Olivine Community: Fresno Energy Program

Sponsored By: Pacific Gas and Electric (PG&E)

FINAL REPORT

Prepared and Submitted by Olivine Inc.

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Executive Summary

Pacific Gas & Electric (PG&E) in partnership with Olivine implemented the Fresno Energy Program in response to the California Public Utilities Commission (CPUC) Decision 18-11-029 directing investor-owned utilities (IOU) to undertake Demand Response (DR) pilots focused on load-constrained disadvantaged communities (DACs) in California.

Modeled after Olivine's Distributed Energy Resources (DER) Community (Olivine Community), the Fresno Energy Program was designed as a behavioral DR program targeting eight zip codes in south-central Fresno located within a 10-mile radius of the Malaga power plant. The program was powered by the Olivine Technology Suite which enabled customer enrollment, engagement and communication, performance measurement and program metrics reporting. The bi-lingual (English and Spanish) Olivine Community web and mobile app enabled customer enrollments through a simple process, allowed customers to monitor home energy usage, receive and respond to DR event notifications, view event performance, track incentives earned, and provide referrals into the program. The Olivine DER Platform managed customer meter data, calculated event performance baselines and load reduction metrics for the program. Olivine's customer relationship management (CRM) system and processes tracked customer program enrollments, managed marketing, supported customer support inquiries and disbursed the surveys and incentives payments.

The program was designed and implemented between October 2019 – March 2021 and the program assessment period was April – December 2021. All enrolled participants participated in twenty DR events during July 2020 – March 2021- split between load shed events. Program customers also participated in two surveys which provided data on how DAC residents used energy in their homes and feedback on their experience of participating in the program.

The program's marketing and outreach strategy included partnering with prominent local community-based organizations (CBOs) to engage the Fresno community in-person through public events, door-to-door campaigning and events focused on education and enrollment assistance. This strategy had to be modified in response to the COVID-19 pandemic and stay-at-home orders issued shortly after the launch of the program. COVID-19 restrictions forced this program to pivot from in-person to digital customer engagement. The COVID-19 restrictions and the inability to engage the DAC-residents in person resulted in the program not meeting its full enrollment potential. The program was successfully able to enroll 458 participants. Of this number, 407 were DAC residents (89% of total) and 51 were non-DAC residents (11%).

The program implementation and data collected through the customer surveys provided valuable insight into the opportunities and barriers of engaging DAC residents in DR programs. Participants showed an overall ability, willingness and interest to participate in DR and were motivated by financial benefits, helping their community, alleviating grid stress and for environmental reasons. The preferred outreach methods by participants were referrals and email, with 36% of enrollments coming from referrals from CBO partners using personalized

communication methods for outreach. The participants had a basic understanding of how to reduce energy through behavioral action, but their awareness of available DR programs and how to participate in them was limited.

The program results possibly debunked some assumptions about DAC participation in demand response. For instance, the program showed a surprisingly high DR program conflict rate in customers, which resulted in 20% of the initiated enrollments not being able to be successfully enrolled. This compels us to question the belief in the industry that taxpayer-funded DR programs and offerings do not adequately reach DAC residents in California.

Another common belief is that language and technology can be a barrier in engaging DAC residents in programs. However, our results show that in a predominantly Hispanic/Latino community, most participants (78%) reported that English was the primary language spoken at home. When presented the choice between Spanish or English and web or mobile enrollment, participants preferred English (93%) and the mobile app (74%).

We also learned that DAC and non-DAC residents both had similar adoption rates for smart, DR enabled technologies in their homes. The program participants delivered an average 0.69 kW/household of load reduction in the summer load-shed season with DAC participants showing higher event notification response rates than non-DAC participants. This load reduction demonstrated was very high for a behavioral DR program and was comparable to performance seen by PG&E SmartAC program which remotely controls over customer's air-conditioning equipment during DR events. The performance results alleviate the concerns that DAC residents may not have the ability to participate or deliver load flexibility in DR programs. The results from the load-shift season were less promising and customers were not able to demonstrate shifting load from evening peak periods into the daytime hours of excess renewable energy available on the grid. This was potentially due to the confusing shift mid-program from a load-shed season to a load-shift season, and participants were unable to perform as expected.

The Fresno Energy Program's 20 DR events implemented during July 2020-March 2021 were able to help PG&E avoid consumption of 3.13 MWh of energy and avoided a total of $1,248.10 in wholesale energy costs and 2,723.8 lbs of CO_2 emissions, which is equivalent to the emissions from vehicles driving 2,447 miles. The program delivered a total of $59,020 in economic benefits to participants in incentives for completion of surveys, participation in DR events and referrals.

At scale, a similar statewide effort could potentially deliver ~685 MW of flexible load capacity with the assumption of 0.5 kW of load drop capacity per household and 10% of all statewide households participating in a behavioral DR program. Olivine recommends that the lessons learned, and insights gained from this program be leveraged to expand behavioral DR as a statewide program. Implementation of behavioral DR programs can keep the costs low for customers, be a tool for managing time-of-use (TOU) pricing and possibly alleviate the utility burden and economic hardship DAC communities face by tapping into the unlocked potential of flexible loads in their homes.

1.0 About Olivine

Olivine, Inc. provides infrastructure and services that enable distributed and aggregated resources such as solar, electric vehicles, battery storage and other appliances to effectively and efficiently offer services to maintain a healthy grid and provide resiliency through clean energy options. Designing first-of-a-kind, proof-of-concept projects, Olivine has developed unique approaches, especially relating to behind-the-meter challenges, and is the first third-party to integrate battery storage and other demand-side technologies into California's wholesale markets.

Olivine has pioneered the concept of the Distributed Energy Resources (DER) Community (The Olivine Community), which defined the basis for the Fresno Energy Program. The Olivine Community model serves as an umbrella for the deployment of DER aggregations that can be managed to meet a set of common goals and objectives. Conventional DER programs focus on deployments of single-technology programs, which minimize the ability to combine the benefits and operational characteristics of multiple technologies across a wide geographic range, customer classes, and customer demographics. The Fresno Energy Program also utilized the award-winning Olivine DER™ Platform, Olivine App and other tools from the Olivine Technology Suite to operationalize the program for enrollments, event management, customer engagement and data reporting.

2.0 Background

In 2015, the Clean Energy and Pollution Reduction Act of 2015 (also known as Senate Bill 350 or SB 350) called upon the California Public Utilities Commission (CPUC) to help improve air quality and economic conditions in communities identified as "disadvantaged." In early 2018, fulfilling a SB 350 requirement, the CPUC and the California Energy Commission (CEC) jointly approved members of the Disadvantaged Communities Advisory Group (DACAG) to provide advice on state programs proposed to achieve clean energy and pollution reduction. The DACAG members represented the diverse nature of disadvantaged communities throughout the state, reflecting the different rural and urban, cultural and ethnic, and geographic regions.

Finally, in 2018, the CPUC Decision 18-11-029 or the Decision (issued December 10, 2018) ordered the Investor-Owned Utilities (IOUs) to each submit a Tier II Advice letter proposing a demand response (DR) pilot focused on providing direct economic benefits to disadvantaged communities (DACs). The Decision defined DACs as census tracts that score above 75th percentile using the CalEnviroScreen tool plus an additional 22 census tracts that score in the

highest five percent of CalEnviroScreen's pollution burden, but do not have an overall CalEnviroScreen score because of unreliable socioeconomic or health data.[1]

In February 2019, Pacific, Gas & Electric (PG&E) filed CPUC Advice Letter 5477-E[2] in response to the Decision and proposed The Olivine Community: Fresno Energy Program as the PG&E DAC Pilot Program. The Fresno Energy Program adopted the Olivine Community framework and methodology used in the Olivine Community Energy Initiative (OCEI)[3] and expanded it to select geographic zones in Fresno, CA with an overall vision of eventually expanding the program to all residents in the Central Valley.

2.1 Program Target Audience

The Decision provided for the use of zip codes or census tracts in targeting for the purposes of this program. The DAC communities from seven zip codes (93701, 93702, 93703, 93706, 93721, 93725 and 93728) within a 10-mile radius of the Malaga power plant[4] became the target area for the program. This area encompassed DAC census tracts in south-central Fresno, previously selected for the Community Air Protection Program under Assembly Bill (AB) 617. In addition, an eighth zip code (93704) with some non-DAC census tracts was added to the target area as a 'study group' in order to provide a comparison of DAC and non-DAC program participants (Figure 1).

[1] D.18-11-029, p. 62. Link: https://oehha.ca.gov/media/downloads/calenviroscreen/fact-sheet/ces30factsheetfinal.pdf
[2] Subsequently in May 2019, PG&E filed supplemental AL-5477-E-A to update the pilot eligible zip codes consistent with Assembly Bill 617.
[3] The OCEI was a behavioral demand response study conducted in Richmond, California between July 2018 and December 2018 to examine household energy consumption in disadvantaged communities and a customer's ability and interest in demand response program participation. The OCEI had been successful at incentivizing participants to complete surveys, participate in demand response events and maximize their earning potential.
[4] The Malaga Power Plant is a 96 MW gas fired peaking plant located in south Fresno.

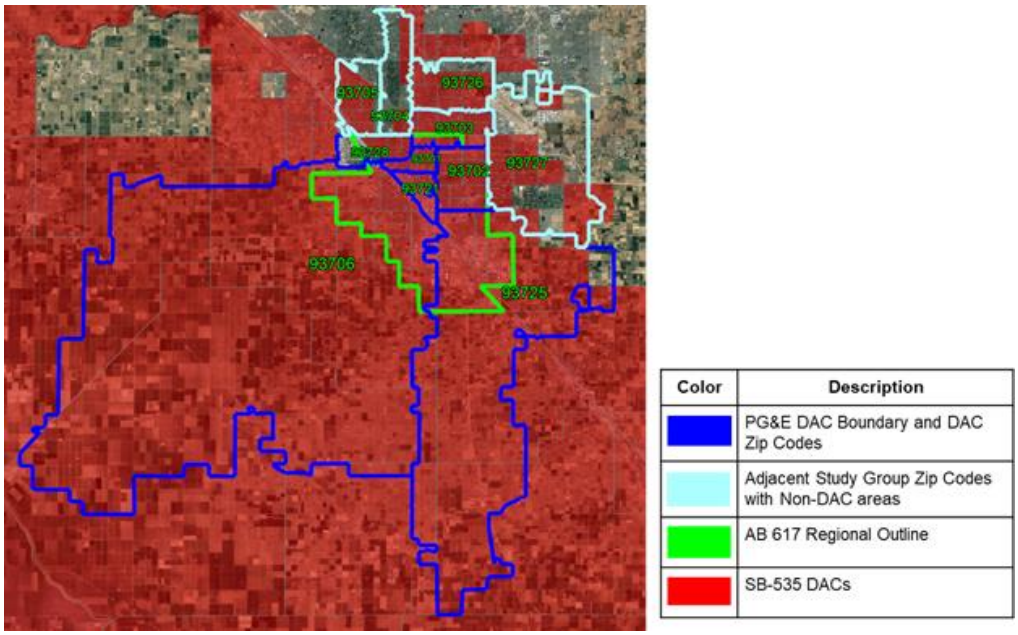

Figure 1. Program Boundary (DAC) and Adjacent Non-DAC zip codes

The target area for the program falls into the Fresno sub-Load-Aggregation-Point (subLAP) as currently defined by the CAISO. During hot summer afternoons the Malaga powerplant can be dispatched to meet high energy demand in the greater Fresno area. Distribution lines serving South Central Fresno can also experience high loading conditions during these same periods. Focusing the implementation of the Fresno Energy Program in this area will help us examine the opportunities and barriers of engaging this community in DR programs which could potentially reduce the need for dispatch and cycling of peaking plants and reduce high loading on distribution lines potentially extending the life of that equipment.

The 2010 U.S. Census Data, 2013-2017 American Community Survey (ACS) 5 Yr. estimates, and PG&E customer data of the target population were analyzed to better understand the target audience and help guide program design decisions. This target area had some of the highest environmental justice (EJ) percentile rankings in the state; the average CalEnviroScreen Score was above the 97th percentile and approximately 75% of households were eligible for utility assistance programs such as California Alternative Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) programs. The target audience for the program was young (median age was 30 years), largely Hispanic/ Latino origin (66% of the population) and low-income with an annual median household income of $29,000.

There were 50,352 households in the target area, with 41,806 residential PG&E service accounts in the program area that could be targeted for enrollment in the Fresno program. The weighted average monthly residential utility bill for all residential customers was $138 across different categories and most residential customers (96%) were on the single-meter residential

E1 rate tariff[5]. The daily load profile analysis (Figure 2) of the PG&E residential customer accounts across each zip code in the program target area showed that the evening peak loads corresponded with the drop-off of solar PV from the grid (4 – 9 pm). Figure 3 shows the monthly average load profiles for the largest zip code by load, 93706. The seasonal difference in load showed the highest load months were between June through September, indicative of high evening air-conditioning loads and these months could be specifically targeted for load shedding. The load profile analysis suggests that by flattening the load profile across the day, the large-scale deployment of DR initiatives might be one potential solution that could decrease grid congestion, emissions and avoid high wholesale energy prices for the target area.

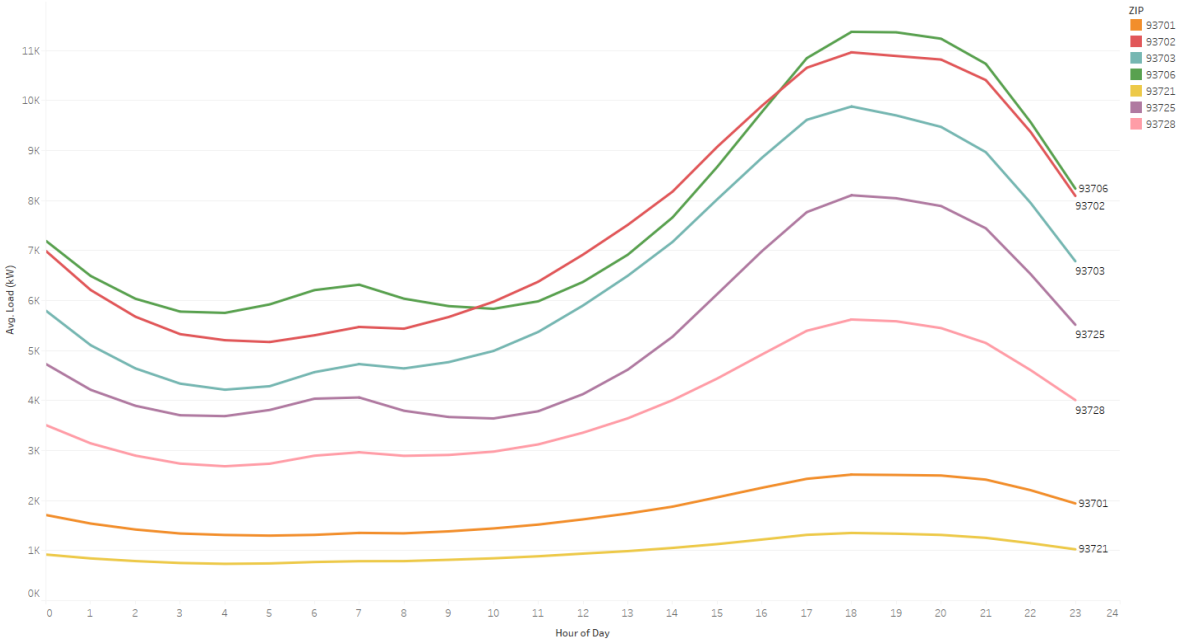

Figure 2. Average daily load profile by zip code

[5] The E1 tariff encompasses customers who are classified as E1, HE1 (E1 smart metered), and HE1N (E1 smart meter with NEM)

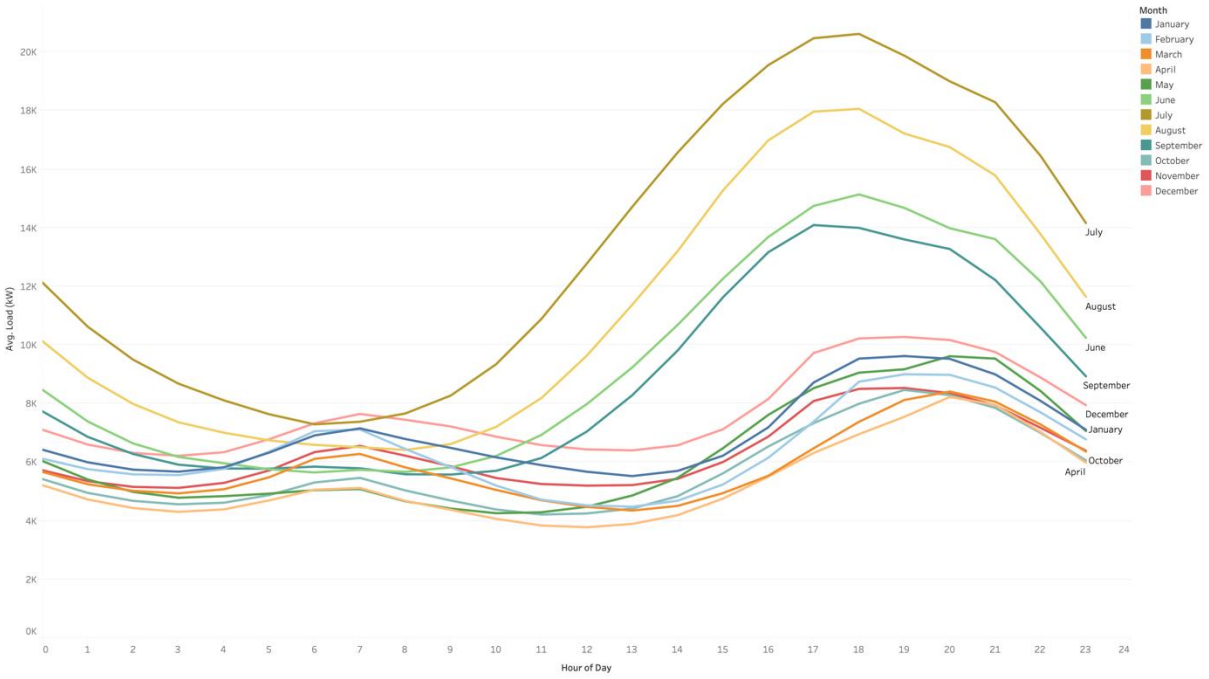

Figure 3. Average daily load profile by month for zip code 93706

3.0 Program Design

The goal of the Fresno Energy Program was to collect demographic, psychographic and energy usage data from program participants to evaluate the willingness and ability of DAC residents to participate in DR programs by reducing or shifting load in response to both economic and environmental signals.

The program was designed as a Behavioral DR program that engaged customers via a web and mobile app for participation in ten summer load-shed DR events in summer and ten load-shift DR events in the winter/spring months. The program also collected data through two surveys administered during the program which collected data about the efficacy of outreach methods, energy use patterns, and the overall experience of participants in the program. The surveys helped analyze the potential of scaling up DR programs in DAC communities and understand what kind of program offerings will be of greatest value to DAC households and benefit them the most. Instrumental to the program design was the robust program team that included community-based organization (CBO) partners and local program ambassadors to conduct outreach and marketing for the program. Figure 4 below summarizes the design of the Fresno Energy Program and what participants were expected to do in the program.

Figure 4. Summary of Fresno Energy Program

3.1 Demand Response Events

The DR event season for the program was between July 2020 – March 2021 and the events were split as follows:

- *Load Shed Events*: Summer 2020 was the peak load shed event study season for the program. There were ten load-shed events dispatched in the summer months of July – September 2020. Events were organized during 4-9 pm peak system load hours and participants were asked to reduce their energy consumption during the event window. The expected results were an energy load reduction during the event hours.

- *Load Shift Events:* Fall and winter months between October 2020 – March 2021 were the load shift season for the program. There were ten load shift events dispatched during this time during the daytime hours when there was an abundant of renewable energy available for the grid. The participants were requested to shift their high energy consuming behaviors (e.g., clothes washing, electric cooking, etc.) into the event window to take advantage of the excess clean energy available. Prior to the program's shift from the load-shed season into the load-shift season, the participants were sent communications educating them about the upcoming change in DR events. The expected results were an energy load increase during the event hours.

Events were each 1-2 hours long, with no more than one event per day and five events per month. Events were called based on close tracking of multiple triggers such as the PG&E system load, wholesale prices, local temperatures, local air quality, and renewable energy curtailment – used as a proxy for excess clean energy on the grid for load-shift event triggers. Program participants received pre-event notifications of upcoming events through email, text or app push notifications. Participants received incentives for event participation if they accepted the event request or provided a reason for declining the request.

The program was designed to trigger a DR event to smooth out periods of system need, reduce the need to operate peaker plants, and to utilize the abundance of renewable energy available on the grid. Data reveals that peaker plants such as the Malaga plant have been

forced to operate primarily during periods of high local temperature, high wholesale prices, high system loads or low availability of renewable sources of energy. The program team tracked the following indicators and used relevant data to trigger the DR events in the program:

- *Local Temperature:* High outdoor temperature prediction for Fresno which have a direct correlation with system load and Malaga runtime. E.g. 106°F
- *P Node Price:* High predicted price of energy during peak demand time. E.g. $600/MWh
- *System Load:* High average PG&E system load E.g. 20,000 MW
- *Air Quality:* High AQI (Air Quality Index) e.g., > 200
- *Renewable Energy Curtailment:* High renewable energy curtailment probability days to trigger a load shift event e.g. if significant renewable oversupply was forecasted by the CAISO for the following day

3.2 Surveys

Two surveys were administered online during the program to collect data about program participants' energy use patterns, technology adoption, DR awareness, program participation experience and to solicit feedback for future program designs.

- Home Energy survey: This survey (Appendix A: Home Energy Survey) was administrated shortly after enrollment and included questions about a participant's demographics, energy usage, concerns related to energy use, household characteristics, awareness of DR programs, willingness to participate, ability to participate and clean energy technology adoption.
- Customer Experience survey: This survey (Appendix B: Customer Experience Survey), administrated after the last event, inquired about a participant's experience with event participation, motivation for participation, outreach, and messaging effectiveness and for input on future program designs.

3.3 Program Incentives

There was a total of $250/household available as direct economic benefits to program participants for providing responses to surveys, DR event participation and program referrals. The incentive payments for DR events were contingent upon the participants responding to the event notifications. The program incentive payments were not performance-based and all participants were paid to stay engaged with the program and provide feedback when not participating in events. Participants did not earn incentives if they ignored notifications and did not engage with the program. Program participants were paid on a regular basis based on their participation activity and did not need to wait till the end of the program to get paid. This helped

keep participants engaged and motivated to continue participating in the program. The incentives were disbursed in the form of electronic cards (eCards) redeemable for gift cards to local retailers or prepaid VISA cards. Table 1 below breaks down the various incentive types and the frequency of payment disbursements.

Incentive Type	Incentive Amount ($)	Payment Frequency
Home Energy Survey	$30	Weekly
Customer Experience Survey	$30	Weekly
Demand Response Events	$170 for all events	Monthly
Referral Bonus* (Limit 10 per household)	$20	Weekly

**Assumes that all households will qualify for at least one successful bonus referral*

Table 1. Program Incentive Structure and Payment Frequency

3.4 Program Team and Community Partners

The program team was led by Olivine as the program administrator and the demand response provider (DRP) for the program and was responsible for program design, program operations, customer outreach and engagement, incentives payments and reporting. PG&E was the program sponsor and provided program oversight and regular review and approval of program content and operations. The two parties collaborated on program marketing where PG&E provided customer data to Olivine to leverage for customer outreach and marketing activities.

The program team also partnered with the following key community-based organizations (CBOs) who provided support with customer outreach and engagement.

- **Fresno Housing Authority (FHA):** A public agency that supports families and individuals across Fresno County access quality housing, become engaged in their neighborhoods, and build vibrant communities. FHA had 24 properties and a total of 1,475 units in the program target area and agreed to work with the program team to provide access to their properties and residents for program marketing.

- **GRID Alternatives:** A 501(c)(3) certified non-profit organization focused on making renewable energy technology and job training accessible to underserved communities. GRID partnered with the program team for program marketing and customer engagement.

- **Central California Food Bank:** Serves Fresno and other central valley residents in need of food through partner feeding sites, fresh produce distribution, grocery pickup and delivery, senior hunger programs and school food programs. The Food Bank partnered with the program and distributed program flyers to its customers in Fresno.

- **United Way of Fresno and Madera Counties:** A charitable organization focused on creating community-based and community led solutions that strengthen the

cornerstones for a good quality of life: education, financial stability, and health. United Way worked with the team to educate its existing clients and inform them about the Fresno Energy Program and encouraged them to enroll in the program. United Way organized social media events, distributed flyers, and helped with telemarketing the program to its community.

- **Community Center for Arts and Technology (CCAT):** A grassroots community-based center that offers classes in performing arts and digital media arts for kids from underserved communities. CCAT helped market the program to its community of members through events and flyer distribution.

- **San Joaquin Valley Air Pollution Control District (Valley Air District):** The Valley Air District is a public health agency whose mission is to improve the health and quality of life for all Valley residents through efficient, effective and entrepreneurial air quality management strategies. They helped market the program to its community through flyer distribution

3.5 Customer Outreach and Program Marketing

The Fresno Energy Program was launched in March 2020 with all marketing, outreach and educational content developed in English and Spanish to serve the predominantly Hispanic population. Since the target audience for the program were hard-to-reach DAC residents in Fresno, the program's success centered around a very active marketing and outreach strategy focused on facilitating customer enrollments. The primary marketing channels were a bi-lingual website[6], bi-lingual print marketing collateral and a bi-lingual customer engagement web and mobile application for program enrollments. The program team established a bi-lingual program customer support call center to help customers understand program benefits, enroll, and answer any questions or concerns during the program.

The original marketing strategy was centered on working in close collaboration with the CBO partners and local program ambassadors to engage the Fresno community in-person through public events, door-to-door campaigning, enrollment, and education events. The CBO partners had planned to engage their networks, distribute program flyers, explain the benefits of program participation, and facilitate customer enrollment by making available technical assistance as needed.

Shortly after launching the program, Governor Gavin Newsom issued a stay-at-home order[7] to slow the spread of COVID-19 and the program's marketing and outreach plan, strategy and implementation was completely redone. The plan was modified to be a multi-channel and

[6] www.fresnoenergyprogram.com
[7] Executive Order N-33-20 https://www.gov.ca.gov/2020/03/19/governor-gavin-newsom-issues-stay-at-home-order/

digital approach through email, social media, online events, webinars, and videos. Traditional print media campaigns, press releases and also some TV and radio segments on the program were also carried out to supplement digital efforts and increase our ability to reach residents during the COVID-19 restrictions. The ability of the CBO partners to do community engagement and outreach for the Fresno program was also largely undermined by the pandemic and the partners supported the digital efforts as best as possible.

3.6 Program Phases

Olivine administered the Fresno Energy Program between October 2019 and December 2021, during which it went through four phases:

- *Program Design (October – December 2019):* This focused on the development of the program design, development of partnerships, technology, processes, operations, and marketing collateral.

- *Program Marketing and Enrollments (Original timeline: January – June 2020):* This focused on program marketing, customer outreach and engagements and active enrollments. The program was scheduled to close enrollments in June 2020 before the start of the DR event season, but the open enrollment period was extended to December 2020 to overcome the customer engagement barriers faced during the COVID-19 lockdown restrictions. Thus, this phase was active between January-December 2020 and enrollments were closed in December 2020. The Home Energy Survey was administered to all enrolled customers during this period.

- *DR Event Season Phase (July 2020 – March 2021):* All enrolled participants participated in twenty DR events- split between load shed events in summer 2020 and load shift events in Fall 2020-Winter 2021. This phase was operationally the busiest time for customer support and incentive reimbursements as well.

- *Performance Assessment Phase (April – December 2021):* This phase included the administration of the Customer Experience Survey, program performance reporting and development of the final report.

4.0 Program Technology and Operations

The Fresno Energy Program was powered by the Olivine Technology Suite which provided key interfaces between participating customers and program team. The Technology Suite enabled customer enrollment, engagement and communication, performance measurement and program metrics reporting. The suite includes an award-winning DER Platform, Olivine Community App, Customer Engagement Platform and state of the art program implementation tracking and reporting tools. Figure 5 below provides an overview of the Olivine DER™ Platform's end-to-end solution for managing behind the meter customer assets for the Fresno

Energy Program.

Figure 5 The Olivine Technology Suite for End-to End Solution Program Implementation

4.1 Olivine Community Customer App

The multilingual Olivine Community app (web and mobile) was the primary way for enrolling and engaging customers in the Fresno Energy Program. The Olivine Community App was natively built for iOS and Android, and all app functionality was supported in modern Web browsers. The Web app was included specifically for hard-to-reach populations, residents of DACs and low-income customers who may not have access to smartphones or data plans to support mobile customer enrollment.

The enrollment process for the Fresno Energy Program was designed to make customer onboarding as smooth as possible. Customers enrolled using a simple process via the bilingual Olivine Community web or mobile app. These customers used the app to create their account, verified themselves as active PG&E customers residing in the target zip codes, accepted program terms and conditions (T&Cs) and the participation agreement (PA), and provided Olivine authorization to access their electric meter data through a PG&E Rule 24 authorization. The Olivine app consolidated all these steps into one seamless process for customers. After confirming that these customers had completed these steps in the Olivine app and were not enrolled in any conflicting DR programs, the team enrolled them in the program. Program marketing efforts primarily guided customers to the Olivine app, and the ease of the app experience facilitated their conversion to full enrollments.

The app was offered in English and Spanish language options and provided a seamless way for customers to enroll in the program. The Olivine Community app also allowed customers to monitor home energy usage and event performance, receive and respond to event notifications, view performance and incentives earned, and provide referrals into the program. Both the mobile and web versions of the app were used by customers in the program, with 74% enrolling through the mobile version and 26% using the web app to enroll and engage with the program. The app was also used to ask the participants how they heard about the program and allowed us to track the efficacy of the outreach methods used.

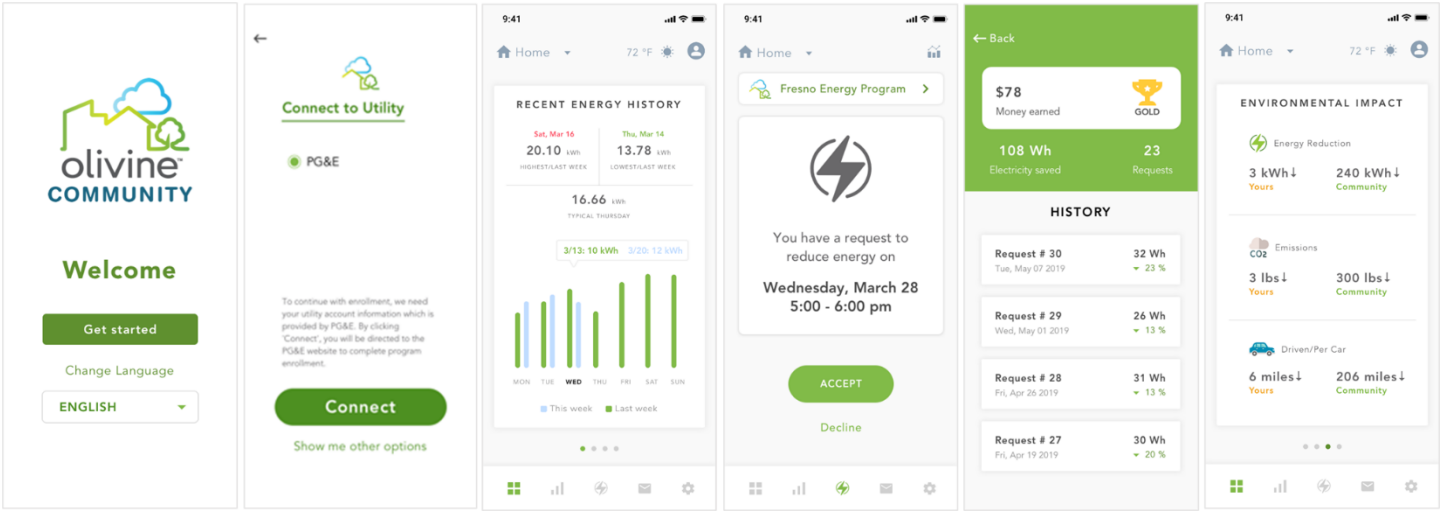

Figure 6. Olivine Community App: Fresno Energy Program Screenshot Examples

4.2 Olivine DER Platform

The award-winning Olivine DER Platform – a comprehensive DER Management System (DERMS) provided business rules for program options, calculated event performance baselines and load reduction metrics, and managed related services such as meter data management and telemetry. The platform managed events and notifications to participants through integrations with the Olivine community in-app push notifications, SMS and email.

Figure 7 shows an example of a screen in the Olivine DER Platform used to monitor event performance.

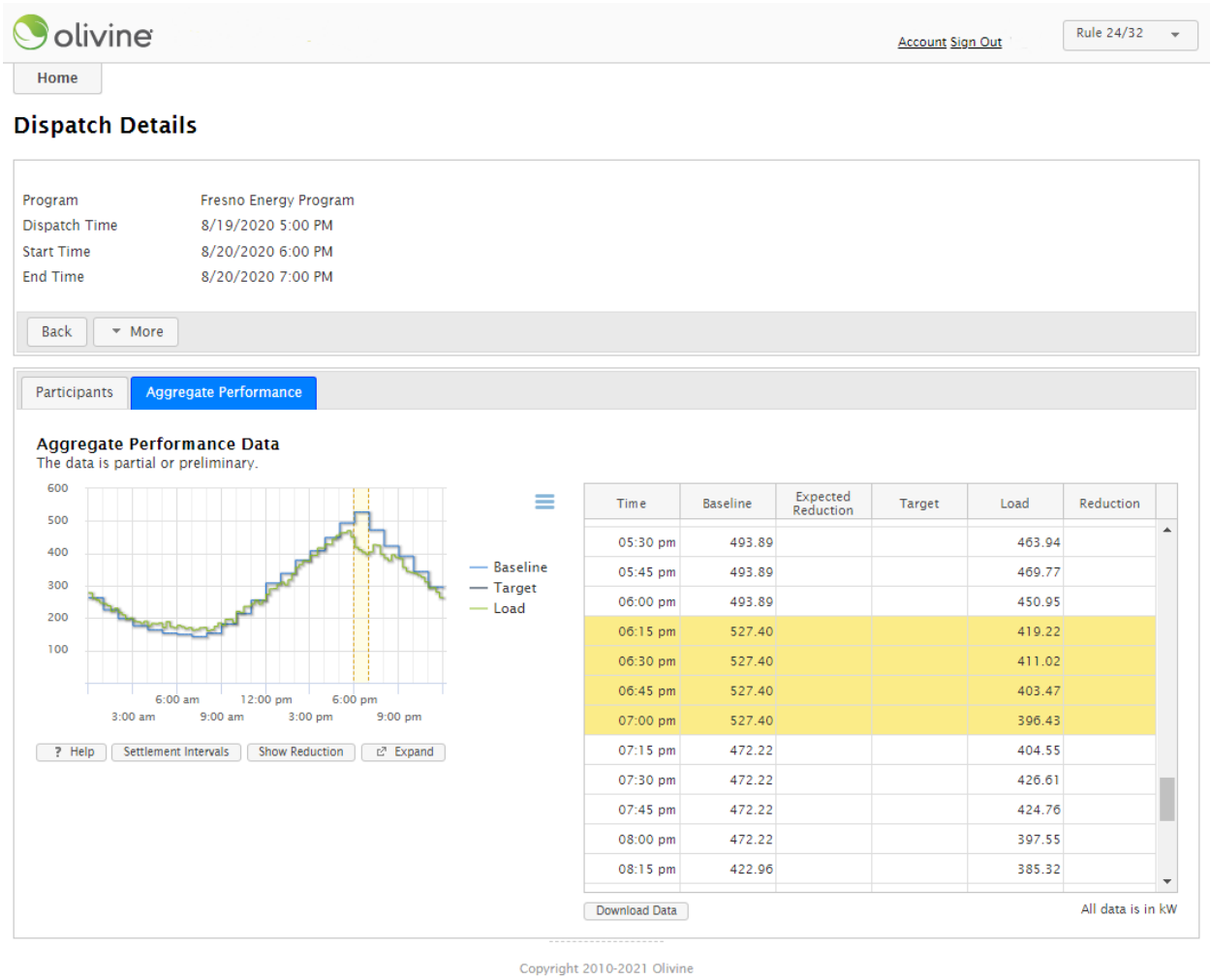

Figure 7. Customer Engagement Platform Screenshot Example

4.3 Customer Engagement Platform

The program's customer engagement processes were anchored around a Customer Relationship Management (CRM) system which tracked customer program enrollments, managed the marketing campaign for the program, sent program email communications to customers, managed customer support interactions with a ticketing system and provided surveys to customers. The customer engagement platform was also used to manage the process of disbursing incentives to customers.

5.0 Program Implementation Reporting

The Fresno Energy Program was successfully able to engage 603 PG&E customers[8] between March-December 2020 who initiated the enrollment process in the program. Table 2**Error! Reference source not found.** below shows the total number of customers in the program, and their final level of enrollment at the conclusion of the program. A total of 458 participants were successfully enrolled in the program. The remaining customers were not eligible for program enrollment due to enrollment in conflicting PG&E DR programs (43 customers), enrollment in conflicting third-party DR programs (76 customers) or not meeting the eligibility requirements (26 customers)[9].

Enrollment Stage	Number of Customers	Percent of Total
Total Potential Enrollments	603	100%
Utility Program Conflict	43	7%
Third Party Conflict	76	13%
Did Not Meet Eligibility Requirements	26	4%
Enrollment Confirmed	458	76%

Table 2. Final enrollment stage of customers entering the program

Most enrolled participants were DAC residents (407; 89% of total) and there were 51 (11%) non-DAC customers. The split between DAC and non-DAC residents among the enrolled participants was useful in trying to tease out the differences in performance and participation experiences of the customers. The enrollments were spread across all eight target zip codes of the program territory (Figure 8) indicating that the marketing and outreach efforts were able to reach residents all across the target area.

[8] The original target enrollment number was 2,500 customers- which was an ambitious enrollment targeted and largely unattainable due to the inability of the program team to engage the target audience in person as per the original marketing strategy. The readjusted enrollment target after the COVID-19 restrictions were put in place was 500 customers.

[9] These 26 customers did not meet program eligibility due to one of the three reasons: 1. Customer was identified as a small business not residential, 2.Customer did not have a proper utility meter; or 3. Rule 24 authorization expired before the end of the program.

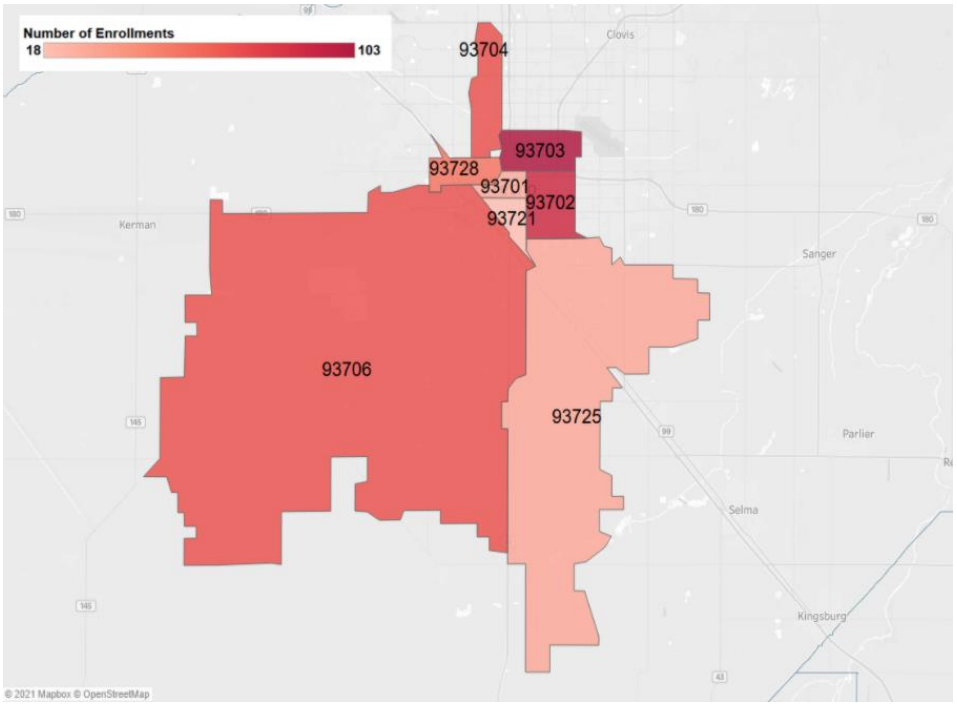

Figure 8. Heat map of the number of enrollments per zip code

The majority of the enrolled participants (93%) opted to enroll in the English version of the Olivine Community App. Most of the enrollments (74%) came via the mobile version of the app and 26% of participants enrolled through the web version of the app.

Results from the Home Energy Survey show that the primary language spoken at home was English (78%) followed by Spanish (20%). Participants also reported that the Olivine app was successful at facilitating a streamlined enrollment process with 89% (313 respondents) of DAC and 91% (29 respondents) non-DAC customers indicating the enrollment process was a “very easy” or “easy” activity via the app. 75% (264 respondents) of DAC and 66% (21 respondents) of non-DAC customers enrolled through the mobile version.

These findings somewhat challenge the notion that smartphones are a commodity and that Hispanic populations prefer Spanish over English. Additionally, the unexpected number of customers unable to enroll due to dual participation compels us to question the belief in the industry and in California that taxpayer-funded DR programs and offerings do not reach DAC residents. This was one of the drivers behind the CPUC ruling and the launch of the pilots focused on DAC communities.

5.1 Performance Metrics

The Fresno Energy Program developed a robust framework to measure program performance results and report on the study goals set forth by design. The program results were measured based on data collected through the enrollment process, monitoring of marketing and outreach efforts, two participant surveys administered, and from the analysis of customer meter data. The Home Energy Survey and Customer Experience Survey each had high response rates of

82% (385 responses out of 472 survey recipients) and 72% (312 responses out of 433 survey recipients) respectively. Of the participants who completed the Home Energy Survey, most did so in English (359, 93%) and were DAC customers (353,92%). The Customer Experience Survey had similar results, 292 (94%) participants completed the English version of the survey and 286 (91%) were DAC customers. Table 3 provides a summary of the different program study goals and how these were measured.

Study Goal	Description	Measurement Method
Outreach Methods	To understand what outreach methods worked the best to effectively reach DAC households.	Survey data
DR Program Awareness	To understand the current level of awareness of demand response program availability among DAC residents and how these create value for customers and the community.	Survey data
Willingness to Participate	To understand the current level of interest among DAC households to participate in demand response programs; and what are motivations for participating in DR programs	Survey data
Energy Use	To understand how different DAC households use energy in their homes	Survey and meter data
Ability to Participate	To understand the ability of DAC households to effectively participate in DR programs and to understand barriers faced in program participation	Survey and meter data
Messaging	To understand what kind of messaging resonated the best with DAC households for program participation.	Survey data
Participant Benefits	To understand what kind of DR incentives and program offerings would provide the greatest value to DAC households and benefit them the most.	Survey data
Energy and Environmental Impacts	To quantify the energy, environmental and financial impacts of program implementation.	Meter data and calculations

Table 3. Summary of program study goals

Where possible, the results were reported for DAC and non-DAC participants to understand if there were any differences between those two types of customers. The results from each of the study goals are described in the following sections.

5.2 Outreach Methods

Traditional outreach methods for DR programs in California have included email and the PG&E website, and there is a concern that these outreach methods have limited success in reaching DAC residents. One of the goals of the program was to understand what outreach methods would be most effective in reaching DAC residents so that the representation of DAC residents in DR programs can be increased. By using a variety of outreach methods, including print and digital media, television, press, social media, CBO partner outreach and more, the program team sought to gain insights into preference and effectiveness of these outreach methods.

The effectiveness of the various outreach methods was measured by examining responses to questions from the Home Energy Survey and the app which asked participants about their preferred outreach method and how they heard about the program. In addition, the rate of enrollments was compared with the timing of different outreach activities to gain an understanding of the drivers of enrollment into the program.

Figure 9 below demonstrates the monthly change in enrollments in relationship with the marketing campaigns conducted during the same timeframe. The results show that the program experienced enrollment spikes in June and December which is aligned with the original and extended enrollment deadlines. Both enrollment spikes are also aligned with press coverage on television and local newspapers and the local press appears to be an effective outreach method for the DAC community.

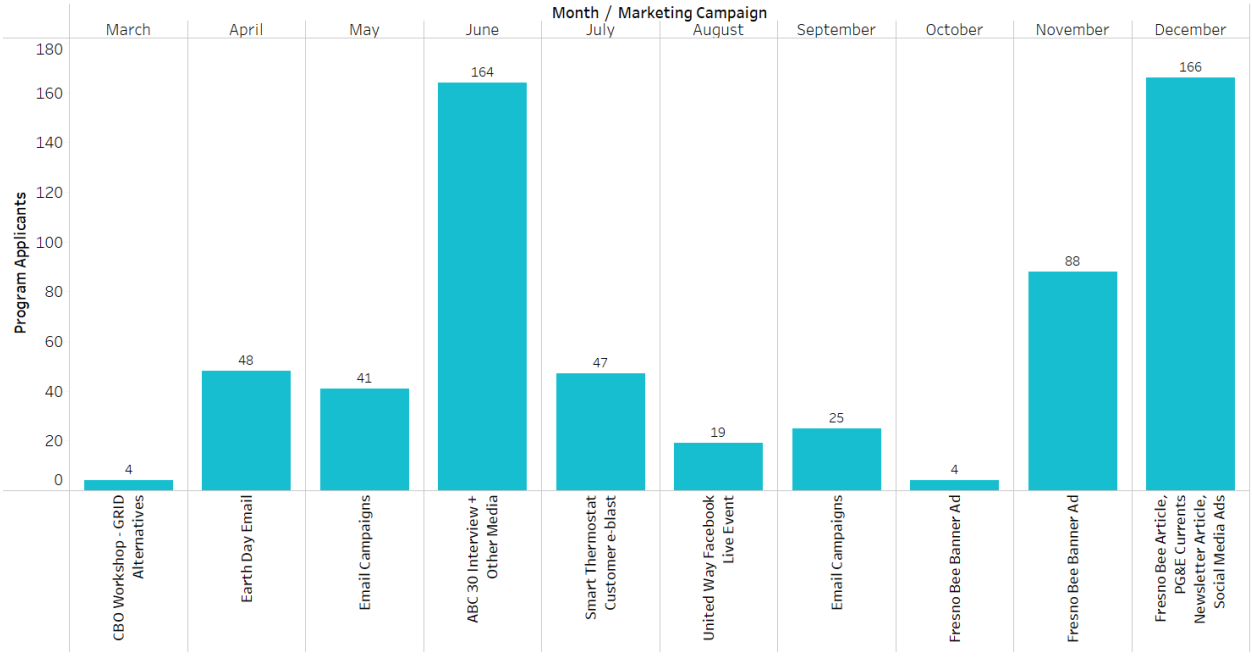

Figure 9. Monthly program enrollments and marketing channels

Analysis of the survey results that among the DAC respondents, email outreach was the most effective method of reach to DAC customers, followed by referrals (CBO partners and personal

referrals). For non-DAC customers, email outreach was less effective, and this group heard about the program through referrals and local news sources (Figure 10).

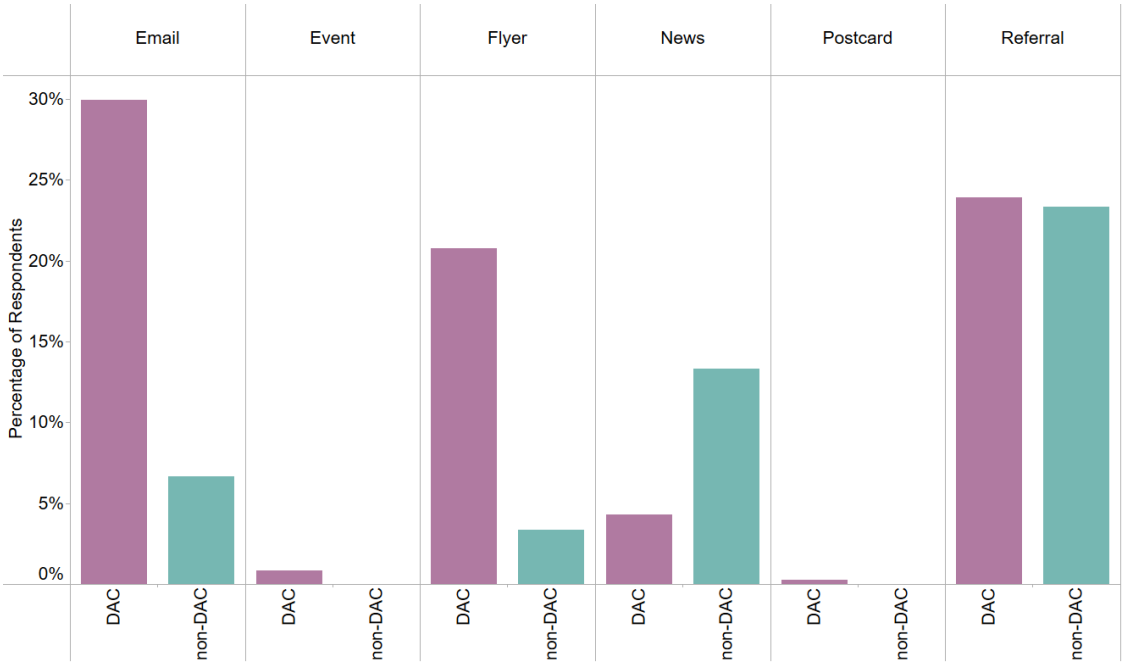

Figure 10. Effectiveness of different program outreach methods
(Home Energy Survey 82% response rate; Total responses 377; DAC respondents 347, non-DAC respondents: 30)

Customers were asked through the survey how they would like to receive information about future program offerings. The survey results also showed that most participants (80% of DAC and 90% of non-DAC) preferred email as their preferred mode of receiving information about future opportunities followed by direct mail and social media, further reinforcing that continuing email outreach can be an effective method of reaching customers.

The findings confirm that email marketing is an effective tool at reaching DAC customers. Other methods sometimes not explored for DR program outreach, such a referral through CBO partners and friends and family, were also effective in increasing DAC community outreach and program participation. The success of the referral program indicates that the DAC community responds well to one-on-one contact and being informed about the program through a trusted source.

5.3 DR Program Awareness

One of the objectives of the Fresno Energy Program was to understand the level of awareness of DR programs among DAC residents and to analyze if a lack of awareness was a factor in historically low DR program participation rate by this community. This was measured through questions in the Home Energy Survey, where customers were asked whether they were aware of other DR programs, and if they understood the value of these programs.

The results showed that most respondents of the Home Energy Survey were either not aware of identified DR programs such as PG&E's Smart AC or Smart Rate programs (38%), not aware of DR programs at all (24%), did not know what DR was (16%), or did not understand DR programs (8%). Those who were aware of DR programs went to choose "reduce energy use", "reduce grid stress" and "reduce cost" as the main values DR programs create for customers (Figure 11), indicating that these customers did understand the value DR programs can provide for customers and the community. The differences in DAC and non-DAC responses were interesting as DAC customers recognized the value of DR programs to be reduction in energy use, cost reduction and reduction in the operation of dirty power plants. However, non-DAC customers emphasized on the environmental benefits of DR programs such as reduction in pollution and GHG emissions. The DR program value of reduction in grid stress was recognized by all customers.

Figure 11. Understanding of DR program value
(Home Energy Survey 82% response rate; Total DAC respondents: 46, total non-DAC respondents: 9)

The relatively low level of awareness in DR programs from the Home Energy Survey but the high rate of DR program conflicts (20%) observed from the enrollment data shown in Table 2 indicates that DAC households might be enrolling in programs but not understanding the dual participation regulatory rule in California which prohibits enrollment in multiple DR programs. The results indicate the need for creating more awareness about DR, regulatory rules/requirements, DR benefits and the need of an education campaign in order to get higher participation rates from DR programs. The high level of customer engagement in the Fresno Energy Program also suggests that that expanded outreach, education, and marketing for DR

programs could help increase overall awareness and attract more customers to these programs.

5.4 Willingness to Participate

A primary goal of the Fresno Energy Program was to evaluate the willingness of DAC customers to participate in DR programs. The Home Energy Survey was leveraged to collect this information. The results show (Figure 12) that financial rewards were motivating for both DAC and non-DAC participants in the program. DAC customers were motivated more by earning incentives than non-DAC customers who were most motivated by energy cost reduction. Other key motivation factors were helping the community, reduction in pollution and GHG emissions. Amongst the survey response options provided to the participants, “grid resilience” was the least motivating factor for respondents for participating in the program. This may indicate the need to educate customers about the importance of grid resilience- particularly when the California grid is currently facing unprecedented challenges triggered due to extreme weather and the state’s decarbonization journey.

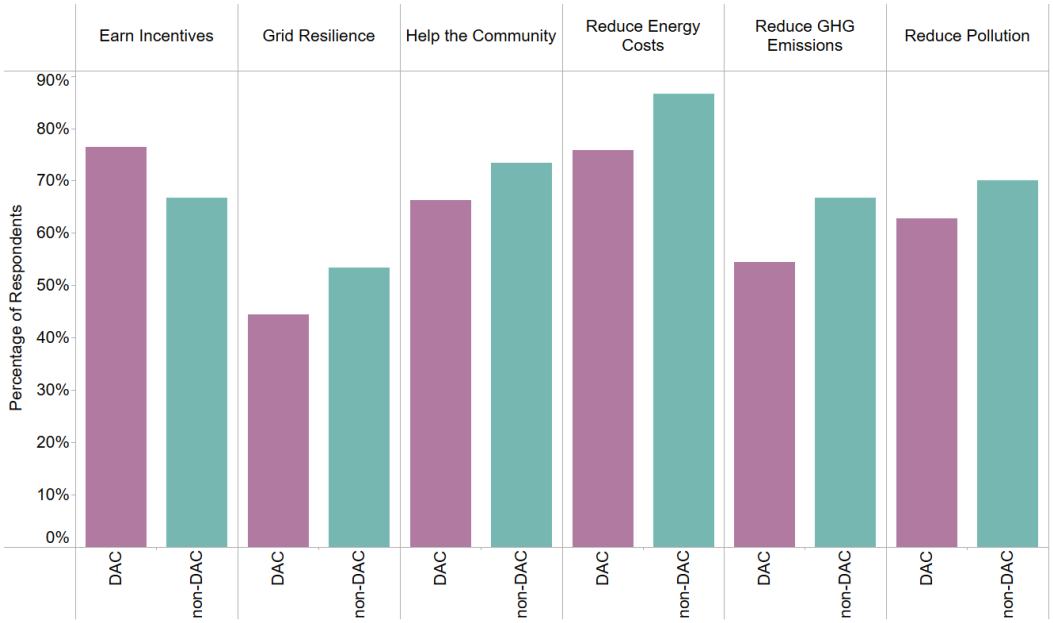

Figure 12. Motivations for participating in the program
(Home Energy Survey 82% response rate; Number of DAC respondents: 453, number of non-DAC respondents: 41)

The Home Energy Survey also analyzed the willingness of customers to participate in DR events during specific hours of the day. The results also showed DAC and non-DAC customers were most willing to participate in load shed events scheduled weekdays from 8-9 pm (Figure 13) and weekends from 8-9 am. These results align with the notion that people are less active during those hours and therefore more willing to reduce energy use. What deserves a closer look however is the +/- 15% distribution across DAC responses for all weekday time slots from 4 to 9 pm in Figure 13 and how it compares to the +/-40% distribution in non-DAC responses. The distribution may be an indication of a DAC customer’s willingness to participate at any hour and earn incentives.

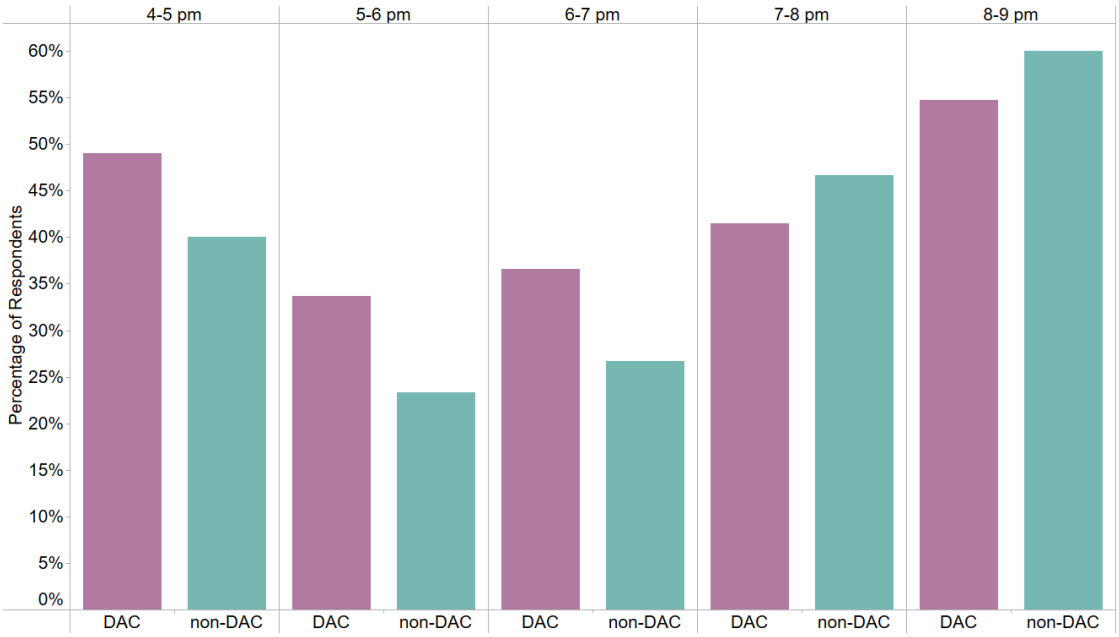

Figure 13. Weekday evening hours convenient to participate in load shed DR events
(Home Energy Survey 82% response rate; Number of DAC respondents: 347, number of non-DAC respondents: 30)

5.5 Energy Use Patterns

The program analyzed customers' energy use patterns by examining baseline energy usage during the load shed and load shift program periods, combined with survey questions focused on technology adoption and household energy use. By understanding the magnitude of energy use and how energy is used throughout the day by program participants, it is possible to assess just how much energy could be shed or shifted in the target population and how the energy use patterns of customers can be leveraged to achieve the desired outcomes of DR programs (i.e. decreased grid stress, GHG emissions, etc.).

The meter data analysis of DAC and non-DAC customer meter data for load shed and load shift event months show that non-DAC customers used as much or more energy on average than DAC customers for most of the 24-hour time period, as illustrated in Figure 14 and Figure 15. The figures show the average energy usage participants in the program over a 24-hour period and demonstrates that non-DAC customers on average used 0.327 kW and 0.122 kW more than DAC customers for load shed and load shift events, respectively. Energy usage increases with income level and the higher load among non-DAC participants could be explained due to higher overall socio-economic status which gets reflected as larger homes, higher technology adoption and an overall higher baseline energy usage. Furthermore, 76% of DAC survey respondents replied that their home size was between 0-1,499 ft^2, while only 58% of non-DAC survey respondents fell in the same category, which supports the idea that non-DAC participants tended to have larger homes, and therefore higher energy usage. Baseline energy usage per square foot was equivalent between DAC and non-DAC participants.

The customer load shapes in Figure 14 and Figure 15 show that all customers had energy consumption patterns that matched closely with overall grid conditions and the peak load hours for customers were in the evening between 4-9 pm. The load profiles also show that all customers experienced a spike in energy usage at 6 pm for load shed event months and two peaks at 12 pm and 8 pm for load shift event months[10]. The Home Energy survey revealed that 56% of DAC and 37% of non-DAC program participants received the CARE discount on their energy bills, and 77% of DAC and 83% of non-DAC participants responded that they have felt burdened by their overall cost of energy. The analysis also revealed that most participants (94%) were on a non-TOU rate and as customers transition to TOU rates by the end of 2022, it is possible that customer baselines during the evening hours will decrease as customers respond to the price signals. While evening peak loads may decrease as more customers are transitioned to TOU rate tariffs, customers will not be able to transition all their energy use away from these hours, and these customers will continue to have capacity to perform in DR events. These customers could benefit from participating in DR programs as a way of reducing their energy consumption and possibly lowering their energy bills. Participation in DR programs might be even more attractive after the TOU rate transition as further energy consumption reductions below baseline during evening hours will be more economically beneficial due to higher evening energy rates.

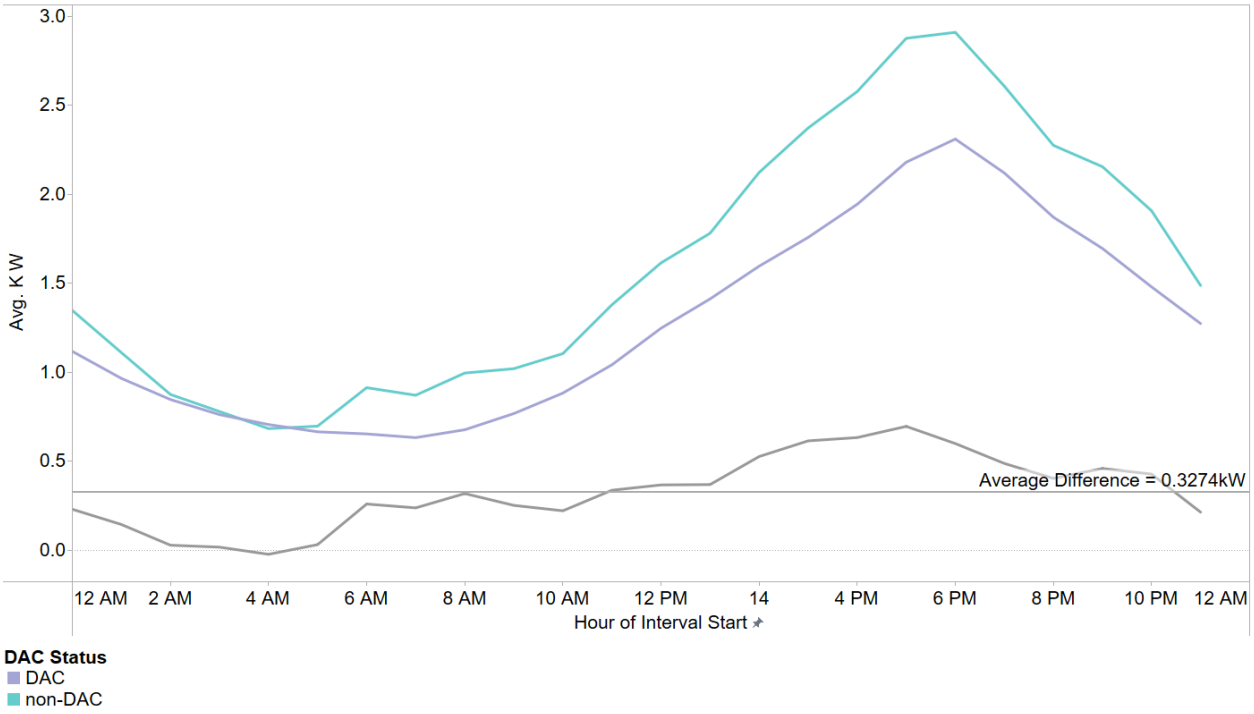

Figure 14. Average daily energy use during load shed months

[10] The observed mid-day peak could be influenced by the COVID-19 stay at home order with most people staying indoors in their homes during the program period.

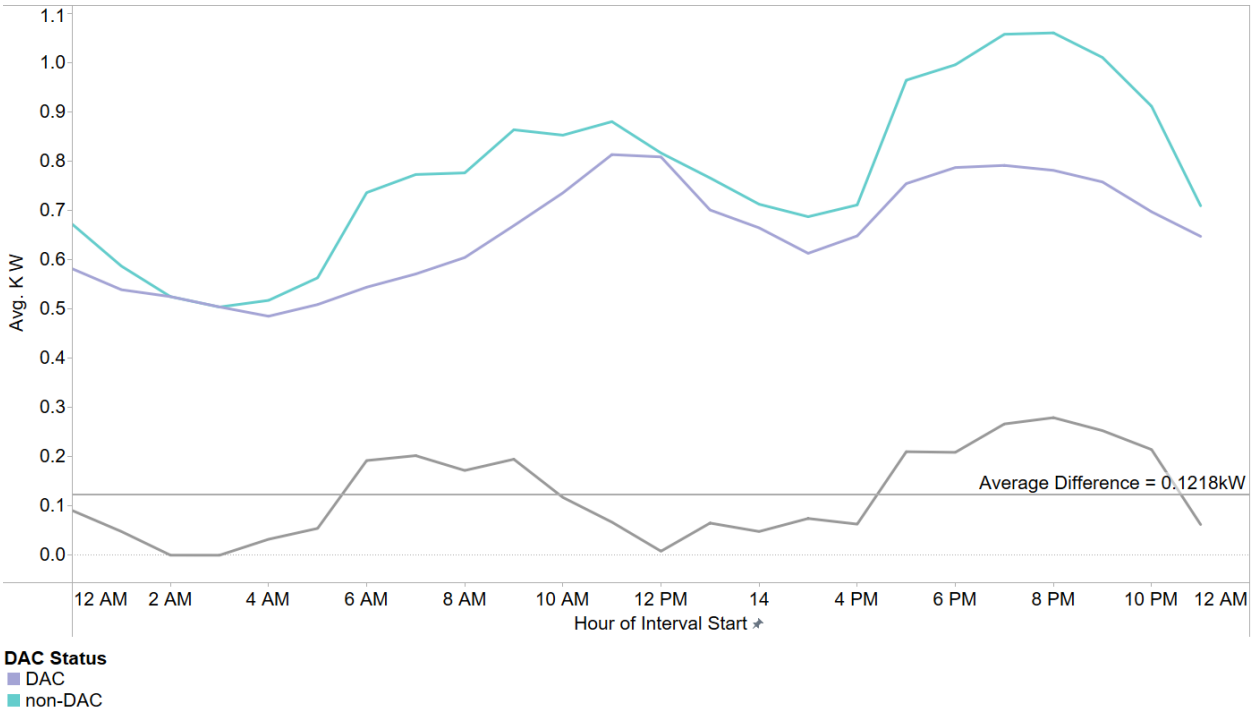

Figure 15. Average daily energy use during load shift months per DAC status

The Home Energy Survey examined the potential for customers to participate in DR programs based on how they used energy in their homes and the level of technology adoption. The results show that all customers used electric appliances to cool their homes – with an average of 61% of participants using central air conditioning in their homes – but with a significantly lower adoption level among DAC households (59%) than non-DAC households (90%). On hot days, air conditioning load can constitute over half of home energy consumption, showing that the load reduction potential from air conditioning was significant among all households with central AC. For other DAC participants (41%) who had decentralized AC units (e.g., window unit, whole house fan or swamp cooler), the overall energy use and the load reduction potential might be much lower. It is also more technologically viable for centralized AC units to be remotely controlled while participating in DR programs, whereas non-centralized cooling technologies might be more appropriate for participating in behavioral DR programs. In addition, 12% of DAC and 33% of non-DAC participants indicated the adoption of Smart Thermostats which offer an additional advantage when participating in DR programs due to their ability to be controlled remotely. The results of the Home Energy Survey also showed that over 56% of DAC households and 90% of non-DAC households use a gas furnace to heat their homes. The use of electric space heating is generally low in this community, with only 22% of DAC households using space heating, indicating that demand response is not a viable option to reduce heating loads in households.

Results from the Home Energy survey also indicate that the adoption of advanced technologies such as smart thermostats, smart plugs, smart lights, electric vehicles, energy storage, smart appliances, efficient lighting, or solar photovoltaic (PV) among customers is not very high but the level of technology adoption doesn't vary considerably among the DAC and

non-DAC customers. (Table 4). All customers are just as likely to live in a smart home[11] and have similar ability to remotely controlling their devices while participating in a DR program.

Smart Home	DAC customers	non-DAC customers
Not Smart Home Enabled	278 (64%)	24 (60%)
Smart Home Enabled	155 (36%)	16 (40%)
Total	433 (100%)	40 (100%)

Table 4. Participants residing in smart enabled homes

The Home Energy Survey asked customers what kind of behavioral actions they typically take to reduce their energy bills. The results indicate that some common actions customers took to reduce their electricity bills were to turn off lights/appliances, install efficient light fixtures, and adjust their temperature setpoint in their house to reduce A/C and heat usage. Responses to this question provide insight that customers were informed and were taking plenty of actions to reduce their overall energy consumption prior to participating in the program. The Customer Experience Survey asked customers which energy saving behaviors they will continue to take after participating in the Fresno Energy Program. A high percentage of both DAC and non-DAC survey respondents plan to reduce energy use in the future by turning off/down lights, rescheduling activities, unplugging unused devices, and adjusting their A/C temperature settings (Figure 16).

[11] Defined as owning at least one of a variety of advanced technologies such as advanced technologies such as smart thermostats, smart plugs, smart lights, electric vehicles, energy storage, smart appliances, efficient lighting, or solar photovoltaic (PV).

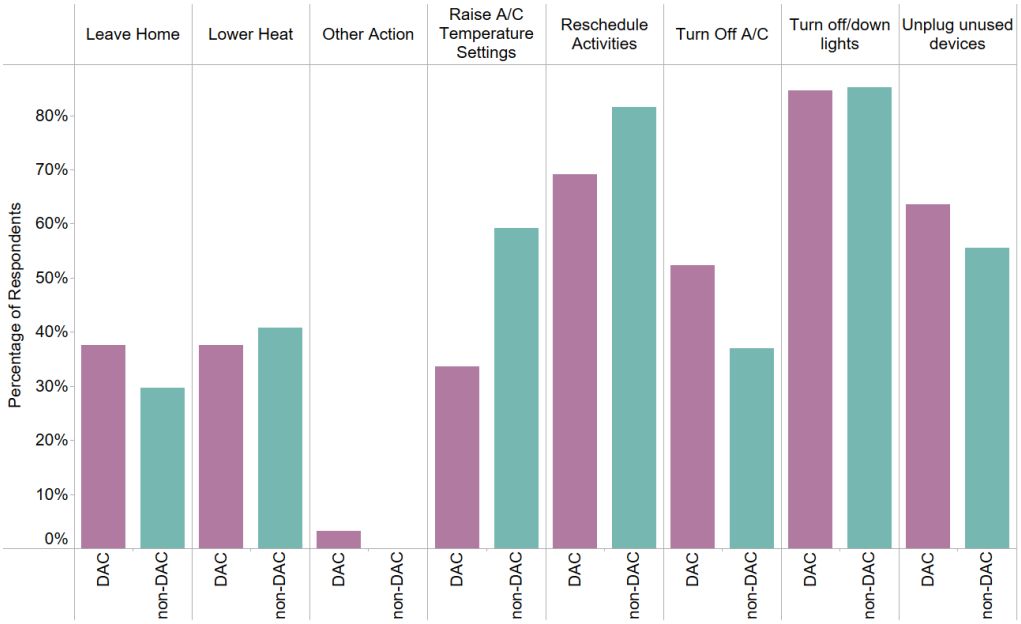

Figure 16. Behavioral actions that will continue after the program ends (Customer Experience Survey 72% response rate; Number of DAC respondents: 265, number of non-DAC respondents: 27)

Overall, the results indicate that program participants had load profiles, end use behaviors and technology adoption levels well-suited for participation in summer DR programs. The program participants also seemed knowledgeable about energy saving behaviors and participating in the Fresno Energy Program potentially helped in their understanding of ways to save energy in their homes. The survey results also possibly indicate that the energy consumption behavior of DAC and non-DAC customers may have changed as a result of participating in the program. Additionally, the upcoming transition to TOU rates might give these customers additional motivation and added benefits from participation in a DR program.

5.6 Ability to Participate

The program examined the ability of customers to participate in a DR program by analyzing the load reduction delivered by participation in DR events and by also examining responses in the Customer Experience Survey.

The survey results show that participants used all four notification methods to learn about DR events in the program with email (81%) and mobile app event notifications (58%) being the most popular modes of customer engagement with the program. The mobile app notifications were used more by non-DAC customers, whereas email, SMS and web-app notifications were used more by DAC participants (Figure 17). These results are a testament to the success of the program's event notification strategy and need for various notification types. Program participants were generally satisfied with the number of events and felt they were provided adequate time to prepare for an energy event (Figure 18 and Figure 19).

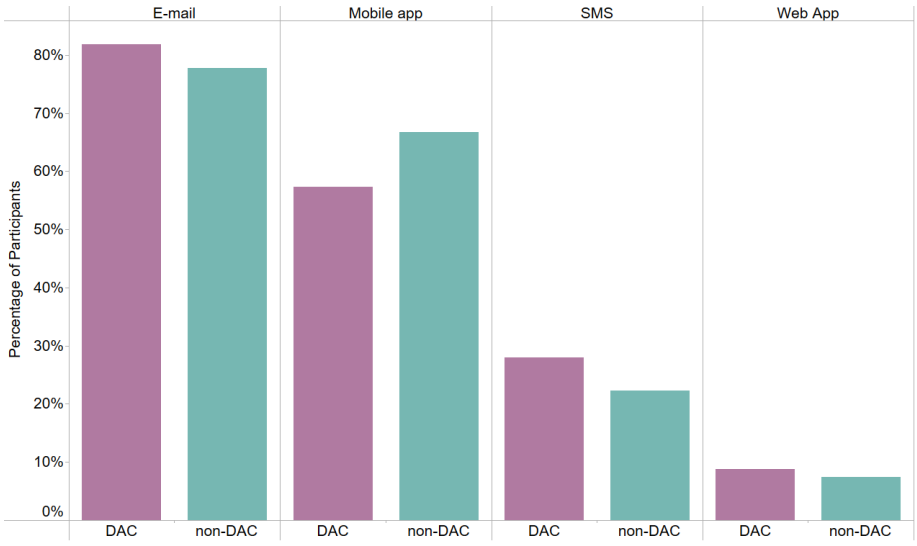

Figure 17. DR event notification preferences

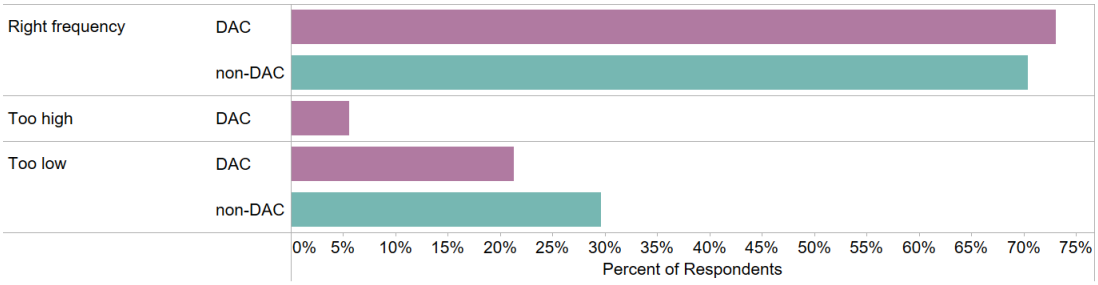

Figure 18. Customer feedback on frequency of DR events
(Customer Experience Survey 72% response rate; DAC responses: 286, Non-DAC responses: 7)

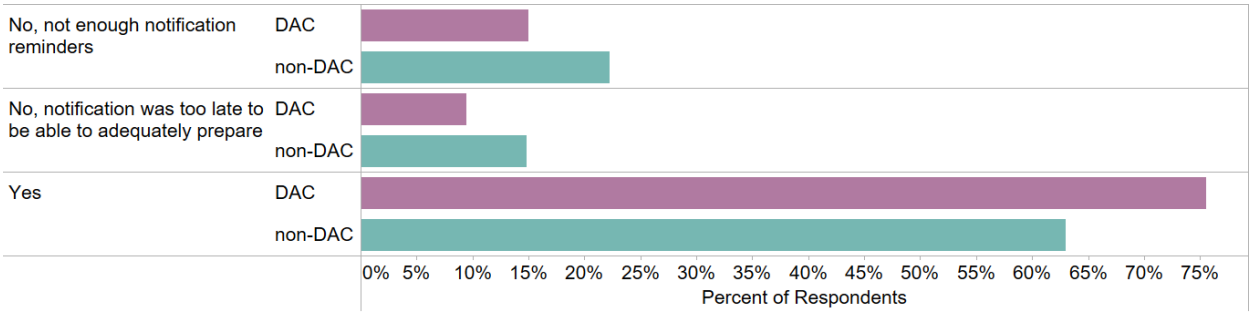

Figure 19. Customer feedback on event preparedness based on DR event notifications
(Customer Experience Survey 72% response rate; DAC responses: 286, Non-DAC responses: 27)

Analyzing the event responses from the Olivine App, we learned that event notifications were ignored for all events by some customers and only some customers actively responded to all DR event notification requests. For all customers, there was a gradual and steady increase in the response rate over the course of the program suggesting that as customers got accustomed to participating in the program over the twenty DR events, their engagement level and DR event response rate also increased. There were also noticeable seasonal differences in the event participant response rate for DAC and non-DAC customers (Figure 20). During the load shed event season in the summer months, the response rate for DAC customers was

generally higher than for non-DAC customers. During the load shift season in the spring and winter months, the response rate for non-DAC respondents was consistently higher. This could be a function of socioeconomic status as DAC customers could have been more motivated to save money and energy during the load shed events in summer, while non-DAC customers valued comfort more than utility bill savings and opted to respond at a lower rate than their counterparts. This could also suggest that perhaps the DAC customers perhaps were not able to understand the switch from the load-shed to the load-shift season and the lack of understanding impacted the lower response rate.

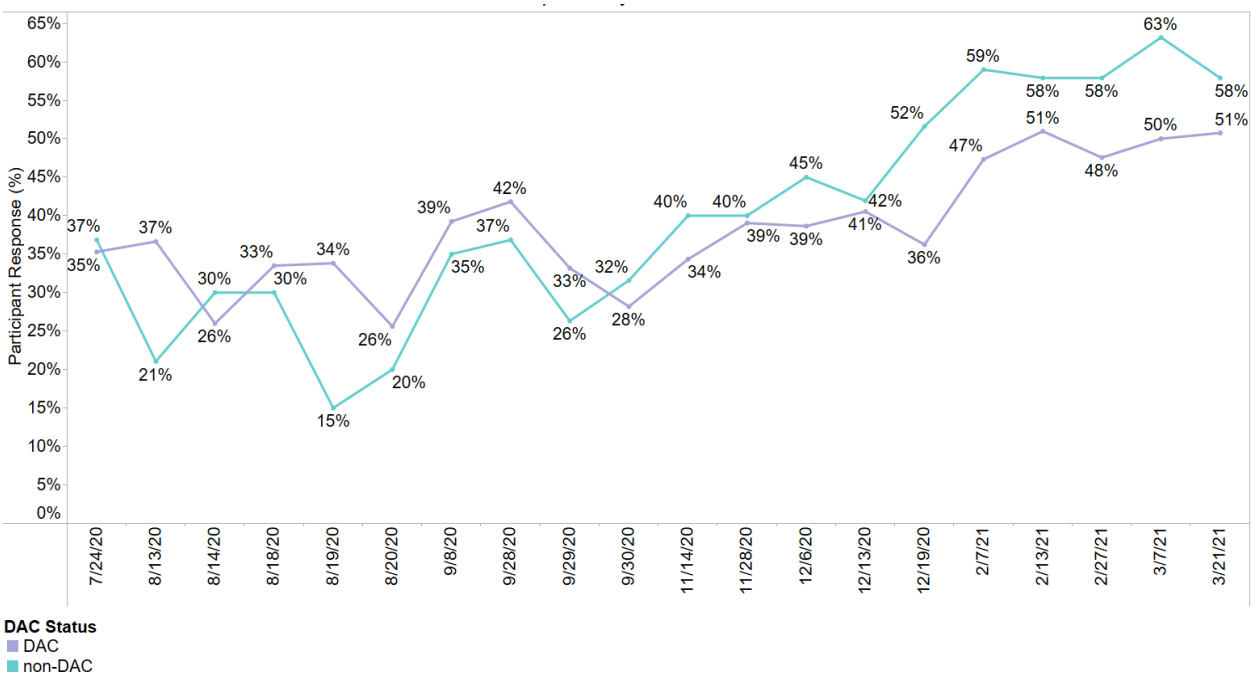

Figure 20. Event response rate per event

The Customer Experience Survey included questions that shed light on customer's ability to adjust their home energy use when requested. Most customers found it “very easy” or “easy” to adjust their home energy use when requested (73% DAC and 67 non-DACs) and about 18% of all customers had a neutral response to the question. About 8% of DAC customers and 15% of non-DAC customers reported some level of difficulty in adjusting energy use when requested (Figure 21).

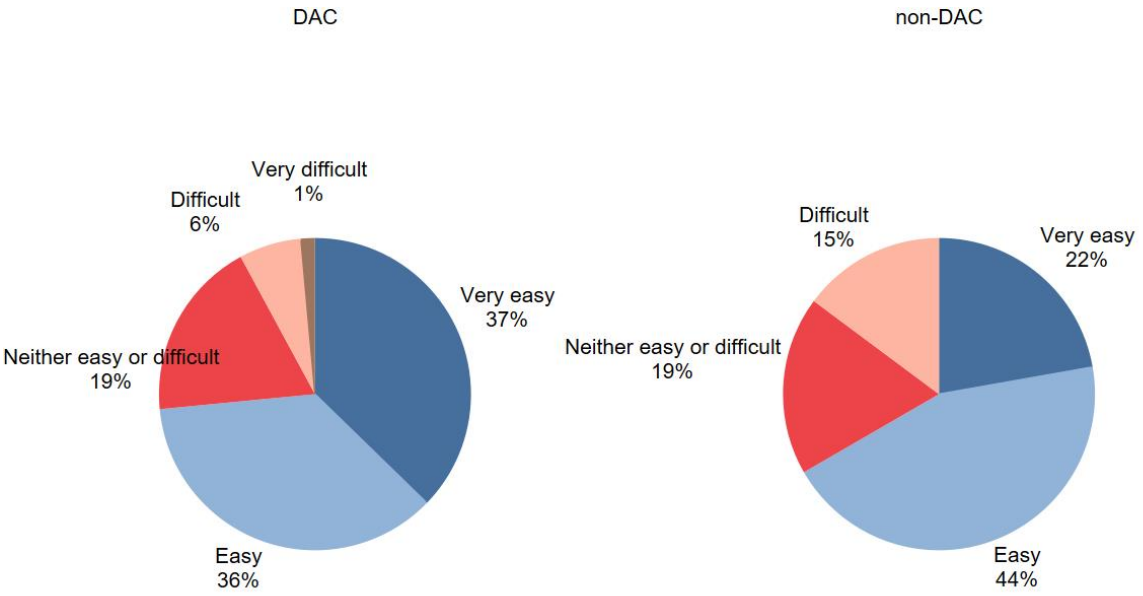

Figure 21. Customer feedback on ease of adjusting energy use during DR events (Customer Experience Survey 72% response rate; Number of DAC respondents: 286, number of non-DAC respondents: 27)

Two of the main reasons it was difficult for customers to adjust energy use when requested were their inability to be at home during the time of the event or not knowing what actions they could take to adjust energy use during an event (Figure 22). The former barrier could be mitigated in future programs by increasing event notification reminders or scheduling events more in advance to allow customers more time to be home during an event. Additionally, supplementing behavioral DR with a participation route where the program adjusts smart devices automatically during events also helps to mitigate that barrier. Lack of knowledge on energy saving ideas can also be mitigated by future programs by more education, outreach and regularly sending energy saving tips to customers.

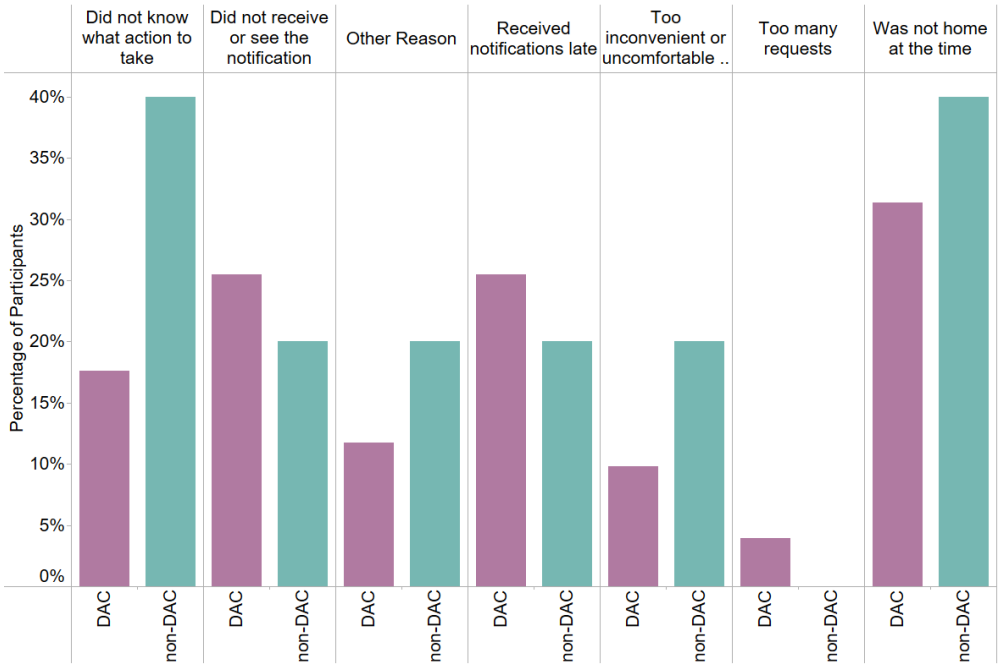

Figure 22. DR event participation barriers
(Customer Experience Survey 72% response rate; Number of DAC respondents: 59)

The most popular action taken by non-DAC customers to reduce energy was to reschedule their activities, whereas DAC customers chose to adjust lighting or unplugging devices to save energy. The response to adjusting air-conditioning during a DR event also varied among the customers. DAC customers mostly turned off their air-conditioning units during an event, whereas non-DAC customers chose to raise the setpoint during an event as their most common behavior (Figure 23).

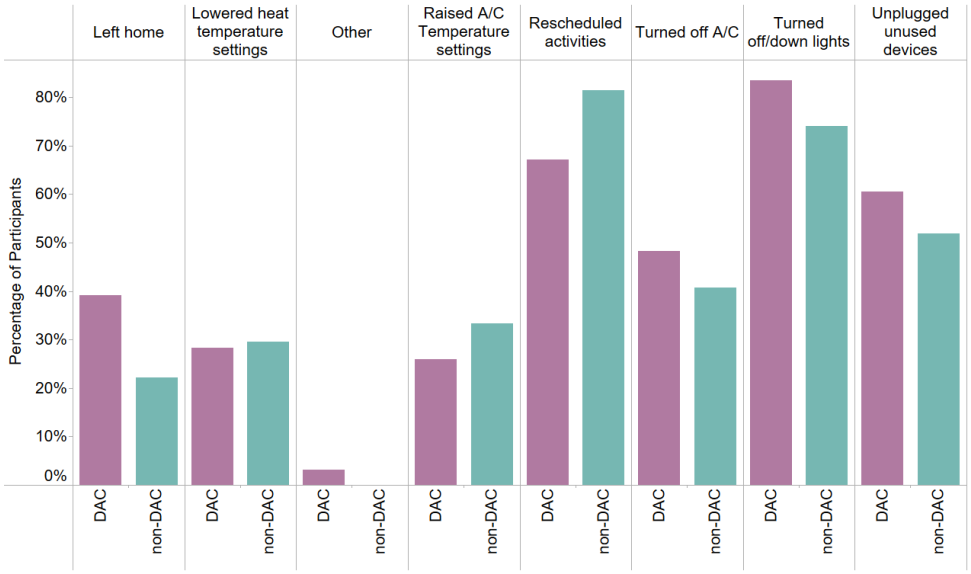

Figure 23. Behavioral actions performed during DR events
(Customer Experience Survey 72% response rate; Number of DAC respondents: 286, number of non-DAC respondents: 27)

5.7 Messaging

An essential component of study was to determine which types of messaging resonated the most with participants when receiving a DR event notification. The program tested that by randomly segmenting participants into three distinct groups that received different messaging as part of the event notification requests. Each group was requested to participate in DR events and adjust their energy use based on three different calls-to-action listed below:

- *Air Pollution:* This group was requested to adjust energy use during a DR event to help mitigate local air pollution.
- *Earn Money:* This group was requested to adjust energy use during a DR event to earn money
- *Grid Stability:* This group was requested to adjust energy use during a DR event to help stabilize the electric grid

To answer the question of which messages resonate best with DAC households, we tracked the response rate and event performance for a total of 10 load shift events which incorporated the custom messaging in the three distinct groups. The results show that the total response rate from the 'Earn Money' group was highest (48%), followed 'Air Pollution' (45%), and 'Grid Stability' (42%). Figure 24 below highlights how different messages were received by the DAC and non-DAC participants.

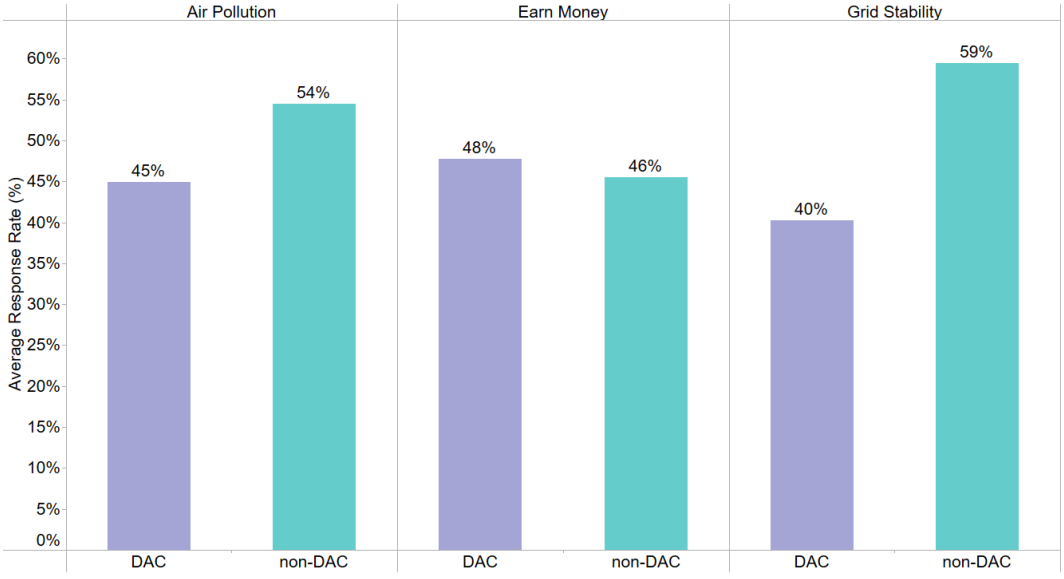

Figure 24. Total response rate by message group

Unsurprisingly, earning money resonates the highest with DAC households, edging out helping the environment as a close second. The disparity between these two and the third - helping the grid - marks a clear distinction in how DAC households rank themselves as stakeholders in the preservation of the electric grid. These survey responses demonstrate that local, more visible

matters such as income and clean air are much more critical when asked to participate in the program. To the contrary – non-DAC households are more responsive to helping the grid – by an average of 19% - indicating that this group is perhaps more sensitive to environmental and economic conditions than their DAC counterparts.

5.8 Participant Benefits

The Fresno Energy Program paid a total of $59,020 to participants as incentives to complete surveys, participate in DR events, refer others and for enrolling into the program during promotional enrollment periods. Almost all participants (~95%) were satisfied by the total amount earned during the program, e-card as the payment method, payment frequency and the options available for redeeming their incentives. The survey showed that customers also valued other aspects of the program such as receiving education about ways to save energy and money (89%), the use of the mobile/web app to understand household energy use patterns (85%) and understanding the positive environmental impacts of DR program participation (90%). Program participants responded that in future programs other ways in which they prefer to receive incentives are bill credits, cash incentives, and free or reduced cost energy saving technologies.

5.9 Impacts

The program assessed the impacts of implementation of the Fresno Energy Program by quantifying the energy, environmental and economic benefits from the load flexibility delivered from DR events. Understanding the impacts can help us understand the unlocked DR potential in DAC communities and help us inform future program offerings targeted towards this customer segment. The program impacts measured included the following:

- *Load reduction/increase:* Determined average event performance in kW, both on an individual household level as well as in aggregate across all participating households. This was measured by calculating the event performance, measured against a 5-in-10 baseline, and averaging across the event duration of all participating households.

- *Energy reduction/increase:* Determined the total event performance in kWh for each household as well as in aggregate across all participating households. This was measured by totaling the event performance across all events against a 5-in-10 baseline.

- *Avoided wholesale energy purchases:* Determined by multiplying the total energy reduction from each event by the DLAP Day Ahead wholesale energy price (measured in $/MWh) during that period.

- *Avoided CO2 emissions:* Determined by multiplying the total energy reduction from each event by the Marginal Operating Emissions Rate (MOER) (measured in lb CO2/MWh) provided by WattTime[12].

- *Equivalent avoided vehicle miles travelled (VMT):* Determined by multiplying the total energy reduction from each event by the equivalent number of emissions that would be created by driving a medium-size light duty vehicle. The factor used to determine equivalent emissions was taken from US EPA data on the average emissions rate for light duty vehicles (404 gCO2/mile).

Load Shed DR Event Season Impacts

Figure 25 shows that customers that actively responded to event notifications performed better in load shed events than those that did not respond, showing an enthusiasm for event participation. During load shed events there was an average of 0.69 kW of flexible load capacity available per customer which is similar to PG&E's Smart AC Program, which does direct control of residential AC compressors at this time. When compared to DAC customers, non-DAC customers performed better, which may be due to better socioeconomic status, larger homes, and the ability to drop more load when requested during a demand response event (Figure 26).

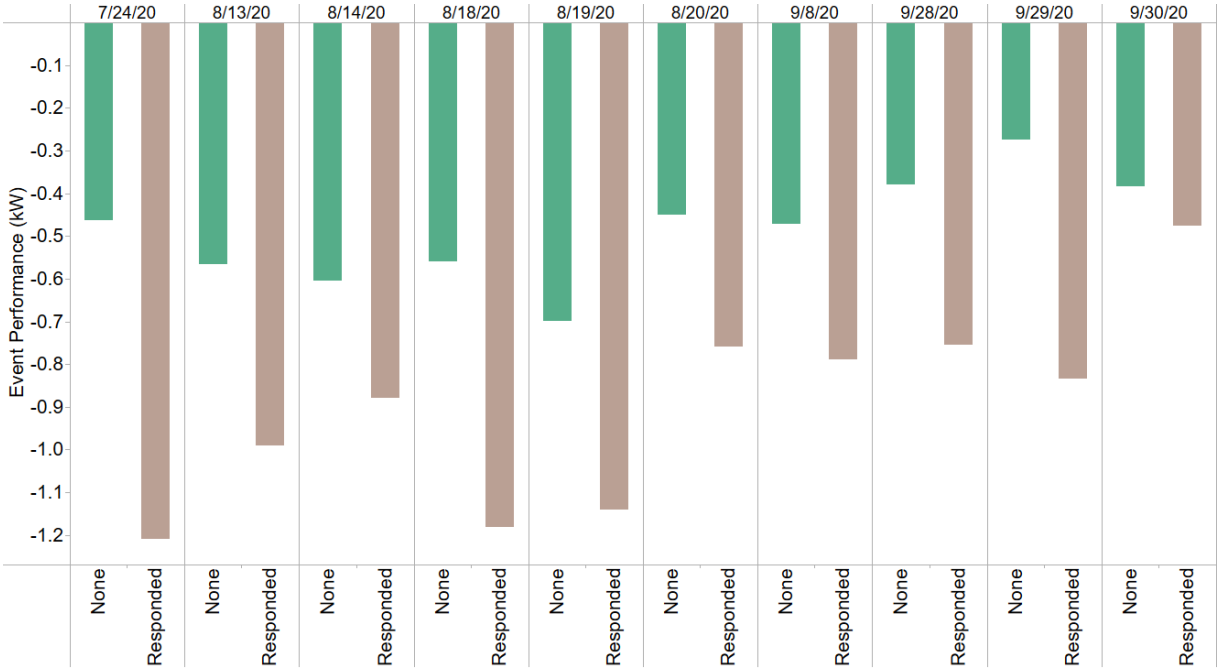

Figure 25. Average flexible load capacity available during load shed events

[12] WattTime is an environmental tech nonprofit, founded by UC Berkeley that empowers all people, companies, policymakers, and countries to slash emissions and choose cleaner energy. https://www.watttime.org/

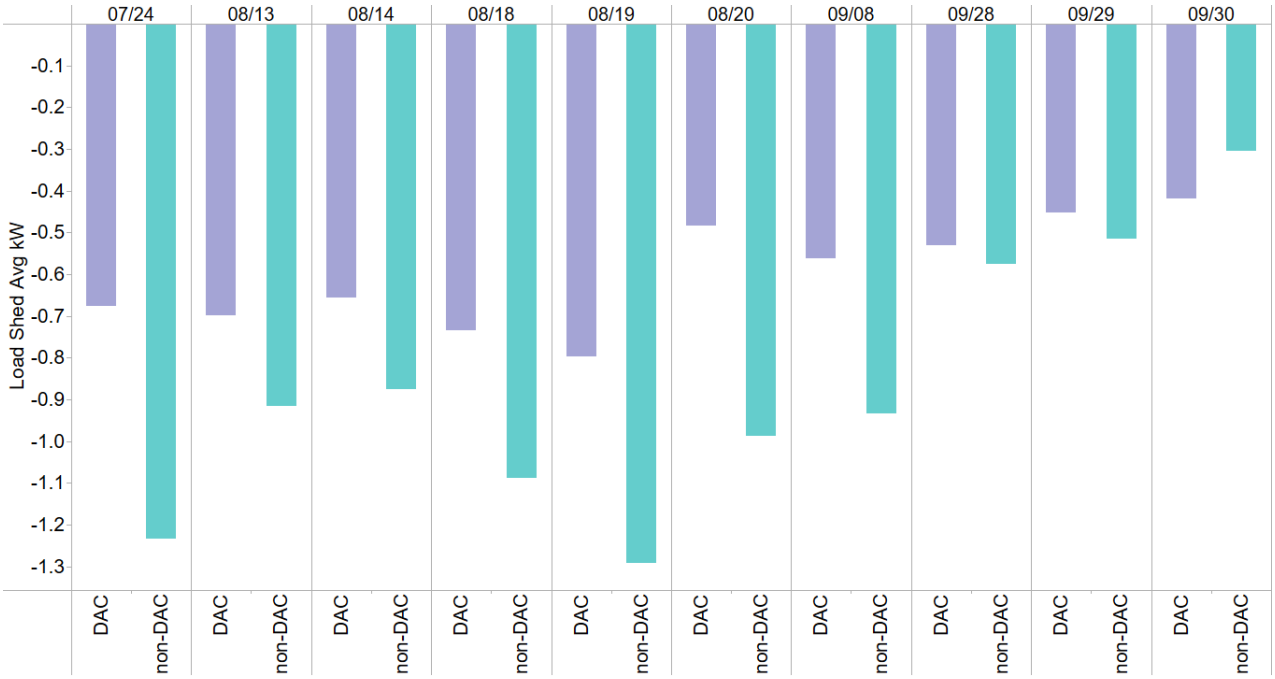

Figure 26. Average event performance for DAC vs non-DAC participants in load shed events

Over the course of the entire load shed season, PG&E was able to avoid consumption of 1.75MWh of energy and avoided a total of $556.7 in wholesale energy costs and 1,739lb CO_2 of emissions, which is equivalent to the emissions of 1,562 vehicle miles traveled (VMT).

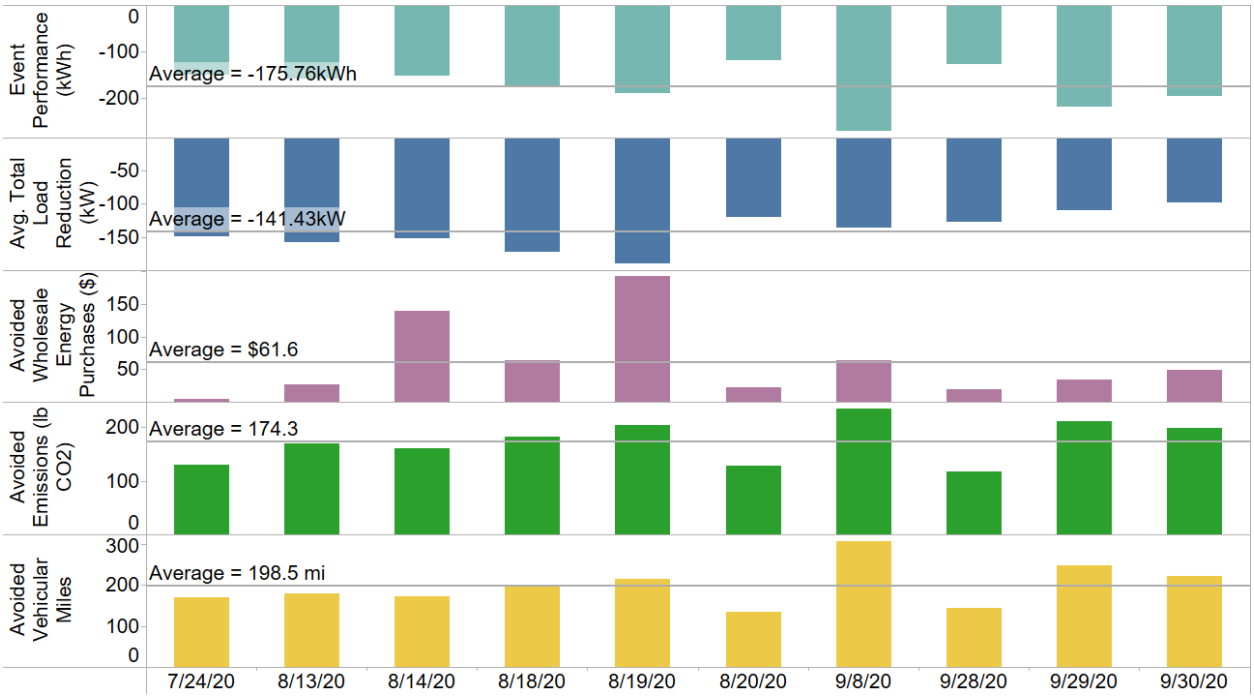

Figure 27. Impact measurements for load shed events

Load Shift DR Event Season Impacts

The expected result from the load-shift events was a load increase during the DR event hours. However, the data shows that we did not get the expected results and on average, participants decreased their energy consumption during the event hours (Figure 28). This may have been due to customer fatigue, confusion about switching from load-shed to the load-shed season, lack of understanding of the intended action, or an inability to shift energy consumption from different times of day.

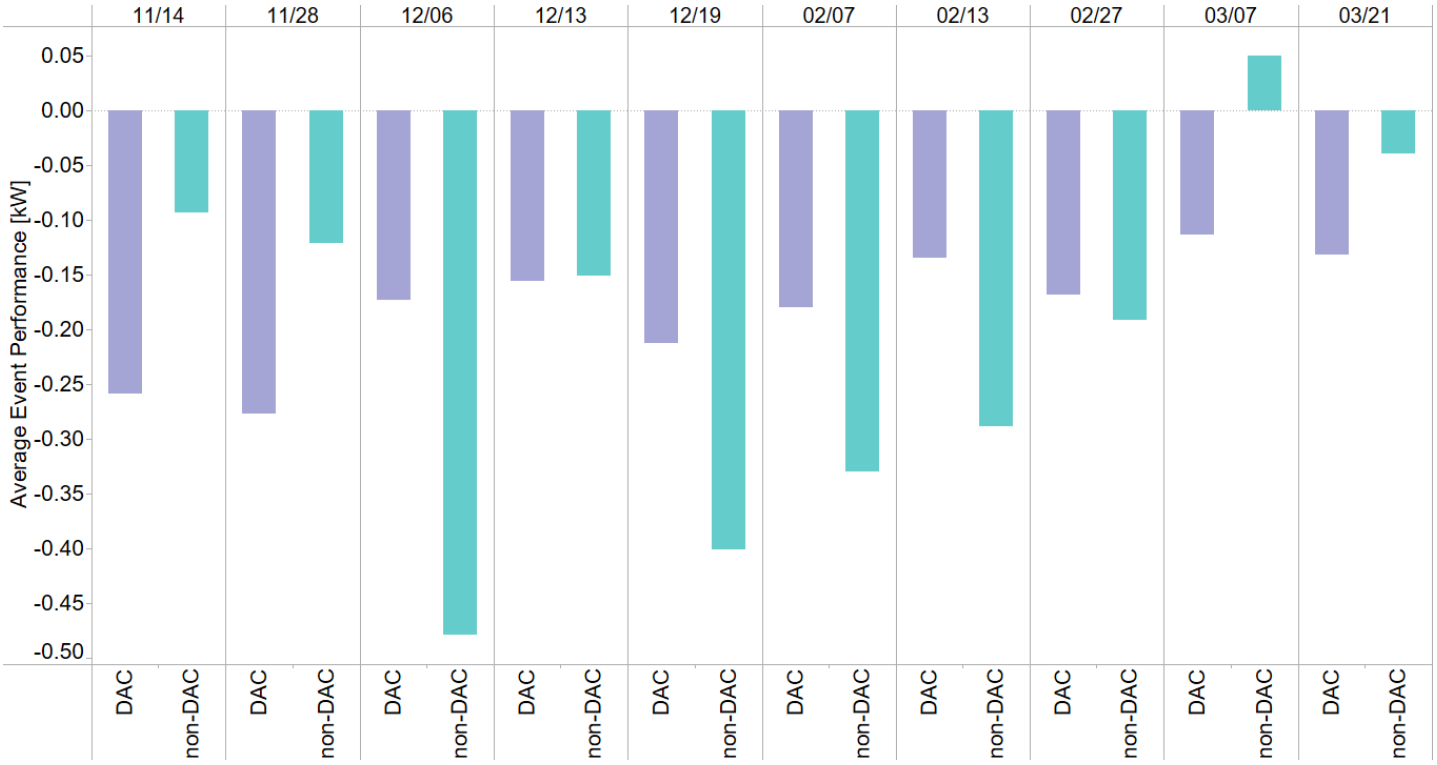

Figure 28 Average event performance for DAC vs non-DAC participants in load shift events

If program participants had performed as expected during the load shift season, the impact calculations would have been more complex than demonstrated, as the increased load during a shift event would have to be offset with some measured load decrease at another time of the day. In theory, a load shift event would defer the consumption of energy from more expensive, higher-emitting hours to less expensive, lower-emitting hours when renewables are generating more energy. Instead, the actual impact of decreasing energy consumption is demonstrated below in Figure 29. The results show that during the load-shift season, participants decreased energy consumption by 1.38MWh, avoided wholesale energy purchases of $691.4, avoided the emission of 984.8lb CO_2, which is equivalent to the emissions of 885 VMT.

Figure 29. Impact measurements for load shift events

Economic Impacts

The Fresno Energy Program was a pilot program, and the goal of the program was to collect data, provide lessons learned and help PG&E make informed decisions about future similar programs for its customers. Additionally, many of the benefits of the program are not easily quantifiable in monetary terms such an environmental benefit, customer engagement and increased customer satisfaction. Thus, a traditional cost-effectiveness analysis is not warranted for this program nor is one required for pilots.[13] The program did calculate economic impacts from the perspective of PG&E and customers using simple metrics. The economic impacts and resource valuation analysis were done only for the load shed season, as the load-shift season did not demonstrate the desired result for the program.

As can be seen in Table 5. Program load-shed season , the program implementation had net negative economic impacts from PG&E's perspective overall due to the incentives payments made to the customers. This was also because the program did not realize many of the monetary benefits that a market-integrated DR program would be expected to yield such as wholesale market revenues and resource adequacy value. The program did deliver economic benefit to customers by keeping the incurred cost to the customer negligible as it did not require the installation of any equipment or any other costs on the customer's part.

[13] 2016 Demand Response Cost Effectiveness Protocols, July 2016 at p. 7.

Item	PG&E Perspective	Item	Average Customer Perspective
		Average Number of Participants	315
Avoided kWh in Events	1757.7	Average Avoided kWh	5.58
		Average On-Peak Energy Cost ($/kWh)	$0.30
Costs		**Costs**	
Lost Retail Revenues	$457.00	N/A	
Incentive Payments	$13,325.50		
Total	$13,782.50		
Benefits		**Benefits**	
Avoided Wholesale Energy	$615.60	Avoided Retail Purchases	$1.67
		Program Incentives	$42.30
Total	$615.60	Total	$43.98
Net Benefits	**-$13,166.90**	**Net Benefits**	**$43.98**

Table 5. Program load-shed season economic impacts

6.0 Lessons Learned and Recommendations

The Fresno Energy Program's implementation in South-Central Fresno's has demonstrated the success of the Olivine Community Model and behavioral DR as a viable mechanism to unlock flexible loads in low-income and DAC communities to provide grid resources. Demand Response programs are typically not targeted towards underserved communities and there is a perception that low-income households don't have enough load for them to be able to participate in DR and aggregate resources to provide grid services.

The Fresno Energy Program participants delivered on average 0.69 kW/household of load reduction in the summer DR season. This is comparable to performance of other PG&E's DR programs such as the SmartAC program that are controlling devices remotely for load

flexibility. These results were delivered while implementing a DR program during COVID-19 restrictions in a DAC community. We believe implementation of similar efforts in a non-Covid period where we would have had the time to engage and educate the community about DR would have resulted in an even better performance and higher load flexibility delivered by program participants. We also believe that implementation of behavioral DR can deliver load flexibility and can keep the program participation costs down for low-income and underserved PG&E customers- making it a wise program design choice for DAC communities.

At scale- a similar statewide effort could potentially deliver ~685 MW of flexible load capacity with the assumption of 0.5 kW of load drop capacity per household and 10% of all statewide households participating in a behavioral DR program. Table 6 summarizes of potential resource levels at scale shows the average resource potential (MW) at different levels of scale such as program, city, county, PG&E territory and statewide.

Resource Level	Fresno Energy Program Pilot (Current)	Fresno Energy Program (Potential)	Fresno City	Fresno County	PG&E	Statewide
Total Household Accounts	59,849	59,849	168,625	307,906	5,100,000	13,700,000
Total Potential Behavioral Accounts	458	5,985	16,863	30,791	510,000	1,370,000
Average Resource Potential (MW)	0.69	3	8	15	255	685

Table 6: Summary of potential resource levels at scale

Some of the other lessons learned from program implementation and data analysis include the following:

- *In-person customer engagement is critical for DAC communities:* The lack of the program team's ability to engage the Fresno community as planned due to the COVID-19 restrictions had a significant impact on the total number of enrollments and the program was only able to meet 18% of its original enrollment target of 2,500 participants. As the program pivoted from a one-on-one customer engagement and outreach strategy to a modified multi-channel digital approach focused on emails, social media, online events, webinars, and videos-the less tech-savvy DAC customers went unsolicited and our community reach was very limited. Local leaders and CBO partners who were intending to perform in-person community engagement were also constraint in their ability to do so. The importance of hearing about program opportunities from referrals and in-person communications was also reflected in the survey results which indicated that 36% of enrollments came from personal referrals of CBO partner

outreach which included personal communications. Involvement of local CBOs helped the community build trust, feel reassured and were able to embrace the program. Hearing about the program from other members in their network, and/or their local press or news outlets also helped them enroll in the program.

Olivine recommends that future customer outreach and engagement efforts focused on DAC communities be designed carefully and aligned with their need for more personalized communication. We recommend leverage CBOs as partners, hiring local staff as program ambassadors and including multiple ways of in-person customer engagement such as door-to-door campaigning, in-person events for education and enrollment assistance and having an in-person program contact based in the target community.

- *Demand Response participation opportunities*: The program implementation helped us understand that DAC communities have the ability and willingness to participate in DR programs, and we have existing opportunities to engage this community and increase their participation in DR programs. The data from the Fresno Energy Program participants illustrates that the utility burden and the economic hardship this community faces could potentially be eased by tapping into the unlocked potential of flexible loads in their homes for participation in DR programs and the energy wholesale markets. DAC communities' energy use patterns show that their peak load is aligned with peak demand and pricing periods for the grid in California, and transition to TOU pricing might help further their economic hardships if they are not educated and empowered to reduce peak time demands. This community already has some basic understanding about how to reduce energy consumption through behavioral response, was able to reduce load in summer months in the program, but their awareness of DR programs is limited. Thus, there are opportunities to build upon these insights and use them as tools for engagement and education in future similar efforts in DAC communities.

Olivine recommends that future efforts at engaging DAC communities capitalize on our understanding and awareness that this community has unlocked flexible load potential that can be tapped into to provide grid resources. We need to engage this community through education and outreach campaigns to help understand this potential, leverage their existing understanding of behavioral energy saving actions, and encourage them to participate in DR programs to make an impact and gain economic benefits.

- *Demand Response participation barriers:* The program's implementation has also shed light on some barriers faced by DAC communities regarding participation in DR program. The results showed that although most customers found the enrollment process via the web and mobile app to be an easy process, there were 273 PG&E customers who initiated enrollment in the app from an eligible zip code but didn't complete the enrollment process. The reason for the incomplete numbers remains unclear- but the utility meter data sharing step – required for DR programs could be one possible barrier towards participation. Other barriers observed were the customer's

overall low awareness and knowledge about DR programs, low DR event notification response rates, and feedback from customers that they didn't understand what to do in an event tells us that the DAC community might need more education and knowledge dissemination regarding DR programs, their value and how to actively participate in behavioral demand response.

Olivine recommends that PG&E and future efforts in DAC communities combine customer engagement efforts with a knowledge building and educational campaign on Demand Response- available programs, economic earnings potential and the overall grid, environmental and societal benefits of tapping into flexible load capacity to reach the maximum potential from deployment of similar programs.

- *High DR program enrollment conflict rate:* The program could not enroll 113 customers (20%) due to these customers being already enrolled in other conflicting DR programs. The high DR program conflict rate was surprising as most customers had indicated in the survey that they were not aware of available DR programs. It could be possible that these customers are enrolling in DR programs without understanding the programs, are not aware of the regulatory restraint on dual participation in DR programs, possibly do not understand requirements for participation and are potentially free riders in the enrolled programs. There is also a general perception in the industry that DR programs are not adequately reaching DAC communities and this main impetus behind the CPUC ruling and the launch of the pilots focused on DAC communities. It is possible that DR programs have adequately reached DAC communities, and DAC households are enrolled in DR, but perhaps they are not engaging with these programs due to lack of education and understanding about these programs.

Olivine recommends that PG&E closely examines the DR program enrollment rate in this community and evaluates the perception of DR programs not reaching DAC communities in general more closely before future similar efforts focused on engaging DACs in DR programs.

- *Technological solutions for Demand Response:* The program surveys revel that the use of Olivine's technology and the web and mobile app to streamline the DR program enrollment process was appreciated by participants and helped them stay engaged in the program. Even though the technological solutions were offered in Spanish as well for the target community, the participants mostly preferred English as their language preference and the mobile app was preferred over the web-version of the app. This data busted some myths and perceptions about the level of technology adoption in the target DAC community and helped us realize that the adoption of web-enabled mobile phones might be higher than we think. The surveys also provided data that this DAC community had a reasonable level of adoption of smart technologies in their homes and this community might be able to participate in other DR programs as well which are

focused on unlocking flexible loads through direct control of smart technologies such as thermostats, lighting, EV chargers etc. Thus, to make more flexible resource capacity available for grid resources, we need to supplement behavioral DR pathway with other mechanisms through which programs can leverage existing DR-enabled devices or use program benefits to deploy new DR-enabled technologies in this community.

Olivine recommends that PG&E explores designing and deploying DR programs in DAC communities that offer multiple enrollment pathways for customers such as (i) Behavioral DR' (ii) DR enabled technology marketplace with rebates to deploy new devices in this community; and ways for customers to enroll existing DR-enabled devices into programs through a (iii) Bring-Your-Own (BYO) technology pathway. All enrollment pathways should deploy technological solutions that can make the DR program enrollment process simple and streamlined for customers.

- *Program Design Features:* The program implementation results – particularly the lack of desired performance during the load shift season – indicates that combining load shed and load shift events in one program was perhaps confusing for participants. The results show that during the summer load shed season, the participants performed great- delivering an average of 0.69kw/household load reduction for the program. However, during the load-shift season, when we requested participants to shift load into the excess renewable energy generation hours, we did not observe a load increase we were expecting to see during the event hours. Participants continued to shed load during the event window as they had done in the prior DR event season and possibly missed or misread the communication, they received announcing the change from the load-shed DR season into the load-shift DR season and how they were expected to behave differently in both seasons.

Olivine recommends that future DR program efforts do not combine different types of DR response behaviors into a single program and keep the program simple and focused on achieving a single focused goal.

- *DAC and non-DAC participant differences:* The program showed that both DAC and non-DAC households were willing and able to participate and deliver flexible load in a DR program. There were some socio-economic, behavioral and preference differences among DAC and non-DAC participants. DAC customers reported a lower socio-economic status, lower household load and were motivated to participate in DR programs and messaging focused on earning money and community benefits. Non-DAC participants appeared to be more motivated or engaged with messaging focused on environmental or grid benefits and had more flexibility in their schedules on which actions and what times they were able and willing to participate in DR events. The need for more community engagement, education and knowledge dissemination about available DR programs, purpose and their value was demonstrated by both groups.

Olivine recommends that future DR program in DAC communities continue to focus on maximizing imparting economic benefits to these residents, but also focus on the educational and community engagement needs of this community in order to get the maximum value from engagement in DR programs.

Thus, to summarize, the Fresno Energy Program was successfully able to implement a behavioral DR program in a DAC community in south-central Fresno. The maximum enrollment potential for the program was undermined due to COVID-19 restrictions and the inability of the program team to engage and market to this community as planned. However, the implementation has resulted in valuable insights and data and has demonstrated that DAC residents can be successful in engaging in DR programs and deliver considerable flexible load capacity to alleviate grid stress and emergencies in California.

Appendix A: Home Energy Survey

1. How did you hear about the program? Check all that apply.
   - Referral from a friend or family
   - Social media
   - Email
   - Flyer
   - An event
   - GRID Alternatives
   - Fresno Housing Authority
   - Valley Air District
   - Other (Please specify)

2. How did you sign up for this program?
   - From a computer using the web app
   - From a smart phone using the mobile app

3. How easy or difficult was it to enroll in the Fresno Energy Program? On a scale of 1-5; 1 being Very Easy and 5 being Very Difficult.
   - 1
   - 2
   - 3
   - 4
   - 5

4. If you selected 4 or 5 in the question above, please tell us why. Please select all that apply.
   - Did not understand the program
   - Setting up an online PG&E account was difficult
   - Using the app was difficult
   - Sharing data by connecting with PG&E was difficult
   - Needed more support during the enrollment process
   - Too many enrollment steps
   - Other (Please specify)

5. What are your main motivations for participating in the program? Please check all that apply.
   - Earn incentives
   - Reduce energy costs
   - Reduce pollution
   - Reduce greenhouse gas emissions

- Increase grid resilience
- Help my community
- Highly Motivating
- Not at All Motivating

6. This program will organize weekday Energy Savings Events between 4-9 pm during times of high energy demand. At what time would it be generally convenient for you to lower your energy use during these events? Please check all that apply.
   Weekdays (Monday-Friday)
   - 4-5 pm
   - 5-6 pm
   - 6-7 pm
   - 7-8 pm
   - 8-9 pm

7. This program will also organize weekend Energy Shifting Events to shift high energy usage activities (e.g. laundry, space cooling, cooking etc.) from the evening (4-9 pm) to midday (10am - 2pm) during times of high renewable energy supply. What times would it be generally convenient to complete these high energy use activities during energy shifting events? Please check all that apply.
   Weekends (Saturday-Sunday)
   Weekdays (Monday-Friday)
   - 8-9 am
   - 9-10 am
   - 10-11 am
   - 11 am – 12 pm
   - 12 pm – 1 pm
   - 1 – 2 pm

8. Are you aware of Demand Response (DR) programs- such as PG&E's Smart AC, Smart Rate, or with any other business?
   - Yes
   - No
   - Not aware of these programs
   - I don't know what Demand Response is
   - Do not understand these programs

9. If you answered "Yes" to the above question, why are you currently not enrolled in any Demand Response (DR) program?
   - Too confusing
   - Too much work
   - Not home enough
   - Too inconvenient/uncomfortable

- Privacy concerns
- Other (Please specify)

10. If you answered “Yes” to the earlier question, what is your understanding of how Demand Response (DR) programs create value for customers? Please choose all that apply.
    - Reduce energy use
    - Reduce energy cost
    - Reduce pollution
    - Reduce greenhouse gas emissions
    - Relieve congestion on the electric grid
    - Increase renewable energy use
    - Reduce use of fossil fuel (e.g., natural gas) generation on the grid
    - Don’t know
    - Other (Please specify)

11. Have you applied for any of the following rebates from your utility? Check all that apply. Energy efficient lighting
    - Energy efficient Heating, Ventilation and Air-Conditioning (HVAC) equipment
    - Energy efficient appliances
    - Smart Thermostat
    - Home energy upgrade (windows, insulation, etc.)
    - Electric vehicle
    - Solar
    - Battery energy storage
    - Not aware of any rebates available
    - Aware of rebates, have not applied

12. What actions do you currently take to keep your energy bill low? Please choose all that apply.
    - Enroll in special rate plan from my utility
    - Use energy at less expensive times of the day
    - Turn off lights/appliances
    - Turn down thermostat/turn up A/C
    - Purchase or rent energy efficient appliances
    - Install efficient lightbulbs (e.g., CFL, LED)
    - Leave home to reduce heating / cooling load (go to a public place, etc)
    - I don’t do anything to lower my energy bill
    - Other (Please specify)

13. Is your home on any of the following electricity rates? Please choose all that apply. This can be found on your electricity bill.

- Time of Use Plan (E6, E- TOU, EL-TOU, EM-TOU)
- Tiered Rate Plan (E-1, EM, ES, ESR, ET)
- Electric Vehicle Plan (EV, EV2, EVL2,)
- CARE: California Alternate Rate for Energy (EL-1, EML, ESL, ESRL, ETL)
- FERA (Family Electric Rate Program)
- Medical Baseline
- Solar net-energy metering (NEM)
- Don't know
- Other (Please specify)

14. What is your average monthly energy bill?
    - Gas
        - $0-$25
        - $25-51
        - $51-75
        - $76-100
        - Over $100
    - Electric
        - $0-$25
        - $25-51
        - $51-75
        - $76-100
        - Over $100

15. Have you ever felt burdened by your overall cost of energy?
    - Yes
    - No
    - Decline to answer

16. How is your home heated? Please check all that apply.
    - Central furnace
    - Wall radiator
    - Space heater
    - Fireplace
    - No heating at home
    - Other (Please specify)

17. How is your home cooled? Please check all that apply.
    - Central air conditioning
    - Wall / window air conditioning unit
    - Plug-in portable air conditioning unit
    - Desert/swamp cooler
    - Whole house/attic fan

- Ceiling fan
- No cooling at home
- Other (Please specify)

18. Please indicate if these appliances in your home are gas or electric.
    - Space heating
    - Space cooling
    - Water heating
    - Clothes washer
    - Clothes dryer
    - Cooking

19. What other large electricity uses do you have in your home? Please check all that apply.
    - Pool heater / spa
    - Pool pump
    - Electric stove/oven
    - Medical equipment
    - Electric vehicle
    - None
    - Other (Please specify)

20. Which of the following clean energy technologies do you currently have in your home and/or are interested in obtaining? Check all that apply (Selecting either Currently own, Interested in obtaining, Not interested/ No opinion or Decline to answer). Your answer will help us design future program offerings and your response will be kept confidential.
    - Smart thermostat
    - Smart plug strips
    - Smart programmable appliances
    - Smart lights
    - Solar panels
    - Battery energy storage
    - Efficient lighting (e.g., LEDs)
    - Electric vehicles
    - Induction cooktop
    - Heat pump water heater (HPWH)

21. What type of residence do you live in?
    - Single-family home, detached
    - Single-family home, attached (Townhome, Duplex/Triplex)
    - Apartment/Condo
    - Mobile home

- Other (Please specify)

22. What is the size of your residence?
    - Less than 500 sq ft
    - 500 to 749 sq ft
    - 750 to 999 sq ft
    - 1,000 to 1,499 sq ft
    - 1,500 to 1,999 sq ft
    - 2,000 to 2,499 sq ft
    - 2,500 to 2,999 sq ft
    - 3,000 to 3,999 sq ft
    - 4,000 or more sq ft

23. Do you rent or own your residence?
    - Rent
    - Own

24. How much is your monthly rent?
    - $0-$500
    - $501-$1000
    - $1001-$1500
    - $1501-$2000
    - $2000+
    - Decline to answer

25. Do you have internet or WiFi in your home?
    - Yes
    - No

26. How many people live in the home?
    - 1
    - 2
    - 3
    - 4
    - 5 or more

27. What is the primary language spoken in the home?
    - Spanish or Spanish Creole
    - English
    - Miao, Hmong
    - Mon-khmer, Cambodian
    - Laotian

- Other (Please specify)

28. What is your age?
    - Under 18
    - 18 – 29
    - 30-44
    - 45-59
    - 60+

29. What's the highest level of school you've completed?
    - Less than high school
    - High school or GED
    - Some college
    - Associates degree (2- year college degree)
    - Bachelor's degree
    - Graduate degree

30. What is the annual income of all members in your household?
    - $0- $24,000
    - $24,001-$37,000
    - $37,001-$49,000
    - $49,001-$61,800
    - $61,801-$80,000
    - $80,001-$100,001
    - $100,000+
    - Decline to answer

31. What is the current employment status of the head of household?
    - Employed, working full – time
    - Employed, working part-time
    - Self-employed
    - Not employed, looking for work
    - Not employed, not looking for work
    - Retired
    - Disabled, not able to work
    - Decline to answer

32. What is your ethnicity?
    - African American or Black
    - American Indian/Alaska Native
    - Asian
    - Hawaii an/Pacific Islander

- Latino/Hispanic
- Middle Eastern/North African
- White
- Decline to answer

Appendix B: Customer Experience Survey

1. How would you rate your overall experience in the program?
   - Very positive
   - Somewhat Positive
   - Ok
   - Somewhat Negative
   - Very Negative

If you answered Somewhat Negative or Very Negative, please describe why

2. Did participation in the Fresno Energy Program helped you better understand and/or manage your household's energy consumption?
   - Yes
   - Somewhat
   - No

3. Did you understand that the program included both energy load reduction and load shifting events?
   - Yes
   - Somewhat
   - No

4. Please rank the following elements of the program in terms of how important they were to you (Very Important, Somewhat Important, or Not Important at all):
   - Receiving bilingual program material- English and Spanish
   - Use of the mobile/web app to enroll in the program
   - Use of mobile app to understand home energy use patterns
   - Use of mobile app to receive Energy Event notifications
   - Flexibility of accepting or declining an Energy Event notification
   - Education about ways to save energy and money
   - Receiving e-gift cards for program participation
   - Positive environmental impacts from my program participation

5. How many Energy Event notifications did you accept for participation?
   - None (0) of the events
   - Between 1-5 events
   - Between 6-10 events
   - Between 11-15 events
   - Between 16-19 events
   - All 20 events

6. Which type of notification (s) did you use for learning about an upcoming energy event? Check all that apply.
   - Mobile App
   - Web App
   - Email

- SMS

7. Did you find the frequency of energy events to be:
   - Too high
   - Right frequency
   - Too low

8. Were the notifications provide adequate to prepare for an energy event?
   - No, notification was too late to be able to adequately prepare
   - No, not enough notification reminders
   - Yes

9. How easy or difficult was it to adjust your home energy use when requested?
   - Very easy
   - Easy
   - Neither easy nor difficult
   - Difficult
   - Very difficult

9. If you answered 'Difficult' or 'Very difficult', please indicate the reason. Please choose all that apply.
   - Was not home at the time
   - Did not know what action to take
   - Too inconvenient or uncomfortable to reduce energy
   - Too many requests
   - Did not receive or see the notification
   - Received notifications late
   - Other (please specify)

11. What did you do to adjust your home energy use during an energy event? Please choose all that apply.
   - Turned off/down lights
   - Rescheduled activities (e.g. running dryer, dishwasher, watching TV)
   - Raised A/C temperature settings
   - Lowered heat temperature settings
   - Turned off A/C
   - Left home
   - Unplugged unused devices and/or appliances
   - Other (please specify)

12. What actions do you believe you will continue to take in the future?
   - Turn off/down lights
   - Reschedule activities (e.g. running dryer, dishwasher, watching TV)
   - Raise A/C temperature settings
   - Lower heat temperature settings
   - Turn off A/C
   - Leave home
   - Unplug unused devices and/or appliances

- Other (please specify)

13. Please rate your experience with Customer Support.
    - Excellent
    - Good
    - Poor
    - Bad
    - Did not contact customer support

Please provide details if your customer support experience was not excellent or good (Optional)

14. How satisfied were you with the amount of rewards earned through your program participation (Selecting either More than satisfied, Satisfied or Less than Satisfied)?:
    - Total program incentives offered
    - Survey completion incentives
    - Energy event participation incentives
    - Referral Bonuses

15. How satisfied were you with the following aspects of redeeming program rewards (Selecting either More than satisfied, Satisfied or Less than Satisfied)?:
    - Program Reward Redemption
    - Electronic method of rewards payment
    - Reward redemption choices
    - Reward payment frequency

16. How did you use the Olivine Community App. Check all that apply.
    - Mobile version on my smartphone
    - Web version on my personal computer
    - Web version on a public computer
    - Did not use the App at all

17. What did you mainly use the Olivine Community app for? Check all that apply.
    - Enrollment in the program
    - Track my household energy use
    - Responding to Energy Event notifications
    - Check Energy Event performance impact
    - Tracking money rewards

18. For mobile app users: How often did you update your app?
    - All or most of the time
    - Occasionally, once or twice
    - Never

19. How easy or difficult was it to use the Olivine Community App?
    - Very easy
    - Easy
    - Neither easy nor difficult
    - Difficult

- Very difficult

20. If you answered 'Difficult' or 'Very Difficult' above, please tell us why. Check all that apply
    - Downloading the App was difficult
    - The App did not feature my language
    - Understanding Energy Event notifications was difficult
    - Understanding my home energy use was difficult
    - Understanding my Energy Event performance was difficult
    - General app usability
    - Technical difficulties while using the App.
    - None
    - Other (please specify)

21. How frequently did you use your app?
    - Daily or Most Days
    - Once a week
    - Only when I get notifications
    - Not since I signed up, I don't really interact with the app much

22. What additional features would you like to see in the Olivine Community App in the future?
    - Learn about other available incentive programs
    - Provide more language options
    - Show me household gas consumption also
    - Allow me to redeem rewards from the App.
    - Allow me to refer others to download the App.
    - Help me understand my home energy bill
    - Show me how my energy use compares with other similar homes
    - Help me pay my bill directly from the App.
    - Allow me to purchase energy saving devices
    - Other, Please explain

23. What information would be helpful for you to better understand your home energy use?
    - Home energy consumption patterns by season
    - Amount of energy used by individual appliances/technologies (e.g. Heating, cooling, cooking etc.)
    - Learn ways to reduce energy
    - Learn about the importance of saving energy
    - Other, please explain

24. What other future program offerings would you like to see through the Olivine Community. Check all that apply.
    - Similar programs to the Fresno Energy Program
    - Programs for commercial customers
    - Programs that offer rebates on energy saving technologies
    - Programs that do not end
    - Other, please explain

25. What kind of incentives would you like to receive as rewards in future programs?
    - Cash incentives

- Free energy saving advice for my home
- Free / reduced cost energy saving technologies
- Reduction to my energy bill
- Other, please explain

26. After the study concludes on March 31st 2021, would you be open to participating in a short interview for an additional incentive?
    - Yes
    - No
    - Possibly, please keep me in mind

27. What is your preferred method to hear about future opportunities?
    - Flyers
    - Social Media
    - Email
    - Direct mail
    - Other. Please specify

28. Is there anything additional you would like us to know about your experience with any aspect of the Olivine Community or the Olivine Community Energy app?
29. How many people live in the home?
    - 1
    - 2
    - 3
    - 4
    - 5 or more

30. What is the primary language spoken in the home?
    - Spanish or Spanish Creole
    - English
    - Miao, Hmong
    - Mon-khmer, Cambodian
    - Laotian
    - Other

31. What is your age?
    - Under 18
    - 18-29
    - 30-44
    - 45-59
    - 60+

32. What's the highest level of school you've completed?
    - Less than high school
    - High school or GED
    - Some college
    - Associates degree (2-year college degree)
    - Bachelor's degree

- Graduate degree

33. What is the annual income of all members in your household?
    - $0- $24,000
    - $24,001-$37,000
    - $37,001-$49,000
    - $49,001-$61,800
    - $61,801-$80,000
    - $80,001-$100,001
    - $100,00+
    - Decline to answer

34. What is the current employment status of the head of household?
    - Employed, working full-time
    - Employed, working part-time
    - Self-employed
    - Not employed, looking for work
    - Not employed, not looking for work
    - Retired
    - Disabled, not able to work
    - Decline to answer

35. What is your ethnicity?
    - African American or Black
    - American Indian/Alaska Native
    - Asian
    - Hawaiian/Pacific Islander
    - Latino/Hispanic
    - Middle Eastern/North African
    - White

Appendix C: Event Summary Tables

	07/24/2020	08/13/2020	08/14/2020	08/18/2020	08/19/2020	08/20/2020	09/08/2020	09/28/2020	09/29/2020	09/30/2020
Total Participants	208	225	228	231	231	231	232	244	244	244
Event Length	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0	2.0
Event Start Hour	18	19	19	18	18	18	18	18	17	17
Event End Hour	19	20	20	19	19	19	20	19	19	19
Event Performance	149.7	158.3	151.5	172.9	190.8	119.9	136.3	127.8	109.3	97.8
Event Avg kW	-0.73	-0.72	-0.68	-0.76	-0.84	-0.53	-0.60	-0.53	-0.46	-0.41
Accepted Count	71	74	59	74	68	54	83	97	73	63
Accepted Percent	34.1%	32.9%	25.9%	32.0%	29.4%	23.4%	35.8%	39.8%	29.9%	25.8%
Accepted Event Performance	-87.3	-75.7	-51.9	-87.7	-78.3	-43.5	-66.3	-74.0	-62.8	-29.5
Accepted Response Event Avg kW	-1.2	-1.0	-0.9	-1.2	-1.2	-0.8	-0.8	-0.8	-0.9	-0.5
Declined Count	2	4	0	3	4	1	4	0	2	2
Declined Percent	1.0%	1.8%	0.0%	1.3%	1.7%	0.4%	1.7%	0.0%	0.8%	0.8%

	07/24/2020	08/13/2020	08/14/2020	08/18/2020	08/19/2020	08/20/2020	09/08/2020	09/28/2020	09/29/2020	09/30/2020
Declined Event Performance	-0.9	-1.5	0	-0.8	-4.0	-0.1	-0.5	0	-0.3	0.2
Declined Response Event Avg kW	-0.5	-0.4	0	-0.3	-1.0	-0.1	-0.1	0	-0.2	0.1
None Count	135	147	169	154	158	174	142	145	166	176
None Percent	64.9%	65.3%	74.1%	66.7%	68.4%	75.3%	61.2%	59.4%	68.0%	72.1%
None Event Performance	-61.5	-81.0	-99.7	-84.4	-107.6	-76.6	-66.0	-53.2	-44.3	-65.5
None Response Event Avg kW	-0.46	-0.55	-0.59	-0.55	-0.68	-0.44	-0.47	-0.37	-0.27	-0.37
Viewed Count	0	0	0	0	1	2	3	2	3	3
Viewed Percent	0.0%	0.0%	0.0%	0.0%	0.4%	0.9%	1.3%	0.8%	1.2%	1.2%
Viewed Event Performance	0	0	0	0	-0.8	0.3	-3.4	-0.7	-1.9	-3.0
Viewed Response Event Avg kW	0	0	0	0	-0.83	0.17	-1.14	-0.33	-0.64	-1.01
Disadvantaged Count	189	206	208	211	211	211	212	224	224	224
Disadvantaged Event Performance	-126.2	-140.9	-134.0	-151.2	-165.0	-100.1	-117.6	-116.9	-99.6	-92.0
Disadvantaged Event Avg kW	-0.67	-0.68	-0.64	-0.72	-0.78	-0.47	-0.55	-0.52	-0.44	-0.41

	07/24/2020	08/13/2020	08/14/2020	08/18/2020	08/19/2020	08/20/2020	09/08/2020	09/28/2020	09/29/2020	09/30/2020
Non-Disadvantaged Count	19	19	20	20	20	20	20	20	20	20
Non-Disadvantaged Event Performance	-23.4	-17.4	-17.5	-21.8	-25.8	-19.8	-18.6	-11.0	-9.8	-5.8
Non-Disadvantaged Event Avg kW	-1.23	-0.92	-0.88	-1.09	-1.29	-0.99	-0.93	-0.55	-0.49	-0.29

Table 7. Summary of load shed events

	11/14/2020	11/28/2020	12/06/2020	12/13/2020	12/19/2020	02/07/2021	02/13/2021	02/27/2021	03/07/2021	03/21/2021
Total Participants	291	319	334	374	393	458	458	455	455	446
Event Length	2	2	2	2	2	2	2	2	2	2
Event Start Hour	11	11	11	11	11	11	11	11	11	11
Event End Hour	13	13	13	13	13	13	13	13	13	13
Event Performance	-71.3	-83.3	-62.8	-57.3	-88.0	-86.8	-66.4	-76.1	-43.5	-54.0
Event Avg kW	-0.25	-0.26	-0.19	-0.15	-0.23	-0.19	-0.15	-0.17	-0.10	-0.12

	11/14/2020	11/28/2020	12/06/2020	12/13/2020	12/19/2020	02/07/2021	02/13/2021	02/27/2021	03/07/2021	03/21/2021
Accepted Count	99	117	33	64	73	181	197	180	186	188
Accepted Percent	34.0%	36.7%	9.9%	17.1%	18.6%	39.5%	43.0%	39.6%	40.9%	42.2%
Accepted Event Performance	-21.9	-49.5	-10.2	-12.8	-18.5	-23.0	-24.6	-27.0	-18.4	-12.1
Accepted Response Event Avg kW	-0.2	-0.4	-0.3	-0.2	-0.3	-0.1	-0.1	-0.1	-0.1	-0.1
Declined Count	1	3	4	4	4	3	6	6	6	4
Declined Percent	0.3%	0.9%	1.2%	1.1%	1.0%	0.7%	1.3%	1.3%	1.3%	0.9%
Declined Event Performance	0.0	-0.2	-0.2	0.7	-1.1	1.1	-1.0	0.3	-0.6	-2.6
Declined Response Event Avg kW	0.0	-0.1	-0.1	0.2	-0.3	0.4	-0.2	0.1	-0.1	-0.6
None Count	191	195	206	223	246	236	221	235	223	217
None Percent	65.6%	61.1%	61.7%	59.6%	62.6%	51.5%	48.3%	51.6%	49.0%	48.7%
None Event Performance	-49.4	-33.8	-32.9	-32.3	-52.4	-60.2	-32.7	-44.7	-24.5	-32.5
None Response Event Avg kW	-0.26	-0.17	-0.16	-0.14	-0.21	-0.26	-0.15	-0.19	-0.11	-0.15
Viewed Count	0	4	91	83	70	38	34	34	40	37
Viewed Percent	0.0%	1.3%	27.2%	22.2%	17.8%	8.3%	7.4%	7.5%	8.8%	8.3%
Viewed Event Performance	0	0.3	-19.5	-12.9	-16.0	-4.7	-8.1	-4.8	0.0	-6.8

	11/14/2020	11/28/2020	12/06/2020	12/13/2020	12/19/2020	02/07/2021	02/13/2021	02/27/2021	03/07/2021	03/21/2021
Viewed Response Event Avg kW	0	0.08	-0.21	-0.16	-0.23	-0.12	-0.24	-0.14	0.00	-0.18
Disadvantaged Count	270	299	314	343	361	419	418	416	416	408
Disadvantaged Event Performance	-68.6	-80.8	-53.3	-52.6	-75.6	-74.0	-55.4	-68.8	-45.4	-52.5
Disadvantaged Event Avg kW	-0.25	-0.27	-0.17	-0.15	-0.21	-0.18	-0.13	-0.17	-0.11	-0.13
Non-Disadvantaged Count	20	20	20	31	32	39	39	39	39	38
Non-Disadvantaged Event Performance	-1.9	-2.4	-9.6	-4.7	-12.4	-12.9	-11	-7.3	1.9	-1.5
Non-Disadvantaged Event Avg kW	-0.09	-0.12	-0.48	-0.15	-0.39	-0.33	-0.28	-0.19	0.05	-0.04

Table 8. Summary of load shift events

Appendix D: Event Trigger Summaries

Event Date	Event Performance (kW)	Total Participants	PG&E System Load (MW)	Max Air Temp (°F)	AQI	Max. Price ($/MWh)
7/24/20	-150	208	15,632	99	65	42
8/13/20	-158	225	18,204	102	84	170
8/14/20	-152	228	19,849	106	140	923
8/18/20	-173	231	20,420	108	133	366
8/19/20	-191	231	18,672	106	170	1,009
8/20/20	-120	231	16,894	100	166	180
9/8/20	-136	232	16,224	106	366	276
9/28/20	-128	244	17,369	93	87	150
9/29/20	-109	244	16,883	102	322	189
9/30/20	-98	244	17,017	100	336	305

Table 9. Load shed event performance compared with event triggers

Event Date	Event Performance (kW)	Total Participants	PG&E System Load (MW)	Max Air Temp (°F)	AQI	Max. Price ($/MWh)	CAISO Oversupply Warning
11/14/20	-73	291	8,969	66	94	64	✓
11/28/20	-83	319	8,587	65	184	56	✓
12/6/20	-63	334	9,110	63	220	62	✓
12/13/20	-57	374	10,882	54	94	70	✓
12/19/20	-88	393	9,180	57	196	70	✓
2/7/21	-87	458	8,245	68	118	49	✓
2/13/21	-66	458	8,880	63	72	245	✓
2/27/21	-76	455	8,290	66	74	49	✓
3/7/21	-44	455	7,237	66	58	59	✓
3/21/21	-54	446	7,719	64	62	49	✓

Table 10. Load shift event performance compared with event triggers