ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

1407 W North Temple, Suite 330
Salt Lake City, Utah 84114

April 30, 2019

VIA ELECTRONIC FILING

Utah Public Service Commission
Heber M. Wells Building, 4th Floor
160 East 300 South
Salt Lake City, UT 84114

Attention: Gary Widerburg
Commission Secretary

RE: **Docket No. 19-035-17 – Rocky Mountain Power's Second Annual Sustainable Transportation and Energy Plan Act ("STEP") Program Status Report**
Docket No. 16-035-36 – In the Matter of the Application of Rocky Mountain Power to Implement Programs Authorized by the Sustainable Transportation and Energy Plan Act

In accordance with Docket No. 16-035-36, Rocky Mountain Power (the "Company") hereby submits for filing its second Annual Sustainable Transportation and Energy Plan Act ("STEP") Program Status Report ("STEP Report"). The STEP Report contains the overall calendar year 2018 monthly accounting detail for the STEP program as well as information on the individual STEP programs, using the reporting template that was approved in a letter from the Utah Public Service Commission ("the Commission") dated October 12, 2017 ("Reporting Template").

The Reporting Template was designed to inform stakeholders of the STEP program's progress and funding, and the Company, the Division of Public Utilities ("Division"), and the Office of Consumer Services ("Office") have generally acknowledged that the STEP Report is a work in progress and may need to be revised annually to keep stakeholders adequately informed on the progress of the STEP programs. In the first annual STEP report, Docket No. 18-035-16 ("First STEP Report"), interested parties requested various modifications to the report, which were summarized in Exhibit A to the Company's July 27, 2018, reply comments. Also, the order issued in Docket No. 16-035-36 on February 6, 2019 ("February 6 Order"), contained additional reporting requirements. A complete list of these changes is provided beginning on page 1.2 along with a reference to where the additional information can be found in the STEP Report. The Company appreciates the feedback received so far on the STEP Report and looks forward to continued collaboration with interested parties to ensure the STEP Report is as useful as possible.

Also, the Smart Inverter project, found on page 15.0 of this report is complete and final reports from the Company's partners, Electric Power Research Institute and Utah State University, are included as Exhibits 15-A and 15-B to this report.

The Company respectfully requests that all formal correspondence and requests for additional information regarding this filing be addressed to the following:

By E-mail (preferred): datarequest@pacificorp.com
utahdockets@pacificorp.com
Jana.saba@pacificorp.com
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By regular mail: Data Request Response Center
PacifiCorp
825 NE Multnomah, Suite 2000
Portland, OR 97232

Informal inquiries may be directed to Jana Saba at (801) 220-2823.

Sincerely,

Joelle Steward
Vice President, Regulation

CERTIFICATE OF SERVICE

Docket No. 19-035-17

I hereby certify that on April 30, 2019, a true and correct copy of the foregoing was served by electronic mail to the following:

Utah Office of Consumer Services	
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Katie Savarin
Coordinator, Regulatory Operations

STEP PROGRAM STATUS REPORT

For Period Ended
December 31, 2018

2018 ANNUAL STEP STATUS REPORT

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Overall STEP Program Information:

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Page No.		CY 2017	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	CY 2018 Total	2017-2018 Cummulative Total
			CY 2018													
	STEP Account Beginning Balance	(15,850,031)	(19,887,838)	(20,001,319)	(20,131,002)	(20,294,033)	(19,516,302)	(19,884,359)	(20,770,408)	(21,356,634)	(22,093,157)	(22,644,936)	(23,246,309)	(23,526,285)	(19,887,838)	(15,850,031)
	Spending by Project:															
2.0	EV Charge Infrastructure	487,502	29,303	96,194	63,785	494,558	129,900	78,886	432,161	138,221	196,348	58,301	96,300	67,746	1,881,703	2,369,205
3.0	Woody-waste Co-Fire Biomass at Hunter Unit 3	-	-	-	-	69,024	-	(6,000)	-	19,425	-	-	77,112	70,716	230,277	230,277
4.0	NOx Neural Network Implementation	457,767	(9,232)	35,332	17,082	-	13,050	(26,101)	52,202	(13,053)	58,891	47,152	-	32,292	207,616	665,383
5.0	Alternative NOx Reduction	131,405	7,000	-	3,500	24,500	-	(8,990)	-	-	-	-	-	-	26,010	157,415
6.0	CO2 Enhanced Coal Bed Methane (CO2 Reduction	-	19,250	8,250	2,750	24,750	-	-	27,500	-	-	2,750	8,779	-	94,029	94,029
7.0	Cryogenic Carbon Capture (Emerging CO2 Capture)	160,451	-	211,316	-	-	75,724	-	-	218,008	-	-	25,241	-	530,289	690,740
8.0	CARBONsafe (CO2 Sequestration Site Characterization	150,239	-	-	-	-	-	-	-	-	-	-	-	-	-	150,239
9.0	Solar Thermal Assessment (Grid Performance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.0	Circuit Performance Meters (Substation Metering	13,676	1,191	906	-	12,237	79,026	13,767	4,062	3,522	67,599	150,364	44,598	50,076	427,349	441,025
11.0	Commercial Line Extension	-	-	-	-	-	43,334	-	-	-	-	-	26,006	-	69,340	69,340
12.0	Gadsby Emissions Curtailment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13.0	Panguitch Solar and Energy Storage Project	331,995	39,181	5,825	5,688	6,182	25,512	31,897	-	37,607	16,978	(74,373)	(19,073)	51	75,474	407,470
14.0	Microgrid Project	-	-	400	448	89,246	90	-	-	351	179	-	-	-	90,713	90,713
15.0	Smart Inverter Project	-	-	1,203	254,193	114,895	4,645	2,163	1,074	1,868	358	358	806	2,297	383,859	383,859
16.0	Utah Solar Incentive Program	4,735,412	919,754	610,471	273,503	422,453	60,974	10,560	147,515	149,876	266,814	101,229	279,064	236,469	3,478,682	8,214,094
	Total Spending	6,468,448	1,006,448	969,897	620,948	1,257,846	432,254	96,182	664,514	555,824	607,167	285,781	538,833	459,647	7,495,340	13,963,787
	Surcharge Collections	(9,756,984)	(1,050,014)	(1,027,088)	(712,970)	(410,018)	(738,745)	(913,238)	(1,179,070)	(1,218,428)	(1,082,835)	(809,079)	(739,237)	(845,240)	(10,725,962)	(20,482,947)
	Ending Monthly Balance before Carrying Charge	(19,138,568)	(19,931,403)	(20,058,511)	(20,223,024)	(19,446,205)	(19,822,792)	(20,701,416)	(21,284,964)	(22,019,237)	(22,568,825)	(23,168,235)	(23,446,712)	(23,911,879)	(23,118,460)	(22,369,190)
	Carrying Charge	(749,270)	(69,916)	(72,491)	(71,009)	(70,096)	(61,567)	(68,993)	(71,669)	(73,920)	(76,111)	(78,073)	(79,573)	(80,843)	(874,261)	(1,623,531)
	Ending Monthly Balance	(19,887,838)	(20,001,319)	(20,131,002)	(20,294,033)	(19,516,302)	(19,884,359)	(20,770,408)	(21,356,634)	(22,093,157)	(22,644,936)	(23,246,309)	(23,526,285)	(23,992,721)	(23,992,721)	(23,992,721)

2018 Annual STEP Status Report
STEP/DSM Assets/Liabilities
(Based on STEP Legislation)

CY 2017

	Program Expenditures	Accrued Program Expenditures	Amortization of Expense (over 10 years)	Unused DSM Revenue Collections	Carrying Charge	End Balance	Cash Basic Accumulated Balance
					10.65%		
FY16	-	2,693,388	-	(7,097,889)		(4,404,501)	(7,097,889)
1	2,648,142	262,689	(11,010)	(5,596,470)	(76,126)	(7,177,276)	(10,133,354)
2	3,754,612	348,093	(37,611)	(5,851,627)	(99,406)	(9,063,215)	(12,367,385)
3	3,478,015	(117,206)	(67,973)	(4,670,909)	(115,356)	(10,556,644)	(13,743,608)
4	4,355,254	586,848	(100,399)	(4,668,416)	(123,810)	(10,507,168)	(14,280,980)
5	3,686,017	(291,172)	(134,079)	(4,563,595)	(131,233)	(11,941,231)	(15,423,870)
6	3,848,077	669,594	(164,408)	(5,989,272)	(147,118)	(13,724,357)	(17,876,590)
7	3,924,229	1,047,010	(197,648)	(7,728,712)	(176,414)	(16,855,892)	(22,055,136)
8	4,036,553	(195,749)	(231,059)	(4,577,217)	(199,164)	(18,022,529)	(23,026,024)
9	2,972,860	924,940	(260,144)	269,800	(191,121)	(14,306,194)	(20,234,629)
10	4,678,938	39,552	(292,027)	269,150	(158,921)	(9,769,503)	(15,737,489)
11	6,803,166	(694,191)	(339,869)	345,359	(109,457)	(3,764,495)	(9,038,290)
12	9,380,581	(1,204,040)	(407,301)	407,396	(38,588)	4,373,553	303,797
Estimate	-	-	-	4,322	(8,859)	4,369,016	299,260
Total	53,566,445	4,069,756	(2,243,529)	(49,448,082)	(1,566,714)		
			55,392,672		(51,014,796)	4,377,875	
			Total Asset		Total Liabilities		

CY 2018

	Program Expenditures	Accrued Program Expenditures	Amortization of Expense (over 10 years)	Unused DSM Revenue Collections	Carrying Charge	End Balance	Cash Basic Accumulated Balance
					9.21%		
FY17	-	4,069,756	-	299,260		4,369,016	299,260
1	3,568,395	522,546	(461,232)	(2,054,799)	6,335	5,950,261	1,357,959
2	3,374,756	(255,983)	(490,143)	(4,171,129)	5,485	4,413,248	76,929
3	4,020,585	(809,314)	(521,052)	(4,312,160)	(2,528)	2,788,779	(738,226)
4	3,506,710	(239,128)	(552,362)	(4,393,042)	(11,187)	1,099,771	(2,188,106)
5	3,627,311	581,878	(582,102)	(4,227,927)	(21,332)	477,599	(3,392,156)
6	4,220,629	699,578	(614,788)	(5,526,489)	(33,405)	(776,876)	(5,346,209)
7	5,022,885	384,297	(653,261)	(7,346,126)	(52,454)	(3,421,535)	(8,375,165)
8	4,164,510	868,008	(691,624)	(7,635,830)	(80,255)	(6,796,726)	(12,618,364)
9	2,671,925	454,900	(720,025)	(6,662,806)	(114,924)	(11,167,655)	(17,444,193)
10	4,757,938	(305,047)	(751,069)	(4,673,096)	(136,441)	(12,275,370)	(18,246,861)
11	6,769,886	(2,282,310)	(799,057)	(4,176,547)	(133,159)	(12,896,557)	(16,585,738)
12	5,518,134	134,805	(850,260)	(4,836,366)	(127,942)	(13,058,187)	(16,882,172)
Estimate	-	-	-		877	(13,057,310)	(16,881,295)
Total	51,223,665	3,823,986	(7,686,975)	(59,717,055)	(700,930)		
				-			
			47,360,676		(60,417,985)	(13,057,310)	
			Total Asset		Total Liabilities		

2018 ANNUAL STEP STATUS REPORT

For Period Ended December 31, 2018

List of Report Changes in Compliance with Commission Orders

The following is a list of modifications to the STEP Report, which have been suggested by interested parties in various dockets pertaining to STEP. Each item is listed along with the source of the change and where the recommendation was incorporated into the STEP Report.

Docket No. 18-035-16 (First STEP Report)

Several recommendations were proposed by parties in response to the First STEP Report. Exhibit A, which accompanied the reply comments of Rocky Mountain Power filed on July 27, 2018, summarized the parties' recommendations. A revised Exhibit A is provided below containing the items that were approved by the Commission, along with a new column that provides a reference to how the Company incorporated the recommendation:

Summary of Requirements from Docket No. 18-035-16				
Topic	Division	Office	SWEEP/UCE	Compliance Reference
USIP	1) Include a spreadsheet that reconciles USIP expenditures and ending balances that correlate to the STEP Report, RMP Exhibit A.			See new USIP section on Page 16.0
Overall DSM/STEP Liability Account	2) Include a brief summary and spreadsheet explaining the DSM/STEP Liability and Asset balancing accounts.			See Page 1.1
Electric Vehicle	3) Include a spreadsheet explaining the Electric Vehicle ("EV") Program expenditures.			See page 2.4 and Exhibits 2A-2F
Electric Vehicle	4) Provide accounting and explanations in the annual report that demonstrate the EV Program in a more transparent manner.	1) Table 1 EVCI should be modified such that the accounting information is presented in a more easily understood format.		See page 2.0
Electric Vehicle		2) Table 3 EVCI should include the date each custom project was accepted by the Company.		See Exhibit 2-A, column "creation date"
Electric Vehicle	5) The parties should meet to discuss how to proceed with accounting for EV custom project incentives and other commitments.			Discussed at STEP Collaborative on October 23, 2018
Electric Vehicle	6) Provide at a minimum, a status report for the additional filing requirements for the EV Program.			Discussed at STEP Collaborative on October 23, 2018
Electric Vehicle			1) modify future reports to include: total number of workplace charging ports by county, the number of employers and sites, the average and range of total costs for each charging station.	See Table 2 and Exhibit 2-A in the EV program report
Clean Coal	7) File with the Commission to reallocate funds from the Alternative NOx Emission Control Technology to another program.	5) Recommends that the Commission clearly indicate that the funds associated with this project are no longer authorized to be spent unless and until the Company receives approval for a reallocation or new proposal that is found to be in the public interest.		Application Submitted 11/13/18, approved 2/6/19
Panguitch Battery Storage		3) The Company should provide an explanation on the battery storage project accounting and milestones in reply comments in this docket.		See Docket No. 18-035-16 RMP Reply Comments p. 3-4
Overall Report	8) The Division suggests that RMP provide an explanation for any external OMAG expense in future reports.			Explanation of external OMAG is provided where applicable
Overall Report		4) The Company should meet with interested parties to discuss potential modifications and/or enhancements to the STEP Annual Status Report.		STEP Collaborative held on October 23, 2018

Additionally, the Office of Consumer Services requested that the Company use consistent line colors in the charts provided in the Huntington Plant Neural Network Optimization Project. The Company has updated the report accordingly.

<u>Docket No. 16-035-36 February 6, 2019 Commission Order</u>

On November 13, 2018 the Company filed for approval to modify the funding amounts previously authorized by the STEP Act. The Commission approved the Company's request in an order issued February 6, 2019. The order included the following additional reporting requirements for the annual STEP report:

<table>
<tr><th colspan="3">Summary of Requirements from February 6, 2019 Order (Docket No. 16-035-36)</th></tr>
<tr><th>Topic</th><th>Requirement</th><th>Compliance Reference</th></tr>
<tr><td>Commercial Line Extension</td><td>Include:
1) number of applications submitted
2) number of applications selected to receive incentives
3) whether recipients received multiple incentive awards
4) if awarded:
a) size of project
b) cost
c) amount of incentive
d) number of charging stations
e) number of conduit extensions installed for future EV charging locations as provided for in Regulation No. 13</td><td>Page 11.0-11.1</td></tr>
<tr><td rowspan="4">Storage and Solar Technology Project</td><td>Meet with parties to discuss:</td><td>Meeting held on February 25, 2019</td></tr>
<tr><td>1) Provide requested project cost data</td><td>Requested data was provided through discovery on March 25, 2019 in Docket No. 16-035-36 OCS 21.1 3rd Supplemental</td></tr>
<tr><td>2) Develop reporting requirements for this data in annual STEP reports going forward</td><td rowspan="2">None at this time although parties anticipate additional reporting requirements may develop as the project moves forward</td></tr>
<tr><td>3) Discuss types of info to be provided after STEP ends (and in what manner)</td></tr>
</table>

STEP Project Report

Period Ending December 31, 2018[1]

STEP Project Name:

Electric Vehicle ("EV") Charging Infrastructure:

1. EV Time of Use ("TOU") Pilot – Schedule 2E;
2. Plug-in EV Pilot Incentive Program – Schedule 120; and
3. Plug-in EV Load Research Study Program – Schedule 121.

Project Objectives:

- Offer a time of use rate schedule option for residential customers who own a plug-in electric vehicle;
- Promote plug-in electric vehicle charging infrastructure and time of use rates; and
- To study the load profiles of customers who have plug-in electric vehicles.

2018 EV PROGRAM BUDGET ACCOUNTING

Table 1 below is an accounting of how the $2 million 2018 EV Program budget was allocated. Prescriptive incentives represent measures that follow a program fiscal year of October 1st through September 30th, while custom incentives for committed funds follow the calendar year. Prescriptive incentives in Table 1 were completed during the EV Program's fiscal year. Custom incentives in Table 1 were committed to custom projects that the Company approved through the customer application process. Incentives for custom projects will be paid to customers upon the actual completion of their projects. Additional details and support for Table 1 prescriptive incentives can be found in Exhibit 2-A.

Table 1 – 2018 EV Program Budget Accounting

2018 EV Program Budget Costs/Commitments				
Category	**Prescriptive Incentives**	**Committed Custom Incentives**	**Program Management**	**Total**
Time of Use Rate Sign-up	$22,400	-	-	$22,400
Time of Use Load Research Study	$10,000	-	-	$10,000
Time of Use Meters	-	-	$79,394	$79,394
Non-Residential AC Level 2 Chargers – Single Port	$102,907	-	-	$102,907
Non-Residential AC Level 2 Chargers – Multi-Port	$189,844	-	-	$189,844
Non-Residential & Multi-Family DC Fast Chargers	$97,878	-	-	$97,878
Custom Projects	-	$998,500	-	$998,500

[1] Incentive payments for the Time of Use Pilot, Non-Residential AC Level 2 Chargers, and Non-Residential & Multi-Family DC Fast Chargers (prescriptive incentives) from October 1, 2018, through December 31, 2018, used 2019 incentive funds, consistent with the program's fiscal year structure approved in Docket No. 16-035-36, and will be included in the reporting period for the 2019 EV Program budget.

Administrative Costs	-	-	$175,427	$175,427
Outreach & Awareness	-	-	$109,479	$109,479
Total	$423,029	$998,500	$364,300	**$1,785,356**

2018 PRESCRIPTIVE INCENTIVE LOCATIONS

Table 2 below is a breakout by city for prescriptive incentive equipment installations and TOU sign-ups from the 2018 EV Program fiscal year occurred (October 1, 2017 through September 30, 2018). There were a combined total of 331 AC Level 2 and DC Fast charging ports installed for public and/or workplace use. Of those, 280 ports were installed across 75 employers and 51 ports were installed across 9 multi-family properties.

Table 2 – EV Charger Installations and Time-of-Use Sign-ups by City

City (UT)	DC Fast Chargers Single Port	AC Level 2 Chargers		TOU Rate Sign-ups	
		Multi-Port	Single Port	Option 1	Option 2
Alpine				1	1
American Fork		1		1	2
Bluff			4		
Brigham City					1
Clearfield			16	2	
Coalville					1
Draper		6	5	2	6
Eagle Mountain					1
Farmington		2	1	1	2
Grantsville			1		
Herriman				3	4
Hill Air Force Base			11		
Ivins					1
Kaysville					1
La verkin					1
Layton					1
Lindon			1		1
Logan			5	1	2
Magna					2
Midvale		6	10	1	2
North Salt Lake		1			2
Ogden			1	2	4
Orem		2	29	2	2
Park city	2		23	4	
Pleasant Grove		2			
Provo			8		
Richmond					1
Riverton			2		3
Roy				1	
Salt Lake City	3	36	51	9	12
Sandy		3	5	4	6
Saratoga Springs					3

City (UT)	DC Fast Chargers Single Port	AC Level 2 Chargers		TOU Rate Sign-ups	
		Multi-Port	Single Port	Option 1	Option 2
South Jordan		5	3	3	2
Syracuse			1		
Tooele		2			2
Tremonton			6		2
Vernal		1			
West Jordan		1	1	1	2
West Valley City			6		3
Woods Cross					1
Total	**5**	**68**	**190**	**38**	**74**

CUSTOM PROJECTS

Custom Projects 10 through 13 are listed in Table 3 below, which includes a description, incentive amount, and equipment to be installed from customer applications that were approved by the Company and committed from the 2018 EV Program budget during the 2018 calendar year. A summary of the 2018 EV Program budget committed funds for custom projects can be found in Exhibit 2-B. Incentives for custom projects will actually be paid to customers upon the completion of their projects, and may be adjusted downward based on the actual equipment that gets installed and actual equipment costs. The 2018 custom projects are expected to be completed and paid in 2019.

Custom Projects 1 through 9 were reported in the 2017 Annual STEP report representing $1,359,874 of committed funds from the 2017 EV Program budget. Exhibits 2-C and 2-D provide updated information on committed custom projects, and compare details against actual/completed details. There were a combined total of one electric bus charger and 56 AC Level 2 and DC Fast charging ports installed for workplace/public use from completed custom projects in 2018.

Table 3 – 2018 EV Program Budget Custom Project Commitments[2]

Custom Projects	Incentive	Description	Equipment Type
Project 10	$308,000	A major city will be installing a city-wide system of EV equipment for residents, guests, travelers, and ride-share drivers. The city is in a key strategic position to embark on such a wide-ranging project. The city is centrally located in the Wasatch Front and has notable popular attractions within its borders which attract a considerable amount of vehicles. The city experiences significant air pollution during bad	44 AC Level 2 Charging Ports and 2 DC Fast Charging Ports

[2] Custom projects listed in Table 3 may evolve and are expected be completed throughout 2019. Actual incentive amounts and installed equipment will be included in subsequent reports for completed custom projects.

Custom Projects	Incentive	Description	Equipment Type
		inversion events in the winter and ozone buildup in the summer. To mitigate these effects, the city believes that by providing EV equipment on a city-wide scale, residents will be encouraged to adopt zero-emissions vehicles as a way to improve air quality	
Project 11	$70,000	A city is in the final stages of completing a new 130,000 sq-ft Public Works facility. The city has been evaluating and preparing to transition to electric fleet vehicles and is preparing to install charging stations at the new facility to service residents, employees, and fleet vehicles.	6 AC Level 2 Charging Ports and 1 DC Fast Charging Port
Project 12	$120,500	A DC Fast charger was selected for installation to fill the gap in charging stations along the east-west Interstate 80 corridor. Level 2 chargers were selected for their lower cost and ease of installation to serve the county fleet as well as residents. This project will provide EV charging infrastructure in the county where little, if any, EV charging exists. In so doing, the county and other municipal governments will be able to deploy more EVs that eliminate tailpipe emissions and lower annual operating costs; provide charging for county employees as well as residents, and set an example for other businesses to provide charging stations.	12 AC Level 2 Charging Ports and 1 DC Fast Charger Port
Project 13	$500,000	A public transit group will be transitioning to electric buses. The chargers will be used for on-route use and battery charging while parked in bus depots.	Two 500 kW Electric Bus Chargers and 5 DC Fast Charging Ports
Total 2018 EV Budget Commitments	$998,500	---	62 AC Level 2 Charging Ports, 9 DC Fast Charging Ports, and two 500 kW Electric Bus Chargers

2018 CALENDAR YEAR ACCOUNTING

Table 4 below provides an accounting of how the EV Program costs for calendar year 2018 are posted to SAP (the Company's accounting system), and reconciles to the STEP accounting. The amount of funds that actually post to SAP in a calendar year is dependent upon when projects complete. For example, most of the custom projects that were committed in 2017 from the 2017 EV Program budget completed in 2018, which means the funds associated with those custom projects posted to SAP in 2018. So while SAP accounting reflects those costs in 2018, they were, in fact, counted towards the $2 million 2017 EV Program budget. Additionally, prescriptive incentives follow a fiscal year of October 1st through September 30th. As such, prescriptive incentives for the 2018 EV Program budget include the timeframe of October 1, 2017 through September 30, 2018, with Q4 2018 prescriptive incentive costs being counted as part of the 2019 EV Program budget. So even though SAP accounting includes prescriptive incentive costs from October 1, 2018, through December 31, 2018, as part of the calendar year, costs during that timeframe for prescriptive incentives are counted towards the $2 million 2019 EV Program budget. Likewise, the prescriptive incentive costs during the timeframe of October 1, 2017, through December 31, 2017, are captured in SAP for that calendar year, but were counted towards the $2 million 2018 EV Program budget, consistent with the fiscal year of the EV Program for prescriptive incentives. Exhibit 2-E provides SAP year over year accounting for each calendar year, which reconciles to the STEP accounting, and Exhibit 2-F provides a year over year accounting for how each $2 million EV Program year budget was allocated.

Table 4 – 2018 Calendar Year Actual SAP Postings

EV Program Actual Postings in SAP by Calendar Year	
Category	**CY 2018**
Time of Use Rate Sign-up	$24,000
Time of Use Load Research Study	$10,000
Time of Use Meters	$79,394
Non-Residential AC Level 2 Chargers – Single Port	$109,990
Non-Residential AC Level 2 Chargers – Multi-Port	$180,716
Non-Residential & Multi-Family DC Fast Chargers	$97,878
Custom Projects	$1,093,820
Administrative Costs	$176,427
Outreach & Awareness	$109,479
Total	**$1,881,703**

2018 ELECTRIC VEHICLE INCENTIVE PROGRAM KEY FINDINGS

Time of Use and Load Research Study

A total of 112 customers received incentives with 2018 EV Program budget funds for participating in the Time of Use program, apart from the load research study. By the end of the EV Program's

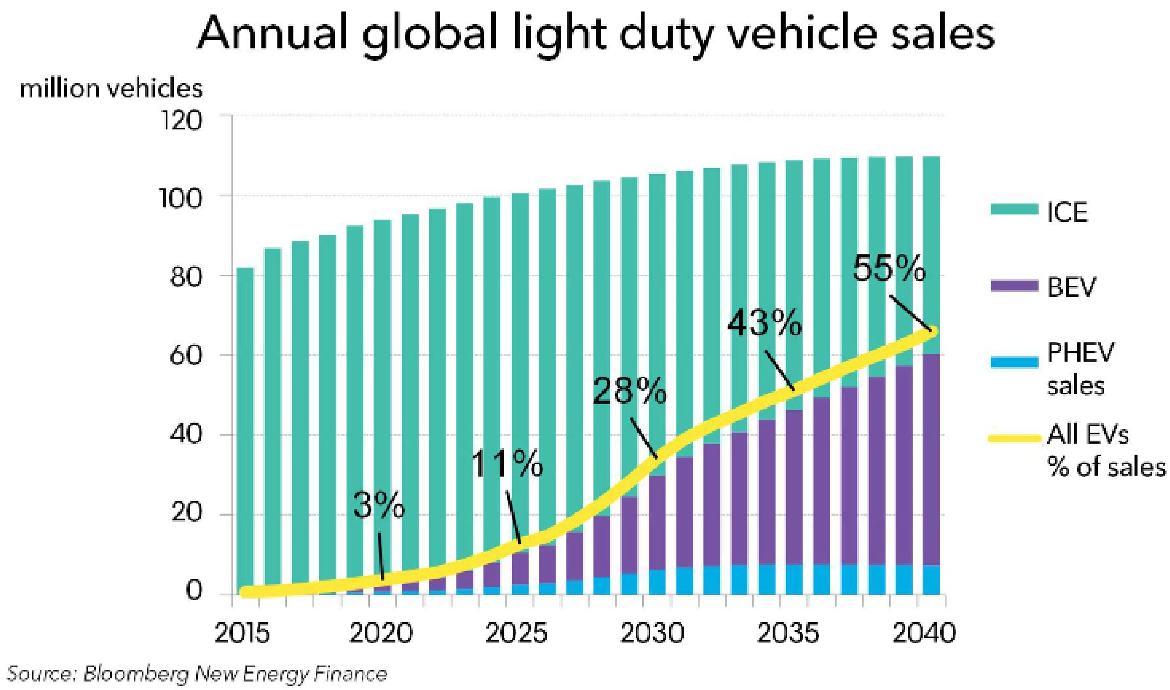
2018 fiscal year, 126 customers were enrolled in the Time of Use program. During 2018, the Time of Use Program was advertised several times outside of the Company's load research study recruitment efforts. In January 2018, an article about the program was included in the customer newsletter. In August 2018, the Company partnered with ChargePoint to send out an email to all ChargePoint app users in Utah. The Company's website[3] describes the time of use rates and the associated $200 incentive. In accordance with the Company's plan and the EV TOU Pilot Reporting Requirements in Exhibit 2-D from the Phase Three Commission Report and Order in Docket No. 16-035-36 dated June 28, 2017, the Company has commenced surveying Time of Use program participants following a one year anniversary letter which informs them of their incremental bill savings or costs of the program.

In 2018, 99 customers were recruited for the electric vehicle load research study. This included 40 on the control group who were not subject to a time-varying rate and 59 on one of the two electric vehicle time of use options. Per the obligations of the settlement made in Docket No. 16-035-36, preliminary results of the study were shared at a meeting with stakeholders on February 7, 2019.

Technology

Plug-in electric vehicle owners in Utah currently represent a small percentage of the total vehicle market (<2% adoption[4]). Electric vehicles owners are considered early adopters and the growth of electric vehicle ownership growth is slow at this stage. Bloomberg New Energy Finance is forecasting sales of electric vehicles to surge from 11 million in 2025 to 30 million in 2030 as they become less expensive to make than internal combustion engines cars.[5] For Utah to achieve this potential adoption, sufficient electric vehicle charging infrastructure must be developed throughout urban and rural Utah. Rocky Mountain Power's electric vehicle program has significantly increased the number of electric vehicle chargers throughout the state of Utah as seen in Table 2.

[3] https://www.rockymountainpower.net/env/ev/utah-ev-time-of-use-rate.html.
[4] https://evadoption.com/ev-market-share/ev-market-share-state/.
[5] https://bnef.turtl.co/story/evo2018?teaser=true.



Participation Distribution

The impact of Rocky Mountain Power's Electric Vehicle Incentive Program has significantly benefited Rocky Mountain Power customers and electric vehicle owners throughout the state of Utah. The program has included participants throughout Utah as noted in Table 2. Electrical Vehicle charging infrastructure is not limited to Salt Lake County. Owning an electric vehicle in Utah is becoming more feasible and the fear of "range anxiety" is becoming less of a barrier for electric vehicle adoption. Interstate electric vehicle charging along Interstate 15 is now a reality and hundreds of additional chargers have been added in Utah during 2018 as a result of the incentive program.

Installation Costs

Install costs for electric vehicle chargers can vary significantly by application. Several factors such as site locations, proximity to electric service, location preference, capacity constraints, and other items impact the overall project costs. Rocky Mountain Power does not collect installation costs for AC Level 2 projects, therefore detailed cost information for Utah's projects is not available. Idaho National Laboratory conducted a multi-year study on electric vehicle installation and determine costs can range from $600 - $50,000 and greater.[6] Their research indicated installation costs ranged from $600 - $12,660 for public and workplace AC Level 2 Chargers. DC

[6] https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf.

fast charger installation costs ranged from $8,500 to over $50,000. Rocky Mountain Power's limited installation data has shown these ranges to be fairly consistent with Utah.

Installation Costs of Electric Vehicle Charging Stations (INL Study)

TYPE OF CHARGING STATION	MINIMUM	MAXIMUM	MEAN
Residential Level 2	A few hundred dollars	$8,000	$1,354
Workplace Level 2	$624	$5,960	$2,223
Public Level 2	$600	$12,660	$3,108
Blink DC Fast Charger	$8,500	$50,000	$22,626

Sources: Idaho National Laboratory, Plugged In: How Americans Charge Their Electric Vehicles, INL/EXT-15-35584, 2015. Page 18.
Idaho National Laboratory, What were the Cost Drivers for Workplace Charging Installations? INL/MIS-15-35390, 2015, Page 2.

Incentive Options

Electric Vehicle charger incentive options available in 2018.

Plug-In Electric Vehicle Charging Station Incentives			Application
Non-residential & multifamily AC Level 2 Charger	Single port	$2,500 per charger up to 75% of total charger cost	Level 2 Charger Application - Word
	Multi-port	$3,500 per charger up to 75% of total charger cost	
Non-residential & multifamily DC Fast Charger	Single port	$30,000 per charger up to 75% of total charger and installation costs	DC Fast Charger Application - Word
	Multi-port	$42,000 per charger up to 75% of total charger and installation costs	
Non-residential & multifamily grant-based custom projects		Custom incentives	Custom Project Funding Application - Word

Participation within each incentive channel is continually being monitored. When the data dictates a need to modify incentive levels or provide different program options, the Company will follow the approved path for recommending and implementing program changes.

PROGRAM PARTNERSHIPS

WestSmartEV – Live Electric

In addition to the STEP Electric Vehicle Program, Rocky Mountain Power received a grant from the Department of Energy (DOE) to accelerate adoption of Plug-in EVs (PEV) in communities located within the Company's electric service territory across the intermountain west by developing a large-scale sustainable PEV charging infrastructure network with coupled PEV adoption programs. The project tasks include: (1) developing electric highway corridors along I-15, I-80, I-70, and I-84; (2) advancing workplace charging within the corridors; (3) incentivizing conversion of fleet vehicles to PEVs within the corridors; (4) building community partnerships to ensure all efforts within the corridors are aligned with long term transportation planning; (5) collecting, processing, and applying data from across all activities to inform project reporting, develop new tools for utility integration of charging infrastructure, and detail lessons learned and best practices; and (6) coordinating outreach, education and dissemination of best practices through a series of workshops and one-on-one meetings with business leaders through community partners.

Attachments:

- Exhibit 2-A: 2018 EV Program Budget Prescriptive Incentives
- Exhibit 2-B: 2018 EV Program Budget Custom Project Commitments
- Exhibit 2-C: 2017 EV Program Custom Project Update
- Exhibit 2-D: EV Program Custom Project Details Year Over Year
- Exhibit 2-E: EV Program Actual SAP Postings by Calendar Year
- Exhibit 2-F: EV Program Budget Allocations Year Over Year

Exhibit 2-A

2018 EV Program Budget Prescriptive Incentives

Project Name	MEASURE_NAME	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_196401	EV DC Fast Charger (single port)	2	2	$ 26,562.96	$ 35,417.28	Dec 5, 2017	Salt Lake City	84111
EVUT_198679	EV DC Fast Charger (single port)	1	1	$ 11,314.54	$ 15,086.05	Dec 12, 2017	Salt Lake City	84115
EVUT_217344	EV DC Fast Charger (single port)	2	2	$ 60,000.00	$ 183,139.70	Feb 6, 2018	Park City	84098
EVUT_186162	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 12,335.00	Oct 2, 2017	Sandy	84070
EVUT_188740	EV Level 2 Charger (multi port)	7	14	$ 21,376.50	$ 28,502.00	Nov 21, 2017	Salt Lake City	84121
EVUT_188762	EV Level 2 Charger (multi port)	1	2	$ 3,142.50	$ 4,190.00	Oct 20, 2017	Midvale	84047
EVUT_194979	EV Level 2 Charger (multi port)	4	8	$ 12,322.50	$ 16,430.00	Nov 21, 2017	Salt Lake City	84111
EVUT_195086	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 13,410.00	Nov 27, 2017	Orem	84058
EVUT_196089	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 12,452.20	Nov 30, 2017	Salt Lake City	84116
EVUT_196121	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 7,454.00	Feb 5, 2018	West Jordan	84088
EVUT_196401	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,100.00	Dec 5, 2017	Salt Lake City	84111
EVUT_209801	EV Level 2 Charger (multi port)	4	8	$ 4,044.60	$ 5,392.80	Dec 21, 2017	Midvale	84047
EVUT_209902	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 15,395.00	Dec 22, 2017	Salt Lake City	84103
EVUT_212063	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,295.00	Jan 29, 2018	Draper	84020
EVUT_213013	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 11,160.00	Jan 25, 2018	Salt Lake City	84115
EVUT_217187	EV Level 2 Charger (multi port)	2	4	$ 3,248.55	$ 4,331.40	Jan 31, 2018	Salt Lake City	84106
EVUT_222706	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,979.00	Mar 1, 2018	Salt Lake City	84116
EVUT_222706	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,541.00	Mar 1, 2018	Salt Lake City	84116
EVUT_222709	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,979.00	Mar 1, 2018	Salt Lake City	84116
EVUT_222709	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,541.00	Mar 1, 2018	Salt Lake City	84116
EVUT_222774	EV Level 2 Charger (multi port)	2	4	$ 5,636.25	$ 7,515.00	Mar 6, 2018	Draper	84020
EVUT_226149	EV Level 2 Charger (multi port)	1	2	$ 2,391.82	$ 3,189.10	Apr 4, 2018	American Fork	84003
EVUT_226150	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 14,012.00	Apr 13, 2018	Salt Lake City	84102
EVUT_228994	EV Level 2 Charger (multi port)	1	2	$ 3,142.50	$ 4,190.00	May 18, 2018	Midvale	84047
EVUT_229361	EV Level 2 Charger (multi port)	6	12	$ 12,050.55	$ 16,067.40	May 14, 2018	Salt Lake City	84115
EVUT_230034	EV Level 2 Charger (multi port)	5	10	$ 17,500.00	$ 25,492.00	May 22, 2018	South Jordan	84095
EVUT_231154	EV Level 2 Charger (multi port)	1	2	$ 2,391.82	$ 3,189.10	Jun 5, 2018	North Salt Lake	84054
EVUT_231315	EV Level 2 Charger (multi port)	1	2	$ 2,250.00	$ 3,000.00	Jun 6, 2018	Farmington	84025
EVUT_234401	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,699.00	Jul 6, 2018	Salt Lake City	84106
EVUT_234445	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 13,620.00	Jul 10, 2018	Draper	84020
EVUT_234445	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,323.33	Jul 10, 2018	Draper	84020
EVUT_235757	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,699.00	Jul 30, 2018	Sandy	84070
EVUT_235757	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,262.00	Jul 30, 2018	Sandy	84070
EVUT_236242	EV Level 2 Charger (multi port)	2	4	$ 1,057.50	$ 1,410.00	Aug 2, 2018	Pleasant Grove	84062
EVUT_238007	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,489.00	Aug 14, 2018	Vernal	84078
EVUT_239233	EV Level 2 Charger (multi port)	1	2	$ 2,250.00	$ 3,000.00	Aug 28, 2018	Farmington	84025
EVUT_240193	EV Level 2 Charger (multi port)	1	2	$ 1,011.15	$ 1,348.20	Sep 10, 2018	Salt Lake City	84108
EVUT_242228	EV Level 2 Charger (multi port)	2	4	$ 4,016.85	$ 5,355.80	Sep 17, 2018	Tooele	84074
EVUT_242431	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,262.00	Sep 20, 2018	Salt Lake City	84111
EVUT_242431	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,699.00	Sep 20, 2018	Salt Lake City	84111
EVUT_243149	EV Level 2 Charger (multi port)	1	2	$ 1,011.15	$ 1,348.20	Sep 27, 2018	Salt Lake City	84104
EVUT_185927	EV Level 2 Charger (single port)	1	1	$ 750.00	$ 1,000.00	Nov 10, 2017	Lindon	84042
EVUT_188133	EV Level 2 Charger (single port)	4	4	$ 1,317.00	$ 1,756.00	Oct 12, 2017	Midvale	84047
EVUT_188134	EV Level 2 Charger (single port)	3	3	$ 1,144.13	$ 1,525.50	Oct 12, 2017	South Jordan	84095
EVUT_188135	EV Level 2 Charger (single port)	4	4	$ 1,317.00	$ 1,756.00	Oct 12, 2017	Tremonton	84337
EVUT_188136	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 12, 2017	Salt Lake City	84103
EVUT_188149	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 12, 2017	Salt Lake City	84115
EVUT_188150	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 12, 2017	Sandy	84092
EVUT_188151	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 12, 2017	Park City	84060
EVUT_188153	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 12, 2017	Park City	84060
EVUT_188741	EV Level 2 Charger (single port)	1	1	$ 381.38	$ 508.50	Oct 18, 2017	Salt Lake City	84124
EVUT_188742	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 18, 2017	Ogden	84403
EVUT_188743	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 18, 2017	Syracuse	84075
EVUT_190005	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 25, 2017	Salt Lake City	84101
EVUT_190014	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 26, 2017	Park City	84060
EVUT_191146	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 31, 2017	Farmington	84025
EVUT_191147	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 31, 2017	Park City	84060
EVUT_191232	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Oct 31, 2017	Park City	84060
EVUT_191256	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Nov 1, 2017	Sandy	84092
EVUT_194082	EV Level 2 Charger (single port)	3	3	$ 987.75	$ 1,317.00	Nov 10, 2017	Salt Lake City	84101
EVUT_194100	EV Level 2 Charger (single port)	4	4	$ 1,317.00	$ 1,756.00	Nov 13, 2017	Draper	84020
EVUT_194101	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Nov 13, 2017	Salt Lake City	84117
EVUT_195086	EV Level 2 Charger (single port)	1	1	$ 345.34	$ 460.46	Nov 27, 2017	Orem	84058
EVUT_196401	EV Level 2 Charger (single port)	2	2	$ 1,224.00	$ 1,632.00	Dec 5, 2017	Salt Lake City	84111
EVUT_212062	EV Level 2 Charger (single port)	2	2	$ 952.50	$ 1,270.00	Jan 4, 2018	Tremonton	84337
EVUT_212076	EV Level 2 Charger (single port)	8	8	$ 9,000.00	$ 12,000.00	Jan 5, 2018	Clearfield	84015
EVUT_217402	EV Level 2 Charger (single port)	4	4	$ 1,317.00	$ 1,756.00	Feb 7, 2018	West Valley City	84119
EVUT_217449	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Feb 9, 2018	Hill AFB	84056
EVUT_223312	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Mar 8, 2018	Riverton	84065
EVUT_223313	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Mar 8, 2018	Sandy	84070
EVUT_224740	EV Level 2 Charger (single port)	8	8	$ 2,634.00	$ 3,512.00	Mar 14, 2018	Provo	84604
EVUT_224751	EV Level 2 Charger (single port)	5	5	$ 5,058.00	$ 6,744.00	Mar 16, 2018	Logan	84321
EVUT_225304	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Mar 19, 2018	Salt Lake City	84103
EVUT_225305	EV Level 2 Charger (single port)	1	1	$ 987.75	$ 1,317.00	Mar 19, 2018	Salt Lake City	84111
EVUT_225309	EV Level 2 Charger (single port)	20	20	$ 6,585.00	$ 8,780.00	Mar 19, 2018	Salt Lake City	84108
EVUT_225324	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	Mar 20, 2018	Bluff	84512
EVUT_225327	EV Level 2 Charger (single port)	1	1	$ 381.38	$ 508.50	Mar 20, 2018	Midvale	84047
EVUT_225788	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Mar 26, 2018	Salt Lake City	84116
EVUT_225904	EV Level 2 Charger (single port)	8	8	$ 11,128.80	$ 14,838.40	Mar 28, 2018	Park City	84060
EVUT_225904	EV Level 2 Charger (single port)	10	10	$ 6,879.38	$ 9,172.50	Mar 28, 2018	Park City	84060
EVUT_225947	EV Level 2 Charger (single port)	5	5	$ 1,646.25	$ 2,195.00	Mar 29, 2018	Midvale	84047
EVUT_226089	EV Level 2 Charger (single port)	2	2	$ 997.50	$ 1,330.00	Apr 12, 2018	Salt Lake City	84115
EVUT_226824	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Apr 11, 2018	Grantsville	84029
EVUT_227149	EV Level 2 Charger (single port)	8	8	$ 10,051.50	$ 13,402.00	Apr 16, 2018	Clearfield	84015
EVUT_228989	EV Level 2 Charger (single port)	1	1	$ 444.75	$ 593.00	May 7, 2018	Salt Lake City	84115
EVUT_228989	EV Level 2 Charger (single port)	3	3	$ 1,134.00	$ 1,512.00	May 7, 2018	Salt Lake City	84115
EVUT_230683	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	May 31, 2018	West Valley City	84119
EVUT_231325	EV Level 2 Charger (single port)	28	28	$ 9,219.00	$ 12,292.00	Jun 8, 2018	Orem	84097
EVUT_231326	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	Jun 8, 2018	Bluff	84512
EVUT_231332	EV Level 2 Charger (single port)	1	1	$ 375.00	$ 500.00	Jun 8, 2018	Salt Lake City	84115
EVUT_232092	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Jun 18, 2018	West Valley City	84119
EVUT_232336	EV Level 2 Charger (single port)	1	1	$ 373.50	$ 498.00	Jun 19, 2018	Draper	84020
EVUT_232337	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	Jun 20, 2018	Riverton	84065
EVUT_232338	EV Level 2 Charger (single port)	2	2	$ 1,240.88	$ 1,654.50	Jun 20, 2018	Salt Lake City	84108
EVUT_232365	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	Jun 25, 2018	Salt Lake City	84116
EVUT_232695	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	Jun 28, 2018	Sandy	84070
EVUT_234409	EV Level 2 Charger (single port)	5	5	$ 5,058.00	$ 6,744.00	Jul 6, 2018	Salt Lake City	84111
EVUT_236441	EV Level 2 Charger (single port)	2	2	$ 4,785.00	$ 6,380.00	Aug 6, 2018	Salt Lake City	84123
EVUT_238909	EV Level 2 Charger (single port)	1	1	$ 375.00	$ 500.00	Aug 24, 2018	West Jordan	84088
EVUT_243150	EV Level 2 Charger (single port)	5	5	$ 1,646.25	$ 2,195.00	Sep 27, 2018	Hill AFB	84056
EVUT_243151	EV Level 2 Charger (single port)	5	5	$ 1,646.25	$ 2,195.00	Sep 27, 2018	Hill AFB	84056
N/A	EV Time of Use Load Research Study	50	-	$ 10,000.00	-	Q4 2017 - Q3 2018	N/A	
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Alpine	84004
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	American Fork	84003

Project Name	MEASURE_NAME	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Clearfield	84015
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Draper	84020
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Farmington	84025
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	3	-	$ 600.00	-	Q4 2017 - Q3 2018	Herriman	84096
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Logan	84341
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Midvale	84047
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Ogden	84404
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Orem	84057
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	4	-	$ 800.00	-	Q4 2017 - Q3 2018	Park City	84098
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Roy	84067
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	9	-	$ 1,800.00	-	Q4 2017 - Q3 2018	Salt Lake City	84104
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	4	-	$ 800.00	-	Q4 2017 - Q3 2018	Sandy	84092
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	3	-	$ 600.00	-	Q4 2017 - Q3 2018	South Jordan	84009
Various	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	West Jordan	84084
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Alpine	84004
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	American Fork	84003
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Brigham City	84302
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Coalville	84017
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	6	-	$ 1,200.00	-	Q4 2017 - Q3 2018	Draper	84020
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Eagle Mountain	84005
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Farmington	84025
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	4	-	$ 800.00	-	Q4 2017 - Q3 2018	Herriman	84096
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Ivins	84738
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Kaysville	84037
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	La Verkin	84745
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Layton	84041
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Lindon	84042
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Logan	84321
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Magna	84044
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Midvale	84047
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	North Salt Lake	84054
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	4	-	$ 800.00	-	Q4 2017 - Q3 2018	Ogden	84401
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Orem	84058
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Richmond	84333
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	3	-	$ 600.00	-	Q4 2017 - Q3 2018	Riverton	84065
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	12	-	$ 2,400.00	-	Q4 2017 - Q3 2018	Salt Lake City	84103
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	6	-	$ 1,200.00	-	Q4 2017 - Q3 2018	Sandy	84070
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	3	-	$ 600.00	-	Q4 2017 - Q3 2018	Saratoga Springs	84045
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	South Jordan	84095
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Tooele	84074
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	Tremonton	84337
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	2	-	$ 400.00	-	Q4 2017 - Q3 2018	West Jordan	84081
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	3	-	$ 600.00	-	Q4 2017 - Q3 2018	West Valley City	84119
Various	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	Q4 2017 - Q3 2018	Woods Cross	84087

Sub-Totals	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	$ 7,600
	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	$ 14,800
	EV Time of Use Load Research Study	$ 10,000
	Non-Residential AC Level 2 Charger Single Port Incentive Payments	$ 102,907
	Non-Residential AC Level 2 Charger Multi-Port Incentive Payments	$ 189,844
	Non-Residential & Multi-Family DC Fast Charger Incentive Payments	$ 97,878

Exhibit 2-B

2018 EV Program Budget Custom Project Commitments

2018 EV Program Budget Custom Projects

(Committed Funds not spent in 2018 calendar year)

Custom Projects	Committed 2018 Funds	Year Completed	$ Paid	$ Variance
Project 10	$ 308,000			
Project 11	$ 70,000			
Project 12	$ 120,500			
Project 13	$ 500,000			
Total	**$ 998,500**		**$ -**	**$ -**

Exhibit 2-C

2017 EV Program Custom Project Update

2017 EV Program Budget Custom Projects

(Committed Funds not spent in 2017 calendar year)

Custom Projects	Committed 2017 Funds	Year Completed	$ Paid	$ Variance
Project 1	$ 250,000	2018	$ 250,000	$ -
Project 2	$ 8,000			
Project 3	$ 470,000	2018	$ 456,441	$ (13,559)
Project 4	$ 153,000	2018	$ 153,000	$ -
Project 5	$ 237,500			
Project 6	$ 50,000	2018	$ 50,000	$ -
Project 7	$ 57,005	2018	$ 56,963	$ (42)
Project 8	$ 69,369	2018	$ 69,369	$ -
Project 9	$ 65,000	2018	$ 58,047	$ (6,953)
Total	**$ 1,359,874**		**$ 1,093,820**	**$ (20,554)**

Exhibit 2-D

EV Program Custom Project Details Year Over Year

Custom EV Projects Year over Year Committed vs. Completed

Committed Information					Completed Information			
Year Committed	Project #	Description	Equipment type	Incentive	Year Completed	Description	Equipment type	Incentive
2017	Project 1	Installation of an electric bus charger for an electric bus that will provide free public transit throughout a community. The electric bus will reduce traffic congestion and improve carbon emissions.	500 kW Electric Bus Charger	$ 250,000	2018	No change from committed.	No change from committed.	$ 250,000
2017	Project 2	Project 2 covers three aspects of installation and monitoring that include: 1) fees for materials associated with installing charging units in snowy, high-alpine environments; 2) two meters to track monthly usage of Tesla and standard chargers (as this would otherwise not be available,); and 3) develop a comprehensive marketing plan to promote electric vehicle chargers and promote electric vehicles at a resort.	4 AC Level 2 Chargers (single port)	$ 8,000	Pending			
2017	Project 3	The goal of this project is to provide EV charging along major traffic corridors in Utah. DC Fast chargers will be strategically placed along interstate corridor to reduce range anxiety among EV drivers.	6 AC Level 2 Chargers & 6 DC Fast Chargers (single port)	$ 470,000	2018	Acutal project costs were less than intial estimates, resulting in a lower incentive payment.	No change from committed.	$ 456,441
2017	Project 4	This project aims to provide electric vehicle charging for the public and employees at a prominent location in down town Salt Lake City by installing 12 AC Level 2 dual port charging stations, and infrastructure for seven future stations.	12 AC Level 2 Chargers (multi-port)	$ 153,000	2018	No change from committed.	No change from committed.	$ 153,000
2017	Project 5	The goal of this project is to significantly expand and enhance the EV charging infrastructure at a major workplace in the Salt Lake Valley. South Parking Lot: • Five dual-port Level 2 EV chargers which will be pay-for-use and available to the public. • Three dual-port Level 2 EV chargers for fleet and enterprise vehicles. • One Level 3 pay-for-use EV charger in the east-side visitor parking area. If unable to support a Level 3 charger, the plan would be to install an additional dual-port Level 2 EV charger at this location. North Parking Lot: • Two dual-port Level 2 pay-for-use EV chargers which will be available to the public. • Tech Center: We are proposing to have two dual-port Level 2 chargers for state vehicles. We are also proposing to add two pay-for-use dual-port Level 2 chargers that would be in front of the Tech Center and be available for public use. • Multiple EV chargers throughout the campus facilities	18 AC Level 2 Chargers & 1 DC Fast Charger (multi-port)	$ 237,500	Pending			
2017	Project 6	A city plans to collaborate with commercial and industrial businesses to increase the adoption of electric vehicle purchases within the city and county in order to satisfy growing driver demand; increase property value, complement LEED and Green Building Programs, and achieve the city community fuel, carbon and energy goals. The project strives to use innovations, test new ideas, and pursue interesting opportunities to better understand how consumers think about and use PEVs to further increase the market penetration of PEVs and hybrids. Installed on city property for public use.	2 AC Level 2 Chargers and 1 DC Fast Charger (single port)	$ 50,000	2018	No change from committed.	No change from committed.	$ 50,000
2017	Project 7	The site selected for the EVSE installation is an Electric Vehicle & Roadway (EVR) Research Facility and electrified test track. The EVR is a state-of-the-art research facility at the forefront of electric vehicle charging and roadway technology development. The EVR is the most appropriate location in Rocky Mountain Power's service area to conduct high-level EV research, enhance infrastructure, and promote sustainable transportation. This project proposes to install two AC Level II chargers and one DC Fast Charger. All ports will be equipped with an advanced network and innovative data tracking capabilities. The DC Fast Charger as proposed herein will be the first available to all EV drivers in Northern Utah. The customizable data will provide further research, grants, and contracts as well as fortify existing research to help develop industry partnerships.	2 AC Level 2 Chargers and 1 DC Fast Charger (multi-port)	$ 57,005	2018	Acutal project costs were less than intial estimates, resulting in a lower incentive payment.	No change from committed.	$ 56,963
2017	Project 8	This site plans on installing four new Level 2 charging stations and one DC fast charger to increase the amount of chargers available to the public, and staff. This site currently has two Level 2 dual port charging stations. One located at the main entrance to campus for the public, free of charge in the Visitor Lot. The other charging station is located by the Facilities building for fleet vehicles. Three new level 2 charging stations will be located around the entire main grounds with one located at the West grounds. The DC Fast Charger will be located in the visitor lot in the front of campus. This is to serve the growing public facility and will be positioned with good access to I-15.	4 AC Level 2 Chargers and 1 DC Fast Charger (multi-port)	$ 69,369	2018	No change from committed.	No change from committed.	$ 69,369
2017	Project 9	This site intends to install EVSE in the parking lot next to an LEED Platinum certified Building. This project involves installing one DC Fast Charger under the solar canopy in the parking lot, and one dual port AC Level 2 charger.	1 AC Level 2 Charger and 1 DC Fast Charger (multi-port)	$ 65,000	2018	Minor change in project scope	AC Level 2 charger was not installed	$ 58,047
2018	Project 10	A major City will be installing a city-wide system of EV equipment for residents, guests, travelers, and ride-share drivers. The City is in a key strategic position to embark on such a wide-ranging project. The City is centrally located in the Wasatch Front and has notable popular attractions within its borders which attract a considerable amount of vehicles. The city experiences significant air pollution during bad inversion events in the winter and ozone buildup in the summer. To mitigate these effects, the city believes that by providing EV equipment on a city-wide scale, residents will be encouraged to adopt zero-emissions vehicles as a way to improve air quality.		$ 308,000	Pending			
2018	Project 11	A City is in the final stages of completing a new 130,000 sq-ft Public Works facility. The City has been evaluating and preparing to transition to electric fleet vehicles and is preparing to install charging stations at the new facility to service residents, employees, and fleet vehicles.		$ 70,000	Pending			
2018	Project 12	A County is committed to leading sustainability actions that balance their fiduciary responsibility to taxpayers with stewardship of our extraordinary natural surroundings, while aligning with partners who have common goals to serve the public. This custom project provides an opportunity for the County and Rocky Mountain Power to partner together in service to residents, local governments, and businesses by expanding the EV charging infrastructure in the County. A DC Fast charger was selected for installation in to fill the gap in charging stations along the east-west Interstate 80 corridor. Level 2 chargers were selected for their lower cost and ease of installation to serve the County fleet as well as residents. This project will provide EV charging infrastructure in the County where little, if any, EV charging exists. In so doing, the County and other municipal governments will be able to deploy more EVs that eliminate tailpipe emissions and lower annual operating costs; provide charging for County employees as well as residents, and set an example for other businesses to provide charging stations.		$ 120,500	Pending			
2018	Project 13	A public transit group will be transitioning to electric buses. The chargers will be used for on-route use and battery charging while parked in bus depots.		$ 500,000	Pending			

Exhibit 2-E

EV Program Actual SAP Postings by Calendar Year

Actual SAP Postings by Calendar Year for EV Program

EV Program Actual Postings in SAP by Calendar Year						
Cost Category	**CY 2017**	**CY 2018***	**CY 2019**	**CY 2020**	**CY 2021**	**TOTAL**
Time of Use Rate Sign-up	$ 6,800	$ 24,000				**$ 30,800**
Time of Use Load Research Study Participation		$ 10,000				**$ 10,000**
Time of Use Meters		$ 79,394				**$ 79,394**
Non-Residential AC Level 2 Chargers – Single Port	$ 116,157	$ 109,990				**$ 226,147**
Non-Residential AC Level 2 Chargers – Multi-Port		$ 180,716				**$ 180,716**
Non-Residential & Multi-Family DC Fast Chargers	$ 54,618	$ 97,878				**$ 152,496**
Custom Projects	$ -	$ 1,093,820				**$ 1,093,820**
Administration	$ 176,176	$ 176,427				**$ 352,603**
Outreach & Awareness	$ 133,751	$ 109,479				**$ 243,230**
Total	**$ 487,502**	**$ 1,881,703**				**$ 2,369,205**

* Includes transferred (OMAG) costs of program expenditures prior to Commision approval in July 2017.

Exhibit 2-F

EV Program Budget Allocations Year Over Year

EV Program Budget Costs / Committed Funds by Year

	2017 EV Budget Costs / Committed Funds			2018 EV Budget Costs / Committed Funds		
	Prescriptive Incentives Completed Q3 2017	**Custom Incentives Committed Q3 - Q4 2017**	**Total 2017**	**Prescriptive Incentives Completed Q4 2017 - Q3 2018**	**Custom Incentives Committed Q1 - Q4 2018**	**Total 2018**
TOU Incentives	$ 2,800		$ 2,800	$ 22,400		$ 22,400
TOU Load Research Incentives				$ 10,000		$ 10,000
TOU Meters						$ 79,394
AC Level 2 Incentives (Single Port)	$ 65,309		$ 65,309	$ 102,907		$ 102,907
AC Level 2 Incentives (Multiple Port)				$ 189,844		$ 189,844
DC Fast Charger Incentives	$ 54,618		$ 54,618	$ 97,878		$ 97,878
Custom Project Incentives		$ 1,359,874	$ 1,359,874		$ 998,500	$ 998,500
Administration			$ 176,176			$ 175,427
Outreach & Awareness			$ 133,751			$ 109,479
		Total	**$ 1,792,528**		**Total**	**$ 1,785,828**

TOTAL ALLOCATED BUDGET FOR ALL YEARS	**$ 3,578,356**

STEP Project Report

Period Ended: December 31, 2018

STEP Project Name: Co-firing Tests of Woody-waste (biomass) Materials in Hunter Unit 3

Project Objective:

This project consists of two co-firing tests of processed woody-waste (biomass) to be fired in the Hunter Unit 3 boiler. The target heat input from woody waste material is 10% of the required total fuel input of the Unit 3 boiler, with coal making up the remaining 90%. The processed woody waste will consist of wood resources including scrap and waste material from logging operations and wood processing plants. A torrified product and a steam exploded product are the two types of processed woody waste that will be tested. The primary objective of these tests will be to determine whether these processed biomass fuels can effectively be used as "drop-in" replacements in lieu of burning coal. In addition to displacing coal and its attendant CO_2 and NOx emissions, using these processed woody waste materials will have the benefit of minimizing particulate matter emissions associated with either controlled or uncontrolled burns of collected forest materials. These tests will also be used as a mechanism to further evaluate and demonstrate these processed woody waste technologies.

In Docket No. 16-035-36, the Commission approved the Company's request to increase funding for the Co-Fired Woody Waste project by $748,980, utilizing funds from the canceled Alternative NOx project. With these additional funds, the Company expanded the scope to substantially increase the amount of biomass material processed by AEG Coalswitch to extend the number of hours in the test burn, to increase the measurements taken during the test to gain a better understanding of boiler operation during the co-firing, and to hire a third party engineer with extensive biomass experience to assist with project planning and execution. The supply contracts with processed woody waste suppliers are being updated and the test burns will be rescheduled according to the fuel supply schedules in the updated contracts. AEG, the supplier of the steam exploded biomass product, has indicated they will provide processed fuel for the test burn in early 2020.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$0.00	$177,032	$177,032
Annual Spend	$0.00	$230,277	$230,277
Committed Funds	$0.00	$0.00	$0.00

Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$0.00	$230,277	$230,277

Project Milestones:

Project Milestones	Delivery Date	Status/Progress
Contracts with PacifiCorp complete	UofU – June 27, 2017 Amaron – February 14, 2018 AEG – March 2, 2018	Complete Complete Complete
Select biomass fuel source	December 1, 2017	Complete
Process first ton of biomass material	Amaron – March 9, 2018	Amaron – Complete
Sign new Supply Agreements	May 31, 2019	On Target
Hire 3rd Party Expert	May 31, 2019	On Target
Revise Schedule for Expanded Test Burn	July 1, 2019	On Target
All biomass material delivered to the Hunter plant	To Be Determined Once Revised Schedule is Completed	
Finalize test burn plan and operating procedures	To Be Determined Once Revised Schedule is Completed	
Test burn monitoring equipment installation complete	To Be Determined Once Revised Schedule is Completed	
Test burn conducted	To Be Determined Once Revised Schedule is Completed	
Final report completed	To Be Determined Once Revised Schedule is Completed	

Key Challenges, Findings, Results and Lessons Learned:

Challenges	Anticipated Outcome	Findings	Results	Lessons Learned
Secure raw biomass material	Several biomass sources were	Finding biomass sources that could guarantee sufficient material	Amaron is using Woodscapes as	

	researched and priced.	availability at a specific price was a challenge.	their biomass supplier.	
Secure supply agreement with AEG	Project will be supplied from a processing facility in the eastern US rather than Utah.	The Company and AEG are trying to reach a mutually beneficial agreement.		
Design the test burn and monitoring plan	University of Utah is developing the project plan.	The test burn and monitoring plan is being updated in response to the project expansion approval.		
Address any plant operation or air permit concerns	Work with Jim Doak to notify the State of Utah about the project.			

Program Benefits:

If successful, the project will create an option to use forest waste products to generate electricity without requiring construction of new facilities or expensive equipment retrofits at existing coal plants. The limited amount of biomass material that exists in Utah and the mountain west region is a supply chain problem that makes it very difficult to justify the capital costs required to retrofit an existing plant or build a new biomass specific generation facility. The ability of an existing coal plant to supplement its coal fuel with biomass, when biomass is available, eliminates the supply chain problem of needing to have continuous resources available to fuel a biomass-specific generation resource.

Burning processed biomass in a coal plant with a controlled burn environment and emissions control equipment should provide air quality benefits compared to the air emissions of forest fires or the intentional burning of slash piles in an open air environment. If the test proves successful, it could be a used in future initiatives to improve forest health and clean air.

Potential future applications for similar projects:

The ability to burn biomass in existing coal plants would create a new option for disposing of wood waste from forest thinning activities. Wood waste products that currently have little or no commercial value could be burned in a controlled environment, rather than an open air environment, and would provide the benefit of generating electricity.

STEP Project Report

Period Ending December 31, 2018

STEP Program Name: Huntington Plant Neural Network Optimization Project (NOx Neural Network Implementation)

Program Objective:

The objective of PacifiCorp's study and use of Neural Network Optimization/Optimizers ("NNO") for control optimization is to achieve the best possible unit efficiency with the lowest possible emissions while safely operating our Electrical Generations Units ("EGU"). The goal of control optimization is unit specific; however, optimization efforts should always address the following: safety, environmental constraints, equipment condition, and plant or fleet operating requirements. There are three factors affected by control optimization that must always govern optimization efforts within the PacifiCorp fleet. In order of priority they are:

> Safety – Optimization efforts will not jeopardize personnel safety.
>
> Environment - Emissions limits will take precedence over all optimization aspects except safety.
>
> Availability – Emphasis on maintaining unit reliability will take precedence over optimizing the unit for efficiency.

This project will provide a detailed analysis of the implementation of NNO on unit controls. The NNO control optimization will initially be applied to the combustion control system. During this time the available control inputs and outputs will be evaluated relative to their use or weight by the NNO. With the combustion optimization targeting nitrogen oxides ("NO_X") for improved emissions and carbon monoxide ("CO") for improved emissions and unit efficiency. Once the combustion control phase is well underway additional plant systems will be evaluated for control optimization. It is expected that the Flue Gas Desulfurization ("FGD") control systems will be next for control optimization. The experience gained from combustion control optimization will guide those decisions.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$547,807	$178,924	$726,731
Annual Spend	$457,767*	$207,616	$665,383
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$457,767	$207,616	$665,383

*Correction from 2017 Annual STEP Report: $30,000 in External OMAG Expenses was reported in CY 2017, however this amount was in error and is correctly reflected as Annual Spend in this report. The total spend for CY 2017 was not affected.

Program Milestones:

Milestones	Target Date	Status/Progress
Project Kick off Meeting	January 26, 2017	Complete
Contracts with PacifiCorp complete	February 15, 2017	Univ. of Utah – Complete Griffin Software – Complete
Instruments upgrades complete	June 5, 2017	Complete
Base Line Data set established. 3 Month Average	April 1 – June 30, 2017	For the 425 – 450 MW range NO_x = 0.23 lbs/mmbtu CO = 348 ppm
Unit base line optimization Manual Boiler tuning	July 27 – August 5, 2017	Complete
Initial installation complete	August 11, 2017	Complete
Neural Network Model and Predictors running	November, 30 2017	Complete
Optimizer turned on	March 31, 2018	Complete
Parametric study on optimization of auxiliary systems complete	August 31, 2018	Cooling Tower Data being analyzed site visit by U of U completed
Annual progress report complete for Year 2	March 31, 2019	Complete
Cooling Tower control systems	June 30, 2019	On Target
Exploratory study on dynamic optimization with set point ramping complete	August 31, 2019	On Target
Final study on impact on emissions complete	December 31, 2019	On Target

Key Program Findings/ Challenges / Lessons Learned:

Challenges	Results/Progress
a. Communications between the Neural Network Server and the Distributed Control System	Problems with process control technology have been identified and resolved. Changed communication protocol to Modbus to prevent further issues in the future. – Complete
b. Supplied Basic Optimization component of software incomplete	Building new optimization algorithm as interim solution. Griffin optimizer is been refined. –Complete
c. Reducing NO_x	Continued model tuning and using predictor at near full load operations is showing positive reduction of NO_x. As seen below of about 18%. – Ongoing
d. Reducing CO and unburned coal improvement.	The initial indication for CO reduction is very positive. Initially seen a large improvement with as much a 50% reduction in CO. – Ongoing
e. Reheat tube temperatures high during load ramping up events forces less than optimal configuration to be used.	Several solutions to this problem have been tried. A solution that allows optimization and controls temperature has not been found yet. Added some rules to minimize this with good results. – Complete
f. Low load NOx reduction very difficult due to minimum air flow requirement.	Air flow monitoring devices have been installed and are currently being added to control system. Should allow reduction of air flow, and improved NOx reduction at low load. – Tuning ongoing and new lows being tried, down to 15% load.
g. FGD control systems	Not started at this time. Changed to Cooling Tower Optimization with the variable frequency drive motors
h. Cooling Tower Optimization	Operating data and weather data has been collected. Varying wind conditions modeling will be a challenge.
i. Upgrading Neural Network Server for required Cyber Security controls	In progress

Program Progress and Benefits:

The Griffin system Neural Network is installed and operational. The Combustion Optimizations System ("COS") has been fully implemented on this unit with very good results. However, there was definitely a learning curve on how the data was modeled and the output recommendations implemented. Some difficulties were encountered, including windbox pressure excursions, and high reheat tube metal temperatures. The solution to high tube temperatures involved a combination of soot blowing, increased O_2, and manipulation of Separated Over Fire Air tilts. The effort to control tube temperatures is counter to what is needed to control NO_X. Griffin uses a particle swarm optimizer to determine if one damper position is better than another. This should work by using the neural model to predict NO_X at the current damper positions. The optimizer then selects values for several other dampers and performs what ifs. The neural model then predicts the NO_X at each damper position. Each position is then adjusted to a new position closer to the position with the lowest NO_X. This process is repeated several thousand times, until one is selected as the lowest NO_X. Then this process continues. It has been difficult to have the model numbers converge into a particular area for improvement. This has been improved on by adding more rules for how the control bias are used. These "Expert Rules" have been developed with the knowledge of the operators and combustion tuners. These rules then guide the COS for the control bias to get the resulting improvements. For the last quarter of 2018 (Oct – Dec), the COS was on 93% of the time.

The sootblower control module Knowledgeable Soot Blowing ("KSB") has been installed and operational. This KSB is strictly an "Expert Rules" based system. The rules have also been developed with the significant input of the operators. The KSB has seen percent usage time increase and is used over 90% of the time now. The number of sootblower operations for the wall blowers has been reduced and seems to reasonably follow coal quality as expected when the coal seems to get worse the operators tend to turn it off. This reduction translated to an improvement in heat rate. The operators have really fully accepted the KSB system with good results. For the last quarter of 2018 (Oct – Dec), the KSB was on 65% of the time and improving.

For tracking proposes, CO_2 has also been looked at, as it is an indicator of Heat Rate. As CO_2 drops it is an indication of improved heat rate. Since the potential for CO_2 reductions was not identified in the original scope of this STEP project, no analysis of CO_2 has been done.

The success of this project is encouraging based on the reduction benefits in both NO_X and especially CO compared to the three month baseline data as shown below. Since NO_X and CO do vary by load, we only want to compare like loads during the given time period, as can be seen in Chart 1. For comparison purposes, the consistent load range of 425-450 mw was chosen. This is 90 – 95% of full load. Since this three month baseline date was in the spring of 2017, loads were typically lower compared to the last quarter of 2018. Even though the load profile of the unit has changed, the NO_X at all loads have been reduced and trended down through the last three months of 2018.

	NO_X	*CO*	*CO2*	
Apr to Jun '17	**0.230**	**348**	**11.14%**	**Baseline Charts 1 & 3**
Oct to Dec '18	**0.187**	**126**	**10.41%**	**Charts 2 & 4**
% Reduction	18.6%	63.8%	6.5%	vs baseline

The data/charts for these can be seen in charts 1 – 4.

For the month of December, Unit 2 with the unit load average been higher than typical, the NO_X average for all loads for the month was 0.181#/mmbtu's.

Based on these results the program so far has been a success. Initially the Company hoped that the NO_X would be reduced 10 – 20% and we are seeing the result near the top end. With the continued support from the University of Utah and Griffin, the optimizer is being tweaked and will continue running in 2019, with the possibility of optimizing the cooling tower as the next challenge.

Potential future applications for similar projects:

With the positive result, the Company is evaluating whether to do a similar Neural Network Optimization on Huntington Unit 1. There is an offer to host a post-NOx report workshop to address questions and concerns related to this report.

Results/Appendix:

Chart 1 – NO_X and CO versus load and percent of time at Load. (baseline)

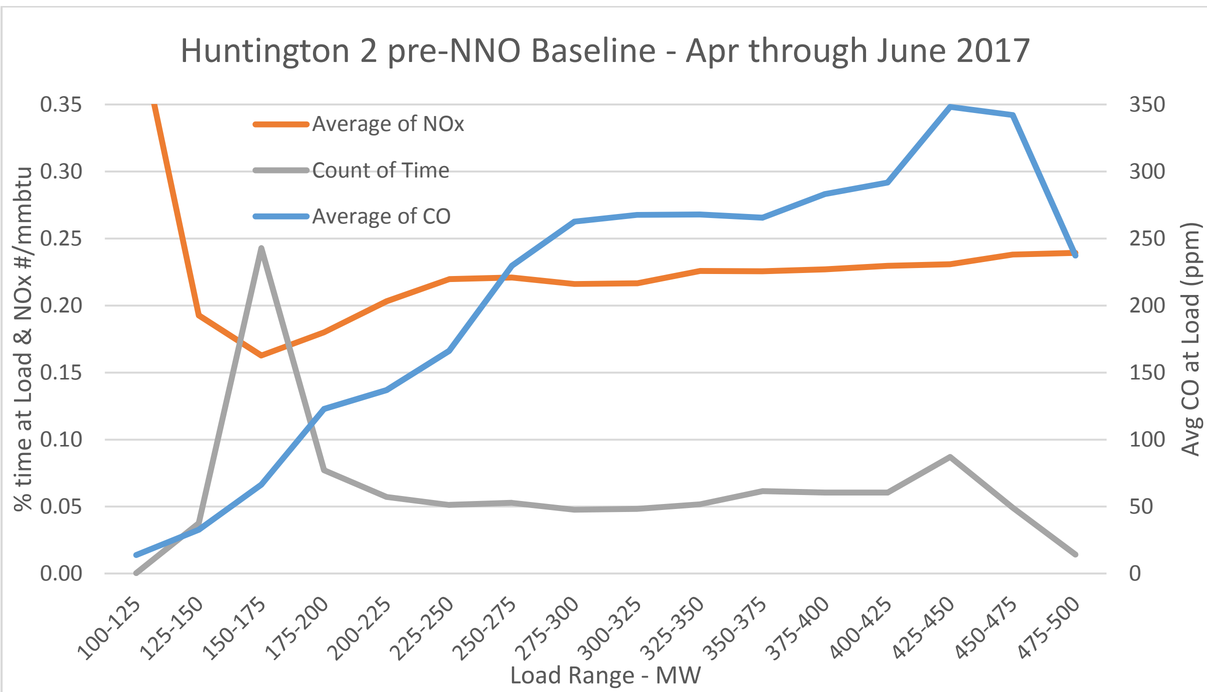


Chart 2 – NOx and CO versus load and percent of time at Load. Oct. – Dec. 2018

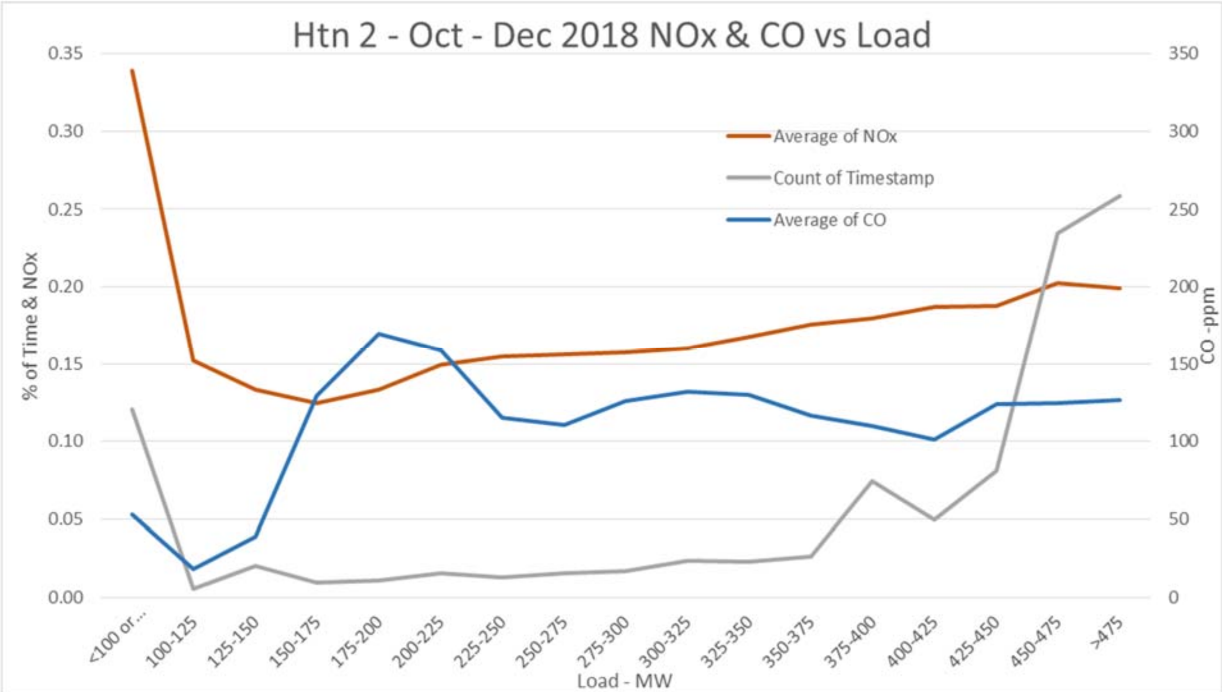


Chart 3 - Three Month data establishing baseline.

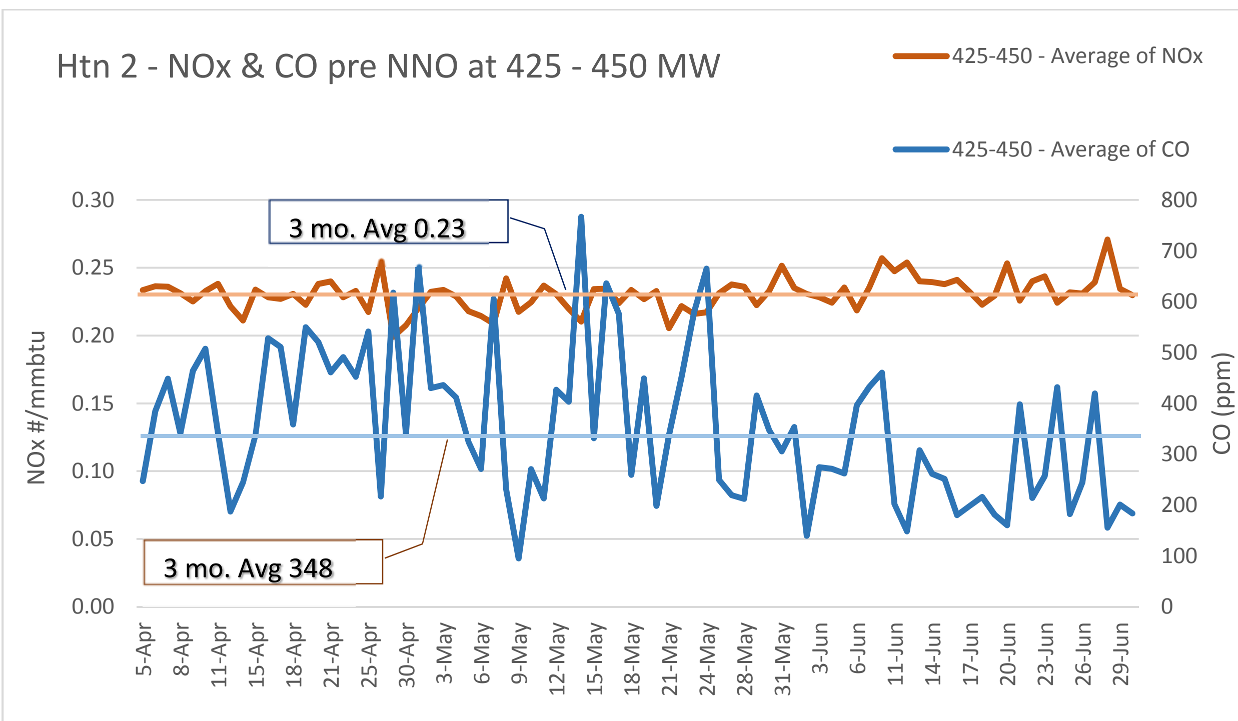
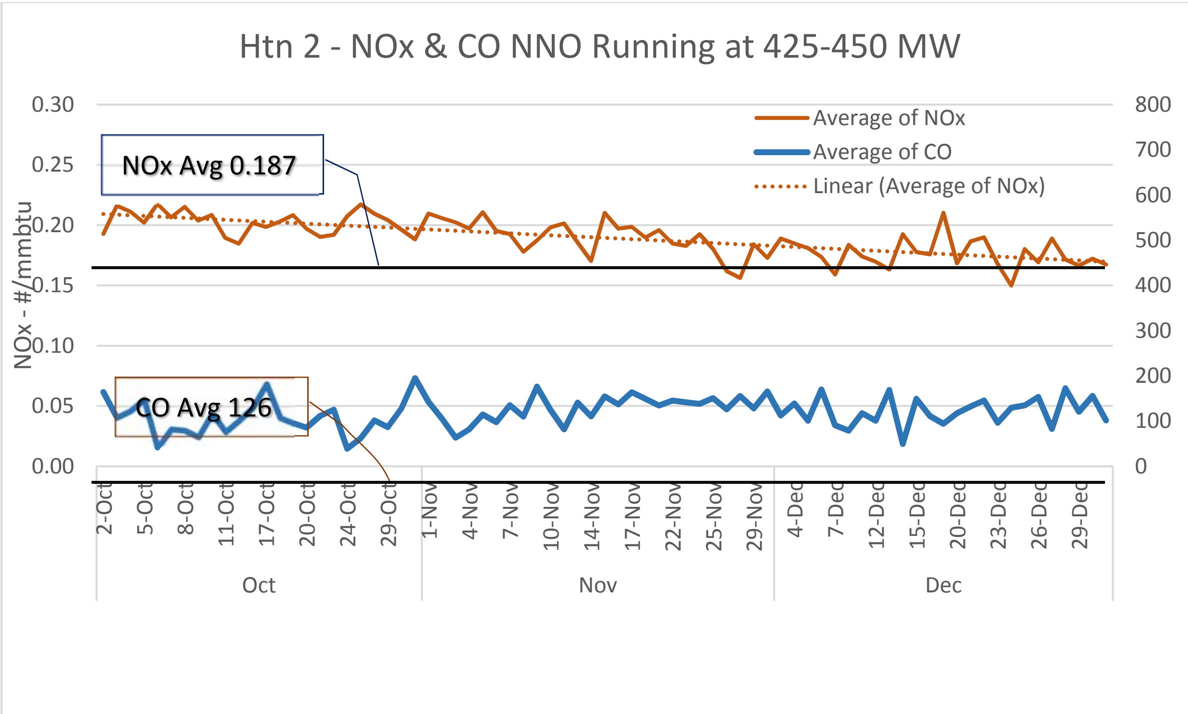


Chart 4 – Three Months, October through December 2018 – NNO running



* The Unit Data for December 2018, is missing about 12 hours of data on December 8 due to a corporate communications issues and resyncing the EDS servers.

STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: Alternative NO_X Reduction (PROJECT CANCELED)

Project Objective:

The project was designed to perform one or more utility scale demonstration tests of an alternative NO_X emission control technology at the Hunter or Huntington power plants. The objective of the project was to find a cost effective technology, or combination of technologies, that can achieve or approach the NO_X emissions that match a Selective Catalytic Reduction ("SCR").

Project Cancelation:

The Alternative NOx Project, which was approved on May 24, 2017, commenced with issuing a request for information from technology providers. The results of the technical and commercial proposals showed that none of the vendors would be able to meet the project's criteria for a cost-effective and innovative technology for a demonstration test. Each of the vendor proposals were outside the project's budget or proposed a technology that was known and established. Rocky Mountain Power concluded, based on the results of the Request for Proposals ("RFP"), that the STEP funding would be better utilized in furthering other Clean Coal Research projects already approved by the Commission over demonstrating a non-innovative NOx control technology with a known emission reduction capability. The Company communicated the proposal to abandon the project in the March 12, 2018, STEP Project Update meeting, and it was also included in the First STEP Annual Report in Docket No. 18-035-16 ("STEP Report Docket"). On November 13, 2018, the Company requested approval to reallocate the remaining unspent funds, a total of $1,161,501, from the Alternative NOx project to the Co-Firing Test of Woody-waste Materials at Hunter Unit 3 and the Croygenic Carbon Capture projects. The Commission approved the request on February 6, 2019. The Company will continue to submit a project report for the canceled Alternative NOx project, although no additional spend or project milestones will occur beyond what is reported below for 2018. The 2018 funds were spent in early 2018 prior to the project's cancellation on the outside services of an owners engineer as part of the evaluation of the RFP.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$125,000	$0.00	$125,000
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$131,405	$26,010	$157,415
Subtotal	$131,405	$26,010*	$157,415

*In the Company's Application to Modify Funding Amounts Previously Authorized by STEP filed on November 13, 2018, in Docket No. 16-035-36, paragraph 19 of the Application stated that a total of $170,356 had been spent on the Alternative NOx project for the RFP and owner's engineer services. This amount included $131,405 in CY 2017 expenses and $38,951 in CY 2018 expenses. The $38,951 in CY 2018 included an accounting accrual of which $12,941 was subsequently reversed. The total for CY 2018 is $26,010. Also in paragraph 19, the Company requested $1,161,501 be transferred to the other clean coal projects, leaving $89,964 unallocated. With the revision in CY 2018 expenses, the unallocated amount is revised as follows:

Original budget for the Alternative NOx Project	$1,415,821
Funds spent on Alternative NOx Project	$157,415
Funds transferred to other clean coal projects	$1,161,501
Unallocated funds	$96,905

Project Milestones:

Project Milestone	Delivery Date	Status
Kick off meeting	March 30, 2017	Complete
Draft version of RFI for Alternative NO_X Technologies	May 18, 2017	Complete, draft received on May 1, 2017
Issue RFI for Alternative NO_X Technologies	May 29, 2017	Completed
RFI Response Due	June 22, 2017	Completed
Summary of RFI Response	August 6, 2017	Completed
Issue RFP for Alternative NO_X Technologies Demonstration Test	August 20, 2017	Complete, August 24, 2017

RFP Response Due	October 9, 2017	Completed
Selection of Technologies for Demonstration Test	December 27, 2017	Complete
Submit Implementation APR for Demonstration Test	February 20, 2018	Deferred (see key challenges)
Project Cancellation	June 30, 2018	Complete
Funding Reallocation to Other STEP Clean Coal Projects	December 31, 2018	Complete

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a. Request for Information	Selected vendors for alternative emission reduction technology	Limited availability implementable technology	Sixteen vendors were approached for their technology	Two vendors provided a substantially different technology for implementation	There is limited number of technologies on the market reach SCR type emission reduction
b. Request for Proposal Cost	A technology supplier capable for performing a demonstration test within the allocated budget	Limited number low cost technology for emission reduction	Only two vendors could meet the target emission reduction rate and neither were within the target budget	No vendor could be sourced that could meet the STEP requirement and were within the allocated budget.	The company should provide more direction to potential vendors before release of the RFP to gain a better understanding as to the cost associated with a demonstration test.

STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: Study Evaluation for CO2 Enhanced Coal Bed Methane Recovery

Project Objective:

The project is to perform a feasibility study to evaluate opportunities to use carbon dioxide (“CO_2”) for beneficial use for enhanced natural gas recovery from coal seams, specifically coal seams in the Emery County area. As part of the study, an assessment will be made of the capability of local coal seams to concurrently sequester CO_2.

Project Accounting:

Cost Object	2017	2018	Total
Annual Collection (Budget)	$0.00	$62,500	$62,500
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$94,029*	$94,029
Subtotal	$0.00	$94,029	$94,029

* External OMAG was a contractual payment to the University of Utah for services performed on the project.

Project Milestones:

Project Milestone	Delivery Date	Status
Notice to Proceed Start Date	January 1, 2018	Completed
Contracts with PacifiCorp Complete	January 31, 2018	Completed
Draft Test Program Submitted	January 31, 2018	Completed
Revised Program Submitted	February 15, 2018	Complete

Annual Report 1 Presented and Submitted	January 31, 2019	Complete
Annual Report 2 Presented and Submitted	January 31, 2020	On Target
Annual Report 3 Presented and Submitted	January 30, 2021	On Target
Develop Concept for Future In-situ Pilot Testing	July 1, 2021	On Target
Final Report Presented and Submitted	October 31, 2021	On Target

Program Benefits:

The benefits of the project will be a technical, economic and environmental study on the costs and benefits of injecting coal fired power plant derived CO_2 for enhanced methane recovery from underground coal beds. The study will also determine whether the Emery County coal beds are conducive to enhanced methane recovery using CO_2. Deliverables will also include proposing technologies and strategies for improving CO_2 injection efficiency. The University of Utah will also study the risk of induced seismicity due to the CO_2 injection.

The deliverables above benefit Rocky Mountain Power's customers by utilizing STEP funding to study increasing the efficiency of energy production while simultaneously decreasing CO_2 emissions. When the benefits of the study are combined with other studies and work being conducted under the STEP program, sufficient knowledge about carbon sequestration is gathered for potential future use.

Key Challenges, Finding, Results and Lessons Learned:

Key Challenges	Results / Progress
Task 1: Resource Evaluation: Identification and selection of a coal resource to be studied for volumetric CO_2 storage	a) Drill logs have been digitalized for coal resource identification b) Stratigraphic Coal Units have been identified from well logs. Six coal units have been identified. From wireline logs and production records obtained from the Utah Department of Oil, Gas and Mining (DOGM) website, it was observed that the producing zones in the northern section of the Buzzard Bench Field coalbeds were identified – clustered- as 'Upper', 'Middle' and 'Lower'. c) The coal units' geological structure was delineated by identifying the top of the Ferron Sandstone, which is identifiable on each well log, and mapping in fence diagrams to observe the depth variation of the coal units along the Buzzard Bench Field. d) The data gathered from the geological structure of the coal units is being used to develop a three dimension model of the study area. Once the model development is complete the data will be used to estimate the amount of CO2 that could be stored.
Task 2: Bench Scale Demonstration:	a) Test apparatus design and test program continues to be refined in preparation for testing in 2019.

Potential future applications for similar projects:

When combined with the results of the STEP CarbonSAFE project and the STEP cryogenic carbon capture demonstration, Rocky Mountain Power would have sufficient information to start to develop a strategy for carbon sequestration in Utah. Additionally, information gathered from the study can be utilized to develop further understanding of potential enhanced energy recovery in Utah with simultaneous sequestration.

Cryogenic Carbon Capture - STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: Cryogenic Carbon Capture (CCC) Demonstration (Emerging CO_2 Capture)

Project Objective:

The objective of this project is to continue the development and demonstration of the promising Cryogenic Carbon Capture technology.

This scope of work is divided into two primary phases. The first, called the Development Phase, involves research to be performed by a contractor into specific areas where it is believed efficiency, reliability, or overall performance of the CCC process can be improved. The contactor's recommendations and experimental results will then be used to make changes and enhancements to the skid demonstration unit provided as part of this Scope of Work. On-site preparations by the contractor of the testing area, most likely the Hunter Power Plant in central Utah, will also be conducted during this time. The Field Demonstration Phase will then use this demonstration unit at the site during an extended test run over approximately five to six months. The contactor's development work will take place during 2017 and early 2018 with the field testing beginning in late 2018.

These phases will be conducted by contactor in parallel with a proposed DOE project to mature the technology and gather critical information in preparation for a scale-up.

In Docket No. 16-035-36, the Commission approved the Company's request to increase funding for the Cryogenic Carbon Capture project by $412,521, utilizing funds from the cancelled Alternative NOx project. With these additional funds, the Company expanded the scope to plan for the next scale of CCC operation to explore the scalability of these and related unit operations as part of this investigation. This project includes one task for each of three major systems. These systems require major changes to the current skid operation in contrast to the incremental changes supported by the current Department of Energy project. The additional milestones have been added to this report.

Project Accounting:

Cost Object	2017	2018	Total
Annual Collection (Budget)	$356,557	$668,301	$1,024,858
Annual Spend (Capital)	$0.00	$0.00	$0.00

Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$160,451	$530,289*	$690,740
Subtotal	$160,451	$530,289	$690,740

*External OMAG consists of contractual payments to Sustainable Energy Solutions for services performed on the project.

Project Milestones:

Project Milestone	Delivery Date	Status
Sustainable Energy Solutions (SES) will deliver a report containing the basic designs for both a self-cleaning heat exchanger and the experimental dual solid-liquid separations system. SES will also begin purchasing equipment for these systems.	6/15/2017	Completed
SES will deliver a report containing the following: - The final designs, documentation of parts ordered, and initial tests of the experimental alternate refrigeration system. - The final designs and documentation of parts ordered of the experimental self-cleaning heat exchanger. - The design, documentation of parts ordered and installation of equipment for pre-treatment of real flue gases and dual solid-liquid separations.	8/15/2017	Completed
SES will deliver a report containing the following: - The purchase orders and initial test reports of improved instrumentation such as advanced cryogenic flow measurement and output measurement. - Results of testing for the experimental integrated system with simulated flue gas at minimum 1/4 tonne per day CO2 - Results of testing of the experimental integrated system tested with real flue gas.	11/15/2017	Completed
SES will deliver a report containing the following: - Designs and documentation of parts ordered for permanent skid-scale unit ops, including heat exchangers, dryers, separations.	2/15/2018	Completed

SES will deliver a report containing the following: - Documentation of parts ordered for permanent skid-scale unit ops and skid integration. - Results of testing the permanent skid system with simulated flue gas at 1 tonne/day. - Shakedown testing completed.	11/20/2018	Completed
SES will deliver a report containing the following: - A description of the preparations and modifications at the Hunter PP site. - Documentation of insurance, transport, personnel trailer, and other on-site needs. - A description of the ongoing on-site setup and shakedown of the ECL testing skid.	8/15/2018	Completed
SES will deliver the following: - Finalized setup and operation of the ECL Skid at the Hunter PP. - A full report of the testing to-date under RMP funding, with continued testing occurring under the NETL contract.	2/26/2019	Completed
SES will deliver a report containing the following: **Task A1 –** Finalized integrated dryer design. Results of experiments used to validate design. Equipment sourced. **Task A2 –** Final selection of the solid-liquid system, or other system designed to meet the same requirements, which will be tested. Initial long lead time parts ordered. Assessment of pollutant removal options and modeling of basic design of system.	4/15/2019	On Target
SES will deliver a report containing the following: **Task A1 –** Record of dryer system equipment being ordered. **Task A2 –** Finalized design and record of system ordered. Description of assembled solid-liquid or other separation system. Designs and parts ordered for the pollutant removal system.	7/15/2019	On Target
SES will deliver a report containing the following: **Task A1 –** The receipt of the system and initial results of both assembly and dryer testing. **Task A2 –** Results of initial testing and subsequent iteration on solid-liquid or other separations system. Description of assembled pollutant removal system.	10/15/2019	On Target
SES will deliver a report containing the following: **Task A1 –** Results of further test results including using real flue gas and initial integration with skid system. Final Reporting.	1/15/2020	On Target

Task A2 – Results of testing the finalized designs. Final Reporting. **Task A3 –** Assessment of scale-up potential of innovative unit ops including dryer and solid-liquid separations.		

Program Benefits:

The benefits are validating a technology that can capture CO_2 gas at an economically viable cost. Such a technology would be beneficial by proving the ability to reduce CO_2 emissions. The demonstration test would allow the Company to evaluate the ability of SES's CCC technology to meet these goals.

The added milestones provide for modifications which improve the reliability and in some cases, decrease the energy and economic costs of the process.

Potential future applications for similar projects:

Third party engineering services will be procured in 2019 to assess the scalability of the technology for complete processing of flue gas at utility power plants.

STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: CarbonSAFE Pre-Feasibility Study – Phase 1 (Sequestration Site Characterization)

Project Objective:

The Company co-funded participation in a University of Utah pre-feasibility study to evaluate the development of commercial scale carbon capture and sequestration ("CCS") storage in Utah. The pre-feasibility study is being performed under Funding Opportunity Announcement (FOA Number DE-FOA-00001584) and is known as the Carbon Storage Assurance Facility Enterprise ("CarbonSAFE").

Project Accounting:

Cost Object	2017	2018	Total
Annual Collection (Budget)	$150,000	$0.00	$150,000
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$150,239	$0.00	$150,239
Subtotal	$150,239	$0.00	$150,239

Project Milestones:

Project Milestone	Delivery Date	Status
Project Kick-off	July 10, 2017	Completed
Quarterly Report	December 31, 2017	Completed
Technology Assessment Completed	December 31, 2017	Completed
Phase II – Application Submission	February 28, 2018	Completed
Quarterly Report	April 31, 2018	Complete

Final Report Presented and Submitted	May 2019	Extended per DOE deadline extension

Program Benefits:

The CarbonSAFE STEP funding was part of a larger funding initiative from the Department of Energy of $1.2 million for conducting a pre-feasibility study into a developing a commercial scale carbon dioxide storage reservoir. The participation into the study has resulted in a high level cost estimate as to the cost to construct a CO_2 capture facility at one of the existing Utah coal fired power plants. The pre-feasibility study along with the high level cost estimate provides information to the Company to determine if CO_2 capture is feasible in Utah. The final report will be available following submission by the University of Utah to the Department of Energy.

Potential future applications for similar projects:

Pending the results of the pre-feasibility study. Depending on the results, the next step would be to conduct a feasibility study. The feasibility study would be part of the Phase II CarbonSAFE funding opportunity from the Department of Energy.

STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: Feasibility Assessment of Solar Thermal Integration – Hunter Plant

Project Objective:

This project will investigate the potential of integrating solar thermal collection to provide steam and/or feedwater heating into the Hunter 3 boiler/feedwater cycle. Integration of a solar thermal collection system would minimize coal consumption and the attendant emissions associated with reduced coal use. The study would focus on the application of parabolic solar troughs and would also consider power tower collections systems. The project is on schedule and began in February 2019.

Factors that will be evaluated in the study are:

- Site specific costs and benefits of solar thermal integration at the Hunter Plant;
- Steam/feedwater injection points in the boiler feedwater cycle and those impacts on performance;
- Impact on coal consumption and associated emissions; and
- Land requirements.

Project Accounting:

Cost Object	**2017**	**2018**	**Total**
Annual Collection (Budget)	$0.00	$0.00	$0.00
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$0.00	$0.00	$0.00

Project Milestones:

Project Milestones	**Delivery Date**	**Status**
Contract between BYU and PacifiCorp complete	2/5/2019	Completed
Kickoff Meeting	2/12/2019	Completed

Report 1 to include literature review and representative model development	4/30/2019	On Target
Report 2, baseline plant model comparison to operational data	8/31/2019	On Target
Report 3, solar resource data, solar integration point, CSP characterization for modeling	12/31/2019	On Target
Report 4, preliminary estimates of fuel reduction, estimates for land use, capital cost, and impact on power generation	4/30/2020	On Target
Report 5, refine the plant model, parametric variations and optimization analyses	12/31/2020	On Target
Final report submitted, update and compilation of previous reports, and recommendation for implementation	12/31/2020	On Target

Program Benefits:

Thermal energy collected from a Concentrated Solar Power ("CSP") plant can be integrated into a traditional power plant (coal, natural gas, etc.) to offset the amount of fossil fuel required for heating. With CSP contributing to the heating load, less fuel is required, resulting in a decrease in fossil fuel cost and emissions. This study will address the viability of integrating CSP with coal-fired power plants including the Hunter Plant in Castle Dale, Utah. To aid in future evaluations, this study will include identifying a general plant model that can be used to determine hybrid feasibility and the optimization of solar integration into a general hybrid plant model. This statement of work outlines the milestones to be achieved during each period.

Potential future applications for similar projects: To be determined.

STEP Project Report

Period Ending December 31, 2018

STEP Project Name: Circuit Performance Meters (Substation Metering)

Project Objective:

Deploy an advanced substation metering program that includes installing advanced metering infrastructure on approximately fifty circuits connected to distribution substations in Utah where limited or no existing communications exist. This project will enable higher data visibility on the distribution system by providing for the installation of advanced meters, setting up remote communication paths with all installed meters and the purchase of a data management and analytics tool to automatically collect, analyze, interpret and report on the available data.

Project Accounting:

	2017	**2018**	**Total**
Annual Collection (Budget)	$110,000	$550,000	$660,000
Annual Spend (Capital)	$13,676	$427,349	$441,025
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$13,676	$427,349	$441,025

The 2018 budget variance was affected by:

1. Twenty circuits were targeted for installation in 2018.
2. Cost variances at individual site installations were affected by balancing available local resource labor with system improvement and customer interconnect projects in 2018.

Project Milestones:

Milestones	Delivery Date	Status/Progress
Complete two pilot sites in 2017	December 31, 2017	The two pilot sites were completed by December 31, 2017.
Execute contract for data analytics software	December 31, 2017	A vendor was selected in December 2017 but due to a delay caused by contract negotiations, contract was awarded in March 2018.
Install metering on twenty five circuits in 2018	December 31, 2018	Meter installations on twenty circuits were completed in 2018. All installed meters are operating and sending data to the Company's data collection system.
Install metering on 23 circuits in 2019	December 31, 2019	The revised target for 2019 is a minimum of thirty circuits. The Company is on track to install the target meters in 2019.

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a.					
b.					
c.					

Program Benefits:

- Enable increasing levels of distributed energy resources on the power grid in an affordable and reliable way by providing increasing visibility on loading levels, load shape, and event information needed to develop thorough interconnection studies and hosting capacities for customers, determine safe switching procedures, and cost effective capital improvement plans.
- Assist in preventing load imbalance on a distribution circuit caused by single phase distributed energy resources that can result in three phase voltage imbalance issues and increased potential for unintended circuit breaker operations from elevated neutral currents.
- Understand harmonic issues caused by distributed energy resources and take appropriate steps to resolve issues, if any, in a proactive way.
- Improve optimization opportunities for capital costs and system losses by providing measurements of per-phase vector quantities for voltage and current.

- Identify service quality issues early to allow timely development and implementation of cost effective mitigation.
- Enhance understanding of intermittent generation resources and their impact on the power grid.
- Reduce time delays of approvals for customers seeking distributed generation interconnections.
- Provide customers with circuit information with a higher level of accuracy.
- Identify and control risks associated with the integration of significant penetration of distributed energy resources. This includes controlling claims from power quality issues, customer equipment failure, utility/customer equipment damage, or impact on customer generation levels.

Potential future applications for similar projects:

There is the potential to install advanced metering devices on all circuits with limited or no communications regardless of the existence of distributed energy resources on those circuits.

STEP Project Report

Period Ending December 31, 2018

STEP Project Name: Commercial Line Extension Pilot Program

Project Objective:

Incentivize developers of commercial/industrial property to install electrical backbone within their developments, and provide for Plug-in Electrical Vehicle charging stations.

Project Accounting:

Table 1 gives the budgeted amounts through 2018. Funds are considered committed when the Company has determined the qualifying job costs and the STEP incentive amount. This is the Approved Date in **Table 2**.

Budget – Table 1			
	2017	**2018**	**Total**
Annual Collection (Budget)	$500,000	$500,000	$1,000,000
Annual Spend (Capital)	$0.00	$69,340	$69,340
Committed Funds	$0.00	$75,524	$75,524
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$0.00	$69,340	$69,340

A total of $16,905 was reported as committed in the 2017 STEP Report. In 2018, two projects committed in 2017 were paid and one project that was originally reported as 2017 committed funds canceled. Table 2 below provides additional details on the incentives.

Table 2 – Individual Project Details

In Docket No. 16-035-36, the Commission issued an order approving the Company's request for approval to raise the per project incentive payment upper limit to $250,000 from the previously approved amount of $50,000, with the total program budget remaining at $2.5 million over the pilot program period.

When a line extension work request is received, the Company meets with the applicant and determines the nature of the project. The Company receives a wide range of line extension requests. For a request to qualify for the commercial line extension pilot program, the developer project must include installation of backbone infrastructure, and also not have any or not enough electric service revenue allowances to cover the cost of that backbone. To this point, none of the developments receiving STEP funds are additional phases of the same development that had previously received STEP funds under a different phase.

As of December 31, 2018, all developments receiving STEP funds were still under construction and no PV charging stations have been installed. Some developments only include roads and utility infrastructure, and no buildings or parking are established by the initial development, thus no charging station locations are established. Other developments include business or buildings as part of the initial development. For developments with buildings, parking is established, and therefore under the STEP program charging station locations are also established.

		Individual Project Details – Table 2							
	Status (paid or committed)	Approved Date	Gross Project Cost	Internal Backbone Cost	STEP 20% Incentive	Number of lots in Develop-ment	Parking installed (Y or N)	Number of charging locations	Number of PV charging stations
1	Paid in 2018	7/7/2017	$ 38,253	$ 36,611	$ 7,322	7	Y	1	TBD
2	Paid in 2018	9/18/2017	$ 40,069	$ 37,606	$ 7,521	5	N	--	--
				2017 Total	**$14,843**				
3	Paid in 2018	1/16/2018	$ 43,685	$ 39,783	$ 7,957	7	Y	1	TBD
4	Paid in 2018	3/14/2018	$ 102,804	$ 102,670	$20,534	7	Y	1	TBD
5	Committed	3/19/2018	$ 80,183	$ 80,183	$16,037	9	N	--	--
6	Paid in 2018	3/20/2018	$ 102,360	$ 100,714	$20,143	3	Y	1	TBD
7	Committed	3/29/2018	$ 25,141	$ 24,218	$ 4,844	5	N	--	--
8	Committed	5/29/2018	$ 68,720	$ 30,669	$ 6,134	6	N	--	--
9	Paid in 2018	7/13/2018	$ 30,957	$ 29,315	$ 5,863	4	Y	2	TBD
10	Committed	7/26/2018	$ 58,410	$ 58,410	$11,682	1	Y	1	TBD
11	Committed	11/1/2018	$ 52,789	$ 13,035	$ 2,607	5	Y	1	TBD
12	Committed	11/7/2018	$ 37,081	$ 33,803	$ 6,761	6	N	--	--
13	Committed	11/12/2018	$ 19,192	$ 19,192	$ 3,838	8	Y	1	TBD
14	Committed	12/6/2018	$ 248,411	$ 118,107	$23,621	1	N	--	--
				2018 Total	**$130,020**				

Project Milestones:

The Commercial Line Extension Pilot Program review is applied each time a commercial or industrial developer requests installation of primary voltage backbone facilities within their development. There are no specific project milestones. Each development is independent, and is evaluated when the developer makes the request for service. Funds are transferred to the individual job upon the developer paying its share of the cost of the development.

Key Challenges, Findings, Results and Lessons Learned:

2018 is the first complete year of this program, and the first year where the program was available in the early months of the year when construction projects are typically initiated. Program participation to date has been less than anticipated. The increase in per project incentive payment upper limit to $250,000 was approved February 6, 2019. The Company will continue to monitor participation in the program and provide annual updates.

Program Benefits:

The Commercial Line Extension Program was designed to encourage developers to install full electrical backbone within their developments. This allows the Company to better engineer the electrical grid serving the area, leading to cost savings, greater reliability and less upgrade work to already installed facilities.

To the extent developers build within their developments, sites for PEV charging will be identified and power made available to those locations. This will encourage adoption of EVs and contribute to the environmental benefits of EV use.

Potential future applications for similar projects:

This program will give the Company experience in incentivizing proper infrastructure planning to developers. This understanding will allow for more efficient upfront design of commercial and industrial developments and siting of electrical infrastructure supporting such areas.

STEP Project Report

Period Ending: December 31, 2018

STEP Project Name: Gadsby Emissions Curtailment

Project Objective:

To help improve air quality, the Gadsby Emissions Curtailment program allows the Gadsby Power Plant to curtail its emissions during winter inversion air quality events as defined by the Utah Division of Air Quality ("UDAQ"). The UDAQ issues action alerts when pollution is approaching unhealthy levels. These alerts proactively notify residents and businesses before pollution build-up so they can begin to reduce their emissions. When pollution levels reach 15 µg/m3 for PM2.5, UDAQ issues a 'yellow' or voluntary action day, urging Utah residents to drive less and take other pollution reduction measures. At 25 µg/m3, 10 µg/m3 below the EPA health standard, UDAQ issues a "red" or mandatory advisory prohibiting burning of wood and coal stoves or fireplaces. It is at the 25 µg/m3 level when RMP will take action to curtail the Gadsby Steam units.

Project Accounting:

Cost Object	2017	2018	Total
Annual Collection (Budget)	$100,000	$100,000	$200,000
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$0.00	$0.00	$0.00

In 2017 and 2018 during DAQ posted air quality events it was not economic for Gadsby to operate, thus no STEP funds were utilized.

Project Milestones:

Project Milestones	Delivery Date	Status/Progress

Key Challenges, Findings, Results and Lessons Learned:

Challenges	Anticipated Outcome	Findings	Results	Lessons Learned

Program Benefits:

Many of the company's customers live in communities that are located within the non-attainment areas, including Salt Lake City, which is where the Gadsby Power Plant is located. The primary benefit of curtailing Gadsby is the potential reduction of NOx emissions which contribute to the formation of PM 2.5. According to UDAQ (see Appendix 1), the Gadsby Power Plant may emit 0.437 tons of NOx per day during a typical winter inversion day, which makes Gadsby the 10th largest emitter of NOx in the Salt Lake non-attainment area. This program would ensure that those emissions would not occur during periods of unhealthy air quality and not contribute pollutants to air sheds of non-attainment areas.

Potential future applications for similar projects:

STEP Project Report

Period Ending December 31, 2018

STEP Project Name: Panguitch Solar and Storage Technology Project

Project Objective:

Rocky Mountain Power will install a five (5) megawatt-hours battery energy storage system to resolve voltage issues on the Sevier–Panguitch 69 kilovolt transmission line. Panguitch substation is fed radially from Sevier, and all capacitive voltage correction factors have been exhausted.

To correct the voltage issues experienced during peak loading conditions, a stationary battery system will be connected to the 12.5 kilovolt distribution circuits that are connected to Panguitch substation. This reduces the loading on the power transformer and improves voltage conditions. The system will be sized to handle the voltage corrections as load grows in the area.

In Docket No. 16-035-36, the Commission approved the Company's request to increase funding for the Solar and Storage Technology Project by $1.75 million due to the response to the Company's Request for Proposals ("RFP"). The majority of the project funds will be budgeted in CY 2019.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$500,000	$2,350,000	$2,850,000
Annual Spend (Capital)	$331,995	$75,474	$407,469
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00
Subtotal	$331,995	$75,474	$407,469

Project Milestones:

Milestones	Delivery Date	Status/Progress
Prairie Dog Permit	July 30, 2018	Complete
Small Generation Interconnection Agreement – Finalized	June 4, 2018	Complete
Award an engineering, procurement and construction (EPC) contract.	February 22, 2019	Complete
EPC Design Complete	August 1, 2019	In progress

EPC Major Equipment Delivered	September 3, 2019	In progress
Construction Complete	November 1, 2019	In progress
Commercial Operation Date	November 15, 2019	In progress

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a. N/A	N/A	N/A	N/A	N/A	N/A
b. N/A	N/A	N/A	N/A	N/A	N/A
c. N/A	N/A	N/A	N/A	N/A	N/A

Project Benefits:

- The loading on the 69–12.5 kilovolt power transformer at Panguitch substation will be reduced thereby ensuring the line voltage on the Sevier–Panguitch 69 kilovolt transmission line does not drop below 90% and will defer the traditional capacity increase capital investment beyond fifteen years when using present growth rates in this area.
- Enables the Company to get first-hand operational experience with control algorithms and efficiency levels associated with energy storage combined with solar. This gained experience will prepare the company in advance of large scale integration of such technology that are now becoming readily available options for customers as energy storage price declines.
- Enables the Company to become familiar with and utilize innovative technologies to provide customers with solutions to power quality issues.

Potential future applications for similar projects:

Depending on the outcome of the installation and operation a this solar-battery system there could be a number of applications across Rocky Mountain Power's system on long radial feeds such as at Panguitch that would provide economic deferral of a major transmission rebuild.

STEP Project Report

Period Ending December 31, 2018

STEP Project Name:

Microgrid Project

Project Objective:

Deploy a microgrid demonstration project at the Utah State University Electric Vehicle Roadway (“USUEVR”) research facility and test track to demonstrate and understand the ability to integrate generation, energy storage, and controls to create a microgrid.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$0.00	$70,000	$70,000
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
Internal OMAG Expenses	$0.00	$1,467	$1,467
External OMAG Expenses	$0.00	$89,246*	$89,246
Subtotal	$0.00	$90,713	$90,713

*External OMAG was a contractual payment to Utah State University for services performed on the project.

Project Milestones:

Milestones	Delivery Date	Status/Progress
Data collection and EVR characterization	06/30/2018	COMPLETE - Installed smart meter and started analyzing the EVR load profiles
Preliminary microgrid planning tool	09/30/2018	COMPLETE - Developed a linear programming based planning tool to determine the size of energy storage.
Microgrid layout and test plan	12/31/2018	COMPLETE - Finalized layout of the EVR microgrid
Deploy microgrid system at EVR	04/30/2019	ONGOING - Procured natural gas generator, 1200A ATS, and SEL 751 protection relay. The equipment for the microgrid is currently being installed. A Matlab based EMS is also under development and tuned with the load data that is being collected.

Optimize planning tool for microgrid	08/31/2019	On target
Apply planning tool to HAFB microgrid	12/31/2019	On target
Create fact sheet for planning tool	4/30/2020	On target
Recommendations to DERs interconnection policy	06/30/2020	On target

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a.					
b.					
c.					

Program Benefits

- Qualifies the viability of operating a microgrid on the Company's distribution system, and any resultant reliability improvement.
- Assists in understanding the intricacies of microgrid system operation, costs and their ability to address other value streams such as reliability, load shaping and power quality.
- Creates a quantified list of Company distribution system impacts resulting from the interconnection of microgrids.
- Enables the creation of policy and standards for subsequent microgrid interconnection requests, if and when allowed by the Company.
- Enables the potential development of a future microgrid service program.

Potential future applications for similar projects:

Collaborate with customers to identify and potentially deploy microgrid systems that utilize advanced control systems and Internet of Things for optimizing distributed energy resources.

STEP Project Report

Period Ending December 31, 2018

STEP Project Name:

Smart Inverter Project

Project Objective:

To investigate the capabilities of smart inverters and their impact and benefit for the Company's electric distribution system. This project is completed and final reports are included as Attachments.

Project Accounting:

	2017	2018	Total
Annual Collection (Budget)	$0.00	$450,000	$450,000
Annual Spend (Capital)	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00
Internal OMAG Expenses	$0.00	$33,861	$33,861
External OMAG Expenses	$0.00	$349,998*	$349,998
Subtotal	$0.00	$383,859	$383,859

*External OMAG includes a contractual payment of $250,000 to Electric Power Research Institute and $100,000 to Utah State University for their services on the project.

Project Milestones:

Milestones	Delivery Date	Status/Progress
Hosting Capacity Study of RMP Distribution Circuits	6/31/2018	Complete
Laboratory Evaluation of Smart Inverters	09/30/2018	Complete
Smart Inverter Setting Analysis	8/31/2018	Complete
Review of Interconnection Requirements and Industry Practices	10/31/2018	Complete

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment

STEP funding for this project was used to investigate the capabilities of smart inverters and their positive and negative impacts on RMP's electric distribution system.

Anticipated Outcome

- Evaluate readiness level of smart PV and battery inverters to comply with the new IEEE 1547-2018 standard.
- Performance analysis of smart inverters during both steady state and transient operating conditions.
- Investigate hosting capacity and potential benefit of smart inverters for several Rocky Mountain Power feeders.
- Analyze smart inverter settings in detail for two different feeders, and report on the range, requirements, and benefit of adjustability.
- Summarize current utility practices for voltage/frequency ride-through and communication between inverters and utility.

Challenges

- There are differences in the ability to control the inverters using Modbus communication protocol, and all the settings cannot be programmed using this protocol.

Findings/ Results

- All the tested PV inverters are compliant with the settings listed in category 2 of the IEEE 1547-2018, except Inverter 2, which is only compliant with category 1, and hence can only be used in areas with low distributed energy resources (DER) penetration.
- Three phase PV inverters are capable of injecting 100% and absorbing 95% of rated active power. Single phase PV inverters, however, are capable of injecting and absorbing 45%-65% of rated active power.
- Over the load range of 10%-100%, the efficiency of all the inverters is higher than 95%
- The battery inverter does not comply with most of the tests designed for smart inverter testing.
- The battery inverter ensures a continuous supply to the backup load, and establishes its local voltage within two fundamental cycles.
- Some of the distribution feeders studied showed hosting capacity gains by using smart inverters; however, most saw limited improvement due to already being thermally constrained.

- Because improvements in hosting capacity depended greatly on the connection point, the improvements were smaller for distributed systems than central systems because the locations were less finely controlled.

Lessons Learned:

- The performance of all PV smart inverters matches closely to the manufacturer specifications. However, for the same power ratings, the performance of inverters differs among manufacturers.
- All PV inverters are suitable for grid integration in accordance with several of the IEEE 1547-2018 standard requirements, and autonomously support grid during voltage transients.
- In addition to hosting capacity, reactive power from inverters can be used to improve distribution losses and substation power factor.
- With the "best" settings, Volt-VAR control performed better than the fixed power factor function; however, with bad settings the performance was worse than all fixed power factor levels.
- Use of several smart inverter functions (such as Volt-VAR) will require updates to PacifiCorp's Generator Interconnection Policy (Policy 138).
- IEEE 1547 introduces the requirement for DER to have communications capability over an open protocol, utilities have not converged on an approach to interfacing with these devices.

Program Benefits:

- This program will enable a greater understanding of these innovative solutions as the Company continues to make the grid more progressive.
- Provides the Company, Commission, and other stakeholders with information regarding the capabilities of advanced inverters and changes to interconnection standards.
- The findings from this project will assist the Company in updating PacifiCorp Policy 138: Distributed energy resource interconnection policy.
- Enables the Company to gain knowledge on smart inverter operation for solar and battery combined projects.
- Enables the Company to become familiar with and utilize innovative technologies to provide customers with solutions to power quality issues.
- Provides guidance to the Company's distribution engineers to enhance the distribution planning process.
- The Company continues to experience rapid growth in interconnection requests and considers innovative technologies such as smart inverters a valuable tool to improve service to customers.
- Provides a better understanding of smart inverter settings that will potentially assist in improved utilization of grid assets, leading to cost savings for customers.

- This project aligns with the goals of the program to support the greater use of renewable energy. Through this project, the Company is taking steps to prepare for increased deployment of distributed and renewable energy sources for its customers.

Potential future applications for similar projects:

Develop an automated hosting capacity analysis tool to leverage on smart inverter capabilities and provide enhanced grid support using DER systems connected to the distribution system.

Attachments:

- Exhibit 15-A: Electric Power Research Institute’s Advancing Smart Inverter Integration in Utah – Final Report
- Exhibit 15-B: Utah State University’s Advancing Smart Inverter Integration in Utah – Final Report

Exhibit 15-A

Electric Power Research Institute’s Advancing Smart Inverter Integration in Utah – Final Report

THIS EXHIBIT IS PROVIDED AS A SEPARATE DOCUMENT

Exhibit 15-B

Utah State University’s Advancing Smart Inverter Integration in Utah – Final Report

Advancing Smart Inverter Integration in Utah

2018 Final Report

Acknowledgements

Utah State University (USU) prepared this report in conjunction with Rocky Mountain Power (RMP):

USU Personnel	RMP Personnel
Regan Zane	Rohit Nair
Baljit Riar	
Daniel Bosco	
Mahmoud Mansour	

Advancing Smart Inverter Integration in Utah

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Executive Summary

With the decreasing cost of photovoltaic (PV) panels and grid-tied inverters, both residential and commercial scale installations of PVs are becoming more popular. There is a potential risk that the increasing adoption of PVs can compromise the stability of utility scale power distribution. Some other risks include voltage rise at the point of common coupling, during which inverters continue to supply current during grid faults; and failure to detect grid outage or, in essence, continue to operate during the island mode. The Institute of Electrical and Electronics Engineers (IEEE) has therefore recently revised standard IEEE 1547-2018, which provides guidance for the interconnection of inverters to the grid.

As part of the Sustainable Transportation Energy Plan (STEP), Rocky Mountain Power (RMP) and Utah State University (USU) established a strategic collaboration investigating the capabilities of smart inverters and their positive and negative impacts for the RMP's electric distribution system. To seamlessly accept the increasing adoption of smart inverters in Utah, the series of tests documented in this report provide appropriate guidance to help align RMP's interconnection policy with IEEE 1547-2018. In line with the project scope, USU has focused on the following:

- Lab testing of smart inverters to understand their capabilities in compliance with IEEE 1547-2018 standard
- Performance analysis of inverters under varying levels of grid disturbances and PV power

This report describes USU/RMP testing and analysis on five inverters, in accordance with IEEE 1547-2018 standard. Characteristics of the inverters relating to Volt-VAR, Volt-Watt, Frequency-Watt, constant power factor, voltage ride-through, transients, and steady-state analysis tests are evaluated and discussed in the report. Finally, performance of the inverters during voltage and frequency variations of the grid is presented.

Key takeaways of the report are: 1) all the tested PV inverters are compliant with the settings listed in category 2 of the IEEE 1547-2018, except Inverter 2, which is only compliant with category 1, and hence can only be used in areas with low distributed energy resources (DER) penetration; 2) the battery inverter does not comply with any of the tests. We found that the maximum output power varies from one inverter to the next. A three-phase inverter can use its entire rated power for stabilizing the grid whereas the contribution of a single-phase inverter is limited to 50–60% of its rated power. Given all the PV inverters provided full access to their settings, these PV inverters were found to be compliant with the new IEEE 1547-2018 standard.

Recommendations for future research include:

- Determine response of multiple inverters when connected in parallel
- Develop inverter models for RMP simulations
- Determine real-time response of inverters controlled by the communication interface

1 Smart Inverters Background

Typical inverters are power electronic devices that efficiently transfer power from dc sources such as photovoltaics (PVs) and batteries to electrical grid. In the case of a battery, flow of power is bidirectional in between the battery and the grid. With advancements in sensing, communications, and controls, these inverters are categorized as smart inverters, enabling PVs, batteries, and loads to be naturally stable over a wide range of operating conditions. With these advancements, smart inverters also support grid stabilization of voltage and frequency variations while regulating both real and reactive power output of the inverters.

2 Smart Inverter Test Setup

In line with the project objectives, USU tested five smart inverters that were selected to cover a broad range of power ratings as well as applications. To perform testing under identical conditions, an experimental setup was developed to allow repeatable grid and PV conditions in the laboratory. Various components of the test setup are discussed in the following sections.

2.1 Inverter Selection

As listed in Table 1, five smart inverters manufactured by four different manufacturers were selected and tested at the USU Electric Vehicle and Roadway (EVR) test facility in accordance with the IEEE 1547-2018 standard. The choice of these inverters was based on their market popularity and with configurations that would cover a broad range of use cases, such as single- or three-phase modes of operation, as well as operation with solar only, battery only, and solar-plus-battery modes. This choice of inverters further represents the most commonly used configurations of smart inverters in both the residential and commercial markets in Utah.

Table 1: Configuration of smart inverters.

Name	Type	Voltage	Power output	Utility connection
Inverter 1	PV inverter	240 V	7.0 kW	Single-phase
Inverter 2	PV inverter	240 V	7.6 kW	Single-phase
Inverter 3	PV inverter	240 V	7.6 kW	Single-phase
Inverter 4	PV inverter	480 V	20 kW	Three-phase
Inverter 5	Battery inverter	240 V	5.0 kW	Single-phase

2.2 Test Description

Smart inverters were tested to determine inverter's 1) capabilities during grid transients and 2) general performance during steady-state operating conditions. All the tests shown in

Error! Reference source not found. analyze inverter responses post and prior to a controlled grid disturbance.

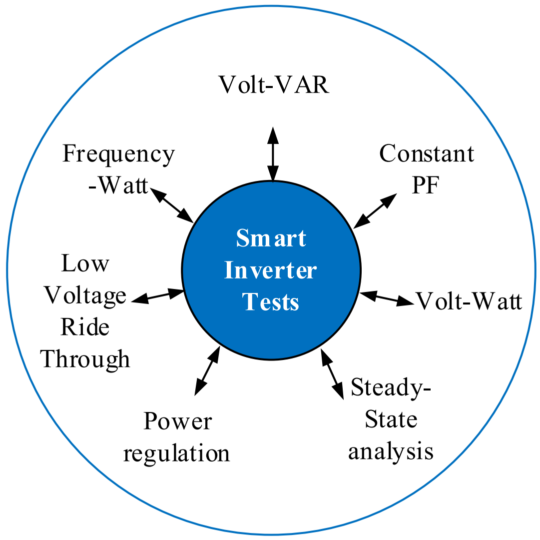

Figure 1: Functional tests for smart inverters.

Smart inverter settings were changed in accordance with the IEEE 1547-2018 causing the inverter to change its mode of operation. These modes include:

- Volt-VAR: Volt-VAR mode enables the inverters to stabilize the AC voltage by either injecting or absorbing reactive power; the Volt-VAR mode is especially beneficial for providing grid support during voltage transients.
- Volt-Watt: Volt-Watt mode helps to stabilize the grid by reducing inverter active power output. This mode is favorable in locations where the active power defines the line voltage.
- Frequency-Watt: Frequency-Watt mode enables the inverters to stabilize the grid frequency by reducing its active power output.
- Constant Power Factor: The Constant Power Factor mode enables the inverters to change their reactive power with the changing active power while maintaining the constant power factor at their terminals. As the PV power varied with the time of day, the inverter regulated its reactive output power to maintain the constant power factor.
- Voltage Ride-Through: Most grid faults are temporary in nature. Smart inverters are expected to ride through these temporary faults without disconnecting from the grid and causing severe stability issues. During grid faults, short-duration voltage dips or increases can cause the inverters to trip if voltage ride-through (VRT) settings are not properly programmed.

- Power Regulation: This is the inverter's normal mode of operation; it determines the inverter's ability to follow commands over the communication interface. Both start/shutdown and amount of power injected by the inverter are controlled using the communication interface.
- Steady-State Analysis: This is the normal mode of operation through which an inverter tracks maximum power point (MPPT), and evaluates power conversion efficiency over its entire power range.

2.3 Experimental Setup

The test setup shown in Figure 2 was used to evaluate inverter performance in reproducible test conditions. With this setup, grid characteristics were simulated by the California Instrument MX30 and Pacific Power Source 390-ASX power supplies to create controlled variations in the frequency and voltages. Initially the 390-ASX power supply was used to test single-phase inverters, and a resistive bank was connected in parallel to the power supply and the inverter. Then the MX30 power, which is capable of three-phase operation and bidirectional power transfer, was used to simulate the grid and act as a load connected to the inverter, eliminating the need for an external resistor bank.

The characteristics of a PV panel were simulated using a Regatron 64 kW power supply. A Yokogawa WT1806 power analyzer was used to capture all the measurements related to voltage, current, frequency, power and harmonic distortions, and a PC was used to communicate with the inverters for sending commands as well as for collecting data every one second. A picture of the experimental setup in the laboratory is shown in Figure 3.

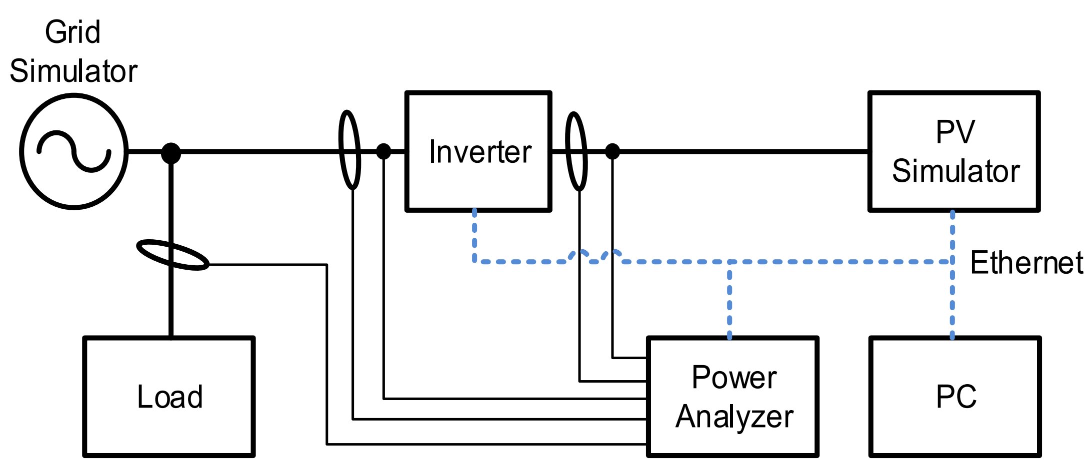

Figure 2: Test setup for smart inverters.

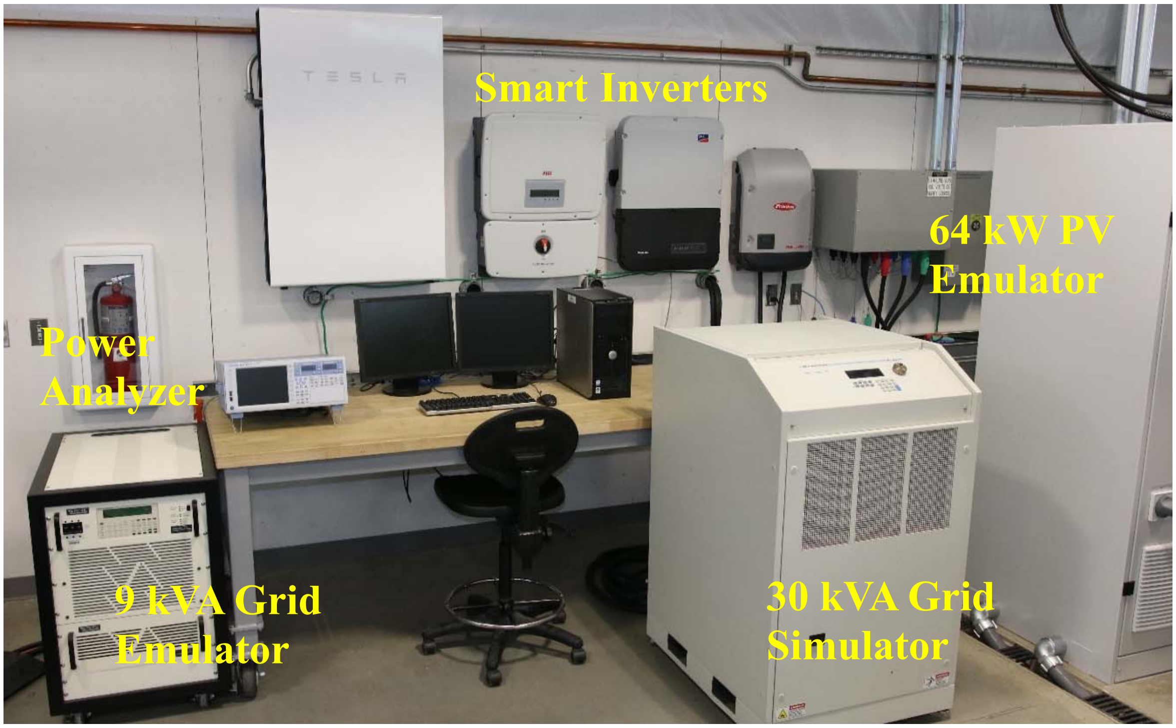

Figure 3: Experimental setup.

2.4 Data Collection and Monitoring

A Yokogawa WT1806 power analyzer was used to capture and record data. A sampling rate of one second was used for recording the measurements, and 30 samples were taken at each observation point. For the voltage ride-through test, a sampling rate of 50 ms was used to increase accuracy and capture waveforms. The power analyzer was connected to the local PC which was further connected to the smart inverter and power supplies over the Ethernet Local Area Network (LAN). The PC was used to send commands to inverters as well as to save data that was processed using MATLAB R2018a software.

3 Test Results

3.1 Volt-VAR

Voltage variations were induced based on the IEEE 1547-2018. Table 2 shows the maximum expected reactive power injection/absorption percentages based on the deviation in voltage from the nominal value. Figure 4 shows the expected trajectory of the power injected or absorbed by the inverter with the variation in the voltage. Additional measurement points were added between the marked data points to improve accuracy of the presented results.

Table 2: Volt-VAR set points.

Volt-VAR set points			
V1	90%	Q1	100%
V2	99%	Q2	0%
V3	101%	Q3	0%
V4	110%	Q4	-100%

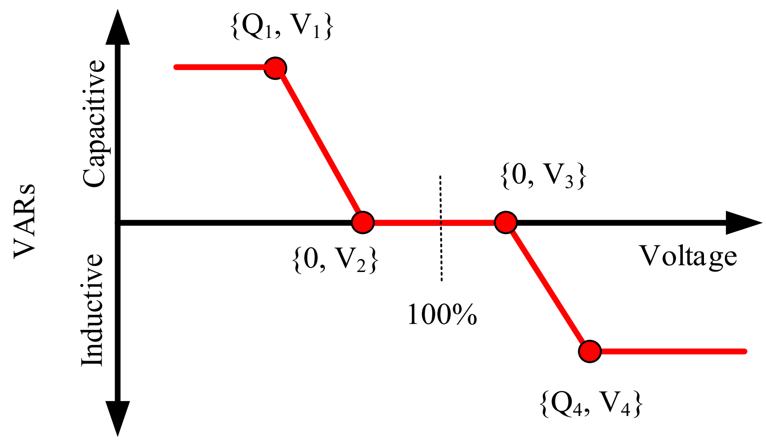

Figure 4: Volt-VAR curve.

Figure 5 shows the trajectories of the three single-phase inverters along with the bounds as defined by IEEE 1547-2018. Figure 6 shows the trajectory of the three-phase inverter. It is clear from Figure 5 that Inverter 1 can inject/absorb VARs up to 50% of the rated power whereas the other two single-phase inverters can inject and absorb reactive power up to 60% of their rated power. The three-phase inverter is capable of injecting 100% of the rated VARs and absorbing 95% of the rated VARs as shown in Figure 6. All the PV inverters remain within the bounds confirming their compliance with IEEE requirements. It is also apparent that all the inverters exchange around 5% reactive power with the grid when the voltage is equal to the nominal value. The data recorded during the test is presented in Appendix A.

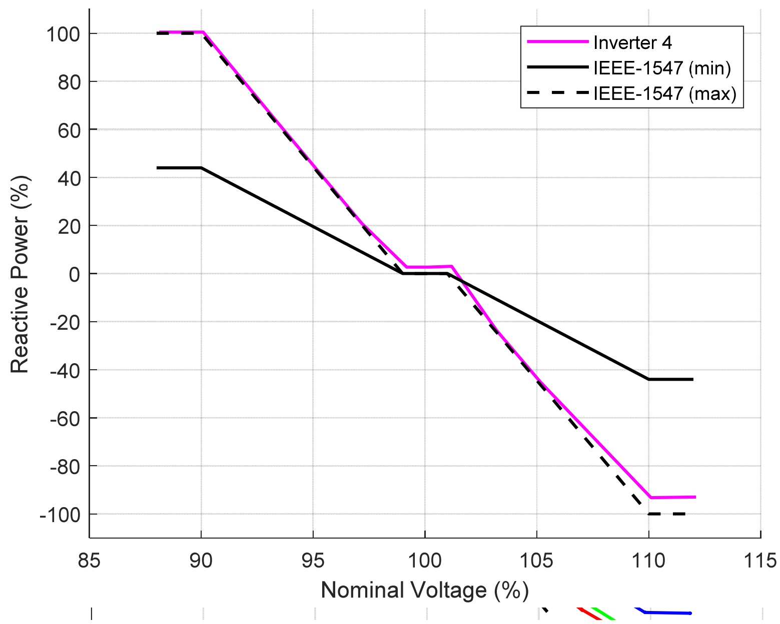

Figure 6: Experimental Volt-VAR curve (three-phase).

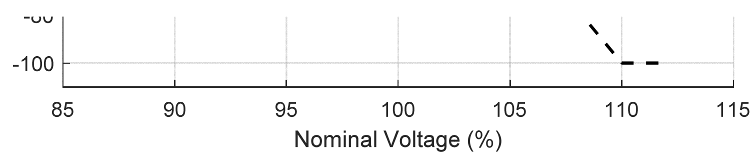

Figure 5: Experimental Volt-VAR curve (single-phase).

3.2 Volt-Watt

Table 3 shows the active power output percentages based on the deviation in the grid voltage from its nominal value. Figure 7 shows the expected graph that the inverters should track during voltage variations. With the experiments, additional measurement points were added in between the marked data points to improve accuracy of the presented results.

Table 3: Volt-Watt set points.

Volt-Watt set points

V1	90%	P1	100%
V2	106%	P2	100%
V3	110%	P3	0%

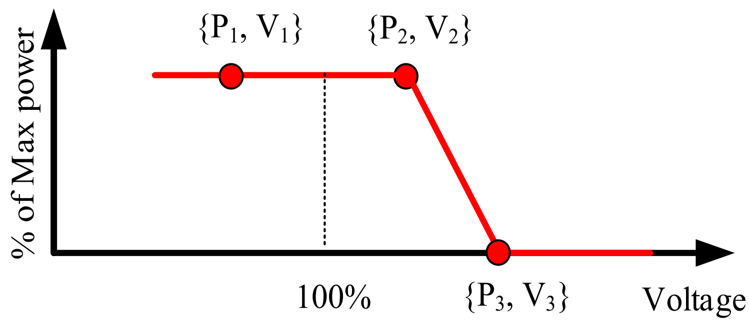

Figure 7: Volt-Watt curve.

Figure 8 shows the plots for the single-phase inverters. The Volt-Watt trajectories follow the IEEE 1547-2018 curve. The output power of Inverter 1 and Inverter 3 is below the expected 100% rated power at 90% nominal voltage but fall within the allowable range of settings. When the voltage exceeds 108%, the output power of Inverter 3 drops abruptly to zero. Inverter 2 does not have the Volt-Watt mode settings and hence fails this test.

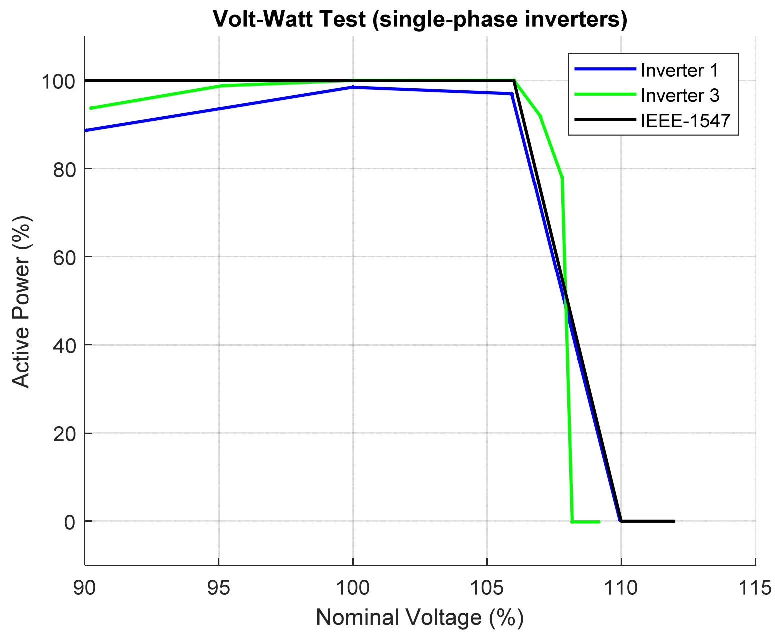

Figure 8: Experimental Volt-Watt curve (single-phase).

Figure 9 shows that the three-phase inverter follows IEEE 1547-2018 requirements more closely than the single-phase inverter. The data recorded during Volt-Watt test is presented in Appendix A.

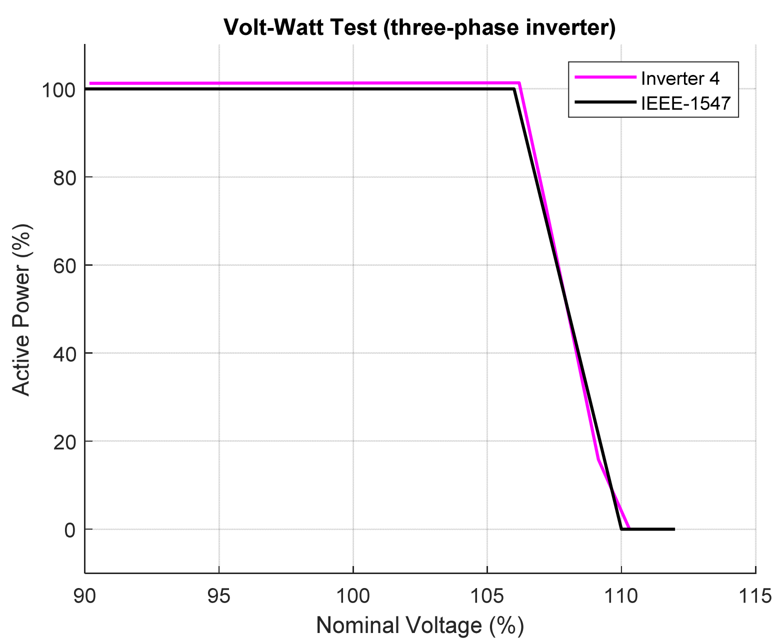

Figure 9: Experimental Volt-Watt curve (three-phase).

3.3 Frequency-Watt

Table 4 shows the active power output percentages based on the grid frequency, and Figure 10 plots the relationship in between the active power and frequency. To improve the accuracy of the results, additional test points were also created.

Table 4: Frequency-Watt set points.

Frequency-Watt set points			
F1	60 Hz	P1	100%
F2	60.1 Hz	P2	100%
F3	61.1 Hz	P3	0%

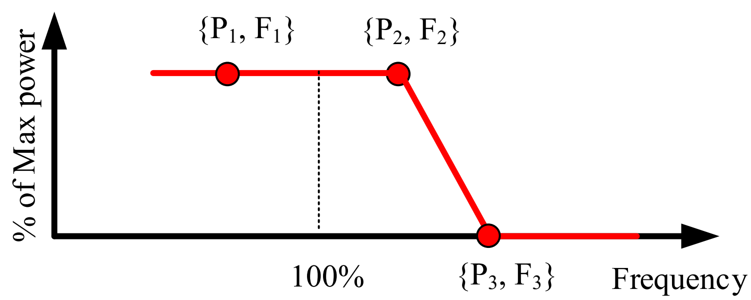

Figure 10: Frequency-Watt curve.

The Frequency-Watt results for the single-phase inverters are presented in Figure 11. Inverter 2 fails this test because it does not have the necessary setting to program this mode. It is clear that Inverter 1 and Inverter 3 follow the expected graph of IEEE 1547-2018. Active output power with Inverter 1 is slightly below 100% when frequency is smaller than 60.1 Hz.

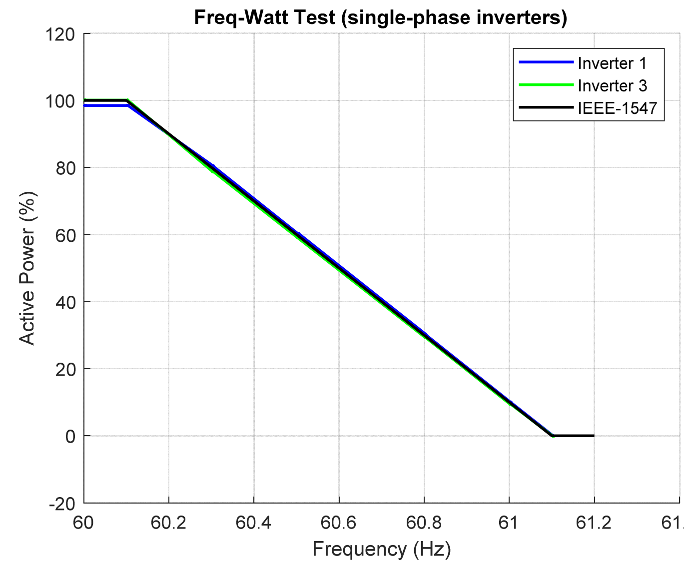

Figure 11: Experimental Frequency-Watt curve (single-phase).

Figure 12 shows that the three-phase inverter deviates from the IEEE graph. The slope of the curve matches that of the IEEE curve when frequency is above 60.3 Hz. At 61.1 Hz, the inverter injects around 10% power whereas it was programmed to shut down. At most 10% variation in the output power are observed with this inverter. Application of this inverter

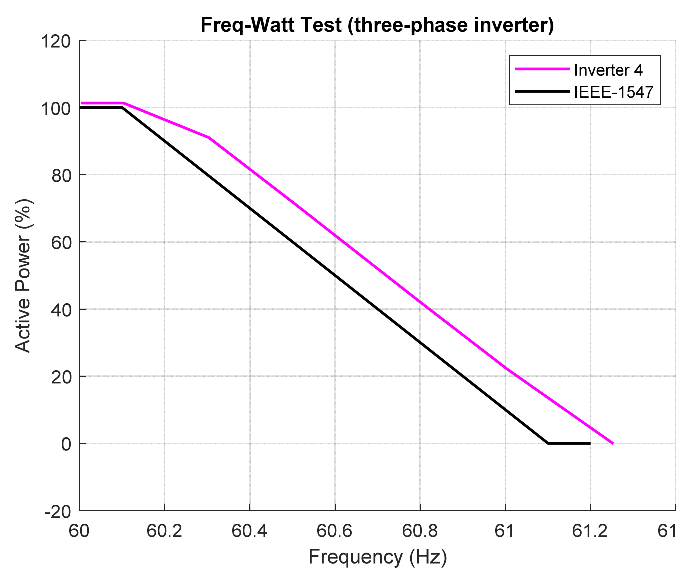

Figure 12: Experimental Frequency-Watt curve (three-phase).

could be approved if the utility provider accepts this 10% variation at the point of common coupling. The data recorded during Frequency-Watt test is presented in Appendix A.

3.4 Constant Power Factor

The range of allowable settings for each inverter can be changed from unity to 0.8 lead or 0.8 lag. The two main observations for this test are as follows: to ensure the inverters have the Constant Power Factor mode ability, and to show how well each inverter tracks the commanded power factor. The experimental curves with inverters 1, 2, 3, and 4 are presented in Figure 13, Figure 14, Figure 15, Figure 16, respectively.

None of the inverters operate with true unity power factor, i.e. inverters always exchange reactive power with the grid even when commanded to inject only real power. There are differences in the inverter abilities to regulate the power factor. These results show that the three-phase inverter follows the requested PF more closely over single-phase inverters. In these figures, maximum output power of the inverters is also plotted at each PF revealing that the active power output of the inverters decreases when operating at non-unity PF. None of the inverters are overrated, and hence PV power reduces in accordance with the choice of power factor.

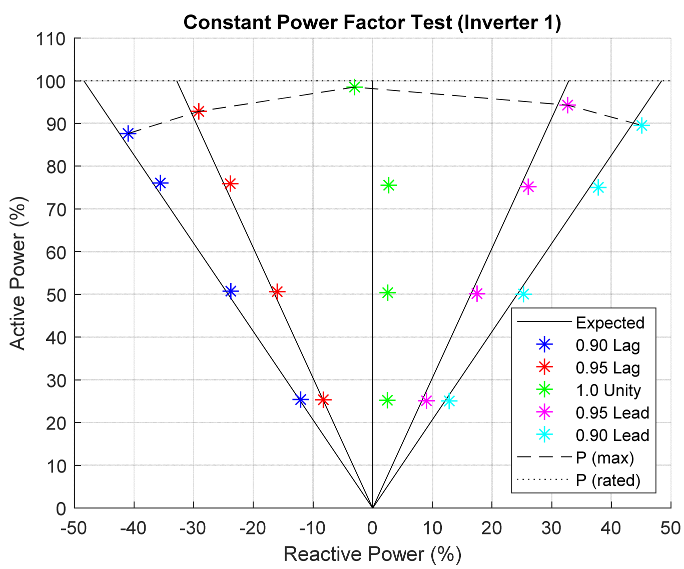

Figure 13: Experimental constant power factor curves with Inverter 1.

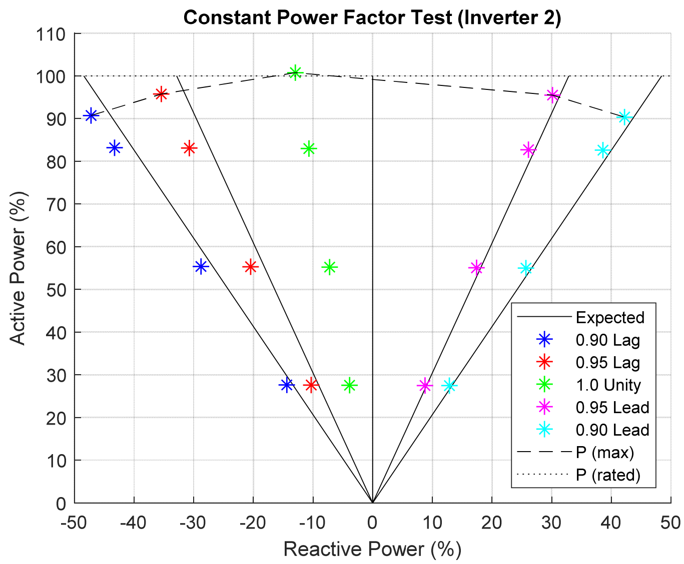

Figure 14: Experimental constant power factor curves with Inverter 2.

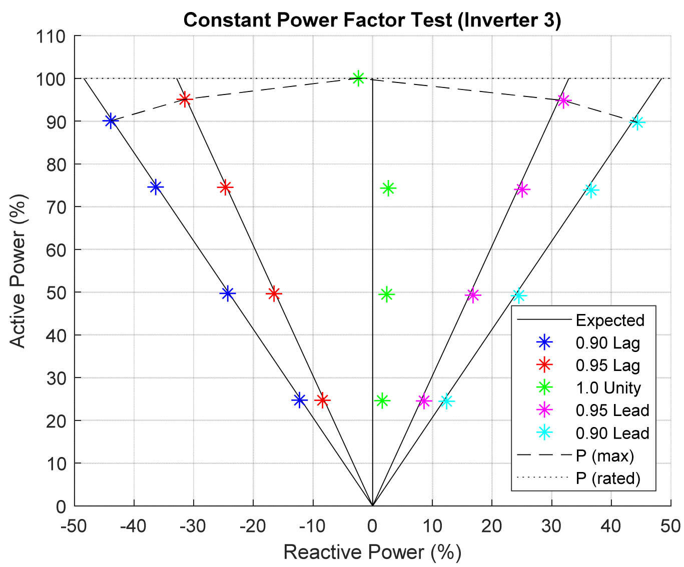

Figure 15: Experimental constant power factor curves with Inverter 3.

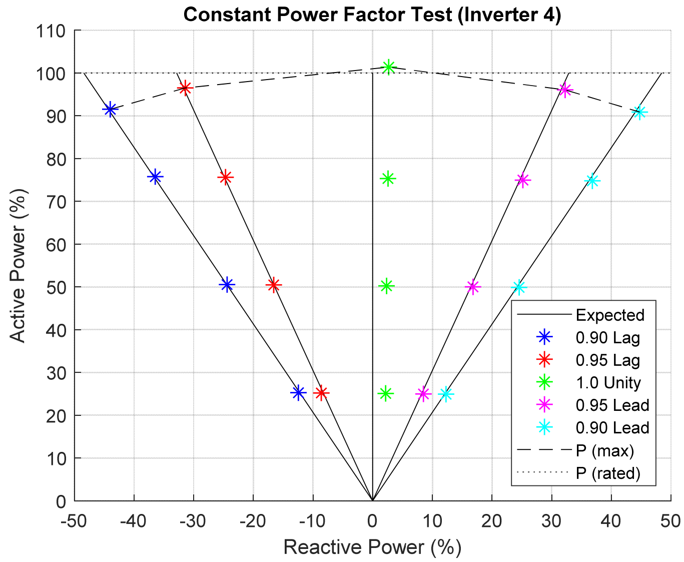

Figure 16: Experimental constant power factor curves with Inverter 4.

3.5 Voltage Ride-Through

The inverters were tested with the settings listed in Table 5. The inverters are expected to trip within the maximum programmed trip time corresponding to each voltage level. Inverter 2 is slightly slower to trip when the voltage increases to 110% or decreases to 70% of the nominal value. Overall all the inverters except inverter 5 comply with the voltage ride-through requirements and continued operating when the time period of the voltage increment/decrement is less than the programmed trip time.

Table 5: Clearing times for different voltage levels.

Voltage (% of nominal value)	**Maximum trip time (ms)**	**Inverter 1, Actual time (ms)**	**Inverter 2, Actual time (ms)**	**Inverter 3, Actual time**	**Inverter 4, Actual time**
120	160	141.3	153.8	153.8	147.9
110	2000	1981	2017	1977	1981
70	10000	9977	10016	6597	9977
45	160	138.4	116.9	155.6	100.5

The waveforms of the voltage and currents when inverters trips after the programmed time has elapsed are presented in Appendix B.

3.6 Transient Test Results Discussion

The overall status of the test performed is shown in Table 6. All the above tests were performed for both the categories of IEEE 1547-2018 standard. Category 1 is suitable for the low penetration of DER and does not require Volt-Watt or Frequency-Watt modes of operation. Category 2 is oriented for high penetration of DER, and requires the inverter to comply with all the modes. Overall, all the PV inverters comply with the category 1 requirements. Inverter 2 is not complaint with the category 2 of the IEEE 1547-2018 requirements, and cannot be used in areas with high penetration of photovoltaics.

Table 6: Overall test results status.

	Volt-Var		Volt-Watt		Frequency-Watt		Constant PF		LVRT	
Inverter1	1	2	1	2	1	2	1	2	1	2
Inverter2	1	2	1	2	1	2	1	2	1	2
Inverter3	1	2	1	2	1	2	1	2	1	2
Inverter4	1	2	1	2	1	2	1	2	1	2
Inverter5	1	2	1	2	1	2	1	2	1	2

1: Category 1 of IEEE 1547-2018, 2: Category 1 of IEEE 1547-2018

	Pass
	Fail

3.7 Steady-State Analysis

All the inverters follow start and shutdown commands when sent over the Ethernet interface. During steady-state operating conditions, total harmonic distortion (THD) of the load current and efficiency of inverters 1, 2, 3 and 4 is presented in Figure 17, Figure 18, Figure 19 and Figure 20, respectively. The THD of the current reduces as the power output of the inverter increases. Over the entire load range, the efficiency of all the inverters is higher than 95%.

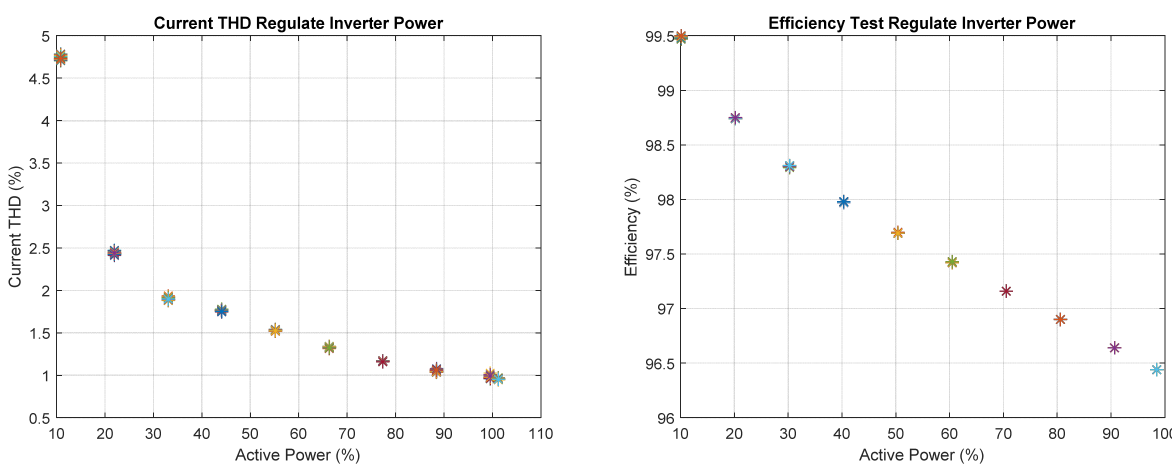

Figure 17: THD and efficiency over the range of power values with Inverter 1.

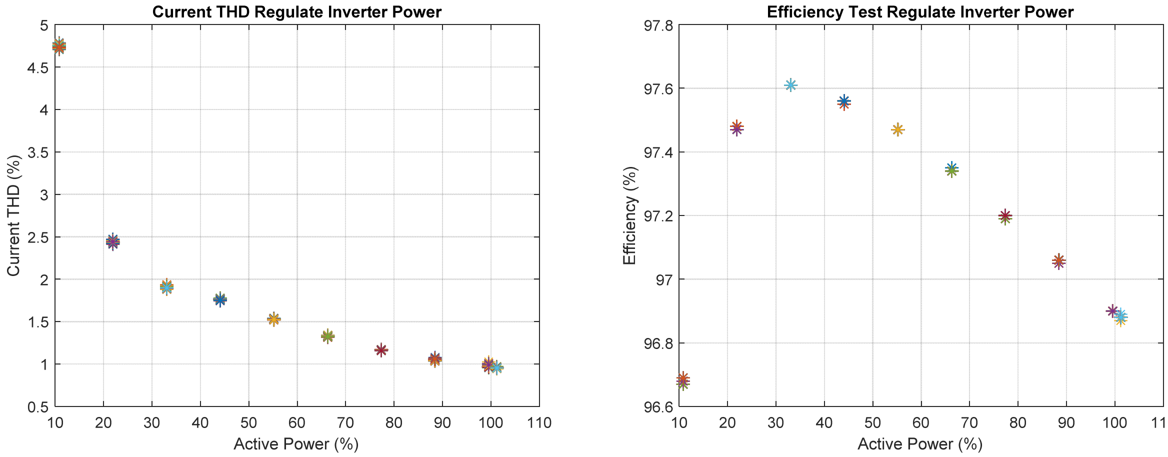

Figure 18: THD and efficiency over the range of power values with Inverter 2.

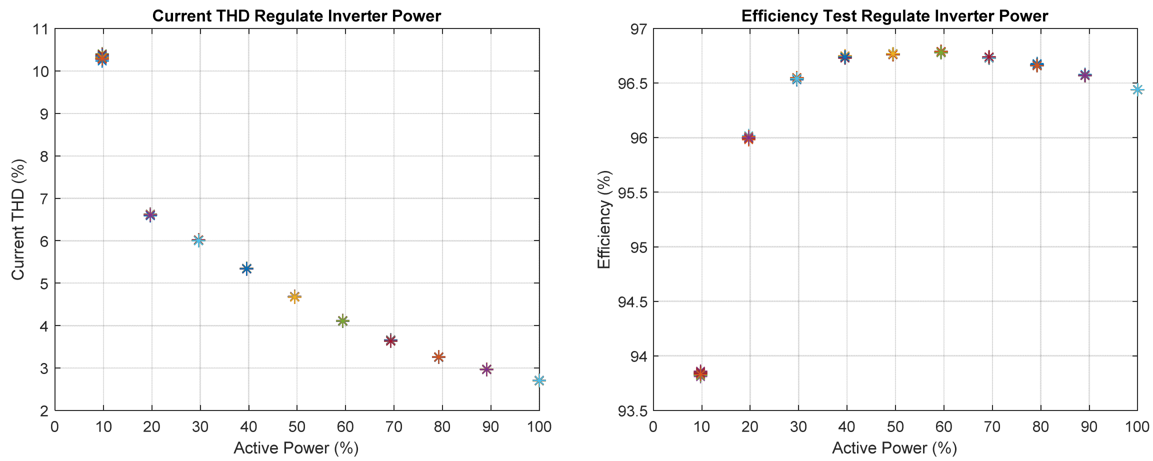

Figure 19: THD and efficiency over the range of power values with Inverter 3.

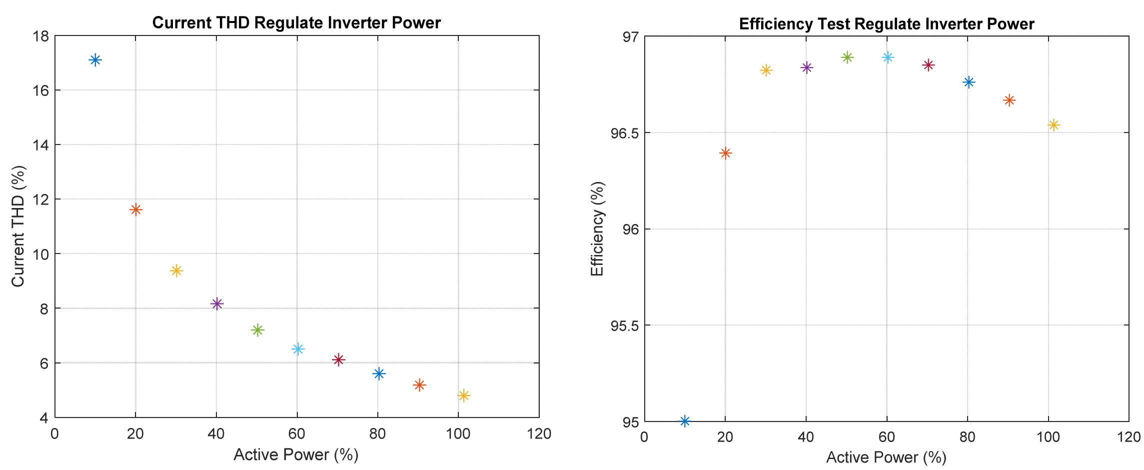

Figure 20: THD and efficiency over the range of power values with Inverter 4.

4 Performance Evaluation of Inverter 5

The control interface of the battery inverter provided limited access to change its settings and hence failed to comply with the IEEE 1547-2018 requirements. This inverter is capable of forming a small nanogrid and can provide an uninterrupted power to loads. Accordingly, a small 5 kW nanogrid, as shown in Figure 21, comprising Inverter 5 and a building load was formed and tested. The gateway unit needed along with this inverter didn't work with the commercial voltage of 208 V, and therefore 208 V to 120/240 V transformer was needed to ensure proper inverter operation.

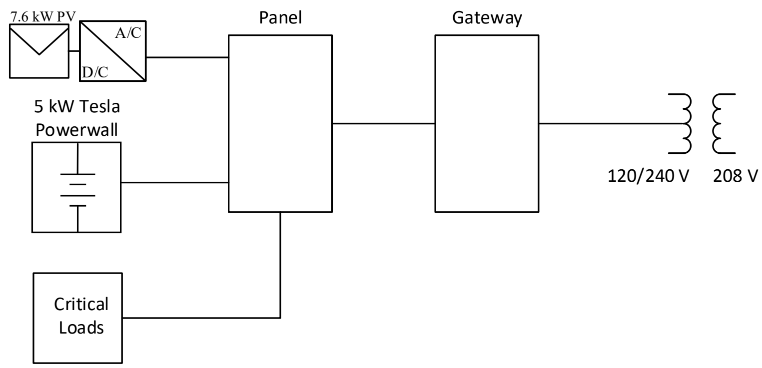

Figure 21: Inverter 5 test setup.

As soon as the grid supply was interrupted, Inverter 5 disconnected the load from grid and established its local voltage within two fundamental cycles, demonstrating its efficacy in delivering continuous uninterrupted power. The waveform of the load voltage during the transient is shown in Figure 22.

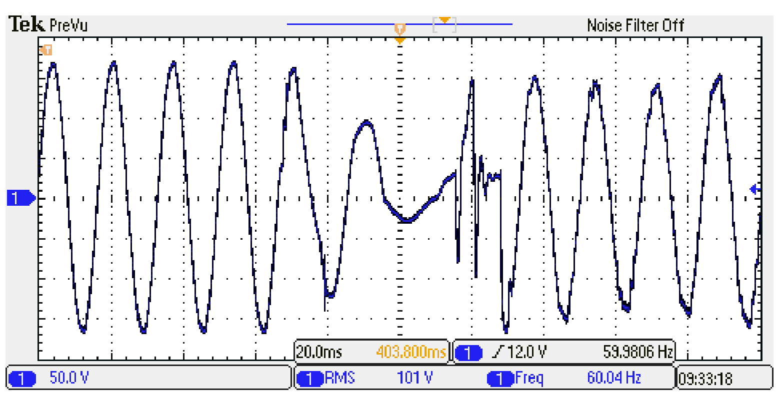

Figure 22: Load voltage during the transients.

In addition, the grid was manually disconnected and the load was varied to observe any changes in the output voltage of the inverter. Table 7 shows that the output voltage of inverter 5 is a function of the load demand, and at light loads the voltage is closer to its nominal value of 240 V. With load demand of 7.6 kW, the inverter supplied power for five seconds before shutting down.

Table 7: Load variation test results.

Load demand (kW)	Load voltage (V)
7.6	220
5	230
4	232
2	235

5 Communications

Communication capabilities of the inverters were also investigated in order to understand their capabilities to be remotely controlled, if necessary. All the inverters provide a Modbus communication interface along with a few other protocols, including JSON and SunSpec. Given Modbus protocol is commonly used at the EVR, all the inverters were tested with this interface. This protocol allows to log data related to the inverter output power, grid voltage and current while allowing the inverter control in the form of power regulation and shutdown/restart, as needed. In addition, all the inverter manufacturers provide web applications, providing another degree of freedom for control, data logging, and reconfiguration of settings.

Although all the inverters have a Modbus communication protocol, there were differences in the ability to control the inverters using this protocol. Inverters 3 and 4 allowed Modbus access to their internal registers through external software, such as MATLAB and other Modbus software, but grid-related settings could only be changed manually through the inverter's buttons. Inverters 1 and 2 allowed the settings to be changed over Modbus. Some general observations related to each inverter were derived:

I. Inverter 1
   - Supports Modbus
   - Allows communication and data monitoring over Modbus
   - Inverter settings can be changed using web application interface

II. Inverter 2
   - Supports Modbus
   - Allows communication and data monitoring over Modbus
   - Inverter can be controlled through Aurora Manager application

III. Inverter 3
   - Supports Modbus
   - Allows data monitoring over Modbus

- Inverter can be controlled through inverter's user interface or Solar-net application provided by the manufacturer

IV. Inverter 4
- Supports Modbus
- Allows change of settings, and acquiring-monitoring data over Modbus
- Can be controlled through inverter's user interface or Solar-net application provided by the manufacturer

6 Conclusions

A detailed experimental test bench that complies with the IEEE 1547-2018 standard was used to analyze the performance of five smart inverters. Four of these were PV inverters and the last, Inverter 5, was a battery inverter. Three of the PV inverters are compliant with the settings listed in IEEE 1547-2018 category 2; one of the PV inverters, Inverter 2, is only compliant with category 1, and, hence, can only be used in areas with a low penetration of DER. Inverter 5, the battery inverter, does not comply with any of the tests because of the limited user access to program its settings in accordance with the standard. Each inverter responded differently to each test. The maximum amount of reactive power output, which ranges between 50–100%, is a function of each inverter's nameplate capacity. For grid stabilization, single-phase inverters can supply reactive power in the range of 50–60% of their rated power, and the three-phase inverter can exchange reactive power up to 100% of its rated capacity. Given all the PV inverters provide full access to their advanced settings, these were found to be compliant with the new IEEE 1547-2018 standard.

Summary of Future Work

The testing described in this report was focused on evaluating the performance of a single inverter. The following are proposed as a part of future work:

- Determine response of multiple inverters when connected in parallel. This study will incorporate known impedances between two or more neighboring inverters to characterize the behavior of multiple inverters when connected at the point of common coupling
- Develop inverter models for RMP simulations
- Determine real-time response of inverters when controlled by the communication interface

Appendix A

The data recorded during Volt-VAR, Volt-Watt and Frequency-Watt mode of operations is presented in Table 8, Table 9, and Table 10, respectively, where each data point is the average value of 30 samples.

Table 8: Volt-VAR data.

	Inverter 1		Inverter 2		Inverter 3		Inverter 4	
Grid Voltage (% nominal)	Voltage (V)	Reactive Power (Var)	Voltage (V)	Reactive Power (Var)	Voltage (V)	Reactive Power (Var)	Voltage (V)	Reactive Power (Var) Per phase
88	184.1413	3608	183.0607	4483.833	183.2977	4542.767	223.82	6699
90	187.33	3503.933	187.3	4464.033	187.4853	4539	228.81	6699
93	193.6	2334.433	193.7287	2946.967	193.8143	3283.6	236.68	4363.27
95	197.735	1561.633	197.9303	1806.5	198.0153	2073.6	241.72	2881.07
97	201.8773	792.1333	202.05	714.0333	202.1517	898.6333	246.83	1385.13
99	205.9517	-211.633	206.0847	-297.367	206.1373	-179.167	251.92	137
100	208.047	-213.467	208.1763	-301.9	208.1773	-13.9333	254.42	138
101	210.126	-185.733	210.2523	-446.467	210.236	-304.133	257.02	163.63
103	214.135	-772.567	214.2937	-1477.23	214.2947	-1282.1	262.11	-1572.87
105	218.2307	-1530.87	218.3847	-2564.13	218.2937	-2292.93	267.08	-3005.3
107	222.3107	-2298.43	222.405	-3631.13	222.3233	-3315.03	272.15	-4449.13
110	228.2887	-3422.23	228.3723	-4811.03	228.1953	-4569	279.65	-6225.5
112	232.46	-3444	232.394	-4820	232.3503	-4566	284.77	-6204.83

Table 9: Volt-Watt data.

	Inverter 1		Inverter 2		Inverter 3		Inverter 4	
Grid Voltage (% nominal)	Voltage (V)	Real Power (W)	Voltage (V)	Real Power (W)	Voltage (V)	Real Power (W)	Voltage (V)	Real Power (W) Per phase
90	187.34	6209.1	-	-	187.7	7122.67	229.03	6748.97
95	197.66	6551.17	-	-	197.94	7512	241.73	6752
100	208.01	6893.83	-	-	208.21	7601.13	254.43	6754
106	220.32	6786.7	-	-	220.5	7603.63	269.72	6756.37
107	222.1	5359.67	-	-	222.52	6983.9	272.15	4958.2
108	223.77	3995.37	-	-	224.21	5932.4	274.69	3017.9
109	225.52	2574.1	-	-	224.98	-11.1	277.22	1044.37
110	228.69	19	-	-	227.02	-11	280.19	-14.17

Table 10: Frequency-Watt data.

	Inverter 1	Inverter 2	Inverter 3	Inverter 4
Frequency (Hz)	**Real Power (W)**	**Real Power (W)**	**Real Power (W)**	**Real Power (W) Per phase**
60	6894.63	-	7606.6	6753.5
60.1	6895.47	-	7605.23	6753.87
60.3	5635.77	-	5985.9	6068.57
60.5	4227	-	4485.03	4763
60.8	2112.83	-	2221.17	2774.57
61	702	-	708.9	1471
61.1	0	-	-11.13	-11

Appendix B

With the low/high voltage ride-through and trip requirements presented in Figure 23, several tests were performed to analyze response time of the inverters. The waveforms of voltage and currents when inverters trips after the programmed time has elapsed are presented for inverters 1, 2 and 3 in Figure 24, Figure 25, Figure 26, respectively. Waveforms are presented for the cases when voltage either increases to 120% or dips to 45% of the nominal value. The other cases where voltage values are in between the above presented values show a similar trend and hence not presented. Overall all the inverters trip within the programmed trip time, and meet IEEE 1547-2018 trip requirements.

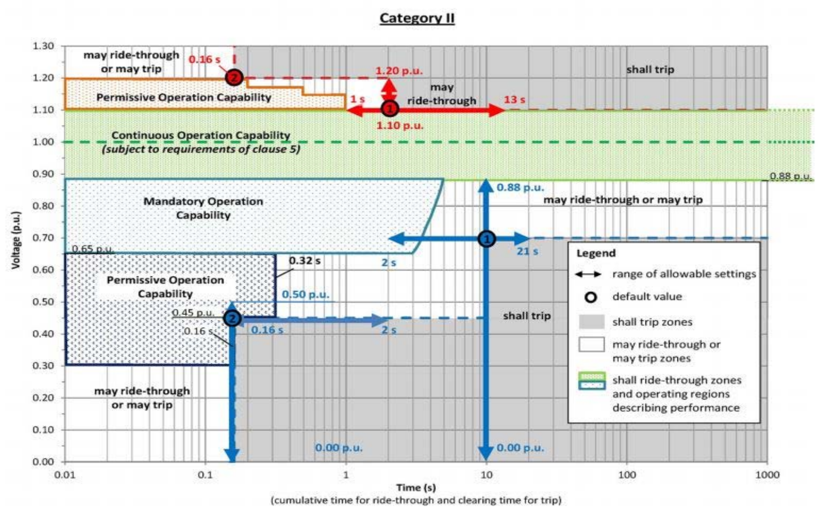

Figure 23: DER response to abnormal voltages and voltage ride-through requirements.

Image taken from IEEE 1547-2018 ©, IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

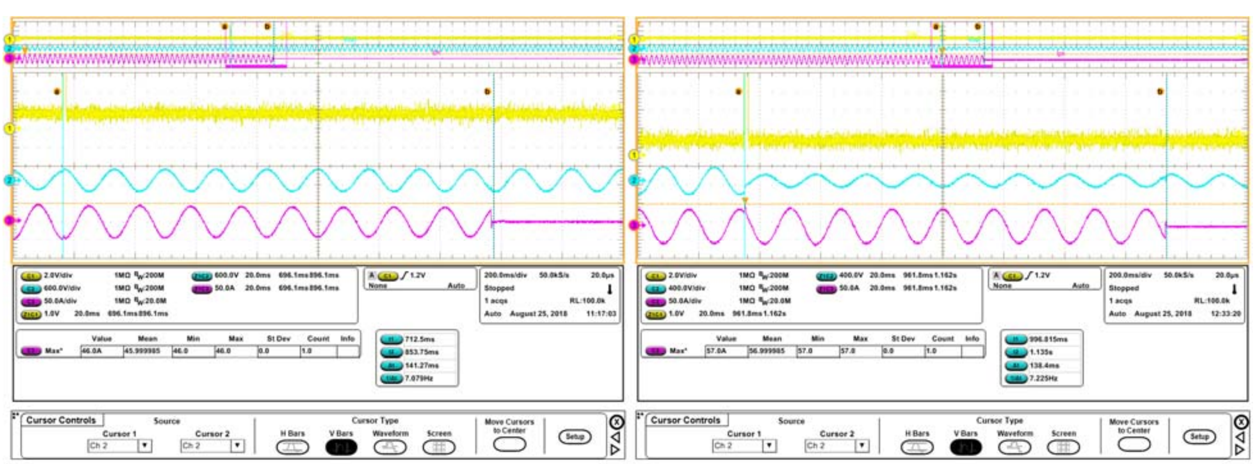

Figure 24: Screenshot of the voltage and current waveforms when inverter 1 trips with 120% voltage increment and 45% voltage dip.

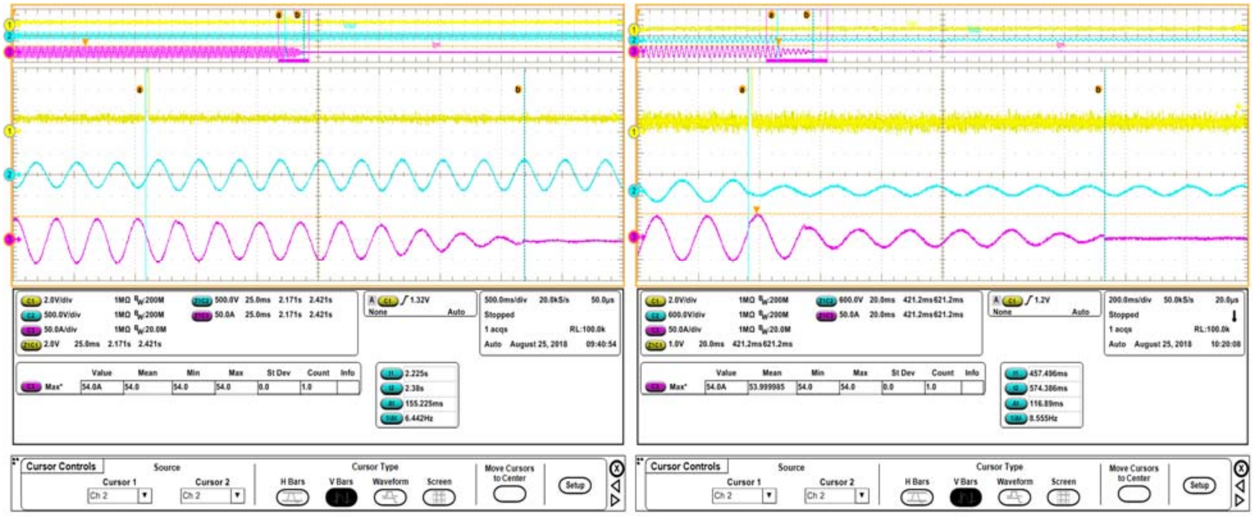

Figure 25: Screenshot of the voltage and current waveforms when Inverter 2 trips with 120% voltage increment and 45% voltage dip.

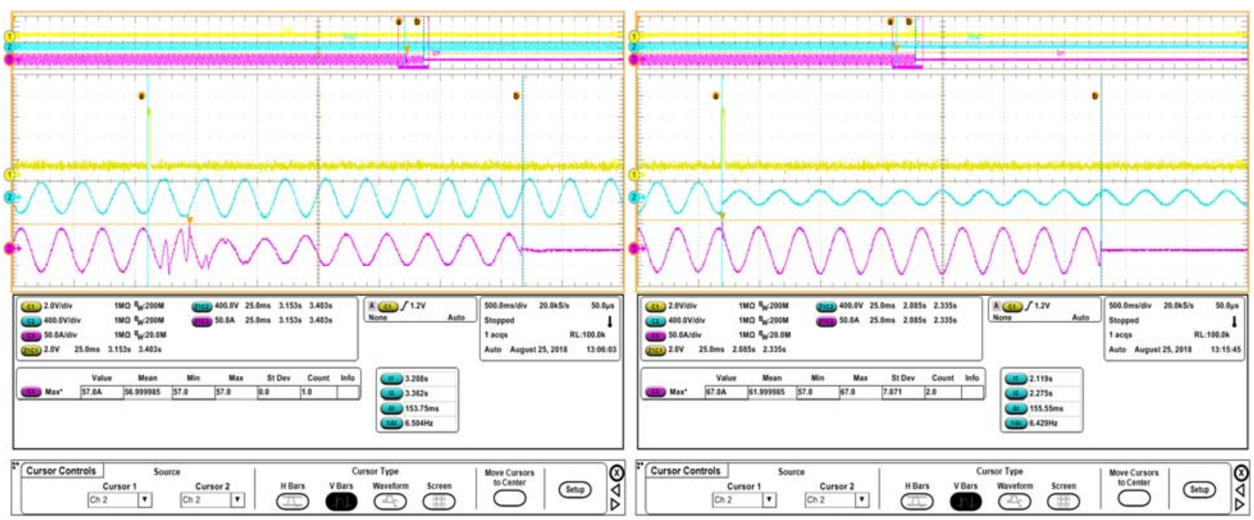

Figure 26: Screenshot of the voltage and current waveforms when Inverter 3 trips with 120% voltage increment and 45% voltage dip.

The waveforms of voltage and currents when inverters ride through the low voltage and high voltage transients are presented in Figure 27—**Error! Reference source not found.**.

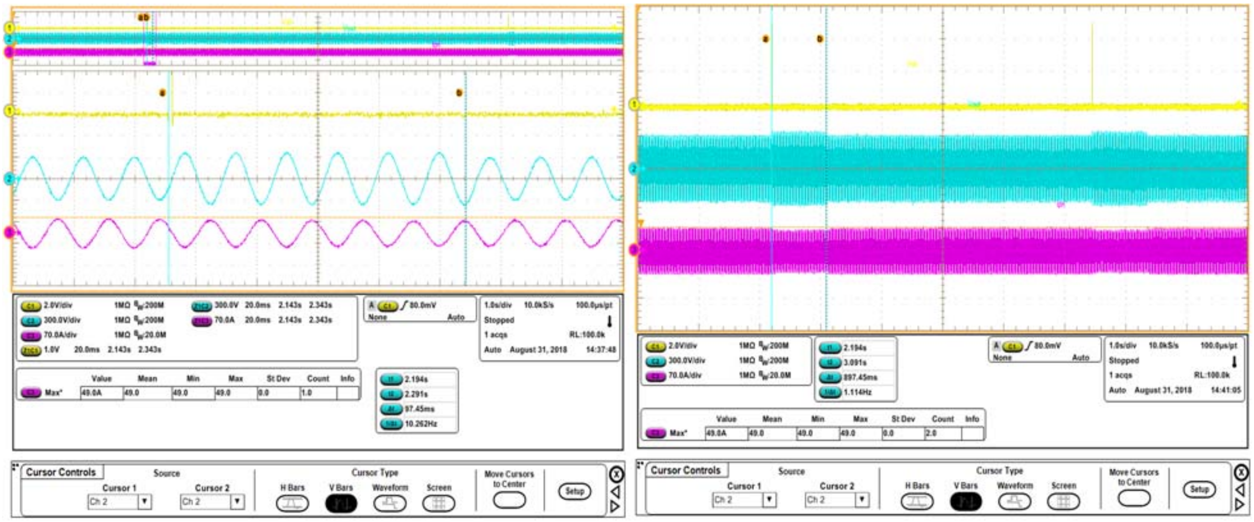

Figure 27: Screenshot of the voltage and current waveforms when Inverter 1 rides through the 120% and 110% voltage increment.

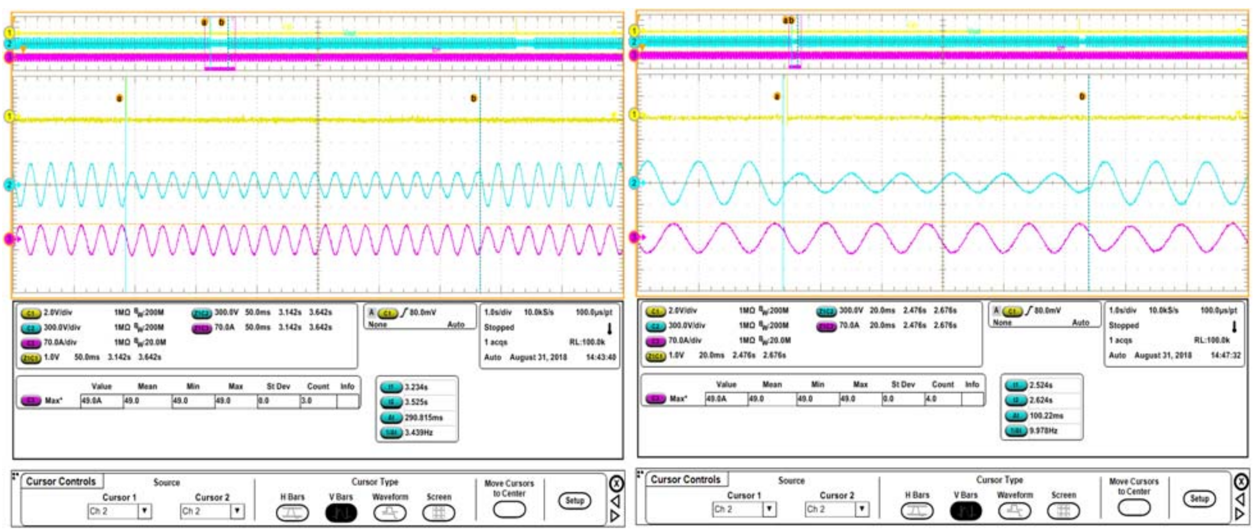

Figure 28: Screenshot of the voltage and current waveforms when Inverter 1 rides through the 60% and 45% voltage dip.

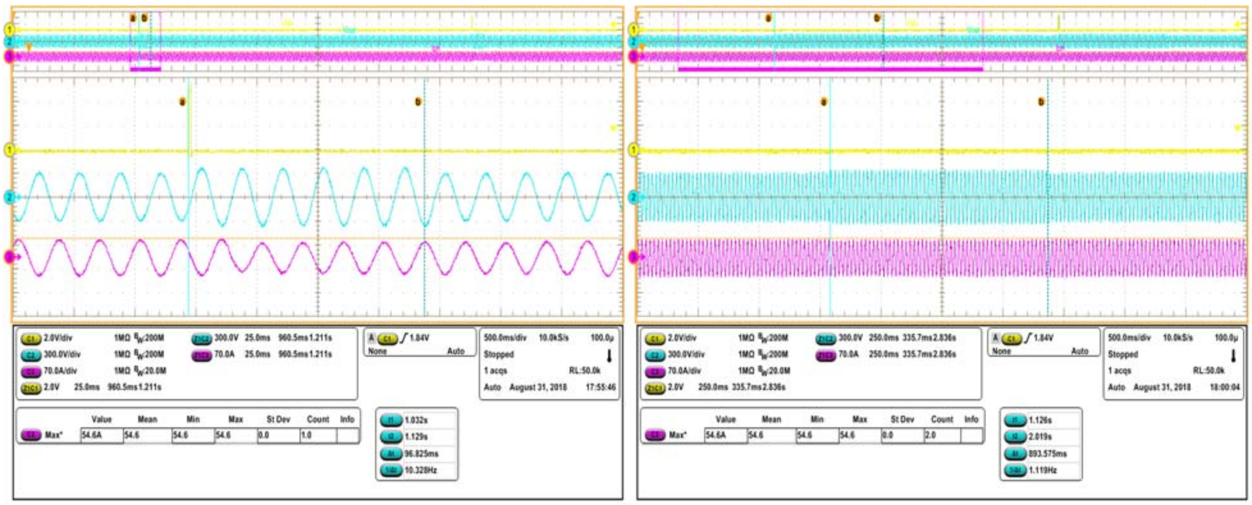

Figure 29: Screenshot of the voltage and current waveforms when Inverter 2 rides through the 120% and 110% voltage increment.

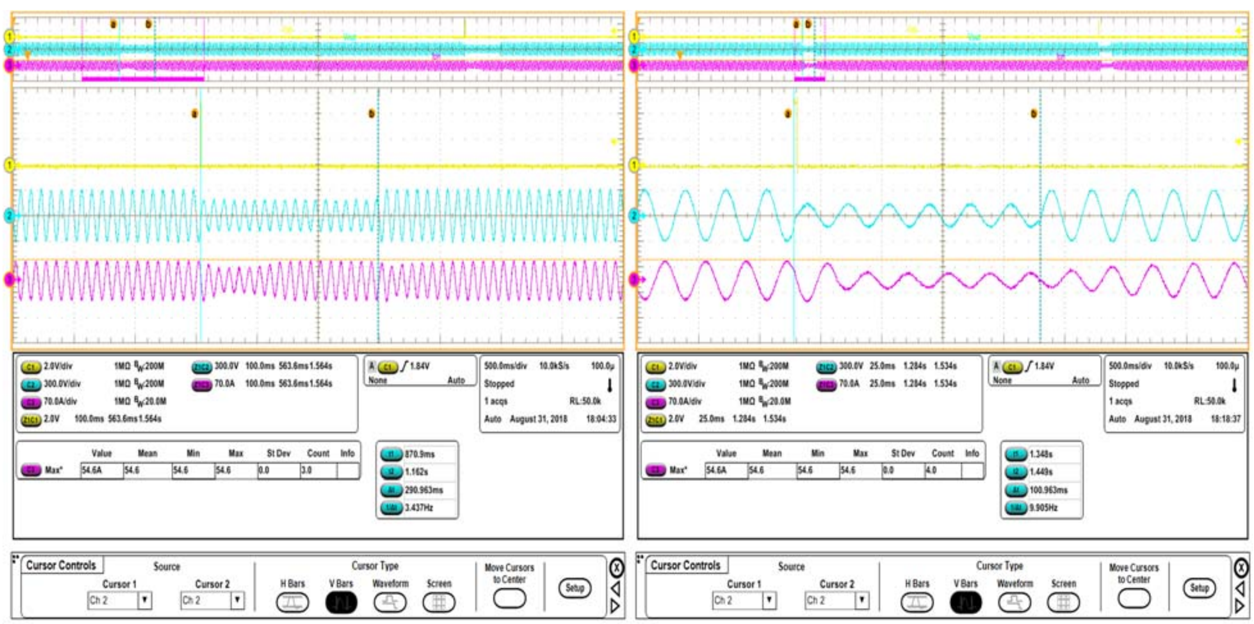

Figure 30: Screenshot of the voltage and current waveforms when Inverter 2 rides through the 60% and 45% voltage dip.

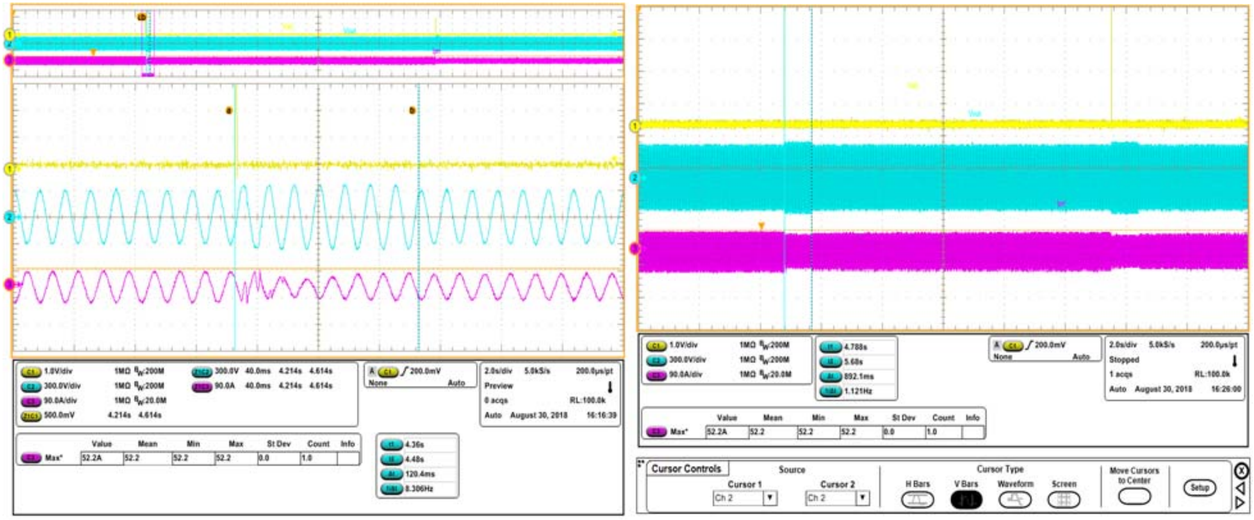

Figure 31: Screenshot of the voltage and current waveforms when Inverter 3 rides through the 120% and 110% voltage increment.

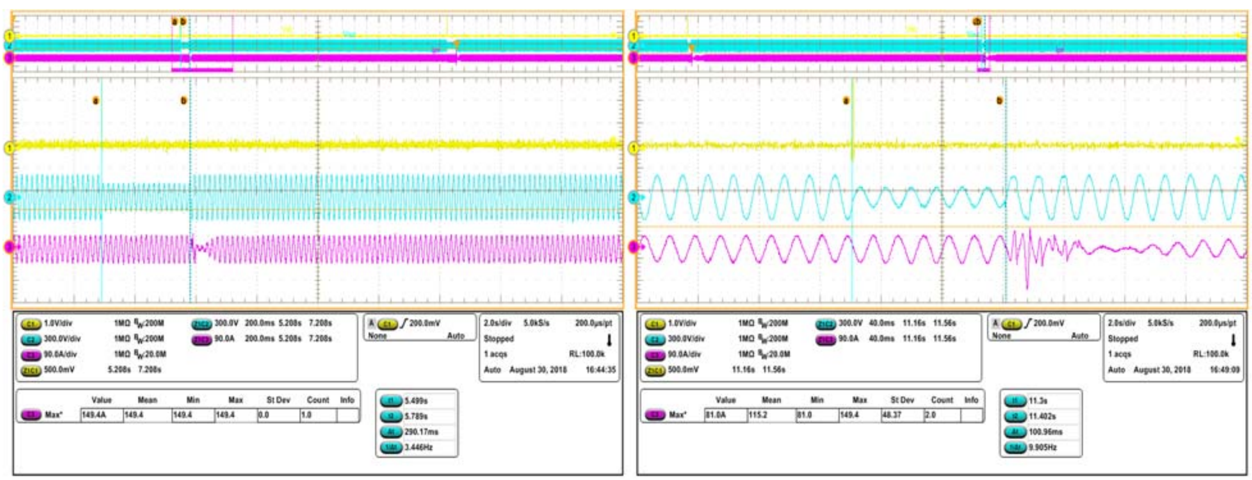

Figure 32: Screen shot of the voltage and current waveforms when inverter 3 rides through the 60 % and 45 % voltage dip.

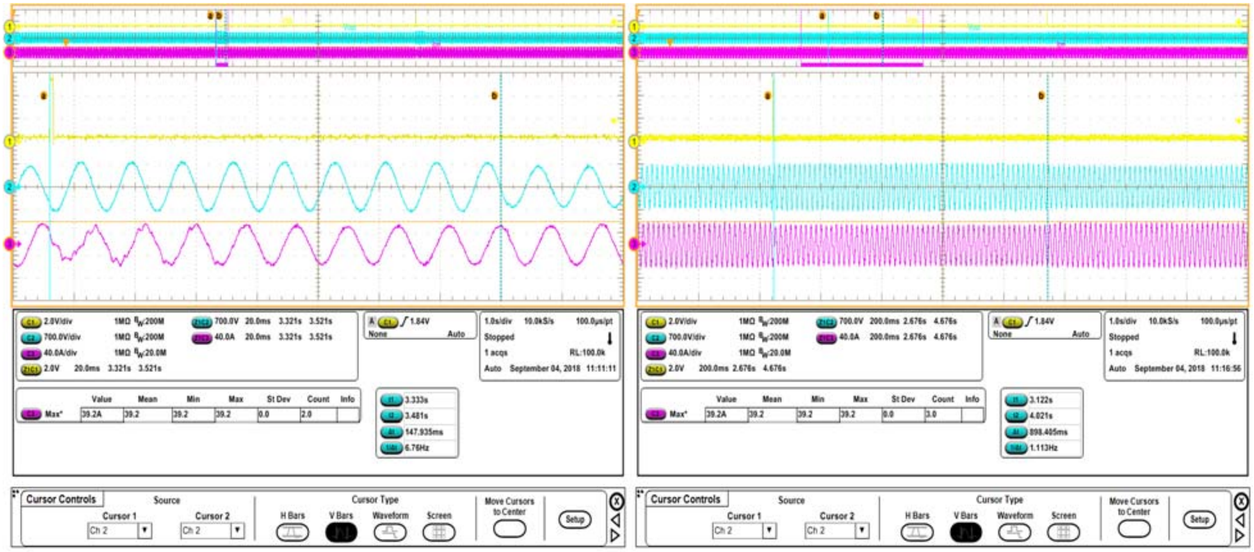

Figure 33: Screenshot of the voltage and current waveforms when Inverter 4 rides through the 120% and 110% voltage increment.

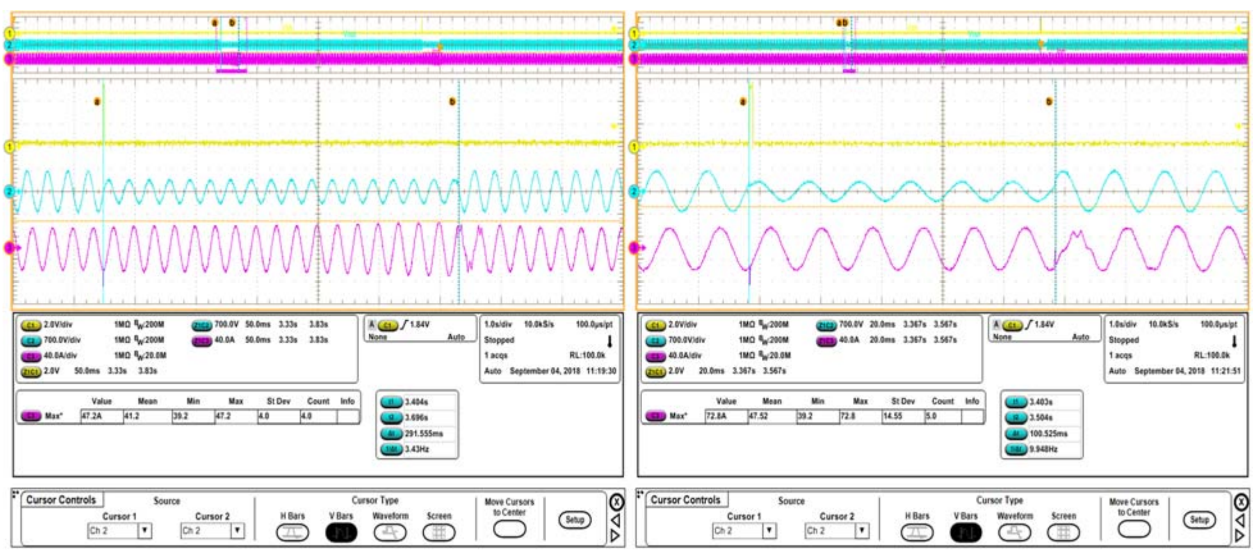

Figure 34: Screenshot of the voltage and current waveforms when Inverter 4 rides through the 60% and 45% voltage dip.

Utah Solar Incentive Program (USIP) Explanation

The USIP amounts shown on page 1.0 represent the actual expenditures of the USIP program. When STEP commenced, the Company anticipated that a portion of STEP revenues would be necessary to fund the remainder of the USIP program obligations through 2023. The Company's September 12, 2016, application in Docket No. 16-035-36 assumed funds would be needed for all remaining USIP project applications that had received, or were expected to receive, conditional approvals but had not yet qualified for incentive payments. At that time, the remaining USIP obligations was estimated to be $33.6 million. Since 2016, an estimated $14.2 million of projects that were previously approved for incentives have expired and are no longer eligible to receive USIP funds. Therefore, the revenues previously collected under the discontinued Electric Service Schedule 107 are sufficient to cover all remaining USIP incentive obligations without the use of any of the $50 million in STEP funds.

Currently, a portion of revenues collected under STEP are credited to the USIP account. On March 8, 2019, the Company filed an application requesting approval to use the STEP funds that were previously budgeted for USIP for a new project (the Advanced Resiliency Management System). If an alternative use for these funds is approved by the Commission, the Company will move the STEP revenues out of the USIP account. For transparency and consistency with prior reports, the company will continue to report USIP expenses in the annual STEP reports for as long as STEP revenues are booked to the USIP account.

Table 1 below provides the current balance in the USIP accounts that includes STEP funds.

Table 1. USIP Account Summary (with STEP Collections)

		Utah Solar Incentive Program Account - Through 2018						Revenue from STEP	
	Order	Program Total	2012	2013	2014	2015	2016	2017	2018*
Program Revenue		(29,707,190)	(961,324)	(6,293,704)	(6,320,828)	(6,317,639)	(6,323,285)	(2,664,945)	(825,465)
Program Expenditures:									
Incentive	331190, 338901		-	981,796	2,328,676	3,292,006	4,884,763	4,740,193	3,459,713
Program Administration	331191; 338902		-	253,665	322,664	173,248	412,866	94,788	27,098
Marketing	331192; 338903		55,905	35,744	25,995	14,515	336	-	-
Program Development	331193' 338904		30,748	99,140	577	-	-	-	-
Expired Deposits	331194; 338905		-	-	-	(36,821)	(103,963)	(99,568)	-
	408641							-	(8,129)
Cool Keeper program			-	-	-	-	(200,000)	-	-
Total Expenditures		20,785,954	86,653	1,370,345	2,677,912	3,442,948	4,994,002	**4,735,412**	**3,478,682**
Interest		(2,925,333)	(5,995)	(219,165)	(473,909)	(721,712)	(685,628)	(627,425)	(191,500)
USIP Account Balance (including STEP funds)		**(11,846,570)**							

Table 2 provides the CY 2018 USIP account balance assuming only USIP collections under Schedule 107. This table shows that even without STEP funds the USIP account balance has a surplus.

Table 2. USIP Account Summary (With Electric Service Schedule 107 revenues only)

		Utah Solar Incentive Program Account - Through 2018							
	Order	Program Total	2012	2013	2014	2015	2016	2017	2018*
Program Revenue		(26,216,780)	(961,324)	(6,293,704)	(6,320,828)	(6,317,639)	(6,323,285)	-	-
Program Expenditures:									
Incentive	331190, 338901		-	981,796	2,328,676	3,292,006	4,884,763	4,740,193	3,459,713
Program Administration	331191; 338902		-	253,665	322,664	173,248	412,866	94,788	27,098
Marketing	331192; 338903		55,905	35,744	25,995	14,515	336	-	-
Program Development	331193' 338904		30,748	99,140	577	-	-	-	-
Expired Deposits	331194; 338905		-	-	-	-	(103,963)	(99,568)	-
	408641							-	(8,129)
Cool Keeper program			-	-	-	-	(200,000)	-	-
Total Expenditures		20,822,775	86,653	1,370,345	2,677,912	3,479,769	4,994,002	**4,735,412**	**3,478,682**
Interest		(3,194,039)	(5,995)	(219,165)	(473,909)	(721,712)	(685,628)	(577,200)	(510,431)
USIP Account Balance (Sch. 107 only)		**(8,588,045)**							

The Total Expenditure amounts showing for CY 2017 and CY 2018 tie to the USIP expenditures on page 1.0 of this report and also tie to Table 15 in the Company's USIP annual reports[1].

[1] See Docket No. 18-035-24 for CY 2017 total expenditures. The CY 2018 USIP annual report will be filed June 1, 2019.