ROCKY MOUNTAIN POWER
A DIVISION OF PACIFICORP

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

March 8, 2019

***VIA ELECTRONIC FILING***

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

Attention: Gary Widerburg
Commission Secretary

RE: Docket No. 16-035-36 – In the Matter of the Application of Rocky Mountain Power to Implement Programs Authorized by the Sustainable Transportation and Energy Plan Act

Rocky Mountain Power hereby submits for filing its Application to Implement Programs Authorized by the Sustainable Transportation and Energy Plan Act, signed into law March 29, 2016, requesting authorization to implement three additional innovative utility programs.

Rocky Mountain Power 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
jana.saba@pacificorp.com
daniel.solander@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

CC: Service List 16-035-36

R. Jeff Richards (7294)
Daniel E. Solander (11467)
1407 West North Temple, Suite 320
Salt Lake City, Utah 84114
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*Attorneys for Rocky Mountain Power*

**BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH**

| | | |
|---|---|---|
| IN THE MATTER OF THE APPLICATION OF ROCKY MOUNTAIN POWER TO IMPLEMENT PROGRAMS AUTHORIZED BY THE SUSTAINABLE TRANSPORTATION AND ENERGY ACT | ) ) ) ) | Docket No. 16-035-36 |

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**APPLICATION TO IMPLEMENT PROGRAMS AUTHORIZED BY THE SUSTAINABLE TRANSPORTATION AND ENERGY ACT**

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Rocky Mountain Power, a division of PacifiCorp ("Company" or "Rocky Mountain Power"), hereby submits this application to the Public Service Commission of Utah ("Commission") pursuant to Utah Code Annotated ("U.C.A") § Section 54-20-101, *et seq*., also known as Senate Bill 115 – the Sustainable Transportation and Energy Plan Act ("STEP"), signed into law March 29, 2016, requesting authorization to implement three additional innovative utility programs authorized by STEP, specifically, U.C.A. § 54-20-105(1)(h) and § 54-20-107.

The three programs the Company is seeking authorization from the Commission to implement are: (1) the Power Balance and Demand Response to Optimize Charging at Intermodal Hub Project (the "Intermodal Hub Project"); (2) the Wasatch Development Partnership Project for Battery Demand Response (the "Battery Demand Response Project"); and (3) the Advanced

Resiliency Management System Project (the "ARMS Project"). In support of its Application, Rocky Mountain Power states as follows:

1. Rocky Mountain Power is a division of PacifiCorp, an Oregon corporation, which provides electric service to retail customers through its Rocky Mountain Power division in the states of Utah, Wyoming, and Idaho, and through its Pacific Power division in the states of Oregon, California, and Washington.

2. Rocky Mountain Power is a public utility in the state of Utah and is subject to the Commission's jurisdiction with respect to its prices and terms of electric service to retail customers in Utah. Rocky Mountain Power's principal place of business in Utah is 1407 West North Temple, Suite 310, Salt Lake City, Utah 84116.

3. Communications regarding this filing should be addressed to:

Jana Saba
Utah Regulatory Affairs Manager
Rocky Mountain Power
1407 West North Temple, Suite 330
Salt Lake City, Utah 84116
E-mail: jana.saba@pacificorp.com

R. Jeff Richards
Daniel E. Solander
Rocky Mountain Power
1407 West North Temple, Suite 320
Salt Lake City, Utah 84116
E-mail: daniel.solander@pacificorp.com

In addition, Rocky Mountain Power requests that all data requests regarding this application be sent in Microsoft Word or plain text format to the following:

By email (preferred): datarequest@pacificorp.com

By regular mail: Data Request Response Center
PacifiCorp
825 NE Multnomah, Suite 2000
Portland, Oregon 97232

Informal questions may be directed to Jana Saba, Utah Regulatory Affairs Manager at (801) 220-2823.

4. This Application is the fifth tranche of proposed STEP programs for which the Company is seeking authorization. Since receiving authorization from the Commission for the first set of innovative utility programs, the Company has continued to seek potential opportunities to partner with stakeholders on additional innovative utility programs that are in the interest of its customers.

5. Based on those efforts, the Company has identified the three programs described in this Application that will provide a variety of benefits, including: (1) providing experience adaptively managing power flow between the grid and electric vehicle charging infrastructure; (2) helping the Company integrate with new technologies as additional distributed generation resources are deployed on the Company's distribution system; and (3) making the Company's distribution grid more progressive.

**Available STEP Funding**

6. The Company's original application to implement programs authorized by STEP, filed September 12, 2016, ("Original Application") presented a STEP Funding Budget as Table 1 on page 4. The Company has updated that table to show the program budgets for STEP projects approved to date and the remaining available STEP Funding.

**Table 1 Updated STEP Funding Budget ($)**

| | Note: | 2017 (Actual) | 2018 (Actual[1]) | 2019 | 2020 | 2021 | Total | Annual Average |
|---|---|---|---|---|---|---|---|---|
| EV Charging Infrastructure | Footnote 2 | 487,502 | 1,880,703 | 2,000,000 | 2,000,000 | 3,300,000 | 9,668,205 | 1,933,641 |
| Clean Coal Technologies | | | | | | | | |
| Woody Waste Co-Fire | Footnote 3 | - | 230,277 | 493,620 | 815,083 | | 1,538,980 | |
| Emerging CO2 Capture | Footnote 3 | 160,451 | 530,289 | 658,639 | 213,000 | 25,000 | 1,587,379 | |
| Sequestration Site Characterization | | 150,239 | - | - | - | - | 150,239 | |
| CO2 Enhanced Coal Bed Methane Recovery | | - | 94,029 | 53,331 | 63,408 | 63,753 | 274,521 | |
| Solar Thermal Assessment | | - | - | 82,951 | 89,992 | 13,500 | 186,443 | |
| NOX Neural Net Implementation | | 457,767 | 207,616 | 216,718 | 32,000 | 32,000 | 946,101 | |
| Advanced NOX Control | Footnote 3 | 131,405 | 26,010 | - | - | - | 157,415 | |
| Subtotal Clean Coal Technologies | | 899,862 | 1,088,221 | 1,505,259 | 1,213,483 | 134,253 | 4,841,078 | 968,216 |
| Innovative Utility Programs | | | | | | | | |
| Battery Storage - Solar | Footnote 4 | 331,995 | 75,474 | 6,102,530 | 120,000 | 120,000 | 6,749,999 | |
| Substation Metering | | 13,767 | 427,349 | 663,538 | - | - | 1,104,654 | |
| Gadsby Emissions Curtailment | | - | - | 60,000 | 100,000 | 100,000 | 260,000 | |
| Line Extension | | - | 69,340 | 500,000 | 500,000 | 500,000 | 1,569,340 | |
| Other Innovative Technology: Microgrid | Footnote 5 | - | 90,713 | 110,000 | 70,000 | - | 270,713 | |
| Other Innovative Technology: Smart Inverter | Footnote 5 | - | 383,859 | - | - | - | 383,859 | |
| **Other Innovative Technology: POWER DEMAND INTERMODAL HUBS** | | | | **815,843** | **951,079** | **228,653** | **1,995,575** | |
| **Other Innovative Technology: BATTERY DEMAND RESPONSE** | | | | **1,470,000** | **1,570,000** | **230,000** | **3,270,000** | |
| Other Innovative Technology (Unallocated) | Footnote 6 | - | - | - | 697,930 | 697,930 | 1,395,860 | |
| Subtotal Innovative Utility Programs | | 345,762 | 1,046,735 | 9,721,911 | 4,009,009 | 1,876,583 | 17,000,000 | 3,400,000 |
| USIP | | - | - | - | - | - | - | - |
| **Conservation, Efficiency and Other New Technology Programs: ADVANCED RESILIENCY MANAGEMENT SYSTEM** | Footnote 7 | - | - | **1,430,000** | **5,690,000** | **9,400,000** | **16,520,000** | 3,304,000 |
| Five Years Projected STEP Fund Use | | 1,733,126 | 4,015,659 | 14,657,170 | 12,912,492 | 14,710,836 | 48,029,283 | 9,605,857 |

Footnotes:
1) 2018 actuals are preliminary and subject to change. Final numbers will be provided in the annual STEP report filing on April 30, 2019.
2) The EV program runs on a FY of September to August of each year. Therefore, 2021 amounts reflect program commitments from the previous years.
3) Amounts reflect the February 11, 2019 order to reallocate funds from the canceled Alternative Nox program to the Co-Fired Woody Waste and Cryogenic Carbon Capture programs.
4) Amount reflects the February 11, 2019 order authorizing an increase the funding for the Battery Storage project.
5) The Microgrid and Smart Inverter projects were approved on October 31, 2017.
6) Approximately $1.4m in funds associated with Other Innovative Technology remain unallocated. The Company is not proposing a use for these funds at this time.
7) Includes the STEP funds previously designated for the Utah Solar Incentive Program (USIP).

7. In the Original Application, a total of $7.85 million was designated for Other Innovative Technology for which the Company committed to file for Commission approval of future projects once identified. On August 15, 2017, the Company filed for, and received approval of, the Microgrid and Smart Inverter programs with a combined approved budget of approximately $700k. Thus, approximately $7.15 million funds associated with Other Innovative Technology are available. In this Application, the Company requests approval for two new projects in this category—approximately $1.96 million for the Intermodal Hubs Project and $3.27 million for the Battery Demand Response Project. As shown in Table 1, approximately $1.4 million remains

unallocated for which the Company is not requesting authorization to spend these funds for a specific use at this time.

8. At the time of Original Application, the Company anticipated that approximately $13 million in STEP funds would be needed for unrecovered costs of the Utah Solar Incentive Program ("USIP"). Based on current information for the USIP incentive payout obligations, these funds will not be needed for USIP. The Company requests the funds be combined with the approximate $5 million for Conservation, Efficiency and Other New Technology Programs and used for the ARMS project, as described below and in the testimony of Company witness Mr. Rohit P. Nair. Approximately $1.5 million remains unallocated for which the Company is not requesting authorization to spend these funds for a specific use at this time.

**Intermodal Hub Project**

9. The proposed Intermodal Hub Project is a partnership with Utah State University's Sustainable Electrified Transportation Center and Utah Transit Authority ("UTA") to develop a power balance and demand response system, including chargers with outputs up to 400 kW, to be installed at UTA's Intermodal Hub located in Salt Lake City.

10. 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 would be the first to combine the 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. The combination of diverse loads allows the opportunity to create an innovative solution to share infrastructure costs and actively manage grid impacts.

11. As more fully described in the Direct Testimony of Company witness Mr. James A. Campbell and Exhibit RMP___(JAC-1), the Company believes that the Intermodal Hub Project would serve as a model for the future deployment of power management systems. The project would also allow the Company to develop tools to optimize system design, which can help avoid oversizing infrastructure equipment in future developments. The Company is requesting authorization to spend approximately $2 million in STEP funds for the Intermodal Hub Project, pursuant to U.C.A. §54-20-105(1)(h) as a technology project that is in the interest of the Company's customers.

**Battery Demand Response Project**

12. The proposed Battery Demand Response Project would be a partnership between the Company and Wasatch Development for the installation of individual batteries in each unit of a 600 unit multi-family development to be constructed. The batteries would be charged by solar facilities, and the Company would have control of the batteries to deploy them for system-wide demand response, similar to the Company's Cool Keeper program.

13. The Battery Demand Response Project is an innovative approach to provide the Company experience with solar and battery integration, along with advanced management of the grid and peak/off-peak energy use. In addition to demand response, the Battery Demand Response Project would also allow the Company to study the value of having behind-the-meter grid-optimized solar and battery storage interconnected to the Company's distribution system, and help the Company evaluate potential rate design options for customers with batteries.

14. As described in the Direct Testimony of Company witness Mr. William J. Comeau and Exhibit RMP___(WJC-1), the Battery Demand Response Project will allow the Company to prepare for larger-scale deployment of battery storage technology and integrate such technology

into the Company's distribution system. The Company is requesting authorization to spend approximately $3.27 million of STEP funds for the Battery Demand Response Project, pursuant to U.C.A. §54-20-105(1)(h) as a technology project that is in the interest of the Company's customers.

**Advanced Resiliency Management System**

15. The proposed ARMS Project includes the installation of encoder receiver transmitter ("ERT") electric meters (also known as automated meter reading facilities), installation of communication radios on distribution line equipment, and deployment of additional line sensor technology on distribution circuits connecting critical customers (e.g. hospitals, trauma centers, and police and fire dispatch) to enable real-time communication with the Company's control center. In addition, the Company is reviewing the deployment of line sensor technology on distribution circuits that have traditionally had poor reliability to improve outage response.

16. The ARMS Project will provide benefits to the Company and its customers by allowing control center operators real-time access to information during major outages to restore service as quickly as possible to critical facilities responsible for public safety and emergency response, while also providing outage information for most other customers in Utah. Installation of the ERT meters will also allow residential and small commercial customers access to interval energy data, which can allow them to make better financial decisions regarding their energy usage. The Company estimates the ARMS Project will provide approximately $71.1 million in reliability benefits to Utah customers over the next 25 years.

17. As described in the Direct Testimony of Rohit Nair and Exhibit RMP___(RPN-1), this project creates a significant opportunity for the Company to develop experience with technologies that can be used for grid modernization applications, including distribution

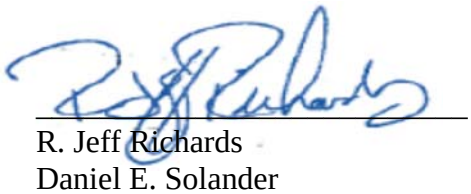
automation, outage management, data analytics, and demand-response programs. The Company is requesting authorization to spend $16.52 million in STEP funds for the ARMS Project pursuant to U.C.A. § 54-20-107, as a cost-effective program that is in the public interest.

WHEREFORE, Rocky Mountain Power respectfully requests that the Commission approve this Application and the proposed programs, as filed, with an effective date of June 6, 2019.

DATED this 8th day of March, 2019.

Respectfully submitted,

ROCKY MOUNTAIN POWER



R. Jeff Richards
Daniel E. Solander

*Attorneys for Rocky Mountain Power*

Rocky Mountain Power
Docket No. 16-035-36
Witness: James A. Campbell

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

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# Direct Testimony of James A. Campbell

March 2019

**Q. Please state your name, business address and position with PacifiCorp dba Rocky Mountain Power ("the Company").**

A. My name is James A. Campbell. My business address is 1407 West North Temple, Salt Lake City, Utah 84116. My present position is Policy and Projects Adviser in the Customer Innovations group.

**QUALIFICATIONS**

**Q. Briefly describe your educational and professional background.**

A. I have a Bachelor of Science in Materials Science and Engineering, a Master of Engineering in Environmental Engineering and a Master of Business Administration all from the University of Utah. I have previously worked as an engineer with Foster Wheeler, Boston Scientific, and the Utah Division of Air Quality. In November 2007, I joined the Company as a Senior Environmental Analyst, and I have also worked as a Legislative Policy Adviser in the Government Affairs group.

**Q. What are your responsibilities as Policy and Projects Adviser?**

A. My primary responsibilities include evaluating and implementing new innovative technologies, policies and programs. I also lead the Company's strategic efforts with electric vehicles and manage the Western Smart Electric Vehicle Community Partnership ("WestSmart EV"), a $4 million United States Department of Energy cost share award to the Company to increase electric vehicle adoption in the intermountain west.

**Q. Have you previously appeared as a witness for the Company?**

A. Yes. I have presented testimony in regulatory proceedings for Rocky Mountain Power in Utah.

## PURPOSE OF TESTIMONY

**Q. What is the purpose of your testimony in this proceeding?**

A. The purpose of my testimony is to explain and provide support for the proposed Power Balance and Demand Response to Optimize Charging at Intermodal Hub Project ("Intermodal Hub Project"). The Company respectfully requests the Commission authorize $1,995,576 in STEP funds for the Intermodal Hub Project pursuant to U.C.A. § 54-20-105(1)(h), as an innovative utility program. Additional details for the project are provided in the exhibit that accompanies my testimony, Exhibit RMP___(JAC-1).

## INTERMODAL HUB PROJECT

**Q. What is being proposed in the Intermodal Hub Project?**

A. The Company proposes to develop a power balance and demand response system for a multi modal transportation hub with electric vehicle charging that has high peak power demand. The electric vehicle charging at the multi modal transportation hub will include chargers with outputs of 400 KW per charger. The primary challenge of these higher wattage chargers is the high cost of grid infrastructure and operation and the associated need for high levels of utilization.

This project addresses the challenge by introducing the concept of the Power Balance and Demand Response Intermodal Hub, together with key research components, to adaptively manage power flow between the grid and various electric vehicle charging needs. The project will leverage a data-driven methodology for forecasting charging demand and expand to consider scheduled routes and demands for TRAX light rail, electric bus route schedules, and vehicle-to-infrastructure communication to inform the Intermodal Hub energy management system of

anticipated demands. Adaptive control algorithms based on forecasting tools will incorporate machine learning techniques that are capable of improving response over time based on historical data. Additionally, cybersecurity measures will be built into the network at the grid interface and site level and at the charger/user interface level. The Intermodal Hub Project will be deployed at the Utah Transit Authority's ("UTA") Intermodal Hub located in Salt Lake City.

**Q. Is the Intermodal Hub Project a new concept?**

A. Yes. This proposal introduces the innovative concept of combining the vast diversity of needs at an intermodal transit center to create multi-megawatt co-located, coordinated, and managed charging systems that minimize infrastructure and operating costs. The state-of-the-art approach is to perform the design and costs based on a worst-case analysis, resulting in much higher infrastructure costs. The proposed approach uses controls, demand management, and intelligent scheduling to limit peak demand while maintaining high quality of service. This results in lower infrastructure costs and lower operating costs due to improved utilization of the infrastructure. The approach combines, at a single site, the electric needs of a light rail system, electric buses, interstate and urban passenger and truck traffic, park-and-ride customers, and first-and-last mile ride hailing and car share service providers. The combination of scheduled and unscheduled services, and high to low power and short- to long-term demands, creates an ideal opportunity to share grid infrastructure costs and actively manage grid impacts and demand charges without significantly impacting quality of service.

**Q. Is the Company partnering with any groups on the Intermodal Hub Project?**

A. Yes. The Intermodal Hub Project is a unique collaboration of the Company, Utah State

University's Sustainable Electrified Transportation Center ("SELECT"), and the UTA. The proposed control system for power balance and demand response will be developed and evaluated at SELECT's Electric Vehicle Roadway research facility and test track and will be deployed and validated at the UTA's Salt Lake City Intermodal Hub. The UTA site will serve as a living laboratory for data collection and a model showcase of sustainable electrified transportation technology.

**Q. What are the potential benefits to customers of the proposed Intermodal Hub Project?**

A. The primary benefit is to develop tools that can avoid oversizing of infrastructure equipment by optimizing system design. 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) to level peak demand loading on the grid.

The system could serve as a model for deployment of highly efficient and intelligent power management systems to additional UTA and other customer sites. For example, UTA needs to upgrade 50 electrical substations that are used to support the existing TRAX light rails. The technology from this project, if proven, could be deployed to the fifty sites to lower infrastructure and operating costs. It could also enable the large scale expansion of an electric transportation network that would improve utilization of the upgraded infrastructure. It is important to note that an

expanded electric transportation network will be critical for the state to develop "a new, extensive, zero emissions transportation system" as it calls for as part of 2030 Winter Olympics bid.[1]

**Q. What are the costs of this Project?**

A. The Company is proposing a budget of $1,995,576 in total through the end of 2021. The project costs go to software algorithm development, hardware installation, development and evaluation at USU, UTA site installation, monitoring, and validation, and development of best practices and generalized tools.

**CONCLUSION**

**Q. Please summarize the proposal for Intermodal Hub Project contained in this Application.**

A. The Company proposes a comprehensive research, development and public demonstration project that will serve as a model for deployment of efficient large-scale, multi modal charging centers consisting of common grid and charging infrastructure with managed power load balancing and operating costs through demand response software and hardware strategies. A primary objective of this project is to develop tools that can avoid oversizing infrastructure equipment by optimizing system design. The proposed cost is $1,995,576 over the three-year term of the STEP pilot period.

**Q. In your opinion, is the Company's Intermodal Hub Project consistent with STEP and in the interest of Rocky Mountain Power's customers?**

A. Yes.

[1] Olympic & Paralympic Exploratory Committee Report, February 2018.

**Q. Does this conclude your direct testimony?**

A. Yes.

Rocky Mountain Power
Exhibit RMP___(JAC-1)
Docket No. 16-035-36
Witness: James A. Campbell

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

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Exhibit Accompanying Direct Testimony of James A. Campbell

# Power Balance and Demand Response to Optimize Charging at Intermodal Hubs

March 2019

**Rocky Mountain Power**

# *Power Balance and Demand Response to Optimize Charging at Intermodal Hubs*

# Sustainable Transportation and Energy Plan

## *Utah Innovative Technology*

**Project Sponsor: Chad Teply**

**Revision: 1**

**Revision by: James Campbell**

**Date: January 10, 2019**

# 1 Executive Summary

As part of the Sustainable Transportation Energy Plan (STEP), Rocky Mountain Power (The Company) requests $1,995,576 to develop a power balance and demand response system for multi modal vehicle charging at sites with high peak power demand. The primary goals are to reduce peak loads and increase utilization of charging equipment which should minimize both infrastructure upgrade and operating costs. This unique collaboration of the Company, USU's Sustainable Electrified Transportation Center (SELECT), and Utah Transit Authority (UTA) will demonstrate the ability to manage the challenges of meeting and coordinating expanding high power vehicle charging demands. The proposed system will be developed and evaluated at the Utah State University Electric Vehicle Roadway (USU EVR) research facility and test track and will be deployed and validated at the UTA Salt Lake City Intermodal Hub (Fig. 1). The UTA site will serve as a living laboratory for data collection and a model showcase of sustainable electrified transportation technology. The lessons learned should reduce the costs for both customers and the system as EV adoption becomes more widespread; thus, this project's objectives are to *develop best practices* for new technology function and deployment and to *evaluate the merit of the technology's application*.


*Figure 1. Utah Transit Authority Intermodal Hub in Salt Lake City.*

# 2 Power Balance and Demand Response

The Company proposes a comprehensive research, development and public demonstration project that will serve as a model for deployment of efficient large-scale, multi modal charging centers consisting of common grid and charging infrastructure with managed power load balancing and operating costs through demand response software and hardware strategies.

A primary challenge for high power electric vehicle (EV) charging is the


*Figure 2. UTA Intermodal Hub aerial view showing current multi modal charging infrastructure.*

independent deployment of charging for different vehicle types as shown at the Intermodal Hub in Fig. 2 (e.g., light and heavy duty vehicles, trains, buses) with a wide range of operational scenarios (e.g., transit/fixed routes, fleets, ride hailing, general use). The traditional approach is to evaluate worst-case conditions and require costly reconductoring and transformer and meter upgrades for each addition of charging equipment. This proposal introduces the innovative concept of combining the vast diversity of needs at an intermodal transit center to create multi-megawatt co-located, coordinated, and managed charging systems that guarantee through controls that worst-case analysis and costing is not required. The approach combines, at a single site, the electric needs of a light rail system, electric buses, interstate and urban passenger and truck traffic, park-and-ride customers, and first-and-last mile ride hailing and car share service providers. The combination of scheduled and unscheduled services, and high to low power and short to long term demands, creates an ideal opportunity to share grid infrastructure costs and actively manage grid impacts and demand charges without significantly impacting quality of service.

**Research activities** – Key research activities will lead to accomplishing the objectives of establishing best practices and evaluating the technology.

*Algorithm development* – To determine optimal scheduling of multi-modal electric demand, including TRAX light rail, e-bus opportunity and depot charging, commuter parking, ride hailing, and fleets, effort will be dedicated to evaluating and developing intelligent prediction algorithms. These Machine Learning (ML) tools will be used to 1) train the system on historical training datasets and continue the learning process with new data as the program progresses and 2) consider framework options such as Markov Decision Process (MDP) to model the charging control process and multiple Dynamic Programming (DP) options such as k-Nearest Neighbors, deep neural network, and shallow neural network to project optimal charge scheduling and demand response. The algorithm outputs will be used to optimize charge scheduling of the electric buses and to consider the potential impact for demand response pricing and incentives for public charging.

*EV charge scheduling and prioritization tools* – Central processing algorithms and remote apps will be developed that can be used by demand response participants. This development will leverage ML algorithms running on a central server to predict optimal charging times and power profiles. These will be developed first to prioritize bus charge scheduling for overhead high power charging and for depot charging. The effort will consider options to tie the approach into the dispatch system for electric buses and implications on bus routing and fleet management. The approach will then be extended to public charging scenarios and development of potential apps and associated incentive programs and demand response pricing to encourage truck, fleet and passenger vehicle charging that increases energy demand without increasing peak demand.

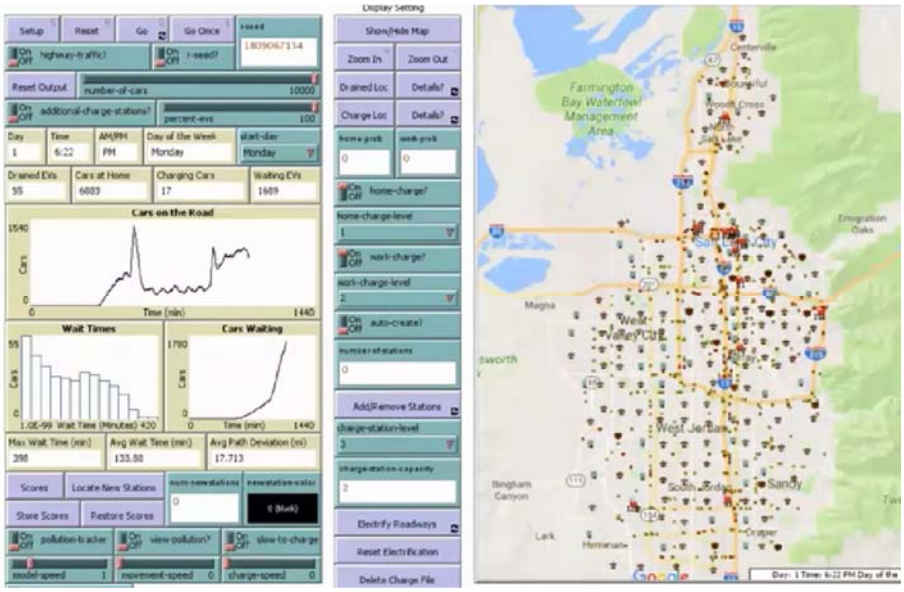


*Figure 3. Sample of agent based simulation showing vehicles traveling through the Salt Lake valley along with their proximity to and use of charging infrastructure (courtesy Dr. John Salmon, Brigham Young University).*

*Grid distribution analysis and system simulation model development* – The developed system will model electric demands across the multi modal network with agent based solutions (e.g., Fig. 3) for fleets and ride hailing as well as deterministic models for bus and train routes. This new understanding will be merged with localized **grid distribution circuit models,** which will be leveraged to evaluate potential impacts for demand response and scheduling control. The model will be used to directly compare worst-case analysis solutions with the proposed managed solution. The simulation testbed will be used to evaluate both the planned early stage deployment with two or three overhead bus chargers and limited public charging and a long term vision for broad deployment with six overhead chargers, 27 or more electric buses and depot chargers, and public charging for truck and passenger vehicles. The model can also be leveraged as a planning tool for future multi modal sites, such as additional TRAX stations along I-15.

*Figure 4. USU EVR capabilities include 750 kW utility, 4,800 sq ft dual high bay, quarter mile test track, L2 and 50kW DC fast charging, DC & AC microgrid, 100 kWh on-site energy storage, and 120kW solar array.*

*Hardware system development and demonstration* – This project will develop specifications and design primary processing and data servers and software for the intermodal system, which will include a bid and procurement process for system hardware as well as programing and evaluating the hardware system at USU's EVR research facility and test track prior to deployment at UTA sites. A similar process will be followed for on-vehicle and grid monitors.

**System testbed** – Prior to public deployment, a scaled version of the engineered system will be set up at the EVR facility (Fig 4.), tying into its solar power enabled microgrid. The EVR's research capability has much of the testing equipment required, including electric and autonomous test vehicle platforms such as a 22-passenger

electric bus and electric Ford Focus, a broad EV charging network with a DC fast charger, multiple L2 chargers, and a wireless charging system, and battery loads that can be used to emulate the train and facility loads.

The project's hardware will be coded and tested at the EVR in parallel with development of control algorithms and software designed to anticipate grid impact and manage power demand for common charging hardware across varying vehicle charging modes and demand profiles. This initial deployment with the test vehicles in the EVR's controlled test environment will provide both algorithm development opportunity and hardware insights that will feed into a larger scale, full deployment. For example, scheduling charging for the EVR's electric bus (simulating a transit vehicle on fixed route) on the facility's test track, in combination with regular charging of the EVR's electric Ford Focus (simulating a ride hailing vehicle on a regular charging schedule) along with random charging from EVs that use the EVR's chargers will provide a realistic test bed to develop initial best practices and system evaluation.

**Intermodal Hub deployment** – The UTA Intermodal Hub is ideally located just off of I-15 and I-80 (Fig. 5) and a few blocks from downtown SLC, with public transit service from UTA's TRAX light rail with routes to the airport and downtown, UTA FrontRunner commuter train, and Amtrak and Greyhound service. The site already includes sufficient public parking and areas for queuing of ride hailing providers and charging fleet vehicles, and includes easy access to downtown SLC amenities and attractions. The project leverages expected UTA deployment of six 450+ kW chargers for electric buses; multiple 50-150kW DC fast chargers, primarily targeting short-stop passenger vehicles, fleet vehicles, and ride hailing providers; Level 2 AC chargers for park-and-ride customers leaving SLC and interstate traffic visiting SLC; and site planning and simulation for future expansion of megawatt electric truck charging.


*Figure 5. UTA's Intermodal Hub ideally located near downtown SLC and Interstate corridors.*

Since the routes of buses in and out of the intermodal hub are known, the power consumption needs can be determined within certain parameters. Thus, bus charging needs can be managed in coordination with trains and other anticipated power needs (relative to actual charging) for ride hailing, private cars, etc. This management approach can be adjusted in real time through the ML demand response strategies under development. The project will add in charging of light, medium and heavy duty trucks (LDV-HDV) from local fleets to expand the broader application of software/hardware under load management through demand response.

**Planned vehicles** – The project vehicles include light rail trains, fleet operated public buses, and passenger vehicles located at the deployment site. As part of this project, UTA will have three e-buses in service by April, 2019, with three e-bus routes: (1) Intermodal Hub to University of Utah with five e-buses, (2) rotator through downtown with five e-buses, and (3) a connector to Park City with 10 e-buses. UTA has requested an additional 27 electric buses

to rotate into service over the next several years at the deployment site, including Xcelsior Charge New Flyer electric buses with 454 kWh battery that will be the initial high power load at the site. UTA will purchase additional Proterra buses with 600 kWh capacity during the project's performance period. The project will also work with local EV fleets. All the chargers at all power levels will be compatible with and available for use by public vehicles, including existing 50 kW and future higher power EVs. A site level commercial grid energy management system will coordinate power demand between the electric buses and passenger vehicles, the TRAX light rail system, and the Intermodal Hub facilities.

## 3 Purpose and Necessity

The current state-of-the-art includes up to 400 kW chargers and the planned release of compatible vehicles over the next three years. The primary challenge is the high cost of grid infrastructure and operation and the associated need for high levels of utilization. This project addresses the challenge by introducing the concept of the Power Balance and Demand Response Intermodal Hub together with key research components to adaptively manage power flow between the grid and various EV charging needs. The project will leverage a data-driven methodology for forecasting charging demand and expand to consider scheduled routes and demands for TRAX light rail, e-bus route schedules, and vehicle-to-infrastructure communication to inform the Intermodal Hub energy management system of future charging intentions as well as anticipated needs. Adaptive control algorithms based on the forecasting tool will incorporate ML techniques and will be realized with the control hardware. Additionally, cybersecurity measures will be built into the network from the beginning at the grid interface and site level and at the charger/user interface level.

## 4 Benefits

**Potential project impact** – 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.

Future funding for expanded deployment could include installations at the airport, Park City, and the UTA Ogden and Orem Depots.

## 5 Public Interest Justification

- Lends to adoption and deployment of electric vehicles that will help to dramatically reduce tailpipe emissions and increase Wasatch Front air quality
- Helps UTA expedite a more rapid conversion to electric vehicles
- Enables a greater understanding of these innovative solutions as the Company continues to make the grid more progressive

- Provides the Company, Utah Public Service Commission, and other stakeholders with information regarding the capabilities of power balancing and demand response technology
- Enables the Company to become familiar with and utilize innovative technologies to provide customers with solutions to power management issues
- Provides guidance to the company's distribution engineers to enhance the company's distribution planning process
- Continues helping the Company to experience rapid growth in power management requests and considers innovative technologies a valuable tool to improve service to customers
- Provides a better understanding of high power multi modal vehicle charging setting and will potentially assist in improved utilization of grid assets leading to cost savings for customers
- Aligns with the goals of the STEP program to support the greater use of renewable energy

## 6 Project Team

The strength of this team exists in its diverse and comprehensive partnerships between industry, metro transit, and university research capability, along with successful collaboration history and access to state-of-the-art facilities.

- **Rocky Mountain Power**, will provide expertise and insights into grid infrastructure and operating costs and cybersecurity and grid connection requirements.
- **USU**, as lead of the SELECT Center, has extensive experience in EV charging infrastructure and grid integration and assist with direct MV connection and site planning, modeling and control. The SELECT team has extensive experience successfully managing multi-million dollar, multi-university and industry partner contracts from DOE, DOD, and industry funding sources.
- Established in 1970, **UTA** serves more than 80% of Utah's population with commuter rail, light rail, buses, ride share, paratransit and more, and will be providing access to the SLC Intermodal Hub and its power and communication networks.

## 7 Legislative Compliance with SB115

The power balancing and the demand response project meets the legislative intent of SB115 54-20-105-1(h) that pertains to "any other technology program" in the best interest of the customers in the state of Utah. This project falls under the STEP's discretionary allotment of funds as part of the Utah Innovative Technology category.

## 8 Alternatives Considered

The default alternative is to apply traditional worst-case analysis and costing to all new charging equipment at the intermodal hub and future sites. This results in very high upfront costs and variable ongoing high demand charge costs. One alternative is to purchase and install on-site energy storage with grid tied inverters to perform peak load shedding. This requires on-site energy storage that exceeds, by a safe margin, the peak power and energy

demand for the TRAX and the overhead chargers. This approach is likely to also have high upfront and operating costs for similar reasons to the worst-case solution. The energy storage and grid tied inverters are rated for full peak to average power but have low utilization and are only used during the worst-case peak loading events. The batteries will age with cycling and must be maintained. They also present a safety hazard, will require review and certification with the fire marshal, and may require rezoning. Solar power can also be added on-site to reduce grid demand during sunlight, but without a managed solution would still require a worst-case analysis and costing for the peak loads on the system.

The proposed approach may be combined in the future with energy storage and solar power to provide critical load backup and a local load for the variable renewable source. The algorithms could be further adapted to predict solar power levels and to minimize the upfront cost and ongoing aging of the battery pack while balancing the managed system loads.

## 9 Purpose and Necessity – Risk Analysis

Through cooperation with co-location, coordinated, managed operation with minimized grid impact and reduced overall cost, the project will catalyze intermodal integration, and its impact can be measured in terms of expediting and expanding the concept while spurring the advanced control innovations necessary for multi-modal charging and mitigating or curbing potential negative grid impacts. Such advancement can be leveraged to secure additional funding for the collaboration from U.S. Department of Energy and other sources as anticipated funding opportunities in these technology areas are announced.

**Key technical risks/issues** – Advancing charging technologies are expected to come to market in the very near term in advance of market vehicle introduction. Some electric buses, for example, currently charge at what is known as extreme fast charging (XFC) levels, but charging equipment for these buses is not standardized. This project will work closely with industry partners to both future proof for and manage the challenges of upgrading charging infrastructure in step with vehicle technology introduction.

The Company impacts without this project:

- Neglecting an emerging technology and failing to preemptively identify its associated impact to the distribution system could potentially put system reliability and power quality at risk.
- A higher cost solution with non-innovative technology will impede any efforts to learn from implementing progressive grid technologies.

## 10 Project Tasks and Deliverables

The project tasks and deliverable are detailed in this section. The overall project covers the research efforts described earlier and provides initial hardware and software development and evaluation in a controlled environment at the USU EVR and a final deployment phase in downtown SLC at the UTA Intermodal Hub.

The overall project development begins with an anticipated July 1, 2019 start and proceeds with the tasks and timeline as show in Table 1:

*Table 1. Detailed project tasks and timeline.*

| **Task 1 – Analysis and Planning**<br>*July 1, 2019 – December 31, 2019* |
|---|
| Multi modal charging analysis (power levels, vehicle types) |
| Distribution capacity/needs/impact analysis |
| City and suburban level planning of grid and transportation charging integration |
| Confirm study participants in addition to UTA (e.g., fleet, including delivery and ride hailing participant vehicles) |
| **Task 2 – Distribution System Simulation Planning and Validation**<br>*October 1, 2019 – December 31, 2020* |
| Design initial intelligent prediction algorithms and demand response concepts |
| Develop system simulation models for charging network and agent-based vehicle response |
| 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)<br>Data used for algorithm development and as machine learning training datasets |
| Perform systems level simulation analysis for early and broad deployment scenarios, validate benefit of managed approach when compared to worst-case design approach |
| **Task 3 – Testbed for Software/Hardware Development and Integration**<br>*January 1, 2020 – March 30, 2021* |
| Specify, bid, and procure system hardware |
| Anticipate needs for and develop cyber security management<br>Design for compatibility with and security of communication network |
| Write code and program algorithms on servers<br>Algorithms include energy/load balancing and management<br>Design for compatibility with AMI |
| Evaluate hardware system (with integrated software) at the USU EVR |
| Iterate algorithm designs and develop pilot demand response program |
| **Task 4 – Deployment and Evaluation** |

| *October 1, 2020 – December 31, 2021* |
|---|
| Integrate hardware and software systems with UTA and RMP equipment and cyber secure communication network |
| Deploy hardware system at the UTA multi-modal hub site through a phased approach in direct coordination with IT and operations at UTA |
| Finalize recruiting, engage work with participants for pilot demand response program |
| Integrate real-time data collection from all partners and participants into the hardware system |
| Evaluate power control and demand response performance; iterate algorithms; develop best practices and recommendations |

Table 2 shows the project flow over its 30-month timeline by quarter.

*Table 2. Summary of project tasks and timeline.*

| **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 | | | | | | | | | | |

## 11 Program Closure

In 2021, the Company will report back to the Utah Public Service Commission regarding lessons learned and the status of report recommendations. If it is necessary to report more often to comply with the STEP statute or other reporting requirement, the Company will comply with those requirements.

Post project completion, all equipment associated with the project installed at the USU EVR will be owned and operated by USU, and all equipment associated with the project installed at the SLC UTA Intermodal Hub will be owned and operated by UTA. The Company will reserve the right to access, participate in, and/or propose follow up projects involving the equipment.

## 12 Project Delivery Risk Factors

The project will be managed to mitigate typical project risks (design and construction resources, permitting material deliveries, weather, etc.) as it applies to scope, schedule, and budget. Appropriate documentation will be created, tracked and communicated to properly manage the project. The appropriate risk mitigation measures will be identified and resolved in the project development phase. Given the emerging technologies associated with the project, there is some risk of incompatibility between various components, which may

introduce additional time in the deployment stage of the project. These risks will be identified in detailed project plans with appropriate timeframes to resolve.

## 13 Target Costs, Budget

Table 3 shows the anticipated budget for USU and the Company. See USU budget breakdown in Appendix A.

*Table 3. Project budget by USU fiscal year.*

| Costs | FY 2019 | FY 2020 | FY 2021 |
|---|---|---|---|
| Utah State University | $802,509.89 | $877,745.90 | $215,320.46 |
| Rocky Mountain Power Internal Engineering and Project Management | 13,333.33 | 73,333.33 | 13,333.33 |

## 14 Accounting Issues or Regulatory Recovery Issues

All expenses towards this project will be recovered through the accounting workflow setup for the Utah Innovative Technologies under the Sustainable Transportation and Energy Plan.

Procurement and Project Delivery Strategy

- Project specifications shall be developed in accordance with applicable engineering specifications and standard designs.
- Utah State University EVR shall procure equipment with approval from the Company project team and will be reimbursed for approved purchases.
- Project delivery strategy to be determined by project team as outlined in Project Tasks and Deliverables.

## 15 Recommendation

- Purchase and install required power balancing and demand response components and controls to operate the Utah State University EVR as a testbed.
- Purchase and install required power balancing and demand response components and controls for deployment at the UTA SLC Intermodal Hub.

**APPENDIX A**

USU Budget Summary by program year.

| | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|
| **Personnel** | | | | |
| > Salary | $206,705.81 | $235,488.71 | $117,744.37 | $559,938.89 |
| > Fringe | $37,273.94 | $39,688.29 | $19,844.14 | $96,806.37 |
| Calculated Direct Costs | $0.00 | $0.00 | $0.00 | $0.00 |
| Personnel Subtotal | $243,979.75 | $275,177.00 | $137,588.51 | $656,745.26 |
| **Non-personnel** | | | | |
| > Equipment | $410,000.00 | $390,000.00 | $0.00 | $800,000.00 |
| > Travel | $4,900.00 | $4,900.00 | $0.00 | $9,800.00 |
| > Participant Support | $24,000.00 | $24,000.00 | $12,000.00 | $60,000.00 |
| > Other Direct | $5,265.00 | $55,265.00 | $2,632.50 | $63,162.50 |
| Calculated Direct Costs | $0.00 | $0.00 | $0.00 | $0.00 |
| Non-personnel Subtotal | $444,165.00 | $474,165.00 | $14,632.50 | $932,962.50 |
| **Totals** | | | | |
| Total Direct Cost | $688,144.75 | $749,342.00 | $152,221.01 | $1,589,707.76 |
| Total F&A Costs | $114,365.14 | $128,403.90 | $63,099.45 | $305,868.49 |
| Totals Subtotal | $802,509.89 | $877,745.90 | $215,320.46 | $1,895,576.25 |

Rocky Mountain Power
Docket No. 16-035-36
Witness: William J. Comeau

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

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# Direct Testimony of William J. Comeau

March 2019

**Q. Please state your name, business address, and present position with PacifiCorp dba Rocky Mountain Power ("the Company").**

A. My name is William J. Comeau and my business address is 1407 West North Temple, Suite 330, Salt Lake City, Utah 84116. I am currently employed as the Director of Customer Innovations for Rocky Mountain Power.

## QUALIFICATIONS

**Q. Briefly describe your educational and professional background.**

A. I have a Bachelor of Science from Weber State University and a Master of Business Administration from Keller University. During my 19 years of working in the utility industry, I have held multiple responsibilities including economic development, customer service, demand side management, customer solutions, and since May 2018, Director of Customer Innovations.

**Q. What are your responsibilities as Director of Customer Innovations?**

A. My primary responsibilities include helping customers implement innovative energy solutions, such as new technology requests from customers.

## PURPOSE OF TESTIMONY

**Q. What is the purpose of your testimony in this proceeding?**

A. The purpose of my direct testimony is to support the Wasatch Development Partnership Project for Battery Demand Response ("Battery Demand Response Project"), described in the Application and in Exhibit RMP___(WJC-1). The Company respectfully requests the Commission authorize $3.27 million in Sustainable Transportation Energy Plan's ("STEP") funds for the Battery Demand Response Project pursuant to U.C.A. § 54-20-105(1)(h), as an innovative utility program.

## BACKGROUND

**Q. Please describe the historical events that lead to the partnership with Wasatch Development for the Battery Demand Response Project.**

A. In January 2018, Wasatch Development ("Wasatch") approached the Company with a proposal to partner with the Company to make an innovative solar and battery solution possible with the development of a 600 unit multi-family community ("Soleil"). The Company and Wasatch worked together throughout 2018 to develop a mutually beneficial battery concept for utilization of the batteries. The concept allows the Company to have full control of the batteries for advanced grid management, including demand response.

## BATTERY DEMAND RESPONSE PROJECT

**Q. Please describe the Battery Demand Response Project.**

A. The Battery Demand Response Project, if authorized, will provide a unique opportunity for the Company to partner with Wasatch and the battery manufacturer to implement an innovative approach to solar and battery integration, along with advanced management of the grid and peak/off-peak energy use. The Battery Demand Response Project will involve the development of a 600 unit multi-family community, with individual batteries, manufactured by Sonnen, for each unit. The solar facilities will charge the batteries during the day and the Company will have control of the batteries to provide energy for the residents during peak periods in the evening and at night. During system needs, the batteries will be utilized for demand response, similar to the Company's residential air conditioner demand response program, Cool Keeper.

Leveraging the Soleil community batteries will create opportunity in the following

areas:

- **Demand Response –** This partnership project will enable the Company to utilize each individual battery for demand response 24 hours per day throughout the year. This has the potential to offset all of the peak grid loads from the Soleil apartment complex and will reduce peak loading on the electric system.

- **Load Shaping** – The Company will examine the value of having behind-the-meter grid-optimized solar and battery storage interconnected to the Company's electrical system. The Company typically has limited behind-the-meter data, so this experience will help the Company prepare for large scale integration of such technology/projects, which are expected to become available options for customers as technology prices decline.

- **Rate Design** – The Company's current rates are not optimized for battery storage applications. Evaluating behind-the-meter battery behavior will help guide and inform future rate design for customers with batteries.

Exhibit RMP___(WJC-1) which accompanies my testimony provides additional details and support for the Battery Demand Response Project.

**Q. Why is Wasatch willing to partner and allow the Company to control the use of the batteries?**

A. Due to batteries being an emerging technology, Wasatch needed the Company partnership to optimize the use of the batteries with the distribution grid. In addition, the STEP funding for battery hardware and integration is necessary to make the batteries financially viable to implement.

**Q. Please provide details of the project costs.**

A. The total cost of the Battery Demand Response Project is estimated to be $34.3 million, of which approximately $12 million is for the purchase of the batteries. The Company is requesting $3.27 million of STEP funds to be allocated for this project. The $3.27 million of STEP funds provides full access to data and control of the batteries for the life of the project, approximately 20 years. Without the partnership and funding,

Wasatch does not intend to move forward with the installation of the batteries. A breakdown of how the $3.27 million will be allocated is provided in the table below.

**Table 1 – Estimated Battery Demand Response Project Costs**

| Cost Estimates | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|
| RMP Energy Management System (EMS) integration | $100,000 | $100,000 | N/A | $100,000 |
| Battery hardware and integration - Soleil | $1,250,000 | $1,250,000 | N/A | $2,500,000 |
| Utility portal software integration and license fees - Sonnen | $100,000 | $150,000 | N/A | $250,000 |
| 3rd party analysis | N/A | N/A | $150,000 | $150,000 |
| Internal labor costs | $20,000 | $20,000 | $30,000 | $70,000 |
| Contingency: | N/A | $50,000 | $50,000 | $100,000 |
| **Total:** | **$1,470,000** | **$1,570,000** | **$230,000** | **$3,270,000** |

**Q. What benefits will the Battery Demand Response Project provide?**

A. The Battery Demand Response Project will benefit customers by enabling the Company to explore options to expand innovative technology options, such as batteries, to improve service options to customers. By partnering with Wasatch for the Battery Demand Response Project, the Company will be able to test the feasibility and economic benefit of battery demand response and study behind-the-meter battery behavior for a fraction of what it would normally cost. The grid will be utilized optimally through daily peak usage reductions, which could lead to cost savings for customers and reduce transmission congestion during summer peak loading periods. The Battery Demand Response Project also provides a renewable and battery grid management solution that can be used to help inform future micro-grid type solutions. The batteries will provide back-up power during grid power outages for each individual apartment, and the first-hand experience gained with behind-the-meter energy storage

information will inform optimized rate design for customers with batteries, and help the Company prepare in advance of large scale integration of such technology.

## CONCLUSION

**Q. Please summarize the proposal for the Battery Demand Response Project.**

A. As battery storage technology develops and becomes more available to customers, the Company will need to be prepared for large scale integration of such technology. The Battery Demand Response Project will help the Company prepare for this type of integration. This project also provides an opportunity for demand response solutions, and will help inform future rate design for customers with batteries.

**Q. In your opinion, is the Battery Demand Response Project consistent with the STEP Act and in the interest of Rocky Mountain Power customers?**

A. Yes.

**Q. Does this conclude your direct testimony?**

A. Yes.

Rocky Mountain Power
Exhibit RMP___(WJC-1)
Docket No. 16-035-36
Witness: William J. Comeau

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

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Exhibit Accompanying Direct Testimony of William J. Comeau

Utah Battery Demand Response Project

March 2019

# Utah Battery Demand Response Project – Behind the Meter

# Rocky Mountain Power

## 1 Executive Summary

As part of the Sustainable Transportation and Energy Plan (STEP), Rocky Mountain Power (the Company) is requesting $3.27 million to develop a demand response solution utilizing residential behind-the-meter batteries. The project will also examine the viability of daily load shaping through 621 individual apartment batteries, assess their grid-optimized value and inform future rate design.

## 2 Purpose and Opportunity

In January 2018, Wasatch Development approached the Company with a proposal to partner to make an innovative solar and battery solution possible. Wasatch Development is committed to leading the innovation of sustainability in buildings and is in the process of developing a 600 unit multi-family community (Soleil) within the Wasatch Front. This project provides a unique opportunity for the Company to implement an innovative solution for solar and battery storage integration along with demand response and advanced management of the grid through daily peak/off-peak energy load shaping.

The project will include the development of a Company owned utility data and dispatch portal with direct access to 621 8kW Sonnen batteries for a total of 4.8 megawatts of capacity and 12 megawatt hours of energy. In addition to the cost savings with leveraging the Soleil community partnership, the project creates opportunity in the following areas:

- **Demand Response –** This partnership project will enable the Company to have full access and control of the batteries for demand response and load shaping 24 hours a day throughout the year. The intent will be to develop an optimized solution for daily load management and demand response based upon the actual performance of the system.

- **Load Shaping** – The Company will examine the value of having behind-the-meter grid-optimized solar and battery storage communities interconnected to the Company's electrical system. The Company typically has limited behind-the-meter data, so this gained experience will help the Company prepare in advance of large scale integration of such technology/projects that are becoming available options for customers as battery prices decline.

- **Rate Design** – The Company's current rates are not optimized for battery storage applications. Evaluating behind-the-meter battery behavior will help guide and inform future rate design for customers with batteries.

## 3 Benefits and Innovation

- Provides a renewable and battery grid management solution behind the meter that can be used to help design micro-grid type solutions and customer rates in the future.
- Enables the Company to get first-hand experience with behind-the-meter energy storage combined with solar. This gained experience will help the Company prepare in advance of large scale integration of such technology/projects that are becoming available options for customers as price declines.
- Currently do not have customer rate options that are optimized for behind-the-meter battery applications. The data from the partnership will help inform future rate designs for customers with batteries.
- Development of a behind-the-meter battery demand response solution that has the potential to offset all of the grid loads from the apartment complex. The project will also determine the feasibility of discharging excess battery capacity into the grid as a utility controlled option and, if possible, implement that solution.
- Provides for the ability to determine financial benefits and feasibility of battery demand response technology, including frequency response.
- Enables the Company to become familiar with and utilize innovative technologies to provide customers with solutions they are starting to ask for, such as batteries and micro-grids.
- Allows evaluation of customer network reliability for demand response solutions.
- Ability to manage load on the electric system due to the Sonnen battery control technology optimizing for daily peak load shifting.
- The batteries will provide back-up power during grid power outages for each individual apartment. The Sonnen batteries will continue to be charged from the on-site solar and provide backup power during grid outages, allowing RMP to test this type of solution for future applications.
- If proven successful, provides a utility dispatch platform solution that can be utilized for all Sonnen batteries in the Companies service territory.

## 4 Public Interest Justification

- The Company is exploring options to expand renewable energy and innovative technology options to improve service to customers.
- The Company is taking steps to prepare for future deployments of micro-grids and innovative customer options.
- Allows for testing the feasibility and economic benefits of customer owned behind-the-meter battery demand response solutions.
- A “partnership” approach allows the Company to test and study behind-the-meter battery solutions on a larger scale at a much lower cost.

- Better utilization of the grid through daily peak usage reductions considering the energy storage device is expected to recharge with solar during off-peak hours and discharge during peak periods.
- Improved utilization of grid assets.
- Reduction in transmission congestion during summer peak loading periods.

## 5 Legislative Compliance with SB115

The proposed solution for the Soleil partnership meets the legislative intent of SB115 54-20-105-1(h) that pertains to "any other technology program" in the best interest of the customers in the state of Utah. This project falls under the STEP's discretionary allotment of funds as part of the Utah Innovative Technology category.

## 6 Alternatives Considered

**Alternatives considered that resolve the customer's and demand response needs:**

Alternative – Company build and maintain a 5 MW solar and 4.8 MW battery solution behind-the-meter for Soleil

Description
The developer of the Soleil project originally approached the Company to build them an on-site solar and battery solution to meet their air quality goals.

Advantages
1) Developer could focus on their building while having the utility provide the solar and battery solution
2) Allow the Company to provide a behind-the-meter solution, as requested from the customer

Disadvantages
1) More expensive than proposed solution. Due to the short-term tax benefits it was determined the project was more economic for the developer to build and own during the first 5 years for accelerated depreciation.
2) Due to customer's needs there would not be enough time to develop a regulatory solution for rates and utility ownership.

Block estimate
$34,300,000

## 7 Purpose and Necessity – Risk Analysis

Company impacts without this project/solution:

- In the absence of the proposed solution, the Company will need to deploy higher cost options to obtain the benefits of a behind-the-meter battery demand project.
- Delays the opportunity to study actual impacts of a behind-the-meter battery solution on the grid. The data learned from this project can help determine value of batteries and future rate designs.
- The partnership limits project solar and battery construction risks for the Company as those costs are born by the developer.

## 8 Major Project Milestones

- June 2019 – Finalize agreements with Wasatch and Sonnen
- July 2019 – Battery installations start
- September 2019 - First building completed
- February 2020 – Utility demand response portal complete
- Jul 2020 – Demand response solution ready for dispatch
- September 2020 – Last building completed
- December 2020 – Full 4.8MW available for control

## 9 Reporting and Decommissioning

The Company will evaluate lessons learned and provide recommendations based upon data collected and intends to use a 3rd party to perform the analysis. If it is necessary to report more often to comply with the STEP statute or other reporting requirement, the Company will comply with those requirements.

The Company will hire a third party consultant to assist in quantifying the benefits achieved from the energy storage system for both the host customer and the company. In addition to project reporting the selected consultant will assist in developing a cost-benefit computation methodology. This methodology will attempt to compare achieved benefits realized through the operation of the storage facility, with projected benefits for Soleil, customers and the Company.

For this project and a condition of the partnership, decommissioning of the solar and batteries will be the responsibility of the facility (Soleil) as opposed to utility-owned assets which are typically the responsibility of the Company.

## 10 Project Delivery Risk Factors

A few project risk factors have been identified that will need special attention through implementation. There are risks associated with:

- Construction and integration of the solar and battery solution within the Soleil project. This will be one of the first projects of its kind and will be subject to the potential risks with the implementation of new technologies. To minimize the financial risk, payments to Soleil will be contingent upon successful commissioning of the solar and batteries at the buildings.
- The software solution for data analysis and demand response needs to be tested and integrated within the Companies systems.
- The Company has limited prior experience of integrating a customer owned battery project of this size into the grid.

## 11 Project Costs

The total cost of this partnership project is estimated to be $34.3 million, of which approximately $12 million is for the purchase of the batteries. The $3.27 million contribution through STEP funds provides full access and control of the batteries for the life of the project, approximately 20 years, and is necessary for Wasatch Development to make the battery component of the project economically viable. Without the partnership and funding, Wasatch does not intend to move forward with the installation of the batteries. A breakdown of how the $3.27 million will be allocated is provided in the table below.

| Cost Estimates | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|
| RMP Energy Management System (EMS) integration | $100,000 | $100,000 | N/A | $100,000 |
| Battery hardware and integration - Soleil | $1,250,000 | $1,250,000 | N/A | $2,500,000 |
| Utility portal software integration and license fees - Sonnen | $100,000 | $150,000 | N/A | $250,000 |
| 3rd party analysis | N/A | N/A | $150,000 | $150,000 |
| Internal labor costs | $20,000 | $20,000 | $30,000 | $70,000 |
| Contingency: | N/A | $50,000 | $50,000 | $100,000 |
| **Total:** | **$1,470,000** | **$1,570,000** | **$230,000** | **$3,270,000** |

## 12 Regulatory Recovery

Expenses towards this project will be recovered through the accounting workflow setup for the Utah Innovative Technologies under the Sustainable Transportation and Energy Plan.

## 13 Recommendation

- Partner with Wasatch to evaluate the benefits of behind-the-meter battery solutions and implement a pilot battery demand response project as part of the Soleil project.
- Leverage the $34.3 million solar and battery project at Soleil to study and develop a battery demand response solution.
- Provide $3.27 million in STEP funds to cover the hardware and integration costs of the batteries and for the Company to have full control for demand response through the life of the project.

# APPENDICES

- Appendix A – Wasatch Group Information
- Appendix B – Soleil Lofts Overview
- Appendix C – Sonnen Batteries Information

# APPENDIX A – Wasatch Group Information

## The Wasatch Group

The Wasatch Group partners with cities, lenders, investors and innovators in envisioning, developing and rehabilitating real estate properties that enhance communities through innovation. Our experience, knowledge, reputation and proven track record in combination with our financial strength makes us the safe and recognized choice for innovative real estate development.

The Development and Construction Division has a mandate to meet the growing need for both market-rate and affordable rental housing communities throughout the western United States. Our vision is to participate in real estate transactions which enhance and add value to the surrounding communities where we are active. We also seek out opportunities for other special projects that augment and complete the company's vision to develop sustainable communities for the future.

The Wasatch Group includes several sub-entities such as: Wasatch Property Management which currently manages 16,050 apartment units across five western states – California, Utah, Arizona, Colorado, and Washington; Wasatch Commercial Management manages 2,559,220 sq. ft. of office buildings, 226,534 sq. ft. of retail developments, 1,129,580 sq. ft. of industrial buildings, and 777,627 sq. ft. of parking, in several states; Wasatch Acquisitions & Capital, Inc. which was organized to evaluate, capitalize, and complete the acquisition of undervalued multifamily and commercial real estate; and Wasatch Guaranty Capital who's primary function is to source and administer debt guaranties and to deploy capital investments in numerous areas of real estate and business. Wasatch Group currently has 2,750 acres of land ready for development.

# APPENDIX B – Soleil Lofts Overview

Soleil Lofts is a state-of-the-art innovative community featuring a 5.2 Megawatt solar system that will deliver 75% of the energy needed for the community. Every home has a state-of-the-art battery that is charged from the solar in coordination with the local utility provider, Rocky Mountain Power.

With a commitment to a clean environment Soleil Lofts will install 104 EV chargers and more coming online as needed. Soleil will also have a near Zero Waste program using valet trash service to pick up trash with a sorting operation including food waste diversion reducing impact on the landfill up to 85%.

Additionally, Soleil Lofts is a smart community. Each apartment includes smart mobile controls including the ability to unlock doors while on vacation or control the thermostat.

Each apartment is equipped with air conditioning & central heating with Energy Recovery Ventilators for further efficiency that allows almost no unfiltered air coming from outside the unit. As well as new energy-efficient appliances (including a personal washer and dryer).

**Energy Efficiency**

57% more energy efficient than baseline energy efficient homes, reducing energy use and costs

100% Electric-grid tied community with 75% onsite energy generation

Sonnen State-of-the-Art Battery Storage and Back-up Power in each unit

**Green Construction**

Near Passive Home Building Envelope Tightness

LED lights

Heat Pump HVAC with Energy Recovery Ventilators

Hybrid heat pump hot water heaters

**Green Lifestyle**

Significantly healthier living environment

- Innovative building design that is part of the solution to improve air quality along the Wasatch Front.
- Soleil Lofts features an onsite 5.2 Megawatt system that delivers 75% of the energy needs to the community.
- Every home has a state-of-the-art battery that provides nearly all the energy and power needed each day and is monitored 24 hours a day.
- Each battery has a 25-year life expectancy
- The community is equipped with smart thermostats with web enabled remote control to maximize efficiency.
- The community has high efficiency heat pump heat and cooling up to 24 SEER and install Energy Recovery Ventilators for further efficiency and a much healthier internal environment for the tenants.
- The building envelope is near passive in its tightness test, meaning a 40% electricity savings, less outside noise transmission, and almost no unfiltered air coming from outside the unit.
- Each unit has the most efficient hot water heater available on the market.
- Whirlpool energy star appliances used in every apartment.
- The community has 104 EV Chargers, and more coming online as needed.
- Committed to a clean environment, Soleil Lofts has a near Zero Waste program using valet trash service to pick up your trash outside your door and a sorting operation including food waste diversion reducing impact on the landfill up to 85%.

# APPENDIX C – Sonnen Batteries

sonnen

# Tech Specs - sonnen ecoLinx

The sonnen ecoLinx is an intelligent energy storage solution that seamlessly integrates with leading smart home automation systems, including Crestron and Control4, to power your home with clean energy – managing your energy usage throughout the day, providing smart configurable backup power during a grid outages and powering smart homes with solar energy, day and night.

| | ecoLinx 10 | ecoLinx 12 | ecoLinx 14 | ecoLinx 16 | ecoLinx 18 | ecoLinx 20 |
|---|---|---|---|---|---|---|
| **Usable Capacity 100% DOD)** | 10 kWh | 12 kWh | 14 kWh | 16 kWh | 18 kWh | 20 kWh |
| **Nominal power rating (off-grid output at 25 deg C)** | 7 kW | 8 kW | 8 kW | 8 kW | 8 kW | 8 kW |
| **Nominal power rating (grid-tied output at 25 deg C)** | 7 kW | 7 kW | 7 kW | 7 kW | 7 kW | 7 kW |
| **Weight (approximate)** | 622 lbs | 683 lbs | 741 lbs | 800 lbs | 850 lbs | 900 lbs |
| **Dimensions W“/H“/D“ (approximate)** | 26/84/16 | | | | | |

## Off-grid specification

| | | | | | | |
|---|---|---|---|---|---|---|
| **Continuous AC output current** | 29 A | 33.33 A | 33.33 A | 33.33 A | 33.33 A | 33.33 A |
| **Max power** | 100ms – 17 KVA<br>5 s – 12 KVA<br>30 m – 9 KVA | | | | | |
| **Max AC current (charge/ discharge)** | 1 ms – 100 A<br>100 ms – 70.7 A<br>5 s – 50 A<br>30 m – 37.5 A | | | | | |

## General specification

| | |
|---|---|
| **Grid integration** | AC coupled |
| **Applications** | Smart configurable backup power, time-of-use management, solar self-consumption, home automation integration |
| **Transfer switch** | Automatic, integrated |
| **Backup capacity** | 2 kilowatt-hours per battery module, up to 20kWh |
| **Listed and recognized components** | Certified to UL 9540, UL 1741 (inverter) and UL 1973 (batteries) standards** |
| **Warranty*** | 15 year or 15,000 cycle system warranty - includes inverter, battery modules, cabinet and components |
| **Inverter efficiency** | 92.5% CEC weighted, 95.0% peak |
| **Roundtrip efficiency % (Grid<>Battery)** | >= 86% |
| **Temperature Range** | 41 °F - 113 °F |
| **Ventilation** | Forced Air |
| **Comm. ports** | Ethernet |
| **Communication and control standards** | SunSpec Alliance<br>Integrates with Control4 and Crestron drivers |
| **EMC / EMI protection** | FCC Part 15B |

## AC specification

| | |
|---|---|
| **AC grid voltage** | 120/240 volts |
| **Max AC grid current** | amps |
| **Nominal frequency** | 60 Hz |
| **Adjustable frequency range** | +/- 0.7 Hz from nominal |
| **Metering capability** | Power meter for load and PV production (not revenue grade) |
| **Tare losses (W)** | 60 watts |
| **Transient protection** | IEEE C62.41 Class B |

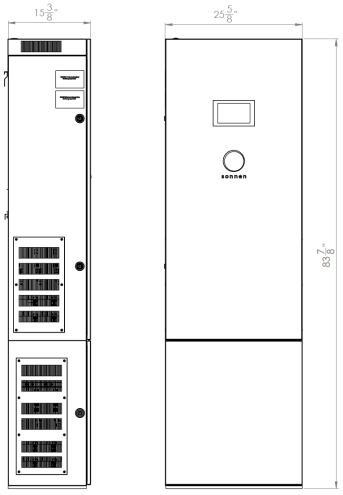
## Transfer switch specification

| | |
|---|---|
| **Current rating** | 200 amps switching and overcurrent protection |
| **Voltage rating** | 120/240 VAC |
| **Certification** | UL Recognized Component |
| **Transfer Time** | < 100 ms |
| **Nominal frequency** | 60 Hz |

## Battery Specification

| | |
|---|---|
| **DC battery input voltage** | 48–56 VDC |
| **Max charge current** | 40 A per module |
| **Nominal charge current** | 30 A per module |
| **Cell discharge** | 95% DoD |
| **Overcharge Protection** | Fuse protection |

## Measurements




**sonnen Inc.**
2048 Weems Rd, Building C
Tucker, GA 30084
Phone: +1 (310) 853-2404



*Please observe our applicable warranty conditions.
**The sonnenBatterie system is certified by ETL to UL 9540 standards and employs UL 1973 Recognized Batteries (Murata/Sony UL file MH48699/model number IJ1001M) and an inverter certified by ETL to UL 1741 standards.

Rocky Mountain Power
Docket No. 16-035-36
Witness: Rohit P. Nair

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

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# Direct Testimony of Rohit P. Nair

March 2019

**Q. Please state your name, business address, and position with PacifiCorp dba Rocky Mountain Power ("the Company").**

A. My name is Rohit P. Nair. My business address is 1407 West North Temple, Suite 290, Salt Lake City, Utah 84116. I am a Grid Solutions Manager in the Transmission & Distribution Operations group, supporting both of the Company's Rocky Mountain Power and Pacific Power Divisions.

## QUALIFICATIONS

**Q. Briefly describe your educational and professional background.**

A. I received a Bachelor of Science degree in electrical engineering from University of Poona, India and a Master of Science degree in electrical engineering from Oklahoma State University. I also have a Master's degree in Business Administration from Sullivan University, Kentucky. In addition to my formal education, I have attended various educational, professional, and electric industry seminars to remain current on industry issues. I am currently the Secretary of IEEE Renewable Technologies Sub-Committee and have been an active member of multiple IEEE working groups on distributed energy resource interconnection standards. I am a registered professional engineer in the state of Arizona.

**Q. What are your responsibilities as Senior Engineer of Engineering Standards and Technical Support?**

A. Since joining the Company in June 2011, I have worked on several renewable energy and innovative technology focused engineering initiatives and projects at the Company. I work on a wide array of grid modernization efforts including studies and projects related to renewable resources, smart inverters for solar photovoltaic systems, energy

storage, distribution automation and electric vehicles. I am currently the engineering lead on all technology projects approved under the STEP Utah Innovative Technologies Program. I also represent the Company on a number of issues related to energy.

**Q. Have you previously appeared as a witness for the Company?**

A. Yes. I have presented testimony in regulatory proceedings for Rocky Mountain Power in Utah. Most recently, I provided testimony in support of the increased funding for the Solar and Storage Technology Project in this docket.

**PURPOSE OF TESTIMONY**

**Q. What is the purpose of your testimony in this proceeding?**

A. The purpose of my testimony is to support the Advanced Resiliency Management System ("ARMS") described in the Application and the exhibit accompanying my testimony, Exhibit RMP___(RPN-1). The ARMS project will include acquiring the ability to receive outage notifications from existing ERT[1] electric meters, installing communication radios on distribution line equipment and deploy line sensor technology on distribution circuits connecting critical customers to enable real-time information exchange with the Company's control center. The Company will also study if the benefits of deploying this technology on distribution circuits that have poor reliability. The Company respectfully requests the Commission approve the Company's proposal to utilize STEP funding in the amount of $16.52 million to implement the Advanced Resiliency Management System project pursuant to U.C.A.

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

§ 54-20-107 (other programs), as an electric grid related project that is cost-effective and in the interest of the Company's utility customers.

**Advanced Resiliency Management System (ARMS)**

**Q. Please summarize the ARMS project.**

A. The Company is requesting authorization to spend up to $16.52 million in STEP funding by the end of 2021 to deploy the ERT Gateway system and the advanced line sensor hardware on the distribution system serving customers in Utah. Based on a detailed analysis, the Company will identify optimal locations for installing the ERT Gateway systems that will enable the Company to collect information from all existing residential Automated Meter Reading ("AMR") meter installations. The Company will also evaluate available information on outage data, number of critical customers on a circuit, distribution circuit configurations (radial or looped), type of distribution equipment installed and other similar information to determine the distribution circuits requiring installation of advanced line sensors and other hardware to improve outage management.

The Company consistently implements reliability and power quality enhancements on its transmission and distribution system to improve safety, reliability and customer service. The ARMS project enables the Company to explore, develop and enhance new outage management capabilities to restore power faster to critical customers such as hospitals, trauma centers, police and fire dispatch centers etc., as well all other customers in the state of Utah. Deploying innovative technologies to improve system reliability will further provide the Company an understanding of the opportunities and challenges of utilizing emerging technology on the distribution

system. In addition to improving reliability and enhancing outage management capabilities, customers will be able to access automated, timely, and accurate bills, regardless of weather conditions or property access limitations, which traditionally hamper collection of meter information. This project will also provide customers the ability to access interval usage data.

**Q. What benefits will the ARMS project provide?**

A. The ARMS project enables a progressive advancement of the grid and will provide the following benefits:

1) Enable residential customers with AMR meters to receive interval usage data;
2) Allow communication-enabled devices to provide outage information to control center operators, which enables restoration to emergency facilities responsible for public safety and emergency response;
3) Improves the Company's ability to detect meter tampering and prevent theft;
4) Improves outage response operations by leveraging real-time information from distribution line devices;
5) Aids in determining safe switching procedures and cost effective capital improvement and maintenance plans;
6) Reduction in employee exposure to safety hazards and customer property visits; and,
7) Reduction in CO2 emissions through fewer Company vehicles on the road.

This project also creates a significant opportunity for the Company to enable technologies that can be leveraged for future grid modernization applications including distribution automation, outage management, data analytics and demand-response programs. Additional information on the customer benefits is provided in Exhibit RMP___(RPN-1).

**Q. Can you explain in greater detail what types of equipment the Company is proposing to install, and how the Company will use the information collected?**

A. Working with Itron, the Company plans to develop and deploy a communications device, the ERT gateway mesh ("EGM"), which will interface with the AMI communications system and receive and translate the Radio Frequency pulse data from existing AMR meters without the need to replace the meters. With this technology, Company personnel would no longer be required to drive to the customer location for data collection. The existing AMR meters provide the current meter register reads in each pulse and also have the capability to send a power outage notification as well as a power restoration notice. The outage notification message cannot be used without the EGM. Using this new technology to receive and transmit the meter pulse data will help detect meter outages, enabling faster response times, and enable the Company to provide those customers with interval energy usage information through a web portal.

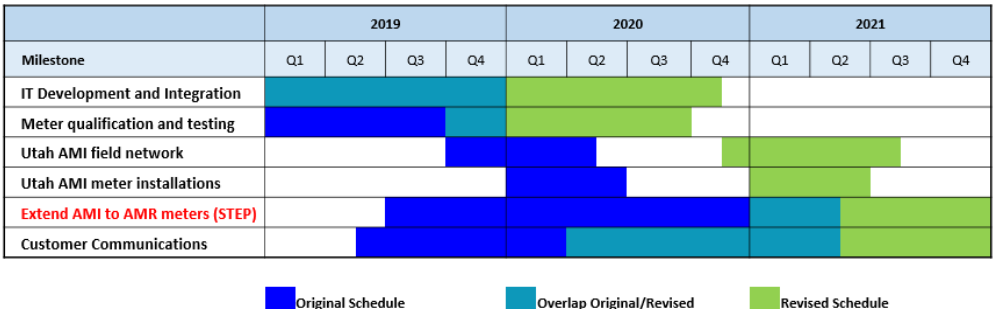
To improve outage response time to critical customers, the Company also plans to install communication-based faulted circuit indicators ("CFCI") on distribution circuits and further integrate the outage information collected by these devices into the Company's IT system. This will help the Company's dispatch operators identify fault locations and expeditiously send field crew to the assigned area for outage restoration.

The Company also plans to install communication radios on existing field equipment to allow dispatch operators with increased visibility of equipment status and, if needed, remotely execute control operation of these devices.

**Q. How does the timing of the ARMS project interface with the timing of the AMI project?**

A. The ARMS project is part of the overall AMI project. The overall timeline for the projects is shown below. AMI was originally planned to begin in 2019, but has been delayed as indicated in the timeline to allow for additional implementation and testing of cybersecurity controls. The ARMS project is scheduled to begin in early 2021.

AMI Project Timeline




**CONCLUSION**

**Q. In your opinion, is the Company's ARMS Project cost effective and in the public interest?**

A. Yes. Details of the project costs and benefits are provided in Exhibit RMP___(RPN-1).

**Q. Does this conclude your direct testimony?**

A. Yes.

Rocky Mountain Power
Exhibit RMP___(RPN-1)
Docket No. 16-035-36
Witness: Rohit P. Nair

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

---

Exhibit Accompanying Direct Testimony of Rohit P. Nair

Advanced Resiliency Management System (ARMS)

March 2019

# An Investment Appraisal for

## *Advanced Resiliency Management System (ARMS)*

## *Utah Innovative Technologies Team*

**Project Sponsor:** Doug Bennion, Curtis Mansfield

**Principal Author**: Rohit Nair

**Reviewed By**: Douglas Marx, Trevor Stuart, Debbie Ross, Glen Sidney, Mike Cochran, John Webb, Robert Mizera, Natalie Swendener, Rich Niska, Jana Noyes, Greg Lyons, Joseph Leineweber

**Date:** March 07, 2019

# Rocky Mountain Power

## 1 Executive Summary

As part of the Sustainable Transportation Energy Plan (STEP), a Utah statute, Rocky Mountain Power (the Company) should request $16,520,000 to develop and deploy an advanced outage management system that includes, but is not limited to, the ability to receive outage notifications from existing ERT[1] electric meters and installing line sensors and communicating faulted circuit indicators on distribution circuits connecting critical customers to enable real-time information exchange with the Company's control center. This project will provide information to control center operators during major outages to enable restoration to emergency facilities responsible for public safety and emergency response as well as outage information for most other customers in Utah. For the purposes of this project, critical facilities will be defined as major emergency facility centers such as hospitals, trauma centers, police and fire dispatch centers, etc. Another benefit of this project is the ability to provide residential and small commercial customers with interval energy data. The anticipated net benefit to Utah customers is $67.6m over the 25 year period of this project.

## 2 Purpose and Necessity

The ability to remotely monitor, measure and control various distribution line equipment is a necessity to build a progressive grid that inherently improves safety, reliability and customer service. This project is expected to help the Company understand ways to address the following challenges:

- Limited visibility of real-time status of distribution line equipment, circuit loading levels, and event information leads to increased outage duration and restoration times.
- Lack of information from distribution line equipment creates inefficiencies in managing outage response situations. Predictive outage management and fault locating software rely on loss of service reports from multiple customer locations in order to estimate fault locations. Changing customer behavior and expectations are decreasing the number of reports received for each outage event thereby reducing the effectiveness of current systems.
- Currently outage information from customer meters cannot be sent to the Company's control center due to absence of any intermediary communication devices.
- Lack of interval data available for customers to make financial decisions based on energy usage.
- The proliferation of distributed energy resources can exacerbate load imbalance on a distribution circuit, causing three phase voltage imbalance issues and increasing the potential for unintended circuit breaker operations from elevated neutral currents.

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

- The company is in the process of striving to make the grid more progressive and this project will enable a greater understanding of these innovative solutions.

# 3 Background

Rocky Mountain Power completed the installation of a mobile automated meter reading (AMR) system in the state of Utah in 2010. The AMR system is an Itron solution using their Centron C1SR electric meters that utilize ERT technology to transmit consumption data. The meters installed during, and subsequent to, the project are read once per month and provide energy and demand billing determinants for all residential and small commercial customers.

Meters for large commercial and industrial customers, as well as meters where interval data is required (e.g. load research, schedule 136, etc.) cannot be read by the mobile AMR solution currently deployed. These meters have not been replaced and continue to be read manually. These are the most expensive meters to read. The number of installations requiring interval data for billing purposes continues to increase dramatically and the need to find a cost effective solution for reading these meters is important to control costs.

To address this need, in late 2017, the Company issued a request for proposal for the installation of an AMI network. This network is designed to avoid the high cost of manually reading large commercial, industrial and interval meters. The network will mitigate the associated increase in manpower as interval meter numbers continue to increase.

In October 2018 the Company awarded a contract to Itron for their OpenWay Riva AMI solution (OW RIVA). The installation of an Itron AMI system in Utah will provide the basic field area network required to automate approximately 18,000 manually read meters as well as all current and future meters associated with schedule 136 (customer generators). Once installed, and in addition to providing daily interval data, this network will be capable of receiving outage detection notices from meters connected to the AMI system. To maximize the effectiveness of the AMI system, it will be necessary to replace an additional 138,000 meters with RIVA meters to cohesively bind the mesh network. The vast majority of these meters being replaced are Centron C1SR meters. The remaining 764,000 meters cannot be read by the Riva AMI network today.

The value of the Centron C1SR meters is their ability to be read by handheld or vehicle-mounted receivers or a fixed network meter reading system. The AMR meters transmit energy and demand data every 30 seconds allowing for the accumulation and parsing of the data stream to provide hourly interval data. When read by a FN, they would provide AMI quality meter reads without the need to replace the existing meters.

The meters also transmit a power outage notification signal in the event of a loss of power as well as a power restoration notification when service is restored. Both of these signals go undetected in a mobile meter reading environment but could be received by a fixed network and used by outage management systems.

# 4 Project Overview

This project proposes to utilize STEP funds to provide for the installation of line sensors and communicating faulted circuit indicators (CFCIs) on distribution circuits connecting critical customers to enable real-time information exchange with the Company's control center and to develop and deploy the necessary field equipment needed to receive outage detection notices from the existing Centron C1SR meters. For the purposes of this project critical facilities will be defined as major emergency facility centers such as hospitals, trauma centers, police and fire dispatch centers, etc.

Line sensors provide real-time circuit line loading information that can be used to enable the restoration power from an alternate source after a faulted section has been isolated. CFCIs provide real time information on fault current flow thereby enabling crews to locate the location of the fault quicker and isolate or repair the damage. These new devices will make information available to control center operators during major outages to enable faster restoration to emergency facilities responsible for public safety and emergency response to reduce their outage times.

Limiting this technology to critical facilities will allow the company to test and refine the technology with a limited investment and will assist the company in those areas of highest concern. As the technology matures and costs decrease, the ability to install these devices on more circuits will become cost effective.

Line sensors and CFCIs provide real-time information to improve efficiencies in locating faults thereby allowing line crews to focus on the specific affected areas, rather than patrolling the entire circuit, to locate, isolate and restore power in a timely manner. The company will explore methodologies to connect the line sensors and CFCIs to the OW RIVA network wherever possible and use cellular communications in cases when this is not practical. The estimated cost to deploy this technology is $5,230,000.

Itron, the supplier for the AMR system, has developed an "ERT Gateway" field device that interfaces with their OW RIVA system that collects and transmits data from ERT equipped gas and water meters. This field device is not currently available for electric meters. Itron will develop the electric ERT Gateway when a project large enough to justify the investment is approved. Itron has stated that they will develop the device if Rocky Mountain Power commits to coverage for the existing Centron C1SR meters in Utah. A six-month development window is required after contract execution. Software integration and management services will also be required. The estimated cost for developing and deploying this technology is $11,290,000.

# 5 Benefits

The Utah advanced outage management project will provide an estimated $930k in annual O&M reductions following the first full year of implementation (2022) increasing slightly each year for the 25 years of the project.

The outage management system will provide the following benefits:

- Reduction of seven meter reading/collection FTEs and associated overheads by eliminating manual and mobile metering requirements.
- Provide the ability to detect instances of meter tampering. 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 employee exposure to safety hazards, customer property visits and reduced driving miles.
- Reduces $CO_2$ emissions through fewer Rocky Mountain Power vehicles on the road.
- Improve outage response operations by leveraging real-time information from distribution line devices as well as help determine safe switching procedures and cost effective capital improvement and maintenance plans.
- Provide better customer service by using fault data, voltage and current to evaluate power quality performance of the distribution circuit and address customer complaints, if any.
- Improve reliability metrics such as Sustained Average Interruption Duration Index (SAIDI) and Customer Average Interruption Duration Index (CAIDI).
- Leverage real-time information collected from distribution line equipment to augment predictive capability of existing outage management systems and reduce Company reliance on customer reporting for outage notification.
- Reduce 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.
- 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.

# 6 Public Interest Justification

Improved Reliability

Real-time data availability from field devices will enable the Company provide higher levels of reliability and improve outage restoration efforts, particularly during major storms. Modern distribution line sensors are equipped with technology that may allow PacifiCorp to detect minute disturbances on the grid and use this information to isolate faults, detect defective equipment before it fails, and analyze the unique patterns of these events to predict the likelihood of future outages. The level of service provided by the Company (actual and perceived) is highly dependent on outage duration and frequency. Real time device data has the potential to facilitate a significant decrease in the time associated with fault detection and fault location. Company resources

expended during service restoration will potentially decrease: labor, vehicle mileage, and fuel consumption.

Customer Service

The ERT Gateway system will enable customers in Utah to be able to access automated, timely, and accurate bills, regardless of weather conditions or property access limitations, which traditionally hamper collection of meter information. Once properly configured, the ERT Gateway system will allow the Company to generate more consistent and accurate bills automatically, with fewer recording errors and customer complaints. The data will be available in 15-minute increments and customers will be able to access this data on the Company's website. This is expected to help customers reduce their monthly bills and have greater control on usage. It also provides the Company an opportunity to plan for proactive, digital, multi-channel, direct engagement with their customers to educate, inform, and protect them.

Financial Prudence

While the costs of the entire project cannot be justified based on company benefits alone (Net Present Value of -$2.8m), the economic costs that power interruptions impose on businesses and residences are considerable. The Interruption Cost Estimation (ICE) Calculator, developed by the Lawrence Berkeley National Laboratory, provides the information needed to analyze those economic costs of power interruptions. Based on more than 20 years of utility-sponsored surveys on the costs of power interruptions to customers, Berkeley Lab developed the tool through close partnerships with industry. To ensure its continued effectiveness, the Berkeley Lab continues to augment it with research on the latest methods for collecting and developing information on the economic consequences of power interruptions on businesses, residences, and society at large.

The calculator tool is designed for electric reliability planners at utilities, government organizations or other entities that are interested in estimating interruption costs and/or the benefits associated with reliability improvements in the United States. The calculator is available online at https://eaei.lbl.gov/tool/interruption-cost-estimate-calculator.

Figure 1 shows the calculated results for customers in Utah with a 2.15% improvement in SAIDI. This improvement produces a Net Present Value customer benefit of $71.1 million over the next 25 years.

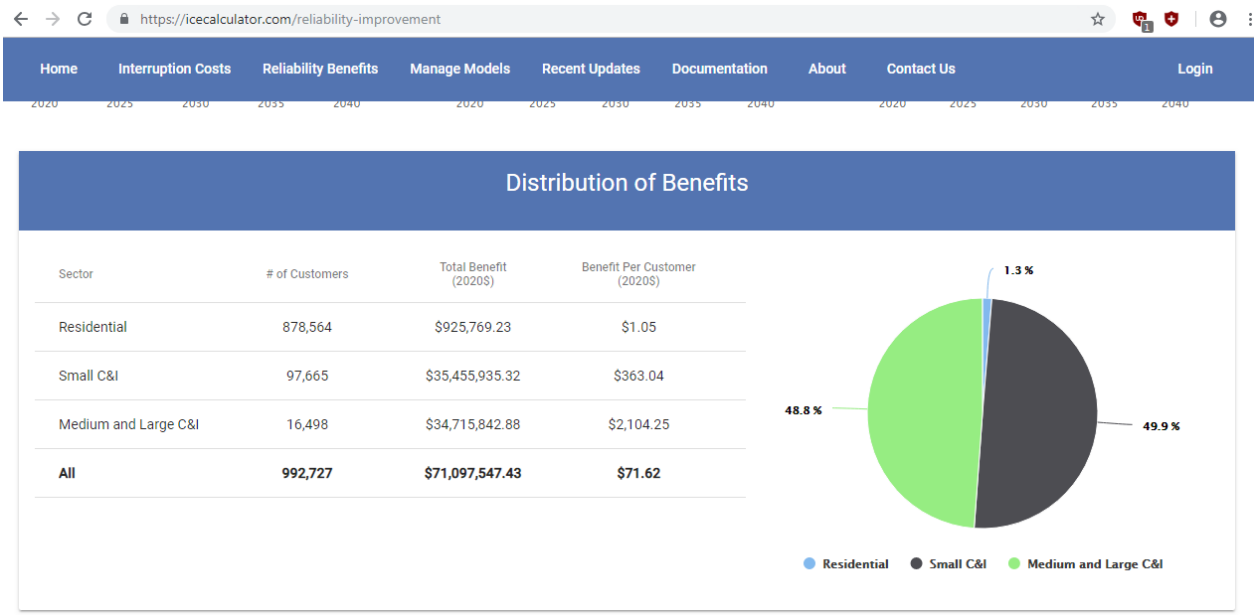



Figure 1

Situational Awareness

Information collected from distribution line equipment as well as residential and commercial meters through the ERT Gateway systems will help boost situational awareness enabling the Company to detect abnormal operating conditions and pinpoint faulted line segments.

Maintain Grid Integrity

Communication-enabled distribution line equipment can help maintain the integrity and reliability of the electrical system during massive load characteristic changes being experienced as increasing levels of distributed energy resources are interconnected to the distribution system.

Modernized Grid

Data collection, synthesis and interpretation is a cornerstone for building a smarter energy infrastructure that will enable accurate load/generation forecasting and planning as well as help understand the status and interaction of the various distribution line equipment installed in the field. This project will further help the Company understand the needs and challenges of deploying a distribution automation architecture.

Security

This program will comply with all NERC CIPS requirements.

# 7 Compliance with SB115

Section 54-20-107 (Other programs) of the Sustainable Transportation and Energy Plan Act states:

The commission may authorize a large-scale electric utility to establish a program in addition to the programs described in this chapter if the Commission determines that the program is cost-effective and in the public interest. Pursuant to this section, Rocky Mountain Power requests that the Utah Public Service Commission authorize $16,520,000 to develop and deploy an advanced outage management system to benefit customers in the state of Utah.

## 8 Alternatives Considered

Alternatives considered that do not resolve the critical issues/needs:

- Do nothing. However, this will not provide the Company, or critical facilities, with advanced outage restoration methods that become critical during large scale outages. In addition, it does not allow the Company to provide interval data to its customers and utilize residential and commercial meters to streamline the outage management process.

## 9 Purpose and Necessity – Risk Analysis

Company Impacts without this project:

- During outage conditions, lack of real-time circuit and line equipment information on equipment status introduces assumptions and inaccuracies while determining safe switching procedures and dispatching crews to restore outage and.
- Lack of fault location data increases outage restoration times and adversely impacts reliability and customer service.
- Lack of interval data does not allow the Company to provide meaningful insights and efficiency actions for customers, thereby limiting the Company's ability to provide better reliability, customer service and community engagement.
- Limited meter/equipment information available to detect power thefts.
- Potential distribution automation and similar grid modernization projects to be considered in future will be adversely affected.
- Limited data analytics and operational system automation will not allow the Company to reduce operational costs by eliminating manual processes and better prioritizing resources.
- Absence of asset monitoring using sensors and meters may impede efforts to improve asset health which is required to provide safe and reliable power to customers and communities.
- Limited reduction in air quality and CO2 emissions.

Customer Impact without this project:

- Challenges in improving efficiency for handling customer calls due to lack of data in the absence of critical technology such as ERT gateways and line sensors.
- Unable to provide load profile data to help customers understand energy usage patterns and impact of tariffs on their monthly bills.
- Limited visibility of distribution line equipment status and operation might negatively impact outage restoration efforts for the critical facility.

- During major storms, fast recovery of critical facilities is highly necessary and limited without this technology.
- Increased customer dissatisfaction and reduced public safety due to slower recovery times during outages.

## 10 Major Project Milestones

FY 2019

- Finalize contracts and project timeline with product vendors for line sensors and ERT Gateways.
- Identify Critical Response Facilities, worst performing distribution circuits, utility assets, and communication modules.
- Finalize locations where line sensors will be deployed.
- Initiate data integration tasks with the Company's IT team and vendor software providers

FY 2020

- Work with Itron to finalize ERT Gateway requirements prior to manufacturing, testing and deployment.
- Finalize locations where ERT Gateways will be deployed.
- Hardware Deployment and Data Integration into the Company's Energy Management System (EMS) and CADOPS outage management tool.
- Perform hardware and software system upgrades, if required.

FY 2021

- Deploy ERT Gateway system and integrate data into the Company's IT network.
- Continue hardware deployment and data integration into the Company's Energy Management System (EMS) and CADOPS outage management tool.
- Verify communication of end devices with the software head-end system.

This project has multiple in-service dates related to the installation of the communication devices on existing line equipment and installation of line sensors on distribution circuits. Additional work will include the integration of data from line devices into the Company's control center which will require complex software modifications in addition to purchase and installation of new software packages.

The project team is aware of the need to record the assets as technically complete in SAP as the assets are put into service. The Work Breakdown Structure (WBS) will be setup accordingly.

## 11 Program Closure, Retirement and Removal Information

In 2021, the Company will report back to the Utah Public Service Commission regarding lessons learned and how it plans to maintain and manage the infrastructure deployed as part of this program. If it is necessary to report more often to comply with the STEP statute or other reporting requirement, the Company will comply with those requirements.

## 12 Project Delivery Risk Factors

The project will be managed to mitigate typical project risks (design and construction resources, permitting material deliveries, weather, etc.) as it applies to scope, schedule, and budget. Appropriate documentation will be created, tracked and communicated to properly manage the project. The appropriate risk mitigation measures will be identified and resolved in the project development phase.

A few critical and unusual project risk factors have been identified that will need special attention in the project development and execution phases:

- If the ERT Gateway network is not sized properly, processes will not complete in a timely manner, including meter reads, connection/disconnection of service, presentation of portal data and the ability to ping meters.
- If the vendors experience a production problem and is unable to deliver equipment according to schedule.
- Risk associated with the integration of data management software with the field-deployed devices

## 13 Target Costs

| Costs | Prior Years | 2019 | 2020 | 2021 |
|---|---|---|---|---|
| 10 Year Plan Budget:-STEP discretionary funding | N/A | xxx | xxx | xxx |
| APR (Gross): | N/A | $1.43m | $5.69m | $9.40m |
| - Reimbursements: | N/A | N/A | N/A | N/A |
| - Contingency: | N/A | N/A | N/A | N/A |
| **APR (Net):** | **N/A** | **$1.43m** | **$5.69m** | **$9.40m** |

| Description | Capital Costs | O&M Costs | Total |
|---|---|---|---|
| Labor | $5.30m | $0.27m | $5.57m |
| Material | $9.02m | | $9.02m |
| Purchase Services | $1.06m | $0.87m | $1.93m |
| **Totals** | **$15.38m** | **$1.14m** | **$16.52m** |

## 14 Accounting Issues or Regulatory Recovery Issues

All expenses towards this project will be recovered through the accounting workflow setup for the Utah Innovative Technologies under the Sustainable Transportation and Energy Plan.

# 15 Financial Analysis

It is recommended to spend $16.52 million to develop and deploy an advanced outage management system that includes, but is not limited to, the ability to receive outage notifications from approximately 764,000 existing ERT electric meters and installing line sensors and communicating faulted circuit indicators on distribution circuits connecting critical customers to enable real-time information exchange with the Company's control center

The following outlines the key financials of the project:

- Capital Project Spend = **$15,120,000**
- O&M Project Spend = **$1,140,000**
- Project Contingency = **$260,000**
- Internal rate of return = **4.09%**
- Net present value @ 6.92% = (**$2,750,000)**
- Present value revenue requirements = **$3,470,000**
- Customer outage management benefits = **$71,100,000**
- Net customer benefits (customer outage benefits minus PVRR) = **$67,600,000**

The financial analysis was based on the following assumptions:

- The financial analysis was completed over 25 years.
- The communication assets are allocated to Utah.
- The in-service dates are December 2020 and December 2021.
- The financial analysis results presented below are based on the project's revenue requirement. This is based on a capital structure of 49% debt and 51% common with a 5.23% debt and a 9.74% common rate.
- A 1.26% Utah property tax rate was used.
- A 6.92% discount rate was used.
- A 24.59% tax rate was used.
- Outage management and demand response related costs and benefits will move to the AMI project in 2022.

# 16 Procurement and Project Delivery Strategy

- In order to satisfy business requirements, ensure best value, and minimize risk, purchases and construction contracts shall be procured through a competitive bid process.
- Project specifications shall be developed in accordance with applicable engineering specifications and standard designs.
- Bidders shall be screened to meet credit and procurement requirements. This process is being managed by the PacifiCorp procurement department.
- Project delivery strategy to be determined by project team.

## 17 Recommendation

- Purchase and install line sensors on pre-determined distribution circuits that serve critical facilities.
- Purchase and install ERT Gateway systems.
- Implement a data management system to automatically download, analyze and interpret data from all line sensors.
- Install communication radios on distribution line equipment including but not limited to line reclosers and transfer trip switches.
- Purchase and install required software packages that will allow data integration of line equipment and Itron meters into the Company's control center.
- Update control center hardware and software to enable display of real-time information from communication-enabled distribution line equipment, line sensors and Itron meters.

## CERTIFICATE OF SERVICE

I hereby certify that on March 8, 2019, a true and correct copy of the foregoing was served by electronic mail on the following:

| |
|---|
| **OFFICE OF CONSUMER SERVICES** |
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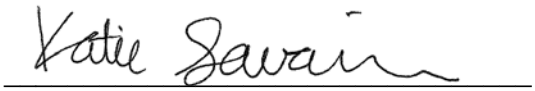

Katie Savarin
Coordinator, Regulatory Operations