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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 PLAN ACT	Docket No. 16-035-36 **COMMENTS OF WESTERN RESOURCE ADVOCATES**

Western Resource Advocates ("WRA") submits these comments in accordance with Utah Admin. Code R746-1-203 and the August 18, 2017 Notice of Filing and Comment Period of the Utah Public Service Commission ("Commission").

I. INTRODUCTION AND SUMMARY

Rocky Mountain Power, a division of PacifiCorp ("Company"), is seeking approval for a Smart Inverter Program and a Microgrid Program to be funded from money collected under the Sustainable Transportation and Energy Plan ("STEP") Act as innovative utility programs compliant with STEP. WRA has reviewed the proposals and generally finds them to be a reasonable use of STEP funds.

The Smart Inverter Program, as proposed, will evaluate "smart" or "advanced" inverters that are part of newer Distributed Solar Generation ("DSG") systems to understand how those inverters will impact the electric grid. WRA recommends that this program also include evaluation of smart inverters used in battery storage systems and in integrated DSG/storage systems. Other utilities are conducting similar studies across the region as a necessary step in improving interconnection requirements and assisting distribution grid planning. WRA supports this investigation with some suggested additions as described below.

The Microgrid Program will evaluate the functioning of a working microgrid under field research conditions to assess how microgrids will impact the larger grid and how they should be interconnected and operated with respect to the Company's grid. WRA also supports this program with some suggested additions as described below.

Upon the completion of both programs, the Company anticipates modifications to its Policy 138 that governs interconnection. WRA agrees that the Company's Policy 138 will require modification. Additionally, Commission-approved Rule R746-312 Electrical Interconnection should be amended based on the findings of both programs and on the changes to the new interconnection standards that apply to smart inverters being finalized by the Institute of Electrical and Electronics Engineers ("IEEE"), which should be published early next year.

II. ANALYSIS AND SUGGESTED MODIFICATIONS TO THE SMART INVERTER PROGRAM

Smart inverters represent a step forward in inverter technology and, in addition to efficiently converting Direct Current ("DC") into Alternating Current ("AC"), provide features that should prevent adverse impacts to the distribution grid that can be caused by high concentrations of Distributed Solar Generation. DSG systems that use older inverter technology, when concentrated in a specific area of the grid, can cause problems of over and under frequency and over and under voltage. Smart inverters have the ability to help counteract these problems, allowing higher concentrations of DSG to operate in a safe manner. However, since each utility's grid and geography is different, it is important that each utility understand how smart inverters will address these problems when implemented on their grid in specific locations. The Company can then require that options on smart inverters are set correctly for operation on their grid. The Company's Smart Inverter Program is designed to evaluate and resolve these important issues.

Part of the Company's Smart Inverter Program will focus on understanding the revision of the IEEE 1547 Standard that will dictate the operation of smart inverters into the future. IEEE 1547 is the acknowledged standard for inverters and has been under revision for a number of years in order to appropriately accommodate smart inverter technology. IEEE 1547 is expected to be approved and published during Q1 2018 and will become, on publication, the national standard for inverters. Once that standard is published, Utah interconnection rules should be updated to require that all DSG and other devices that employ inverters, such as battery storage, comply with the standard.

The Smart Inverter Program will help to inform the Commission and other parties about how various options in smart inverters can be best utilized when interconnected with the Company's grid. For example, options can be set in smart inverters to control the timing and magnitude of their response to grid status, including their response to disruptive events on the grid. It is essential that smart inverters respond appropriately to specific events to prevent potential outage situations. This will involve the proper application of IEEE 1547 to the specifics of the physical structure of the Company's grid and its operation.

The Smart Inverter Program, as proposed by the Company, will include lab testing, modeling and simulation, detailed interpretation of the updated IEEE 1547 standard, and the development of a guideline document that will recommend revisions to the Company's interconnection policies. The project will be conducted by the Company in collaboration with Utah State University ("USU") and the Electric Power Research Institute ("EPRI"). The project does not propose field testing of smart inverters associated with new DSG installations at customer locations. It is worth noting that field testing could provide additional, valuable information on the actual operation of smart inverters that are interconnected with the grid, as further discussed below.

One of the critical elements of the proposed program is the analysis of hosting capacity of the distribution grid with and without smart inverters. The hosting capacity of a distribution grid feeder is generally considered to be the maximum amount of DSG generation capacity that can be interconnected at particular locations on the feeder, while maintaining grid safety, reliability and power quality. High concentrations of DSG without smart inverters have been found to cause frequency and voltage problems in some circumstances. The National Renewable Energy Laboratory ("NREL") recently published a report touting the benefits of advanced inverters in addressing challenges associated with integrating high levels of DSG on the electricity system.[1] NREL also published a detailed handbook for distribution engineers, addressing these challenges in more detail and recommending specific mitigation measures.[2] Smart inverters, when their options are properly set, can help to prevent these problems, allowing higher levels of DSG penetration than could be otherwise accommodated.

WRA supports the Company's Smart Inverter Program. This effort should help to identify how much hosting capacity can be improved with smart inverters, as well as assist the

[1] Advanced Inverter Functions To Support High Levels of Distributed Solar, NREL/BR-6A20-62612, Nov. 2014.
[2] High-Penetration PV Integration Handbook for Distribution Engineers: Seguin, Woyak, Costyk, Hambrick and Mather, NREL/TP-5D00-63114, January 2016.

Company in improving its analysis of feeder hosting capacity in general. Based on the Company's proposal, it appears that EPRI will conduct much of the analysis for the Company using their Distributed Resource Integration and Value Estimation ("DRIVE") tool for this part of the project. WRA strongly recommends that the Company acquire a similar tool in the near future so that going forward, they can conduct this type of analysis internally.

In addition, WRA recommends that the Company consider adding the following elements to the program. First, the Company should include lab testing, modeling and simulation of what are being called "hybrid" smart inverters. These are inverters that, in addition to converting DC to AC, also directly couple DSG with battery storage. Hybrid smart inverters control the flow of energy between the solar panels and the battery, as well as supplying AC power to the customer's load and controlling power that is exported, if any. This type of smart inverter is already starting to be marketed in integrated DSG/battery storage systems by several companies. Issues are arising in Colorado, Arizona and Nevada about the interconnection requirements for these systems, how they are metered, and how they are managed. The Company should include them in the Smart Inverter Program so that discussions on interconnection of these systems are better informed.

WRA also recommends that the Company consider a second phase of the program that would test smart inverter controlled systems at customer locations in the field. Lab testing and modeling are a good beginning, but there is no substitute for actual field experience. Specifically, WRA recommends that, as a second phase to the program, the Company test between ten and twenty smart inverter controlled systems on a single feeder on their grid. These systems could be owned by the Company, the customers, or third parties. Xcel Energy in Colorado, NV Energy in Nevada, and Arizona Public Service in Arizona are all engaged in testing of this nature. The Company could test the smart inverter settings they are recommending and also test communication to and from smart inverters in actual operation in the field.

III. ANALYSIS AND SUGGESTED MODIFICATIONS TO THE MICROGRID PROGRAM

In addition to its Smart Inverter Program, the Company is proposing a Microgrid Program to evaluate the interaction of a research microgrid with the Company's power grid. Microgrids are designed to be small distribution grids that can be "islanded" from the utility's grid when an outage occurs. When power from the utility grid fails, the microgrid can disconnect and maintain power within the microgrid from generation and storage that is on-site. The microgrid may also perform other functions such as managing energy production and storage among various generators, storage units and loads either in an "island" mode or in a more normal, grid-connected mode. Microgrids are becoming popular in some "campus" type situations such as military bases, university campuses, and industrial parks. Their main use is to provide backup power to a customer's distribution grid when utility grid power is lost. They are also being used to efficiently control multiple customer-owned generation units such as DSG, fuel cells, natural gas microturbines and other distributed generators, as well as multiple energy storage units. The microgrid can be used to control critical and non-critical loads with real-time demand response and the charge and discharge of battery storage systems. Microgrids have "grid forming" controllers that can provide regulated 60 Hz AC with voltages that meet national standards. When microgrids are interconnected with the utility grid, they must be subject to reasonable interconnection rules. In the future, microgrids could be offered as a service by the utility or third parties, or constructed and managed privately by large customers who are interested in the benefits.

WRA supports the Company's proposal to study microgrids and the impacts of their interconnection with the Company's distribution system. The Company, Commission and interested parties need to understand how microgrids interact with the Company's grid and how interconnection rules should be written to provide requirements and guidance for connection of the grids and operation under varying conditions. The proposed program should provide valuable information on microgrid operation and interconnection.

The microgrid that will be used for the proposed program could be characterized as a *research* microgrid rather than a *production* microgrid. I am making this distinction as the microgrid to be used will provide power to a research facility and not a critical facility like Hill Air Force Base. This is probably appropriate, given the experimental nature of the program and the variety of equipment the Company is planning to evaluate. However, the Company should consider a project to evaluate a production microgrid in the future that provides power to a critical facility on an ongoing basis under normal conditions. In addition, from the One Line Diagram of the microgrid (Appendix A-USU EVR One Line Diagram), it is unclear whether the microgrid to be used will actually be able to island normal load at the USU facility at all. It appears that the microgrid will mostly be operated in parallel with the utility grid and the main loads of the facility cannot be islanded by the microgrid controller. While this may be appropriate, given the experimental nature of the project, it does not put the same stress on the microgrid or the same urgency to have it operate properly. As an example, Xcel Energy in Colorado is conducting a pilot with Panasonic at the Denver International Airport to test a microgrid under production conditions. WRA recommends that the Company consider testing a microgrid under similar production level circumstances as a second phase to the proposed Microgrid Program.

IV. CONCLUSION AND RECOMMENDATION

In summary, WRA supports both the Smart Inverter Program and the Microgrid Program as proposed by the Company. WRA recommends that the Commission approve both programs as proposed by the Company with the following additions: (1) the Company should add the study of hybrid smart inverters to the Smart Inverter Program; (2) the Company should contemplate a customer-sited field trial of smart inverters as a second phase to the Smart Inverter Program; and (3) the Company should consider testing a production-scale microgrid project as a second phase to the Microgrid Program. Finally, WRA recommends that the Commission consider opening a new docket in the first quarter of 2019 to amend interconnection rules and policies to take best advantage of smart inverters and microgrids.

Dated this 13th day of September 2017.

Respectfully submitted,

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CERTIFICATE OF SERVICE
Docket No. 16-035-36

I hereby certify that a true and correct copy of the foregoing was served by email this 13th day of September 2017 on the following:

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