ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

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

April 30, 2020

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 Administrator

RE: **Docket No. 20-035-21—Rocky Mountain Power's Third Annual Sustainable Transportation and Energy Plan Act ("STEP") Program Status Report**

In accordance with Docket No. 16-035-36, Rocky Mountain Power (the "Company") hereby submits for filing its third Annual Sustainable Transportation and Energy Plan Act ("STEP") Program Status Report ("STEP Report"). The STEP Report contains the overall calendar year 2019 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 continues to modify and supplement the report based on feedback and recommendations from interested parties through various proceedings. A complete list of these changes is provided on pages 1.2 through 1.5 along with a reference to where the additional information can be found in the STEP Report, if applicable. 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 NOx Neural Network Implementation (Huntington Plant) project, Page 4.0, and the CarbonSAFE project, Page 8.0 are complete and final reports are included in this filing.

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
John.hutchins@pacificorp.com

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. 20-035-21

I hereby certify that on April 30, 2020, a true and correct copy of the foregoing was served by electronic mail to the following:

Utah Office of Consumer Services	
Cheryl Murray	cmurray@utah.gov
Michele Beck	mbeck@utah.gov
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dpudatarequest@utah.gov	
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Katie Savarin
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ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

STEP PROGRAM STATUS REPORT

For Period Ended
December 31, 2019

2019 ANNUAL STEP STATUS REPORT

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Overall STEP Program Information:

STEP Project Reports:

Utah Solar Incentive Program:

2019 Annual STEP Status Report
STEP and USIP Accounting
CY 2019

Page No.		CY 2017	CY 2018	Jan-19	Feb-19	Mar-19	Apr-19	May-19
				CY 2019				
	STEP Account Beginning Balance	(15,850,031)	(19,861,068)	(23,946,249)	(24,516,425)	(25,214,174)	(24,424,754)	(24,119,511)
	Spending by Project							
2.0	EV Charge Infrastructure	487,502	1,881,703	167,183	29,552	28,147	121,399	320,862
3.0	Woody-waste Co-Fire Biomass at Hunter Unit 3	-	262,837	-	-	45,738	79,084	79,472
4.0	NOx Neural Network Implementatio	457,767	207,616	115	22,243	12,568	23,451	14,256
5.0	Alternative NOx Reductior	131,405	26,010	-	-	-	-	-
6.0	CO2 Enhanced Coal Bed Methane (CO2 Reduction	-	73,041	0	(8,779)	10,725	124	-
7.0	Cryogenic Carbon Capture (Emerging CO2 Capture	160,451	530,289	-	-	309,118	95,249	-
8.0	CARBONsafe (CO2 Sequestration Site Characterization	150,239	-	-	-	-	-	-
9.0	Solar Thermal Assessment (Grid Performance	-	-	-	-	20,250	-	18,500
10.0	Circuit Performance Meters (Substation Metering	13,676	427,349	(58,371)	122,766	(19,238)	2,208	36,388
11.0	Commercial Line Extensior	-	69,340	-	-	38,740	-	-
12.0	Gadsby Emissions Curtailmen	-	-	-	-	-	-	-
13.0	Panguitch Solar and Energy Storage Project	331,995	75,474	(1,417)	3,284	677,690	518,443	612,277
14.0	Microgrid Project	-	90,713	-	-	1,007	98	-
15.0	Smart Inverter Projec	-	383,859	-	-	-	-	-
16.0	Battery Demand Response	-	-	-	-	-	-	-
17.0	Intermodal Hub	-	-	-	-	-	-	-
18.0	Advance Resiliency Management Systen	-	-	-	-	-	-	-
19.0	Utah Solar Incentive Progran	4,762,182	3,486,811	226,598	-	504,948	263,509	(301)
	Total Spending	6,495,218	7,515,042	334,109	169,066	1,629,693	1,103,565	1,081,453
	Surcharge Collections	(9,756,984)	(10,725,962)	(821,678)	(782,255)	(755,666)	(710,020)	(700,237)
	Ending Monthly Balance before Carrying Charge	(19,111,798)	(23,071,989)	(24,433,819)	(25,129,614)	(24,340,147)	(24,031,209)	(23,738,296)
	Carrying Charge	(749,270)	(874,261)	(82,606)	(84,559)	(84,607)	(88,303)	(87,310)
	Ending Monthly Balance	(19,861,068)	(23,946,249)	(24,516,425)	(25,214,174)	(24,424,754)	(24,119,511)	(23,825,606)

Page No.		Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	CY 2019 Total	2017-2019 Cummulative Total*
	STEP Account Beginning Balance	(23,825,606)	(23,951,249)	(23,699,725)	(23,791,236)	(23,478,140)	(23,550,338)	(23,304,970)	(23,946,249)	(15,850,031)
	Spending by Project									
2.0	EV Charge Infrastructure	140,899	438,389	88,439	322,975	83,267	47,199	35,828	1,824,139	4,193,344
3.0	Woody-waste Co-Fire Biomass at Hunter Unit 3	-	110,367	-	127,071	-	147,211	-	588,943	851,780
4.0	NOx Neural Network Implementatio	-	39,149	-	-	39,152	1,760	78,928	231,621	897,004
5.0	Alternative NOx Reductior	-	-	-	-	-	-	-	-	157,415
6.0	CO2 Enhanced Coal Bed Methane (CO2 Reduction	28,201	-	280	11,582	-	-	-	42,133	115,174
7.0	Cryogenic Carbon Capture (Emerging CO2 Capture	-	123,522	-	13,843	2,635	53	167,330	711,750	1,402,490
8.0	CARBONsafe (CO2 Sequestration Site Characterization	-	-	-	-	-	-	-	-	150,239
9.0	Solar Thermal Assessment (Grid Performance	-	-	-	-	44,307	-	-	83,057	83,057
10.0	Circuit Performance Meters (Substation Metering	8,333	15,271	64,263	106,295	87,497	33,364	53,002	451,777	892,802
11.0	Commercial Line Extensior	-	-	-	45,360	-	-	-	81,743	151,083
12.0	Gadsby Emissions Curtailmen	-	-	-	-	-	-	7,067	7,067	7,067
13.0	Panguitch Solar and Energy Storage Project	630,230	432,029	883,136	584,400	443,937	380,209	1,209,331	6,373,549	6,781,019
14.0	Microgrid Project	-	782	75,829	-	-	-	-	77,717	168,430
15.0	Smart Inverter Projec	-	-	-	-	-	-	-	-	383,859
16.0	Battery Demand Response	-	-	-	-	-	925	3,344	4,270	4,270
17.0	Intermodal Hub	-	-	-	-	-	-	802,510	802,510	802,510
18.0	Advance Resiliency Management Systen	-	-	5,770	6,440	12,040	10,676	5,005	39,931	39,931
19.0	Utah Solar Incentive Progran	9,857	246,904	72,856	296,871	65,652	437,659	49,188	2,173,740	10,422,733
	Total Spending	817,519	1,406,412	1,190,573	1,514,838	778,487	1,059,056	2,411,533	13,493,946	27,504,205
	Surcharge Collections	(856,158)	(1,068,112)	(1,195,600)	(1,115,577)	(765,041)	(728,357)	(508,773)	(10,007,474)	(30,490,421)
	Ending Monthly Balance before Carrying Charge	(23,864,245)	(23,612,949)	(23,704,751)	(23,391,975)	(23,464,693)	(23,219,639)	(21,402,211)	(20,459,778)	(18,836,247)
	Carrying Charge	(87,005)	(86,776)	(86,485)	(86,165)	(85,644)	(85,331)	(81,586)	(1,026,377)	(2,649,907)
	Ending Monthly Balance	(23,951,249)	(23,699,725)	(23,791,236)	(23,478,140)	(23,550,338)	(23,304,970)	(21,483,797)	(21,486,154)	(21,486,154)

*the STEP Account Begninning Balance of ($15,850,031) is the begninng balance as of January 2017

2019 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 (10.65%)	End Balance	Cash Basic Accumulated Balance
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 (9.21%)	End Balance	Cash Basic Accumulated Balance
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		

CY 2019

	Program Expenditures	Accrued Program Expenditures	Amortization of Expense (over 10 years)	Unused DSM Revenue Collections	Carrying Charge (9.21%)	End Balance	Cash Basic Accumulated Balance
FY18	-	3,823,986	-	(16,881,295)		(13,057,310)	(16,881,295)
1	2,226,187	409,558	(882,851)	(4,647,371)	(142,243)	(16,094,030)	(20,327,574)
2	3,125,236	(851,191)	(905,431)	9,742,037	(110,111)	(5,093,489)	(8,475,842)
3	3,363,644	929,979	(932,571)	(3,986,014)	(71,019)	(5,789,470)	(10,101,802)
4	4,141,721	(298,685)	(963,923)	(3,566,324)	(79,022)	(6,555,703)	(10,569,350)
5	3,750,564	(389,337)	(996,702)	(3,546,409)	(84,161)	(7,821,747)	(11,446,057)
6	3,030,543	1,099,368	(1,025,077)	(4,533,002)	(97,548)	(9,347,465)	(14,071,142)
7	4,107,773	377,100	(1,055,307)	(5,916,482)	(118,987)	(11,953,367)	(17,054,144)
8	4,296,799	101,144	(1,090,082)	(6,793,244)	(144,654)	(15,583,403)	(20,785,325)
9	5,468,058	(705,972)	(1,130,583)	(6,211,505)	(166,719)	(18,330,125)	(22,826,074)
10	4,265,394	757,369	(1,171,487)	(3,787,195)	(177,851)	(18,443,895)	(23,697,214)
11	5,000,367	360,815	(1,209,461)	(3,584,184)	(181,083)	(18,057,442)	(23,671,575)
12	8,872,512	276,491	(1,267,099)	(4,176,107)	(168,519)	(14,520,163)	(20,410,787)
Estimate	-	-	-		9,874	(14,510,289)	(20,400,913)
Total	51,648,796	5,890,625	(12,630,573)	(57,887,094)	(1,532,043)		
				-			
			44,908,848		(59,419,137)	(14,510,289)	
			Total Asset		Total Liabilities		

2019 ANNUAL STEP STATUS REPORT

For Period Ended December 31, 2019

List of Report Changes in Compliance with Commission Orders and Other Commitments

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 or otherwise provided.

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 1st STEP Report 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 Page 19.0
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-2E
	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
		2) Table 3 EVCI should include the date each custom project was accepted by the Company.		See Exhibit 2-A, column "creation date"
	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
	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
			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
		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

Docket No. 16-035-36 February 6, 2019 Commission Order

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:

Summary of Requirements from February 6, 2019 Order (Docket No. 16-035-36)

Topic	Requirement	Compliance Reference
Commercial Line Extension	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	Page 11.0-11.1
Storage and Solar Technology Project	Meet with parties to discuss:	Meeting held on February 25, 2019
	1) Provide requested project cost data	Requested data was provided through discovery on March 25, 2019 in Docket No. 16-035-36 OCS 21.1 3rd Supplemental
	2) Develop reporting requirements for this data in annual STEP reports going forward	None at this time although parties anticipate additional reporting requirements may develop as the project moves forward
	3) Discuss types of info to be provided after STEP ends (and in what manner)	

***********************************NEW***********************************

Docket No. 16-035-36 June 28, 2019 Commission Order

On March 8, 2019 the Company filed for approval of three new innovative utility programs under the STEP Act. The Commission approved the Company's request in an order issued June 28, 2019. The order included the following additional reporting requirements for the annual STEP report:

Summary of Requirements from June 28, 2019 Order (Docket No. 16-035-36)		
Topic	**Requirement**	**Compliance Reference**
Intermodal Hub	STEP Annual Report include progress on achieving the project's four tasks outlined in the Application	Starting on Page 17.0
	- Provide cost benefit analysis at project conclusion (Office)	will be provided at conclusion
	- Report on any elements that are not resolved within appropriate timeframes (Office)	will be reported if applicable
EXIT strategy Meeting	Include a summary of meeting in STEP Report (Division & PSC recommendation)	See Page 1.6
Ongoing OMAG	reporting on ongoing OMAG (Office)	See Page 1.6
Other	Quarterly updates w/ project accounting (Division and Office)	Ongoing, next update scheduled May 19, 2020
Battery Demand Response	comprehensive performance update report - mid year and in STEP report (WRA - RMP reply comments)	Nothing to report at this time. Updates will begin in Q4 2020
	- proof of permit from city (Division)	filed Docket No. 16-035-36, 8/28/19
	- legal protections for ratepayers (Division)	filed Docket No. 16-035-36, 4/17/20

<u>Docket No. 19-035-T12 August 20, 2019 Commission Order</u>

On July 23, 2019 the Company filed for approval to refund $3.06 million in surplus revenues collected under the discontinued Schedule 107 related to the canceled Utah Solar Incentive Program through a reduction in the STEP surcharge collections through Schedule 196. The Commission approved the Company's request to refund the revenues over 12 months beginning November 1, 2019. The order included the following additional reporting requirement for the annual STEP report:

Summary of Requirements from August 20, 2019 Order (Docket No. 19-035-T12)		
Topic	**Requirement**	**Compliance Reference**
USIP	Order: include the additional USIP balance reporting that the DPU requested in its August 9, 2019 comments in RMP's annual STEP and USIP status reports. DPU comments:The Division recommends the Commission direct RMP to include in its Annual STEP Report and Annual USIP Report an accounting of the USIP balance including the current variable charges explained above.	See USIP Explanation beginning on Page 19.0.

Docket No. 19-035-17 (Second STEP Report)

Below is a summary recommendations from the 2nd annual STEP report:

Summary of Requirements from 2nd STEP report (Docket No. 19-035-17)		
Topic	**Requirement**	**Compliance Reference**
USIP	coordinate and add detail on USIP	See USIP Explanation beginning on Page 19.0.
Accounting Summary	add footnote - see revised exhibit A (Office)	Footnote added to Page 1.0
Line extension	- specify number of applications received better - clarify if anyone received multiple rewards - check column labels on table 2	Pages 11.0-11.2

STEP Exit Strategy and Planning Meeting
November 12, 2019

Attendees

In person:
Brenda Salter, DPU
Justin Jetter, AG's Office for the DPU
Bob Davis, DPU
Cheryl Murray, OCS
Kate Bowman, UCE
Sophie Hayes, WRA
Kelly Francone, UAE
Jana Saba, RMP
Shawn Grant, RMP

On the phone:
Kayla Bishop, RMP
Artie Powell, DPU
Robert Meredith, RMP

Discussion Topics & Meeting Summary

1. Remaining Unspent STEP funds
   The company shared that it estimates that, based on current STEP budget projections, some remaining STEP funds is likely. Participants discussed possible uses of any remaining funds including refund to customers, continuation of a current STEP project, or a new project. Many expressed a preference to refund any excess funds to customers. Parties also discussed the possibility of retaining a portion of the funds in a regulatory liability to use for any ongoing costs of STEP projects beyond 2021 as discussed in more detail below. Parties decided to meet again after the conclusion of STEP once the amount of remaining funds is certain to collaborate on the use of the funds. If a refund is the preferred approach, the refund could be proposed as part of the final annual STEP filing, due to be filed in 2022.
   a. USIP balance end of 2023 *(reference Docket No. 19-035-T12, 7/23/19 Tariff Filing)*
      Although the USIP incentive payouts are scheduled to go through 2023, the majority of the USIP incentives will be paid at the time the use of any excess STEP funds is being determined (Q2/Q3 of 2022). Therefore parties discussed that it may make sense to combine the excess USIP funds with the excess STEP funds and apply the same treatment. This item will also be discussed at the conclusion of STEP.
2. Ongoing STEP costs
   a. Reporting

Type, granularity, format, and timing of information *(reference Docket No. 16-035-36, 6/28/19 Report and Order)*

Parties agree that the company will provide the detailed information by project for any ongoing costs associated with STEP projects when it files its final reports on the STEP projects in 2022.

   b. Ongoing benefits
   c. Regulatory liability
      i. Terms (length, carrying charge, etc)
      ii. What to do with any remaining balance
      The parties discussed the option of setting aside a portion of any remaining STEP funds to use for ongoing costs. It was determined that parties would discuss once the STEP program concludes after 2021 when the magnitude of the expected ongoing costs can be reasonably estimated.

3. Final accounting
   a. EV program use or lose and September fiscal year
      i. The EV program prescriptive incentives for AC Level 2 and DC Fast Chargers follow an October 1st through September 30th fiscal year, while Grant-based custom projects and partnerships follow a January 1st through December 31st program year. Accounting for the EV program in this manner helps ensure funding for the EV program is used efficiently, and helps avoid the unnecessary loss of funds due to the use-it-or-lose-it nature of the EV program's funding.
   b. Can projects be allowed a few months close out process? Or must all costs stop 12/31/2021?
   The STEP period is 2017-2021. The company informed the meeting participants that it may take time to close out the accounting and payouts associated with STEP projects, which may necessitate a delay of the final STEP report – due April 30, 2021 – to capture the final accounting for the projects. The group generally discussed allowing the company until March 31, 2022 to finalize the accounting for the projects. The company would request a delay from the Commission to delay the final report filing – likely to June 30, 2022.
4. Final reporting timing
In early 2022, the company would request permission from the Commission to delay the final report filing – from April 30, 2022 to possibly June 30, 2022. Note, the final report is intended to represent the final annual STEP report that presents CY 2021 actual information. This is not referencing the report and recommendation to the Legislature as referenced in 54-20-106.
5. Exit Meeting report to the PSC *(reference Docket No. 16-035-36, 6/28/19 Report and Order)*

STEP Project Report

Period Ending December 31, 2019[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.

2019 EV PROGRAM BUDGET ACCOUNTING

Table 1 below is an accounting of how the $2 million 2019 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 – 2019 EV Program Budget Accounting

2019 EV Program Budget Costs/Commitments				
Category	**Prescriptive Incentives**	**Committed Custom Incentives**	**Program Management**	**Total**
Time of Use Rate Sign-up	$29,400	-	-	$29,400
Time of Use Load Research Study	$17,000	-	-	$17,000
Time of Use Meters	-	-	$554.48	$554.48
Non-Residential AC Level 2 Chargers – Single Port	$108,013.58	-	-	$108,013.58
Non-Residential AC Level 2 Chargers – Multi-Port	$520,440.58	-	-	$520,440.58
Non-Residential & Multi-Family DC Fast Chargers	$265,678.33	-	-	$265,678.33
Custom Projects	-	$669,439.49	-	$669,439.49
Administrative Costs	-	-	$127,958.88	$127,958.88
Outreach & Awareness	-	-	$261,514.66	$261,514.66
Total	$940,532.49	$669,439.49	$390,028.02	**$2,000,000**

[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, 2019, through December 31, 2019, used 2020 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 2020 EV Program budget.

2019 PRESCRIPTIVE INCENTIVE LOCATIONS

Table 2 below is a breakout by city for prescriptive incentive equipment installations and TOU sign-ups from the 2019 EV Program fiscal year occurred (October 1, 2018 through September 30, 2019). There were a combined total of 573 AC Level 2 and DC Fast charging ports installed for public and/or workplace use. Of those, 460 ports were installed across 86 employers and 113 ports were installed across 4 multi-family properties.

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

City (ut)	DC Fast Charger Single Port	AC Level 2 Chargers		TOU Rate Sign-ups	
		Multi-Port	Single Port	Option 1	Option 2
Alta		1	2		
American Fork					2
Bluff			1		
Bluffdale				2	1
Cedar city			2		1
Cedar fort					1
Cedar hills					1
Centerville			4		
Clearfield		11			
Coalville		5			
Corinne			8		
Cottonwood Heights		12	23		1
Draper		14	2	1	8
Erda				1	1
Farmington				2	3
Farr west					1
Francis				1	
Grantsville					2
Harrisville					1
Herriman				3	6
Highland				2	
Hill Air Force Base			2		
Holladay					1
Kaysville					1
Lake point			2		
Layton	2				7
Liberty			2		1
Logan		50			
Mapleton				1	
Marriott Slaterville					1
Midvale		7	2		
Millcreek		1	3	5	8
Moab		2			
Murray					1
New Harmony					1
Nibley				1	1

City (ut)	DC Fast Charger Single Port	AC Level 2 Chargers		TOU Rate Sign-ups	
		Multi-Port	Single Port	Option 1	Option 2
North logan					2
North Ogden					3
North Salt Lake				1	1
Ogden			2	1	4
Orem			8		2
Park City	8	9		1	4
Plain City				1	
Pleasant Grove		7			
Riverton				2	1
Roy					1
Salt Lake City		79	71	2	9
Sandy		1	3	1	5
Saratoga Springs					1
South Jordan					2
South Salt Lake			7	1	2
Stansbury Park				1	2
Summit County			1		
Syracuse				1	1
Taylorsville		2	1	2	3
Tooele				1	
Toquerville					1
Tremonton			6		1
Vernal					1
Vineyard				1	1
Wellsville					1
West Bountiful				1	1
West Haven					1
West Jordan				2	2
West Valley City		4	1		4
White City				1	
Woods Cross					1
Total	**10**	**205**	**153**	**39**	**108**

CUSTOM PROJECTS

Custom Projects 14 through 16 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 2019 EV Program budget during the 2019 calendar year. A summary of the 2019 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 2019 custom projects are expected to be completed and paid in 2020.

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. Custom Projects 10 through 13 were reported in the 2018 Annual STEP report representing $998,500 of committed funds from the 2018 EV Program budget. Exhibits 2-B and 2-C provide updated information on committed custom projects. There were a combined total of 67 AC Level 2 and DC Fast charging ports installed for workplace/public use from completed custom projects in 2019.

Table 3 – 2019 EV Program Budget Custom Project Commitments[2]

Custom Projects	Incentive	Description	Equipment Type
Project 14 Accepted June 2019	$330,000	A major healthcare provider is committed to provide vehicle charging to its customers and caregivers. Its goal is to install EV charging at all of its campuses, clinics and business locations. The business is committed to maintaining a consistent model and technology for ease of our customers, maintenance, and data. The equipment also provides us with the needed billing functionality required for Stark laws regarding our physician population. The project will include 66 AC Level 2 Chargers at 33 different locations.	66 AC Level 2 Charging Ports
Project 15 Accepted June 2019	$170,000	A city is planning to install 45 AC Level 2 electric vehicle chargers. The city has a goal to promote elecrification and wants charging to convenient for residents and visitors	45 AC Level 2 Charging Ports
Project 16 Accepted December 2019	$169,439	A government agency will be installing several electric vehicle chargers throughout the state of Utah. Specific sites have been identified in areas where electric vehicle charging is lacking. The intent of this project is to allow EV drivers to be able to charge throughout the state.	18 AC Level 2 Charging Ports and 10 DC Fast Charger Port
Total 2019 EV Budget Commitments	$669,439	---	129 AC Level 2 Charging Ports, 10 DC Fast Charging Ports

[2] Custom projects listed in Table 3 may evolve and are expected be completed throughout 2020. Actual incentive amounts and installed equipment will be included in subsequent reports for completed custom projects.

2019 CALENDAR YEAR ACCOUNTING

Table 4 below provides an accounting of how the EV Program costs for calendar year 2019 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 2018 from the 2018 EV Program budget completed in 2019, which means the funds associated with those custom projects posted to SAP in 2019. So while SAP accounting reflects those costs in 2019, they were, in fact, counted towards the $2 million 2018 EV Program budget. Additionally, prescriptive incentives follow a fiscal year of October 1st through September 30th. As such, prescriptive incentives for the 2019 EV Program budget include the timeframe of October 1, 2018 through September 30, 2019, with Q4 2019 prescriptive incentive costs being counted as part of the 2020 EV Program budget. So even though SAP accounting includes prescriptive incentive costs from October 1, 2019, through December 31, 2019, as part of the calendar year, costs during that timeframe for prescriptive incentives are counted towards the $2 million 2020 EV Program budget. Likewise, the prescriptive incentive costs during the timeframe of October 1, 2018, through December 31, 2018, are captured in SAP for that calendar year, but were counted towards the $2 million 2019 EV Program budget, consistent with the fiscal year of the EV Program for prescriptive incentives. Exhibit 2-D provides SAP year over year accounting for each calendar year, which reconciles to the STEP accounting, and Exhibit 2-E provides a year over year accounting for how each $2 million EV Program year budget was allocated.

Table 4 – 2019 Calendar Year Actual SAP Postings

EV Program Actual Postings in SAP by Calendar Year	
Category	**CY 2019**
Time of Use Rate Sign-up	$28,600
Time of Use Load Research Study	$17,000
Time of Use Meters	$554.48
Non-Residential AC Level 2 Chargers – Single Port	$108,565.43
Non-Residential AC Level 2 Chargers – Multi-Port	$507,769.60
Non-Residential & Multi-Family DC Fast Chargers	$265,678.33
Custom Projects	$506,497.68
Administrative Costs	$127,958.88
Outreach & Awareness	$261,514.66
Total	**$1,824,139.06**

2019 ELECTRIC VEHICLE INCENTIVE PROGRAM ACTIVITIES

Time of Use and Load Research Study

A total of 147 customers received incentives with 2019 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 2019 fiscal year, 273 customers were enrolled in the Time of Use program. During 2019, the load research study concluded and participants were surveyed.

EV Program Changes

On November 18, 2019, the Company filed Advice No. 19-16 in Docket No. 19-035-T16 to adjust existing incentives, add program controls, and to add a new offering for residential customers. Incentives for non-residential and multi-family AC Level 2 Chargers were decreased to better align with the Utah Department of Environmental Quality's incentive program and to allow for additional participation due to steady partication growth. Program controls were also added to help prevent scenarios that may have resulted in customers receiving tens of thousands of dollars more than the actual cost of their equipment. Lastly, a new offering for residential customers was added to the EV Program, providing an incentive of up to $200 for residential AC Level 2 Chargers. These proposed program changes were approved by the Commission in their order issued December 31, 2019, with an effective date of January 1, 2020.

Attachments:

- Exhibit 2-A: 2019 EV Program Budget Prescriptive Incentives
- Exhibit 2-B: EV Program Custom Project Committed Funds and Expenditures
- Exhibit 2-C: EV Program Custom Project Details Year Over Year
- Exhibit 2-D: EV Program Actual SAP Postings by Calendar Year
- Exhibit 2-E: EV Program Budget Allocations Year Over Year

Exhibit 2-A

2019 EV Program Budget Prescriptive Incentives

EV Program Prescriptive Incentives (2019 Budget Funds)

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_265370	EV DC Fast Charger (single port)	8	8	$ 240,000.00	$ 686,656.00	2/1/2019	PARK CITY	84060
EVUT_278367	EV DC Fast Charger (single port)	2	2	$ 25,678.33	$ 34,237.77	6/4/2019	LAYTON	84041
EVUT_243565	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 5,364.00	10/2/2018	MILLCREEK	84117
EVUT_247305	EV Level 2 Charger (multi port)	2	4	$ 4,016.85	$ 5,355.80	11/5/2018	Pleasant Grove	84062
EVUT_247487	EV Level 2 Charger (multi port)	1	2	$ 2,008.43	$ 2,677.90	11/5/2018	CLEARFIELD	84015
EVUT_248438	EV Level 2 Charger (multi port)	5	10	$ 10,042.13	$ 13,389.50	11/7/2018	MIDVALE	84047
EVUT_249771	EV Level 2 Charger (multi port)	12	24	$ 16,046.10	$ 21,394.80	11/13/2018	SLC	84116
EVUT_252210	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 4,700.00	12/14/2018	DRAPER	84020
EVUT_253677	EV Level 2 Charger (multi port)	3	6	$ 6,025.27	$ 8,033.70	12/18/2018	COTTONWOOD HEIGHTS	84121
EVUT_266670	EV Level 2 Charger (multi port)	2	4	$ 2,575.65	$ 3,434.20	2/11/2019	SALT LAKE CITY	84109
EVUT_267047	EV Level 2 Charger (multi port)	6	12	$ 12,050.55	$ 16,067.40	2/19/2019	SALT LAKE CITY	84115
EVUT_267803	EV Level 2 Charger (multi port)	2	4	$ 6,852.00	$ 9,136.00	3/8/2019	TAYLORSVILLE	84129
EVUT_267919	EV Level 2 Charger (multi port)	5	10	$ 10,042.13	$ 13,389.50	3/12/2019	PARK CITY	84098
EVUT_272631	EV Level 2 Charger (multi port)	4	8	$ 8,037.00	$ 10,716.00	4/16/2019	SLC	84104
EVUT_272632	EV Level 2 Charger (multi port)	5	10	$ 10,042.13	$ 13,389.50	4/16/2019	SLC	84116
EVUT_272633	EV Level 2 Charger (multi port)	4	8	$ 8,033.70	$ 10,711.60	4/16/2019	West Valley City	84119
EVUT_273033	EV Level 2 Charger (multi port)	10	20	$ 10,111.50	$ 13,482.00	4/24/2019	CLEARFIELD	84016
EVUT_275866	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 4,700.00	5/9/2019	PARK CITY	84098
EVUT_277937	EV Level 2 Charger (multi port)	5	10	$ 15,000.00	$ 20,000.00	5/23/2019	COTTONWOOD HEIGHTS	84121
EVUT_278376	EV Level 2 Charger (multi port)	1	2	$ 2,008.43	$ 2,677.90	6/4/2019	DRAPER	84020
EVUT_278377	EV Level 2 Charger (multi port)	2	4	$ 5,068.50	$ 6,758.00	6/4/2019	MIDVALE	84047
EVUT_280009	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 10,670.00	6/21/2019	COALVILLE	84017
EVUT_280009	EV Level 2 Charger (multi port)	3	6	$ 10,278.00	$ 13,704.00	6/21/2019	COALVILLE	84017
EVUT_280192	EV Level 2 Charger (multi port)	2	4	$ 4,227.45	$ 5,636.60	6/25/2019	PLEASANT GROVE	84062
EVUT_280496	EV Level 2 Charger (multi port)	4	8	$ 8,033.70	$ 10,711.60	6/26/2019	SALT LAKE CITY	84106
EVUT_281381	EV Level 2 Charger (multi port)	3	6	$ 3,434.17	$ 4,578.90	7/3/2019	SALT LAKE CITY	84108
EVUT_281502	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 14,166.00	7/11/2019	Salt Lake City	84115
EVUT_281502	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 6,569.00	7/11/2019	Salt Lake City	84115
EVUT_282407	EV Level 2 Charger (multi port)	4	8	$ 8,033.70	$ 10,711.60	7/16/2019	SALT LAKE CITY	84116
EVUT_283335	EV Level 2 Charger (multi port)	4	8	$ 8,454.90	$ 11,273.20	7/30/2019	COTTONWOOD HEIGHTS	84047
EVUT_283463	EV Level 2 Charger (multi port)	1	2	$ 1,144.72	$ 1,526.30	8/5/2019	Sandy	84070
EVUT_282954	EV Level 2 Charger (multi port)	1	2	$ 3,500.00	$ 4,700.00	8/14/2019	PARK CITY	84098
EVUT_284278	EV Level 2 Charger (multi port)	50	100	$ 137,812.50	$ 183,750.00	8/14/2019	LOGAN	84321
EVUT_284432	EV Level 2 Charger (multi port)	7	14	$ 24,500.00	$ 33,789.00	8/16/2019	SALT LAKE CITY	84114
EVUT_284432	EV Level 2 Charger (multi port)	8	16	$ 27,186.00	$ 36,248.00	8/16/2019	SALT LAKE CITY	84114
EVUT_284437	EV Level 2 Charger (multi port)	4	8	$ 14,000.00	$ 19,308.00	8/16/2019	SALT LAKE CITY	84116
EVUT_284439	EV Level 2 Charger (multi port)	7	14	$ 24,500.00	$ 33,789.00	8/16/2019	DRAPER	84020
EVUT_284441	EV Level 2 Charger (multi port)	5	10	$ 17,500.00	$ 24,135.00	8/16/2019	DRAPER	84020
EVUT_284442	EV Level 2 Charger (multi port)	8	16	$ 27,186.00	$ 36,248.00	8/16/2019	SALT LAKE CITY	84111
EVUT_284444	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 9,654.00	8/16/2019	SALT LAKE CITY	84114
EVUT_284861	EV Level 2 Charger (multi port)	2	4	$ 7,000.00	$ 9,400.00	8/20/2019	MOAB	84532
EVUT_286344	EV Level 2 Charger (multi port)	3	6	$ 3,167.10	$ 4,222.80	8/29/2019	SALT LAKE CITY	84104
EVUT_286374	EV Level 2 Charger (multi port)	1	2	$ 910.57	$ 1,214.10	9/3/2019	ALTA	84092
EVUT_285124	EV Level 2 Charger (multi port)	3	6	$ 10,500.00	$ 14,100.00	9/4/2019	PLEASANT GROVE	84062
EVUT_286959	EV Level 2 Charger (multi port)	4	8	$ 14,000.00	$ 22,512.00	9/10/2019	SALT LAKE CITY	84112
EVUT_288400	EV Level 2 Charger (multi port)	2	4	$ 2,111.40	$ 2,815.20	9/24/2019	PARK CITY	84060
EVUT_243682	EV Level 2 Charger (single port)	4	4	$ 2,481.75	$ 3,309.00	10/4/2018	SALT LAKE CITY	84101
EVUT_243684	EV Level 2 Charger (single port)	1	1	$ 444.75	$ 593.00	10/4/2018	SOUTH SALT LAKE	84115

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_243684	EV Level 2 Charger (single port)	3	3	$ 1,134.00	$ 1,512.00	10/4/2018	SOUTH SALT LAKE	84115
EVUT_243685	EV Level 2 Charger (single port)	4	4	$ 1,317.00	$ 1,756.00	10/4/2018	SLC	84119
EVUT_243686	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	10/4/2018	ALTA	84092
EVUT_243687	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	10/4/2018	SANDY	84093
EVUT_244360	EV Level 2 Charger (single port)	3	3	$ 3,255.75	$ 4,341.00	10/18/2018	SALT LAKE CITY	84101
EVUT_244361	EV Level 2 Charger (single port)	2	2	$ 4,485.00	$ 5,980.00	10/18/2018	COTTONWOOD HEIGHTS	84121
EVUT_244362	EV Level 2 Charger (single port)	6	6	$ 13,455.00	$ 17,940.00	10/18/2018	COTTONWOOD HEIGHTS	84121
EVUT_244646	EV Level 2 Charger (single port)	2	2	$ 750.00	$ 1,000.00	10/23/2018	CEDAR CITY	84720
EVUT_244858	EV Level 2 Charger (single port)	2	2	$ 1,243.50	$ 1,658.00	10/30/2018	OGDEN	84414
EVUT_244859	EV Level 2 Charger (single port)	8	8	$ 4,230.00	$ 5,640.00	10/30/2018	CORINNE	84307
EVUT_245004	EV Level 2 Charger (single port)	4	4	$ 3,215.40	$ 4,287.20	11/1/2018	OREM	84097
EVUT_248404	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	11/5/2018	TREMONTON	84337
EVUT_250817	EV Level 2 Charger (single port)	1	1	$ 336.83	$ 449.10	11/30/2018	BLUFF	84512
EVUT_251271	EV Level 2 Charger (single port)	2	2	$ 733.50	$ 978.00	12/5/2018	SALT LAKE CITY	84105
EVUT_251393	EV Level 2 Charger (single port)	2	2	$ 750.00	$ 1,000.00	12/7/2018	MILLCREEK	84124
EVUT_253677	EV Level 2 Charger (single port)	2	2	$ 1,240.88	$ 1,654.50	12/18/2018	COTTONWOOD HEIGHTS	84121
EVUT_262599	EV Level 2 Charger (single port)	4	4	$ 1,347.00	$ 1,796.00	1/22/2019	SLC	84111
EVUT_262605	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	1/23/2019	OREM	84058
EVUT_267045	EV Level 2 Charger (single port)	1	1	$ 329.25	$ 439.00	2/19/2019	MIDVALE	84047
EVUT_267931	EV Level 2 Charger (single port)	2	2	$ 658.50	$ 878.00	3/13/2019	Hill Air Force Base	84056
EVUT_268257	EV Level 2 Charger (single port)	6	6	$ 2,020.95	$ 2,694.60	3/18/2019	SALT LAKE CITY	84111
EVUT_268687	EV Level 2 Charger (single port)	10	10	$ 3,368.25	$ 4,491.00	3/19/2019	Salt Lake City	84105
EVUT_269190	EV Level 2 Charger (single port)	1	1	$ 573.06	$ 764.08	3/27/2019	SUMMIT COUNTY	84098
EVUT_271416	EV Level 2 Charger (single port)	4	4	$ 1,317.30	$ 1,756.40	4/8/2019	SALT LAKE CITY	84102
EVUT_272507	EV Level 2 Charger (single port)	2	2	$ 673.65	$ 898.20	4/12/2019	LAKE POINT	84074
EVUT_272508	EV Level 2 Charger (single port)	1	1	$ 412.49	$ 549.99	4/12/2019	MILLCREEK	84109
EVUT_276557	EV Level 2 Charger (single port)	2	2	$ 868.05	$ 1,157.40	5/14/2019	SALT LAKE CITY	84116
EVUT_277484	EV Level 2 Charger (single port)	4	4	$ 1,347.30	$ 1,796.40	5/16/2019	SALT LAKE CITY	84101
EVUT_277864	EV Level 2 Charger (single port)	1	1	$ 303.75	$ 405.00	5/21/2019	OREM	84058
EVUT_277936	EV Level 2 Charger (single port)	6	6	$ 2,604.15	$ 3,472.20	5/23/2019	SALT LAKE CITY	84102
EVUT_278370	EV Level 2 Charger (single port)	1	1	$ 444.75	$ 593.00	6/4/2019	SOUTH SALT LAKE	84115
EVUT_278371	EV Level 2 Charger (single port)	1	1	$ 444.75	$ 593.00	6/4/2019	SANDY	84070
EVUT_278376	EV Level 2 Charger (single port)	2	2	$ 673.65	$ 898.20	6/4/2019	DRAPER	84020
EVUT_278375	EV Level 2 Charger (single port)	1	1	$ 476.25	$ 635.00	6/4/2019	LIBERTY	84310
EVUT_278375	EV Level 2 Charger (single port)	1	1	$ 498.75	$ 665.00	6/4/2019	LIBERTY	84310
EVUT_279492	EV Level 2 Charger (single port)	1	1	$ 673.65	$ 898.20	6/11/2019	TAYLORSVILLE	84129
EVUT_279494	EV Level 2 Charger (single port)	4	4	$ 1,525.50	$ 2,034.00	6/11/2019	SALT LAKE CITY	84105
EVUT_280008	EV Level 2 Charger (single port)	1	1	$ 375.00	$ 500.00	6/21/2019	SOUTH SALT LAKE	84115
EVUT_281145	EV Level 2 Charger (single port)	2	2	$ 1,334.91	$ 1,779.88	7/3/2019	TREMONTON	84337
EVUT_281147	EV Level 2 Charger (single port)	4	4	$ 2,994.10	$ 3,992.13	7/3/2019	CENTERVILLE	84014
EVUT_281411	EV Level 2 Charger (single port)	1	1	$ 381.38	$ 508.50	7/9/2019	SOUTH SALT LAKE	84119
EVUT_282408	EV Level 2 Charger (single port)	1	1	$ 561.75	$ 749.00	7/29/2019	OREM	84057
EVUT_283198	EV Level 2 Charger (single port)	4	4	$ 1,525.50	$ 2,034.00	7/29/2019	SALT LAKE CITY	84116
EVUT_283443	EV Level 2 Charger (single port)	6	6	$ 2,020.95	$ 2,694.60	8/1/2019	SALT LAKE CITY	84180
EVUT_283879	EV Level 2 Charger (single port)	8	8	$ 3,051.00	$ 4,068.00	8/9/2019	SALT LAKE CITY	84111
EVUT_284277	EV Level 2 Charger (single port)	1	1	$ 375.00	$ 500.00	8/14/2019	WEST VALLEY CITY	84120
EVUT_285967	EV Level 2 Charger (single port)	9	9	$ 20,182.50	$ 26,910.00	8/26/2019	COTTONWOOD HEIGHTS	84121
EVUT_285974	EV Level 2 Charger (single port)	4	4	$ 8,970.00	$ 11,960.00	8/26/2019	COTTONWOOD HEIGHTS	84121
EVUT_285976	EV Level 2 Charger (single port)	1	1	$ 1,950.00	$ 2,600.00	8/26/2019	MIDVALE	84047

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_286376	EV Level 2 Charger (single port)	1	1	$ 381.38	$ 508.50	9/3/2019	ALTA	84092
EVUT_288404	EV Level 2 Charger (single port)	2	2	$ 1,971.00	$ 2,628.00	9/24/2019	TREMONTON	84337
N/A	EV Time of Use Load Research Study	81	-	$ 17,000.00	-	Q4 2018 - Q3 2019	N/A	
EVUT_243844	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	10/16/2018	BLUFFDALE	84065
EVUT_244027	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	10/16/2018	HERRIMAN	84096
EVUT_244408	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	10/23/2018	MAPLETON	84664
EVUT_258968	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	12/26/2018	RIVERTON	84065
EVUT_259445	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	1/2/2019	SANDY	84070
EVUT_259662	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	1/7/2019	HIGHLAND	84003
EVUT_260081	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	1/10/2019	NIBLEY	84321
EVUT_260098	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	1/14/2019	HERRIMAN	84096
EVUT_263685	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	1/31/2019	WEST JORDAN	84088
EVUT_265369	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/1/2019	VINEYARD	84059
EVUT_266480	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/8/2019	DRAPER	84020
EVUT_266485	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/11/2019	MILLCREEK	84124
EVUT_266486	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/11/2019	RIVERTON	84096
EVUT_267225	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/25/2019	FARMINGTON	84025
EVUT_267218	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/25/2019	FARMINGTON	84025
EVUT_267508	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	2/28/2019	HIGHLAND	84003
EVUT_267238	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	3/1/2019	PARK CITY	84098
EVUT_268051	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	3/14/2019	NORTH SALT LAKE	84054
EVUT_269183	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	3/26/2019	TAYLORSVILLE	84129
EVUT_269186	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	3/28/2019	MILLCREEK	84109
EVUT_271328	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/4/2019	WHITE CITY	84094
EVUT_272503	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/16/2019	MILLCREEK	84106
EVUT_272872	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/22/2019	WEST JORDAN	84081
EVUT_273040	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/25/2019	SALT LAKE CITY	84108
EVUT_273043	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/26/2019	HERRIMAN	84096
EVUT_273048	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/29/2019	PLAIN CITY	84404
EVUT_273050	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	4/29/2019	MILLCREEK	84124
EVUT_273692	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	5/1/2019	TAYLORSVILLE	84129
EVUT_275861	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	5/1/2019	FRANCIS	84036
EVUT_277996	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	5/29/2019	TOOELE	84074
EVUT_281136	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	7/1/2019	STANSBURY PARK	84074
EVUT_282701	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	7/26/2019	SOUTH SALT LAKE	84106
EVUT_282702	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	7/26/2019	ERDA	84074
EVUT_282910	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	7/26/2019	OGDEN	84403
EVUT_283346	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	8/1/2019	BLUFFDALE	84065
EVUT_283442	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	8/1/2019	MILLCREEK	84109
EVUT_283462	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	8/5/2019	WEST BOUNTIFUL	84087
EVUT_284466	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	8/20/2019	SYRACUSE	84075
EVUT_284877	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	1	-	$ 200.00	-	8/23/2019	SALT LAKE CITY	84106
EVUT_243210	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/1/2018	PARK CITY	84098
EVUT_243211	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/1/2018	HERRIMAN	84096
EVUT_243569	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/4/2018	AMERICAN FORK	84003
EVUT_243696	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	SALT LAKE CITY	84103
EVUT_243701	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	WEST VALLEY CITY	84119
EVUT_243702	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	SALT LAKE CITY	84105
EVUT_243843	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	OREM	84097

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_243850	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	KAYSVILLE	84037
EVUT_243851	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	SOUTH JORDAN	84009
EVUT_243857	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	HERRIMAN	84096
EVUT_244048	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	WEST VALLEY CITY	84120
EVUT_244166	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/16/2018	MILLCREEK	84124
EVUT_244367	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/19/2018	MILLCREEK	84124
EVUT_244405	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/23/2018	VINEYARD	84059
EVUT_244857	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	10/30/2018	SANDY	84070
EVUT_245001	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/1/2018	WEST JORDAN	84081
EVUT_248410	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/6/2018	LAYTON	84041
EVUT_250502	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/27/2018	STANSBURY PARK	84074
EVUT_250606	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/27/2018	TOQUERVILLE	84774
EVUT_250802	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/29/2018	FARMINGTON	84025
EVUT_250803	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	11/29/2018	OREM	84057
EVUT_251231	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/5/2018	PARK CITY	84098
EVUT_251398	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/12/2018	WEST JORDAN	84088
EVUT_251998	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/12/2018	SALT LAKE CITY	84103
EVUT_251397	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/13/2018	WEST VALLEY CITY	84119
EVUT_252141	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/13/2018	GRANTSVILLE	84029
EVUT_258963	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/26/2018	BLUFFDALE	84065
EVUT_258964	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	12/26/2018	CEDAR HILLS	84062
EVUT_259524	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/4/2019	WEST VALLEY CITY	84119
EVUT_259651	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/4/2019	TAYLORSVILLE	84129
EVUT_259661	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/7/2019	ERDA	84074
EVUT_259664	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/8/2019	HERRIMAN	84096
EVUT_260082	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/10/2019	DRAPER	84020
EVUT_262833	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/25/2019	NORTH OGDEN	84414
EVUT_262840	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/25/2019	SANDY	84092
EVUT_262846	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/28/2019	HARRISVILLE	84414
EVUT_262847	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/28/2019	MILLCREEK	84124
EVUT_262848	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/28/2019	WELLSVILLE	84339
EVUT_263686	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	1/31/2019	SALT LAKE CITY	84109
EVUT_264537	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/1/2019	LIBERTY	84310
EVUT_265378	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/5/2019	SARATOGA SPRINGS	84045
EVUT_265372	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/5/2019	MILLCREEK	84124
EVUT_266321	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/6/2019	DRAPER	84020
EVUT_266479	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/8/2019	DRAPER	84020
EVUT_266482	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/8/2019	NORTH OGDEN	84414
EVUT_266671	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/12/2019	SOUTH JORDAN	84009
EVUT_266741	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/14/2019	MILLCREEK	84124
EVUT_267235	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/25/2019	COTTONWOOD HEIGHTS	84121
EVUT_267239	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	2/25/2019	SALT LAKE CITY	84105
EVUT_267509	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/1/2019	SANDY	84093
EVUT_267530	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/1/2019	DRAPER	84020
EVUT_267808	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/12/2019	FARMINGTON	84025
EVUT_267821	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/12/2019	VERNAL	84078
EVUT_267930	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/13/2019	SOUTH SALT LAKE	84115
EVUT_268102	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/14/2019	MILLCREEK	84109
EVUT_268682	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/19/2019	SYRACUSE	84075

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_268692	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/20/2019	NORTH OGDEN	84414
EVUT_269185	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	3/27/2019	OGDEN	84404
EVUT_271326	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/3/2019	FARMINGTON	84025
EVUT_271417	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/9/2019	LAYTON	84041
EVUT_272504	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/16/2019	NEW HARMONY	84757
EVUT_272869	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/19/2019	DRAPER	84020
EVUT_272873	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/22/2019	NORTH LOGAN	84341
EVUT_272874	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/23/2019	RIVERTON	84096
EVUT_272875	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/23/2019	WEST HAVEN	84401
EVUT_273049	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/29/2019	SANDY	84092
EVUT_273051	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	4/29/2019	AMERICAN FORK	84003
EVUT_275862	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	5/1/2019	GRANTSVILLE	84029
EVUT_276006	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	5/6/2019	LAYTON	84041
EVUT_276007	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	5/6/2019	LAYTON	84040
EVUT_276501	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	5/13/2019	DRAPER	84020
EVUT_278365	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/4/2019	SALT LAKE CITY	84108
EVUT_278383	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	WEST BOUNTIFUL	84087
EVUT_278451	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	OGDEN	84403
EVUT_278452	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	MURRAY	84121
EVUT_278453	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	FARR WEST	84404
EVUT_278454	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	HOLLADAY	84121
EVUT_278458	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	OGDEN	84403
EVUT_279490	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/11/2019	LAYTON	84041
EVUT_279632	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/18/2019	HERRIMAN	84096
EVUT_280189	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	6/25/2019	MARRIOTT SLATERVILLE	84404
EVUT_280695	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/1/2019	PARK CITY	84060
EVUT_281409	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/9/2019	NORTH SALT LAKE	84054
EVUT_281503	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/11/2019	SOUTH SALT LAKE	84115
EVUT_282529	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/23/2019	TAYLORSVILLE	84123
EVUT_282539	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/23/2019	MILLCREEK	84106
EVUT_282696	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/23/2019	DRAPER	84020
EVUT_282717	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/26/2019	LAYTON	84041
EVUT_282902	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/26/2019	SALT LAKE CITY	84105
EVUT_283196	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	7/29/2019	MILLCREEK	84109
EVUT_283459	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/2/2019	NIBLEY	84321
EVUT_283461	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/5/2019	HERRIMAN	84096
EVUT_282540	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/13/2019	SALT LAKE CITY	84105
EVUT_284271	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/14/2019	LAYTON	84040
EVUT_284398	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/16/2019	DRAPER	84020
EVUT_285079	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/23/2019	CEDAR FORT	84013
EVUT_285832	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/26/2019	WOODS CROSS	84087
EVUT_285833	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/26/2019	TREMONTON	84337
EVUT_286329	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	8/29/2019	PARK CITY	84098
EVUT_286371	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/3/2019	CEDAR CITY	84721
EVUT_286725	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/6/2019	TAYLORSVILLE	84123
EVUT_286726	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/6/2019	STANSBURY PARK	84074
EVUT_286964	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/11/2019	OGDEN	84404
EVUT_287252	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/16/2019	ROY	84067
EVUT_287627	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/18/2019	HERRIMAN	84096

Project Name	Measure_Name	Quantity	Number of Ports	Customer Incentive	Measure Cost	Creation Date	City	Zip Code
EVUT_287628	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/18/2019	SANDY	84092
EVUT_288208	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/19/2019	SALT LAKE CITY	84108
EVUT_288221	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	1	-	$ 200.00	-	9/23/2019	NORTH LOGAN	84341
				$ 940,532.49				

Sub-Totals	EV Time of Use Rate option 1 - off peak 7 cents, on peak 22 cents	$ 8,200.00
	EV Time of Use Rate option 2 - off peak 3 cents, on peak 34 cents	$ 21,200.00
	EV Time of Use Load Research Study	$ 17,000.00
	Non-Residential AC Level 2 Charger Single Port Incentive Payments	$ 108,013.58
	Non-Residential AC Level 2 Charger Multi-Port Incentive Payments	$ 520,440.58
	Non-Residential & Multi-Family DC Fast Charger Incentive Payments	$ 265,678.33
Grand Total		**$ 940,532.49**

*Includes 2019 EV fiscal year budget incentive payments (October 1, 2018 - September 30, 2019)

Exhibit 2-B

EV Program Custom Project Committed Funds and Expenditures

EV Program Budget Custom Project Expenditures

Year Committed	Custom Projects	Committed Funds	Year Completed	$ Paid	$ Variance
2017	Project 1	$ 250,000	2018	$ 250,000	$ -
	Project 2	$ 8,000	2019	$ 7,998	$ (2)
	Project 3	$ 470,000	2018	$ 456,441	$ (13,559)
	Project 4	$ 153,000		$ 153,000	$ -
	Project 5	$ 237,500	2020	$ 237,500	$ -
	Project 6	$ 50,000	2018	$ 50,000	$ -
	Project 7	$ 57,005		$ 56,963	$ (42)
	Project 8	$ 69,369		$ 69,369	$ -
	Project 9	$ 65,000		$ 58,047	$ (6,953)
	Total	**$ 1,359,874**		**$ 1,339,318**	**$ (20,556)**
2018	Project 10	$ 308,000	2019	$ 308,000	$ -
	Project 11	$ 70,000		$ 70,000	$ -
	Project 12	$ 120,500		$ 120,500	$ -
	Project 13	$ 500,000	TBD	$ -	$ -
	Total	**$ 998,500**		**$ 498,500**	**$ -**
2019	Project 14	$ 330,000	TBD	$ -	$ -
	Project 15	$ 170,000	TBD	$ -	$ -
	Project 16	$ 169,439.49	TBD	$ -	$ -
	Total	**$ 669,439.49**		**$ -**	**$ -**

Exhibit 2-C

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	2019	No change from committed.	No change from committed.	$ 7,998.00
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	2020	No change from committed.	No change from committed.	$ 237,500
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.	44 AC Level 2 Charging Ports and 2 DC Fast Charging Ports	$ 308,000	2019	No change from committed.	No change from committed.	$308,000
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.	6 AC Level 2 Charging Ports and 1 DC Fast Charging Port	$ 70,000	2019	No change from committed.	No change from committed.	$70,000
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.	12 AC Level 2 Charging Ports and 1 DC Fast Charger Port	$ 120,500	2019	No change from committed.	No change from committed.	$120,500
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.	Two 500 kW Electric Bus Chargers and 5 DC Fast Charging Ports	$ 500,000	Pending			

Exhibit 2-D

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	$ 28,600.00			**$ 59,400**
Time of Use Load Research Study Participation		$ 10,000	$ 17,000.00			**$ 27,000**
Time of Use Meters	$ -	$ 79,394	$ 554.48			**$ 79,948**
Non-Residential AC Level 2 Chargers – Single Port	$ 116,157	$ 109,990	$ 108,565.43			**$ 334,713**
Non-Residential AC Level 2 Chargers – Multi-Port		$ 180,716	$ 507,769.60			**$ 688,486**
Non-Residential & Multi-Family DC Fast Chargers	$ 54,618	$ 97,878	$ 265,678.33			**$ 418,174**
Custom Projects	$ -	$ 1,093,820	$ 506,497.68			**$ 1,600,318**
Administration	$ 176,176	$ 176,427	$ 127,958.88			**$ 480,562**
Outreach & Awareness	$ 133,751	$ 109,479	$ 261,514.66			**$ 504,744**
Total	**$ 487,502**	**$ 1,881,703**	**$ 1,824,139.06**			**$ 4,193,344**

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

Exhibit 2-E

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			2019 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	Prescriptive Incentives Completed Q4 2018 - Q3 2019	Custom Incentives Committed Q1 - Q4 2019	Total 2019
TOU Incentives	$ 2,800		$ 2,800	$ 22,400		$ 22,400	$ 29,400		$ 29,400
TOU Load Research Incentives				$ 10,000		$ 10,000	$ 17,000		$ 17,000
TOU Meters						$ 79,394			$ 554.48
AC Level 2 Incentives (Single Port)	$ 65,309		$ 65,309	$ 102,907		$ 102,907	$ 108,013.58		$ 108,013.58
AC Level 2 Incentives (Multiple Port)				$ 189,844		$ 189,844	$ 520,440.58		$ 520,440.58
DC Fast Charger Incentives	$ 54,618		$ 54,618	$ 97,878		$ 97,878	$ 265,678.33		$ 265,678.33
Custom Project Incentives		$ 1,359,874	$ 1,359,874		$ 998,500	$ 998,500		$ 669,439.49	$ 669,439.49
Administration			$ 176,176			$ 175,427			$ 127,958.88
Outreach & Awareness			$ 133,751			$ 109,479			$ 261,514.66
		Total	**$ 1,792,528**		**Total**	**$ 1,785,828**		**Total**	**$ 2,000,000**

TOTAL ALLOCATED BUDGET FOR ALL YEARS $ 5,578,356

STEP Project Report

Period Ended: December 31, 2019

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 be effectively 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. The consultants responsible for planning, conducting, and reporting the results of the tests are engineering professors from the University of Utah's Combustion Laboratory and from Brigham Young University.

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 processed biomass material from both woody waste providers to extend the number of hours in the test burn and to increase the measurements taken during the test to gain a better understanding of boiler operation during the co-firing.

Project Update:

Amaron provided 724 tons of torrified biomass material to the Hunter Plant. The test burn of the torrified material was conducted in Unit 3 of the Hunter Plant on August 22 and August 23 of 2019 and the consultants gave a review of preliminary results of the torrified test burn on December 5, 2019. The test used a blend of 20% biomass material and 80% coal over a period of 12 hours. The biomass fuel performed as planned in the test and produced lower concentrations of NO_x and SO_2 as expected.

AEG, the supplier of steam exploded biomass material, has moved their production facility to North Carolina. PacifiCorp and AEG are currently re-negotiating the supply contract and delivery schedule for the steam exploded biomass material. Once an agreement is reached with AEG, the test burn of the steam exploded material is expected to occur in the second half of 2020.

Project Accounting:

	2017	2018	2019	Total
Annual Collection (Budget)	$0.00	$177,032	$515,668	$692,700
Annual Spend	$0.00	$262,837*	$588,943	$851,780
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$0.00	$262,837	$588,943	$851,780

*The 2018 STEP report reported total spend for 2018 as $230,277. However, there was a $32,560 feedstock payment to AEG that was that was made in 2018, but not included in the 2018 STEP report because there was a 2 month period when this payment was backed out of the Company's accounting records and then reposted.

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 Amaron supply agreement	May 31, 2019	Complete
Revise schedule for expanded Amaron test burn	July 1, 2019	Complete
All Amaron biomass material delivered to the Hunter plant	August 15, 2019	Complete
Finalize Amaron test burn plan and operating procedures	August 15, 2019	Complete
Test burn monitoring equipment installation complete	August 15, 2019	Complete

Amaron test burn conducted	August 31, 2019	Complete
Sign updated AEG supply agreement	April 30, 2020	On Schedule
Schedule expanded AEG test burn	To be determined	
All AEG biomass material delivered to the Hunter plant	To be determined	
Finalize AEG test burn plan and operating procedures	To be determined	
Test burn monitoring equipment installation complete	To be determined	
AEG test burn conducted	To be determined	
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 researched and priced.	Finding biomass sources that could guarantee sufficient material availability at a specific price was a challenge.	Amaron is using Woodscapes as 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 is working on agreement and schedule from AEG.		
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.	The test burn of the Amaron product went smoothly and the preliminary results align with the pre-test expectations	
Address any plant operation or air permit concerns	Worked with Jim Doak to notify the State of Utah about the project.	The relatively small quantities of biomass material do not impact the air permit.		

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, 2019

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

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 is designed to 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. Combustion optimization targets nitrogen oxides ("NO_X") for improved emissions and carbon monoxide ("CO") for improved emissions and unit efficiency. Once the combustion control phase is 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	2019	Total
Annual Collection (Budget)	$547,807	$178,924	$216,718	$943,449
Annual Spend	$457,767	$207,616	$231,621	$897,006
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$457,767	$207,616	$231,621	$897,006

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	Complete December 31, 2019 and ongoing.
Exploratory study on dynamic optimization with set point ramping complete	August 31, 2019	Focused on Cooling Tower Optimization
Final study on impact on emissions complete U of U	December 31, 2019	Complete March 11, 2020

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 9.6%. – Ongoing

d. Reducing CO and unburned coal improvement.	The initial indication for CO reduction is very positive. Initially seen a large improvement with over 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	The cooling Tower Optimization activated August 27, 2019, and has been running since the unit overhaul. Some improvements have been noted. – Ongoing
i. Upgrading Neural Network Server for required Cyber Security controls	This has been a periodic issue when the unit had the DCS controls upgrade the communication between the DCS and the COS was broke temporarily and a new patch from Griffin solved this issue.
j. Unit Load Volatility	The unit load profile has shifted to amore of a short term dispatch mode which means larger and more frequent load changes. This creates additional challenges for optimization. – Ongoing
k. Lower Low Load Operation	With the necessity to get the unit load to as low as possible, the unit is not designed for optimized low load operation. However with learning this new area we are able to get the NO_x and CO lower than where it started. Still this is an area that needs work. – Ongoing

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 excellent results. The Company continues to learn while improving the data model and implementing output recommendations. Challenges included 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 SOFA 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-if scenarios". 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.

It has been difficult to have the model numbers converge into a particular area for improvement. This has been addressed 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 2019, the COS was running 67% 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 number of sootblower operations for the wall blowers has been reduced and seems to reasonably follow coal quality. As expected, when the coal quality deteriorates the operators tend to turn off the KSB.

The reduction in KSB up-time, translated to an improvement in heat rate, although the impact is difficult to quantify. The operators have accepted the KSB system with good results. For 2019, the KSB was on 66% of the time (73% during the first three quarters and only 15% during the last quarter due to overhaul and outages).

For tracking proposes, CO_2 has also been considered, 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 results of this project are encouraging based on the reduction benefits in both NO_X and CO compared to the three month baseline data as shown below. Since NO_X and CO vary by load, only like loads during the given time period are compared, 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 low. Looking at 2019 the load has shifted, more time at low load with the P-min at 70 MW and less time in the middle loads and more time at the upper loads. Even though the load profile of the unit has changed, the NO_X at all loads have been reduced through 2019.

	NO_X	*CO*	*CO2*	
Apr to Jun '17	**0.230**	**348**	**11.14%**	**Baseline Charts 1 & 3**
2018	0.199	126	10.47%	
2019	**0.208**	**115**	**9.06%**	**Charts 2 & 4**
% Reduction	9.6%	67.0%	18.67%	2019 vs baseline

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

In 2019, new system-wide demand really changed how the unit was operating and the load began to swing significantly throughout the day. This volatility of the unit creates new challenges for the COS in achieving low NO_X. The unit load average has come down with increased load variability. This variability can be measured with a Volatility Factor. The Volatility Factor in this case is the standard deviation over the previous five hours of the percent of load change compared to the previous five minutes. With the Volatility factor tracked it show correlation with NO_X and CO and does play a role in optimizing combustion. When at steady or near steady state combustion optimization works fairly easy but as the load changes and particularly as pulverizers need to come in or out of service to get the new load, this has a significant impact on optimization. This volatility factor for 2019 can be seen in Chart 5.

For 2019, Unit 2's load average was 311 MW, the NO_X average for all loads for the year was 0.185 #/mmbtu's, also seen in Chart 5. For comparison Chart 6 shows the average load for 2017 was 336 MW with an average NO_X of 0.209 #/mmbtu's. The load has been split more, with less time in the mid-range, higher at top and bottom load ranges. In the same Chart 6, for 2019 it shows what the NO_X was with the COS on and with the COS off. With the COS on the average NO_X reduction is 7% from 0.193 to 0.180 #/mmbtu's. The COS was on 60% of the time in 2019. (66% the first three quarters and only 12% the last quarter due to overhaul and outages)

Initially the Company hoped that the NO_X would be reduced 10–20%, which has been in line with the results. CO has seen remarkable improvements. With the continued support from the University of Utah and Griffin, the optimizer is being tweaked and will continue running in the foreseeable future. This project will continue for two more years ending December 2021. The University of Utah and Griffin will continue to be available to support the project as needed, to evaluate additional achievements and continue to monitor the status. This project continues to fund the Griffin license through 2021.

Potential future applications for similar projects:

With the positive result, the Company installed a similar Neural Network Optimization on Huntington Unit 1 and on Hunter Units 1 & 2.

Attachments:

Exhibit 4-A University of Utah Final Project Report STEP NO_x Neural Network Project

Results/Appendix:

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

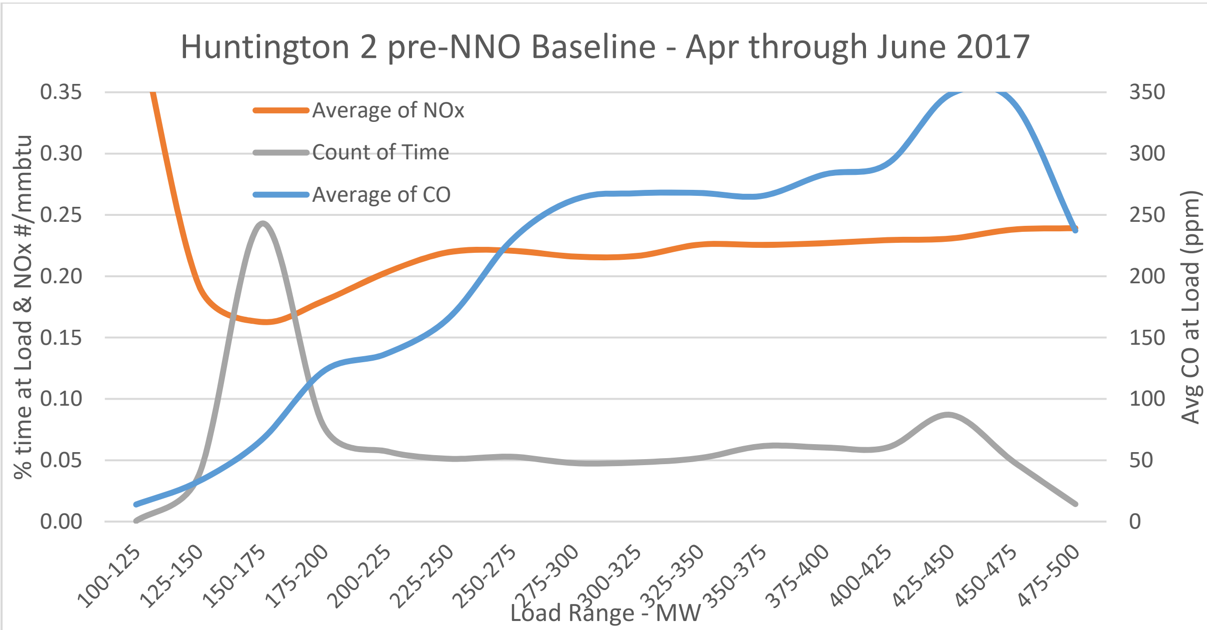

Chart 2 – NOx and CO versus load and percent of time at Load. 2019

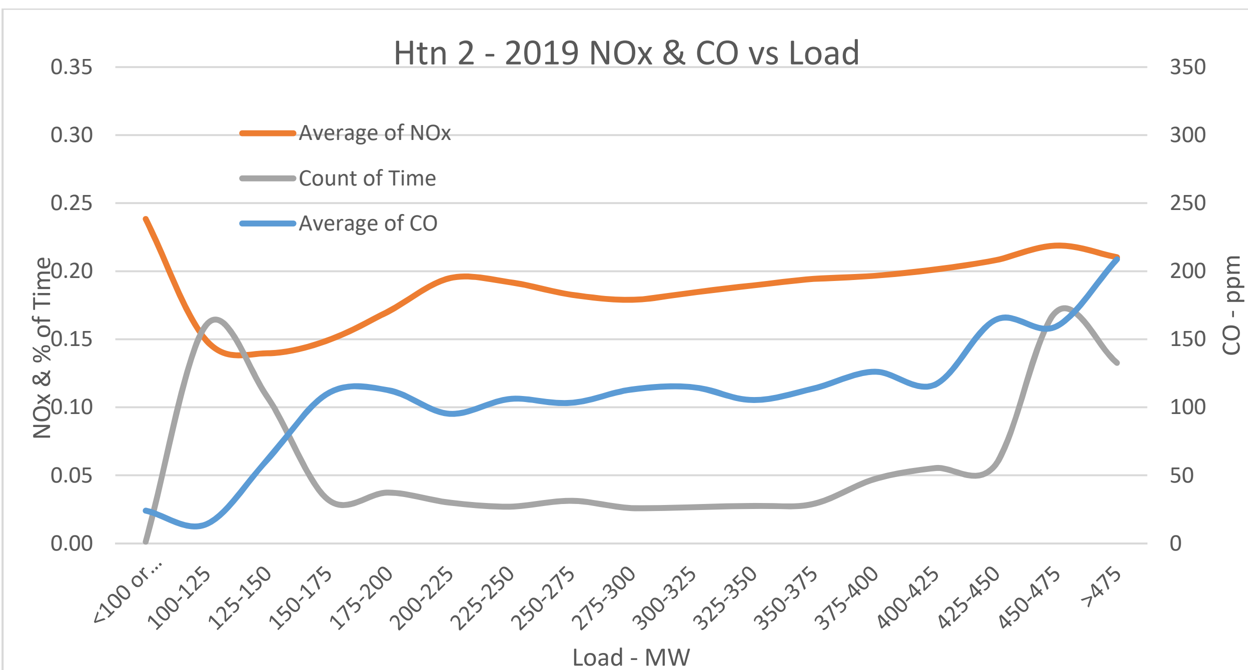

Chart 3 – Three Month data establishing baseline.

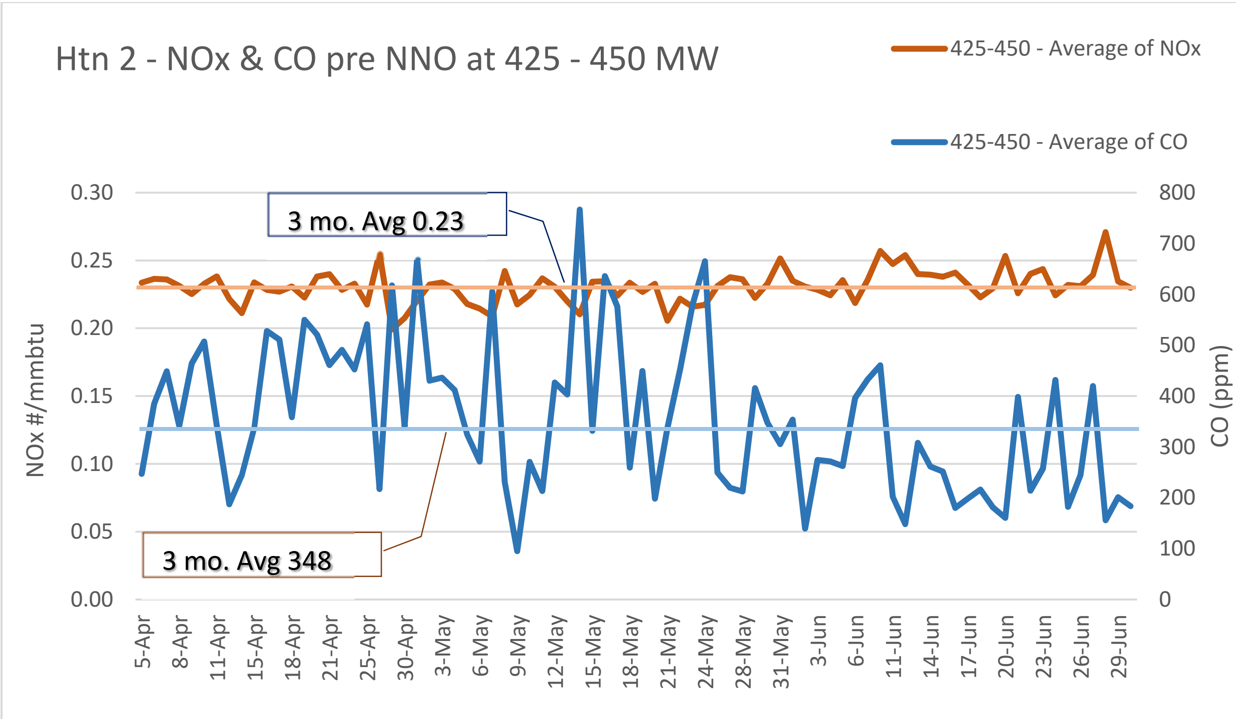

Chart 4 – Daily NOx & CO Average at comparison load

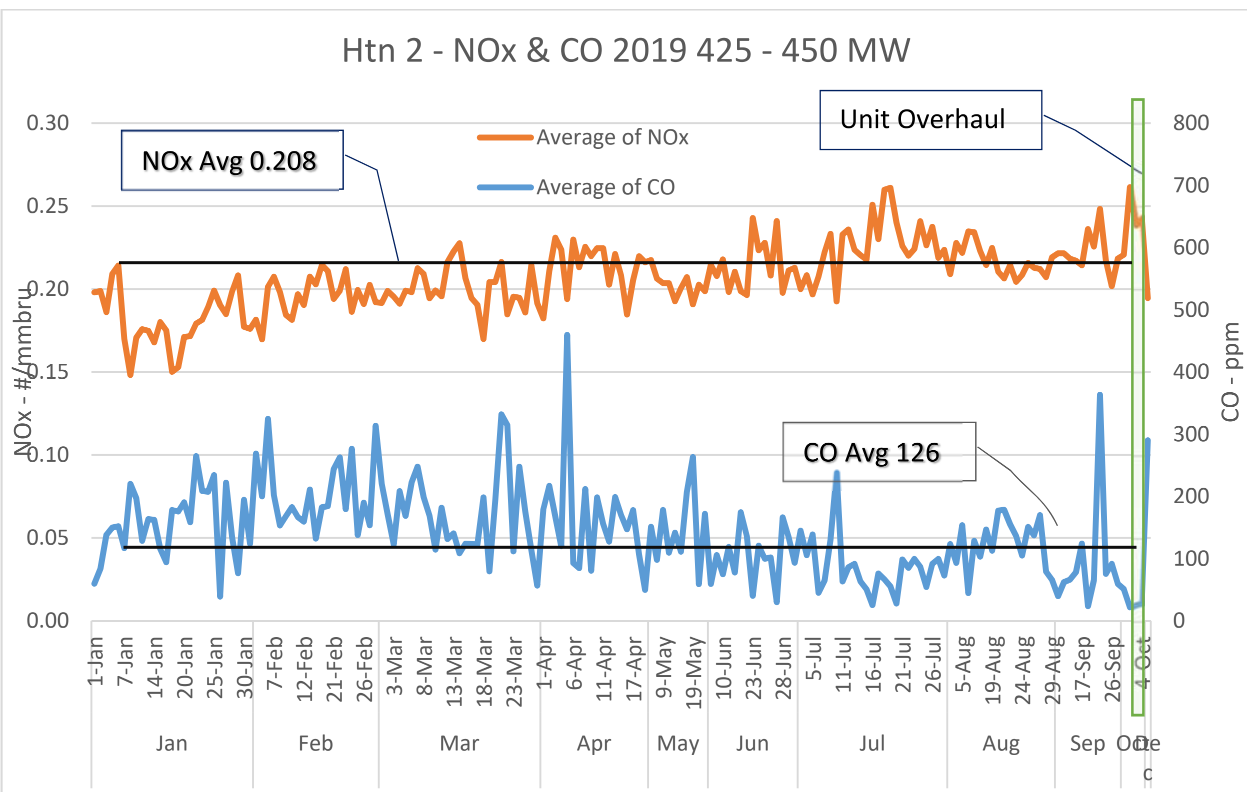

Chart 5 – 2019 Load, Volatility & NOx – Daily Average

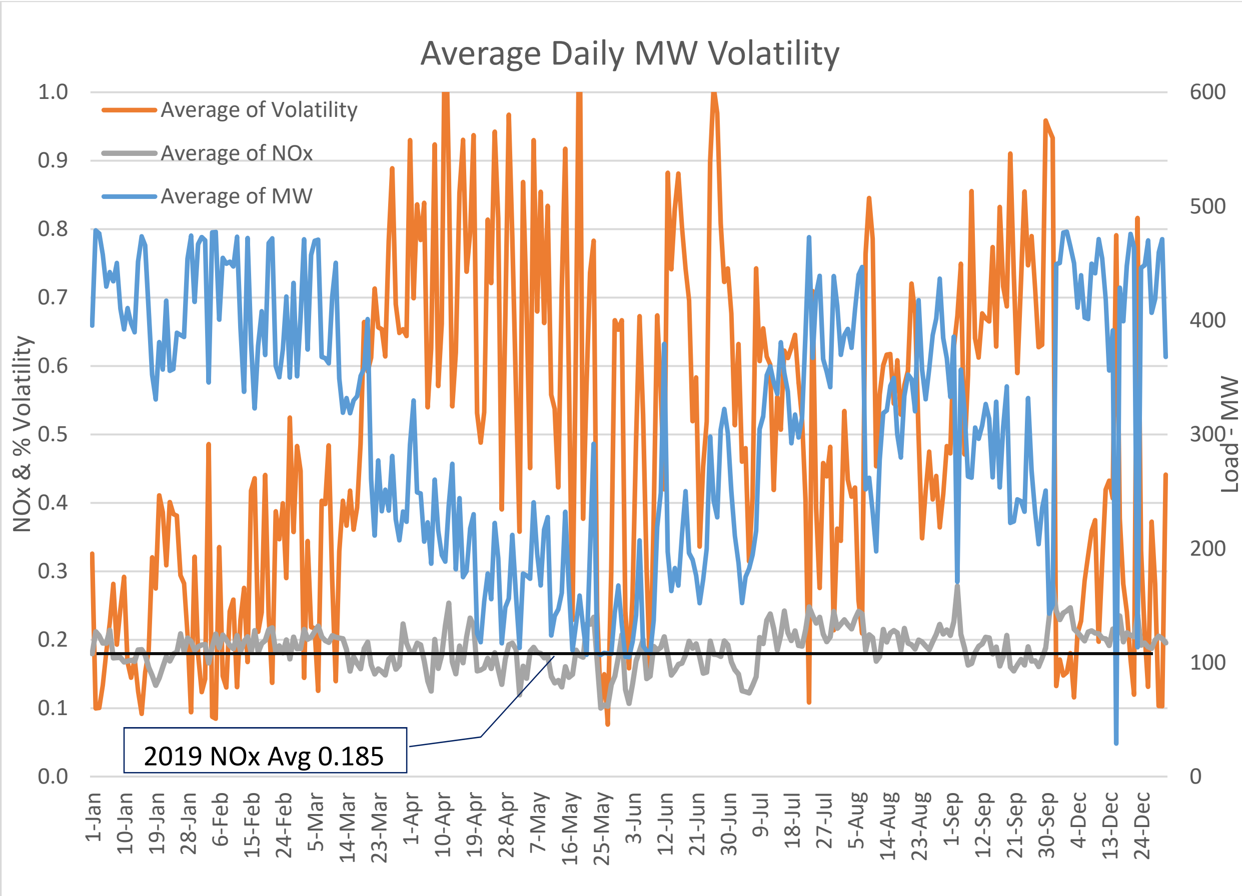

Chart 6 – COS On/Off Comparison and % of Time at unit load

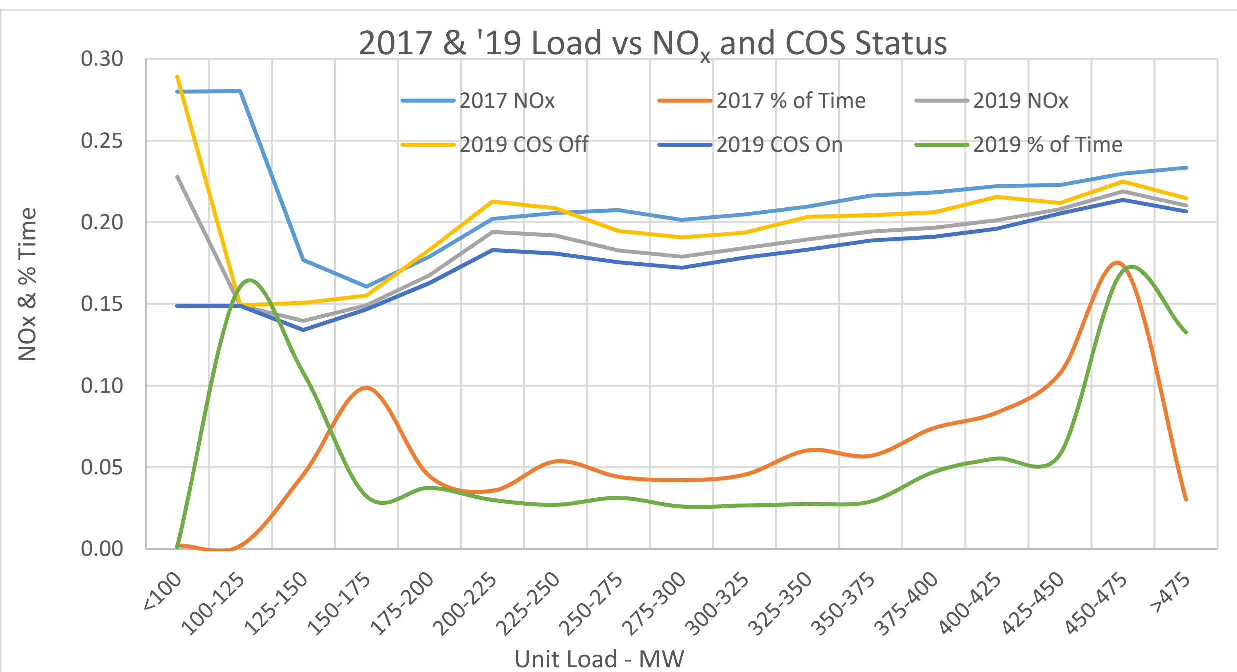

Exhibit 4-A

University of Utah Final Project Report STEP NOx Neural Network Project

DEPARTMENT OF
Chemical Engineering
COLLEGE OF ENGINEERING | THE UNIVERSITY OF UTAH

University of Utah – U2 STEP NOx Neural Network Project

Final Project Report (January 2017 – December 2019)

Research Team Members – Dr. Kody Powell, Jake Tuttle, Landen Blackburn

Executive Summary:

The overall objective of the U2 STEP NOx Neural Network Project was to install, establish, and perform further research on the use of artificial neural networks to optimize coal combustion. The University of Utah (U of U) has been the primary research institution involved in this project and implemented control schemes and performed research on the unit's combustion process using the Griffin Open Systems Toolkit provided by Griffin Open Systems LLC. As the system was installed, brought online, and refined at PacifiCorp's Huntington Power Plant, Unit 2, important observations were made while working to achieve defined objectives of NOx reduction and overall system performance. The deliverable areas which the U of U focused on throughout the project along with quantifiable objectives worked toward are provided below. Results and observations associated with each area are summarized.

Overall, this project was able to realize large decreases in observed NOx emission rates across the unit's load range, and to make advancements in the application of artificial intelligence methods to other areas of the power plant with positive impacts. Although specific KPIs were not able to be achieved for NOx across the load range, the observed NOx reduction due to optimization using artificial intelligence models and methods was significant. Observations of unit performance and system developments to address other circumstances within the unit such as high temperatures benefitted day to day operation, contributing to greater flexibility of the station within the everchanging power market, and greatly helped increase adoption of the system by operators at the station.

University of Utah Deliverables & Objectives:

Parametric Study

Perform a parametric study of the test unit pre-installation, during installation, during learning phase, and after system has been brought online. Identify most effective control loops and input variables.

NOx emission rate (lbs/MMBtu) was the focus of this work, and identification of control methods and parameters which most affected its generation were evaluated throughout the project. Average NOx at each 10 MW increment of load was identified during the baseline period and each year of the project (2017, 2018, and 2019). The baseline period is defined as beginning with the unit's return from the last major unit overhaul prior to project beginning (August 2015) up to activation of the optimization system (September 2017). NOx emission rate profiles for each period are displayed in Figure 1.

The 2017 profile is very similar to the baseline, due in part to the baseline being partly comprised of 2017 data and also to the 2017 period seeing very little optimizer operation as the system was in its learning and major development phase. The 2018 and 2019 periods both display noticeable improvements on baseline and 2017 operation, with 2018 being the overall best, other than at minimum unit load. The unit experienced a large degree of hardware degradation during the 2019 period, contributing in large part to its observed overall decreased performance relative to 2018. For these yearly averages, the **2018 period displays a 15.2% improvement** on the baseline profile, and the **2019 period displays a 12.3% improvement**. Performance was analyzed quarterly during the project, which identified QIV 2018 as displaying the **greatest average NOx emission rate reduction of 22.5%** relative to the baseline period.

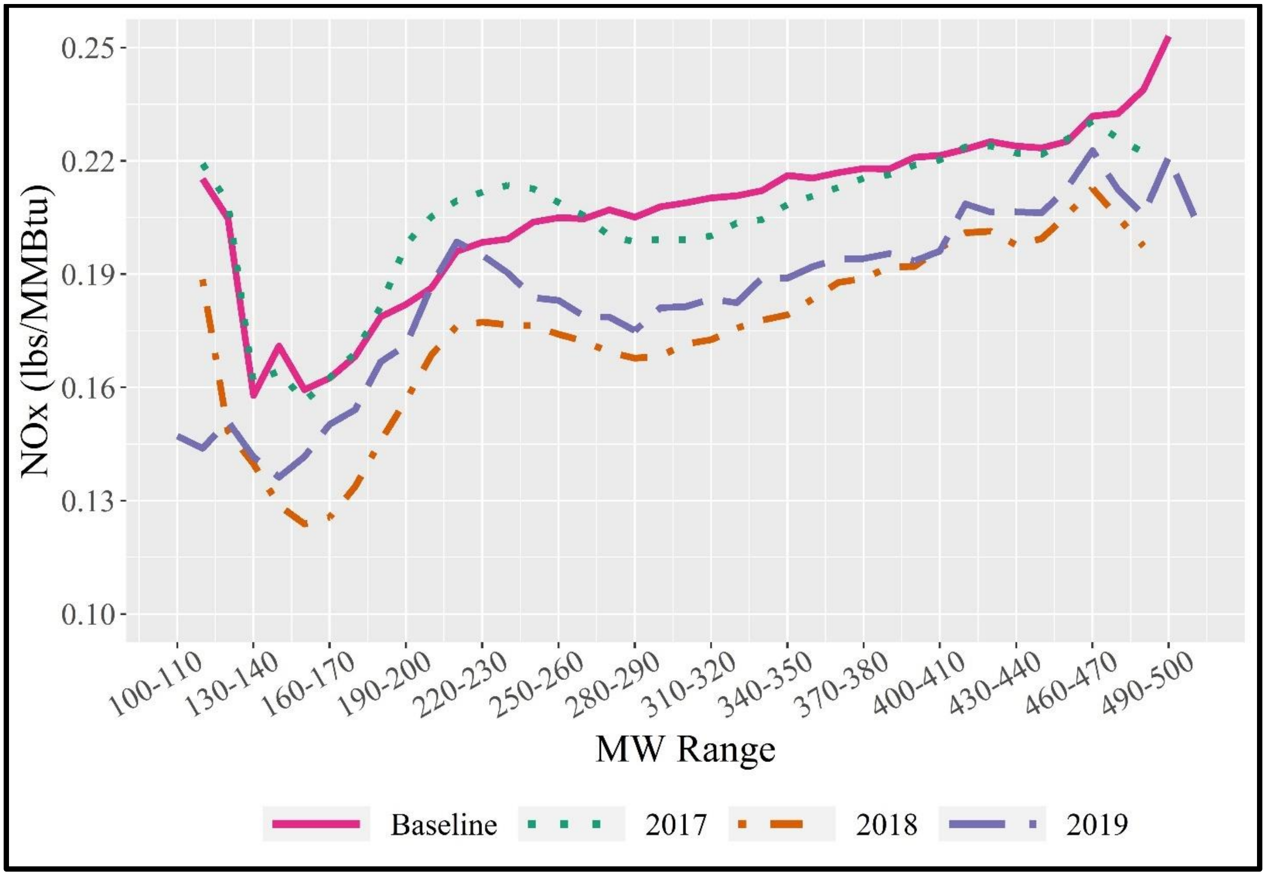

Figure 1 – NOx emission rate profile across unit load range

The vast majority of observed operation of the unit occurred in the megawatt ranges of 100 – 150 and 460 – 490 MW, and the parametric study of contributing factors was performed in these two ranges. The identified parameters which most impact NOx generation were included in this analysis: SOFA 1, 2, 3, and 4 damper positions and tilts; and Excess O2 measurement. Overfire air placement was found to move quite dramatically over the course of the project, moving from a uniform position due to manual tuning to varying positions from corner to corner as identified by the optimization system. Changes in O2 balancing across the unit are also displayed within this analysis, presented later in this report.

Installation, Implementation, and Evaluation of Optimizer and Neural Network

Assist PacifiCorp and Taber Int. personnel with the installation/implementation of the optimizer. Evaluate the neural network in operation and provide recommendations. Report on the performance of the neural network optimizer with regards to usage level, benefits received, benefits lost, and improvement recommendations.

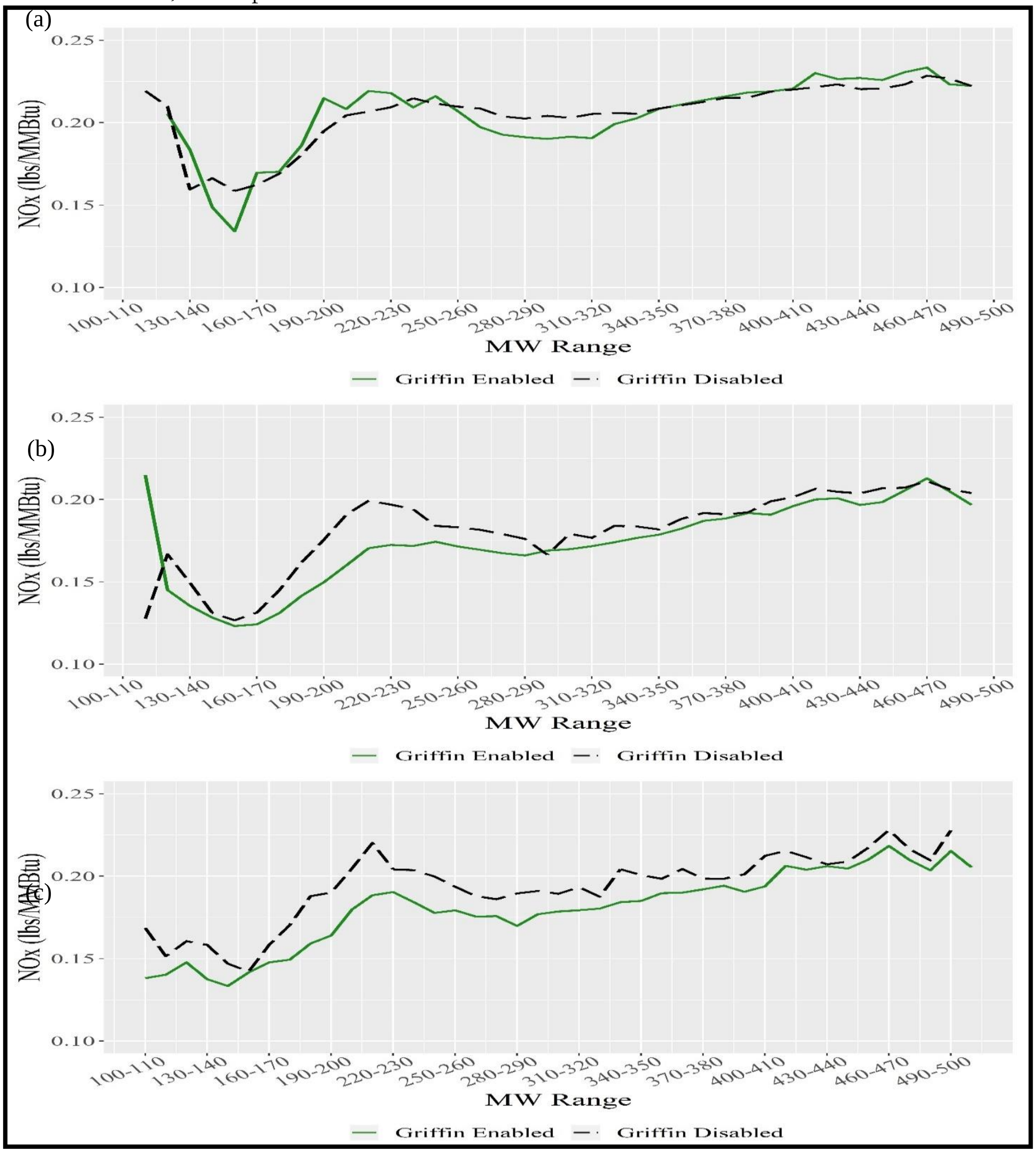

Figure 2 – Yearly NOx emission rate with Griffin system enabled and disabled: (a) 2017 (b) 2018 (c) 2019

Following the initial training phase of the system (latter portion of 2017), the NOx emission rate profile has always been improved by having at least one aspect of the Griffin optimization system enabled (excluding the lowest operating load in 2018 which saw very little application of Griffin, skewing the rate profile). The 2018 year saw a 7.7% improvement with Griffin enabled compared to disabled that year, and 2019 saw an 8.7% improvement with Griffin enabled compared to disabled that year. Although the average NOx emission rate increased from 2018 to 2019, the benefit received by the Griffin system increased, further supporting that the optimization system was continually learning and improving as more operation was experienced.

The overall service factor of the system over the project's length (beginning when the optimizer first became available) was 60.0%. The service factor during each annual period is shown below.

Table 1 – Annual Service Factor of COS

Period	Service Factor
2017	29.7%
2018	79.4%
2019	53.2%

The decreased service factor from 2018 to 2019 was primarily due to performance issues arising caused by hardware deterioration as the unit approached its scheduled overhaul during October 2019. The new circumstances encountered required many operators to disable the Griffin system in order to address the problems they were experiencing. A number of these were addressed post-event with expert logic development within the COS, but not all cases were able to be corrected in this manner.

A detailed analysis of the system's emission rate performance during many combinations of system disabled parameters are discussed later in this report.

Expansion of Neural Network and Further Research

Expand usage of optimizer to include auxiliary plant processes (e.g. cooling tower fan control, scrubber control, etc). Identify and conduct further research to enhance neural network control of unit performance.

Over the course of the project, a number of opportunities were identified and explored for expansion of the artificial intelligence modeling and optimization system and expert logic application. These areas were soot blower control, real-time classification of combusting coal quality, cooling tower fan speed, and superheat and reheat attemperator valves. Optimization of pump motors within the flue gas desulfurization (FGD) system was initially proposed as a potential project area, but after thorough consideration this topic was not selected for further analysis in order to pursue more potentially beneficial areas. Each of the analyzed systems and areas had differing objectives and were approached and analyzed according to different methods and metrics. Successes were achieved with each effort, and each is described thoroughly later in this report, with a brief summary of each provided below.

Sootblower Control: Knowledge-based Sootblowing (KSB) was developed in the earlier half of 2018, shortly after the combustion optimization system became functional. This project was largely led by Griffin Open Systems according to other applications they have performed of similar systems. The ultimate objective of soot blower control was to provide greater consistency to ash cleaning within the unit, leading to less tube metal wear and improved efficiency. The retract controller aspect of the system was used across the project for this purpose. The wall blower controller aspect of the system quickly evolved to aid in steam temperature control. This system was configured to automatically blow walls around the unit in response to rapidly increasing or already elevated steam temperatures in a manner to manage temperature with the fewest number of blows. Due to the high number of occurrences of elevated temperatures, the KSB system naturally led to more wall blower activations to achieve its evolved objective. Through many control iterations, the system has seen increasing service factor between annual periods, and is appreciated by operations for providing consistency between different crews with varying operating styles.

Table 2 – KSB Yearly Service Factor and Average Blower Activations

Year – Blower Type	Service Factor	System Active Average Activations	System Inactive Average Activations
2018 – Retracts	32.7%	41.9	37.3
2018 – Walls	29.2%	93.4	95.7
2019 – Retracts	68.2%	39.4	26.5
2019 – Walls	66.1%	107.8	66.4

Coal Quality Classification: The combustion process is significantly influenced by the quality of fuel within the system at that instant. Because of the nature of coal, the characteristics of the feed stock are not constant. Unfortunately, this is a largely unknown factor as measurement techniques to directly determine coal quality and relate it to current conditions are not available. In order to provide the neural network optimization system with more information of currently combusting coal quality, another type of artificial intelligence modeling method was developed and applied onsite. This system utilizes a Support Vector Machine (SVM) to classify the quality of currently combusting coal based on readily available system measurements such as the ratio of feeder speeds to current generation level and others. The SVM system then informs 3 new, specific neural networks trained exclusively on 3 unique coal quality classification outputs: good, ok, and poor. The application of this system was found to increase the prediction accuracy of the neural network models by nearly 50% on two weeks of unseen test data (Figure 3) and improve the optimization capability of the application.

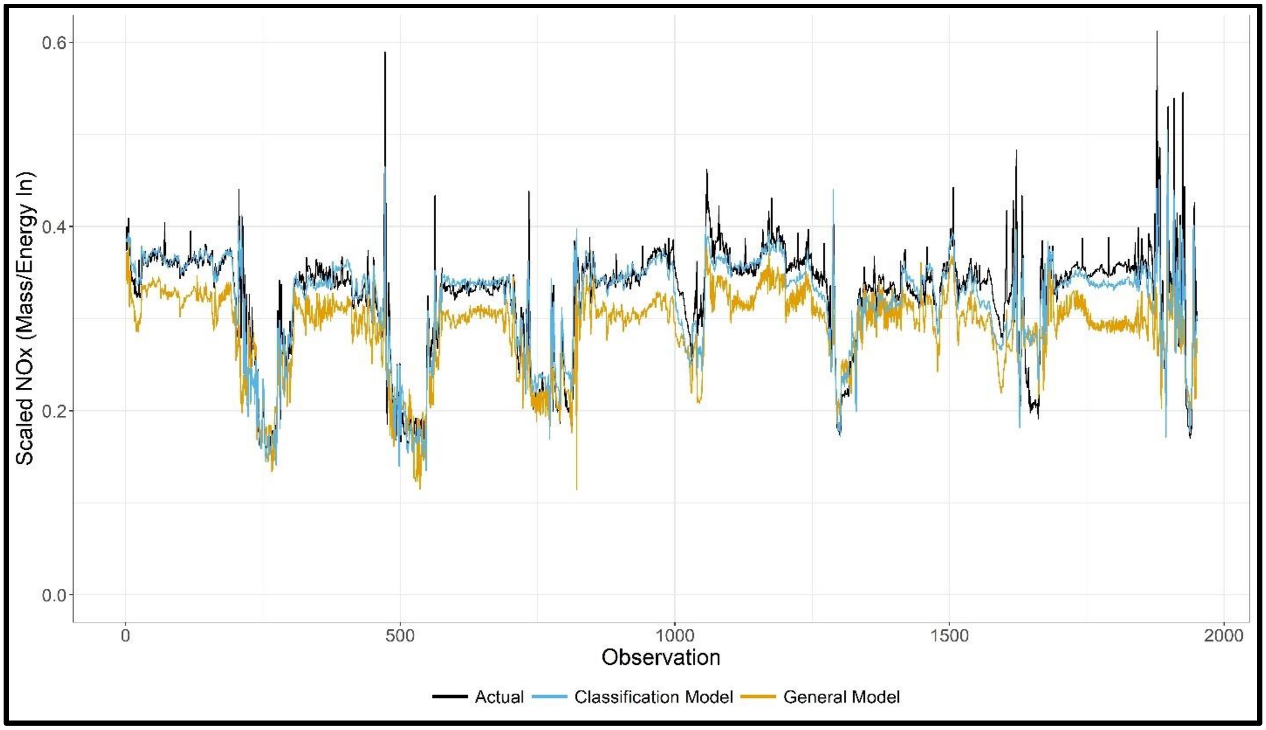

Figure 3 – Improved prediction ability of SVM classification neural network model (blue) against previously existing neural network model (orange)

Cooling Towers: Operation of the cooling tower represents a large parasitic power draw within the power plant, directly affecting net unit heat rate (NUHR). A neural network optimization system similar to the existing combustion optimization system was developed to reduce the power consumption of the fans within each cooling tower cell (12 fans). Equipped with variable-frequency drives (VFDs) these fans can be individually controlled to achieve the desired condensate cooling. Existing DCS controls assume that each cell is identical, however initial analysis confirmed that each cell behaves very differently, and their behavior changes as unit load changes.

Following a simulation study which predicted a potential theoretical power consumption reduction of 10%, the cooling tower optimization system was deployed onsite in closed-loop control on August 27th, 2019. Operation of this system continued until the unit's scheduled outage in October 2019. During this period, the power consumption of the cooling tower fans was 5.2% less on average with the Griffin optimizer active compared to when the Griffin optimizer was inactive, shown in Figure 4.

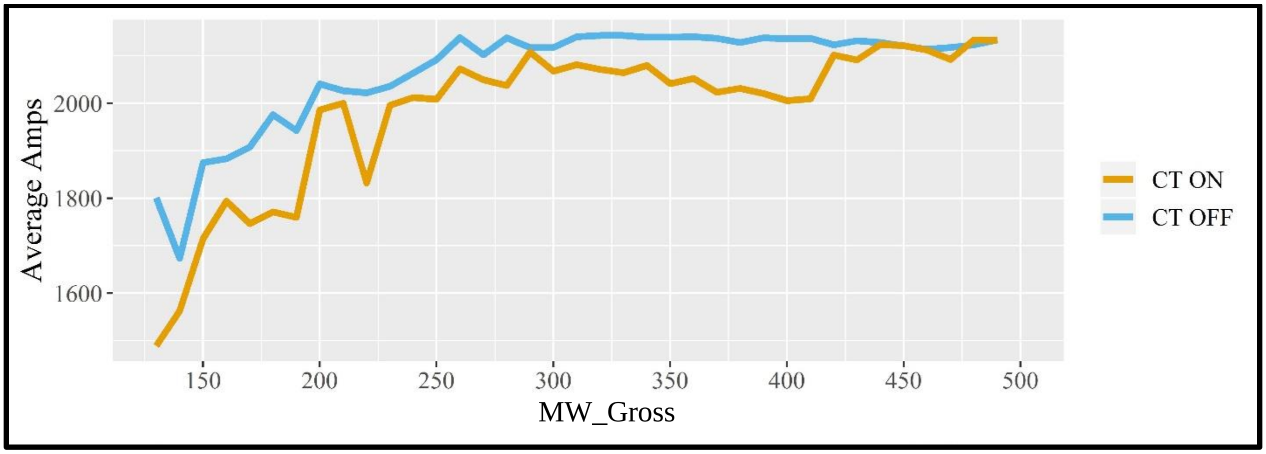

Figure 4 – Cooling tower power consumption (represented by amps) with Griffin Optimization active (orange) compared to off (blue) from Aug 27th to Oct 5th, 2019

Attemperator Valve Control: Attemperator valves at the Huntington power plant are known to be slow-acting and unresponsive, at times responding exactly opposite of what is needed (cooling steam below setpoint). Largely contributing to this is the new dynamics being encountered by the unit from fast ramping and operation at new loads. Utilizing previously existing bias points within the DCS to alter the setpoint of the existing attemperator valve control, an application within the Griffin system was developed to improve the attemperator valve response.

Working within the limitation of only being capable of altering an underlying PID setpoint, a number of control system methods were attempted (fuzzy feedback control, PID control, curve-fitting and first-principles based modeling). The best identified system was found to be PID control utilizing a properly tuned derivative component and integral reset. The system became available August 27th. Since that time, the amount of time that the unit has experienced main steam temperatures above 1050° is 50% lower with the Griffin attemperator valve control active compared to inactive (reduced from 1% of operating time to 0.5% of operating time). The amount of time of observed main steam temperatures above 1050° is shown in Figure 5. Due to the attemperator control system being developed later in the year, its service factor during 2019 was only 9.7%. It has been well accepted by operations however, and is expected to see a high service factor in the future.

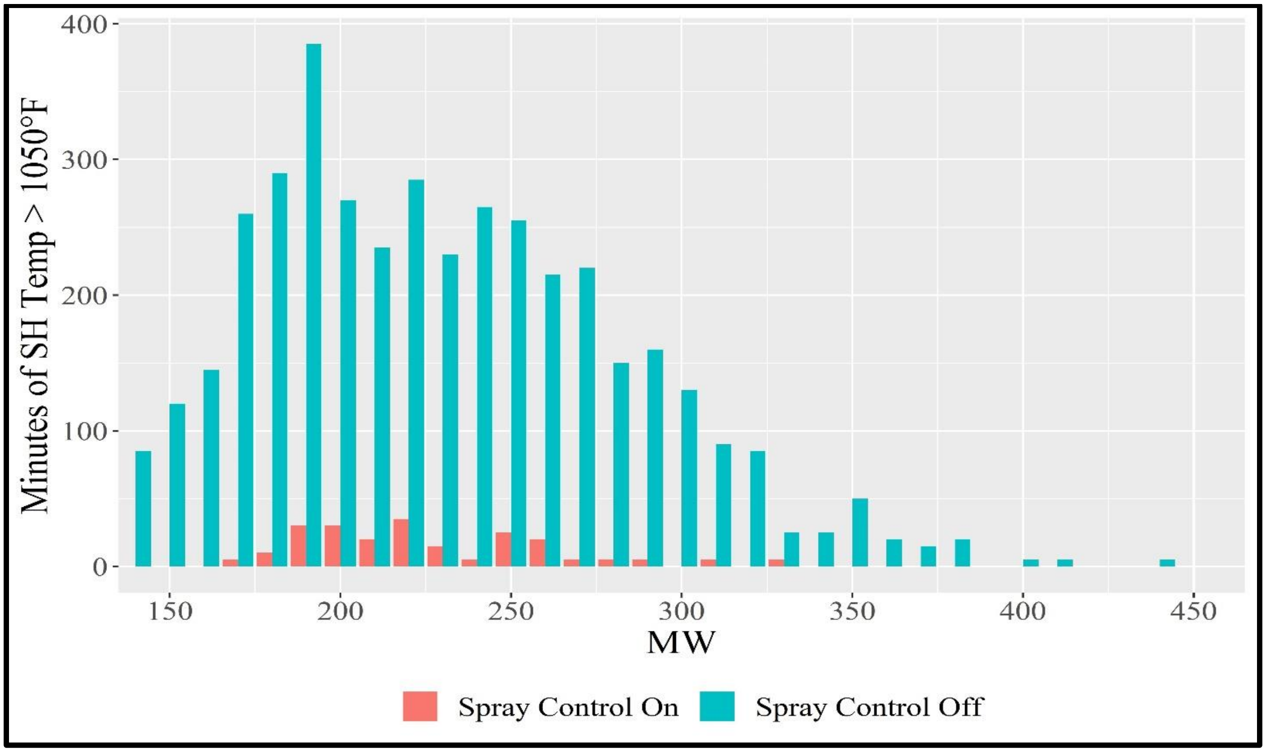

Figure 5 – Observed time of main steam above 1050° with Griffin Attemperator Control active and inactive during 2019.

System Adoption

Evaluate factors that may discourage system usage e.g. poor human machine interface, excessive maintenance, lack of understanding or trust by operators, etc. Where possible, identify mitigation opportunities and aid in their implementation.

Over the course of the project, operator adoption of the newly created combustion optimization system and the additional control systems created was largely affected by changes in operating behavior of the unit, individual operator experience at different loads and in changing circumstances, operator oversight, and the onsite presence of the research team. A table of the quarterly service factor of the COS is displayed and discussed in Table 3.

Table 3 – Project timeline service factors with corresponding major events and developments

	QI - QIII 2017	QIV 2017	QI 2018	QII 2018	QIII 2018	QIV 2018	QI 2019	QII 2019	QIII 2019	QIV 2019
Service Factor	0%	49%	66%	54%	80%	86%	77%	69.0%	61.0%	6.0%
System Changes	Install & Learning Phase	COS Activated		KSB Activated	SOFA Tilt for Tube Temps			Low Load O2 / SVM Coal Quality	Spray and Cooling Tower	Unit Overhaul & Learning

The quarterly performance of the system and developments during each quarter shown in Table 3 suggest that the most influential single event which occurred to improve service factor was the development of the SOFA Tilt controller to help manage high tube temperatures, which during QIII of 2018. This controller was developed in direct response to reoccurring challenges faced by operators which were a priority for them to maintain. Previously existing methods for control resulted in detrimental behavior to other portions of the system. The SOFA Tilt method developed here was able to reduce measured high four-tube average temperatures by more than 80%, with no direct detrimental side effects, as the NOx emission rate profile continued to decrease during QIII 2018 and after.

Additional factors related to system adoption are discussed later in this report.

Neural Network Operator Training

Provide ongoing training to plant operators and others on operating optimization system.

The continual onsite presence of the research team's Jake Tuttle led to many opportunities to interact with operations and management and perform training as needed. In most situations, this took on the form of asking and answering questions to explain certain behaviors of the system and overall objectives. Often times, this process led to new developments and further refinements within the optimization system to help operators address circumstances encountered within the unit automatically.

During the latter half of 2019, a weekly meeting was organized by engineering and operations management to unite and inform everyone affected by the project of the current status of the neural network optimization system and challenges faced by operations. This practice was very beneficial, leading to further system adjustments of optimizer operating ranges while the unit prepared for its October 2019 outage. A summary guide explaining the expected behavior of the neural network system and operating performance was provided and updated with new changes throughout this time.

With years' worth of interaction between the research team and operations, each control room operator is familiar with the optimization system and its objectives and behavior. Many operators have stated that they are satisfied with how the system functions in most situations, and understand that in any circumstance they can disengage the system to address other unit issues. Most re-activate the system after those issues are resolved, allowing the optimization system to continue to provide benefits to NOx emission rates.

Establishment of KPI's

Help to establish KPI's for success e.g. NO_x emission levels < X.XX lbs/MMBtu, CO less than permitted value, X.XX% Net Unit Heat Rate (NUHR) reduction, etc.

Established NOx emission goal: 0.19 lbs/MMBtu

Established CO emission goal: between 90 and 250 ppm

Throughout the project's length, the emission rate profile of NOx (Figure 1) shows, despite the percent improvements realized through use of the optimization system, no year saw the full emission rate profile across the unit's load range below the established NOx emission rate goal of 0.19 lbs/MMBtu. The CO emission rate profile during each year of the project at loads above 160 MW was within the objective range (except for one outlier at an extreme high load point). This shows improvement in CO management compared to the baseline CO emission rate profile. Below 160 MW the unit is affected by a total minimum air flow limit which is unavoidable due to safety reasons. High levels of excess air cause CO emission rates to go to 0, and cannot be addressed without major DCS changes outside the scope of this project.

The overall yearly average NOx emission rate and CO emission rate are shown in Table 4.

Table 4 – Average NOx and CO emission rates

	Baseline	**2017**	**2018**	**2019**
NOx (lbs/MMBtu)	0.206	0.206	0.185	0.184
CO (ppm)	192	130	104	113

The average NOx emission rates during 2018 and 2019 are below the target value of 0.19 lbs/MMBtu. However, this overall average is likely lower due to significantly more operational time at lower loads, which inherently generate less NOx emissions.

Based upon the performance of similar systems at other sites, additional operational time and use of the optimization system will continue to improve the system's performance and the NOx emission rate reduction ability. Neural network models benefit from more data to train and learn from, and as the system continues to gather data and retrain itself, it is expected that additional benefits will be realized.

Year-Round Support

Provide year-round onsite coverage and support

During the initial learning stages of the project, university personnel traveled to the plant site weekly to take part in research and installation activities with Griffin Open Systems personnel. Beginning mid-quarter of QII 2018, research team member Jake Tuttle has been onsite nearly daily during the project period to evaluate system performance and perform tuning and development of new control techniques. Additionally, by having a constant presence onsite, problems and issues were immediately addressable and often resolved within the day. All partners and members of the research team have been available throughout the project's duration via email and phone for questions and troubleshooting.

These practices have established strong long-term relationships between all partners which will help to support the overall Griffin system's functionality and use for years beyond the project's completion.

Details of Work Performed:

Parametric Study

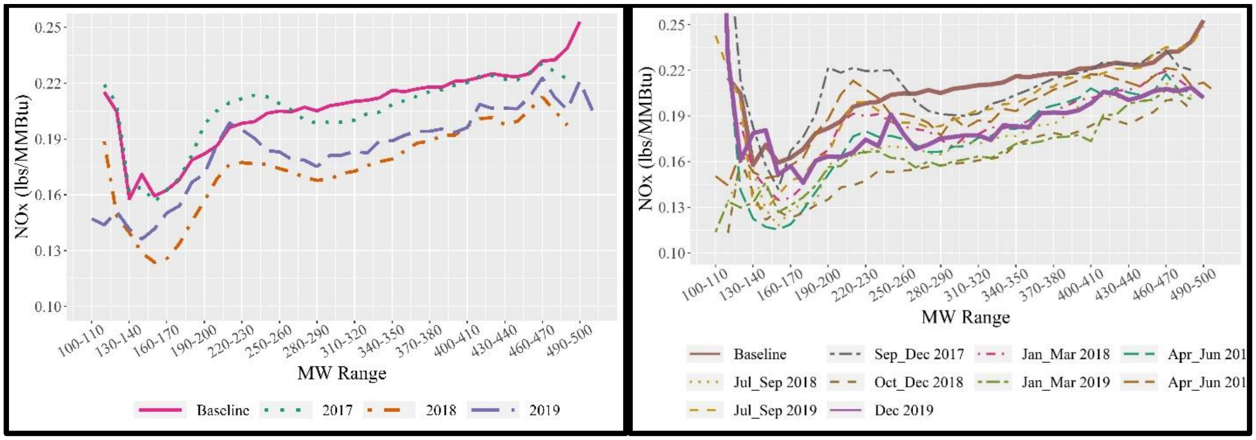

Figure 6 – Yearly and quarterly NOx emission rate profiles

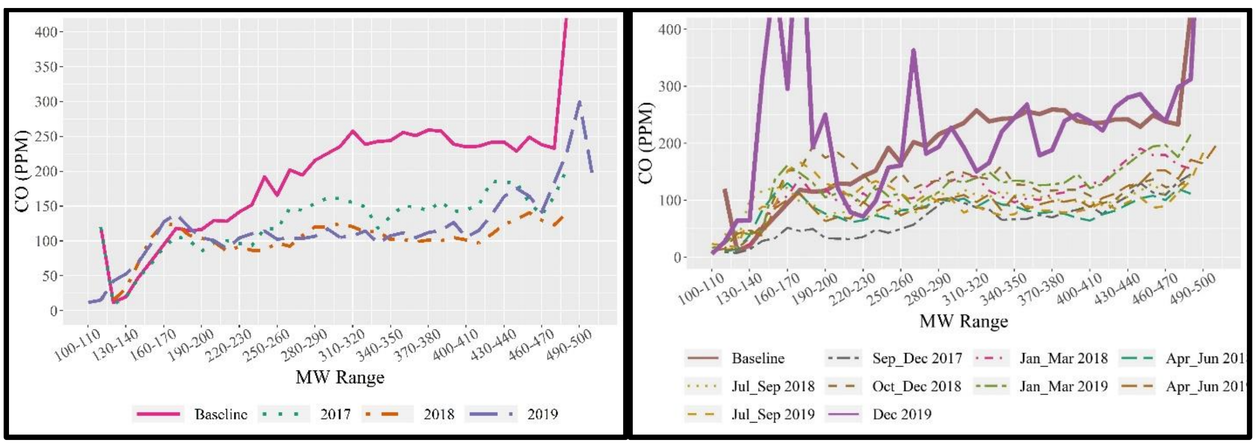

Figure 7 – Yearly and quarterly CO emission rate profiles

Performance and behavior of the unit varies considerably based on the current generation level. To best compare emission rates across time, comparison of individual generation ranges provides the most accurate results. The load range of the unit was broken into 10 MW increments, and the observed NOx and CO values within each of these MW bins was averaged to generate the profiles in Figures 6 and 7.

The NOx emission rate profiles were the main focus of this project, and the neural network models generated were always used to predict NOx emission rate and used to optimize damper and tilt positions across the boiler. CO was mainly controlled using the excess O2 trim bias, which operated according to a fuzzy controller to remove or add O2 in response to current CO ppm levels to remain with the target range of 90 – 250 ppm.

A parametric study of the behavior of SOFA air placement and resulting excess O2 measured across the backpass of the unit was conducted to understand some of the correlations being identified and exploited by the neural network and how this was affecting O2 balancing. Because the majority of unit operation occurs above 460 MW and below 150 MW, an analysis of high load behavior (460 – 490 MW) and low load behavior (100 – 150 MW) was performed of the average positions of these parameters during each annual period. Additionally, the best NOx performance records were isolated from these datasets to further recognize relationships which promote excellent NOx emission rates. For the low load range, NOx records below 0.13 lbs/MMBtu were considered, and for the high load range, NOx records below 0.18 lbs/MMBtu were considered. The behavior of each level of SOFA dampers and tilts, and the O2 probes are displayed in Figures 8 – 15.

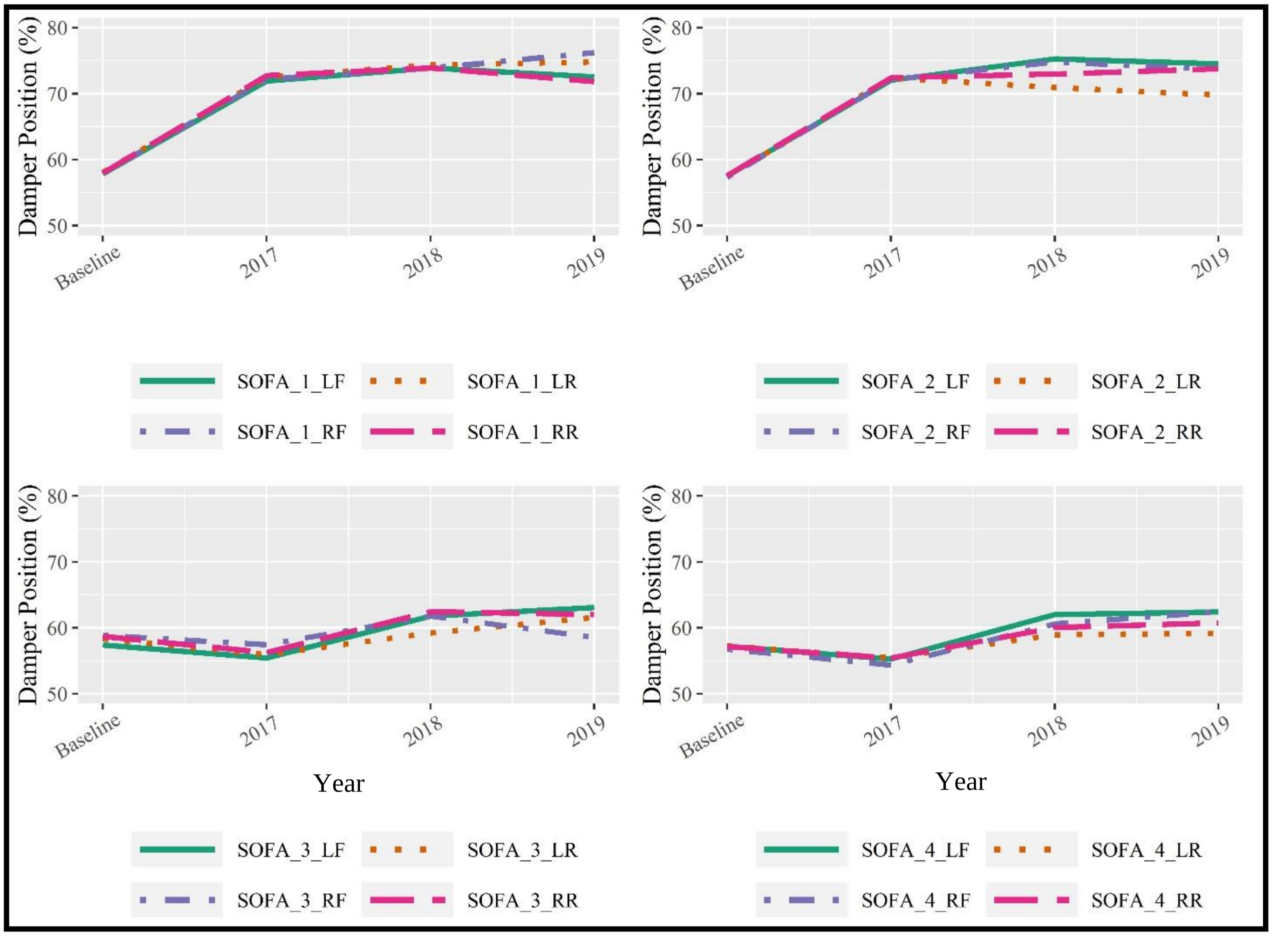

Figure 8 – SOFA damper levels average position during each annual period at high load

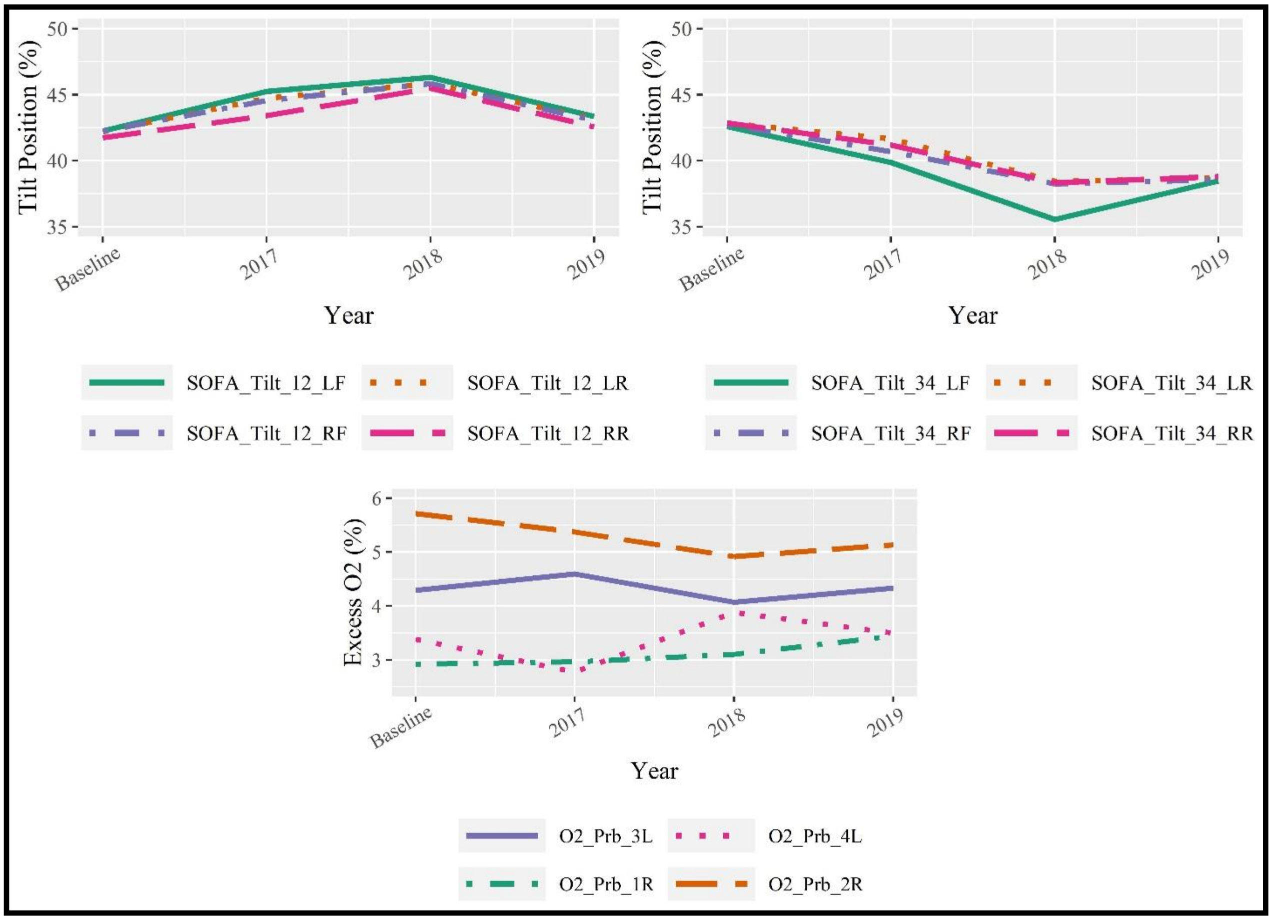

Figure 9 - SOFA tilt average positions and excess O2 averages during each annual period at high load

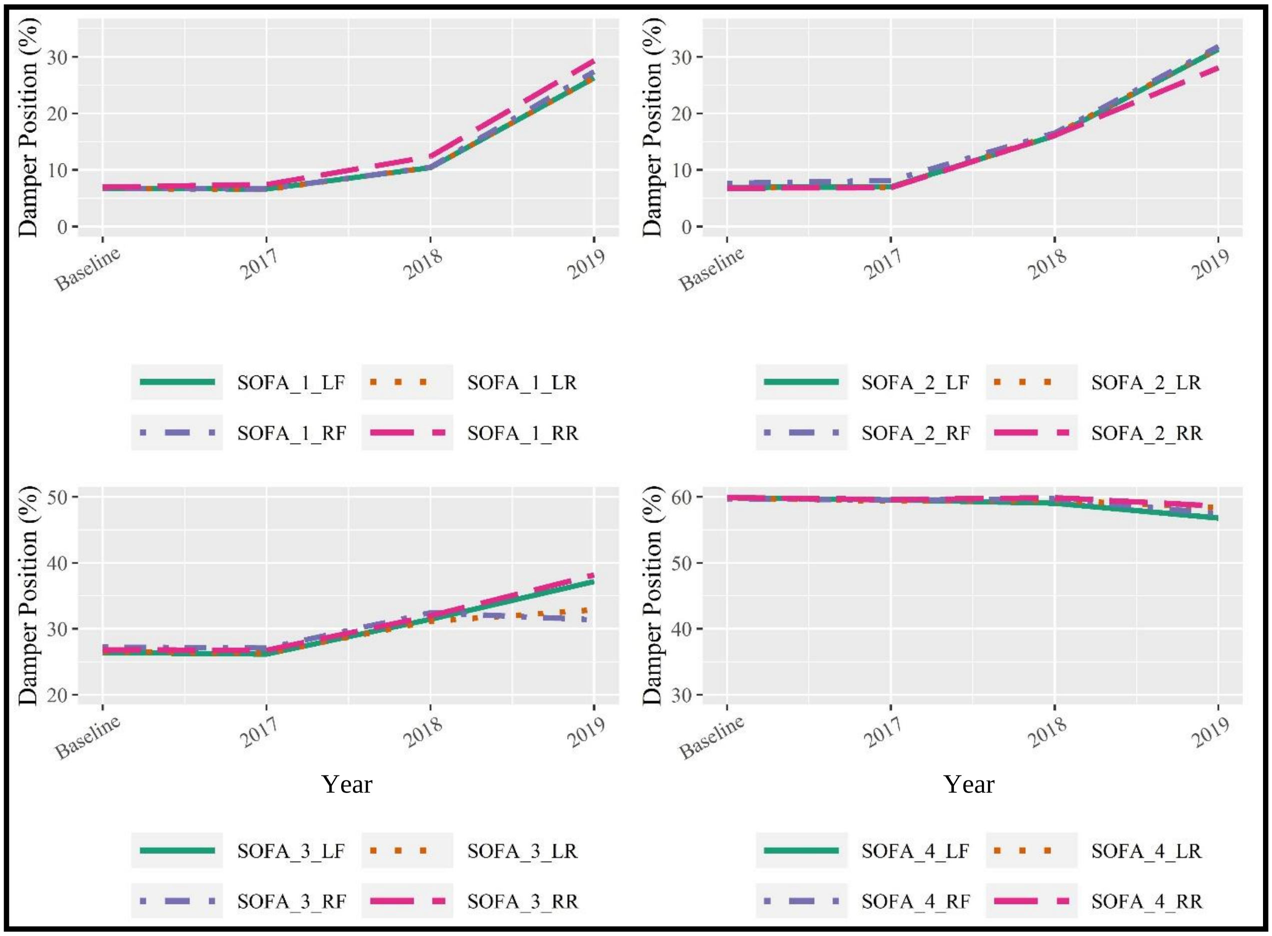

Figure 10 - SOFA damper levels average position during each annual period at low load

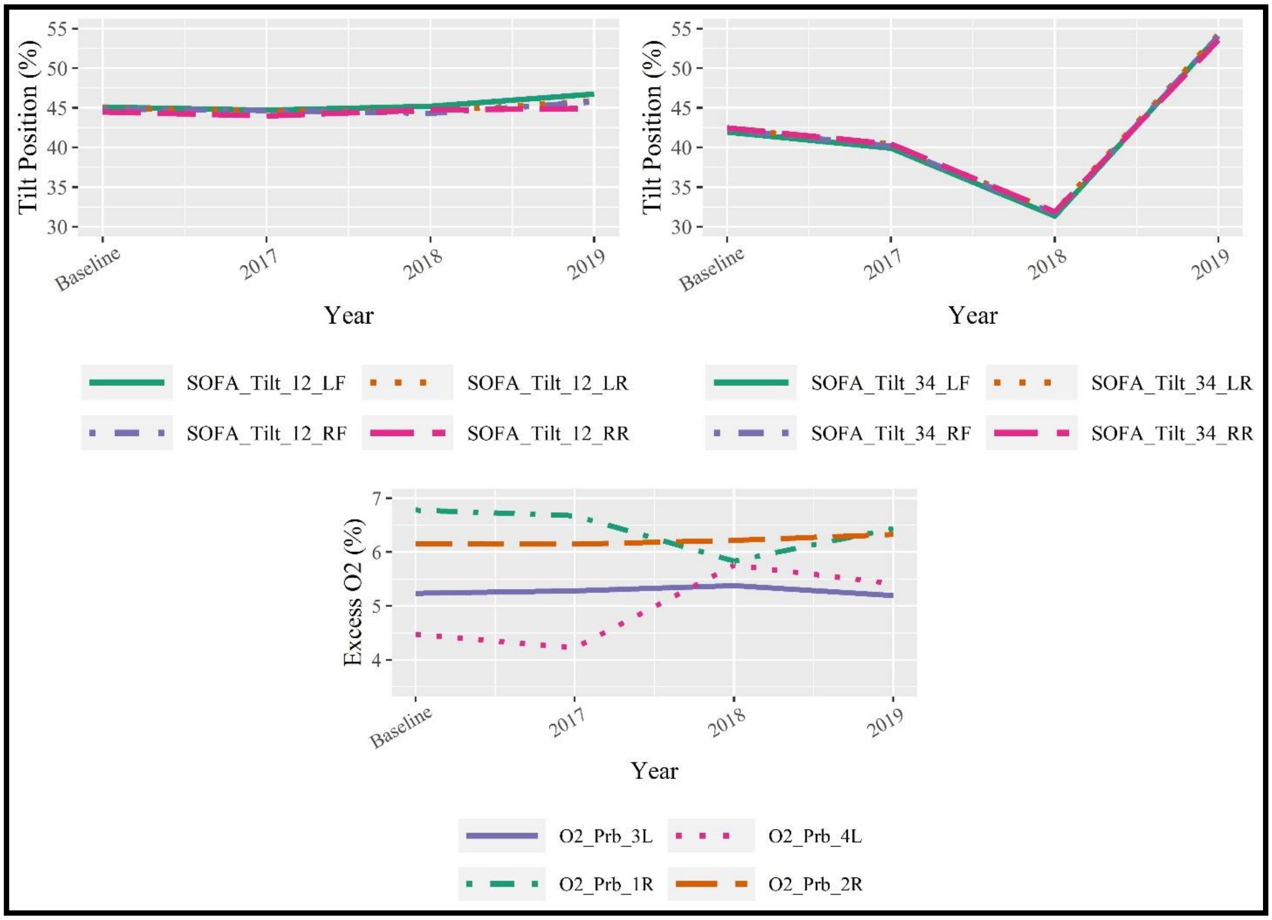

Figure 11 - SOFA tilt average positions and excess O2 averages during each annual period at low load

At both low and high load, we see that as the optimizer realized greater benefits compared to operation without the optimizer active, larger differences began to exist from corner to corner on individual levels of the SOFA dampers. We also see that the SOFA dampers generally became more open as time went on. Also at both low and high load, we see that O2 probes appear to be more even and balanced during 2018 and 2019 compared to the baseline period and 2017.

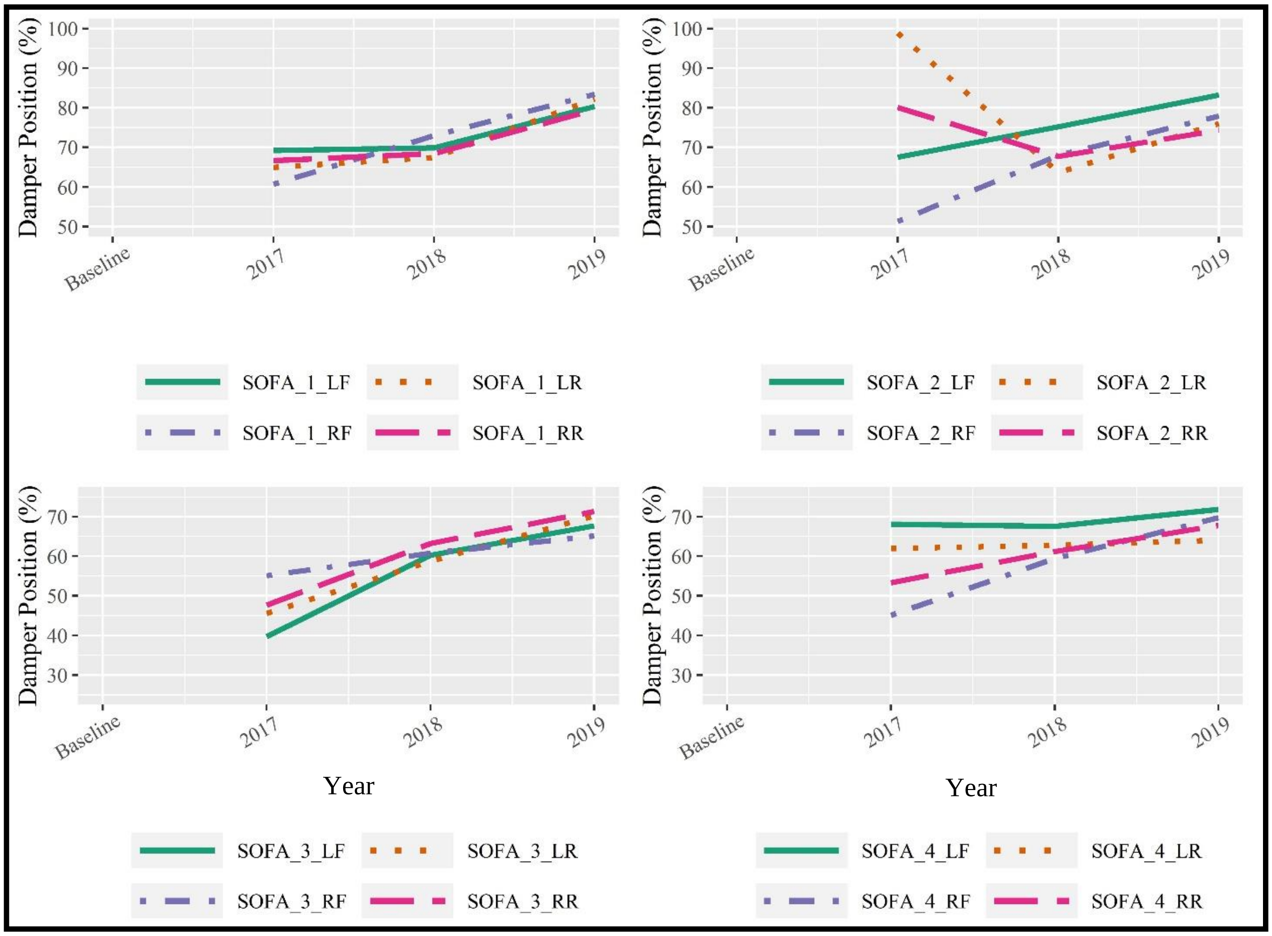

Figure 12 - SOFA level damper position averages during each annual period at high load where NOx emission rates were observed to be less than 0.18 lbs/MMBtu

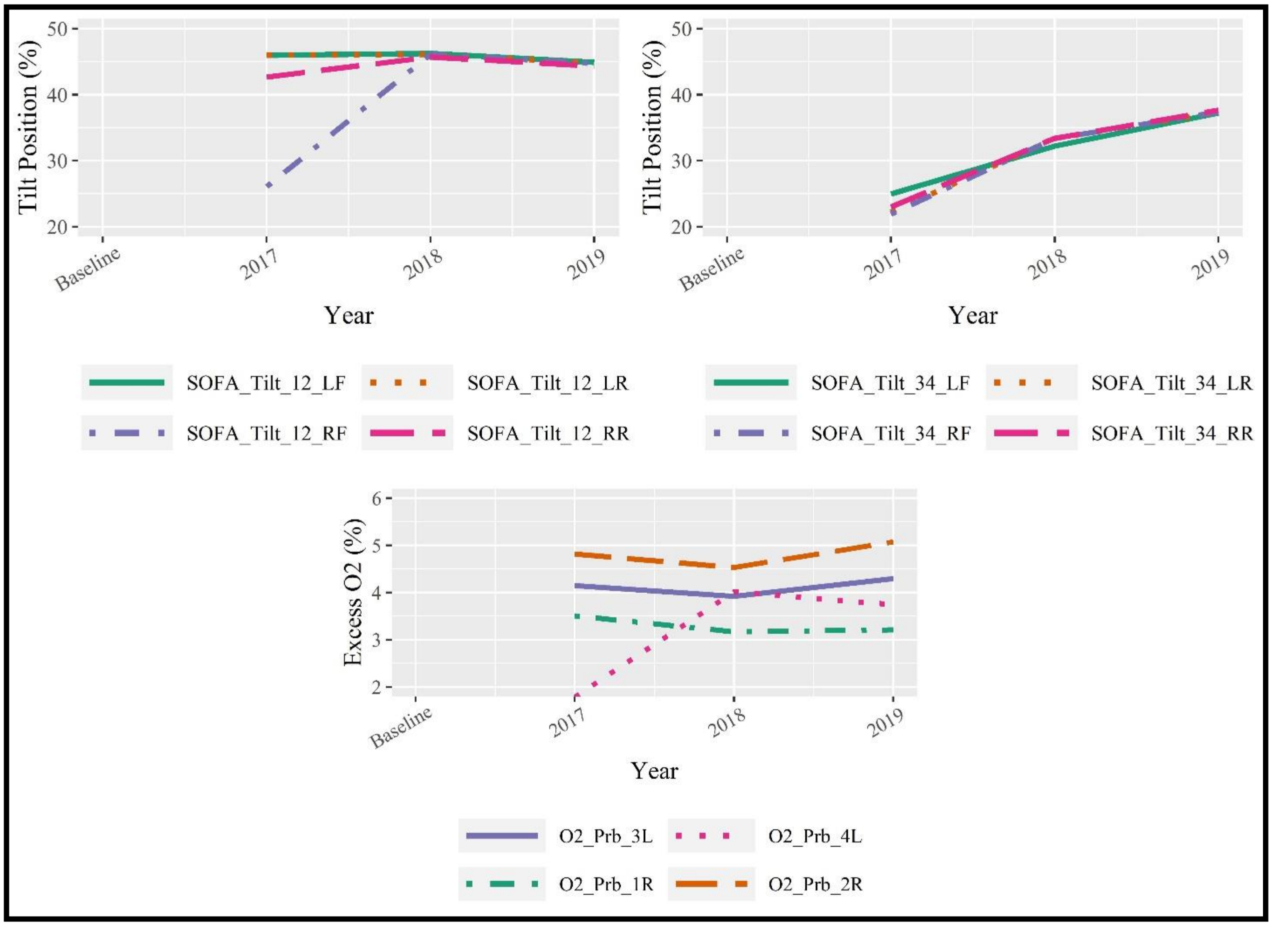

Figure 13 - SOFA tilt average positions and excess O2 averages during each annual period at high load where NOx emission rates were observed to be less than 0.18 lbs/MMBtu

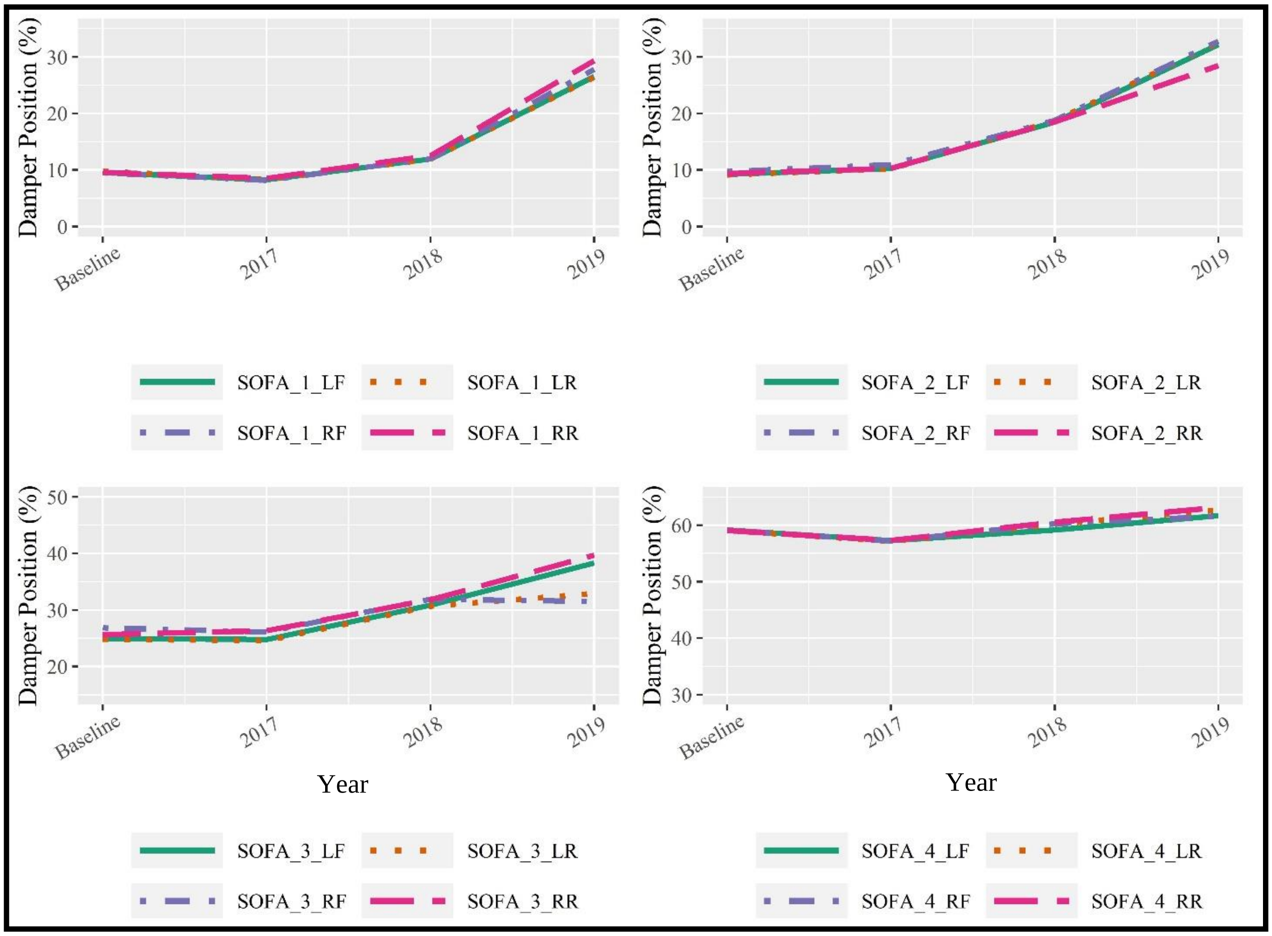

Figure 14 - SOFA level damper position averages during each annual period at low load where NOx emission rates were observed to be less than 0.13 lbs/MMBtu

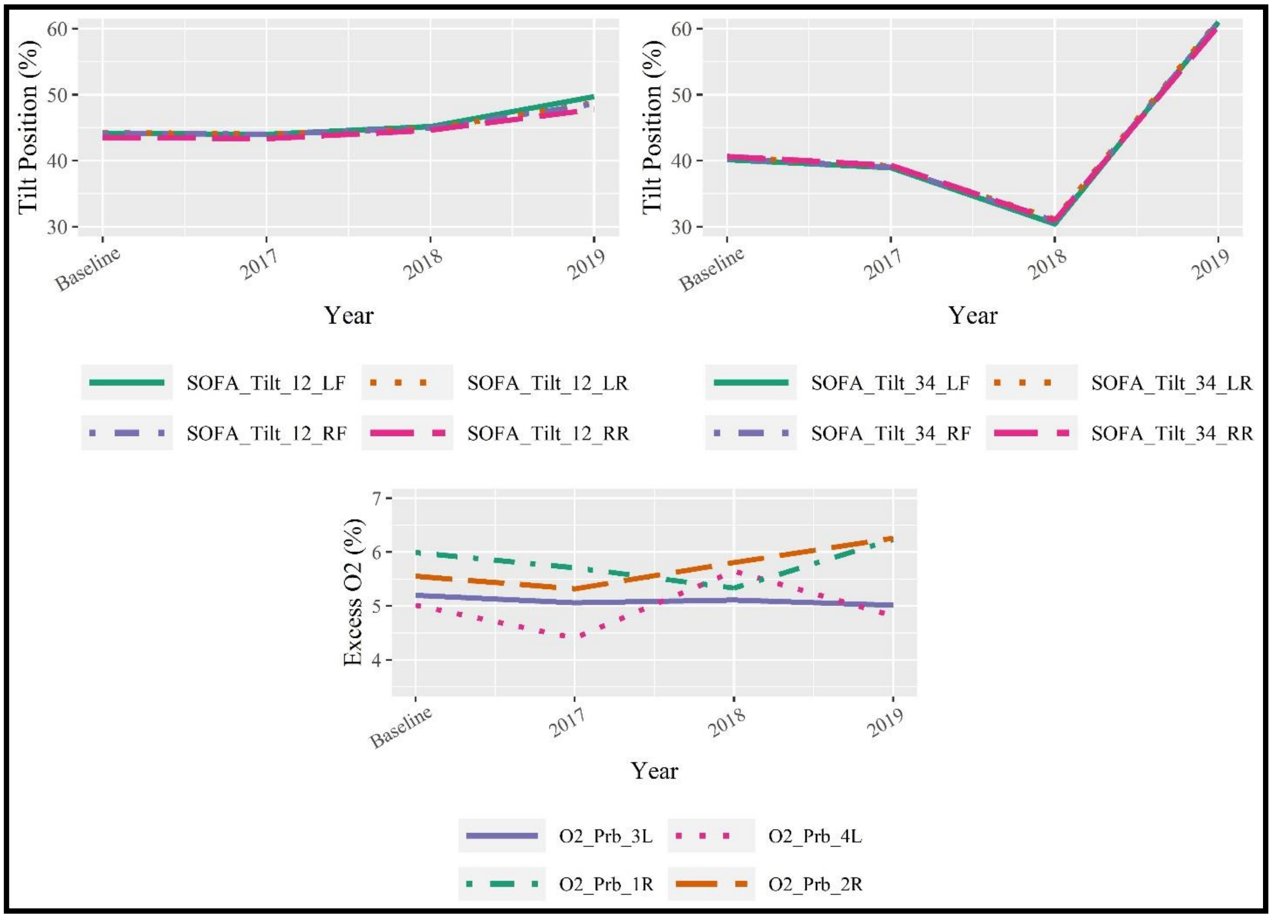

Figure 15 - SOFA tilt average positions and excess O2 averages during each annual period at low load where NOx emission rates were observed to be less than 0.13 lbs/MMBtu

The baseline period contained no records at high load where NOx emission rate was observed to be below the 0.18 lbs/MMBtu threshold, as seen by the absence of parameter values in Figures 12 and 13. The best NOx configurations contained much fewer records than the overall analysis, which contributed to the larger differences from corner to corner of many parameters and the less generalized trends of behavior. Regardless of this, we do see some important phenomenon which may be able to be utilized in the future by operations. At both low and high load, SOFA tilt position, particularly lower SOFA tilt positions, were higher during 2019 where the greatest improvement with the Griffin optimization system active was realized relative to operation without. Low load O2 probes appear to be within 1% (reading) of one another across all periods. SOFA dampers at both low and high load trend to more open as time goes on.

Installation, Implementation, and Evaluation of Optimizer and Neural Network

Service factor of individual components of the system during each quarter were evaluated and NOx emission rate performance within each situation displayed to better understand shortcomings of the system and areas where further attention should be paid. Project length service factors of each component are available within Table 5.

Table 5 – Quarterly service factor of individual components of the optimization system during project

	Sep – Dec '17	**Jan – Mar '18**	**Apr – June '18**	**July – Sep '18**	**Oct – Dec '18**
Any Griffin Control	48.9%	65.7%	54.1%	79.8%	86.2%
Griffin Fully On	10.3%	1.9%	15%	49.8%	65.5%
Griffin O2 Off	0%	0%	0.7%	2.5%	13.5%
Griffin WB Off	0%	29.5%	2.2%	0.9%	0.1%
Griffin O2 & WB Off	0%	21.9%	3.3%	1.6%	1.1%
Griffin SOFA Tilts Off	0%	0%	33.5%	13.7%	0.1%
Griffin O2 & SOFA Tilts Off	0%	0%	3.7%	3.8%	0%
Griffin Upper SOFA DMPs Off	0%	0.7%	0.8%	0.6%	0.4%
Griffin O2 & Upper SOFA DMPs Off	0%	1.8%	0.7%	1.3%	0%
Griffin Fully Off	51.1%	34.3%	45.9%	20.2%	13.8%
		Jan – Mar '19	**Apr – Jun '19**	**July – Sep '19**	**Oct – Dec '19**
Any Griffin Control		76.9%	69.0%	61.0%	6%
Griffin Fully On		43.5%	42.1%	26.4%	5%
Griffin O2 Off		18.3%	4.8%	14.5%	0%
Griffin WB Off		1.1%	3.5%	0.2%	0%
Griffin O2 & WB Off		6.2%	4.2%	6.3%	1%
Griffin SOFA Tilts Off		0.1%	0.7%	0.3%	0%
Griffin O2 & SOFA Tilts Off		0.5%	0%	1.1%	0%
Griffin Upper SOFA DMPs Off		0.5%	1.9%	1.3%	0%
Griffin O2 & Upper SOFA DMPs Off		0.3%	0.4%	3.3%	0%
Griffin Fully Off		23.1%	31.0%	39.0%	94%

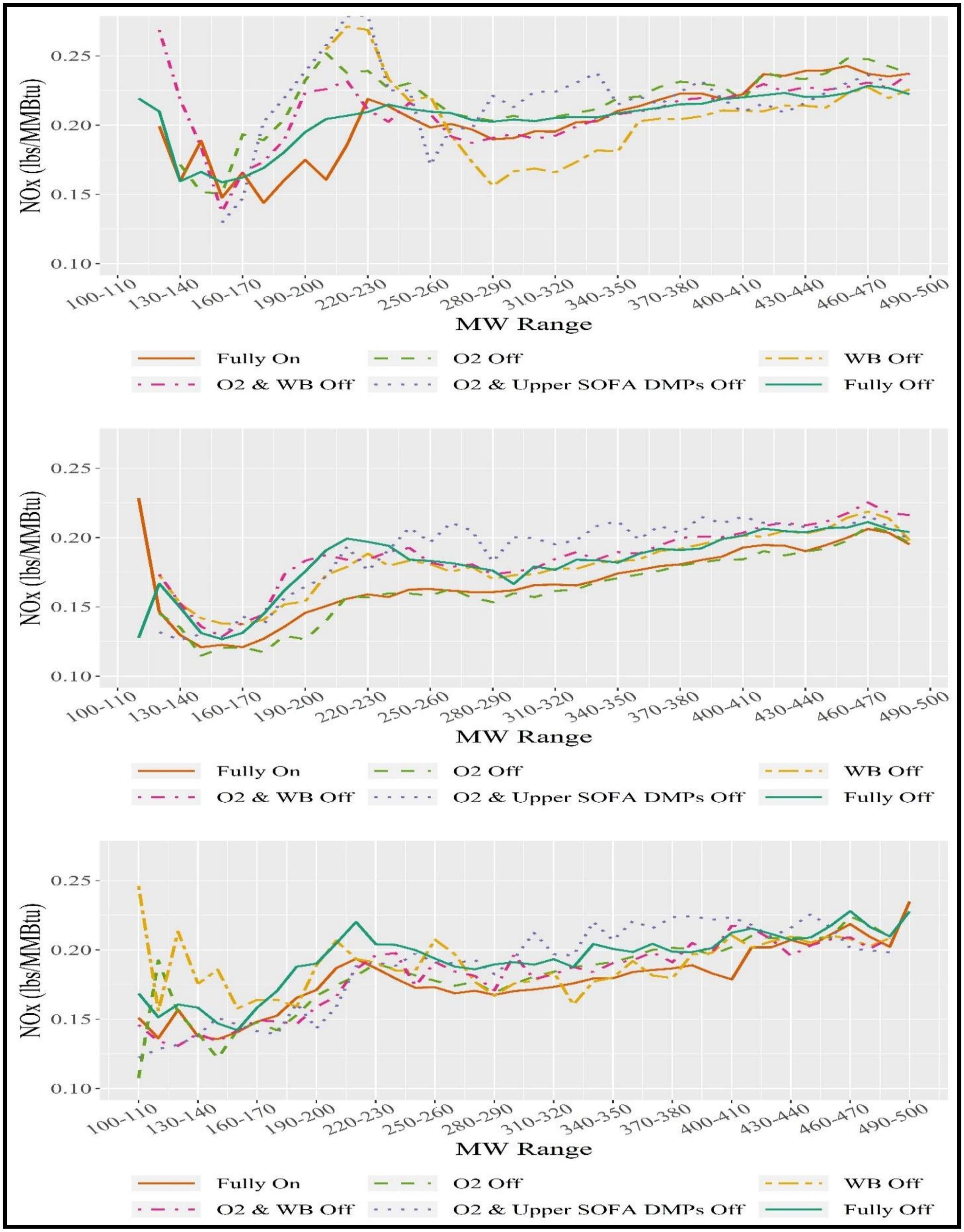

Figure 16 – NOx emission rates with various components of Griffin system out of service

During the 2018 and 2019 periods where the optimization system was fully active, we see that the system typically performed best with all parameters in service, or when the O2 controller was inactive. The fact that the system performed well and realized NOx reductions with the O2 controller inactive provides further support to the effectiveness of air staging and placement for combustion optimization, as generally the removal of excess O2 leads to NOx benefits.

During 2018, all other combinations of components being out of service performed about the same or worse than the system being completely off. This had changed by 2019, where all but the O2 and upper SOFA dampers out of service performed similarly to or better than the system being fully off. Having the WB component out of service performed much worse at the lowest loads during 2019.

Expansion of Neural Network and Further Research

Sootblower Control: Knowledge-based Sootblowing (KSB) was first activated July 1, 2018. The retract blower portion of this system has remained relatively unchanged, with only small adjustments to time windows and knowledge rules being performed. In general, the retracts were activated more often by KSB to enhance heat transfer to the steam from combustion gases and improve overall efficiency.

The wall blower portion of the system was primarily used to aid in steam temperature management, being developed heavily during 2018 to respond to rapidly increasing steam temperatures and high temperatures. Table 2 earlier in this report displays the average activations of each blower type during the 2018 and 2019 periods with KSB active and inactive. Daily sootblower activations and KSB service factor for the 2018 and 2019 periods are displayed in Figure 17.

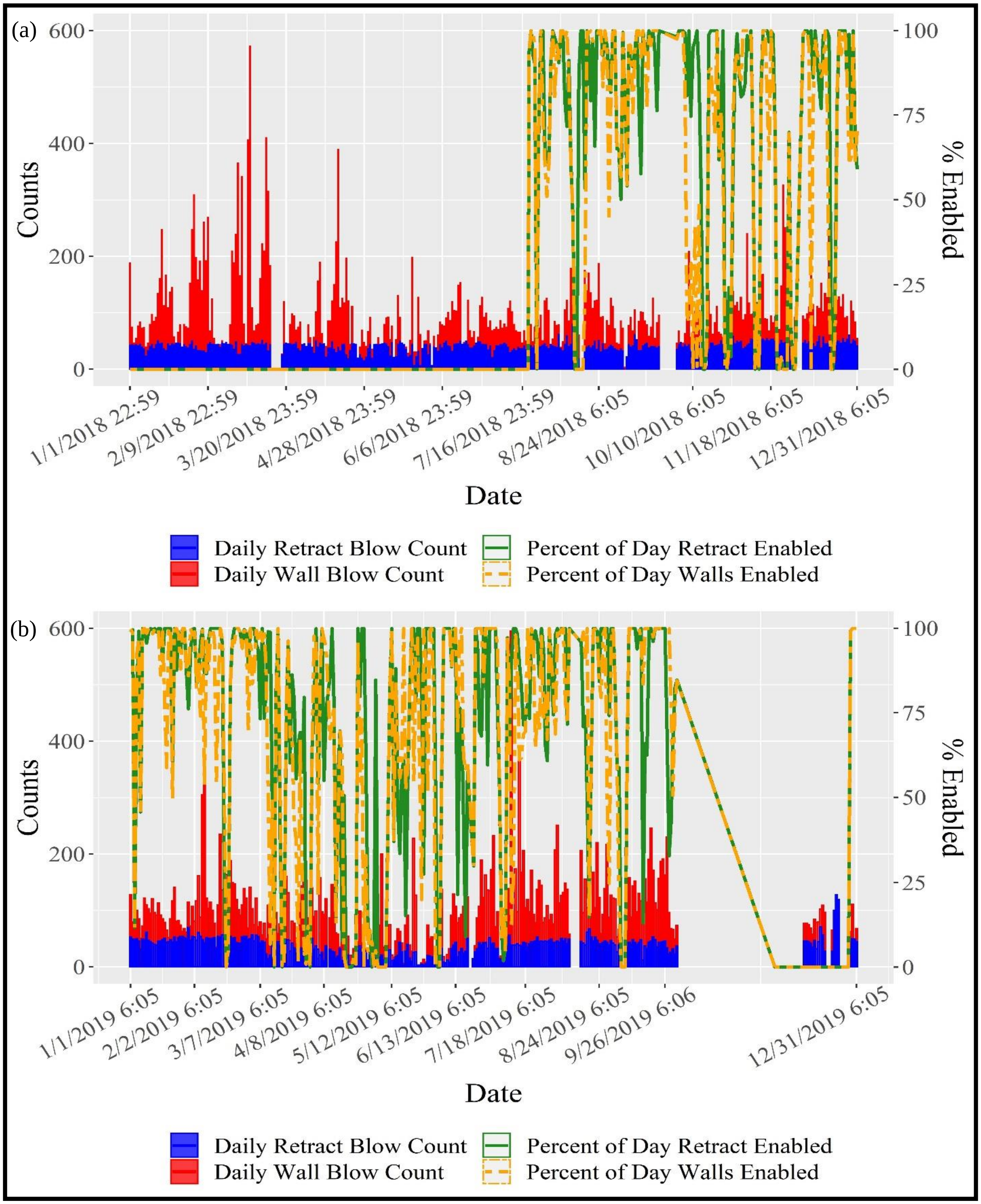

Figure 17 – Sootblower activations and KSB service factor during (a) 2018 and (b) 2019

Coal Quality Classification: To provide the neural network optimization system with real-time information about currently combusting coal quality, another type of artificial intelligence modeling method was developed and applied onsite. This system utilizes a Support Vector Machine (SVM) to classify the quality of currently combusting coal. New combustion features were engineered to better represent factors related to coal quality such as BTU, moisture, sulfur, and ash content. This feature engineering procedure utilizes readily available parameters available from the DCS, and transforms them by combining multiple parameters to more indicative of the coal quality parameters just mentioned. Four features were created to inform the SVM model:

$$Load2Coal = \frac{MW_{Gross}}{Total\ Fuel\ Flow} \qquad Hardness = \frac{Mill\ Amps}{Feeder\ Speed}$$

$$Drying\ Air = \frac{Total\ Hot\ Air\ DMP}{Load2Coal} \qquad Normalized\ SO_2 = \frac{Inlet\ SO_2\ PPM}{Total\ Fuel\ Flow}$$

Data from the online coal analyzer was used to confirm relationships and create a labeled set for SVM training. The coal analyzer data had to be manually matched to combustion data, which were found to be mismatched by anywhere from 2 to 8 hours, depending on load. With the datasets manually matched, the newly created features were compared to BTU/lb, moisture-%, sulfur-%, and ash-%. Figure 18 shows the relationship of a subset of these features, ash content related to "Load2Coal" and moisture-% related to "Drying Air".

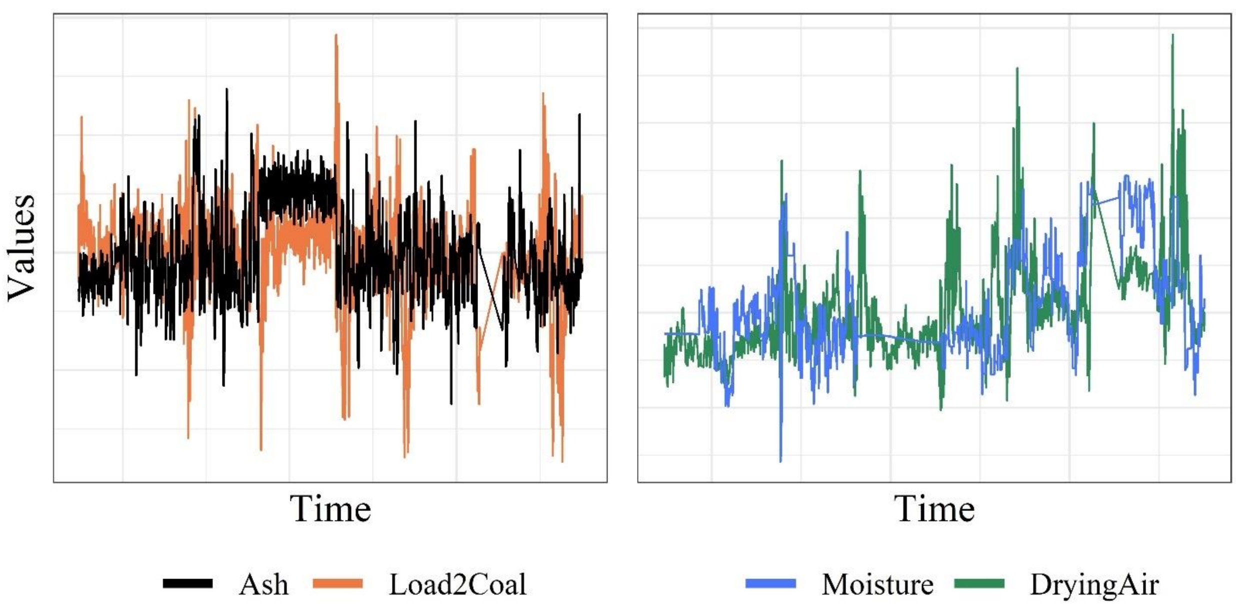

Figure 18 – Engineered features related to measured coal analyzer data

Although the relationships are not identical, the trends and correlations are near enough to provide improved information to the SVM classification model. The SVM model was trained using the labeled matched set and a classification system which balanced the contribution of coal quality indications from the analyzer data to qualities of "good", "ok", and "poor". This classification system was developed through interactions with operators and their knowledge of each parameter's general effect on combustion performance.

By classifying the existing dataset, it could be separated into unique datasets comprised only of each quality record (i.e. a "good" dataset, an "ok" dataset, and a "poor" dataset) and used to train unique neural networks. This process of reducing the dataset to similar conditions reduces variance error inherent in machine learning models, and helps to make the neural networks more accurate.

With each of these components available, the coal quality classification system was developed within the Griffin toolkit to perform prediction in real-time. A comparison of the previous method and this new approach is shown in Figure 19.

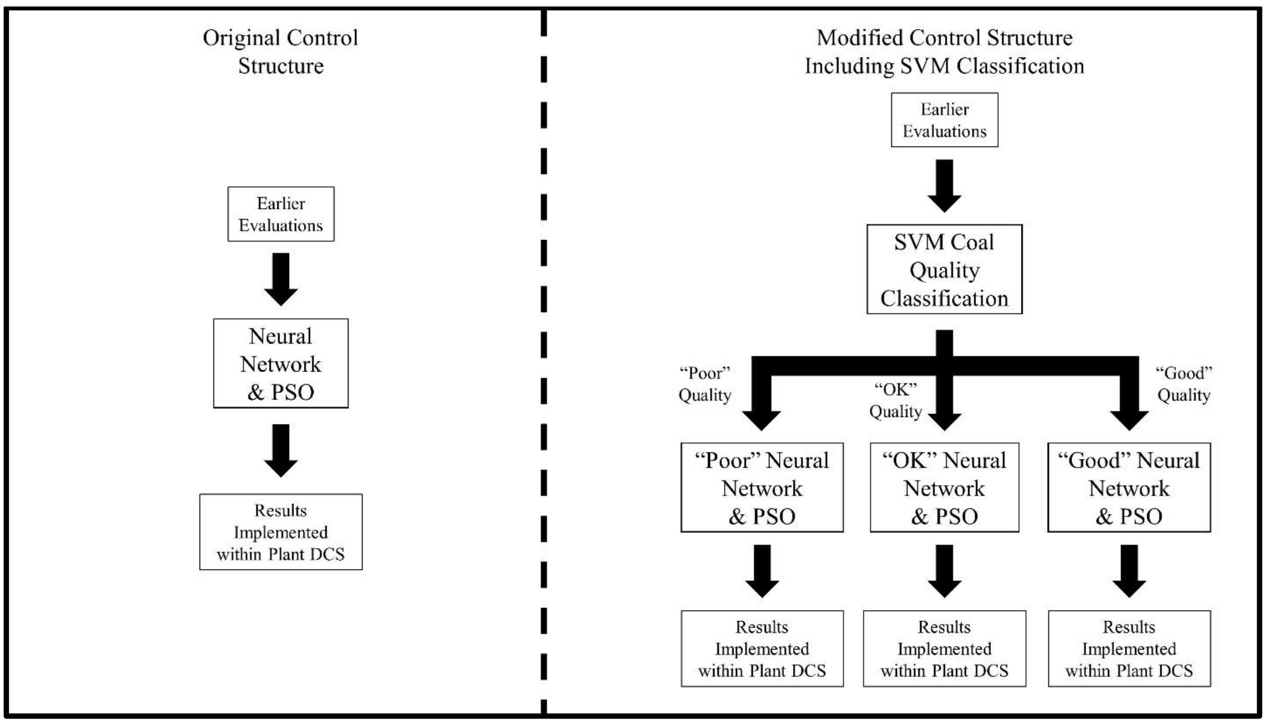

Figure 19 – Original control structure and neural network implementation in the SVM informed structure

NOx prediction ability using this modified neural network structure was found to improve prediction accuracy by nearly 50% on a two-week dataset. Since, these enhanced neural network models have been implemented and used by the optimization system within the COS.

Following the unit outage in October 2019, the SVM system was never reconstructed and trained to be applicable to performance changes resulting from the overhaul, and is currently out of service.

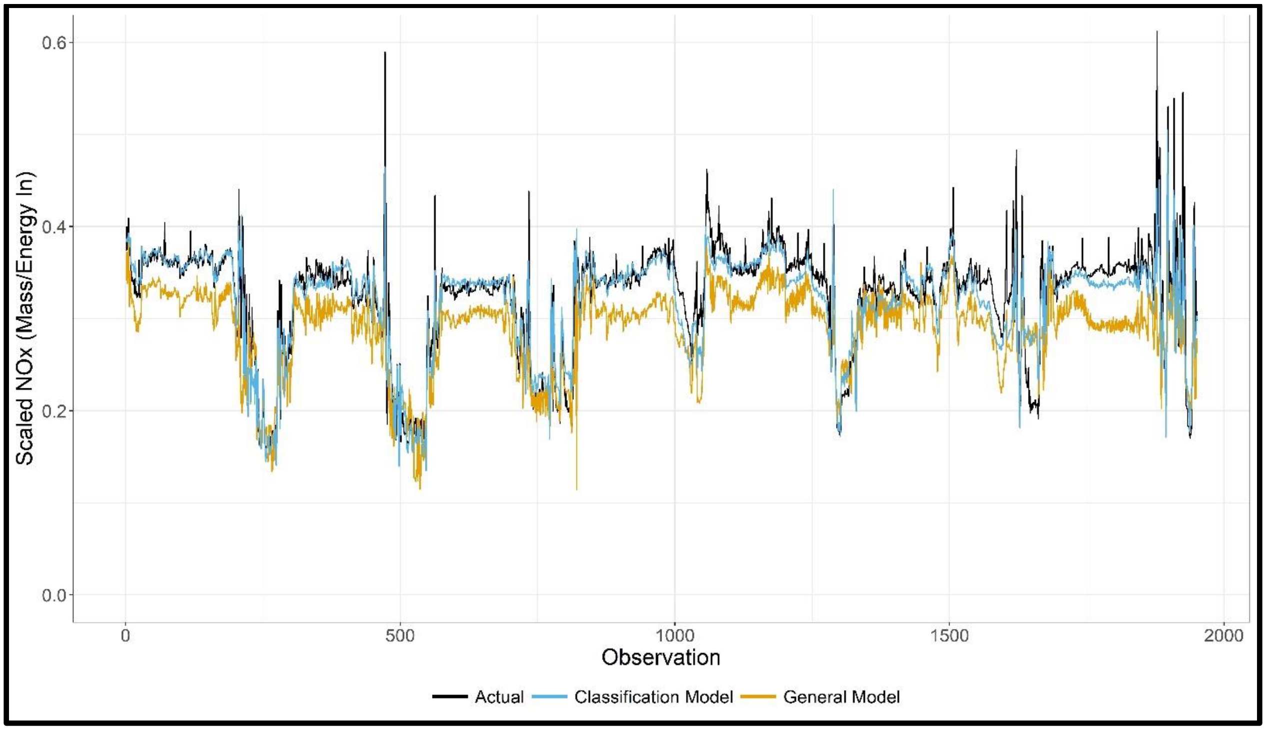

Figure 20 - Improved prediction ability of SVM classification neural network model (blue) against previously existing neural network model (orange)

Cooling Tower Control: Optimization of cooling tower performance was performed in a two-part study, consisting of a simulation study followed by closed-loop development within an application onsite. A simulation study was performed first for two main reasons: to evaluate potential auxiliary power benefits from optimization of cooling tower fan speeds and to "jump-start" the training of a neural network model for use onsite at the plant with data generated from theoretical relationships based in heat and mass transfer. To first identify if the existing DCS assumption of identical performance of each cooling tower cell was valid or not, data obtained from the plant of individual fan power use was analyzed. Figure 21 shows the effect which load changes and ambient temperature have on each cell's power draw. It can be easily seen that the performance of each fan changes with load and ambient temperature, so much as to effect which cells operate more efficiently as load moves. These large changes in power usage verify that the individual cells are certainly not identical, and there is likely benefit to be gained from optimization of individual fan speeds.

A theoretical simulation model of the station's 12-celled cooling tower was created and used as proxy for the physical tower during the initial analysis. The potential major benefits of optimization lie in exploiting efficiency differences between each cell, so within the physical model each cell was assigned a varied efficiency factor to better replicate the performance found in the data. This model is displayed as Figure 22.

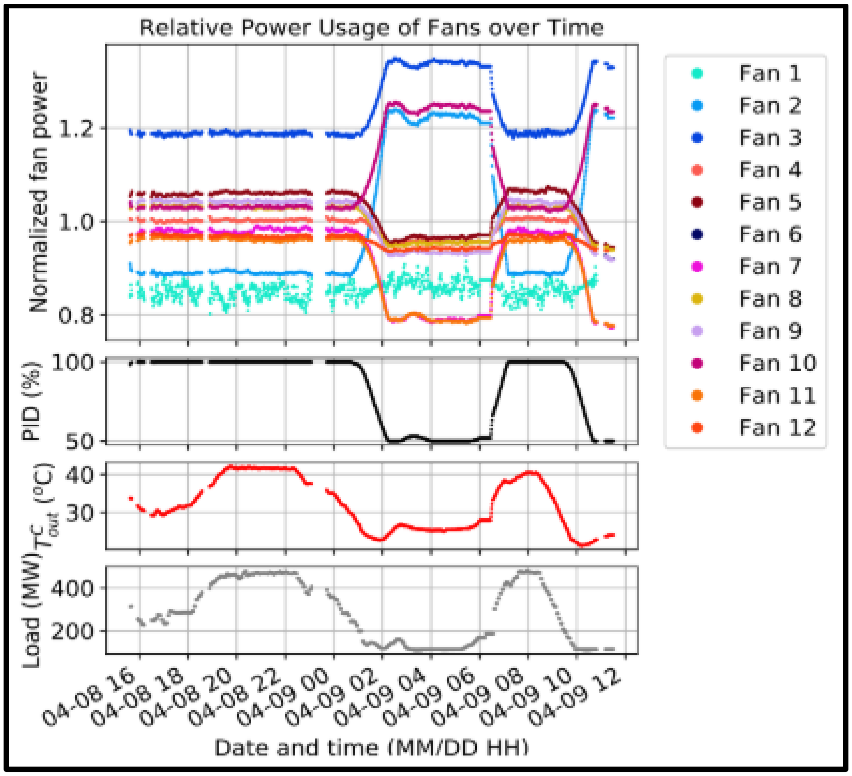

Figure 21 – Power consumption of individual cooling tower fans

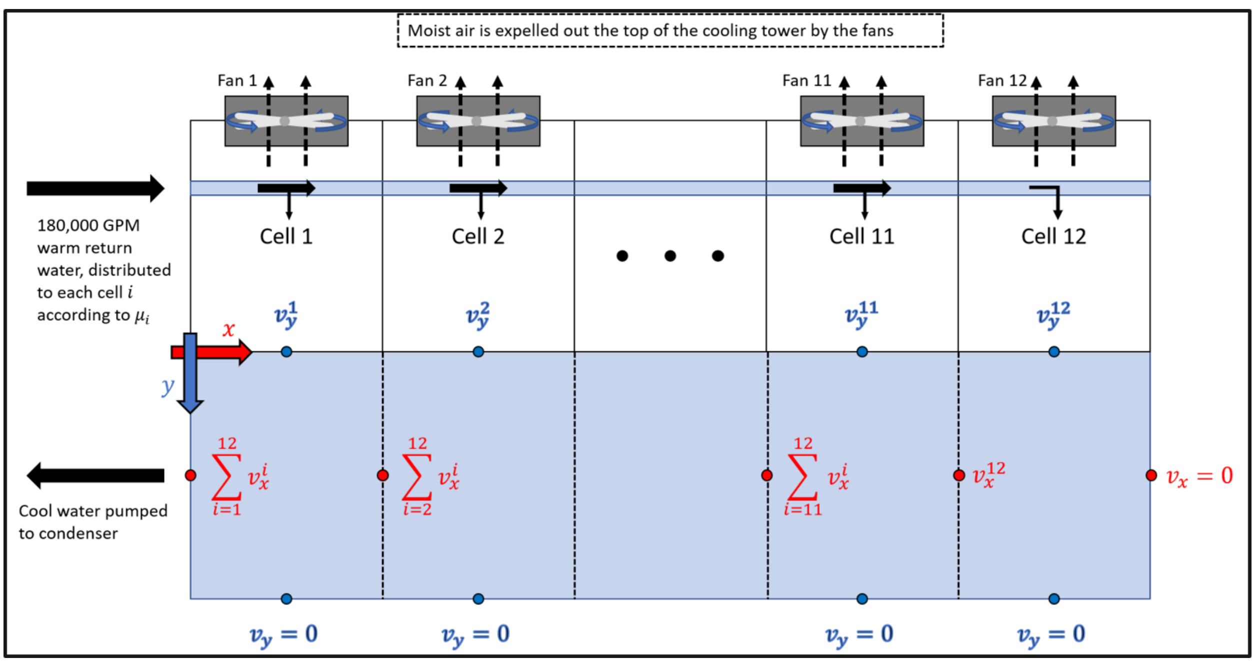

Figure 22 – Physical model of cooling tower cells

A neural network was trained from the power usage and cooling results obtained from the simulation model. The neural network demonstrated a high degree of accuracy, as shown in Figure 23. With the trained neural network, the system was allowed to "self-generate" varied data, meaning the neural network was allowed to vary fan speeds as determined by optimizing the neural network results within the simulation model to generate data across the operational space and to assess the potential benefits from optimization. This process is shown in Figure 24.

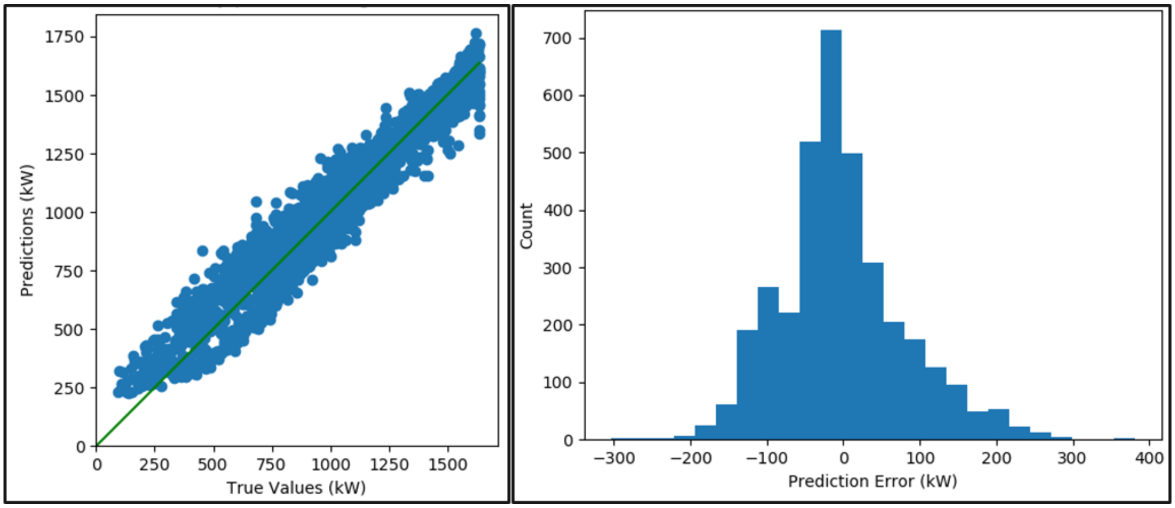

Figure 23 – Neural network results compared to actual values and histogram of prediction error

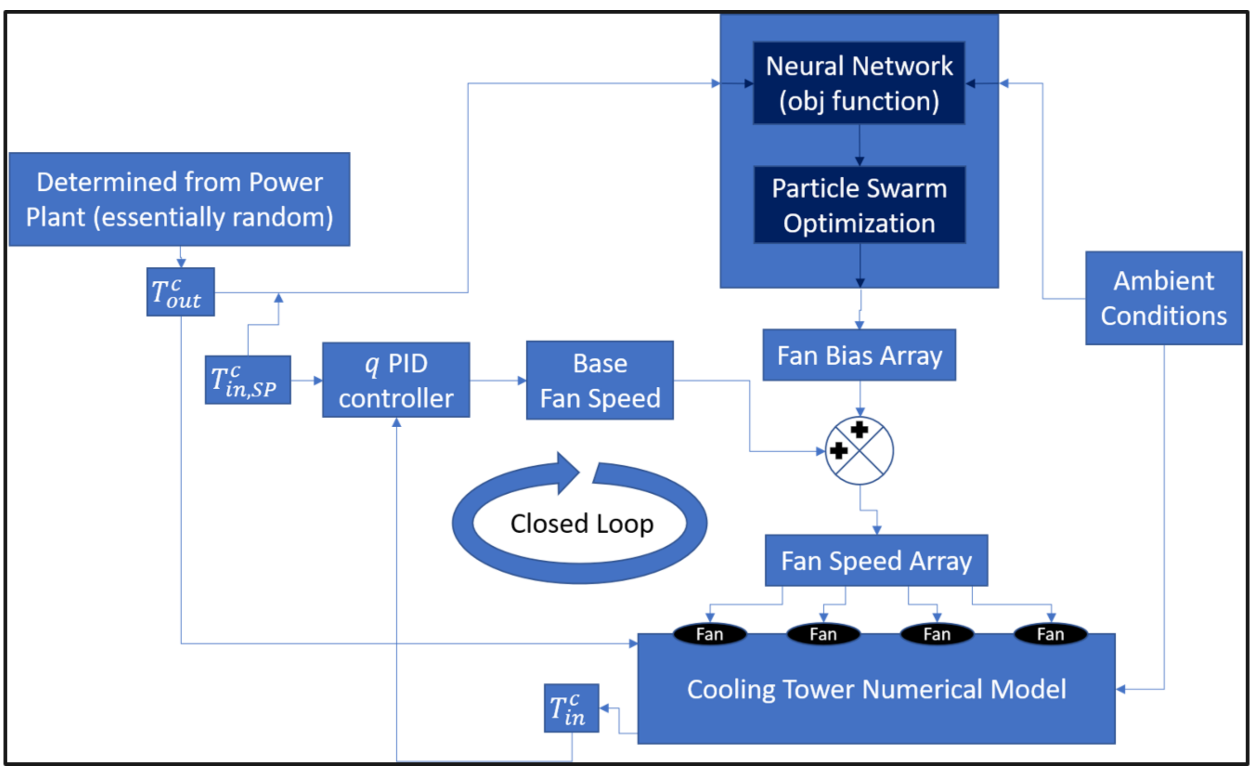

Figure 24 – Diagram of closed-loop simulation neural network optimization

Results of this simulation analysis are displayed in Figure 25 and Figure 26. A potential cost savings due to optimization of individual fan speed setpoints greater than 10% was estimated through this analysis. These results confirmed that closed-loop development onsite at the power plant was warranted and could be expected to generate benefits in power consumption, heat rate, and ultimately cost savings.

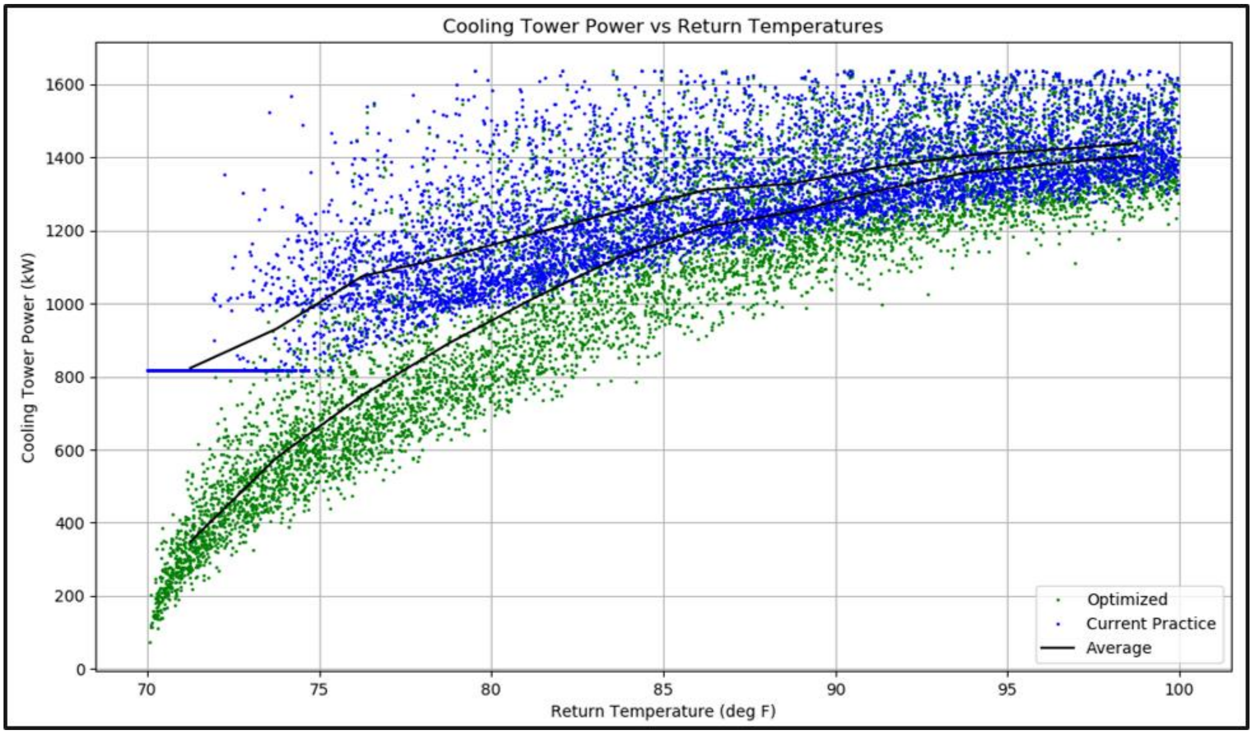

Figure 25 – Directly measured and optimized within simulation total cooling tower power usage

	Current Practice	Remove 50% fan floor	Optimize
Total Energy (kWh)	10,797,520	10,575,760	9,619,067
Total Cost	$669,446	$655,697	$596,382
Savings (%)	-	2.05%	10.91%
Savings ($)	-	$13,749	$73,064

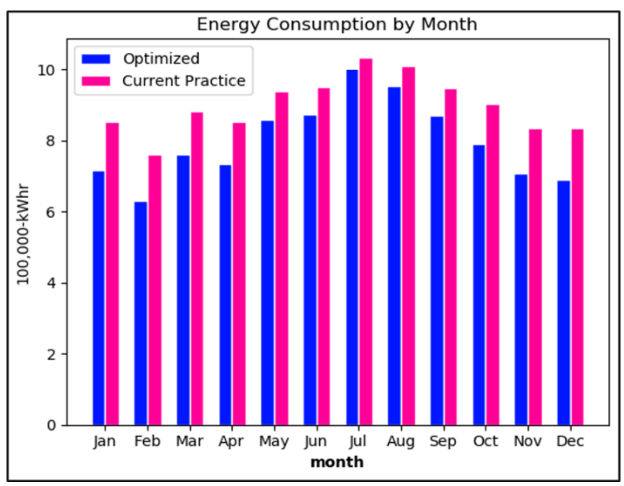

Figure 26 – Calculated cost savings and energy consumption by month using current practices and optimization

Onsite development of the cooling tower optimization application was completed on August 27th, 2019. Before this, operators were asked to manually adjust individual fan setpoints on the unit to help generate a varied dataset for the neural network model to be trained from. Operators was very willing to help with this, and their cooperation has been greatly appreciated and helped to make this study effective.

The developed system functions very similarly to the existing COS application, being governed and limited by multiple biasing limits from DCS setpoint as well as limits on the final position of parameter setpoints. The actual implementation within the DCS is slightly different, as the existing control hardware does not accept biases, so direct fan setpoints are written from the Griffin system to the individual cooling tower fans.

A direct measurement of fan power usage is not available within the DCS, however since power is related to amperage according to

$$P = V * A * constant$$

and the volts of each fan are identical and constant and the constant value is constant, minimization of amperage is effectively minimization of power consumption, and amperage is what is considered by the neural network model and focused on by this application.

Between onsite development and the outage in October 2019, the optimization application was activated by individual operators at various times. A comparison of measured total amps of the cooling tower fans while the application was active and inactive within each 10 MW bin across the unit's load range shows that on average cooling tower fan speed optimization achieved a 5.2% reduction in cooling tower power consumption, as shown in Figure 27. At the three load ranges where the majority of plant operation and optimization use were seen (140 – 150, 460 – 470, and 470 – 480 MW) the weighted average benefit was 6.9%, due mostly to the large improvement observed at lower load. It can be seen within Figure 27 that the observed optimization benefit during this time period decreased significantly at loads greater than 400 MW. It can be concluded that as these higher loads were reached and fan speeds approached maximum to meet cooling demands of the unit, that the cooling tower is required to operate at full capacity. This observation is positive from the viewpoint of the cooling tower application, as it demonstrates that the base cooling tower function of meeting cooling demand and achieving appropriate turbine exhaust pressures is prioritized over power consumption minimization, ensuring that the system is robust and safe for constant use.

Figure 27 – Onsite cooling tower optimization system performance in closed-loop at power plant and observed hours at each generation level

System Adoption

Early on in the project, the single largest factor which affect service factor of the system was operator's relationship with the system. Often times, many operators being unfamiliar with the system and it's use, would simply forget it was there and not turn it on if it was not already on. As well, in many instances a circumstance would arise with an unrelated piece of equipment, and the system would be turned off to address that problem. It was then never turned back on until research team members asked the current operator if it could be reactivated. This factor did decrease overtime with the constant onsite presence of the research team and continual training and answering of questions which operations had of the system's behavior. However, at the project's close, this circumstance of operator oversight was still being observed to a small degree.

Overall, the system was well received by operations. Many operators expressed that they were pleased with how the Griffin optimizer handled most commonly encountered situations, and when it was not performing well due to uncommon circumstances, they would disengage the system until the condition was resolved, then reengage the system afterward.

The strong working relationship between the research team and operations was a major factor contributing to overall system adoption and use. Operations having the ability to "recognize a face" associated with the system and having a person to discuss problems and ask questions to was indispensable in making this project a success and seeing the system used continually. This helped operators to develop trust in the system, and to also recognize that if any aspect of the system did not perform, it could be addressed and fixed by simply discussing the matter with the research team.

A major example of this was the development of the SOFA Tilt controller to aid with managing tube temperatures during QIII 2018. Operations had voiced to the research team that they had been struggling for an extended period of time with seeing measured tube temperatures exceed desired levels. Working closely with the operators, the research team was able to identify the relationship of SOFA tilts to decreasing tube temperatures, and quickly constructed a controller to exploit this relationship.

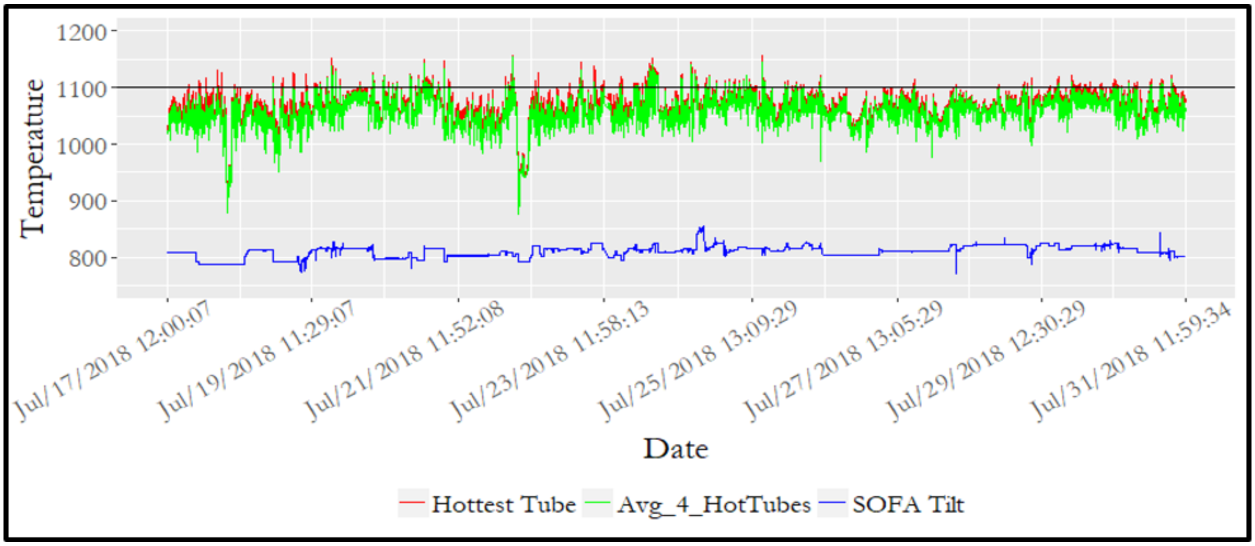

Figure 28 – Observed hottest tube temperature and average of hottest four tubes for one month prior to SOFA tilt control being developed

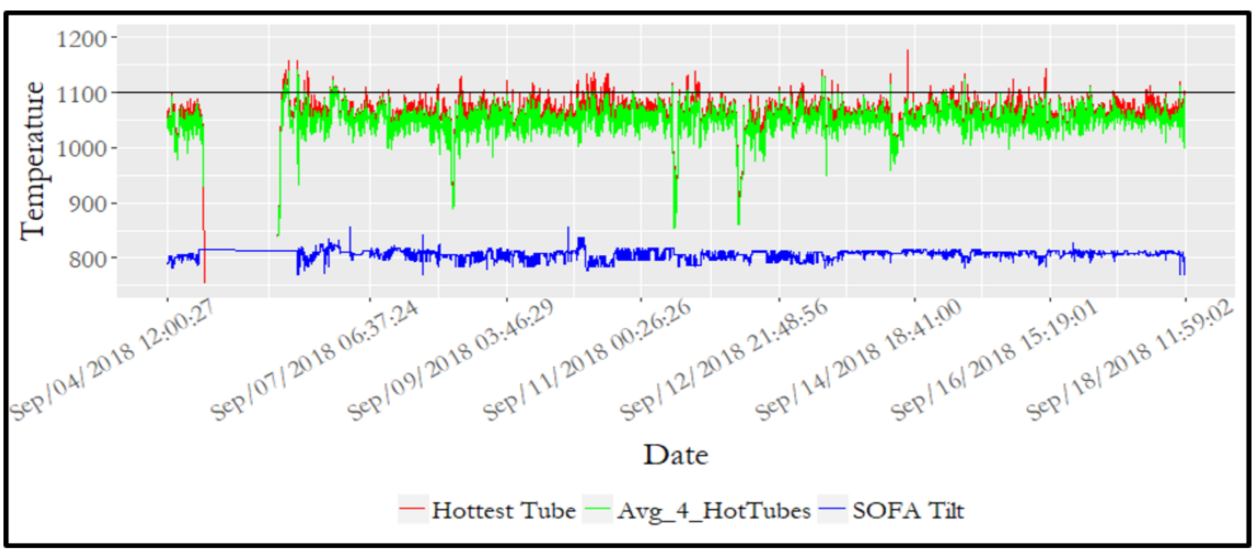

Figure 29 - Observed hottest tube temperature and average of hottest four tubes for one month with SOFA tilt control active

Figures 28 and 29 show the observed hottest tube temperature and the average of the hottest four tubes for one month before and for one month with the newly developed SOFA tilt control active. The average of the hottest four tubes was considered a more reliable indicator of tube temperatures, as the single hottest tube measurement was seen to behave erratically at times. The simple control methodology of automatically lowering the lower SOFA tilts proportionally to the elevated four tube average temperature was able to drastically reduce the amount of time which these tubes were observed to exceed desired levels, by more than 87%.

Table 6 – Observed time of high tube temperatures before and with control within the Griffin COS

	Hottest Tube Above Target	Hottest 4 Tube Average Above Target
Before Control	39.8 hrs	21.4 hrs
With Control	18.9 hrs	2.4 hrs
Percent Change	-46.2%	-87.2%

This one development was observed to contribute to a significant increase in service factor during QIII 2018 and subsequent quarters of the project, from 54% during QII 2018 to 80% during QIII. Situations such as this where operations was able to express issues and problems to the research team and see direct positive impacts of changes made to the optimization system played a large role in overall system adoption and project success.

Calculated Data for NOx, CO, and Cooling Tower Amps Across Load Range:

MW Bin	Average NOx (lbs/MMBtu)			
	Baseline	2017	2018	2019
100 – 110	N/A	N/A	N/A	0.147
110 – 120	0.215	0.219	0.189	0.144
120 – 130	0.205	0.209	0.148	0.151
130 – 140	0.158	0.161	0.140	0.142
140 – 150	0.171	0.164	0.129	0.136
150 – 160	0.159	0.156	0.124	0.142
160 – 170	0.163	0.163	0.126	0.150
170 – 180	0.168	0.169	0.134	0.154
180 – 190	0.179	0.181	0.146	0.167
190 – 200	0.182	0.198	0.157	0.171
200 – 210	0.186	0.205	0.169	0.187
210 – 220	0.196	0.209	0.176	0.199
220 – 230	0.198	0.212	0.177	0.195
230 – 240	0.199	0.214	0.177	0.190
240 – 250	0.204	0.213	0.176	0.184
250 – 260	0.205	0.209	0.174	0.183
260 – 270	0.205	0.206	0.172	0.179
270 – 280	0.207	0.200	0.169	0.179
280 – 290	0.205	0.199	0.168	0.175
290 – 300	0.208	0.199	0.168	0.181
300 – 310	0.209	0.199	0.172	0.181
310 – 320	0.210	0.200	0.173	0.183
320 – 330	0.211	0.204	0.176	0.182
330 – 340	0.212	0.205	0.178	0.189
340 – 350	0.216	0.208	0.179	0.189
350 – 360	0.215	0.211	0.183	0.192
360 – 370	0.217	0.213	0.188	0.194
370 – 380	0.218	0.215	0.189	0.194
380 – 390	0.218	0.216	0.192	0.195
390 – 400	0.221	0.219	0.192	0.194
400 – 410	0.221	0.220	0.197	0.196
410 – 420	0.223	0.224	0.201	0.209
420 – 430	0.225	0.224	0.201	0.206
430 – 440	0.224	0.222	0.198	0.207
440 – 450	0.223	0.222	0.199	0.206
450 – 460	0.225	0.226	0.206	0.213
460 – 470	0.232	0.231	0.213	0.223
470 – 480	0.233	0.226	0.205	0.212
480 – 490	0.239	0.222	0.197	0.206
490 – 500	0.253	N/A	N/A	0.221
500 – 510	N/A	N/A	N/A	0.205

MW Bin	Average CO (PPM)			
	Baseline	2017	2018	2019
100 – 110	N/A	N/A	N/A	12
110 – 120	120	120	20	15
120 – 130	11	9	15	43
130 – 140	20	19	32	53
140 – 150	48	47	69	70
150 – 160	71	67	105	96
160 – 170	95	91	125	127
170 – 180	118	107	124	139
180 – 190	115	101	108	119
190 – 200	116	85	104	105
200 – 210	130	98	98	101
210 – 220	128	101	86	89
220 – 230	142	96	92	104
230 – 240	152	94	86	111
240 – 250	192	118	87	114
250 – 260	165	117	97	102
260 – 270	202	147	92	105
270 – 280	194	144	107	103
280 – 290	216	154	120	107
290 – 300	225	162	120	117
300 – 310	236	161	125	105
310 – 320	258	155	120	107
320 – 330	238	149	113	114
330 – 340	243	119	114	97
340 – 350	244	135	102	108
350 – 360	256	151	102	112
360 – 370	251	148	99	105
370 – 380	259	144	101	112
380 – 390	258	156	100	115
390 – 400	239	142	105	127
400 – 410	235	145	101	105
410 – 420	236	152	97	115
420 – 430	242	186	109	137
430 – 440	242	184	123	164
440 – 450	229	184	131	175
450 – 460	249	155	141	164
460 – 470	238	137	130	142
470 – 480	233	164	123	184
480 – 490	430	204	141	228
490 – 500	473	N/A	N/A	299
500 – 510	N/A	N/A	N/A	196

MW Bin	Average Cooling Tower Amps		Observed 5 minute Increments	
	Griffin On 2019	Griffin Off 2019	2018	2019
100 – 110	2213	978	1	3
110 – 120	N/A	1466	N/A	5
120 – 130	2202	1846	1	36
130 – 140	1490	1801	51	482
140 – 150	1563	1674	277	3109
150 – 160	1715	1875	47	556
160 – 170	1794	1883	37	271
170 – 180	1747	1908	43	266
180 – 190	1771	1976	44	302
190 – 200	1760	1943	104	715
200 – 210	1986	2041	39	446
210 – 220	2000	2026	43	298
220 – 230	1832	2022	60	299
230 – 240	1996	2036	44	272
240 – 250	2012	2064	117	297
250 – 260	2008	2092	104	391
260 – 270	2072	2138	105	346
270 – 280	2050	2102	75	268
280 – 290	2037	2138	48	273
290 – 300	2107	2117	69	227
300 – 310	2068	2117	63	223
310 – 320	2081	2140	52	284
320 – 330	2072	2143	63	292
330 – 340	2064	2143	83	298
340 – 350	2080	2139	52	296
350 – 360	2041	2139	50	318
360 – 370	2052	2140	64	268
370 – 380	2023	2137	64	279
380 – 390	2031	2128	70	347
390 – 400	2020	2138	120	385
400 – 410	2006	2136	379	709
410 – 420	2009	2137	78	337
420 – 430	2102	2123	28	302
430 – 440	2091	2132	29	443
440 – 450	2124	2128	54	395
450 – 460	2121	2121	152	511
460 – 470	2112	2114	405	1881
470 – 480	2092	2118	265	3377
480 – 490	2133	2123	9	127
490 – 500	2132	2133	2	2

STEP Project Report

Period Ending: December 31, 2019

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	2019	Total
Annual Collection (Budget)	$125,000	$0	$0.00	$125,000
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$131,405	$26,010	$0.00	$157,415
Subtotal	$131,405	$26,010*	$0.00	$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 NOx Technologies	May 18, 2017	Complete, draft received on May 1, 2017
Issue RFI for Alternative NOx Technologies	May 29, 2017	Completed
RFI Response Due	June 22, 2017	Completed
Summary of RFI Response	August 6, 2017	Completed
Issue RFP for Alternative NOx 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, 2019

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

Project Objective:

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

Project Accounting:

Cost Object	2017	2018	2019	Total
Annual Collection (Budget)	$0.00	$62,500	$42,133	$104,633
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses*	$0.00	$73,041**	$42,133	$115,174
Subtotal	$0.00	$73,041	$42,133	$115,174

* External OMAG for 2018 and 2019 was for contractual payments to the University of Utah for the feasibility study they provided on the project.

**The amount reported in the 2018 STEP report, $94,029 was the amount of original committed funds, but has been updated to reflect the actual amount spent of $73,041.

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	Completed
Annual Report 1 Presented and Submitted	January 31, 2019	Completed
Annual Report 2 Presented and Submitted	January 31, 2020	Completed
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 study will give us more knowledge on the technical, economic, and environmental effects of injecting coal-fired-power-plant-derived CO_2 into underground coal beds for enhanced methane recovery. The study will also determine whether the Emery County coal beds are conducive to enhanced methane recovery using CO_2. Deliverables will include an evaluation of the technologies and strategies for improving CO_2 injection efficiency. The University of Utah will also study the risk of induced seismicity due to CO_2 injection.

Depending on the results of the study, Rocky Mountain Power's customers may ultimately benefit through increased efficiency of energy production with less CO_2 emissions. When the benefits of the study are combined with other studies and work being conducted under the STEP program, applicable real-world knowledge will be gained about the risks, costs, and benefits of carbon sequestration.

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, 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 was used to develop a three-dimensional model of the study area. e) The model is complete the data and is being utilized to estimate the amount of CO2 that could be stored.
Task 2: Bench Scale Demonstration:	a) The test apparatus was designed and constructed in 2019. Shake down tests of various materials began in late 2019. Coal sample testing is planned for 2020.

Potential future applications for similar projects:

When combined with the results of the STEP CarbonSAFE project and the STEP Cryogenic Carbon Capture program, Rocky Mountain Power would have sufficient experience with these technologies 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, 2019

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 promising CCC technology.

The 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. Rocky Mountain Power (RMP) contracted with Sustainable Energy Solutions (SES) to do this work. SES's recommendations and experimental results were used to make changes and enhancements to the skid demonstration unit provided as part of this Scope of Work. On-site preparations by SES and RMP personnel of the testing area at the Hunter Power Plant in central Utah were completed in 2019. The Field Demonstration Phase used the demonstration unit at the site during an extended test run over approximately six months. SES's development work took place during 2017 and early 2018 with the field testing beginning in early 2019.

These phases were conducted by SES 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.

The project includes an economic assessment of utility-scale implementation of technology. In 2019 RMP hired Sargent & Lundy to deliver a report assessing the scalability of SES's technology to a size capable of processing all exhaust flue gas from one or more existing coal fueled thermal generation power plants owned by RMP.

Project Accounting:

Cost Object	2017	2018	2019	Total
Annual Collection (Budget)	$356,557	$668,301	$412,521	$1,437,379
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses*	$160,451	$530,289	$711,750	$1,402,490
Subtotal	$160,451	$530,289	$711,750	$1,402,490

*External OMAG consists of contractual payments to Sustainable Energy Solutions for services performed on the project. A description of these services is described in the project milestone section below.

Project Milestones:

Project Milestone	Delivery Date	Status
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	Completed
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	Completed
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	Completed

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. **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.	1/15/2020	Completed
Sargent & Lundy scalability study assessing the scalability of the technology for complete processing of flue gas at utility power plants.	7/1/2020	On Schedule

Program Benefits:

This program will help us determine the economic feasibility of CCC technology. The technology shows promise in being able 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:

SES has applied for U. S. Department of Energy ARPA-e funding. Utah State funding has been approved for a larger SES CCC scale-up project which may be hosted at one of PacifiCorp's plants.

STEP Project Report

Period Ending: December 31, 2019

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

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	2019	Total
Annual Collection (Budget)	$150,000	$0.00	$0.00	$150,239
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00		$0.00	$0.00
External OMAG Expenses	$150,239	$0.00	$0.00	$150,239
Subtotal	$150,239	$0.00	$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	Completed

Final Report Presented and Submitted	May 2019	Completed

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment

STEP funding for this project was used to support a pre-feasibility study of carbon dioxide (CO_2) capture and sequestration capabilities in the intermountain west. 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 CO_2 storage reservoir. The summary provided below is taken from the Carbonsafe Rocky Mountain Phase I: Ensuring Safe Subsurface Storage Of Carbon Dioxide In The Intermountain West Final Report (Attachment A).

Anticipated Outcome

- Determine if central Utah's geological formations were suitable for storing up to 50 million metric tons (tonnes) of CO_2 in a saline aquifer.
- Identify a study area that could be utilized by Utah's existing coal-fired facilities.
- Identify the commercial and non-techncial challenges in developing a CO_2 storage aquifer.
- Provide a template protocol for future and existing coal-fired and gas-fired facilities that could be utilized for further development of a CO_2 storage aquifer.

Challenges

- Four key challenges were identified in pre-feasiblity study. These challenges are:
    - Cost and cost recovery of construction and operation CO_2 capture and sequestration (CCS) infrastructure;
    - the lack of price signal or financial incentive for developing, construction and operation of a CCS;
    - liability risks associated with the storage aquifer, including legacy liability; and
    - an overall lack of a comprehensive CCS regulation.
- Additional challenges recognized were:
    - Overall lack of CCS regulatory framework; and
    - lack of historical cost information to implement and operated CCS.

Findings / Results

- Capture assessments were performed using both commercial and emerging technologies to capture approximately 2.75 million tonnes per year for one of the boiler units at the Hunter Power Plant. The estimates showed that the:
    - Amine based (commercial technology) system cost of capture was estimated of 45.50/tonne.
    - The cryogenic based (emerging technology) cost of capture was estimated at $37.75/tonne.

- Compression of the captured CO_2 and transportation, via high pressure pipeline, would increase the cost per tonne. The cost would be highly dependent on the specific injection location and rights of way and therefore not estimated in the pre-feasibility study.
- The area around the Hunter and Huntington Power Plants were subject of a high-level technical sub-basinal evaluation to verify CO_2 storage capacity and integrity. The result of the evaluation showed potential injection sites might be available, into the high permeability (~200 mD) and high porosity (20%) Navajo sandstone in the Buzzards Bench area of central Utah.
- A comprehensive analysis of the proposed reservoir and seals was conducted and a 3-dimensional model was created. Simulation and risk assessment on the proposed site were conducted. The findings showed that the CO_2 capacity estimates for the Navajo Sandstone, approximately 18 kilometers from the Hunter plant, are well in excess of the 50 million tonnes goal of the project.
- Non-technical assessments for a commercial-scale CO_2 storage facility in central Utah was conducted. The Environmental Protection Agency's Underground Injection Control Class VI and National Environmental Policy Act permitting present particular challenges in developing a saline aquifer for CO_2 storage. Surface and subsurface ownership and rights are also not straight forward and would need to be resolved if any storage facility would be constructed. Most critically is the legacy ownership and risk of a CO_2 storage facility.

Lessons Learned

- Some critical lessons learned and challenges that were identified in the study were:
  - Lack of clarity of pore space ownership – Utah does not have a clear precedent on who would own the subsurface pore space for CO_2 storage.
  - Commercial operation capital cost, operations and maintenance cost and regulatory recovery – Further work is needed to determine if regulatory approval for PacifiCorp could be obtained to construct and CCS facility. Challenges identified include PacifiCorp's six state operations and differing regulatory requirements.
  - Permitting a CO_2 capture and storage facility – There is not a clear process in which an entity could permit a CO_2 capture and storage facility. History of previously permitted facilities were reviewed and each faced numerous challenges, environmental approvals and public comments.
  - Brine and waste disposal – Since brine would be created from the saline aquifer and cannot be used for enhanced oil recovery another method must be used for disposal. Methods such as evaporation face their own environmental challenges and would increase cost and risk of a storage facility

Program Benefits

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 University of Utah to the Department of Energy final report is provies a detail insight as to the challenges in constructing a CCS facility.

Attachments:

(Note: the attachment is voluminous and is provided as a separate attachment)

Exhibit 8-A CARBONSAFE ROCKY MOUNTAIN PHASE I: ENSURING SAFE SUBSURFACE STORAGE OF CARBON DIOXIDE IN THE INTERMOUNTAIN WEST

Exhibit 8-A

University of Utah Pre-feasibility Study

THIS EXHIBIT IS PROVIDED AS A SEPARATE DOCUMENT

STEP Project Report

Period Ending: December 31, 2019

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 will focus on the application of parabolic solar troughs and will 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	2019	Total
Annual Collection (Budget)	$0.00	$0.00	$187,000	$187,000
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$83,057*	$83,057
Subtotal	$0.00	$0.00	$83,057	$83,057

*All OMAG expenses were paid to Brigham Young University for the completion of the milestones listed below.

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	Completed
Report 2, baseline plant model comparison to operational data	8/31/2019	Completed
Report 3, solar resource data, solar integration point, CSP characterization for modeling	12/31/2019	Completed
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: As we learn more about the technology, we will have a better understanding of potential future applications. It is possible that this technology could be deployed at several traditional power plants.

STEP Project Report

Period Ending December 31, 2019

STEP Project Name: Circuit Performance Meters (Substation Metering). COMPLETE.

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. The scope of the project involves setting up remote communication paths with all installed meters and the purchase of a data management and analytics tool to analyze, interpret and report on the collected data.

Project Accounting:

	2017	2018	2019	Total
Annual Collection (Budget)	$110,000	$550,000	$440,000	$1,100,000
Annual Spend (Capital)	$13,676	$427,349	$451,777	$892,802
External OMAG Expenses	$0	$0	$0	$0
Subtotal	$13,676	$427,349	$451,777	$892,802

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	Meter installations on thirty four circuits were completed in 2019. All installed meters are operating and sending data to the Company's data collection system.

Program Benefits

- Enable increasing levels of distributed energy resources on the power grid by economically providing increased visibility on loading levels, load shape, and event information. Information gained will be used to develop interconnection studies and hosting capacities for customers while determining 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 which 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 and allow timely development and implementation of cost effective mitigation.
- Enhance understanding of intermittent generation resources and their impact on the power grid.
- Reduce distributed generation interconnection customer approval delays.
- 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. The Company is also looking into the possibility of integrating the smart meter with remote terminal units. Results of this investigation will be made in the final report that is on track to be complete by the end of 2020.

STEP Project Report

Period Ending December 31, 2019

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 2019. 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 3**. When funds are transferred into the job they are included in the Annual Spend (Capital). These correspond to the Paid items in the Status column in **Table 3**.

Table 1				
	2017	**2018**	**2019**	**Total**
Annual Collection (Budget)	$500,000	$500,000	$500,000	$1,500,000
Annual Spend (Capital)*	$0.00	$69,340	$81,743	$151,083
Committed Funds	$0.00	$11,682	$94,265	$105,947
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$0.00	$81,022	$176,008	$257,030

*The annual spend figures correlate to the numbers shown on the accounting information provided on page 1.0.

Applications Received:

The request for primary voltage facilities also serves as the application for the Commercial Line Extension Pilot Program. 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 project must include installation of backbone infrastructure, and also not have enough electric service revenue allowances to cover the cost of that backbone. None of the developments receiving STEP funds are additional phases of the same development that had previously received STEP funds under a different phase.

Applications – Table 2				
	2017	2018	2019	Total
Applications Received	2	12	10	24
Applications Approved	2	12	10	24
Recipients Receiving Multiple Rewards	0	0	0	0

Table 3 – Individual Project Details:

In Docket No. 16-035-36, the Commission issued an order on February 6, 2019 approving the Company's request to increase the per-project incentive payment limit to $250,000 from the previously approved amount of $50,000. The intention of this change was to incentivize larger projects that could benefit from the funds to participate in the program. The total program budget is $2.5 million over the five-year pilot program period.

As of December 31, 2019, all developments receiving STEP funds were still under construction. At the time of this report no PV charging stations have been installed. Some developments only include road and utility infrastructure. These developments have no buildings or parking established by the initial developer. No charging station locations have been established at developments without buildings or parking

Other developments have plans for specific business or buildings as part of the initial development. For those developments where parking is established, charging station locations have been established as defined by the the STEP program.

Individual Project Details – Table 3									
	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 (Conduit Extensions)	Number of individual 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	Paid in 2019	3/19/2018	$ 80,183	$ 80,183	$ 16,037	9	N	--	--
6	Paid in 2019	3/20/2018	$ 102,360	$ 100,714	$ 20,143	3	Y	1	TBD
7	Paid in 2019	3/29/2018	$ 25,141	$ 24,218	$ 4,844	5	Y	1	TBD

8	Paid in 2019	5/29/2018	$ 68,720	$ 30,669	$ 6,134	6	N	--	--
9	Paid in 2019	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	Paid in 2019	11/1/2018	$ 52,789	$ 13,035	$ 2,607	5	N	--	--
12	Paid in 2019	11/7/2018	$ 37,081	$ 33,803	$ 6,761	6	N	--	--
13	Paid in 2019	11/12/2018	$ 19,192	$ 19,192	$ 3,838	8	Y	1	TBD
14	Paid in 2019	12/6/2018	$ 248,411	$ 118,107	$ 23,621	1	N	--	--
				2018 Total	**$ 130,020**				
15	Committed	2/6/2019	$ 51,316	$ 48,038	$ 9,608	6	N	--	--
16	Committed	3/4/2019	$ 28,080	$ 22,827	$ 4,565	8	N	--	--
17	Paid in 2019	3/8/2019	$ 12,246	$ 11,794	$ 2,359	5	Y	1	TBD
18	Committed	4/10/2019	$ 56,807	$ 51,889	$ 10,378	8	N	--	--
19	Committed	4/10/2019	$ 57,078	$ 52,160	$ 10,432	8	Y	1	TBD
20	Paid in 2019	4/11/2019	$ 111,259	$ 77,709	$ 15,542	9	N	--	--
21	Committed	5/29/2019	$ 209,393	$ 133,897	$ 26,779	10	N	--	--
22	Committed	10/4/2019	$ 36,628	$ 34,160	$ 6,832	5	N	--	--
23	Committed	10/9/2019	$ 81,901	$ 77,787	$ 15,557	10	Y	1	TBD
24	Committed	11/6/2019	$ 50,570	$ 50,570	$ 10,114	4	N	--	--
				2019 Total	**$ 112,166**				

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. 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:

The Commercial Line Extension Program was designed to encourage developers to install a 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 fewer future upgrade investments.

To the extent developers build within their developments, sites for PV 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, 2019

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	2019	Total
Annual Collection (Budget)	$100,000	$100,000	$100,000	$300,000
Annual Spend	$0.00	$0.00	$7,067	$7,067
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$0.00	$0.00	$7,067	$7,067

On December 4 - 9, 2019, the Company curtailed Gadsby power plant due to UDAQ issuing a red advisory. The total calculated value of the curtailment over the time period was $7,067. The curtailment value is calculated by taking the difference between the on peak/off peak market price and the dispatch cost by unit. The difference is multiplied by the generation in MWh by unit. Confidential workpapers containing the calculation are included with this filing.

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, 2019

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 12.47 kilovolt distribution circuits that are connected to the 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"). Commercial operation commenced on March 3, 2020, but the Company awaits final completion from the EPC contractor.

Project Accounting:

	2017	2018	2019	Total
Annual Collection (Budget)	$500,000	$2,350,000	$5,900,000	$8,750,000
Annual Spend (Capital)*	$331,995	$75,474	$6,373,549	$6,781,019
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$331,995	$75,474	$6,373,549	$6,781,019

*The information provided includes funds charged to the STEP account and does not include funds from the Blue Sky program that were allocated to this project.

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	Complete
EPC Major Equipment Delivered	September 3, 2019	Complete
Construction Complete	November 1, 2019	Complete
Commercial Operation Begins	March 9, 2020	Complete
Final Completion	December 31, 2020	On track

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a. Enable Investment Tax Credit (ITC)	Utility will operate the solar and battery system to address system issues as well as capture ITC benefits	System not original designed for such capability	The battery and solar control architecture was not initially designed to accommodate ITC requirements	Control architecture changes were implemented on January 21, 2020	During design and setting of design criteria include ITC philosophy in specification and controls
b. Interconnection cost increases	N/A	Tight labor market for procurement of contractors (and wth required schedule); Nine poles required replacement from Panguitch Substation to the site	Contractor cost increases; Communication costs and labor higher than originally estimated	Passage of time also impacted estimates; in the end interconnection costs increased significantly	Detailed loading information and field inspection may be needed to accurately estimate interconnection costs.

c. Issues with fencing and grounding	Repaired in field	Issues with project construction quality	Multiple issues were identified that raised concerns regarding construction quality.	Fencing and grounding issues were corrected during the commission ing stage.	Establish clear fencing and grounding standards in the contract; conduct both design and field reviews during commissio ning
d. Consider providing temporary diesel generators for battery back-ups	More reliable and robust system	Cost of generators, permitting, and other ancillary electrical	Cost of generators, permitting, and other ancillary electrical	Not included; future project if justified	May not be required depending on future project location

Project Benefits

- The loading on the 69–12.47 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 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.
- Provides battery and solar training for Company personnel at both the office and field levels including the operation and maintenance on similar facilities and equipment.

Potential future applications for similar projects:

Depending on the outcome, there could be a number of applications across Rocky Mountain Power's system on long radial feeds similar to Panguitch. These applications would provide economic deferrals for major transmission rebuilds.

STEP Project Report
Period Ending December 31, 2019

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	2019	Total
Annual Collection (Budget)	$0.00	$70,000	$110,000	$180,000
Annual Spend (Capital)	$0.00	$90,713	$77,717	$168,430
Committed Funds	$0.00	$0.00	$0.00	$0.00
Internal OMAG Expenses	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$0.00	$90,713	$77,717	$168,430

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	04/30/2020	ONGOING - A Matlab based EMS is also under development and tuned with the load data that is being collected. Streamlining communication protocol of all microgrid components.

Optimize planning tool for microgrid	08/31/2019	COMPLETE
Apply planning tool to HAFB microgrid	12/31/2019	MILESTONE REMOVED
Create fact sheet for planning tool	4/30/2020	ONGOING – Authoring sheet to simplify explanation of planning tool and microgrid implementation with economic benefits.
Recommendations to DERs interconnection policy	06/30/2020	ONGOING – Reviewing current proposed redlines to policy 138 and generating additional recommendations.

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a. Microgrid system operational at USU's EVR	Connect microgrid components to the central control system at the EVR for monitoring and control.	1. Establishing a connection interface for all components to get a complete view of the system. Commands from inverters are not the same across vendors. 2. Policy 138 requirement of a grounding transformer. 3. Transformer requirement to be located at point of interconnection of the solar array (policy 138), but the microgrid system required a neutral reference when disconnected from the grid. This requires a neutral reference be located at the service entrance and automatic transfer switch rather than at the solar array POI. 4. Grounding transformer needed to be increased in order to handle the neutral currents of the single-phase loads of the facility when islanded while also meeting the interconnection requirements. 5. Determining the allowable facility ampacity and	1. With revisions to policy 138 and transient overvoltage protection, the need for a grounding transformer for that feature was not required. 2. Plotting of the transformer not a concern. 3. The different system voltage needs of the facility, along with the ampacity usage, resulted in the widespread installation of solar inverters across the facility. 4. Communications for data collection and control of the inverters are vital for microgrid operation. 5. Much equipment is designed for conventional grid and must be revised for microgrid operation.	1. Data / Solar data to be available on EVR server for real-time viewing.	1. The grounding transformer was needed due to the battery inverter not able to establish a neutral reference for the facility when isolated. 2. Smart inverters that adhere to the IEEE 1547-2018 standard have TROV protection. This eliminates the need for grounding transformer TROV. 3. Try to establish the same types of communication protocols. 4. Market share for microgrid equipment is limited. 5. Protection relays are necessary for quick response to grid transients and fast control of equipment. 6. Natural gas generators are limited at the hundreds of kilowatts range. 7. In order to parallel a generator with the utility, the generator has to be prime power rated. This kind of rating is only

		ampere interrupt capacity of the EVR for DER interconnections. 6. Limited market share for microgrid equipment. 7. Designing for facility constraints.	6. Shortage on micro grid equipment in the hundreds of kilowatts range (i.e. automatic transfer switch and natural gas generator).		currently available at higher power levels (thousands of kilowatt levels). 8. Emergency standby generators are only available at the power levels the EVR is operating at.
b. Optimize planning tool for microgrid	Creation of planning tool for use in industry.	1. Quantifying real equipment prices as tool inputs	1. Many different technical, financial, and meteorological components have an effect on the design and economics of a microgrid	1. Optimized planning tool for various customers communicated.	1. The design and financial benefits of a microgrid can be easily quantified, given accurate pricing, load, and weather data.
c. Create fact sheet for planning tool	Fact sheet to provide explanation for process to implement a microgrid and its benefits.	1. None currently identified.	1. Planning tool is simple to use and quantifies economic benefits of a microgrid to a customer	1. Clear fact sheet describing purpose of tool and value of results.	1. The microgrid planning tool can be applied to various customers to conceptually design a microgrid and detail its load-shaping and cost-saving capability.
d. Policy 138 review and proposed changes	Review of the interconnection policy, and identify areas for possible revision.	1. EVR facility has multiple inverters, policy 138 required a manual disconnect for each inverter within ten feet of the utility meter. Due to space limitations, the AC disconnects are not able to be located next to the meter. 2. Early challenge of grounding transformer for policy 138 compliance. 3. Transformer POI to the EVR facility was significant challenge. 4. Transformer requirement to be located at point of interconnection of the solar array (policy 138), but the microgrid system required a neutral reference when disconnected from the grid. This requires a neutral reference be located at the service entrance and automatic transfer switch rather than at the solar array POI.	1. Changes to policy 138 TROV protection, resulted in grounding transformer not needed. 2. Exceptions to AC disconnect locations can be granted on a per review basis. 3. Protection relays will help ensure that tripping times specified in the policy 138 are met.	1. Submission of proposed rule changes to policy 138.	1. Through software control, energy storage can be controlled similar to PV smart inverters. 2. SEL-751 protection relays have fast response to grid/facility transients. 3. Protection relays can be used to monitor energy storage, and disconnect the energy storage/facility from the grid. 4. A combination of software and hardware controls allows seamless control of energy storage to allow interconnection to utility. 5. The AC and DC disconnects on the inverters themselves are lockable and disable the inverter from operation. 6. The disconnects on the inverters could serve as the utility required disconnects for interconnection.

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.
- Establishes a tool to optimize conceptual design for a microgrid given location, load shape, and rate structure.

Potential future applications for similar projects:

Collaborate with customers to identify and potentially deploy microgrid systems utilizing advanced control systems and Internet of Things (IoT) for optimizing distributed energy resources.

STEP Project Report

Period Ending December 31, 2019

STEP Project Name:

Smart Inverter Project (COMPLETE)

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	2019	Total
Annual Collection (Budget)	$0.00	$450,000	$0.00	$450,000
Annual Spend (Capital)	$0.00	$0.00	$0.00	$0.00
Committed Funds	$0.00	$0.00	$0.00	$0.00
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
Internal OMAG Expenses	$0.00	$33,861	$0.00	$33,861
External OMAG Expenses	$0.00	$349,998*	$0.00	$349,998
Subtotal	$0.00	$383,859	$0.00	$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.

STEP Project Report

Period Ending December 31, 2019

STEP Project Name:

Battery Demand Reponse

Project Objective:

Rocky Mountain Power has partnered with Wasatch Development on their 600 unit multi-family development in Herriman, Utah. The apartments, known as Soleil Lofts, feature solar panels on the rooftops and a large storage battery within each unit. The batteries are integrated to the grid for system-wide demand response. The Battery Demand Response Project provides Rocky Mountain Power experience in solar and battery integration. The Company will also gain valuable real-world experience in advanced grid management during peak/off-peak energy use.

There are three main objectives we are seeking with this program: 1) better understanding of demand response 2) how behind-the-meter behavior affects load shaping, and 3) insights into creating rate design for customers with batteries.

Demand Response: The partnership with Wasatch Development will allow the company to utilize each battery for demand response at any given time. The Company can draw on this resource during peak grid loads which will reduce the peak load for the entire electric system.

Load Shaping: The Company has historically had limited access to behind-the-meter data. In the future, similar projects will likely be added to the grid and will interact with the grid load in new ways. Information gained in this project will help the Company plan for these future integrations.

Rate Design: By looking at behind-the-meter battery behavior, the Company can better understand how to create rate design pilots for customers with batteries.

Project Accounting:

	2017	**2018**	**2019**	**Total**
Annual Collection (Budget)	$0	$0	$0	$0
Annual Spend (Capital)	$0	$0	$4,270	$4,270
Committed Funds	$0	$0	$0	$0
Uncommitted Funds	$0	$0	$0	$0
Internal OMAG Expenses	$0	$0	$0	$0
External OMAG Expenses	$0	$0	$0	$0
Subtotal	$0	$0	$4,270	$4,270

Project Milestones:

Milestones	Delivery Date	Status/Progress
Project Approved by Public Service Commission of Utah Docket No. 16-035-36	June 28, 2019	Approved
Battery installations start	July, 2019	Completed
First Building Completed	September, 2019	Completed
Soleil Lofts become available for occupancy	Third quarter 2019	Completed
Project Kickoff meeting with PacifiCorp and Sonnen	December 1, 2019	Completed
Develop preliminary system communication design	December 15, 2019	Completed
RTU Configuration	March 31, 2020	Completed
Establish VPN setup and establish security protocol	March 31, 2020	Completed
Battery Demand Response (DR) test event	June 30, 2020	Scheduled
Last building completed.	September, 2020	Scheduled
Full 4.8 MW available for control	December, 2020	Scheduled

Program Benefits:

Knowledge and data gained from this project will allow the Company to explore the option of offering battery demand response technology in the future. Battery demand response could lead to lower costs for customers as well as less transmission congestion during summer peak loads.

The partnership with Wasatch Development allows the Company to study behind-the-meter behavior at a much cheaper price than starting a similar program from scratch. Information gained from this project, can be used to develop future rate design options for battery-system-integrated customers. Also, what we learn in this project, will enable a larger roll-out of similar projects in the future.

Potential future applications for similar projects:

Work with developers and other industry partners to identify and potentially deploy battery demand response systems connected to the grid that benefit the customer with lower rates and benefit the Company with lower peak load.

STEP Project Report

Period Ending December 31, 2019

STEP Project Name:

Intermodal Hub

Project Objective:

The Intermodal Hub Project will develop a power balance and demand management system for multi modal vehicle charging at sites with high peak power demand. The Intermodal Hub Project is designed to address the high cost of grid infrastructure needed for high output chargers by researching methods to adaptively manage power flow between the grid and various electric charging needs. The project will combine a diversity of electric charging needs (light rail, bus, passenger, truck, and ride hailing services) at an intermodal transit center to create a multi-megawatt, co-located, coordinated, and managed charging system.

Project Accounting:

	2017	2018	2019	Total
Annual Collection (Budget)	$0.00	$0.00	$0.00	$0.00
Annual Spend	$0.00	$0.00	$802,510	$802,510
Uncommitted Funds	$0.00	$0.00	$0.00	$0.00
Internal OMAG Expenses	$0.00	$0.00	$0.00	$0.00
External OMAG Expenses	$0.00	$0.00	$0.00	$0.00
Subtotal	$0.00	$0.00	$802,510	$802,510

Project Schedule:

Project Task	2019		2020				2021			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analysis and Planning	■	■	■							
Simulation Planning/Validation			■	■	■	■	■			
Testbed for Software/Hardware				■	■	■	■	■		
Deployment and Evaluation						■	■	■	■	■

Project Milestones:

Milestones	Delivery Date	Status/Progress
Task 1 Analysis and Planning: Multi modal charging analysis (power levels, vehicle types)	3/31/2020	In Progress – Consideration of current e-buses and charge equipment requirements have been accounted in learning model. Priority meters across the UTA site have been identified. Coordination with both UTA and RMP to obtain meter history for input to learning algorithms and load modeling. Continued development of model to simulate site dynamics and load optimization.
Task 1 Analysis and Planning: Distribution capacity/needs/impact analysis	3/31/2020	In Progress – Ongoing development of Open DSS model to evaluate electric distribution loading. Conversion of CYME files to model input format. Additional meter information required for review and model implementation.
Task 1 Analysis and Planning: City and suburban level planning of grid and transportation charging integration	3/31/2020	In Progress – Site walk/review and CYME files of grid. Open DSS modeling to identify capacities and optimization potentials for charging equipment.

<u>Task 1 Analysis and Planning:</u> Confirm study participants in addition to UTA (e.g., fleet, including delivery and ride hailing participant vehicles)	3/31/2020	In Progress – Determination with site (UTA) of current electric bus status and future planning. Site review for feasibility of EV public access and control. Discussions with EV charging equipment vendors (ABB) and third-party EV managers (Greenlots, EV Connect) to understand limitations of current management software and identify requirements for active control through USU developed algorithms.
<u>Task 2 – Distribution System Simulation Planning and Validation</u> Design initial intelligent prediction algorithms and demand response concepts	3/31/2021	In Progress – Algorithm development in Matlab. Integration of learning algorithm with agent model. Identification of rewards (e.g. pricing, battery SOC, load optimization, etc).
<u>Task 2 – Distribution System Simulation Planning and Validation:</u> Develop system simulation models for charging network and agent-based vehicle response	3/31/2021	In Progress – Initial agent-based models are being developed through Open AI Gym and Matlab. Reward identification and coding in process. Continued inputs and improvements as data inputs are received (both historical and realtime when available).
<u>Task 2 – Distribution System Simulation Planning and Validation:</u> Collect data from TRAX power feed and TRAX light rail cars; e-bus fleet; all charging equipment; fleet (including delivery and ride hailing participant vehicles) Data used for algorithm development and as machine learning training datasets	3/31/2021	In Progress – Planning process for data acquisition and hardware installation. Receipt of historical meter data from RMP for identified priority meters. New Flyer e-bus performance reports. ABB depot charger data through Driver Care and local data logger in progress.

Task 2 – Distribution System Simulation Planning and Validation: Perform systems level simulation analysis for early and broad deployment scenarios, validate benefit of managed approach when compared to worst-case design approach	3/31/2021	Not Started
Task 3 – Testbed for Software/Hardware Development and Integration: Specify, bid, and procure system hardware	6/30/2021	In Progress – Discussion with EV equipment vendors (ABB) and third-party software management (Greenlots, EV Connect) for integration and public access
Task 3 – Testbed for Software/Hardware Development and Integration: Anticipate needs for and develop cyber security management Design for compatibility with and security of communication network	6/30/2021	Not Started
Task 3 – Testbed for Software/Hardware Development and Integration: Write code and program algorithms on servers Algorithms include energy/load balancing and management Design for compatibility with AMI	6/30/2021	Not Started
Task 3 – Testbed for Software/Hardware Development and Integration: Evaluate hardware system (with integrated software) at the USU EVR	6/30/2021	Not Started
Task 3 – Testbed for Software/Hardware Development and Integration: Iterate algorithm designs and develop pilot demand response program	6/30/2021	Not Started

<u>Task 4 – Deployment and Evaluation:</u> Integrate hardware and software systems with UTA and RMP equipment and cyber secure communication network	12/31/2021	Not Started
<u>Task 4 – Deployment and Evaluation:</u> Integrate hardware and software systems with UTA and RMP equipment and cyber secure communication network	12/31/2021	Not Started
<u>Task 4 – Deployment and Evaluation:</u> Integrate hardware and software systems with UTA and RMP equipment and cyber secure communication network	12/31/2021	Not Started
<u>Task 4 – Deployment and Evaluation:</u> Deploy hardware system at the UTA multi-modal hub site through a phased approach in direct coordination with IT and operations at UTA	12/31/2021	Not Started
<u>Task 4 – Deployment and Evaluation:</u> Finalize recruiting, engage work with participants for pilot demand response program	12/31/2021	Not Started
<u>Task 4 – Deployment and Evaluation:</u> Integrate real-time data collection from all partners and participants into the hardware system	12/31/2021	Not Started

Task 4 – Deployment and Evaluation: Evaluate power control and demand response performance; iterate algorithms; develop best practices and recommendations	12/31/2021	Not Started

Key Challenges, Findings, Results and Lessons Learned:

Description of Investment	Anticipated Outcome	Challenges	Findings	Results	Lessons Learned
a. Understanding of system and energy requirements to be managed	a. Gather necessary meter inputs from site loads and charging equipment. Develop learning and electrical system models.	1. Charge equipment and meter information in as close to real-time as possible	1. In Progress	1. In Progress	1. Continued efforts in installing required hardware for metering information
a. Active control of EV equipment – OCPP communication (Open Charge Point Protocol)	a. Receive inputs in realtime and actively control EV equipment	1. Installation of local communication for realtime data and active control. Limitations/lag through cloud database and current OCPP	1. In Progress – discussion with third party EV software management	1. In Progress	1. Realtime control anticipated to be accomplished in a laboratory setting and limited communication requirements, with increased complexities and public access, integration with third-party EV managers necessary. Currently these third-party managers are not actively controlling charge capacity to assist with load balancing across a site.

Potential future applications for similar projects:

A key outcome of this project will be a "roadmap" for high power electric vehicle charging complexes that leverage existing infrastructure from dominant peak loads such as TRAX to support a host of additional multi modal vehicle charging needs at minimal cost. The roadmap guides the confluence of accommodating different vehicle types with combined known loading and scheduling of charging (expected and variable) and peak pricing/surge charging to level peak demand loading on the grid.

The system will serve as a model for deployment of highly efficient and intelligent power management systems to additional UTA and Company sites. It also enables leadership in managing charging demands that can disseminated to other agencies regionally, nationally and globally.

STEP Project Report

Period Ending December 31, 2019

STEP Project Name:

Advanced Resiliency Mangement System

Project Objective:

The ARMS project enables outage notifications from existing ERT[1] electric meters, installation of communication radios on distribution line equipment, and deployment of line sensor technology on distribution circuits. These technologies connect critical customers and enable real-time information exchange with the Company's control center. The Company will also study if there would be benefits of deploying this technology on distribution circuits that have poor reliability.

Project Accounting:

	2017	2018	2019	Total
Annual Collection (Budget)	$0	$0	$1,430,000	$1,430,000
Annual Spend (Capital)	$0	$0	$39,931	$39,931
Committed Funds	$0	$0	$0	$0
Uncommitted Funds	$0	$0	$0	$0
Internal OMAG Expenses	$0	$0	$0	$0
External OMAG Expenses	$0	$0	$0	$0
Subtotal	$0	$0	$39,931	$39,931

Spend in 2019 was under the budgeted amount due to software license purchases being delayed from 2019 to 2020 and 2021. Overall budget for project has not been changed.

Project Milestones:

Milestones	Delivery Date	Status/Progress
Request for DOE funding	August 2019	Complete
Test cellular communications for distribution protection devices	December 2019	Complete
Develop process to finalize circuit list for fault indicator installation	December 2019	Complete
Finalize Circuit List	June 2020	On Target
IT Cybersecurity clearance	June 2020	On Target
Test fault indicators	June 2020	On Target
Test EGMs	April 2021	On Target

[1] An encoder receiver transmitter (ERT) is a technology that allows manual meter reading to be replaced by a human driving an automobile equipped with a special computer and radio receiver. The meter's consumption data is transmitted through a simple digital radio protocol. This general technique has come to be known as automated meter reading, or AMR.

Procure & Install EGMs	Oct 2021	On Target
EGMs Go Live	Dec 2021	On Target

Project Benefits:

- Reduces manual and mobile metering requirements by removing seven meter reading/collection FTEs and associated overhead.
- Provides meter tampering detection. This ability will improve Rocky Mountain Power's ability to detect and prevent theft.
- Provides interval usage data to Utah customers through the Company's website.
- Provides a platform that can be leveraged for future grid modernization applications including distribution automation, outage management, data analytics and demand-response programs.
- Reduces customer property visits, meter-reading miles, and employee exposure to safety hazards.
- Reduces CO_2 emissions through fewer Rocky Mountain Power vehicles on the road.
- Improves outage response operations by leveraging real-time information from distribution line device. Helps determine safe switching procedures and cost effective capital improvement and maintenance plans.
- Improves reliability metrics such as Sustained Average Interruption Duration Index (SAIDI) and Customer Average Interruption Duration Index (CAIDI).
- Leverages real-time information collected from distribution line equipment to augment predictive capability of existing outage management systems and reduces Company reliance on customer reporting for outage notification.
- Reduces operations and maintenance costs by eliminating the need for manual load reading performed on circuits that do not have sophisticated meters with remote communication capabilities.

Potential future applications for similar projects:

Lessons learned in this project can be used for a wide range of meter and circuit installations in the future. As improvements are made to the system, the Company can upgrade the system using the knowledge and experience gained from this project.

Utah Solar Incentive Program (USIP)

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 collected under the discontinued Electric Service Schedule 107 ("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 June 28, 2019, the Commission approved the Company's request to use the STEP funds that were previously budgeted for USIP for the Advanced Resiliency Management System project. On August 20, 2019 the Commission approved the Company's request to begin refunding $3.06 million in surplus revenue collected through Schedule 107 through a reduction in Electric Service Schedule No. 196 Sustainable Transportation and Energy Plan ("STEP") Cost Adjustment Pilot Program rates over one year beginning November 1, 2019[1]. 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 provides the CY 2019 USIP account balance with USIP collections under Schedule 107.

Table 1: USIP Account Summary (With Electric Service Schedule 107 revenues only)

Utah Solar Incentive Program Account - Through 2019											
		Order	Program Total	2012	2013	2014	2015	2016	2017	2018	2019
Program Revenue			(26,298,037)	(961,324)	(6,293,704)	(6,320,828)	(6,317,639)	(6,323,285)	(308,633)	-	227,376
Program Expenditures:											
	Incentive	331190, 338901		-	981,796	2,328,676	3,292,006	4,884,763	4,766,963	3,459,713	2,317,571
	Program Administration	331191; 338902		-	253,665	322,664	173,248	412,866	94,788	27,098	13,807
	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)	-	(157,638)
		408641							-	-	-
	Cool Keeper program			-	-	-	-	(200,000)	-	-	-
Total Expenditures			23,031,414	86,653	1,370,345	2,677,912	3,479,769	4,994,002	4,762,183	3,486,811	2,173,740
Interest			(3,451,708)	(5,995)	(219,165)	(473,909)	(721,712)	(685,628)	(627,425)	(569,938)	(147,937)
USIP Account Balance (Sch. 107 only)			(6,718,331)								

The Total Expenditure amounts showing for CY 2017, 2018 and 2019 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[2].

The 2019 program revenue of $227,376 shown in Table 1 for CY 2019 represents the credits back to customers through the reduction in Schedule 196 beginning November 1, 2019. The USIP workpaper provides the updated forecast program expenditures.

[1] See Docket No. 19-035-T12.

[2] See Docket No. 18-035-24 and Docket No. 19-035-25 for CY 2017 and 2018 total expenditures, respectively. The CY 2019 USIP annual report will be filed June 1, 2020.