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November 2022:

Dominion Energy **Off-Peak Plan**

We all can agree Thanksgiving is host to many great things - turkey, mashed potatoes, stuffing and more. But as an Off-Peak Plan participant, there's one more thing to be thankful for - no On-Peak Hours!

This Thanksgiving holiday, **Thursday, November 24th**, there is no need to shift your energy usage from on-peak hours. However you choose to spend the holiday, there will be no on-peak hours to think about so sit back, relax, and enjoy the day off. Resume shifting your usage the following day to continue saving on your bill.

PEAK TIMES REMINDER

Now until April 30th, the peak times to avoid higher energy rates are in the morning from 6:00am to 9:00am and in the evening from 5:00pm to 8:00pm. Try using energy outside of those times to save on your bill! Remember, there are no on-peak hours on weekends or holidays.

BILL COMPARISON REMINDER

The bill comparison tool compares what you are paying on the Off-Peak Plan with what you would have paid on your previous rate. It's a quick and easy way to see how much money you are saving or losing on the Off-Peak Plan. Access it by logging into your online account and clicking on Off-Peak Plan. Keep in mind it's best to evaluate your performance over the course of a year - not just month to month.

We're Here to Help

We recognize the challenges many are facing due to the COVID-19 pandemic. We're here to help. If you have fallen behind on your bill, we encourage you to contact us for payment arrangement options.

Payment options to fit your needs | Ways to Save | Assistance programs

Get social. Connect with us. Learn more.

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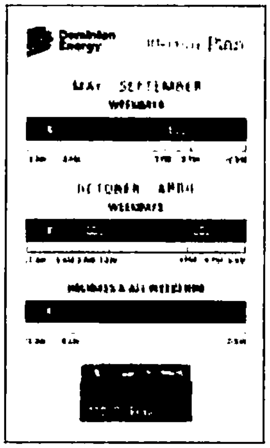
December 2022:

Dominion Energy | Off-Peak Plan

When you first enrolled in the Off-Peak Plan you should have received a magnet that looks like this:



Posting this somewhere visible in your home can be a great tool in helping you remember when to shift your electricity usage to more affordable hours. If you would like an additional magnet as an extra reminder to post throughout your home, please send an email to OffPeak@dominionenergy.com

Need some more reminders? We also have Off-Peak Plan Reminder Tags available on our website. You can print these off, cut them out, and place in multiple spaces throughout your home.

PEAK TIMES REMINDER

[illegible]

BILL COMPARISON REMINDER

[illegible]

We're Here to Help

We recognize the challenges many are facing due to the COVID-19 pandemic. We're here to help. If you have fallen behind on your bill, we encourage you to contact us for payment arrangement options.

Payment options to fit your needs | Ways to Save | Assistance programs

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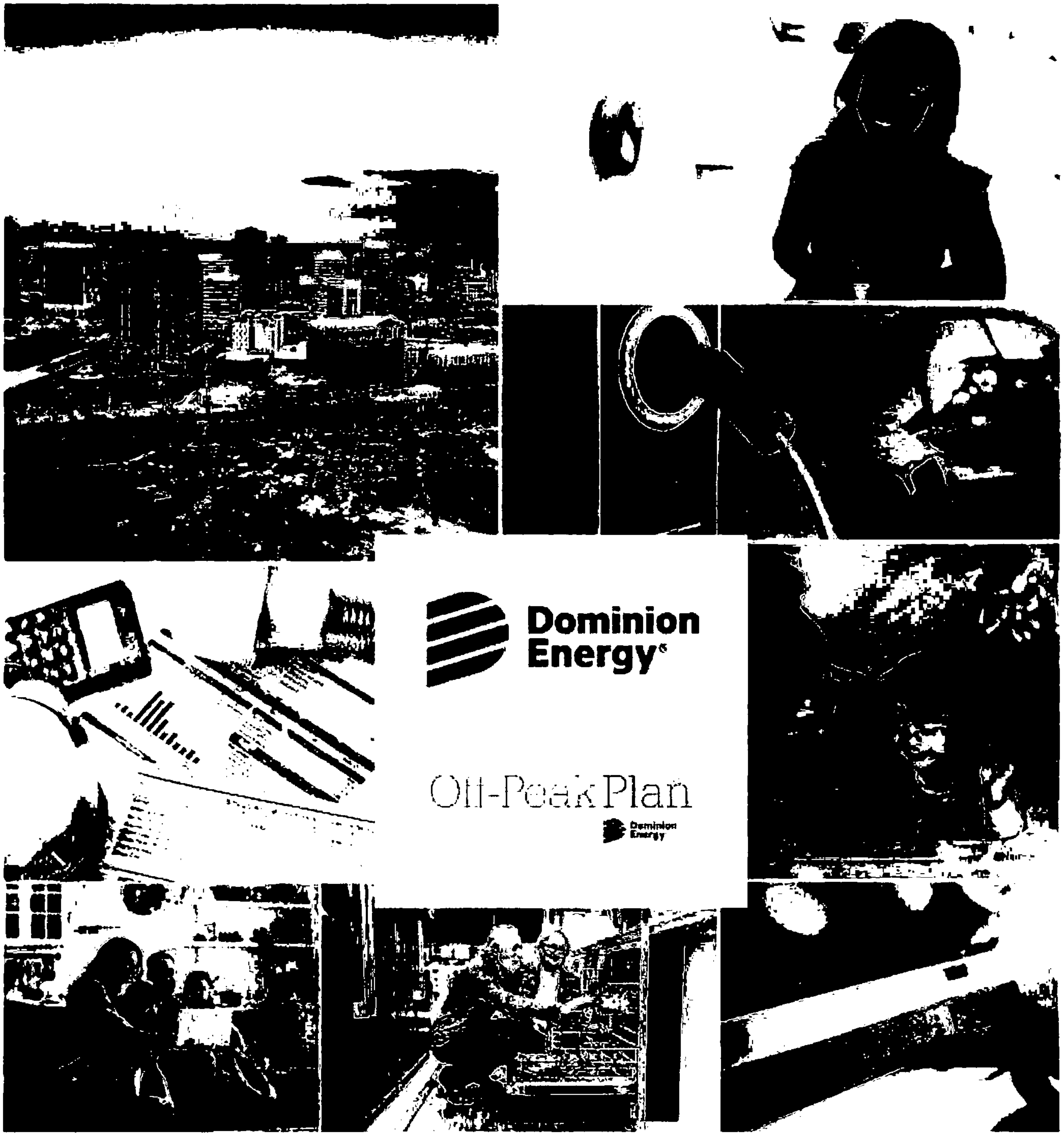

SCHEDULE 1G, RESIDENTIAL SERVICE (EXPERIMENTAL) RATE

2022 ANNUAL PROGRAM EVALUATION REPORT

DNV

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EXECUTIVE SUMMARY

This report is the second in a series of annual evaluation, verification, and measurement (EM&V) reports of the Time-Of-Use Rate Schedule 1G (Experimental) pilot (Off-Peak Plan) launched early in 2021.

Off-Peak Plan

These reports provide Dominion Energy Virginia and its stakeholders with an early indication of customer expectations and experience with the rate. The Commonwealth of Virginia State Corporation Commission (the Commission) approved the Off-Peak Plan in May of 2020.[1] The Off-Peak Plan is available to up to 10,000 customers who have an advanced metering infrastructure (AMI) meter and do not participate in the Company-sponsored demand response (DR) programs or peak-shaving DR programs.

The Off-Peak rate structure provides customers with an opportunity to save money on their electric bill if they shift electricity use from the peak hours to other times of day.[2] From a Company perspective, the Plan needs to optimize customer engagement while balancing customer value. If successful, the rate should result in a load shift that reduces consumption during peak periods while maintaining customer satisfaction among its current and future enrollees.

The 2022 EM&V report presents DNV's findings from the 2022 Summer Off-Peak Plan Customer Experience Survey (Summer Survey) for the program evaluation of the Off-Peak Plan. It is accompanied by the 2022 Off Peak Plan Load and Bill Impact Analysis that examines the electric load shift and bill impacts of enrollees that have AMI interval data spanning 12 months before and at least 12 months after enrollment. The Summer Survey reported here offers insight into the following topics:

- What communication methods are effectively engaging participants?
- How satisfied are participants with the program?
- How well do participants understand the plan?
- Do participants think they are saving money on the program?
- What are participants doing to reduce energy consumption?
- Participant use of technology, particularly smart thermostats, to control their energy bills.

The Summer 2022 survey sample was developed from the pool of enrollees that were active as of September 13, 2022. After removing enrollees that left the 1G rate through natural attrition (i.e., moveouts) or voluntarily unenrollment, those subscribed to Arcadia's community solar program,[3] those missing emails, any enrolled after April 1, 2022, and a randomly sampled of 10% reserve,[4] the remaining sample included 7,747 participants. The survey began on October 10, 2022 and

1 State Corporation Commission, Final Order Approving Experiment, Case No. PUR-2019-002142021, May 20, 2020; Virginia Electric and Power Company's 2021 Annual Report to the State Corporation Commission of Virginia on Residential Time-of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 22, 2021; Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, designated Time-Of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 12, 2019. Tariff of Virginia Electric and Power Company, 1G Residential Service (Experimental)

2 3pm to 6pm in the May-September and 6am-9am and 5pm to 8pm October to April

3 In this case, 158 participants were enrolled in Arcadia's community Solar Program and the customer email address was linked to their Arcadia account and is not linked to the customers email address (e.g., sz-786572356@a.arcadiapower.com).

4 10% of eligible participants were held back to mitigate a low response rate or unanticipated problems during the survey deployment (n=863).

closed on November 17, 2022. This report is based on 1,076 responses: 903 completed surveys and 173 mostly completed surveys for a response rate of 14%.

Key findings

The Plan is successfully achieving its major objectives of customer satisfaction, bill reduction, and peak reduction.

- 74% of survey respondents are satisfied with the plan (4 or 5 on a 5-point satisfaction scale).
- 79% of respondents accurately identified the summer rate schedule.
- 85% of respondents say they often or sometimes avoid using energy during peak hours, and 94% say they intend to respond to peak hours in the future by reducing or delaying energy use.
- 60% of respondents selected "with a little effort", they can save money on the rate. Another 18% said they can save money "with a lot of effort".
- 59% of survey respondents think their energy bill is lower than their previous rate, and another 32% think it about the same.
- According to the 2022 Off-Peak Plan Load and Bill Impact Report, participants shifted 9.4% of their load during summer peak hours, 2.9% during winter peaks.

Survey respondents are using automation and choosing the less inconvenient behaviors to reduce energy consumption.

- 79% delay running large appliances during peak hours.
- 64% adjust their thermostat temperature to reduce heating and cooling load during peak times. 48% use thermostat automation or programming; another 29% adjust their thermostat a few times per day.
- 61% report turning off some lights during peak hours.
- Respondents selected other behaviors less frequently: cover windows (34%); delay cooking (34%); delay showers (29%); powering down computers (25%); shutting down electronics (21%). These behaviors require more manual steps, or create an inconvenience (e.g., eating later) relative to the more frequently reported behaviors.

Respondents earning less than the state median income (household income <$75,000) have less access to automated technology.

- 40% of respondents who earn less than the state median income say they do not have smart devices or a programmable thermostat, compared to only 23% of respondents earning the state median income or more.
- Barriers more commonly cited by respondents earning less than the state median income were lack of automation (28% versus 19% of households earning the state median or more), and safety or medical needs (11% versus 6% of households earning state median or more).
- Respondents who earn less than the state median income were more likely to report taking manual actions (e.g., turn off cooling system, alternate cooling system) and less convenient actions (e.g., delay showers, delay cooking, powering down computers, powering down electronics) than higher-income earners.

Respondents place a higher value on discomfort than manual or automated behaviors.

- 26% said they would need to realize at least $30/month in savings to be "a little uncomfortable".
- 20% valued making energy saving upgrades to their home at $30/month.

- 19% valued manual effort (e.g., delaying use of major appliances) at $30/month.
- 18% valued automation (e.g., reprogram thermostat) at $30/month.

Survey respondents prefer email communications.

- 82% reported reading program emails.
- Fewer than half the respondents chose another communication method such as the online customer portal (32%); text messages (26%); program website (21%).
- There is some potential for bias on this response because survey invitations were sent via email.

Recommendations

Increase the use of email to proactively inform participants about the Plan.

- Whether or not participants are saving money on the plan was the most frequently identified information that respondents wanted to know more about (49%). Emails should direct customers to the online portal where they can look up the difference in their bills. If possible, include an individualized report of how much the customer's bill differs from what it would have been on the previous rate in the email itself.
- Include more tips for how to reduce energy consumption during peak hours. This was the second most requested information (36%). Including a range of typical annual savings from doing the less common behaviors such as delaying cooking, delaying showers, powering down computers, and powering down electronics might encourage more participants to engage in those behaviors.
- Include reminders of the hourly rate schedule and kWh cost at those times. 29% of all respondents asked for more information about how much electricity costs during the peak, off-peak, and super-peak hours, and 21% of respondents were not able to correctly identify the summer rate schedule.
- Dominion Energy might want to pilot alternative email messaging with a subset of participants before rolling out to all of them.

Expanding or creating programs that provide free smart thermostats to lower income customers to help reduce the gap in access to this technology.

Smart thermostats, especially those whose algorithms can adjust to the specific hours of a time-of-use rate plan, represent a low-effort way of getting benefit from the Plan. Wealthier households have better access to this technology, and thus can get more for less from the Plan.

DNV

1 INTRODUCTION

This report is the second in a series of annual evaluation, verification, and measurement (EM&V) program evaluation reports of the Off-Peak Plan launched early in 2021. The Final Order of the Commonwealth of Virginia State Corporation Commission (the Commission) approved the Dominion Energy Virginia (Dominion Energy) Time-Of-Use Rate Schedule 1G (Experimental) pilot (Off-Peak Plan).[5] These reports provide Dominion Energy Virginia and its stakeholders with an early indication of customer expectations and experience with the rate.

Subject to a participation limitation of 10,000 accounts, the Off-Peak Plan is available to customers who have an advanced metering infrastructure (AMI) meter and do not participate in the Company-sponsored DR programs or peak-shaving DR programs. A customer who unenrolls from the Plan within 12 months may not re-enroll for the next 12 months.

The Off-Peak Plan has two seasons: Summer (May 1–September 30) and Winter (October 1–April 30).

The Off-Peak rate structure provides customers with an opportunity to save money. From a Company perspective, the plan needs to optimize customer engagement while balancing customer value. If successful, the rate should result in a load shift that reduces consumption during peak periods while maintaining customer satisfaction among its current and future enrollees.

The 2022 EM&V report presents DNV's findings from the 2022 Summer Off-Peak Pan Customer Experience Survey (Summer Survey) for the program evaluation of the Off-Peak Plan. It is accompanied by the 2022 Off Peak Plan Load and Bill Impact Analysis that examines the electric load shift and bill impacts of enrollees that have AMI interval data spanning 12 months before and at least 12 months after enrollment. The Summer Survey reported here offers insight into the following topics:

- How well do participants understand the plan?
- What communication methods are effectively engaging participants?
- Do participants think they are saving money on the program?
- How satisfied are participants with the program?
- What are participants doing to reduce energy consumption?
- To what extent participants are using technology, particularly smart thermostats and electric vehicles, to control their energy bills?

The following sections describe the survey results across five segments: All respondents, and the subset of respondents that are smart Wi-Fi enabled homes, solar-user homes, EV-user homes, and at income levels above and below $75,000.

The analysis is supplemented with U.S. Census data, Dominion Energy Conservation Program data, and third-party data describing household occupancy and income. The next section describes the population of Off-Peak Plan participants (Plan participants) followed by the survey results.

5 State Corporation Commission, Final Order Approving Experiment, Case No. PUR-2019-002142021, May 20, 2020; Virginia Electric and Power Company's 2021 Annual Report to the State Corporation Commission of Virginia on Residential Time-of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 22, 2021; Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, designated Time-Of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 12, 2019. Tariff of Virginia Electric and Power Company, 1G Residential Service (Experimental)

1.1 Off-Peak Plan customers

The rate of customer enrollment exceeded initial expectations. When defining EM&V goals, the Company's 2019 application cites participation goals of 5,225 customers by July 31, 2022, and 6,600 by the end of 2022.[6] At the end of 2021, there were 9,800 active Plan participants and the Plan reached its enrollment goal of 10,000 participants approximately three years ahead of schedule. The Company maintains a waiting list and adds new participants pending unenrollment or natural attrition. The report differentiates between several categories of Dominion Energy customers who have engaged with the Off-Peak Plan:

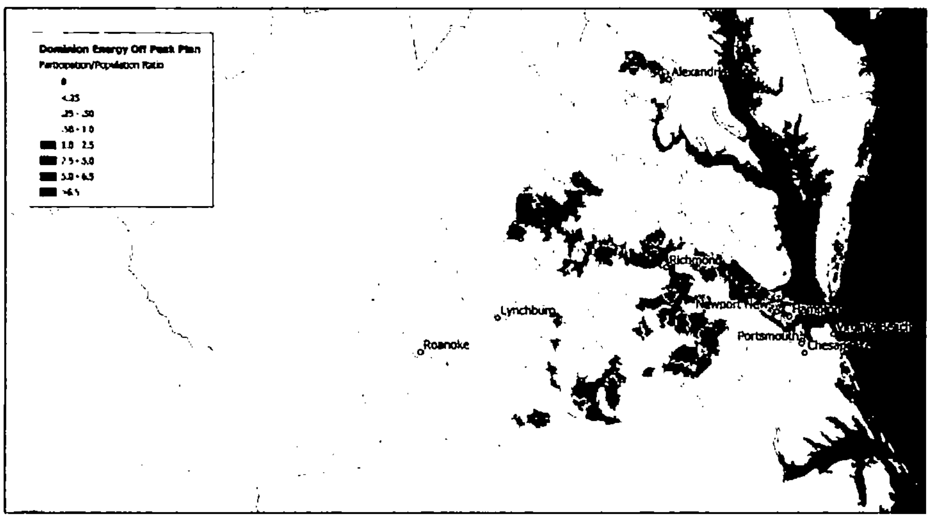
- **Enrollees** are customers who enrolled in the program between January 29, 2021, and September 13, 2022
- **Participants** are enrolled and active on the Off-Peak Plan rate as of September 13, 2022
- **Unenrolled** are enrolled participants that unenrolled from the Off-Peak Plan between February 25, 2021, and September 13, 2022, either voluntarily or through natural attrition
- **Respondents** are participants who responded to the Summer 2022 Dominion Energy Customer Experience Survey (Summer Survey)

Of 12,486 enrollees, 8% (1,034) have voluntarily unenrolled. Most participants unenrolled soon after they joined the program because they didn't see evidence of bill savings. Of unenrolled participants, 36% left the program within four months and an additional 29% between four and seven months. Only 18% of all unenrolled left the program after one year. 12% (1,492) of enrollees left the program due to natural attrition such as a change in account status. Although all the specific reasons are unknown, moveouts are the predominant driver of this attrition.

1.2 Location

The geographical distribution of Plan participants is dependent on the availability of AMI metering. The participant map Figure 1-1 shows the distribution of Plan participants given as a ratio between Plan participants in each zip code relative to the population in that zip code (n=9896). More customers will have access to the Plan as the rollout of AMI meters proceeds and enrollment expands.

Figure 1-1. Geographical distribution of Plan participants given as a ratio between Plan participants in each zip code relative to the population in that zip code



[6] Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, p. 12.

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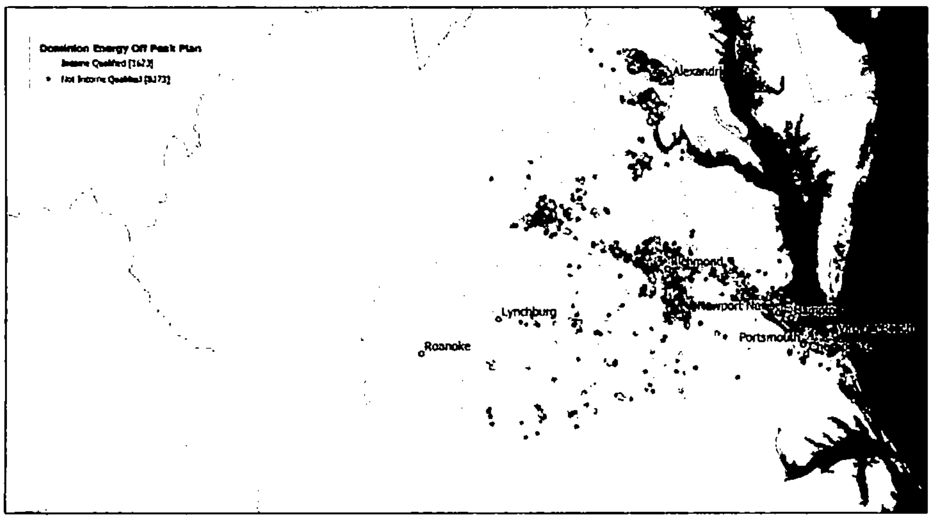
Zip codes with no participants are white. Zip codes with a ratio less than 1:1 (<1.0) are shades of red, and zip codes with a ratio over 1.0 are shades of green. A ratio over 1.0 indicates there is more participation in that zip code than one would expect based on population. A ratio less than 1.0 indicates that there is less participation in that zip code than one would expect based on the amount of the state's population living there. For example, zip code 23509 (in Norfolk) had ~0.64% of the population participate in the Off-Peak Plan while that zip code's population is ~0.16% of the state's overall population; therefore, there is a 4:1 ratio (4.0) between the participation rate and population. In zip code 23146 (Rockville), ~0.04% of the Off-Peak Plan participants live here and the zip code has ~0.04% of the state's overall population; this results in a 1:1 ratio (1.0).[7]

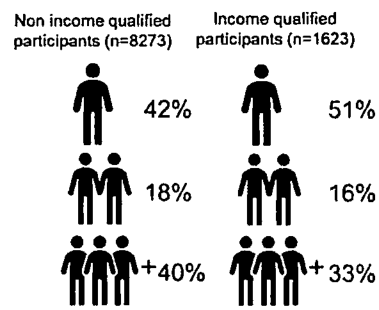
The second map (Figure 1-2) shows the same participants according to income qualification. Non-income-qualified participants are shown in purple (n=8273) and income-qualified participants are shown in green (n=1623). 16% of participants fall into the income qualified (IQ) category as defined by the Virginia Department of Housing and Community Development (Virginia DHCD).[8]

Figure 1-2. Distribution of non-IQ and IQ participants



1.3 Household occupancy

Non-IQ participants are predominantly split between single-person and three-or-more person households. The subset of IQ participants households lives in predominantly single-person households.



7 The map utilizes participant address data (n=9896) and public ZIP level population data from the U.S. Census Bureau's American Community Survey data (2019). All other geospatial data (boundary layers, etc) are publicly available from data.census.gov. The map was created using ERSI's ArcMap 10.8 and QGIS3's software suites. The map shows participants as of 09/13/2022. 64 participants are not included due to zip code mismatches to census data.

8 Virginia Department of Housing and Community Development (DHCD), Revised Income Limits for Virginia Weatherization Assistance Program (Information Notice 03-2022) March 2022. Income qualification is based on income and size of the family unit.

2 SAMPLE DEVELOPMENT AND SURVEY DEPLOYMENT

The following section describes how the survey sample was developed, which enrollees were eligible for the survey, survey response rates, and a description of the survey deployment.

2.1 Survey eligibility and disposition

The survey sample was developed from the pool of participants that were active as of September 13, 2022. Enrollees that left the 1G rate through natural attrition (i.e., moveouts) or voluntarily unenrolled from the Plan were removed from the sample frame. Participants were also removed if they were subscribed to a community solar program, had missing emails, were enrolled after April 1, 2022, or were included in the random sample of 10% of participants held in reserve.[9] The remaining sample included 7,747 participants. Figure 2-1 shows the category and number of enrollees that were used to determine the sample of survey-eligible participants.

Of the of 7,747 participants in the eligible sample, 1076 responses are reported here. Participants completed 903 surveys, and an additional 173 surveys were substantially completed. Accounting for undelivered emails, no response, and eligibility to complete the survey, the response rate was 14% (Figure 2-2).

Figure 2-1. Categories of enrollees used to define the survey sample

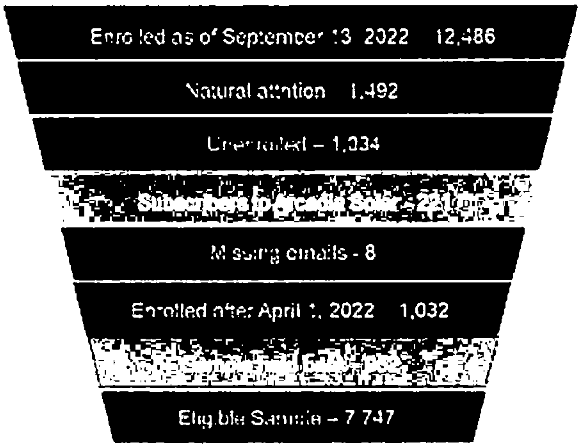
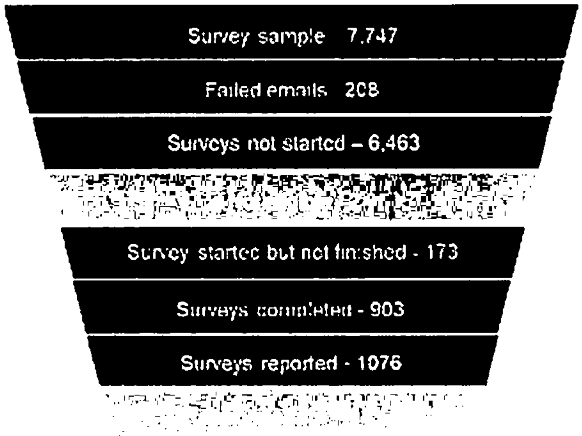


Figure 2-2. Survey disposition



2.2 Fielding the survey

The EM&V Plan specified annual winter and summer surveys with a goal of 300 completed surveys per season, or 600 per year by year three to yield a sufficient sample to achieve 90/10 statistical precision.[10] Due to the higher-than-expected enrollment rate, the EM&V Plan was accelerated, and the survey was sent to the census of all eligible participants.

[9] In this case, 158 participants were enrolled in Arcadia's community Solar Program and the customer email address was linked to their Arcadia account and is not linked to the customers email address (e.g., sz-786572356@a.arcadiapower.com). 10% of eligible participants were held in reserve to mitigate a low response rate or unanticipated problems during the survey deployment (n=863)

[10] DNVGL Evaluation Plan for Rate Schedule 1G, Dominion Energy Services, Inc. October 2020.

DNV prepared an online survey using the Qualtrics web-based platform.[11] A survey invitation was emailed to 7,702 participants beginning on October 10, 2022, and the survey closed approximately one month later. The survey invitation is shown in Figure 2-3.

DNV applied a two-phase survey deployment. 10% of the sample received the survey invitation on October 10th, 2022, and the remaining 90% were delivered by October 18. This two-phase deployment approach allowed DNV to review preliminary results and amend the survey for clarity as warranted. Non-responders received up to two reminder emails to encourage participation.

The survey closed on November 17, 2022. Respondents who were unaware of their enrollment in the Off-Peak Pan (n=2) were thanked for their response and were not presented with remaining questions.

Figure 2-3. 2022 Summer Off-Peak Pan Customer Experience Survey invitation

From: Dominion Energy Off-Peak Plan <OffPeakPlan@cemailserver.com>
Sent: Tuesday, October 13, 2022 10:13 AM
To: Andrea Leghe
Subject: We're Listening – Tell Us About Your Experience with Dominion Energy's Off Peak Plan

Dominion Energy

Dear Andrea,

How has your experience been with Dominion Energy's Off-Peak Plan? Dominion Energy is seeking feedback on customers' experience with the Off-Peak Plan. Dominion Energy requests your input and perspective in the "Summer User Experience Survey". This brief 10 minute online survey will help us identify if this program is meeting your expectations and helping achieve your energy saving goals. If you were one of the customers who previously participated in the customer "Enrollment Survey" we acknowledge and thank you for your continuous feedback.

To get started, click this link: Take the Summer Experience Survey

Your answers will be held in the strictest confidence. The information you provide will be combined with information from other households that complete the survey. Individual household data will not be published. The results are reported in summaries such as group averages, percentages, and other general statistics.

We need your help. DNV Energy is the research provider retained by Dominion Energy to help administer this survey. DNV Energy is a company that specializes in energy research and analysis. If you have any concerns about the legitimacy of this survey, you can contact Dominion Energy at offpeak@dominionenergy.com

Thank you for helping to improve programs in Virginia

Amalia Berry
Program Manager

To learn more about the voluntary rate visit: Off-Peak Plan

CONFIDENTIAL COMMUNICATION: If you are not the intended recipient of this email message, any review, distribution or copying of this email is strictly prohibited. If you have received this email in error, please immediately delete this message and destroy any copies. If you would like to unsubscribe from this survey request, click on this link: [illegible]

[11] Qualtrics XM

3 SUMMER SURVEY RESULTS

In the next sections, we present the results from the 2022 summer survey that highlight customers' responses to and their overall understanding of key components of the program. We've organized these results into four main sections and provide a set of high-level findings and recommendations in each section.

We segmented survey respondents into four areas; smart Wi-Fi enabled homes, solar-user homes, EV-user homes, and at income above and below $75,000 to better understand and identify statistically significant differences (SSD) among the respondents. Our team also compared selected characteristics of survey respondents to all Dominion Energy's residential customers using the "Dominion Energy Residential Home Energy Use Survey" (Residential Home Energy Use Survey results).[12]

This is followed by an analysis of respondent awareness and understanding of distinct features of the Plan. We also present respondents' use of program resources, such as, communication tools, the online portal, reasons they may not be using the resources, and their usefulness. Next, we report on which elements of the Plan they would like to learn more about, the benefits of participation, and overall participant satisfaction. We explore whether they perceive they are saving money and if not why, the level of effort to save money, and how much money they need to save to make it worth their while.

In the last two sections, we present how respondents took to the Plan based on new and potential behavior changes and smart technology. Specifically, we ask what actions or household habits they have undertaken to save money. We also explore the barriers preventing respondents from modifying behavior and achieving deeper load shifts.

Because smart technology can help individuals reduce their energy use during Off-Peak hours, we anticipate that customers with enabling technologies would have an easier time participating and staying in the Plan. These technologies offer participants the convenience to enable them to live their lives in a way that sync their energy use to be lowest during peak hours. In this last section, we explore to what extent customers use smart thermostats and to what extent are customers participating in the program to reduce their transportation costs and charge their vehicles during off peak hours.

3.1 Customer segmentation and housing characteristics

The following section provides demographic data for participants of the survey.

3.1.1 Customer segmentation

We identify participant area of interest based on themes among respondents and then segment the survey respondents into four groups. We compared statistically significant differences at 95% confidence levels. The segmented groups are then compared to each other and respondents overall (total respondents). Although not mutually exclusive, the four sub-groups are useful for characterizing respondents' motivations (Figure 3-2).

[12] Dominion Energy Residential Home Energy Use Survey, 2019-2020. The home energy use survey updates similar studies conducted for Dominion Energy's 2013 and 2016 Market Characteristics Studies. These surveys provide data about the energy consumption characteristics of customer end uses and energy consumption.

Figure 3-1. Customer segmentation

Respondents: Participants who took the survey.
The results include responses from 1078 participants. 903 respondents who completed the survey and 175 respondents who answered some but not all survey questions.

Smart homes: Participants with smart Wi-Fi enabled devices including smart thermostats, smart plugs, smart appliances, and/or home energy management systems. The starting sample is 441 Smart home and 621 non-smart homes respondents. When describing "smart homes," we are referring to 441 participants.

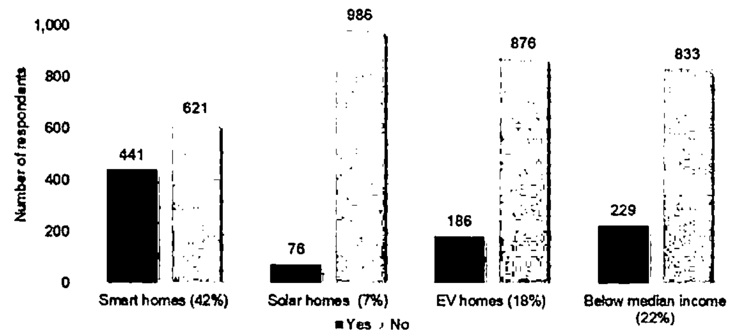
Solar homes: Respondents with photovoltaic solar panels installed on the home.
The starting sample is 75 solar and 986 non-solar respondents. When describing "solar homes," we are referring to 75 solar home respondents.

EV homes: Respondents with either a plug-in or hybrid plug-in electric vehicle who charge at home.
The starting sample is 186 EV and 876 non-EV respondents. When describing "EV homes," we are referring to 186 respondents.

Below median-income homes: Participants who earn less than of $75,000.[13] The starting sample is 229 below median-income earners and 833 above-median income earners. When describing "below median-income homes," we are referring to 229 participants.

Figure 3-2 illustrates the number of respondents by the four segmented groups. The table is interpreted as e.g., "441 respondents have one or more Wi-Fi-enabled devices and 621 did not, etc.

Figure 3-2. Number of respondents by Wi-Fi-enabled homes, solar-user homes, EV-user homes, and income (n=1062)



3.1.2 Housing characteristics and demographics

The respondents answered a series of questions to characterize their demographics, household energy use equipment such as heating, water heating fuel types, and end uses. Figure 3-3 below shows the general characteristics of respondents' homes and compares them to the "Residential Home Energy Use Survey," where applicable. Relevant contrasts identify similarities and differences between Off-Peak Plan participants and Dominion Energy's overall residential population.

[13] State median household income in the 2021 ACS 5-year estimate is $80,615. https://www.census.gov/quickfacts/fact/table/VA/AFN120217

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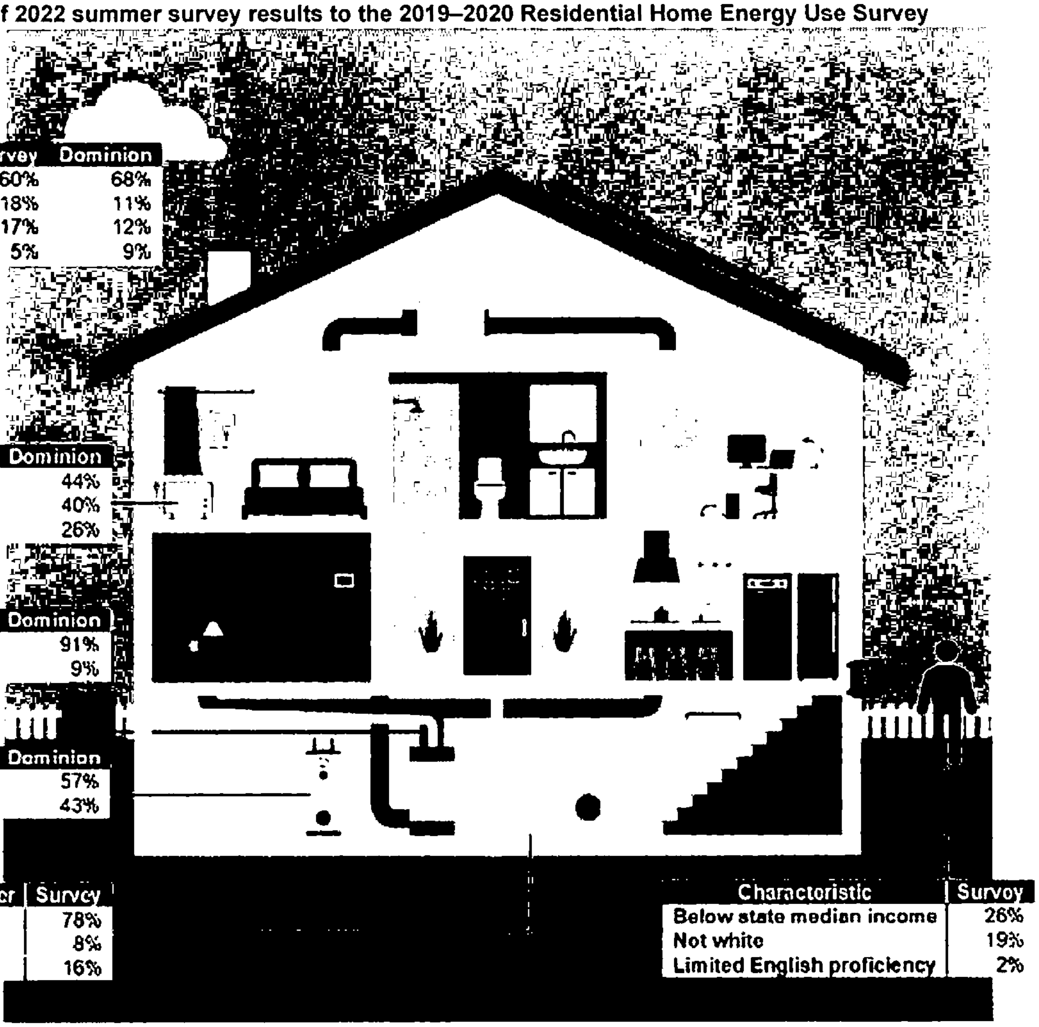
The results show, how housing types differ with more attached and apartment dwellers participating in the Plan as well as a higher share of electric heat and gas water heating users as compared to the general Dominion Energy residential population.

Figure 3-3. Comparison of 2022 summer survey results to the 2019–2020 Residential Home Energy Use Survey



Building type	Survey	Dominion
Single family detached	60%	68%
Single family attached	18%	11%
5+ units	17%	12%
Other	5%	9%

Heating fuel	Survey	Dominion
Electric	53%	44%
Gas/Propane/Oil	35%	40%
Other/Don't know	22%	26%

Air conditioning	Survey	Dominion
Central forced air	92%	91%
Other/None	8%	9%

Water heating	Survey	Dominion
Electric	52%	57%
Gas/Other	48%	43%

Clothes dryer	Survey
Electric	78%
Gas/Other	8%
None	16%

Characteristic	Survey
Below state median income	26%
Not white	19%
Limited English proficiency	2%

3.1.3 Home energy upgrades

Participants have been making home improvements with a little under half (47%) having purchased one or more home upgrades and 12% having purchased an EV in the last year. We included this inquiry to support future load and bill impact analyses as they are expected to impact home energy use in year two and beyond.

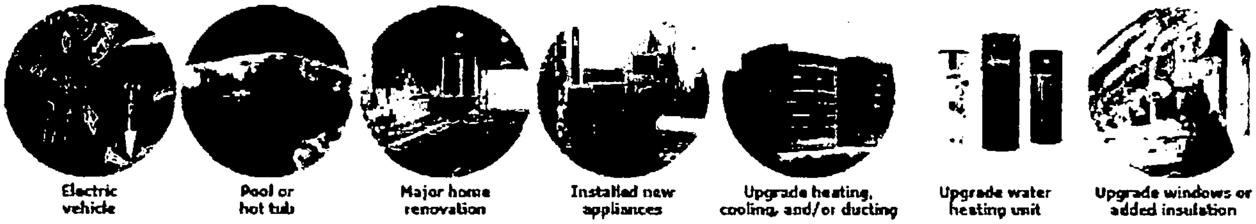
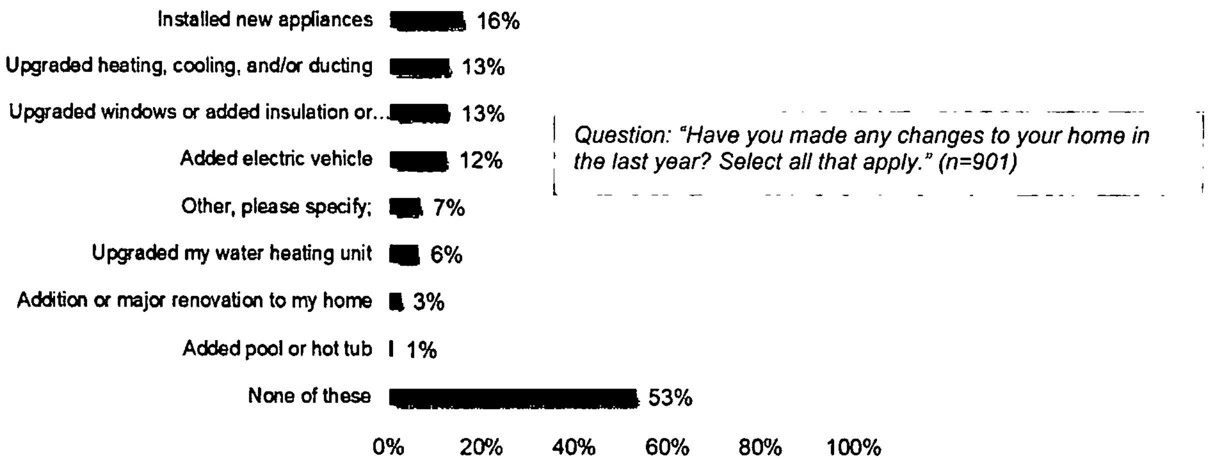


Figure 3-4. Changes to homes in the last year



4 UNDERSTANDING FEATURES IN THE OFF-PEAK PLAN

The survey included three broad research questions to determine how well customers understand features of the Off-Peak Plan. We've summarized the results below.

Satisfaction

Survey respondents are satisfied with the rate, with 74% giving a satisfaction rating of 4 or 5 on a 5-point scale. Satisfaction will be measured again in March 2023. Concerns expressed by the less than satisfied respondents included: wanting online bill comparisons, too many peak hours during the day and evening, it is too difficult to reduce consumption during winter peak hours, requesting that Dominion Energy provide energy saving equipment such as smart thermostats, and having to rely on information in monthly bills or the website, which were difficult to access and not as informative as desired.

Understanding of seasonal summer and winter peak hours

Overall, respondents have a good understanding of the program – 79% correctly identified the summer period pricing structure. Approximately one-fifth of respondents could not correctly identify the current pricing structure. Approximately 29% of respondents reported they would like to know the cost of electricity during the peak, off-peak, and super off-peak hours, which roughly aligns with the percent who could not identify the current rate structure. Another 13% indicated they would like to know how the summer and winter peaks differ. Another 10% wanted to know the hours of the peak periods. Maintaining frequent messaging will be an important factor for fostering a deeper understanding of the details of the rate.

Use of the education materials and online platform

Most respondents reported reading email communications from the program (82%) and using the online portal (70%). Households earning less than the median income were more likely to say the information on the portal was "completely useful" (68%) than households earning over the median income (57%).

The most frequently mentioned information gap across all respondents was whether they are saving money on the rate compared to the standard rate (49%). While the online portal shows participants the difference in how much energy is saved under this Plan as compared to the standard rate, nearly half of respondents desire this information. Customers would also like more information on what actions they can take to reduce consumption during peak periods (36%).

Perceptions of the rate

Most customers (58%) think they are saving money under this rate, and another 32% think their bills are about the same.

Most customers (60%) expected that saving money on the rate would require a little bit of effort. The number of "natural winners" and "natural losers" was about the same. Only 6% thought they'd save without any changes to behavior (natural winners) and 5% thought they would lose money on the rate despite behavior changes (natural losers).

Recommendations

Because email is the dominant source of information about the program, Dominion Energy should focus on using it to increase customer understanding of the program. One of the themes expressed by less than satisfied customers was that it was too difficult to get information about their bills. Emphasis on email communication represents a way for Dominion Energy to proactively communicate with participants and reduce the level of effort required to get information.

Customized emails that include a comparison of each participant's bills to what they would pay on the standard rate and links to Plan videos and the online portal should be considered.

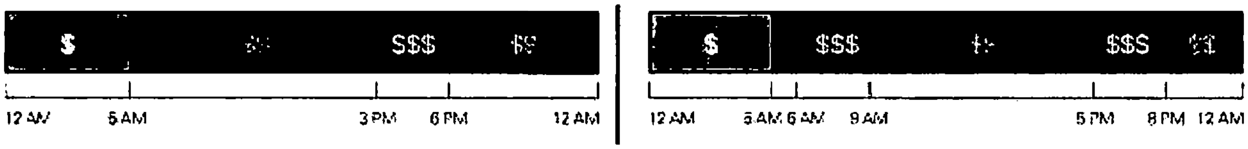
DNV

4.1 Detailed results–understanding of summer and winter peak hours

The survey first asks respondents how well they understand the different seasons and tiers associated with the Off-Peak Plan. Nearly all respondents (94%) indicated they are either completely knowledgeable (77%) or somewhat knowledgeable (18%). The remaining 6% collectively didn't understand components of the Plan "very well" (3.5%), or "not at all" (1.2%), or "don't know because they do not look at specific charges" (0.7%). Our results found statistically significant differences (SSD) with the highest level of self-reported knowledge among EV owners (88%) and 81% of smart Wi-Fi enabled homeowners being very knowledgeable. The least knowledgeable and again, a SSD, was among those who had no smart Wi-Fi (4.5%).

After participants provided self-reported knowledge, the survey then tested their knowledge of the seasonal rate plans by presenting them with the illustration of the summer and winter peak hours and asking them to select the schedule that belongs to the respective season. To improve respondent recall we aided them with the following statement:

Figure 4-1. Knowledge of seasonal rate plans

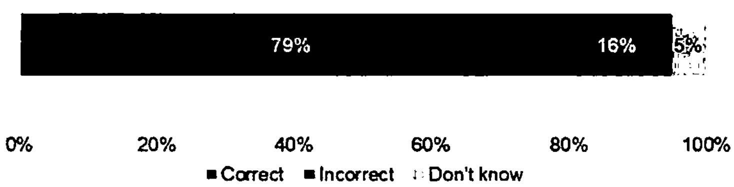


"Under the Off-Peak Plan, there are two seasons, summer, and winter. And for each season there are three electric rate tiers that vary from 8 to 22 cents/kWh depending on when electricity is used. The three rate tiers are referred to as the "peak period", the "off-peak period", and the "super off-peak period."

Through this sequence of questions, we see that customer self-reported knowledge was slightly higher than actual knowledge. Some 79% of respondents correctly selected the rate Plan that aligned with summer.

The 186 EV owners were the most knowledgeable with 87% selecting the correct rate. This compares to 85% of solar owners, 83% of smart Wi-Fi owners, and 76% of below median income earners correctly selecting the season rate plans. The non-smart Wi-Fi group had 23% selecting either the incorrect season or stating they didn't know; this compared to 24% of below median income and 22% of non-EV.

Figure 4-2. Understanding of the summer and winter peak hours



Question: There are two seasons under this plan, a "summer" season and a "winter" season. The summer season runs from May to September and the winter runs from October to April. The images below reflect the two seasons under this plan. Please click the image block that represents the summer seasonal rate. In the images below, Green represents "Super-Off-Peak" hours, Blue is "Off-Peak," and Black is "On-Peak." (n=1,068)

DNV

4.2 Use of Off-Peak Plan communication resources

We presented participants with a list of communication resources to identify which resources participants use and how useful the resources are. Over 90% of participants in the Plan read one or more of the program communication resources. The resource most often read are the program emails (82%). The second most often read resource is the online customer portal, at 32%, followed by text messages at 26%, and the program website at 21% (Figure 4-3). Our surveys shows that the program website is used more often among smart Wi-Fi enabled homes, solar-user homes, EV-user homes, and higher income earners.

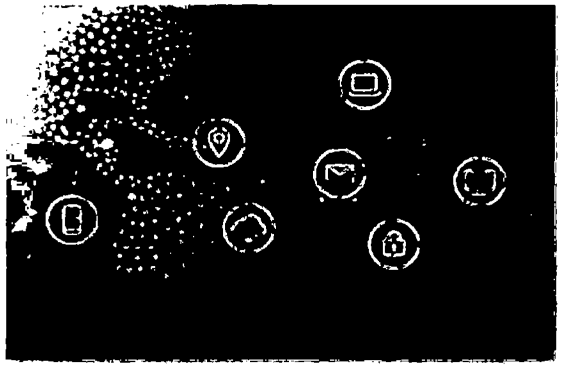


Figure 4-3. How participants receive program messaging

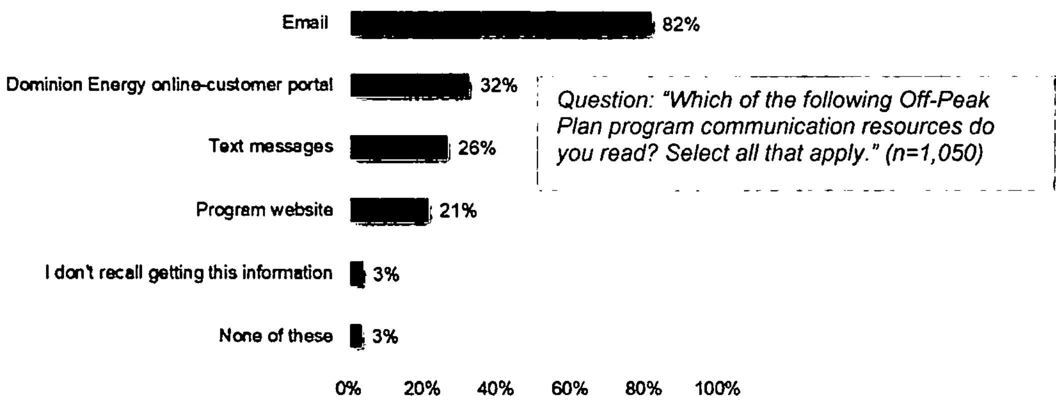
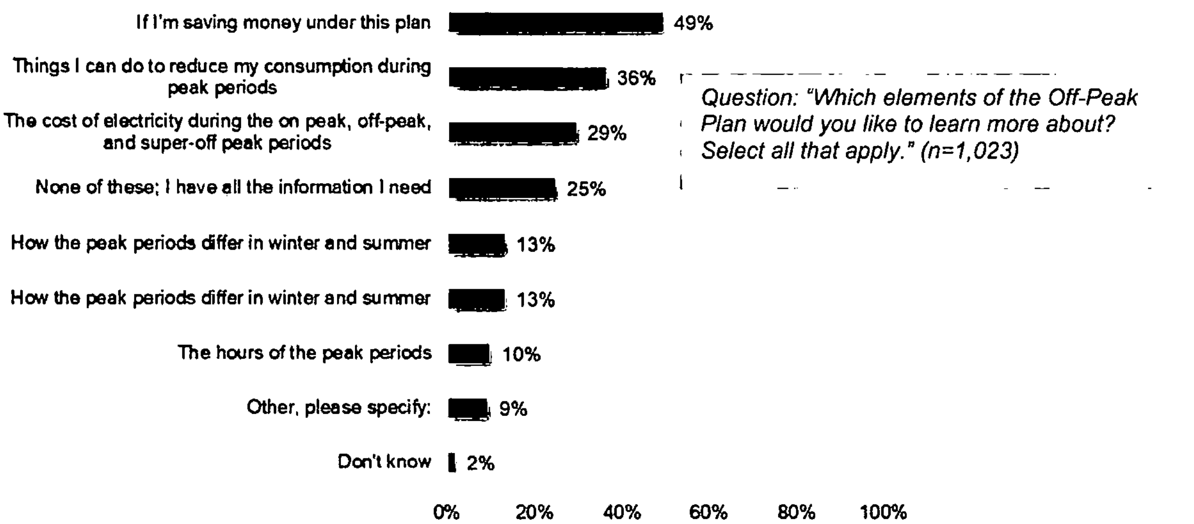


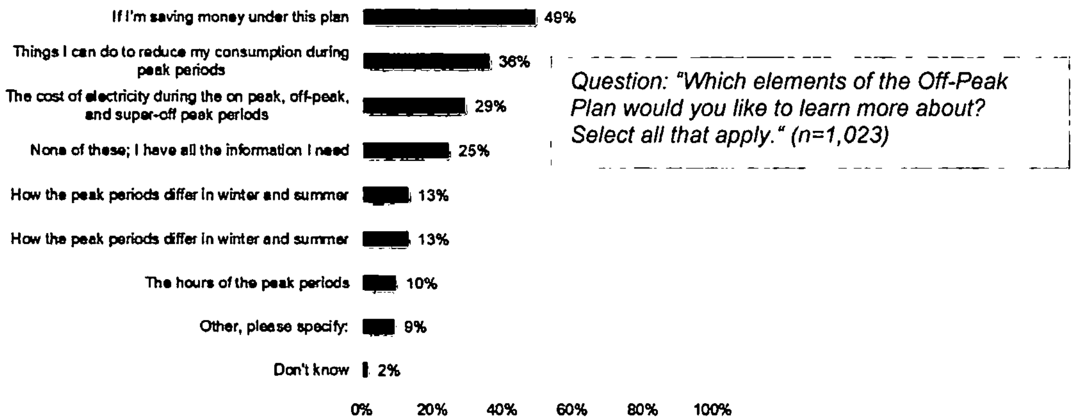
Figure 4-4. Elements of the Plan participants want to learn more



DNV

Figure 4-5 shows a quarter of respondents are satisfied with the information they receive from the program while 75% indicated they would like to learn about one or more elements of the Plan. While the online portal does already show participants the difference in energy saving under this Plan as compared to the alternate rate plans, nearly half of participants desire this information, especially among non-solar and non-EV homes, and below median-income earners. This indicates they are not aware that this information is available. And of the respondents who felt they had the information they needed, EV-homes especially – were more likely to report that they had the information they needed.

Figure 4-5. Elements of the Plan participants want to learn more about



9% of respondents reported that they were interested in "other" elements of the Plan. Some examples are provided below.

What criteria is used to determine peak periods and how are summer and winter terms defined? One respondent commented, "How were the time periods and winter/summer periods decided? What criteria was used to set up the 3 peak periods and when Summer and Winter periods start?"

Offline tools. Participants praised the refrigerator magnets and encouraged the use of additional materials to highlight the rate periods. As one customer commented, "I am grateful for the refrigerator magnet with the different periods, which means I do not have to memorize them."

Rate structure. Respondents noted interest in learning more about their usage costs on the Plan versus off the Plan and commented that side by side comparisons would be helpful. Participants also noted more frequent usage reports would be helpful with "being able to view usage in real time or at a minimum a 24-hour delay so I can make better decisions on how to adjust our usage."

How to effectively interact with the program website, app, and customer service. Several comments reported having difficulties interacting with the program website and customer service, noting the "Analyze" website page had experienced downtime and the customer service team was unaware of program specifics.

DNV

4.3 Use of the online portal

In addition to the program emails and text messages, the online portal is a critical resource. The survey asks if they use the portal to "pay bills and compare to their previously plan". Aided with a screenshot of Dominion Energy's online portal in the survey, 70% of respondents said they do use the portal.

Ninety-seven percent of those "found the portal useful." 57% said they found it completely or somewhat (40%) useful. Households earning less than the median income were more likely to say the portal information was "completely useful" (68%) as compared to higher-income earners (57%). This is likely a result of greater sensitivity to bill amounts among lower income households.

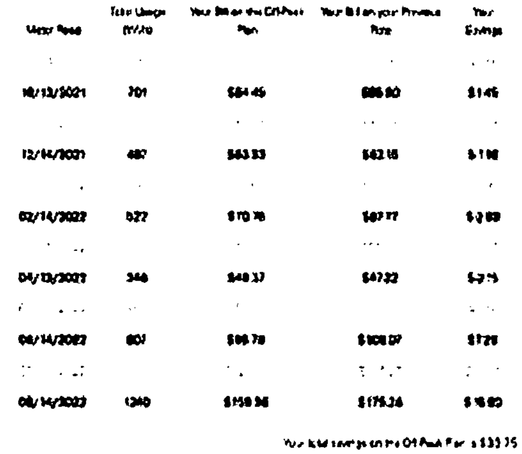
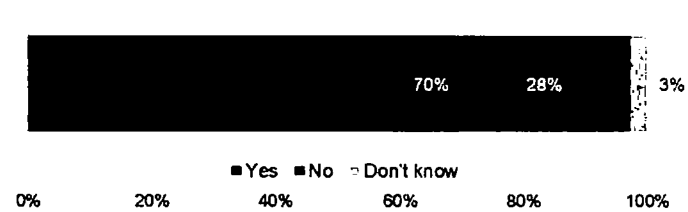


Figure 4-6. Using online portal to pay and compare bills to previous plan



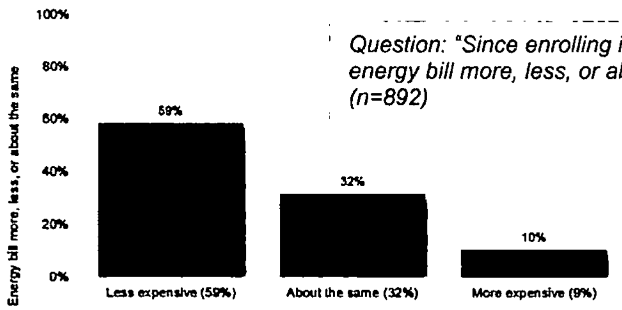
Question: "Have you used Dominion Energy's online portal, where you can pay your bills electronically and compare the Off-Peak Plan to your previous plan." (n=1,042)

Respondents who stated they do not use the online portal (27%) were asked why, "what is main reasons you haven't used the online portal (to view your usage data?" Among them, 44% stated they did not know the information was available, 20% ware satisfied with the information on their bill, and 15% said it was difficult to locate. All others stated they either did not have time (11%), were not interested (2%), had other reasons (10%), or no reasons / don't know (9%). There were no statistically significant differences between the groups of Smart Wi-Fi, EV, Solar, Income, etc.

4.4 Participant perception of bill savings under this Plan

The survey asks, "since enrolling in the Plan if the energy bill is more, less, or about the same". Most respondents state they are saving money under this Plan (59% – less expensive). The Plan is 'about the same' according to 32%, and 9% indicated the "Plan is more expensive". When we looked across the segmented groups, we found SSDs among solar-homes, 17% of who stated that the Plan was more expensive (Figure 4-7Figure 4-7).

Figure 4-7. Participant perception of bill savings under this Plan



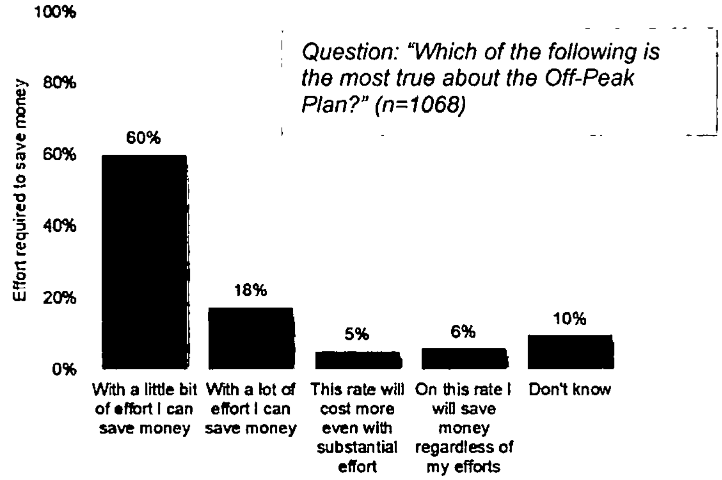
Question: "Since enrolling in the Off-Peak Plan, is your energy bill more, less, or about the same as before?" (n=892)

Among the near 10% who stated they were paying more since joining the plan, DNV asked what they thought was the cause of their higher energy bills. Most (55%) attribute the Plan as the reason for the higher bill. Less common reasons for the perception of higher energy bills included: the household forgets to shift usage during on-peak hours (10%), an increase in energy use in the home (9%), 20% did not know, and some (20%) stated other reasons.

4.5 Ease of saving energy on the Off-Peak Plan

Customer perception of how easy or difficult it is to save energy while enrolled in the Plan is an important finding and good news for the program. Survey results show around two-thirds of respondents' state that saving energy requires "a little bit of energy to save on the Plan." Participants who perceive it to be difficult are less likely to stay on the plan and have higher levels of dissatisfaction.

Figure 4-8. Ease of saving energy on the Off-Peak Plan

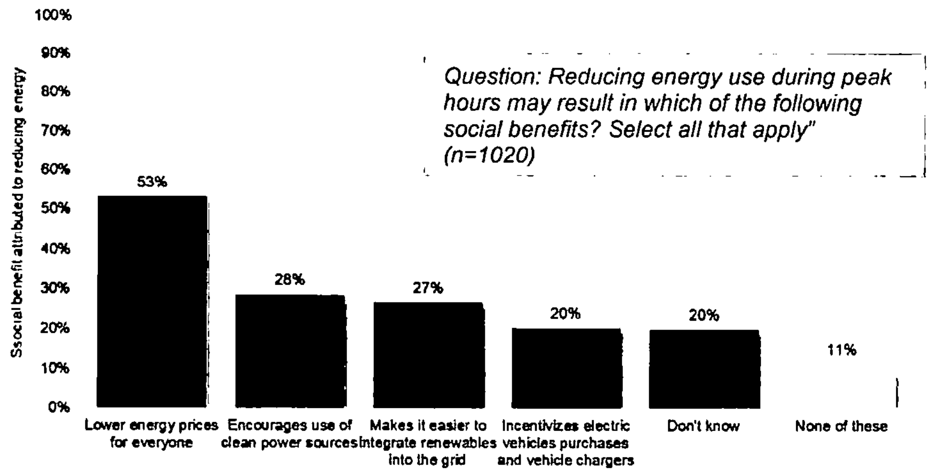


4.6 Social benefits

Nearly 70% of participants indicated there is one or more social benefit attributed to reducing energy during peak hours. Just over half of the respondents (53%) believed that reducing energy use during peak hours may result in "lower energy prices for everyone". Smart Wi-Fi-enabled homes, solar-user homes, and EV-user homes were more likely to indicate additional social benefits such as:

- "Encourages use of clean power sources"
- "Makes it easier to integrate renewables into the grid"
- "Incentivizes electric vehicle purchases and vehicle chargers" (the smart Wi-Fi-enabled homes, solar-user homes, EV-user homes, and higher income earners are all more likely to indicate this response.

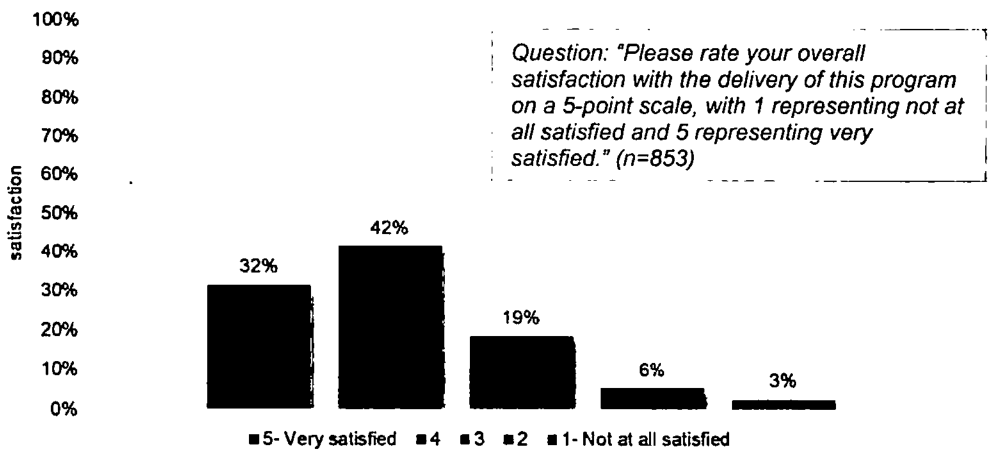
Figure 4-9. Perception of program social benefits associated with the reducing peak hours



4.7 Participant satisfaction and intent to maintain enrollment

The survey asked participants to rate overall satisfaction with the Plan using a five-point Likert scale. Nearly 3 out of 4 respondents gave a satisfaction rating of 4 or 5 (Figure 4-10Figure 4-10). Generally, DNV considers a highwater benchmark of program success, when combined, 90% of respondents rank the program 4 or 5. Satisfaction will be measured again in March 2023 and survey responses indicate there are opportunities to improve participant satisfaction.

Figure 4-10. Participant satisfaction

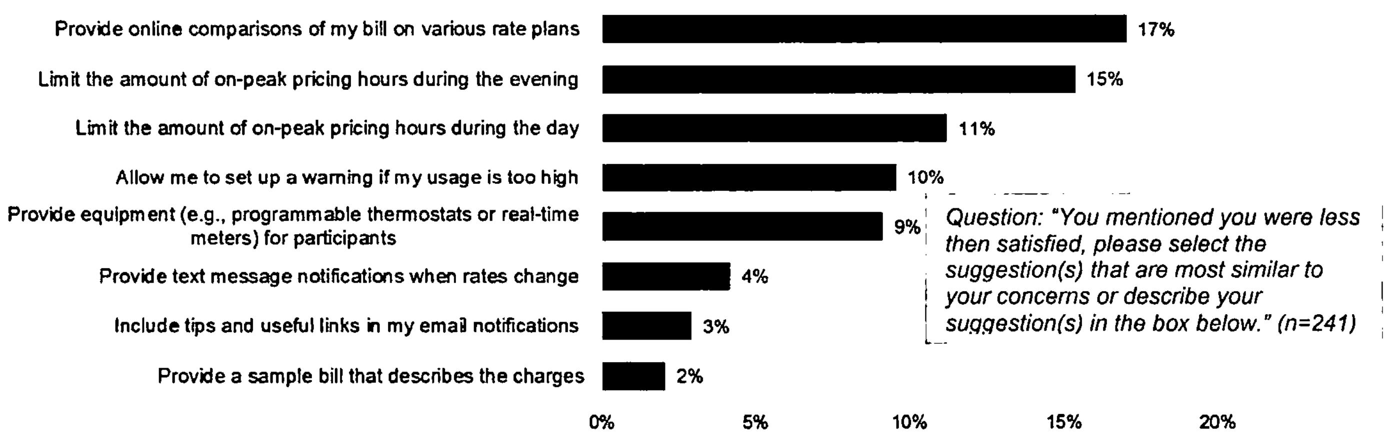


To have better insight into the elements of the program survey respondents who rated less than a 4 for Plan satisfaction (Figure 4-11), we asked them to select the suggestion(s) that are most like their concerns or describe their suggestion(s) in an open-ended comment. The results show nearly a third had suggestions unrelated to those presented in the survey (29%). A less common issue, at 17%, is related to "providing online comparison to their bill on various rate plans." While this is a feature the program already offers, the response shows the importance of reminding customers of the bill comparison feature in the online portal. The third and fourth most common request is to limit the number of on-peak hour (collectively accounting for 27% of responses). About one in ten respondents would like the programs' help by providing equipment (e.g., programmable thermostats or real-time meters) to participants (9%).

The open-ended comments pertained largely to two elements of the program: participants dissatisfaction with the winter peak structure and real-time information on energy usage, making it difficult to find a practical time to conduct energy intensive tasks.

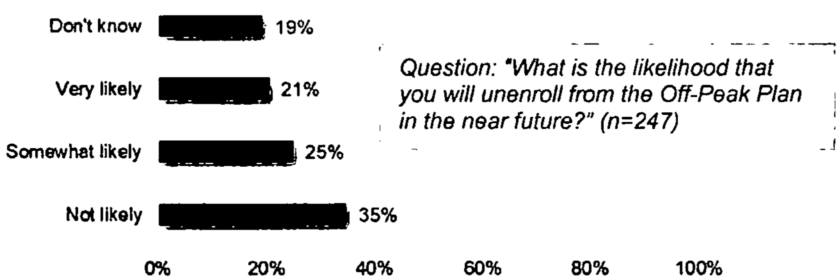
Our analysis found that smart Wi-Fi-enabled homes, solar-user homes, EV-user homes, were more likely to report having additional elements of the program with which they were unsatisfied. Solar users reported difficulties in interpreting how solar credits are incorporated into the program billing, "*Please clarify how credits for solar panels work, and make the description on the monthly bill clear. There are months where I have put energy on the grid during the peak period. I should have a credit for that month that carries over to the next month. If it is there, I don't see it on my monthly bill.*"

Figure 4-11. Why participants are less than satisfied with the Plan



Recognizing that attrition is inevitable, we asked the 247 respondents that rated program satisfaction less than a four, (Figure 4-12), what is the likelihood of unenrolling from the Plan in the near future? About half or 113 participants expressed interest in unenrolling. There was no difference in the responses among the different segmented groups.

Figure 4-12. Likelihood that less satisfied participants will unenroll from the Plan



5 RESPONDING TO THE OFF-PEAK PLAN THROUGH BEHAVIOR

In this section of the report, we present on the following broad topics related to behavior:

- What monetary incentive would customers need to shift behavior?
- What behaviors/habits have customers adopted to control their bills under the rate?
- What barriers prevent customers from achieving deeper savings?

Valuation of tradeoffs

Avoiding inconvenience aligns with respondents' higher valuation of comfort over other tradeoffs. More respondents said they would require saving $30 or more per month to be a little uncomfortable (26%) than to shift electricity usage (19%), program or automate thermostats (17%), or to make energy saving upgrades in their home (20%).

Behaviors to reduce consumption during peak hours

As expected, the easier and less inconvenient the behaviors, the more common it was for respondents to adopt them. Most respondents (79%) said they reduce consumption during peaks hours by delaying the use of large appliances. Most also reported adjusting their thermostat (64%) and/or turning off some lights (61%). Other less common strategies included covering windows (34%), delaying cooking (34%), delaying or shortening showers (29%), powering down computers (25%) and entertainment electronics (21%). Lower income-earners were more willing to engage in these less common, less convenient behaviors than higher income earners and this behavior is evident in the bill and load impact analysis.

Barriers to achieving deeper savings

The most frequently mentioned barriers to achieving deeper savings are that people are home during the day (47%), and that respondents thought they had shifted everything that could be shifted (44%). These answers might represent some misunderstanding of the peak hours. Daytime household occupancy should only affect the beginning of the summer super off-peak hours, and generally would not overlap with the winter on-peak hours. Shifting everything that can be shifted may mean shifting everything that respondents are willing to shift. Considering the relatively high valuation for comfort and preference for convenient behaviors, some respondents may be *capable* of deeper savings.

Recommendations

Another type of information that could be included in the emails is the typical amount or range of energy consumed (or saved) by discretionary end-use equipment. Converting that energy consumption to bill impacts using the per kWh electricity rates might further help participants understand which behaviors are most effective at reducing their electricity bills. Note that considering the preference for convenience and comfort, such messaging could backfire if participants decide the tradeoff is not worth the bill savings. Therefore, Dominion Energy should test such messaging and assess the effects before implementing program wide.

Additionally, respondents may simply benefit from continuous messaging on other actions they could take (assuming they have exhausted all those they previously thought of). The results show there is opportunity to further educate customers given how infrequent most actions could have been undertaken.

5.1 Customer valuation of the effort it takes to shift behavior

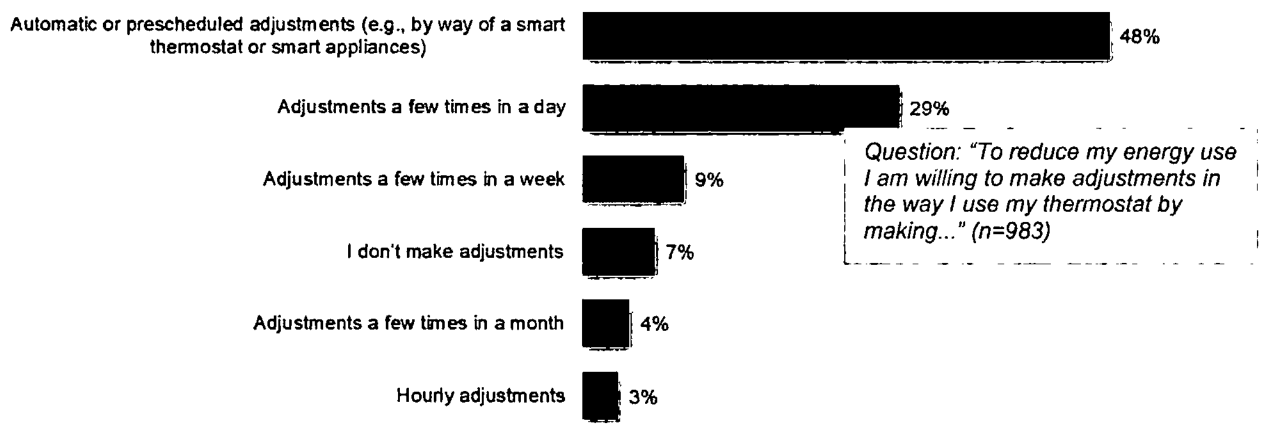
The survey asks how much money participants would need to save each month to adopt a behavior with savings ranging from as low as $5 to a high of $30 or more. The question states, "*Complete each of the following four statements. 'I am willing to...'*" and then presents respondents with a list of actions they could take and the amount that would incentivize action. We calculated the average savings, by dollar amount, across all actions. The results show that a slight majority at 28% are most willing to make behavior changes so long as they see a reduction in their bill around $10–15 a month. Additionally, the results show that comfort is the priority with 55% indicating they must save $30 or more, or no amount is enough to "be a little uncomfortable."

5.2 Behaviors and habits adopted to control energy

We presented a sequence of actions respondents could take during peak hours to reduce energy use. Presented with three main household end uses, we coupled them into categories of heating and cooling, cooking, hot water and laundry use, lighting, and plug-loads. Respondents then selected from a "check all that apply" what actions they took to save energy during peak hours.

Some 308 (29%) respondents reported they owned a smart thermostat, and programmable thermostats make up the plurality (43%). When asked how frequently they adjust their thermostat to reduce energy use, we see that about half rely on automation and more than a quarter are adjusting a few times a day (Figure 5-1).

Figure 5-1. How frequently participants adjust thermostat to reduce energy use during peak hours



For heating and cooling, nearly two in three respondents (64%) stated the action respondents most commonly took is to "adjust temperature" (Figure 5-2). Recall that 92% of households surveyed use central air conditioning. Thus, this is an impactful action for the program. About one in three respondents take other actions far less frequently.

DNV

Figure 5-2. How participants reduce heating and cooling energy use during peak times

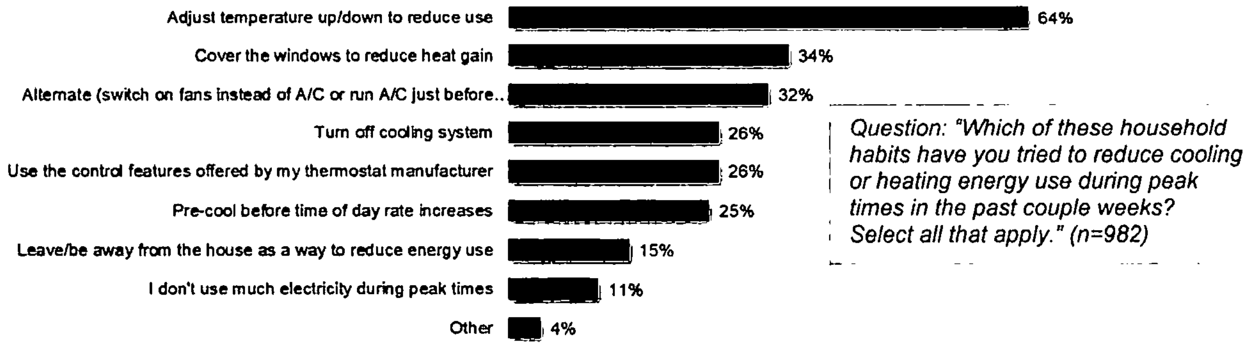
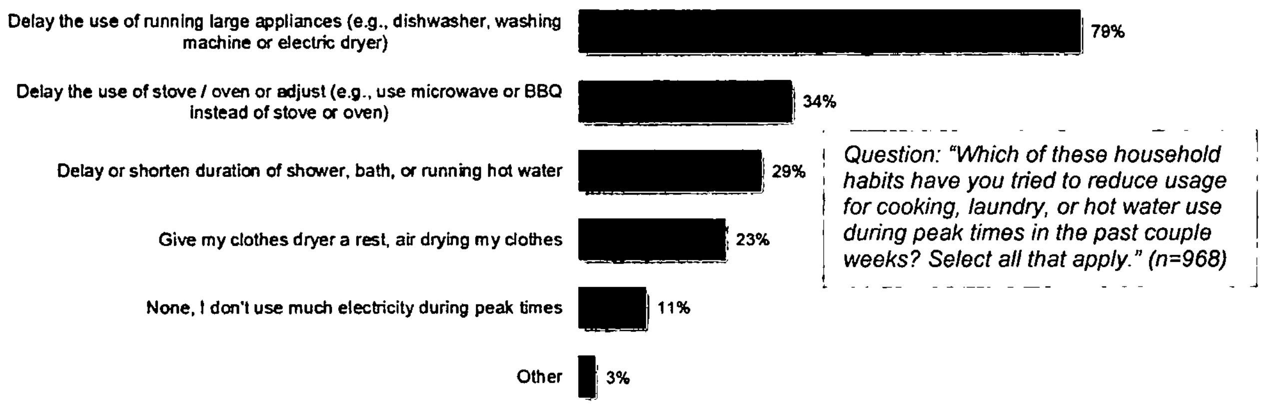


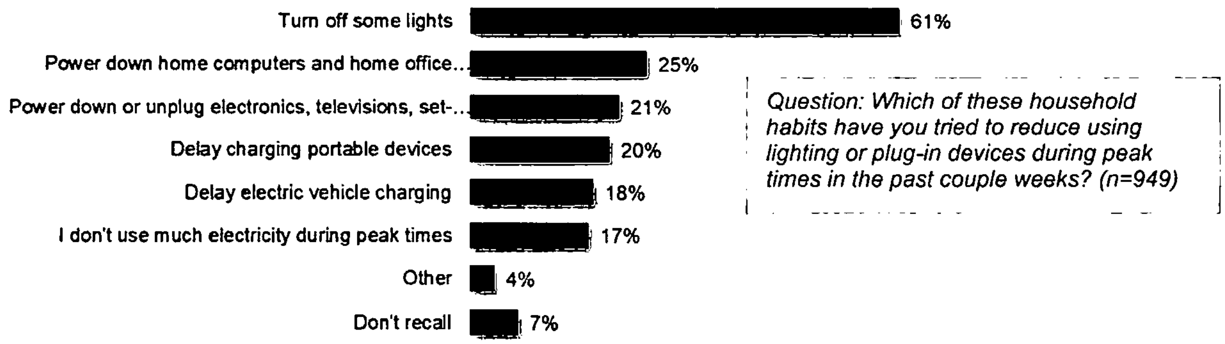
Figure 5-3 shows that when asked about reducing energy use for cooking, laundry, or hot water, nearly four in five or (79%) "[delayed the] use of large appliances during peak times." Delaying hot water use is an effective means to save among those who have electric water heaters. Given about half of the respondents use electricity for water heating (52%), we expected more would "delay the use of hot water," but only 29% undertook this action. The remaining actions to reduce energy usage occur less frequently, or about one in three.

Figure 5-3. How participants reduce cooking, laundry, or hot water energy use during peak times



The final behavior related question asks about actions for lighting and plug-load use (Figure 5-4). Most respondents indicate they are "turning lights off" during peak times to reduce energy use while all other actions were undertaken on average by one in five, or about 21%. Approximately 86% of EV owners reported they delay charging their EV's.

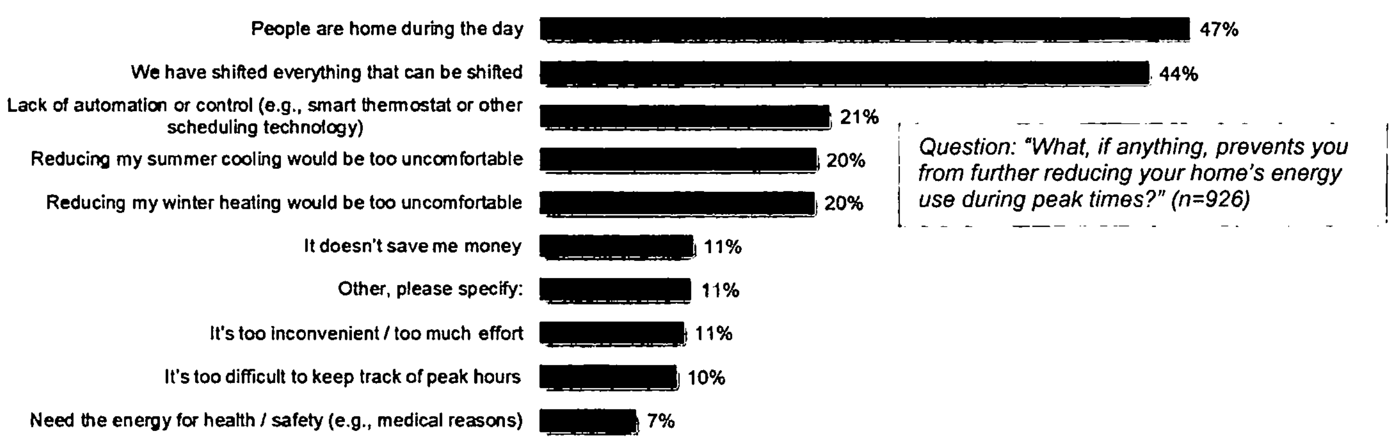
Figure 5-4. How participants reduce plug load energy during peak times



5.3 Barriers that prevent customers from achieving deeper savings

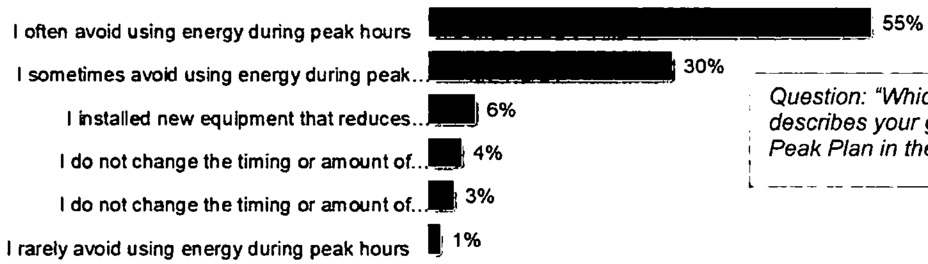
All respondents were asked what barriers prevent them from achieving deeper energy savings. Presented with a "select all that apply" question we see under half of all respondents have "people home during the day" and "shifted all they can." This seems to indicate that achieving deeper savings requires a large commitment and possibly decreased comfort or inconvenience. We note that about one in five or 21% see the lack of automation as a barrier to saving energy. Most utilities have lowered the cost of smart thermostats through rebates (including Dominion Energy) or offered them for free to entice customers to join similar types of time-of-use programs. Dominion Energy may want to evaluate the cost/benefit of free smart thermostats, and interactivity with Dominion Energy's DSM program offerings, to reduce this barrier particularly among lower income earners.

Figure 5-5. Barriers to further reducing energy use during peak times



On the topic of barriers, we revisit the respondents' general approach to the program (Figure 5-6). Most (85%) state they either "often avoid energy or sometimes avoid energy use during peak hours." This is a good sign for the program and an indicator of success. If peak-period prices were too low, the savings would not be worth the effort, and if prices were too high, there would be too much effort with little return. We see self-reported behavior changes but few "install new equipment to reduce energy use." In the next section of the report, we look at technology as a means to save energy. The participants who reported making purchases more often were solar-user homes (16%), EV-user homes (10%) and Wi-Fi-enabled homes (9%). Only 6% of lower income earners self-reported installing energy saving equipment.

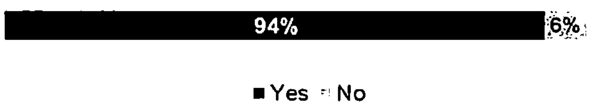
Figure 5-6. General approaches to energy use on the rate



Question: "Which of the following best describes your general approach to the Off-Peak Plan in the summer months?" n= (938)

Figure 5-7 shows that a near census of participants, 94%, "intend to respond to peak hours in the future either by reducing energy (e.g., turning off energy using equipment) and/or delaying energy using equipment," while 6% will not respond. Lower income earners and smart Wi-Fi-enabled homes were the most likely to indicate they would reduce energy use indicating that smart devices make it easier to respond, and the urgency to save money is a strong motivation.

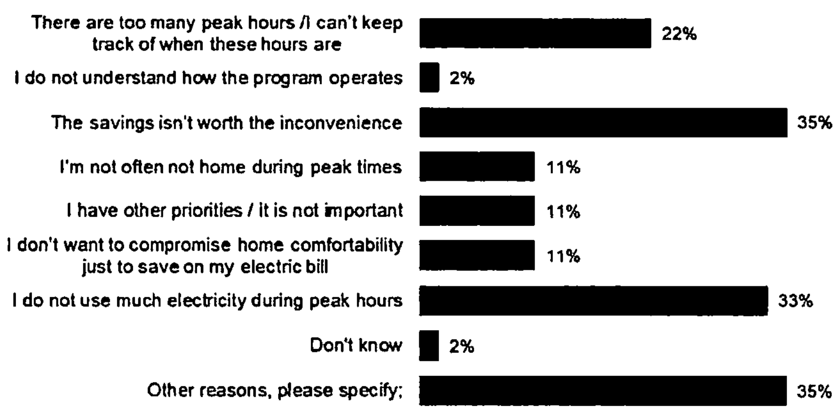
Figure 5-7. Responding to the peak rates



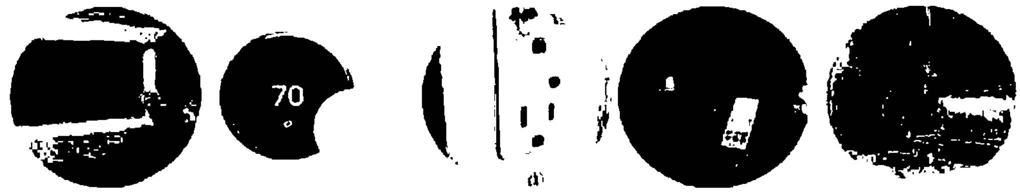
Question: "Do you intend to respond to peak hours in the future either by way of reducing energy (e.g., turning off energy using equipment) and/or delaying energy using equipment?" (n=889)

Those who said they will not reduce energy and/or delay energy using equipment during peak hours, were asked to select among a list of reasons why they would not respond to peak hours in the future. The most frequently selected reasons were "other reasons" (35%), I do not use much electricity (35%), and there are too many peak hours (22%).

Figure 5-8. Why participants would not respond to peak hours in the future



6 RESPONDING TO THE OFF-PEAK PLAN THROUGH TECHNOLOGY



Programmable thermostat | Smart or WiFi thermostat | Smart or WiFi outlet or light bulb | Home energy management system, home hub, smart hub | Smart appliances

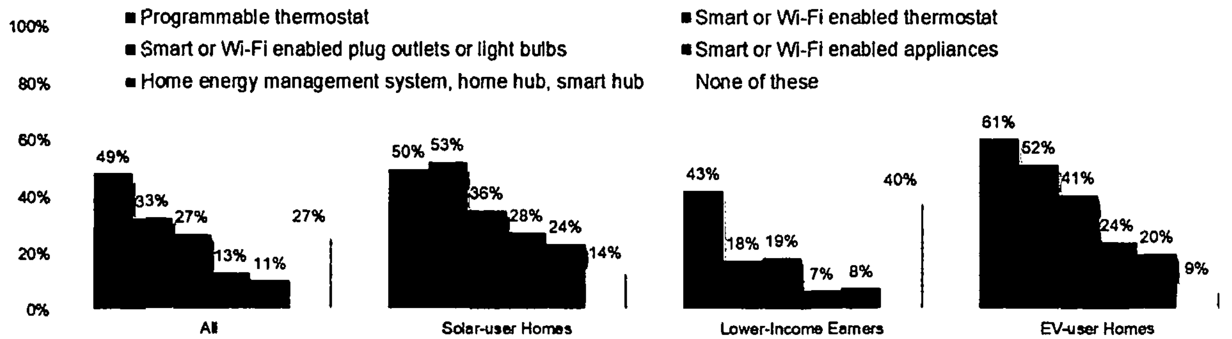
The survey explored to what extent customers are using smart technology, particularly smart thermostats, and electric vehicles, to control their energy bills. As the market transforms, increased adoption of smart technologies will enable participants to be more successful with the Off-Peak Plan. Smart devices enable behavior changes that reduce energy use overall and during peak hours. In the future, eligibility for DR programs will translate into even deeper savings and load shifts.

Technology use

The adoption of technology among all participants is relatively low. Just under half of the homes (49%) have at least one of: programmable thermostat, smart or Wi-Fi-enabled thermostat, smart or Wi-Fi-enabled appliances, smart or Wi-Fi-enabled plug outlets or lights, or a home energy management system. Respondents with EVs were more likely to have each of the technologies, solar-user homes were more likely to have Smart-Wi-Fi and Wi-Fi-enabled thermostats. Lower-income earners were less likely to have one of the devices (40%). Respondents who lacked technology and lower-income earners were more likely to express willingness to take more deliberate actions to reduce consumption, such as manually setting back thermostats. Figure 6-1 shows how many survey respondents within each segment reported using each type of technology.

Figure 6-1. Smart technology used in the home

Question: "Are any of the following forms of technology used in your home to manage your energy use?" (n=942)



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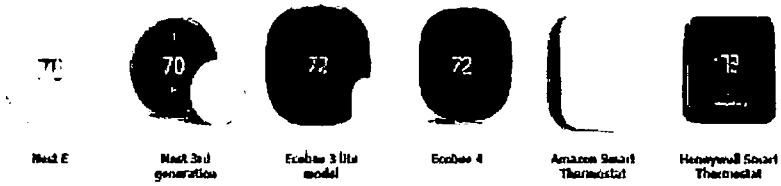
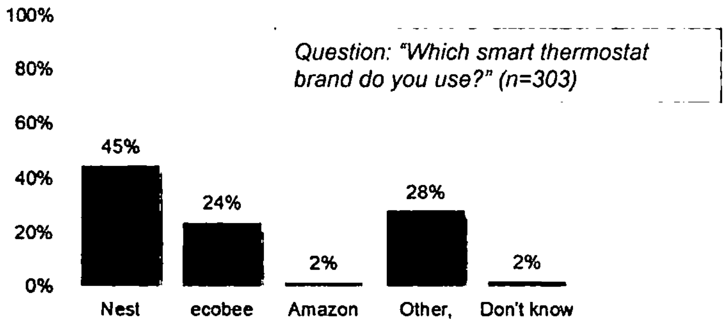
6.1 Smart thermostats

Smart thermostats come in a variety of models. There are basic models that cost about $150– $200 (e.g., Nest E and ecobee 3 lite) and upgraded models that cost about $250– $300, which offer additional sensing technology. Generally, the upgrade from the basic to the advance model costs about $100 but the advanced models are advertised to generate deeper savings. The survey explored what technology and type of thermostat participants are using.



The models presented in the survey are the Google Nest, ecobee, Amazon, and Honeywell branded thermostats along with others. Because the Google nest was one of the first smart thermostats on the market, it is not surprising that the largest percentage of respondents (45%) had Nest thermostats. The next most popular thermostat was ecobee, at 24%. Amazon recently entered the smart thermostat market and was used by only 2% of survey respondents. The remainder of respondents used Honeywell or other brands 28%. The advanced models are largely Google products, and some 41% of the smart thermostat users had either a Google or ecobee advanced version (32% and 9% respectively).

Figure 6-2. Technology, smart thermostat types



Among respondents who have a programmable or Wi-Fi-enabled thermostat, the survey sought to identify if the programming aligns to the Plan's seasonal rate. The results show just over two in three participants program their thermostat to match the seasonal rateRecommendations

Because respondents indicate they desire a minimum of effort to realize savings, smart thermostats with algorithms that account for peak hours are the most accessible technology to achieve this goal. . Additionally, survey results indicate participants with smart thermostats are generating even deeper savings when they use optimization features. We asked the 285 smart thermostat users if they were "*using smart thermostat eco-setting optimization that automatically adjusts the temperature up or down by a few degrees to save energy?*" Again, nearly two in three homes use this feature.

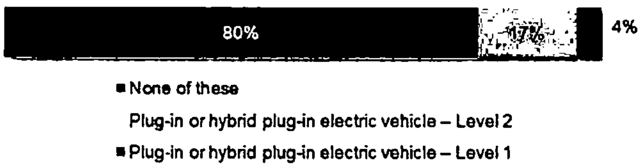
Recommendations

Because respondents indicate they desire a minimum of effort to realize savings, smart thermostats with algorithms that account for peak hours are the most accessible technology to achieve this goal.

6.2 Electric vehicles

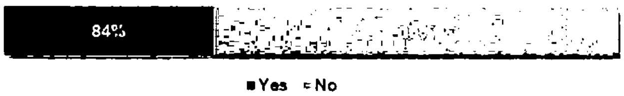
EV-user homes account for 21% of the respondents and earlier we reported that 12% of those participants purchased an EV in the last year. EV owners can greatly benefit from the Plan because it allows them to charge their vehicles at low rates. Among those who are charging, four in five use the level 2, 240V electric vehicle charger. The Virginia Department of Motor Vehicles reports that Tesla's larger battery models make up 50% of the market share and draw up to 17 KW depending on the model.

Figure 6-3. Electric vehicles, type of EV charger in the home



Question: "Does anyone in your home use a plug-in electric vehicle charger?" (n=927)

EV-user homes were asked if they enrolled in the Plan to take advantage of the lower rate for charging. Not surprising the majority (84%) indicate "yes". We also asked EV-user homes if they had shifted the time when they charge to off-peak hours of which a near census (95%) are shifting their charging to off-peak. Among the small group that have not shifted, a slightly larger percent were solar-user homes.



Question: "Did you enroll in the Off-Peak Plan to take advantage of the lower rate for charging your electric vehicle? (n=188)

7 DEMAND SIDE MANAGEMENT PROGRAMS

Company Demand Side Management (DSM) programs and DR programs are administered by the Energy Conservation Group. Almost 10% of participants in the Off-Peak Plan participate in the Company's Residential Customer Engagement Program (n=912). The Customer Engagement Program is an opt-out behavior program that delivers regular paper or digital reports to a large group of residential account holders. Like the Off-Peak Plan that provides consistent messaging, behavior programs have proven to be an effective way to reduce household energy consumption and foster customer engagement and supplement the programs' communications suggestions for how to save energy. Off-Peak Plan participants have also purchased smart appliances from Dominion Energy's Residential Efficient Products Marketplace (n=509) and received rebates from the Smart Thermostat program (n=309).

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About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

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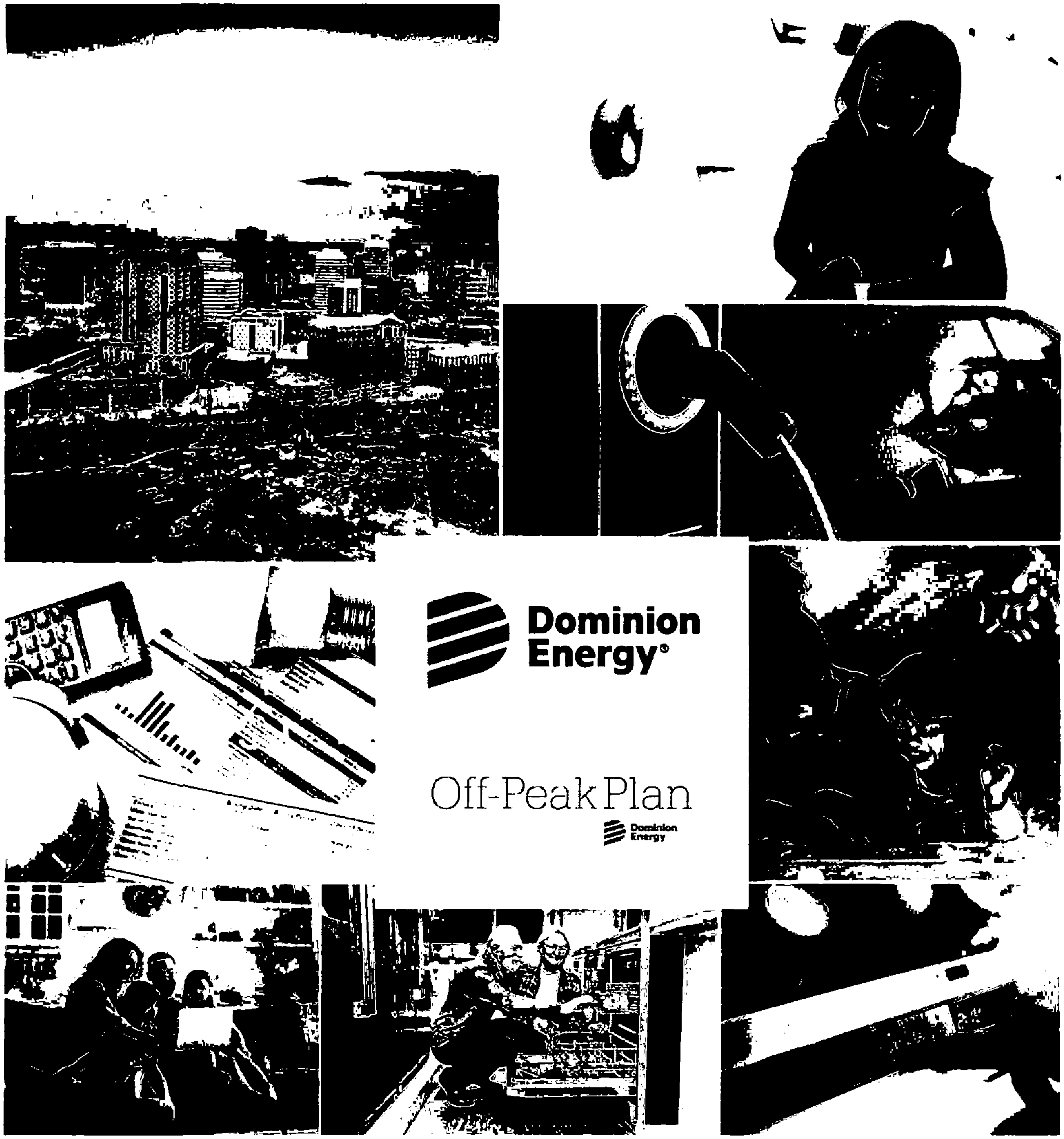

SCHEDULE 1G, RESIDENTIAL SERVICE (EXPERIMENTAL) RATE

2022 LOAD AND BILL IMPACT EVALUATION

DNV

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DNV

1 EXECUTIVE SUMMARY

This report is the first load and bill impact evaluation in a series of annual evaluation, verification, and measurement (EM&V) reports of the Schedule 1G, Residential Service (Experimental) Rate 2022 (Off-Peak Plan) launched in early 2021. This report offers Dominion Energy Virginia and its stakeholders an early indication of the load and bill impacts of the off-Peak Plan.

The Commonwealth of Virginia State Corporation Commission (the Commission) approved the off-Peak Plan in May 2020.[1] The Off-Peak Plan is available to up to 10,000 customers who have an advanced metering infrastructure (AMI) meter and do not participate in the Company-sponsored demand response (DR) programs or peak-shaving DR programs.

Off-Peak Plan

Dominion Energy

The Off-Peak rate structure provides customers with an opportunity to save money on their electric bill if they shift electricity use from the peak hours to other times of day.[2] From a Company perspective, the Plan needs to optimize customer engagement while balancing customer value. If successful, the rate should result in a load shift that reduces consumption during peak periods while maintaining customer satisfaction among its current and future enrollees.

This impact evaluation quantifies the customer load impacts of participation in the Off-Peak Plan (Plan). The evaluation identified Off-Peak Plan participants with sufficient pre-Plan AMI data to assess those changes in energy consumption behavior moving from the existing residential rate to the new Off-Peak Plan Rate. A matched comparison group of Dominion Energy customers, also with AMI data during the analysis period, served to control bias associated with non-Plan-related changes in customer energy consumption. The result is the quantification of load shifting from the Plan's on-peak period to the off-peak and super off-peak periods during the structurally distinct summer and winter seasons.

Figure 1-1 shows the impact of the Off-Peak Plan on participants' electric load compared to the matched control group for each rate period on weekdays and weekends in each season. The plot demonstrates that during both summer and winter on-peak periods, Plan customers reduced load by 9% and 3%, respectively, statistically significant at 95% confidence. The plot also shows that significant load was shifted to the super off-peak periods on both weekdays and weekends during both summer and winter seasons. Finally, the plot shows that in shifting load to off-peak periods, Plan participants increased energy consumption by just over 2% more than they would have consumed on the standard residential rate.

1 State Corporation Commission, Final Order Approving Experiment, Case No. PUR-2019-002142021, May 20, 2020; Virginia Electric and Power Company's 2021 Annual Report to the State Corporation Commission of Virginia on Residential Time-of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 22, 2021; Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, designated Time-Of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 12, 2019. Tariff of Virginia Electric and Power Company, 1G Residential Service (Experimental)

2 3:00-6:00 p.m. from May to September and 6:00-9:00 a.m. and 5:00-8:00 p.m. October to April

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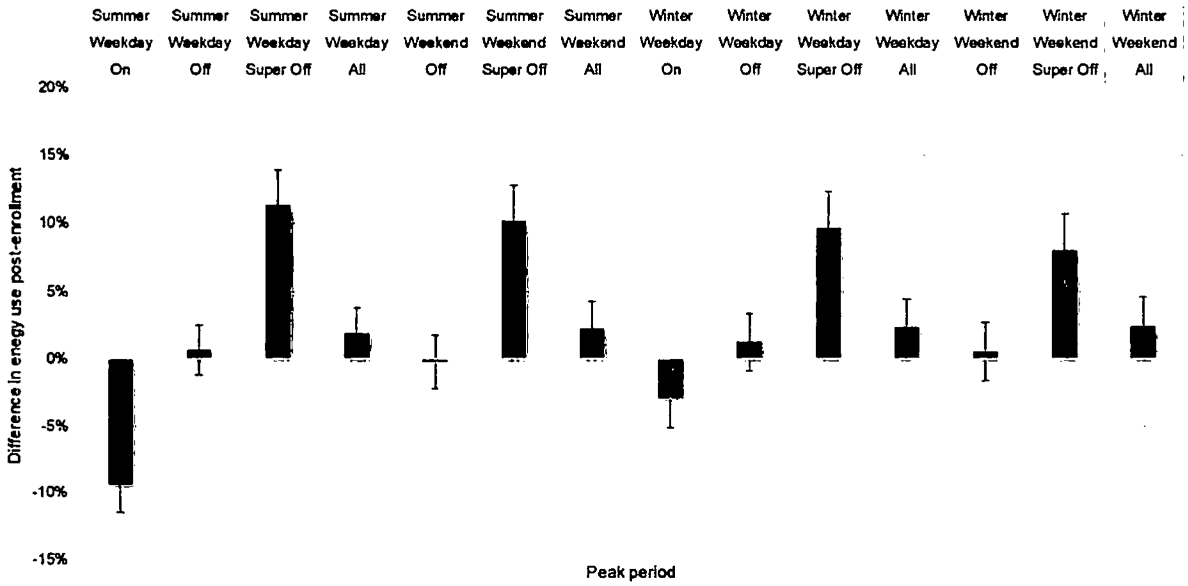
Figure 1-1. Percent difference in post-enrollment load for participants by season, day-type and TOU period



This evaluation also quantifies the load impacts of the Off-Peak Plan for:

- Income-qualified (IQ) customers compared to non-IQ customers
- Customers who benefit from the rate with no change in energy consumption (structural winners) vs. those who must adjust the timing of energy consumption to avoid bill increases (high baseline customers)

In addition to quantifying load impacts, the evaluation also quantifies associated bill impacts for the average Plan participant as well the subsets defined above.

1.1 Key findings

Key findings of the off-Peak impact evaluation include:

- The Off-Peak Plan delivered 9.4% summer on-peak period load reduction and 2.9% winter on-peak period load reduction for Plan participants. The summer peak load reduction is substantial given the relatively modest 2:1 price ratio. The Plan's peak load reduction is comparable to a recent Baltimore Gas and Electric TOU program despite that program's much more aggressive peak period ratio of almost 5:1.[3]
- Preliminary evidence indicates that Off-Peak Plan impacts persisted in the second summer for participants who enrolled early and for whom two summers worth of data were available.
- The Plan rate leads to substantial decreases for the 5 summer-season monthly bills and increases in the 7 winter-season monthly bills. On average, across the year, the typical customer will see a slight decrease in monthly bills of roughly 2.6% ($1.42), or $17.04 per year.

[3] BG&E's TOU rate only had on- and off-peak rates making the comparison inexact, but even a Peak to Super off-peak ratio is only 2.5 – 1 ratio. BG&E results and rates from *PC44 Time of Use Pilots: Year One Evaluation*. Prepared for the Maryland Utilities by Brattle Group. September 15, 2020.

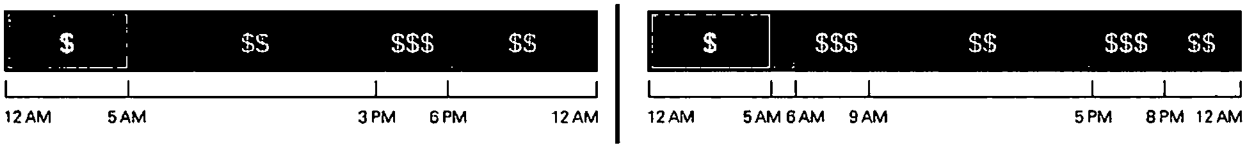
- IQ customers provided almost as much summer on-peak load reduction, on a percentage basis, as non-IQ customers (8.9% versus 9.7%, respectively). IQ customers showed modest winter load reduction, directionally, but this was not statistically significantly different from zero.
  - IQ customers experienced a similar pattern of bill impacts as non-IQ customers with a decrease in bills during the summer and an increase during the winter. Across the whole year, IQ customer bills were lower, directionally, but the reduction was not statistically significant.
  - Customers with high baseline peak period consumption contributed lower summer on-peak reduction than structural winners who have lower baseline peak period consumption. This is contrary to expectations, as high baseline customers have both greater on-peak period consumption to reduce and a greater monetary motivation to reduce that consumption. High baseline customers also increased off- and super off-peak period consumption substantially more than structural winners, which drives the overall summer increase in consumption for high baseline customers.
  - In contrast, high baseline customers provided substantial winter on-peak load reduction while structural winners offered no on-peak load reduction during winter months. High baseline customers' winter on-peak load reductions were of similar magnitude (~10%) to structural winners' summer on-peak load reductions. Overall winter consumption was lower for high baseline customers than structural winners.
  - Despite substantial on-peak load reduction in both seasons, the average high baseline customer faced an increased bill over the year on average. The seasonal pattern of lower summer bills and higher winter bills was consistent with the overall population, but the winter bill increase for high baseline customers was almost three times that of the structural winners despite the evident greater efforts at load reduction during the winter on-peak period.

2 INTRODUCTION

This report presents the load and bill impact results of the first year of the Schedule 1G, Residential Service (Experimental) Rate (Off-Peak Plan). It is the first impact evaluation in a series of annual evaluation, verification, and measurement (EM&V) reports of the Off-Peak Plan launched in early 2021.[4] The Off-Peak Plan allows customers to better control their energy costs while rationing system demand. The rate encourages customers to reduce load during certain peak hours (3:00-6:00 p.m. during the summer and 6:00-9:00 a.m. and 5:00-8:00 p.m. during the winter). In doing so, they will see bill reductions. At the system level, a time-of-use rate acts as an additional tool to address capacity issues and high peak-period energy costs.

The Off-Peak Plan has two seasons: Summer (May 1–September 30) and Winter (October 1–April 30). Figure 2-1 shows the summer (left) and winter (right) periods. Peak hours are shown in black, off-peak in blue, and super-off-peak in green.

Figure 2-1. Off-Peak Plan peak hours (black), off-peak (blue), and super-off-peak (green).



Subject to a participation limitation of 10,000 accounts, the Off-Peak Plan is available to customers who have an advanced metering infrastructure (AMI) meter and do not participate in the Company-sponsored DR programs or peak-shaving DR programs. A customer who unenrolls from the Plan within 12 months may not re-enroll for the next 12 months.

Customers who would have paid less for their prior year of electricity consumption are referred to as "structural winners." Their energy usage already favors off-peak periods, and the Plan rate rewards those characteristics. Structural losers are customers who have relatively greater consumption during peak periods and as a result, the Plan rate increases their bill. Either type of customer may be able change their usage characteristics to further shift load off-peak and save additional money relative to their pre-rate bill. It is assumed that structural winners may have less ability to further shift load off-peak. It is also assumed that many structural loser customers may be able to shift their consumption sufficiently to come out ahead with respect to bill levels on the new rate. Finally, in addition to motivating shifts in consumption from one period to another, TOUs will sometimes also have a conservation effect, reducing overall consumption.

The load and bill impact evaluation identified Off-Peak Plan participants with pre-Plan AMI data to assess those changes in energy consumption behavior moving from the existing basic residential rate to the Off-Peak Plan. A matched comparison group of Dominion Energy customers, also with AMI data during the analysis period serve to control bias associated with non-Plan related changes in customer energy consumption. The result is the quantification of load shifting from the Plan's on-peak period to the off- and super off-peak period during the structurally distinct summer and winter seasons.

4 State Corporation Commission, Final Order Approving Experiment, Case No. PUR-2019-002142021, May 20, 2020; Virginia Electric and Power Company's 2021 Annual Report to the State Corporation Commission of Virginia on Residential Time-of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 22, 2021; Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, designated Time-Of-Use Rate Schedule 1G (Experimental), Case No. PUR-2019-00214, December 12, 2019. Tariff of Virginia Electric and Power Company, 1G Residential Service (Experimental)

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2.1 Off-Peak Plan customers

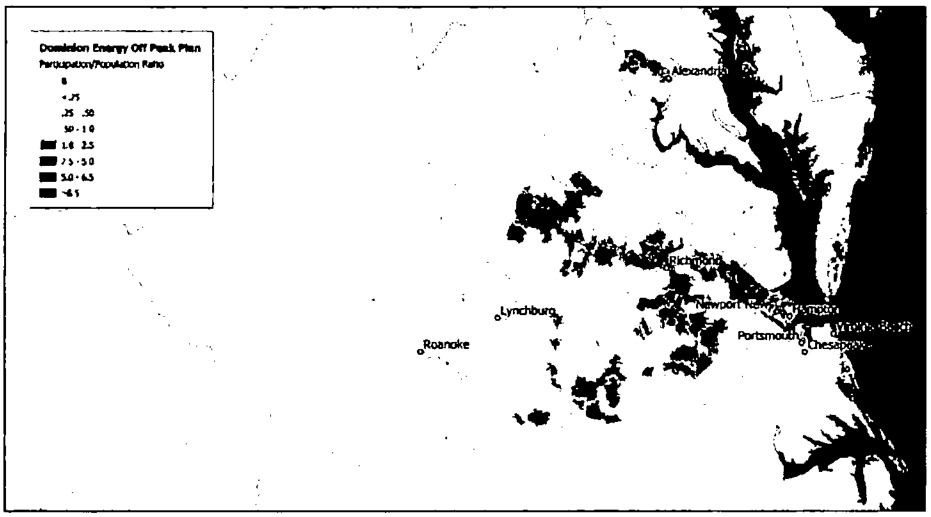
The rate of customer enrollment exceeded initial expectations. When defining EM&V goals, the Company's 2019 application cites participation goals of 5,225 customers by July 31, 2022, and 6,600 by the end of 2022.[5] At the end of 2021, there were 9,800 active Plan participants and the Plan reached its enrollment goal of 10,000 participants approximately three years ahead of schedule. The Company maintains a waiting list and adds new participants pending unenrollment or natural attrition.

Of 12,486 enrollees, 8% (1,034) have voluntarily unenrolled. Most participants unenrolled soon after they joined the program because they didn't see evidence of bill savings. Of unenrolled participants, 36% left the program within four months and an additional 29% between four and seven months. Only 18% of all unenrolled left the program after one year. Twelve percent (1,492) of enrollees left the program due to natural attrition such as a change in account status. Although all the specific reasons are unknown, move-outs are the predominant driver of the attrition.

2.2 Location

The geographical distribution of Plan participants is dependent on the availability of AMI metering. The participant map in Figure 2-2 shows the distribution of Plan participants given as a ratio between Plan participants in each zip code relative to the population in that zip code (n=9896). More customers will have access to the Plan as the rollout of AMI meters proceeds and enrollment expands.

Figure 2-2. Geographical distribution of Plan participants given as a ratio between Plan participants in each zip code relative to the population in that zip code.



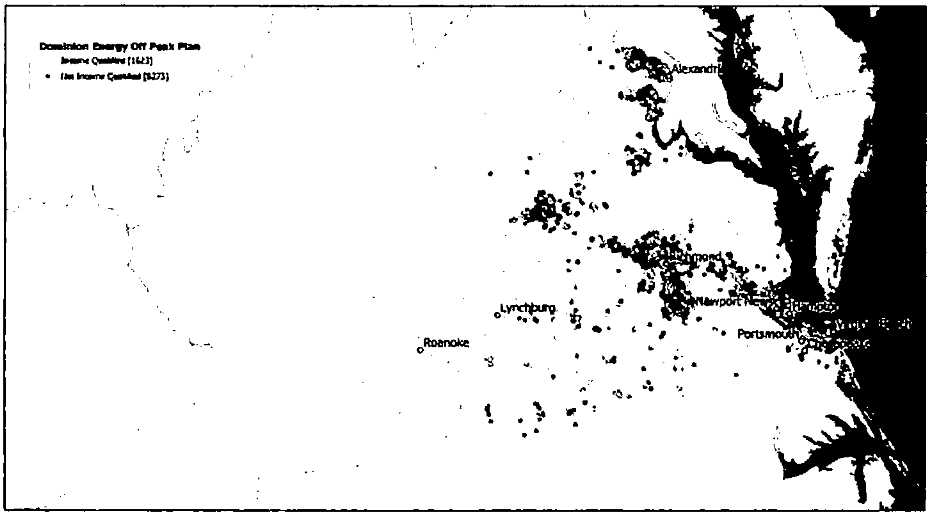
Zip codes with no participants are shown in white. Zip codes with a ratio less than 1:1 (<1.0) are in shades of red, and zip codes with a ratio over 1.0 are in shades of green. A ratio over 1.0 indicates there is more participation in that zip code than one would expect based on population. A ratio less than 1.0 indicates that there is less participation in that zip code than one would expect based on population. For example, zip code 23509 (in Norfolk) had ~0.64% of the population participate in the Off-Peak Plan while that zip code's population is ~0.16% of the state's overall population; therefore, there is a 4:1 ratio

[5] Application of Virginia Electric and Power Company for approval to establish an experimental residential rate schedule, p. 12.

(4.0) between the participation rate and population. The zip code 23146 (Rockville) has ~0.04% of the Off-Peak Plan participants living there and also ~0.04% of the state's overall population; this results in a 1:1 ratio (1.0).[6]

The second map Figure 2-3shows the same participants according to income qualification. Non-IQ participants are shown in purple (n=8,273) and IQ participants are shown in green (n=1,623). Sixteen percent of participants fall into the IQ category as defined by the Virginia Department of Housing and Community Development (Virginia DHCD).[7]

Figure 2-3. Distribution of non-IQ and IQ participants



6 The map utilizes participant address data (n=9896) and public ZIP level population data from the U.S. Census Bureau's American Community Survey data (2019). All other geospatial data (boundary layers, etc) are publicly available from data.census.gov. The map was created using ERSI's ArcMap 10.8 and QGIS3's software suites. The map shows participants as of 09/13/2022. 64 participants are not included due to zip code mismatches to census data.

[7] Virginia Department of Housing and Community Development (DHCD), Revised Income Limits for Virginia Weatherization Assistance Program (Information Notice 03-2022) March 2022. Income qualification is based on income and size of the family unit.

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3 METHODS

3.1 Overview

This study models Off-Peak Plan participants and a group of matched comparison customers over pre- and post-rate periods to estimate the average impacts of the Plan rate on participants. The panel model compares Off-Peak Plan participant hourly load data, year over year, adjusted by the parallel comparison of a carefully matched set of similar customers over the same time frame. The result is an estimate of the effects of the rate controlling for exogenous effects through the comparison group. The Covid-19 pandemic represents an extreme example of an exogenous effect with clear energy consumption implications. As the comparison group is designed to be as similar as possible to the Plan participant group except for participation in the Plan rate, it offers a counterfactual representation of participants' consumption path through the analysis period.

3.2 Eligible participants

The analytical approach used for this evaluation requires pre-Plan rate interval data for each participant. Many new AMI customers were recruited into the Off-Peak Plan starting in spring 2021. Some were recruited shortly after their new meter was installed, making their pre-rate data insufficient for the analysis. Customers who waited long enough after their AMI meters were installed had sufficient pre-rate data and were included in the analysis. Existing AMI customers were also recruited for the Plan starting in spring 2021 and had sufficient pre-participation data to be included in the analysis.

To maximize the number of eligible participants, the analysis considered summer and winter periods separately. All participants with at least one complete season pre- and post-Plan participation were included in the analysis. Due to the timing of the Off-Peak Plan recruitment process, more customers had complete summer periods pre- and post-rate than complete winter periods pre- and post-rate. As a result, the first-year Plan summer model results have greater statistical power than the winter models. Also, a subset of these customers has a second summer season, allowing an assessment of rate persistence in a subsequent season.

3.3 Matched non-participants

The quasi-experimental design model approach employed for this analysis represents the best feasible observational study approach given the lack of a randomized controlled trial experimental design. In the absence of a randomized sorting of participants to participant and control groups, a matched comparison approach is used to develop a comparison group with many of the same properties of a true control group. The matching approach uses both monthly seasonal shapes and daily hourly shapes to identify a non-participating household with similar consumption characteristics for each Plan participant.

As part of its general evaluation process, DNV models all Dominion Energy residential customers each year to disaggregate overall annual customer consumption into cooling, heating, and baseload consumption. These data facilitate the tracking of energy efficiency program installations. They also offer a simple way to characterize the Dominion Energy population to facilitate development of the matched comparison group.

The matching process had two steps. The first divided the entire Dominion Energy residential population with AMI data in place by January 1, 2020 into strata defined by geographic area, three levels of cooling consumption, three levels of heating consumption, and three levels of baseload consumption. These strata grouped customers from the same geographical area with similar seasonal heating, cooling, and baseload attributes shapes. Within each stratum, customers were sorted by overall consumption, largest to smallest.

Each eligible Plan participant was assigned to their appropriate stratum and cut into non-participant ranking based on their overall consumption. DNV then selected the 10 customers with the closest overall consumption above and below the participant in the ranking. As a result, we produced a preliminary 20:1 set matched non-participating customers for each Plan participant.

The second step of the process used minimum distance algorithm matching techniques to identify the non-participant that most closely matched each participant based on additional characteristics developed from the pre-rate AMI data: 1) total consumption in kWh; 2) the ratio of average daily consumption in the summer to average daily consumption in shoulder months; 3) the ratio of average daily consumption in the winter to average daily consumption in shoulder months; 4) maximum summer demand; and 5) maximum winter demand. For this purpose, summer months are defined as June–September, winter months are defined as December–February, and shoulder months are defined as March–May and October–November.

This two-step process produces a matched non-participant group that closely mimics the participants in average hourly shapes and seasonal consumption.

3.4 Difference-in-difference model

We used panel data analysis, specifically difference-in-difference regression, to evaluate load impact. The Off-Peak ran over multiple years, yielding repeated measures for both the enrolled and matched control groups, and both groups have several months of data for both pre- and post-enrollment periods. A panel data regression can model variations across individual customers and across time to provide the most precise estimates of the Plan's impact. Additionally, a panel analysis approach allows us to control for differences in observable differences in weather, seasonality, and other factors of interest. Finally, panel analysis provides customer-level fixed effects that account for unobservable characteristics of individual customers that could introduce bias into the impact estimation results otherwise.

The general form of the regression model used is as follows:

$$kWH_{idh} = \mu_i + \beta_{Tdh} THI_{idh} + \beta_{dh} post_{dh} + \gamma_{dh} treat * post + \theta_{dh} + e_{idh}$$

where:

- kWH_{idh} is the natural log of electricity consumption for customer *i* on day type *d* at hour *h*.
- μ_i is a customer specific effect modeled as a fixed effect and independent of time;
- THI_{idh} is the natural log of temperature-humidity index (THI) for customer *i* on day type *d* at hour *h;*
- β_{Tdh} measures the effect of THI on electricity consumption across all customers;
- $post_{dh}$ is an indicator variable equal to 1 during the post-enrollment period and 0 otherwise;
- β_{dh} measures the difference in consumption between pre- and post-enrollment periods common to Plan enrollees and matched controls
- $treat * post$ is the enrollment indicator, equal to 0 for matched controls at all times and enrollees in the pre-enrollment period, and 1 for enrollees in the post-enrollment period;
- γ_{dh} measures the average impact of the Off-Peak Plan on electricity consumption and is the primary estimate of interest;
- θ_{dh} is a set of month indicators and month-THI interaction variables that measure monthly shifts in consumption common to enrollees and matched controls;
- e_{idh} is the residual error term

DNV applied the above model to various subsets of our data. We ran the model for all combinations of season, day type (weekday or weekend), and peak period separately to reflect the billing structure of the Off-Peak Plan. We also broke this down further to season, day type, and hour of day to fine tune the impact estimation. We also analyzed various customer sub-groups by further breaking out the season, day-type, and rate period data, and running the model on the sub-groups. Compared sub-groups include IQ versus non-IQ customers and structural winners versus high baseline customers.

Additionally, a small subset of participants started on Off-Peak Plan rates soon enough after the program started to have two full summers in their post-enrollment period. For this sub-group, we analyzed the impact of the program in the second summer post-enrollment by running the above model with an additional *treat * post* term, the first measuring the impact of post year 1 and the second measuring the impact of post year 2.

3.5 Bill impact methodology

The Off-Peak Plan's impact on customer bills is of interest, as this is the incentive for customers to enroll in and remain on the Plan rates. To investigate this impact, post-enrollment electricity consumption for enrollees was estimated using the hourly regression models described above in linear form (rather than log transformed). The models were applied to a simulation of a full year of 8,760 hourly time points for the participants that had a full year of AMI data in pre- and post-enrollment periods. For participants with only a full summer or winter of AMI data, a set of hours corresponding to the given season was simulated. These simulations were weather-normalized by applying hourly Typical Meteorological Year (TMY3) weather data, calculated as THI, based on the weather station closest to the participant's zip code. These simulations were run assuming the participants were enrolled in the Off-Peak Plan (the reality) and assuming the non-participants were not enrolled (the counterfactual). Plan and non-Plan rates were then applied to the modeled consumption and the resulting average monthly charges were compared across season and peak period. Only charges that differed between the Plan and non-Plan rates were used in these calculations. Any charges common to the rates, such as charges applied regardless of consumption level, were not included. Additionally, the modeled consumptions in kWh were compared between the simulated participant and non-participant results.

4 ANALYSIS DATA SUMMARY

4.1 Program population

The Off-Peak Plan had signed up 12,486 Dominion Energy customers as of September 13, 2022. Out of the 12,486 participants available for this 2022 evaluation, 3,655 (29%) had at least 3 months of available AMI data both pre- and post-enrollment for a single season, based on AMI start date. Similarly, there were 580,903 non-participants with the same minimum availability of AMI data to serve as potential controls. Of these, 3,503 participants and 555,255 potential controls had sufficient 2020 consumption data to be stratified by 2020 consumption bins and run through the initial 20:1 matching procedure. Over 99% of these participants were matched to 20 controls and none were matched to less than 11 at this stage. The remaining customers without sufficient 2020 consumption data were grouped into a separate stratum and were not run through the 20:1 matching procedure. In total, 76,699 customers–all 3,655 participants and 73,044 potential controls–were included in the request for AMI data and the next stage of refinement for the 1:1 nearest neighbor matching.

Upon receipt of AMI consumption data, all cases and controls were checked again for insufficient data coverage. First, only customers with AMI data covering at least 1 full season in both pre- and post-enrollment periods were retained. Then, any customers missing more than 50% of hourly consumption data in either their pre- or post-enrollment period were dropped. At this stage, 2,076 participants and 30,027 controls remained for 1:1 nearest neighbor matching. All participants were matched to a control. The final sample consisted of 4,152 total customers, 2,076 participants and matched controls for each.

4.2 Matched comparison group

The matched comparison group that closely mirrors the eligible Plan participants is developed from Dominion Energy customers with sufficient AMI data who have not yet chosen to participate in the Off-Peak Plan. The goal of the matching process is to identify a comparison group with consumption characteristics that match the Plan participants. The following plots show how the matching process chooses a set of similar non-participants.

Figure 4-1. Participant versus comparison group Summer Weekday average load shape comparison

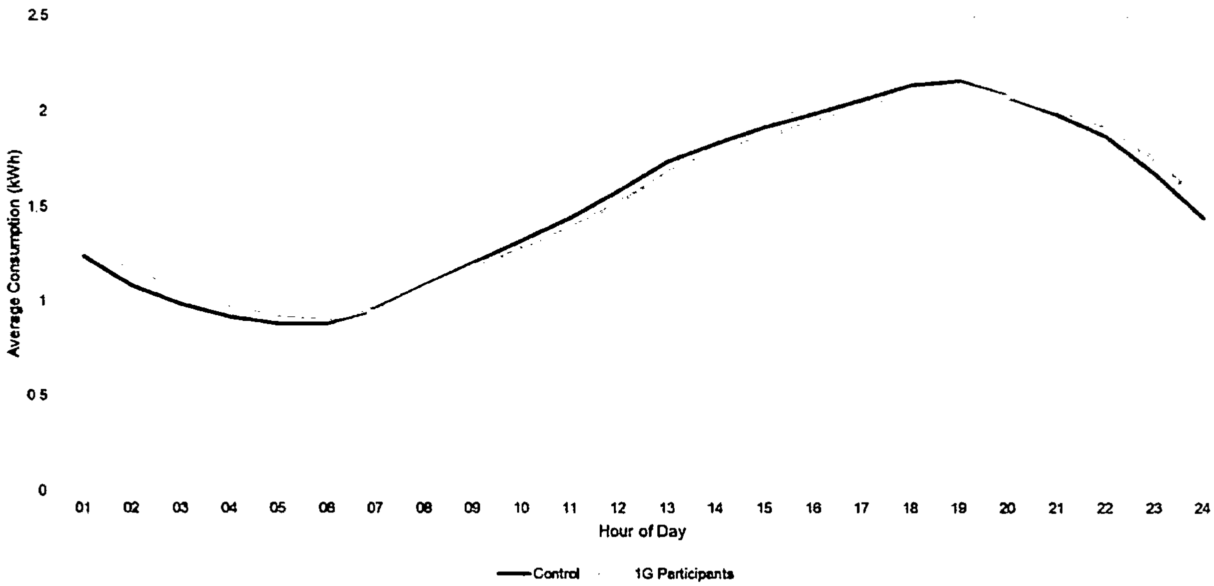

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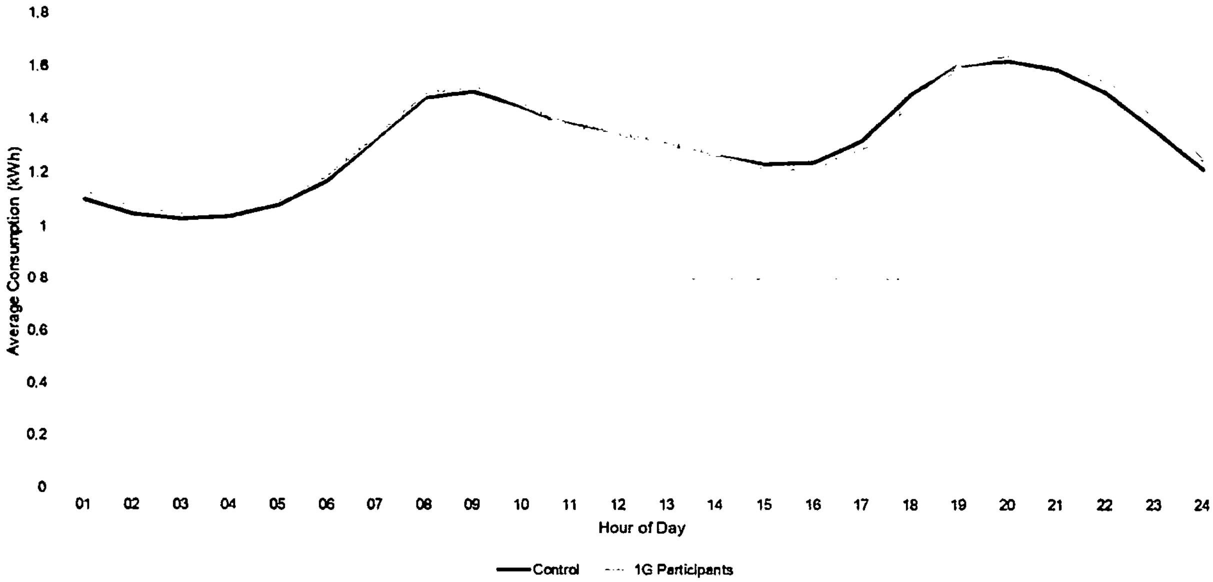
Figure 4-2. Participant versus comparison group Winter Weekday average load shape comparison



In addition to selecting a closely matched comparison group for use in the analysis, the difference-in-difference structure of the analysis regression effectively controls for small differences between the participant and comparison groups. The regression results can be interpreted as quantifying the consumption characteristic differences under the Plan rate between participant and comparison group members, controlling for any differences between those two groups based on pre-rate differences.

5 RESULTS

This evaluation produces both load and bill impact results. Load impacts are produced on a percentage basis using a log-transformed regression model. The bill estimates are based on a parallel linear version of the same regression model that facilitates estimating the full consumption profile of participants and non-participants that is required to apply the different rate structures. The bill impact estimates are based on typical weather whereas the percentage load impact estimates are not explicitly a function of weather.[8] Where it is possible to compare results across these models, and load reduction on a percentage basis, they are closely aligned. The report only presents the percentage-based load reduction estimates from the load impact regressions because this is the standard approach for estimating Plan impacts.

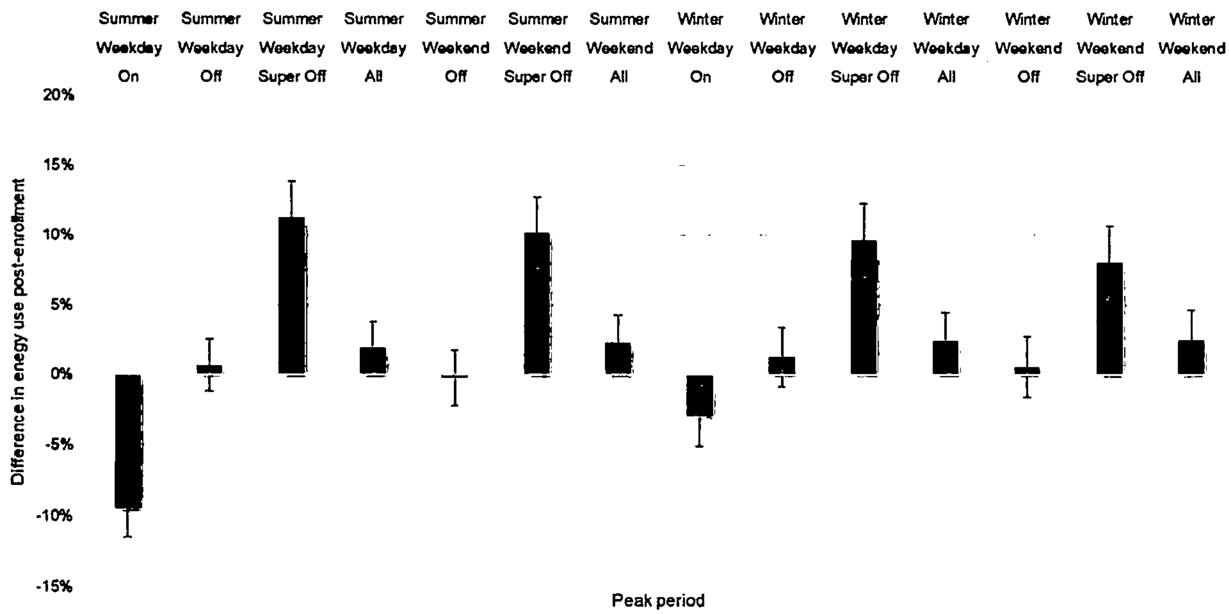
5.1 Load impacts

The results in this section are estimated in the log-transformed version of the analysis regression presented in section 3.4.

5.1.1 Overall Off-Peak Plan load impact

Figure 5-1 shows the impact of the Off-Peak Plan on participants' average electric load compared to the matched control group for each rate period on each day type in each season. During the summer on weekdays, participants shifted consumption from the on-peak period to the super off-peak period. On-peak average load decreased by 9.4% and super off-peak average load increased by 11.3%. Both results are statistically significant at the 95% confidence level. Off-peak average load increased slightly by 0.6% but this was not significant. Overall daily consumption increased slightly by 1.9%. Similarly, on summer weekends/holidays, off-peak average load negligibly decreased by 0.2%, super off-peak average load increased by 10.2%, and overall daily consumption increased by 2.3%.

Figure 5-1. Percent difference in post-enrollment average load for participants by season, day-type and period



[8] The regression includes weather variables, of course, but the impacts are not estimated as a function of weather in either model.

On winter weekdays, participants exhibited a similar shift from on-peak consumption to super off-peak consumption, although to a lesser extent. On-peak average load decreased by 2.9% and super off-peak average load increased by 9.6%, both of which were statistically significant. Off-peak average load increased slightly by 1.2% and was not significant. Overall daily consumption increased by 2.3%. Similarly on Winter weekends/holidays, off-peak average load increased negligibly by 0.5%, super off-peak average load increased by 8.0%, and overall daily consumption increased by 2.5%.

The notable difference between summer and winter is the increased degree of load reduction during the summer on-peak period. There are multiple possible explanations for this difference. The summer peak period may cover hours during which participants are not home and changes to primary energy consuming end uses such as cooling can be accomplished without discomfort or inconvenience. In addition, pre-cooling has the potential to similarly facilitate load reduction with limited comfort implications. There are two winter peaks, morning and evening, that cover twice as many hours and are situated during times that customer are more likely to be home and cooking meals. Rate-related adjustments during these time periods may be more difficult, though to the extent electric heat is contributing to consumption at these times, pre-heating remains a supporting option.

Error! Reference source not found. shows the same results by hour of day rather than peak period to show the program impacts in more detail.

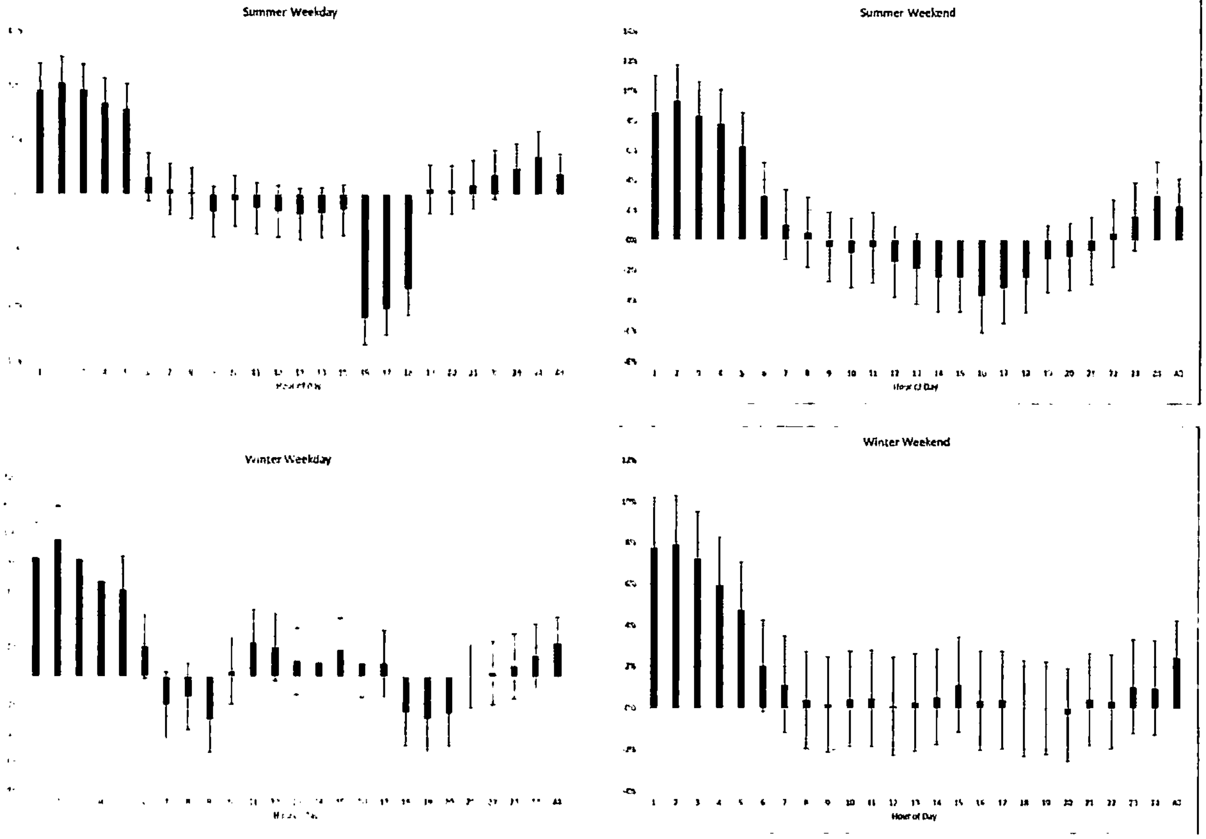
The first panel shows hourly impacts for summer weekdays. The greatest load increase in the super off-peak period is 10.8%, occurs at hour ending 2 (1:00-2:00 a.m.), and then tapers off until the first off-peak hour at hour ending 6 (5:00-6:00 a.m.) where no significant change in load is observed.

Then at hour ending 16 (3:00-4:00 p.m.), corresponding to the start of the on-peak period, load decreases to 10.6%. Decreased load continues, although to a lesser extent, until the end of the on-peak period.

When the second off-peak period begins at hour ending 19 (6:00-7:00 p.m.), load immediately reverts to typical levels and continues as such until hour 23 (10:00-11:00 p.m.) where load increases slightly by 2.4%, presumably in preparation for the next day's super off-peak period to begin.

The dramatic shifts at the period boundaries indicates that customers are actively targeting increased or decreased consumption during the specific period hours. While the greater on-peak load reduction in the first hour of on-peak is consistent with some AC control starting at the beginning of the period, there is no evidence supporting an increase in consumption prior to the start of on-peak that could be associated with pre-cooling.

Figure 5-2. Percent difference in post-enrollment load by season, day-type and hour of day



The second panel of **Error! Reference source not found.** shows that summer weekends exhibit the same general trends as summer weekdays during off and super off-peak periods. Interestingly, the consumption decreases observed during hours ending 16–18, which correspond to on-peak hours during summer weekdays, are significant but smaller in magnitude than on summer weekdays. This implies a behavioral "spillover" effect from weekdays into weekends that results in consumption shifts even without the cost incentive that exists on weekdays. This kind of spillover tends to be linked to technology-assisted load reduction, such as increasing AC setpoints, though any behavioral activity has the potential to persist. Similar spillover was observed and highlighted in a 2011 DNV evaluation of an early Dominion Energy rate-design pilot.[9]

The third panel of **Error! Reference source not found.** shows hourly consumption changes for winter weekdays. Super off-peak consumption change maxes out at an increase of 10.1% at hour ending 2 (1:00-2:00 a.m.) and then tapers off until the first on-peak period begins at hour ending 7 (6:00-7:00 a.m.), at which point consumption decreases by 2.0% and continues to be reduced throughout the first on-peak period. While across the whole morning on-peak period, average load reduction is statistically significant, these hourly results indicate that the greatest and only statistically significant load reduction is during the last hour of the morning period, hour ending 9 (8:00 am–9:00 am).

At hour ending 10 (9:00-10:00 a.m.), the start of the first off-peak period, consumption is not statistically different from controls and remains so throughout the midday off-peak period. Consumption again decreases compared to control by 2.5%

9 "Dominion Virginia Power's Dynamic Pricing Pilot 2016 Impact Evaluation Report," Case No. PUE-2010-00135, July 29, 2016.

at hour ending 18 (5:00-6:00 p.m.), corresponding to the start of the second on-peak period, and the load reduction remains statistically significant throughout the on-peak period.

Finally, during the second off-peak period starting at hour 21 (8:00-9:00 p.m.), consumption is not significantly different than controls, although it does increase by the hour in preparation for the next day's super off-peak period.

The winter weekday hourly plot visually demonstrates that the winter rate has more hours and covers hours many households come together before and after the typical workday. The shift in consumption behavior at the on-peak period boundaries, indicative of active rate-related activities, is still visually evident but less dramatic than the beginning of the summer on-peak period. Despite other differences to the overall winter shape, the increase in super off-peak consumption is of similar magnitude to the summer increase, statistically significant, and distinct from the surrounding rate periods.

The fourth panel of **Error! Reference source not found.** shows hourly load changes for winter weekends. Unlike summer weekends, there does not appear to be a behavioral "spillover" effect from winter weekdays during on-peak hours. Consumption during the super off-peak period remains significantly higher than controls, maxing out at 8.2% higher at hour ending 2 (1:00 am–2:00 am). There is no significant difference from controls throughout the rest of the day after the super off-peak period ends.

5.1.2 Load impact by income-qualified – non-income-qualified

To investigate the program's equity, we obtained income flags for 2,003 (96%) of the matched Plan participants. Of those, 241 (12%) were flagged as income-qualified customers.[10]

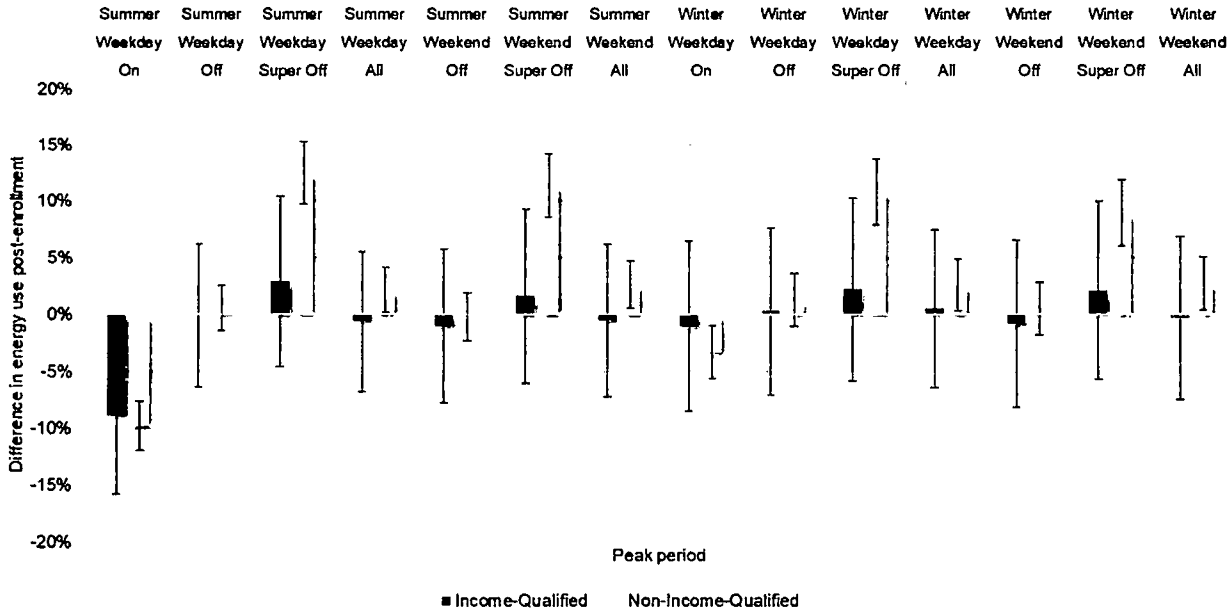
DNV repeated our peak group case/control regression model for breakouts based on income status. Results are shown in Figure 5-3. In general, participants flagged as income-qualified exhibit the same general trends as those not flagged as income-qualified across season and day-type, although most results are not statistically significant due to a combination of smaller effects and the low sample size of the IQ group.

Of note is the summer weekday on-peak period result. IQ participants' average load decreased by 8.9% in the on-peak period, similar to the non-IQ participants' 9.7% decrease. At the same time, the IQ participants' average load increased by only 2.9% in the super off-peak period, whereas the non- IQ participants' average load increased by 12.5%. This suggests that IQ participants are shifting their consumption from on-peak to super off-peak periods but are being more conservative than non-IQ participants at how much electricity they are using in the super off-peak period. This is evident in the consumption changes for all summer weekday hours taken together; IQ participants daily consumption decreased by 0.6% while non-IQ participants daily consumption increased by 2.1%. That pattern of relative overall consumption change persists for both day-types and seasons.

The Plan effects on IQ participants are modest across all periods during the winter season. Their winter on-peak load reduction is small and not statistically significant while they continue to shift very little consumption to the super off-peak period. Across all hours, IQ customer consumption is almost unchanged in contrast to an apparent, but not statistically significant, increase in overall consumption for non-IQ customers.

[10] Virginia DHCD

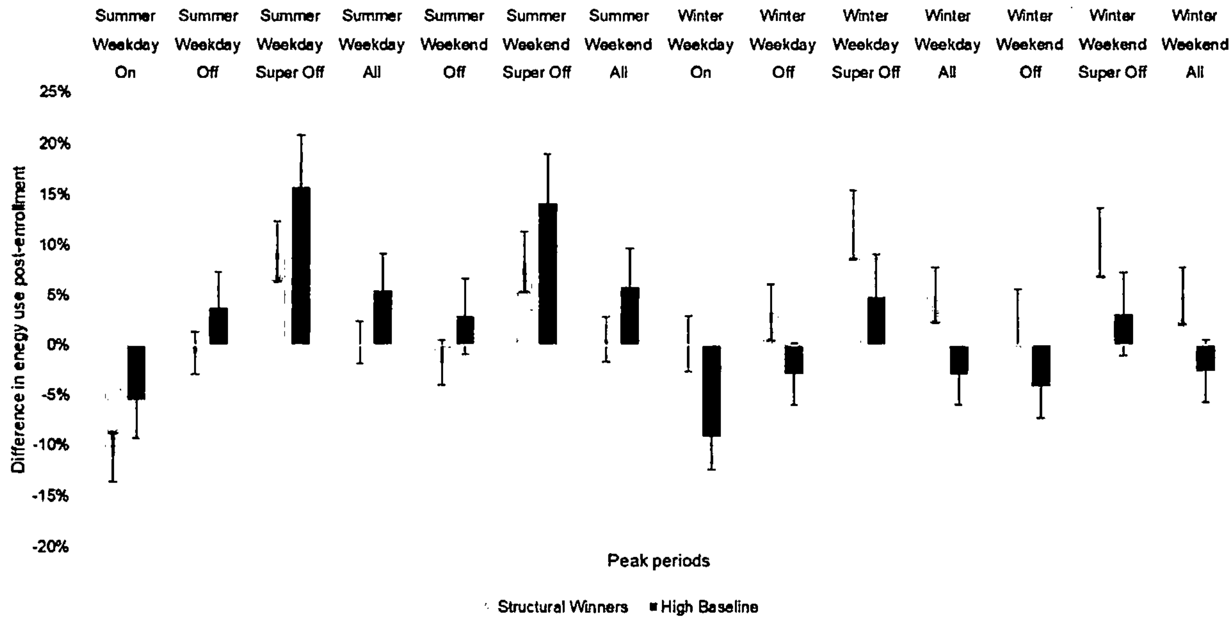
Figure 5-3. Percent difference in post-enrollment average load by income status



5.1.3 Load impact by structural winner vs high baseline load

Figure 5-4 provides load impact results based on baseline period load characteristics. The participants were flagged as structural winners if their bill charges, based on pre-participation consumption, would decrease simply by moving to the Off-Peak Plan rates without any consumption shifts. In contrast, those whose bill charges would increase on Plan rates without any behavioral change are identified as high baseline customers. All matched cases and controls were identified as either structural winners or high baseline customers using their actual pre-period consumption and calculating their full pre-period non-Plan and Plan charges with the corresponding rates. Structural winners composed 67% of both participants and matched controls. Note that the equal fraction of structural winners in the 2 groups further demonstrates that the control group is well matched to the participants.

Figure 5-4. Percent difference in post-enrollment average load by structural winner/high baseline customer status



Comparing Plan impacts by structural winner versus high baseline customers offers some unexpected findings. Contrary to expectations, structural winners decreased summer on-peak average load by more than twice as much as high baseline customers. That is, customers who already use relatively less during summer on-peak periods were still able to shift more, on a percentage basis, than customers who had high baseline on-peak period average load. Also, during both weekday and weekend super-off-peak, high baseline customers increased average load substantially more than structural winners.

These two findings combine to indicate that high baseline customers account for effectively all the overall consumption increase that occurs during the summer period. These findings indicate that during the summer season, structural winners more effectively shift load off on-peak on a percentage basis while not increasing overall consumption. In contrast, high baseline customers with more consumption to shed and a higher economic incentive to do so, did not shift load off on-peak or reduce overall consumption as well. Finally, these percentage impacts could be based on sufficiently different consumption denominators between these two groups that the actual magnitude of on-peak load reductions is similar. Unfortunately, while this moderates the difference, high baseline customers provide less load production on a kW basis.

Comparing winter Plan impacts by structural winner versus high baseline customers offers results that contrast with both overall results and the summer period high baseline customer results. In the winter season, only high baseline customers reduced load during on-peak periods. High baseline customers' on-peak reduction is almost double their reduction during summer on-peak. Structural winner load reduction drops to zero from a summer on-peak reduction level of 12%. High baseline customers continue to provide load reduction during off-peak hours. At the same time, the average load increase during super off-peak is relatively modest. In contrast, structural winners take greater advantage of both off-peak and super off-peak periods. The winter season results are more in line with general expectations that the ability to load shift is a function of having load during that period that can be shifted. During the winter, structural winners provide no on-peak period load reduction while increasing overall consumption by 5%. High baseline customers provide substantial on-peak load reduction (9%) while reducing overall consumption by almost 3%.

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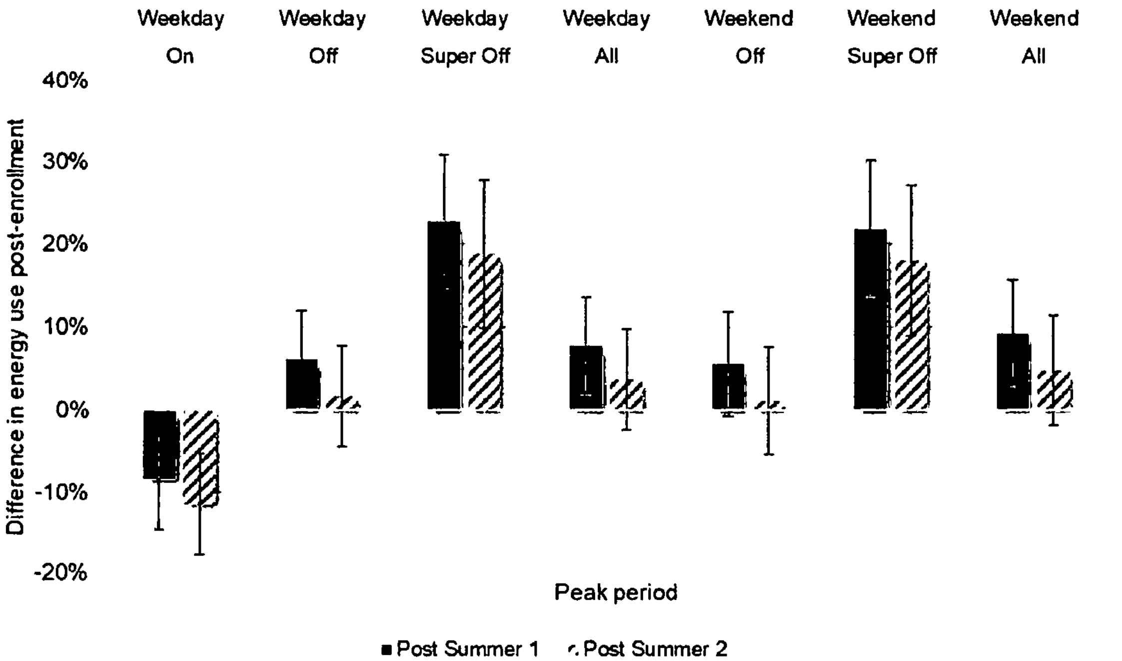
5.1.4 Load impact persistence

A subset of 325 participants enrolled in the Off-Peak Plan prior to the summer 2021 season. These participants have elapsed two full summers in their post-enrollment period and presented an opportunity to analyze the summer season impact of the program on a second summer season of participation. All 325 matched controls also had sufficient post-enrollment data to be included in this analysis. Figure 5-5 indicates that Plan effects for this subset remain relatively constant in the second summer. None of the changes in the second summer are statistically different from the prior summer's levels. To the extent there is movement, the efficacy of the Plan rate appears to be improving. On-peak load reduction is greater during the second summer. Off-peak, super-off-peak average load and overall consumption all decrease in the second summer for both day-types. These results cover Plan effects for just the summer and the subset represents a group of early adopter participants with greater super off-peak average load than the full Plan participant population. However, they indicate that Plan impacts will remain in a second year and may, in fact, improve in load shifting and overall consumption characteristics.

Figure 5-5. Percent difference in post-enrollment summer load for participants with two full post summers



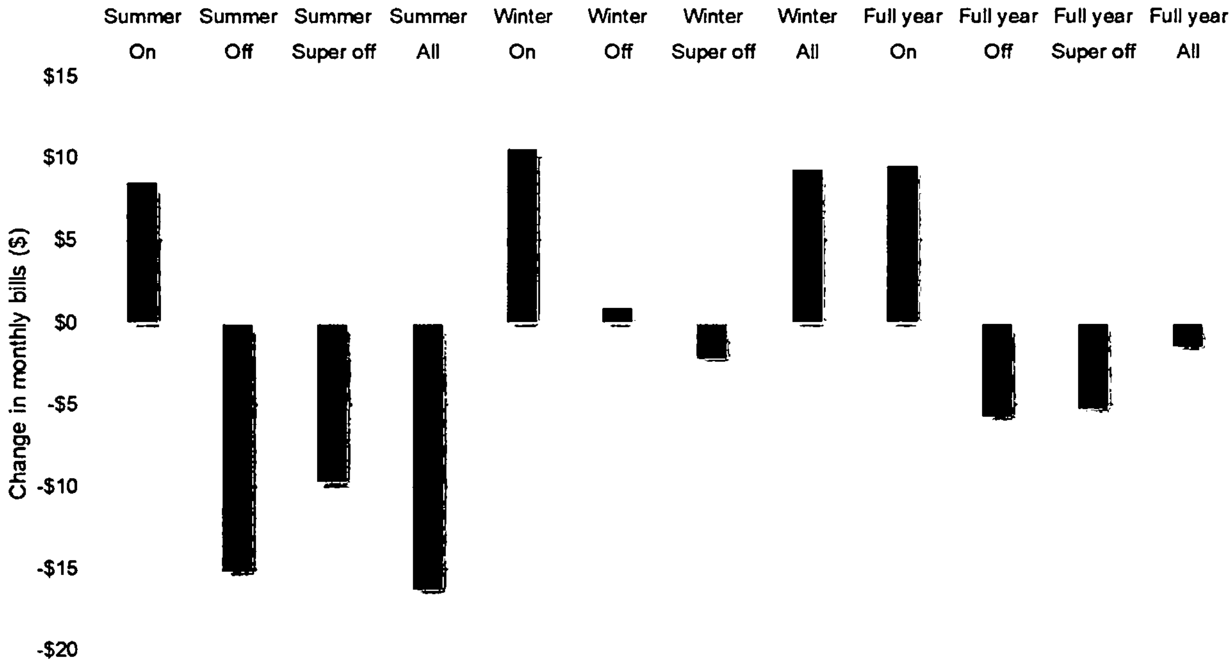
5.2 Bill impacts

As discussed in section 3.5, Bill impacts are calculated from a linear (non-logged), weather normalized version of the same model that produces the percentage load impacts above. This is necessary because full kWh consumption in each rate period must be estimated, not just the rate-related impacts. The fact that model inputs are not logged will not affect the impacts, but the weather-normalization may change the full period consumption results as the model results are put on typical weather terms. Finally, the non-Plan residential rate (100) is calculated within TOU periods to illustrate in which periods the rate impacts occur.

5.2.1 Overall bill impacts

Figure 5-6 provides the bill impacts associated with the load impacts shown in Figure 5-1. The values plotted are monthly changes in bill amounts, by TOU rate period, for summer and winter separately, as well as the full year. Despite an almost 10% drop in consumption during summer on-peak period, customers paid $8 more per month during the summer on-peak hours. In contrast, increases in consumption during off- and super off-peak periods led to substantial decreases in bill charges during those hours. Overall summer bills were $16 lower for customers on the Off-Peak Plan rate.

Figure 5-6. Average change in monthly bill in dollars by season and rate period

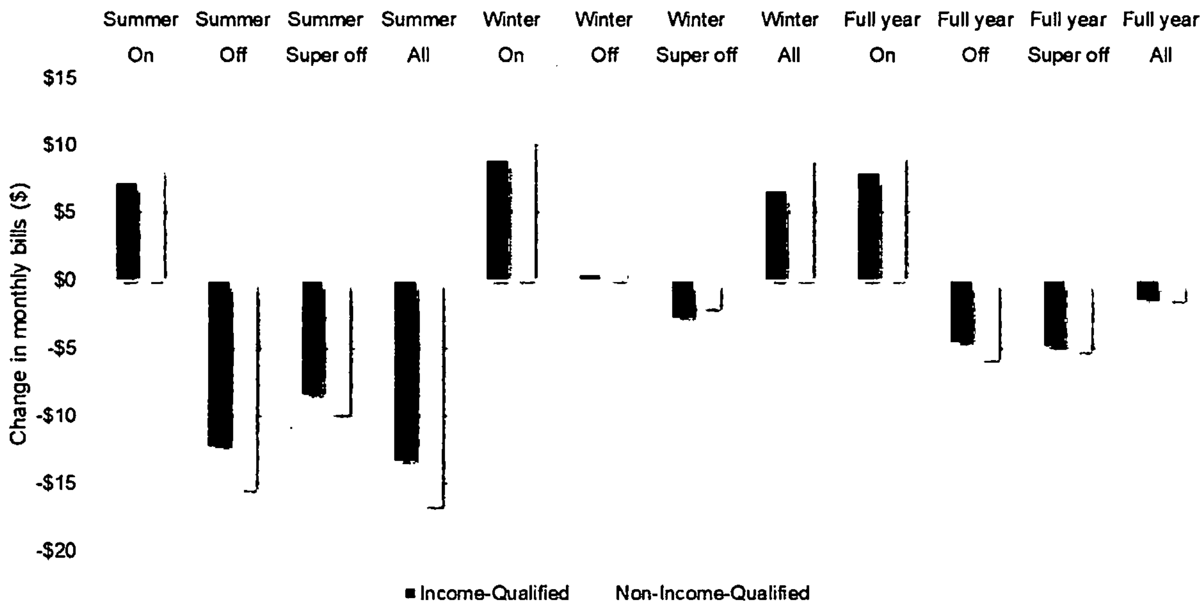


The winter period has a similar increased charge during on-peak periods; however, the off and super off-peak periods do not balance the on-peak increase with substantial decreases. Overall, winter bills increased by $9 per month. The full year results show a similar period to period pattern with overall bills decreasing by $1.42 per month, or $17.04 annually. While the summer overall decrease appears larger than the winter overall increase, there are 5 summer months and 7 winter months, and the combined bill impact reflects the weighted combination of the seasons.

5.2.2 Bill impact by non-income-qualified –income-qualified

Figure 5-7 provides the bill impacts associated with the IQ and non- IQ load impacts shown in Figure 5-3. IQ and non-IQ bill impacts are remarkably similar despite some clear differences in the load impacts. For example, the substantial relative decrease in summer super off-peak load for IQ customers does not lead to decrease in average monthly summer super off-peak bills. For both IQ and non-IQ, the imbalance between summer and winter bills remains and the combined annual effect is a similarly modest average monthly reduction in bill amount. On a percentage basis, the bill reduction is roughly 3% for both groups.

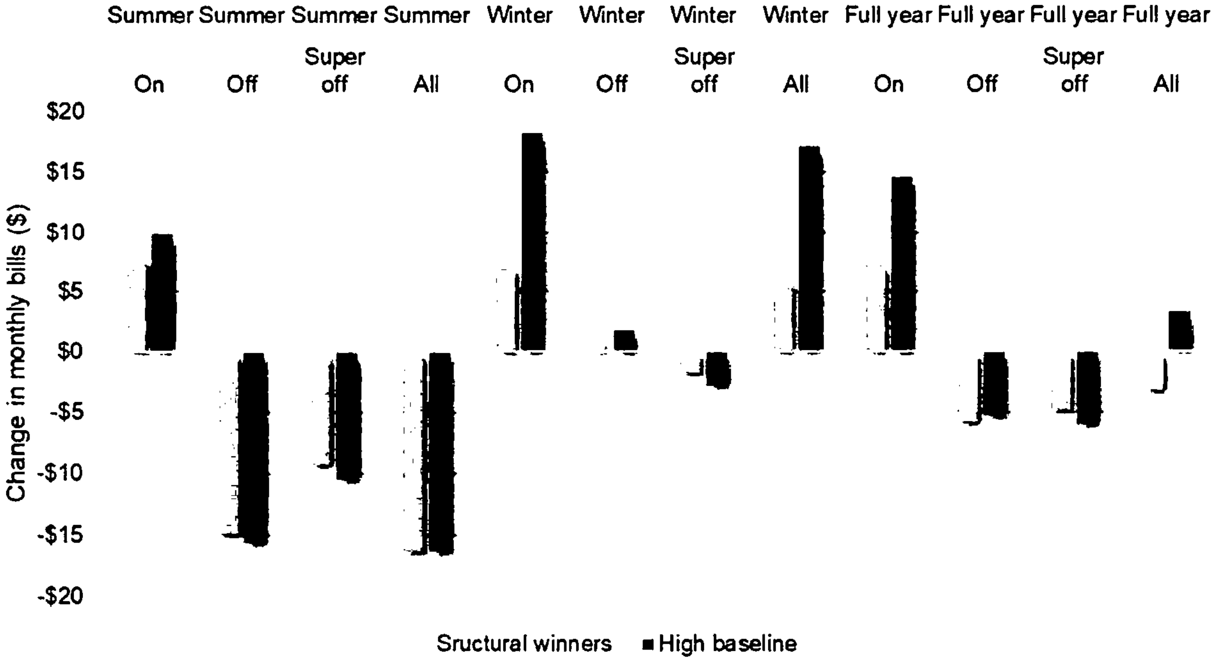
Figure 5-7. Average change in monthly bill in dollars by season, rate period and income status



5.2.3 Bill impact by structural winners and losers

Bill impacts take into consideration the baseline level of consumption in each period as well as the change in consumption. That is, if consumption starts high during expensive on-peak period hours, despite a substantial decrease in consumption, bills during that period may still increase. Figure 5-8 provides the bill impacts associated with the structural winner and high-consumption customer load impacts shown in Figure 5-4. Relative summer charges for each period in this figure are consistent with expectations based on load differences on a percentage basis in Figure 5-4. For example, high baseline customers reduce less on-peak, and their bills increase more during that period. Structural losers also increase load more in the super off-peak period but given the low bill rate in that period, the increase in bill differential is relatively small for that period.

Figure 5-8. Average change in monthly bill in dollars by season, rate period and structural winner/high baseline customer



The winter period bill impact results demonstrate the effects of the higher on-peak rate on customers with higher baseline on-peak consumption. Those customers starting from a higher consumption during winter on-peak decrease their load by a much larger percentage than structural winners in the winter on-peak period but still pay more than double for energy in that period. In contrast, structural winner increases in consumption in the super off-peak period do not translate into a bill increase for that period. High baseline customers' bills increase by just under 5%, representing an increase of $3.31 per monthly bill on average. In contrast, structural winners decrease their bills by just over 7%, representing a decrease of $3.32 per monthly bill on average.

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6 FINDINGS

The Off-Peak Plan delivered 9.4% summer on-peak period load reduction and 2.9% winter on-peak period load reduction for Plan participants. The summer peak load reduction is substantial given the relatively modest 2:1 price ratio. The Plan delivered peak load reduction comparable to a recent Baltimore Gas and Electric TOU program despite that program's much more aggressive peak period ratio of almost 5:1.[11]

Preliminary evidence indicates that Off-Peak Plan impacts were persistent in the second summer for participants who enrolled early and for whom two summers worth of data were available.

The Plan rate leads to substantial decreases for the five summer-season monthly bills and increases in the seven winter-season monthly bills. On average, across the year, the typical customer will see a slight decrease in monthly bills of roughly 2.6% or $1.42 or $17.04 per year.

IQ customers provided almost as much summer on-peak load reduction, on a percentage basis, as non-IQ customers (8.9% versus 9.7%, respectively). IQ customers showed modest winter load reduction, directionally, but it was not statistically significantly different from zero.

IQ customers experienced a similar pattern of bill impacts as non-IQ customers with a decrease in bills during the summer and increase during the winter. Across the whole year, IQ participant bills were lower, directionally, but the reduction was not statistically significant.

Customers with high baseline peak period consumption contributed lower summer on-peak reduction than structural winners who have lower baseline peak period consumption. This is contrary to expectations, as high baseline customers have both greater on-peak period consumption to reduce and a greater monetary motivation to reduce that consumption. High baseline customers also increased off- and super off-peak consumption substantially more than structural winners, which drives the overall summer increase in consumption for high baseline customers.

In contrast, high baseline customers provided substantial winter on-peak load reduction while structural winners offered no on-peak load reduction during winter months. High baseline customers' winter on-peak load reductions were of similar magnitude (~10%) to structural winner summer on-peak load reductions. Overall winter consumption was lower for high baseline customers than structural winners.

Despite substantial on-peak load reduction in both seasons, the average high baseline customer faced an increased bill on average over the year. The seasonal pattern of lower summer bills and higher winter bills was consistent with the overall population, but the winter bill increase for high baseline customers was almost three times that of the structural winners despite the evident greater efforts at load reduction during the winter on-peak period.

[11] BG&E's TOU rate only had on- and off-peak rates making the comparison inexact, but even a Peak to Super off-peak ratio is only 2.5 – 1 ratio. BG&E results and rates from *PC44 Time of Use Pilots: Year One Evaluation*. Prepared for the Maryland Utilities by Brattle Group. September 15, 2020.

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