

# U.S. DOE Southwest CHP TAP Final Report

## 1. Project Details

**Region:** Southwest

**Award Number:** DE- EE0006280

**Recipient:** Houston Advanced Research Center

**Director:** Gavin Dillingham, HARC

**Title:** Program Director

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**Sub-Recipients:** International District Energy Association (IDEA), Darrell Thornley, Tom Broderick

**Time Period:** October 1, 2015 to September 31, 2017 – extension out to January 31, 2018

**Website:** [www.southwestCHPTAP.org](http://www.southwestCHPTAP.org)

## 2. Project Description and Outcomes

### Project Objective

The objective of the Department of Energy's Southwest Combined Heat and Power Technical Assistance Partnership (Southwest CHP TAP) is to provide essential support to continue the market penetration of CHP's suite of technologies and to substantially contribute to the national goal of 40 GW of new CHP installations by 2020. The CHP TAP work is designed to assist CHP installations by providing technology and fuel-neutral technical assistance to potential end-users, and, to a lesser degree, providing education and engagement to a variety of stakeholders including end-users (commercial, industrial, institutional and more), electric and gas utilities, trade associations, non-profit organizations, and policymakers. This assistance includes evaluating the economic, energy savings, reliability, and environmental value of proposed CHP systems and conveying this value to encourage CHP installations. The CHP TAPs represent multi-state regions and are DOE's CHP experts providing fact-based, unbiased information on CHP, including technologies, project development, project financing, local electric and natural gas utility interfaces, and related best practice policies. CHP applications (including WHP) can be both stand-alone as well as in District Energy or Microgrid configurations and the CHP TAPs will encourage the installation of CHP in these various configuration types as appropriate.

## Task 1: Technical Assistance to End Users

A primary focus for this project was to provide technical assistance to end-users. We worked to engage potential end-users to identify, evaluate, and technically support prospective CHP projects, including stand-alone CHP, waste heat to power, district energy and Microgrid with CHP as appropriate. Funds are intended to cover costs of the technical and engineering services as well as the preparation of Project Profiles that present the outcome of successful TAP engagement. DOE asked that spend about 60% of the CHP TAP's efforts to be assigned to this Task. This task included providing technical assistance in the form of qualification screenings, feasibility studies, deeper dive feasibility studies and advanced technical assistance which may include third-party review of CHP proposal for end-users, help with permitting and interconnection processes and proposal development. We also were expected to update and develop additional project profiles. These profiles are very helpful to engage end-users with examples of real-world success stories.

The metric set was to perform a total of 84 technical assistance activities by the end of each budget period with the intent of leading facilities toward CHP installation. Some technical assistance activities were given more than one point, such as more in-depth feasibility studies and advanced technical assistance. This was at the discretion of the DOE HQ staff.

For our first official budget period, BP1 of the entire project, we completed 76 technical assistance activities. Much of the work is with qualification screenings. Ten of the 76 points was for assisting with the watch list to help with the updating of the DOE CHP database. Our state with the most technical assistance activity was Texas. As this is no surprise due to the states significant size and industrial base. The next state with the most activity was Arizona. As can be seen in the table below listing all of the TA activity, there was a wide diversity of sectors that received assistance. This is largely due to growing applications of CHP to less traditional applications. The sector with the greatest activity was the health care sector. This was largely due to a request by Health South to look at a large number of their sites in our region. We find that a good bit of our requests are driven by interest in a site improving resilience to reduce disruption and improve public safety.

During this budget period, we did a handful of advanced technical assistance which primarily focuses on working with end-users on some technical questions about a project, permitting and interconnection. We conducted two project profiles. Both for new wastewater treatment plants in Texas.

The breakdown of TA activity can be found in the following table.

BP 1 Completed TA Activities by Location and Type			
Company Name	Site Name	State	Date Completed
<b><i>Qualification Screenings</i></b>			
Toyota Motor Co.	Toyota Manufacturing and Assembly Plant	TX	12/21/2015
Flight Safety International	FSI – Fort Worth	TX	12/23/2015
G&W Systems	800 Wilcrest	TX	1/18/2016
Salt Lake City Convention Center	Salt Palace	UT	2/1/2016
Aztec School District	Aztec High School	NM	2/9/2016
Utah State University	Space Dynamics Lab	UT	2/17/2016
Utah State University	Research Greenhouse	UT	2/17/2016
M&A Technologies	M&A Technologies	TX	3/7/2016
Braskem	La Porte Site 1	TX	3/4/2016

Braskem	La Porte Site 2	TX	3/4/2016
Drever Capital	Gateway Senior Living	TX	5/27/2016
Dixie Chemical	Plant A	TX	5/17/2016
Dixie Chemical	Plant B	TX	5/17/2016
Dixie Chemical	Plant A & B	TX	5/17/2016
City of Houston	Holcombe Lab	TX	5/10/2016
Trinity River Authority	TRA Central Regional WWTP	TX	5/6/2016
NXP Semiconductor	Ed Bluestein Facility	TX	5/4/2016
NXP Semiconductor	Oak Hill Facility	TX	5/4/2016
Fifth Generation LLC	Not Disclosed	TX	5/4/2016
American Ice	Tucson Plant	AZ	6/14/2016
Reddy Ice	Phoenix Plant	AZ	6/14/2016
Health South	6701 Oakmont Blvd	TX	7/28/2016
Health South	18550 IH 45 South	TX	7/28/2016
City of Houston	8000 North Stadium Drive	TX	7/26/2016
Health South	901 W 24th Street	AZ	7/20/2016
Health South	1325 Highway 6	TX	7/28/2016
Health South	325 Parkside Drive	CO	7/20/2016
Health South	330 W Ben White Blvd	TX	7/28/2016
Health South	1921 W. Hospital Drive	AZ	7/20/2016
Health South	5652 E. Baseline Drive	AZ	7/20/2016
Health South	13460 N. 67th Ave	AZ	7/20/2016
Health South	18903 S. Memorial Blvd	TX	7/20/2016
Health South	117 Vision Park Blvd	TX	7/28/2016
Health South	Chasewood Park Drive	TX	7/28/2016
Health South	1400 Hesters Crossing	TX	7/28/2016
Health South	2304 State Highway 121	TX	7/28/2016
Health South	2650 North Wyatt Drive	AZ	7/20/2016
Health South	2800 West 15th Street	TX	7/28/2016
Health South	3131 Troup Hwy	TX	7/28/2016
Health South	3200 Matlock Road	TX	7/28/2016
Health South	3340 Plaza 10 Blvd	TX	7/28/2016
Health South	3901 Armory Road	TX	7/28/2016
Health South	7930 Northhaven Road	TX	7/28/2016
Health South	9119 Cinnamon Hill Dr	TX	7/28/2016

Health South	Wortham Center Drive	TX	7/28/2016
City of Mesa	Site one	AZ	9/29/2016
City of Mesa	Site two	AZ	9/29/2016
<b><i>Advanced Technical Assistance</i></b>			
City of Dallas	City Hall	TX	10/19/2015
Texas State University	Texas State U - San Marcos	TX	3/25/2016
Austin Community College	Highland Campus	TX	8/30/2016
Texas State University	Texas State University	TX	8/30/2016
Centex Airport	Centex Airport Industrial Site	TX	8/15/2016
LANL	LANL	CO	8/9/2016
<b><i>RFP/Proposal Review</i></b>			
Aztec Independent School District	Aztec High School	NM	3/11/2016
<b><i>Project Profiles</i></b>			
Village Creek WWTP	Village Creek WWTP	TX	4/25/2016
Southside WWTP	Southside WWTP	TX	4/2/2016

#### BP 4 Technical Assistance Activities

For budget period four we did a total of 74 technical assistance activities. Once again, ten of these points were for assisting with updates to the DOE CHP database. We saw a bit more diversity of activity from states in this budget period. However, Texas was still the state with by far the most activity. Oklahoma had a nice uptick in activity. Much of this was due to interest by the military and public sector which has a growing focus on resilience. Similar to budget period three, resilience continues to be a big driver across sectors for CHP interest.

We continued to provide advanced technical assistance to handful of sites. We also did two feasibility studies. One for the Trinity River Authority WWTP and one for the Houston Airport System. Both looked very promising and there was significant interest to move forward. We are still engaged with the Houston Airport System and have recently conducted additional analysis for them to assess further options.

BP 2 Completed TA Activities			
Company Name	Site Name	State	Date Completed
<b><i>Qualification Screenings</i></b>			
Dairy Farmers of America	Schulenburg Dairy	TX	10/12/2016
Presbyterian Santa Fe Hospital	Presbyterian Santa Fe Hospital	NM	10/17/2016
City of Santa Fe	Santa Fe WWTP	NM	10/3/2016
City of Houston	Intercontinental Airport	TX	11/4/2016
Jewish Community Center	Jewish Community Center	TX	11/9/2016
Backyard Microgrid	Backyard Mixed-Use	TX	11/1/2016

OWASA	OWASA WWTP	NC	12/1/2016
City of Westminster, CO	Westminster District Energy	CO	12/14/2016
Arizona National Guard	Camp Navajo	AZ	1/6/2017
Northern Cochise Community Hospital	Northern Cochise Community Hospital	AZ	1/17/2017
HISD	Hattie Mae	TX	2/17/2017
HISD	Bennington Food Processing	TX	2/17/2017
Baylor University	Baylor College of Medicine	TX	2/24/2017
Campbell Soup	Paris Site	TX	2/24/2017
Campbell Soup	Paris Site - 2	TX	2/24/2017
Port of Houston	Turning Basin - Exec Office	TX	2/27/2017
Port of Houston	Bayport Terminal	TX	2/28/2017
University of Texas El Paso	Main Campus	TX	3/6/2017
Symmetry, Inc.	Symmetry, Inc.	TX	3/28/2017
Sam Houston State University	Innovation Plaza	TX	3/30/2017
Sam Houston State University	Main Campus	TX	3/30/2017
Texas National Guard	Camp Bergstrom	TX	3/30/2017
Texas National Guard	Camp Bowie	TX	3/30/2017
Texas National Guard	Camp Mabry	TX	3/30/2017
Texas National Guard	Ft. Bliss National Guard	TX	4/5/2017
Texas National Guard	Grand Prairie	TX	4/5/2017
Texas National Guard	Camp Swift	TX	4/5/2017
Texas National Guard	Camp Maxey	TX	4/5/2017
City of Oklahoma City	Chisholm Creek WWTP	OK	4/17/2017
City of Oklahoma City	OKC WWTP	OK	4/18/2017
City of Oklahoma City	Deer Creek WWTP	OK	4/18/2017
City of Oklahoma City	N Canadian WWTP	OK	4/18/2017
ROC City Aquaponics	ROC City Aquaponics	NY	5/3/2017
Oklahoma National Guard	Tulsa RC	OK	5/3/2017
Oklahoma National Guard	OMD Building	OK	5/3/2017
Oklahoma National Guard	Durant RC	OK	5/3/2017
Oklahoma National Guard	Broken Arrow	OK	5/3/2017
Ball Corporation	Texas Plant	TX	5/24/2017
Ball Corporation	Arizona Plant	AZ	5/25/2017
City of Houston	61 Riesner	TX	6/6/2017
City of Houston	3203 Dairy Ashford - West Police Station	TX	6/6/2017

City of Houston	3301 Commerce - Health Pharmaceutical Warehouse	TX	6/6/2017
Ordway Greenhouse	Ordway Greenhouse	CO	6/22/2017
Harbec - Manufacturing	Plant 1	NY	9/4/2017
Harbec - Manufacturing	Plant 2	NY	9/26/2017
<b><i>Advanced Technical Assistance</i></b>			
Oklahoma National Guard	Camp Broken Arrow	OK	6/20/2017
Baxter RMC	Baxter RMC	AR	6/22/2017
Wind Rivers LLC	La Quinta	UT	7/7/2017
Oklahoma National Guard	Broken Arrow Base	OK	7/10/2017
Xavier College Prep	Xavier College Prep	AZ	7/13/2017
<b><i>Feasibility Assessments</i></b>			
Trinity River Authority	TRA WWTP	TX	8/15/2017
City of Houston Airport System	City of Houston Airport System	TX	1/26/2018
<b><i>Project Profile</i></b>			
Southwestern Energy	Southwestern Energy	TX	10/4/2016

## Task 2: Engagement and Education of End Users

### Budget Period 2 End-User Engagement

For this task, we were to engage and educate end users about CHP, its benefits, and DOE resources available, through strategically hosting / participating in webinars, workshops and other forums. The intent of this engagement and education is to drive the technical assistance efforts of Task 1. DOE expected about 20% of the CHP TAP's efforts to be assigned to this Task. We largely engaged and educated end users about CHP, its benefits, and DOE resources available, in prioritized market segments in each of the states where appropriate, using a combination of direct outreach and target market end user events

We focused on a relatively small set of end-user market sectors. These included data centers, wastewater treatment plants, food processing, higher education, industrial/manufacturing, chemical/plastics and hospitals. We conducted webinars and presented at conferences for each of these sectors. We also had the opportunity to engage in industry association lunch and learn events, as well as conduct tours for a few sites. We found through our engagements, a growing interest to discuss resilience of facilities, particularly by the public sector and health care. We used this feedback to focus more of our outreach efforts on how CHP can improve site resilience.

Also, during this time, we started to look at opportunities to engage the upstream oil and gas sector and held a webinar on the electrification of the oil field. There is a growing interest by this sector to reduce costs while at the same time quickly expanding operations without the use of diesel generation as the main source of power.

We also conducted direct engagement of state energy offices to determine public and private sector opportunities across the Southwest region; set-up meetings with potential end-users; assistance with coordinating association meetings and webinars. We find that state energy offices have a deep understanding of energy

issues across the state, as well as operate programs that can be leveraged to engage public and private sector end-users. We were able to engage all of the energy offices in our region other than Arizona which lacked such an office.

Also, during this period we began further engaging natural gas utilities. The intent was to educate and provide outreach to key account reps of natural gas companies on the value of CHP, characteristics of good CHP projects, and CHP TAP services to identify potential customers for the TAP services. We worked to provide training to Atmos, Center Point Energy, Mesa Utilities, One Gas and Texas Gas. We anticipated that this knowledge would present greater CHP TA opportunities for the TAP. We did receive a handful of CHP TA from the utilities.

We also began to work more closely with industry associations to place articles in magazines and newsletter, as well as blog posts on their sites. We looked to find free advertising opportunities in industry association publications. For example, we posted a small advertisement in the AFCOM (data center industry association) newsletter. They helped us publicize and hold a tour of a data center in Austin. Another example is the placement of an advertisement in the Water Environment Federation industry journal. Both ended up with contacts with end-users. We find that engagement to the end-user base using their platform is essential for credibility. Our presence in their media platforms demonstrates acceptance of our work and increases buy-in from end-users

Finally, during this period we began to engage end-users through LinkedIn. This is a business focused social media platform that allowed us to share information about CHP and the CHP TAP to a wider audience. It also allowed us to have more frequent engagement with end-users and keep the TAP in front of them. This increased our name recognition and the number of TA opportunities.

Following is a breakdown of the end-user activities.

BP1 Completed End-User Education Activities				
Event/Activity Title	Activity Type	Target Market	Attendees	Date
IDEA Campus Energy Conference - Booth	Other	Colleges & Universities	800	2/9/2016
Combined Heat and Power Opportunities for Critical Infrastructure	Webinar	Other	24	2/17/2016
Combined Heat and Power Technologies and Applications - with Tour of 3M Site	End-User Tour	Other	30	2/18/2016
Stakeholder Advisory Group - Monthly Meeting	Meeting	Other	6	3/7/2016
Texas Gas Training	Other	Other	7	3/24/2016
Presentation to New Mexico Gas Executives	Meeting	Other	10	4/5/2016
Texas Industrial Energy Management Forum	Booth	Refinery	45	4/7/2016
CHP Industry Input and Assessment	Meeting	Other	8	4/19/2016
CHP in the Microgrid	Webinar	Microgrids	45	4/18/2016
CHP and WWTP	Webinar	Other	48	4/21/2016
CHP in Higher Education	Webinar	Higher Education	50	5/4/2016

CHP 101 at AEE Chapter Meeting	Presentation	Multiple	22	5/11/2016
CHP in Industrial Facilities	Webinar	Industrial	54	5/12/2016
CHP in the Oil Field	Webinar	Oil and Gas	24	5/24/2016
CHP TAP TA Ad with RMWEA	Advertising	Other	N/A	6/10/2016
CHP TAP TA Ad with TXIOF Newsletter	Advertising	Other	N/A	6/28/2016
Monthly Stakeholder Outreach and Education Meeting	Stakeholder Outreach	Other	11	6/27/2016
ASHE Annual Conference and Technical Exhibition	Booth	Other	3200	7/10/2016
10th Annual Water and Wastewater Conference - Rocky Mt WEFTEC	Presentation	WWTP	35	8/3/2016
CHP and Data Center Webinar Post on Linked-in	Other	Data Centers	121	8/9/2016
SUPRA USA	Presentation	Industrial Market	2	8/11/2016
AAFCOM Data Center Managers	Presentation	Data Centers	15	8/25/2016
Discussion on CHP Financing Options in Texas	Presentation	Industrial Market	2	8/29/2016
Discussion on WWTP and CHP - Making it Pencil Out	Meeting	WWTP	12	9/6/2016
Meeting with Western Farmers COOP	Meeting	Other	5	9/8/2016
Meeting with Trinity River Authority	Meeting	WWTP	5	9/12/2016
CHP and Data Centers	Webinar	Other	20	9/13/2016
District Energy and CHP - win - win situation	Webinar	Other	90	9/20/2016
CHP in the Oil Field - meeting with Chevron on compressor stations	Meeting	Other	6	9/21/2016
WEFTEC Conference	Booth	WWTP	200	9/26/2016
CHP Funding Opportunities in Texas	Meeting	All	2	7/11/2017
Project Development Barriers in Texas	Meeting	All	4	7/13/2017
Project Development Barriers in Texas	Meeting	All	4	7/17/2017
How to fund CHP in the ERCOT market	Meeting	All	2	7/18/2017
Discuss CHP in the Oil Field	Meeting	Oil and Gas	4	8/1/2017
Overview of CHP in SW - ACEEE Summer Study	Presentation	All	30	8/15/2017
Discuss Interconnection in TX	Meeting	All	2	8/25/2017

## Budget Period 2 End-User Engagement

Much of the education and outreach activities continued into BP2. We continued to build our LinkedIn presence by creating a company profile on LinkedIn. This provides a place for end-users and interested parties to go to learn more CHP and our upcoming activities. We also continued to send out a regular newsletter to our CHP contacts. This largely included CHP TAP activities and events, as well as pertinent industry news. We segmented the lists to ensure we were not over subscribing some to CHP events that were not applicable. We saw a significant increase in traffic with the newsletters.

Also, during this budget period we conducted an Oil and Gas Workshop in partnership with Shell Oil. This was done to further develop the dialogue around CHP in the Oil Field. We anticipated about 30 participants and ended up with 80+. We had speakers across the industry, including vendors discussing how CHP can help with enhanced oil recovery, as well as with treatment of produced water. We are looking to conduct a second workshop in Colorado under the new CHP TAP contract.

See CHP activities below for BP2.

BP2 Completed End-User Education Activities				
Event/Activity Title	Activity Type	Target Market	Attendees	Date
CHP Potential in Texas Market	Meeting		3	10/11/2016
USGBC Energy Summit Houston	Presentation	Commercial Buildings	30	10/13/2016
Market Intelligence Committee Meeting	Presentation		18	11/1/2016
CHP Workshop: Cost-Effective, Environmental Risk Mitigation & Increased Power Reliability through On-Site Power Generation	Workshop		20	11/9/2016
Discuss Ship Channel CHP Opportunities	Meeting	Refinery	3	11/14/2016
CHP in Breweries	Webinar	Food Processing	51	11/17/2016
Joint Professional Organization Meeting - AIChE	Meeting	Chemicals	100	1/10/2017
CHP Market Analysis for Oil and Gas - HCS Group	Meeting	Oil and Gas	3	1/10/2017
CHP Market Analysis for WWTP - Opterra Energy	Meeting	Municipalities	3	1/17/2017
CHP Market Analysis for Industry - MP2	Meeting	Refinery	3	1/19/2017
Air Permitting Barriers for CHP in Texas - Zephyr Environmental	Meeting	Refinery	3	1/19/2017
CHP 101 with Houston Independent School District	Meeting	Schools (K-12)	5	1/26/2017
CHP in the Oilfield Workshop	Workshop	Oil and Gas	70	2/7/2017
CHP in Higher Education - Sam Houston State University	Meeting	Colleges & Universities	8	2/9/2017
Natural Gas Utility Training	Other	Utilities	20	2/14/2017
CHP Market Intelligence Group	Meeting	Multiple	12	2/20/2017
CHP Opportunities with Navajo Tribe Utilities	Meeting	Utilities	2	2/21/2017
Natural Gas Utility Training	Other	Utilities	3	2/24/2017
CHP and Biogas at WWTF	Webinar	WWTP	54	2/28/2017

Introduction to CHP - GSA Region 6	Meeting	Government, Federal	5	3/6/2017
Reducing Energy Costs with Waste Heat to Power	Webinar	WHP	103	3/14/2017
Discuss CHP opportunities in TX with City of Houston	Meeting	Government, Local	2	3/14/2017
Discuss CHP activity in SW Region with ACEEE	Meeting	Multiple	2	3/15/2017
District Energy and CHP in Hospitals	Webinar	Hospitals	125	3/27/2017
CHP and Industrial Applications	Webinar	Refinery	32	4/26/2017
CHP Trends in our Region with ACEEE	Meeting	Other	2	4/7/2017
Interconnection Process with CenterPoint	Meeting	Other	12	4/7/2017
Tariff issues and demand charges in regulated portions of TX	Meeting	Other	7	4/11/2017
Discuss CHP in Oklahoma with utilities - natural gas and electric	Meeting	Other	25	4/21/2017
Micro-grids with CHP – Improving Campus and Community Resilience	Webinar	Microgrids	271	5/2/2017
CAHED Annual Meeting - Colorado Association of Healthcare Engineers and Directors	Workshop	Hospitals	150	5/4/2017
Discuss CHP opportunities with City of Houston Facilities Manager	Meeting	Government, Local	1	5/16/2017
Discuss CHP Financing with Siemens	Meeting	Other	2	5/17/2017
Discuss CHP Opportunities in Hospitals with HGA	Meeting	Hospitals	5	5/26/2017
World Biogas	Meeting	Wastewater Treatment Plants	1	5/30/2017
Gulf Coast Water Development Authority	Meeting	Wastewater Treatment Plants	5	5/31/2017
CHP for Food Processing - Lowering Operating Costs and Improving Food Quality	Webinar	Food Processing	85	6/13/2017
IETC in New Orleans	Booth	Other	100	6/20/2017
IDEA Annual Conference - Booth and Presentation by Carlos - Long-term profitability scenarios for CHP based-microgrid	Booth	Microgrids	30	6/26/2017

### Task 3: Policymaker Education

The goal of Task 3 is to engage and educate policymakers about CHP, its benefits, and DOE resources available, through strategically hosting / participating in webinars, workshops and other forums. The intent of this engagement and education is to drive policies supportive of CHP. DOE expected about 10% of the CHP TAP's efforts to be assigned to this Task. We did not spend a great deal of time in this area. This is largely due to the fact that we only had a two year contract and much of the push from DOE HQ was to do technical assistance. All of the metrics were focused on conducting TA.

The policy making and regulatory process moves very slowly and with such a short period of time to work with and not a lot of momentum in the policy making arena coming from the previous TAP's efforts, we did not see that it was a wise use of resources to engage too much with the regulatory community. If a longer term opportunity is presented, then the efficacy of such engagement is more likely, and we will make greater effort to educate policy makers.

For both budget periods we did review the ACEEE 2016/17 State Energy Efficiency Scorecard. Our intent was to review and correct the CHP scores for all Southwest states for accuracy and completeness. The scorecard is used by policymakers in each Southwest state to determine major policies needed to support CHP; Southwest TAP has on-the-ground knowledge of existing CHP policies in our states

BP1 Completed Policy Maker Education Activities			
Requesting Organization	Activity	Primary Policy Type	Date
Utah State Energy Office	Other	Other	5/10/2016
Utah State Energy Office	Other	Other	6/29/2016
CO Energy Office	Other	State Energy Plan	6/22/2016
OK Dept of Energy	Other	Interconnection	6/16/2016
TX House	Other	Other	7/12/2016

BP 2 Completed Policy Maker Education Activities			
Requesting Organization	Activity	Primary Policy Type	Date
PUC of Texas	Other	Discussion of Interconnection Rules and Self-Generation Rules	3/27/2017
Colorado Energy Office and Department of Ag	Meeting	State Energy Plan	5/18/2017

**4. Cost Status.** A comparison of the approved budget by budget period and the actual costs incurred during the reporting period shall be provided. If cost sharing is required, the cost breakdown shall show the DOE share, recipient share, and total costs.

	<u>Original Budget</u>	<u>Actual Expenditures</u>
Salaries & Wages	339,067.00	344,361.82
Fringe Benefits	152,230.00	156,057.44
Supplies	1,000.00	451.66
Travel	59,000.00	33,309.04
Other Direct Costs	120,113.00	138,543.79
Contractual	<u>241,300.00</u>	<u>169,931.10</u>
Total Direct Costs	912,710.00	842,654.85
Indirect Costs	<u>226,657.00</u>	<u>296,712.15</u>
<b>Total Federal Costs</b>	<b>1,139,367.00</b>	<b>1,139,367.00</b>
Cost Share	<u>285,450.00</u>	<u>322,764.46</u>
<b>Total Project Costs</b>	<b><u>1,424,817.00</u></b>	<b><u>1,462,131.46</u></b>

## 5. Schedule Status

HARC was asked by the DOE to enter into this contract two years into the project period. The previous organization hosting the CHP TAP decided not to continue operation of the CHP TAP after budget period two. HARC completed out operations for the Southwest CHP TAP for budget period three and four. Budget period two was extended out a little more than one additional quarter to allow for wrap-up of BP2 efforts. HARC was on track to wrap-up by end of the originally set budget period, but due to length of contract negotiations and delayed decision on the next round of CHP TAPs, HARC was encouraged to continue work for four months under BP2. Work was completed at the end of January 2018.

## 6. Changes to Approach

Describe any changes during the reporting period in project approach and the reasons for these changes. Remember, significant changes to the project objectives and scope require prior approval by the Contracting Officer.

None to report.

## 7. Delays or Problems

Describe any actual or anticipated problems or delays and any actions taken or planned to resolve them.

None to report.

## 8. Personnel

Describe any absence or changes of key personnel or changes in consortium/teaming arrangement during the reporting period.

Team as listed below remained intact throughout project except for one change. Satish Ravindran, PE was one of our energy engineers. He left during BP2. He was replaced with Carlos Gamarra, PE. Carlos had significant CHP technical experience prior to joining HARC and picked up right where Satish left off.

### Team Members

Name	Organization	Location	Email	Phone
Gavin Dillingham, Director	HARC	Houston, TX	<a href="mailto:gdillingham@harcresearch.org">gdillingham@harcresearch.org</a>	281-216-7147
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Tom Broderick	Contractor	Flagstaff, AZ	<a href="mailto:tbbflag@npgcable.com">tbbflag@npgcable.com</a>	928-527-8036
Darrell Thornley	Contractor	Austin, TX	<a href="mailto:darrell.thornley@gmail.com">darrell.thornley@gmail.com</a>	512-279-0755
Laxmi Rao	IDEA	Cambridge, MA	<a href="mailto:Laxmi.idea@districtenergy.org">Laxmi.idea@districtenergy.org</a>	617-272-6879

## 9. Products Produced

List and describe any product produced or technology transfer activities accomplished during this reporting period:

Website – [www.southwestchptap.org](http://www.southwestchptap.org)

