Rocky Mountain Power
Docket No. 14-035-114
Witness: Douglas L. Marx

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

Rebuttal Testimony of Douglas L. Marx

July 2017

Q. Are you the same Douglas L. Marx who sponsored direct testimony supporting the Company's application in this proceeding?

A. Yes I am.

Purpose of Rebuttal Testimony

Q. What is the purpose of your rebuttal testimony?

A. My rebuttal testimony responds to the direct testimony of Vote Solar witness Dr. David W. DeRamus, Utah Solar Energy Association ("USEA") witness Micah Stanley, and Vivint Solar witness Richard Collins. I rebut their criticisms of my testimony and challenge their ability to refute technical, engineering principles which they either ignore or are not able to refute.

Rebuttal of Utah Solar Energy Association witness Micah Stanley

Q. Do you agree with Mr. Stanley's statements that all customers benefit when net energy metering ("NEM") customers purchase new transformers or other equipment and if not, why not?

A. I do not agree with Mr. Stanley's broad, unsubstantiated statement. New transformers or other equipment installed for the benefit of a NEM customer do not translate into benefits for other customers. The new equipment only benefits the NEM customer whose system requires additional capacity. In other words, but for the NEM customer's distributed solar generation ("DSG") system, the replaced equipment would have been able to sufficiently handle the load requirements of the other existing customers. The replacements became necessary only due to the reverse power flow caused by the NEM customer's DSG system, which causes the rating of the replaced equipment to exceed its capabilities.

Q. Do you have any comments regarding Mr. Stanley's claim that "the solar industry and NEM customers have invested upwards of $10 million in upgrades to the overall grid?"

A. I thought it was a bold statement and was curious about its source. In response to the Company's request for supporting information, it became clear that there is no data, study, or any other analysis to support his claim. Specifically, USEA responded to the Company's request for supporting information, as follows:

> Mr. Stanley's statement in Direct Testimony is based on his 9 years of experience working in the energy industry and his expertise with providing financing for renewable infrastructure as described in lines 1 through 33. Documentation of these upgrades is not in his possession.[1]

Mr. Stanley's inability to provide support for his "$10 million in upgrades" statement leads me to the conclusion that those numbers are not based on any factual information and should therefore be ignored.

Q. Is there data to support costs that have been incurred or invested by NEM customers for new equipment or "upgrades" to the grid?

A. Yes. Company data shows that NEM customers have invested less than $250,000 of total upgrades to the Company's grid.

[1] RMP data request 1 attached as Exhibit RMP___(DLM-1R).

Q. Mr. Stanley testifies that "every 100 kWh's that the NEM program generates at the residential level is equivalent to 109.32 kWh's of energy generated through traditional means. The Studies fail to account for the value of the 9.32kWh's saved by all customers in that example."[2] Assuming his reference to "the studies" mean the cost of service studies filed by the Company, do you agree with his statement?

A. No. His statement is based on the flawed assumption that no portion of the generation from NEM customers at the residential level is subject to line losses. Only that portion of the customer's generation that is consumed instantaneously and within the premises is not subject to distribution line losses. Any excess generation that leaves the customer's premise is subject to line losses through the distribution system – where the greatest portion of the system losses occur. Further, all replacement energy for excess generation is subject to the full complement of system line losses which further reduces the value of any excess generation.

Q. How do you respond to Mr. Stanley's statements that "[w]hen NEM customers upgrade to new smart meters, they contribute a benefit to non-NEM customers because the new meters reduce the Company's operation costs, including costs associated with remote billing, troubleshooting, and data gathering. For example, smart meters reduce the meter readers' work load because they do not have to inspect each individual meter. Presumably, the Company passes on the associated savings to all customers, including non-NEM customers"?[3]

A. This is another example of Mr. Stanley's broad, conclusory and unsupported statements. The Company has an automatic meter reading system that remotely reads

[2] USEA witness Micah Stanley Direct Testimony, ll. 108-10.

[3] Stanley Direct Testimony, ll. 127-32.

over 98 percent of the meters in Utah. Thus, none of the savings he attributes to "smart meters" are available to the Company. In fact, the meters required by RMP's meter reading system for a NEM account are actually more expensive to install and replace than the meters installed for non-NEM accounts. The installation of more NEM meters will actually increase the Company's meter reading costs.

Rebuttal of Vote Solar witness Dr. David W. DeRamus

Q. What will you be addressing in Dr. DeRamus's testimony?

A. I address errors in his testimony based on technical engineering principles, noting certain popular but erroneous myths, contradictions and false assumptions. In contrast, Dr. DeRamus's testimony appears to be presented from an economist's perspective and is inaccurate from an engineering or technical perspective.

I assume that when Dr. DeRamus discusses the reduced energy consumption of NEM customers, he refers to the delivered energy at the point of interconnection (the electric meter). The introduction of on-site solar generation does not result in load reductions, it only changes the generation source for some of the load requirements.

In his testimony, Dr. DeRamus states "[the Company] significantly overstates the amount of exports by a typical Utah residential NEM customer during the summer (or any other season)."[4] He then contradicts himself when he says "residential NEM customers consumed 19 percent less energy than non-NEM customers, and they *exported 46 percent of a non-NEM customer's consumption.*"[5] [Emphasis added]. I would not characterize 46 percent as an overstatement.

Dr. DeRamus further states that "RMP cannot "handle" something it does not

[4] Vote Solar witness Dr. David DeRamus, Ph.D. Direct Testimony, ll. 700-1.
[5] *Id.* at ll. 715-17.

measure, attempt to control, or otherwise respond to."[6] This mischaracterizes the Company response to a Vote Solar data request he cites as the basis for his statement. Specifically, Vote Solar data request 4.2 asked: "[p]lease provide hourly data showing incremental upstream distribution line use due to excess solar export power flows from NEM solar customers in 2015." RMP responded:

> This data is not available. Metering systems are not capable of differentiating sources of energy generation, and bi-directional flow is only measured at the point of interconnection. [emphasis added].

Thus, Dr. DeRamus's statement that the Company "cannot handle something it doesn't measure" ignores the latter part of the Company's response in which the Company notes that it measures the bi-directional power flow at the customer's meter (*the point of interconnection*). Because this energy is entering the electric grid, RMP must "handle" it while ensuring the integrity of the electric grid. At the current time, energy flow is not measured in the normal course of business along the distribution lines. It is metered at the distribution substation and at customers' premises. Further, any excess generation that is put back to the grid must be accounted for as well as the utility replacement energy generated and delivered when the NEM customer has load requirements that exceed their system's generation ability and when the customer's system cannot generate. Thus, all excess energy is handled twice – when initially received from the NEM customer and again when it is delivered back to them.

Dr. DeRamus then erroneously concludes, "Mr. Marx's assertion that RMP "handles" reverse power flows is therefore entirely speculative and *unsupported by any evidence that such reverse flows exist* [emphasis added]."[7] This statement directly

[6] *Id.* at ll. 995-6.

[7] *Id.* at ll. 1001-3.

contradicts his earlier testimony stating: "I estimated the complete profile of the average NEM customer's usage characteristics, including production, on-site consumption, *energy exported to the grid*, and energy delivered from the grid [emphasis added]."[8]

Dr. DeRamus continues with the popular but erroneous assumption that the neighboring loads consume the NEM customers' exported power before it reaches the upstream distribution system.[9] He offers no proof to substantiate his claim (because such proof does not exist). Once any excess energy passes the NEM customer's electric meter, it enters the distribution system. It cannot be consumed by any other load, even if that load exists next door at the exact time as the excess energy is produced, without traversing RMP's electric distribution system.

Dr. DeRamus acknowledges in his testimony that reverse power flow does exist today.[10] But even assuming the Company did not measure the power flow at the point of interconnection (which is not the case), the insinuation of his statement that "RMP cannot "handle" something it does not measure, attempt to control, or otherwise respond to" (that just because you do not measure something means that it does not exist), is erroneous.

Dr. DeRamus correctly notes that "RMP does not need to measure or manage reverse power flows at *current levels* of residential distributed generation penetration [emphasis added]",[13] but he fails to acknowledge the long-term planning aspects required in utility design and construction. Utility engineers must ensure the designs

[8] *Id.* at ll. 724-6.
[9] *Id.* at ll. 998-1001.
[10] *Id.* at ll. 716-17.

and investments made today will provide safe and reliable service for many decades. Electric systems have life spans that exceed 30 years and it is not uncommon to see facilities with even longer useful lives. His testimony on technical matters is based on simplistic, anecdotal data that is prevalent in the public setting. It demonstrates a lack of technical knowledge and understanding of the dynamics of power flow or the necessary requirements for planning an efficient electric system.

When designing the electric system, with the objective of keeping rates flat or to minimize rate increases while also increasing reliability, engineers must consider the extended life of these assets as they analyze historical data, study industry trends and forecast future needs. These extended asset lives require sophisticated modeling of future systems including running various what-if scenarios, with increasing amounts of distributed generation, to form a basis for investments in the infrastructure.

California is an example of the effect of a large amount of solar energy on power flows and the energy export market created by the high level of solar that exists today. Solar production continues to grow annually and the levels seen today were most likely not planned for thirty years ago. A simple “CAISO duck curve” web query will produce reports that illustrate the challenges electric utilities will face in the future as more solar generation is brought online and as more residential customers seek to become “net-zero” energy consumers with larger, more efficient solar systems if they are not planned for.

Q. You presented two studies that show close to a seven percent reduction in system peak demand yet you did not recommend any changes to the infrastructure to account for this reduction. Why?

A. That is correct. I presented studies for the Northeast #16 circuit showing a seven percent reduction and a study for the Bingham #11 circuit showing a 6.8 percent reduction. While my direct testimony incorrectly stated a reduction of 3.6 percent for the Bingham #11 circuit, it was later corrected through discovery to the 6.8 percent reduction I note here. Based on these studies, I stated "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."[11]

Both of these studies were based on "best case" solar and standard temperature conditions with each rooftop "loaded" with as many solar panels as practical and without regard to the actual electrical load or mechanical loading of the individual premise. The studies did not include the effects of solar degradation due to aging panels, increased ambient temperatures, shading, cloud cover, etc. Distributed generation is a variable resource and, due to these changing conditions, cannot be relied upon to support the distribution system at any level that would exceed the calculated "best case" output. Thus, in planning studies the assumption that the distributed generation is not readily available is the most prudent planning approach to ensure system reliability and provide electric service at the time required. Therefore, his argument that it is premature to reach a meaningful conclusion should be given no weight - the studies assumed "best

[11] RMP witness Mr. Douglas Marx Direct Testimony, ll. 50-4.

case" scenarios.

Second, distribution equipment, including transformers and wire, are available in standard sizes. The incremental differences in capacity would not provide for accommodating condition changes in the small magnitude levels shown in these studies. It is evident that a small change in the peak demand on a distribution system would not materially affect the equipment sizes selected.

Q. In your previous testimony, you stated that NEM customers use the grid more than non-NEM customers yet Dr. DeRamus states that your methodology is flawed. How do you respond?

A. Dr. DeRamus states "[a] NEM customer either imports power from the grid or exports excess to the grid, and not both at the same time."[12] In that sentence, he acknowledges that NEM customers do use the grid differently than non-NEM customers. He proceeds to state "[w]hen NEM customers import power from the grid, they use the grid *less* than they would otherwise"[13] followed with "[w]hen NEM customers export power to the grid, they also use the grid less than they would otherwise, because their exported power is consumed by neighboring loads."[14]

My testimony quantified the increased level that a NEM customer uses the grid relative to a non-NEM customer, in terms of kilowatt-hours, for the total amount of energy both imported and exported by a NEM customers. It shows that the sum of those two values, which is the value of energy handled by the system, exceeds the total energy imported by a non-NEM customer. Thus, when accounting for the true use levels, NEM

[12] DeRamus Direct Testimony, ll. 1065-6.
[13] *Id.* at ll. 1068-9.
[14] *Id.* at ll. 1070-2.

customers indeed use the grid more than non-NEM customers and they use it for different purposes.

Q. Dr. DeRamus claims that due to the "different use" characteristics of a NEM customer, NEM actually benefits non-NEM customers. Do you agree?

A. No. There are several errors in his claims. First, he states "they do use the grid differently (at times) than other residential customers; but other residential customers benefit from that "different use," and RMP has submitted no evidence to support the conclusion that this "different use" has caused RMP to incur additional costs."[15] The Company supplied responses to numerous data requests showing the additional costs associated with current NEM customers, attached to my testimony as Exhibit RMP___(DLM-2R).[16] Apparently, Dr. DeRamus has chosen to ignore, this data.

Dr. DeRamus then proceeds to state "[o]n the contrary, the "different use" associated with NEM customers' exports reduces line-loadings on the local distribution network during time periods when that reduction is of value to the system."[17] The Company has demonstrated that the reduction in line loadings is an insignificant amount at the peak times and, when considering the variability of solar generation, the small level of reduction does not translate to any reduction in equipment sizing as required for peak demand periods. Dr. DeRamus continues to base his assumptions on false premises reflecting limited understanding of engineering principles employed in distribution planning.

Lastly he states "[f]urthermore, the recipients of that exported power

[15] *Id.* at ll. 1078-81.

[16] *See* Vote Solar data requests 1.24, 1.25, 3.7, 3.15-3.18, USEA data requests 2.1-2.3, and Vivint Solar data requests 2.9-2.10.

[17] DeRamus Direct Testimony, ll. 1081-3.

(neighboring customers) obtain that excess energy as if it had come from RMP's resources – and they pay RMP for that power at the full retail rate, i.e., inclusive of embedded transmission and distribution costs, generation capacity and fuel costs, line losses, etc."[18] Dr. DeRamus implies that excess energy does not have to be replaced as required in the net metering tariff and he chooses to ignore the fact that all energy, including excess energy, is subject to line losses as it traverses the distribution system. As stated earlier, all replacement energy for excess generation is subject to line losses which further reduces the value of that excess generation.

He continues with a similar myth that all excess energy produced by NEM customers is consumed by their neighbors. That statement holds true only in limited situations when the neighbors do not produce solar energy (as they could be producing excess at the same time) or when the neighbor's load is sufficiently high enough to require the full amount of excess energy. As more NEM customers approach net-zero generation, the already limited ability for "neighbors" to absorb the excess energy diminishes greatly. Further, as more NEM customers approach net-zero generation, local distribution losses will actually increase. As losses are included in retail rates, this resulting increase would effectively increase those rates passing additional costs to non-NEM customers in Utah.

[18] *Id.* at ll. 1083-6.

Q. Dr. DeRamus claims that RMP's proposal is not justified because, among other reasons, RMP points to "hypothetical" costs associated with "reverse flows," and because there has been no increase in maintenance activities on the distribution system related to NEM generation. Did the Company include any additional costs associated with "reverse power flows" or with maintenance activities on the distribution system in its costs of service studies as a cost to the NEM program or in the proposed rates?

A. No.

Rebuttal of Vivint Solar witness Richard Collins

Q. Mr. Collins states that you argue that "in May the maximum exported power could be as much as 50 percent more than the maximum imported power in July" and further claims "this argument is a red herring and only applies in limited cases."[19] How do you respond?

A. Mr. Collins' statement misrepresents my testimony. My testimony stated:

> 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 [emphasis added].[20]

Mr. Collins goes on to state that "only 13 percent of all [current] net metered customers are zero net energy."[21] That is not an insignificant number today and especially when one considers the potential for larger, more efficient systems being installed as solar panel efficiencies increase and panel prices continue to decrease,

[19] Collins Direct Testimony, ll. 737-39.

[20] Marx Direct Testimony, ll. 73-7.

[21] Collins Direct Testimony, l. 746.

making these installations more economical. There are long term planning aspects required in utility design and construction and RMP routinely analyzes several possible scenarios to understand future impacts. The potential for an increase in export power demand levels at the distribution level during spring months is real and must be considered. The Company will continue to study the effects of distributed generation on RMP's system through planning studies and when the time comes that these negative impacts become more pronounced, we will be in a better position to address them and ensure continued reliability of the electric system.

Q. Mr. Collins states that if "one or two customers on the transformer are a non-NEM customer or less than full zero net energy customer, then the exported power from the NEM customer will simply negate the inflow of power to the non-Net metering customers."[22] Do you agree?

A. No. His statement is only true within very limited parameters and highly dependent on the number of customers connected to the transformer and then, only to the extent that those non-NEM customers have the load requirements to absorb that exported power. A residential customer's load is typically at the lowest point during the spring and fall months. This is also the time when the solar panels have their highest generation output. As stated earlier, we will continue to analyze and plan for several factors across the electric system.

Q. Mr. Collins states that the seven percent peak demand reduction "may delay the need for future upgrades to the circuit."[23] Is this true?

A. That's a very ambiguous statement with no framing around "delay the need" and the

[22] *Id*. at ll. 741-4.
[23] *Id*. at ll. 749-50.

operative word is “may.” As I stated in my rebuttal of Dr. DeRamus’s testimony, these studies were based on “best case” solar and standard temperature conditions. The studies did not include the effects of solar degradation due to aging panels, increased ambient temperatures, shading, cloud cover, etc. Distributed generation is a variable resource and, due to these changing conditions, would not be relied upon to support the distribution system at any level that would exceed the calculated “best case” output. Furthermore, the system dynamics change year on year. With the addition of new loads, shifting usage characteristics associated with increasing spring or fall solar generation levels, and associated system requirements for protection and control to ensure system reliability, this “may” actually accelerate upgrades to the circuits.

Q. Please summarize your rebuttal testimony.

A. While the current level of NEM customers found on RMP’s distribution system does not require immediate action to manage or mitigate potential operational effects, testimony has shown that increasing levels will have a negative and costly effect on the distribution system. Residential 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. I have shown that the “different use” by NEM customers is quantifiable and exceeds that of non-NEM customers and the excess energy must be handled and managed by the Company on the customer’s behalf. Furthermore, I have dispelled the myth that excess residential solar energy is consumed by the neighbors. In fact, as more customers and neighborhoods approach “net-zero” energy profiles, the excess energy will continue to propagate further into the

distribution system and is subject to higher line losses than seen today. When all these factors are considered, the introduction of large amounts of NEM distributed generation does not produce system benefits and increases operational costs.

Q. Does this conclude your rebuttal testimony?

A. Yes.