pilot FIT for renewables	NIPSCO agreement to proceed with pilot FIT request to Utility Commission …..Winter 2012	Not yet started
	Michigan	▪	Expanded CEAC work in Michigan	Identify and initiate expanded CHP opportunities for CEAC involvement ….Fall 2012	Not yet started
	Kansas Missouri Nebraska North Dakota South Dakota		Support CHP activities as required	Nothing identified at this time	
	Boiler MACT			• Training Session …Jan. 2012 • Develop Implementation Plan …. March 1st, 2012 • Method of Screening Opportunities • Materials Development • Method of Contacting Opportunities (including site visits) • Resources Split (internal versus subcontracts) • Implementation ….. Spring 2012 • Ohio Test Case: Work with PUC Ohio – January 2012	• Completed • Ongoing • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Resources identified • Pilot underway in Ohio • Work underway – initiated March
	SEEAction			Planned FY 12/FY 13 Activities/Milestones • Lead the development of CHP version of Policy Guide • Provide assistance to Hdqtrs in development of white papers and policy guide book.. ongoing • Participate in the Development & Implementation of 2 Regional Utility/Regulatory Workshops (MW & SE) •	Lead shifted to Eric by DOE Hdqtrs Ongoing Ongoing coordination with MEEA
	Market Sector Development		Market Sector Business Plans	Plan development participation: - Hospitals – NE lead….Spring ○ Project Profile ○ White Paper - WHR – Pacific lead….Spring - Biomass – NW lead….Spring	• Ongoing (participated on conference calls, reviewed drafts, provided comments) • Ongoing ((participated on conference calls, reviewed drafts, provided comments) • Ongoing (participated on conference calls, reviewed drafts, provided comments)
	Other		Educational Materials	• Updated CHP Resource Guide • Project Profiles	• Outline to be submitted to DOE for review in April 2012 • Ongoing

Industrial/Commercial/Institutional Boiler MACT

Combined Heat and Power
A Technical & Economic Compliance Strategy

January 17, 2012

John Cuttica, Midwest Clean Energy Application Center
Bruce Hedman, ICF International

ICI Boiler MACT

- Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters (excludes any unit combusting *solid waste*)
- Major source is a facility that emits:
  - 10 tpy or more of any single Hazardous Air Pollutant, or 25 tpy or more of total HAPs
- Emissions limits applicable to new and existing units > 10 MMBtu/hr
  - Mercury (Hg)
  - Particulate Matter (PM) as a surrogate for non-mercury metals (alternative limits for total selective metals (TSM))
  - Hydrogen Chloride (HCl) as a surrogate for acid gases
  - Carbon Monoxide (CO) as a surrogate for non-dioxin organics)

Impacts of the Boiler MACT

- Compliance straight forward for natural gas fired units (tune-ups)
- Rule significantly impacts oil, coal and biomass boilers and process heaters
- Controls are potentially required for Hg, PM, HCl and CO
- Emissions limits must be met at all times except for start-up and shutdown periods
- Also includes monitoring and reporting requirements
- Limits are economically challenging for oil and coal units

Compliance Options

- The specific emissions limits depend on fuel type and combustor design, but all pollutants within a group (Hg, PM, HCl, CO) can be controlled with the same measures
- Required compliance measures for any unit depend on current emissions levels and control equipment already in place
- Fabric filters and activated carbon injection are the primary control devices for Hg
- Electrostatic precipitators may be required for units that need additional control for PM or TSM
- Wet scrubbers or fabric filters with dry injection are primary controls for HCl
- Tune-ups, replacement burners, combustion controls and oxidation catalysts for CO and organic HAPs control

Potential Opportunity for CHP?

- Compliance with MACT limits will be expensive for many coal and oil units - some users will consider switching to natural gas
- Potential opportunity to move to natural gas CHP
  - Trade off of benefits and additional costs
  - Economics now based on incremental investment over compliance costs
- Affected units (EPA ICR Database – all facilities)
  - 616 coal units ($2.7 Billion capital cost)
  - 903 liquid fuel units ($1.7 Billion capital cost)
  - 508 biomass units ($0.6 Billion capital cost)

Affected Industrial/Commercial/Institutional Boilers

	EPA ICR Data	
Number of Facilities	652	
Fuel Class	# Units	Capacity (MMBtu/hr)
Coal	495	131,526
Heavy Liquid	287	38,020
Light Liquid	202	19,926
Biomass	442	97,131
Process Gas	78	21,146
Total	**1,504**	**307,749**

Excludes non-continental liquid, Gas 1 (NG/RG) and limited use units

Facilities with Affected Boilers by Region

Region	Number of Facilities	Number of Coal Units	Number of Oil Units	Number of Biomass Units	Number of Process Gas Units
Midwest	**187**	**242**	**114**	**55**	**53**
Southeast	**270**	**153**	**200**	**248**	**7**
Mid-Atlantic	56	68	58	14	18
North East	37	11	58	16	0
Mountain	8	10	7	0	0
Northwest	45	7	20	55	0
Gulf Coast	39	3	13	46	0
Pacific	10	1	19	8	0
Total	**652**	**495**	**489**	**442**	**78**

Includes only Industrial/Commercial/Institutional units

Affected Coal, Oil, and Process Gas Boilers by Industry (drops biomass boilers)

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)
Mining (except Oil and Gas)	7	14	4,767
Food Manufacturing	64	134	27,745
Textiles	13	28	1,851
Wood and Furniture	18	27	2,508
Paper Manufacturing	87	149	48,566
Petroleum Refining	19	65	10,491
Chemical Manufacturing	74	199	34,347
Plastics and Rubber Manufacturing	22	54	4,500
Primary Metal Manufacturing	20	107	35,048
Transportation Equip. Manufacturing	23	80	11,151
Other Industrial	11	28	8,877
Educational Services	26	68	10,400
National Security and Int'l Affairs	9	64	4,695
Other Institutional	17	45	5,673
Total	410	1062	210,618

Includes only industrial, commercial and institutional boilers

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	242	62,071
Heavy Liquid	63	10,351
Light Liquid	51	4,461
Process Gas	53	14,820
Total	**409**	**91,705**

Includes only coal, oil, and process gas industrial, commercial and institutional boilers (drops out biomass boilers)

Affected Coal, Oil, and Process Gas Boilers in the Midwest

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)	Existing CHP Sites	Existing CHP Capacity (MW)
Mining and Agriculture	5	14	4,397	2	134
Food Processing	**42**	**89**	**20,299**	**19**	**676**
Wood Products	4	8	421	0	0
Paper Products	**29**	**55**	**13,716**	**19**	**739**
Refining	5	10	857	1	40
Chemicals	**21**	**48**	**7,135**	**2**	**6**
Plastic and Rubber Products	5	13	781	0	0
Primary Metals	**9**	**64**	**23,529**	**5**	**547**
Transportation Equipment	**12**	**40**	**6,840**	**1**	**3**
Other Industrial	11	27	6,787	2	24
Colleges/Universities	13	34	6,294	9	268
Hospitals	1	3	191	1	1
Other Institutional	2	4	456	0	0
Total	159	409	91,705	61	2,439

Affected Boilers in the Southeast

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	153	39,353
Heavy Liquid	110	11,716
Light Liquid	90	7,422
Process Gas	7	1,322
Total	**360**	**59,814**

Includes only coal, oil, and process gas industrial, commercial and institutional boilers (drops out biomass boilers)

Affected Coal, Oil, and Process Gas Boilers in the Southeast

Application	Number of Facilities	Number of Units	Boiler Capacity (MMBtu/hr)	Existing CHP Sites	Existing CHP Capacity (MW)
Food Processing	10	16	2,258	2	31
Beverage and Tobacco	3	5	1,123	2	25
Textile Mills	8	16	1,387	0	0
Wood Products	8	10	412	0	0
Paper Products	**36**	**60**	**24,612**	**25**	**1,706**
Chemicals	**31**	**102**	**17,028**	**6**	**301**
Plastics and Rubber Products	**11**	**30**	**2,354**	**0**	**0**
Transportation Equipment	4	16	1,794	0	0
Other Industrial	8	24	2,801	1	40
Colleges and Universities	6	12	1,511	3	44
National Security and Int'l Affairs	6	56	3,623	0	6
Other Institutional	5	13	910	0	0
Total	136	360	59,813	39	2,152

CHP as a Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler

Example – Affected Facility in Pennsylvania

- Four existing coal boilers at the site

Boiler Capacity	Fuel	Annual Hours	Existing Controls
10.2 MMBtu/hr	Coal	8000	Cyclone
17.0 MMBtu/hr	Coal	8000	Cyclone
20.4 MMBtu/hr	Coal	8000	Cyclone
20.4 MMBtu/hr	Coal	4000	Cyclone

  - Average steam demand of 40 MMBtu/hr
  - Pays $0.08/kWh for power and $3.10 MMBtu for coal
- Projected compliance costs
  - Additional controls required for PM, HCl and CO
  - $4,100,000 Capital cost
  - $723,000 annual operating and maintenance costs

Comparative Steam Costs

	Existing Coal Boilers	New Natural Gas Boilers	Natural Gas CHP
Steam Capacity, MMBtu/hr	60	60	60
Avg Steam Demand, MMBtu/hr	40	40	40
Boiler Efficiency	76%	80%	N/A
CHP Capacity, MW	0	0	8
CHP Electric Efficiency	N/A	N/A	29%
Fuel Use, MMBtu/year	416,842	396,000	752,993
Annual Fuel Cost	$1,292,211	$2,772,000	$4,901,985
Annual O&M Cost	$1,242,189	$502,920	$1,154,664
Annual Compliance O&M	$723,000		
Annual Electric Savings			($4,692,557)
Annual Steam Operating Costs	$3,257,400	$3,274,920	$1,364,092

Based on delivered coal price of $3.10/MMBtu, natural gas price of $7.00/MMBtu, and industrial electricity price of $0.08/kWh (CHP avoids 90% of retail rate)

CHP Paybacks

		Existing Coal Boilers	Natural Gas Boilers	Natural Gas CHP
1	Annual Steam Operating Costs	$3,257,400	$3,274,920	$1,364,092
2	Annual Operating Savings (coal compliance)			$1,893,308
3	Annual Operating Savings (gas boiler)			$1,910,828
4	Installed Costs	$4,103,000	$2,643,750	$16,000,000
5				
6	CHP Incremental costs (coal compliance)			$12,000,000
7	CHP Payback (coal compliance)			6.3 years
8				
9	CHP Incremental costs (gas boiler)			$13,355,000
10	CHP Payback (gas boiler)			7.0 years

CHP Benefits

- Compliance with MACT
- Investment versus Operating Cost
- Payback between 6 and 7 years
- Increase Electric Service Reliability
- Enhance Economic Competitiveness
- Reduce Carbon Emissions

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	227	495	131,526	13,155
Heavy Liquid	120	287	38,020	3,803
Light Liquid	91	202	19,926	1,993
Process Gas	14	78	21,146	2,115
Total	452*	1062	210,618	21,065

*Some facilities are listed in multiple categories due to multiple fuel types; there are 410 affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

Boiler MACT Assistance Available

- List of available state incentives for emissions controls, energy efficiency measures, boiler replacements/tune-ups, CHP, and energy assessments (DOE)
  - http://www1.eere.energy.gov/industry/states/pdfs/incentives_boiler_mact.pdf
  - Will be updated when final reconsidered rule signed
- Extensive assistance materials for Area Source rule available from EPA
  - Tune-up guidance, fast facts, brochure, table of requirements, small entity compliance guide, etc.
  - www.epa.gov/ttn/atw/boiler/boilerpg.html
- DOE technical assistance for Major Source rule (when final reconsidered rule signed)
  - Site-specific technical and cost information for evaluation of clean energy compliance options for facilities with coal/oil-fired boilers through Regional Clean Energy Application Centers. Includes site visits.

Thank You!

U.S. Department of Energy
Midwest Clean Energy Application Center

Biogas Renewable Energy
CHP Projects for Clinton County
Electric Coop Dairy Farmers:

Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line

Knotty Pine Restaurant ● Breese, Illinois

February 3, 2012

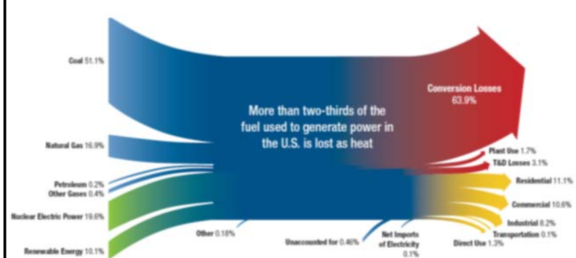
Thank You to All our Sponsors!

Today's Workshop Agenda

- Regulations impacting operations
- Implementing an anaerobic digester project
- Investigating digester outputs
- On-farm case study
- Interconnection
- Funding
- Lunch
- Q&A

Why is the U.S. DOE interested in Combined Heat & Power (CHP)?

Look at our Current Efficiency in the Power Generation Sector

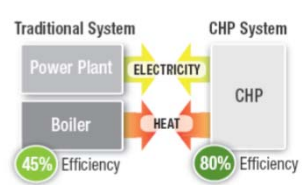


Is there a more efficient way?

Key Part of our Energy Future is CHP

What is Combined Heat and Power (CHP)?

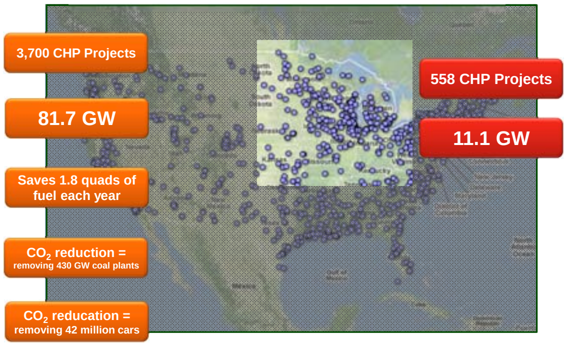
- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building or facility
- Provides at least a portion of the electrical load and
- Recycles the thermal energy for
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification
  - Additional generation



CHP provides efficient, clean, reliable, affordable energy – today and for the future.

40 more Gigawatts of CHP by 2020?

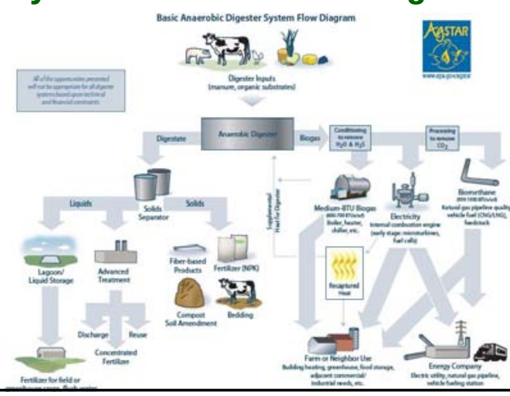
Snapshot of Existing U.S. CHP Installations



Where does CHP make sense?

1. Good Coincidence Between Electric and Thermal Loads
2. Central Heating/Cooling System
3. Large "Spark Spread" - Cost Differential Between Electricity (Grid) and CHP Fuel
4. Long Operating Hours
5. Energy Concerns (current/future costs, power reliability, facility efficiency/conservation, etc.)
6. Environmental Concerns
7. Renovation and/or expansion of existing facilities
8. Access to on-site or nearby biomass/biogas resources

Why CHP and Anaerobic Digesters?



Where are farm AD projects located?

161 farm scale projects
15 regional/centralized or multiple-farm projects

Enjoy the workshop!

- Ask questions…
- Get engaged…
- Network…
- Don't forget to complete the survey…

Introduction to Combined Heat & Power (CHP)

2012 NARUC Winter Meetings
February 6, 2012

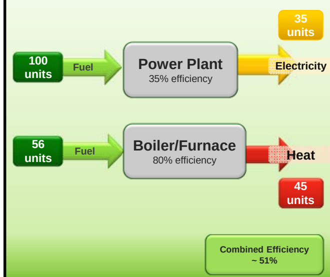
Panel Discussion:
Combined Heat & Power – Panacea or Pandora's Box

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

U.S. Department of Energy Midwest Clean Energy Application Center

www.midwestcleanenergy.org

Traditional Energy Systems



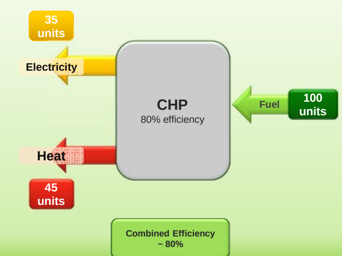
Combined Heat and Power

Conventional CHP

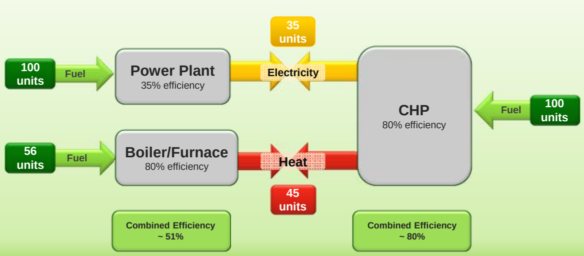
The onsite sequential production of useful electric and thermal power from a single **dedicated** fuel source

3

Conventional CHP System



Traditional Energy System vs. Conventional CHP System



Conventional CHP

- What drives system efficiency in a conventional CHP system?

Ability to utilize as much of the thermal energy as possible + coincidence between electric and thermal loads

- To ensure high system efficiency, how would you size a conventional CHP system?

Size for thermal load and generate electricity when operating to meet the thermal load

- What maximizes the effectiveness of a conventional CHP system?

Long operating hours + max efficiency = max savings/effectiveness

6

Combined Heat and Power

Conventional CHP

The sequential production of useful electric and thermal power from a single **dedicated** fuel source

Waste Heat Recovery CHP

Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power.

Another Form of CHP = Waste Heat Recovery

Waste Heat Recovery CHP

- No additional fossil fuel (capturing waste heat as the fuel)
- No incremental emissions
- Like conventional CHP, power generated at site (DG)
- Base load generation – industrials operate 24/7
- High temp (> 800ºF) is low hanging fruit industrial

Positive Impacts and Benefits (U.S. Businesses)

- Reduces energy costs for the user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability
- Provides stability in the face of uncertain electricity prices

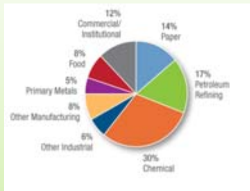
Positive Impacts and Benefits (Nation)

- Provides immediate path to increased energy efficiency and reduced GHG emissions
- Offers low cost approach to new electricity generation capacity and lessens need for new T&D
- Uses abundant, domestic energy sources
- Uses highly skilled local labor & American technologies

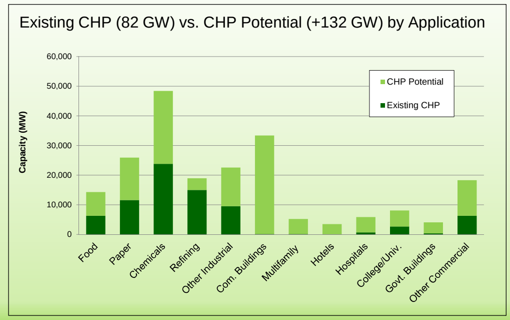
CHP Is Used at the Point of Demand

Existing CHP Capacity

- ~ 8% US generating capacity
- ~ 12% total annual MWh generated
- Industrial applications represent 88% of existing capacity
- Commercial/institutional applications represent 12% of existing capacity:
  - Hospitals, Schools, University Campuses, Hotels, Nursing Homes, Office Buildings, Apartment Complexes,
    Data Centers

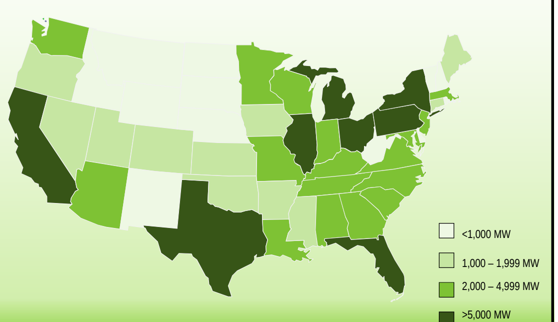


Snapshot



Source: ICF internal estimates

CHP Onsite Technical Potential Market



Source: ICF internal estimates

15

What's Needed to Increase Market Share

- Removal of state policy barriers (interconnection, standby rates, etc)
- Clear value proposition for electric utilities
- Increased awareness of CHP benefits by end-users, state decision makers, & policy makers
- Supportive federal policies
- Technology advancements

Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center

A program at

UIC Energy Resources Center

A program sponsored by

U.S. Department of Energy – Energy Efficiency & Renewable Energy

Strategic States and SEE-Action Network for Industrial EE & CHP

Presentation to:
IDEA Business Development Workshop
February 6th, 2012

Presentation by:
John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

U.S. Department of Energy
Midwest Clean Energy Application Center

Presentation Outline

- Description of the State Energy Efficiency (SEE) Action Network
  - Industrial EE and CHP Working Group
  - First Year Activities
- Examples of ongoing Clean Energy Application Center (CEAC) State Policy Efforts
- CHP as a Boiler MACT Compliance Strategy

The State and Local Energy Efficiency Action Network (SEE-Action)

The Opportunity

1. Energy efficiency represents one of our nation's largest untapped energy resources
2. Investing in cost-effective energy efficiency improvements could save hundreds of billions of dollars nationally over the next 10–15 years*
3. State and local programs and policies are critical to capturing the benefits of efficiency:
   - Job creation and economic development
   - Reduced demand and need for new transmission and distribution investments; improved system reliability
   - Reduction in fossil fuel use; significant public health and environmental benefits

What is SEE Action?

- A state- and local-led effort facilitated by US DOE and US EPA to take energy efficiency to scale that builds on the National Action Plan for Energy Efficiency.**
- SEE Action offers best practice recommendations and technical assistance to state and local decision makers as they seek to advance energy efficiency in their jurisdictions

Goal: to achieve all cost effective energy efficiency by 2020

*McKinsey Global Energy and Materials (2009), *Unlocking Energy Efficiency in the U.S. Economy*
**For more information visit www.epa.gov/eeactionplan

3

Decision Maker Action

SEE Action supports individuals and organizations seeking to reap the benefits of energy efficiency through policies and programs:

- **Utility Regulators and their utility partners** who can utilize efficiency as an energy resource to ensure reliable, affordable energy for ratepayers
- **State and Local Policymakers** including governors, legislators, and mayors, who can implement effective energy efficiency policies and programs for their communities
- **State Energy and Air Officials** who can develop and implement cost-effective energy efficiency programs to realize energy, cost, and emissions savings among other benefits
- **State and Local Partners,** including utilities and other energy efficiency program administrators, financial institutions, energy services companies, industrial facility and commercial building owners, and many others

4

SEE Action Network Structure

SEE Action's Eight Working Groups:

Executive Group Members:
Leadership/strategic direction and vision of SEE Action Network

Working Group Chairs:
Leadership of 8 priority issue areas.

DOE/EPA Staff Leads:
Support/coordination of Working Groups and Executive Group.

Who is the Network?

Over 200 leaders from state and local government, associations, business & industry, NGOs, and others who provide visionary leadership, strategic direction, and drive to reach the goal.

Membership lists at www.seeaction.energy.gov

5

SEE Action Working Group Priorities

+ Driving Ratepayer-Funded Efficiency Through Regulatory Policies
Increase investments in energy efficiency through ratepayer-funded programs.

+ Building Energy Codes
Increase the adoption of model and stretch building energy codes, and increase compliance with adopted codes for new and renovated buildings.

+ Existing Commercial Buildings
Improve energy efficiency in commercial-scale public and private buildings by promoting solutions for whole-building improvements such as retro-commissioning and high performance leasing.

+ Residential Retrofit
Increase the number and effectiveness of moderate income residential energy efficiency programs nationwide, and support development of a thriving home energy upgrade industry.

+ Customer Information and Behavior
Decrease residential energy consumption through behavior change, information, and feedback.

+ Evaluation, Measurement, and Verification
Transform EM&V to yield more accurate, credible, and timely results that accelerate deployment and improve management of energy efficiency.

+ Financing Solutions
Increase and improve energy efficiency financing instruments and mechanisms in the residential and commercial sectors.

+ Industrial Energy Efficiency and Combined Heat and Power (CHP)
Improve energy efficiency in the U.S. manufacturing sector though programs and policies that support industrial efficiency and implementation of CHP.

6

SEE Action IEE/CHP Working Group

- <u>Chairs</u>: Todd Currier, WA Energy Office & Greg White, Commissioner – Michigan PSC
- <u>DOE/EPA staff leads</u>: IEE (Sandy Glatt-DOE, Betsy Dutrow-EPA) and CHP (Katrina Pielli-DOE, Neeharika Naik-Dhungel-EPA)
- <u>Members include</u>: ACEEE, ASE, NRDC, NYSERDA, SoCal Gas, MW CEAC, Saint Gobain
- <u>Blueprint has Four Focus Areas</u>:
  - Demand for Industrial Energy Efficiency & CHP
  - Build the Workforce
  - Promote Efficient Operations & Investment
  - Move the Market

7

IEE / CHP Working Group Scope

- IEE / CHP Working Group addresses:
  - Industrial sector/manufacturing:
    - Large-, medium-, and small-sized industries
    - Varying levels of energy intensity
  - Energy efficiency of systems and processes in terms of:
    - Energy intensity (as a measure of efficiency)
    - Combined Heat and Power (CHP)

<u>Energy Intensity</u> – energy consumption per unit of GDP. Chosen over solely BTUs consumed because it does not include energy efficiency savings that might occur due to industrial downsizing or other market events.

<u>CHP</u> – the simultaneous production of useful thermal and electric energy from a single fuel source (dedicated fuel or waste heat recovered from industrial equipment or processes).

8

IEE / CHP Working Group Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Note: The working group recognizes that the reduction may not be an annual 2.5% achievement, but a cumulative effort over time that equates to a 2.5% annual reduction, on average, over the next 10 years.

9

Building Blocks to Meet the Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Drive Demand for IEE & CHP	Build the Workforce	Promote Efficient Operations & Investment	Move the Market

10

Key Solutions & Actions to Achieve the Goals

Achieve an average 2.5% reduction in industrial energy intensity annually through 2020; install 40 GW of new, cost-effective CHP by 2020

Drive Demand for IEE & CHP	Build the Workforce	Promote Efficient Operations & Investment	Move the Market
1. State, Local, & Utility Programs for Industry Programs that better meet the needs of industry **2. State Policy Models** Broader adoption of model policies **3. National Energy Efficiency Policy** Enhance national policy with regard to industrial energy efficiency and CHP **4. Education & Outreach** Build corporate culture; foster greater understanding of the economic value of industrial energy efficiency and CHP	**5. Education & Workforce Development** Identify industry's needs and workforce needs; develop new programs to address needs **6. Develop Training & Academic Curricula** From the plant floor to the corporate level **7. Licensing & Certification Protocols** Certified Energy Manager (CEM); DOE Qualified Specialists; Continuous Energy Improvement, etc.	**8. Financing Innovation** Loan guarantees, energy service companies (ESCOs), etc. **9. Financial Incentives** Address industry ROI and refit cycles **10. Technical Solutions** Improve availability of energy efficiency and CHP information and tools for industry **11. Energy Management Programs/Continuous Energy Improvement** Ex: ISO 50001, Superior Energy Performance (SEP), ENERGY STAR, and others	**12. Technology Demonstration** Adoption of existing technologies **13. Regulatory Recommendations to Support CHP** Offer comprehensive CHP policies **14. Reduce Uncertainty Related to State Interconnection** Harmonization across broad regions and states **15. Financing Reform** Depreciation rules and Sarbanes-Oxley Act

Red = IEE and CHP solution
Purple = CHP only solution

11

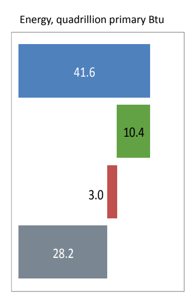
Impact of IEE / CHP WG Goals

Where We Are Today: According to the Energy Information Administration, gross domestic product (GDP) growth estimates with fixed energy intensity, the industrial sector will consume 41.6* quads of primary energy in the year 2020 (Business as Usual).

Working Group Goals: Based on the McKinsey report, 13.4 quads of potential industrial Btu savings by 2020 exist.** The working group's goals to <u>reduce industrial energy intensity by 2.5%</u> annually through 2020 <u>and install 40 GW of new, cost-effective CHP</u> by 2020 will achieve a reduction of 10.4 quads.***

Scope: Reaching goals would capture 78% of the potential energy efficiency in the industrial sector, leaving 3.0 quads to address through other activities.

Resulting 2020 Energy Use if all potential is addressed:



* Total industrial sector energy consumption includes refining-related efforts.
** The McKinsey non-transportation industrial estimates were used to calculate the potential for the full industrial sector.
*** 2020 efficiency potential is based on an estimated 25.2% growth in GDP by 2020 (Annual Energy Outlook 2008) and a fixed industrial energy intensity (energy consumption per value of shipments) through 2020.

IEE/CHP Working Group – First Year Activities

- 2012 Webinar Series (http://www1.eere.energy.gov/seeaction/iee.chp.webinars.html)
  - EPA Regulations and CHP (held January 17th)
  - Showcasing Model Utility IEE Programs (Feb 7th)
  - Elevating IEE Regulatory Issues for Commissioners (March 6th)
  - Successful State CHP Policies (Summer, 2012) – see below
- Developing "Guide to Implementing Successful State CHP Policies" & "IEE Model Programs & Policies Guide"
- Regional (MW & SE) Utility/Industry Workshops
  - Overcoming IEE and CHP Barriers ….. Spring/Summer 2012
- Engage Utility Regulators on Successful State Policies (IEE and CHP)

U.S. DOE Clean Energy Application Centers (CEACs)

- **Market Assessments:** Supporting analyses of CHP/WHR market potential
- **Education and Outreach:** Information on benefits and application to state and local policy makers, regulators, energy end-users, utilities, others
- **Technical Assistance:** Providing technical information, site assessments, feasibility studies, technical & financial analyses

Pacific CEAC --- California

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Self-Generation Incentive Program (SGIP) Extension	Economic analysis of benefits to state contributed to $250 M extension
Treatment of CHP under CA Cap-and-Trade	Initiated technical paper on CHP and GHG reduction to ensure "fair" treatment under cap-and-trade policies
Support for Governor's 6.5GW CHP Installation Goal	Completing CHP jobs creation/economic impact analysis
Garner Support for Balanced CA Energy Portfolio	Work to demonstrate how CHP, energy efficiency, & renewable can work together to move away from centralized fossil generation – CA 33% RPS

South East CEAC --- North Carolina

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Parity for CHP with Renewable Resources – Tax incentive – Portfolio Standard	Fostered understanding among renewable & policymakers: – 35% tax credit in place – Renewable & EE Std. incl. CHP
Revise public IOUs business model to recognize CHP as viable new generation capacity	Part of utility/industry team investigating the feasibility of pilot program fostering utility/industry partnership (Duke Energy – potential docket 2012)
Third Party CHP Investment	Efforts Include: – Collaboration ESCO, SEO, NCState, Fort Bragg – Projects underway, – Tech. analysis on HB 906 – Third Party Sale of Electricity –Biomass CHP

Midwest CEAC --- Ohio

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
New interested Gov and Ohio PUC Chairman – Energy Summit highlights CHP	Education and technical support of environmental & industrial coalition. Strong policy recommendations:
More favorable inclusion of CHP/WHR in the State Advanced Energy Resource Standard – SB 221	– WHR as an eligible technology in RPS – Conventional CHP benchmark in advanced technology section
CHP as First Option Considered in New Generation Capacity Building	– AEP Energy Security Plan stipulates 350 MW of CHP
Access to low interest financing	– Integration into existing OAQDA program or similar agency to administer a loan program

Northeast CEAC --- New York

Policy Issues ---------Education/Outreach/Tech Assistance -------Status

Policy Issues	Education/Outreach/Tech Assistance – Status
Preserve/expand resources dedicated to CHP in 2012-2015 (5yr) SBC IV Plan	Extensive education & support efforts turned $0 allocation to $75M for CHP acquisitions under SBC IV
Engage IOUs on recognizing benefits of CHP as an alternative to distribution system capital investments	Collaborative with: – National Grid to create "Principles Document" on non wires alternatives & pilot 2012 project. – Con Ed on "CHP Zones" that would create significant system benefits, exploring new incentive designs.
Promote realization of 800MW CHP goal – PlaNYC	Asked to partner with Mayor's Office to assist in implementation – work starts in Feb 2012
Innovative Financing	Working with DASNY – hospitals/universities

CHP as a Boiler MACT Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Retrofitting old boilers (pre mid 1970s) very difficult
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler

19

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20

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	227	495	131,526	13,155
Heavy Liquid	120	287	38,020	3,803
Light Liquid	91	202	19,926	1,993
Process Gas	14	78	21,146	2,115
Total	452*	1062	210,618	21,065

*Some facilities are listed in multiple categories due to multiple fuel types; there are 410 affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

21

CHP Compliance Option – Potential Benefits

- Compliance with MACT
- Investment versus compliance cost/expenditure
- More Favorable Paybacks
- Increase electric service reliability
- Enhance economic competitiveness (higher efficiency plant)
- Reduce Carbon Emissions
- Potential partnership with Utilities facing EPA power plant emission regulations

Thank You

John Cuttica
(312) 996-4382
cuttica@uic.edu

www.midwestcleanenergy.org

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

A program at

UIC Energy Resources Center
College of Engineering

A program sponsored by

U.S. Department of Energy
Energy Efficiency & Renewable Energy

Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers:

Understanding Issues, Evaluating Combined Heat & Power Opportunities, Increasing Energy Efficiency, and Improving Your Bottom Line

Keller Convention Center • Effingham, Illinois

February 9, 2012

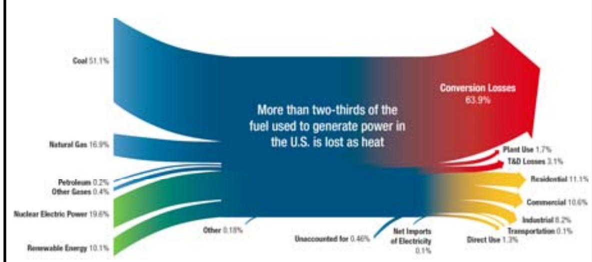
Thank You to All our Sponsors!

Today's Workshop Agenda

- Regulations impacting operations
- Implementing an anaerobic digester (AD) project
- Investigating digester outputs
- Real life on-farm case study
- Connecting to the grid
- Available funding
- Lunch
- Q&A

Why is the U.S. DOE interested in clean and renewable on-site power generation?

Look at our Current Efficiency in the Power Generation Sector



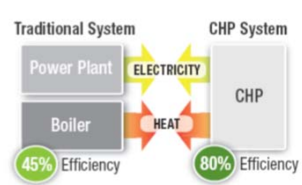
Source: DOE/ORNL

Is there a more efficient way?

CHP: A Key Part of our Energy Future

What is Combined Heat and Power (CHP)?

- Form of Distributed Generation (DG)
- An integrated system
- Located at or near a building or facility
- Provides at least a portion of the electrical load and
- Recycles the thermal energy for
  - Space Heating / Cooling
  - Process Heating / Cooling
  - Dehumidification
  - Additional generation



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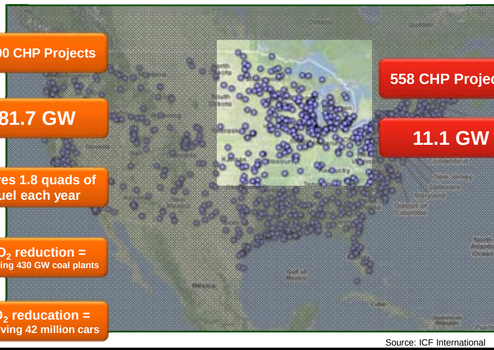
CHP provides efficient, clean, reliable, affordable energy – today and for the future.

40 more Gigawatts of CHP by 2020?

Snapshot of Existing U.S. CHP Installations



3,700 CHP Projects

81.7 GW

Saves 1.8 quads of fuel each year

CO_2 reduction = removing 430 GW coal plants

CO_2 reducation = removing 42 million cars

558 CHP Projects

11.1 GW

Source: ICF International

What are the benefits of CHP and when does it make sense?

CHP does not make sense in all applications, but where it does make technical and economic sense, it will provide:

- Lower energy costs
- Reduced energy consumption
- Increased electric reliability
- Standby power
- Improved environmental quality
- Public relations benefits

Making sense when…

- Good coincidence between electric and thermal loads
- Central heating/cooling system
- Large "Spark Spread" - cost differential between electricity (grid) and CHP fuel
- Long operating hours
- Energy concerns (current/future costs, power reliability, facility efficiency/conservation, etc.)
- Environmental concerns
- Renovation and/or expansion of existing facilities
- Access to on-site or nearby biomass/biogas resources

Why CHP and Anaerobic Digesters?

AD / CHP projects can help meet compliance issues and provide a ROI

Where are farm AD projects located?

Source: EPA AgStar www.epa.gov/agstar

161 farm scale projects

15 regional/centralized or multiple-farm projects

US DOE Regional Clean Energy Application Centers (CEACs)

- **US DOE Midwest Clean Energy Application Center**
- **www.midwestcleanenergy.org**
- DOE goal of 40 GW of CHP by 2020
- Today the center promotes the use of **CHP, District Energy, and Waste Heat Recovery** Technologies
- Strategy: provide a technology outreach program to end users, policy, utility, and industry stakeholders focused on:
  - **Market Assessments**
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U.S. Department of Energy Midwest Clean Energy Application Center

Enjoy the workshop!

- Ask questions and get engaged…
- Network and utilize the available resources…
- Don't forget to complete the survey…

Biogas Renewable Energy CHP Projects for South-Central Illinois Livestock Producers:

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Spoon River College Community Outreach Center

February 10, 2012 • Macomb, Illinois

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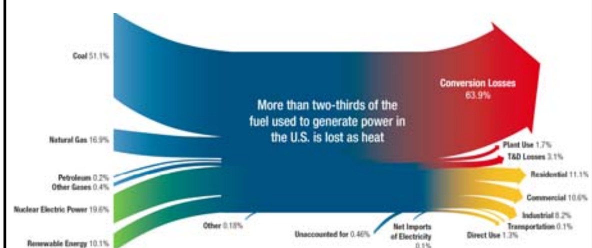

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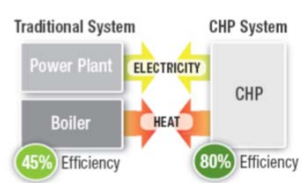

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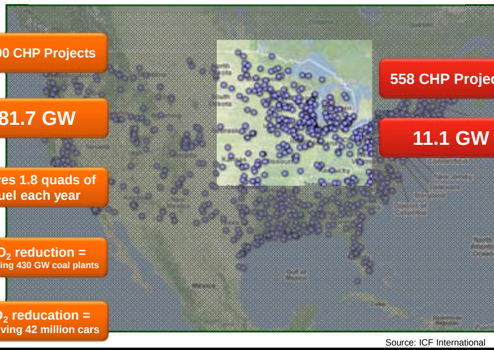

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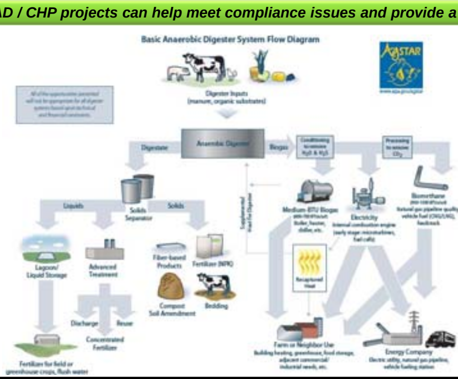

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U.S. Department of Energy Midwest Clean Energy Application Center

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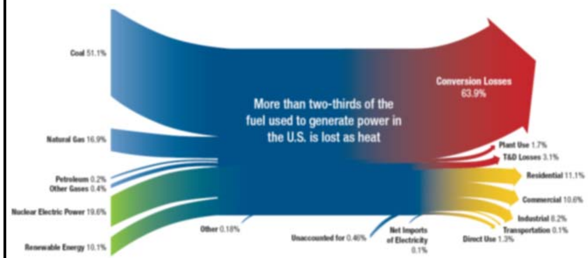
CHP & WHR Technology Briefing and Environmental Benefits

Tuesday, February 14, 2012

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

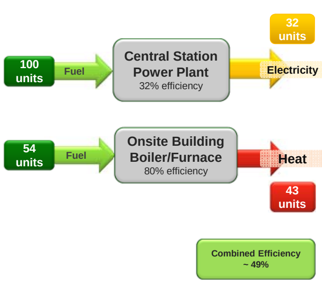
U.S. Department of Energy
Midwest Clean Energy Application Center

Fuel Utilization by U.S. Utility Sector



The energy lost in the U.S. from wasted heat in the utility sector is greater than the total energy use of Japan.

Traditional Energy Systems



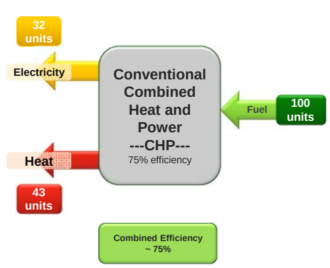
Combined Heat and Power

Conventional CHP
Topping Cycle CHP

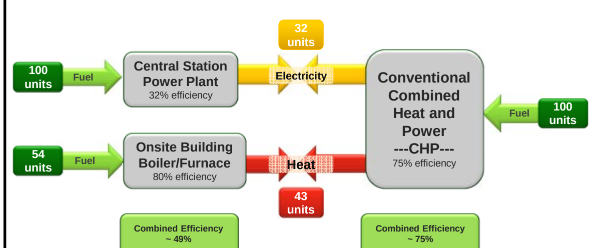
The sequential production of useful electric and thermal power from a single **dedicated** fuel source

4

Conventional CHP System (Topping Cycle)



Traditional Energy System vs. Conventional CHP System



CHP provides efficient, clean, reliable, affordable energy – today and for the future

Conventional CHP

- What drives system efficiency in a conventional CHP system?

Ability to utilize as much of the thermal energy as possible + coincidence between thermal and electric loads

- To ensure high system efficiency, how would you size a conventional CHP system?

Size for thermal base-load and generate electricity when operating to meet the thermal load

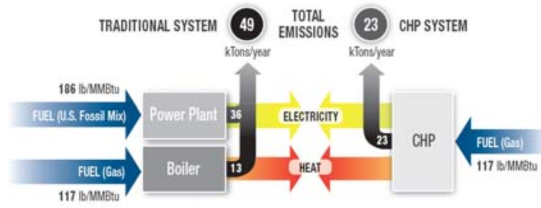
- What maximizes the effectiveness of a conventional CHP system?

Long operating hours + max efficiency = max savings/effectiveness

7

CHP Role in Our Environmental Future

Impact on Carbon Emissions



Example of the CO_2 savings potential of CHP based on a 5 MW gas turbine CHP system with 75% overall efficiency operating at 8,500 hours per year providing steam and power on-site compared to separate heat and power comprised of an 80% efficient on-site natural gas boiler and average fossil based electricity generation with 7% T&D losses.

8

Source: http://www.chpcentermw.org/pdfs/ORNL_Report_Dec2008.pdf

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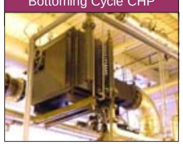
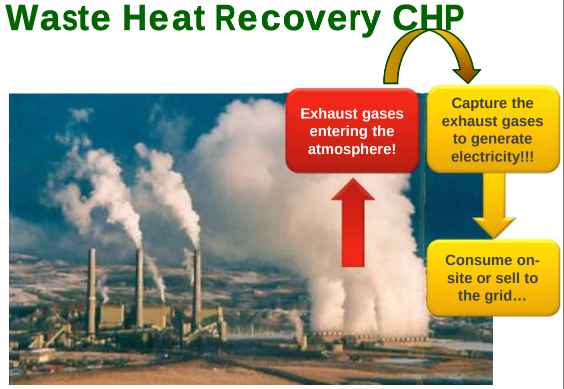
Waste Heat Recovery CHP
Bottoming Cycle CHP



Captures heat otherwise wasted in an industrial / commercial process and utilizes it to produce electric power.

9

Waste Heat Recovery CHP



Waste Heat Recovery CHP

- No additional fossil fuel (capturing waste heat as the fuel)
- No incremental emissions
- Like conventional CHP, power generated at site (DG)
- Base load generation – industrials operate 24/7
- High temp (> 800ºF) is low hanging fruit industrial

CHP Nomenclature

- Conventional CHP
- Topping Cycle CHP
- Traditional CHP
- Natural Gas CHP

- Waste Heat Recovery CHP (WHR)
- Bottoming Cycle CHP
- Waste Energy Recovery CHP (WER)
- Waste Heat to Power CHP (WHP)

12

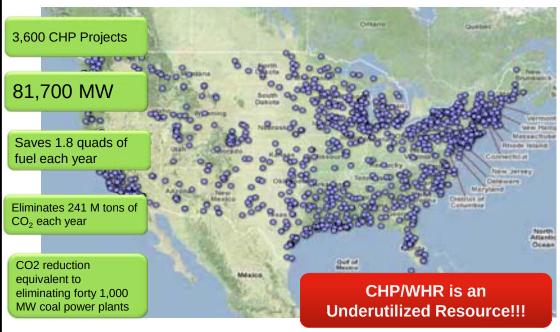
Positive Impacts and Benefits (U.S. Businesses)

- Reduces energy costs for the end-user
- Increases energy efficiency, helps manage costs, maintains jobs
- Reduces risk of electric grid disruptions & enhances energy reliability
- Provides stability in the face of uncertain electricity prices

Positive Impacts and Benefits (Nation)

- Provides immediate path to increased energy efficiency and reduced GHG emissions
- Offers low cost approach to new electricity generation capacity and lessens the need for new T&D
- Uses abundant, domestic energy sources
- Uses highly skilled local labor & American technologies

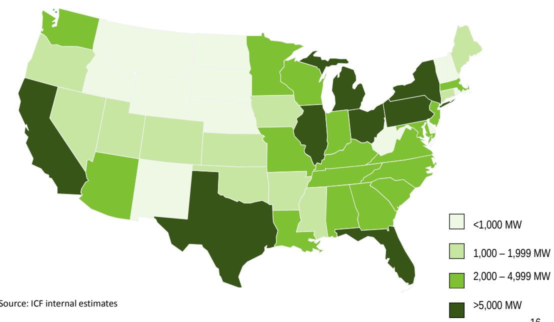
CHP Is Used at the Point of Demand



Source: ICF International

CHP Onsite Technical Potential Market

Existing CHP (82 GW)
CHP Potential W/O Export (+132 GW)



Source: ICF internal estimates

16

Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	766.6 MW	9,800 MW
CHP % of Total Ohio Electric Generation	2.3%	29.4%
Nationally, CHP % of Total Generation	*8.0%*	*-*

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	9,800

CHP Technical Potential

Attractive CHP Markets



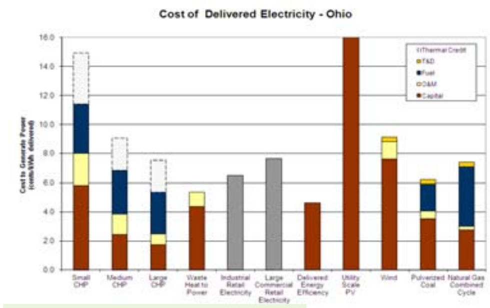

Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

CHP as a Boiler MACT Compliance Alternative

- Compliance with MACT limits will be expensive for many coal and oil users
- Many are considering switching to natural gas
  - Conversion for some oil units
  - New boilers for most coal units
- Some are considering moving to natural gas CHP (gas turbine system)
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by avoided costs for emissions controls or new gas boiler
  - Investment rather than control cost

20

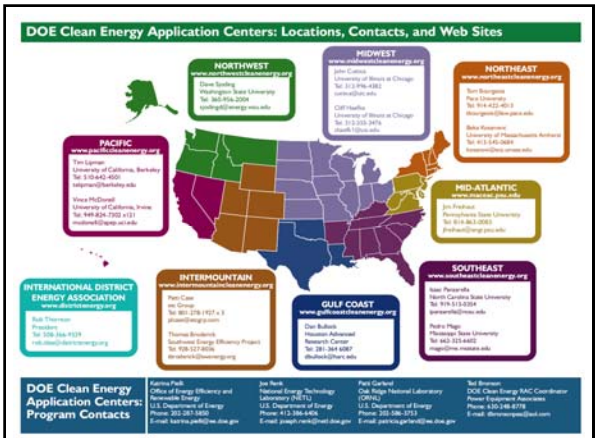
MACT Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	398	84,495
Heavy Liquid	82	11,760
Light Liquid	79	6,487
Biomass	67	8,705
Process Gas	71	18,892
Total	**697**	**130,339**

Includes industrial, commercial and institutional boilers only

What's Needed to Increase Market Share

- Removal of state policy barriers (interconnection, standby rates, etc)
- Clear value proposition for electric utilities
- Increased awareness of CHP benefits by end-users, state decision makers, & policy makers
- Supportive federal policies
- Technology advancements



Thank You

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www.midwestcleanenergy.org

U.S. Department of Energy Midwest Clean Energy Application Center

A program at UIC Energy Resources Center

A program sponsored by U.S. Department of Energy, Energy Efficiency & Renewable Energy

U.S. Department of Energy Boiler MACT Technical Assistance Pilot Program

Public Utilities Commission of Ohio (PUCO) Educational Forum

March 9, 2012

John Cuttica
Director, Energy Resources Center
University of Illinois at Chicago
US DOE Midwest Clean Energy Application Center

U.S. Department of Energy
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Presentation Outline

- What is Combined Heat and Power (CHP)
- Status and Opportunity of CHP in the US and Ohio
- Boiler MACT and CHP as a Control Strategy
- U.S. DOE Boiler MACT Technical Assistance Pilot Program
- U.S. DOE Clean Energy Application Centers

DOE Boiler MACT Technical Assistance Team

- Katrina Pielli --- DOE Headquarters
- Patti Garland --- Oak Ridge National Laboratory
- Bruce Hedman & Ann Hampson --- ICF International
- John Cuttica & Cliff Haefke --- Midwest CEAC
- Jim Freihaut --- Mid Atlantic CEAC
- Tom Bourgeois --- Northeast CEAC
- Isaac Panzarella --- Southeast CEAC

Presentation Message / Take Away

- Combined Heat & Power (CHP) is an important energy resource that provides
  - Benefits for U.S. Industry
    - Reduces energy costs for the user
    - Reduces risk of electric grid disruptions
    - Provides stability in the face of uncertain electricity prices
  - Benefits for the Nation
    - Provides immediate path to increased energy efficiency and reduced GHG emissions
    - Offers a low-cost approach to new electricity generation capacity and lessens need for new T&D infrastructure
    - Enhances grid security
    - Enhances U.S. manufacturing competitiveness
    - Uses abundant, domestic energy sources
    - Uses highly skilled local labor and American technology

Presentation Message / Take Away

- Ohio has significant CHP potential – 9,800 MW
  - Today, Ohio has only 766 MW of CHP installed
- Current circumstances have highlighted the role additional CHP can play in the energy resource mix & achieve above benefits
  - Coal power plant retirement announcements
  - Boiler MACT opportunity for new CHP
  - Focus on maintaining and increasing manufacturing in the US
- DOE currently provides technical information and assistance, market development, and education on CHP, Waste Heat Recovery, and District Energy options through its 8 regional Clean Energy Application Centers (CEACs)

Presentation Message / Take Away

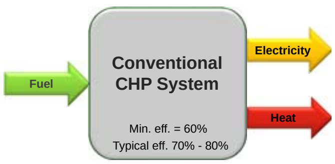
- DOE, through the CEACs, is supplementing this ongoing effort by providing site-specific technical and cost information on clean energy compliance strategies to those major source facilities affected by the Boiler MACT rule currently burning coal or oil.
  - These facilities may have opportunities to develop compliance strategies, such as CHP, that are cleaner, more energy efficient, and that can have a positive economic return for the plant over time
- DOE Boiler MACT Technical Assistance program is being piloted in Ohio now, and will be rolled out nationally when the EPA rule reconsideration process is complete (Spring 2012)

http://www1.eere.energy.gov/manufacturing/distributedenergy/boilermact.html

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

Conventional CHP
(also referred to as Topping Cycle CHP or Direct Fired CHP)

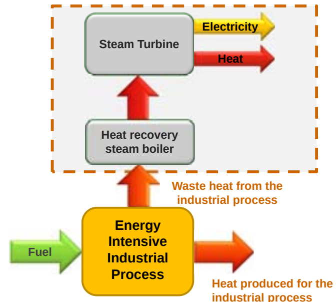


- Simultaneous generation of heat and electricity
- Fuel is combusted/burned for the purpose of generating heat and electricity
- Normally sized for thermal load to max. efficiency – 70% to 80%
- Minimum efficiency of 60% normally required
- Normally non export of electricity
- Low emissions – natural gas

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source

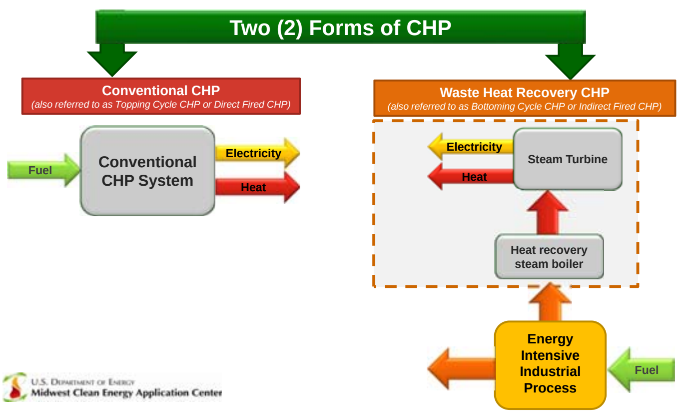
Waste Heat Recovery CHP
(also referred to as Bottoming Cycle CHP or Indirect Fired CHP)



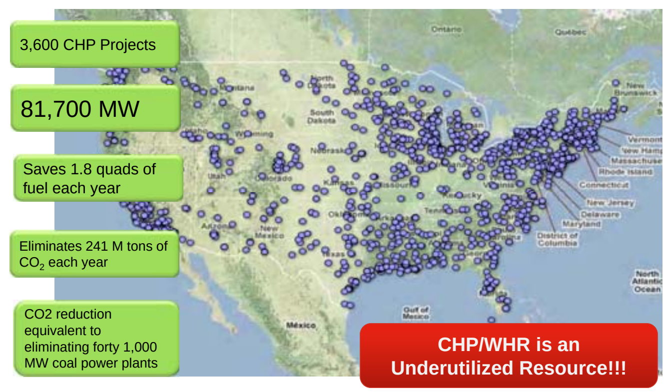
- Fuel first applied to produce useful thermal energy for the process
- Waste heat is utilized to produce electricity and possibly additional thermal energy for the process
- Simultaneous generation of heat and electricity
- No additional fossil fuel combustion *(no incremental emissions)*
- Normally produces larger amounts electric generation *(often exports electricity to the grid; base load electric power)*
- Required high temperature (> 800°F) *(low hanging fruit in industrial plants)*

Defining Combined Heat & Power (CHP)

The on-site simultaneous generation of two forms of energy (heat and electricity) from a single fuel/energy source



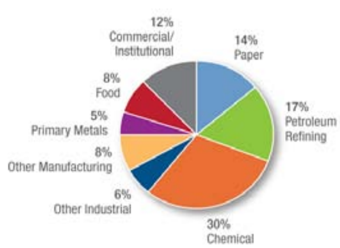
CHP Is Used at the Point of Demand



Source: ICF International

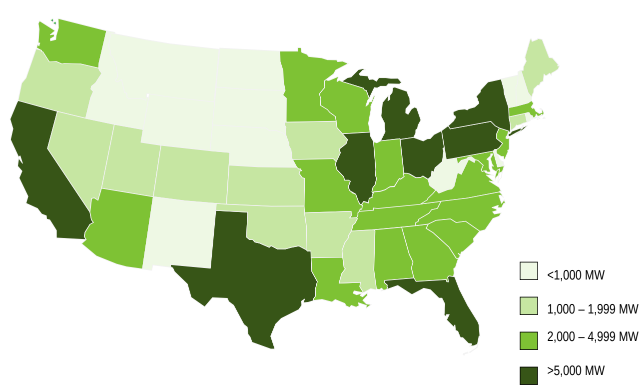
Existing CHP Capacity

- ~ 8% US generating capacity
- ~ 12% total annual MWh generated
- Industrial applications represent 88% of existing capacity
- Commercial/institutional applications represent 12% of existing capacity:
  - Hospitals, Schools, University Campuses, Hotels, Nursing Homes, Office Buildings, Apartment Complexes, Data Centers, Fitness Centers



Source: ICF International

CHP Onsite Technical Potential Market



Source: ICF internal estimates

Snapshot of Ohio CHP Market

	Current	Potential
CHP Implementation in Ohio	766.6 MW	9,800 MW
CHP % of Total Ohio Electric Generation	2.3%	29.4%
Nationally, CHP % of Total Generation	*8.0%*	*-*

Market Sector	Gen. Potential (MW)
Paper	2,329
Chemicals	2,838
Primary Metals	430
Food	310
Other Industrial	767
Commercial/Institutional	3,082
Total	9,800

CHP Technical Potential

Attractive CHP Markets



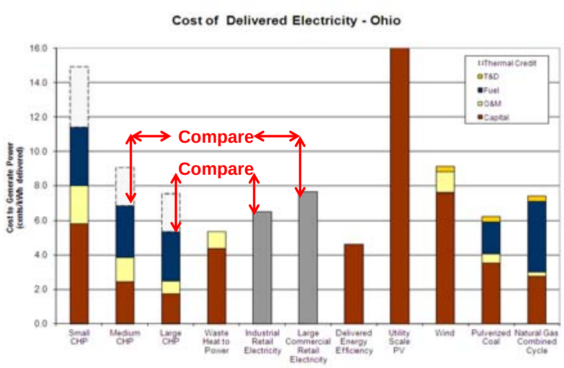

Industrial
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Rubber and plastics

Commercial
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

Institutional
- Hospitals
- Landfills
- Universities & colleges
- Wastewater treatment
- Residential confinement

Agricultural
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)

CHP Represents a Cost-Effective Electricity Resource in Ohio



CHP thermal credit reflects the cost of boiler fuel avoided by capturing and using the waste heat from CHP

EPA ICI Boiler MACT

- Three rules. DOE effort focused on Major Source Boiler MACT
- Standards for hazardous air pollutants from major sources: industrial, commercial and institutional boilers and process heaters (excludes any unit combusting *solid waste*)
- Major source is a facility that emits:
  - 10 tpy or more of any single Hazardous Air Pollutant, or 25 tpy or more of total Hazardous Air Pollutants (HAPs)
- Emissions limits applicable to new and existing units > 10 MMBtu/hr
  - Mercury (Hg)
  - Particulate Matter (PM) as a surrogate for non-mercury metals (alternative limits for total selective metals (TSM))
  - Hydrogen Chloride (HCl) as a surrogate for acid gases
  - Carbon Monoxide (CO) as a surrogate for non-dioxin organics

Impacts of the Boiler MACT

- Compliance straight forward for natural gas fired units (tune-ups in lieu of more rigorous control options)
  - Refinery and blast furnace gases are treated as natural gas
- Rule significantly impacts oil, coal and biomass boilers and process gas boilers
  - Emissions limits must be met at all times except for start-up and shutdown periods
  - Controls are potentially required for Hg, PM, HCl and CO
  - Also includes monitoring and reporting requirements
  - Limits difficult (technically and economically) for oil and coal units

Standard Compliance Measures

- Mercury (Hg): Fabric filters and activated carbon injection are the primary control devices
- Particulate Matter (PM): Electrostatic precipitators may be required for units to meet emission levels
- Hydrogen Chloride (HCl): Wet scrubbers or fabric filters with dry injection are the primary control technologies
- Carbon Monoxide (CO): Tune-ups, replacement burners, combustion controls and oxidation catalysts are the preferred control technologies

Required compliance measures for any unit depend on current emissions levels and control equipment already in place

Affected Facilities by CEAC Region

CEAC Region	Number of Facilities	Number of Coal Units	Number of Oil Units	Number of Biomass Units	Number of Process Gas Units
Gulf Coast	46	10	11	48	8
Intermountain	16	19	11	0	0
Mid-Atlantic	133	126	152	32	23
Midwest	264	378	159	64	59
Northeast	85	23	149	23	6
Northwest	78	20	30	89	0
Pacific	23	5	16	32	0
Southeast	326	179	224	317	15
Total	**971**	**760**	**752**	**605**	**111**

The data in this chart is still being refined

- This table includes only industrial/commercial/institutional boilers
- There are 217 affected utility facilities not included in this table

Affected Boilers in the Midwest

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	378	80,902
Heavy Liquid	82	11,760
Light Liquid	77	6,427
Biomass	64	8,128
Process Gas	59	15,292
Total	**660**	**122,509**

The data in this chart is still being refined

Includes industrial, commercial and institutional boilers only

Affected Boilers in Ohio

Fuel Type	Number of Units	Capacity (MMBtu/hr)
Coal	76	12,202
Heavy Liquid	5	563
Light Liquid	10	1,579
Biomass	6	1,106
Process Gas	13	4,114
Total	**110**	**19,565**

The data in this chart is still being refined

Includes industrial, commercial and institutional boilers only

Affected Coal and Oil Boilers in Ohio

Application	# Facilities	# Units	Capacity (MMBtu/hr)
Food	5	9	1,150
Paper	7	15	2,195
Petroleum and Coal	1	2	108
Chemicals	10	21	2,856
Plastics and Rubber	2	5	740
Primary Metals	2	3	1,347
Fabricated Metals	3	7	716
Machinery	1	4	400
Transportation Equip.	5	16	3,383
Educational Services	4	9	1,450
Total	**40**	**91**	**14,345**

The data in this chart is still being refined

CHP as a Compliance Strategy

- Compliance with MACT limits will be expensive for many coal and oil users (standard compliance measures)
- May consider converting to natural gas
  - Conversion for some oil units
  - New boilers for most coal units?
- May consider moving to natural gas fueled “Conventional CHP” (trade off of benefits versus additional costs)
  - Represents a productive investment
  - Potential for lower steam costs due to generating own power
  - Higher overall efficiency and reduced emissions
  - Higher capital costs, but partially offset by required compliance costs or new gas boiler costs

Potential CHP Capacity

Fuel Type	Number of Facilities	Number of Affected Units	Boiler Capacity (MMBtu/hr)	CHP Potential (MW)
Coal	333	760	177,435	17,746
Heavy Liquid	194	422	52,358	5,237
Light Liquid	145	330	29,495	2,950
Total	**672***	**1,512**	**259,288**	**25,933**

The data on this chart is still being refined

*Some facilities are listed in multiple categories due to multiple fuel types; there are 621 ICI affected facilities

CHP potential based on average efficiency of affected boilers of 75%; Average annual load factor of 65%, and simple cycle gas turbine CHP performance (power to heat ratio = 0.7)

DOE Boiler MACT
Technical Assistance Program
(Ohio Pilot)

The U.S. DOE Midwest CEAC will supplement its normal CHP services by:

- Providing site specific technical and cost information to the 40+ major source facilities (~ 90 to 100 boilers) in Ohio currently burning coal or oil (Decision Tree Analysis)
- Meeting with willing individual facility management to discuss “Clean Energy Compliance Strategies” including potential funding and financial opportunities.
- Assisting interested facilities in the implementation of CHP as a compliance strategy

DOE Boiler MACT
Technical Assistance Program

- Site specific “Decision Trees” will include:
  - Facility Info
  - Site Financial Data
  - Contact Info
  - Boiler Unit Data
  - Compliance Control Requirements
  - CHP as an Alternative Compliance Option
  - Comparative Cost of Compliance Options
  - CHP Payback
  - Available Financial Options

Decision Tree Analysis Example
XXXX Co. (Ohio)

- Existing Boilers

Total Capacity MMBtu/hr	Primary Fuel	Annual Hours	Year Installed	Existing Controls
156	Coal	8,400	1,960	Electrostatic Precipitator
245	Coal	8,539	1,968	Electrostatic Precipitator

  - Average steam demand of 240 MMBtu/hr
  - Pays $0.07/kWh for power and $2.50 MMBtu for coal
- Projected compliance costs
  - Additional controls required for PM and CO
  - $17,921,813 Capital cost
  - $3,111,500 annual operating and maintenance costs of controls

Comparative Costs

	Existing Coal Boilers	New Natural Gas Boilers	Natural Gas CHP
Steam Capacity, MMBtu/hr input	400	400	
Avg Steam Demand, MMBtu/hr	240	240	240
Boiler Efficiency	75%	80%	N/A
CHP Capacity, MW	0	0	25*
CHP Electric Efficiency	N/A	N/A	32%
Fuel Use, MMBtu/year	2,720,000	2,550,000	3,404,334
Annual Fuel Cost	$5,984,000	$15,300,000	$20,426,003
Annual O&M Cost	$8,105,600	$3,238,500	$4,990,500
Annual Compliance O&M	$3,111,500		
Annual Electric Savings			($12,622,500)
Annual Steam Operating Costs	$17,201,100	$18,538,500	$12,794,003
Capital Costs	$17,921,500	$14,800,000	$35,000,000

Calculations based on delivered coal price of $2.50/MMBtu, natural gas price of $6.00/MMBtu, and industrial electricity price of $0.07/kWh (CHP avoids 90% of retail rate)
* Steam demand could support 50 to 55 MW CHP system; system designed to meet the facility electric load of 25 MW (non-export mode)

CHP Paybacks

	Existing Coal Boilers	Natural Gas Boilers	Natural Gas CHP
Annual Steam Operating Costs	$17,201,100	$18,538,500	$12,794,003
Annual Operating Savings (coal compliance)			$4,407,097
Annual Operating Savings (gas boiler)			$5,744,497
Installed Costs	$17,921,500	$14,800,000	$35,000,000
CHP Incremental costs (coal compliance)			$17,078,500
CHP Payback (coal compliance)			**3.9 years**
CHP Incremental costs (gas boiler)			$20,200,000
CHP Payback (gas boiler)			**3.5 years**

Frequently Asked Questions

- How accurate is the Decision Tree Analysis results?

The results are only as good as the assumptions utilized. We expect the facilities will update the assumptions after the one-on-one meetings.

- What are the sources of the facility and unit data assumptions?

ICR – Survey data on boilers, process heater and other combustion units, submitted to EPA (facility & unit level data)

ECHO – EPA Enforcement & Compliance History Online database (facility level data on major source polluters)

REPIS – NREL Renewable Electric Plant Info System database (facility and unit level data for biomass facilities)

MIPD – Major Industrial Plant database (facility data for large industrial plants

LBDB – Large Boiler database (facility & unit level data – boilers > 250 MMBtu/hr

ELECUTIL – ICF Electric Utility database (facility & unit level data for utility boilers

Frequently Asked Questions

- What is the value of an option that has such a significantly larger first cost?

Investment (with payback) versus a cost - higher efficiencies & lower emissions – potential for lower steam costs

- As a “rule of thumb,” which boilers are most favorable for a CHP control strategy?

Older coal and oil boilers where installing standard control technologies and/or converting the existing boiler to natural gas is very expensive.

- If the facility wants to further explore CHP, what specific services can the CEAC provide?

Assist in scoping the project (level 1 sizing, costs, design options); assist in securing needed engineering, financial and installation support

Next Steps – Ohio

- Midwest CEAC will send letters to all affected Ohio facilities explaining the pilot program, providing contact info, and urging them to contact the Midwest CEAC (March)
- Midwest CEAC will call all major sources that use coal or oil to set-up one-on-one meetings (March)
  - Site visits will be made to those interested major source facilities that use coal or oil to meet and discuss their “Decision Tree” and CHP opportunity (ASAP starting immediately)
- Continue technical assistance as appropriate
- Want to work with in-state trade associations, utilities and others to spread word

DOE Boiler MACT Technical Assistance information:

http://www1.eere.energy.gov/manufacturing/distributedenergy/boilermact.html

Ohio Effort

“Because of coal plant retirements, educating consumers on combined heat power is of particular interest to the PUCO. A facility’s decision to invest in CHP may constitute a rational market response that not only benefits the facility but which will also supports grid reliability in Ohio.”

Public Utilities Commission of Ohio
Chairman Todd Snitchler
February 23, 2012

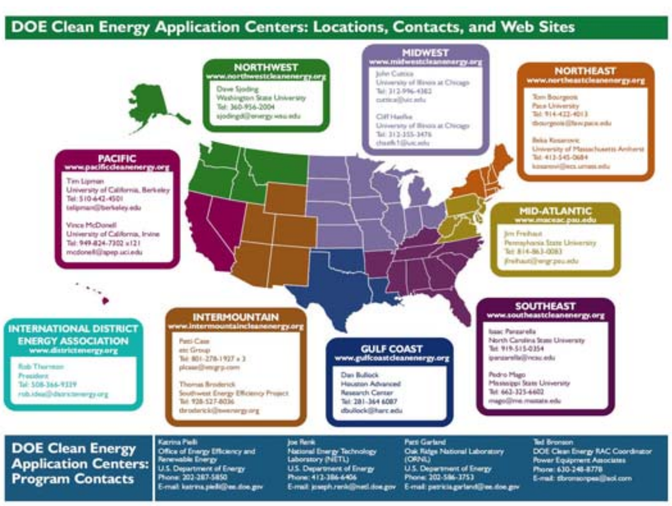
http://www.puco.ohio.gov/puco/index.cfm/industry-information/industry-topics/us-doe-pilot-program-for-combined-heat-power/

CEAC Mission and Focus

- **CEAC Mission:** Develop technology application knowledge and the educational infrastructure necessary to promote “clean energy” technologies as viable energy options and reduce any perceived risks associated with their implementation.

CEAC Focus: Assist in transforming the market for CHP, WHR, and DE technologies and concepts throughout the United States by providing:

- Market Analysis & Evaluation
- Education & Outreach
- Technical Assistance



DOE & Midwest CEAC Contacts

DOE Headquarters

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Senior Policy Advisor
Office of the Deputy Assistant Secretary for Energy Efficiency
U.S. Department of Energy
Washington DC

http://www1.eere.energy.gov/manufacturing/distributedenergy/ceacs.html

Midwest CEAC

Director: John Cuttica; 312/996-4382; cuttica@uic.edu

Associate Director / Lead Engineer: Cliff Haefke; 312/355-3476; chaefk1@uic.edu

www.midwestcleanenergy.org

States Covered: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2012 – 3rd Quarter
April 1, 2012 through June 30, 2012

Submission Date:
July 30, 2012

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
July 30, 2012

Dear Mr. Renk,

Please find the attached Progress Report for the 3rd Quarter of Fiscal Year 2012 (FY2012.Q3) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced -$12,452.58 for FY2012.Q3:

- April 2012: $5,631.33
- May: -$6,018.54
- June: -$12,065.37

Below you will find a brief synopsis of our activities (deliverables and tasks) for FY2012.Q3. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
3rd Quarter Fiscal Year 2012

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 7/30/2012
b. Reporting Period: April 1, 2012 through June 30, 2012

Sections 4,5, 7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the eight DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat recovery, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 3rd Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q3.FY2012 set out in the MW CEAC Project Management Plan.

Ohio – Q3.FY2012 activities focused on the Governor's new energy plan and the DOE Boiler MACT Pilot program.

- The MW CEAC participated in the planning and preparation of the June 20th PUCO CHP Case Studies Workshop in Columbus, OH.
- The MW CEAC presented at the June 20th PUCO CHP Case Studies Workshop in Columbus, OH.
- The MW CEAC launched the DOE Boiler MACT Technical Assistance pilot program on March 9th. The MW CEAC has continued their efforts in Q3 of targeting and contacting Boiler MACT affected facilities in Ohio and sharing the Decision Tree Analyses. The MW CEAC has brought on board two sub-contractors to assist in this effort.
- Ohio Governor Kasich introduced an energy bill, Senate Bill 315 (SB 315), on March 22nd that included the treatment of CHP and WHR under existing law. The MW CEAC worked with the Ohio CHP Coalition and other key stakeholders in the preceding months and prior year providing education and information on the concepts, benefits, and applications of CHP and WHR technologies. SB 315 was passed into law on June 11, 2012 with WHR now qualifying as a Renewable Energy technology and CHP & WHR both qualifying as EE technologies. Next steps are to determine how the utilities will incorporate these qualifying measures into their utility plans.
- The MW CEAC has continued to meet with CHP stakeholders in Ohio in regards to SB 315 and Boiler MACT.
- The MW CEAC provided planning assistance to DOE and the Midwest Energy Efficiency Alliance towards the Midwest IEE/CHP Regional Meeting on June 21, 2012. The MW CEAC also presented at this workshop.

Illinois – Q3.FY2012 activities focused on AD/CHP development.

- The MW CEAC has been working with Growing Power (high profile urban based community digester CHP project within city limits of Chicago) and with a downstate community digester project located near Breese to initiate engineering studies and investigate financing options for AD/CHP projects.
- The MW CEAC has been working with the Village of Fox River Grove Wastewater Treatment Facility (100 kW) and the City of Danville Wastewater Treatment Facility (100 kW) over the past year in developing two separate AD/CHP projects. Both facilities are expected to begin CHP operations later this calendar year.
- The MW CEAC has been working with Downers Grove Sanitary District (138 kW) and the Sanitary District of Decatur (500 kW) on two CHP projects that are expected to be online in calendar year 2013.
- The MW CEAC has not yet started discussions with the Illinois Power Authority committing to WHR as an approved technology under the state's RPS program (i.e. long term contracts). The MW CEAC has determined that the regulatory landscape of this activity is not feasible at this time and will revisit later in 2012 closer to the elections.

Wisconsin – Q3.FY2012 activities focused on development of educational outreach materials.

- The MW CEAC delayed the education outreach efforts with the WI SEO until Fall 2012 due to the increased level of MW CEAC efforts in Ohio and the DOE Boiler MACT Technical Assistance pilot program in Ohio.
- The MW CEAC is working on a Project Profile for the 1.1 MW landfill gas fired CHP project at Gundersen Lutheran Health System in Onalaska, WI, that began operation in January 2012. The MW CEAC provided technical assistance towards the development of this LFG-CHP project. The Midwest CEAC attended the May 8th announcement in Onalaska, WI, announcing that via the LFG-CHP project, the Gundersen Lutheran – Onalaska Campus is the first known energy independent medical campus in the country.

Iowa – Q3.FY2012 activities focused on utility rate barriers to CHP implementation.

- The MW CEAC met in Des Moines on March 7th with the Mid-American Energy Company, the Iowa Office of Consumer Advocates, IEC, and ELPC to begin discussions of the utility rate barriers study that was developed by the MW CEAC. Mid-American did not deny their utility rates were outdated, but initially did not concede to needing to adjust their rates prior to the 2013-2014 utility rate case period. In May 2012, Mid-American during informal conversations with IEC and MW CEAC stated the would be seeking to modify their standby rates in calendar year 2012, prior to the official utility rate case period.
- The MW CEAC began the development of a technical paper for the Iowa Environmental Council (IEC) on the topic of recommended standby rate utility practices for Mid-American (next steps study) that avoid unfair utility practices and that do not further negatively impact the implementation of CHP development. This paper will be used as a technical document for IEC to use in discussions with Mid-American Energy Company.

Minnesota – Q3.FY2012 activities focused on utility standby rate and net metering barriers to CHP implementation.

- In May, the ERC submitted a proposal to the Division of Energy Resources (DER) Minnesota Department of Commerce – Request for Proposals – under the Conservation Applied Research and Development Grant Program to study viable CHP opportunities that could aid Minnesota meeting their state energy savings goals through analyzing net metering and standby rates. The proposed study was a response to the workshop discussion topics that took place at the MN DER sponsored DG/CHP workshops in the Fall of 2011 that the MW CEAC attended. The ERC was notified in July that the MN DER has high interest in this study and will be awarded funding for ERC to complete this study. This study was identified by the Midwest CEAC in the Goals and Milestones.

Market Sector Business Plans – Q3.FY2012 focused on the initial developments of the CHP Market Sector Business Plans (presentations of plans expected in Q4.FY2012)

- Hospitals – MW CEAC assisted lead NE CEAC

- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Educational Material – Q3.FY2012 focused on the update of the CHP Resource Guide

- The MW CEAC began updating the 2005 CHP Resource Guide, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems.

Section 6: Cost Status – The center invoiced -$12,452.58 for FY2012.Q3.

- April 2012: $5,631.33
- May: -$6,018.54
- June: -$12,065.37

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **5/15 – Market Opportunities for Biogas Utilization** @ AW&WMA Lake Michigan States Section's Waste Not Conference, Oakbrook Terrace, IL

   ii. **5/16 – Panel: Advancing Pro-CHP Policy in Ohio** @ USCHPA Spring Forum, Washington DC

   iii. **6/14 – CHP Opportunities and DOE's Regional Clean Energy Application Centers** @ Indiana District Energy Seminars, Indianapolis, IN

   iv. **6/20 - Combined Heat and Power 101** @ Public Utility Commission of Ohio's Combined Heat and power Case Studies: Voices of Experience, Columbus, OH.

   v. **6/21 – Session 2: "Opportunities and Potential for Industrial CHP"** @ Industrial Energy Efficiency & CHP Dialogue, US DOE Regional Meeting – Midwest, Columbus, OH.

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

Appendix

CEAC Goals and Milestones from January Presentations and Project Management Plan

CEAC	Goals	Activities	Outcomes	Milestones	Status (as of 7/30)
Midwest	Ohio		• Inclusion of CHP /WHR as a specified & recognized technology with an installed capacity target in the new Governor's energy plans , Ohio energy regulations, Ohio energy legislation. • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Participate Workshop(s) (energy summit follow-up) PUCO…Feb. 2012 • Develop consensus on the policy direction (Ohio CHP Coalition) ….Spring ,2012 • Policy reform introduced from Gov Office to Legislature and/or PUCO…. Spring 2012 • Provide educational and technical support to the Coalition (biweekly conference calls, white paper(s) identifying issues and suggested actions to be considered: rate structures /jobs ..Ongoing • Initiate Boiler MACT activities with PUCO …. Winter 2012 • Complete Policy Options Paper (standby rates)..Spring2012	• COMPLETED Q2: March Workshop hosted on 3/9, MW CEAC participated in PUCO workshop on 6/20, MW CEAC will present at 7/24 NASEO webinar on OH status, MW CEAC will be presenting at 8/2 PUCO workshop • Ongoing (Ohio CHP Coalition is now working on how to incorporate CHP and WHtP into the utility plans) • COMPLETED Q2: Gov. Kasich introduced energy plan (SB 315) on 3/22. Gov. Kasich signed into law SB 315 on June 11, 2012 which qualifies WHtP as a Renewable Technology and CHP & WHtP as EE technologies. With the law signed, next steps are to determine how CHP and WHtP are implemented into Ohio utility plans. MW CEAC will offer technical assistance where needed) • Ongoing • Initiated March, MW CEAC has been contacting Ohio facilities and working with ICF and PUCO • Ongoing (to be published in August 2012 and potentially used in September PUCO workshop)
	Illinois		• Initiate the implementation of a minimum of two biogas CHP projects with the Association of Illinois Electric Cooperatives securing their commitment to biogas CHP within the state and expanding biogas CHP within the state • Bring the Ohio model to Illinois (ELPC, IEC, NRDC, others) • Expand educational activities to identify new CHP avenues within the state: • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Partnership with AIEC, identification of 2 CHP sites & initiation of engineering studies (includes 3 planned workshops)…..Fall 2012 • Successful start-up of minimum 2 additional CHP biogas sites…Fall 2012 • Illinois Power Authority commitment to WHR as approved technology for RPS (long term contracts)….Spring 2012 • IDEA workshop on Community Energy Development Guide…(Chicago) --- District Energy/CHP as redevelopment tool ….June, 2012 • Develop plan for bringing Ohio model to Illinois … Fall 2012	• Ongoing (Working with Growing Power / Iron Street Farms & Downstate Community Digester Ag Project in Breese, IL), 3 Workshops Completed: co-sponsored on 2/3, 2/9, 2/10) • Ongoing (working with four WWTFs in Illinois: Fox River Grove WWTF (100 kW) and Danville WWTF (100 kW) to be installed/operating by end of 2012, Downers Grove WWTF (138 WWTF) and Decataur WWTF (500 kW) to be installed/operating by end of 2013 • Ongoing • Ongoing • Not yet started
	Wisconsin		• Re-engage the SEO, include CHP in their energy programs. • Continue technical support on high visibility CHP/WHR projects (target markets remain biogas and pulp/paper) • Inclusion of CHP as a viable	• Identify and implement outreach activities with SEO and targeted markets (Breweries, Food Processing, Livestock, WWTF).. Ongoing efforts with potential webinars by spring/summer 2012 • Min 2 project profiles from tech assistance efforts … ongoing	• Workshops delayed till fall • Initiated work on one project profile (March), Gundersen Lutheran Health System in Onalska, WI

			approach to meet Boiler MACT Regs •		(completion expected May 2012)
	Iowa		• IEC & ELPC introducing utility rate reform to PUC • SEO/Industry sponsored education webinars • CHP as a viable approach to meet Boiler MACT Regs	• Rate study analysis completed (best practices).. Spring 2012 • CHP Market Impact Analysis .. Summer 2012 • Settlement agreement meeting ..Summer 2012 • IEC & ELPC submittal of reform request to PUC … Fall 2012 • 1 Targeted webinar .. Summer/Fall	• COMPLETED: submitted Feb • Ongoing (draft expected Aug 2012) • COMPLETED: first meeting held with Mid-American on 3/7 in Des Moines, first meeting with Alliant to be held in August • Ongoing (Mid-American will be modifying standby rates prior to 2013 rate case; MW CEAC is providing technical assistance to IEC & ELCP) • Not yet started
	Minnesota		• Inclusion of CHP/WHR in SEO programs and recommendation to PUC for DG policy reform • CHP as a viable approach to meet Boiler MACT Regs	• Rate study / net metering paper(s) for SEO.. Summer 2012 • Reform recommendations to PUC .. Fall 2012	• Ongoing (MW CEAC submitted proposal on standby rate and net metering study to MN SEO; MW CEAC was notified in July of award; work on study to begin Fall 2012) • Not yet started (actions will follow study)
	Indiana	▪	NIPSCO initiate pilot FIT for CHP similar to existing pilot FIT for renewables	NIPSCO agreement to proceed with pilot FIT request to Utility Commission …..Winter 2012	Not yet started
	Michigan	▪	Expanded CEAC work in Michigan	Identify and initiate expanded CHP opportunities for CEAC involvement ….Fall 2012	Not yet started
	Kansas Missouri Nebraska North Dakota South Dakota		Support CHP activities as required	Nothing identified at this time	
	Boiler MACT			• Training Session …Jan. 2012 • Develop Implementation Plan …. March 1st, 2012 • Method of Screening Opportunities • Materials Development • Method of Contacting Opportunities (including site visits) • Resources Split (internal versus subcontracts) • Implementation ….. Spring 2012 • Ohio Test Case: Work with PUC Ohio – January 2012	• Completed • Ongoing • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Resources identified • Pilot underway in Ohio • Work underway – initiated March
	SEEAction			Planned FY 12/FY 13 Activities/Milestones • Lead the development of CHP version of Policy Guide • Provide assistance to Hdqtrs in development of white papers and policy guide book.. ongoing • Participate in the Development & Implementation of 2 Regional Utility/Regulatory Workshops (MW & SE) •	Lead shifted to Eric by DOE Hdqtrs Ongoing Ongoing coordination with MEEA, MW CEAC assisted DOE and MEEA with June 21 Regional Meeting in Columbus, OH
	Market Sector Development		Market Sector Business Plans	Plan development participation: - Hospitals – NE lead….Spring ○ Project Profile	• Ongoing (participated on conference calls, reviewed drafts, provided

				○ White Paper - WHR – Pacific lead….Spring - Biomass – NW lead….Spring	comments) • Ongoing (participated on conference calls, reviewed drafts, provided comments) • Ongoing (participated on conference calls, reviewed drafts, provided comments)
	Other		Educational Materials	• Updated CHP Resource Guide • Project Profiles	• Outline submitted to DOE for review in April 2012, comments received by DOE in Summer 2012 • Ongoing

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2012 – 3rd Quarter
July 1, 2012 through September 30, 2012

Submission Date:
October 31, 2012

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
October 31, 2012

Dear Mr. Renk,

Please find the attached Progress Report for the 4th Quarter of Fiscal Year 2012 (Q4.FY2012) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $230,532.94 for Q4.FY2012:

- July 2012: $57,538.62
- Aug: $84,027.11
- Sep: $88,967.21

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q4.FY2012. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
4th Quarter Fiscal Year 2012

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 10/31/2012
b. Reporting Period: July 1, 2012 through September 30, 2012

Sections 4,5, 7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat recovery, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 4th Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q4.FY2012 set out in the MW CEAC Project Management Plan.

Ohio – Q4.FY2012 activities focused on the Governor's new energy plan, the DOE Boiler MACT Pilot program, and standby rate analysis.

- The MW CEAC participated in the planning and preparation of the August 2nd PUCO CHP Financial Tools Workshop in Columbus, OH. The MW CEAC presented at the August 2nd PUCO CHP Financial Tools Workshop in Columbus, OH.
- The MW CEAC participated in the planning and preparation of the September 13th PUCO CHP & Standby Rates Workshop in Columbus, OH.
- The MW CEAC launched the DOE Boiler MACT Technical Assistance pilot program on March 9th. The MW CEAC has continued their efforts in Q4 of targeting and contacting Boiler MACT affected facilities in Ohio and sharing the Decision Tree Analyses.
- Ohio Governor Kasich introduced an energy bill, Senate Bill 315 (SB 315), on March 22nd that included the treatment of CHP and WHR under existing law. The MW CEAC worked with the Ohio CHP Coalition and other key stakeholders in the preceding months and prior year providing education and information on the concepts, benefits, and applications of CHP and WHR technologies. SB 315 was passed into law on June 11, 2012 with WHR now qualifying as a Renewable Energy technology and CHP & WHR both qualifying as EE technologies. The MW CEAC has been meeting with stakeholders on how to determine the EE savings calculations that will be proposed by the Ohio CHP Coalition.
- The MW CEAC has continued to meet with CHP stakeholders in Ohio in regards to SB 315 and Boiler MACT. MW CEAC assisted in the Ohio Coalition for CHP webinar on July 18, 2012.
- The MW CEAC is working on a rate barriers study analyzing the standby rates of the Ohio investor owned utilities (IOUs). This document is expected to be published in Q1.2012. In conjunction with this study, the MW CEAC attended a meeting at the PUCO on September 12th to discuss standby rate analysis of AEP by DOE sub-contractor Lisa Schwartz.

Illinois – Q4.FY2012 activities focused on AD/CHP development and state EE/CHP planning.

- The MW CEAC has been working on two potential community digester CHP projects in Illinois initiating engineering studies and investigating funding and financing options:
    - Growing Power and Green Era (high profile urban based community digester CHP project within city limits of Chicago)
    - Clinton County downstate community digester project located near Breese, IL
- The MW CEAC has been working with Illinois Department Commerce and Economic Opportunity (DCEO-SEO) on four (4) CHP projects at WWTPs:
    - Village of Fox River Grove Wastewater Treatment Facility (100 kW) – Oct '12 startup
    - City of Danville Wastewater Treatment Facility (100 kW) – Oct '12 startup
    - Downers Grove Sanitary District (138 kW) – operational in '13

- Sanitary District of Decatur (500 kW) – operational in '13

- The MW CEAC worked with the Illinois Governor's Office, Illinois Commerce Commission, Illinois Department of Commerce and Economic Opportunity (DCEO), and Illinois EPA to assist Illinois to submit a proposal to NGA on developing Industrial EE/CHP State Action Plans through NGA's Policy Academy.
  - The MW CEAC believes this will be the stepping stoneto the MW CEAC proposed Goals & Milestones of starting discussions with the Illinois Power Authority to committing to WHR as an approved technology under the state's RPS program (i.e. long term contracts).
  - Illinois was awarded September 13, 2012 by the NGA as 1 of the 4 awarded states for the NGA Policy Academy.
  - The MW CEAC hosted the kickoff meeting for the Illinois Policy Academy actions on September 27, 2012.

Wisconsin – Q4.FY2012 activities focused on development of educational outreach materials.

- The MW CEAC is working on two project profiles:
  - 1.1 MW landfill gas fired CHP project at Gundersen Lutheran Health System in Onalaska, WI, that began operation in January 2012
  - 633 kW anaerobic digester biogas CHP project at City Brewery in La Crosse, WI (owned by Gundersen Lutheran Health System)
- The MW CEAC delayed the education outreach efforts with the WI SEO until Fall 2012 due to the increased level of MW CEAC efforts in Ohio and the DOE Boiler MACT Technical Assistance pilot program in Ohio. MW CEAC expected to reach out to WI SEO in the Q1.2013 timeframe.

Iowa – Q3.FY2012 activities focused on utility rate barriers to CHP implementation and state EE/CHP planning.

- The MW CEAC met in Des Moines on August 24th with Alliant Energy, the Iowa Office of Consumer Advocates, IEC, and ELPC to begin discussions of the utility rate barriers study that was developed by the MW CEAC. Alliant Energy did not agree that their standby rates pose any unfair barriers in this meeting. The MW CEAC will be following up with Alliant Energy in Q1.2013.
- The MW CEAC was informed by Mid-American that they will not be modifying their standby rates in Calendar Year 2012, but will be consolidating their three service territories'' standby rates into one uniform updated rate filing in May 2013.
- The MW CEAC is developing a technical paper for the Iowa Environmental Council (IEC) on the topic of recommended standby rate utility practices for Mid-American (next steps study) that avoid unfair utility practices and that do not further negatively impact the implementation of CHP development. This paper will be used as a technical document for IEC to use in discussions with Mid-American Energy Company.

- National Governors Association (NGA) selected Iowa as 1 of the 4 states to be awarded with the NGA Policy Academy to develop state-wide action plans for Industrial EE/CHP. The MW CEAC will be assisting the Iowa efforts including travel to the NGA Policy Academy Meeting in Portland in early October.

Minnesota – Q4.FY2012 activities focused on utility standby rate and net metering barriers to CHP implementation.

- In May, the ERC submitted a proposal to the Division of Energy Resources (DER) Minnesota Department of Commerce – Request for Proposals – under the Conservation Applied Research and Development Grant Program to study viable CHP opportunities that could aid Minnesota meeting their state energy savings goals through analyzing net metering and standby rates. The proposed study was a response to the workshop discussion topics that took place at the MN DER sponsored DG/CHP workshops in the Fall of 2011 that the MW CEAC attended. The ERC was notified in July that the MN DER has high interest in this study and will be awarded funding for ERC to complete this study. This study was identified by the MW CEAC in the Goals and Milestones. The MW CEAC is in the midst of contracting with the MN DER and will begin work on this study in Q1.2013.

Market Sector Business Plans – Q4.FY2012 focused on the initial developments of the CHP Market Sector Business Plans (presentations of plans expected in Q4.FY2012)

- Hospitals – MW CEAC assisted lead NE CEAC (MW CEAC will be leading Hospital Market plan beginning in Q1.2013)
- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Educational Material – Q4.FY2012 focused on the update of the CHP Resource Guide

- The MW CEAC is updating the 2005 CHP Resource Guide, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems.

Section 6: Cost Status – The center invoiced $230,532.94 for Q4.FY2012.

- July 2012: $57,538.62
- August: $84,027.11
- September: $88,967.21

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **7/24 – Combined Heat and Power: Ohio's Statewide Effort to Move CHP Policy and Legislation Forward** @ NASEO Webinar

   ii. **8/2 – CHP Project Costs Screening** @ PUCO CHP: Financial Tools Workshop, Columbus, OH

   iii. **9/25 – Combined Heat & Power (CHP) and Waste Energy Recovery (WER) Opportunities for Ohio Industries** @ 7th Annual Northern Ohio Energy Management Conference, Toledo, OH

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2013 – 5th Quarter
October 1, 2012 through December 31, 2012

Submission Date:
February 5, 2013

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
February 5, 2013

Dear Mr. Renk,

Please find the attached Progress Report for the 5th Quarter of Fiscal Year 2013 (Q5.FY2013) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $175,535,93 for Q5.FY2013:

- Oct 2012: $84,072.09
- Nov: $54,823.53
- Dec: $36,640.31

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q5.FY2013. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
5th Quarter Fiscal Year 2013

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
   i. John Cuttica, (312) 996-5620, cuttica@uic.edu
   ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 02/05/2013
b. Reporting Period: October 1, 2012 through December 31, 2012

Sections 4,5, 7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat recovery, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 5th Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q5.FY2013 set out in the MW CEAC Project Management Plan.

Ohio – Q5.FY2012 activities focused on the Governor's new energy plan, the DOE Boiler MACT Pilot program, activities and engagement with the PUCO, and standby rate analysis.

- The MW CEAC participated in the planning and preparation of the September 13th Public Utilities Commission (PUCO) CHP & Stand-by Rates Workshop in Columbus, OH.
- The MW CEAC led the planning, preparations, and presentations for the December 7th PUCO Natural Gas Key Account Reps Training for CHP in Columbus, OH for the Ohio natural gas key account representatives.
- The MW CEAC met with several potential end users of CHP coordinated by the PUCO.
- The MW CEAC launched the DOE Boiler MACT Technical Assistance pilot program on March 9th. The MW CEAC continued their efforts in Q5.FY2013 of targeting and contacting Boiler MACT affected facilities in Ohio and sharing the DOE Boiler MACT Technical Assistance program. The MW CEAC presented the results for the Boiler MACT Decision Tree Analysis to MillerCoors and also met with representatives from Miami of Ohio University to discuss the ensuing CHP opportunities, both on November 14th.
- Ohio Governor Kasich introduced an energy bill, Senate Bill 315 (SB 315), on March 22nd that included the treatment of CHP and WHR under existing law. The MW CEAC worked with the Ohio CHP Coalition and other key stakeholders in the preceding months and prior year providing education and information on the concepts, benefits, and applications of CHP and WHR technologies. SB 315 was passed into law on June 11, 2012 with WHR now qualifying as a Renewable Energy technology and CHP & WHR both qualifying as EE technologies. The MW CEAC has been meeting with stakeholders on how to determine the EE savings calculations that will be proposed by the Ohio CHP Coalition. The Ohio CHP Coalition is targeting the January/February timeframe to host a webinar introducing the proposed methodology to the larger group of stakeholders.
- The MW CEAC is updating the rate barriers study analyzing the standby rates of the Ohio investor owned utilities (IOUs) following the September 12th workshop on standby rates and meeting with DOE sub-contractor Lisa Schwartz on September 12th. This document is expected to be published in the 6th or 7th quarter of FY2013.

Illinois – Q5.FY2013 activities focused on AD/CHP development and state EE/CHP planning.

- The MW CEAC continued to work with two potential community digester CHP projects in Illinois initiating engineering studies and investigating funding and financing options:
    - Growing Power and Green Era (high profile urban based community digester CHP project within city limits of Chicago). MW CEAC is assisting in securing grant funding and providing technical analysis.
    - Clinton County downstate community digester project located near Breese, IL that involves several key state parties (Association of Illinois Electric Cooperatives, Illinois EPA, EPA Region 5, Department of

    - Commerce and Economic Opportunity). MW CEAC presented on a panel at the project bidders meeting on November 19th.
- The MW CEAC has been working with Illinois Department Commerce and Economic Opportunity (DCEO-SEO) on four (4) CHP projects at WWTPs (2 projects began operation in Q5.2013 and 2 are expected completion in 2013):
    - Village of Fox River Grove Wastewater Treatment Facility (100 kW) – Oct '12 startup
    - City of Danville Wastewater Treatment Facility (100 kW) – Oct '12 startup
    - Downers Grove Sanitary District (138 kW) – operational in '13
    - Sanitary District of Decatur (500 kW) – operational in '13
- The MW CEAC worked with the Illinois Governor's Office, Illinois Commerce Commission, Illinois Department of Commerce and Economic Opportunity (DCEO), and Illinois EPA to assist Illinois to submit a proposal to NGA on developing Industrial EE/CHP State Action Plans through NGA's Policy Academy in Q4.FY2012. The Illinois team was awarded September 13th as 1 of the 4 awarded states for the NGA Policy Academy to develop an Action Plan for the State of Illinois to identify policy and regulatory activities that could favorably impact CHP development.
    - The MW CEAC attended and participated in the NGA Policy Academy in Portland, OR with the Illinois Team on the dates of October 15th to 18th.
    - The MW CEAC organized and conducted a meeting with the Illinois Core Team and the investor owned utilities (IOUs) on November 27th to discuss how the utilities can integrate CHP and WHP into their EEPS and RPS programs.
    - The MW CEAC worked with the Illinois Core Team throughout Q5.FY2013 working on developing a state plan. Activities included one-on-one phone calls, conference calls, email correspondences, etc.
    - The MW CEAC met with the Board Members of the Midwest Cogeneration Association (MCA) on October 8th and November 13th.
    -

Wisconsin – Q5.FY2013 activities focused on development of educational outreach materials.

- The MW CEAC delayed the education outreach efforts with the WI SEO due to the increased level of MW CEAC efforts in Ohio and the DOE Boiler MACT Technical Assistance pilot program in Ohio. MW CEAC expected to reach out to WI SEO in the Q6/Q7.FY2013 timeframe once the Boiler MACT ruling is finalized.

Iowa – Q5.FY2013 activities focused on utility rate barriers to CHP implementation and state EE/CHP planning.

- In Q5.FY2013, National Governors Association (NGA) selected Iowa as 1 of the 4 states to be awarded with the NGA Policy Academy to develop state-wide action plans for Industrial EE/CHP. The MW CEAC has been assisting the Iowa efforts participating in phone calls, email correspondences, etc. The MW CEAC attended and participated in the NGA Policy Academy in Portland, OR with the Iowa Team on the dates of October 15th through 18th.

- The MW CEAC was informed by Mid-American that they will not be modifying their standby rates in Calendar Year 2012, but will be consolidating their three service territories'' standby rates into one uniform updated rate filing in May 2013.The MW CEAC is completed a technical paper on December 6th for the Iowa Environmental Council (IEC) on the topic of recommended standby rate utility practices for Mid-American (next steps study) that avoid unfair utility practices and that do not further negatively impact the implementation of CHP development. This paper will be used as a technical document for IEC to use in discussions with Mid-American Energy Company.

Minnesota – Q5.FY2013 activities focused on utility standby rate and net metering barriers to CHP implementation.

- In May 2012, the ERC submitted a proposal to the Division of Energy Resources (DER) Minnesota Department of Commerce – Request for Proposals – under the Conservation Applied Research and Development Grant Program to study viable CHP opportunities that could aid Minnesota meeting their state energy savings goals through analyzing net metering and standby rates. The proposed study was a response to the workshop discussion topics that took place at the MN DER sponsored DG/CHP workshops in the Fall of 2011 that the MW CEAC attended. The ERC was notified in July that the MN DER has high interest in this study and will be awarded funding for ERC to complete this study. This study was identified by the MW CEAC in the Goals and Milestones. The MW CEAC is still in the midst of contracting with the MN DER. Work was expected to begin in Q5.2013 but has been pushed back to Q6.FY2013.

Market Sector Business Plans – Q5.FY2013 focused on the developments of the CHP Market Sector Business Plans (presentations of plans expected in Q5.FY2013)

- Hospitals – MW CEAC took over the lead of the Hospital Market Sector plan in Q5.FY2013. The NE CEAC and IDEA are assisting CEACs.
- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Educational Material – Q5.FY2013 focused on the update of the CHP Resource Guide

- The MW CEAC is updating the 2005 CHP Resource Guide, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems. The completed update of the CHP Resource Guide will be delayed until the ASHRAE CHP Guide that is being developed by the Mid-Atlantic CEAC is completed and the EPA CHP Catalog of Technologies is updated. The MW CEAC wants to ensure consistent information is published between all three documents, most notably equipment and installation costs.

Section 6: Cost Status – The center invoiced $175,535.93 for Q5.FY2013.

- Oct 2012: $84,072.09
- Nov: $54,823.53
- Dec: $36,640.31

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **12/7 – Natural Gas Key Account Reps Training for CHP** @ PUCO Workshop for NG Key Account Reps, Columbus, OH.

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

Appendix

CEAC Goals and Milestones from January Presentations and Project Management Plan

CEAC	Goals	Activities	Outcomes	Milestones	Status (as of 12/31/12)
Midwest	Ohio		• Inclusion of CHP /WHR as a specified & recognized technology with an installed capacity target in the new Governor's energy plans , Ohio energy regulations, Ohio energy legislation. • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Participate Workshop(s) (energy summit follow-up) PUCO…Feb. 2012 • Develop consensus on the policy direction (Ohio CHP Coalition) ….Spring ,2012 • Policy reform introduced from Gov Office to Legislature and/or PUCO…. Spring 2012 • Provide educational and technical support to the Coalition (biweekly conference calls, white paper(s) identifying issues and suggested actions to be considered: rate structures /jobs ..Ongoing • Initiate Boiler MACT activities with PUCO …. Winter 2012 • Complete Policy Options Paper (standby rates)..Spring2012	• COMPLETED Q2: March Workshop hosted on 3/9, MW CEAC participated in PUCO workshop on 6/20, MW CEAC presented at 7/24 NASEO webinar on OH status, MW CEAC presented at 8/2 PUCO workshop, MW CEAC organized and presented at 12/7 PUCO NG Key Accounts Training • Ongoing (Ohio CHP Coalition is now working on how to incorporate CHP and WHtP into the utility plans), MW CEAC working with OH CHP Coalition to organize webinar for Jan/Feb 2013 to introduce proposed methodology • COMPLETED Q2: Gov. Kasich introduced energy plan (SB 315) on 3/22. Gov. Kasich signed into law SB 315 on June 11, 2012 which qualifies WHtP as a Renewable Technology and CHP & WHtP as EE technologies. With the law signed, next steps are to determine how CHP and WHtP are implemented into Ohio utility plans. (MW CEAC will offer technical assistance where needed) • Ongoing • Initiated March, MW CEAC has been contacting Ohio facilities and working with ICF and PUCO • Ongoing (draft submitted to DOE in Aug, MW CEAC modifying paper due to DOE updates and Sep PUCO Standby Rates workshop)
	Illinois		• Initiate the implementation of a minimum of two biogas CHP projects with the Association of Illinois Electric Cooperatives securing their commitment to biogas CHP within the state and expanding biogas CHP within the state • Bring the Ohio model to Illinois (ELPC, IEC, NRDC, others) • Expand educational activities to identify new CHP avenues within the state: • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Partnership with AIEC, identification of 2 CHP sites & initiation of engineering studies (includes 3 planned workshops)…..Fall 2012 • Successful start-up of minimum 2 additional CHP biogas sites…Fall 2012 • Illinois Power Authority commitment to WHR as approved technology for RPS (long term contracts)….Spring 2012 • IDEA workshop on Community Energy Development Guide…(Chicago) --- District Energy/CHP as redevelopment tool ….June, 2012 • Develop plan for bringing Ohio model to Illinois … Fall 2012	• Ongoing (Working with Growing Power / Green Era & Downstate Community Digester Ag Project in Clinton County, IL… MW CEAC attended and presented at the Nov 19th project bidders meeting in Clinton County), 3 Workshops Completed: co-sponsored on 2/3, 2/9, 2/10) • Ongoing (working with four WWTFs in Illinois: Fox River Grove WWTF (100 kW) and Danville WWTF (100 kW) CHP systems are now operating, Downers Grove WWTF (138 WWTF) and Decataur WWTF (500 kW) to be installed/operating by end of 2013 • Started Q4.2012 – MW CEAC

					working with IL on NGA Policy Academy, conducted utilities workshop on Nov 27th • Completed June 2012 • Started Q4.2012 – working with NGA Policy Academy award
	Wisconsin		• Re-engage the SEO, include CHP in their energy programs. • Continue technical support on high visibility CHP/WHR projects (target markets remain biogas and pulp/paper) • Inclusion of CHP as a viable approach to meet Boiler MACT Regs •	• Identify and implement outreach activities with SEO and targeted markets (Breweries, Food Processing, Livestock, WWTF).. Ongoing efforts with potential webinars by spring/summer 2012 • Min 2 project profiles from tech assistance efforts … ongoing	• Workshops/webinars delayed till FY2013 • Working on two project profiles: LFG CHP at GLHS in Onalaska, AD/CHP at GLHS in La Crosse (completed LFG CHP profile in Dec 2012)
	Iowa		• IEC & ELPC introducing utility rate reform to PUC • SEO/Industry sponsored education webinars • CHP as a viable approach to meet Boiler MACT Regs	• Rate study analysis completed (best practices).. Spring 2012 • CHP Market Impact Analysis .. Summer 2012 • Settlement agreement meeting ..Summer 2012 • IEC & ELPC submittal of reform request to PUC … Fall 2012 • 1 Targeted webinar .. Summer/Fall • State plan for Industrial EE/CHP	• COMPLETED: submitted Feb • Ongoing (draft expected Q6.2013, MW CEAC working with ICF/DOE) • COMPLETED: first meeting held with Mid-American on 3/7 in Des Moines, first meeting with Alliant to be held in August • Ongoing (Mid-American will be file updated standby rates in May 2013, draft rates to be circulated Jan 2013; MW CEAC is providing technical assistance to IEC & ELCP; MW CEAC completed 2nd paper on Iowa standby rates on Dec. 6th for Mid-American rate filing) • Not yet started • NGA awarded Iowa with NGA Policy Academy; MW CEAC assisting IA efforts
	Minnesota		• Inclusion of CHP/WHR in SEO programs and recommendation to PUC for DG policy reform • CHP as a viable approach to meet Boiler MACT Regs	• Rate study / net metering paper(s) for SEO.. Summer 2012 • Reform recommendations to PUC .. Fall 2012	• Ongoing (MW CEAC submitted proposal on standby rate and net metering study to MN SEO; MW CEAC was notified in July of award; work on study has been delayed due to contracting, work expected to begin Feb 2013) • Not yet started (actions will follow completion of study)
	Indiana	▪	NIPSCO initiate pilot FIT for CHP similar to existing pilot FIT for renewables	NIPSCO agreement to proceed with pilot FIT request to Utility Commission …..Winter 2012	Not yet started
	Michigan	▪	Expanded CEAC work in Michigan	Identify and initiate expanded CHP opportunities for CEAC involvement ….Fall 2012	Not yet started
	Kansas Missouri Nebraska North Dakota South Dakota		Support CHP activities as required	Nothing identified at this time	

	Boiler MACT			• Training Session …Jan. 2012 • Develop Implementation Plan …. March 1st, 2012 • Method of Screening Opportunities • Materials Development • Method of Contacting Opportunities (including site visits) • Resources Split (internal versus subcontracts) • Implementation ….. Spring 2012 • Ohio Test Case: Work with PUC Ohio – January 2012	• Completed • Ongoing • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Ongoing (test case Ohio) • Resources identified • Pilot underway in Ohio • Work underway – initiated March
	SEEAction			Planned FY 12/FY 13 Activities/Milestones • Lead the development of CHP version of Policy Guide • Provide assistance to Hdqtrs in development of white papers and policy guide book.. ongoing • Participate in the Development & Implementation of 2 Regional Utility/Regulatory Workshops (MW & SE) •	Lead shifted to Eric by DOE Hdqtrs Ongoing Ongoing coordination with MEEA, MW CEAC assisted DOE and MEEA with June 21 Regional Meeting in Columbus, OH
	Market Sector Development		Market Sector Business Plans	Plan development participation: - Hospitals – NE lead….Spring o Project Profile o White Paper - WHR – Pacific lead….Spring - Biomass – NW lead….Spring	• Ongoing (participated on conference calls, reviewed drafts, provided comments)… Hospital Plan turned over to MW CEAC in Oct '12 • Ongoing (participated on conference calls, reviewed drafts, provided comments) • Ongoing (participated on conference calls, reviewed drafts, provided comments)
	Other		Educational Materials	• Updated CHP Resource Guide • Project Profiles	• Outline submitted to DOE for review in April 2012, comments received by DOE in Summer 2012, work began in Q4.2012; completion postponed until ASHRAE CHP Guide and EPA CHP Catalog of Technologies are published • Ongoing: completed Gundersen Lutheran LFG CHP Project Profile Dec 2012

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2013 – 6th Quarter
January 1, 2013 through March 31, 2013

Submission Date:
May 3, 2013

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
May 3, 2013

Dear Mr. Renk,

Please find the attached Progress Report for the 6th Quarter of Fiscal Year 2013 (Q6.FY2013) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $119,768.86 for Q6.FY2013:

- Jan 2013: $24,511.20
- Feb: $54,514.45
- Mar: $40,743.21

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q6.FY2013. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
6th Quarter Fiscal Year 2013

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 05/03/2013
b. Reporting Period: January 1, 2013 through March 31, 2013

Sections 4,5,7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat recovery, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 6th Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q6.FY2013 set out in the MW CEAC Project Management Plan.

Ohio – Q6.FY2013 activities focused on the Governor's new energy plan, the DOE Boiler MACT Pilot program, activities and engagement with the PUCO, and standby rate analysis.

- The MW CEAC participated in the planning and preparation of the Ohio CHP Coalition's webinar on February 2nd, 2013 focused on Ohio Senate Bill 315 and the inclusion of CHP in the utility EE programs. The MW CEAC has been working with the Ohio CHP Coalition in developing a white paper with the proposed position of the Coalition towards the CHP calculations and measures in the utility energy efficient portfolio standards (EEPS).
- The MW CEAC met with several potential end users of CHP coordinated by the PUCO. The MW CEAC continued to support the PUCO in all CHP/WHP inquiries.
- The MW CEAC continued their efforts in Q6.FY2013 of targeting and contacting Boiler MACT affected facilities in Ohio and sharing the DOE Boiler MACT Technical Assistance program

Illinois – Q6.FY2013 activities focused on state EE/CHP planning and AD/CHP development.

- The MW CEAC worked with the Illinois Governor's Office, Illinois Commerce Commission, Illinois Department of Commerce and Economic Opportunity (DCEO), and Illinois EPA develop Industrial EE/CHP State Action Plans through the National Governors Association's (NGA) Policy Academy in Q6.FY2013.
  - The MW CEAC worked with the Illinois Core Team throughout Q6.FY2013 working on developing the state plan. Activities included one-on-one phone calls, conference calls, email correspondences, etc.
  - The MW CEAC presented at the Annual Midwest Energy Efficiency Alliance (MEEA) Conference in Chicago, Illinois on January 17, 2013 on the topic of utilizes and greater energy savings through CHP.
  - The MW CEAC presented at the March 20, 2013 Illinois Stakeholders Advisory Group (SAG) in Chicago, Illinois on the topic of the inclusion of CHP in the state EEPS.
  - The MW CEAC will be presenting at The Institute for Regulatory Policy Studies workshop on April 18, 2013 in Springfield, Illinois.
  - The MW CEAC met with the Board Members of the Midwest Cogeneration Association (MCA) on February 19, 2013 and March 25, 2013.
- Illinois Boiler MACT Outreach Activities
  - The MW CEAC presented the DOE Boiler MACT Technical Assistance Outreach activities via a MEEA sponsored webinar to the Midwest region on January 30, 2013.
  - The MW CEAC presented the DOE Boiler MACT Technical Assistance Outreach activities to the Illinois EPA staff on February 14, 2013 via a webinar.

- The MW CEAC continued to work with two potential community digester CHP projects in Illinois initiating engineering studies and investigating funding and financing options:
  - Growing Power and Green Era (high profile urban based community digester CHP project within city limits of Chicago). MW CEAC is assisting in securing grant funding through the Illinois Department of Commerce and Economic Opportunity and providing technical analysis on the development of the project. An initial study was completed March 2013 titled – "Preliminary Financial Overview - Design, Build, Own, Operate and Maintain and Urban Merchant Biogas Plant."
  - Clinton County downstate community digester project located near Breese, IL that involves several key state parties (Association of Illinois Electric Cooperatives, Illinois EPA, EPA Region 5, Department of Commerce and Economic Opportunity). MW CEAC provided technical assistance during January/February to select a qualified engineering firm to complete the feasibility study (reviewing proposals, attending bidder interviews, conference calls, emails, etc.). Feasibility Study is underway with completion date in Fall 2013.
- The MW CEAC has been working with Illinois Department Commerce and Economic Opportunity (DCEO-SEO) on four (4) CHP projects at WWTPs in FY2013 (2 projects already began operation in Q5.2013 and 2 are expected completion in Q7/Q8.2013):
  - Downers Grove Sanitary District (138 kW) – to be operational in '13
  - Sanitary District of Decatur (500 kW) – to beoperational in '13

Wisconsin – Q5.FY2013 activities focused on the development of educational outreach materials.

- The MW CEAC delayed the education outreach efforts with the WI SEO due to the increased level of MW CEAC efforts in Illinois and Iowa with the NGA Policy Academy and the DOE Boiler MACT Technical Assistance pilot program in Ohio. MW CEAC expected to reach out to WI SEO in the Q7/Q8.FY2013.

Iowa – Q6.FY2013 activities focused on utility rate barriers to CHP implementation and state EE/CHP planning.

- In Q5.FY2013, National Governors Association (NGA) selected Iowa as 1 of the 4 states to be awarded with the NGA Policy Academy to develop state-wide action plans for Industrial EE/CHP. The MW CEAC has been assisting the Iowa efforts participating in phone calls, email correspondences, etc. in Q6.2013.
- The MW CEAC began work on a CHP Market Penetration Study with ICF International in Q6.2013 analyzing the impacts of improved standby rates and incentives via utility energy efficiency programs within Iowa. This study will be utilized by the IEC and ELPC during upcoming rate cases and conversations with the Iowa Utilities Board.

- The MW CEAC reviewed proposed standby rates submitted by Mid-American that will be submitted to the Iowa Utilities Board in Q7.2013. MW CEAC met with Mid-American, IEC, and ELPC to discuss the proposed standby rates

Minnesota – Q6.FY2013 activities focused on utility standby rate and net metering barriers to CHP implementation.

- In May 2012, the ERC submitted a proposal to the Division of Energy Resources (DER) Minnesota Department of Commerce – Request for Proposals – under the Conservation Applied Research and Development Grant Program to study viable CHP opportunities that could aid Minnesota meeting their state energy savings goals through analyzing net metering and standby rates. The proposed study was a response to the workshop discussion topics that took place at the MN DER sponsored DG/CHP workshops in the Fall of 2011 that the MW CEAC attended.
- The MW CEAC completed contracting negotiations with the MN DER in March 2013. Work officially commenced on 3/25/2013 with completion of the studies expected in Q8.2013.

Market Sector Business Plans – Q6.FY2013 focused on the developments of the CHP Market Sector Business Plans

- Hospitals – MW CEAC leads the development of the Hospital Market Sector plan. The NE CEAC and IDEA are assisting CEACs. The GC CEAC joined the Hospital Market Sector Business Plan at the CEAC Directors meeting in San Diego, CA.
    - Hospital Market Sector Plan Update was presented at CEAC Directors Meeting on February 20, 2013 in San Diego, CA
    - MW CEAC developed with assistance from the Pacific CEAC a CHP 101 Presentation for Hospitals. The presentation will be given at the April 4th webinar sponsored by the Pacific CEAC.
    - The MW CEAC completed a Project Profile on the 2012 LFG CHP installation at the Gundersen Lutheran Health System in Onalaska, Wisconsin.
- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Educational Material

- The MW CEAC is updating the 2005 CHP Resource Guide in FY2013, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems. The completed update of the CHP Resource Guide will be delayed until the ASHRAE CHP Guide that is being developed by the Mid-Atlantic CEAC is completed and the EPA CHP Catalog of Technologies is updated. The MW CEAC wants to ensure consistent information is published between all three documents, most notably equipment and installation costs.

Section 6: Cost Status – The center invoiced $119,768.86 for Q6.FY2013.

- Jan 2013: $24,511.20
- Feb: $54,514.45
- Mar: $40,743.21

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **1/30 – Combined Heat and Power as a Boiler MACT Compliance Strategy** @ MEEA Webinar Series.
   ii. **2/14 – Combined Heat and Power as a Boiler MACT Compliance Strategy** @ Illinois EPA Webinar Meeting.
   iii. **2/22 – Combined Heat and Power as a Boiler MACT Compliance Strategy** @ Missouri DNR Webinar Meeting.

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

Appendix

2013 CEAC Goals and Milestones from January Presentations and Project Management Plan

CEAC	Goals	Activities	Outcomes	Milestones	Status (as of 3/31/13)
Midwest	Ohio		• Implementation of CHP / WHR as a specified & recognized technology in the utility EE programs. • Inclusion of CHP as a viable approach to meet Boiler MACT Regs • Implementation of minimum 6 CHP/WER installations	• Participate in implementation activities (workshops, hearings, meetings, etc.) for SB 315 (Task 3, Item 26) • Develop consensus on policy direction (Ohio CHP Coalition) (Task 3, Item 27) • Successful Implementation of SB 315 into electric utility plans (Task 3, Item 28) • Identify and initiate implementation of minimum 6 sites for CHP/WER installations (implementation of SB 315 and/or Boiler MACT) (Task 4/5, Item 29) • Education and Technology support for Ohio coalition and other stakeholders (Task 2/3/5, Item 30) • Work with PUCO as follow up to standby rate study (Task 4, Item 31)	• Ongoing • COMPLETED: White Paper to be published by OH CHP Coalition Apr, Q7.2013 • Ongoing: workshop to be hosted by PUCO in Apr, Q7.2013 • Ongoing: several projects in developmental phase; MW CEAC has met with PUCO to assist several potential projects • Ongoing: MW CEAC participates in conference calls, email communications, etc. • Ongoing
	Illinois		• Initiate the implementation of a minimum of two biogas CHP projects • Bring the Ohio model to Illinois via the NGA Policy Academy (ELPC, IEC, NRDC, others) • EE/CHP Report to be submitted to Governor via NGA Policy Academy • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Work with Illinois on NGA Industry Policy Academy – Action Plan (Task 3, Item 32) • Start up (initiate) minimum 2 biogas CHP sites (partnerships with AIEC, DCEO, EPA Region V, etc.) (Task 5, Item 33) • Minimum 2 project profiles as result of CEAC Tech Assistance work (Task 4, Item 34)	• Ongoing (final report due May 1, Q7.2013) • Ongoing – Danville WWTF (100 kW CHP system) – operating Q5.2013 – Downers Grove WWTF (138 kW) and Decataur WWTF (500 kW) to be operating Q7/Q8.2013 – CHP Studies underway for 2 high profile community digester CHP projects during FY2013 (studies by sub-contractors) • Developing 5 project profiles: – 4 WWTPs (2 to be completed Q7.2013, 2 to be completed Q8.2013) – 1 Ethanol Plant (to be completed Q7.2013)
	Wisconsin		• Re-engage the SEO, include CHP in their energy programs. • Continue technical support on high visibility CHP/WHR projects (target markets remain biogas and pulp/paper) • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Work with SEO in targeted markets (outreach activities) (Task 2, Item 35) • Min 1 project profile as result of technical assistance work (Task 4, Item 36)	• Ongoing: – Providing technical assistance to projects in identified target markets – CHP Boiler MACT analysis underway at paper mill • COMPLETED: – Gundersen Lutheran LFG CHP Project Profile, Onalaska, WI (completed Q5.2013) – Gundersen Lutheran Biomass CHP Project Profile, La Crosse, WI (expected completion Q7.2013) •
	Iowa		• IEC & ELPC introducing utility rate reform to PUC • EE/CHP Report to be submitted to Governor via NGA Policy Academy • CHP as a viable approach to meet Boiler MACT Regs	• Complete standby rate recommendations study with IEC (Task 4, Item 37) • Provide Tech Assistance to Iowa NGA Industry Policy Academy efforts (Task 4, Item 38) • Assist/participate as appropriate in Utility Standby Rate Proceedings (2013) (Task 3, Item 39)	• COMPLETED: submitted Dec, Q5.2013. MW CEAC reviewed proposed standby rates of Mid-American in Q6.2013 and provided recommendations. • Ongoing (final report to be submitted Q7.2013) • Ongoing

					– written testimony to be submitted Q7.2013 on behalf of IEC on inclusion of CHP in Alliant Energy's 3 Year EE Program; in-person testimony expected Q7.2013) – MW CEAC working with ICF on market penetration study analyzing impacts of standby rates and EE incentives (expected completion in Q7.2013)
	Minnesota		• Inclusion of CHP/WHR in SEO programs and recommendation to PUC for DG policy reform • CHP as a viable approach to meet Boiler MACT Regs	• Complete study/papers on net metering and standby rates (Task 4, Item 40)	• Ongoing (MW CEAC under contract with MN SEO Mar, Q6.2013, work on study to commence April, Q7.2013)
	Rest of States		• CHP as a viable approach to meet Boiler MACT Regs	• Activities as required and identified (Task 6, Item 41)	• Ongoing
	Other		• Educational Material	• Update Resource Guidebook (Task 4, Item 42)	• Partially Completed; guidebook stalled due to waiting for completion of ASHRAE CHP Guide by MA CEAC and ICF publication of CHP Installation Costs (material needed for guidebook to ensure consistency of CHP publications)
	Other		• Educational Materials published on CEAC Website	• Launch 2 additional market sector pages on Website (per direction of CEAC Website Working Group) (Task 4, Item 43)	• MW CEAC developing hospital and dairy market sector pages (expected completion Q7.2013)
	Boiler MACT		• Midwest CHP System Installations	• Boiler MACT – finish pilot in Ohio, transfer pilot to other assigned states (Task 7, Item 44)	• Ongoing: Ohio Boiler MACT activity continued; status log provided to ICF every two weeks • Other States: – MW CEAC under contract with 8 sub-contractors in Q6.2013; MW CEAC to host kick-off meeting with sub-contractors in April, Q7.2013 to launch Boiler MACT outreach (initially assigning 80+ sites to team members). – MW CEAC presented Boiler MACT outreach on 3 webinars during Q6.2013.
	SEEAction		• Educational Materials on CHP Policy	• SEE Action participation on IEE/CHP working group (rep CEACs) (Task 3, Item 45)	• Ongoing: – SEE Action Report published Q6.2013 – MW CEAC to co-lead CEAC conference call in May, Q7.2013 – MW CEAC participation in conference calls, emails, etc.
	Market Sector Development		• Market Sector Business Plans	• Take lead on development of Hospital market sector plan (Task 2, Item 46) • Support development of Biomass (NW lead) WHP (Pacific lead) market sector plans (Task 2, Item 46)	• Ongoing – Updated plan submitted Feb, Q6.2013 – MW CEAC developed CHP 101 Presentation for Hospitals Mar, Q6.2013 (to be presented Apr, Q7.2013)

					• Ongoing participation on conference calls, reviewing drafts, providing comments of other Market Sector Plans
	Other		Midwest CHP System Installations	• Monitor installation of new CHP sites in MW • Identify/Assist in installation of min 10 new CHP/WER sites in MW (Task 2/4/5, Item 47)	• Ongoing (submit info to ICF) • Ongoing

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2013 – 7th Quarter
April 1, 2013 through June 30, 2013

Submission Date:
July 26, 2013

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
July 26, 2013

Dear Mr. Renk,

Please find the attached Progress Report for the 7th Quarter of Fiscal Year 2013 (Q7.FY2013) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $186,845.83 for Q7.FY2013:

- Apr 2013: $59,382.41
- May: $57,420.41
- June: $70,043.83

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q7.FY2013. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
7th Quarter Fiscal Year 2013

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 07/28/2013
b. Reporting Period: April 1, 2013 through June 30, 2013

Sections 4,5,7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat to power, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 7th Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q7.FY2013 set out in the MW CEAC Project Management Plan.

Ohio – Q7.FY2013 activities focused on the Governor's new energy plan, the DOE Boiler MACT Pilot program, activities and engagement with the PUCO, and standby rate analysis.

- The MW CEAC has continued to assist in the evaluation of CHP as an EE measure working with stakeholders in Ohio.
- The Ohio CHP Coalition published "Implementing the Combined Heat and Power and Waste Energy Recovery Provisions of Revised Code Section 4928.66" in April 2013. The paper was prepared by NRDC and OEC; the Midwest CEAC reviewed and commented on the paper.
- The MW CEAC attended and presented at the Public Utilities Commission of Ohio (PUCO) workshop on April 23rd in Columbus, OH, that initiated its five-year review of Ohio's energy efficiency and alternative energy portfolio standard rules.
- The MW CEAC has continued to support the PUCO in all CHP/WHP inquiries relating to individual projects and technical assistance (including Boiler MACT).

Illinois – Q7.FY2013 activities focused on state EE/CHP planning, AD/CHP development, and other education outreach efforts

- The MW CEAC worked with the Illinois Governor's Office, Illinois Commerce Commission, Illinois Department of Commerce and Economic Opportunity (DCEO), and Illinois EPA to develop Industrial EE/CHP State Action Plans through the National Governors Association's (NGA) Policy Academy in Q7.FY2013.
- The final report for the Illinois CHP NGA Policy Academy Team was submitted on April 30th, 2013 to the Governor titled: State of Illinois Action Plan Enhancing Industry through Energy Efficiency & Combined Heat and Power.
- The Midwest CEAC assisted the Illinois EE/CHP NGA Policy Academy Team in organizing and implementing the June 5th Illinois Workshop on Combined Heat and Power (CHP) investigating the CHP EE opportunities in Illinois. Attendees included Peoples and NICOR (gas utilities), Ameron and ComEd (electric utilities), Illinois Commerce Commission, Illinois Power Authority, Department of Commerce and Economic Opportunity (Illinois SEO), and other stakeholders.
- The MW CEAC presented at The Illinois Institute for Regulatory Policy Studies Conference "Utility Regulation: The Good, the Bad, and the Efficient" in Springfield, Illinois on April 18th on the presentation titled "Combined Heat and Power (CHP), An Opportunity for Illinois Policy."
- The MW CEAC met with the Board Members of the Midwest Cogeneration Association (MCA) on June 25th.
- The MW CEAC coordinated a site tour to the UIC West Campus CHP Plant for Congressman Mike Quigley (D-IL) on April 2nd. Congressman Quigley is the U.S. Representative for Illinois' 5th congressional district, serving since the April 7, 2009 special election.

- The MW CEAC continued to work with two potential community digester CHP projects in Illinois initiating engineering studies and investigating funding and financing options:

- Growing Power and Green Era (high profile urban based community digester CHP project within city limits of Chicago). MW CEAC is assisting in securing grant funding through the Illinois Department of Commerce and Economic Opportunity and providing technical analysis on the development of the project. An initial study was completed March 2013 titled – "Preliminary Financial Overview - Design, Build, Own, Operate and Maintain and Urban Merchant Biogas Plant."
- Clinton County downstate community digester project located near Breese, IL that involves several key state parties (Association of Illinois Electric Cooperatives, Illinois EPA, EPA Region 5, Department of Commerce and Economic Opportunity). MW CEAC provided technical assistance during January/February to select a qualified engineering firm to complete the feasibility study (reviewing proposals, attending bidder interviews, conference calls, emails, etc.). Feasibility Study is underway with completion date of Fall 2013.
- The MW CEAC has been working with Illinois Department Commerce and Economic Opportunity (DCEO-SEO) on four (4) CHP projects at WWTPs in FY2013.
  - 2 CHP projects already began operation in Q5.2013 (the Midwest CEAC attended the Open House on April 26th for the Danville Sanitary District)
  - 2 CHP projects are expected completion in Q7/Q8.2013 (Downers Grove Sanitary District Sanitary District of Decatur)

Wisconsin – Q5.FY2013 activities

- The MW CEAC attended the May 1st Ribbon Cutting ceremony for the Biomass CHP plant at Gundersen Lutheran in LaCrosse, WI. The Midwest CEAC provided technical assistance early in the developmental phase of the project.

Iowa – Q7.FY2013 activities focused on utility rate barriers to CHP implementation and state EE/CHP planning.

- In Q7.FY2013, the MW CEAC continued to assist the Iowa CHP NGA Policy Academy team.
- The MW CEAC has continued work on a CHP Market Penetration Study with ICF International in Q7.2013 analyzing the impacts of improved standby rates and incentives via utility energy efficiency programs within Iowa. This study will be utilized by the IEC and ELPC during upcoming rate cases and conversations with the Iowa Utilities Board.
- The MW CEAC is preparing to testify on utility energy efficiency portfolio hearings in July (Alliant) and August (Mid-American).

Minnesota – Q7.FY2013 activities focused on utility standby rate and net metering barriers to CHP implementation.

- The Midwest CEAC has been working with the Division of Energy Resources (DER) Minnesota Department of Commerce study viable CHP opportunities that could aid Minnesota meeting their state energy savings goals through analyzing net metering and standby rates. Study to be completed in Fall 2013.

- The Midwest CEAC presented "Combined Heat & Power (CHP)" @ the 2013 CenterPoint Energy Efficiency and Technology Conference, Track 2: Industrial Energy Efficiency, Minneapolis, MN on May 21st. The MW CEAC also hosted an booth exhibit.

Market Sector Business Plans – Q7.FY2013 focused on the developments of the CHP Market Sector Business Plans

- Hospitals – MW CEAC leads the development of the Hospital Market Sector plan. The NE CEAC and IDEA are assisting CEACs. The GC CEAC joined the Hospital Market Sector Business Plan at the CEAC Directors meeting in San Diego, CA.
    - MW CEAC developed with assistance from the Pacific CEAC a CHP 101 Presentation for Hospitals. The presentation was given at the April 4th webinar sponsored by the Pacific CEAC.
    - The MW CEAC attended the ribbon cutting ceremony for the Gundersen Lutheran biomass CHP project on May 1completed a Project Profile on the 2012 LFG CHP installation at the Gundersen Lutheran Health System in Onalaska, Wisconsin.
    - The MW CEAC is preparing a booth exhibit at the 50th Annual American Society for Healthcare Engineers (ASHE) Conference on July 22-24.
- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Activities

- The MW CEAC completed a CHP Course for the UIC Energy Engineering Masters Course in May 2013.
- The MW CEAC is updating the 2005 CHP Resource Guide in FY2013, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems. The completed update of the CHP Resource Guide will be delayed until the ASHRAE CHP Guide that is being developed by the Mid-Atlantic CEAC is completed and the EPA CHP Catalog of Technologies is updated. The MW CEAC wants to ensure consistent information is published between all three documents, most notably equipment and installation costs.
- The MW CEAC is continuing technical assistance efforts.
- The MW CEAC is continuing Boiler MACT technical assistance efforts and other CEAC technical assistance efforts.

Section 6: Cost Status – The center invoiced $186,845.83 for Q7.FY2013:

- Apr 2013: $59,382.41
- May: $57,420.41
- June: $70,043.83

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **4/18 – Combined Heat and Power (CHP), An Opportunity for Illinois Policy** @ The Institute for Regulatory Policy Studies Conference "Utility Regulation: The Good, the Bad, and the Efficient", Springfield, Illinois.
   ii. **5/21 – Combined Heat & Power (CHP)** @ the 2013 CenterPoint Energy Efficiency and Technology Conference, Track 2: Industrial Energy Efficiency, Minneapolis, MN.
   iii. **6/19 – Taking Advantage of Combined Heat and Power (CHP)** @ 2013 RE AMP Annual Meeting: Getting Clean Energy Built Workshop, Chicago, IL.
   iv. **6/28 – DOE CEACs, CHP Market Drivers, & CHP Applications** @ Iowa Combined Heat and Power Workshop, Des Moines, IA (Sponsored by NGA and hosted by IEDA)

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

Appendix

FY2013 CEAC Goals and Milestones

CEAC	Goals	Activities	Outcomes	Milestones	Status (as of 3/31/13)
Midwest	Ohio		• Implementation of CHP / WHR as a specified & recognized technology in the utility EE programs. • Inclusion of CHP as a viable approach to meet Boiler MACT Regs • Implementation of minimum 6 CHP/WER installations	• Participate in implementation activities (workshops, hearings, meetings, etc.) for SB 315 (Task 3, Item 26) • Develop consensus on policy direction (Ohio CHP Coalition) (Task 3, Item 27) • Successful Implementation of SB 315 into electric utility plans (Task 3, Item 28) • Identify and initiate implementation of minimum 6 sites for CHP/WER installations (implementation of SB 315 and/or Boiler MACT) (Task 4/5, Item 29) • Education and Technology support for Ohio coalition and other stakeholders (Task 2/3/5, Item 30) • Work with PUCO as follow up to standby rate study (Task 4, Item 31)	• Ongoing • COMPLETED: White Paper published by OH CHP Coalition Apr, Q7.2013 • Delayed: Initial PUCO workshop conducted by in Apr, Q7.2013. Further proceedings will take place Fall '13 • Ongoing: several projects in developmental phase; MW CEAC has met with PUCO to assist several potential projects • Ongoing: MW CEAC participates in conference calls, email communications, etc. • Ongoing
	Illinois		• Initiate the implementation of a minimum of two biogas CHP projects • Bring the Ohio model to Illinois via the NGA Policy Academy (ELPC, IEC, NRDC, others) • EE/CHP Report to be submitted to Governor via NGA Policy Academy • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Work with Illinois on NGA Industry Policy Academy – Action Plan (Task 3, Item 32) • Start up (initiate) minimum 2 biogas CHP sites (partnerships with AIEC, DCEO, EPA Region V, etc.) (Task 5, Item 33) • Minimum 2 project profiles as result of CEAC Tech Assistance work (Task 4, Item 34)	• COMPLETED: Final report was completed Q7.2013; concluding workshop conducted in June) • Ongoing – Danville WWTF (100 kW CHP system) – operating Q7.2013 – Downers Grove WWTF (138 kW) and Decataur WWTF (500 kW) to be operating Q7/Q8.2013 – CHP Studies underway for 2 high profile community digester CHP projects during FY2013 (studies by sub-contractors) • Developing 5 project profiles: – 4 WWTPs (2 drafts completed Q7.2013, 2 more to be completed Q8.2013) – 1 Ethanol Plant (to be completed Q8.2013)
	Wisconsin		• Re-engage the SEO, include CHP in their energy programs. • Continue technical support on high visibility CHP/WHR projects (target markets remain biogas and pulp/paper) • Inclusion of CHP as a viable approach to meet Boiler MACT Regs	• Work with SEO in targeted markets (outreach activities) (Task 2, Item 35) • Min 1 project profile as result of technical assistance work (Task 4, Item 36)	• Ongoing: – Providing technical assistance to projects in identified target markets – CHP Boiler MACT analysis underway at paper mill • COMPLETED: – Gundersen Lutheran LFG CHP Project Profile, Onalaska, WI (completed Q5.2013) – Gundersen Lutheran Biomass CHP Project Profile, La Crosse, WI (expected completion Q8.2013) •
	Iowa		• IEC & ELPC introducing utility rate reform to PUC • EE/CHP Report to be submitted to Governor via NGA Policy Academy	• Complete standby rate recommendations study with IEC (Task 4, Item 37) • Provide Tech Assistance to Iowa NGA Industry Policy Academy efforts (Task 4, Item 38) • Assist/participate as appropriate in Utility Standby	• COMPLETED: submitted Dec, Q5.2013. MW CEAC reviewed proposed standby rates of Mid-American in Q6.2013 and provided recommendations.

			• CHP as a viable approach to meet Boiler MACT Regs	Rate Proceedings (2013) (Task 3, Item 39)	• COMPLETED (final report submitted Q7.2013) • Ongoing – written testimony submitted Q7.2013 on behalf of IEC on inclusion of CHP in Alliant Energy's 3 Year EE Program; in-person testimony expected Q7.2013) – MW CEAC working with ICF on market penetration study analyzing impacts of standby rates and EE incentives (expected completion in Q8.2013)
	Minnesota		• Inclusion of CHP/WHR in SEO programs and recommendation to PUC for DG policy reform • CHP as a viable approach to meet Boiler MACT Regs	• Complete study/papers on net metering and standby rates (Task 4, Item 40)	• Ongoing (work on study began April, Q7.2013)
	Rest of States		• CHP as a viable approach to meet Boiler MACT Regs	• Activities as required and identified (Task 6, Item 41)	• Ongoing
	Other		• Educational Material	• Update Resource Guidebook (Task 4, Item 42)	• Partially Completed; guidebook stalled due to waiting for completion of ASHRAE CHP Guide by MA CEAC and ICF publication of CHP Installation Costs (material needed for guidebook to ensure consistency of CHP publications)
	Other		• Educational Materials published on CEAC Website	• Launch 2 additional market sector pages on Website (per direction of CEAC Website Working Group) (Task 4, Item 43)	• MW CEAC developing hospital and dairy market sector pages (expected completion Q8.2013)
	Boiler MACT		• Midwest CHP System Installations	• Boiler MACT – finish pilot in Ohio, transfer pilot to other assigned states (Task 7, Item 44)	• Ongoing: Ohio Boiler MACT activity continued; status log provided to ICF every two weeks • Other States: – MW CEAC under contract with 8 staff members and sub-contractors in Q7.2013; MW CEAC hosted kick-off meeting with sub-contractors in April, Q7.2013 to launch Boiler MACT outreach (initially assigned 80+ sites to team members). –
	SEEAction		• Educational Materials on CHP Policy	• SEE Action participation on IEE/CHP working group (rep CEACs) (Task 3, Item 45)	• COMPLETED / Ongoing: – SEE Action Report published Q6.2013 – MW CEAC co-led CEAC conference call in May, Q7.2013 – MW CEAC participation in conference calls, emails, etc.
	Market Sector Development		• Market Sector Business Plans	• Take lead on development of Hospital market sector plan (Task 2, Item 46) • Support development of Biomass (NW lead) WHP (Pacific lead) market sector plans (Task 2, Item 46)	• Ongoing – Updated plan submitted Feb, Q6.2013 – MW CEAC developed CHP 101 Presentation for Hospitals Mar,

					Q6.2013 (presented Apr, Q7.2013) – MW CEAC preparing for July ASHE Conference (booth exhibit) • Ongoing participation on conference calls, reviewing drafts, providing comments of other Market Sector Plans
	Other		Midwest CHP System Installations	• Monitor installation of new CHP sites in MW • Identify/Assist in installation of min 10 new CHP/WER sites in MW (Task 2/4/5, Item 47)	• Ongoing (submit info to ICF) • Ongoing

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2013 – 8th Quarter
July 1, 2013 through September 30, 2013

Submission Date:
November 1, 2013

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
November 1, 2013

Dear Mr. Renk,

Please find the attached Progress Report for the 8th Quarter of Fiscal Year 2013 (Q8.FY2013) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $151,619.32 for Q8.FY2013:

- Jul 2013: $46,004.86
- Aug: $30,354.48
- Sep: $75,259.98

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q8.FY2013. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
8th Quarter Fiscal Year 2013

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 11/01/2013
b. Reporting Period: July 1, 2013 through September 30, 2013

Sections 4,5,7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat to power, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

- Market Assessments – Supporting analyses of CHP market potential in diverse sectors, such as, health care, industrial sites, hotels, and new commercial and institutional buildings.
- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC was active during the 8th Quarter in a number of the twelve Midwest states encompassing a variety of activities. The following highlight the major activities and goals accomplished during Q8.FY2013 set out in the MW CEAC Project Management Plan.

Ohio – Q8.FY2013 activities focused on the Governor's energy plan, the DOE Boiler MACT Pilot program, activities and engagement with the PUCO, and standby rate analysis.

- The MW CEAC continued to assist in the evaluation of CHP as an EE measure technology working with stakeholders in Ohio.
- The MW CEAC provided assistance to the Ohio CHP Coalition in preparing the October 16th webinar titled: "Developing CHP & WER Projects at the Public Utilities Commission of Ohio." This webinar will assist in CHP projects today to investigate energy efficiency incentives prior to rules being finalized in early 2014.
- The MW CEAC presented to the Ohio Manufacturing Association (OMA) Energy Efficiency and CHP Working Group on July 17th, 2013.
- The MW CEAC continued to support the PUCO in all CHP/WHP inquiries relating to individual projects and technical assistance (including Boiler MACT).

Illinois – Q8.FY2013 activities focused on state EE/CHP planning, AD/CHP development, and other education outreach efforts

- The MW CEAC continued to support and promote the Industrial EE/CHP Action Plan submitted by the Illinois NGA Policy Academy team (Illinois Governor's Office, Illinois Commerce Commission, Illinois Department of Commerce and Economic Opportunity (DCEO), and Illinois EPA).
- The MW CEAC provided technical assistance to the Department of Commerce and Economic Opportunity (DCEO) and reviewed DCEO's proposed CHP incentive as part of the three year EE plan for the public sector submitted August 31st. The three year filing will be ruled on by the Illinois Commerce Commission (ICC) by December 2013 with incentives becoming available June 2014 if the incentives are approved.er.
- The MW CEAC presented on the topic of CHP and energy resiliency at two Illinois Energy Assurance workshops.
- The MW CEAC continued to work with two potential community digester CHP projects in Illinois initiating engineering studies and investigating funding and financing options:
    - Growing Power and Green Era (high profile urban based community digester CHP project within city limits of Chicago). MW CEAC is assisting in securing grant funding through the Illinois Department of Commerce and Economic Opportunity and providing technical analysis on the development of the project.
    - Clinton County downstate community digester project located near Breese, IL that involves several key state parties (Association of Illinois Electric Cooperatives, Illinois EPA, EPA Region 5, Department of Commerce and Economic Opportunity). MW CEAC provided technical assistance to this project reviewing the feasibility phases of project development.
- The MW CEAC has been working with the Illinois Department Commerce and Economic Opportunity (DCEO-SEO) on four (4) CHP projects at WWTPs during FY2013 (2 are operational, 2 expected to be operation FY2014).

Iowa – Q8.FY2013 activities focused on utility rate barriers to CHP implementation and state EE/CHP planning.

- In Q8.FY2013, the MW CEAC promoted the Action Plan published by Iowa CHP NGA Policy Academy team.
- The MW CEAC submitted testimony in September to the Iowa Utilities Board (IUB) regarding proposed standby rates by Mid-American.
- The MW CEAC worked with ICF International exploring the CHP economic potential in Iowa. The economic results may be used in testimony with regards to CHP being included in the Iowa IOUs EE filings.

Minnesota – Q8.FY2013 activities focused on utility standby rate and net metering barriers to CHP implementation.

- The Midwest CEAC has been working with the Division of Energy Resources (DER) Minnesota Department of Commerce studying the viable CHP opportunities that could aid Minnesota meeting their state energy savings goals in the Conservation Improvement Program (CIP) through analyzing net metering and standby rates. The study is expected to be completed in October 2013.

Market Sector Business Plans – Q8.FY2013 focused on the developments of the CHP Market Sector Business Plans

- Hospitals – MW CEAC leads the development of the Hospital Market Sector plan. The NE CEAC and IDEA are assisting CEACs.
    - The MW CEAC attended the 50th Annual American Society for Healthcare Engineers (ASHE) Conference in July and manned a booth representing all 8 CEACs. The MW CEAC met with over 70 contacts and identified 40+ facilities with potential for CEAC technical assistance.
- Waste Heat Recovery – MW CEAC assisted lead Pacific CEAC
- Biomass – MW CEAC assisted lead NW CEAC

Other Activities

- The MW CEAC is updating the 2005 CHP Resource Guide in FY2013, a rules-of-thumb / ready reference document initially developed by the MW CEAC for a wide range of interested parties considering the application of CHP systems. The completed update of the CHP Resource Guide will be delayed until the ASHRAE CHP Guide that is being developed by the Mid-Atlantic CEAC is completed and the EPA CHP Catalog of Technologies is updated. The MW CEAC wants to ensure consistent information is published between all three documents, most notably equipment and installation costs.
- The MW CEAC is continuing technical assistance efforts with several facilities including working with several federal facilities in preparation of future FEMP incentives.
- The MW CEAC is continuing Boiler MACT technical assistance efforts and other CEAC technical assistance efforts.

Section 6: Cost Status – The center invoiced $151,619.32 for Q8.FY2013:

- Jul 2013: $46,004.86
- Aug: $30,354.48
- Sep: $75,259.98

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results. Publications are listed on the Midwest CEAC website..

   i. **7/17 – Taking Advantage of Combined Heat and Power (CHP)** @ Ohio Manufacturing Association (OMA) Energy Efficiency & CHP Working Group, webinar.
   ii. **7/22 – CHP and Critical Infrastructure** @ State of Illinois Energy Assurance Workshop for Municipalities, Springfield, IL.
   iii. **7/23 – CHP and Critical Infrastructure** @ State of Illinois Energy Assurance Workshop for Municipalities, Glen Ellyn, IL.
   iv. **7/31 – Taking Advantage of Combined Heat and Power (CHP)** @ Illinois Commerce Commission Joint Electric and Gas Policy Committee Meeting Combined Heat and Power (CHP) and its Role in Industrial Energy Efficiency, Springfield, IL.
   v. **8/22 – Combined Heat and Power as a Boiler MACT Compliance Strategy** @ Air Waste & Management Association (AWMA), Chicago, IL
   vi. **9/15 – Combined Heat and Power (CHP) Update on Security and Resiliency** @ Energy Security Committee NASEO Annual Meeting, Denver, CO

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A

PROGRESS REPORT

U.S. DEPARTMENT OF ENERGY
Midwest Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Award Number:
DE-EE0001108

Award Recipient:
University of Illinois at Chicago

Principal Investigators:
John Cuttica, (312) 996-5620, cuttica@uic.edu
Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Reporting Period:
Fiscal Year 2013 – 9th Quarter
October 1, 2013 through December 31, 2013

Submission Date:
January 30, 2014

Submitted to:
U.S. DOE / NETL
Joseph Renk, (412) 386-6406, Joseph.Renk@NETL.DOE.GOV

Mr. Joe Renk
Project Manager
Power and Vehicle Technology Division
NETL
PO Box 10940
Pittsburgh, PA 15236-0940
January 30, 2014

Dear Mr. Renk,

Please find the attached Progress Report for the 9th Quarter of Fiscal Year 2013 (Q9.FY2013) for award number DE-EE0001108 – "Midwest Region Clean Energy Application Center."

The center has invoiced $223,288.98 for Q9.FY2013:

- Oct 2013: $79,292.89
- Nov: $48,301.02
- Dec: $95,695.07

Below you will find a brief synopsis of our activities (deliverables and tasks) for Q8.FY2013. If you have any questions, please do not hesitate to contact John Cuttica (312-996-4382, cuttica@uic.edu) or Cliff Haefke (312-355-3476, chaefk1@uic.edu).

Thank you,

John Cuttica
Cliff Haefke

Quarterly Progress Report
9th Quarter Fiscal Year 2013

Section 1: Award Number: DE-EE0001108

Section 2: Project Title and Name of Directors / Principal Investigators

a. Project Title: Midwest Region Clean Energy Application Center
b. Name of Project Directors / Principal Investigators
    i. John Cuttica, (312) 996-5620, cuttica@uic.edu
    ii. Cliff Haefke, (312) 355-3476, chaefk1@uic.edu

Section 3: Report and Period Covered by the Report

a. Report submitted 01/30/2014
b. Reporting Period: October 1, 2013 through December 31, 2013

Sections 4,5,7: Quarterly Accomplishments & Schedule Status

The US DOE Midwest Clean Energy Application Center (MW CEAC), one of the nine DOE sponsored Clean Energy Application Centers, promotes and assists in transforming the market for CHP, waste heat to power, and district energy technologies and concepts throughout the twelve Midwest state region. The MW CEAC was the first Application Center awarded by DOE in 2001 and is managed by personnel located at the Energy Resources Center at the University of Illinois at Chicago. The key services of the Regional Clean Energy Application Centers include:

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- Education and Outreach – Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations, and others.
- Technical Assistance – Providing technical information to energy end-users and others to help them consider if CHP, waste heat recovery or district energy makes sense for them. This includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

The MW CEAC completed the assigned DOE Technical Assistance Outreach activities during Q9.FY2013:

- The MW CEAC was tasked with contacting a combined 287 sites in the Intermountain, Midwest, Northwest, and Pacific CEAC Regions that were identified by the U.S. EPA and/or other sources as sites that would be impacted by Boiler MACT that burn coal or oil.

- The CEACs were tasked to provide these major sources with information on cost-effective clean energy strategies for compliance.
- DOE piloted this technical assistance effort in Ohio since March 2012 through the Midwest CEAC, working with the Public Utilities Commission of Ohio (PUCO).
- These clean energy strategies were considered along with investments in pollution controls to comply with the standards in the rule. Facilities that make use of this technical assistance could potentially develop strategies to comply with the regulations while adding to their bottom line. One strategy was natural gas CHP, which is cleaner, more energy efficient, and can have a positive economic return for the plant over time.
- The MW CEAC worked with 8 sub-contractors completing the Boiler MACT Technical Assistance Outreach efforts to the assigned sites.
- The status updates of all contacts, outreach efforts, conversations, technical analysis, technical assistance, and other related Boiler MACT activities related to the 287 sites were submitted monthly and at the end of the contract period per the request of DOE HQ to ICF International and in the communications format developed by ICF International (i.e. DOE Contractor providing management support of the DOE Boiler MACT Technical Assistance Outreach Efforts).

Section 6: Cost Status – The center invoiced $223,288.98 for Q9.FY2013:

- Oct 2013: $79,292.89
- Nov: $48,301.02
- Dec: $95,695.07

Section 8: Changes in Approach – N/A

Section 9: Anticipated Problems or Delays – N/A

Section 10: Absence or Changes of Key Personnel – N/A

Section 11: Product Produced or Technology Transfer Activities Accomplished

a. Publications; conference papers; or other public releases of results.

b. Web site or other Internet sites that reflect the results of this project – see ongoing development of Midwest CEAC website @ www.midwestcleanenergy.org

c. Networks or collaborations fostered – N/A

d. Technologies/Techniques – N/A

e. Inventions/Patent Applications – N/A

f. Other products – N/A