

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO**

* * * * *

IN THE MATTER OF ADVICE NO. 1814-)
ELECTRIC OF PUBLIC SERVICE)
COMPANY OF COLORADO TO REVISE)
ITS COLORADO P.U.C. NO. 8 - ELECTRIC) PROCEEDING NO. 19AL-XXXXE
TARIFF TO REFLECT A MODIFIED)
SCHEDULE RE-TOU AND RELATED)
TARIFF CHANGES TO BE EFFECTIVE ON)
THIRTY-DAYS' NOTICE.)

DIRECT TESTIMONY AND ATTACHMENTS OF STEVEN W. WISHART

ON

BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

December 2, 2019

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GLOSSARY OF ACRONYMS AND DEFINED TERMS

<u>Acronym/Defined Term</u>	<u>Meaning</u>
CACJA	Clean Air – Clean Jobs Act Rider
CO ₂	Carbon Dioxide
DSMCA	Demand-Side Management Cost Adjustment
EAP	Electric Affordability Program
ECA	Electric Commodity Adjustment
EV	Electric Vehicle
GRSA	General Rate Schedule Adjustment
kWh	Kilowatt hours
LEAP	Low Income Energy Assistance Program
MEP	Medical Exemption Program
Modified RE-TOU	Modified Residential Energy Time-of-Use Rate
Navigant	Navigant Consulting, Inc.
Navigant Report 2	Navigant’s Findings from October 2018 through September 2019 (Attachments BAT-3 to Company witness Brooke A. Trammell’s Direct Testimony)
Navigant Reports	Interim Navigant reports (Attachments BAT-2 and BAT-3 to Ms. Trammell’s Direct Testimony)
Public Service or the Company	Public Service Company of Colorado
PCCA	Purchased Capacity Cost Adjustment
RESA	Renewable Energy Standard Adjustment
RE-TOU Trial or Trial	Limited time of use rate trial for residential customers initiated in 2017

<u>Acronym/Defined Term</u>	<u>Meaning</u>
S&F	Service and Facilities
Schedule R	Residential tiered rate structure in Residential General Service - Schedule R
Three Case Settlement	Settlement Agreement in Proceeding Nos. 16AL-0048E, 16A-0139E and 16A-0055E
TCA	Transmission Cost Adjustment
Xcel Energy	Xcel Energy Inc.
XES	Xcel Energy Services Inc.

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1 I. **INTRODUCTION, QUALIFICATIONS, PURPOSE OF TESTIMONY, AND**
2 **RECOMMENDATIONS**

3 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

4 A. My name is Steven W. Wishart. My business address is 1800 Larimer, Suite
5 1400, Denver, Colorado 80202.

6 **Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT POSITION?**

7 A. I am employed by Xcel Energy Services Inc. ("XES") as Manager of Pricing and
8 Planning. XES is a wholly owned subsidiary of Xcel Energy Inc. ("Xcel Energy"),
9 and provides an array of support services to Public Service Company of
10 Colorado ("Public Service" or the "Company") and the other utility operating
11 company subsidiaries of Xcel Energy on a coordinated basis.

12 **Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THE PROCEEDING?**

13 A. I am testifying on behalf of Public Service.

1 **Q. PLEASE SUMMARIZE YOUR RESPONSIBILITIES AND QUALIFICATIONS.**

2 A. As the Manager of Pricing and Planning, I am responsible for financial and policy
3 analyses associated with the Company's electric, natural gas, and steam rates,
4 in addition to the regular administration of the Company's electric, natural gas,
5 and steam tariffs. My duties include quantitative analyses, cost allocation and
6 rate design, and policy support on a number of state regulatory issues. A
7 description of my qualifications, duties, and responsibilities is set forth after the
8 conclusion of my Direct Testimony in my Statement of Qualifications.

9 **Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

10 A. In my Direct Testimony I describe the details of our modified Residential Energy
11 Time-of-Use ("Modified Schedule RE-TOU") rate filing, which the Company is
12 filing pursuant to the terms of the settlement in consolidated Proceeding Nos.
13 16AL-0048E, 16A-0055E and 16A-0139E (the "Three Case Settlement"), as
14 explained in more detail in the Direct Testimony of Company witness Ms. Brooke
15 A. Trammell. In 2017 Public Service initiated a limited time of use rate trial for
16 residential customers ("RE-TOU Trial" or "Trial"). Based in part on the results of
17 that Trial, the Company now proposes modifying Schedule RE-TOU, and making
18 it the default rate for all residential customers.

19 While the RE-TOU Trial included year-round time of use pricing, the
20 Company now proposes in the Modified Schedule RE-TOU to limit time of use
21 pricing to summer months only (June, July, August, and September). As
22 described in more detail in Section IV of my Direct Testimony, hourly data for the

1 Public Service system shows that these summer months have the highest load
2 levels and carbon emissions. Limiting time of use pricing to summer months will
3 make bills simpler for our customers to manage. The Company also proposes to
4 shift the On-Peak period from 2 p.m. to 6 p.m. to 3 p.m. to 7 p.m. The
5 Company's proposal calls for residential customers to migrate to the Modified
6 Schedule RE-TOU rate structure as Advanced Meters are deployed in their area.
7 Customer currently on the RE-TOU Trial rate would be migrated to the Modified
8 Schedule RE-TOU as soon as it becomes effective on January 1, 2021.

9 In Section II of my Direct Testimony I discuss the modifications the
10 Company proposes to make to Schedule RE-TOU, compared with the rate
11 structure in the Trial, and how they were developed. The Company believes that
12 the proposed Modified Schedule RE-TOU rates can contribute to achieving the
13 Company's long-term carbon reduction goals. In the future, there will be fewer
14 and fewer hours in which the Public Service system will be dispatching carbon
15 emitting resources. Time of use rates can send price signals to customers that
16 encourage them to avoid using electricity in those hours. With this goal in mind,
17 the Company has refined the RE-TOU On-Peak time periods to target the hours
18 with the highest carbon dioxide ("CO₂") emissions. Currently, this is weekdays
19 between 3 p.m. and 7 p.m. during the summer months.

20 In Section VII I discuss the potential bill changes that will result from the
21 migration of residential customers to Modified Schedule RE-TOU. The current
22 Residential tiered rate structure in Residential General Service - Schedule R

1 (“Schedule R”) requires customers with high summer usage to pay more on
2 average than customers with low summer usage. The Modified Schedule RE-
3 TOU will better match cost recovery to the costs imposed on the Company’s
4 system by creating specific On-Peak pricing in summer months. The Company
5 used hourly load data from its RE-TOU Trial to estimate how the Modified
6 Schedule RE-TOU may change bills for residential customers and specifically for
7 low income customers. The analysis shows that bills for low income customers
8 will not be subject to any greater change than bills for the average residential
9 customer. The Company’s Electric Affordability Program (“EAP”) will remain
10 available for low income customers. This program provides financial assistance
11 for low income customers’ current bills along with arrearage forgiveness. This
12 program, along with the Colorado Low-income Energy Assistance Program
13 (“LEAP”), Energy Outreach Colorado, and the Medical Exemption Program, offer
14 low income customers multiple opportunities to mitigate utility costs.

15 I conclude my Direct Testimony with an analysis of the RE-TOU Trial that
16 was conducted from 2017 through 2019. I specifically focus on the design of the
17 Trial rate and the subsequent bill impacts observed in the Trial. Ms. Trammell
18 also discusses the RE-TOU Trial and its results, and Company witness Ms.
19 Stacey L. Simms discusses marketing and recruitment activities for the Trial as
20 well as the customer surveys that were conducted as part of that Trial.

1 **Q. ARE YOU SPONSORING ANY ATTACHMENTS AS PART OF YOUR DIRECT**
2 **TESTIMONY?**

3 A. Yes, I am sponsoring the following attachments, which were prepared by me or
4 under my direct supervision:

- 5 • Attachment SWW-1 – RE-TOU Rate Design;
- 6 • Attachment SWW-2– Revenue Proof;
- 7 • Attachment SWW-3 – Clean Tariff Sheets; and
- 8 • Attachment SWW-4 – Redlined Tariff Sheets.

9 **Q. ARE YOU SEPARATELY PROVIDING ANY ADDITIONAL DATA AFTER**
10 **YOUR TESTIMONY IS FILED?**

11 A. Yes. I am providing work papers in support of my bill impact analysis in Section
12 VII of my Direct Testimony. In addition I am supplying anonymized data that was
13 used by Navigant Consulting, Inc. (“Navigant”) in its RE-TOU Trial Evaluation
14 Report 2 (Findings from October 2018 through September 2019)¹ for the RE-
15 TOU Trial. Provision of this data was required by the Three Case Settlement.
16 The data includes monthly time of use and billing data for customers involved in
17 the RE-TOU Trial.

18 **Q. ARE YOU MAKING SPECIFIC RECOMMENDATIONS IN YOUR DIRECT**
19 **TESTIMONY?**

20 A. Yes. I recommend that the Commission approve the following:

¹ This is included as Attachment BAT-3 to Ms. Trammell’s Direct Testimony, and is also sometimes referred to as “Navigant Report 2.”

- 1 • The Company's proposed rate design of the Modified Schedule RE-
- 2 TOU, which I discuss in my Direct Testimony. These modifications
- 3 are intended to optimize the effectiveness of time of use rates for our
- 4 Residential class.
- 5 • Changes to the applicable rate riders to allow for percentage-based
- 6 calculations that are applied to base energy charges. This change will
- 7 allow rates riders for residential customers under the Modified
- 8 Schedule RE-TOU to exhibit the same time of use characteristics as
- 9 Residential base rates; and
- 10 • Revisions to the Company's tariff, as reflected in my Attachments
- 11 SWW-3 and SWW-4, to incorporate the Modified Schedule RE-TOU
- 12 Revisions to the Company's tariff, which include revision of the
- 13 existing Schedule R, Schedule RE-TOU, rate riders, and the Medical
- 14 Exemption Program ("Schedule MEP") tariff provisions.

1 **II. OVERVIEW OF PROPOSED MODIFIED SCHEDULE RE-TOU**

2 **Q. WHAT IS THE COMPANY’S PROPOSAL REGARDING TIME OF USE RATES**
3 **FOR RESIDENTIAL CUSTOMERS?**

4 A. The Company recommends that, once deployment of Advanced Meters is
5 complete in their area, residential customers will be transferred to the proposed
6 Modified Schedule RE-TOU.² Other residential rates may be available as
7 options that customers can select, but the existing Schedule R will no longer be
8 available to a residential customer after the installation of their Advanced Meter.

9 The modifications to Schedule RE-TOU include changing the rate from
10 year round time of use to summer only; changing the On-Peak hours from 2 p.m.
11 – 6 p.m. to 3 p.m. – 7 p.m.; and decreasing the On-Peak to Off-Peak price ratio
12 from 2.4 to 1 to 2 to 1. Public Service is also proposing to change all rate riders
13 for Schedule RE-TOU including the Electric Commodity Adjustment (“ECA”),
14 Purchased Capacity Cost Adjustment (“PCCA”), Demand-Side Management
15 Cost Adjustment (“DSMCA”), the Transmission Cost Adjustment (“TCA”), and the
16 Clean Air – Clean Jobs Act (“CACJA”) Rider from a cents per kilowatt-hour
17 (“kWh”) rate to percentages applied to customers’ base energy charges. As I
18 explain later in my Direct Testimony, this modification allows the riders to exhibit
19 the same hourly price variation as the base rates in Modified Schedule RE-TOU.
20 Table SWW-D-1 compares the existing Schedule R to the proposed Modified
21 Schedule RE-TOU.

² As Company witness Ms. Jennifer B. Wozniak discusses in her Direct Testimony, customers will be notified of the transfer before their first billing under the proposed Modified Schedule RE-TOU.

1 **Table SWW-D-1 – Comparison of Schedule R & Modified Schedule RE-TOU**

Time Periods	Schedule R		Modified RE-TOU		
	Winter / Summer Tier 1	Summer Tier 2	Off-Peak	Shoulder	On-Peak
	Winter All Sales	Summer > 500kWh	Summer Weekdays 10:00 pm - 11:00 am Summer Weekends & Holidays All Winter Hours	Summer Weekdays 11:00 am -3:00 pm & 7:00 pm - 10:00 pm	Summer Weekdays 3:00 pm - 7:00 pm
% of Residential Sales	85.1%	14.9%	84.8%	9.2%	6.0%
S&F Charge	\$5.41	\$5.41	\$5.41	\$5.41	\$5.41
Base Rates	\$0.05461	\$0.09902	\$0.05539	\$0.08309	\$0.11078
GRSA	-4.19%	-4.19%	-4.19%	-4.19%	-4.19%
ECA	\$0.02674	\$0.02674	43.66%	43.66%	43.66%
DSMCA	\$0.00162	\$0.00162	2.65%	2.65%	2.65%
PCCA	\$0.00401	\$0.00401	6.55%	6.55%	6.55%
TCA	\$0.00203	\$0.00203	3.31%	3.31%	3.31%
CACJA	\$0.00301	\$0.00301	4.92%	4.92%	4.92%
RESA	2%	2%	2%	2%	2%
Average Energy Rate	\$0.09153	\$0.13493	\$0.08865	\$0.13298	\$0.17729

2 **Q. WHAT ARE YOUR OBSERVATIONS OF TABLE SWW-D-1?**

3 A. My first observation is that the proposed Average Energy Rate for the Off-Peak
 4 period (\$0.08865/kWh) in Modified Schedule RE-TOU is lower than the
 5 Winter/Summer Tier 1 rate for Schedule R (\$0.09153/kWh). These Off-Peak
 6 rates will cover approximately 84.8 percent of all Residential sales, and the
 7 proposed rate decrease of 3 percent should benefit many customers. My next
 8 observation is that the Modified Schedule RE-TOU Shoulder and On-Peak rates
 9 will be applied to only 15.2 percent of all Residential sales volumes. This is
 10 almost identical to Summer Tier 2 sales in Schedule R, which covered 14.9
 11 percent of sales. Finally, Table SWW-D-1 illustrates how the conversion of rider
 12 charges from cents per kWh to a percentage of base energy charges helps to
 13 achieve an On-Peak to Off-Peak price ratio of 2 to 1.

1 **Q. IS THE COMPANY PROPOSING TO MODIFY THE MONTHLY SERVICE AND**
2 **FACILITIES (“S&F”) CHARGE IN THIS ADVICE LETTER?**

3 A. No. The Company is not proposing a modification to the Residential S&F charge
4 in this proceeding, nor is it recommending changes to the Production Meter and
5 Load Meter charges for residential customers, which are included on Modified
6 Schedule RE-TOU.

7 **Q. ARE ANY OF THE OTHER TERMS AND CONDITIONS ASSOCIATED WITH**
8 **RESIDENTIAL RATES BEING MODIFIED IN THIS ADVICE LETTER?**

9 A. Yes. In order to implement the Modified Schedule RE-TOU as proposed,
10 additional tariff changes will be required. I discuss the Company’s proposed tariff
11 changes in more detail in Section VIII of my Direct Testimony.

12 **Q. WHEN WOULD CUSTOMERS BE SWITCHED TO THE MODIFIED RE-TOU**
13 **RATE?**

14 A. As discussed by Ms. Trammell in her Direct Testimony, customers on Schedule
15 R would generally be transitioned to the Modified RE-TOU rate structure as the
16 deployment of Advanced Meters is completed in their area. In most scenarios,
17 Advanced Meter deployment will occur at some point in the middle of the
18 customer’s billing cycle. In this situation, the customer’s next bill will reflect a
19 partial month under Schedule R and the remainder of the month under the
20 Modified Schedule RE-TOU. Customers on the RE-TOU Trial would be switched
21 to the Modified Schedule RE-TOU when it becomes effective on January 1,
22 2021.

1 **III. POLICY BASIS FOR THE MODIFIED SCHEDULE RE-TOU**

2 **Q. WHAT IS THE POLICY BASIS FOR THE COMPANY'S MODIFIED**
3 **RESIDENTIAL TIME OF USE PROPOSAL?**

4 A. As explained by Ms. Trammell, the Company believes that the proposed time of
5 use rates in the Modified Schedule RE-TOU will encourage residential customers
6 to shift their summer usage away from periods when demand for electricity is
7 greatest, which is also when system costs as well as fossil fuel generation and
8 associated CO₂ emissions are at their highest. In addition to creating the
9 opportunity for customers to reduce their summer bills by moving their energy
10 usage to Off-Peak periods, the Modified Schedule RE-TOU can help the
11 Company achieve its long-term carbon reduction goals.

12 **Q. WILL THE MODIFIED TIME OF USE RATES HAVE ANY POTENTIAL**
13 **BENEFITS BEYOND MEETING CARBON REDUCTION GOALS?**

14 A. Yes, time of use rates may help to avoid or reduce the need for investments in
15 peaking plants or potentially energy storage facilities in the future. The proposed
16 On Peak period of 3 p.m. to 7 p.m. in the summer corresponds to the timing of
17 Public Service's system peak demand. By reducing load during the system peak
18 demand, time of use rates may eliminate the need for a new natural gas peaking
19 plant in the future. Shifting load in this fashion might also allow the Company to
20 forestall constructing energy storage facilities to meet system peak demands and
21 bridge between periods of abundant renewable energy generation. Avoidance of
22 storage capacity has the potential to be even more valuable than avoiding the

1 need to add peaking generation. The 2019 Annual Energy Outlook published by
2 the Energy Information Administration lists the cost of a conventional natural gas
3 combustion turbine as \$1,072 per kW and the cost of battery storage as \$1,857
4 per kW. This means that avoiding future energy storage capacity may be 73
5 percent more valuable than avoiding a natural gas peaking plant.

6 **Q. WHY IS THE COMPANY TARGETING CARBON EMISSIONS WITH ITS TIME**
7 **OF USE RATE PROPOSAL?**

8 A. The Company seeks to achieve an 80 percent reduction in CO₂ emissions by
9 2030 from 2005 levels and has set a goal to achieve 100 percent reduction by
10 2050. The State of Colorado and many of our stakeholders share our vision to
11 lead the way in carbon reduction. Senate Bill 19-236 shows this alignment. On
12 May 3, 2019, the Bill was passed by the Colorado General Assembly and it
13 became part of the Colorado Public Utilities Law upon the signature of Governor
14 Polis. It is now codified at C.R.S. § 40-2-125.5, and sets forth clean energy
15 standards that qualifying retail utilities must meet by 2030, and by 2050, so long
16 as doing so is technically and economically feasible. Those standards match the
17 goals previously announced by the Company (80 percent reduction by 2030, 100
18 percent clean energy by 2050). These reductions will be challenging to achieve
19 and the Company will need to use all of the options at its disposal, including rate
20 design, to accomplish these goals. Historically, time of use rates were designed
21 to target time periods with the highest load levels and correspondingly highest
22 system costs. More recently, States such as California and Minnesota have

1 designed time of use rates to target load net of renewable generation, which is
2 the basis for California's famous 'duck curve'.³ The use of rates to target CO₂
3 emissions is another step in the evolution of time of use rates.

4 Currently there is little difference between designing time of use rates
5 based on load, load net of renewables, or CO₂ emissions. However in the future
6 there will likely be fewer and fewer hours in which carbon emissions are a critical
7 issue and stronger price signals in those hours will help to reduce load and
8 associated emissions.

9 **Q. HAS THE COMPANY ESTABLISHED A SPECIFIC LEVEL OF CO₂**
10 **REDUCTIONS THAT IT HOPES TO ACHIEVE THROUGH RESIDENTIAL TIME**
11 **OF USE RATES?**

12 No. The best way to track the success of time of use rates will be to measure the
13 amount of On-Peak energy used by residential customers. The carbon emission
14 profile for Public Service is going to change dramatically over the coming years
15 through the implementation of the Colorado Energy Plan and Senate Bill 19-236,
16 which would make it difficult if not impossible to differentiate carbon reductions
17 associated with time of use rates from carbon reductions attributable to additional
18 renewable energy resources. As an alternative, Public Service will monitor the
19 weather normalized On-Peak energy usage of residential customers, to see how
20 the actual usage compares to the assumptions used in the rate design and to

³ The 'duck curve' draws its name from the fact that the increasing presence of solar resources in utility generation portfolios has begun to produce a power production demand curve that in graphical form resembles a duck. The duck curve shows the timing imbalance between peak demand and renewable energy production.

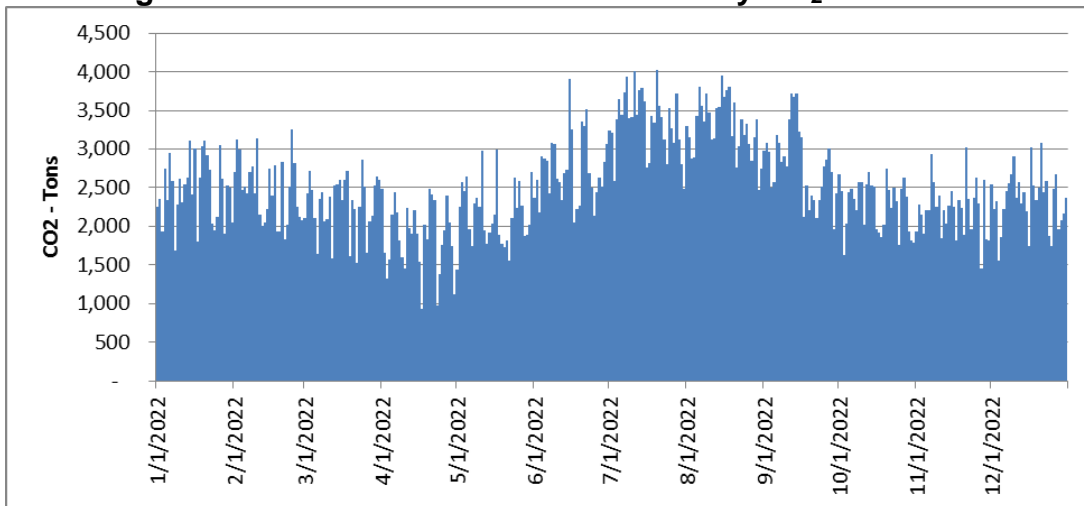
1 estimate reductions in On-Peak energy usage. Ms. Trammell discusses in her
2 Direct Testimony the Company's plan to share with the Commission and
3 stakeholders data relating to actual results being delivered by the Modified
4 Schedule RE-TOU.

1 **IV. DERIVATION OF TIME OF USE PERIODS**

2 **Q. HOW DID YOU UTILIZE CO₂ EMISSIONS DATA TO DEVELOP THE**
3 **RECOMMENDED CHANGES TO SCHEDULE RE-TOU?**

4 **A.** I used simulations of hourly load, renewable energy generation, and CO₂
5 emissions for 2022 to establish average hourly patterns for each month in 2022.
6 I chose 2022 data because this will be the first full summer in which the proposed
7 Modified Schedule RE-TOU rates would be implemented.⁴ Figure SWW-D-1
8 illustrates the hourly pattern of CO₂ emissions that resulted from the PLEXOS
9 model simulations. Figure SWW-D-2 is a heat map of average CO₂ emissions by
10 month and by hour.

11 **Figure SWW-D-1 – 2022 Forecasted Hourly CO₂ Emissions**



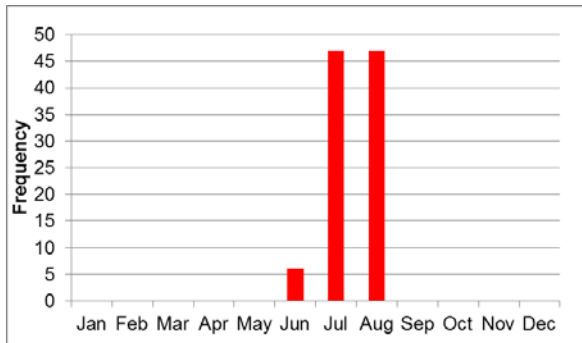
⁴ Advanced Meter deployment is currently scheduled to begin in the second quarter of 2021. However, less than 200,000 customers are likely to receive Advanced Meters in the summer of 2021 and then only for a portion of the summer months. The Company has over 1.2 million residential customers. As such, summer of 2022 was identified as the first full summer of Advanced Meter deployment.

1 **Figure SWW-D-2 – 2021 Ave. CO₂ Emission (tons) by Hour & Month**

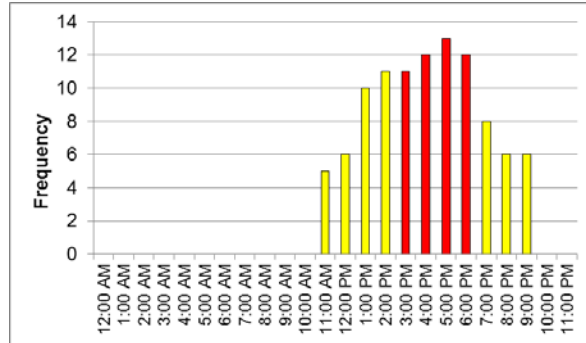
	Hour Beginning											Weekends & Holidays													
	12am	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12pm	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm	
Jan	1,889	1,856	1,889	1,885	1,962	2,131	2,316	2,414	2,400	2,376	2,324	2,284	2,275	2,267	2,265	2,320	2,469	2,633	2,650	2,583	2,468	2,285	2,081	1,919	
Feb	1,603	1,568	1,576	1,652	1,783	2,021	2,273	2,348	2,318	2,251	2,203	2,170	2,120	2,106	2,038	2,082	2,249	2,429	2,473	2,424	2,278	2,074	1,834	1,671	
Mar	1,536	1,494	1,490	1,556	1,613	1,736	1,885	2,020	2,069	2,031	1,969	1,915	1,867	1,852	1,836	1,797	1,859	1,961	2,070	2,091	2,017	1,887	1,752	1,665	
Apr	1,186	1,190	1,190	1,242	1,276	1,360	1,613	1,705	1,800	1,821	1,810	1,775	1,735	1,660	1,583	1,507	1,467	1,429	1,469	1,533	1,525	1,423	1,257	1,165	
May	1,487	1,342	1,282	1,258	1,284	1,412	1,636	1,778	1,922	1,956	1,991	2,005	2,002	1,976	1,945	1,936	1,935	1,947	1,960	2,030	2,061	2,015	1,787	1,559	
Jun	1,660	1,570	1,519	1,488	1,464	1,519	1,659	1,824	1,971	2,121	2,265	2,418	2,554	2,633	2,672	2,665	2,664	2,621	2,625	2,618	2,554	2,445	2,172	1,938	
Jul	2,073	1,997	1,949	1,965	2,016	2,113	2,301	2,495	2,663	2,827	3,028	3,224	3,349	3,453	3,537	3,575	3,594	3,540	3,408	3,211	3,047	2,902	2,690	2,442	
Aug	2,072	2,070	2,038	2,006	2,058	2,167	2,319	2,488	2,566	2,694	2,796	2,903	3,040	3,162	3,244	3,243	3,219	3,224	3,166	3,085	2,952	2,833	2,580	2,306	
Sep	1,428	1,513	1,533	1,517	1,549	1,683	1,954	2,123	2,227	2,288	2,304	2,348	2,402	2,471	2,523	2,563	2,561	2,542	2,412	2,196	2,034	1,832	1,637	1,480	
Oct	1,332	1,318	1,385	1,384	1,451	1,552	1,790	1,987	2,020	2,041	2,062	2,043	2,028	1,990	1,980	2,003	1,991	1,980	1,942	1,887	1,794	1,677	1,578	1,449	
Nov	1,400	1,374	1,352	1,423	1,509	1,679	1,851	1,892	1,842	1,851	1,860	1,819	1,803	1,724	1,683	1,816	1,918	2,042	2,011	1,913	1,802	1,709	1,585	1,510	
Dec	1,908	1,840	1,854	1,934	2,026	2,201	2,390	2,459	2,416	2,278	2,189	2,189	2,165	2,132	2,064	2,078	2,238	2,440	2,565	2,560	2,507	2,412	2,278	2,046	1,885
Winter	1,400	1,399	1,413	1,447	1,488	1,535	1,588	1,650	1,676	1,658	1,660	1,639	1,629	1,615	1,624	1,703	1,821	1,899	1,901	1,861	1,787	1,698	1,594	1,460	
Summer	1,847	1,786	1,746	1,741	1,756	1,783	1,820	1,834	1,935	2,124	2,300	2,427	2,556	2,661	2,722	2,756	2,769	2,778	2,751	2,653	2,516	2,347	2,091	1,839	

2 To identify the time of use time periods, I developed histograms that
 3 illustrate the distribution of the 100 hours with the highest levels of CO₂
 4 emissions. Figures SWW-D-3 and SWW-D-4 provide this analysis.

**Figure SWW-D-3
 Monthly Distribution of 100 Highest
 CO₂ Emission Hours**



**Figure SWW-D-4
 Hourly Distribution of 100 Highest
 CO₂ Emission Hours**



5 The histograms for the top 100 CO₂ hours indicate that the highest levels
 6 of carbon emissions are from 3 p.m. to 7 p.m. during the summer months.
 7 Although the emissions are also high in the 2 p.m. hour, to limit the
 8 inconvenience to customers I recommend that the On-Peak period be limited to
 9 four hours from 3 p.m. to 7 p.m. The charts also show significant emissions from
 10 11 a.m. to 3 p.m. and from 7 p.m. to 10 p.m. I therefore recommend these
 11 periods as the Shoulder hours for the Modified RE-TOU rates.

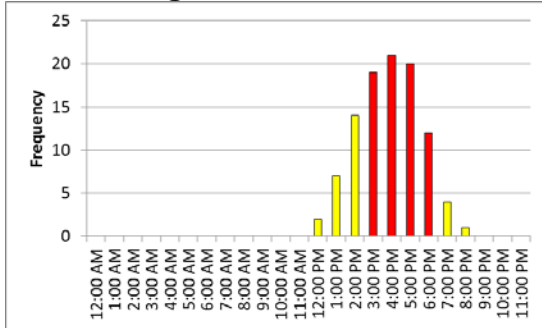
1 **Q. AREN'T THERE BENEFITS TO REDUCING CO₂ EMISSIONS IN ANY HOUR?**

2 A. Yes, currently in all hours of the year the Public Service system emits CO₂ and
3 load reductions in most hours would result in reductions of CO₂. However, the
4 proposed time of use rate design targets the periods with the highest levels of
5 carbon emissions. This methodology not only establishes a relationship between
6 varying energy prices at different times of the day but also the relationship
7 between customer demands on the system and CO₂ emissions.

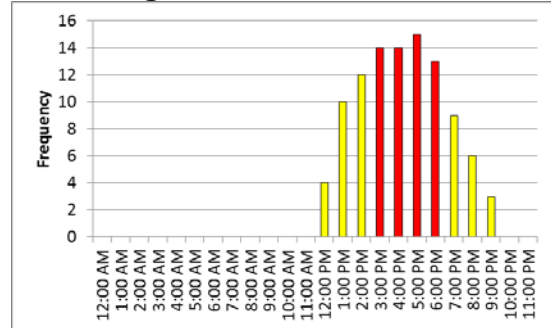
8 **Q. WOULD YOUR RECOMMENDATION FOR TIME OF USE PERIODS BE ANY**
9 **DIFFERENT IF YOU HAD USED MARGINAL ENERGY COSTS, LOAD, OR**
10 **LOAD NET OF RENEWABLES INSTEAD OF CO₂ EMISSIONS?**

11 A. Analysis of load net of renewable generation and marginal energy costs also
12 indicates that summer months between 3 p.m. and 7 p.m. are the most critical
13 time periods for Public Service's system. Figures SWW-D-5, SWW-D-6, SWW-
14 D-7, and SWW-D-8, respectively, illustrate the distribution of the top 100 hours
15 for, load, load net of renewables, CO₂ emissions, and marginal energy costs.

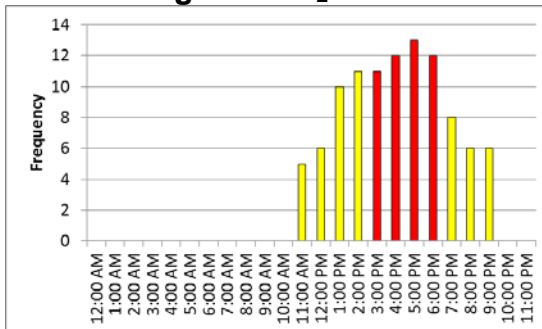
**Figure SWW-D-5
 Hourly Distribution of the 100
 Highest Load Hours**



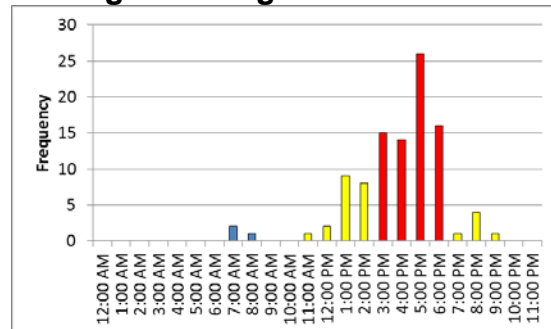
**Figure SWW-D-6
 Hourly Distribution of the 100
 Highest Net Load Hours**



**Figure SWW-D-7
 Hourly Distribution of the 100
 Highest CO₂ Hours**



**Figure SWW-D-8
 Hourly Distribution of the 100
 Highest Marginal Cost Hours**



1 **Q. WHY IS THE TOP 100 HOURS ANALYSIS DIFFERENT FOR LOAD?**

2 A. In 2022, the Company will have deployed sufficient solar resources that the
 3 critical system hours are anticipated to shift from 2 p.m. – 6 p.m. to 3 p.m. – 7
 4 p.m. This is Colorado’s first step towards the ‘duck curve’ that I mentioned
 5 previously. California has deployed even more solar generation than Colorado
 6 and San Diego Gas and Electric has recently set their On-Peak period to 4 p.m.
 7 – 9 p.m. I expect that the timing of Public Service’s critical peak hours will also
 8 shift to later in the day as more solar resources are added to the Company’s

1 system. Therefore, I believe that load net of renewables (Figure SWW-D-6)
2 serves as a better starting point for evaluating On-Peak hours, as compared with
3 gross load (Figure SWW-D-5). In addition, load net of renewables is consistent
4 with what the highest CO₂ hours (Figure SWW-D-7) and marginal energy costs
5 (Figure SWW-D-8) show in suggesting an On-Peak period of 3 p.m. – 7 p.m.

1 **V. SCHEDULE RE-TOU AS THE DEFAULT RESIDENTIAL RATE**

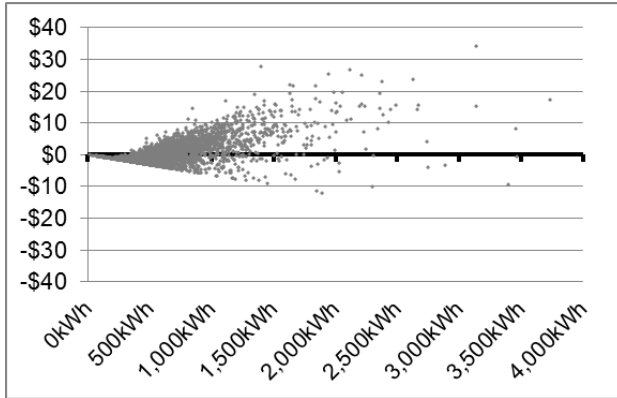
2 **Q. WHY IS THE COMPANY PROPOSING THAT MODIFIED SCHEDULE RE-TOU**
3 **BE THE DEFAULT RATE STRUCTURE INSTEAD OF AN OPTIONAL RATE?**

4 A. As described by Ms. Trammell in her Direct Testimony, the Company is making
5 this request for four main reasons, as follows: default time of use rates will
6 maximize total system benefits; reliance on voluntary participation is unlikely to
7 result in material demand reductions at the class level; time of use pricing is a
8 more precise rate design tool than inclining tiered rates; and tiered rates may
9 become a barrier to electrification in the future, particularly electric vehicle (“EV”)
10 adoption.

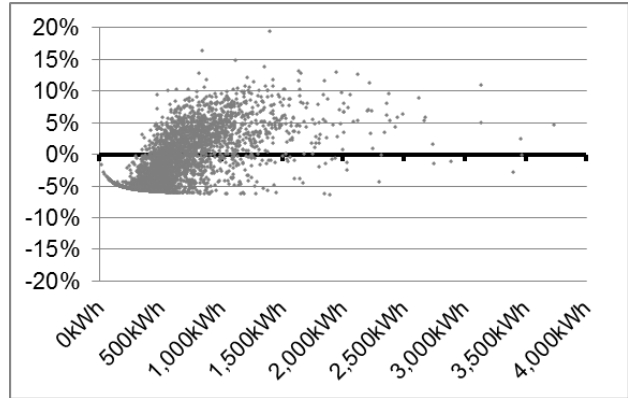
11 **Q. WHAT WERE THE IMPACTS TO CUSTOMERS WHEN THE EXISTING**
12 **SCHEDULE R TIERED RATE STRUCTURE WAS IMPLEMENTED?**

13 A. When tiered rates were implemented for Public Service, beginning in 2010,
14 customers with lower summer usage realized bill decreases, while customers
15 with higher summer usage realized bill increases. Using customer load data
16 from the RE-TOU Trial and RD-TDR Pilot programs, I calculated the average
17 monthly bill differences between the current tiered rate structure in Schedule R
18 and an equivalent flat energy rate. The analysis showed that about 35 percent of
19 customers realized a bill increase while 65 percent saw a bill decrease.
20 However, the average bill increase was more than twice the size of the average
21 bill decrease. The following figures illustrate the impact of the current tiered rate
22 structure on residential customers.

**Figure SWW-D-9
Impact of Tiered Rates
Average Monthly Bill Impacts \$**



**Figure SWW-D-10
Impact of Tiered Rates
Average Monthly Bill Impacts %**



1 Figures SWW-D-9 and SWW-D-10 illustrate that when customers were
2 migrated from flat rates to tiered rates there was a large concentration of small
3 bill savings for low use customers that was offset by a smaller number of larger
4 bill increases for customers with higher usage. Bill impacts similar to these have
5 been in place since 2010.

6 **Q. IF THE MODIFIED SCHEDULE RE-TOU BECOMES THE DEFAULT RATE**
7 **FOR ALL CUSTOMERS, IS THERE A POTENTIAL THAT LOW INCOME AND**
8 **OTHER CUSTOMERS MAY EXPERIENCE LARGE BILL INCREASES?**

9 A. I do not believe so. Later in my Direct Testimony I present the estimated bill
10 impacts of the Modified Schedule RE-TOU rate on low income customers. The
11 analysis shows that based on the RE-TOU Trial, low income customers use less
12 On-Peak energy than average customers, which will help minimize the bill
13 impacts associated with the migration to time of use rates. Data from LEAP
14 qualified customers also show that this customer group also tends to use more
15 energy in the winter months than average customers, presumably due to the

1 greater prevalence of electric space heating. The proposed modifications to
2 Schedule RE-TOU result in winter rates that are about three percent lower than
3 the current Schedule R winter rates. This modification should help low income
4 and other customers that use electric heat in the winter.

VI. MODIFIED RE-TOU RATE DESIGN

Q. HOW DID YOU DESIGN THE RATES FOR THE MODIFIED SCHEDULE RE-TOU?

A. I designed the Modified Schedule RE-TOU rates to be equivalent to the current Schedule R for the average customer. This ensures that aggregate Residential class revenue will not be impacted by the conversion to time of use rates. I specified an On-Peak to Off-Peak price ratio of 2 to 1 and utilized a weather normalized load shape for our Residential class as well as results from our RE-TOU Trial to estimate the sales volumes in each time of use period. Attachment SWW-1 provides the calculations performed to derive the modified RE-TOU rates and is reproduced in part below. Table SWW-D-2 shows that for the average customer the annual electric bill under the Modified Schedule RE-TOU rates would be within five cents, or 0.01 percent of the annual bill under the current Schedule R. The small difference between the annual bills is due to rounding.

Table SWW-D-2 – Modified RE-TOU Rate Design

Schedule R - Base Rates							Schedule R - Riders			
	Sales	Customers	Average Usage	Rates	Base Rate Charges	Current Rate	Volume	Revenue		
Tier 2	1,385,288,662 kWh	14.9%	1,260,811	1,099 kWh	\$0.09902	\$108.80	ECA	\$0.02674	7,364 kWh	\$196.90
Tier 1	7,898,802,258 kWh	85.1%	1,260,811	6,265 kWh	\$0.05461	\$342.12	DSMCA	\$0.00162	7,364 kWh	\$11.93
Total	9,284,090,919 kWh			7,364 kWh		\$450.92	PCCA	\$0.00401	7,364 kWh	\$29.53
				Average Rate	\$0.06124		TCA	\$0.00203	7,364 kWh	\$14.95
							CACJ	\$0.00301	7,364 kWh	\$22.16
							Total	\$0.03741	7,364 kWh	\$275.47
							Total Bill			\$726.39

Schedule RE-TOU - Base Rates							Schedule RE-TOU - Riders			
	W/N Sales w/ YE Adj	Customers w/YE adj	Average Usage	Rates	Base Rate Charges	Percentage Charge	Base Rate Charges	Revenue		
On-Peak	552,458,159 kWh	6.0%	1,260,811	438 kWh	\$0.11078	\$48.54	ECA	43.66%	\$450.95	\$196.89
Shoulder	856,240,454 kWh	9.2%	1,260,811	679 kWh	\$0.08309	\$56.43	DSMCA	2.65%	\$450.95	\$11.95
Off-Peak	7,875,392,306 kWh	84.8%	1,260,811	6,246 kWh	\$0.05539	\$345.98	PCCA	6.55%	\$450.95	\$29.54
Total	9,284,090,919 kWh			7,364 kWh		\$450.95	TCA	3.31%	\$450.95	\$14.93
				Average Rate	\$0.06124		CACJ	4.92%	\$450.95	\$22.19
							Total	61.09%	\$450.95	\$275.49
							Total Bill			\$726.44

1 **Q. WHY DO YOU RECOMMEND LIMITING TIME OF USE RATES TO THE**
2 **SUMMER MONTHS ONLY?**

3 A. Because Modified Schedule RE-TOU will be the default rate for all residential
4 customers, the Company intentionally limited the scope of time of use rates to
5 summer weekdays only. This will help minimize the potential bill impacts
6 associated with the change by leaving the eight winter months and summer
7 weekends essentially unchanged.⁵ It will also focus customer attention on their
8 usage for this more limited, but critical, On-Peak time period, which the Company
9 believes may foster better results than expecting customers to adapt to year-
10 round pricing signals.

11 **Q. WHY DID YOU USE A TWO TO ONE PRICE RATIO WHEN MODIFYING RE-**
12 **TOU RATES?**

13 A. Because the Modified Schedule RE-TOU rate structure would be the default rate
14 for all residential customers, the Company sought to minimize any impacts
15 associated with the rate. Higher price ratios inevitably lead to larger bill changes
16 for customers.

17 **Q. HOW DOES THE PROPOSED TWO TO ONE PRICE RATIO COMPARE TO**
18 **THE RATIOS USED BY OTHER UTILITIES WITH TIME OF USE RATES?**

19 A. The modified price ratio is in the middle of the range of some other time of use
20 rates around the country. San Diego Gas & Electric is the largest U.S. utility that
21 has default time of use rates for residential customers and utilizes a price ratio of

⁵ Holidays are also excluded from time of use pricing.

1 1.6 to 1. The City of Ft. Collins also has mandatory time of use rates with a price
 2 ratio of 3.5 to 1. The following table lists the price ratios used at some other
 3 utilities. It is not a comprehensive list of all time of use rates, but does illustrate
 4 the range of price ratios.

Table SWW-D-3 – On-Peak to Off-Peak Price Ratios

Utility	Rate	Summer Price Ratio
Orange & Rockland	Residential TOU	15.5 to 1
Baltimore Gas & Electric	Schedule RD	5 to 1
Oklahoma Gas & Electric	Residential TOU	4 to 1
City of Ft. Collins	Residential Time of Day	3.5 to 1
Colorado Springs Utilities	Time of Day Option	3.5 to 1
Arizona Public Service	Saver Choice	2.2 to 1
Public Service of Colorado	Modified RE-TOU	2 to 1
Arizona Public Service	Saver Plus	1.9 to 1
San Diego Gas & Electric	Residential DR-1	1.6 to 1
Consumers Energy MI	Residential Time of Day	1.5 to 1
Duke Energy SC	Residential TOU	1.2 to 1

6 **Q. HOW DID YOU DERIVE THE CUSTOMER USAGE ESTIMATES FOR THE**
 7 **MODIFIED RE-TOU RATES?**

8 A. I used two sources of data to estimate the amount of energy residential
 9 customers would be expected to consume in the On-Peak, Shoulder, and Off-
 10 Peak periods. The first was the Residential sales data that the Company used in
 11 its rebuttal testimony in its 2019 Electric Rate Review, Proceeding No. 19AL-
 12 0268E. That data specified total Residential sales of 9,284,090,919 kWh in the
 13 2019 test year. Second, I used an hourly weather normalized load shape for the
 14 entire Residential class that was developed in the Spring of 2019. This load
 15 shape follows the same methodology that the Company uses for developing load

1 shapes in Class Cost of Service Studies. I used that hourly pattern to establish
2 estimates of the percentage of sales in each time of use period and adjusted the
3 results to reflect the load changes measured by Navigant in their 2019 interim
4 report. The results were 84.8 percent of sales in the Off-Peak period, 9.2 percent
5 in the Shoulder, and 6.0 percent in the On-Peak period. This data is included in
6 Attachment SWW-1.

7 **Q. HOW DID YOU ADJUST THE RESIDENTIAL SALES TO REFLECT THE**
8 **RESULTS OF THE NAVIGANT STUDY?**

9 A. Based on the results of the Navigant analysis, I reduced On-Peak usage by 3.2
10 percent and increased Off-Peak usage by 3.7 percent. I did not adjust the
11 shoulder usage because the Navigant results were not statistically significant. I
12 made these adjustments to reflect the expectation that customers will modify
13 their behavior in response to time of uses rates. While it is possible that
14 customer response will not exactly match Navigant's estimate these are the best
15 estimates available at this time. As discussed by Ms. Trammell in her Direct
16 Testimony, the Company commits to provide follow-on data in this proceeding,
17 for informational purposes only, to help the Commission and stakeholders
18 understand and evaluate the actual results being delivered by the residential
19 TOU rates.

1 **Q. PLEASE DISCUSS THE COMPANY'S PROPOSAL TO CONVERT ALL RATE**
2 **RIDERS FOR RESIDENTIAL CUSTOMERS FROM CENTS PER KWH TO A**
3 **PERCENTAGE OF BASE ENERGY CHARGES.**

4 A. There are currently five adjustments on residential customer bills that are
5 charged on a cents per kWh basis: 1) the ECA; 2) the DSMCA; 3) the PCCA; 4)
6 the TCA; and 5) the CACJA Rider. However, Proceeding No. 19AL-0268E
7 included a proposal to roll the CACJA Rider into base rates with the exception of
8 the true-ups that will continue through 2021. As part of our implementation of the
9 Modified Schedule RE-TOU rates, the Company is proposing to change these
10 riders for residential customers to percentages applied to base energy charges.
11 This change will allow rate riders to exhibit the same hourly price variations as
12 the base rate charges without the need to add line items to customers' bills.

13 **Q. WHY IS THE COMPANY PROPOSING TO MAKE THIS CHANGE TO THE**
14 **RIDERS FOR MODIFIED SCHEDULE RE-TOU?**

15 A. The Company believes that all bill elements, except the fixed monthly S&F
16 charge, should be used to send price signals to customers to reduce their usage
17 during periods of high carbon emissions. This will help achieve the 2 to 1 price
18 ratio. However, during the RE-TOU Trial the Company received feedback
19 regarding the complexity of customer bills under time of use rates. Instead of a
20 Tier 1 and Tier 2 charge there were now three TOU charges plus two line items
21 for the On-Peak and Off-Peak ECA. These line items double twice a year when
22 bills transition between winter and summer rates. If the base energy charges

1 and all five riders were converted to TOU energy charges, there would be 18 line
 2 items on customers' bills. The Company felt that such a cumbersome bill would
 3 be unacceptable to customers. Therefore, the Company is recommending that
 4 the rate riders be converted to percentage charges for the modified Schedule
 5 RE-TOU. The following table illustrates how the current rate riders would be
 6 converted to a percentage basis.

Table SWW-D-4 – Rider Conversion Calculations

Schedule R - Riders					
	Current Rider Rate		Average Base Rate Energy Charge		Rider As a % of Base Energy Charge
ECA	\$0.02674	÷	\$0.06124	=	43.66%
DSMCA	\$0.00162	÷	\$0.06124	=	2.65%
PCCA	\$0.00401	÷	\$0.06124	=	6.55%
TCA	\$0.00203	÷	\$0.06124	=	3.31%
CACJ	\$0.00301	÷	\$0.06124	=	4.92%

8 **Q. WHAT IF RIDERS WERE NOT MODIFIED FOR SCHEDULE RE-TOU?**

9 A. If the riders were not modified the resulting On-Peak to Off-Peak ratio would be
 10 only 1.6 to 1, which would diminish the effectiveness of the Company's modified
 11 TOU proposal.

12 **Q. COULD TIME OF USE BASE RATES BE ADJUSTED, SUCH THAT WITH**
 13 **FLAT CENTS PER KWH RIDERS, A PRICE RATIO OF TWO TO ONE CAN**
 14 **STILL BE ACHIEVED?**

15 A. Technically yes, but the Company would not be willing to accept the financial
 16 risks associated with such a modification. In order to achieve a 2 to 1 price ratio
 17 with flat rate riders, the base rate charges would need to have a price ratio of

1 almost 2.75 to 1. In this scenario, On-Peak base rate energy charges would be
2 increased from the 11 cents that the Company has proposed to 14 cents. This
3 high On-Peak charge corresponds to 14 percent of revenue recovery being
4 concentrated in 3.8 percent of the hours in the year. This modification would
5 make Residential revenues significantly more risky for the Company.

6 **Q. WILL THE PROPOSED CONVERSION OF RATE RIDERS TO PERCENTAGE**
7 **ADJUSTMENTS RESULT IN RESIDENTIAL CUSTOMERS PAYING MORE?**

8 A. No. The derivation of the rider percentages is designed such that in total,
9 residential customers will contribute the same amount to riders as they would
10 have under flat cent per kWh based rates. However, individual customers who
11 use relatively more On-Peak energy will contribute more to each rider while
12 customers who shift their usage to Off-Peak hours will pay less, mirroring what
13 will happen with energy base rates.

14 **Q. ONCE THE RIDERS ARE CONVERTED TO PERCENTAGES, WHAT WOULD**
15 **BE THE EFFECTIVE CHARGES TO CUSTOMERS?**

16 A. The effective riders' rates can be calculated by applying the percentages derived
17 above to the Modified Schedule RE-TOU base rates. The following table shows
18 these values.

1

Table SWW-D-5 – Effective TOU Rider Rates

TOU Base Energy Charges			On-Peak	Shoulder	Off-Peak
			\$0.11078	\$0.08309	\$0.05539
			Equivalent TOU Charges		
	Current Rider Rate	% Based Riders	On-Peak	Shoulder	Off-Peak
ECA	\$0.02674	43.66%	\$0.04837	\$0.03628	\$0.02419
DSMCA	\$0.00162	2.65%	\$0.00293	\$0.00220	\$0.00147
PCCA	\$0.00401	6.55%	\$0.00725	\$0.00544	\$0.00363
TCA	\$0.00203	3.31%	\$0.00367	\$0.00275	\$0.00184
CACJ	<u>\$0.00301</u>	<u>4.92%</u>	<u>\$0.00544</u>	<u>\$0.00408</u>	<u>\$0.00272</u>
Total	\$0.03741	61.09%	\$0.06767	\$0.05076	\$0.03384

2 **Q. ARE ANY OF PUBLIC SERVICE’S OTHER RATE RIDERS APPLIED AS**
 3 **PERCENTAGES?**

4 A. Yes. Currently the Company utilizes the General Rate Schedule Adjustment
 5 (“GRSA”) and the Renewable Energy Standard Adjustment (“RESA”) on electric
 6 customers’ bills, both of which are percentage based adjustments. In addition,
 7 the DSMCA is charged as a percentage on Public Service’s natural gas bills.
 8 Charging rate riders as percentages instead of cents per kWh is not a new
 9 concept. The Company’s proposal is consistent with the way other riders are
 10 currently applied and will help to achieve the policy goals of time of use rate
 11 structures.

12 **Q. COULD THE PERCENTAGE-BASED RIDERS BE USED WITH OTHER**
 13 **RESIDENTIAL RATE OPTIONS?**

14 A. Yes. The Company expects to propose additional Residential rate options in the
 15 future, some of which will likely also use time-differentiated pricing structures.
 16 The percentage-based riders could be equally applied to those rates. For
 17 example, the Company could offer an optional rate based on a dynamic pricing

1 structure where prices and time periods change on a daily basis depending on
2 system conditions. The effectiveness of dynamic base rates could be further
3 enhanced by including percentage based riders, which should result in greater
4 customer response.

5 **Q. WILL THE MODIFIED SCHEDULE RE-TOU RATES CREATE ADDITIONAL**
6 **REVENUES FOR PUBLIC SERVICE?**

7 A. No. The rates are designed such that the expected revenue under the Modified
8 Schedule RE-TOU rates is the same as the revenue from Schedule R (*i.e.*, the
9 rate design change is revenue neutral). I have included a Revenue Proof
10 analysis as Attachment SWW-2, which shows that revenues under the Modified
11 Schedule RE-TOU are expected to be within 0.01 percent of Schedule R. The
12 small difference in total class revenue is attributable to rounding.

13 **Q. WHAT OTHER TIME OF USE RATE DESIGN OPTIONS DID PUBLIC**
14 **SERVICE CONSIDER?**

15 A. The Company also considered keeping the current Trial RE-TOU rate structure,
16 other year round time of use rate designs, two period time of use rates, the
17 inclusion of a demand charge, and different On-Peak to Off-Peak Price ratios.
18 However, the Company did not make these rate design proposals for the reasons
19 explained further in my testimony.

1 **Q. WHY DIDN'T THE COMPANY PROPOSE TO USE THE CURRENT RE-TOU**
2 **TRIAL RATE DESIGN?**

3 A. The net load, marginal energy cost, and CO₂ emission data does not support
4 year round time of use rates. Specifically the spring and fall months do not see
5 extreme system conditions that would justify time differentiated rates. And while
6 there can be elevated system conditions in the winter months, at this time they
7 are infrequent enough that I do not recommend time of use rates in those months
8 either. Also, as I noted previously, limiting time of use pricing to summer months
9 will focus customer attention on their usage for this more limited, but critical, On-
10 Peak time period, which we believe may foster better results than expecting
11 customers to adapt to year-round pricing signals like those we had in the RE-
12 TOU Trial. Finally the next section of my testimony presents various bill impact
13 analyses, one of which demonstrates that the current year round Schedule RE-
14 TOU rate design would result in larger bill impacts than the modified summer-
15 only structure.

16 **Q. WHY DID THE COMPANY PROPOSE THREE TIME PERIODS RATHER THAN**
17 **TWO?**

18 A. The Company chose to retain the three period structure (On-Peak, Shoulder, and
19 Off-Peak) so that the On-Peak period could be limited to four hours. The
20 Company felt that longer On-Peak time periods would be inconvenient and hard
21 to manage for our customers. However the hours preceding and following the
22 On-Peak period are also potentially important hours to reduce load, so the

1 Company elected to retain the use of a Shoulder period although it was reduced
2 from eight hours to seven.

3 **Q. DID THE COMPANY CONSIDER INCLUDING A DEMAND CHARGE IN ITS**
4 **MODIFIED SCHEDULE RE-TOU PROPOSAL?**

5 A. Yes. However, the Company is currently conducting a Pilot on Residential
6 Demand-Time Differentiated Rates, Schedule RD-TDR, which is scheduled to
7 continue through 2021, and the Company felt that it was premature to consider a
8 demand charge in a default residential time of use rate prior to the conclusion of
9 that Pilot. However, the Company continues to believe that demand charges can
10 be valuable pricing tools that encourage customers to minimize their peak energy
11 usage and that accurately assess the cost of grid services used by customers.

12 **Q. DID THE COMPANY CONSIDER USING A HIGHER ON-PEAK TO OFF-PEAK**
13 **PRICE RATIO THAN THAT USED IN THE SCHEDULE RE-TOU TRIAL?**

14 A. After analyzing the Trial data the Company decided to decrease the price ratio
15 from 2.4 to 1 in the Trial to 2 to 1 in Modified Schedule RE-TOU. Public Service
16 is concerned about the bill changes that may result from the change to time of
17 use rates, and higher price ratios can lead to even greater changes. While we
18 recognize that higher price ratios can lead to more load shifting by customers, at
19 this time we feel that it is prudent to balance that consideration with our goal of
20 implementing time of use rates that minimize the impacts to our customers. It is
21 possible that we may recommend a change in this price ratio at some point in the
22 future after our customers have acclimated to time of use rates.

1 **VII. BILL IMPACT ANALYSIS**

2 **Q. HAS THE COMPANY QUANTIFIED THE POTENTIAL BILL IMPACTS**
3 **ASSOCIATED WITH THE MODIFIED SCHEDULE RE-TOU RATE?**

4 A. Yes. The Company ran several bill impact scenarios using various data sets.
5 The analysis consisted of quantifying the monthly energy volumes for each
6 customer based on the load data that was collected through the Residential Trial
7 and Pilot. Next the current Schedule R rates and the Modified Schedule RE-
8 TOU rates were applied to the monthly volumes to derive monthly bills under
9 each rate structure. I have supporting workpapers for each of the bill impact
10 scenarios discussed in this section.

11 **Q. IS YOUR BILL IMPACT ANALYSIS COMPARABLE TO THE ANALYSIS**
12 **PERFORMED BY NAVIGANT ON THE RE-TOU TRIAL?**

13 A. No. I am evaluating the Modified Schedule RE-TOU while the Navigant study
14 evaluated the RE-TOU rate structure that was used in the Trial. Also, the
15 Navigant study was focused on developing specific measurements of customers'
16 responses to time of use price signals. The analysis I present here is intended to
17 give the Commission and other parties an estimate of the range of bill impacts
18 that may occur as residential customers are switched to the Modified Schedule
19 RE-TOU. I discuss the Navigant study in more detail later in Section IX of my
20 Direct Testimony.

1 **Q. WHAT WERE THE RESULTS OF YOUR BILL IMPACT ANALYSIS?**

2 A. The most representative analysis involved residential customers who volunteered
 3 for either the RE-TOU Trial or the RD-TDR Pilot, but were designated part of the
 4 Control group, meaning that they remained on Schedule R and did not receive a
 5 time of use price signal. I also narrowed the sample to customers that were
 6 classified as ‘General Population,’ meaning that they were not designated as one
 7 of the sub-segments that were studied by Navigant. Ms. Simms discusses the
 8 sub-segments in her Direct Testimony. This 2018 Control/General Population
 9 data set consisted of 478 observations.⁶ I believe this is the best representation
 10 of the potential bill impacts of the modified RE-TOU rates on customers who do
 11 not modify their behavior. Customers who are able to shift or curtail On-Peak
 12 usage would have smaller bill increases or larger bill decreases. Table SWW-D-
 13 6 summarizes the results of the bill impact analysis on the Control/General
 14 Population set of customers.

15 **Table SWW-D-6 – Bill Impacts 2018 Control/General Population**

Volume Comparison			Bill Impact Summary			
	Rate Design	Sample		Count	Average Monthly Bill Impacts	
Ave Usage	614kWh	646kWh	Total	478	-\$0.04	-0.1%
Tier 1	85.1%	84.5%	Bill Increases	331	\$1.50	3.0%
Tler2	14.9%	15.5%	Bill Decreases	147	-\$2.96	-2.7%
On-Peak	6.2%	6.2%	Maximum Monthly Bill impacts			
Shoulder	9.2%	9.2%	Max Bill Impact		10.9%	\$4.24
Off-Peak	84.6%	84.7%	Min Bill Impact		-7.5%	-\$47.98

⁶ The analysis only included customers who had load data for the entire 12 months of 2018. Using partial year data can result in a misleading bill impact analysis. However, limiting the analysis to only customers with a full 12 months of data resulted in relatively small sample sizes.

1 The results show that based on actual 2018 load data from this group of
2 customers, the average monthly bill impact would be a reduction of \$0.04 or 0.1
3 percent of bills. This indicates that the load characteristics of the sample are
4 very similar to the expected characteristics of the residential population as a
5 whole. The volume comparison to the left of the table substantiates this
6 conclusion. It shows that the sample population used slightly more energy on a
7 monthly basis, but that their usage distribution between On-Peak, Shoulder, and
8 Off-Peak was almost identical to the estimate for the entire Residential class.

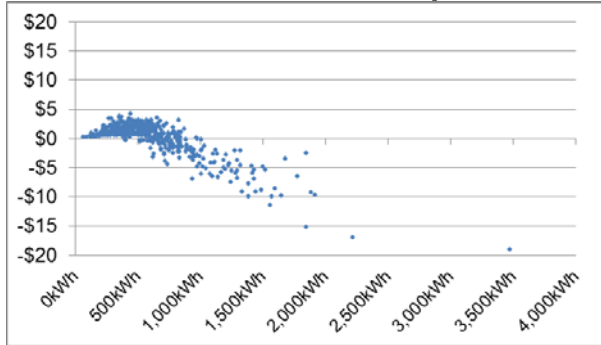
9 Table SWW-D-6 also illustrates that there will likely be more bill increases
10 than decreases as residential customers are transitioned to time of use rates, but
11 that the average size of monthly bill increases will only be about \$1.50 per
12 month.

13 **Q. CAN YOU PROVIDE GRAPHICAL REPRESENTATIONS OF THE 2018**
14 **CONTROL/GENERAL POPULATION BILL IMPACT ANALYSIS?**

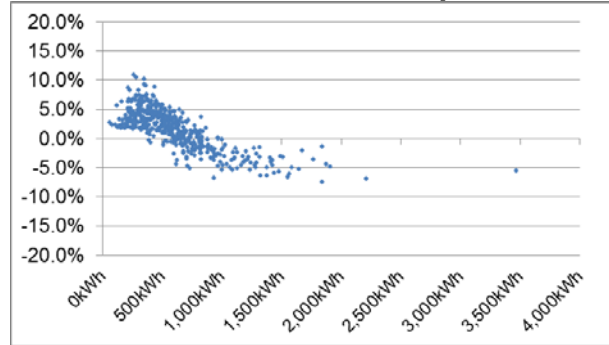
15 A. Yes. I first developed scatter plots that charted bill impacts relative to average
16 monthly kWh.⁷

⁷ These tables were truncated at average monthly usage of 4,000 kWh. This truncation eliminated one customer observation with average monthly usage over 9,000 kWh.

**Figure SWW-D-11
Average Monthly Bill Impacts \$
2018 Control/General Population**



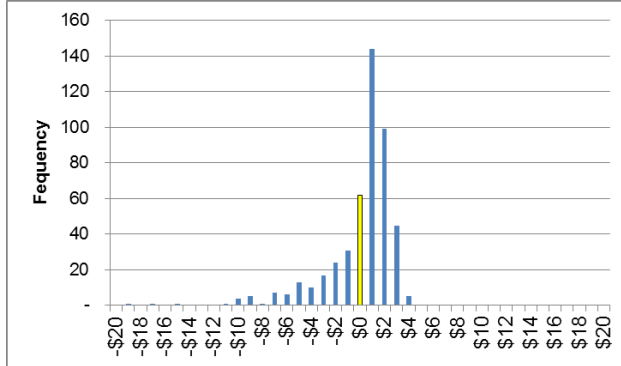
**Figure SWW-D-12
Average Monthly Bill Impacts %
2018 Control/General Population**



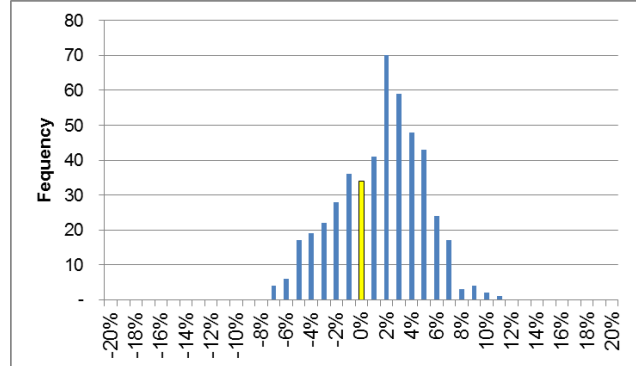
1 Figures SWW-D-11 and SWW-D-12 illustrate that moving to time of use
2 rates will create both bill increases and decreases from an impact perspective
3 and that customers with higher usage are more likely to see bill decreases. This
4 is a natural result of moving away from a tiered rate structure.

5 Next, I sorted the bill impacts into histograms that illustrate how many
6 customers would experience bill impacts at various levels. To give the reader an
7 easy point of reference, I highlighted the bins representing average monthly bill
8 impacts between -\$0.50 and +\$0.50 and -0.5 percent and +0.5 percent.

**Figure SWW-D-13
Bill Impacts Histogram \$
2018 Control/General Population**



**Figure SWW-D-14
Bill Impacts Histogram %
2018 Control/General Population**



1 **Q. THE HISTOGRAMS APPEARED SKEWED TOWARDS BILL INCREASES, IS**
2 **THAT AN ACCURATE ASSESSMENT OF THE EXPECTED BILL IMPACTS**
3 **ASSOCIATED WITH THE MODIFIED RE-TOU RATES?**

4 A. Based on this analysis I do expect that bill increases will be more common than
5 bill decreases, but that the magnitude of the increases will be smaller, resulting in
6 an overall net impact of zero for the entire Residential class.

7 **Q. DID YOU CONDUCT AN ANALYSIS ON CUSTOMERS WHO WERE ON THE**
8 **SCHEDULE RE-TOU TRIAL RATE?**

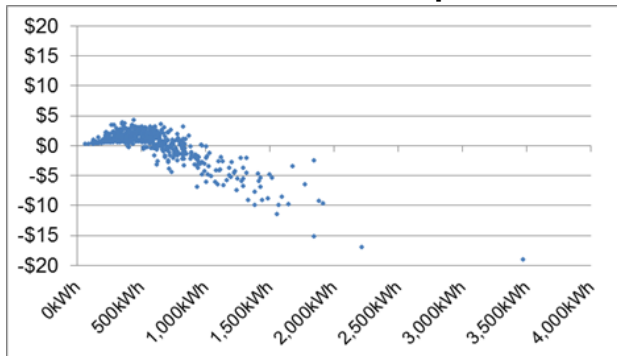
9 A. Yes. I conducted an identical analysis on customers who were on the RE-TOU
10 Trial rate in 2018 and classified as General Population. Because customers on
11 the Trial rate were exposed to On-Peak and Shoulder pricing during the summer
12 months, I believe that this analysis provides a rough estimate of bill impacts from
13 time of use rates inclusive of the behavioral responses from customers. The
14 results of this analysis showed that for customers on the RE-TOU Trial, their On-
15 Peak usage fell from 6.2 percent for the Control/General Population (*i.e.*, no price

1 signals) sample to 5.6 percent for the RE-TOU/General Population sample. Also,
 2 bill savings were more frequent and slightly larger, with the average monthly bill
 3 savings increasing from \$0.04 for the Control/General Population sample to
 4 \$0.18 for the RE-TOU/General Population sample. The following table and
 5 figures compare the bill impact results for customers in the Control group to
 6 customers actually on the RE-TOU Trial rate. The Control group results quantify
 7 the impact of the rate change alone; the RE-TOU Sample column adjusts those
 8 results for behavioral response from the customers, based on the RE-TOU Trial
 9 results.

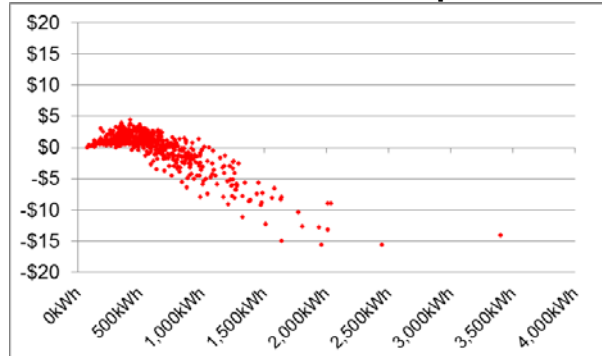
**Table SWW-D-7 – Bill Impact Comparison
 Control/General Population versus RE-TOU/General Population**

Volume Comparison				Bill Impact Summary			
	Rate Design	Control Sample	RE-TOU Sample	Control Sample		RE-TOU Sample	
				Count	Average	Count	Average
Ave Usage	614kWh	646kWh	623kWh	Total	478	600	-\$0.18
Tier 1	85.1%	84.5%	85.6%	Bill Increases	331	416	\$1.42
Tier2	14.9%	15.5%	14.4%	Bill Decreases	147	184	-\$3.29
On-Peak	6.2%	6.2%	5.6%	Maximum Monthly Bill impacts			
Shoulder	9.2%	9.2%	8.7%	Max Bill Impact	\$4.24	\$4.47	13.2%
Off-Peak	84.6%	84.7%	85.7%	Min Bill Impact	-\$47.98	-\$33.88	-8.3%

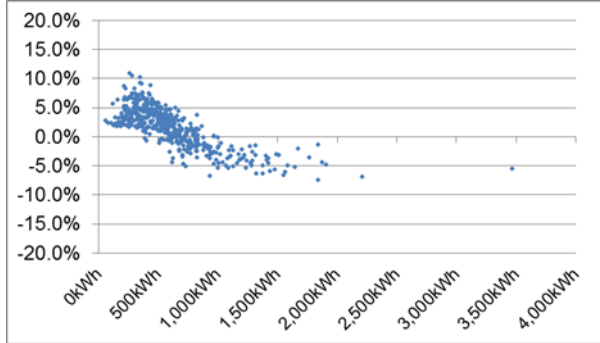
**Figure SWW-D-15
 Average Monthly Bill Impacts \$
 2018 Control/General Population**



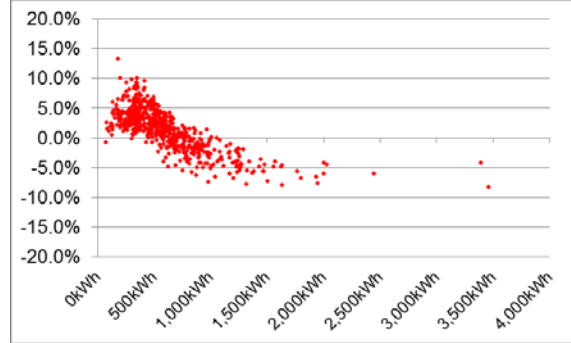
**Figure SWW-D-16
 Average Monthly Bill Impacts \$
 2018 RE-TOU/General Population**



**Figure SWW-D-17
Average Monthly Bill Impacts %
2018 Control/General Population**



**Figure SWW-D-18
Average Monthly Bill Impacts \$
2018 RE-TOU/General Population**



1 Although it may not be visually apparent in the bill impact graphs,
2 customers who were actually exposed to time of use rates responded to the price
3 signals and modified their behavior to reduce their monthly bills. This is
4 consistent with the Navigant findings in their evaluation of the RE-TOU Trial.

5 **Q. DID YOU ALSO PERFORM A BILL IMPACT ANALYSIS OF LOW INCOME**
6 **CUSTOMERS?**

7 A. Yes, the Company understands the concern about potential impacts of time of
8 use rates on low income customers. As Ms. Trammell explains, the Company
9 plans to maintain its current Energy Assistance Program that effectively caps the
10 amount that low income customers pay for electricity, while additional programs
11 including LEAP, Energy Outreach Colorado benefits, and the Colorado Medical
12 Exemption Program are also available to assist customers with their utility needs.
13 As such, TOU rates would not impact customers in our EAP program.

14 I again used 2018 load data from our Residential Trial and Pilot for the bill
15 impact analysis for low income customers. The customer sample included all
16 customers identified as low income who were placed in the Control group for the

1 study. I did not restrict the sample in any other way, meaning that the low
2 income sample included low income customers with EVs and smart thermostats,
3 as well as low income renters and seniors. In total, the Control/Low Income
4 sample consisted of 137 low income customers.

5 **Q. WHAT LOAD CHARACTERISTICS DO LOW INCOME CUSTOMERS HAVE**
6 **BASED ON 2018 DATA?**

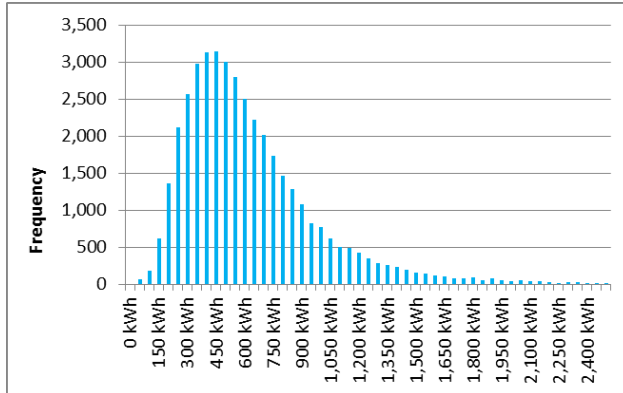
7 A. Electric use by low income customers is just as diverse as usage by other
8 residential customers. I cannot identify a particular characteristic for low income
9 customers' load patterns, but in general low income customers had lower than
10 average monthly usage in the summer, and slightly higher usage in the winter.

11 **Table SWW-D-8 – Average Usage LEAP Customers**

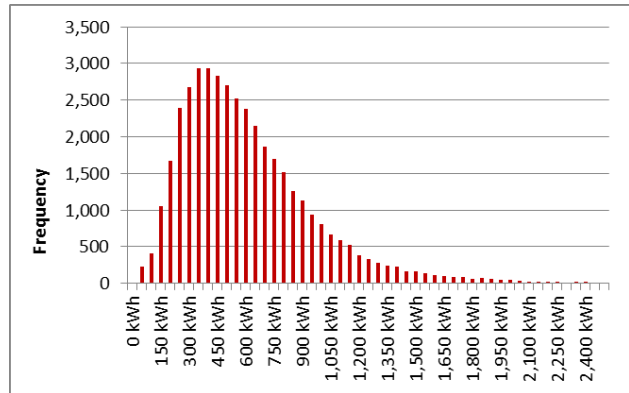
	All Residential Customers	LEAP Qualified Customers	Difference	
Summer	697 kWh	589 kWh	-108 kWh	-15%
Winter	583 kWh	612 kWh	29 kWh	5%

12
13 However, there is great diversity in the LEAP qualified customer group. Average
14 usage ranges from 50 kWh per month to over 2,500 kWh. Therefore the
15 Modified Schedule RE-TOU rates will have different impacts for different
16 customers. The following histograms show the diversity in summer and winter
17 usage for LEAP qualified customers.

**Figure SWW-D-19
 Average Monthly Winter Usage
 2018 LEAP Qualified Customers**



**Figure SWW-D-20
 Average Monthly Summer Usage
 2018 LEAP Qualified Customers**



1 **Q. WHAT WERE THE BILL IMPACT RESULTS FOR THE 2018 CONTROL/LOW**
 2 **INCOME SAMPLE?**

3 A. First the Control/Low Income sample had much lower average usage than
 4 expected. The 2018 average usage for the 136 customers in the Control/Low
 5 Income sample was only 487 kWh. The Company was not able to explain why
 6 Low Income customers in the RE-TOU Trial had lower usage than the population
 7 of LEAP customers. The Control/Low Income sample also had lower On-Peak
 8 usage than the Control/General Population. The average bill increase for both
 9 samples was \$1.50 per month.

10 **Table SWW-D-9 – Bill Impact Comparison
 Control/General Population versus Control/Low Income**

Volume Comparison				Bill Impact Summary				
	Rate Design	Control Sample	Low Income Sample	Control Sample		Low Income Sample		
				Count	Average	Count	Average	
Ave Usage	614kWh	646kWh	492kWh	Total	478	-0.04	137	\$0.16
Tier 1	85.1%	84.5%	89.1%	Bill Increases	331	\$1.50	113	\$1.50
Tier2	14.9%	15.5%	10.9%	Bill Decreases	147	-\$2.96	24	-\$3.02
On-Peak	6.2%	6.2%	5.6%	Maximum Monthly Bill impacts				
Shoulder	9.2%	9.2%	8.6%	Max Bill Impact	\$4.24	10.9%	\$3.97	11.2%
Off-Peak	84.6%	84.7%	85.7%	Min Bill Impact	-\$47.98	-7.5%	-\$13.18	-6.7%

Figure SWW-D-21
Average Monthly Bill Impacts \$
2018 Control/General Population

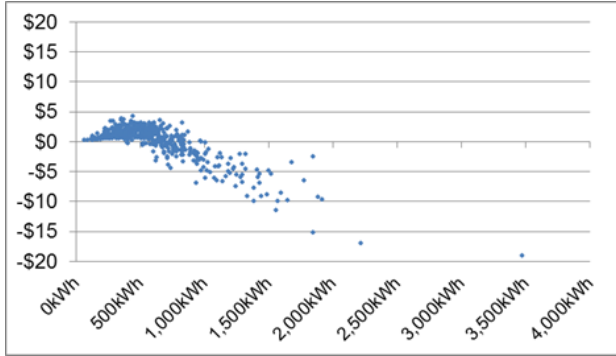


Figure SWW-D-22
Average Monthly Bill Impacts \$
2018 Control/Low Income

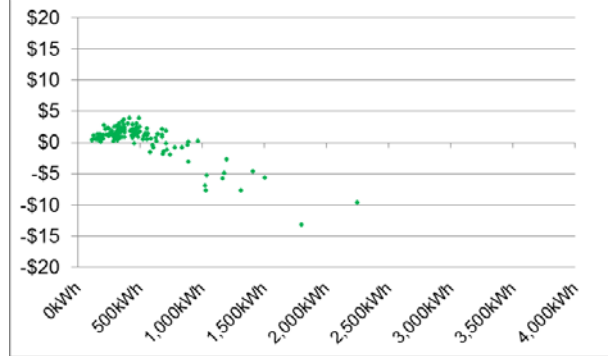


Figure SWW-D-23
Average Monthly Bill Impacts %
2018 Control/General Population

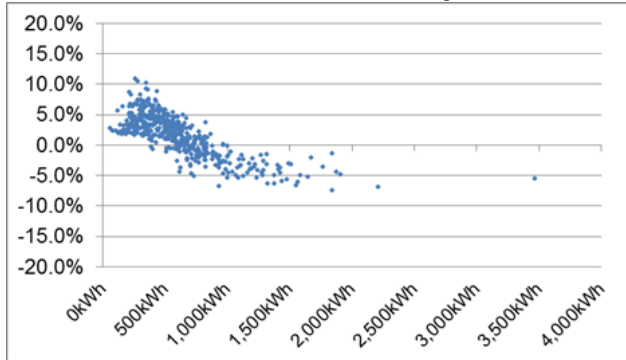
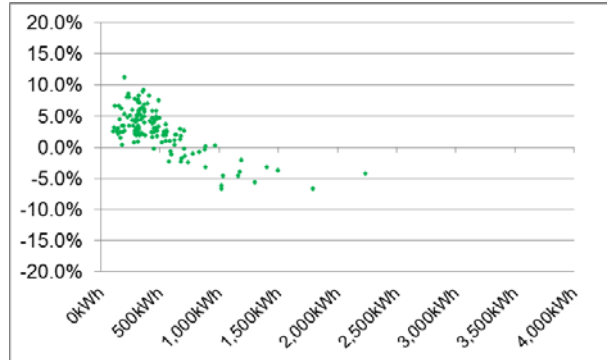


Figure SWW-D-24
Average Monthly Bill Impacts %
2018 Control/Low Income



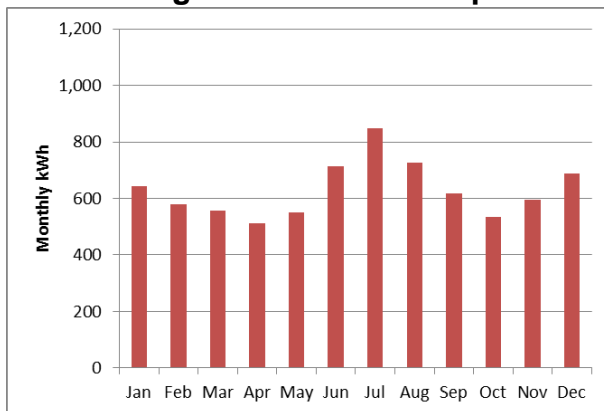
1 For the 2018 Control/Low Income sample, the largest observed bill
2 increase associated with the modified RE-TOU rates was \$3.97 per month and
3 the largest bill decrease was \$13.18 per month. The bill impact scatter plots
4 show that bill increases were primarily associated with customers that used
5 between 100 kWh and 600 kWh monthly. This is the same pattern observed in
6 the other Trial samples and is the inevitable result of moving away from the
7 existing tiered rate structure.

1 **Q. FROM YOUR ANALYSIS WHAT DO YOU OBSERVE ABOUT THE LOW**
2 **INCOME CUSTOMERS WITH THE LARGEST BILL IMPACTS?**

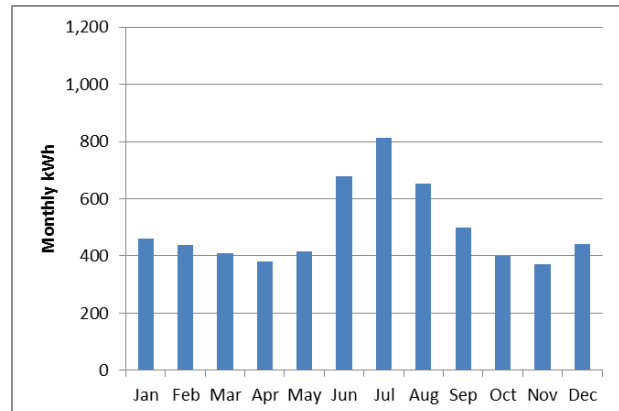
3 A. I investigated the 2018 Control/Low Income customer with the largest average
4 monthly bill impact of \$3.97 or an average increase of 7.5 percent. With
5 consideration to data privacy, I will refer to this customer as Customer X. I found
6 that in addition to being identified as low income, Customer X was also identified
7 as senior. Customer X volunteered for the RE-TOU Trial in October of 2017 but
8 was placed in the Control group.

9 The load data showed that Customer X used less electricity in the winter
10 months but in the summer used about as much electricity as the average
11 customer who participated in the Residential Trial or Pilot.

**Figure SWW-D-25
2018 Monthly Usage
Average Trial/Pilot Participant**

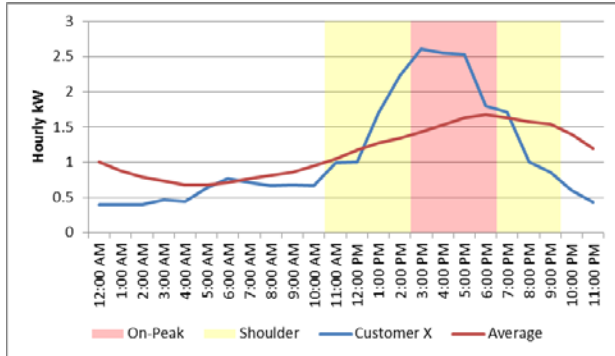


**Figure SWW-D-26
2018 Monthly Usage
Customer X**

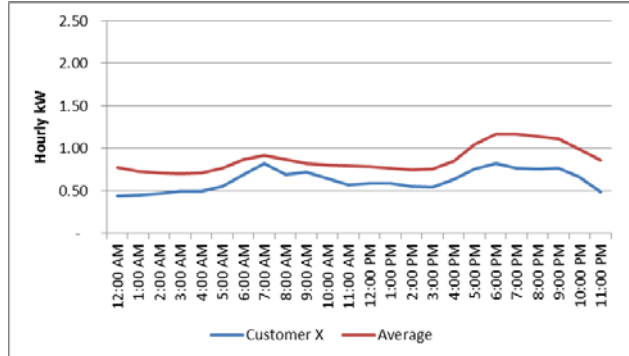


12 Analysis of Customer X's hourly load patterns shows that the customer
13 uses significant amounts of energy during the modified On-Peak period in the
14 summer and had fairly flat usage during the winter.

**Figure SWW-D-27
July Average Hourly Load Patterns**



**Figure SWW-D-28
January Average Hourly Load Patterns**



1 **Q. WHAT CONCLUSIONS DO YOU DRAW FROM YOUR INVESTIGATION OF**
2 **LOW INCOME CUSTOMER X?**

3 A. The large bill impact for Customer X is driven by the customer's high usage of
4 energy during the On-Peak and Shoulder hours in the summer. Customer X's
5 July hourly usage pattern, illustrated in Figure SWW-D-27, is the type of behavior
6 that drives system costs today and will make it difficult to eliminate carbon
7 emissions in the future. As such, I believe that the higher average monthly
8 charges for Customer X under the modified Schedule RE-TOU are reasonable
9 and appropriately reflect the costs to serve this customer.

10 It is also important to remember that Customer X was not on the RE-TOU
11 Trial rate. This means the customer was not receiving the price signals to reduce
12 consumption during the On-Peak and Shoulder periods. Perhaps with the
13 appropriate time of use price signals, Customer X would have modified their
14 behavior in order to limit their bill impacts.

1 **Q. WHAT PROGRAMS ARE AVAILABLE TO CUSTOMERS LIKE CUSTOMER X**
2 **TO HELP MANAGE THEIR ELECTRIC BILL?**

3 A. Customers may apply to the Company's EAP program and receive bill payment
4 assistance from the Company. As explained by Ms. Trammell, the EAP program
5 limits customers' energy bills. Customers like Customer X could also take
6 advantage of low-income solar opportunities as well as Demand Side
7 Management programs offered by the Company. Additional programs, as
8 elaborated in Ms. Trammell's testimony, include Colorado LEAP, Energy
9 Outreach Colorado benefits and the Colorado Medical Exemption Program.

10 **Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE POTENTIAL BILL**
11 **IMPACTS OF THE MODIFIED RE-TOU RATES ON LOW INCOME**
12 **CUSTOMERS?**

13 A. Although the frequency of bill increases are higher than the frequency of bill
14 decreases, the average size of the increases are \$3.97 per month, compared to
15 \$4.24 per month for the Control/General Population sample. While bill increases
16 are never desirable, it is important to remember that a majority of the increases
17 are simply reversals of bill decreases that occurred in 2010 when the tiered rate
18 structure was first implemented. As explained by Ms. Trammell, the Company's
19 EAP program as well as other community programs will continue to be available
20 for low income customers that are struggling with their utility bills.

1 **Q. TURNING BACK TO THE GENERAL POPULATION FROM THE TRIAL, DID**
 2 **YOU CONDUCT BILL IMPACT ANALYSIS COMPARING RESULTS UNDER**
 3 **THE RE-TOU TRIAL RATE WITH RESULTS UNDER THE MODIFIED RE-TOU**
 4 **RATES?**

5 **A.** Yes. I thought it was important to compare the impacts of the modified RE-TOU
 6 rates to the rate structure used in the RE-TOU Trial. The Trial rate utilized year-
 7 round TOU rates with a different On-Peak to Off-Peak price ratio.

8 **Table SWW-D-10 – Comparison RE-TOU Trial & Modified RE-TOU**

	Current RE-TOU			Modified RE-TOU		
Time Periods	On-Peak	Shoulder	Off-Peak	On-Peak	Shoulder	Off-Peak
	Summer & Winter Weekdays & NonHolidays 2:00 pm - 6:00 pm	Summer & Winter Weekdays & NonHolidays 9:00 am -2:00 pm & 6:00 pm - 9:00 pm Summer & Winter Weekends & Holidays 9:00 am - 9:00 pm	Summer & Winter Weekdays & Weekends & Holidays 9:00 pm - 9:00 am	Summer Weekdays 3:00 pm-7:00 pm	Summer Weekdays 11:00 am-3:00 pm & 7:00 pm-10:00 pm	Summer Weekdays 10:00pm-11:00am Summer Weekends & Holidays All Winter Hours
% of Sales	13.1%	44.8%	42.1%	6.0%	9.2%	84.8%
S&F Charge	\$5.41	\$5.41	\$5.41	\$5.41	\$5.41	\$5.41
Base Rate-Summer	\$0.13814	\$0.08420	\$0.04440	\$0.11078	\$0.08309	\$0.05539
Base Rate-Winter	\$0.08880	\$0.05413	\$0.04440			
GRSA	-4.19%	-4.19%	-4.19%	-4.19%	-4.19%	-4.19%
ECA	\$0.03112	\$0.03112	\$0.01921	43.66%	43.66%	43.66%
DSMCA	\$0.00162	\$0.00162	\$0.00162	2.65%	2.65%	2.65%
PCCA	\$0.00401	\$0.00401	\$0.00401	6.55%	6.55%	6.55%
TCA	\$0.00203	\$0.00203	\$0.00203	3.31%	3.31%	3.31%
CACJ	\$0.00301	\$0.00301	\$0.00301	4.92%	4.92%	4.92%
RESA	2%	2%	2%	2%	2%	2%
Ave Rate - Summer	\$0.17762	\$0.12491	\$0.07387	\$0.17729	\$0.13298	\$0.08865
Ave Rate - Winter	\$0.12941	\$0.09552	\$0.07387			
Price Ratio	Summer 2.4 to 1 Winter 1.75 to 1			2 to 1		

9 Table SWW-D-10 shows more residential sales were subject to On-Peak
 10 and Shoulder period pricing under the RE-TOU Trial. In the RE-TOU Trial 57.9
 11 percent of sales were either on the On-Peak or Shoulder rate, compared to 15.2

1 percent under the Modified Schedule RE-TOU structure. The table also shows
 2 that the Modified Schedule RE-TOU rate structure has an On-Peak to Off-Peak
 3 price ratio that is between the summer and winter ratios used in the Trial.

4 **Q. HOW DO THE BILL IMPACTS ASSOCIATED WITH THE RE-TOU TRIAL**
 5 **COMPARE TO THE PROJECTED BILL IMPACTS FROM THE MODIFIED**
 6 **SCHEDULE RE-TOU RATES?**

7 A. Using the Control/General Population sample from 2018, I conducted bill impact
 8 analysis similar to what I've previously described. The analysis showed that the
 9 Modified RE-TOU rate structure would result in slightly more bill increases, but
 10 that the increases would be smaller in magnitude.

**Table SWW-D-11 – Bill Impact Comparison
 Modified Schedule RE-TOU versus RE-TOU Trial**

	Modified RE-TOU		RE-TOU Trial	
	Count	Average	Count	Average
Total	478	-\$0.04	478	-\$0.01
Bill Increases	331	\$1.50	311	\$1.75
Bill Decreases	147	-\$2.96	167	-\$1.92
Maximum Bill Impact				
Max Bill Impact	\$4.24	10.9%	\$6.55	13.8%
Min Bill Impact	-\$47.98	-7.5%	-\$53.70	-10.6%

11

Figure SWW-D-29
2018 Control/General Population
Modified RE-TOU
Average Monthly Bill Impacts \$

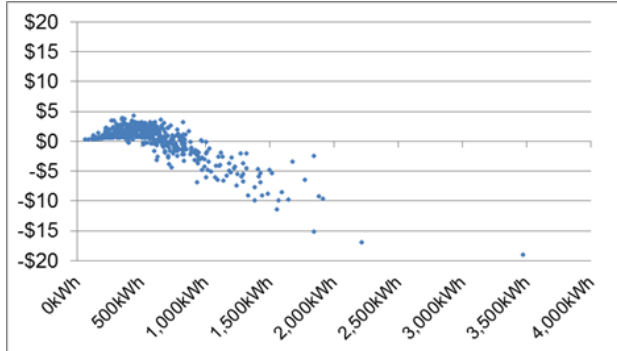


Figure SWW-D-30
2018 Control/General Population
RE-TOU Trial
Average Monthly Bill Impacts \$

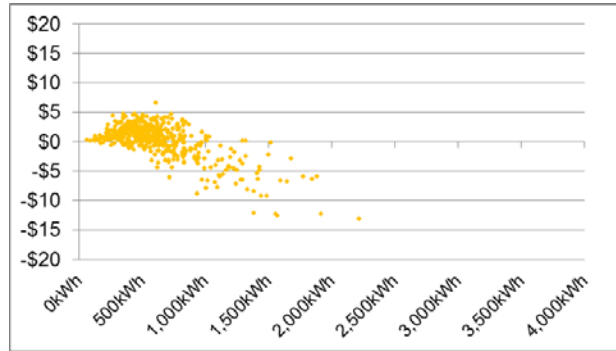


Figure SWW-D-31
2018 Control/General Population
Modified RE-TOU
Average Monthly Bill Impacts %

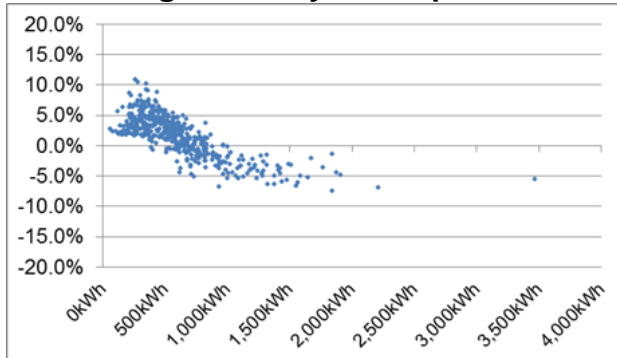
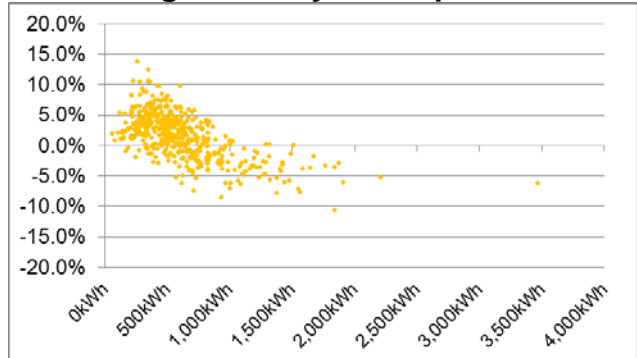


Figure SWW-D-32
2018 Control/General Population
Modified RE-TOU
Average Monthly Bill Impacts %



1 **Q. HOW WILL THE MODIFIED RE-TOU RATES IMPACT CUSTOMERS WITH**
2 **NET METERED SOLAR?**

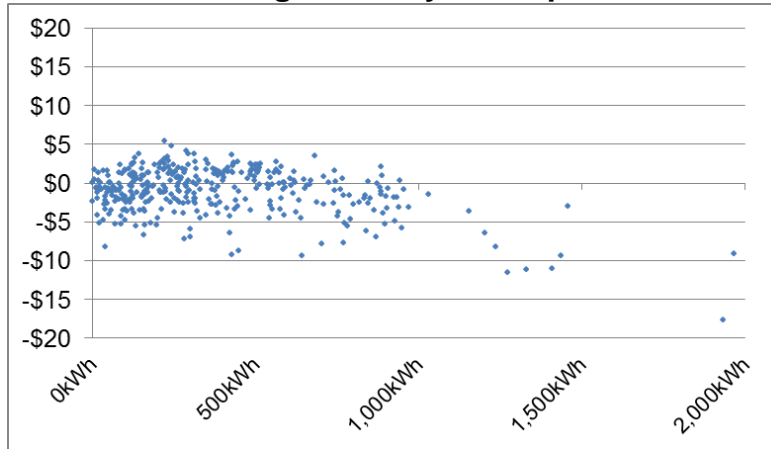
3 A. In general, net metered customers will see smaller bill increases or larger bill
4 decreases than the average residential customer. I repeated the bill impact
5 analysis for net metered customers in the RE-TOU Trial. For 2018, I was able to
6 identify 450 customers with load data covering the entire year. The average net
7 usage for these customers was only 336 kWh per month compared to average

1 usage of 646 kWh for the Control/General Population group. The bill impact
 2 analysis showed an average savings of \$3.53 per month for the solar net
 3 metered customers, in comparison to the average savings of \$0.20 for the
 4 Control/General Population group. The following table and figures provide the
 5 results of this analysis.

6 **Table SWW-D-12 – Bill Impacts 2018 Solar Net Metered**

	Count	Average Usage	Average Monthly Bills		Average Bill Impacts	
			Schedule R	Modified RE-TOU		
Total	450	336kWh	\$37.94	\$36.20	-\$1.74	-4.6%
Bil Increases	159	305kWh	\$34.36	\$35.82	\$1.46	4.2%
Bil Decreases	291	353kWh	\$35.19	\$33.54	-\$1.65	-4.7%

7 **Figure SWW-D-33 – Average Monthly Bill Impacts Solar Net Metered**



8 **Q. WHY ARE BILL SAVINGS LARGER AND MORE FREQUENT FOR SOLAR**
 9 **NET METERED CUSTOMERS?**

10 The bill savings are larger and more frequent for net metered solar customers because
 11 they are benefiting from the elimination of the tiered rates currently in Schedule R. In
 12 general, customers with solar net metering have larger gross energy usage than
 13 average customers and like all high use customers they will benefit from the elimination

1 of the higher Tier 2 charges. The Modified Schedule RE-TOU rates actually result in
2 smaller bill savings from net metering than the current Schedule R, but the smaller solar
3 benefit is more than offset by the large benefit from elimination of the tiered rate
4 structure.

VIII. TARIFF CHANGES

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Q. PLEASE DESCRIBE THE CHANGES TO EACH OF THE TARIFFS INCLUDED IN THIS SECTION OF YOUR TESTIMONY AND WHY THE COMPANY IS PROPOSING THESE CHANGES.

A. In the following section, I provide an overview of the changes to the applicable tariffs, discuss the Company’s reasons for proposing these changes, and explain why such changes are reasonable and should be approved by the Commission as part of our implementation of Modified Schedule RE-TOU. Clean and redlined versions of all tariff sheets are included as Attachments SWW-3 and SWW-4, respectively.

Q. WHAT CHANGES ARE BEING MADE TO SCHEDULE RE-TOU?

A. As reflected in the redlines in Attachment SWW-4, Schedule RE-TOU, is being modified to:

- Change the rates and make Modified Schedule RE-TOU the default rate structure for residential customers over time; transitioning Trial participants to Modified Schedule RE-TOU when it becomes effective on January 1, 2021;
- Remove Trial program specific provisions (such as early adopter, hold harmless provisions, and limits to participation);
- Change the time-of-use rate from year round to summer only (June – September);
- Modify the On-Peak, Shoulder, and Off-Peak periods;
- Decrease the On-Peak to Off-Peak price ratio from 2.4: to 1 to 2: to 1;
- Add a Medical Exemption rate for RE-TOU;

- 1 • Remove the ECA Time-of-Use provision;⁸
- 2 • Include the Load Meter charge and provisions previously on Schedule R
- 3 for customers with distributed energy storage systems; and
- 4 • Incorporate transition of special conditions, monthly minimum, and service
- 5 period language from Schedule R.

6 **Q. WHAT CHANGES ARE BEING MADE TO SCHEDULE R?**

7 A. The Company is adding an availability section to explain that customers will only
8 be served under the Schedule R until such time that Advanced Meter deployment
9 is complete in their area, after which service under Schedule R will no longer be
10 available, and the residential customer will be automatically transferred from
11 Schedule R to Modified Schedule RE-TOU. The customer will be notified of the
12 transfer before the first billing cycle under Schedule RE-TOU.⁹ Once all
13 residential customers have been migrated to Modified Schedule RE-TOU, we will
14 make an appropriate filing to cancel Schedule R.

15 **Q. WHAT CHANGES ARE BEING MADE TO THE MEDICAL EXEMPTION**
16 **PROGRAM (“MEP”) TARIFF?**

17 A. The Company is proposing to update the MEP to include the Modified Schedule
18 RE-TOU. These updates are to the applicability and availability sections of the
19 MEP tariff. The current MEP is applicable to Residential General (Schedule R)
20 customers that qualify under the Commission Rules to be medically exempt from
21 tiered rates. It is appropriate to allow these customers to remain on the Medical

⁸ The Company is proposing to change the ECA applicable to Schedule RE-TOU from a conventional time of use rate to a percentage that is applied to time of use base energy charges.

⁹ Ms. Wozniak explains the customer education and communication that will occur for the transition to the Modified RE-TOU rate.

1 Exemption rate if their medical condition requires On-Peak usage similar to the
2 Tier 2 usage. However, these customers may be better situated if they have
3 flexibility to use energy during Off-Peak or Shoulder periods. The MEP for tiered
4 rates will be discontinued when all customers have been transitioned to RE-TOU.
5 The Company will modify the tariffs accordingly prior to this date.

6 **Q. WHAT CHANGES ARE BEING MADE TO THE ELECTRIC RATE RIDERS?**

7 A. The Company is proposing to modify the following riders such that the rate
8 applicable to the Modified Schedule RE-TOU is a percentage adjustment
9 applicable to base energy charges, rather than a per kilowatt hour charge:
10 DSMCA, PCCA, ECA, TCA, and CACJA. This requires changes to the Rate
11 Design, Definition, and Rate Schedule sections of the riders to explain that
12 customers on Modified Schedule RE-TOU will be billed on a percentage basis
13 applicable to base energy charges. Earlier in my Direct Testimony I explain how
14 this allows the rate riders to exhibit the same hourly price variation as the base
15 rates. Additional changes were made to the ECA to remove the Trial from the
16 "Time-of-Use ECA Factors Applicability" section, and to add a reference to
17 Modified Schedule RE-TOU in the portion addressing the MEP Cost.

1 **IX. REVIEW OF RE-TOU TRIAL**

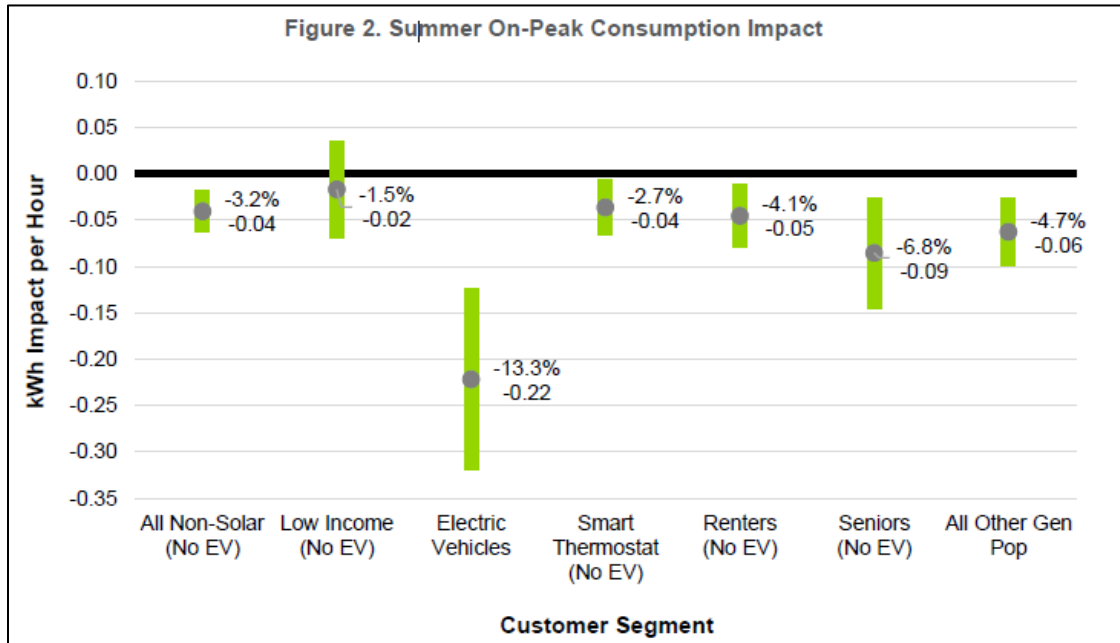
2 **Q. CAN YOU PROVIDE MORE DETAIL ON THE RESULTS OF THE RE-TOU**
3 **TRIAL?**

4 A. The interim Navigant reports are included with Ms. Trammell's Direct Testimony
5 as Attachments BAT-2¹⁰ and BAT-3 (collectively, the "Navigant Reports"). As
6 Ms. Trammell discusses in her testimony, the Company conducted a trial of the
7 Schedule RE-TOU rate from June 2017 through 2019. Ms. Trammell provides
8 an overview of the Navigant Reports associated with the Trial. I focus here on
9 the bill impacts identified in the Navigant Reports. One of the most significant
10 data points from Navigant's analysis in is that residential customers in the
11 Schedule RE-TOU Trial reduced their summer on-peak usage by about 3.2
12 percent. As I indicated previously in my testimony, I used this data point to
13 adjust usage for our Schedule R customers to evaluate bill impacts for these
14 customers under Modified Schedule RE-TOU.

¹⁰ Navigant RE-TOU Trial Evaluation Report 1 (Findings from June 2017 to September 2018). Also referred to as "Navigant Report 1."

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**Figure SWW-D-34 – Navigant Report 2
On-Peak Load Reductions**



2 **Q. WHAT ARE YOUR OBSERVATIONS REGARDING THE NAVIGANT**
3 **ANALYSIS?**

4 A. I believe that Navigant did an excellent job of performing the measurement and
5 verification analysis. Their Randomized Control Trial analysis for estimating
6 customer response to time of use rates was thorough and in most cases resulted
7 in statistically significant evidence of customer response. Navigant also
8 successfully managed the customer surveys. Ms. Simms discusses the survey
9 results in her Direct Testimony.

10 **Q. DO YOU DISAGREE WITH ANY OF THE NAVIGANT FINDINGS?**

11 A. No, I have no reason to believe that any of the calculations or analysis performed
12 by Navigant is incorrect. However, I do believe it is important to view the
13 Navigant report in the proper context.

1 **Q. IS THE MOST RECENT NAVIGANT REPORT COMPARABLE TO THE**
2 **ANALYSIS YOU PRESENT IN OTHER SECTIONS OF YOUR TESTIMONY?**

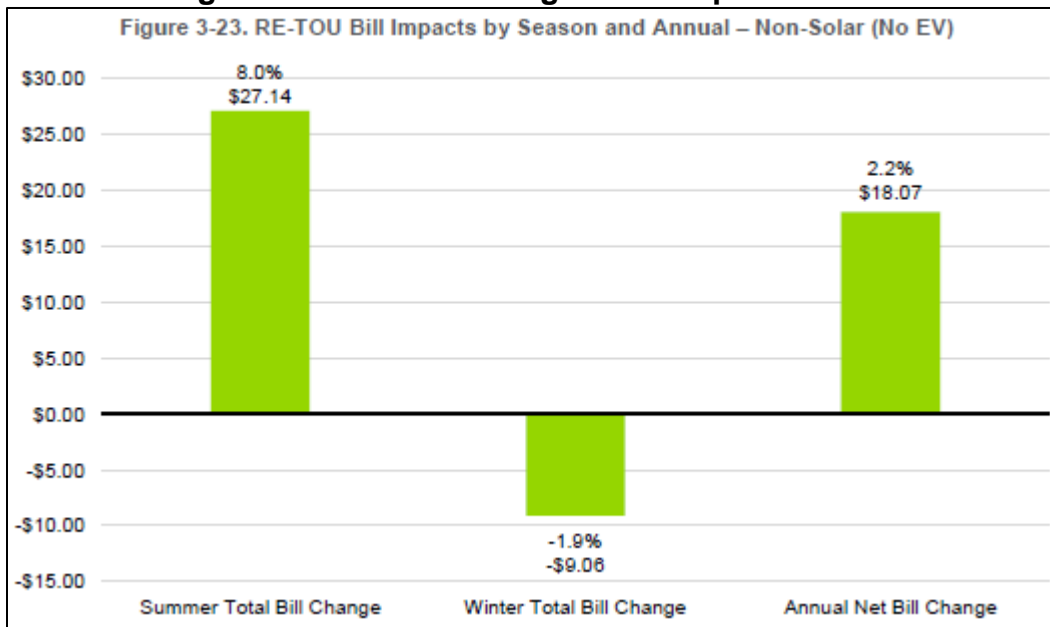
3 A. No. As I previously explained, my analysis was focused on Modified Schedule
4 RE-TOU rates and intended to provide parties with an estimate of the
5 approximate range of bill impacts that may result. I based my analysis on 2018
6 load shapes from the Residential Trial and Pilot, but did not attempt to replicate
7 Navigant's analysis. Navigant was focused on estimating customer response to
8 time of use price signals and measuring the statistical significance of those
9 estimates.

10 **Q. WHAT WERE NAVIGANT'S BILL IMPACT FINDINGS FOR THE RE-TOU**
11 **TRIAL EXCLUDING SOLAR AND EV CUSTOMERS?**

12 A. Navigant Report 2 found that overall, customers' bills had been slightly higher
13 under the RE-TOU Trial. Figure 3-23 from that report indicated that on average,
14 customers' annual bills were 2.2 percent higher under the RE-TOU Trial than
15 they were under Schedule R.

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Figure SWW-D-35 – Navigant Bill Impact Results



2 **Q. DO THESE RESULTS IMPLY THAT MONTHLY BILLS WILL ALSO BE 2.2**
3 **PERCENT HIGHER UNDER THE MODIFIED SCHEDULE RE-TOU RATE?**

4 A. No. As I've previously discussed, the Modified Schedule RE-TOU rate structure
5 is not expected to increase bills for the average customer, nor increase
6 aggregate revenues for Public Service. However, as I demonstrated in Section
7 VII of my testimony, while the average customer's bill should not be impacted,
8 there will be bill increases and decreases for customers who deviate from the
9 average.

10 **Q. WHY DID THE RE-TOU TRIAL RESULT IN AVERAGE BILLS THAT WERE 2.2**
11 **PERCENT HIGHER?**

12 A. While I have not replicated Navigant's bill impact results, I have analyzed the
13 data used in Navigant Report 2 and I have identified significant differences
14 between the assumptions used to design the RE-TOU Trial rate and customer

1 usage that was actually observed in the Trial. In general, the summer Tier 2
 2 usage by customers in the Trial was lower than expected. This implies that the
 3 Trial participants' bills under Schedule R were lower than expected. On the other
 4 hand, the time of use usage by Trial participants was much closer to
 5 expectations. As a result there was a difference between the average bills under
 6 Schedule R and the RE-TOU Trial. Table SWW-D-13 compares the usage levels
 7 that were used in the design of Schedule R and the RE-TOU Trial. It shows that
 8 the largest deviation was for the Summer Tier 2 usage for Schedule R.

9 **Table SWW-D-13 – RE-TOU Trial Rate Design vs Actual Usage**

Schedule R			
	Rate Design	RE-TOU Trial	Difference
Summer Tier 1	20.6%	23.5%	2.9%
Summer Tier 2	17.5%	14.4%	-3.1%
<u>Winter</u>	<u>61.9%</u>	<u>62.1%</u>	<u>0.1%</u>
Total	100.0%	100.0%	0.0%

RE-TOU Trial			
	Rate Design	RE-TOU Trial	Difference
Summer On	5.5%	5.5%	0.0%
Summer Shoulder	16.8%	18.6%	1.8%
Summer Off	13.3%	13.8%	0.5%
Winter On	7.5%	6.9%	-0.6%
Winter Shoulder	28.4%	28.2%	-0.2%
<u>Winter Off</u>	<u>28.5%</u>	<u>26.9%</u>	<u>-1.6%</u>
Total	100.0%	100.0%	0.0%

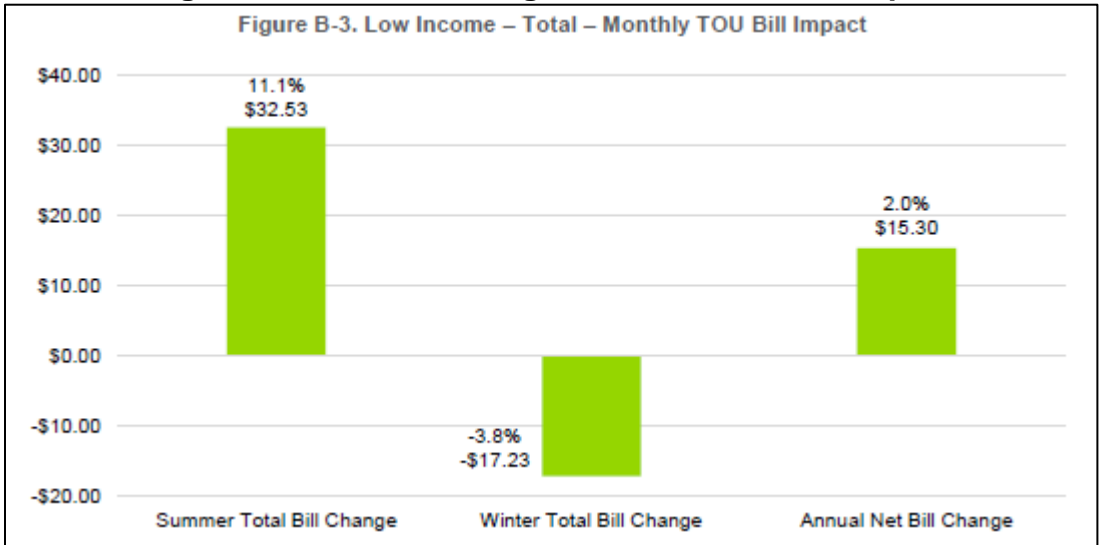
1 **Q. WHAT IS YOUR OVERALL ASSESSMENT OF THE BILL IMPACT RESULTS**
2 **REPORTED BY NAVIGANT?**

3 A. I surmise that in the 2016 Phase II Proceeding No. 16AL-0048E, the Company
4 overestimated the level of Tier 2 usage in the summer, and as a result, the rates
5 for Schedule R were set too low. As a result customers' bills under the Schedule
6 RE-TOU Trial were higher than the bills under Schedule R.

7 **Q. DID NAVIGANT'S MOST RECENT REPORT PROVIDE BILL IMPACTS FOR**
8 **LOW INCOME CUSTOMERS RESULTING FROM SCHEDULE RE-TOU IN THE**
9 **TRIAL?**

10 A. Yes. Navigant reported estimated bill impacts for each of the customer
11 segments studied. The results showed that the impacts on low income
12 customer's bills were 2.0 percent, compared to 2.2 percent for all non-solar, non-
13 EV customers studied.

14 **Figure SWW-D-36 – Navigant Low Income Bill Impact**



1 **Q. WERE THE BILL IMPACTS FOR LOW INCOME UNDER SCHEDULE RE-TOU**
 2 **IN THE TRIAL ALSO IMPACTED BY LOWER THAN EXPECTED TIER 2**
 3 **SALES?**

4 A. Yes, the same issue affected the bill impact analysis for low income customers in
 5 the Navigant analysis, although the difference between the Tier 2 sales in the
 6 rate design and the actual Tier 2 usage by low income customers wasn't as large
 7 as it was for the entire population of Trial participants.

8 **Table SWW-D-14 – Low Income RE-TOU Trial Rate Design vs Actual Usage**

Schedule R			
	Rate Design	RE-TOU Trial	Difference
Summer Tier 1	20.6%	22.3%	1.7%
Summer Tier 2	17.5%	15.3%	-2.2%
<u>Winter</u>	<u>61.9%</u>	<u>62.4%</u>	<u>0.4%</u>
Total	100.0%	100.0%	0.0%

RE-TOU Trial			
	Rate Design	RE-TOU Trial	Difference
Summer On	5.5%	5.5%	0.0%
Summer Shoulder	16.8%	18.3%	1.5%
Summer Off	13.3%	13.8%	0.5%
Winter On	7.5%	7.3%	-0.2%
Winter Shoulder	28.4%	28.5%	0.2%
<u>Winter Off</u>	<u>28.5%</u>	<u>26.6%</u>	<u>-1.9%</u>
Total	100.0%	100.0%	0.0%

1 **Q. DO THE NAVIGANT RESULT INDICATE THAT BILLS FOR LOW INCOME**
2 **CUSTOMERS WILL BE HIGHER UNDER THE MODIFIED SCHEDULE RE-**
3 **TOU RATES?**

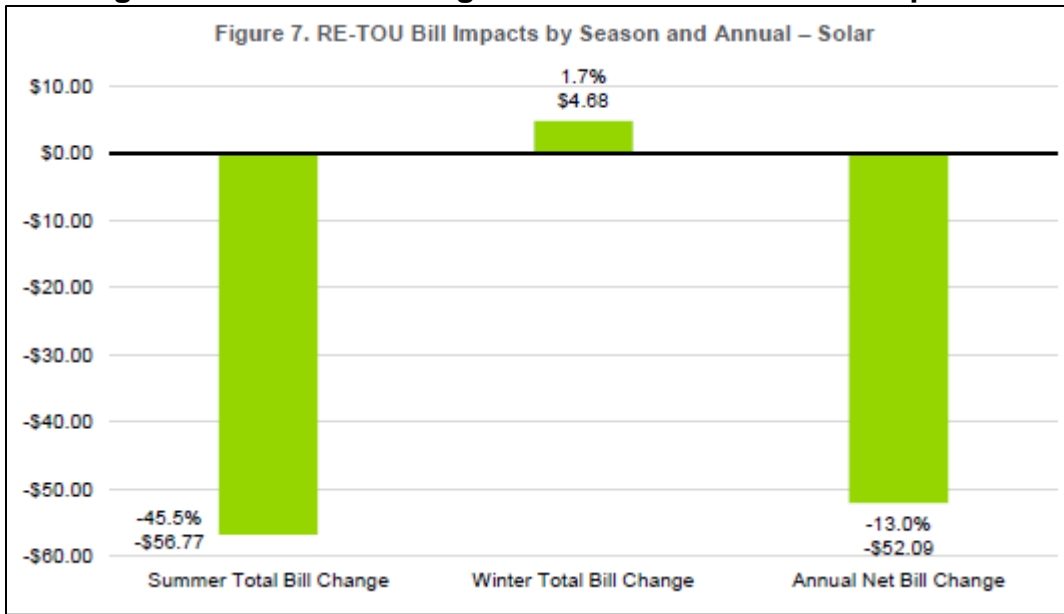
4 A. No. There is no evidence that low income customers use significantly more On-
5 Peak energy which could potentially cause greater bill impacts on time of use
6 rates. In Section VII of my testimony I show that based on sample data the
7 average bill impact for low income customers was 16 cent per month or 0.3
8 percent. The actual impacts on low income customers will be even smaller than
9 that because the low income sample from the Trial had abnormally low average
10 monthly usage.

11 **Q. DOES THE NAVIGANT STUDY SUPPORT YOUR CONCLUSION THAT**
12 **CUSTOMERS WITH NET METERED SOLAR WILL BENEFIT FROM TIME OF**
13 **USE RATES?**

14 A. Yes. Navigant's analysis in its most recent report shows even larger bill savings
15 of customers with net metered solar. This is because the Trial RE-TOU included
16 year round time of use rates which net metered customer were able to take
17 advantage of to further lower their monthly bills. The Modified Schedule RE-TOU
18 rates that the Company is proposing help reduce this impact by limiting the TOU
19 rates to the summer only.

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Figure SWW-D-37 – Navigant Solar Net Metered Bill Impacts



1 **X. CONCLUSION**

2 **Q. PLEASE SUMMARIZE YOUR DIRECT TESTIMONY AND**
3 **RECOMMENDATIONS.**

4 A. In my Direct Testimony I present the rate design for the Modified Schedule RE-
5 TOU rates and discuss how these rates support the Company's long term carbon
6 reduction goals. I estimate potential bill impacts that may result from the
7 transition to time of use rates. That analysis shows that some customers'
8 monthly bills will go up while others go down. But the average customer monthly
9 bill will remain the same as under Schedule R. Time of use rates allow
10 customers the opportunity to limit any negative impacts by shifting their usage to
11 the Off-Peak period. I recommend that the Commission approve the Modified
12 Schedule RE-TOU and rate design. I also recommend that the Commission
13 approve the proposed tariff modifications reflected in Attachments SWW-3 and
14 SWW-4 to my Direct Testimony, inclusive of the proposed changes to the various
15 rate riders, as I described herein, to percentage based charges for our residential
16 customers.

17 **Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

18 A. Yes.

Statement of Qualifications

Steven W. Wishart

I began my employment with Xcel Energy Services, Inc. in 2005, in the Company's Demand-Side Management department. I am currently a Manager in the Pricing and Planning Group. My responsibilities include quantitative analyses, cost allocation, and rate design, and policy support on a number of Colorado regulatory issues.

Prior to taking my current position, I worked for Xcel Energy Services Inc. in Minneapolis, Minnesota, as Director of Resource Planning and Bidding for the Northern States Power region. In that role, I oversaw resource planning and resource acquisition processes for that company.

From 2009 through 2012, I worked for the Company as the Manager of Quantitative Analytics. In that role, I managed a group responsible for conducting long-term analyses of the costs and performance of Xcel's electric generating systems.

Prior to joining Xcel Energy in 2005, I was a PhD candidate in the Department of Applied Economics at the University of Minnesota where I studied energy related topics.