Rocky Mountain Power
Docket No. 16-035-____
Witness: Douglas L. Marx

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

Direct Testimony of Douglas L. Marx

November 2016

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

A. My name is Douglas L. Marx. My business address is 1407 West North Temple, Salt Lake City, UT 84095. I am the director of Engineering Standards and Technical Services for Rocky Mountain Power ("RMP").

Qualifications

Q. Briefly describe your educational and professional background.

A. I have worked for the Company for 35 years in various engineering, operations and management positions. I hold a bachelor's degree in electrical engineering from the University of Utah and a master's degree in business administration from Utah State University. I am a licensed professional engineer in the state of Utah.

Q. Please describe your present duties.

A. I oversee all non-routine technical studies including distributed generation, power quality and smart grid reports. I am responsible for the development of all material and equipment specifications and standards used in the construction and maintenance of the transmission and distribution systems.

Purpose and Summary of Testimony

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

A. In support of the Company's need to ensure adequate cost recovery from residential customers with private generation, I present the operational issues associated with private customer generation, specifically rooftop solar, and the system changes that will be required with increasing levels of distributed generation on the electrical distribution system. In addition, I explain the process and costs incurred in reviewing interconnection requests for net metering applications in support of the proposed changes to the application fees.

Q. Please summarize your testimony.

A. My testimony demonstrates that rooftop solar generation does not reduce the peak demand on the distribution system to a degree that could warrant a reduction in infrastructure. Instead, rooftop solar may actually increase the requirements for infrastructure at the local level. Further, residential net metering customers use the electric grid at a level higher than other residential customers. The total amount of energy transferred to and from the electric grid by net metering customers can exceed the amount of energy delivered to other customers by a significant amount. In addition, the Company incurs additional costs associated with applications for rooftop solar generation and their interconnection.

System Impacts

Q. Please describe the studies you have done on neighborhood rooftop solar.

A. In 2014 in Docket No. 13-035-184 ("2014 GRC"), I presented the results of a neighborhood rooftop solar study for the area served by the Northeast #16 circuit. This study evaluated the viability of rooftop solar to offset utility infrastructure upgrades by modeling high efficiency solar panels on every viable roof space on the circuit. The study showed that, under a best case scenario, solar generation offsets only seven percent of the peak demand on the circuit, which means that the utility still needed to provide 93 percent of customers' demand.[1]

In response to questions raised about the relevance of the findings of the Northeast #16 study to other locations within the Salt Lake valley, the Company initiated a new study in 2015. We selected the Bingham #11 circuit located in the southwest quadrant of the valley in South Jordan, Utah. A copy of the study report is attached as Exhibit RMP__ (DLM-1). This study shows that the effects of rooftop solar reduced the peak circuit loading by only 3.6 percent. Due to this small reduction, and considering the interaction between variable customer load and variations in solar production due to cloud cover and other interference, our distribution planning guidelines will continue to be based on peak load requirements without including solar generation reductions.

Q. Can increased levels of rooftop solar generation reduce the size of local distribution infrastructure?

A. No. As the studies show, increasing levels of rooftop solar can actually force the Company to increase the local distribution system including distribution transformers, secondary cables and service conductors to handle the excess generation. If customers install the level of rooftop solar required to offset their annual electric energy usage, also known as net zero-electric energy customers, the Company will need to increase the size of the local distribution system to handle the reverse energy flow delivered to the grid by the customers.

[1] See Docket No. 13-035-184, Rebuttal Testimony of Douglas L. Marx (June 2014).

The peak output for the rooftop solar systems in Utah will occur during the spring months, typically April or May. This is the time of year the solar insolation is approaching its peak level for the year, and the ambient temperatures are relatively moderate. This combination allows the solar system to maximize its output. As the temperatures increase through June and July, the output will actually decrease. This decrease occurs at the same time a residential customer’s load is reaching its peak demand, typically July. The peak demand typically occurs in the evening when the rooftop solar system’s output is near its lowest point of production for the day.

To handle the higher level of energy flow experienced in the spring months, the local distribution system must be sized to accommodate the greater of the two values. Consequently, the system may be sized up to 30 percent greater than normal. In a few cases, the reverse power flow could approach 50 percent more as compared to the customers’ peak load demand.

If a customer installs the level of rooftop solar required to offset all of their energy usage, including conversion of their gas appliances and gasoline vehicles to electric, the magnitude of exported energy demand can be much greater and the reverse flow effect becomes even more dramatic.

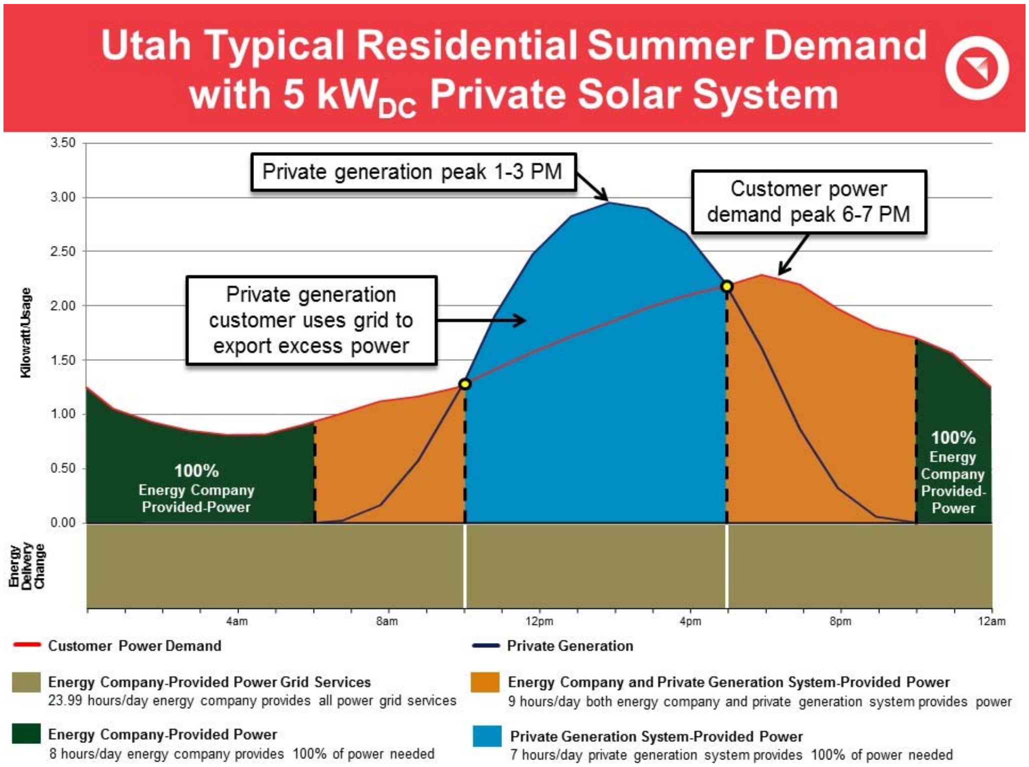
Q. Is the distribution system capable of handling increasing levels of distributed generation without any modification?

A. No. In addition to the local distribution system, increasing levels of distributed generation will require several changes. Advanced metering to monitor the system, updates in regulator, relay and recloser controls to account for two-way power flows and protect the system, increased levels of voltage management equipment and dead-line checking systems will be required. Retrofitting these systems can range in price from a few thousand dollars per device to several hundred thousand per substation for updated protection schemes. Most of these increased costs were discussed in my rebuttal testimony filed in the 2014 GRC.

Q. Please explain how a net metering customer uses the electric grid as compared to other customers.

A. Figure 1 below illustrates the power flow between the electric grid and a net metering customer. The figure demonstrates that the net metering customer utilizes the grid 24 hours per day except for two instantaneous points, shown by the small circles, when the direction of current flow changes from energy delivered to energy received. What the figure does not do is quantify the absolute level of grid utilization by the customer.

Figure 1



I have already explained that a net metering customer's peak utilization of the local distribution system occurs during the spring months and can be much higher than their summer peak load demand. This effect necessitates an increase in size of the local distribution facilities in order to accommodate the peak output for the solar facility. To illustrate the magnitude of grid utilization, one must calculate the absolute value of the energy flow between the customer and the electric grid. The absolute value is the sum of energy at the point of interconnection irrespective of the direction of flow. This is the level of energy that the Company must manage on each customer's behalf.

The average Utah residential customer consumes approximately 8,601 kilowatt-hours of energy annually. The absolute value of the energy flow for the electric net-zero energy customer used in this example is 11,558 kWh. This equates to a 134 percent higher level of energy managed on their behalf than for other customers. If customers install rooftop solar at a level to offset all of their energy usage on a net basis, including gas appliances and vehicles, the level of managed energy increases even more dramatically.

Proposed Application Fee

Q. Please explain the costs associated with processing net metering applications.

A. There are two cost categories associated with net metering applications: application processing and interconnection. Four departments are involved with the review and processing of net metering applications: customer call center, customer generation, and engineering and operations. The costs associated with each department are discussed below.

The customer call center incurs costs associated with creating work requests, handling customer information calls, processing net meter exchanges and production meter installs within the customer service system, handling suspended statements and reviewing related reports.

The customer generation department incurs costs related to application processing, database entry, billing, tracking, mapping and other regulatory reporting requirements. With the increase in applications, the need to automate the application process and receive payments must be part of the solution. These costs are incurred whether the customer's generation system is ultimately connected or not.

Once the application is accepted and entered, each application is reviewed by engineering to determine if the interconnection will create operational issues. These issues are typically limited to equipment and component overload or voltage and reliability problems. If the engineering review shows that system issues will occur, in accordance with applicable Commission rules, the customer must pay for the necessary corrections before her application is approved and before we will interconnect the generation system.

After the net metering application has been approved and the rooftop solar installation is completed, there are further costs associated with completing the interconnection and setting up the correct configurations within our Customer Service System ("CSS") for the net metering customer.

The operations department is responsible for completing the interconnect process with an inspection and installation of the net meter as well as constructing any required system modifications. If any issues are noted during the inspection, the installation of the net meter is postponed until all noted deficiencies have been corrected. After the meter exchange is completed at the customer's premise, the customer service group creates a virtual meter in CSS to reflect the measured delivered energy to the grid from the customer’s solar panels. The operations department then reviews the CSS system to validate the exchange, and verifies billing determinants are accurate to ensure a correct bill is presented.

Q. Are there differences in processing net metering applications under Levels 1, 2, and 3?

A. Yes. The key difference is the time that may be required by the engineering department to review the application for operational issues. Level 1 is defined as distributed energy systems of 25 kilowatts or smaller that operate with an inverter. These are the systems most commonly used in residential and small commercial applications. For Level 1 applications, the distribution system components generally reviewed are the service conductor, secondary cables and the distribution transformer and, in some circumstances, the distribution feeder and protection schemes. Level 2 is defined as systems 2 megawatts or less that don't otherwise qualify for Level 1. Level 3 is defined as systems 20 megawatts or less that don't otherwise qualify for Level 1 or 2.

The time required to review each application varies by complexity and location. While Level 1 interconnections are typically less complex to review, the majority of time spent by the engineering department is spent on Level 1 due to the volume of applications. Approximately eighty percent of applications reviewed are satisfied at Level 1.

The customer call center and customer generation group costs are similar to Level 1 for Level 2 and Level 3 applications. The engineering time for these higher level reviews are significant. These reviews can be as simple as a grounding review but can evolve into full system impact studies and require anywhere from two times up to and sometimes greater than eight times to review as a Level 1.

Level 2 reviews can be completed with a fairly simple engineering analysis and usually without using complex electrical models. The existing generation levels, along with the proposed new generation, are compared to several limits including circuit peak load, daytime light load, fault current at the point of interconnection as well as existing circuit protection schemes. A review of the grounding and protection requirements is also completed at this time. If any limits are exceeded, the application fails the analysis and referred to a Level 3 review.

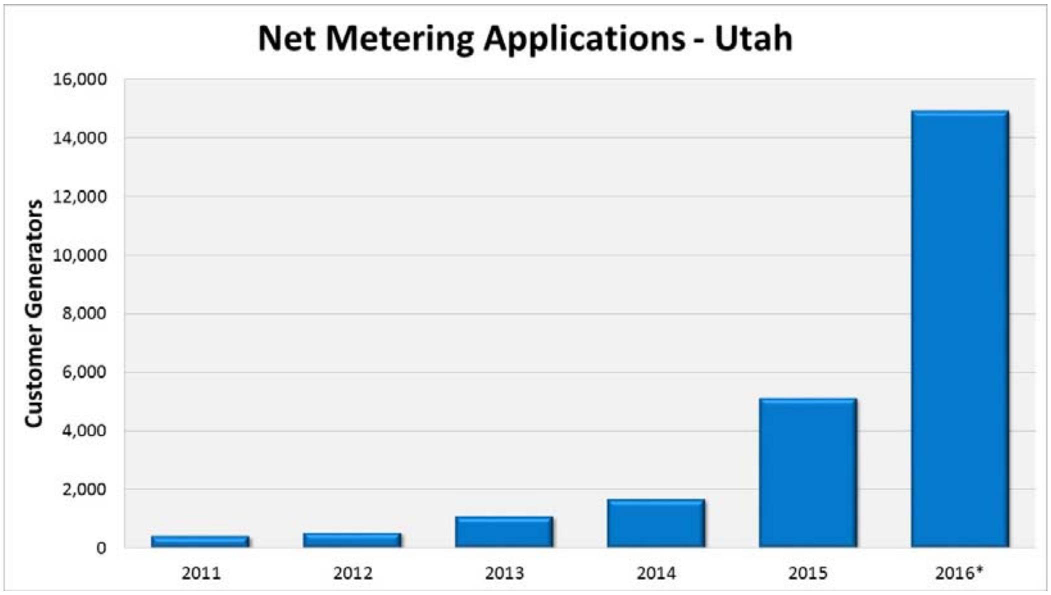
A Level 3 review expands upon the Level 2 analysis by including those results in complex engineering models that provide a detailed analysis of the interaction of the proposed generation with the electric system and with other generation points currently operating on the circuit. Load flow, short circuit, and protection scheme analysis studies are typical, and may require project management to develop and scope the solution before the application is approved.

Once approved and accepted by the customer, the operations department will complete the interconnect process as noted above, including constructing any required system modifications.

Q. Are net metering applications increasing?

A. Yes. The volume of applications throughout Rocky Mountain Power has increased exponentially since 2011. Most of this increase is in the Utah service territory. The following Figure 2 shows the actual number of new customer generators by year through 2015 and the forecasted level for 2016.

Figure 2



Q. What is the impact of this increase on the Company?

A. Due to the current level of applications, we have begun investigating ways to automate the application process in order to both manage the volume to meet our customers' expectations and to reduce the overall costs associated with processing these applications.

In addition, as the number of installations increase, the impact to the distribution system will increase and drive the required upgrades and modifications discussed earlier in my testimony. This includes protection and control systems, voltage regulations, transformer upgrades, etc. A change to operating equipment standards will be required to make them fully functional when two-way energy flows become more common.

Q. Are you aware of other states that have application fees for Level 1?

A. Yes. Net metering application fees are not new to the industry. For example, the state of California provides for the collection of application fees for solar installations. Fees up to $150 per Level 1 application to cover administration and engineering expenses have been reported. In the state of Washington, Pacific Power collects $100 from each applicant installing a system rated less than 25 kilowatts and $500 for systems rated from 25 to 100 kilowatts.

Conclusion

Q. Please summarize your testimony.

A. Rooftop solar generation does not reduce the distribution peak demand experienced by the electric grid to a degree that could warrant a reduction in infrastructure and could actually increase the base requirements for infrastructure at the local level. Furthermore, the total amount of energy transferred to and from the electric grid by residential net metering customers exceeds that of other customers by a significant amount. This is energy that must be stored, accounted for and managed by the Company on the customer's behalf. In addition, the Company incurs significant costs associated with applications for rooftop solar generation and their interconnection.

Q. Does this conclude your direct testimony?

A. Yes.