



# CPUC Market Adoption Study Research Plan

**Prepared for:**

**California Public Utilities Commission**



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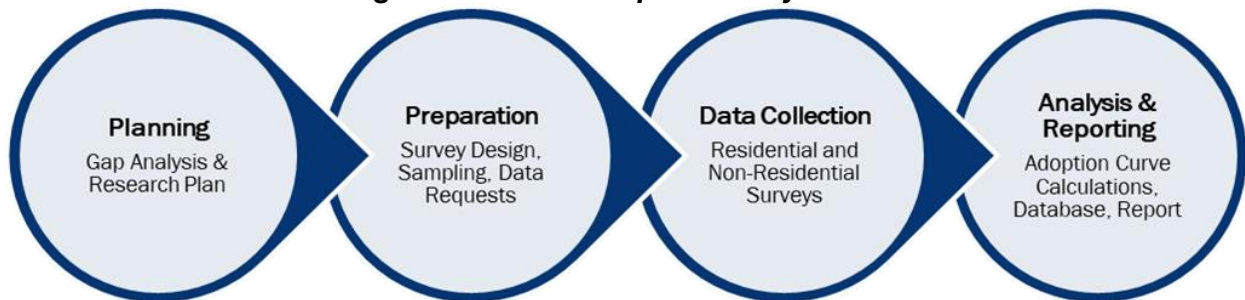
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## Study Overview

This research plan outlines the research activities that will be conducted under the California Public Utilities Commission (CPUC) Market Adoption study. The main activities include primary data collection, adoption curve analyses, and reporting. Findings from the Market Adoption study will be used to support the overarching 2021 Potential and Goals (PG) study as well as inform the Energy Efficiency Potential Forecast. The collected primary data will be provided as data inputs to create adoption curves for the next Potential and Goals update.

**Figure 1** below summarizes the four phases of the Market Adoption Study. The study commences with planning activities: the development of this research plan and a gap analysis that will support the creation of the data collection instruments. Opinion Dynamics will conduct these planning activities in close coordination with the CPUC, Guidehouse, and DNV-GL. As a part of the gap analysis and research plan, Opinion Dynamics will identify topic areas to be considered in the data collection instruments, including prioritized technologies, measures, fuel substitution, incentivization scenarios, willingness-to-adopt energy efficiency (EE) measures, and various customer attitudes, behaviors, and characteristics. Furthermore, Opinion Dynamics will create a detailed sampling plan and submit data requests to develop the sample frames for each survey. After survey instruments and sample frames are finalized, Opinion Dynamics will field the residential, multifamily, and nonresidential online surveys to collect primary data. Finally, Opinion Dynamics will calculate adoption curves and ultimately create a database that will integrate into the Potential and Goals analysis.

**Figure 1. Market Adoption Study Phases**



## Study Goals & Objectives

The Market Adoption Study will gather data on adoption characteristics and customer attitudes and behaviors to inform adoption decision-making factors in the 2021 PG study for four segments: residential single-family, residential multifamily (five or more units) property owners, small commercial, and large commercial. Opinion Dynamics will gather this primary data through online residential and nonresidential customer surveys. The customer responses will provide data that can be used to revise and inform the core adoption algorithms within the EE potential model.

Historically, the PG study did not collect such primary data and largely relied on secondary datasets and assumptions vetted with stakeholders. The Market Adoption Study aims to fill key data gaps by collecting market adoption characteristics via primary data collection. Information about market drivers, customers' willingness to adopt energy efficiency technology, and

potential barriers.

## **Study Data Sources**

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Opinion Dynamics will collect primary data from California customers to capture the data elements required for this study. Opinion Dynamics will conduct primary research through three online surveys. Primary data collection will provide insights into residential and nonresidential customer characteristics that drive energy efficiency measure adoption via willingness-to-adopt scenarios, barriers, and opportunities for EE-Demand Response (DR) pairings, fuel substitution, energy efficiency adoption, energy-related attitudes and behaviors, and key demographic and firmographic characteristics.

Additionally, Opinion Dynamics will compile supporting secondary data sources that also may be relevant for market adoption to inform the study. This includes the 2019 California Residential Appliance Saturation Study (RASS), CPUC financing studies for small commercial and residential, and DNV GL's Evaluation for CPUC Group A Home Energy Report Programs, among other relevant market studies.

## **Data Collection**

### **Primary Data Collection**

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Historically, customer adoption characterization in the PG study was based primarily on the payback period of an EE technology, leveraged from out-of-state, third-party utility data, and subsequently vetted by stakeholders. As such, these data were limited in scope and excluded the complexities that influence California customers' decisions to implement energy efficiency projects, as well as the evolution of programs, products, and markets in California. Due to these specific data and information gaps, the 2021 PG study will collect primary data and information critical to customer adoption in the California energy efficiency market.

As part of the primary data collection, Opinion Dynamics will survey residential single-family customers, multifamily building owners or managers, and small and large commercial customers. We will develop the instruments necessary for the primary data collection activities and will work with key project partners (CPUC and Guidehouse) to finalize them. The surveys will capture decision-making factors and enable model updates that will feed into the EE potential forecast, improving the foundation of its results.

### **Residential**

Opinion Dynamics will conduct two mail-push-to-web online surveys for the residential segment of the PG study: one survey targeting residential customers living in single family homes and homes with four or fewer units, and the other targeting owners and managers of multifamily buildings with five or more units

#### *Residential Single-Family Customer Online Survey*

Overall, the residential single-family customer survey will collect data on customer characteristics, behaviors, and attitudes, as well as willingness-to-adopt select energy efficiency

technologies/measures and program offerings.

### Sampling

Opinion Dynamics will prepare a detailed data collection sampling plan based on the approved research plan. We will propose a sample design to support the key objectives of this effort. The plan will identify the required sample sizes and proposed sub-segments for eligible residential single-family customers to satisfy 90/10 confidence/precision for key strata. The timeline for finalizing the Sampling Plan is May 2020.

We will target non-low-income California residents who live in homes with four or fewer units across the four investor owned utility (IOU) service territories and will develop our sample frame based on IOU customer databases. We will work with Guidehouse and the CPUC to develop an IOU customer-based sample frame that provides coverage of the single-family population across the state. We will request electric customer data to provide coverage of all areas but limit issues of customer matching between electric and natural gas accounts. Fuel access will then be confirmed within the survey data collection activities.

We will collect 600 completed surveys. This targeted number of completed surveys allows us the ability to sub-segment, where feasible, to develop statistically valid results for key segments of interest for the PG study such as single-family owners versus renters.

### Instrument Design

Opinion Dynamics will develop the instrument necessary for the residential customer online survey and will work with Guidehouse and the CPUC to align the instrument with the approved sample design and modeling needs. We will craft the instrument to be easy to understand and navigate and to require no more than 20 minutes to complete.

The residential customer survey will collect data on customers' willingness to adopt select energy efficiency technologies/measures, as well as their willingness to participate in DR programs. We will assess factors that may enhance residential willingness, including financial incentives/benefits and intrinsic motivators. Additionally, we will evaluate factors that may negatively influence willingness to adopt/participate across customer segments, including financial barriers, limited technology availability, structural barriers, and low awareness, among others. To account for potential COVID-19 impacts, we will include questions specific to pre-COVID-19 and current barriers and motivators. Gathering these past and present inputs will provide us with projections for modeling how COVID-19 affects adoption. These barrier and motivator variables will feed into characterizing customer adoption by capturing the important decision-making factors that influence willingness to adopt. These adoption questions will be structured through specific EE/DR scenarios: a series of survey questions that capture willingness to adopt/participate based on varying end-uses, EE measures, and applicability (**Table 1**).

As noted in **Table 1**, we will focus on groupings of EE measures, DR controls, and fuel substitution equipment based on residential applicability for each scenario. We will ask residential decision-makers about their willingness to adopt EE HVAC systems, HP water heaters, EE appliances, and insulation measures given varying levels of rebates, contrasting financial and non-energy benefits. We will provide specific measure examples and gauge respondents' willingness to adopt by adjusting upfront and levelized costs. These inputs will help determine what incentive levels and financing are needed to encourage adoption of the EE

measures. Similarly, we will ask residential customers their willingness to adopt DR controlled devices such as smart thermostats in addition to their willingness to participate in DR programs. We will work with Guidehouse to develop any additional priorities for EE technologies with DR benefits. Lastly, we will prioritize space heating and water heating as key fuel substitution measures that would displace existing natural gas with added electricity consumption. We will include questions targeting homeowners about their willingness to switch fuels for these measures.

**Table 1. Adoption Curve Data Collection: Residential Survey**

| Technologies   | Applicability   | Willingness-to-Adopt Scenario   |
|--|---|---|
| End-uses/EE Measures   |   | <ul style="list-style-type: none"> <li>▪ Rebate levels</li> <li>▪ Pay-For-Performance</li> <li>▪ Value of non-energy benefits/intrinsic motivators</li> </ul> |
| HVAC systems<br>Heat pump water heater<br>Major appliances<br>Insulation | Residential customers who have the end-use/measure and have decision-making authority over it |   |
| DR Controls  |   |   |
| EE Technology/DR Controls  | Residential customers who have or are interested in the specified EE technology               |   |
| Fuel Substitution  |   |   |
| Space/water heating equipment  | Single-family customers who own their homes   |   |

**Outreach & Fielding**

We will invite 5,000 residential customers to participate in the survey through a mailed survey invitation. Each invitation will include a unique link to a secure website to complete the survey over the web. Survey invitations will include the CPUC letterhead.

For non-responders, we will send a variety of reminder invitations. All reminder invitations will also include a toll-free telephone number to call to take the survey with an interviewer. This approach will ensure that all customers without access or with limited Internet access may complete the survey over the telephone. Non-responders will receive mailed postcard reminder if we do not have an email address. Non-responders with an email address, will receive two emailed reminders.

We will provide a \$10 gift card for survey participants, including a digital and physical gift card option. Our goal is to complete the survey with 600 residential customers. If we are struggling to reach our targets with the proposed outreach, we will be able to send out additional invitations to an additional subset of the sample.

**Residential Multifamily Building Owner/Manager Online Survey**

Opinion Dynamics will also conduct a mail-push-to-web online survey with owners and managers of multifamily buildings with five or more units in California. Since the measures we focus on in this study typically require owner/manager approval for replacements or upgrades, we will target the owners/managers as the key decisionmakers instead of the tenants. Overall,

the survey will collect data on owners' and managers' building characteristics, energy-related attitudes, and their willingness-to-adopt select energy efficiency technologies/measures and program offerings.

### Sampling

Opinion Dynamics will prepare a detailed data collection sampling plan based on the approved research plan and will propose a sample design to support the key objectives of this effort. The plan will identify the required sample sizes for eligible multifamily building owners/managers to satisfy 90/10 confidence/precision for key strata. The timeline for finalizing the Sampling Plan is May 2020.

We will collect 100 completed surveys. We will target the owners and managers of multifamily properties that have five or more units across the four-investor owned utility (IOU) service territories. We will develop our sample frame by purchasing a database with a random selection of 3,000 or more multifamily building addresses serviced by the four IOUs, using zip codes to align with the IOU territories.

### Instrument Design

Opinion Dynamics will develop the instrument necessary for the multifamily building owner and manager online survey and will work with Guidehouse and the CPUC to align the instrument with the approved sample design and modeling needs. We will craft the instrument to be easy to understand and navigate and to require no more than 20 minutes to complete.

The multifamily building owner and manager survey will collect data on owners/managers' willingness to adopt select energy efficiency technologies/measures for their properties. We will assess factors that may enhance owners/managers' willingness, including financial incentives/benefits, payback period, and intrinsic motivators. Additionally, we will evaluate factors that may negatively influence willingness to adopt/participate across multifamily segments, including financial barriers, split incentives, limited technology availability, structural barriers, and low awareness, among others. These variables will feed into characterizing multifamily adoption by capturing the important decision-making factors that influence willingness to adopt. The adoption questions will be structured through specific EE scenarios: a series of survey questions that capture willingness to adopt/participate based on varying end-uses, EE measures, and applicability (**Table 2**).

As noted in Table 2, we will focus on technologies that are centralized and shared in multifamily buildings: applicable EE measures, DR controls, and fuel substitution equipment for each willingness-to-adopt scenario. We will ask multifamily building owners/managers about their willingness to adopt EE HVAC systems, HP water heaters, and insulation measures given varying levels of rebates, contrasting financial and non-energy benefits. Similarly, we will ask their willingness to adopt DR controlled devices such as smart thermostats for their common areas in addition to their willingness to participate in DR programs. Lastly, we will prioritize space heating and water heating as key fuel substitution measures that would displace existing natural gas with added electricity consumption. We will include questions asking about multifamily building owners/managers' willingness to switch fuels for these measures.

**Table 2. Adoption Curve Data Collection: Multifamily Building Owner/Manager Survey**

| Technologies  | Applicability  | Willingness-to-Adopt Scenario   |
|---|--|---|
| End-uses/EE Measures  |  |   |
| HVAC systems<br>Water heater equipment<br>Insulation/Weatherization | Multifamily building owners and managers who have the end-use/measure and have decision-making authority over it | <ul style="list-style-type: none"> <li>▪ Rebate levels</li> <li>▪ Pay-For-Performance</li> <li>▪ Value of non-energy benefits/intrinsic motivators</li> <li>▪ Payback period</li> </ul> |
| DR Controls   |  |   |
| EE Technology/DR Controls for building common areas                 | Multifamily building owners and managers who have or are interested in the specified EE technology               |   |
| Fuel Substitution   |  |   |
| Space/water heating equipment                                       | All multifamily building owners and managers who have equipment type and decision-making/purchasing control      |   |

### Outreach & Fielding

We will invite 3,000 multifamily building owners and managers to participate in the survey through a mailed survey invitation. The invitation will include a unique link to a secure website to complete the survey over the web. Survey invitations will include the CPUC letterhead. For non-responders, we will send a follow-up postcard reminder.

We will provide a \$25 gift card for survey participants, including a digital and physical gift card option. Our goal is to complete the survey with 100 multifamily building owners and managers. If we are struggling to reach our targets with the proposed outreach, we will be able to send out additional invitations to a subset of the sample.

### Non-Residential

Like the residential effort, we will conduct an online survey with nonresidential California customers that will include questions about prioritized technologies and measures, policy priorities such as fuel substitution, and alternative incentivization techniques, such as pay-for-performance scenarios. Overall, the survey will collect data on firmographics, behaviors, and attitudes, as well as willingness-to-adopt select energy efficiency technologies/measures and DR program offerings.

### Sampling

Opinion Dynamics will prepare a detailed data collection sampling plan based on the approved research plan. Opinion Dynamics will propose a sample design to support the key objectives of this effort and include a discussion of minimum data needed to meet these goals. The plan will identify the required sample sizes and proposed sub-segments for eligible nonresidential customers. We will target two key nonresidential segments across the four IOU service territories: small commercial and large commercial. The timeline for finalizing the Sampling Plan



is May 2020.

We will develop our sample frame based on IOU customer databases of active accounts. In the sampling plan, we will identify key nonresidential strata as there are many commercial segments within the nonresidential sector; this will allow us to sub-segment as needed. We will stratify the sample into small and large commercial customers based on 2019 kWh. Small commercial customers will be identified as those with 300,000 or less kWh in 2019, while large commercial customers will be identified as those with more than 300,000 kWh in 2019.

We will also confirm small and large commercial customer size by including questions in the survey about number of employees and average annual revenue; these criteria align with the federal Small Business Administration (SBA) qualifying characteristics for “small business”. To account for COVID-19 impacts and get an improved understanding of commercial size, we will ask commercial customers to confirm how many staff they currently employ as well as their number of employees in 2019, before COVID-19. We will aim to collect 600 completed surveys: 400 completes with small commercial businesses, and 200 completes with large commercial businesses. This targeted number of completed surveys allows us the ability to sub-segment, where feasible, to develop statistically valid results for key end-uses and make comparisons between segments.

#### *Instrument Design*

Opinion Dynamics will develop the instrument necessary for the nonresidential customer online survey and will work with the CPUC and Guidehouse to align the instrument with the approved sample design.

We will craft the instrument to be easy to understand and navigate, and to require no more 20 minutes to complete.

The nonresidential customer survey will collect data on businesses' willingness to adopt select energy efficiency technologies/measures, as well as their willingness to participate in California DR programs. Like the residential survey, we will assess factors that may enhance willingness, including financial incentives through different payback scenarios, intrinsic motivators, and potential non-energy impacts. Additionally, we will evaluate factors that may negatively influence willingness to adopt/participate across nonresidential segments, including financial barriers, company policies on payback minimums, structural barriers, and others.

Resembling the residential customer survey, we will also develop specific EE/DR scenarios to assess willingness-to-adopt among nonresidential customers. These data will be captured through a series of questions that focus on the end-uses and EE measures listed in **Table 3**. Specifically, we will ask nonresidential decision-makers their willingness to adopt various EE measures, including HVAC, water heating, and refrigeration at varying rebate levels, pay-for-performance scenarios, and across different non-energy benefits. For small business customers that have central air conditioners (CACs) and/or water heaters, we will include questions about willingness to adopt smart technologies and DR programs or customized load control programs. Finally, our scenario questions will cover fuel substitution measures, where we will ask all nonresidential customers about their willingness to switch fuels for certain technologies, including space heating, and water heating.

**Table 3. Adoption Curve Data Collection: Nonresidential Survey**

| Technologies   | Applicability   | Willingness-to-Adopt Scenario   |
|--|---|---|
| <b>End-uses/EE Measures</b>  |   |   |
| HVAC equipment<br>Water heating equipment<br>Refrigeration equipment<br>( <i>major vs. minor changes</i> ) | Non-Residential customers who have the end-use/measure and have decision-making authority over it | <ul style="list-style-type: none"> <li>▪ Rebate levels</li> <li>▪ Pay-For-Performance</li> <li>▪ Value of non-energy benefits/intrinsic motivators</li> </ul> |
| <b>DR Controls</b>   |   |   |
| Customized load control  | Large non-residential customers   |   |
| EE Technology/DR Controls  | Small non-residential customers who have or are interested in the specified EE technology         |   |
| <b>Fuel Substitution</b>   |   |   |
| Space/water heating equipment  | All non-residential customers who have equipment type and decision-making/purchasing control;     |   |

#### *Outreach & Fielding*

We will utilize two recruitment modes for inviting nonresidential customers to participate in the online survey: mailed invitations and emails. We will mail survey invitations to nonresidential customers who do not have an available email address. These mailers will be printed on the CPUC letterhead. Non-responders who do not have an email address will receive one follow-up reminder mailer. Mailed invitations will have a unique survey web link so that customers may access the survey online. We will email survey invitations to customers who have available email addresses. For those non-responders, we will send two follow-up email reminders.

To reduce potential COVID-19 effects on our survey recruitment, we will add more time to our survey fielding timeline to account for potential delays in mail delivery, increase the number of survey reminders as needed to improve lower-than-expected response rates, and leverage multiple outreach modes to contact harder-to-reach businesses. While different types of businesses may or may not be open to customers at this time, we are expecting that active businesses will continue to check their incoming postal mail and email accounts.

We will provide a \$25 digital gift card for survey participants. Our goal is to complete the survey with 200 large commercial and 400 small commercial customers. If we are struggling to reach our targets with the proposed outreach, we will be able to send out additional invitations to an additional subset of the sample.

#### **COVID-19 Considerations**

In light of the current COVID-19 situation that has affected nearly all Californians, we believe it is very important to be flexible and thoughtful of customer's situations while seeking to understand their energy behaviors, needs, and plans. In all of our survey outreach, we will communicate to sampled customers that we acknowledge the current situation and that they can complete the survey later or opt-out if they are dealing with a COVID-19 related issue. We

will also include a few questions in the surveys to gauge how the pandemic has affected their household's or business's energy usage and needs, their energy-related decision-making and plans for the future, and other potential covariates. We are currently working on a CPUC COVID-19 ME&O study. Our research for this study will help to inform survey questions and will be incorporated into our findings for this adoption study. We have also been closely following ongoing tracking surveys to get a pulse on how Americans have been impacted, their future outlook, and other important considerations.

We will work closely with Guidehouse to incorporate the effects of the current economic downturn during this pandemic on adoption assumptions and potential study models.

## Analysis and Reporting

Following the completion of the online customer surveys, we will analyze the key data inputs and willingness-to-adopt scenarios to create adoption curves for the 2021 PG update. Adoption curves will be based on a series of survey questions, including barriers to adopting energy-efficient equipment and participating in DR programs, willingness-to-participate at different incentive/payback levels, and ability to pay for/finance the incremental cost of energy-efficient equipment.

We will help prepare an interactive Excel database that summarizes the data by key market segments and technologies. The database will include a directory page, summary statistics organized on separate tabs and the raw data with a data dictionary. The database will be designed to integrate into the Potential and Goals analysis seamlessly.

In addition to the adoption curve database, we will prepare a short report that summarizes the market research methodologies and key results. The report will be designed as one or more chapters of the overall Potential and Goals study report. We will develop an outline of the market research chapter(s), followed by the draft report. The final report will contain any revisions deemed necessary based on stakeholder comments. We will also deliver final datasets with anonymized survey data.

## Project Management

To ensure that the activities outlined in this Research Plan will be executed on time, on budget, and at a high level of quality, we will conduct various internal and external project management activities. Internal management activities may include check-in meetings with various team members and task leaders; coordination on overarching issues; and resource planning. External management activities may include the following:

- **Conference Calls.** During these calls with Opinion Dynamics, Guidehouse, and CPUC personnel, we will provide updates about the project's status or deliverables. These calls will be scheduled around deliverables as needed.
- **Stakeholder Meetings.** We will attend a limited number of meetings with stakeholders, as needed.

Making this project a success will require working and coordinating with multiple involved and interested parties. Opinion Dynamics will work together with the CPUC, Guidehouse, and DNV-

GL. Beyond that, we recognize that successful coordination on this scale requires an understanding of, and attention to, the context in which this project will be managed.

Opinion Dynamics will not treat the project management duties in this task as just opportunities for a one-way communication or "reporting out" of status. Rather, we will use them as interactive channels for communication among the research team and other parties on the status of activities, any issues or concerns, project needs, and next steps.

## Timelines and Deliverables

The following table (**Table 4**) outlines the timing of the research deliverables, organized by task and milestone.

**Table 4 Milestone & Deliverables Schedule**

| Milestone  | Tasks   | Deliverables                                     | Timeline           |
|--|---|--|--------------------|
| 1: Planning  | Gap analysis and development of this research plan  | Research Plan                                    | April 2020         |
| 2: Completion of Data Request, survey instruments, and sampling plan | Samplings plans, data requests, and survey instrument design for residential, nonresidential, and multifamily surveys | Sampling Plan                                    | May 2020           |
|  |   | Data Request                                     |                    |
|  |   | Survey Instrument                                | June 2020          |
| 3: Completion of Data Collection                                     | Data collection for Residential and Nonresidential Surveys  | Residential single-family online customer survey | July - August 2020 |
|  |   | Nonresidential online customer survey            |                    |
|  |   | Multifamily building owner/manager online survey |                    |
| 4: Adoption Curve Database and Report                                | Adoption Curve Calculations and Reporting   | Adoption Curve Analysis                          | September 2020     |
|  |   | Adoption Curve Database                          | October 2020       |
|  |   | Report   |                    |

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