BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF COLORADO

IN THE MATTER OF ADVICE LETTER NO. 1712 FILED BY PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ELECTRIC BASE RATES AND CHANGES TO TARIFF SHEETS AND REPLACE PUC NO. 7 – ELECTRIC TARIFF WITH PUC NO. 8 – ELECTRIC TARIFF	)	**PROCEEDING NO. 16AL-0048E**

HEARING EXHIBIT NO. 1001

ANSWER TESTIMONY AND ATTACHMENTS OF

TIM WOOLF

ON BEHALF OF

ENERGY OUTREACH COLORADO

June 6, 2016

TABLE OF CONTENTS

LIST OF ATTACHMENTS

Attachment TW-1	Resume of Tim Woolf
Attachment TW-2	PSCo Response to OCC 1-7
Attachment TW-3	PSCo Response to OCC 1-6
Attachment TW-4	PSCo Response to OCC 16-1
Attachment TW-5	Excerpts from James Bonbright's *Principles of Public Utility Rates*
Attachment TW-6	PSCo Response to EOC 2-17
Attachment TW-7	PSCo Response to SWEEP 1-39 (c)
Attachment TW-8	Attachment SWEEP1-31 A6, to PSCo Response to SWEEP 1-31
Attachment TW-9	Residential Time-of-Day Service Rates and Availability
Attachment TW-10	Rocky Mountain Institute, *A Review of Alternative Rate Designs*, May 2016
Attachment TW-11	PSCo Response to EOC 4-24
Attachment TW-12	PSCo Response to EOC 4-29
Attachment TW-13	PSCo Response to EOC 2-18
Attachment TW-14	PSCo Response to EOC 5-6
Attachment TW-15	PSCo Response to EOC 4-18
Attachment TW-16	Synapse Energy Economics (2016) *Caught in a Fix*, prepared for Consumers Union
Attachment TW-17	PSCo Response to OCC 10-1
Attachment TW-18	PSCo Response to EOC 4-28
Attachment TW-19	PSCo Response to SWEEP 1-5
Attachment TW-20	PSCo Response to OCC2-1
Attachment TW-21	PSCo Response to EOC 4-8

1. Introduction and Qualifications

Q. PLEASE STATE YOUR NAME, TITLE AND EMPLOYER.

A. My name is Tim Woolf. I am a Vice President at Synapse Energy Economics, located at 485 Massachusetts Avenue, Cambridge, MA 02139.

Q. PLEASE DESCRIBE SYNAPSE ENERGY ECONOMICS.

A. Synapse Energy Economics is a research and consulting firm specializing in electricity and gas industry regulation, planning, and analysis. Our work covers a range of issues, including economic and technical assessments of demand-side and supply-side energy resources; energy efficiency policies and programs; integrated resource planning; electricity market modeling and assessment; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients, including state attorneys general, offices of consumer advocates, trade associations, public utility commissions, environmental advocates, the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), U.S. Department of Justice, the Federal Trade Commission and the National Association of Regulatory Utility Commissioners. Synapse has over 25 professional staff with extensive experience in the electricity industry.

Q. PLEASE SUMMARIZE YOUR PROFESSIONAL AND EDUCATIONAL EXPERIENCE.

A. Before joining Synapse Energy Economics, I was a commissioner at the Massachusetts Department of Public Utilities (DPU) for four years. In that capacity, I was responsible for overseeing a substantial expansion of clean energy policies, including

significantly increased ratepayer-funded energy efficiency programs; an update of the DPU energy efficiency guidelines; the implementation of decoupled rates for electric and gas companies; the promulgation of net metering regulations; review and approval of smart grid pilot programs; and review and approval of long-term contracts for renewable power. I was also responsible for overseeing a variety of other dockets before the Commission, including several electric and gas utility rate cases.

Prior to being a commissioner at the Massachusetts DPU, I was employed as the Vice President at Synapse Energy Economics; a Manager at Tellus Institute; the Research Director at the Association for the Conservation of Energy; a Staff Economist at the Massachusetts Department of Public Utilities; and a Policy Analyst at the Massachusetts Executive Office of Energy Resources.

I hold a Masters in Business Administration from Boston University, a Diploma in Economics from the London School of Economics, a BS in Mechanical Engineering and a BA in English from Tufts University. My resume, attached as Attachment TW-1, presents additional details of my professional and educational experience.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS CASE?

A. I am testifying on behalf of Energy Outreach Colorado (EOC), an independent, non-profit organization in Colorado that works to help limited income Coloradans afford home energy.

Q. WHY IS EOC INTERVENING IN THIS DOCKET?

A. EOC is a Colorado non-profit corporation whose mission is to ensure that low-income Colorado households can meet their home energy needs. EOC provides bill

assistance and funds energy efficiency measures for low-income customers to this end. Several proposals by Public Service Company of Colorado's (PSCo or the Company) in this proceeding raised concerns for EOC that low-income customers could be negatively impacted. These concerns include the projected increased rates for residential customers, particularly through increases to customers' fixed charges, and proposals to shift price signals, to which signals many low-income users will be unable to respond and therefore will be disproportionately impacted. EOC Executive Director, Skip Arnold, testifies further in his Answer Testimony concerning EOC's mission and the importance of intervening in this proceeding.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to address the Company's proposed rate design, and its implications for residential and low-income customers. In particular, my testimony discusses the Company's ultimate goal of creating a "common platform" for rate design across all of its classes, including moving residential customers to a demand charge. I also discuss concerns regarding the specific design and implementation of the Grid Use Charge and the residential demand – time-of-use (RD-TOU) service.

2. Summary of Conclusions and Recommendations

Q. PLEASE SUMMARIZE YOUR PRIMARY CONCLUSIONS.

A. First, the Company's professed goal of eventually implementing demand charges for residential customers is misguided and should not be used to justify modifications to its current rate designs. Demand charges for residential customers are not a recommended backbone for future policy. Demand charges suffer several flaws and risks: 1)

inconsistency with widely-held and fundamental rate design principles, 2) creating inefficient price signals, 3) unnecessary complexity and difficulty for residential customers to respond to, 4) placing an undue burden on low-usage and low-income customers in particular, and 5) will ultimately increase long-term electricity costs.

Second, alternatives to residential demand charges, such as time-of-use rates, are being widely implemented and can achieve many of the objectives behind demand charges without any of the problems listed above. The Company has not provided a meaningful analysis of such important rate design alternatives.

Third, there is no sound justification for implementing a dramatic change in the residential rate structure. The Company has been able to adequately recover revenues in recent years, and even if that were to become a problem in the future, there are alternative, superior ways to address revenue recovery. In addition, the Company has not demonstrated that there are significant customer equity problems under current rate designs, or that there are likely to be any such problems in the near-term future. Furthermore, the current seasonal inclining block rate is highly effective in encouraging customers to consume electricity efficiently.

Fourth, and especially in the absence of sound rationale for moving to demand charges, the proposed Grid Use Charge is a significant departure from historical rate designs, suffers from all of the problems of residential demand charges described above, and suffers from additional problems because it is so poorly designed. It will be very difficult for residential customers to understand, to monitor, and to respond in a meaningful way to the proposed Grid Use Charge. In order to move into a lower tier, a

customer will need to change his or her 12-month average energy use, which will require significant, sustained energy savings that few customers will be able to achieve or even know whether and how to achieve. Some customers will see increases in their fixed charges of 200, 400, and even 600 percent. One customer who is unlucky enough to have energy consumption slightly higher than a tier cutoff could pay significantly higher electric bills than a neighbor whose energy consumption is just slightly lower than that tier cutoff.

Fifth, the Company's proposed optional residential demand – time-of-use (RD-TOU) service is more like a demand charge than a time-of-use rate, and therefore suffers from all of the problems of residential demand charges described in my testimony.

Finally, the class cost of service study that utilizes the stratification methodology is the preferred study and should be used in this proceeding, because the stratification method reasonably assumes that generation facilities are constructed for purposes other than merely serving peak load.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A. I recommend that the Commission do the following:

- Reject the Company's proposal for a mandatory Grid Use Charge on residential customers.
- Reject the Company's proposal for an optional residential demand – time-of-use service.
- Direct the Company to maintain its current seasonal, inclining block rate structure, while reducing the services and facility (S&F) charge to $5.78.

- Direct the Company to expand its pilot energy-based TOU rates, Peak Time Rebates, or Critical Peak Pricing rates to all residential customers on an opt-in basis.
- Defer consideration of wholesale changes to the default rate structure until after decoupling is investigated by the Commission as an alternative solution to mitigate potential revenue recovery concerns.
- Direct the Company to record and maintain data related to the dates and times of individual feeder peaks in order to inform the future rate design.
- Direct the Company to use the CCOSS with the stratification methodology.

3. The Company's Rate Design Proposal

Q. WHAT RATE DESIGN CHANGES DOES PSCO PROPOSE FOR THE RESIDENTIAL CLASS?

A. The Company is proposing to:

- apply mandatory Grid Use Charges for all of its Residential and Small Commercial classes;
- offer an optional residential demand – time-of-use (RD-TOU) service; and
- phase out its existing Residential Demand (RD) service.

Q. PLEASE DESCRIBE THE GRID USE CHARGE.

A. The Company states that "an interim step before the implementation of a demand charge, the Company is proposing to add the fixed, monthly Grid Use Charge ("GUC")

that would be designed to "allow [the Company] to recover customer-related costs and distribution costs through fixed charges."[1] Under the Company's proposal, distribution-related costs would no longer be recovered through the energy charge,[2] but would be recovered through the mandatory fixed GUC.

This fixed, monthly charge would vary based on a customer's size, as approximated through the customer's average monthly use over the past 12 months.[3] Based on this metric, customers would be grouped into five tiers and assigned a grid use charge ranging from $2.62 to $44.79 per month.

Q. WOULD THIS NEW FIXED CHARGE REPLACE THE CURRENT SERVICE AND FACILITIES (S&F) FIXED CHARGE?

A. No. The GUC would be in addition to the S&F fixed charge. While the Company is proposing to reduce the S&F fixed charge by $0.97, when combined with the new fixed GUC, the percentage increase in the fixed charge for residential customers is dramatic. The percentage increase in the fixed charge would range from 24 percent to nearly 650 percent for residential customers, as shown in the table below.

[1] Direct Testimony and Attachments of Scott B. Brockett. Hearing Exhibit 103, 16AL-0048E, January 25, 2016 ("Brockett"), at p. 20
[2] Brockett, at p. 27
[3] Brockett, at p. 33

Table 1. PSCo Proposed Residential Rate

Component	Tier (kWh)	Current	Proposed	Total Fixed Charge (S&F + GUC)	% Increase
Service & Facility Charge	All	$6.75	$5.78		
Grid Use Charge (GUC)	Up to 200 kWh		$2.62	$8.40	24%
	Up to 500 kWh		$7.76	$13.54	101%
	Up to 1000 kWh		$14.56	$20.34	201%
	Up to 1400 kWh		$25.69	$31.47	366%
	Above 1400 kWh		$44.79	$50.57	649%

Q. FOR THE RESIDENTIAL CUSTOMER CLASS, DO YOU KNOW WHAT PERCENTAGE OF THE COMPANY'S REVENUES THE COMPANY EXPECTS TO COLLECT THROUGH THE S&F AND THE GUC?

A. In discovery, the Company provided that if the GUC and the S&F charge were in effect in 2013, they would have accounted for 25.2% of the revenue from the residential customer class.[4] The Company did not provide estimates for 2014, 2015, or future years. However, we do know that the Company has been steadily increasing the portion of residential class revenue it recovers through fixed charges (from 10.1% to 10.6% from 2013 to 2015).[5]

Q. HOW WILL A CUSTOMER MOVE INTO A LOWER TIER?

[4] Response to OCC 1-7, attached as **Attachment TW-2**.
[5] Response to OCC 1-6, attached as **Attachment TW-3**.

A. A customer will move into a lower tier only after reducing his or her 12-month average usage below the tier threshold.[6]

Q. WOULD THE ENERGY CHARGE BE COMMENSURATELY REDUCED?

A. Yes. The upper block of the summer inclining block rate (IBR) would be reduced by 13% (from $0.090 to $0.079), while the winter and first block of the summer IBR would be reduced by 27% (from $0.046 to $0.034.)[7]

Table 2. Proposed Decrease in Energy Charge

Energy Charge ($/kWh)	Current	Proposed	% Decrease
Summer Season			
First 500 kWh	$0.04604	$0.03366	-27%
All over 500 kWh	$0.09000	$0.0786	-13%
Winter			
All kWh	$0.04604	$0.03366	-27%

Q. PLEASE DESCRIBE THE RESIDENTIAL DEMAND – TIME-OF-USE CHARGE (RD-TOU).

A. The RD-TOU charge is a seasonal demand rate, which would assess customers a demand charge based on the customer's maximum usage from 2:00 pm to 6:00 pm on non-holiday weekdays. During the summer months (June – September), the demand

[6] Brockett, at p. 34 states that the GUC will be based on "the customer's average monthly use for the most recent 12 months."

[7] *See* Direct Testimony and Attachments of Steven W. Wishart. Hearing Exhibit 106, 16AL-0048E, January 25, 2016 ("Wishart"), at p. 3.

charge would be $9.89 per kW, while during the winter it would be $6.92 per kW.[8] In addition to the demand charge, the Company proposes to assess customers on Schedule RD-TOU a Grid Use Charge identical to that proposed for Schedule R.[9]

4. Principles of Rate Design

Q. WHAT RATEMAKING PRINCIPLES SHOULD BE CONSIDERED WHEN DESIGNING RATES?

A. In his seminal work, *Principles of Public Utility Rates*, Professor James Bonbright discusses eight key criteria for a sound rate structure. These criteria are as follows:

1. The related, "practical" attributes of simplicity, understandability, public acceptability, and feasibility of application.
2. Freedom from controversies as to proper interpretation.
3. Effectiveness in yielding total revenue requirements under the fair-return standard.
4. Revenue stability from year to year.
5. Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers.
6. Fairness of the specific rates in the appointment of total costs of service among the different customers.
7. Avoidance of "undue discrimination" in rate relationships.

[8] Corrected demand charges submitted by the Company in response to OCC 16-1, attached as **Attachment TW-4**.
[9] Brockett, at p. 48.

8. Efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use:

(a) in the control of the total amounts of service supplied by the company;

(b) in the control of the relative uses of alternative types of service (on-peak versus off-peak electricity, Pullman travel versus coach travel, single-party telephone service versus service from a multi-party line, etc.).[10]

Q. ARE THESE PRINCIPLES WIDELY RECOGNIZED AND USED BY COMMISSIONS?

A. Yes. The principles listed above have been recognized for many years across the nation. Bonbright's principles are also referenced by Company Witness Alice Jackson to present the Company's analysis to the Commission.[11] I note that Ms. Jackson references a later version of Principles of Public Utility Rates, which was influenced by additional authors, and therefore differs slightly from Bonbright's original eight principles, but there is no substantive difference between the two editions in the ratemaking principles.[12]

Q. IS THE COMPANY'S RATE DESIGN PROPOSAL CONSISTENT WITH BONBRIGHT'S PRINCIPLES?

A. No. Neither the Company's long-term rate design strategy of moving toward demand charges nor the specific rate designs proposed in this case comport with Bonbright's criteria.

---

[10] James Bonbright, *Principles of Public Utility Rates*, Columbia University Press, 1961, page 291, provided in **Attachment TW-5.**

[11] Direct Testimony and Attachments of Alice K. Jackson. Hearing Exhibit 101, 16AL-0048E, January 25, 2016 ("Jackson"), at pp. 22-24.

[12] Jackson, at pp. 22-24.

Specifically, taking the proposed step toward demand charges will fail to achieve the goals of equity and efficiency, and in fact would reduce customer control, distort price signals, and lead to significant customer confusion. Further, the Company's Grid Use Charge is a step *backward* from the current rate design, as it would act as a fixed charge that is difficult for customers to modify, while being a worse reflection of cost causation than the current energy charge.

Finally, it is important to recognize that Bonbright's principles may sometimes be in tension with each other. For example, the Company's ability to recover its allowed revenues may sometimes be in conflict with sending efficient price signals. However, that is not the case in this proceeding. While the Company cites concerns regarding revenue recovery as a rationale for implementing its preferred rate design,[13] such concerns are misplaced and can be better addressed through alternative, superior mechanisms. I will address each of these points throughout the remainder of my testimony.

5. Problems With Residential Demand Charges

Q. THE COMPANY STATES THAT ITS PROPOSED RESIDENTIAL RATE DESIGNS ARE "AN INTERIM STEP BEFORE THE IMPLEMENTATION OF A DEMAND CHARGE." WHY IS THE COMPANY TAKING STEPS TO MOVE RESIDENTIAL CUSTOMERS TO A DEMAND CHARGE?

A. Company witness Scott Brockett testifies that, "Ideally, a separate rate or rates would recover each of these three types of costs. A fixed monthly charge would recover

[13] *See, e.g.*, Jackson, at pp. 31-35.

all customer-related costs, an energy charge or charges would recover all usage-related costs, and a demand charge or charges would recover all capacity-related costs."[14]

However, the Company's "ideal" is based on several flawed premises:

1) that a demand charge is the most accurate means of recovering demand-related costs because it is cost-based;
2) that a demand charge sends an efficient price signal; and
3) that demand charges are appropriate for residential customers.

In fact, none of these are true.

Demand Charges Are Not Cost Based

Q. FIRST, PLEASE IDENTIFY WHAT TYPES OF COSTS ARE TYPICALLY "DEMAND-RELATED" OR "CAPACITY-RELATED"?

A. Demand-related costs are those that vary with demand (expressed in kW) on the system, and include portions of the production, transmission, and distribution system related to meeting peak demands.

Q. WHY IS A THREE-PART RATE DESIGN (CONSISTING OF A CUSTOMER CHARGE, DEMAND CHARGE, AND ENERGY CHARGE) NOT IDEAL?

A. Despite its intuitive name, a "demand charge" does not accurately reflect demand-related costs, particularly for residential customers. Demand charges may make sense for large commercial and residential customers, where certain components of the system must be sized to meet that individual customer's maximum demand. But equipment on

[14] Brockett, at p. 18.

the utility system is generally not sized to meet an individual residential customer's non-coincident maximum demand. Instead, the utility system is sized to meet the system's coincident peak demands.[15] Thus, it is not the individual residential customer's peak demand that drives system costs, but the timing of that demand and its coincidence with other demands on the system.[16]

Q. DID THE COMPANY PROVIDE ANY STUDIES DEMONSTRATING THAT DISTRIBUTION COSTS ARE DRIVEN LARGELY BY A CUSTOMER'S NON-COINCIDENT PEAK LOAD?

A. To the contrary. The Company admitted in discovery that it has no such studies. It appears to rely for its assertion solely on the conclusion that non-coincident and coincident peaks are themselves positively correlated.[17]

Q. IS THERE MORE THAN ONE COINCIDENT PEAK THAT DRIVES COSTS?

A. Yes. Different components of the utility system may experience peaks at different times. For example, a distribution system feeder must be sized to meet the local coincident peak demand of all of the customers served by that feeder, which may include tens, hundreds, or thousands of customers. Transmission systems, on the other hand, must be sized to meet the coincident peak demand of all the customers affected by the relevant

---

[15] The system coincident peak demands may vary at different levels of the system. For example, a distribution system feeder may experience its peak demand at a different time than the bulk transmission system.

[16] *See, for example:* Jim Lazar, "Use Great Caution in Design of Residential Demand Charges," *Natural Gas & Electricity*, February 2016, available at https://www.raponline.org/document/download/id/7844, p. 19: "NCP [Non-Coincident Peak] demand is not relevant to any system design or investment criteria above the final line transformer, and only there if the transformer serves just a single customer."

[17] **Attachment TW-6**, PSCo Response to EOC 2-17.

transmission area, which will include many more customers than those served by the distribution system feeder, and may occur at a completely different time.

Q. WOULD A DEMAND CHARGE THAT IS ASSESSED ONLY DURING PEAK HOURS BETTER REFLECT COINCIDENT DEMAND?

A. A demand charge that is assessed only during coincident peak hours when the system is likely to experience a coincident peak is a significant improvement over a demand charge that is based on a customer's non-coincident maximum demand at any time. However, the demand charge sends a less efficient signal than alternative rate designs.

Demand Charges Send Inefficient Price Signals

Q. PLEASE EXPLAIN WHY A DEMAND CHARGE SENDS A LESS EFFICIENT PRICE SIGNAL THAN ALTERNATIVE RATE DESIGNS?

A. The demand charge concentrates the price signal into a single hour of the month – the hour of the customer's individual maximum demand. During the other peak hours, the price signal sent to customers to reduce demand is limited, since reducing demand below his or her monthly peak will have no financial benefit for the customer. Similarly, the price signal to reduce overall energy usage is reduced as implementing a demand charge is accompanied by a reduction in the energy usage charge.[18]

In effect, a demand charge sends customers an inefficient price signal: that reducing electricity consumption outside of the customer's single peak hour is of less

[18] *See* Table 2, above.

value to the system. A more efficient price signal would encourage customers to reduce energy consumption in each and every hour that the system is stressed, not just for the single hour that an individual customer reaches his or her maximum demand.

Q. CAN YOU PROVIDE AN EXAMPLE OF HOW A DEMAND CHARGE FAILS TO SEND AN EFFICIENT PRICE SIGNAL?

A. Yes. Suppose that Customer A hosted an event on July 3 that caused her to set a peak demand of 10 kW. Since Customer A's typical demand is less than 5 kW, she has little incentive to minimize her demand for the rest of the month, since it is unlikely that she will exceed the 10 kW.

Now suppose that the actual system peak is reached on a hot summer day later that month. While it would be valuable to the system for Customer A to reduce her demand as much as possible, the demand charge does not reward her for doing so. Thus Customer A continues to run her central air conditioning at full force, while doing laundry and running the dishwasher, for a total demand of 9 kW during the system peak.

This simple example demonstrates how, by concentrating the demand charge on a customer's single peak hour, a demand charge fails to provide an efficient price signal to reduce demand-related costs on the system.

Q. YOU NOTED THAT IMPLEMENTING A DEMAND CHARGE REDUCES THE ENERGY CHARGE. WILL REDUCING THE ENERGY CHARGE IMPACT CUSTOMER INCENTIVES TO INVEST IN ENERGY EFFICIENCY?

A. Yes. It is well-established that residential customers exhibit negative elasticity of demand. This means that, holding all else equal, a reduction in the price of electricity will

lead to an increase in electricity consumption, and incentives for energy efficiency and conservation will be reduced.[19]

When a demand charge is implemented, some of the costs that were previously recovered through the energy charge are moved to the demand charge, thereby lowering the volumetric price paid per kilowatt-hour. It follows that incentives for energy efficiency and conservation would therefore be reduced, unless this effect is offset by price signals embedded in the demand charge. As discussed elsewhere, however, the price signal sent by a demand charge is inefficient and much less transparent, and there is limited empirical evidence as to whether customers respond to demand charges.

Q. ARE THERE OTHER RATE DESIGNS THAT PROVIDE MORE EFFICIENT PRICE SIGNALS?

A. Yes. Energy-based rates that include a time component (such as traditional energy-based time-of-use rates, critical peak pricing, or peak time rebates) send strong price signals to customers to reduce load during every peak hour, not just a single hour. They can also send better price signals regarding the costs at system coincident peak times that are different at different points along the grid (e.g., at the feeder level versus the transmission level).

Energy-based time-of-use rates typically define a peak period and an off-peak period for each weekday. Customers face a higher price of energy during the peak periods, and are therefore incentivized to reduce usage during every peak hour.

[19] This fact is acknowledged by the Company in response to interrogatory SWEEP 1-39 (c), attached as **Attachment TW-7**.

Critical Peak Pricing (CPP) and Peak Time Rebates (PTR) also provide an energy-based price signal during "critical event" hours, during which time the system is stressed (as determined by the utility or grid operator in advance). Returning to our example above, if the system were not stressed on July 3, Customer A would not face a higher charge than normal for consuming 10 kW. However, on the day that the system peak occurred, Customer A would face a very high financial incentive (e.g., $0.60/kWh)[20] for consumption of energy during the critical event period. In this way alternative rate designs are better able to provide meaningful price signals to customers when it really matters to the system.

Finally, even the current seasonal and inclining block rates provide a simple, sustained price signal to manage usage during each hour, and a strong price signal during the summer months when system peaks tend to occur.

Q. HAS THE COMPANY TESTED ANY OF THESE ALTERNATIVE RATE DESIGNS?

A. Yes. The Company has implemented several pilots. For example, the SmartGridCity™ (SGC) pricing pilot was a three-year, comprehensive rate pilot with nearly 4,000 participants. This pilot tested energy-based TOU rates, Critical Peak Pricing (CPP), and Peak Time Rebates (PTR).[21] The Company's affiliates have also implemented TOU rates in Minnesota, Wisconsin, South Dakota, North Dakota, and

[20] A critical peak price of approximately $0.60/kWh was used in the California Statewide Pricing Pilot, but the price can be set higher or lower. *See:* Stephen George and Ahmad Faruqui, "California's Statewide Pricing Pilot: Overview of Key Findings," May 4, 2005. *Available at* sites.energetics.com/MADRI/pdfs/california_050405.pdf

[21] Attachment SWEEP1-31 A6, to PSCo Response to SWEEP 1-31, p. 1, attached hereto as **Attachment TW-8**.

Michigan. Although I am not familiar with the details of those rates, I have attached information provided by the Company that shows the time-varying nature of the energy rate, without a demand charge.[22]

Q. DID COLORADO CUSTOMERS RESPOND TO THE TOU RATES, CRITICAL PEAK PRICING, OR PEAK TIME REBATES?

A. Yes, all of these rate designs resulted in significant load reductions during peak hours. According to the Company's December 19, 2013 Pilot Evaluation and Final Report, "Customers on the CPP rate realized reduced peak demand approaching 30%, PTR participants realized load reductions of nearly 15% and TOU participants averaged 5-9%."[23]

Q. HOW WELL DO RESIDENTIAL CUSTOMERS RESPOND TO DEMAND CHARGES RELATIVE TO OTHER RATE DESIGN OPTIONS?

A. It is unknown. Demand charges are largely untested for residential customers, making Colorado a potential test case for the nation. The Colorado-based Rocky Mountain Institute issued a report on the subject just this year. The report noted, "there is limited empirical evidence on the efficacy or impacts of mass-market demand charges on any desired outcome beyond cost recovery."[24] In other words, we only know that demand charges help to provide utilities with more stable revenues, but we do not have evidence that customers actually respond to demand charges in a meaningful way.

---

[22] *See* **Attachment TW-9**, Residential Time-of-Day Service Rates and Availability.
[23] *See* Attachment TW-8.
[24] *See* **Attachment TW-10**, Rocky Mountain Institute, *A Review of Alternative Rate Designs*, May 2016 ("RMI Review"), at p. 79,

Rocky Mountain Institute also reports that only three studies have quantified peak reductions from a demand charge, but they are limited in their usefulness, because:

- Two of the studies are nearly 40 years old, and the other one is from Norway.
- All three studies had very small sample sizes (ranging from 40 to 443 participants).[25]

Q. WHAT DO YOU CONCLUDE FROM THE LACK OF EVIDENCE REGARDING DEMAND CHARGES?

A. I conclude that it would not be prudent to embark on a path that is largely untested, particularly given that demand charges also suffer from numerous practical challenges, especially simplicity, understandability, and acceptability. Furthermore, moving toward an unproven rate design is not necessary, given that there are other options, such as TOU, CPP, and PTR rates that have demonstrated significant peak demand reductions across the United States and in PSCo's service territory.

Demand Charges Are Complex and Not Well-Understood

Q. YOU STATED THAT DEMAND CHARGES ARE INAPPROPRIATE FOR RESIDENTIAL CUSTOMERS. PLEASE EXPLAIN.

A. In addition to being largely untested, demand charges represent a much more complex rate design than residential customers are accustomed to. Surveys and focus groups have found that the concept of demand charges are not well-understood and

[25] RMI Review, at p. 60.

frequently raise concerns from customers.[26] Not only are demand charges conceptually new, customers generally lack the tools needed to manage their demand. Without investing in automating technology, residential customers have little ability to monitor and quickly adjust their demand levels.[27] Such technology is not currently widely available, and would be out of reach for most low-income customers. Further, where residential demand charges have been implemented, enrollment tends to be very low, indicating low levels of customer acceptance.

Q. WHAT PERCENTAGE OF CUSTOMERS HAS ENROLLED IN DEMAND-BASED RATES?

A. Despite having been in place for many years, PSCo reports that only 1,168 customers (0.1% of residential customers) are currently enrolled in its Residential Demand (RD) rate. This level of enrollment has held relatively constant for the past four years, with a slight downward trend.[28]

---

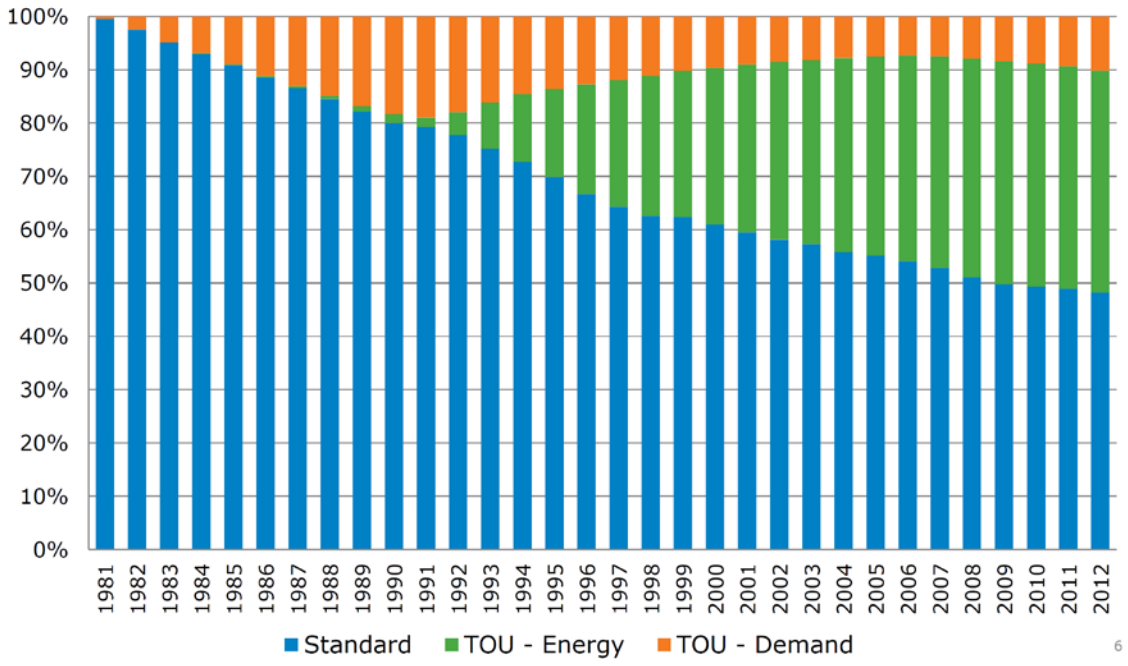
[26] Recent surveys indicate that approximately 50% of residential customers do not understand the terms "kW" and "kWh". *See:* LeBlanc, Bill. "Do Customers Understand Their Power Bill? Do They Care? What Utilities Need to Know." Blog summary of E Source Survey. January 21, 2016. *https://www.esource.com/email/ENEWS/2016/Billing* In addition, results of PSCo's focus groups revealed that a demand charge "is seen as somewhat punitive and providing less attainable energy reduction goals because energy use during the specified hours… is perceived as harder to control." Attachment AKJ-1.

Further, focus groups in Ontario found that the concept of maximum use during peak hours "is difficult for people to understand and raised concern among a few. There is no template for measuring maximum use that people are used to in the way they understand TOU." Customers also expressed concerns regarding fairness, specifically that "that small lapses in their conservation efforts will mean they will have to pay a high price". *See:* Gandalf Group, Ontario Energy Board Distribution Charge Focus Groups Final Report, October 9, 2013("Gandalf Report"), available at : http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2012-0410/Appendix%20B%20-%20Gandalf%20Distribution%20Focus%20Groups.pdf at p. 9.

[27] For example, a widely held concern of participants in focus groups in Ontario regarding demand charges is that they do not have the tools to manage their demand. *See:* Gandalf Report, at pp. 6, 11.

[28] **Attachment TW-11**, PSCo Response to EOC 4-24

This low enrollment level is not unique to PSCo. Of the 24 other examples of demand charge rates that have been applied to residential customers in the US on an opt-in basis, most have enrollment below 1%,[29] despite existing for multiple years and customer marketing efforts.[30] The exceptions are Arizona Public Service (APS) with enrollment of 11% and Black Hills Power with enrollment of 8%.[31] Yet even at APS, customers prefer the energy-only time-of-use rate to the demand charge rate by a margin of four to one.[32] This strong preference for energy-based rates can be seen in the graph below, which shows that approximately 40 percent of customers have opted in to the energy-only TOU rate versus the 11 percent that have chosen the demand rate.



[29] RMI Review, at p. 72.
[30] For example, Alabama Power Co. has enrollment levels far below 1%, despite marketing efforts and having had the program in place for more than four years.
[31] RMI Review, at p. 72.
[32] Eddie Easterling, "EUCI Residential Demand Charge Summit," May 14, 2015.

Source: Grabel, Meghan, "Residential Demand Rates: APS Case Study" Presentation on June 25, 2015

Q. HAVE ANY INVESTOR-OWNED UTILITIES MADE DEMAND-BASED RATES MANDATORY FOR RESIDENTIAL CUSTOMERS?

A. No. The Company states that it knows of no other investor-owned utility that requires enrollment in a demand-based rate for residential customers.[33]

Q. YOU REFER TO "ADOPTION RATES" OF OTHER UTILITIES. IS THAT WHAT PSCO IS PROPOSING HERE?

A. It appears that PSCo eventually intends to make some form of demand charges mandatory for residential customers. The Company's GUC (discussed below) would be a mandatory proxy for a demand charge.

Q. DO YOU THINK THAT DEMAND CHARGES SHOULD BE APPLIED TO RESIDENTIAL CUSTOMERS ON A MANDATORY BASIS?

A, No. In my view, demand charges should never be applied to residential customers on a mandatory basis. First, demand charges suffer fundamental flaws when applied to residential customers, as described above. Second, demand charges place undue risks on low-income customers. Such customers are less likely to have the tools or ability to manage their energy usage, as their load shapes differ from the typical residential customer. For example, low-income customers may be elderly or work night shifts, requiring that they are home during the daytime, as discussed in the testimony of EOC Executive Director, Skip Arnold, in his Answer Testimony. These customers are

[33] PSCo Response to EOC 4-29, attached as **Attachment TW-12**.

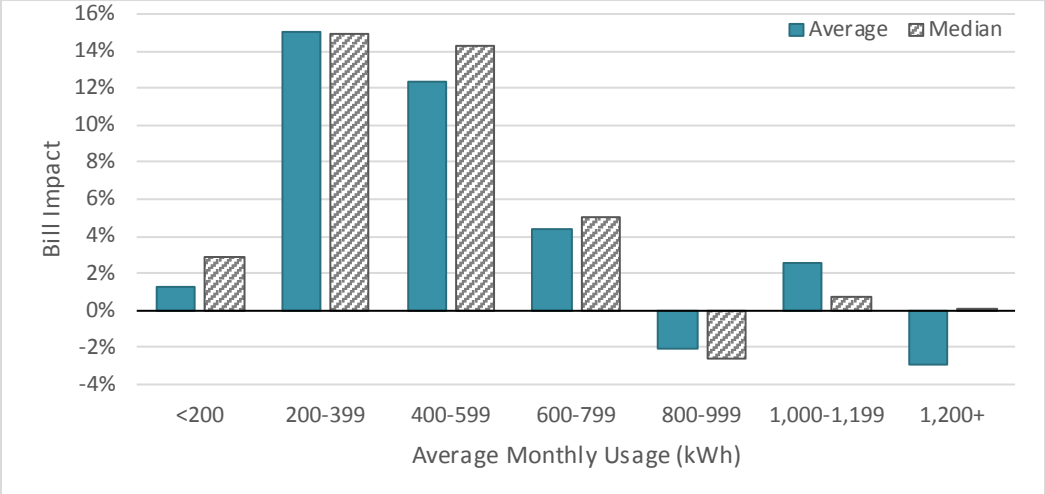
therefore more likely to be negatively impacted by charges with peak periods during the middle of the day.

Demand Charges Disproportionately Burden Low-Usage and Low-Income Customers

Q. HAVE YOU EXAMINED THE IMPACT OF DEMAND CHARGES ON DIFFERENT TYPES OF CUSTOMERS?

A. Yes. We have examined usage data for PSCo, and found that demand charges disproportionately increase bills for customers with below-average usage, while generally reducing bills for large residential customers. Figure 1 depicts this phenomenon, showing average bill changes under the Company's RD-TOU rate for PSCo customers in different usage groups.

Figure 1. Potential Impacts on PSCo Residential Customers from Company's RD-TOU Rate



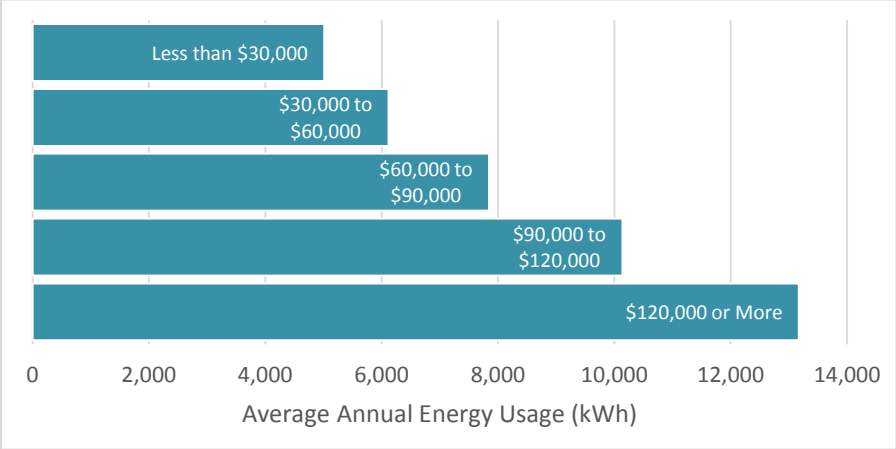
Source: Calculated from PSCo load research data provided in response to VS1-7.

As illustrated by the graph above, low- and moderate- usage customers are likely to bear a disproportionate amount of the bill increases under a demand charge, while customers consuming 800 kWh or more would largely experience reduced bills. Such results imply that low-income customers would likely be hit hardest by a demand charge.

Q. PLEASE EXPLAIN WHY LOW-INCOME CUSTOMERS WOULD BE HIT HARDEST.

A. While we do not have data on the individual customers that would sustain the highest bill increases, we know that in general, low-income customers have the lowest electricity usage, according to the Energy Information Administration. The graph below presents the average electricity usage for each income group and shows that average usage tends to increase as household income rises.

Figure 2. Electricity Usage increases with Income in Colorado



Source: EIA's Residential Energy Consumption Survey, 2009, Colorado data

The demand charges will concentrate bill increases on customers with low- or moderate usage. The Company estimates that low-income residential customers will predominantly have net 12-month average usage of 1,000 kWh or less.[34] Thus, it is very likely that low-income customers will be more harmed than high-income customers by any move toward demand-based rates. This is due to low-income customers' propensity to be low-usage customers.

Q. WHAT DO YOU CONCLUDE REGARDING THE COMPANY'S STATED INTENT TO MOVE RESIDENTIAL CUSTOMERS TOWARD A DEMAND-BASED RATE?

A. The Company's goal is not justified, is inconsistent with rate design goals, would exacerbate customer inequities, and would lead to higher long-term electricity costs. Demand charges fail to meet the goals of efficiency, equity, understandability, and acceptability. Instead, they have only been shown to improve utility revenue recovery. As discussed below, revenue recovery is not a pressing issue in this case and can be addressed through alternative, superior mechanisms.

6. Problems With the Company's Grid Use Charge Proposal

Q. THE COMPANY IS PROPOSING TO IMPLEMENT A GRID USE CHARGE AS A PROXY FOR A DEMAND CHARGE. DO YOU HAVE CONCERNS REGARDING THIS PROPOSED RATE DESIGN?

[34] *See* **Attachment TW-13**, PSCo Response to EOC 2-18.

A. Yes. While the GUC would not have exactly the same impacts as a theoretical demand charge, it has many significant flaws, some more serious than a theoretical demand charge:

1) The GUC would send inefficient price signals,
2) The GUC would worsen customer equity,
3) The GUC is complex and would make it difficult for customers to respond to,
4) The GUC violates the goal of continuity.

The GUC Would Send Inefficient Price Signals

Q. WHY ARE EFFICIENT PRICE SIGNALS AN IMPORTANT RATE DESIGN GOAL?

A. Providing customers with efficient price signals is a fundamental rate design goal, as efficient price signals, and efficient customer responses to those signals, will lead to the lowest cost mix of supply-side and demand-side resources over the long term. This in turn will lead to the lowest electricity system costs for all customers.

Q. WILL THE GRID USE CHARGE PROVIDE CUSTOMERS WITH EFFICIENT PRICE SIGNALS?

A. No. Although the Company claims that its primary goals include sending accurate price signals to promote efficient energy use, [35] and that the GUC would provide

[35] Brockett, at p. 16.

customers with a reasonable opportunity to reduce their GUC through reducing energy usage,[36] the Company's rate design accomplishes neither of these objectives.

Q. PLEASE EXPLAIN WHY THE COMPANY'S PROPOSED GUC WOULD NOT SEND AN ACCURATE PRICE SIGNAL.

A. The Grid Use Charge is inefficient for two reasons. The first reason is that the Company's proposed rate design does not reflect marginal costs. As economists (including Professor Bonbright) have long recognized, efficient rates should be based on long-run marginal costs. Company Witness Scott Brockett acknowledges this, stating that "it is important to send price signals to small customers who are often faced with making long-term investment decisions that reflect or are informed by long-run marginal costs."[37] Nevertheless, the Company states that it is "not attempt[ing] to reflect marginal costs" in the Grid Use Charge.[38]

Q. WHY DOES THE COMPANY NOT SEEK TO REFLECT MARGINAL COSTS IN THE DESIGN OF THE GRID USE CHARGE?

A. The Company states that reflecting marginal costs in the GUC would be "more difficult and less effective."[39]

---

[36] Brockett, at 35
[37] Brockett, at p. 41. In Docket 15AL-0135G, the Company's most recent rate case, Mr. Brockett testified that "efficient prices are those that reflect marginal costs." *See* Rebuttal and Answer Testimony of Scott Brockett, 15AL 0135G, July 20, 2015, at p. 50.
[38] PSCo Response to EOC 5-6, attached as **Attachment TW-14**.
[39] PSCo Response to EOC 5-6.

Q. WHY WOULD IT BE DIFFICULT FOR THE COMPANY TO REFLECT MARGINAL DISTRIBUTION SYSTEM COSTS IN RATES?

A. Based on the Company's responses in discovery, it seems that a primary reason may be that the Company does not systematically collect and store key information related to its distribution system, such as the time and date that its feeders experience peak demand.[40] Without such information, it is difficult to design rates that reflect marginal distribution-related costs. However, such information can and should be collected so that it can be used to work toward a design in which rates reflect efficient price signals based on marginal costs.

Q. WHAT IS THE SECOND REASON THAT THE GUC WOULD NOT SEND AN EFFICIENT PRICE SIGNAL?

A. The GUC does not provide an efficient price signal, as it in practice imposes an additional fixed charge on customers' bills. Increasing the total fixed charges by up to 649 percent will send less efficient price signals by making more of the customers' bill essentially unavoidable until the customer succeeds in reducing her average 12-month usage. This sends customers the signal that their usage of the system does not affect costs on the system, which is inefficient and inconsistent with Professor Bonbright's rate design principles described above.

[40] PSCo Response to EOC 4-18, attached as **Attachment TW-15**.

Q. WHAT IS THE IMPACT OF SENDING INEFFICIENT PRICE SIGNALS?

A. Inefficient price signals will generally result in higher long-term electricity costs for all customers. Higher fixed charges are widely recognized as reducing incentives for energy efficiency and conservation.[41] If customers implement less energy efficiency and conservation as a result of higher fixed charges, then the Company will be required to spend more money on generation, transmission, and distribution costs, resulting in higher electricity costs over the long-term. This concern about increased fixed charges sending inefficient price signals is one of the main reasons why many commissions around the country have rejected significant increases to fixed charges in recent years.[42]

Further, it is critical to recognize that a price signal can only be efficient if it is effective. That is, if the target customer has the ability to respond in an efficient fashion. (In this way, the goals of simplicity and efficiency are closely linked.) However, it will be very difficult, for customers to understand, monitor, and respond in a meaningful way to the Grid Use Charge.

Q. PLEASE EXPLAIN WHY IT WILL BE VERY DIFFICULT FOR CUSTOMERS TO UNDERSTAND, MONITOR AND RESPOND TO THE GRID USE CHARGE?

A. The Grid Use Charge is based on a customer's average monthly energy usage over 12 months in order to determine the tier that a customer will fall into. Thus, in order for a customer to move to a lower tier, he or she will need to change her 12-month

---

[41] Ceres (2015) *Pathway to a 21st Century Electric Utility Model*, by Peter Kind, at p. 6. Peter Kind is also the author of the influential 2013 EEI Report titled *Disruptive Challenges.*

[42] *See* **Attachment TW-16**, Synapse Energy Economics (2016) *Caught in a Fix*, prepared for Consumers Union, at pp. 30-34 (citing recent decisions in Missouri, Minnesota, Washington, and other jurisdictions rejecting higher fixed charges).

average energy use. Not only does this result in a significant delay in financial savings from the installation of energy efficiency measures, but the information and effort required to lower one's GUC will be much greater.

Q. WHAT KIND OF INFORMATION WOULD A CUSTOMER NEED TO MOVE TO A LOWER TIER?

A. In order to move to a lower tier (other than by chance), a customer would have to know their average energy usage over the past 12 months, how much energy they are likely to consume in the current month, and how much they would have to reduce their energy usage by in the current month to move their 12-month average below a tier threshold.

Q. CAN CUSTOMERS EASILY ACCESS THIS INFORMATION?

A. No. Energy usage can vary significantly due to many factors, including weather, changes in household size, and changes in household appliances. While a customer could use their monthly usage from the previous year to guess what their current usage might be, this is likely to be no more than a rough estimate. In addition, customers do not have the means to monitor their usage during the course of a month to determine how close they are to exceeding their expected usage.

Q. HOW MUCH EFFORT WOULD IT TAKE TO MOVE TO A LOWER TIER?

A. In very few cases would customers be able to reduce their usage for one month and successfully move into another tier. In most cases, a sustained effort of energy reduction for several months would be required before a customer can move into a lower

tier. In addition, due to the averaging effect, any reduction in energy usage would generally need to be significant in order to shift tiers.[43]

Q. HAVE YOU ANALYZED ANY DATA ON THE LEVEL OF EFFORT REQUIRED TO MOVE TO A LOWER TIER?

A. Yes. Using the Company's load research data, I assessed the effort required for customers to move to a lower tier, starting with the month of January. I found that only 14% of customers would be able to reduce their January usage enough (as compared to the previous year) to move to a lower tier in one month. If a customer sustained their energy reductions for three months (January – March), 41% could move to a lower tier through three months of sustained energy reductions. However, such energy reductions would need to be substantial – averaging more than 50% of historical consumption.

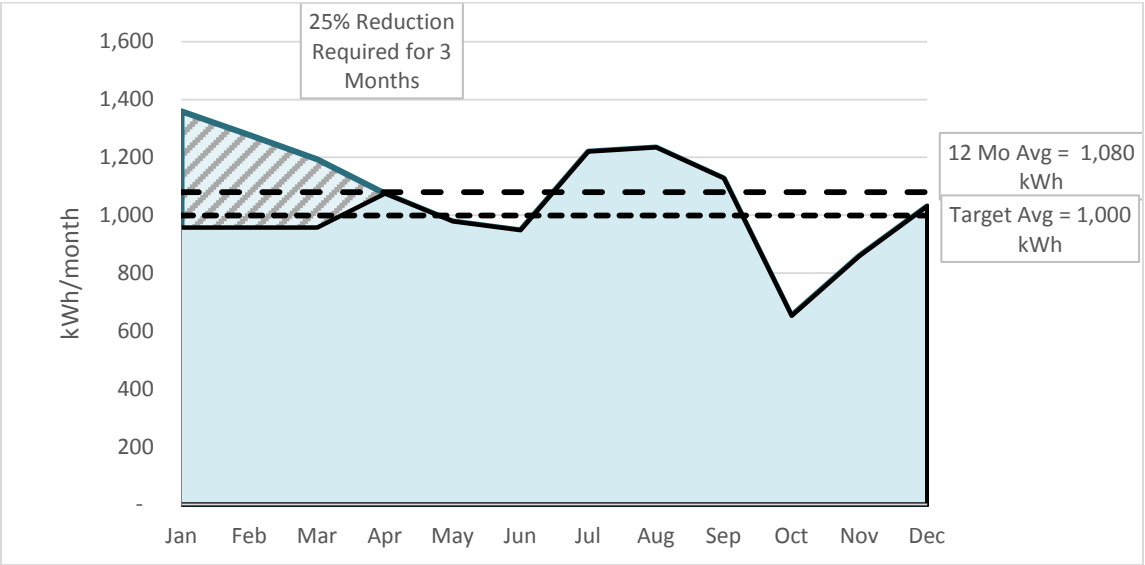
Q. CAN YOU PROVIDE AN EXAMPLE?

A. Yes. Consider the customer whose 12-month average energy usage is 1,080 kWh. The customer only needs to reduce this 12-month average by 81 kWh (approximately 7.5%) to move to a lower tier. Yet in order to move to a lower tier in three months instead of 12, the customer would need to reduce her usage by an average of 320 kWh per month. In other words, the customer would have to reduce her usage by an average of 25% for three continuous months in order to move to a lower tier, as shown in the figure below.

---

[43] The Company has itself provided that the best indicator of the next monthly Grid Use Charge is the previous month's Grid Use Charge, suggesting little opportunity to change tiers from month to month. *See* PSCo Response to OCC 10-1, attached as **Attachment TW-17**.

Figure 3. Example Reduction Necessary to Move to Lower Tier



Reductions of such magnitude would be very difficult for most customers to achieve. Sustained reductions for many months may also be difficult to achieve, due to the seasonal usage patterns of heating and cooling appliances.

The GUC Would Worsen Customer Equity

Q. WILL THE COMPANY'S PROPOSAL IMPROVE CUSTOMER EQUITY?

A. No. The Company has not demonstrated that the Grid Use Charge based on a customer's average 12-month energy use is a better indicator of a customer's demand than current volumetric rates based on monthly energy usage. In fact, the Company's own data indicates that its proposed proxy is a worse indicator of a customer's demand on the system than monthly energy usage. This can be seen by comparing the explanatory power of two metrics: (1) a customer's 12-month average usage, and (2) a customer's monthly energy usage. The correlation of these metrics with a customer's peak demand (kW) is shown in the graphs below.

Figure 4 shows data representing 232 customers from the Company's load research study.[44] The vertical axis represents the customer's maximum demand during July peak hours, while the horizontal axis represents the customer's 12-month average usage. The R^2 value indicates how well a customer's July maximum demand is explained by a customer's 12-month average usage data, with an R^2 of 1 indicating perfect explanatory power.[45] In this case, the R^2 value is 0.63.

Figure 4. Correlation Between July Billed Demand (kW) and 12-Month Average Usage (kWh)

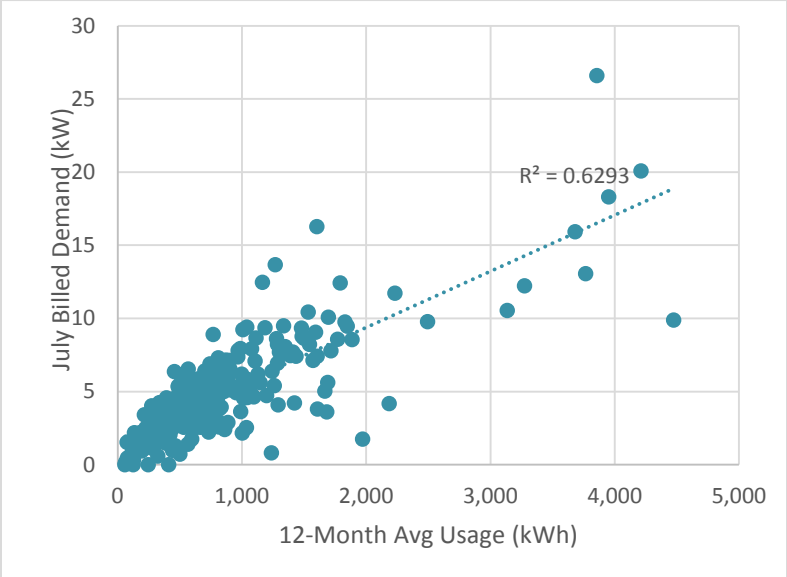
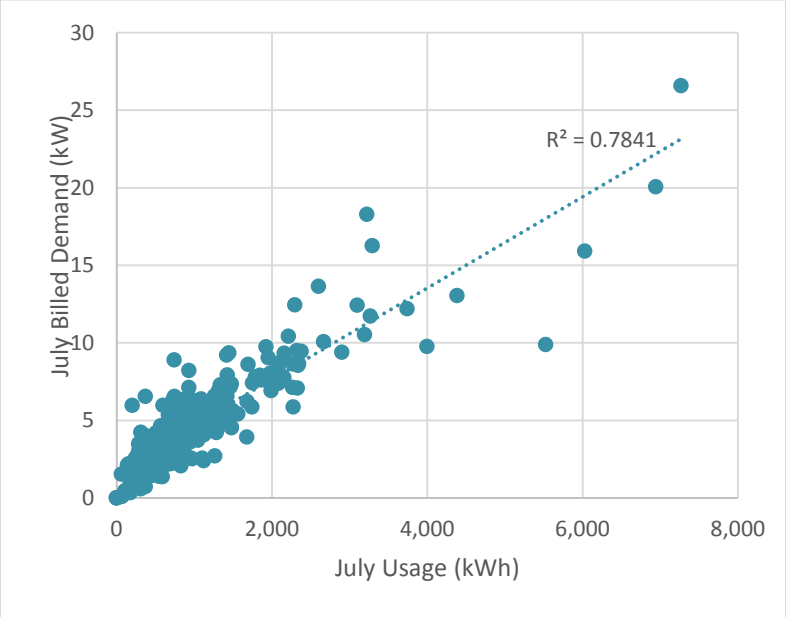


Figure 5 below shows the relationship between a customer's July energy usage and their July peak demand. In this case, the R^2 value is much higher at 0.78.

[44] Data provided by the Company in "Attachment VS1-7.A1_Residential 2013 IND PREM KW.xlsx". Two outliers were dropped.

[45] The R^2 is the square of the correlation coefficient, which measures the strength of the linear relationship between two variables.

Figure 5. Correlation between July Billed Demand (kW) and July Usage (kWh)



Q. DID YOU ANALYZE ANY OTHER MONTHS OF DATA OR OTHER METRICS?

A. Yes. I also analyzed the relationship for January, April, and the combined four summer months. In addition, I looked at two different measures of demand during each time period analyzed: demand during peak hours (non-holiday weekdays from 2:00 pm to 6:00 pm), and demand occurring during any hour. In virtually all cases, the results are similar to those presented above – a customer's monthly (or seasonal) energy usage is a better indicator of their monthly (or seasonal) demand than is their average 12-month energy usage.[46]

[46] The only exception was for April demand measured during the hours of 2:00 pm to 6:00 pm. In this one case, average 12-month energy usage was a better proxy than April energy usage.

Q. WHY IS THIS FINDING IMPORTANT?

A. A significant rate design change should be accompanied by a significant improvement in the ability to meet rate design goals. The Company states that one of its primary goals is to "recover costs equitably from customer classes based on the costs they impose"[47] in order to minimize cross-subsidization within and between customer classes. In particular, the Company is pursuing alternative rate designs in order to better reflect demand related costs imposed by customers. However, by using a 12-month average energy use as a proxy for customer demand, the Company has worsened the relationship between demand and customer bills, thereby making any existing cross-subsidies worse. Therefore, there is no reason based on customer equity to implement the Company's drastic rate design changes.

Q. WOULD THE GUC HAVE ANY OTHER IMPACTS ON CUSTOMER EQUITY?

A. Yes. In addition to failing to improve customer equity, the GUC would also lead to similar customers experiencing large differences in their bills, depending upon whether their average energy usage falls just above or below a tier boundary.

Q. PLEASE EXPLAIN WHY SIMILAR CUSTOMERS WOULD EXPERIENCE DISSIMILAR BILLS.

A. An artifact of the tiered GUC structure is that it may produce widely differing impacts on customers due to a difference of 1 kWh in average energy usage, depending

[47] *Id*, at p. 16

on whether the additional kilowatt-hour moves the customer across a boundary between two tiers.

For example, consider two neighboring residential customers who have similar end-uses and load profiles, but with slightly different average energy usage. If Customer A's average energy usage were 495 kWh, while Customer B's average energy usage were 500 kWh, Customer B's Grid Use Charge would be 88% higher than Customer A's. This translates into a total bill difference between the two customers of 14%, as shown in the table below.

Table 3. Change in GUC and Bill due to 1% Change in Average Energy Usage

	Average Energy Usage	% Difference in Average Energy Usage	% Difference in Grid Use Charge	% Difference in Total Bill
Customer A	495 kWh			
Customer B	500 kWh	+1%	+ 88%	+ 14 %

Q. WHAT DO YOU CONCLUDE FROM THE DIFFERENCE IN A CUSTOMER'S BILL FROM A SMALL DIFFERENCE IN ENERGY USAGE?

A. Such significant variation between two otherwise comparable customers clearly violates the goal of fairness.

Q. COULD A CUSTOMER OPT OUT OF THE NEW RATE STRUCTURE IF THEY WOULD EXPERIENCE A SIGNIFICANT BILL INCREASE?

A. Not unless that customer is enrolled in the Company's Solar*Rewards® program as of December 31, 2016. All customers without solar generation would be required to take service under the new rate with the Grid Use Charge.[48]

Q. IS IT CONCERNING THAT CUSTOMERS WITHOUT SOLAR GENERATION WOULD BE REQUIRED TO TAKE SERVICE UNDER THE NEW RATE STRUCTURE?

A. Yes. While I do not believe that any residential customer should be required to take service under the new rate structure, I am especially concerned that low-income customers would be among those least likely to be able to opt out of the new rate structure.

Q. WHY WOULD LOW INCOME CUSTOMERS BE LESS LIKELY TO BE ABLE TO OPT OUT OF THE NEW RATE STRUCTURE?

A. Low-income customers generally face significant barriers to installing and owning distributed solar generation, as they are often renters, live in multi-family housing, or have limited access to credit. EOC Witness Sanders Arnold discusses these barriers in his testimony. Because of these barriers, it is unlikely that many low income customers are enrolled in the Company's Solar*Rewards® program – the only customers that the Company proposes to allow to opt out.

[48] According to the Company, even LEAP customers would not be allowed to opt out of the GUC. PSCo Response to EOC 4-28, attached as **Attachment TW-18**.

The GUC Would Be Complex and Difficult to Respond to

Q. DOES THE COMPANY'S GRID USE CHARGE PROPOSAL MEET THE GOAL OF SIMPLICITY?

A. No. The Company's proposal violates the goal of simplicity and understandability. First, the rationale for the tiered customer charge – as a proxy for measuring a customer's maximum demand – will be difficult for customers to understand. As discussed above, residential customers do not generally have a good understanding of demand, nor are they likely to understand what their 12-month average energy usage has to do with their maximum demand.

Second, customers do not have experience estimating what tier they are likely to fall into based on 12-month average usage, nor do they have the tools or experience to estimate whether their usage during the month is approaching the point where they might be knocked into a higher tier. Simplicity should mean that customers are well positioned to adjust their behavior in order to reduce the magnitude of their bill. Currently residential customers understand that if they want to pay less, they should use less energy. Under the Company's proposal, this becomes much more difficult, as the customer does not know if his or her current use is likely to impact their tier or not, and has no reasonably easy way to find out.

The GUC Violates the Basic Goal of Continuity

Q. DOES THE COMPANY'S PROPOSED GRID USE CHARGE COMPORT WITH THE PRINCIPLE OF CONTINUITY?

A. As described above, the Company has proposed to increase the total fixed charges for residential customers by between 24 percent and 649 percent from current rates. Such a massive increase cannot be described as "gradual," and clearly violates the principle of continuity.[49]

Q. ARE THERE COMPELLING REASONS FOR DEVIATING FROM THE PRINCIPLE OF CONTINUITY IN THIS CASE?

A. The Company has offered no compelling reason to impose such a drastic change in the rate structure. Instead, the Company has proposed a proxy for a demand charge that provides no improvement over the current rate structure, while threatening to create or exacerbate other inequities.

Q. DOESN'T THE COMPANY NOTE A FORECASTED BILL REDUCTION FOR SOME NUMBER OF CUSTOMERS WITH THE GUC?

A. Yes, it does. Table SWW-4 in Mr. Wishart's testimony suggests that customers on the high end of one of the GUC tiers will see a small monthly bill reduction, while those on the low end of the tiers will see an increase.[50] Mr. Wishart also suggests the

---

[49] Bonbright describes this principle as follows: "Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers. (Compare "The best tax is an old tax.")" Bonbright (1961) *Principles of Public Utility Rates*, p. 291

[50] Wishart, at pp. 32-33.

"average" residential customer will see a monthly bill reduction of $2.[51] However, it would be unwise to implement a fundamental change in rate design for the sake of achieving short-term bill reductions for some customers, while simultaneously creating new inequities among customers and leading to higher system costs (and thus higher bills) for all customers over the long term.[52]

7. Problems With the Company's Residential TOU Rate Proposal

Q. DO YOU HAVE ANY CONCERNS REGARDING THE COMPANY'S PROPOSED RD-TOU RATE?

A. Yes. In Section 5 above, I described the numerous flaws associated with a theoretical demand charge. The Company's proposed RD-TOU rate is essentially a seasonal demand charge rate, and, as such suffers from all of the flaws associated with demand charges of its type.

Q. THE COMPANY'S PROPOSED RD-TOU RATE WOULD ONLY ASSESS A DEMAND CHARGE DURING PEAK HOURS. DOES THIS ALLAY YOUR CONCERNS WITH THE RATE?

A. No. While a demand charge assessed only during peak hours is marginally better than one assessed during any hour of the day, it is still vastly inferior than a time-based energy rate for several reasons.

---

[51] Wishart, at p. 31.

[52] As we have noted elsewhere, the GUC would treat similarly situated customers differently, while reducing incentives for energy efficiency, likely leading to higher system costs in the long-run.

First, a demand charge concentrates the price signal into a single hour during a completely arbitrary time period – a month. During the rest of the hours during that month, a customer has limited incentive to reduce demand below the customer's monthly peak. In contrast, an energy-based price signal (such as an energy-based TOU rate or the current seasonal rate) would encourage the customer to reduce consumption during each peak hour (or hour of the summer season). In fact, an energy-based TOU rate is akin to assessing a demand charge during each peak hour, rather than just on one hour of the month.

Second, a demand charge separates out the demand and price signals into two separate signals, thereby weakening the price signal to reduce energy usage and invest in energy efficiency. That is, by assessing a demand charge based on a single hour of the month, the price of energy is reduced for all hours of the month. In contrast, an energy-based time-varying rate combines both energy-related and demand-related costs into a strong price signal during each peak hour, thereby encouraging both demand and energy reductions.

8. A Dramatic Change To Rate Design Is Not Warranted

Q. HAS THE COMPANY DEMONSTRATED THAT IT IS UNABLE TO RECOVER ITS ALLOWED REVENUES?

A. No. The Company states that the Grid Use Charge "allow[s] the Company a fair opportunity to recover 100 percent of the distribution costs allocated to the residential

class." [53] However, the Company has failed to demonstrate it has problems with cost recovery. The Company's earned ROE has steadily increased from 8.75 percent in 2011 to close to 11.5 percent in 2014. The Company exceeded its authorized ROE in 2012, 2013, and 2014, with excess earnings of close to $50 million in 2014.[54]

Q. HAS THE COMPANY DEMONSTRATED THAT THE CURRENT RATE DESIGN IS INEFFICIENT?

A. No. To the contrary, the current seasonal, inclining block rate (IBR) design has proven to be effective in reducing system peak demand. For example, in 2013, the Company estimated that that the IBR reduced peak demand by 3.6%.[55]

Q. HAS THE COMPANY DEMONSTRATED THAT REVENUE RECOVERY OR COST SHIFTING FROM SOLAR CUSTOMERS IS A PROBLEM?

A. No. The Company also asserts that Residential rooftop solar erodes revenue recovery[56] and that its rate design will address customer equity. However, the Company has not presented an analysis of cost-shifting, nor of the benefits provided by rooftop solar. Further, any revenue recovery issues or equity issues would be small, given that the rooftop solar customers make up less than 1 percent of the total number of Residential Customers.[57] Finally, the Company's proposed rate design would be largely ineffective at recovering costs from solar customers.

---

[53] Brockett, at p. 34.
[54] Attachment TW-19, PSCo Response to SWEEP1-5.
[55] Attachment DEG-5
[56] Jackson, at p. 30.
[57] PSCo Response to OCC2-1(a). and (b), attached as **Attachment TW-20.**

Q. WHY WOULD THE COMPANY'S RATE DESIGN BE INEFFECTIVE IN RECOVERING COSTS FROM SOLAR CUSTOMERS?

A. As discussed above, existing customers with solar generation are the only customers that would be allowed to opt-out of the Company's Grid Use Charge. In addition, any solar customers that are assessed the Grid Use Charge would likely only pay a very low charge, since the GUC would be based on a customer's consumption net of their generation.[58] Thus, even if cost-shifting from solar customers were demonstrated to be a problem, the Company's proposed Grid Use Charge would fail to effectively remedy it.

Q. ARE THERE BETTER METHODS OF ADDRESSING REVENUE RECOVERY OR COST SHIFTING FROM SOLAR CUSTOMERS?

A. Yes. If cost recovery from solar customers was to become a problem in the future, there are other methods besides a fixed Grid Use Charge that can achieve this without such large rate impacts; for example, decoupling and alternative rate designs. One should not implement adverse rate design for all residential customers to address a non-issue.

Q. HAS THE COMPANY EXPLORED REVENUE DECOUPLING AS AN OPTION?

A. As directed by the Commission in Decision No. C16-0127, the Company plans to file for approval of a revenue decoupling mechanism in the third quarter of 2016.[59]

---

[58] Brockett, at p. 34.
[59] **Attachment TW-21**. PSCo Response to EOC 4-8(c).

Q. HOW DOES THE FACT THAT THE COMPANY PLANS TO FILE FOR A REVENUE DECOUPLING MECHANISM WITHIN THE NEXT FEW MONTHS AFFECT THE RATE DESIGN IN THIS CASE?

A. As I have demonstrated above, the Company's proposed rate design would not achieve any of Bonbright's widely-recognized rate design goals other than improving the Company's ability to recover revenue. However, this goal is rendered moot by revenue decoupling, since revenue decoupling allows a utility to recover its allowed revenues (and no more or less). Since approval of a revenue decoupling mechanism would remove the last remaining rationale for the Company's rate design, it would be prudent to wait until after a decision is made by the Commission regarding revenue decoupling before implementing any rate designs to improve revenue recovery.

9. Service & Facilities Charge

Q. YOU NOTED THAT THE SERVICE AND FACILITIES (S&F) CHARGE HAS DECREASED FOR RESIDENTIAL CUSTOMERS FROM $6.75 TO $5.78. HOW DID THE COMPANY DEVELOP ITS RESIDENTIAL S&F CHARGE?

A. The Company states that "Allocated customer-related costs were used to calculate the Service and Facilities ("S&F") Charge."[60]

[60] Wishart, at p. 20.

Q. DO YOU SUPPORT THE COMPANY'S PROPOSED S&F CHARGE FOR RESIDENTIAL CUSTOMERS?

A. Yes. I agree that the S&F charge should be designed to collect only customer-related costs. The Company's estimate of such costs appears reasonable.

10. Stratification

Q. WHY HAS THE COMPANY PRESENTED TWO CLASS COST OF SERVICE STUDIES, ONE WITH STRATIFICATION AND ONE WITHOUT?

A. There are numerous methods for conducting cost of service studies. In 2009, PSCo proposed a change to the Company's cost of service methodology, advocating use of the 4 Coincident Peak Demand-Average Excess Demand (4CP-AED) methodology to allocate costs associated with production and transmission.[61] In that same case, the Office of Consumer Counsel (OCC) advocated adoption of the stratification methodology instead.[62]

The Commission stated that, "We believe OCC's Stratification Method may have some merit," and ultimately directed the Company to "file a [class cost of service study] CCOSS that includes a stratification adjustment in addition to the Company's proposed CCOSS."[63] For this reason, the Company has filed two cost of service studies in the instant proceeding.

---

[61] Docket No. 09AL-299E.
[62] *See* Decision No. C10-0286, Docket No. 09AL-299E, March 29, 2010 ("2009 Phase II Decision"), at ¶ ¶ 21-24.
[63] 2009 Phase II Decision, at ¶ 34.

Q. PLEASE DESCRIBE THE PREMISE OF THE STRATIFICATION METHOD.

A. The Stratification method, also known as the Equivalent Peaker method, is based on generation expansion planning practices. According to NARUC's Electric Utility Cost Allocation Model, the Stratification method is based on two premises: "(1) that increases in peak demand require the addition of peaking capacity only; and (2) that utilities incur the costs of more expensive intermediate and baseload units because of the additional energy loads they must serve."[64]

Q. DO YOU SUPPORT USE OF THE STRATIFICATION METHOD FOR COST OF SERVICE STUDIES?

A. Yes. The Stratification method is a reasonable method for allocating production plant costs, because many generation facilities are built for the purpose of providing baseload energy in addition to serving peak load.

Q. WHAT DO YOU RECOMMEND FOR THIS PROCEEDING?

A. I recommend that the Commission adopt the Stratified CCOSS.

11. Conclusions and Recommendations

Q, PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. My conclusions can be summarized as follows:

- The Company's goal of eventually implementing demand charges for residential customers is misguided and should not be used to justify modifications to its current rate designs. Demand charges for residential

[64] NARUC, *Electric Utility Cost Allocation Manual*, 1992, p. 53

customers are inconsistent with widely-held rate design principles, create inefficient price signals, are too complex and difficult for residential customers to respond to, place an undue burden on low-usage and low-income customers in particular, and will ultimately increase long-term electricity costs.

- Alternatives to residential demand charges, such as time-of-use rates, can achieve many of the objectives behind demand charges without any of the problems, yet the Company has not provided a meaningful analysis of such important rate design alternatives.
- There is no sound justification for implementing a dramatic change in the residential rate structure, given that the Company is generally recovering sufficient revenues, the Company has not demonstrated that there are significant customer equity problems under current rate designs, and the current seasonal inclining block rate is highly effective in encouraging customers to consume electricity efficiently.
- The proposed Grid Use Charge is a significant departure from historical rate designs, suffers from all of the problems of residential demand charges described above, and suffers from additional problems because it is so poorly designed. It will be very difficult for residential customers to understand, monitor, and respond in a meaningful way to the proposed Grid Use Charge, and will result in vastly different bills for similar customers.

- The Company's proposed optional residential demand – time-of-use (RD-TOU) service is more like a demand charge than a time-of-use rate, and therefore suffers from all of the problems of residential demand charges described in my testimony.
- Finally, the CCOSS based on stratification is a reasonable method for allocating production plant costs and should be used in this proceeding.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.

A. I recommend that the Commission do the following:

- Reject the Company's proposal for a mandatory Grid Use Charge on residential customers.
- Reject the Company's proposal for an optional residential demand – time-of-use service.
- Direct the Company to maintain its current seasonal, inclining block rate structure, while reducing the S&F charge to $5.78.
- Direct the Company to expand its pilot energy-based TOU rates, Peak Time Rebates, or Critical Peak Pricing rates to residential customers on an opt-in basis.
- Defer consideration of significant changes to the default rate structure until after decoupling is investigated as an alternative solution.
- Direct the Company to record and maintain data related to the dates and times of individual feeder peaks in order to inform the future rate design.
- Direct the Company to use the CCOSS with the stratification methodology.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.