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**BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH**

<b>In the Matter of the Application of Rocky Mountain Power to Establish Export Credits for Customer Generated Electricity</b>	<b>DOCKET NO. 17-035-61</b>
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**REBUTTAL TESTIMONY OF CHRISTOPHER WORLEY  
FOR VIVINT SOLAR, INC.**

**April 10, 2018**

/s/Christopher Worley

1 **I. INTRODUCTION AND PURPOSE OF TESTIMONY**

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

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

5 **Q. Did you submit direct testimony in this proceeding?**

6 A. Yes.

7 **Q. What is the purpose of your rebuttal testimony?**

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

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

12 A. Generally, the Division witnesses endorse RMP’s proposed methodology, calling “the  
13 design... sound and practical”<sup>1</sup> and “reasonable” though Mr. Peterson has some concerns on  
14 sampling.<sup>2</sup> In contrast, Ms. Bowman, Mr. Gilliam, and I have strong concerns with the  
15 Company’s proposed sampling and data collection methodology.

16

17 **II. PURPOSE OF THIS PROCEEDING**

18 **Q. What is the purpose of this proceeding?**

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

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<sup>1</sup> Direct Testimony of Robert A. Davis, page 10.

<sup>2</sup> Direct Testimony of Charles E. Peterson, page 7.

22 **Q. Is this proceeding supposed to be different from the proceeding in Docket 14-035-**  
23 **114?**

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

27 **Q. Has this proceeding been different?**

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

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

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

41

### 42 **III. DEFICIENCIES OF PROPOSED STRATIFIED SAMPLING**

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

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

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

56 Secondly, stratification on system capacity is a poor proxy variable for system exports  
57 because it ignores customer load profiles and system specifics that can strongly influence the  
58 amount of generation. Ignoring factors like orientation, tilt, and shading will bias the estimation  
59 of system generation. Mr. Gilliam notes “Neither rooftop solar capacity nor generation is a proxy  
60 for the variable of interest in this proceeding – exported energy – nor will either provide  
61 sufficient information about the customers’ load profiles or the behaviors that drive the exported  
62 energy profile for which this proceeding will establish a rate.”<sup>5</sup>

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

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<sup>3</sup> Direct Testimony of Kenneth Lee Elder Jr, page 6.

<sup>4</sup> Direct Testimony of Kate Bowman for UCE, page 14.

<sup>5</sup> Direct Testimony of Rick Gilliam, page 24.

65 method is compounded by the failure to draw samples of sufficient size to generate statistically  
66 significant conclusions.”<sup>6</sup>

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

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

71 **Q. Do you agree?**

72 A. I agree with that recommendation.

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

75 A. Ms. Bowman and Mr. Gilliam recommend stratifying on total household consumption.

76 Additionally, to address issues with system orientation, tilt, and shading, Ms. Bowman

77 recommends “the Company collect information about orientation, tilt, and degree of shading of

78 systems by visually inspecting the systems when meters are read or installed and/or issuing a

79 survey to customers participating in the Load Research Study.”<sup>7</sup> And Mr. Gilliam recommends

80 “RMP... verify the rooftop system capacity, the orientation, and tilt angle of each system, as well

81 as the location (zip code) and estimated degree of shading.”<sup>8</sup>

82 **Q. What are your recommendations on stratification?**

83 A. I recommend not stratifying and instead using simple sampling. While stratified sampling

84 reduces the data requirements of conducting a load research study, reducing the sample will

85 decrease the statistical power of the data in Phase II. Parties need to ensure there is enough data

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<sup>6</sup> Direct Testimony of Rick Gilliam, page 22.

<sup>7</sup> Direct Testimony of Kate Bowman for UCE, pages 16-17.

<sup>8</sup> Direct Testimony of Rick Gilliam, page 27.

86 to conduct the Phase II study. Using simple sampling will increase the sampling requirement to  
87 379 for a study with accuracy of +/-5% at the 95% confidence level.<sup>9</sup>

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

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

95 A. If the Commission prefers stratified sampling, I agree with Ms. Bowman and Mr. Gilliam  
96 that the load research study should stratify on total household usage and running separate  
97 analyses for residential customers and commercial customers.<sup>10</sup>

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99 **IV. DEFICIENCIES OF PROPOSED COUNTY-LEVEL GEOGRAPHIC SAMPLING**

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

101 A. The Company proposes county-level sampling, roughly based on the number of DG  
102 systems currently installed.<sup>11</sup> They claim this approach provides a “geographically representative  
103 sample.”<sup>12</sup>

104 **Q. Do parties identify issues with RMP’s geographic sampling methodology?**

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

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<sup>9</sup> <https://www.surveysystem.com/sscalc.htm>

<sup>10</sup> Direct Testimony of Kate Bowman for UCE, page 24 and Direct Testimony of Rick Gilliam, pages 29-30.

<sup>11</sup> Direct Testimony of Kenneth Lee Elder Jr, Table 2 in Exhibit RMP\_\_\_\_(KLE-1) Page 4 of 4

<sup>12</sup> Direct Testimony of Kenneth Lee Elder Jr, page 11.

107 between regions. In particular, the concern is that southern Utah may be systematically different  
108 than northern Utah.”<sup>13</sup> Additionally, he is concerned “there might be under-sampling in an area  
109 that is systematically different from the rest of the system and that make a material contribution  
110 to the overall system results.”<sup>14</sup>

111 **Q. Do you agree with Mr. Peterson’s concerns?**

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

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

116 A. It seems Mr. Peterson recommends a visual inspection of the data to determine regional  
117 differences. “This possibility could be examined by looking for any systematic differences along  
118 north versus south regions.” To address regional sampling concerns, he suggests that the study  
119 may “require additional sampling or other study of one or both regions.”<sup>15</sup>

120 **Q. How do you recommend controlling for regional differences?**

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

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

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<sup>13</sup> Direct Testimony of Charles E. Peterson, page 6.

<sup>14</sup> Direct Testimony of Charles E. Peterson, page 6.

<sup>15</sup> Direct Testimony of Charles E. Peterson, page 6.

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

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

138

## 139 **V. SUMMARY AND RECOMMENDATIONS**

### 140 **Q. Please summarize your recommendations.**

141 A. I recommend the following:

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

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<sup>16</sup> 2016 EIA Form 816 data <https://www.eia.gov/electricity/data/eia861/>

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

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

154 **Q. Does this conclude your rebuttal testimony?**

155 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 10<sup>th</sup> day of April, 2018, on the following:

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