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BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power to Implement the Programs Authorized by the Sustainable Transportation and Energy Plan Act	**Docket No. 16-035-36** UCE Exhibit 3.0 – Phase Three Direct Testimony

PHASE THREE (ELECTRIC VEHICLES) DIRECT TESTIMONY OF SARAH WRIGHT

ON BEHALF OF

UTAH CLEAN ENERGY

DATED this 6th of April, 2017

Sophie Hayes
Attorney for Utah Clean Energy

INTRODUCTION

Q: Please state your name and business address.

A: My name is Sarah Wright. My business address is 1014 2nd Ave, Salt Lake City, Utah 84103.

Q: By whom are you employed and in what capacity?

A: I am the Executive Director of Utah Clean Energy, a non-profit and non-partisan public interest organization whose mission is to lead and accelerate the clean energy transformation with vision and expertise. We work to stop energy waste, create clean energy, and build a smart energy future.

Q: On whose behalf are you testifying?

A: I am testifying on behalf of Utah Clean Energy (UCE).

Q: Please review your professional experience and qualifications.

A: I am the founder and director of Utah Clean Energy. Through my work with Utah Clean Energy over the last 15 years, I have been involved in a number of regulatory dockets, including Integrated Resource Planning, rate cases, tariff filings, and other dockets relating to energy efficiency, renewable energy, and net metering.

I have 15 years of energy policy experience working on state, local, and national energy policy, providing expertise and policy support for renewable energy and energy efficiency. I have served on numerous energy policy working groups and taskforces, including the Energy Efficiency and Energy Development Committees supporting Governor Herbert's Energy Task Force and Ten Year Energy Plan; the Governor's Utah Renewable Energy Zone Task Force; Governor Huntsman's Energy Advisory Council and Blue Ribbon Climate Change Advisory Council; Utah's Legislative Energy Policy

Workgroup, and Salt Lake City's Climate Action Task Force. Currently, I participate in the Utah Clean Air Task Force and Energy Task Force convened by Envision Utah.

For 15 years prior to founding Utah Clean Energy, I was an occupational health and environmental consultant, working on occupational health and ambient air quality issues for a wide variety of commercial, industrial, and governmental clients across the west. I have a BS in Geology from Bradley University in Peoria, Illinois and a Master of Science in Public Health from the University of Utah in Salt Lake City.

OVERVIEW AND CONCLUSIONS

Q: What is Utah Clean Energy's interest in this phase of the docket?

A: Utah Clean Energy prioritizes a more efficient, cleaner, and smarter energy future which is predicated on a modernized and resilient electricity grid. We envision and enable increased utilization of energy efficiency, distributed generation, demand response, storage, utility-scale renewable energy and electric vehicles. Customer side of the meter decisions, including when and how customers use energy will have a profound impact on grid capabilities and the costs to reliably serve customers.

Effective time of use (TOU) rate structures can send effective signals both to shift electricity use away from peak use periods to times when the demand on the system is lower *and* to reduce overall demand and. Given that the grid, distribution system, and generation resources must be built to meet peak demand, reducing both overall energy use and peak demand through effective time of use rates will help reduce the need for costly utility investments and thereby put downward pressure on electricity rates for all customers. Utah Clean Energy strongly supports a transition to electric vehicles;

however, as the penetration of electric vehicles increases, it will be critical that customers be encouraged to charge their vehicles during off-peak times. We are very supportive of a pilot TOU project and have some recommended changes to the Company's proposal.

This phase of the docket also addresses utility investments and incentives for electric vehicle charging infrastructure. Utah Clean Energy's Energy Efficiency Program Director, Kevin Emerson, provides testimony that reviews and makes recommendations for the Company's proposed electric vehicle charging infrastructure incentive program.

Q. Please summarize your testimony.

A. In my testimony, I provide a critique of the Company's two TOU rate proposals. Utah Clean Energy opposes the current proposals because they reward high energy users (even without load shifting) and do not maintain a conservation price signal. To address these concerns, I propose two alternative TOU rate designs. Utah Clean Energy's rate proposals retain a simplified tiered rate structure to maintain a conservation price signal, while also providing incentives to shift load away from peak hours. Our second TOU rate design implements a "super off peak" rate to encourage electric vehicle charging from midnight to 6 am, when demand on Rocky Mountain Power's system is generally at its lowest. Further, our analysis brings into question whether the morning winter peak period is necessary.

TIME OF USE RATE PROPOSAL

Q: What is the basis for the company's proposal?

A: As part of the 2016 STEP Act, the Utah Legislature enacted Utah Code Section 54-20-103, "Electric vehicle incentive program," which provides that the Commission shall authorize an electric vehicle charging program that includes time of use pricing.

Q. What are Utah Clean Energy's goals for this pilot time of use program?

A. Utah Clean Energy's primary goal for the TOU rate design pilot is to test on a pilot basis rate designs that will encourage the following:

1. Overall electricity conservation;
2. Shifting energy consumption to times that are most beneficial for the grid, with a focus on shifting electric vehicle charging to off peak periods;
3. Simplicity, without sacrificing the above two principles; and
4. Fairness to high and low use residential energy users.

Q. Please describe the Company's TOU pilot program proposal.

A. The Company has proposed an EV TOU pricing pilot for residential customers who own or lease plug-in electric vehicles. The Company has proposed two different rate options under the residential TOU pilot, both of which include different on peak and off peak energy charges. The on peak time period extends from 3 pm-8 pm in the summer (May-September, M-F) and from 8 am-10 am and 3 pm-8 pm in the winter (October-April, M-F). All other hours (including weekends and holidays) are categorized as off peak hours. The Company's two rate design proposals are as described in Table 1 below.

Table 1 – RMP's proposed EV TOU Pilot rate options

	Rate Option 1	***Rate Option 2***
Customer Charge – 1 Phase	$6.00	$6.00
Customer Charge – 3 Phase	$12.00	$12.00
On peak (cents/kWh)	22.2755	34.3753
Off peak (cents/kWh)	6.7881	3.4003

Q. What is your response to the Company's proposals, generally?

A. Utah Clean Energy appreciates the Company's efforts and the workgroups they hosted on this topic. However, upon reviewing the bill impacts associated with the Company's proposed options, we oppose the current proposal because it unreasonably benefits high energy users, who save on their electric bill even without shifting any consumption away from peak hours. I address this later in my testimony.

After the Company made its filing, we dug deeper into their proposed rate design options. We are concerned about moving to a residential rate design that does away with inclining block tiered rates, which are designed to send signals to conserve energy at all times. Both of the Company's proposed TOU rate design eliminate tiered inclining block rates. Eliminating price signals to conserve is not in the public interest overall.

Q. Aside from energy conservation concerns do you have other concerns with respect to the Company's TOU option 1?

A. Yes, we have concerns regarding the impact that this rate design option will have on low energy users as compared to high energy users. I discuss this issue later in my testimony.

Q. The Company's TOU rate option 2 has a 10 to 1 differential between on and off peak prices. Do you think this is a good rate design to meet the objectives of both conserving electricity and shifting peak?

A. No. With the respect to Company's proposed rate option 2, we are very concerned with the extreme differential between on peak and off peak prices. During all off-peak hours of the day, including weekends and holidays, electricity is billed at the extremely low rate of 3.4 cents/kWh. These off peak hours constitute 85% of summer hours and 80% of winter hours.

An overall objective of TOU rates is to achieve economic efficiency through a rate structure that not only shifts consumption to off peak hours but continues to promote energy efficiency and conservation among customers. The 10 to 1 differential will definitely send the signal to shift electric vehicle charging and other movable consumption to off peak times, but at what cost? The extremely low off-peak rate blunts all signals to conserve electricity overall and will reduce the payback for most energy efficiency investments that do not target reductions in peak time energy use.

Energy efficiency has been demonstrated to be a cost effective resource that puts a downward pressure on rates. I am somewhat sympathetic to wanting to create a very

low rate as an incentive for charging electric vehicles, but certainly not at the risk of driving up overall energy consumption through an extremely low rate of 3.4 cents/kWh for 85% of all summer hours and 80 % of winter hours.

In order to address these issues, Utah Clean Energy proposes two alternatives to the Company's proposed rate designs, described later in my testimony. Our second rate design proposal offers a very low rate for electricity charging, but only during the middle of the night when system demand is the lowest.

Q. How do the Company's proposed rates impact customer bills, and does this impact change with the amount of electricity that a customer uses?

A. Utah Clean Energy analyzed the bill impact analysis the Company provided in Robert Meredith's work papers, shown below. The Company evaluated the impact of their proposed rate designs on bills for customers with different monthly energy usage ranging from 500 to 3000 kWh per month, and analyzed shifting 0%, 10%, 25%, 50% and 75% of customer usage to off peak times, then compared these results to bills under the current Schedule 1.

The analysis showed that customers that use more than 1000 kWh per month save money on their energy bills even *without* making any changes and *without* shifting any of their usage to off peak times. In contrast, customers that use less than 1000 kWh per month pay more. Please see the bill comparison tables excerpted from Robert Meredith's work papers below. If a number is preceded by a (-) then that customer is paying *more* than they would have under the current Schedule 1. If the savings number is positive they are saving money relative to schedule 1. For example, a customer that uses 3000 kWh per month saves 12% or $44 per month without shifting a single kWh to off peak

times. In the tables below, the percentage numbers in the second row of the table indicate the amount of energy consumption shifted to the off peak time period.

Table 2 - Rocky Mountain Power
UT EV TOU Pilot Rates Monthly Billing Comparison
Schedule 1 vs. Company's proposed TOU rate option 1

		Present	Sch 2E - % of Switching from On-Peak to Off-Peak									
kWh		0%	0%	Saving	10%	Saving	25%	Saving	50%	Saving	75%	Saving
500		$55	$60	-9%	$58	-5%	$56	0%	$51	8%	$47	16%
698	*	$78	$81	-4%	$79	-1%	$75	4%	$69	12%	$63	20%
750		$85	$87	-3%	$84	0%	$80	5%	$73	13%	$67	21%
1,000		$114	$114	0%	$110	3%	$105	8%	$96	16%	$87	24%
1,250		$146	$141	4%	$136	7%	$130	11%	$118	19%	$107	27%
1,500		$179	$168	6%	$162	9%	$154	14%	$141	21%	$127	29%
1,750		$211	$195	8%	$188	11%	$179	15%	$163	23%	$147	30%
2,000		$243	$222	9%	$214	12%	$204	16%	$186	24%	$168	31%
2,500		$308	$275	11%	$266	14%	$253	18%	$230	25%	$208	33%
3,000		$373	$329	12%	$318	15%	$302	19%	$275	26%	$248	33%

* Average monthly usage.

Table 3 - Rocky Mountain Power
UT EV TOU Pilot Rates Monthly Billing Comparison
Schedule 1 vs. Company's proposed TOU rate option 2

		Present Sch 1	Sch 2E - % of Switching from On-Peak to Off-Peak									
kWh		0%	0%	Saving	10%	Saving	25%	Saving	50%	Saving	75%	Saving
500		$55	$60	-9%	$57	-2%	$51	8%	$42	24%	$33	40%
698	*	$78	$81	-4%	$76	3%	$69	12%	$56	28%	$44	44%
750		$85	$87	-3%	$82	3%	$74	13%	$60	29%	$47	45%
1,000		$114	$114	0%	$107	6%	$96	16%	$78	31%	$60	47%
1,250		$146	$141	4%	$132	10%	$118	19%	$96	34%	$74	50%
1,500		$179	$168	6%	$157	12%	$141	21%	$114	36%	$87	51%
1,750		$211	$195	8%	$182	14%	$163	23%	$132	37%	$101	52%
2,000		$243	$222	9%	$207	15%	$186	24%	$150	38%	$114	53%
2,500		$308	$276	11%	$258	16%	$231	25%	$186	40%	$141	54%
3,000		$373	$330	12%	$308	17%	$276	26%	$222	41%	$168	55%

* Average monthly usage.

Q. What is your response to the bill impacts associated with the Company's rate proposals?

A. This rate design effectively rewards high, even on peak, consumption, as opposed to energy efficient consumption, in contravention of the objectives of this program. I believe that eliminating the inclining tiered block rates is the root of this problem.

Q. Please explain the issues and potential problems associated with eliminating inclining block rates in the Company's proposed TOU rate designs?

A. Utah Clean Energy has two significant concerns. The first is that inclining block rates are the primary price signal to residential customers to conserve electricity and to make cost-effective investments in energy efficient appliances, homes, lighting, and other measures. Further, it appears that removing inclining block rates in the Company's proposed TOU rates is the main driver creating bill savings for larger energy users who don't shift a single kWh of consumption to off peak times. In other words, by eliminating tiered rates, larger energy users benefit simply by moving to a TOU rate, even without changing their behavior and the timing of their energy consumption.

This is problematic from a public policy perspective. As an energy policy expert who has spent years participating in integrated resource planning and DSM advisory groups, it is my opinion that a price signal that subverts the incentive to invest in energy efficiency is not in the public interest.

Inclining block rates encourage customers to conserve electricity at all times. A well-designed inclining block/tiered rate design can be expected to reduce total electricity

usage by about 10% while also reducing on peak usage significantly.[1] So while I support TOU rates, I recommend that they should be combined with inclining block rates to drive behaviors, such as conservation, efficiency, and load shifting, which will put a downward pressure on all rates. TOU rates with tiered block rates will enable this pilot program to achieve economic efficiency by encouraging shifts in consumption to off peak hours while still promoting cost effective energy efficiency and conservation. Importantly, this result is fairer to residential energy users of all sizes.

Q. Are there studies that show the impact and benefits of combining TOU rates with inclining block rates?

A. Yes, the Regulatory Assistance Project presented a webinar on November 3, 2016, TOU rates as part of the TOU workgroups associated with this docket.[2] Table 4 is an excerpt from the webinar that illustrates the impact of combining an inclining block rate with a TOU rate. TOU rates combined with inclining block rates have the ability to reduce peak demand by 15%-30% while TOU rates alone are shown to reduce peak demand 10%-20%. Further, this table shows that TOU rates alone have little effect on overall electricity consumption whereas TOU rates combined with inclining block rates lead a reduction in overall consumption of 5% to 10%.

[1] Lazar, J. and Gonzalez, W. (2015). *Smart Rate Design for a Smart Future*. Montpelier, VT: Regulatory Assistance Project.

[2] *Regulatory Assistance Project Webinar, Time-of-Use rates Methods, Experience, Results, for Utah Public Service Commission,* November 3 2016, available at: http://www.raponline.org/event/time-of-use-rates-methods-experience-results/ and attached as *UCE Exhibit 3.1*.

Table 4 – Impact of different rate forms on kWh usage and peak demand

	Peak Demand	Total kWh
Flat Rate $5/mo + $.12/kWh	Baseline	Baseline
Inclining Block	▼5% -10%	▼5% -10%
High Fixed Charge	▲5% - 10%	▲5% - 10%
NCP Demand Charge	▼1% -2%	▲5% - 10%
CP Demand Charge	▼5% -10%	▲5% - 10%
TOU Rate	▼10% -20%	Little Change
Critical Peak Rate	▼20% - 30%	Little Change
TOU + Inclining Block	▼15% - 30%	▼5% -10%
Critical + Inclining Block	▼25% - 35%	▼5% -10%

Source: Regulatory Assistance Project Webinar, Time-of-Use rates Methods, Experience, Results, for Utah Public Service Commission, November 3 2016
http://www.raponline.org/event/time-of-use-rates-methods-experience-results/

Q. What is Utah Clean Energy's rate design proposal?

A. Utah Clean Energy proposes two alternative TOU rate design options. Both of our rate design options include on- and off-peak tiered inclining block rates to drive both efficiency and load shifting. The rate options include two tiers (0-1000 kWh and >1000 kWh) in both on-and off-peak hours. These rate options modify work papers provided by the Company as part of the TOU workgroup process. The on peak hours in our proposals are consistent with the company's. The main difference between UCE's two rate proposals is that our proposal 2 includes a "super off peak rate" to encourage nighttime electric vehicle charging.

Q. Do you agree that the Company's peak periods are the correct peak periods?

A. No, I can't say that based upon the data currently on the record. After reviewing 2015 load data, I am somewhat concerned about whether the winter morning peak period is necessary, or whether it adds undue complexity without adding significant grid and economic benefits. Please see Figure 1 below that shows that, in 2015, Utah demand

during the 8-10 am period is nearly 25% lower than the Utah annual peak. Demand between 8 and 10 am is below the majority of the maximum daytime peaks for the year. In Figure 2, below, which looks at the entire system, the peak during 8-10 am is nearly 20% below annual system peak.

To date, we have only been able to review 2015 load data. The 2015 data indicates that a morning winter on-peak period may *not* be called for. UCE is currently reviewing load data from 2011-2016 based on a data request response, to inform our analysis of peak times We intend to address this issue further in our rebuttal testimony and we hope to work with the Company and parties to evaluate peak time periods and the associated value of reducing demand during winter mornings.

Finally, with regard to peak periods, best practices presented by the Regulatory Assistance Project at their November 3, 2016, webinar indicate that a shorter peak period of three hours is ideal for peak shifting and doesn't have a significant impact on customer lifestyle.

Figure 1 – Utah load shape by hour of day for 2015

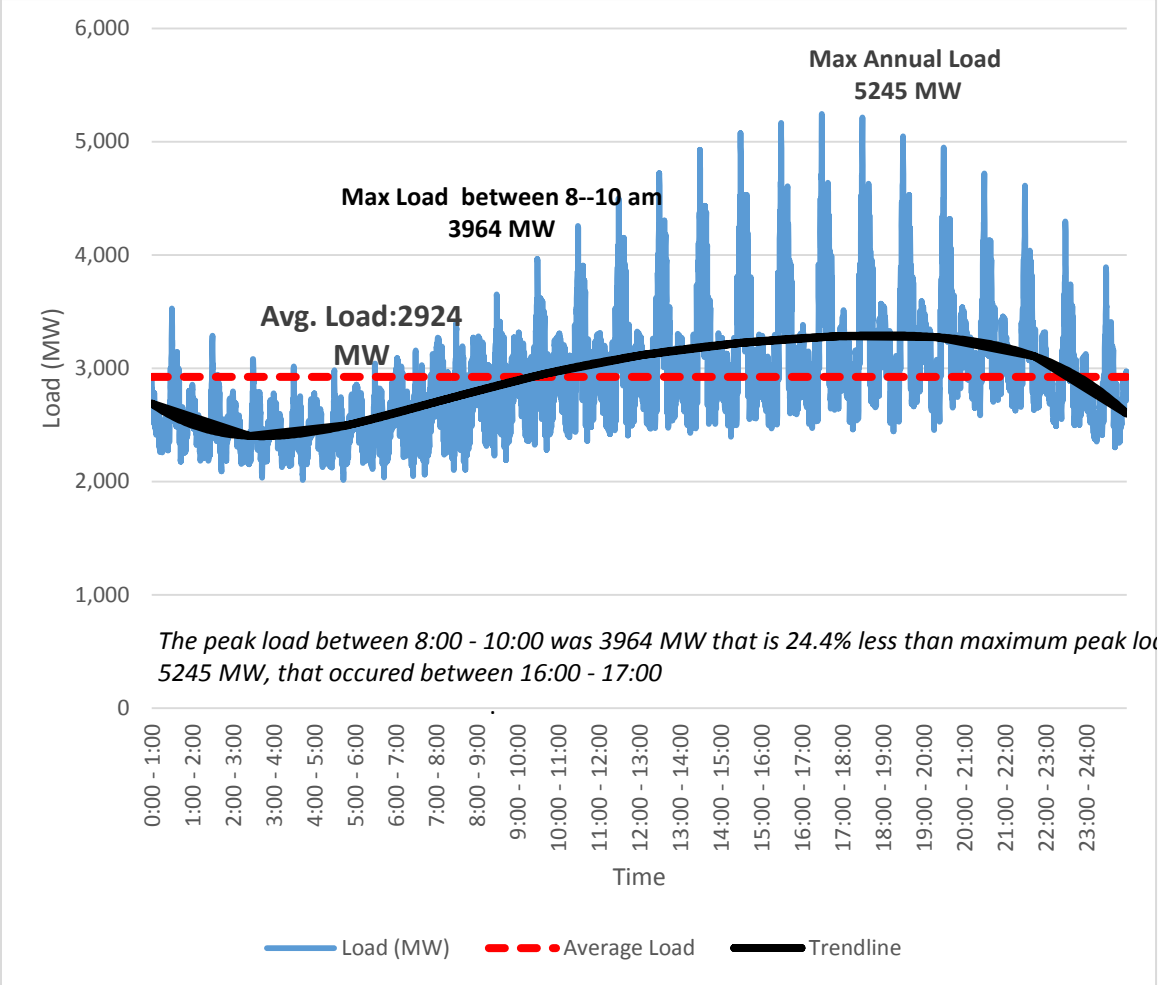
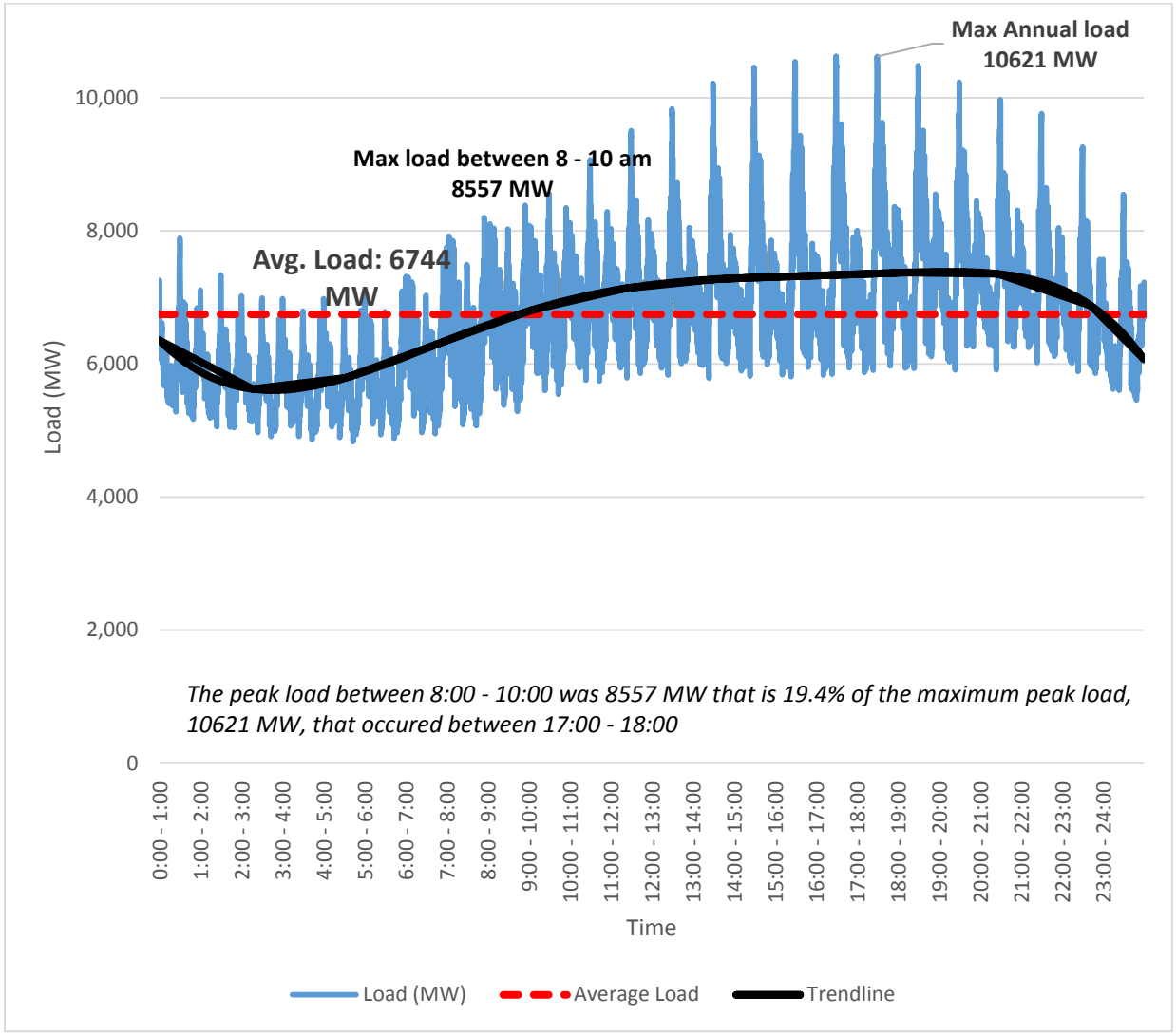


Figure 2 – System load shape by hour of day for 2015



Q. Did the Company provide data and information to support the economic value to Utah ratepayers of including a morning winter peak period in the pilot TOU rates?

A. No. While Robert Meredith's testimony describes the company selection process based upon the timing of the system and coincident peaks and distribution coincident peaks over the last five cost of service studies filed with the commission, he does not take the next step of demonstrating the economic value of shifting load from these morning winter time periods. Through my long standing work with the DSM program, I understand that shifting our summer peak brings substantial value to Utah rate payers. Our system is built to meet the summer peak. But I have not seen analysis that shows the value of the economic benefits to Utah Rate Payers of shifting winter peak periods.

So while there may be value in reducing load in the morning in the winter, the Company did not demonstrate that value in their testimony. My simple assumption is that the system infrastructure is built to meet peak load and that the incremental costs to serve load during these winter morning time periods may not warrant their inclusion in the TOU rate design pilot. I am open to gaining further understanding of the economic benefits of including a winter peak periods including the morning winter peak.

Q. Based upon the lack of evidence on the value to Utah Rate Payers for the morning winter peak, what is your recommendation for TOU rate design?

A. My preference is for the Company and parties to evaluate the value during the rebuttal and surrebuttal phase of this docket, so that we can make data driven decisions on the peak periods for TOU rate design. However, in absence of that analysis, my recommendation is to remove the winter morning peak as it overcomplicates the rate structure.

Q. If you question the appropriateness of the peak time periods, why did you include them in your rate design?

A. Utah Clean Energy does not have the internal analytical capabilities to completely change the company's rate design. Therefore, for our rate design calculations, we were reliant on the Company's worksheets for purposes of testing out different TOU options and were therefore not able to change the on- and off-peak periods in developing alternative rate proposals. Therefore, our proposals use the same peak period assumptions as the Company. We would still like to continue to work with the Company and other parties to review the appropriateness of the on- and off-peak periods.

Q. If your conclusions about the on-and off-peak periods change, would that change your rate proposal?

A. Yes, but not significantly. The rates/kWh would change, but the overall structure and differential between the two periods would remain similar.

Q. **Please provide more detail about your UCE TOU rate proposal 1.**

A. Table 3 below describes Utah Clean Energy's proposed rate option 1. Under this option we have two tiered inclining block rates in the on and off peak periods, and the the first tier on peak rate is 2.8 times higher than the first off peak tier.

Table 5 – Utah Clean Energy's proposed TOU rate 1

	Utah Clean Energy's Rate Option 1
Customer Charge – 1 Phase	$6.00
Customer Charge – 3 Phase	$12.00
On peak, first tier: 0-1000 kWh (cents/kWh)	20.1539
On peak, second tier: >1000 kWh (cents/kWh)	22.7089
Off peak, first tier: 0-1000 kWh (cents/kWh)	7.1600
Off peak, second tier: >1000 kWh (cents/kWh)	9.7150

Q. **You set the break point for moving into the second block at 1000 kWh. What is your rationale for that break point?**

A. Frankly, I think the break point should be lower in the range of 500 to 750 kWh as it applies separately to both on and off peak power. That is, under the currently proposed tiered blocks, you could utilize 2000 kWh (1000 kWh on peak and 1000 kWh off peak) before moving into the second tier. Unfortunately, our analytical capabilities were limited to the Company's worksheets that utilized a 1000 kWh threshold. We would love to explore this question further with the Company and other parties. A good starting point might be Schedule 1's first tier of 400 kWh, plus the additional kWhs that it would take to charge and electric vehicle (approximately 300 kWh per month)[3] for a total of 700 kWh for the first tier.

[3] Calculations based on the assumption that an average American drives 1000 miles per month and average efficiency of 2015 Nissan leaf is 0.30 kWh/miles
https://www.fhwa.dot.gov/ohim/onh00/bar8.htm
https://www.fueleconomy.gov/feg/noframes/34918.shtml

Q. If you changed the kWh break points for your proposed tiers, would it change your rate design proposal?

A. Yes, but not significantly. The overall structure and differential between the two periods would remain similar, and the kWh rates for the on and off peak tiers would change slightly.

Q. **Please explain how Utah Clean Energy developed rate option 1.**

A. Utah Clean Energy appreciates Company's efforts in developing and presenting different rate design options at EV workgroup meetings, including TOU proposals with inclining block rates. To calculate UCE TOU Rate Option 1, we used work papers provided by the Company as part of the TOU work group process and modified the weighting between the cost of energy and the average retail rate in the Company's rate option 14.

Our Program and Policy Associate, Mitalee Gupta, worked with Robert Meredith to develop the rate option. We used the work paper developed by the Company for their rate option 14, titled EV TOU Rate Design – Workpaper – 1-6-17. In the rate design work sheet, we changed the entry in cell AO45 to 0.4. Changing this cell changed the value in AO24. We then used this value in AO24 and entered it in cell BI46. Changing the entry in BI46 changed all the values in column BI and BK and accordingly modified the off peak tiered energy price. Next, we adjusted the value in BK45 back to 0. We used goal seek to set the value in BK45 to 0 by changing cell BI20. Setting back BK45 to 0 helped us adjust the on peak energy price based on the revenue requirement. All these changes in the rate design work sheet automatically fed into the Bill-O14 sheet which

calculates the bill impacts on all energy users. All of the calculations and bill impacts have been shared in UCE Workpaper 1.

Q. **Please provide more detail on UCE TOU Option 2**

A. Utah Clean Energy's Option 2 includes a "super off peak rate" of 3.4 cents/kWh, with two objectives: it creates an incentive for electric vehicle charging while simultaneously sending a really strong signal to charge your vehicle during the system's lowest demand hours – midnight to 6:00 am. The proposed super off peak price is the same as the company's off peak price of 3.4 cents/kWh included in their rate option 2, but limited to a shorter number of hours in the middle of the night to maintain a stronger signal to conserve energy at all other times. While we appreciate the Company's rate option 2 as an effort to create a very low off peak price that would give an incentive to EV customers, we are very concerned with a rate design that sells electricity for 80-85% of the time for $3.4 cents/kWh.

The differentiating factor between UCE's two rate designs is the super off peak period. This will test whether a super off peak rate will encourage customers to charge during times that are the most beneficial for the grid and also test whether other load is shifted away from the peak periods. Table 6 below illustrates Utah Clean Energy's proposed rate option 2.

Table 6 – Utah Clean Energy's proposed rate option 2

	Utah Clean Energy's Rate Option 2
Customer Charge – 1 Phase	$6.00
Customer Charge – 3 Phase	$12.00
On peak, first tier: 0-1000 kWh (cents/kWh)	TBD
On peak, second tier: >1000 kWh (cents/kWh)	Tier 1 on peak + 2.5
Off peak, first tier: 0-1000 kWh (cents/kWh)	7-9
Off peak, second tier: >1000 kWh (cents/kWh)	9.5-11.5
Super off peak (cents/kWh) 12 am – 6 am	3.4003

Q. Why does your proposal lack specific numbers?

A. Given that the Company's existing work papers lack the capability to segregate load data based on different on and off peak periods than the Company's, Utah Clean Energy submitted a data request with the Company on March 31, 2017, requesting them to run the calculations necessary to help us determine an appropriate on peak rate, and we are currently working with the Company to populate the rest of the prices. Our rate option 2 is based on a super off peak energy price of 3.4 cents from 12 am – 6 am every day and includes tiered off peak/weekend rates of 7-9 cents/kWh for the first tier (0-1000 kWh) and 9.5-11.5 cents/kWh for the second tier (>1000 kWh). The on-peak prices will be calculated based on the rest of the prices, with the second tier being 2.5 cents higher than

the first peak tier. We are awaiting more information from the Company before locking in a final pricing proposal, which we will be filing as a part of our rebuttal testimony.

Q. **Are there other utilities in the country that have a super off peak rate design?**

A. Yes. A report by Rocky Mountain Institute states that in 2014 that utilities in more than 49 states and DC adopted some form of time based rates.[4] A number of these utilities that are offering TOU rates do have a super off peak energy price. San Diego Gas & Electric has EV TOU rates with a super off peak period that runs from midnight to 5:00 am in the morning and has the lowest electricity price per kWh.[5] Similarly, Southern California Edison, Virginia Electric and Power Company, and Georgia Power are a few other utilities that have a super off peak period with the lowest per kWh energy price for residential customers with an EV.

Q. Please explain the super off peak, proposed as a part of Utah Clean Energy's rate option 2.

A. Our overall objective for the pilot EV TOU program is to achieve economic efficiency through a rate structure that not only shifts consumption (with a focus on electric vehicles) to off peak hours but continues to promote energy efficiency and conservation among customers. Utah Clean Energy's rate option 2 includes three time periods: on peak, off peak, and super off peak. The on peak hours is the time when the demand on the grid is highest. Utah Clean Energy proposes a new time period called

[4] James Sherwood et al., *A Review of Alternative Rate Designs: Industry experience with time-based and demand charge rates for mass-market customers* (Rocky Mountain Institute, May 2016), http://www.rmi.org/alternative_rate_designs.
[5] http://www.sdge.com/clean-energy/ev-rates

super off peak, with a kWh rate that is lower than the off peak energy price and will facilitate bill savings to EV customers who charge during that time.

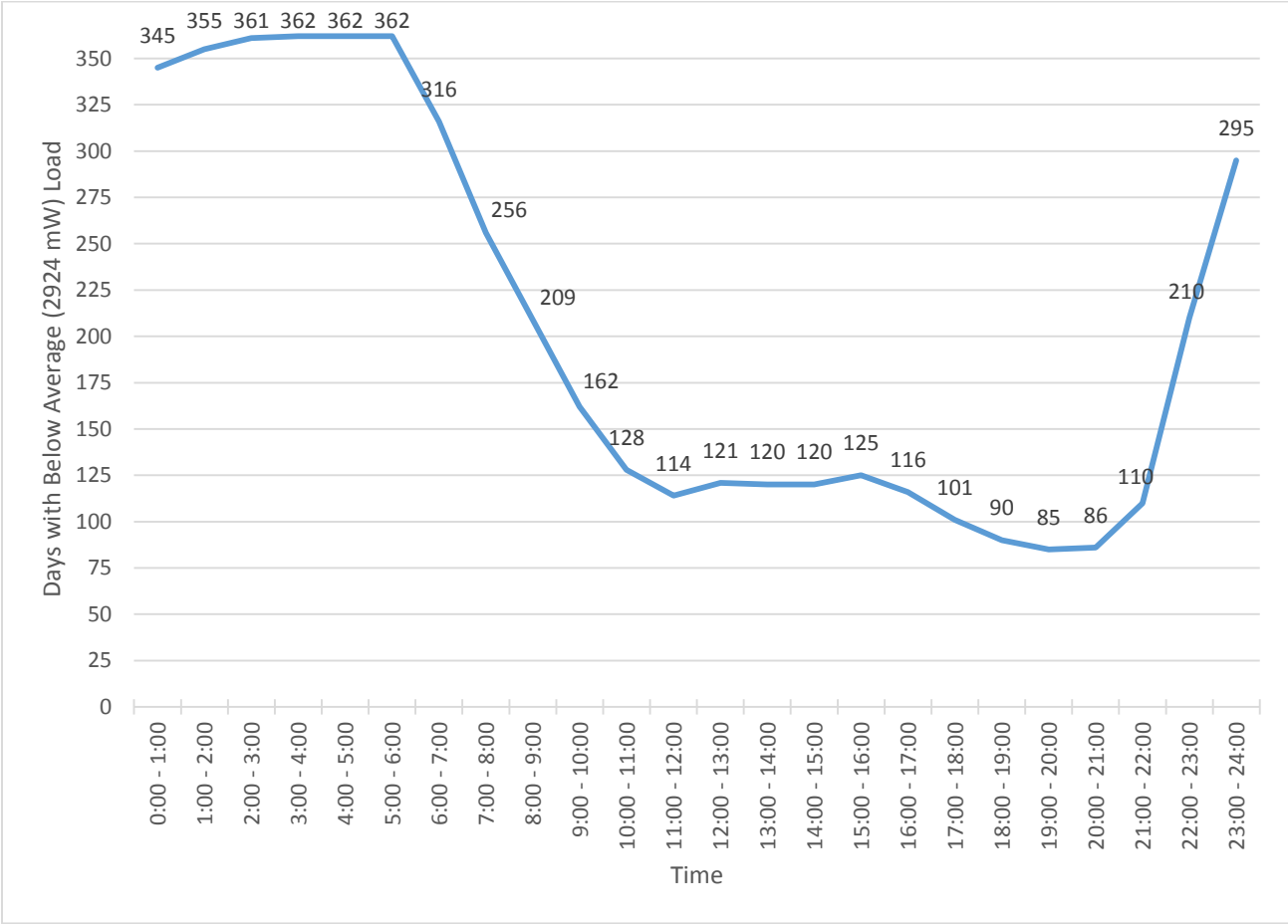
During late night hours, demand on the grid is consistently below average; hence, there is enough room to accommodate additional EV load during this time period. Electricity during these late hours in the night can be priced at a fairly low value. Utah Clean Energy believes that a 3.4 cents/kWh during off peak hours will promote appropriate charging behavior among customers and deter them from charging during on peak hours. Promoting charging during super off peak hours, when the load on the grid is below average, is the most effective way to use the grid.

Q. **How did Utah Clean Energy determine the super off peak hours?**

A. Utah Clean Energy dug into the 2015 hourly load data shared by the Company in response to a data request. We first evaluated the average Utah load for the 8760 hours in 2015. The average load for the entire year was 2924 MW. After determining the average, we looked at the hours when load was below average (that is, the hours when load was below 2924 MW).

Once all the hours for which load was below average were sorted, we then determined the incidence of occurrence of each of those hours. Based on the incidence of occurrence for each hour, we found that during 12 am-6 am the load was below average for more than 345 days in the year, i.e., more than 94.5% of days in 2015. Figure 3 below describes the days and hours of the day when the load was below average in 2015. Please refer to UCE Workpaper 2 for more information.

Figure 3 – Utah incidence of days when load was below average 2015



It can be clearly seen from Figures 1 and 3 that load was below average between 12 am and 6 am.

Following the analysis of Utah load, we performed a similar analysis for the hourly load at the system level to see how it corresponded in the same time window. Based on our calculations we found that for more than 336 days in 2015 (i.e. 92% of days) the load on the system between 12 am and 6 am was below average. The average load on the system in 2015 was 6744 MW. Figure 2 (above) illustrates the load shape by

hour for the system in 2015 and thus shows us how the load was below average between 12 am and 6 am.

An important point to note here is that our analysis of super off peak is currently based on 2015 load data. We have just received hourly load data (in MW) for Utah and the System for 2011, 2012, 2013, 2014 and 2016. We will perform similar super off peak analysis for this additional historical load data.

Q. How do Utah Clean Energy's proposed rate options 1 and 2 address the concerns you raised earlier in your testimony about rewarding large energy users, even without load shifting, and sending conservation price signals?

A. Our rate options both include tiered rates in order to addresses the issue of differential saving opportunities between small and large residential energy users. Our tiered rate options do not *eliminate* the magnitude of different savings opportunities between small and large residential energy users (large energy users will still benefit more than small energy users), but both of our proposed rate structures will eliminate the ability of above-average customers to save money simply by shifting to the TOU rate, even without shifting any load to off peak periods.

Our analysis of the bill impacts from our rate option 1, in Table 7, shows that both low and high energy users start with either a slightly higher bill or no bills savings at all when they switch from Schedule 1. Starting with no savings or a slightly higher bill will encourage customers to shift their usage to off peak hours while sending the right signals to conserve at all times.

Table 7– UT EV Monthly Billing Comparison of UCE proposed rate option 1

	Present	% of Switching from On-Peak to Off-Peak									
kWh	0%	0%	Saving	10%	Saving	25%	Saving	50%	Saving	75%	Saving
500	$54	$58	-7%	$57	-5%	$55	-1%	$51	6%	$48	13%
750	$83	$84	-1%	$82	1%	$79	5%	$74	12%	$68	18%
1,000	$112	$110	1%	$108	4%	$103	8%	$96	14%	$89	21%
1,250	$144	$143	0%	$140	3%	$134	7%	$125	13%	$116	19%
1,500	$176	$176	0%	$172	2%	$165	6%	$155	12%	$144	18%
1,750	$208	$209	-1%	$204	2%	$196	6%	$184	12%	$171	18%
2,000	$240	$242	-1%	$236	2%	$227	5%	$213	11%	$199	17%
2,500	$304	$307	-1%	$300	1%	$289	5%	$271	11%	$253	17%
3,000	$368	$373	-1%	$364	1%	$351	4%	$330	10%	$308	16%

Our rate option 2, which adds a super off peak period, addresses the differential saving issue while sending a very strong signal for customers to charge during the period of lowest system demand. This rate option could encourage electric vehicle adoption as it will provide customers with an opportunity to achieve real bill savings by charging their cars at the super off peak energy price of 3.4 cents/kWh.

Q. **The on peak to off peak differential for both of the Utah Clean Energy's rate options is lower than 3. Do you think that that that differential is sufficient to drive peak shifting behavior? Please explain why.**

A. Yes, I do. UCE TOU Option 1 has a differential of 2.8 between on peak and off peak prices for the first 1000 kWh consumed in each time period (7.16 cents/kWh off peak to 20.15 cents/kWh on peak). I strongly believe that a customer that has been properly educated about the rate structure will shift load that can easily be shifted. Electric vehicle charging is an easily shifted load as vehicles can be programed to begin charging at specific times. After education and an understanding of the rate structure, there are additional loads that can be easily shifted, including dishwashers, dryers, etc.

Both of our proposed rate options have an on peak to off peak price differential of roughly 3:1 as we believe that it will send a sufficient signal to shift peak while still maintaining a reasonable off peak kWh charge that is high enough to send a conservation signal. Many individuals shop around to save 5 to 10 cents on a gallon of gas, and with education they will likely take the simple steps to program their vehicle to charge when the rate is approximately a third the cost of on peak hours, or move to middle of the night charging under UCE TOU rate option 2.

Q. Is there anything about EV charging that particularly lends itself to TOU pricing?

A. Yes. Electric vehicles have the capability to be programmed to begin charging at a set time. This makes shifting charging away from peak time period easy and automatic.

Q. **Both of your proposed rate designs are more complex than current rate designs and more complex than the Company's TOU proposals. Does this concern you and, if so, what are your recommendations to address this added complexity?**

A. No, it doesn't concern me. Admittedly, when I first considered the combination of inclining block rates and TOU, I thought it might be too complicated. But as I reflected on our current tiered rates, I realized that all residential customers are already well accustomed to tiered rates and that the only thing we are adding are peak periods. As we implement EV TOU rate structures, smart communication tools and education will be key to success – for any TOU rate design. I do not think that layering TOU rates onto our existing, well-established framework of inclining block rates creates a significant education hurdle. In developing our TOU proposals, we strove to make them as simple as possible, while maintaining conservation price signals and creating an incentive to shift load away from peak hours.

Q. **Please explain how Utah Clean Energy's proposed rate options are different from the current rate schedule 2 (optional time of use rate).**

A. Schedule 2 has a seven hour on peak period that extends from 1:00 pm to 8:00 pm.[6] Our proposal is in alignment with the Company's proposed 5 hour summer (3:00 pm – 8:00 pm) and seven hour winter (8:00 am – 10:00 am and 3:00 pm – 8:00 pm) peak for EV customers. Furthermore, the differential between on peak and off peak rates in the current rate schedule 2 is not more than 1.85:1. Utah Clean Energy's proposed rate options still provide a roughly 3:1 differential, which send appropriate signals encouraging people to charge their EVs during off peak or super off peak hours and to conserve during on peak hours. And education and communication will likely be the key to the success of any TOU rate.

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

A. Yes.

[6] Rocky Mountain Power, Electric Service Schedule 2, https://www.rockymountainpower.net/content/dam/rocky_mountain_power/doc/About_Us/Rates_and_Regulation/Utah/Approved_Tariffs/Rate_Schedules/Residential_Service_Optional_Time_of_Day_Rider_Experimental.pdf