

**Before the Public Service Commission of Utah**

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In the Matter of the Investigation of the Costs and Benefits of PacifiCorp's Net Metering Program	<b>Docket No. 14-035-114</b> Vote Solar Exhibit 4.0 (SRT)
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**SURREBUTTAL TESTIMONY OF DAVID W. DERAMUS, PH.D.**

**ON BEHALF OF**

**VOTE SOLAR**

August 8, 2017

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1 **Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.**

2 **A.** My name is David W. DeRamus. I am a Partner with Bates White, LLC. My business address  
3 is 1300 Eye Street N.W., Suite 600, Washington, DC 20005.

4 **Q. HAVE YOU SUBMITTED TESTIMONY PREVIOUSLY IN THIS DOCKET?**

5 **A.** Yes. I filed direct and rebuttal testimony in this docket on behalf of Vote Solar. This  
6 responsive surrebuttal testimony is also sponsored by Vote Solar.

7 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

8 **A.** I have been asked to review and respond to the July 25, 2017 Rebuttal Testimony filed by  
9 certain witnesses from RMP, DPU, and OCS in this proceeding as it relates to my Direct  
10 Testimony.

11 **Q. RMP WITNESS STEWARD CONTENDS THAT THE USAGE CHARACTERISTICS**  
12 **OF RESIDENTIAL NEM CUSTOMERS RESULT IN RMP UNDER-RECOVERING**  
13 **ITS COSTS.<sup>1</sup> HOW DO YOU RESPOND?**

14 **A.** I disagree with Ms. Steward's contention, but more fundamentally, it is irrelevant to the  
15 inquiry required in this proceeding. The purpose of this proceeding is to determine not  
16 whether RMP is over or under-recovering its costs, but the separate question of whether the  
17 benefits of the NEM program outweigh its costs. First, Ms. Steward agrees that RMP's current  
18 residential rate structure causes "high use customers to subsidize other customers;" and that  
19 in adopting DSG, NEM customers, who are typically higher use customers, are responding to  
20 incentives created by the Commission in the current rate structure to reduce their load.<sup>2</sup> Ms.  
21 Steward concludes, however, that "back-up" generation provided to NEM customers by RMP,  
22 along with compensation of export energy at retail rates, "together" lead RMP to under-

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<sup>1</sup> Steward Rebuttal Testimony, lines 164 – 183.

<sup>2</sup> Steward Rebuttal Testimony, lines 170 – 172.

23 recover its costs.<sup>3</sup> In my Direct Testimony, I raise the point about high use customers  
24 subsidizing low use customers not to justify maintaining the status quo, as Ms. Steward  
25 implies, but to show the inherent fallacy of RMP’s analytical framework in which it includes  
26 its lost revenue as a “cost” of the NEM program. If high use customers are subsidizing low  
27 use customers through the existing rate structure; and if some high use customers are able to  
28 reduce or even eliminate that subsidy by lowering their load, e.g., by installing DSG systems;  
29 then even if RMP *were* under-recovering costs (a “fact not in evidence”), and if the  
30 Commission *were* to allow RMP to increase rates to all residential customers as a result (an  
31 assumption regarding the outcome of a future rate proceeding), it would be more appropriate  
32 to consider such a hypothetical “cost shift” as the elimination of a prior subsidy, and not the  
33 creation of a new one, as RMP assumes. This is why it is important from a methodological  
34 perspective for the Commission to focus on whether the NEM program has resulted in actual  
35 incremental costs, caused directly by DSG customers, that have not been recovered from  
36 NEM customers, rather than allowing RMP to include its lost revenues as an inherent part of  
37 the cost-benefit calculus. If RMP were able to show that the NEM program caused RMP to  
38 incur actual incremental, unreimbursed costs (i.e., expenditures), and that the benefits of the  
39 NEM program did not exceed those costs, then the Commission would have a reasonable basis  
40 to conclude that the cost exceed the benefits and that there is a subsidy that it may need to  
41 address (depending on the magnitude of the costs). RMP, however, has not made that  
42 showing.

43 **Q. HOW DO YOU RESPOND TO MS. STEWARD’S ARGUMENTS ABOUT BACK-UP**  
44 **GENERATION COSTS AND THE RETAIL CREDIT VALUE FOR DSG EXPORTS?**

45 **A.** With regard to Ms. Steward’s argument that RMP incurs additional unreimbursed costs in  
46 providing “back-up” generation for residential NEM customers’ intermittent DSG systems,

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<sup>3</sup> Steward Rebuttal Testimony, lines 176 – 181.

47 RMP provides no evidence or analysis to suggest that such “back-up” costs are not already  
48 embedded in the retail rates that residential NEM customers pay for the power they purchase.  
49 Given that the average monthly load of residential NEM customers is slightly higher than for  
50 non-NEM customers, I would expect that NEM customers are bearing a reasonably  
51 proportionate share of such “back-up” costs. Ms. Steward’s argument that crediting NEM  
52 customers’ generation exports at the full retail rate (via the crediting mechanism) may not be  
53 consistent with their value is premature and unsupported by the evidence in this proceeding.  
54 That issue should be addressed in a separate proceeding, using a methodology capable of fully  
55 quantifying the value of NEM customers’ exports. Determining an appropriate credit value  
56 for residential NEM customers’ exports requires a very different analytical approach than  
57 determining whether their load characteristics are sufficiently different from non-NEM  
58 customers to justify segregating them into a distinct rate class, with an entirely different rate  
59 structure (as RMP proposes to do). DPU, OCS, and RMP agree that the export credit rate  
60 should be decided in a later proceeding.<sup>4</sup>

61 **Q. RMP WITNESS STEWARD CRITICIZES YOUR ANALYSIS OF RESIDENTIAL**  
62 **NEM VS. NON-NEM CUSTOMER LOAD. HOW DO YOU RESPOND?**

63 **A.** I disagree with Ms. Steward’s characterizations of the data and the conclusions she draws  
64 from the data. According to Ms. Steward, residential NEM customers have “notably lower  
65 load factors” than non-NEM customers, and a greater variation in load factors, which she  
66 interprets as providing support for RMP’s proposal for segregating NEM customers into a  
67 separate rate class.<sup>5</sup> The data show otherwise. First, Ms. Steward concedes that residential  
68 NEM and non-NEM customers have similar average monthly electricity consumption.<sup>6</sup> Thus,  
69 there are not sufficient differences between residential NEM vs. non-NEM customers in terms

<sup>4</sup> Powell Direct Testimony, lines 454 – 528; Beck Direct Testimony, lines 337 – 653; Hoogeveen, lines 205 – 212.

<sup>5</sup> Steward Rebuttal Testimony, lines 110-111.

<sup>6</sup> Steward Rebuttal Testimony, line 107.

70 of their monthly average consumption to justify separating NEM customers into a separate  
71 rate class. In fact, as I discuss in my Direct Testimony, NEM customers on average continue  
72 to have higher consumption than non-NEM customers even after they install DSG, except  
73 during the summer, when their consumption is lower than non-NEM customers due to the  
74 increased output of their DSG systems – and this relative reduction in their summer loads  
75 provides a system benefit.<sup>7</sup> I also agree with Ms. Steward and other witnesses that the hourly  
76 consumption pattern is different for NEM vs. non-NEM customers, because NEM customers  
77 generate electricity from their DSG systems during the day, which reduces their load during  
78 daylight hours. However, Ms. Steward incorrectly considers this daytime production to be a  
79 potential system cost, due to the resulting reduction in RMP’s revenues and the exports from  
80 DSG systems in certain hours. By contrast, I consider this generation from NEM customers’  
81 DSG systems during the daytime – including during peak hours – to be an important system  
82 benefit, because it supplies electricity and reduces load at times when it is of significant value  
83 to do so. RMP has not provided any evidence that exports from residential DSG systems have  
84 caused RMP to incur incremental unreimbursed system costs, e.g., to accommodate “reverse  
85 flows” (I discuss Mr. Marx’s Rebuttal Testimony on this below).

86 **Q. HOW DO YOU RESPOND TO MS. STEWARD’S ASSERTIONS REGARDING**  
87 **LOAD FACTORS?**

88 **A.** I disagree with Ms. Steward that load factors for NEM customers are “notably lower” than  
89 for non-NEM customers. As I discuss in my Direct Testimony, the average load factors are  
90 25% for residential NEM customers vs. 26% for residential non-NEM customers, but this  
91 small difference is not statistically significant.<sup>8</sup> DPU witnesses Powell and Faryniarz agree  
92 with this assessment in their Direct Testimony: Dr. Powell states that average load factors are

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<sup>7</sup> DeRamus Direct Testimony, lines 948 – 967.

<sup>8</sup> DeRamus Direct Testimony, lines 940 – 942.

93 “similar,”<sup>9</sup> while Mr. Faryniaz states that there are not “large differences” in load factors.<sup>10</sup>  
94 Dr. Powell’s Table 6 in his Direct Testimony also shows that the difference between residential  
95 NEM and residential non-NEM customers’ load factors of 25% and 26% (respectively) is not  
96 statistically significant. Moreover, given the small sample size on which RMP’s load study is  
97 based, this small difference in load factors falls within margins of statistical error. In fact,  
98 RMP’s own analysis of customer load factors shows that the load factors for residential NEM  
99 and non-NEM customers are not meaningfully different. As noted in my direct testimony, the  
100 mean and standard deviation of the load factors for the 52 residential NEM customers are 25%  
101 and 10%, compared to 26% and 8% (respectively) for the 195 residential non-NEM  
102 customers. At the “tails” of the distribution, the 20th and 80th percentile load factors for the  
103 NEM customers are 17% and 33%, compared to 19% and 32% (respectively) for non-NEM  
104 customers. Thus, the load factors for RMP’s selected sample of residential NEM solar  
105 customers are not significantly different from those for other residential customers.<sup>11</sup> While  
106 I conclude that the overall distribution of load factors is not significantly different for NEM  
107 vs. non-NEM customers (based on RMP’s limited customer sample), Dr. Powell notes some  
108 “ambiguity” in the available data, while Mr. Faryniaz concludes that RMP’s sample shows  
109 there is some increased variation in NEM customer load factors, “but not drastically so.”<sup>12</sup>  
110 Further, the “ambiguity” in the data Dr. Powell notes at most reflects the inadequate size of  
111 RMP’s load study sample, demonstrating the statistical inadequacy of its data to support a  
112 drastic change in rates such as separating DSG customers as a separate rate class. Thus,  
113 Ms. Steward’s asserted differences in load factors provide no basis to segregate NEM  
114 customers into a separate rate class.

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<sup>9</sup> Powell Direct Testimony, lines 435 – 437.

<sup>10</sup> Faryniaz Direct Testimony, lines 1277 – 1280.

<sup>11</sup> DeRamus Direct Testimony, lines 940 – 944.

<sup>12</sup> Faryniaz Direct Testimony, lines 1277 – 1280.

115 **Q. HOW DO YOU RESPOND TO MS. STEWARD’S ASSERTION THAT YOUR**  
116 **COMPARISON OF THE DISTRIBUTION OF LOAD FACTORS FOR NEM VS.**  
117 **NON-NEM CUSTOMERS WAS FLAWED?**

118 **A.** Ms. Steward states that I incorrectly concluded that the distribution of NEM customers’ load  
119 factors is not significantly different than for non-NEM customers, because the average load  
120 factors for the 52 residential NEM customers in RMP’s sample are “not sufficient for the KS  
121 test” (referring to the Kolmogorov-Smirnov test I applied in my Direct Testimony).<sup>13</sup> As I  
122 note in Direct Testimony (and explain further below), her observation, although technically  
123 incorrect as applied to the KS test, underscores my overall criticism of RMP’s data: namely,  
124 that RMP’s sample of NEM customer load data is far too small to be sufficiently reliable to  
125 be used a basis for robust statistical analysis and policy recommendations in this proceeding.  
126 While the KS test can be applied to a sample of only 52 observations, this small sample size  
127 does limit the ability of the KS test to identify any actual differences that may exist in the  
128 distribution of load factors between the broader populations of NEM and non-NEM  
129 customers. Ms. Steward, however, goes further and applies the KS test to RMP’s sample of  
130 residential customers’ monthly load factor data (such that each monthly load factor is a single  
131 observation, rather than using an average annual load factor); from this, she concludes that  
132 the distributions of *monthly* average load factors are significantly different between NEM and  
133 non-NEM customers, even if the data are insufficient to detect such differences on an *annual*  
134 average basis. Comparing the distribution of *monthly* load factors, however, does not address  
135 the relevant question for this proceeding, namely: whether the load factors for NEM and non-  
136 NEM customers sufficiently different – both on average and across all customers – such that  
137 RMP is unable to recover a reasonable share of costs from NEM customers vs. non-NEM  
138 customers over the course of a given year. While RMP bills customers on a monthly basis,

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<sup>13</sup> Steward Direct Testimony, lines 191 – 192.

139 the rate structure targets cost recovery (plus a return) on an annual basis (as in a standard cost-  
140 of-service analysis). With a volumetric rate structure, if there is a very low load factor for  
141 NEM customers vs. non-NEM customers on an annual average basis, this may indicate that  
142 annual revenues charged to NEM customers may not adequately compensate RMP for their  
143 peak-period consumption (as compared to non-NEM customers). But that is not what the data  
144 show: the annual average load factors for residential NEM vs. non-NEM customers are  
145 virtually undistinguishable. The variation in monthly load factors observed by Ms. Steward,  
146 however, has nothing to do with RMP's annual cost recovery from NEM and non-NEM  
147 customers.

148 **Q. ARE THERE ANY OTHER PROBLEMS WITH MS. STEWARDS MONTHLY**  
149 **LOAD FACTOR ANALYSIS?**

150 **A.** Yes. Ms. Steward incorrectly assumes that she can cure RMP's small customer sample size  
151 by simply using the data on a monthly basis rather than an average basis; thus 52 customer  
152 observations (for load) becomes 621 monthly observations.<sup>14</sup> There are significant statistical  
153 problems with this approach. The KS test assumes that the observations are independent of  
154 one another; Ms. Steward's approach violates this assumption of independence. A customer's  
155 consumption in one month is not independent of their consumption in another month; if a  
156 customer lives in a large or a small house, they are likely to be a relatively large or small  
157 electricity user across all months. This lack of independence among the monthly observations  
158 thus limits the usefulness of the KS test, as applied by Ms. Steward. Furthermore, there are  
159 likely systematic differences in load factors between different months (i.e., in March vs. July).  
160 This further limits the reliability or relevance of Ms. Steward's comparison, since it assumes  
161 that all of the monthly observations are comparable (i.e., as if the load factors for NEM  
162 customers in March were comparable with those of non-NEM customers in July). Given

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<sup>14</sup> There are 3 missing observations out of 624 monthly observations.



163 RMP's small sample of NEM customers, Ms. Steward's analysis is thus not sufficient to  
164 establish that the monthly consumptions are different, but even if the data were sufficient, it  
165 would not have any implication for whether NEM customers should be segregated in a  
166 separate rate class, since it would be testing an irrelevant hypothesis.

167 **Q. MS. STEWARD SAYS THAT HER MONTHLY LOAD FACTOR ANALYSIS**  
168 **SUPPORTS DR. POWELL'S CONCLUSIONS. HOW DO YOU RESPOND?**

169 **A.** I disagree. Ms. Steward says that the results of the KS test she performs are consistent with  
170 the results of the KS test obtained by Dr. Powell in his Direct Testimony. But Dr. Powell uses  
171 the KS test very differently than Ms. Steward. Ms. Steward uses the KS test to analyze  
172 monthly load factors; Dr. Powell uses the KS test to determine whether the load *shapes* of  
173 NEM customers, i.e., the distribution of a customer's load over the course of a typical day,  
174 are significantly different than those of non-NEM customers. As I noted above, this is one  
175 area where we are in agreement, and where the use of KS test is unnecessary: the DSG systems  
176 owned by NEM customers generate power during the day, which reduces NEM customers'  
177 daytime loads, which will make their daily load pattern different than those of non-NEM  
178 customers. Furthermore, as Dr. Powell's Figure 2 demonstrates, residential NEM customers'  
179 load in non-daylight periods (i.e., in off-peak periods, when both generation costs and grid  
180 use is lowest) is as much as 60% *higher* than non-NEM customers' load. This provides a  
181 reasonable indication of how much higher residential NEM customers' overall consumption  
182 (in all hours) had been relative to non-NEM customers, prior to installing their DSG systems.  
183 According to Dr. Powell's Figure 2, however, residential NEM customers' load drops to as  
184 much as 50% *less* than non-NEM customers during afternoon hours – and there is a persistent  
185 and significant reduction *throughout* the peak hours, when this reduction is most valuable  
186 (i.e., when generation costs and grid use is highest).<sup>15</sup> This observation regarding differences

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<sup>15</sup> Powell Direct Testimony, line 357.

187 in daily load *shapes* does not establish that there are differences in average load *factors*, as  
188 Ms. Steward mistakenly suggests in her Rebuttal Testimony.<sup>16</sup> In fact, it is precisely those  
189 differences in load shapes that demonstrate the benefits that customer investments in DSG  
190 systems provide to RMP’s system as a whole.

191 **Q. HAVE YOU EVALUATED MS. STEWARD’S OPTIONAL TOU RATE FOR**  
192 **RESIDENTIAL NEM CUSTOMERS?**

193 **A.** Yes. As an alternative (or complement) to RMP’s primary proposed rate structure for  
194 residential DSG customers based on demand charges, Ms. Steward proposes an optional TOU  
195 rate, with an energy charge of 28.6 cents/kWh in peak hours and 3.6 cents in off-peak hours;  
196 as well as a monthly fixed customer charge of \$28. With regard to the energy charge, RMP’s  
197 proposal indicates that a customer’s reduction in its peak-period consumption is worth  
198 approximately 8 times the reduction in its consumption during off-peak periods. I have not  
199 fully evaluated whether a rate structure with such a large differential between on-peak and  
200 off-peak rates is supportable. I do note, however, that if it were cost-justified, this TOU rate  
201 structure would be supportive of the benefits that residential DSG provides to the system  
202 under the current NEM program, since a significant share of DSG exports occur during peak  
203 hours, and these exports are currently valued at the average retail rate, which is far less than  
204 28.6 cents/kWh. With regard to RMP’s proposed \$28 monthly customer charge, this change  
205 to existing residential rates, for DSG customers only, is as unjustified and unreasonable as  
206 RMP’s proposal to increase residential NEM customers’ monthly charges in its proposed  
207 demand charge-based rate, for the same reasons described in my Direct Testimony.<sup>17</sup> It is also  
208 instructive to compare RMP’s proposed TOU rates for NEM customers with RMP’s current  
209 Schedule 2 “time-of-day” rider. The current Schedule 2 has a considerably smaller differential

<sup>16</sup> Steward Rebuttal Testimony, lines 201 – 204.

<sup>17</sup> DeRamus Direct Testimony, lines 1453 – 1464.

210 between peak and off-peak energy rates (a differential of 6 cents/kWh vs. 25 cents/kWh in the  
211 proposal for NEM customers); and *no* additional monthly charge (other than RMP’s standard  
212 residential monthly charge). This radical difference between the TOU rate RMP proposes for  
213 residential NEM customers vs. the TOU rate available to other residential customers  
214 demonstrates the unduly discriminatory way in which RMP can use rate design to financially  
215 penalize customers who choose to install DSG systems, if the Commission were to approve  
216 segregating residential NEM customers into a separate class.

217 **Q. RMP WITNESS MEREDITH STATES THAT IT IS INAPPROPRIATE TO**  
218 **ANALYZE THE CONSUMPTION OF RESIDENTIAL NEM CUSTOMERS**  
219 **BEFORE AND AFTER THEY ADOPT DSG SYSTEMS.<sup>18</sup> HOW DO YOU**  
220 **RESPOND?**

221 **A.** I strongly disagree. Mr. Meredith suggests that it would not be useful to compare NEM  
222 customers’ consumption before and after installing DSG, due to potential changes in weather  
223 and “different usage patterns for each customer.”<sup>19</sup> Mr. Meredith’s position on this issue is  
224 puzzling. There are standard ways of normalizing consumption data to account for differences  
225 in weather. His concern about “different usage patterns” is even more puzzling, since  
226 analyzing NEM customers’ usage patterns – and changes in those usage patterns after  
227 installing rooftop solar – is precisely the point. When customers adopt DSG, their system  
228 load – and potentially their aggregate consumption – changes. At issue in this proceeding is  
229 whether those changes are beneficial or detrimental from a system perspective. My analysis  
230 of the available data suggests that such changes are beneficial, since the adoption of DSG  
231 reduces peak-period load for the system and pushes out the peak-hour demand by NEM  
232 customers. Further, RMP has not submitted any evidence that it has had to make  
233 (unreimbursed) system upgrades to accommodate reverse flows, or that it is likely to do so in

<sup>18</sup> Meredith Rebuttal Testimony, lines 255 – 267.

<sup>19</sup> Meredith Rebuttal Testimony, lines 261 – 268.

234 the near future, given the low level of DSG penetration in Utah. Additional data to fully  
235 understand the impact of the adoption of residential DSG on system load – with implications  
236 for system costs – can only be helpful to the Commission.

237 **Q. MR. MEREDITH STATES THAT RMP’S SAMPLE OF NEM CUSTOMER DATA**  
238 **WAS SUFFICIENT FOR THIS PROCEEDING.<sup>20</sup> HOW DO YOU RESPOND?**

239 **A.** Mr. Meredith contends that RMP’s sample of 52 residential NEM customers for load data,  
240 and 36 customers for production data, provides sufficient data for this proceeding,  
241 notwithstanding the recent growth of residential NEM customers. I disagree with his  
242 assertion. The dramatic increase in the number of residential DSG customers in Utah between  
243 the time the sample was selected in 2014 and 2017 – from 1,578 to 19,000 customers –  
244 significantly reduces its reliability as a guide to policy-making on a going-forward basis, for  
245 three reasons. First, determining the necessary sample size is not simply a matter of inputting  
246 a few numbers into a single formula, as Mr. Meredith incorrectly suggests; it depends  
247 considerably on the parameter(s) of interest (e.g., load factor, hourly consumption patterns,  
248 the amount of behind-the-meter generation, etc.); what types of hypotheses about the  
249 parameter(s) of interest are to be tested (e.g., whether there are significant differences between  
250 NEM and non-NEM customers in terms of their average load factors, the variance among  
251 individual customers in their average load factors, monthly consumption patterns, hourly  
252 consumption patterns, etc.); the potential (and likely unknown) variance of the parameter(s)  
253 of interest for the population as a whole, including most importantly here, the potential  
254 variance of load factors among residential NEM vs. non-NEM customers; the statistical  
255 “power” of the hypothesis test; the degree of precision needed; and perhaps most importantly,  
256 the overall purpose of the analysis. RMP is proposing a major change in rate design for NEM  
257 customers based on this data sample, and as such, the reliability of its data needs to be very

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<sup>20</sup> Meredith Rebuttal Testimony, lines 268 – 302.

258 high. The parameter of interest on which RMP's proposal hinges – the load factor for  
259 residential NEM vs. non-NEM customers – can vary considerably among individual  
260 customers, in ways that cannot be determined *ex ante*, given RMP's lack of AMI or other data  
261 collection; hence, the need for a sufficiently large sample to allow one to perform a detailed  
262 comparison of usage patterns, and to implement statistically valid hypothesis testing. Indeed,  
263 the potential for even larger variance of load factors among NEM customers, due to the fact  
264 that both the output of individual DSG systems and the individuals' consumption may vary,  
265 implies that it would be particularly important to oversample for residential NEM customers.  
266 By comparison, when APS proposed a change to its rates, APS analyzed the hourly data of  
267 over 37,000 residential DSG customers in Arizona (67% of the residential DSG customers to  
268 date).<sup>21</sup>

269 **Q. YOU SAID THERE ARE A NUMBER OF REASONS WHY RMP'S SMALL DATA**  
270 **SAMPLE IS INSUFFICIENT. WHAT ARE OTHER REASONS?**

271 **A.** The large and rapid increase in the number of customers (by more than an order of magnitude)  
272 is likely attributable to the declining cost of DSG. This, in turn, implies that usage  
273 characteristics of residential DSG customers may be changing over time, e.g., due to  
274 installations on smaller houses, or by individuals with lower incomes (since lower costs  
275 increase the affordability of DSG); the potential for the installation of larger or smaller DSG  
276 systems relative to customer usage; or other customer or system characteristics that can result  
277 in systematic differences in consumption patterns. The consumption characteristics of early  
278 DSG adopters in 2014 may well be significantly different than later adopters in 2017 and  
279 beyond. Even the potential for such systematic differences in NEM customers over time will  
280 significantly reduce the reliability of the conclusions that can be drawn from RMP's small

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<sup>21</sup> Direct testimony of James A. Heidell before the Arizona Corporation Commission, Docket No. E-01345A-16-0036 (February 3, 2017), at p. 5.

281 sample for forward-looking policy purposes. Contrary to Mr. Meredith’s assertion, I am not  
282 suggesting that residential DSG growth needs to stabilize before drawing an adequate sample;  
283 I simply note that this rapid growth strongly supports the need for a significantly larger sample  
284 in order to draw any meaningful conclusions from the data, and to ensure against potential  
285 selection biases that may otherwise result from a small sample selected based on 2014 criteria.

286 **Q. MR. MEREDITH STATES THAT IF THE SAMPLE HAD BEEN SELECTED IN**  
287 **2016, IT WOULD BE THE SAME SIZE AS THE CURRENT SAMPLE.<sup>22</sup> HOW DO**  
288 **YOU RESPOND?**

289 **A.** Mr. Meredith states that since “the standard deviation of the population declined  
290 considerably” between 2014 and 2016, the number of customers that would be required today  
291 for a sufficient sample would be approximately the same as determined in 2014. Mr. Meredith  
292 does not provide the calculations on which he bases this statement. Nor is Mr. Meredith clear  
293 what standard deviation he calculated (monthly consumption or load factors?) and to what  
294 “population” he is referring (residential NEM customers or all Utah residential customers?).  
295 Based on the available data, there is no way for Mr. Meredith to even calculate the load factors  
296 or the amount of behind the meter generation (the two parameters of greatest importance in  
297 this proceeding) for the entire population of NEM and non-NEM customers; that is precisely  
298 why RMP needs to draw a sample of customers. By stating that the size of the sample would  
299 be the same, it also is not clear whether Mr. Meredith means that the sample would consist of  
300 62 load meters (i.e., including the 10 customers in the 2014 sample who were actually wind  
301 generation customers and thus not used in the data analysis for DSG), as indicated in RMP  
302 Exhibit J (RMP’s 2014 sampling plan for residential DG); or 52 load meters, as was actually  
303 used by RMP in support of its testimony in this proceeding; or even 36 production meters,  
304 given the refusal of more than 30% of RMP’s sample to allow RMP to install production

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<sup>22</sup> Meredith Rebuttal Testimony, lines 276 – 292,

305 meters and collect production data. Indeed, the refusal of such a large portion of RMP's  
306 already small sample to allow RMP to install production meters significantly undermines the  
307 reliability of its analysis, particularly given the potential selection bias associated with this  
308 refusal. More fundamentally, however, as both Dr. Powell's and my analysis in my Direct  
309 Testimony show, it is important to understand much more than simply whether the average  
310 load factors are the same or different between NEM and non-NEM customers. As both Dr.  
311 Powell and I concluded, the average load factors are not significantly different for NEM vs.  
312 non-NEM customers. However, Dr. Powell and I both attempt to understand how the load  
313 factors vary among NEM and non-NEM customers; whether there is a greater prevalence of  
314 low vs. high-load factor customer (the "skewness" of the distribution); and whether there is a  
315 greater prevalence of customers in the "tails" of the distribution (the "kurtosis" or "peakiness"  
316 of the distribution).<sup>23</sup> The sample selection criteria described by Mr. Meredith, even if they  
317 had been correctly applied to analyze the difference in average load factors, are not designed  
318 to determine the sample size needed to compare these "higher moments" of the distribution  
319 (variance, skewness, and kurtosis) between NEM and non-NEM customers with any  
320 meaningful level of precision. Furthermore, it is widely accepted that an important measure  
321 of system benefits is the extent to which a given policy reduces peak load consumption; which  
322 implies that data on changes in NEM customers' hourly consumption are at least as important  
323 as an overall indicator of the benefits of the NEM program as the average load factors for  
324 NEM vs. non-NEM customers; which further implies that additional data are needed from a  
325 larger sample of residential NEM customers in Utah.

326 **Q. IN MUCH OF YOUR RESPONSE ON THE ISSUE OF SAMPLE SIZE, YOU OFTEN**  
327 **REFERENCE THE IMPLICATIONS FOR THE ANALYSIS OF LOAD FACTORS.**

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<sup>23</sup> Powell Direct Testimony, Table 6, line 421. In my Direct Testimony, I applied a statistical test (the Kolmogorov-Smirnov test) to evaluate whether there was a statistically significant difference between the overall distributions. DeRamus Direct Testimony, lines 935 – 947 and fn. 57.

328 **DO YOU HAVE ANY DISTINCT CONCERNS REGARDING THE SMALL**  
329 **CUSTOMER SAMPLE FOR PRODUCTION DATA?**

330 **A.** Yes. The fact that information on residential DSG customers' production is only available for  
331 a sample of 36 customers is even more concerning than its load data drawn from a sample of  
332 52 customers. In its cost-benefit analysis, RMP's estimate of NEM customers' behind the  
333 meter generation is based entirely on this exceptionally small data sample; and this parameter  
334 is a basic input into RMP's estimate of both its "costs" (RMP's lost revenues) and benefits  
335 (RMP's avoided generation costs associated with generating this volume of energy). Not only  
336 does this production sample suffer all the same defects of the load sample (since it is a subset  
337 of that sample), but it also suffers from the fact that more than 30% of RMP's customer sample  
338 refused to allow RMP to collect production data from them, which introduces potential  
339 selection bias. Again, much depends on the outcome of RMP's cost-benefit analysis, and this  
340 production parameter in particular. RMP simply has not provided a sufficiently reliable  
341 information basis to support its analysis and rate proposals.

342 **Q. PLEASE SUMMARIZE MR. WILDING'S RESPONSE TO YOUR DIRECT**  
343 **TESTIMONY.**

344 **A.** Mr. Wilding agrees with me that RMP's solar integration cost estimate used in its original  
345 analysis is outdated and that variable O&M costs were incorrectly omitted in the unit dispatch  
346 costs. Mr. Wilding has revised his original NPC analysis by updating the solar integration  
347 cost and including variable O&M costs. This revision increases the NPC benefit from  
348 \$19.49/MWh to \$24.87/MWh. He disagrees, however, with other criticisms raised in my  
349 Direct Testimony, when he claims that there is no avoided capacity costs from the NEM  
350 program because RMP is resource-sufficient until 2029, and that a marginal heat rate is used  
351 in RMP's GRID model.



352 **Q. DO YOU AGREE WITH MR. WILDING'S UPDATED NPC ANALYSIS?**

353 **A.** No. Even RMP's revised estimate of \$24.87/MWh, or \$1.44 million, for NEM benefits in  
354 2015 is much lower than RMP's QF avoided cost of approximately \$50/MWh in 2015.<sup>24</sup> As  
355 I explain in my Direct Testimony, the benefits from distributed generation in Utah must be  
356 greater than the QF avoided costs, since NEM customers generate power at the point of  
357 consumption, while energy purchased from a QF must be delivered over the transmission and  
358 distribution network to the point of consumption. As a result, at a minimum, DSG avoids  
359 delivery losses (and over the longer term, it reduces the need for infrastructure costs as well).  
360 There is also a "multiplier effect" associated with such avoided energy losses, since they  
361 further reduce the required amount of capacity, operating reserves, and emissions needed to  
362 enable a given kWh of energy consumption by a customer.<sup>25</sup> Using RMP's QF avoided cost  
363 as a lower bound proxy for the value of NEM benefits in Utah increases the NPC benefit from  
364 \$1.44 million to approximately \$2.9 million.

365 **Q. HOW DO YOU RESPOND TO MR. MEREDITH'S REBUTTAL TESTIMONY IN**  
366 **WHICH HE DISAGREES WITH YOUR CONCLUSION THAT RMP'S LOST**  
367 **REVENUE FROM BEHIND-THE-METER GENERATION SHOULD NOT BE**  
368 **CONSIDERED A COST?**

369 **A.** Mr. Meredith states that treating RMP's lost revenue from behind-the-meter as a cost is  
370 necessary in order to be consistent with the Commission's November 2015 Order. In support  
371 of this interpretation of the Commission's Order, he states that "bill credits for private  
372 generation consumed behind-the-meter is appropriate, because it is a cost borne by other non-  
373 participating customers."<sup>26</sup> That statement is factually incorrect, on three counts. First, a

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<sup>24</sup> Direct testimony of Paul Clements on behalf of RMP, at p. 4:72-74. Docket No. 14-035-114 (Submitted July 30, 2015). "My testimony shows that the value or benefit of distributed solar generation using an avoided cost method such as Schedule 37 (the "benefit" in our cost-benefit analysis) is currently equal to approximately five cents per kilowatt-hour..."

<sup>25</sup> DeRamus Direct Testimony, lines 1265 – 1272.

<sup>26</sup> Meredith Rebuttal Testimony, lines 198 – 200.

374 NEM customers' behind-the-meter generation is not a "bill credit." Indeed, that generation is  
375 not even *measured* by RMP, which is why RMP has to rely on its exceptionally small and  
376 unreliable sample of only 36 NEM customers' production meters to estimate the amount of  
377 behind-the-meter generation for all NEM customers in its CFCOS. Second, RMP's lost  
378 revenue is not a "cost," i.e., an actual expenditure resulting from a NEM customers' actions;  
379 I know of no precedent in electricity rate proceedings, or any other regulatory proceeding, for  
380 conflating costs with lost revenues. Third, the "costs" at issue are not lost revenue to other  
381 ratepayers, but lost revenue to *RMP*; if RMP had made those additional electricity sales to  
382 NEM customers in a counterfactual world with no rooftop solar, it would have increased its  
383 profits by the amount of the margin on those sales (i.e., the differential between the retail rate  
384 and its generation costs). The "net cost" that RMP purports to measure with these  
385 counterfactual behind-the-meter sales (i.e., by subtracting its production costs from its  
386 foregone revenues) is not a net cost to other ratepayers, but RMP's foregone profits as a result  
387 of the NEM program.

388 **Q. HOW DO YOU RESPOND TO MR. MEREDITH'S ASSERTION THAT**  
389 **INCLUDING RMP'S LOST REVENUE FROM BEHIND-THE-METER**  
390 **GENERATION IS REQUIRED ACCORDING TO THE COMMISSION'S ORDER?**

391 **A.** I disagree with Mr. Meredith's interpretation of the Commission's November 11, 2015 Order.  
392 Indeed, read in its entirety, the Order implies the opposite of Mr. Meredith's interpretation.  
393 The Order states that "the point of preparing a CFCOS and comparing it to the ACOS is to  
394 obtain a picture of the utility's *costs* with and without the participation of net metering  
395 customers."<sup>27</sup> In other words, the Order asks RMP to calculate how much incremental costs  
396 resulted from the NEM program. The Order further states that both the CFCOS and ACOS  
397 "should contain the *categories of costs that typically comprise such studies*," and that these

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<sup>27</sup> Commission November 11, 2015 Order, p. 9.

398 cost categories “should generally be *consistent with those PacifiCorp employs in preparing*  
399 *cost of service studies for ratemaking purposes.*”<sup>28</sup> I have reviewed PacifiCorp’s prior “cost  
400 of service studies for ratemaking procedures,” and I have not identified any prior instance in  
401 which PacifiCorp included lost revenues as a cost, nor would I expect a regulatory  
402 commission to allow such an approach. It is my understanding that when PacifiCorp applies  
403 to the Commission for cost recovery associated with energy efficiency or demand-side  
404 management programs, it seeks to recover its incremental costs associated with such  
405 programs, not the foregone revenues or lost profits associated with the resulting reduction in  
406 its retail sales. Indeed, under Mr. Meredith’s interpretation, almost any program that reduces  
407 energy consumption would necessarily fail a cost-benefit test, because the lost revenue from  
408 any reduction in load is always greater than the costs that RMP would have incurred to  
409 generate the energy that would have served that “lost load” (particularly given RMP’s  
410 volumetric rate design for residential customers).

411 **Q. HOW DO YOU RESPOND TO DPU WITNESS FARYNIARZ’S CRITIQUE OF**  
412 **YOUR CONCLUSION THAT RMP’S LOST REVENUE FROM BEHIND-THE-**  
413 **METER GENERATION SHOULD NOT BE CONSIDERED A COST?**

414 **A.** While Mr. Faryniarz acknowledges that “under traditional utility ratemaking, a utility is not  
415 entitled to recover “lost revenues,” he accepts RMP’s characterization of the Commission’s  
416 Order in this proceeding that the purpose of the CFCOS study was to compare “RMP’s costs  
417 and revenues” under the two scenarios (with and without DSG).<sup>29</sup> As a consequence, for  
418 RMP’s analysis in this proceeding, he considers it appropriate that RMP treats all of its lost  
419 revenue resulting from NEM customers’ generation – both for generation that is consumed  
420 behind-the-meter and that is exported – as a cost. While Mr. Faryniarz also states that it may

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<sup>28</sup> Commission November 11, 2015 Order, pp. 12 – 13.

<sup>29</sup> Faryniarz Rebuttal Testimony, lines 930 – 935.

421 be appropriate to “analyze scenarios” focusing only on export energy, he concludes that this  
422 “is simply a different analysis.”<sup>30</sup> He also disagrees with the way in which I implemented the  
423 analysis, since he contends that in excluding RMP’s lost revenues from the analysis, I should  
424 have also excluded RMP’s costs of generating the energy that would have been used to serve  
425 NEM customers’ behind the meter consumption in the counterfactual world.

426 **Q. HOW DO YOU RESPOND TO MR. FARYNIARZ’S ARGUMENTS REGARDING**  
427 **RMP’S APPROACH TO INCLUDING LOST REVENUES AS A COST?**

428 **A.** Mr. Faryniarz incorrectly accepts RMP’s premise that it was appropriate and necessary to  
429 evaluate both its costs and revenues, and that such an analysis provides a reasonable cost-  
430 benefit analysis for the NEM program. In my response to Mr. Meredith, above, I describe  
431 why the Commission’s November 2015 Order precludes treating RMP’s lost revenues from  
432 behind-the-meter generation as a cost, particularly as lost revenues are not “typically,” if ever,  
433 included as cost categories in cost of service studies used by PacifiCorp (or other utilities) for  
434 “ratemaking purposes.”<sup>31</sup> Indeed, in his Rebuttal Testimony, Mr. Faryniarz acknowledges  
435 that the costs typically included in the cost of service “under traditional utility ratemaking”  
436 does not include “lost revenues,” but only “prudently-incurred costs.”<sup>32</sup> Ultimately, Mr.  
437 Faryniarz’s argument appears to rest on his general concern that, if left to grow unchecked,  
438 the continued decline in revenues from the NEM program could result in rate increases in the  
439 future (which would presumably affect NEM customers, as well as non-NEM customers).  
440 This concern *assumes*: a.) the continuing growth in NEM adoption, far above its current level;  
441 b.) the absence of any offsetting increases in RMP’s revenues, e.g., due to overall load growth,  
442 new housing construction, population growth, electric vehicle growth, etc.; and c.) the absence  
443 of off-setting benefits from NEM in the form of reduced RMP infrastructure investments for

<sup>30</sup> Faryniarz Rebuttal Testimony, lines 929 – 945.

<sup>31</sup> Commission November 11, 2015 Order, pp. 12 – 13.

<sup>32</sup> Faryniarz Rebuttal Testimony, lines 930 – 931.

444 generation, transmission, or distribution assets. Regardless of Mr. Faryniarz's concerns with  
445 regard to how the distant future may unfold, however, his hypothetical future concerns are  
446 irrelevant to how NEM customers' actual behind the meter generation – during the 2015 test  
447 year – should be treated in the cost of service framework established by the Commission in  
448 this proceeding.

449 **Q. HOW DO YOU RESPOND TO MR. FARYNIARZ'S ARGUMENT THAT IF YOU**  
450 **EXCLUDE THE FOREGONE REVENUES ASSOCIATED WITH NEM**  
451 **CUSTOMERS' BEHIND THE METER GENERATION, YOU SHOULD ALSO**  
452 **EXCLUDE THE COSTS OF RMP'S ASSUMED REPLACEMENT GENERATION?**

453 **A.** Conceptually, I agree with Mr. Faryniarz that in excluding the revenue that RMP would have  
454 earned from sales to NEM customers to replace their behind-the-meter generation, it would  
455 also be appropriate to exclude the costs that RMP would have incurred associated with the  
456 assumed replacement generation. I note, however, that in criticizing the analysis I offered in  
457 my Direct Testimony, Mr. Faryniarz ignores the fact that the burden is on RMP to provide a  
458 reliable cost-benefit analysis that is consistent with the Commission's Order and that provides  
459 reasonable evidentiary support for any proposed changes in customer rates. Nonetheless, I  
460 have updated my analysis to account for Mr. Faryniarz's argument. In my Direct Testimony,  
461 I simply subtracted RMP's lost revenue associated with NEM customers' behind the meter  
462 generation from RMP's total cost calculation. Also, while I noted that RMP's estimate of the  
463 cost of the replacement generation (for both behind the meter and export generation) was  
464 incorrect, I did not explicitly correct for that in my analysis. In my response to Mr. Wilding's  
465 Rebuttal Testimony, above, I provide that correction. Implementing both changes – correcting  
466 RMP's NPC analysis and removing the cost of RMP's replacement generation for behind the  
467 meter consumption – leaves my overall conclusion that the net benefits of the Utah residential  
468 NEM program amount to about \$200,000 for the 2015 test year unchanged, even before  
469 considering the wider range of longer-term benefits from DSG.

470 **Q. COULD YOU EXPLAIN HOW YOU ARRIVE AT THAT CONCLUSION?**

471 **A.** Yes. Behind-the-meter generation accounts for approximately 53.3% of DSG production  
472 (based on RMP’s inadequate sample of production data). As noted above, correcting RMP’s  
473 total avoided generation costs in its NPC analysis using RMP’s 2015 QF avoided costs  
474 produces an estimate of NEM benefits of \$2.9 million (approximately twice RMP’s estimate);  
475 this includes RMP’s costs of replacing both behind the meter and export generation in the  
476 assumed counterfactual world. Removing 53.3% of that amount to account for the costs of  
477 behind the meter generation (consistent with eliminating the lost revenues from behind the  
478 meter generation) reduces the NPC benefit to \$1.35 million. In my Direct Testimony, I relied  
479 on RMP’s original NPC benefit estimate of \$1.3 million (for all generation). Thus, making  
480 all of these corrections – eliminating the lost revenues from behind the meter generation,  
481 correcting RMP’s NPC analysis, and then backing out the portion of generation costs  
482 associated with the replacement energy for behind the meter generation – results in no changes  
483 to my original conclusion that the benefits of the NEM program exceed the costs.

484 **Q. OCS WITNESS BECK ALSO THINKS RMP WAS JUSTIFIED IN TREATING LOST**  
485 **REVENUE FROM BEHIND-THE-METER GENERATION AS A COST. HOW DO**  
486 **YOU RESPOND?**

487 **A.** While OCS witness Beck agrees that “behind the meter” consumption be “evaluated carefully  
488 and treated differently than exports of excess energy,” she states that it would be contrary to  
489 the statute to “eliminate costs that are simply being shifted from NEM to non-NEM  
490 customers.”<sup>33</sup> First, RMP’s COS analysis – on which Ms. Beck relies for her conclusion that  
491 the costs of the NEM program exceed the benefits – does *not* treat behind the meter  
492 consumption any differently than exports of excess energy, nor has RMP otherwise “evaluated  
493 carefully” the difference between the two. Second, the language in the cited statute makes no

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<sup>33</sup> Beck Rebuttal Testimony, lines 232 – 241.

494 reference to a need to treat a reduction in RMP’s revenue as a “cost;” where the statute requires  
495 a need to consider the costs that “other customers will incur from a net metering program,”<sup>34</sup>  
496 from an accounting, financial, or economic perspective, it is reasonable to infer that the  
497 relevant costs at issue are incremental expenditures – i.e., actual costs – potentially borne by  
498 other customers as a result of the net metering program, such as the additional unreimbursed  
499 cost of meters, applications, studies, line upgrades, transformer upgrades, etc.

500 **Q. MR. MARX TAKES ISSUE WITH YOUR CONTENTION THAT RMP DOES NOT**  
501 **CURRENTLY “HANDLE” EXPORTS BY NEM CUSTOMERS.<sup>35</sup> HOW DO YOU**  
502 **RESPOND?**

503 **A.** Mr. Marx appears to be confusing statements in my Direct Testimony regarding current  
504 generation exports by NEM customers with my statements regarding RMP’s lack of evidence  
505 that such exports have caused RMP to incur additional costs (e.g., unreimbursed cost  
506 associated with transmission upgrades) or to manage its system differently than in the past.  
507 In Mr. Marx’s Direct Testimony, he implied that RMP was actively managing the local  
508 distribution and transmission network, and presumably its generation resources, in order to  
509 “handle” the exports by current NEM customers. To be clear, my testimony is as follows: (1)  
510 current residential NEM customers do export some significant amount of their generation to  
511 the local grid; (2) the volume of such exports relative to system load is exceedingly small at  
512 present; (3) the volume of such exports is sufficiently small that it is likely consumed by  
513 neighboring loads on NEM customers’ local distribution circuits; (4) RMP has not provided  
514 any evidence that it has incurred any unreimbursed costs, e.g., transformer or other equipment  
515 upgrades, associated with that relatively small volume of export generation to date; and (5)  
516 RMP has not provided any evidence that it has changed the way it is managing system dispatch

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<sup>34</sup> Cited in Beck Rebuttal Testimony, line 239 – 241.

<sup>35</sup> Marx Rebuttal Testimony, lines 85 – 149.

517 or other operations to account for this relatively small amount of exports from NEM  
518 customers' DSG systems. Nothing in Mr. Marx's Rebuttal Testimony contradicts these five  
519 conclusions. I agree with Mr. Marx that at very high levels of solar penetration (utility scale  
520 as well as residential solar), as in California, the resulting "duck curve" for the aggregate  
521 system generation and load shape can require significant changes in system planning,  
522 investments, and dispatch protocols; and that at very high levels of DSG penetration, or with  
523 relatively large DSG systems (e.g., 5 MW systems), reverse flows on network elements  
524 designed for unidirectional flows can pose engineering challenges and can require additional  
525 investments to accommodate those reverse flows. Utah, however, is very, very far from  
526 reaching such a high solar or high DSG penetration scenario, in which such larger system  
527 costs become an issue. (I also note that at such higher levels of DSG penetration, it also  
528 becomes easier to identify major infrastructure upgrades that are avoided by DSG.) The issue  
529 before the Commission in this proceeding, however, is not whether residential DSG in Utah  
530 *could* result in future incremental costs or operational challenges in some speculative, very  
531 high solar penetration scenario, but whether it has caused such incremental costs in the 2015  
532 test year; whether it is causing such incremental costs today; and whether it is likely to cause  
533 such incremental costs in the near future. The evidence submitted by RMP demonstrates that  
534 it has not.

535 **Q. MR. MARX CLAIMS THAT YOU IGNORED DATA HE PREVIOUSLY**  
536 **SUBMITTED SHOWING THAT NEM CUSTOMERS HAVE IMPOSED**  
537 **ADDITIONAL UNREIMBURSED SYSTEM COSTS. HOW DO YOU RESPOND?**

538 **A.** In fact, in preparing my Direct Testimony, I did review the data responses identified by Mr.  
539 Marx,<sup>36</sup> and I concluded that those data responses do not demonstrate that NEM customers

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<sup>36</sup> These are Vote Solar data requests 1.24, 1.25, 3.7, 3.15 – 3.18, USEA data responses 2.1 – 2.3, and Vivint Solar data requests 2.9 – 2.10.



540 have imposed incremental, unreimbursed system costs.<sup>37</sup> For example, DPU 6.5(b) shows  
541 that RMP has *not* paid any additional costs associated with the asserted increase in NEM  
542 customers' use of the system; while Vivint Solar 2.9 and 2.10 show that the all of the costs of  
543 distribution system upgrades required for DSG installations – both transformer upgrades and  
544 line upgrades – are borne by the NEM customers. I have not seen any data responses  
545 submitted by RMP in this proceeding that show the contrary.

546 **Q. DOES THIS CONCLUDE YOUR SURREBUTTAL TESTIMONY?**

547 **A.** Yes.

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<sup>37</sup> DeRamus Direct Testimony, lines 775 – 810.