BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Investigation of the Costs and Benefits of PacifiCorp's Net Metering Program	)))	Docket No. 14-035-114 DPU Exhibit 1.0D

Direct Testimony of

Artie Powell, Ph.D.

Division of Public Utilities

June 8, 2017

Q: PLEASE STATE YOUR NAME, EMPLOYER, TITLE, AND BUSINESS ADDRESS FOR THE RECORD.

A: My name is Artie Powell. I am employed by the State of Utah and work in the Division of Public Utilities (Division). I am the manager of the energy section. My business address is 160 East 300 South, Salt Lake City, Utah.

Q: ARE YOU TESTIFYING ON BEHALF OF THE DIVISION?

A: Yes I am.

Q: PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A: I earned a doctorate degree in economics from Texas A&M University. Prior to joining the Division, I taught courses in economics, regression analysis, and statistics for both undergraduate and graduate students. I joined the Division in 1996 and have since attended several professional courses and conferences such as, the NARUC Annual Regulatory Studies Program (1996) and IPU Advanced Regulatory Studies Program (2005). Since joining the Division, I have testified and presented information on a variety of topics, including cost of service and rate design issues, electric industry restructuring, incentive-based regulation, revenue decoupling, energy conservation, evaluation of alternative generation projects, and the cost of capital.

Q: HAVE YOU PARTICIPATED IN PRIOR PHASES OF THE CURRENT DOCKET?

A: Yes. I have participated in this docket from its inception, commencing with the Commission's notice of Technical Conference on August 29, 2014. I also have helped prepare the Division's position on the issues in prior phases of this docket and filed surrebuttal testimony on September 29, 2015, explaining the Division's proposal on the

cost/benefit analysis framework and responding to the rebuttal testimony of other intervenors in the docket.

I also filed testimony on certain Company proposals concerning net metering customers in the Company's last general rate case, Docket No. 13-035-184. In my testimony, the Division supported, although at a lower rate, the Company's proposed net energy metering (NEM) surcharge to apportion more fairly the costs of service among residential customers.

Q: PLEASE BRIEFLY DESCRIBE THE PURPOSE OF YOUR TESTIMONY.

A: I will present the Division's position and recommendations regarding the Company's application and requests in this docket. I will also introduce the Division's other witness.

Q: PLEASE SUMMARIZE THE DIVISION'S POSITION AND RECOMMENDATIONS IN THIS CASE.

A: The current net metering program, in the Division's opinion, does not fairly capture and apportion the benefits and costs of distributed generation, and is unsustainable in the long run. Although the Company's proposal satisfies many of the concerns with the current program, portions of the Company's proposal and structure are premature and the Division does not recommend their adoption at this time. Specifically, in its application, the Company asks that the Commission find or approve the following six items. The Division's brief opinion follows each numbered Company request.

1. Find whether the counter factual cost of service (CFCOS), the actual cost of service (ACOS), and the net metering breakout cost of service study ("NEM Breakout COS") are compliant with and fulfill the November 2015 Order.

The Division has reviewed the Company's application and cost of service studies, and we has asked numerous data requests of the Company and reviewed the responses, and reviewed the requests of and the Company's responses to other parties. Based on this review, the Division concludes that the Company's filing is generally consistent with the Commission's November 2015 order.

2. Based on the cost of service analyses, find whether the costs of the net metering program under the current rate structure exceed its benefits.

Given the framework adopted by the Commission, the Division concludes that the costs do exceed the benefits.

3. Based on the cost of service analyses, find whether the unique usage characteristics of net metering customers justify segregating them into a distinct class.

While it may not be unreasonable to create a separate class for NEM customers, as discussed herein, the Division believes the evidence is mixed. The Commission, if it chooses, can make a final determination on this matter in the Company's next general rate case.

4. Determine whether the current rate structure for net metering customers is unjust and unreasonable because it does not reflect the costs imposed on and benefits contributed to the system, and unfairly shifts costs from net metering customers to other customers.

Based on our review and analysis, the Division concurs with the Company's request. The current net metering program providing banking and compensation for excess generation at retail rates is not in the public interest. The structure of the program puts unwarranted upward pressure on retail rates, even when the Company's costs are relatively flat or declining.

5. Approve, as just and reasonable, the Company's proposed Schedule 136, Net Metering Service, with modifications to net metering service and Schedule 5, Residential Service for Customer Generators, which includes a three-part tariff structure that reflects the costs and benefits that net metering customers impose on and contribute to the system.

Conceptually, given modifications described herein, the Division is in agreement with the Company. The Division supports the development and use of new rate designs, such as the Company's proposed Schedule 5, for customers with distributed generation, but recommends the adoption of more than one rate design to allow for customer choice. The Division proposes the adoption of at least two designs: the Company's three part design and a simple time of use (TOU) structure with on and off peak pricing. While the

Division recommends the adoption of these rate structures going forward, final rates should be set in the next general rate case. Relatedly, if no base rates are set in this proceeding, the Company's request for deferred accounting treatment of certain revenues is moot.

6. Approve a waiver of Utah Admin. R. 746-312-13, pursuant to Utah Admin. R. 746-312-3(2) for changes to the application fee.

The Division is not opposed to the Company's request for a waiver.

In addition to the above responses to the Company's requests, the Division recommends that the Commission request the Legislature eliminate the current net metering program and move to a new model (as described herein) for small-scale distributed generation, fully effective no later than January 1, 2025. The Division also recommends the Commission reduce the current program cap to a level equal to the estimated interconnected capacity of NEM customers as of January 1, 2018. Current NEM customers, including those who interconnect before January 1, 2018, would remain on their relevant schedule until the end of the transition period, December 31, 2024. Customers with distributed generation facilities requesting compensation for excess generation and who interconnect after January 1, 2018, would transition to new schedules approved by the Commission. Specific transition steps are described later in my testimony. For residential customers, the Division recommends adoption of at least two rate designs, one with three part rates similar to the Company's Schedule 5, and

one TOU design. The base rates for each schedule should be determined in the Company's next general rate case. Finally, with the Commission's order in this docket, all excess generation would be compensated at a rate to be determined by the Commission. To accommodate the time necessary to determine a reasonable compensation method and rate, the Division recommends as an intermediate step a rate halfway between the Company's current avoided cost and the customer's relevant retail rate.

Q: PLEASE IDENTIFY THE DIVISION WITNESSES.

A: The Division has two witnesses at this stage of the docket, Mr. Stan Faryniarz and me. Mr. Faryniarz is a Principal Consultant with Daymark Energy Consultants (Daymark). The Division engaged Daymark to help in its review and evaluation of the Company's application and cost of service models.

Q: YOU TESTIFIED IN THE PREVIOUS GENERAL RATE CASE SUPPORTING THE COMPANY'S RATE DESIGN FOR NEM CUSTOMERS. DID THE COMMISSION ADOPT THE COMPANY'S PROPOSED RATE DESIGN?

A: No. In the last general rate case (Rate Case), Docket No. 13-035-184, the Company proposed applying a Net Metering Facilities Charge (NMFC) to NEM customers' bills. In light of the Company's proposed NMFC, the Commission issued a public notice on April 16, 2014, indicating its intent to "reach the determinations specified in subsections (1) and (2) of Utah Code Ann. § 54-15-105.1."[1] Various parties, including the Division, addressed the Company's NMFC; however, the Commission concluded that, "the

[1] Report and Order, Docket No. 13-035-184, August 29, 2014, p. 58. (Rate Case Order).

testimony and comments (both written and verbal) provided in this proceeding fall short of providing the Commission the substantial evidence necessary to make the determinations required under Utah Code Ann. § 54-15-105.1(1), (Rate Case Order, pp. 58-59).

Thus, the Commission initiated the current docket with a notice of technical conference (dated August 29th, 2014). The technical conference was held on November 5, 2014 at the Commission's offices.

Q: DID THE COMMISSION PROVIDE GUIDANCE ON WHAT EVIDENCE IT WAS SEEKING TO MAKE A DETERMINATION UNDER THE STATUTE?

A: Yes, the Commission's order does identify specific areas or issues that need addressing. To begin with, the Commission stated, "We emphasize that ratemaking is a dynamic process and must respond appropriately as the demands customers place on the utility system change" (Rate Case Order, p. 67). The Division concurs. Rate and compensation structures and levels under one paradigm may not be appropriate under another. In other words, rate making must be sufficiently flexible to adapt to changing circumstances. While there are multiple objectives of rate making, which may conflict one with another, general or universal guarantees of cost recovery or rate stability to one group at the expense of another is neither fair nor efficient.[2]

[2] The utility operating as a regulated monopoly is entitled to a fair rate of return as a consequence of it being required by law to provide service. NEM customers have no such obligation to serve and the same principles do not apply. *See Ex. Stewart v. Utah Public Service Com'n*, 885 P.2d 759, 767 (Utah 1994) citing to *Mountain States Tel. & Tel. v. Department of Pub. Serv. Comm'n,* 191 Mont. 331, 624 P.2d 481, 483 (1981) ("The commission can no more permit the utility to have confiscatory rates for the service it performs than it can compel a utility to provide service without just and equitable compensation.")

The Commission also stated, "if net metered customers are a subclass (as PacifiCorp asserts), data must confirm this assertion" (Rate Case Order, p. 67). The Commission explained, "we must understand the usage characteristics, e.g., the load profile, load factor, and contribution to relevant peak demand" (Rate Case Order, p. 68).

In reference to the load shape for NEM customers, the Commission expressed a desire to see "evidence showing the impact this demand profile has on the cost to serve them, in order to understand the system costs caused by these customers" (Rate Case Order, p. 68).

Finally, the Commission indicated that, "it will be necessary and appropriate to re-examine various aspects of the net metering program called into question in this [rate case], (Rate Case Order, p. 68) including, "the possibility of the program refinements we alluded to in the 2009 Order" (Rate Case Order, p. 69). While the Division interprets the Commission's direction to "reexamine various aspects of the net metering program" as an invitation to examine all aspects of the net metering program, the Commission's 2009 Order[3] addresses four fundamental issues:

1. The program cap, which is currently set at 20% of the Company's 2007 peak load or demand;

2. The value or credit for excess generation;

[3] In the Matter of the Consideration of Changes to Rocky Mountain Power's Schedule No. 135 - Net Metering Service, Docket No. 08-035-78, February 12, 2009.

3. Whether NEM customers are subject to a minimum bill; and

4. The ownership of renewable energy certificates.

Q: HAS THE COMMISSION MADE ANY DETERMINATIONS IN PRIOR PHASES OF THIS DOCKET?

A: Yes. Earlier in this docket, the Commission adopted an analytical framework that compares the Company's actual or current cost of service to a counterfactual study that treats NEM customers as full requirements customers.

As I previously stated, the Commission initiated the current docket with a notice for a technical conference, which was held on November 5, 2014. At that conference, PacifiCorp presented its plan for performing a load and research study focused on residential net metered customers with a schedule for the study's completion in September 2015. Subsequent to the technical conference, the Commission directed the Division to conduct a series of workgroups to explore an appropriate analytical framework to be used to determine costs and benefits of net metering. Although the workgroup sessions were informative, the outcome was inconclusive ending with no agreement between the parties.

In response to legal briefing, on July 1, 2015, the Commission ordered that for purposes of performing the analysis under Utah Code Ann. § 54-15-105.1(1), the relevant costs and benefits are those that accrue to the utility or its non-net metering customers in their capacity as ratepayers of the utility. Costs or benefits that do not directly affect

the Company's cost of service will not be included in the final framework to be established in this phase of the docket.[4]

After several rounds of testimony, the Commission ordered the use of a cost of service framework. Specifically, the Commission directed the Company to file no later than the date PacifiCorp files its next general rate case, three cost of service studies:[5]

1. An Actual Cost of Service (ACOS);
2. A Counter Factual Cost of Service (CFCOS); and
3. ACOS-NEM Breakout.

The ACOS study reflects actual cost of service with net metering customers' participation, meaning PacifiCorp provides net metering customers with energy only when their self-generation is insufficient to meet their load and net metering customers push any surplus energy they produce to the system. The CFCOS study estimates what the cost of service would be if net metering customers produced no electricity, drawing their entire load from PacifiCorp and providing no surplus energy to the system. The ACOS-NEM Breakout segregates net metering customers from the class in which they

[4] Commission's July 1, 2015 Order, Order RE: Conclusions of Law on Statutory Interpretation and Order Denying Motion to Strike*, It necessarily follows that any cost or benefit to be included in the Subsection One analysis must be a cost or benefit that has some impact on the utility's cost of service. Therefore, costs and benefits that do not impact the utility's cost of service are not relevant to the Subsection One analysis and will not constitute part of the framework the Commission ultimately adopts in this docket.* (p. 15)

[5] Commission's Order, Docket No. 14-035-114 Order, at p. 16. November 15, 2015.

194 presently participate, and reflects the resulting class cost of service to the net metering
195 customers as a separate class.

196 In response to the Commission's previous order, on November 9, 2016, the Company
197 filed the requested cost of service studies and recommendations for NEM customers,
198 albeit outside the contemplated general rate case.

199 **Q: YOU AGREE WITH THE COMMISSION THAT RATE MAKING IS DYNAMIC. WOULD YOU**
200 **PLEASE EXPLAIN?**

201 A: As I previously stated, rate making must be sufficiently flexible to adapt to changing
202 circumstances. Therefore, the public interest is likely better served through the
203 application of meaningful guidelines or principles, rather than adhering to rigid pricing
204 rules or structures.

205 For example, as Professor Bonbright[6] explains, the partial harmony between customers
206 and investors of public utilities "justifies a public service commission in going far toward
207 the acceptance of the long-run interests of consumers as its sole responsibility," with
208 one important qualification. Namely, "the possible obligation of commissions to protect
209 the interests of investors who may have committed their funds in reliance on rules of
210 rate making no longer accepted" (Bonbright, p. 39). This is not to say that current utility
211 investors are or should be guaranteed a return. Indeed a great deal of flexibility and

[6] James C. Bonbright, Principles of Public Utility Rates, Columbia University Press, New York, New York, 1961.

indeterminacy, and hence the controversy, exists in determining a fair return (See Bonbright, pp. 155-158).

Similarly, customers make rational decisions assuming reasonable stability and predictability of electric service rates. Again, according to Professor Bonbright, "unless rate-making policies are sufficiently stable to permit a consumer to predict with reasonable confidence what his charges will be . . . a cost-price system of rate making will be self-defeating when viewed as a means of securing a rational control of demand" (Bonbright, p. 297).

While there are many such principles or objectives, which may conflict one with another, according to Professor Bonbright, "three may be called primary, not only because of their wide spread acceptance but also because most of the more detailed criteria are ancillary thereto" (Bonbright, p. 292). These three objectives are:

1. The revenue-requirement or financial-need objective;
2. The fair-cost-apportionment objective; and
3. The optimum-use or consumer-rationing objective.

The Revenue Requirement Objective: The utility's costs or revenue requirement includes a fair return on its investment. While determining a fair return is quite controversial, in general, the return should be set so the utility has the ability to attract the necessary capital to maintain safe and reliable service.

The Fair Cost Apportionment Objective**:** The utility's costs or revenue requirement should be apportioned among classes of rate payers commensurate with the benefits or services those classes receive; the so called cost-causation principle. In general, those customers who cause the costs should bear the burden of those costs.

The Customer Rationing Objective: Rates are designed and set to encourage efficient use of public utility services including, uses that are "economically justified in view of the relationships between costs incurred and benefits received" (Bonbright, p. 292).

Based on these three objectives and its statutory obligations, the Division uses the following guiding principles for establishing or promoting reasonable rate designs and rates.

1. Simplicity—Rates should be as simple as possible in design and easy to understand and administer. Customers are more likely to accept and understand relatively simple rate designs or structures. Tariff descriptions should be clear, unambiguous, and understandable by the public.

2. Correct Price Signals—Rates based on costs can incent customers to make appropriate decisions about energy use including energy conservation. While some customer classes are better able to understand complicated rates than others, a complicated rate that is not understood may not provide clear or correct price signals.

3. Marginal and Embedded Costs—Generally, regulated rates should be designed to recover the apportioned revenue requirement of a rate schedule. Marginal or incremental, and average unit embedded costs should be reviewed and taken into account when setting prices.

4. Rate Structures—Generally, three-part rates with customer, energy, and demand components, and time of use rates will more fairly apportion the costs among individual customers than one or two part rates.

5. Gradualism—Gradual changes in rates help promote rate stability and minimize impacts on individual customers.

6. Customer Charges—Costs that generally increase with the number of customers, but are not caused by each customer, should be included within the commodity or other components of rates, not in the customer charge. (See Commission Order in Docket No. 82-057-15)

Q: IN ITS RATE CASE ORDER, THE COMMISSION INDICATED THE NEED FOR FURTHER EVIDENCE SUPPORTING THE COMPANY'S ASSERTION THAT NEM CUSTOMERS FORM A SUBCLASS. HAS THE DIVISION LOOKED FOR SUCH EVIDENCE?

A: Yes, the Division and its consultants have reviewed the Company's application and work papers, and we have asked numerous data requests in part to address the Commission's desire for evidence. Specifically, the Division analyzed the available data to compare load profiles, load factors, unit costs, and other characteristics to determine if NEM customers are distinguishable from their counterparts.

Q: WHAT ARE THE DIVISION'S CONCLUSIONS?

A: It is axiomatic that a net metering customer uses the utility's system differently than a typical residential customer. It is not yet clear to the Division exactly how that different use impacts the utility's costs. Given that the Company does not intend to file a general rate case for at least another year, the Commission has an additional opportunity to determine whether distributed generation customers should be separated from their current class. As I discuss below, the typical measures, such as load factor, do not appear to warrant splitting NEM customers into their own class. Still, other factors and data suggest the traditional measures do not capture the full spectrum of customer impacts and a separate class may be appropriate.

Q: WILL YOU EXPLAIN THE BASIS FOR THE DIVISION'S CONCLUSIONS?

A: I will in part explain the basis for Division's conclusions. I will specifically address the residential class. The Division's consultant, Mr. Stan Faryniarz, will also discuss and present further evidence for the Division's conclusions.

In its rate case order, the Commission expressed a desire to "understand the usage characteristics, e.g., the load profile, load factor, and contribution to relevant peak demand" to determine if NEM customers could be distinguished from other customers. In its application, the Company provides several datum to address the Commission's request.

For example, the Company's witness, Ms. Joelle Steward, calculates the average monthly kWh for residential Non-NEM and NEM customers.[7] The underlying data supporting these calculations comes from the Company's breakout cost of service analysis.[8] She reports an average usage of 725 kWh and 743 kWh respectively for Non-NEM and NEM customers. I have replicated these calculations and added the median monthly usage for both groups. (See Table 1)

Table 1: Delivered Energy – Test Year Data, Residential Customers

	Annual Total Energy (MWh)	Number of Customers	Average (kWh)	Median (kWh)
Res Non NEM	6,523,256	749,673	725	684
Res NEM	39,124	4,390	743	729

Q: WHY DID YOU CALCULATE THE MEDIAN CONSUMPTION PER CUSTOMER?

A: I included the median monthly usage per customer to emphasize the need for careful—apples to apples—comparisons. In expressing its need for further evidence, the Commission stated, "evidence shows the typical residential customer uses 500-600 kWh per month, not the average of 698 kWh per month relied upon by PacifiCorp . . . The record shows net metered customer's **average** use of 518 kWh per month is in the same range as that of other **typical** residential customers."[9] The usage for the "typical"

[7] Prefiled Direct Testimony of Ms. Joelle Steward, Table 4, p. 20.

[8] See Ms. Steward's work papers, Table 4 - Res & Res NEM Characteristics.xlsx.

[9] Rate Case Order, p. 62. (Emphasis added).

residential customer was derived from billing analysis and appears to represent the mode[10] for the underlying data. In other words, the intervening party (in the rate case) presenting this information compared the mode from Non-NEM customers to the average of NEM customers. This comparison is inaccurate and can lead to erroneous conclusions. Consider, for example, the summary statistics in Table 1. The information indicates that NEM customers' use is on average approximately 2.5 percent more per month than Non-NEM customers; 743 kWh versus 725 kWh. However, if we compare the average usage for Non-NEM customers (725 kWh) to the median usage for NEM customers (729 kWh)), we would conclude the usage difference is much less, only 0.6 percent.

Q: HOW DOES THE AVERAGE USAGE OF THE TWO GROUPS COMPARE?

A: As previously indicated, NEM customers use on average is approximately 2.5 percent more than Non-NEM customers.

Q: DO YOU CONSIDER THIS TO BE A SIGNIFICANT DIFFERENCE?

A: Not statistically. A two-tailed t-test indicates that the difference in the average usage is not significant. (See Table 2)

[10] There are three common measures of central tendency for a statistical population or sample: the mode, median, and mean. The mode is the value in the data set that occurs most often. If no value is repeated, the data set does not have a mode. A mode, however, can be estimated for most data sets by grouping values in bins or ranges and using the midpoint (or some other numerical characteristic) of the range that contains the largest frequency. The median is a value in the middle of the data set when arranged from smallest to largest: 50 percent of the values are less than the median and 50 percent are greater. The mean (or average) is the most common measure of central tendency and usually refers to the arithmetic mean of the data set. While each measure reveals useful information about the data set (or underlying population), they are calculated differently and, except in special cases, are not equivalent.

Table 2: Average Usage — t-Test, Assuming Unequal Variances

	RES	*NEM*
Mean	725	740
Variance	26865	27962
Observations	12	12
Hypothesized Mean Difference	0	
Degrees of Freedom	22	
P(T<=t) two-tail	0.83	
t Critical two-tail	2.07	

However, the median[11] usage for NEM customers is approximately 6.6% more than that of Non-NEM customers, indicating that some characteristics of the underlying data may be masking a difference in the average usage.[12]

Some clues that this is the case may be found in Ms. Steward's direct testimony, Figure 2,[13] which for convenience, I have replicated here. (See Figure 1, below). The source data are in Ms. Steward's work papers.[14]

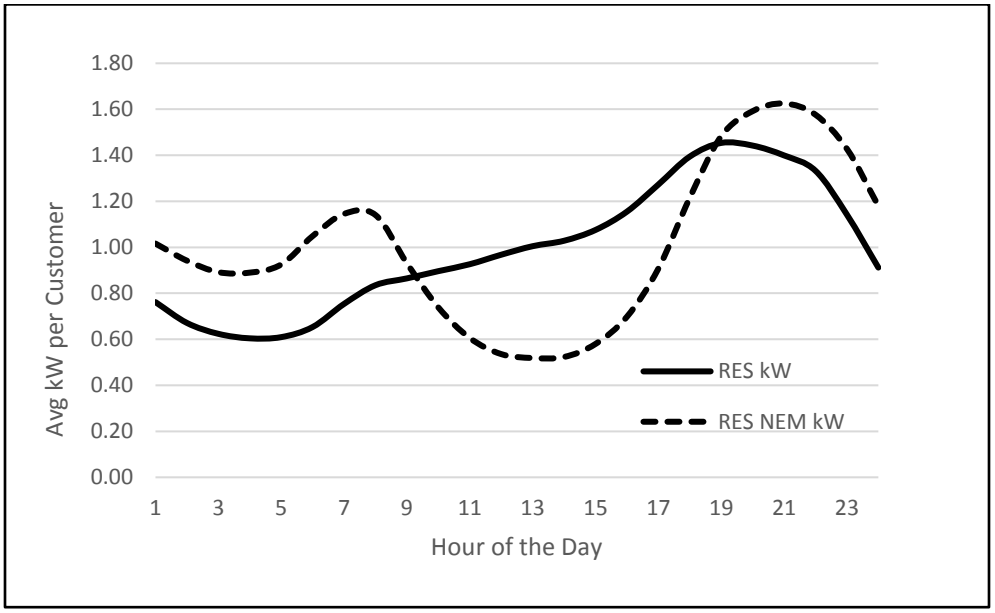
[11] A Mann-Whitney test for equal medians indicates that the medians are not significantly different. This test is a nonparametric test based on the relative rankings of the combined sample observations. See, Wayne W. Daniel, Applied Nonparametric Statistics, 2nd Ed., [1990], PWS-Kent Publishing, pp. 90-95.

[12] For both the t-test and the Mann-Whitney test, the null hypothesis is that the relevant parameters (the mean and median respectively) are equal. In other words, the underlying population distributions have equal locational parameters, and should exhibit similar sample characteristics with respect to their central tendency. In the case where the underlying populations are identically distributed, ignoring randomness in the samples, the difference in the means and medians would be similar. In the instant case, the difference in the medians (6.6 percent) is more than twice the difference in the means (2.5 percent).

[13] Ms. Joelle Steward, Direct Testimony, p. 15.

[14] Figures 2 & 3 - Res Compared to Res-NEM Profiles.xlsx.

Figure 1: Average kW per Customer



A side-by-side comparison of the two load shapes appears to indicate differences in the two groups of customers. For example, while the usage for NEM customers is below that of Non-NEM customers in the middle of the day, their usage in the morning and evening are higher – the "duckbill" graph. From the lowest NEM usage to the highest NEM usage, hour 14 to hour 21, usage increases in total by 221 percent, or approximately 30 percent per hour. Over this same period, Non-NEM usage increases by only 36 percent, or approximately 5 percent per hour. In other words, over the 7 hours from hour 14 to hour 21, NEM customers' usage increases at a rate six times that of Non-NEM customers. (See Table 3)

Even if we look at the longer window from hour 4 to hour 19, where Non-NEM usage goes from lowest to highest,[15] NEM usage (from hour 14 to hour 21) increases on an hour-to-hour basis by almost twice that of Non-NEM customers: 16% for Non-NEM customers versus 30% for NEM customers.

Table 3: Change in Usage

	Non-NEM	NEM
Change from Hour 14 to 21	36%	211%
Change per hour Hour 14 to 21	5%	30%

In Figure 2, I plotted the percentage difference in the two usage profiles. From the graph, we see that at the beginning and ending of the day, hours 1 and 24, NEM customers' usage is approximately 30 percent greater than Non-NEM usage. In the morning hours at the greatest difference, the usage for NEM customers is approximately 60 percent greater; whereas in the afternoon, it is approximately 50 percent less.

Q: ARE THERE OTHER DIFFERENCES THAT YOU SEE?

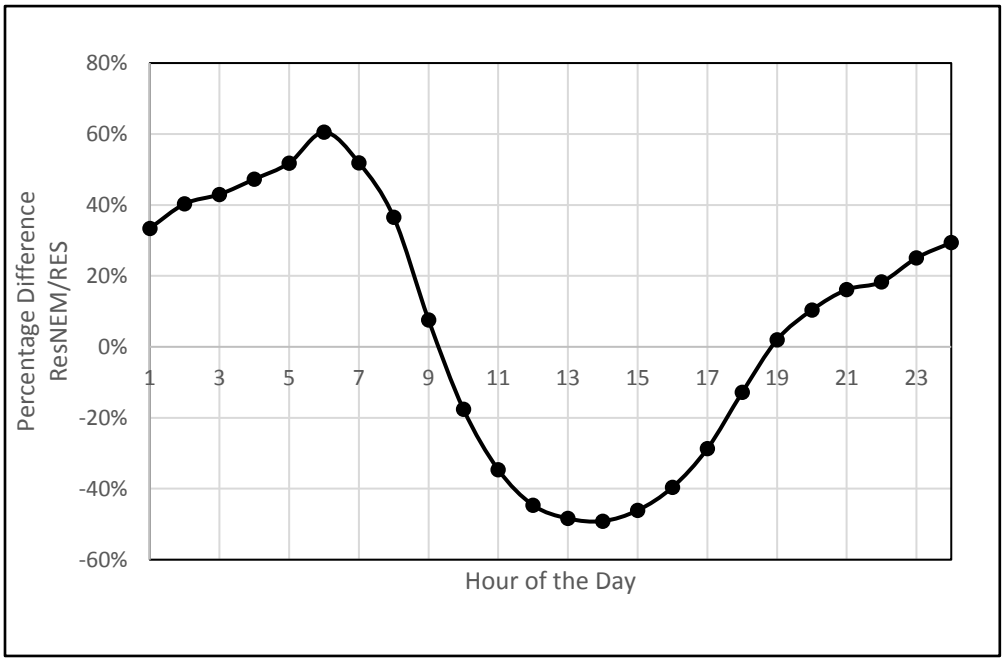
A: Yes. Again, using the data supporting Ms. Steward's Figures 2 and 3, I created a histogram for both the residential and NEM customers. A comparison can be seen in Figure 3 below. While the distributions look similar, a Goodness-of-Fit test[16] indicates

[15] The common denominator in this comparison is from lowest to highest usage for each group. For Non-NEM customers this occurs between hour 4 to hour 19; for NEM customers it is from hour 14 to hour 21.

[16] The Kolmogorov-Smirnov test compares two samples to determine the likelihood that the samples were drawn from the same population or populations with the same distribution. The test statistic is based on the maximum difference between the cumulative or empirical distributions of the two samples. (See Daniel, pp. 330-339).

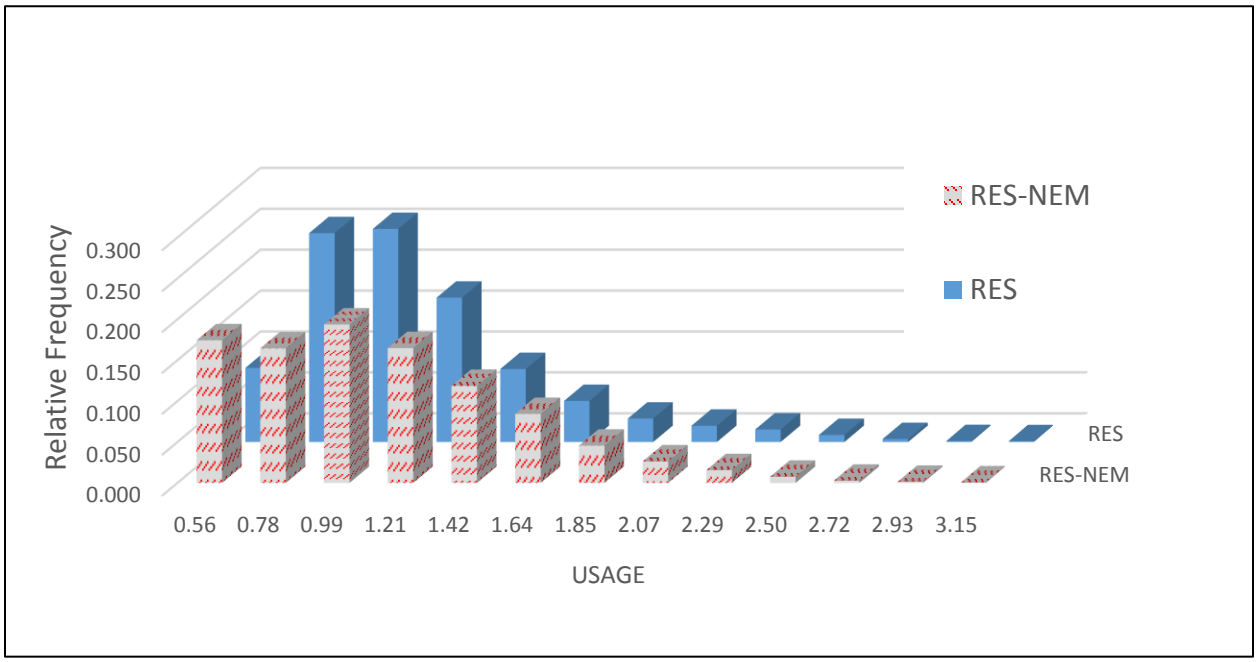
that the distributions are indeed different: the test statistic has a p-value[17] of less than 0.01 percent, a strong indication that the distributions are different.

Figure 2: Percentage Difference in Usage



[17] The p-value is the probability of finding the observed value—the test statistic—or a more extreme value when the null hypothesis is true. In this case the null hypothesis is that the two samples are drawn from the same population; the test statistic—the maximum difference in the distributions—is 0.085; and the critical value for a significance level of 0.01 percent is 0.029. Thus, if the distributions were the same, the probability of observing a difference of 0.085 is less than 0.01 percent.

Figure 3: Usage Distribution



Q: BASED ON USAGE, DO YOU SEE A DISTINCTION BETWEEN NEM AND NON-NEM CUSTOMERS?

A: Yes. While the average (or median) usage is similar between the two groups, an analysis of the usage profile (or load shape) indicates that they are very different. NEM customers' usage is much greater at certain times of the day and much lower at other times. This at least partially explains why the average usage is similar.

Additionally, we see that usage by NEM customers increases hour-over-hour much faster than for Non-NEM customers. Furthermore, by both drawing energy from and putting energy to the grid, NEM customers use the system differently than Non-NEM customers. Edison Electric Institute (EEI) described NEM customers' usage characteristics as follows:

> Customers with these types of generation systems connect to the local electric grid and use the grid both to buy power from their local electric utility during times when their DG systems are not producing enough to meet their needs and to sell power to their utility when their systems are producing more electricity than is needed. To be clear, the utility's grid infrastructure is the mechanism by which all buying and selling is actually accomplished. . . . The grid connection enables residential rooftop solar users to buy power when their system does not produce enough electricity to meet their needs and to sell electricity onto the grid if their system generates more than they need. Customers with DG systems also rely on the grid to ensure that their own power supply provides reliable, high-quality service at all times.[18]

EEI's statement combined with the observations of Company witness Mr. Douglas Marx, a witness for the Company who stated, "residential net metering customers use the electric grid at a level higher than other residential customers. The total amount of energy transferred to and from the electric grid by net metering customers can exceed the amount of energy delivered to other customers by a significant amount,"[19] would indicate that the two groups of customers are not only distinguishable, but significantly different.

Finally, the distribution of usage throughout the day is much different between the two groups.

Q: HAS THE DIVISION LOOKED AT OTHER MEASURES TO DETERMINE IF RESIDENTIAL AND NEM CUSTOMERS ARE DISTINGUISHABLE?

[18] "Straight Talk about Net Metering," Edison Electric Institute, January 2016.

[19] Direct Testimony, Mr. Douglas Marx, p. 2, lines 30-33.

A: Yes. I will present some evidence on load factors for the two groups. Mr. Faryniarz will present some independent analysis on load factors and other characteristics of the two groups.

Generally speaking, customers with lower load factors are costlier for the Company to serve on a per kilowatt basis. Continuing with the same data[20] as above, I calculate an overall load factor for each of the two groups. The load factor for the NEM customers is approximately 13% less than for residential customers. (See Table 4)

Table 4: Overall Load Factors

	RESIDENTIAL	NEM
Annual Energy Consumption	6,547,168,076	39,124,078
Maximum Hourly Consumption	2,377,492	16,342
Annual Hours	8,759	8,759
Average Hourly Consumption	747,479	4,467
Overall Load Factor	31.44%	27.33%
NEM/Residential	-13.06%	

I also calculated load factors using the non-coincident peaks (NCP) at sales using the data from the Company's cost of service study.[21] These are consistent with the overall load factors: for the 12 NCP, the NEM load factor is approximately 13% less than for

[20] Ms. Steward's work papers, Figures 2 & 3 - Res Compared to Res-NEM Profiles.xlsx.

[21] Ms. Steward's Work Papers, Table 4, Res and Res NEM Characteristics.

residential customers. At the maximum NCP, the NEM load factor is 34% less. (See Table 5)

Table 5: Load Factors - NCP at Sales

	Residential	NEM	
12 NCP (kW)	56,098,384	387,862	
Average (kW)	4,674,865	32,322	
Maximum (kW)	5,346,914	48,530	
Average Load (kWh)	744,664	4,466	
	Load Factor		% Difference
Max NCP	13.93%	9.20%	-33.9%
AVG NCP	15.93%	13.82%	-13.3%

The Company's load research data reveals similar differences for residential and NEM customers. (See Table 6) In this case the difference in the average load factor is only approximately two percent. However, the variation in load factors for the NEM customers is much larger than for residential customers. The Coefficient of Variation,[22] for example, is 30% greater for NEM customers. The two measures for relative normality—kurtosis and skewness—are even more dramatic for NEM customers.[23]

[22] The Coefficient of Variation is the ratio of the sample's standard deviation to its average. This standardized variation measure allows the comparison of variance between samples. The greater the coefficient, the greater the relative variation in the sample.

[23] Kurtosis measures how peaked (or flat) the sample distribution is relative to a normal distribution with the same mean and standard deviation. A positive value indicates that the sample is more peaked. Skewness measures the symmetry of the sample distribution relative to a normal distribution: the greater the value, the more asymmetric the sample distribution is relative to a normal distribution. A positive value indicates that the right tail of the sample distribution is fatter than that of a normal distribution. Both measures indicate that the load factors for NEM customers depart much more from a normal distribution than for residential customers.

However, a Kolmogorov-Smirnov test (for the null hypothesis that the load factors for the two groups are drawn from populations with the same distribution) yields a p-value of approximately 15%. In other words, there is at least a 15% chance that the differences in the two observed distributions are random.

Table 6: Load Factors -- Load Research Data

	NEM	*RES*	*Difference*
Mean	0.254	0.260	-2.23%
Median	0.244	0.255	-4.67%
Standard Deviation	0.101	0.079	26.72%
Coefficient of Variation	0.395	0.305	29.62%
Kurtosis	3.481	0.215	1516.18%
Skewness	1.451	0.432	236.03%
Range	0.528	0.425	24.10%
Minimum	0.110	0.054	
Maximum	0.638	0.479	
Sum	13.233	51.016	
Count	52	196	

In conclusion, while the absolute difference in load factors does not appear large, NEM customers consistently have notably lower load factors than other residential customers.

Q: THE COMPANY PROPOSES CREATING A SEPARATE CLASS FOR RESIDENTIAL NEM CUSTOMERS. IN YOUR OPINION, DOES THE DATA SUPPORT SEPARATING NEM CUSTOMERS INTO THEIR OWN CLASS?

A: The evidence to support separating residential NEM customers is mixed. For example, as shown above, the average usage and load factors appear to be similar. However, other analysis and comparisons indicate that NEM customer usage is much different

from that of residential customers and that the load factors for NEM customers are lower and vary to a greater extent than for Non-NEM customers. Similarly, Mr. Faryniarz finds differences in the cost to serve NEM and non-NEM customers, but concludes that the differences are not as great as the Company claims. This ambiguity may indicate that traditional measures or analysis do not capture the full spectrum of customer impacts well and more research is needed. While the Division believes that separating residential NEM customers into their own class is not unreasonable, the Commission may wish to reserve a final decision to do so for a future rate case.

Q: DO YOU HAVE ANY FINAL COMMENTS ON SEPARATING NEM CUSTOMERS INTO THEIR OWN CLASS?

A: Yes. One aspect of the question of a separate class that the previous analysis does not address is the distribution of benefits. Any benefits that NEM customers bring to the system are distributed or dispersed to all customers in the class. If NEM customers are in a class with Non-NEM customers, those benefits are diluted, i.e., are shared with all other customers in the class. If, however, NEM customers are in their own class, they enjoy all of the benefits. For example, if NEM customers are in their own class and contribute to a reduction in peak demand, fewer costs are allocated to their class and they enjoy the full effect of that reduced allocation. Thus, having a separate class for NEM customers is consistent with the regulatory principle of cost causation.

The remainder of my comments assume that a separate class is created for residential NEM customers, though many apply with equal force if the customers remain in the residential class.

Q: IN ITS 2009 ORDER, THE COMMISSION INVITED COMMENTS AND RECOMMENDATIONS ON VARIOUS ASPECTS OF THE NET METERING PROGRAM. DOES THE DIVISION HAVE A RECOMMENDATION ON THE PROGRAM CAP?

A: Yes. The net metering program is a billing construct that renders effective ratemaking difficult because its requirement for monthly netting is too crude a tool to properly recover costs and compensate customers. Additionally, the current program puts undue upward pressure on retail rates—the greater the penetration of NEM customers, the higher retail rates must be to collect the allocated share of the Company's revenue requirement. This is not sustainable in the long run. Therefore, the Division proposes an immediate decrease in the net metering program size cap to reflect the approximate size the program will be on January 1, 2018. The Company can provide an estimate of that cap as part of this proceeding and true the estimate to an actual value once all interconnections prior to January 1, 2018 are known.

For net metering customers who enter the program before the cap is met, the Division proposes no immediate change. However, the Commission should suggest the Legislature eliminate the net metering program statute after an appropriate transition period of approximately seven years. In the absence of legislative changes, the Commission should consider how to adjust the net metering program cap to prevent new entrants from unreasonably extending the program's life.

Residential NEM customers in this group would remain on Schedule 1 until the end of the transition period. However, in the Company's next general rate case, or another

appropriate proceeding, the compensation rate for such customers should be changed to reflect an amount closer to distributed generation customers' actual avoided costs.

Q: DOES THE DIVISION HAVE A PROPOSAL ON HOW TO DETERMINE AN APPROPRIATE COMPENSATION RATE FOR EXCESS GENERATION?

A: Yes. As discussed in Mr. Faryniarz' testimony, the Commission should initiate a separate proceeding to develop an appropriate method to calculate compensation rates for excess distributed generation.[24] Since this process may take time, and may not be completed prior to the next general rate case, as an intermediate step, in the next rate case the compensation rate could be set halfway between the average relevant retail rate and the Company's most-recent avoided cost filing for the type of resource.[25] This rate should also be immediately applied to distributed generation customers not entering the NEM program before it is closed. This change could be applied immediately, as described below.

Q: SHOULD NEM CUSTOMERS BE SUBJECT TO A MINIMUM BILL?

A: Yes. The Division recommends that the level of the minimum bill, as well as all other rates, be set in the next general rate case.

Q: SHOULD OWNERSHIP OF RENEWABLE ENERGY CERTIFICATES (RECS) REMAIN WITH THE CUSTOMER?

[24] The Division notes that the initial docket establishing Schedule 38, avoided cost procedures for large qualifying facilities, took approximately two years.

[25] The Division's intent is to move customers gradually to the new compensation rates. The compensation rate is likely between the average retail rate, which includes transmission, generation, and other costs, and the Schedule 37 avoided cost rate. Once the compensation method is determined, new compensation rates would apply. The alternative would be to start now with the avoided cost rate and move up to the new compensation rates once they are determined.

A: Yes, as long as compensation rates are set at appropriate levels, as I previously discussed, customers should retain ownership of RECs.

Q: DOES THE DIVISION HAVE A PROPOSAL ON OTHER PROGRAM DESIGNS OR RATE STRUCTURES?

A: Yes. Before presenting those proposals, I need to define four groups of customers potentially created as a result of changing the program cap as previously described or other features discussed hereafter. The first group, Group 1, are the existing NEM customers including those who interconnect before January 1, 2018. Group 2 are customers with distributed generation requesting compensation for excess generation who interconnect to the Company's system after January 1, 2018, but before the rate effective period of the next general rate case. Group 3 are customers that interconnect after the rate effective period but before the end of a defined transition period, preferably matching the Group 1 transition period. Finally, Group 4 are customers that interconnect after the end of the transition period.

Q: PLEASE DEFINE THE TRANSITION PERIOD.

A: If the Commission adopts the Division's recommendation to petition the Legislature to eliminate the net metering program statute after approximately seven years, the transition period would be approximately to January 1, 2025. Given the Commission initiated the current docket with its notice of a technical conference, dated August 29, 2014, current and future NEM customers will have been on notice of possible changes in the NEM program for more than ten years.

At the end of the transition period, all customers with distributed generation requesting compensation for excess generation would be subject to new rate structures, retail rates, compensation rates, and other program features approved by the Commission.

Q: YOU IDENTIFIED FOUR GROUPS OF CUSTOMERS. HOW WOULD THE TRANSITION APPLY TO EACH GROUP?

A: GROUP 1: current NEM customers, and those who interconnect before January 1, 2018, would remain on the relevant retail schedule until the end of the transition period. However, the Commission could choose to change the compensation rate for Group 1 in the next general rate case.

As I discussed earlier, customers make rational investments assuming reasonable stability of utility rates. As of January 1, 2025, current and potential NEM customers will have been on notice of changes in the NEM program for ten years. The Division believes ten years is a reasonable notice period for those who interconnect before January 1, 2018.

GROUP 2: The Commission should order that Group 2 customers be billed as current net metering customers, with the exception that the compensation rate for excess generation be set at an amount halfway between the average Schedule 1 rate and the Schedule 37 rate for the type of resource. The current retail rate compensation method is not in the public interest and represents an overpayment for energy. To date, the Division has seen no evidence that the value of the energy provided exceeds the avoided cost price in Schedule 37 plus perhaps some transmission and distribution line

loss factor, which may be partially included in the Schedule 37 rate. The Schedule 37 avoided cost price for fixed solar is currently approximately $0.03/kwh, and is updated annually. In the interest of gradualism, the Commission can find that a price somewhere between the Schedule 37 price and the average retail rate is in the public interest. It is exceedingly unlikely that the midpoint I suggest undercompensates distributed generation customers. Changing the rate is permissible in this proceeding because customers outside the net metering program take rates under Schedule 1. Group 2 customers would be Schedule 1 customers who receive compensation for their excess product. We propose no change to the underlying Schedule 1 rate. However, the Commission routinely sets compensation rates—such as the one we propose here—outside of a rate case for QFs. Further, the utility routinely contracts to purchase power from different vendors at different prices. Those flow through net power costs and can be accounted for in the Energy Balancing Account without the need for deferred accounting.

Upon the conclusion of the Company's next general rate case, the Commission should move Group 2 customers to a transitional plan that will conclude simultaneously with the conclusion of the Group 1 time period around January 1, 2025. Such a plan should involve periodic steps defined as a percentage moves toward the desired end result. For instance, if the Commission determines in this docket or the next general rate case that a demand charge is warranted, it could order four approximately annual steps, each 25% of the way, toward the full demand charge as determined in the Company's next

general rate case. Other charges (i.e., energy charges) would move accordingly. Using a percentage instead of a specific dollar amount is preferable in case there is an intervening rate case that changes the amount of the charge. At the end of that period, Group 2 customers would join Group 1 customers in whatever rate structure the Commission has ordered for the post-January 1, 2025 period.

GROUP 3: Customers with distributed generation, who enter after the rate effective date of the next general rate case, would take the then-current Group 2 rate and effectively join Group 2 in its transition toward the January 1, 2025 end date.

GROUP 4: Group 4 customers are those customers joining after the January 1, 2025 date and would join whatever rate structure the Commission has then instituted for all distributed generation customers.

In summary, the Division recommends that the Commission immediately lower the program cap and request the Legislature to eliminate the current NEM program effective January 1, 2025. These actions will allow the Commission to adopt a new distributed generation paradigm that more fairly apportions benefits and costs. For the new program, the Division recommends that the Commission adopt at least two rate structures, one with three part rates similar to the Company's Schedule 5 and one TOU with on and off peak pricing, with the rates being set or determined in the next rate case. Current NEM customers would remain on their applicable schedule until the end of the transition period when the NEM program is eliminated. Distributed generation

customers interconnecting after the Commission's order in this docket would transition to the new base rates at predefined steps to be determined in the next rate case. The Division recommends that the Commission initiate a separate procedure to determine the appropriate method and level of compensation rates for excess generation. Given this is likely to take time, as an intermediate step, the Division recommends that the compensation rate be set halfway between the current Schedule 37 avoided cost rate and the average applicable retail rate.

Q: DOES THAT CONCLUDE YOUR DIRECT TESTIMONY?

A: Yes it does.