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BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power to Establish Export Credits for Customer Generated Electricity	**DOCKET NO. 17-035-61** **Vivint Solar Exhibit 1R – Phase 1**

REBUTTAL TESTIMONY OF CHRISTOPHER WORLEY FOR VIVINT SOLAR, INC.

April 10, 2018

/s/Christopher Worley

I. INTRODUCTION AND PURPOSE OF TESTIMONY

Q. Please state your name, title and business address.

A. My name is Christopher Worley. My business address is 1800 W. Ashton Blvd, Lehi, Utah 84043. I am Director of Rate Design with Vivint Solar.

Q. Did you submit direct testimony in this proceeding?

A. Yes.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of my testimony is to respond to the direct testimony of Utah Division of Public Utilities ("Division") witnesses Robert A. Davis and Charles E. Peterson, Utah Clean Energy witness Kate Bowman, and Vote Solar witness Rick Gilliam.

Q. Do parties support or oppose the proposed structure of RMP's load research study?

A. Generally, the Division witnesses endorse RMP's proposed methodology, calling "the design… sound and practical"[1] and "reasonable" though Mr. Peterson has some concerns on sampling.[2] In contrast, Ms. Bowman, Mr. Gilliam, and I have strong concerns with the Company's proposed sampling and data collection methodology.

II. PURPOSE OF THIS PROCEEDING

Q. What is the purpose of this proceeding?

A. To determine the costs and benefits of exported power from rooftop solar systems on RMP's distribution system from which the Commission can establish a just and reasonable rate for the exported power.

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[1] Direct Testimony of Robert A. Davis, page 10.
[2] Direct Testimony of Charles E. Peterson, page 7.

Q. Is this proceeding supposed to be different from the proceeding in Docket 14-035-114?

A. At Vivint Solar, we thought the Commission intended parties to work more collaboratively and to thoroughly examine and analyze more and better data to enable the Commission to establish a just and reasonable export rate.

Q. Has this proceeding been different?

A. No, not so far. While there are some differences in RMP's proposed methodology for their load research study in this docket, it is not substantially different from what they proposed in Docket 14-035-114. There has been very little effort to consider and address other stakeholders' concerns.

Q. What do parties need from Phase I of this proceeding?

A. Parties need adequate data from distributed generation (DG) customers' solar systems to determine the impact of those systems on RMP's distribution system. Without enough correct data, parties will not be able to estimate adequately and justify the costs and benefits of exported power in Phase II of this proceeding. That will leave the parties other than RMP and the Division at a serious disadvantage. We will be forced to justify the benefits of solar power we propose without adequate data. In addition, the Commission's charge to establish a just and reasonable export rate will be much more difficult if RMP is not required to modify their proposed load research study and enlarge the sample.

III. DEFICIENCIES OF PROPOSED STRATIFIED SAMPLING

Q. Are parties satisfied with RMP's proposed use of stratified sampling?

A. The Division witnesses have no apparent concerns with stratified sampling. On the other hand, Utah Clean Energy and Vote Solar agree with Vivint Solar that there are serious issues with the proposed stratified sampling. Those issues will likely result in biased estimates, frustrating the estimation of costs and benefits in Phase II. I agree with Utah Clean Energy and Vote Solar on three main issues.

Firstly, RMP proposes mixing exported energy and delivered energy data from transition customers with generation data from grandfathered net energy metering ("NEM") customers.[3] This mixing of data will prevent the estimation of specific impacts on the RMP system. As Utah Clean Energy witness Ms. Bowman states, "Collecting generation data from specific customers is useful only to the extent that the data provides insight into the intertemporal relationship between exported energy, delivered energy, and total energy usage, which requires that all three data streams (generation, exports, and deliveries) are gathered from the same customer."[4]

Secondly, stratification on system capacity is a poor proxy variable for system exports because it ignores customer load profiles and system specifics that can strongly influence the amount of generation. Ignoring factors like orientation, tilt, and shading will bias the estimation of system generation. Mr. Gilliam notes "Neither rooftop solar capacity nor generation is a proxy for the variable of interest in this proceeding – exported energy – nor will either provide sufficient information about the customers' load profiles or the behaviors that drive the exported energy profile for which this proceeding will establish a rate."[5]

Thirdly, the proposed load research study sample size is too small for parties to estimate costs and benefits in Phase II. Mr. Gilliam agrees, stating "The unreliability of the sampling

[3] Direct Testimony of Kenneth Lee Elder Jr, page 6.
[4] Direct Testimony of Kate Bowman for UCE, page 14.
[5] Direct Testimony of Rick Gilliam, page 24.

method is compounded by the failure to draw samples of sufficient size to generate statistically significant conclusions."[6]

Q. How do Utah Clean Energy and Vote Solar recommend addressing the mixing of generation, export, and delivery data?

A. Ms. Bowman and Mr. Gilliam recommend that generation, export, and delivery data should be collected for each study participant.

Q. Do you agree?

A. I agree with that recommendation.

Q. How do Utah Clean Energy and Vote Solar recommend addressing issues arising from stratifying on system capacity?

A. Ms. Bowman and Mr. Gilliam recommend stratifying on total household consumption. Additionally, to address issues with system orientation, tilt, and shading, Ms. Bowman recommends "the Company collect information about orientation, tilt, and degree of shading of systems by visually inspecting the systems when meters are read or installed and/or issuing a survey to customers participating in the Load Research Study."[7] And Mr. Gilliam recommends "RMP… verify the rooftop system capacity, the orientation, and tilt angle of each system, as well as the location (zip code) and estimated degree of shading."[8]

Q. What are your recommendations on stratification?

A. I recommend not stratifying and instead using simple sampling. While stratified sampling reduces the data requirements of conducting a load research study, reducing the sample will decrease the statistical power of the data in Phase II. Parties need to ensure there is enough data

[6] Direct Testimony of Rick Gilliam, page 22.
[7] Direct Testimony of Kate Bowman for UCE, pages 16-17.
[8] Direct Testimony of Rick Gilliam, page 27.

to conduct the Phase II study. Using simple sampling will increase the sampling requirement to 379 for a study with accuracy of +/-5% at the 95% confidence level.[9]

Additionally, I agree that system orientation, tilt, and shading are important determinants of system production. As such, RMP should collect that information to augment the load research data set. That could be done visually, as recommended by Ms. Bowman, or it could be collected from solar installers. If the Company works with installers to collect generation data from inverters (as I recommended in my Direct Testimony), the installer could also share these system characteristics.

Q. What do you recommend if the Commission chooses stratified sampling?

A. If the Commission prefers stratified sampling, I agree with Ms. Bowman and Mr. Gilliam that the load research study should stratify on total household usage and running separate analyses for residential customers and commercial customers.[10]

IV. DEFICIENCIES OF PROPOSED COUNTY-LEVEL GEOGRAPHIC SAMPLING

Q. How does RMP propose to control for regional differences in the study?

A. The Company proposes county-level sampling, roughly based on the number of DG systems currently installed.[11] They claim this approach provides a "geographically representative sample."[12]

Q. Do parties identify issues with RMP's geographic sampling methodology?

A. Yes. Specifically, Division witness Mr. Peterson has two concerns. "The first concern is that the Company is implicitly assuming that the population variance is reasonably homogeneous

[9] https://www.surveysystem.com/sscalc.htm
[10] Direct Testimony of Kate Bowman for UCE, page 24 and Direct Testimony of Rick Gilliam, pages 29-30.
[11] Direct Testimony of Kenneth Lee Elder Jr, Table 2 in Exhibit RMP___(KLE-1) Page 4 of 4
[12] Direct Testimony of Kenneth Lee Elder Jr, page 11.

between regions. In particular, the concern is that southern Utah may be systematically different than northern Utah."[13] Additionally, he is concerned "there might be under-sampling in an area that is systematically different from the rest of the system and that make a material contribution to the overall system results."[14]

Q. Do you agree with Mr. Peterson's concerns?

A. Yes. I agree with Mr. Peterson that the RMP system is not likely to be homogeneous and that regional differences may under-sample or over-sample an area. Such a scenario would bias the results of the study.

Q. How does Mr. Peterson recommend addressing regional differences?

A. It seems Mr. Peterson recommends a visual inspection of the data to determine regional differences. "This possibility could be examined by looking for any systematic differences along north versus south regions." To address regional sampling concerns, he suggests that the study may "require additional sampling or other study of one or both regions."[15]

Q. How do you recommend controlling for regional differences?

A. Visual inspection of the data is not sufficient to control for regional differences because there are too many regional combinations that could be inspected (e.g., North vs. South, East vs. West, North vs. West, etc.). Furthermore, the results of the visual inspection would be subject for dispute unless parties could determine measurable, objective criteria to demonstrate the existence of regional differences.

The concerns Mr. Peterson raises are enough to cast serious doubt on the proposal RMP is making in this proceeding. The best way to address regional issues is to ensure the sample is

[13] Direct Testimony of Charles E. Peterson, page 6.
[14] Direct Testimony of Charles E. Peterson, page 6.
[15] Direct Testimony of Charles E. Peterson, page 6.

large enough to average out the impact of any one sub-region. As such, I recommend using simple sampling with a study accuracy of +/-5% at the 95% confidence level.

The real issue is that parties need to understand how exported power impacts RMP's distribution system under a variety of scenarios, like when distribution circuits have many DG systems and when distribution circuits have few DG systems. According to the Energy Information Administration, RMP has 1,055 distribution circuits.[16] It is unclear how many of these have DG installed or whether DG regularly causes backflow to transformers. I recommend the Company create a representative sample of distribution circuits so that parties can estimate how exported power impacts RMP's system under different scenarios. Study participants should be sampled from those distribution circuits.

V. SUMMARY AND RECOMMENDATIONS

Q. Please summarize your recommendations.

A. I recommend the following:

- Collect generation, delivery, and export data from each study participant
- Collect orientation, tilt, and shading for each DG system in the study
- Use simple sampling (instead of stratified sampling) with a study accuracy of +/-5% at the 95% confidence level
- Work with solar installers to access data from system inverters to increase the sample at a reasonable cost
- Use geographic sampling based on RMP's distribution system topology, creating a representative sample of distribution circuits

[16] 2016 EIA Form 816 data https://www.eia.gov/electricity/data/eia861/

If the Commission chooses stratified sampling instead of simple sampling, I recommend the following:

- Stratify on total household usage rather than system capacity
- Conduct separate analyses for residential and commercial customers

Q. Does this conclude your rebuttal testimony?

A. Yes.

Certificate of Service

I hereby certify that a true and correct copy of the foregoing Rebuttal Testimony of Christopher Worley for Vivint Solar, Inc. in Docket No. 17-035-61 was served by email this 10th day of April, 2018, on the following:

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