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The Advanced Manufacturing Jobs and Innovation Accelerator Challenge (AMJIAC)

Innovations in Advanced Materials and Metals Manufacturing Project (IAM^2)

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INTRODUCTION

Despite high energy consumption costs in the metals and advanced materials industries, there is significant opportunity for small and medium manufacturers to improve energy efficiency as compared with larger manufacturers. According to a 2006 load forecast study undertaken by the Northwest Energy Efficiency Alliance (NEEA), the electricity consumption for industrial users in the Pacific Northwest was 40,647,585 MWh. Metals and advanced materials manufacturing, which includes foundries, metals fabrication, chemicals processing, non-woven textiles, advanced materials, and high-technology chip and silicon fabrication, comprised of 24% of the total electricity consumption volume. In these sectors, the primary energy consumptions in the production process are from melting, casting, heat treatment, material processing, material handling, and other motors. Energy loads from infrastructure include pumps, fans and blowers, compressed air, material handling and processing, HVAC systems, and lighting.

Incentives to reduce technical risk of energy efficiency technologies tend to target the heaviest industrial load users, which also happen to be larger companies employing 250 or more. The heaviest industrial load users in the Pacific Northwest are in wood processing, pulp and paper, and food processing. NEEA published a strategic market study that analyzed the knowledge of energy efficiency management practices in small and medium manufacturers employing less than 250 in the Pacific Northwest. Specifically, NEEA sought to identify the number of companies who have implemented strategic energy management (SEM) within their organizations, which requires setting an energy reduction goal, top management dedicating resources (i.e. staff, budget,

training, and capital improvements) to achieve the goal, and staff responsible for making regular reports on progress towards the energy reduction goal. The study reported that SEM is widely adopted by larger manufacturers (25%) but less than 3% for small and medium manufacturers. Furthermore, only 7% of all metals manufacturers actually meet the SEM criteria defined by NEEA.

Despite strong outreach and involvement from Energy Trust of Oregon (ETO), Bonneville Power Administration (BPA), and the utilities, research shows there is potential for significant energy savings, not only in electricity, but in natural gas, water, and waste water, as well, by small and medium enterprises that lack the resources to leverage existing programs. This project, under the Jobs and Innovation Accelerator Challenge, Innovations in Advanced Materials and Metals Manufacturing Project, contracted with Cascade Energy to provide a shared energy project manager engineer to work with five different companies throughout the Portland metro grant region to implement ten energy efficiency projects and develop a case study to analyze the project model. As a part of the project, the energy project manager also looked into specific new technologies and methodologies that could change the way energy is consumed by manufacturers—from game-changing equipment and technology to monitor energy use to methodologies that change the way companies interact and use their machines to reduce energy consumption.

BUSINESS PROGRAMS AND INCENTIVES

At the federal level, there are a number of energy efficiency initiatives for small to medium sized business, however, most of the funding programs come through the state

or other entity, such as an economic development council in the form of a grant. In 1999, Oregon's electricity restructuring law established a public purpose fund for conservation, energy efficiency, and renewable energy programs. The programs are funded through a non-bypassable 3% "public purposes charge" on total revenues collected by the utilities (DOE). In 2013, the state's utility budgeted over $150 million to promote increased energy efficiency in Oregon and additional resources were allocated through the Northwest Energy Efficiency Alliance (NEEA), Bonneville Power Administration (BPA), and the Northwest Power and Conservation Council (NWPCC) regional organizations. Funds are administered through the Energy Trust of Oregon (ETO), a non-profit organization, and offers a number electric and natural gas efficiency programs to customers of Pacific Power, Portland General Electric, Cascade Natural Gas, and NW Natural. A complete list of available incentives can be found on ETO's website at http://energytrust.org/library/forms/BE_PI_IncentiveBooklet.pdf.

Washington State is one of a number of states, however, that does not have any "public-purpose-funded energy efficiency programs" (DOE). Instead, the state's utilities budget includes funding for programs to increase energy efficiency in the state, which in turn are administered by local utility providers. In Clark County, Clark Public Utilities District is the utilities provider for most of county and programs can be customized to meet specific client and industry needs. Programs include:

- (CLIP) Commercial/Industrial Lighting Incentive Program
    - Program Description: Advanced in technology can dramatically cut costs for lighting workspaces and reduce maintenance costs. CLIP provides financial incentives to improve lighting efficiency. Lighting reviews to

identify opportunities for upgrades are available through independent contracts as well as Clark Public Utilities. Both existing buildings as well as new construction projects served by Clark Utilities are eligible for the program.

- On-site Energy Assessment
    - Many business owners or facilities managers are interested in improving the energy efficiency of their buildings, but do not know how to identify potential energy savings or prioritize opportunities for investment. A designated utility account manager can provide a walk-though of your building to recommend cost effective opportunities to improve your building's energy efficiency and reduce operating costs.
- EnergySmart Grocer
    - The EnergySmart Grocer program provides businesses with free energy audits and information about industry-specific technologies, processes and management strategies that can help cut electric costs. Incentives may be available through EnergySmart to improve your organization's energy efficiency.
- Commercial Heating System Incentives
    - Clark PUD's incentive programs can make it more affordable for businesses to increase the efficiency of commercial heating systems with heat pump installations, conversions, and upgrades. The PUD will reimburse up to $250.00 per ton of installed outdoor unit heating capacity for each DHP unit serving a qualified indoor space.

- Custom Projects
    - Clark PUD offers a unique opportunity for businesses that have an energy efficiency idea that doesn't fit into existing incentive programs. The PUD offers flexible incentives for custom projects that meet criteria for projected savings and cost effectiveness. All commercial and industrial customers of Clark PUD are eligible to participate in this program.

In addition to the locally managed, state funded incentive programs, the Bonneville Power Administration (BPA) also develops commercial and industrial programs, which are administered by local PUD's. Programs like EnergySmart Industrial are developed and supported by BPA, however, costs are offset by Clark PUD.

Natural gas incentive programs are also available to commercial and industrial clients in Clark County and they are developed and administered by the EnergyTrust of Oregon and NW Natural, the natural gas utility provider in Clark County. Programs include:

- Existing Building Program
    - Incentives are "unit based" on the amount of energy saved with new equipment purchases and savings vary by equipment. Eligible equipment upgrades include HVAC unit heater, warm-air furnace, radiant heater non-modulating, radiant heater modulating, commercial tank water heaters, commercial tankless/instantaneous water heaters, boiler, modulating boiler burner, boiler vent damper, steam traps, showerheads, bathroom faucet aerators, kitchen faucet aerators,

commercial laundry washers, attic insulation, roof insulation, wall insulation, pipe insulation, domestic hot water/heating hot water, low pressure steam, medium pressure steam, gas griddle, gas convection oven, gas fryer, gas steam cooker, undercounter dishwasher, single tank door/upright dishwasher, single tank conveyor dishwasher, and turbo pot with lid.

- Custom Equipment Incentive Program
    - Additional energy efficient equipment not included in the previous list may still qualify for incentives through the custom incentive program, as well. Projects eligible for custom incentives may require additional energy analysis or other technical assistance in the project design process and all equipment purchases must be pre-qualified by the Energy Trust of Oregon, and post-installation verification may also be required.

EXISTING PROGRAMS AND AMJIAC IAM^2 PROJECT

One of the goals of this project was to increase awareness of the energy efficiency incentives available for small to medium sized commercial and industrial businesses in the Portland region and then to utilize these programs in the energy efficiency projects completed by the shared energy project manager (EPM). In total, 15 projects were completed under the Advanced Manufacturing Jobs and Innovation Accelerator Challenge's (AMJIAC) Innovation in Advanced Materials and Metals Manufacturing Project (IAM^2). The aggregated cost of the projects was $1,199,487.00

and companies received $266,729.00 in incentive funding to help offset project costs. More importantly, energy savings amounted to 2,543,870 kWh across the four facilities.

PROJECT DESCRIPTIONS

The goal of the AMJIAC IAM^2 project was to complete 10 energy efficiency projects at 5 different facilities throughout the five county project area. Originally we hoped to select one company in each of the five counties to have equal representation throughout the metro, however, we did not have any companies interested in participating from Cowlitz County, and so two companies from Clark County were selected. Furthermore, one of the companies that was selected to receive services ultimately decided not to continue with the program after initial evaluation, so a sixth facility was selected to undergo evaluation. Ultimately no projects were completed at that site either, but overall, 15 projects were completed at four facilities. Below is a table showing the projects that were completed, including cost metrics, as well as additional projects that were analyzed and maybe under future consideration. The second table includes a brief description of each project that was completed and benefits incurred from the project.

Status	Customer	Description	Subsystem	Energy Savings (kWh)	Energy Savings (therms	Energy Savings ($)	Project Cost ($)	Incentive Funding ($)	Completed
0. Canceled	Acumed	Shop Occ Sensors	Lighting	93,859		$ 6,570	$ 15,225		
1. Identified	Acumed	VFD Air Compressor	Compressed Air	25,000		$ 1,750			
2. Analyzing	Acumed	Freezer Controls	Refrigeration	10,000		$ 700	$ 2,750	$ 1,350	
7. Completed	**Acumed**	**Strategic Energy Mgmt (SEM)**	**SEM**	**150,000**		**$ 10,500**	**$ 6,000**	**$ 6,000**	**Q3 2015**
7. Completed	**Acumed**	**Air Leaks**	**Compressed Air**	**10,000**		**$ 700**	**$ 1,500**		**Q2 2015**
7. Completed	**Acumed**	**Brookwood - HVAC Controls**	**HVAC**	**88,622**	**16,613**	**$ 16,056**	**$ 58,411**	**$ 29,206**	**Q1 2015**
7. Completed	**Acumed**	**Corn. Pass - Re-tune HVAC**	**HVAC**	**151,374**	**26,877**	**$ 26,526**	**$ 14,973**	**$ 8,385**	**Q1 2015**
0. Canceled	AIG	MHs to T8s in Warehouse	Lighting						
0. Canceled	AIG	VFD Air Compressor	Compressed Air	15,000		$ 1,050			
0. Canceled	AIG	Inverter Welders	Welders	187,075		$ 13,095	$ 23,834	$ 11,917	
2. Analyzing	Celestica	Lighting Retrofit	Lighting	400,000		$ 28,000			
2. Analyzing	Celestica	Lower Air Pressure Setpoint	Compressed Air	5,000		$ 350			
7. Completed	**Enoch**	**Cool Roof**	**Envelope**	**25,000**	**5,000**	**$ 1,750**	**$ 327,943**	**$ 0**	**Q3 2015**
7. Completed	**Enoch**	**HVAC/Chiller Upgrade**	**HVAC**	**85,000**		**$ 5,950**	**$ 209,727**	**$ 0**	**Q2 2015**
7. Completed	**Enoch**	**LEDs & Occ Sensors**	**Lighting**	**281,478**		**$ 18,640**	**$ 65,653**	**$ 32,835**	**Q1 2015**
7. Completed	**Enoch**	**Air Leaks**	**Compressed Air**	**17,827**		**$ 1,248**	**$ 1,200**	**$ 1,200**	**Q2 2014**
4. Waiting On Site	Hydra-Power	Electric Vehicle Chargers	Transportation						
4. Waiting On Site	Hydra-Power	VFD Air Compressor	Compressed Air	54,491		$ 3,814	$ 42,494	$ 13,623	
0. Canceled	Hydra-Power	HVAC Controls	HVAC	40,000					
6. Implementing	**Hydra-Power**	**Occupancy Sensors**	**Lighting**	**20,000**		**$ 1,400**	**$ 2,500**		
7. Completed	**Hydra-Power**	**Exterior LED Lighting**	**Lighting**	**26,962**		**$ 1,887**	**$ 19,584**	**$ 6,391**	**Q2 2015**
7. Completed	**Hydra-Power**	**Air Leaks**	**Compressed Air**	**8,000**		**$ 560**	**$ 1,000**	**$ 0**	**Q3 2014**
7. Completed	**Hydra-Power**	**High SEER AC Unit**	**HVAC**	**275**		**$ 19**	**$ 3,127**	**$ 84**	**Q2 2014**
7. Completed	**Hydra-Power**	**Office Lighting Controls**	**Lighting**	**4,316**		**$ 302**	**$ 50**	**$ 0**	**Q3 2014**
0. Canceled	Kyocera	VFD Comp & Cycling Dryer	Compressed Air						
0. Canceled	Kyocera	Electric Vehicle Chargers	Transportation						
2. Analyzing	Kyocera	Dewaxer Furnace Blower	Compressed Air						
2. Analyzing	Kyocera	Dewax Heat Recovery	Heat Recovery						
2. Analyzing	Kyocera	Repipe Dust Collector	HVAC	16,534	6,409	$ 5,003			
3. Analyzed	Kyocera	Controls Upgrade on 17 RTUs	HVAC	310,000		$ 21,700	$ 95,000	$ 35,438	
7. Completed	**Kyocera**	**CNC Cooling Pump VFDs**	**Pumps**	**40,134**		**$ 2,809**	**$ 5,638**	**$ 2,819**	**Q2 2015**
7. Completed	**Kyocera**	**Air Leaks**	**Compressed Air**	**8,000**		**$ 560**	**$ 1,000**	**$ 0**	**Q4 2014**
7. Completed	**Kyocera**	**Upsized Cooling Tower w/ VFD**	**Process Cooling**	**469,923**		**$ 21,216**	**$ 301,878**	**$ 117,481**	**Q4 2014**

DESCRIPTION OF COMPLETED PROJECTS

SEM	Acumed	Completed
The site has completed their Strategic Energy Management program through Energy Trust of Oregon. Overall, the program has been a huge success. Acumed is now able to move forward with managing their energy through their own internal management structure. This will ensure that the concepts are now institutionalized and ongoing.		

Cool Roof	Enoch	Completed
Enoch has completed installation of their new roof. Savings on both cooling and heating costs have been seen by the site. In addition, the new roof should greatly reduce maintenance costs related to their old roof.		

Fix Compressed Air Leaks	Hydra-Power	Completed
The EPM provided the site with an ultrasonic leak detector to identify leaks for repair. This will be an ongoing project as the site integrates leak detection into regular maintenance. This situation is ideal, as compressed air leaks will reappear and typically need regular attention.		

Office Lighting Controls	Hydra-Power	Completed
Hydra-Power was able to identify a few control failures within their lighting control system that caused lighting to stay on throughout the weekend, even if the facility was unoccupied. After upgrading a few relays, the site has seen a significant drop in office lighting consumption. This has also created employee awareness around energy and their ability to help the bottom line.		
Fix Compressed Air Leaks	Enoch	Completed
When the site was not in production, the EPM observed that nearly 40% of the air compressors capacity was serving dead loads. The EPM worked with site personnel and vendor to tag leaks throughout the facility. By utilizing a combination of Energy Trust of Oregon funding and vendor expertise, Enoch was able to repair these leaks, thereby reducing their compressed air leak load and reclaiming about 12% of their compressor capacity.		
Install Efficient AC Unit	Hydra-Power	Completed
The site has a number of aging AC units. When one unit broke down, the EPM worked with the site and their preferred vendor to ensure a high efficiency unit was installed. Ultimately, a 2-ton, 16 SEER Carrier unit was installed, meeting requirements set by the utility. However, due to a need to move quickly, Hydra-Power was not able to take advantage of incentives.		
Fix Compressed Air Leaks	Acumed	Completed
The site used an ultrasonic leak detector to identify air leaks for repair. Plans are to continue this program into the future. This work was related to their SEM program.		
HVAC/Chiller Upgrade	Enoch	Completed
The new chiller is installed and running. The new unit is more energy efficient than their previous model and will also take much less maintenance. The control system was update as well, providing Enoch with increased insight into their system which should also drive energy savings down the road.		
Exterior LED Lighting	Hydra-Power	Completed
All exterior lighting was replaced with LEDs, greatly reducing energy consumption and increasing safety as well. The site is very happy with the final product and is aiming to do additional projects.		
CNC Cooling Pump VFDs	Kyocera	Completed
Kyocera completed an overhaul of their CNC cooling system. Instead of each machine being cooled locally, a central system allows for more efficient operation and higher solids removal.		
Brookwood – HVAC Controls	Acumed	Completed
Before this project, HVAC controls at Acumed's Brookwood facility were controlled using standard thermostats. By upgrading to a central control system, Acumed is able to take advantage of various optimization opportunities to run their system as efficiently as possible. Estimated savings is about 89,000 kWh and 17,000 therms.		
Cornelius Pass – Re-tune HVAC	Acumed	Completed
At this facility, Acumed already had an existing control system in place. This project aimed to re-tune the system to run optimally per best practices. This included running economizers, resetting setbacks, and in general reducing run hours. Overall, this cut energy consumption by 151,000 kWh and 27,000 therms.		
Fix Compressed Air Leaks	Kyocera	Completed

The EPM provided the site with an ultrasonic leak detector to identify air leaks for repair. The site immediately moved forward with identifying and repairing leaks. Plans are to continue this program into the future.		
Utilize VFD Control on New, Larger Cooling Tower	Kyocera	Completed
Kyocera completed installation and commissioning of a large cooling tower upgrade. This included installing a single cooling tower to handle their entire process load, adding fan VFDs to match cooling load, and installing new pumps for a more efficient cooling loop. Overall, the project was a huge success and should net Kyocera over 430,000 kWh in energy savings and $117,000 in utility incentive funding.		
LED Lighting and Occupancy Sensors	Enoch	Completed
This project was completed with all metal halides and exterior lighting upgraded to LED technology. The site is in the process of closing the project out with the utility and will be receiving an incentive check for about $65,000 based on 280,000 kWh in energy savings.		

EPM PROJECT RESULTS

Overall, the EPM component of the AMJIAC IAM^2 was very successful; the shared EPM was able to complete 50% more projects than originally expected while maintaining the same project budget. Energy savings amounted to 2,543,870 kWh across the four facilities. The aggregated cost of the projects was $1,199,487.00 and companies received $266,729.00 in incentive funding to help offset project costs. The project management team was disappointed that we were unable to secure a participant from Cowlitz County, however, it worked well to add an additional participant from Clark County and keep equal Washington representation.

With the exception of one company, all of the partners were extremely responsive and engaged throughout the duration of the projects. The company that went unresponsive part way through the program cited changes in management for the lack of coordination with the shared EPM and ultimately, they were replaced with another company. The only financial incentive companies had to participate in the program came in the form of consulting—companies were responsible for 100% of the

costs related to equipment, installation, and maintenance costs. Therefore, the financial incentives provided by existing federal, state, and local utility providers were critical to offset the equipment costs for the project participants.

ENERGY EVENTS

In addition to the energy efficiency consulting, the CREDC and our regional partners attended a number of energy efficiency related events to bring back ideas and best practices to the region. Findings were shared at monthly economic development partner meetings, quarterly AMJIAC IAM^2 project managers meetings, and regional industry consortium events. Energy efficiency events attended by CREDC and project partners included:

- ACEEE Summer Study on Energy Efficiency in Industry
    - The 10th biennial Summer Study on Energy Efficiency in Industry was held on July 23- 26, 2013, at the Conference Center Niagara Falls in Niagara Falls, NY. Participants from around the world gathered for three days to discuss technical, policy, financing, and program issues related to increasing energy efficiency in industry. We were delighted to welcome Brian Platt, *New York State Energy Research and Development Authority* and Joe Vehec, *American Iron and Steel Institute* as this year's Co-Chairs of the Summer Study.
- World Energy Engineering Congress
    - The World Energy Engineering Congress (WEEC) is the largest energy conference and technology expo held in the U.S. specifically for business,

industrial and institutional energy users. It brings together the top experts in all areas of the field to help you set a clear, optimum path to energy efficiency, facility optimization and sustainability.

- ACEEE's Behavior, Energy, & Climate Change Conference
    - BECC is the premier event focused on understanding individual and organizational behavior and decision-making related to energy usage, greenhouse gas emissions, climate change, and sustainability. Every year, BECC builds on the overwhelming success of previous conferences, at which 700 participants discussed innovative policy and program strategies, shared important research findings, and engaged in building dynamic new networks and collaborations.
- ACEEE National Symposium on Market Transformation
    - The National Symposium on Market Transformation is the premier spring event dedicated to energy efficiency. For 20 years, the symposium has become a regular fixture for efficiency aficionados from the US and abroad. The symposium program, developed with guidance from an independent advisory committee, features leading thinkers, experts, and professionals who cover diverse and emerging topics within the scope of market transformation. The symposium program is spread over three days and is designed to provide ample opportunity to network, compare program ideas, and learn about new market transformation approaches.
- Industrial Energy Technology Conference

    - The IETC is hosted by the Energy Systems Laboratory at Texas A&M University and the Louisiana Department of Natural Resources. It is a one-of-a kind conference featuring a topics important to industrial energy managers, utility experts, government program managers, vendors and others. The latest technologies and expertise on smart manufacturing, corporate energy management, energy opportunity analysis, and case studies of successful, real-world industrial efficiency projects are presented.
- Global Energy Outlook Forum
    - The Platts Global Energy Outlook Forum is a high-level leadership event which annually draws nearly 200 senior executives. With an agenda that demands a lively debate, you'll get a balance of C-Suite strategy and real-world tactics. Notable speakers included HE Abdalla Salem El-Badri (Former Secretary General, OPEC), John Kingston (Director, S&P Global Market Insights), and Saad Rahim (Chief Economist, Trafigura).
- EIA Energy Conference
    - The EIA Energy Conference has become a premier forum for addressing energy issues in the United States and worldwide. This event provides a unique opportunity to meet and network with fellow energy experts and decision makers. Past conferences have drawn more than 1,000 thought leaders from industry, government, and academia. Participants discussed current and future challenges facing domestic and international energy markets and policymakers.

- NW Industrial Energy Efficiency Summit
    - The region's premier gathering of experts and industrial colleagues from the Pacific Northwest, working together to advance energy efficiency and manufacturing competitiveness. Session topics include: SEM Best Practices, Workforce Development, New Motor Regulations, Thermal Efficiencies, the Water-Energy Nexus, and the Future of Industrial Manufacturing.

CONCLUSION

Overall, this was a very successful project. This was a completely different approach to economic development than CREDC had ever done before and we had the opportunity to deepen relationships with our utility partners, as well as the companies we serve. We also had a number of challenges that we needed to overcome. One of the major goals that was originally identified to be part of this project was the exploration and implementation of game-changing technologies, along with technical reports to evaluate their impact. However, due to the high costs of these new technologies—not only in the actual upfront cost, but the unknown opportunity costs that come with early technology adoption—and the grant only covering technical assistance, we did not find any companies that were willing to invest in a new technology that we could evaluate impacts. This also created the need to shift the thinking on the white paper project that was supposed to occur and in its place, the shared EPM scoped additional energy efficiency projects and completed five additional projects. The CREDC was also able then to allocate more time to attend events and conferences related to industrial energy

efficiency innovations and bring back insights to share with all of our AMJIAC IAM^2 partners.

One of the most successful AMJIAC IAM^2 outcomes was the Investing in Manufacturing Communities Partnership (IMCP) designation the Portland “supra” region received in 2015. The Pacific Northwest Manufacturing Partnership (PNMP) was formed in response to a federal initiative: the Investing in Manufacturing Communities Partnership (IMCP), which aims to accelerate the resurgence of manufacturing in the United States and create a competitive climate for job creation and private investment. In 2014, 12 qualified U.S. communities with winning strategies received the designation of "Manufacturing Community" that gives them elevated consideration for $1.3 billion in federal dollars and assistance from 13 cabinet departments and agencies. PNMP partners hope that initiatives that began under the AMJIAC program will continue under PNMP and that the opportunity for preferential funding opportunities will help offset program costs. The first catalytic project identified under the PNMP initiative is related to the commercialization of cross laminated timber (CLT) in the Northwest. CLT and associated advanced wood products manufacturing technologies combine our region's traditional competitive advantage in softwood timber supply from Pacific Northwest forests with advanced material science. Since this industry relies on new technology and has high energy demands, we hope there are opportunities to develop a cluster energy efficiency consortium, similar to what was used for this project, to spur innovation and encourage energy efficient practices.

In conclusion, the team would like to extend a special thank you to all of the DOE federal partners that supported us during this groundbreaking project. We are greatly

appreciative of the opportunity to work with the DOE and look forward to partnering on future projects.