



California Public Utilities Commission and California Energy Commission Staff Proposal for Building Decarbonization Pilots - Draft

In compliance with SB 1477 (2018) and with
CPUC R.19-01-011

Abstract: SB 1477, the “Low Emissions Buildings and Sources of Heat Energy” bill, authorizes pilot programs that will enable California to pave the way toward decarbonization of the state’s building stock. This California Public Utilities Commission and California Energy Commission joint staff proposal details recommendations for the implementation of the two programs directed by SB 1477, Building Initiative for Low Emission Development (BUILD) and Technology and Equipment for Clean Heating (TECH).



California Public Utilities Commission and California Energy Commission Staff Proposal for Building Decarbonization Pilots - Draft

In compliance with SB 1477 (2018) and with CPUC R.19-01-011

Written by:

California Energy Commission: Martha Brook, Tiffany Mateo, Robert Ridgley

California Public Utilities Commission: Christie Torok, Genesis Tang, Chari Worster,
Rory Cox

Peer Review: Joy Morgenstern, Kristina Abidjan

Managing Editor: Rory Cox

Reviewed by: Hal Kane, Shannon O'Rourke, Pete Skala, Edward Randolph

July 16, 2019



Table of Contents

1. Executive Summary	5
1.1 Legislative and Regulatory Overview	5
1.2 Common Pilot Guidelines	6
1.3 Program Overview: Building Initiative for Low Emissions Development (BUILD)	7
1.3.1 New Construction GHG Reduction-Based Incentives	7
1.3.2 CPUC Oversight and Energy Commission Administration	8
1.3.3 RFP for Low Income Technical Assistance Contractor	8
1.3.4 Budget - \$20 Million/Year	8
1.4 Program Overview: Technology and Equipment for Clean Heating (TECH)	8
1.4.1 Market Transformation Framework	8
1.4.2 CPUC Oversight and Third-Party Administration	9
1.4.3 RFP for Statewide Implementer	9
1.4.4 A budget of \$30 million per year	9
1.5 Evaluation	9
2. Legislative and Regulatory Background	10
2.1 History and Summary of SB 1477	10
2.2 Procedural History of R.19-01-011	11
2.3 Summary of Party Comments	11
2.3.1 Administrative Structure	14
2.3.2 Budget Allocation	14
2.3.3 Targeted Sector	15
2.3.4 Fuel Source	15
2.3.5 Proposed Approaches for the Implementation of SB 1477	16
3. Common SB 1477 Pilot Guidelines	17
3.1 Budget - \$50 Million/Year	17
3.2 Funding Source	19
3.3 Clean Heating Technologies Defined	20
3.4 Guiding Principles	21



- 3.5 Greenhouse Gas Benefits Metrics.....22
- 3.6 Projected Utility Bill Savings.....25
- 3.7. Target Population.....25
- 3.8 Target Technology.....26
- 3.9 Non-GHG Benefits27
- 3.10 Scalability.....27
- 3.11 Leveraging Other Programs.....27
- 3.12 Evaluation.....27
- 3.13 Stakeholder Review Workshops28
- 4. BUILD Design Proposal.....28
 - 4.1 GHG Reduction-Based Incentives for New Construction29
 - 4.2 CPUC Oversight and Energy Commission Roles and Responsibilities.....29
 - 4.3. Reporting31
 - 4.3.1 Implementation Plan.....31
 - 4.3.2 Amendments31
 - 4.3.3 Progress reports31
 - 4.3.4 Informal collaboration31
 - 4.3.5 Final report31
 - 4.4 Program Architecture32
 - 4.4.1 Eligibility Structure32
 - 4.4.2 Low-Income and Disadvantaged Communities Set Aside.....32
 - 4.4.3 Incentive Structure32
 - 4.4.4 GHG Baseline33
 - 4.4.5 Incentive Levels by Technology Type and Climate Region34
 - 4.4.6 Kicker Incentives.....35
 - 4.4.7 Appropriate Project Level for BUILD Incentives.....35
 - 4.4.8 Technical Assistance for Low Income Project Developers35
 - 4.4.9 Education and Outreach to Builders.....36



4.4.10	Alternative Performance Metrics to Be Tracked	36
5.	TECH Program Proposal.....	38
5.1	Addressing Market Barriers.....	38
5.2	Program Architecture & the Program Implementer.....	39
5.2.1	Strategy 1: Incentives and partnerships with supply-side market actors (upstream)	41
5.2.2	Strategy 2: Market facilitation activities, including workforce development, education and outreach (midstream).....	41
5.2.3	Strategy 3: “Quick Start” Grants Program	42
5.2.4	Strategy 4: Prize Program	42
5.2.5	Target Geographical Area	43
5.3	Independent Evaluator	43
5.4	Program Oversight and Administration	44
5.5	Technology Eligibility	45
5.5.1.	GHG reduction potential.....	46
5.5.2	Commercial readiness.....	46
5.5.3.	Equipment and installation costs	46
5.5.4.	Eligible Technologies for Incentives	46
5.6	Tracking Market Share for eligible technologies for TECH.....	47
5.7	Fuel Replacement Criteria	48
5.8	Primary Activities, Components and Outputs of each TECH Primary Actor	48
5.9	Request for Proposals.....	51
5.10	Education and Outreach.....	52
6.	Appendix	53
6.1	GHG Emission Intensities	53
6.2	CA Climate Regions & New Home Starts.....	54
6.3	GHG Baselines: Mixed-Fuel Homes Built to the 2019 Title-24 Standards.....	55
6.4	Potential Incentive Allocation Schema	57
6.5	Alternative Allocation Schema	58



1. Executive Summary

1.1 Legislative and Regulatory Overview

Building energy consumption is responsible for a quarter of California’s greenhouse gas (GHG) emissions. To address these emissions, the California Legislature passed Senate Bill (SB) 1477 (Stern – 2018), which calls on the California Public Utilities Commission (CPUC), in consultation with the California Energy Commission (Energy Commission), to develop two programs with a combined annual budget of \$50 million per year focused on reducing direct greenhouse gas emissions from buildings: the Building Initiative for Low-Emissions Development (BUILD) program and the Technology and Equipment for Clean Heating (TECH) program. The programs are to be funded with the revenues received by gas corporations “...as a result of the direct allocation of greenhouse gas allowances provided to gas corporations as part of a market-based compliance mechanism.”¹

In January 2019, the CPUC issued an Order Instituting Rulemaking (OIR) which scoped in four policy areas regarding building decarbonization:

1. Implementation of the SB 1477 BUILD and TECH programs.
2. Potential pilot programs to address new construction in areas damaged by wildfires.
3. Coordinating CPUC policies regarding decarbonization in the Title 24 State Building Code.
4. Developing a long-term policy framework for building decarbonization.

Grid impacts of the widespread adoption of building decarbonization measures will be an issue if these pilots lead to longer term decarbonization efforts. Electrification plays into the changing dynamic of California’s energy grid and can both exacerbate and potentially mitigate against re-shifting load profiles – including shifts to later in the day and increases in winter peaks. This, and other policy implications, will be taken up as part of the long-term policy framework being examined in the fourth phase of this proceeding.

This proceeding is not the only proceeding where the CPUC is considering issues related to building decarbonization. Specifically:

- In Rulemaking 13-11-005, the CPUC approved a \$56 million investment for pilot projects in 11 San Joaquin Valley communities that do not have access to natural gas in an effort to increase access to clean, affordable energy in disadvantaged communities and reduce the use of propane and wood burning.²

¹ SB 1477 (2018)

² <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M250/K547/250547876.PDF>



- In Rulemaking 12-11-005, the CPUC is considering using funds generated by the Self-Generation Incentive Program to promote heat pump water heaters as an energy storage method.³
- In Rulemaking 13-11-005, the CPUC is considering changing the rules regarding the “3-prong test” regarding the use of public purpose energy efficiency funds for fuel substitution.⁴

While these proceedings impact building decarbonization overall, they have no direct impact on the funding for the pilots described in this proposal, which would be funded by revenues received by natural gas utilities from the Cap-and-Trade Program.⁵ There are two CPUC proceedings which directly address the role of the natural gas IOUs in the Cap-and-Trade Program: R.14-03-003, which addresses natural gas utility Cap-and-Trade issues, and A.13-08-026, which addresses long-term GHG outreach activities.⁶

In response to the R.19-01-011 OIR, the CPUC received comments from over 30 parties, which are summarized in Section 2, the *Legislative and Regulatory Background* section of the report. The CPUC and Energy Commission have created proposed program designs for both BUILD and TECH that are intended to meet the requirements of SB 1477.

1.2 Common Pilot Guidelines

Energy Commission and CPUC Staff recommend the following guidelines for both the BUILD and TECH programs:

- **Budget:** The \$50 million per year budget should be split between the programs, with 40 percent going to BUILD and 60 percent going to TECH. The larger amount for TECH is because a successful decarbonization effort will have to address existing buildings, which parties agree will be more challenging to decarbonize due to the number of existing buildings, their diversity, and barriers facing home energy retrofits.
- **Funding:** Programs will be funded from proceeds obtained by gas corporations from the sale at auction of greenhouse gas emissions allowances received as part of the state’s Cap-and-Trade Program.
- **Eligible Technologies:** The “clean heating technologies” that will be targeted in BUILD and TECH should include heat pump technologies for space and water heating, and solar thermal

³ Proceeding documents available at <https://apps.cpuc.ca.gov/apex/f?p=401:59:0::NO>

⁴ Proceeding documents available at <https://apps.cpuc.ca.gov/apex/f?p=401:57:0::NO>

⁵ California’s Cap-and-Trade Program for greenhouse gases helps to fight climate change by limiting greenhouse gas pollution and placing a steadily increasing price on carbon emissions. The Cap-and-Trade Program was designed by the California Air Resources Board (ARB) to achieve the goals of the Global Warming Solutions Act of 2006 (AB 32). More information is at <https://ww3.arb.ca.gov/cc/capandtrade/capandtrade.htm>

⁶ More information on the CPUC’s role in the Cap-and-Trade Program can be found at <https://www.cpuc.ca.gov/General.aspx?id=5920>



technologies for water heating. Other technologies that achieve comparable heating-related GHG emission reductions to heat pumps and solar thermal in new and/or existing homes should also be considered.

- **Guiding Principles:** CPUC and Energy Commission Staff recommends that the BUILD and TECH programs should put California on a path to have completely carbon-free homes by 2045. The programs should also strive for equity, cost effectiveness, regulatory simplicity, market transformation, and equity.
- **Metrics:** Program success will be measured using the following metrics:
 - Volume of greenhouse gas (GHG) emissions reduced or avoided.
 - Cost per metric ton of avoided GHG emissions,
 - Projected utility bill savings,
 - Number of low-emission systems installed (BUILD only)
 - Market share for eligible technologies (TECH only).

1.3 Program Overview: Building Initiative for Low Emissions Development (BUILD)

1.3.1 *New Construction GHG Reduction-Based Incentives*

According to SB 1477, the BUILD program is intended “for the deployment of near-zero-emission building technologies to significantly reduce the emissions of greenhouse gases from those buildings below the minimum projected emissions that would otherwise be expected from the (Title 24 Building Code.)”⁷ Per the legislation, 30 percent of the BUILD funds are required for low-income residential housing located in disadvantaged or low income communities.

Staff proposes that BUILD incentives will be offered to only new construction projects designed to be all-electric. The incentive design will be guided by projected GHG emission reductions. Staff recommends considering supplemental BUILD incentives, or “kicker incentives,” to encourage technologies that provide additional GHG emission reduction benefits compared to the baseline incentivized technologies, such as thermal storage, electrical storage and the use of low-global warming potential (GWP) refrigerants. Section 4 below provides more details.

⁷ The section of the building code referred to is Section 150.1 of Subchapter of Part 6 of Title 24 of the California Code of Regulations.



1.3.2 CPUC Oversight and Energy Commission Administration

The CPUC will provide oversight of the BUILD program. Staff proposes that the Energy Commission be the BUILD program administrator, responsible for designing the BUILD program, controlling day-to-day operation of the program, tracking and reporting performance metrics, and managing a low-income technical assistance contractor.

1.3.3 RFP for Low Income Technical Assistance Contractor

Staff proposes that the Energy Commission hire technical expertise in low-income property development and low-GHG heating systems applicable to low-income properties to encourage low-income property participation in the program.

1.3.4 Budget - \$20 Million/Year

The BUILD program funding will be \$20 million per year, or \$80 million for the total four-year pilot program. Per SB 1477, 30 percent of the total funding allocated to BUILD must be for new low-income housing. “Low-income housing” refers to properties located in a census tract or equivalent geographic area defined by the U.S. Census Bureau in which at least 50 percent of the households have an income less than 60 percent of the area median gross income. (A disadvantaged community is defined in Section 39711 of the Health and Safety Code.⁸) If low-income reserved funds are unspent after two years, the program administrator may evaluate potential changes and reallocate those funds for other purposes consistent with program guidelines.

1.4 Program Overview: Technology and Equipment for Clean Heating (TECH)

1.4.1 Market Transformation Framework

The TECH program directed by SB 1477 is intended “... to advance the state’s market for low-emission space and water heating equipment in existing and new buildings.” The bill requires the CPUC to “identify and target key low-emission space and water heating equipment technologies that are in an early stage of market development and would assist the state in achieving the state’s greenhouse gas emission goal for 2030...”⁹ It should accomplish this “...through upstream market development, consumer education, contractor and vendor training, and the provision of upstream and midstream incentives to install low-emission space and water heating equipment...”¹⁰

⁸https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=HSC&division=26.&title=&part=2.&chapter=4.1.&article=

⁹ SB 1477 (2018), 922 (2) (b)

¹⁰ SB 1477, 2018, 922. (a) (1)



Energy Commission and CPUC staff recommend that TECH be implemented with a market transformation framework, described in Section 5 below. The CPUC will run a competitive solicitation for an implementer.

The implementer will, at minimum, conduct an effort that will include four strategic initiatives:

1. Provide incentives and create partnerships with supply-side market actors to promote electric space and water heating equipment (upstream)
2. Design and manage market facilitation activities, including workforce development, education and outreach. Bidders should propose how their interventions will affect contractors, builders, plumbers, electricians, and retail sales outlets (midstream)
3. Manage the procurement and administration of a portfolio of high-impact pilot projects and strategy-testing engagements with local, regional and other third-party implementers.
4. Manage a prize program for innovative programs for building decarbonization.

1.4.2 CPUC Oversight and Third-Party Administration

Energy Commission and CPUC Staff proposes a governance structure which designates the CPUC as being responsible for oversight of the program, and a 3rd party implementer as being responsible for day to day operations and program performance. In addition, Section 5 below includes an organization chart and explains a process by which the Energy Commission and parties in this proceeding may offer input into program implementation.

1.4.3 RFP for Statewide Implementer

A competitive request for proposals for a third party implementer will be issued via proceeding R.19-01-011. A prime contractor candidate may form a bidding team with other sub-contractors.

1.4.4 A budget of \$30 million per year

Energy Commission and CPUC Staff proposes a budget of \$30 million per year for the TECH program, including approximately \$1 million for evaluation, which is 60 percent of the overall funding. It will be essential to retrofit existing homes in order to meet program goals, and retrofit markets face a broader range of market barriers including higher costs.

1.5 Evaluation

There will be two levels of evaluation, measurement, and verification (EM&V). Program implementers will be directed to embed approaches to monitoring and evaluation into BUILD and TECH from the beginning, so that real-time, robust data and results will be available for evaluations and understanding lessons learned:

1. The program implementers will collect data on program performance to the metrics, and report the data to the CPUC and Energy Commission staff on at least a quarterly basis. They will also make data available to the independent evaluator.



2. The CPUC will contract with one independent evaluator who will provide an evaluation of the programs’ long-term market impact, and a qualitative assessment of the effectiveness of program implementation. The data collected and submitted by the program implementers will be used for this evaluation of both the impact and the process of the programs.

	BUILD	TECH
OBJECTIVE	Provide incentives for the deployment of near-zero emission technologies in new building construction	Accelerate the market development and sales of high efficiency electric heating equipment in existing homes
TARGETS	New residential buildings, low-income	Existing residential buildings customers most likely to see utility bill savings
ANNUAL BUDGET	\$20M	\$30M
ADMINISTRATION	Energy Commission	Third Party Administrator
OVERSIGHT	CPUC	CPUC
PROGRAM DESIGN	Energy Commission	Third Party Administrator
TECHNICAL SPECIFICATIONS	Energy Commission	Energy Commission
DATA COLLECTION	Energy Commission	Third Party Administrator
EVAULATION	Independent Evaluator	Independent Evaluator
EVALUATION METRICS	Total avoided GHGs, number of low-emission systems installed, projected utility bill savings, cost per metric ton of avoided GHG emissions	Total avoided GHGs, market share of eligible technologies, projected utility bill savings, cost per metric ton of avoided GHG emissions

2. Legislative and Regulatory Background

2.1 History and Summary of SB 1477

In September 2018, Governor Brown signed into law SB 1477 (Stern) which calls on the CPUC, in consultation with the Energy Commission, to develop two programs focused on reducing direct GHG emissions from buildings: the Building Initiative for Low-Emissions Development (BUILD) program and the Technology and Equipment for Clean Heating (TECH) program. SB 1477 authorizes \$50 million per year through 2023 for the two clean building pilot programs. These programs will be funded from proceeds obtained by gas corporations from the sale at auction of greenhouse gas emissions allowances allocated as part of the state’s Cap-and-Trade Program.¹¹

¹¹ More information available at <https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>



The BUILD Program will provide financial incentives for the deployment of near-zero-emission building technologies aimed at reducing building GHG emissions below what they otherwise would be, if they followed Energy Commission building energy efficiency standards. The program also sets aside 30 percent of BUILD funds for low-income residential housing in disadvantaged communities and directs the CPUC to ensure such projects receive technical assistance and higher incentives than do other new residential buildings, while ensuring that customers do not experience increased utility bills.¹²

The TECH Initiative provides incentives to develop markets for low-emission space and water heating equipment for new and existing residential buildings. The TECH program will also provide consumer, contractor, and vendor training to support these early stage technologies.¹³

2.2 Procedural History of R.19-01-011

In January 2019, the CPUC instituted a new rulemaking on building decarbonization (R.19-01-011). The initial scope of this proceeding was designed to be inclusive of any alternatives that could lead to the reduction of GHG emissions associated with energy use in buildings. The scope may include all policy framework issues, including programs, rules, and rates, that will help accomplish building decarbonization, as part of the state's GHG reduction goals.

The proceeding addresses four general categories of issues:

- 1) Implementing SB 1477;
- 2) Potential pilot programs to address new construction in areas damaged by wildfires;
- 3) Coordinating CPUC policies with Title 24 Building Energy Efficiency Standards and Title 20 Appliance Efficiency Standards developed at the Energy Commission; and
- 4) Establishing a building decarbonization policy framework.

The subject of this proposal is limited to the first item, implementation of SB 1477.

2.3 Summary of Party Comments

Parties were invited to comment on R.19-01-011 and its preliminary scoping memo. The CPUC received comments and reply comments from over 30 parties including utilities, local governments, community choice aggregators, and environmental organizations. On April 8, 2019 the CPUC and the Energy Commission conducted a Joint Agency Workshop on Building Decarbonization in Los Angeles. This workshop was intended to continue the process of developing and refining a shared understanding of the opportunities for the decarbonization of buildings. Throughout the proceeding,

¹² https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1477

¹³ https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1477



the CPUC has focused on creating an open forum where stakeholders can engage, share their insight, and come up with strategies to achieve the goals established by SB 1477. This section is dedicated to a high-level summary of some of the comments. Comments are also cited throughout the proposal to support specific recommendations.

Parties expressed consensus regarding the following:

- Expedite the proceeding wherever possible to ensure timely implementation of BUILD and TECH and to achieve 2030 goals.
- Develop rate reform that helps enable decarbonization in a separate proceeding.
- Prioritize low-income and disadvantaged communities with a minimum of 30 percent of budget allocation for the BUILD program.¹⁴
- Many parties reject the idea of a gas company being eligible for consideration as a program administrator. Only SoCalGas, SDG&E, and Environmental Defense Fund believe that all actors should be eligible for consideration to be program administrator.

¹⁴ .19-01-011 Opening/Reply Comments-GRID Alternatives/NRDC/Sierra Club/CA for Balanced Energy Solutions/Center for Sustainable Energy

Table 2: Chart of comments and reply comments received from the OIR in R.19-01-011

	Party Filing Comments	Opening	Reply
1	Association of Bay Area Governments (ABAG)	√	√
2	California Building Industry Association (CBIA)	√	
3	California Efficiency and Demand Management Council (CEDMC)	√	√
4	California Energy Storage Alliance (CESA)	√	
5	California Environmental Justice Alliance (CEJA)		√
6	California Housing Partnership Coalition (CHPC)	√	
7	California Hydrogen Business Council (CHBC)	√	√
8	California Municipal Utility Association (CMUA)	√	
9	Californians for Balanced Energy Solutions (CBES)		√
10	Center for Sustainable Energy (CSE)	√	√
11	City and County of San Francisco (CCSF)	√	
12	City of Palo Alto (CPA)	√	
13	Coalition for Renewable Natural Gas (CRNG)	√	√
14	Coalition of California Utility Employees (CCUE)	√	
15	County of Los Angeles/So Cal REN (SCREN)	√	
16	East Bay Cty Energy, Cities of Berk, Oak, Fremont (EBCE)	√	
17	Energy Solutions (ES)	√	
18	Environmental Defense Fund (EDF)	√	√
19	Enex X (formerly EnerNOC) (ENERX)	√	
20	Grid Alternatives (GA)	√	√
21	Joint CCAs (Sonoma, Penin., Marin, SV, Monterey) (JCCA)	√	√
22	National Fuel Cell Research Center (NFCRC)	√	√
23	Natural Resources Defense Center & Sierra Club (NRDC/SC)	√	√

California Public Utilities Commission and California Energy Commission Staff Proposal for Building Decarbonization Pilots - Draft



24	Pacific Gas & Electric (PGE)	√	√
25	Public Advocates Office (PAO)	√	√
26	San Diego Gas & Electric (SDGE)	√	√
27	Small Business Utility Advocates (SBUA)	√	√
28	Solar Energy Industries Association (SEIA)	√	
29	Southern California Edison (SCE)	√	√
30	Southern California Gas Company (SCG)	√	√
31	Southwest Gas Corporation	√	
32	The Utility Reform Network	√	√
33	Vermont Energy Investment Corp	√	√
34	Wild Tree Foundation	√	√

The following reflect the most prominent topics of discussion among parties and their positions.

2.3.1 Administrative Structure

SB 1477 indicates a gas corporation, the Energy Commission, or a third party as a possible program implementer.

Parties have expressed different views regarding administrative structure for the BUILD and TECH programs. Some believe a single, third-party administrator for both the BUILD and TECH programs is best positioned to provide statewide consistency and to maximize efficiencies and economies of scale as the risk with multiple administrators is that they may duplicate work. Other parties believe the BUILD program should be administered by the Energy Commission given that the program should align with Title 24 Building Energy Efficiency Standards, while the TECH program should be administered by an independent third party. Investor Owned Utilities (IOU) have expressed interest in being the program administrator (SoCalGas wants to administer the program in its own jurisdiction while PG&E is supporting SCE to be selected as an implementer).¹⁵

2.3.2 Budget Allocation

SB 1477 authorizes \$50 million per year through 2023 for the two building decarbonization pilot programs.

¹⁵ R.19-01-011 Opening/Reply Comments-PG&E, SoCalGas and SCE



There is not a consensus among parties regarding budget allocation for the BUILD and TECH programs, although the majority concur that a minimum 30 percent allocation to low-income communities is appropriate (and is required). California Environmental Justice Alliance (CEJA) says that at least 70 percent should be allocated to disadvantaged communities (DAC), noting that the 30 percent is a minimum threshold established by SB 1477, and not a ceiling.¹⁶ Other parties believe most of the funding should be in the TECH program as this is the program that seeks to provide the long-term solution for the major source of emissions, existing buildings. Vermont Energy Investment Corporation (VEIC) stated, “Wildfire might be a powerful and visible factor, but the greatest challenges for achieving GHG goals rest in the TECH program.” In contrast, PG&E felt it was premature to determine specific budget allocations while others believe it should be an even split.¹⁷

2.3.3 Targeted Sector

SB 1477 creates two programs focusing on reducing direct emissions from buildings: The Building Initiative for Low-Emissions Development (BUILD) program and the Technology and Equipment for Clean Heating (TECH) program. While the BUILD program focuses on owners or developers of new residential housing, the TECH program aims at new and existing residential buildings.

There is debate among parties as to the specific sectors SB 1477 should focus on. Some parties, including IOUs, argued that they would like to see the inclusion of all sectors in both programs, considering that the commercial sector is a large energy user. Small Business Utility Advocates (SBUA) pointed out results from the California Air Resources Board (CARB) Greenhouse Gas Inventory that showed that GHG emissions from the commercial sector increased by 63 percent from 2000-2016 while the residential sector experienced only 8.5 percent growth. VEIC also expressed the importance of developing a roadmap for reducing gas distribution infrastructure over time, while addressing cross-subsidies between electric and gas utilities and ratepayer impacts.¹⁸

2.3.4 Fuel Source

SoCalGas pointed out that the CPUC must pay attention to stakeholders and ratepayers who are concerned about the cost implications and should ensure that ratepayers become aware that they could experience an increase in their electricity costs. They also defended the usefulness of renewable natural gas as an alternative to traditional natural gas. SoCalGas argued that a supply of Renewable Natural Gas (RNG) is available in-state (although not enough) but that there is the potential to achieve 20 percent of the total supply of natural gas by 2030. Building Decarbonization Coalition pointed out a study conducted by Energy Commission on renewable natural gas to learn how much renewable gas

¹⁶ Definitions of Disadvantaged Communities can be found at <https://www.energy.ca.gov/commission/diversity/definition.html>

¹⁷ R.19-01-011 Reply Comments-NRDC/Sierra Club

¹⁸ R.19-01-011 Opening/Reply Comments VEIC



can be produced in California.¹⁹ It showed that production of RNG in CA will not meet the demand necessary to meet the 2030 goals and the cost would be high.²⁰

2.3.5 Proposed Approaches for the Implementation of SB 1477

Most parties agree that building electrification is a cost-effective approach to building decarbonization as discussed below.

In their comments, SMUD pointed out the need to focus on new and existing buildings to achieve goals, and SMUD is currently offering electrification programs to its customers with incentives from \$1,000 to \$10,500. SMUD shared strategies to reach customers, for example by giving 287 induction cooktops to online survey members as a thank you gift for taking the survey. SMUD included results of a survey that demonstrated that 47 percent of gas stove users are likely to consider induction cooktops in the future. Also, SMUD commented on the important role of contractors in selling the program by activities such as printing flyers, renting billboards, setting up home show displays, and installing an all-electric showroom.²¹

SCE pointed out that all-electric adoption by builders is not currently economical and to address this, incentives are needed. SCE says that this can be accomplished by: 1) Understanding barriers and learning from successful all-electric developments/missed opportunities; and 2) During the early stage market, implementing incentive programs to reduce upfront costs and pairing them with market education. SCE also pointed out a Consumer Awareness Study by EMI Consulting stating that market and customer education is key for market transformation.²²

Natural Resources Defense Council/Sierra Club's (NRDC/SC) recommendation for the BUILD program is to focus on builders and developers by helping the building industry gain wider experience with zero-emission technologies and by providing direct outreach, design, and modeling technical support to low-income developers. For the TECH program, NRDC/SC explains that to create a statewide market development for low- emission space and water heating equipment, an "upstream and midstream" approach combined with incentives, contractor and vendor training, and consumer education can be beneficial. They also commented on the importance of engagement with manufacturers, distributors, and contractors. They pointed out that focusing on contractors is key to success. Finally, they recommend creating a task force to engage industry and community stakeholders to keep TECH and BUILD on track, similar to the one formed for the New Solar Homes Partnership.²³

¹⁹ Joint Agency Workshop on Building Decarbonization, April 8, 2019. California Energy Commission

²⁰ Joint Agency Workshop on Building Decarbonization, April 8, 2019

²¹ Joint Agency Workshop on Building Decarbonization, April 8, 2019

²² Joint Agency Workshop on Building Decarbonization, April 8, 2019

²³ Joint Agency Workshop on Building Decarbonization, April 8, 2019



At the April 8 workshop, the Building Decarbonization Coalition (who are not a party in this proceeding) shared their Roadmap Goals:²⁴

Goal 1: Build customer, builder, contractor and policy-maker awareness and interest in decarbonization.

Goal 2: Ensure that customers receive good value from adopting building decarbonization measures.

Goal 3: Ensure that building decarbonization provides a better value to builders and contractors than fossil-fuel heating.

Goal 4: Prepare supply-chains and delivery agents are to meet the rising demand for carbon-free building technologies with a quality product.

Goal 5: Align policy to meet other goals.

Some parties, including the California Efficiency and Demand Management Council and Grid Alternatives, supported the idea of layering existing energy efficiency program funding with building decarbonization funding in order to streamline the existing and future programs. They say that this would provide utilization of funding for customers, as well as streamline programs that can further expand emissions reductions such as energy efficiency, solar, and storage.²⁵

3. Common SB 1477 Pilot Guidelines

CPUC and Energy Commission staff recommend the following common guidelines for both of the SB 1477 pilot programs, BUILD and TECH. In the case of TECH, we expect bidders to develop guidelines based on the questions below. Bids to the competitive solicitations for TECH should reflect these guidelines and will be scored with these criteria in mind.

3.1 Budget - \$50 Million/Year

Per SB 1477, funding for both BUILD and TECH shall be made available from an annual pool of \$50 million per year derived from the Cap-and-Trade Program allowances directly allocated to natural gas corporations. SB 1477 does not specify the funding allocation split between BUILD and TECH.

Therefore, the CPUC must decide how much of the \$50 million per year total will be allocated to BUILD, and how much to TECH.

In the OIR, parties were invited to comment on how the CPUC should establish the budget for each program. Parties had mixed opinions on the budget split between the two programs. Based on the impact each program may have on carbon reduction and the relative difficulty in achieving program goals, ABAG, BayREN, East Bay Clean Energy (EBCE), and Vermont Energy Investment Corporation (VEIC) support a higher allocation to TECH. Conversely, because the BUILD program includes support for low-income housing, some parties support more funding for it as energy efficiency programs have

²⁴ Joint Agency Workshop on Building Decarbonization, April 8, 2019

²⁵ R.19-01-011 Reply Comments- California Efficiency and Demand Management Council / Grid Alternatives



been shown to be successful with low-income projects, and they provide non-energy benefits such as indoor air quality. CHPC supports higher allocation to BUILD. SCG and Southwest Gas (SWG) also support a higher budget allocation to BUILD.

While a case could be made that an emphasis should be on new construction as it is easier to build a zero carbon building than to retrofit to one, the problem that remains is that the only way to achieve the state's decarbonization goals is to retrofit large numbers of existing buildings. As ABAG (Bay REN) states in their comments, "Given that existing buildings continue to be the highest source of GHG emissions in California, BayREN recommends that more funding be allocated to the TECH Initiative, at least in the short term."²⁶ As such, CPUC and Energy Commission staff agree that 60 percent of the budget, or \$30 million per year, should be allocated to TECH, and 40 percent, or \$20 million to BUILD.

The BUILD program will have a focus on low-income housing. Per SB 1477, 30 percent of the total funding allocated to BUILD must be for new low-income housing. With a \$20 million per year allocation to BUILD, at least \$6 million must be reserved for new low-income housing. Staff proposes that up to 10 percent of the program funding, or \$2 million per year, be reserved for administration by the Energy Commission. CPUC and Energy Commission staff also recommend \$1.5 million per year be budgeted for low-income technical assistance.

The TECH program will be broken up as follows, with a budget total of \$30 million. More details are in section 5 below:

- \$5 million will be allocated to a grants program that is intended to pilot innovative ideas soon after the program launches.
- \$2 million will be allocated to a competitive prize program.
- \$22 million will be the main program operating expenses to develop a longer term framework of market facilitation through upstream and mid-stream interventions.
- \$2 million for evaluation.

²⁶ Opening comments of Association of Bay Area Governments, page 5



Table 3: SB 1477 Annual Program Budget Summary	
BUILD	TECH
\$20 million - Total	\$30 million - Total
\$12 million for program costs	\$23 million for program costs
\$6 million for low-income program costs	\$5 million for “quick start” grants
\$2 million for administration	\$2 million for prize program
\$2 million for evaluation (of both programs)	

3.2 Funding Source

Senate Bill 1477 requires the CPUC to annually allocate, in fiscal years 2019-2020 through 2022-2023, \$50 million of the revenues obtained across all gas corporations from sale at auction of allowances received as a part of the state’s market-based compliance mechanism (Cap-and-Trade Program) to implement the BUILD program and TECH Initiative.²⁷

Under the California Global Warming Solutions Act of 2006, the California Air Resources Board (CARB) is vested with the authority to develop and run a market-based compliance mechanism, now called the Cap and Trade Program. As part of this program, the State allocates GHG allowances to natural gas suppliers to be used for the benefit of ratepayers consistent with the goals of AB 32. Under the Cap-and-Trade Regulation, CARB requires natural gas suppliers to consign to auction a minimum of 25 percent of allocated allowances in 2015, increasing 5 percent each year through 2030, when 100 percent of allocated allowances will be consigned to auction. ²⁸ D.15-10-032 and D.18-03-017 directed that starting with 2019, all GHG allowance funds (less approved administrative and outreach costs) from these auctioned allowances be returned to residential households in the form of a credit that appears on their utility bill, the “California Climate Credit.”²⁹

Energy Commission and CPUC staff recommends the CPUC authorize a funding mechanism to allocate \$50 million of the revenues across all natural gas companies, including any accrued interest, received by a gas corporation as a result of the sale of directly allocated allowances for the BUILD

²⁷ SB 1477, Chapter 378, Stern, Low-emissions buildings and sources of heat energy.

²⁸ California Code of Regulation (CCR) §95893 Table 9-4

²⁹ D.15-10-032 Ordering Paragraph 14 at 64. Administrative costs are subtracted before calculating amounts to return to residential customers.



program, the TECH initiative, and the EM&V contract for both for fiscal years starting 2019-2020 through 2022-2023. Staff recommends that the authorization specify the portion to be provided by each gas corporation and define an account to receive these funds and disburse them to project implementers and the program evaluator. These funds would originate from the Greenhouse Gas Balancing Account (GHGBA) that is managed by the gas corporations.³⁰

Because the funding comes from the sale of Cap-and-Trade Program allowances allocated to natural gas suppliers, the administrators will be required to ensure compliance with Cap-and-Trade Regulation requirements for the use of this allowance value. These requirements are contained primarily in section 95893 of the Cap-and-Trade Regulation. Designed to further the goals of AB 32 and protect ratepayers, these provisions require annual reporting to CARB on the use of this value and, when applicable, estimation of expected GHG emission reductions. Programs funded by allowance proceeds and focused on GHG emission reductions must expect to achieve GHG emission reductions. Additional requirements include that allowance value must be used within ten years of receipt by the gas corporations.

3.3 Clean Heating Technologies Defined

According to SB 1477, there are a variety of technologies that can attain significant GHG emissions reductions from buildings including advanced energy efficiency technologies, clean heating technologies, energy storage, and load management strategies.³¹ There has been wide support among parties for clean heating technologies as one of the keys to success in reducing GHG emissions in buildings. This is because clean heating technologies provide heat without directly emitting CO₂ or any other harmful gas or particulate matter,³² in contrast to traditional heating technologies that use combustion of carbon compounds such as coal, oil, and natural gas to produce heat.

The most common forms of clean heating technologies are heat pump space and water heating. According to Synapse Energy, “Electric heat pumps move heat instead of burning fuel to create heat, making them vastly more efficient than gas-powered furnaces, boilers, hot water heaters, and dryers. Solar hot water with electric backup offers another clean energy solution and can be particularly cost-effective for larger buildings that use a lot of hot water, such as hotels and hospitals. Heat pump dryers provide a low-carbon option for replacing gas or conventional electric dryers, and induction cooktops offer a faster, safer, cleaner alternative to gas cookstoves.”³³

More details about eligible technologies for BUILD and TECH are covered in sections 4 and 5 below.

³⁰ The GHGBA tariff sheet is available here: <https://www.socalgas.com/regulatory/tariffs/tm2/pdf/GHGBA.pdf>

³¹ https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1477

³² https://www.icax.co.uk/Clean_Heating_Technology.html

³³ <http://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf>



3.4 Guiding Principles

The Order Institute Rulemaking (OIR) listed some guiding principles for the TECH and BUILD programs, including technology and vendor neutral competition; transparency; regulatory simplicity; market transformation; and equity. While many parties supported these as guiding principles, NRDC and the Sierra Club offered some modifications and clarifications, as well as an additional guiding principle. While Energy Commission and CPUC staff agree with most of these edits, staff do not agree that the principles of transparency and simplicity are lower priorities than the others as written in the OIR. Staff recommend placing an equal emphasis on all of these guiding principles. In addition, the Small Business Utility Advocates submitted additional language regarding equity, which we add below. The revised Guiding Principles are listed here:

1. **Equity:** Programs, incentives, and policies should be specifically targeted to benefit low-income California residents and those in disadvantaged communities and designed to include and be accessible to all Californians in progress towards decarbonized buildings. Costs, as well as benefits, should be allocated equitably. Underserved and hard-to-reach customers should be targeted and, other things being equal, widespread participation should be valued.
2. **Path to carbon neutrality:** Choose emission reduction strategies that achieve 2045 carbon neutrality in a fair and transparent manner. The CPUC should focus on the most promising and economic strategies to reduce building emissions in line with the statewide goal of achieving carbon neutrality by 2045 or sooner. The CPUC should consider the available strategies, and encourage competition among technologies, vendors, and approaches.
3. **Regulatory Simplicity:** All else being equal, the fewer and simpler the rules, the better. The simpler the approach, the easier it will be for people to understand the rules, and the easier it will be for them to participate in CPUC programs and respond to those rules in ways that benefit ratepayers and the public at large. This also makes CPUC oversight easier.
4. **Transparency:** The CPUC should strive to make its decision making, rules, policies, procedures, and program data as transparent as possible.
5. **Market Transformation:** The CPUC should aim to develop self-sustaining market practices where targeted technologies or approaches can operate in the general market without subsidies once the markets are better developed, and once supporting building decarbonization is aligned with the profit motives of market actors. In the context of building decarbonization, market transformation should focus on the transformation and availability and costs of the technologies that decarbonize buildings and on building a skilled, trained, and motivated workforce needed to install and service the technologies. Market transformation can take time to deliver results at scale; therefore programs, metrics, and policies should be designed with this long-term perspective in mind.

In addition, the Small Business Utility Advocates recommended some new guiding principles, which Energy Commission and CPUC staff also recommend the CPUC adopt, listed below



6. Lessons Learned and Data Reporting: Programs should seek to provide meaningful data and actionable new information about effective techniques, existing market conditions and consumer behavior to generate and support effective GHG-reduction approaches in the future.

7. Cost-Effectiveness: Programs should seek to maximize GHG-reduction and customer cost savings per investment dollar while removing fixed cost barriers to entry and assisting marginalized groups to take advantage of low-cost opportunities.

3.5 Greenhouse Gas Benefits Metrics

One of the key distinguishing features of decarbonization programs is that the objective outcome—GHG reductions—result from program-induced changes that cut across fuel-types, and must consider source energy, as well as transmission, distribution and other grid level operational factors. In contrast to traditional energy efficiency programs which minimize energy use within an existing fuel, decarbonization programs are intended to minimize GHG emissions, often by switching from a higher GHG-intensive fuel to a lower one (e.g., natural gas to electricity) where operating the equipment using a different fuel type yields overall GHG emissions reductions.

Consequently, measuring the GHG impacts of decarbonization measures involves comparison of GHG emissions resulting from continued operation of the existing or equivalent gas-fueled equipment and the GHG emissions resulting from operating replacement equipment under the alternative fuel type over its projected lifecycle. This comparison requires an understanding of two equipment scenarios. In particular, total energy consumption, use patterns (loadshape), and GHG emissions associated with electricity generation, transmission and distribution during the times of operation need to be considered.

Further, while energy consumption of the equipment may be relatively constant over time, the GHG emissions resulting from the use of electricity not only fluctuate over the hours of each day, but are also expected to change over time, with decreases in CO₂ emissions from grid electricity occurring in accordance with state goals (e.g., renewable energy). The magnitude and cost of GHG reductions achieved through building decarbonization must consider: 1) lifetime equipment costs of electric versus gas technologies, 2) the energy consumption and costs of electric versus gas technologies, and 3) the carbon emissions of the electric grid or natural gas infrastructure serving those end uses.

The appendix of this proposal summarizes electricity sector GHG emission intensities that vary by hour and month. The appendix also compares these expected electricity sector emission intensities with those of natural gas and propane.

More specific information about baseline technologies are in Sections 4 (for BUILD) and 5 (for TECH) below.



Pursuant to Senate Bill 1477 the TECH and BUILD programs should include specific program metrics:

- Cost per metric ton of avoided GHG emissions
- Projected annual and lifetime utility bill savings
- Number of low-emission systems installed (BUILD only)
- Market share for eligible technologies (TECH only)

Key sub-metrics needed to calculate the cost per metric ton of avoided GHG emissions include but may not be limited to the following:

- Upfront incremental equipment costs
- Upfront incremental installation costs (including labor and infrastructure upgrades)
- Upfront incremental design costs
- Annual incremental operation and maintenance costs
- Avoided or incremental energy-to-the-home infrastructure costs³⁴
- Effective useful lifetime (EUL) of equipment and buildings, if applicable
- Remaining useful lifetime (if applicable, re any early replacement of existing equipment)
- Annual energy consumption and load profiles of decarbonized and baseline technologies
- GHGs associated with refrigerants used in electric appliances
- Avoided or incremental GHG emissions of electric and gas generation and delivery
- Avoided or incremental energy costs
- Avoided or incremental transmission and distribution system (T&D) costs
- Other relevant avoided or incremental costs
- GHG emissions associated with refrigerants used in electric appliances and of combustion and methane leakage in gas appliances

The costs of GHG reduction is a lifetime metric as opposed to a first-year metric. It is expected that the marginal carbon emissions of the electric grid will decrease over the lifetime of the electrified end uses,

³⁴ For example, costs of extending gas lines to homes with gas end uses and piping gas lines within those homes (a cost savings for all-electric homes). For all-electric homes this would include increased panel capacity, where needed.



resulting in a lower cost per unit of GHG reduction than would occur in the first year of operation. Initially, the metric will require a forecast of grid emissions as well as coordination between agencies to ensure consistent accounting and modeling of GHG reduction estimates. In particular, the specific parameters and algorithms applied to calculate the cost per metric ton of avoided GHG emission should be consistent with the approach the Energy Commission will use for Title 24 in the 2022 code cycle.

Pursuant to section 95893(e)³⁵ of the Cap-and-Trade Regulation, each utility's share of the program will also need to provide the following annually, based on expenditures during the previous calendar year:

- Total avoided GHG emissions expected from that year's expenditures (estimated).
- Total expenditures.
- Itemization of administration and outreach expenditures.
- Description of the nature and purpose of the program, including aspects such as eligibility requirements. Optionally, this description may include co-benefits such as health effects of increased indoor air quality.

Avoided GHG emissions may be estimated using the cost per metric ton of avoided GHG emissions applicable for each technology or activity, the amount of that activity (e.g. number of installations and cost per installation) funded during the previous calendar year, and the percentage of activity costs covered by the use of these funds. Methods for calculating avoided GHG emissions must follow Cap-and-Trade Regulation section 95893(e) requirements. The use of the same metrics used for SB 1477 and Cap-and-Trade Regulation reporting is encouraged wherever possible.

The program evaluator will use these metrics to generate regular TECH and BUILD program evaluation reports. Since natural gas utilities must annually report on their use of allowance value to CARB pursuant the Cap-and-Trade Regulation, the program evaluator will ensure that TECH and BUILD program evaluation reports are provided to the utilities with sufficient and timely information so that natural gas utilities can incorporate the information into their annual reports to CARB.

³⁵ <https://www.arb.ca.gov/cc/capandtrade/capandtrade.htm> (see "Current Regulation and Proposed Regulatory Amendments", "Current Regulation"). Also see 95892(e) which has reporting requirements for the electric utilities, and the EDU reporting form, which are very similar to the ones for gas suppliers but include some additional details for the types of programs that we (initially) had assumed electric utilities would be more likely than gas utilities to actually implement.



Potential bidders to the TECH program will be requested to include in their submissions details on how they will track and report these GHG metrics. Bidders should design their reporting timelines and deliverables to meet both SB 1477 and Cap-and-Trade Regulation requirements.

3.6 Projected Utility Bill Savings

Per SB 1477, it is essential that program interventions in new and existing buildings also improve energy and housing affordability, particularly in low-income communities. Among the requisite performance metrics for both BUILD and TECH programs, per SB 1477, are the projected utility bill savings.

Calculation of this metric requires estimates of annual energy consumption for impacted fuels and end uses, which when combined with the appropriate tariffs will produce an estimate of utility bill impacts. Per the text of SB 1477, projects are eligible to receive incentives under the BUILD and TECH programs *only if they result in utility bill savings for the building occupant*³⁶.

However, to maintain a more comprehensive view of cost effectiveness, Energy Commission and CPUC Staff recommend tracking the full net lifetime cost to end-users. That is, equipment (capital costs), installation, maintenance, and other costs associated with the operation of the alternative or previously existing equipment, and the new and lower-GHG equipment. This comprehensive view of cost effectiveness from the end users' perspective aligns with the Participant Cost Test, whereas the consideration of utility bill savings alone is only one input to that test.³⁷

3.7. Target Population

Both the BUILD and TECH programs are intended to foster long-term changes in the new construction, contracting, retrofit, and appliance marketplace. At the same time, the budgets are limited, and Energy Commission and CPUC staff expect bidders to be strategic in what they will focus on. As such, bidders to these programs, in particular the TECH program, should address what strategy they will employ for the following audiences. The TECH implementer will be expected to coordinate with the BUILD implementer and other market actors to leverage resources and data:

Upstream: What interventions does the bidder propose with regard to manufacturers of appliances, building materials, or other upstream actors?

³⁶ SB 1477, Section 1) a) 5) c) "It is also the intent of the Legislature that projects receive incentives under the programs created by this act only if they result in utility bill savings for the building occupant."

³⁷ Information about the CPUC's Participant Cost Test can be found at <https://www.cpuc.ca.gov/general.aspx?id=5267>



Midstream: What interventions does the bidder propose with regard to distributors and supply chains? What interventions does the bidder propose with regard to contractors, builders, plumbers, electricians, and retail sales outlets?

At this time, Energy Commission and CPUC staff does not propose a target population but rather invites bidders to propose what populations they would reach and to explain the value of those approaches.

3.8 Target Technology

In April 2019, the consultant firm Energy and Environmental Economics (E3) published a study evaluating the consumer economics, greenhouse gas savings and grid impacts of electrification in residential low-rise buildings across six representative homes type in six climate zones in California. Consumer economics were evaluated in three ways, by comparing: 1) upfront installed capital costs, 2) energy bills, and 3) lifecycle savings between gas-fired and electric technologies.³⁸ Focusing on selected climate zones is more cost effective than incentivizing heat pump technologies in areas of low air conditioning loads, according to the study, and these homes are not as likely to need an expensive panel upgrade. Staff is persuaded by the value of this approach.

As such, staff recommends that the program implementer should develop programs that prioritize California's hotter climate zones. Specifically, Energy Commission and CPUC Staff recommend that the program implementers prioritize the following findings from the E3 study in their program design.

- For new construction, the E3 study recommended promoting all-electric new construction, and an update to the building code.
- For existing buildings covered by the TECH program, E3 recommended the following:
 - Heat Pump HVAC systems in residential low-rise retrofit homes, where central air conditioning is needed or wanted.
 - HVAC heat pumps to replace space heating currently provided by propane, distillate, or electric resistance heat.
 - High efficiency HVAC heat pumps rather than standalone central AC units should be encouraged wherever possible.
 - Early replacement program for older gas furnaces and gas water heaters should be considered.

³⁸ Taken from E3 – Energy & Environmental Economics. *Residential Building Electrification in California*. April 2019.



- Incentives and low-cost financing targeted to landlords and low-income consumers to overcome capital cost barriers and ensure that clean energy benefits are enjoyed by all communities.
- Other customer costs such as installation.

3.9 Non-GHG Benefits

Energy Commission and CPUC Staff recommends that bidders to the RFP for TECH articulate the co-benefits of building decarbonization, beyond the reduction of greenhouse gas emissions. For instance, non-combusting space-conditioning equipment (e.g., heat pumps instead of furnaces) can also result in improved indoor air quality for the building occupant by eliminating the by-products of natural gas combustion entirely.

3.10 Scalability

A later phase of the R.19-01-011 proceeding will consider a long-term building decarbonization policy framework, and the SB 1477 pilots are intended to inform that framework. If pilots are not designed so that they can be scaled, then the value of these pilots may be limited. Staff recommends that the pilot programs be able to demonstrate scalability in the marketplace and that any response to a solicitation include information on how the proposal could grow to a larger scale over time, or how the program will lead to information on how to more rapidly drive market transformation after the pilot is complete.

3.11 Leveraging Other Programs

Potential implementers should be aware of other customer energy programs available to consumers and should demonstrate how their approach will leverage, combine, and interact with those other programs. This could include energy efficiency, the Self-Generation Incentive Program, demand response, electric vehicle incentive programs, and others.

3.12 Evaluation

The OIR asked parties to weigh in on how the program should be evaluated, and what percentage of the program budget should be dedicated to evaluation. Environmental Defense Fund (EDF) commented that this program requires a new set of evaluation criteria based on reduced greenhouse gas emissions, which is consistent with the aim of the program. Energy Commission and CPUC Staff agree with this approach and recommend that evaluation be based on greenhouse gas emission reductions using the metrics detailed in Section 3.5 of this proposal.

With regard to managing the evaluation, Energy Solutions recommended not having a firewall between the evaluator and the program implementer, while NRDC/SC commented that the evaluation should be embedded in the program design. Regarding how evaluation impacts program outcomes, VEIC stated that implementers should be subject to performance holdbacks based on evaluation data.



Regarding the evaluation budget, PG&E commented that the evaluation budget should be set at 4 percent of program costs, while SCE gave a range of between 1.6 percent and 4 percent. For context and comparison, Energy Commission and CPUC staff notes that while the current evaluation budget for Energy Efficiency programs is set at 4 percent, these funds are split between the CPUC and the IOUs.

Based on the record, and on the CPUC staff's experience with evaluating energy efficiency programs, staff recommend the following:

- The evaluation program budget should be set at 4 percent of program costs, or \$2,000,000 per year.
- The CPUC will directly solicit for, hire, and manage one evaluator for both programs. The evaluation budget will be split between the two programs based on what the evaluator finds appropriate, in consultation with the Project Coordination Group.
- The CPUC will form a Project Coordination Group (PCG), which will include CPUC Energy Division staff, Energy Commission staff, program implementer staff, and the evaluator staff. The PCG will advise the evaluation process. It will be up to the CPUC's Energy Division staff to determine if any other parties are appropriate for the PCG and to design the meeting schedule and format for the PCG.
- The evaluation will be based on metrics as detailed elsewhere in this proposal (impact) as well as qualitative data collection to assess the success and scalability of program strategies employed (process).
- The CPUC will conduct a competitive solicitation for a program evaluator through the state contracting process overseen by Department of General Services (DGS). Upon CPUC authorization, Energy Division staff will develop a budget change proposal for reimbursable funds from the cap and trade account to be used for program evaluation.

3.13 Stakeholder Review Workshops

The CPUC and the Energy Commission, in collaboration with their respective contractors, will be responsible for organizing public quarterly Stakeholder Review Workshops. The Stakeholder Review Workshops will be noticed, at a minimum, to the service list of R.19-01-011. The purpose of the Stakeholder Review Workshops is to provide input to the CPUC, Energy Commission and program implementers at key decision points in the BUILD and TECH programs, and to comment on the evaluation methodologies, results and recommendations. As discussed above, the logistics and communications for stakeholders will be managed by the Energy Commission, the CPUC, and the Program Implementers.

4. BUILD Design Proposal



4.1 GHG Reduction-Based Incentives for New Construction

The BUILD program will provide incentives for the deployment of near-zero-emission building technologies to significantly reduce GHG emissions from buildings, beyond what would be achieved by the 2019 *Title 24, Building Energy Efficiency Standards*. The amount of the incentive provided will be proportional to the projected amount of GHG emission reductions resulting from the installation of the near-zero-emission building technology. The incentives will encourage building designs that reduce GHG emissions beyond standard industry practices, which are characterized by the 2019 (most current) version of the California Building Energy Efficiency Standards located in California Building Code, Title 24, Part 6. Buildings that serve low-income residents may have more flexible incentive qualifications than those that serve other residential customers. Energy Commission staff proposes that BUILD incentives be offered only to all-electric residential new construction projects.

4.2 CPUC Oversight and Energy Commission Roles and Responsibilities

In SB 1477, Public Utilities Code section 921.1(a)(2) states, “The commission may determine whether each gas corporation or a third party, including the Energy Commission, shall administer the program.”

Stakeholder comments on BUILD program administration state the need and preference for a single statewide administrator. There is a consensus by a group of stakeholders that administration of BUILD by a state agency is preferable to administration by private entities, including the utilities that may have potential conflicts of interest.

CPUC Staff recommends that the Energy Commission is the appropriate entity to administer the BUILD program, which is supported by comments from Association of Bay Area Government, California Building Industry Association, California Municipal Utilities Association, City and County of San Francisco, NRDC, and Sierra Club. Stakeholders cite the Energy Commission’s role, experience, and success implementing New Solar Homes Partnership (NSHP) and Electric Program Investment Charge (EPIC) programs, as well as its link to compliance provisions and documentation requirements associated with the Building Energy Codes.

Energy Commission and CPUC Staff recommends that the CPUC provide ultimate policy oversight of the BUILD program, with the Energy Commission designing and administering the program.

To help make the proposed roles and responsibilities clear, we distinguish between two sets of responsibilities: 1) policy oversight; and 2) program design and administration.

“Policy oversight,” is defined as activities typically performed by the CPUC where ratepayer funds are expended for public interest purposes. For example, the CPUC retains ultimate policy oversight in the areas of energy efficiency, demand response, renewables, and general procurement of electricity. In



some programs CPUC retains ultimate policy oversight like establishing criteria for eligibility for the program, establishing budgets and incentive levels, and determining program evaluation criteria.

“Program design and implementation” of the BUILD program we define as implementing the day-to-day operation of the program, operating under the parameters set by the CPUC. The administrator is responsible for the following types of activities:

- Awarding funds to specific entities according to the criteria established by the CPUC.
- Handling disbursement of funds.
- Collecting data and information to inform evaluation and lend insight to program successes and failures. Data collection plans should be coordinated with the CPUC and the independent evaluator.
- Submitting an annual report as set forth further below

In addition, staff recommends convening scoping workshops on the design of BUILD and conducting stakeholder consultation with a wide variety of parties to access their expertise. The Energy Commission, as administrator, may consult with stakeholders as needed and useful to its work administering the program.

As administrator, the Energy Commission will track and report performance metrics of the BUILD program. Per SB 1477, BUILD program metrics must include, at a minimum, the number of low-emission systems installed in each building type, projected utility bill savings, and the cost per metric ton of avoided GHG emissions. The Energy Commission will also track and report the estimated GHG reductions of the BUILD program. These reports will include the necessary information and follow the necessary timelines to fulfill both SB 1477 and Cap-and-Trade Regulation requirements.

If approved, Energy Commission staff will oversee the selection process for a low-income technical assistance provider. Once selected, the Energy Commission will oversee the provider’s activities to ensure program compliance with low-income and DAC requirements outlined in SB 1477; effective targeting; and optimal deployment of program resources.

The Energy Commission, in consultation with the CPUC, will assess the feasibility of using SB 1477 incentive funds to complement existing programs such as those with energy utilities (e.g., Emerging Technologies Program (ETP), California Advanced Homes Program (CAHP), and existing Publicly Owned Utility programs), and EPIC, as appropriate.

Staff believe that flexibility will be needed in the BUILD program design and implementation to accommodate any unforeseen changes in California’s new construction market and to best implement



the SB 1477 guiding principles. Over-prescribing program design parameters at this stage could hamper later efforts to improve program performance.

4.3. Reporting

4.3.1 Implementation Plan

Staff proposes that the Energy Commission submit a four-year implementation plan for BUILD to the CPUC within three months following the final decision regarding this staff proposal. The Energy Commission shall vet the implementation plan in a public workshop to gather stakeholder input before it is submitted to CPUC staff. The implementation plan shall summarize and respond to any stakeholder input at the Energy Commission-led workshop. The implementation plan shall be filed as a letter to the CPUC's Executive Director, and the CPUC will approve the implementation plan through their resolution process.

4.3.2 Amendments

Staff proposes that the Energy Commission make any amendments to the BUILD program, consistent with the guiding principles and parameters described in the decision arising out of the OIR for this proceeding, through submittals to CPUC staff. Having flexibility to update incentivized technologies, incentive levels, projects, and recipients will ensure that the Energy Commission effectively administers the funds in a way that maximizes the benefits of the near-zero emission technologies deployed under this program.

4.3.3 Progress reports

Energy Commission and CPUC Staff propose that the Energy Commission submit annual progress reports to CPUC staff on the BUILD implementation plan. CPUC and Energy Commission staff will collaborate to identify appropriate materials to include in the progress reports.

4.3.4 Informal collaboration

Energy Commission Staff should hold monthly meetings with between CPUC staff to discuss program implementation and any issues or areas that may need stakeholder input, or to be adjusted in response to program feedback.

4.3.5 Final report

Energy Commission and CPUC staff propose that the Energy Commission submit to the CPUC a final report within one year of the expenditure of all BUILD program funds that contains the metrics tracked and analyzed over the life of the BUILD program (see section 4.4.10 below) along with any findings or recommendations that the Energy Commission may have regarding the program's progress toward achieving the state's decarbonization goals.



4.4 Program Architecture

Staff recommends that the BUILD program provide builder and/or developer incentives for low-carbon new construction solutions in residential and multifamily buildings. According to SB 1477, a minimum of 30 percent of the BUILD funding will be allocated to new low-income residential housing located in disadvantaged communities or low-income communities.³⁹ Staff recommends that the BUILD incentives complement other ratepayer-funded residential new construction energy efficiency programs, to the extent that this allows for streamlined incentive delivery for participating builders.

Staff additionally proposes that up to 10 percent of the BUILD funding be set aside for the Energy Commission's administration of the BUILD program.

4.4.1 Eligibility Structure

Staff recommends that the BUILD incentives be available only for all-electric residential new construction projects. The Energy Commission estimates that new homes built to the *2019 Building Energy Efficiency Standards*⁴⁰ (Standards) have marked differences in expected GHG emissions. For example, all-electric new single-family homes built to the 2019 Standards will produce approximately 1 ton CO₂/year less than new homes that use natural gas for space heating, water heating, and cooking. Further, new homes do not require an extension of the natural gas distribution system, reducing infrastructure costs by about \$6,000 per home. Limiting natural gas line extensions are of strategic policy value to California⁴¹. Therefore, it is not appropriate to provide BUILD incentives for projects that ultimately require natural gas infrastructure extensions to serve one or more home appliances.

4.4.2 Low-Income and Disadvantaged Communities Set Aside

To comply with SB 1477, staff proposes to set aside 30 percent of the BUILD program funding for low-income and/or disadvantaged community (LI/DAC) projects, including technical assistance to low-income developers. Staff proposes that a portion of this low-income funding be devoted to incentives for new low-income residential housing and a portion to a contractor with low-income project development expertise to provide technical assistance to low-income residential project developers.

4.4.3 Incentive Structure

Staff proposes to develop a robust but limited set of prescriptive incentives for low-carbon new construction solutions. This will allow the Energy Commission to determine and clearly communicate the clean energy policy value of specific new construction features across the state. Staff propose to use

³⁹ SB 1477 (2019), 921.1 (c) (1)

⁴⁰ <https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency>

⁴¹ E3 Consulting. "Residential Building Electrification in California: Consumer Economics, Greenhouse Gases, and Grid Impacts." April 2019. Page 23. https://www.ethree.com/wp-content/uploads/2019/04/E3_Residential_Building_Electrification_in_California_April_2019.pdf



the 2019 software used to determine compliance with the Title 24 performance approach for residential buildings (California Building Energy Code Compliance-Residential, CBECC-Res) to calculate the incentive levels based on expected GHG emission reductions from a GHG baseline defined in the next section.⁴² This approach will have lower implementation costs because the CBECC-Res software will not need to be modified and maintained over the BUILD program period to calculate incentives for individual projects.

Incentives may be allocated according to numerous potential alternatives, including:

- Per-building
- Per-subdivision
- Statewide focus
- Focus on BUILD climate regions with highest GHG reduction potential
- Incorporation of an incentive floor of \$48/ton of reduced emissions⁴³

Additional framing of these incentive design alternatives is delineated in the appendix and will inform the subsequent program design by the Energy Commission.

4.4.4 GHG Baseline

The baselines used to estimate the GHG emission reductions from BUILD incentives will be the GHG emissions expected from mixed-fuel homes built to the 2019 Standards. The Energy Commission models a mixed-fuel home as follows:

- Natural gas furnace
- Packaged electric air conditioner
- Natural gas water heater
- Natural gas stove and cooktop
- Electric appliances (all other)
- Electric lighting and plug loads
- On-site photovoltaic electricity generation

⁴² Software available at <http://www.bwilcox.com/BEES/BEES.html>

⁴³ Table 8, pg.16. Social Cost of Carbon 2020-2030, CARB Proposed Plan January 2017
https://www.arb.ca.gov/cc/scopingplan/app_e_economic_analysis_final.pdf



GHG baselines according to the 2019 Standards levels are illustrated in the appendix for the following systems and technologies: space heating (gas furnace), space cooling (electric air conditioner), water heating (gas water heater), cooking (gas stove/cooktop) and electricity generation (on-site photovoltaics). These baselines will vary by climate regions, defined below as larger groupings of the Energy Commission Building Climate Zones.⁴⁴

GHG baselines would be weight-averaged for these climate regions based on the projected new residential construction starts used in the 2019 Standards Impact Analysis⁴⁵. This would provide fewer geographic areas with distinct GHG emission baselines, which would be simpler for builders, developers, and stakeholders to understand. The estimates of new residential construction starts, the proposed climate regions, and the GHG emission baselines for these climate regions are delineated in the appendix. The GHG baseline levels are preliminary and may be adjusted or updated during the program design by the Energy Commission.

4.4.5 Incentive Levels by Technology Type and Climate Region

Staff recommend that BUILD incentives be established for specific technology categories and climate regions. Staff recommends that building climate zones be grouped into California climate regions for simplicity of administration. Recommended climate zone groupings can be found in the appendix and may be adjusted by the Energy Commission during the BUILD program design.

Energy Commission staff proposes to establish BUILD incentives for technology categories of space heating and cooling, water heating, and cooking. Some technologies apply to energy end uses that are weather dependent, so incentives may vary by climate region. Other technologies apply to energy end uses that are not significantly climate dependent, so in those cases incentives should not vary by climate region. Proposed eligible technologies for BUILD are enumerated in the appendix, and may be adjusted or updated by the Energy Commission as part of its BUILD program design and in response to stakeholder input and feedback.

Any technology option that receives Title 24 performance credit cannot receive an incentive from the BUILD program. For example, if a builder uses a Northwest Energy Efficiency Alliance (NEEA) Tier 3 heat pump to comply with the Building Energy Efficiency Standards, they may not receive a BUILD incentive for that heat pump. The intent is to avoid providing incentives for equipment or installations that the builder would have had to install anyway to comply with the mandatory standards.

⁴⁴ https://ww2.energy.ca.gov/maps/renewable/building_climate_zones.html

⁴⁵ Available at

https://www.energy.ca.gov/title24/2019standards/post_adoption/documents/2019_Impact_Analysis_Final_Report_2018-06-29.pdf



4.4.6 *Kicker Incentives*

Energy Commission Staff recommends including additional BUILD incentives for a small number of technologies that will provide incremental GHG emission reductions beyond the basic incentives introduced above. These additional “kicker incentives” will only be available for projects that qualify for one or more of the basic incentives introduced above. Examples of “kicker incentives” include very-high-efficiency heat pumps for space cooling, electric battery technologies where a PV system is installed, heat pump water heaters that use low global warming potential (GWP) refrigerants, or design assistance incentives to fund complex efficient designs.

The design assistance incentive is proposed to provide BUILD incentives to partially off-set additional design costs needed to include a system design or new technology in new construction projects. Designing a space heating system that employs hot water from a heat pump water heater is one example. The appendix includes proposed BUILD kicker incentives. The Energy Commission may adjust or update the eligible technologies or designs that receive kicker incentives as well as the incentive levels through the BUILD program design to achieve the goals of this program.

4.4.7 *Appropriate Project Level for BUILD Incentives*

Staff is considering offering BUILD incentives at the subdivision level rather than, or in addition to, the building level. Significant long-term GHG emission reduction benefits likely occur if developers chose to construct and market all-electric new subdivisions. The appendix (Section 6) includes estimates of new subdivision developments planned in California. The BUILD program will need to be designed with flexibility to adjust recipients of the incentives to maximize the impact of the limited program funding.

4.4.8 *Technical Assistance for Low Income Project Developers*

Public Utilities Code Section 921.1(d)(1) states that the CPUC must ensure that projects funded with the 30 percent reserved for low-income and disadvantaged communities are offered technical assistance to encourage the use of the program.

Energy Commission Staff recommends that the BUILD program administrator (the Energy Commission) select an expert company/organization to conduct the technical assistance to reach low-income housing developers. Reaching and effectively influencing the low-income building industry will require focused outreach and diligent relationship management. Recognizing that the low-income housing sector is different from the market-rate housing sector, with additional challenges and limitations, an entity experienced in working with this market segment is required to ensure that funds reserved for this group are fully and efficiently deployed.

Accordingly, staff recommends requiring the BUILD program administrator to contract with an organization with experience and existing relationships with low-income housing developers to



provide this technical assistance. This organization would need to have comprehensive knowledge of the low-income and affordable housing sector, including deed-restricted housing. The technical assistance should include a range of flexible services and should help low-income housing developers navigate the BUILD program from start to finish. The awardee should be able to demonstrate the ability to assist with building system design, identify vendors, and connect and coordinate with other incentive programs aimed at low-income housing.

4.4.9 Education and Outreach to Builders

Title 24 energy code compliance includes field verification of proper envelope construction and mechanical system installation. Staff recommend that BUILD-incentivized new construction measures also include field verification protocols. This field installation information can be re-assembled as builder outreach materials to educate builders on the BUILD incentive program, with specific information on each incentive category, including the type of equipment that is eligible, the proper installation guidelines, and the expected emission reductions.

4.4.10 Alternative Performance Metrics to Be Tracked

SB 1477 requires tracking the number of low-emissions systems installed by building type for the BUILD program. Staff proposes that BUILD incentives be limited to new construction of all-electric residential dwelling units, where the GHG emissions reductions are calculated versus a mixed fuel home. In keeping with the legislative direction to track low-emissions systems, as well as the proposed architecture for the BUILD program, staff proposes tracking a number of overarching installation metrics, as well as more detailed counts of system-specific incentives.

The following metrics are recommended:

- Number of all-electric single-family detached dwellings
- Total square footage of all-electric single-family detached dwellings
- Number of all-electric multi-family buildings, up to 10 dwelling units
- Total square footage of all-electric multi-family buildings, up to 10 dwelling units
- Number of all-electric multi-family buildings, 11+ dwelling units
- Total square footage of all-electric multi-family buildings, 11+ dwelling units
- Number of all-electric multi-family dwelling units, (all multi-family building sizes)
- Total square footage of all-electric multi-family dwelling units (all multi-family building sizes)
- Number of low-income dwelling units
- Number of disadvantaged community dwelling units



The following counts of system-specific installations are also recommended to track and report for each targeted building type (single-family and multi-family) and income strata (low-income, disadvantaged community):

- 1. Heat Pumps installed with a Heating Seasonal Performance Factor (HSPF) of greater than 10**
 - Number of heat pump installations
 - Total capacity (sum of the rated capacity of all installed heat pump systems)
 - Average HSPF rating (weighted by capacity)
 - Average SEER rating (weighted by capacity)
- 2. Efficient Envelope**
 - Average improvement in envelope performance, as a percent over 2019 Building Code requirements
- 3. Heat Pump Water Heater Tier 3⁴⁶**
 - Number of dwelling units with heat pump water heaters installed
 - Total capacity
 - Average efficiency rating (weighted by capacity)
- 4. Water heaters installed with demand management capability (grid connectivity/dispatchable storage capacity)**
 - Number of grid connected heat pump water heaters installed
 - Total installed thermal storage capacity
 - Average thermal storage capacity (capacity per dwelling unit)
- 5. Solar thermal and solar PV water heaters**
 - Number of solar water heater systems installed
 - Number of dwelling units served by installed solar water heaters
- 6. Cooking Equipment**
 - Number of dwelling units with induction cooktop
 - Number of dwelling units with electric oven

⁴⁶ Defined in NEEA's heat pump water heater (HPWH) Qualified Products List



7. Behind the meter battery storage

- Number of dwelling units served by behind-the-meter battery storage system
- Number of behind-the-meter battery storage systems
- Total installed battery systems' rated capacity
- Average capacity of battery system installed (capacity per dwelling unit)

5. TECH Program Proposal

5.1 Addressing Market Barriers

It is important that the TECH program implementer clearly state how they intend to address market barriers for the technologies listed in this proposal (see Section 3.8). As guidance, Energy Commission and CPUC Staff recommend the market barriers that have been identified in the Building Decarbonization *Coalition's Roadmap to Decarbonize California Buildings*, including the following:

- Lack of incentives encouraging customer adoption
- Lack of financing solutions to help customers manage up-front costs
- Lack of coordination with existing building weatherization support programs
- Lack of paths to market for electric load shift enabled by heat pumps
- Lack of customer bill savings in some utility service territories at current electric and gas rates
- Lack of markets to monetize grid and climate values

This extends to the contracting and building community as well, as the Roadmap lists these barriers for contractors and builders:

- Lack of incentives encouraging builders to construct carbon-free structures
- Lack of training for builders and contractors
- Lack of recognition for builders and contractors promoting building decarbonization
- Lack of coordination and support for local government permitting offices
- Lack of adequate measurement and valuation of GHG emissions
- Lack of consumer demand



To address these barriers, the Roadmap lists several strategies, which are summarized below as examples of a possible approach by the TECH program implementer as part of a holistic market transformation effort:

1. Customers, builders, contractors and policy makers are made aware of and encouraged to demand building decarbonization measures.
2. Customers receive a good value from adopting building decarbonization measures.
3. Building decarbonization provides a better value to builders and contractors than fossil-fuel heating.
4. Supply-chains and delivery agents are able to meet rising demand for carbon-free building technologies with a quality product.⁴⁷

According to E3's study, *Residential Building Electrification in California*, the most cost-effective target audiences for electrification retrofits are homes in California's hotter climates that already have air conditioning. According to the study, "High capital costs of electric heat pump retrofits in existing homes are often perceived as a barrier to electrification, but this assumption was not borne out for homes that are otherwise upgrading their air conditioning system...87 percent of the simulated single family retrofit homes (all of which are assumed to have air conditioning) see lifecycle savings from switching from a gas furnace and air conditioner to an electric heat pump HVAC system."⁴⁸

As such, Energy Commission and CPUC staff expect the TECH program to take a regional approach in its initial targeting of customers who are most likely to see utility bill savings.

5.2 Program Architecture & the Program Implementer

This effort will focus a long-term approach to promote electric heating equipment (space and water). The objective is to deploy a creative, well-informed, multi-phased and multi-strategy approach to substantially accelerate the market development and sales of high efficiency electric heating equipment in existing homes (in contrast to BUILD, which will have a focus on new construction).

The CPUC will solicit bids for third parties to design an incentive program that meets the CPUC's requirements. The innovation and expertise available through California organizations and companies will be brought to bear on designing the TECH incentive program, and the CPUC will select the chosen bid and design after a robust competitive Request for Proposal (RFP) process.

The budget for this program allows for piloting approaches in California in order to arrive at scalable strategies and approaches for future program design. While the TECH program is not expected to completely decarbonize every home in the state, it should put California's existing buildings on a path

⁴⁷ *A Roadmap to Decarbonize California's Buildings*. Building Decarbonization Coalition. 2019. <http://www.buildingdecarb.org/resources/a-roadmap-to-decarbonize-californias-buildings>

⁴⁸ Energy & Environmental Economics (E3). *Residential Building Electrification in California*. April 2019. Page xiv.



to complete decarbonization by 2045. As such, the implementer should come with proven strategies that are replicable and scalable.

The strategy deployed by the TECH implementer should be informed by a solid understanding of market structure and mechanics, and the barriers to increasing targeted technology uptake. In addition, the TECH Implementer should consider the need for supply and sales data for the tracking of key performance metrics in the negotiation of relationship and incentive terms.

Energy Commission and CPUC proposes TECH to be a market transformation initiative conducted by four primary actors, each with separate assignments that together comprise the program. The proposed divisions are: Program Administrator (CPUC); Market Transformation (MT) Program Implementer; an Independent Evaluator; and stakeholders, who will be engaged through stakeholder workshops. The MT Program Implementer has the largest and most significant role of the four actors. The Implementer will be awarded the contract via a competitive solicitation to operate under oversight of CPUC.

Below is one proposed approach to the entire supply chain, demonstrating some of the roles and responsibilities for the various layers in the supply chain:⁴⁹

- **Manufacturers** - Promote new and existing products, increase market share, and are a midstream ally.
- **Manufacturers' representative** - When the manufacturer has no sales force, a representative is more cost effective, by promoting new and existing products, increasing market share, and serving as a midstream ally.
- **Distributors** – This describes companies that offer sales and marketing support, elevate inventories, offer product and program training and lines of credit/financing forms, and are a midstream allies.
- **Contractors** – Function as trusted advisors and trade allies.
- **End users** – Find the value in indoor comfort, improvements in health and safety, lifetime benefits and tangible bill savings.

If administrators understand the importance of the relationships with the supply chain, this can result in a successful market transformation.⁵⁰

⁴⁹ Joint Agency Workshop on Building Decarbonization, April 8, 2019. Presentation by VEIC.

⁵⁰ A case study of this approach is available at: VEIC, 2018. *Ramping Up Heat Pump Adoption in New York State*.

<https://www.veic.org/documents/default-source/resources/reports/veic-ramping-up-heat-pump-adoption-in-new-york-state.pdf>



Per the recommendation by VEIC, Energy Commission and CPUC staff recommends a holdback of 10 percent from the program implementer, which will be contingent on meeting program targets set out in the RFP, and agreed upon in the contracting process.

An implementer should be prepared to develop strategies and approaches to addressing the appropriate market barriers listed in section 5.4 in the most cost-effective and strategic way possible. This includes addressing the parts of the supply chain detailed in the strategies below. The Implementer will conduct an effort that will include four strategies. Bidders or groups of bidders may be asked to propose approaches to each of these in an RFP process:

5.2.1 Strategy 1: Incentives and partnerships with supply-side market actors (upstream)

For the purposes of TECH, we are defining “Upstream” as a “Program element aimed at encouraging manufacturers to make the most efficient equipment available at competitive prices, as well as program elements that provide incentives to distributors. This also includes manufacturer buydowns to targeted channels such as retailers that are not in a position to collect data from the purchaser or end-user.”

To drive rapid market adoption of energy-efficient products, the TECH program must address the real and perceived business risks of the “upstream” supply chain actors (manufacturers, manufacturer representatives, and distributors).⁵¹ As an example, if focusing on transforming the HVAC market, collaborating with the supply chain is key, one supplier at a time. The elements where intervention should be considered include sales, marketing, inventory, and training designed to increase distributor revenues. The desired results include improvements in stocking practices, fewer financial barriers for suppliers, many more products brought to market, and a compendium of best practices. If successful, the upstream element will deliver significant decreases in GHG emissions, compared to “downstream” rebate programs for end users.

Successful upstream programming is not a matter of simply letting supply channel actors know about efficiency program offerings or technologies, or of simply offering large incentives, but rather understanding and collaborating closely with the supply chain at every step of the way.

5.2.2 Strategy 2: Market facilitation activities, including workforce development, education and outreach (midstream)

We are defining Midstream as “a program element that provides incentives to wholesale distributors, retailers, e-commerce companies and/or contractors to stock and/or sell more efficient products,” and which includes the collection of data from the market actor’s purchaser. The definition includes program elements that require a percent pass-through of the incentive to the distributor’s purchaser or

⁵¹ https://aceee.org/files/proceedings/2016/data/papers/7_460.pdf page 1



customer and could also include a spiff/management fee paid to the applicant for participating with the program and the program's requirements such as collecting data. It could also include interventions that will affect contractors, builders, plumbers, electricians, and retail sales outlets.

Well-designed midstream programs offer a proven strategy to rapidly transform markets, generate energy and bill savings, reduce greenhouse gas emissions, and scale up the adoption of emerging technologies. Successful midstream programs treat supply chain market actors as partners, with established memoranda of understanding (MOUs) and shared sales, marketing, and training strategies. For example, it will be important to closely coordinate TECH offerings with midstream HVAC programs sponsored by utilities that target the same technologies or supply chain actors.⁵²

5.2.3 Strategy 3: "Quick Start" Grants Program

Under this program category, the Implementer will work with a limited carve out of the TECH budget to not exceed \$5 million. These funds will be intended to fund localized, vanguard approaches to decarbonization. This program will consist of a grants program involving the procurement and administration of a portfolio of high-impact projects and strategy testing engagements with local, regional and other third-party implementers.

The TECH Implementer will manage an open solicitation process to procure a strategically designed grant program of high-impact projects and partnerships. The goal of the grants is to test market transformation strategies approaches, and to support technology development, demonstrations, and/or market research.

As such, the ideal implementer is one with considerable expertise in target markets, and with the capacity to manage both direct implementation activities (5.2.1 and 5.2.2 above) as well as manage the solicitation, funding and evaluation of a portfolio of smaller projects and funded partnerships.

The objective is to deploy comprehensive market facilitation and support strategies to address barriers related to knowledge, awareness and acceptance. The efforts should target measurable and timely improvements in supplier and consumer awareness of technologies and benefits, as well as workforce expertise and program awareness. These grants are intended to be awarded within 9 months after the execution of the implementer's contract, with the goal of providing lessons learned for the longer-term effort.

5.2.4 Strategy 4: Prize Program

Similar to the grants program, the Prize program is intended to foster innovative, short term approaches by market actors. For this program, the CPUC and the program implementer, with the input of

⁵² Parties comments page 10



stakeholders, will set a simple target for entities to hit (e.g. the number of heat pump HVAC systems installed), and a prize may be given to the first party who hits the target. Lower prizes may be given based on other targets set. This program would provide simple guidelines and minimal restrictions, and a limited amount of time to hit the goal. This approach has been used by the Department of Energy to promote goals such as domestic solar panel production.⁵³ For this program, Energy Commission and CPUC staff proposes a \$2 million carve out for prize money and administrative costs. The winners of the grants program should not need be in the initial bid to the program RFP. Rather, it will be a competition run and administrated by the winning bidder of the RFP.

5.2.5 Target Geographical Area

According to E3s study, *Residential Building Electrification in California*, the most cost-effective target audiences for electrification retrofits are homes in California's hotter climates that already have air conditioning. According to the study, "High capital costs of electric heat pump retrofits in existing homes are often perceived as a barrier to electrification, but this assumption was not borne out for homes that are otherwise upgrading their air conditioning system....87 percent of the simulated single family retrofit single family retrofit homes (all of which are assumed to have air conditioning) see lifecycle savings from switching from a gas furnace and air conditioner to an electric heat pump HVAC system."⁵⁴ One factor E3 cites is that these homes are not as likely to need an expensive electrical panel upgrade.

As such, we expect the TECH program to take a regional approach in its initial targeting of customers who are most likely to see bill savings, and where first costs are minimized. The CPUC is also interested in targeting some activities in the areas of natural gas infrastructure failures, particularly the area around Aliso Canyon in Southern California.

5.3 Independent Evaluator

As discussed in Section 3.12 above, the independent evaluator will be under a separate contract from the program implementer and will be a non-financially interested service provider. They will be responsible for the tracking and reporting of program performance metrics, providing early feedback evaluation results and recommendations, publishing bi-annual market progress reports, and facilitating communications between the program implementer, CPUC, Energy Commission and stakeholders.

⁵³ <https://www.energy.gov/articles/department-energy-launches-3-million-prize-competition-boost-domestic-solar-manufacturing>

⁵⁴ Energy & Environmental Economics (E3). Residential Building Electrification in California. April 2019. Page xiv.



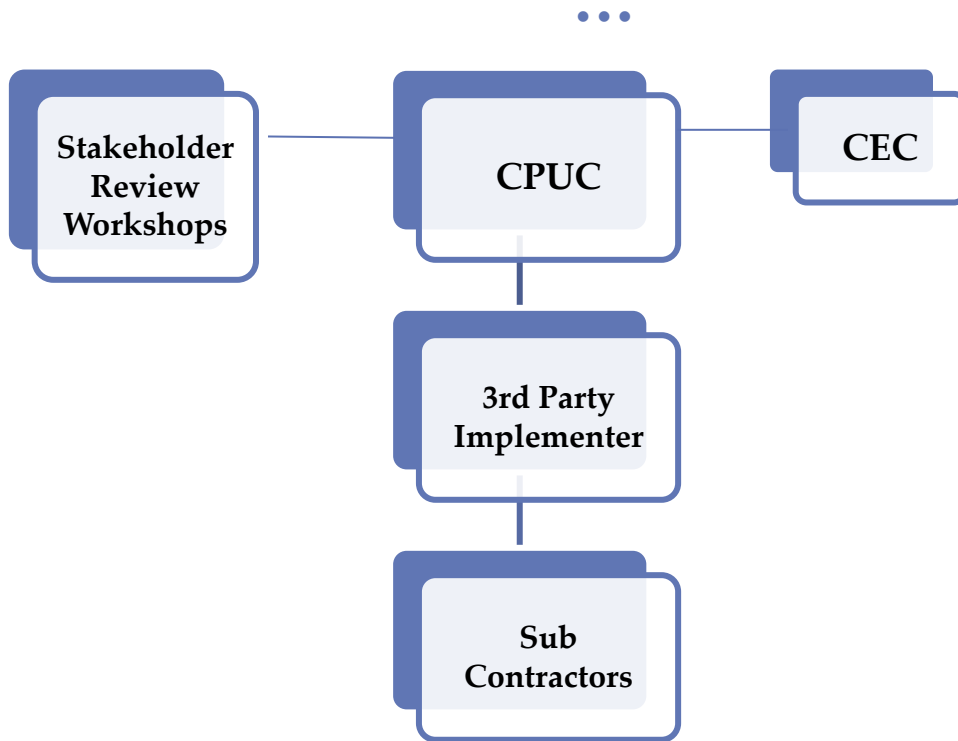
5.4 Program Oversight and Administration

According to SB 1477, “The commission (CPUC) shall develop and supervise the administration of the Technology and Equipment for Clean Heating (TECH) Initiative, a statewide market development initiative...”⁵⁵ There was a consensus among parties that TECH program implementation should be contracted to a third party implementer (Association of Bay Area Governments, Center for Sustainable Energy, California Municipal Utilities Association, NRDC/SC), while other parties were less concerned with who implements the program than they were with having a single implementer (Energy Solutions, VEIC, PG&E, SCE). SCG commented that they should administer it in order to leverage the work they’re already doing, while the Public Advocates Office commented that it should not be implemented by any gas company due to conflict of interest issues.

Energy Commission and CPUC Staff agrees that a statewide program is best run by a single statewide implementer, under the supervision of the staff of the CPUC’s Energy Division. However, as TECH is intended to test and model unique approaches to building decarbonization, we also intend the winner of the RFP to be a single, leading contractor working with sub-contractors by which to take advantage of short term, localized opportunities while simultaneously developing a long term market transformation approach. More detail on this is provided in the following sections.

For management of the TECH program contract, Energy Commission and CPUC staff recommends the CPUC manage a governance structure similar to what it currently has for the Statewide Marketing, Education, and Outreach and Solar on Multifamily Affordable Housing (SOMAH) programs. The structure is summarized in this organizational chart.

⁵⁵ SB 1477, 2018, Sec. 922 (a) (1)



This structure leaves the details of running the TECH program to the implementer, provides for strong oversight by the CPUC, while also allowing the Energy Commission and stakeholders (described below) to provide collaborative input and advice. The meetings may also include presentations from other parties besides the implementer. The implementer will work with Energy Division staff on the agendas and goals for these meetings.

Energy Commission and CPUC Staff also recommend that the RFP will require the implementer to facilitate at minimum quarterly, in-person stakeholder meetings, to be noticed to all parties to this proceeding. The meeting will be in person, and also be accessible remotely via webinar.

Energy Commission and CPUC Staff recommends Southern California Edison hold the contract and create a balancing account that will distribute funds from the natural gas Cap-and-Trade Program allowance proceeds to the program implementer. Energy Commission and CPUC Staff also recommends that SCE runs the solicitation process with guidance from CPUC staff.

5.5 Technology Eligibility

Energy Commission and CPUC Staff recommend that the Energy Commission provide preliminary specifications for eligible technologies in the appropriate TECH solicitations, then work with the selected contractors to finalize all technology eligibility requirements as needed. The CPUC will have final approval over these specifications.

Energy Commission and CPUC Staff propose to leverage existing technical specifications for space and water heating equipment to the greatest extent possible. The Northeast Energy Efficiency Partnership



has established a cold-climate air-source heat pump specification that should work well in all California climates⁵⁶. For water heating, the Northwest Energy Efficiency Alliance (NEEA) has developed a performance specification for heat pump water heaters⁵⁷. The Energy Commission uses this NEEA specification in the 2019 Title-24 Building Energy Efficiency Standards. Other best practice performance standards may also be appropriate for select technologies.

However, incentivizing heating technologies in the TECH program should consider attributes beyond technical performance. Energy Commission and CPUC Staff recommend that decisions on technology eligibility also consider these additional attributes, below.

5.5.1. GHG reduction potential

In some cases, based on home construction characteristics and geographic locations, replacement technologies may not significantly reduce GHG emissions compared to the existing equipment that provide space and/or water heating services. Energy Commission and CPUC Staff recommend that the Energy Commission review and approve all technologies proposed for deployment in the TECH program to confirm that the expected GHG reductions are significant.

5.5.2 Commercial readiness

Technologies may meet technical specifications but not be ready for market deployment for other reasons. Energy Commission and CPUC Staff expect that the program implementer will have knowledge of each proposed technology's availability in all applicable areas of California, understand product performance history in California home applications, and understand other critical supply chain information.

5.5.3. Equipment and installation costs

Managing technology costs will be a critical component of the TECH program, and the CPUC will be looking for program proposals that make the most cost effective use of the funding. Even if the TECH program does not incentivize all of these costs, for decarbonized heating solutions to scale in California, homes' replacement costs must be judged reasonable by consumers. For this reason, Energy Commission and CPUC Staff recommends that the program administrator understand and find ways to reduce, if needed, replacement costs for low-carbon heating technologies.

5.5.4. Eligible Technologies for Incentives

These are detailed in section 3.8 above.

⁵⁶ https://neep.org/sites/default/files/ColdClimateAir-sourceHeatPumpSpecification-Version3.0FINAL_0.pdf

⁵⁷ https://neea.org/img/documents/Advanced-Water-Heating-Specification_181010_152257.pdf



5.6 Tracking Market Share for eligible technologies for TECH

SB 1477 requires tracking the market share for eligible technologies for the TECH program. The focus of the TECH program is on the replacement of existing gas-fueled space and water heating equipment with low emission electric technologies. When considering the market share of a targeted technologies there are two possible dimensions to consider, and it is useful to keep them distinct and consider them separately.

The first is often called ‘saturation,’ and it is the portion of the total eligible population where the target technology installed. For example, in this case it would be the percent of dwelling units with low-emission electric space and/or water heat. The second dimension is the sales share, which refers to the percent of new purchases (or installations) of the target technology. In the case of the TECH program, this would represent the percent of removed or broken gas-fired water heaters that are replaced with low-emission electric water heaters. Energy Commission and CPUC Staff recommends tracking both metrics.

The Energy Commission’s 2019 Residential Appliance Saturation Survey⁵⁸ (RASS, expected March 2020) will provide saturation data regarding the technologies and fuel types of space and water heating and will be a good starting resource from which to create an initial baseline saturation level. At both the program mid-point (two-years of operation) and end point (four years) Energy Commission and CPUC staff recommends the independent evaluator (described above) design and execute a representative survey of residential dwellings across the state to update saturation statistics. This survey should also collect detailed data on any recent space/water heating replacements, to inform the calculation of market share. Preliminary work on this may be done using the most recent RASS from 2009.

To supplement the residential population survey method recommended above, Energy Commission and CPUC staff also recommends supply side data collection. More specifically, Energy Commission and CPUC staff recommends the program implementer work with equipment suppliers (manufacturers, distributors, retailers, and/or contractors/installers) to collect data on the relative share of current installations and sales that are low-emission electric technologies versus standard gas-fueled technologies. Careful market research must be done upfront to establish the market size and supply chain mechanics, to appropriately set the sample frame and sampling methodology.

The TECH program mechanics will involve developing relationships with the appropriate low-emission space and water heat equipment suppliers. Thus, Energy Commission and CPUC staff recommends that the program implementer negotiate data sharing and data access as part of the

⁵⁸ The RASS can be found on the CEC’s website at <https://www.energy.ca.gov/appliances/rass/>



established relationships, in order to facilitate the collection of market share tracking data. The specifics of these elements of the negotiated relationships should be coordinated with the independent evaluator, who will ultimately be responsible for the analysis and reporting of program progress metrics. The independent evaluator should not rely solely on the program implementer relationships, however. Instead the independent evaluator should leverage those data in combination with other data collection activities to create a robust and representative metric. Results of supply side market share research should be published alongside the results of the saturation survey results, at the same intervals. This will facilitate a comprehensive analysis and reconciliation of various data sources.

5.7 Fuel Replacement Criteria

The intent of this initiative is to not only advance the state’s market for low-emission space and water heating equipment for new and existing residential buildings but also to provide incentives to eligible applicants for the deployment near zero-emission building technologies that would assist the state in achieving its greenhouse gas emissions reductions goals. This includes replacing natural gas equipment with high efficiency electric equipment. Replacing natural gas equipment with a higher efficiency natural gas equipment does not qualify for this program, and incentives are already available for doing so in the Energy Efficiency program. Replacing existing electric equipment with high efficiency electric equipment is only eligible if the project is proposed as a strategic opportunity for low-income or disadvantaged communities and/or for workforce development and/or a market facilitation program component. Replacing propane equipment with high efficiency electric equipment is eligible to participate in this program.

5.8 Primary Activities, Components and Outputs of each TECH Primary Actor

Table 4 below describes the main activity areas, components, and outputs of each primary actor contributing to the proposed TECH program process.

Primary Actor	Activity	Components	Outputs
TECH Program Implementer	Market characterization and initial Market Transformation Program Theory and Logic Model	Document market structure and mechanics; market actors/roles; potential leverage points; and potential intervention strategies	<ul style="list-style-type: none"> • Initial Program theory and logic model • Plan for continuous refining and validating key assumptions
TECH Program Implementer	Develop Forecast Baseline (Bass Diffusion curve or other)	<ul style="list-style-type: none"> • Establish forecast values for naturally occurring market 	<ul style="list-style-type: none"> • Initial CPUC adopted baselines vetted at Stakeholder Review Workshop



Table 4: Primary Activities, Components and Outputs of each TECH Division			
Primary Actor	Activity	Components	Outputs
		<ul style="list-style-type: none"> Establish targets for key market goals and performance metrics 	<ul style="list-style-type: none"> Initial targets and timeline for reaching key milestones Plan and schedule for updates to baselines
TECH Program Implementer	Establish supply-side market partnerships and incentive strategies	<ul style="list-style-type: none"> Negotiate agreements and financial commitments with key entities in target market Structure and approach relate clearly to program theory and logic model. Include data collection and other ongoing feedback and validation of program theory 	<ul style="list-style-type: none"> Agreements with upstream/midstream actors including incentives, data collection and sharing, Targets, milestones, success metrics, and reporting schedule for supply-side incentives
TECH Program Implementer	Market facilitation, workforce development, education and outreach program	<ul style="list-style-type: none"> Structure and approach relate clearly to program theory and logic model. Include ongoing feedback and validation of program theory Address key market actors and key barriers Establish metrics and targets 	<ul style="list-style-type: none"> Implementation plan for market facilitation, workforce development, education and outreach Targets, milestones, success metrics, and reporting schedule
TECH Program Implementer	Conduct solicitation for local/regional/third party partners for grants and prize programs, seeking a range of intervention strategies, demonstration projects, technology development, and/or research	<ul style="list-style-type: none"> Each bid relates to program theory and logic model. Each bid to include customized evaluation plans and success criteria Selection of bids is balanced to address all barriers, test key assumption, and intervention strategies 	<ul style="list-style-type: none"> Portfolio of funded projects and partnerships



Table 4: Primary Activities, Components and Outputs of each TECH Division			
Primary Actor	Activity	Components	Outputs
Independent Evaluator	Comprehensive evaluation plan addressing all funded projects/partners from solicitation	<ul style="list-style-type: none"> • Evaluation plans and success metrics drawn from each funded proposal. • Conduct or oversee project-specific evaluation activities • Cross-cutting analysis to learn from and refine strategies and identify most promising scalable approaches 	<ul style="list-style-type: none"> • Annual reports with interim progress, finding and recommendations • Final report with results from all funded projects/partners. • Recommendations for scaling project or further testing of strategies.
Independent Evaluator	Early evaluation, measurement and evaluation plan	<p>Focused on TECH initiative as a whole, including establishing supply-side partnerships, project/partner solicitations, and other TECH Administration functions.</p> <p>Focus on providing feedback to support program improvement and success.</p>	<ul style="list-style-type: none"> • Early evaluation plan • Communication plan • Regular communication and reporting • Final report
Independent Evaluator	Ongoing / longer-term evaluation, measurement and verification Plan for continuous refining and validating key assumptions	<ul style="list-style-type: none"> • Monitoring, program progress, market developments, characteristics, and dynamics over time • Address key market-related data gaps/ information needs 	<ul style="list-style-type: none"> • Annual market progress evaluation report • Updates to program theory & logic model • Plans for the following year research
CPUC and Program Implementer	Facilitate Stakeholder Review workshop meetings and webinars	<ul style="list-style-type: none"> • Organization and logistics • Set meeting agendas • Manage communications • Compile meeting notes and action items • Facilitate stakeholder discussion 	<ul style="list-style-type: none"> • Quarterly in-person meetings • Monthly webinars • Ongoing stakeholder communications • Documentation of meeting discussions and action items



Primary Actor	Activity	Components	Outputs
Stakeholder Review Workshop	Quarterly Review Meetings	Assess program findings, progress, documents, reports	<ul style="list-style-type: none"> • Provide feedback and recommendations to CPUC, Energy Commission, Program Administrator, and other stakeholders

5.9 Request for Proposals

Energy Commission and CPUC Staff recommends that a competitive request for proposals be issued for a third-party implementer of the TECH program. A prime contractor candidate may form a group with other sub-contractors.

Some parties stated the need for a fast and efficient RFP process (ABAG, SBUA, CSE), while at the pre-hearing conference for this proceeding, other parties, including EBCE, voiced a similar urge to bring the program to market as soon as possible, in order to meet the state’s decarbonization goals.

Energy Commission and CPUC staff find that the best RFP structure that will meet the needs of program effectiveness and speed is to follow these steps:

- A request for proposals (RFP) will be issued on the R.19-01-011 service list. The RFP will include the program parameters for TECH, program metrics, and proposal scoring criteria.
- Within 10 days of the RFP mailing, the CPUC staff will hold a bidders’ conference to take any questions regarding the RFP.
- Proposals on the RFP without cost sheets may be served to the CPUC and the R.19-01-011 up to 30 days after the bidders’ conference.
- Cost sheets may be mailed to the CPUC under separate cover and will be kept confidential by CPUC staff.
- Comments by parties on the proposals will be accepted for up to two weeks after the proposals are issued to the service list.
- A scoring committee of CPUC and Energy Commission staff will score the proposals based on the quality of the written proposals, the cost sheets, and input from the parties. The scores will be kept confidential.
- The CPUC will announce the winning proposal via a decision in this proceeding.



5.10 Education and Outreach

The TECH statute "...require[s] gas corporations to advance the state's market for low-emission space and water heating equipment for new and existing residential buildings through upstream market development, consumer education, contractor and vendor training, and the provision of upstream and midstream incentives to install low-emission space and water heating equipment in existing and new buildings."⁵⁹

Parties have addressed the importance of ensuring the program administrator includes consumer education and workforce training as part of its solicitation. Specifically, NRDC and Sierra Club stated "The administrator of the TECH program...must be able to provide a range of service providers to deploy the right combination of engagement with manufacturers, distributors, and contractors, and possibly education to customers, to be effective."⁶⁰ Similarly, VEIC points out that bidders should include in their bids a description of their approaches for determining methods for contractor and vendor training, and strategies for consumer education in the use of the new technologies.⁶¹ Public Advocates Office also addressed the inclusion of consumer education and workforce training.

GRID Alternatives has observed that mission-driven third-party entities with on-the-ground experience are best positioned to provide the appropriate education and outreach services necessary to ensure strong program adoption and maintain community trust.⁶²

Small Business Utility Advocates pointed out that outreach to electricians and other contractors should be employed to familiarize them with the new technologies. Then they can be trained to install them, working closely with building managers, owners, and developers. This will lead them to understand the technologies better and translate this by educating end-users about low-GHG alternatives, in turn generating demand for these products.⁶³ Finally, SCE pointed out a Consumer Awareness Study by EMI Consulting stating that market and customer education is key for market transformation "With education, customers appear to be willing to adopt building electrification technologies." SCE believes that during the early stage market, implementing incentive programs to reduce upfront costs and pair them with market education can help the all-electric adoption.

Given this consensus on the importance of education and outreach, Energy Commission and CPUC staff recommend that the implementer for the TECH program provide a robust plan to educate the key actors.

⁵⁹ Pub. Util. Code § 922(a)

⁶⁰ NRDC and Sierra Club joint comments on R.19-01-011 OIR, page 10

⁶¹ VEIC comments on R.19-01-011 OIR, page 7

⁶² GRID comments on R.19-01-011 OIR, page 7

⁶³ Small Business Utility Advocates comments on R.19-01-011 OIR, page 4

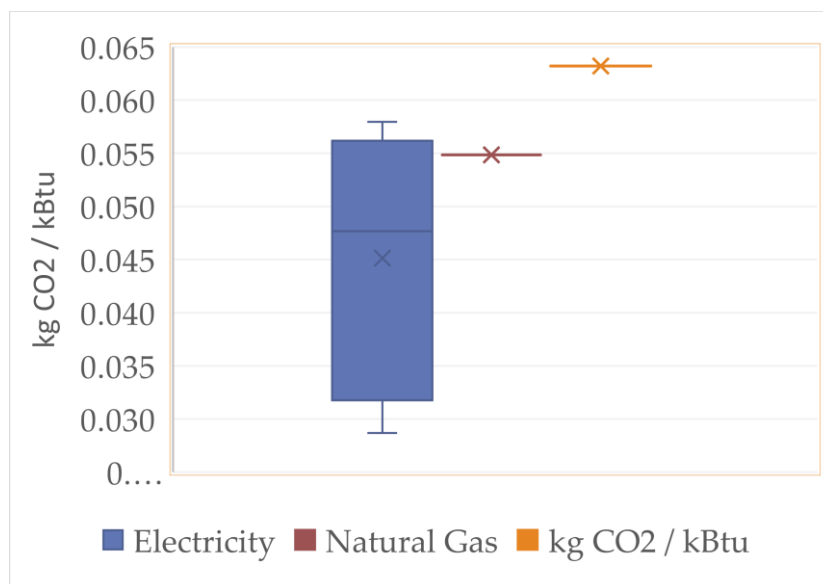


6. Appendix

6.1 GHG Emission Intensities

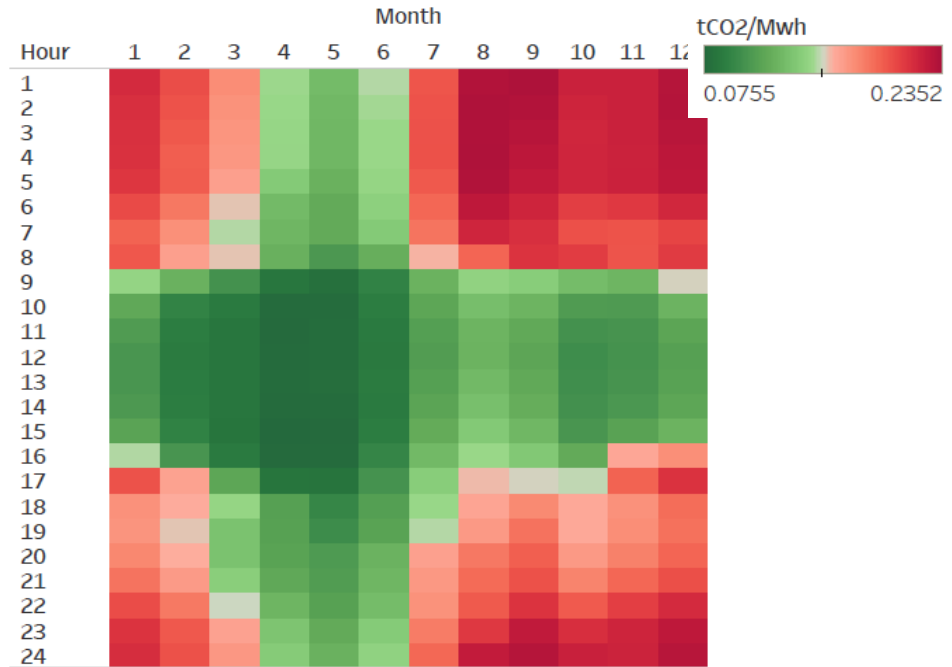
In Tables 1 and 2, electricity sector emission intensities are calculated on an hourly basis using electricity production cost modeling under the renewable portfolio targets imposed by SB 100. Assumptions of how the electricity grid changes over time are included. The hourly emission intensities summarized below are the result of a 30-year net present value calculation, where a 3 percent annual discount rate is applied to future years' hourly emission intensities.

Appendix Table 1: Hourly Average GHG Emission Intensity





Appendix Table 2: Hourly Average Electricity GHG Emission Intensity



6.2 CA Climate Regions & New Home Starts

Appendix Table 3: Estimated Annual New Home Starts		
Climate Zone	Single Family	Multi-Family
1	465	111
2	3,090	1,318
3	11,496	2,831
4	7,435	1,089
5	1,444	747
6	6,450	1,400
7	5,779	3,939
8	9,948	1,899
9	12,293	4,419
10	18,399	2,897
11	3,947	522
12	19,414	4,935
13	7,034	1,309



14	3,484	756
15	3,203	454
16	3,188	1,441

BUILD Climate Region	2019 Standards Climate Zones	Percent Share of New Homes	
		Single	Multi
North & Central Coast	1,2,3,4,5	20%	20%
South Coast	6,7,8,9,10	45%	48%
Central Valley	11,12,13,14	29%	25%
Southern Desert	15	3%	2%
Mountains	16	3%	5%

6.3 GHG Baselines: Mixed-Fuel Homes Built to the 2019 Title-24 Standards

Energy Commission staff recommend that the GHG emission baselines be set to the expected emissions from mixed-fuel homes built to the 2019 Standards. Baselines vary according to climate zone, type of building (single vs. multi-family home), and square footage. Climate region GHG baselines result from weight averaging the mixed-fuel GHG emissions and the expected new home starts by climate zone. Energy Commission staff will determine how best to segment BUILD incentives into new home size bins, if needed. Examples of GHG baselines for three building sizes follow:

BUILD Climate Region	Single Family Homes		Multifamily Homes
	2100 sq ft	2700 sq ft	6960 sq ft
North & Central Coast	1,066	1,038	2,479
South Coast	380	385	897
Central Valley	1,939	2,099	1,972
Southern Desert	573	614	1,911
Mountains	2,728	2,829	5,492

BUILD Climate Region	Single Family Homes		Multifamily Homes
	2100 sq ft	2700 sq ft	6960 sq ft
North & Central Coast	0.51	0.49	1.03
South Coast	0.18	0.18	0.42
Central Valley	0.92	0.99	0.91
Southern Desert	0.27	0.28	0.89
Mountains	1.29	1.33	2.71



North & Central Coast	0.51	0.38	0.36
South Coast	0.18	0.14	0.13
Central Valley	0.92	0.78	0.28
Southern Desert	0.27	0.23	0.27
Mountains	1.30	1.05	0.79

The GHG emissions of the baseline mixed-fuel home are delineated by end use in tables 6-8. Photovoltaic electricity generation provides GHG emission reductions, compared to grid electricity, but only if the locally generated electricity is used on-site. The PV GHG emissions should be used to establish the GHG emission reductions expected if batteries are incented by the BUILD program.

Appendix Table 7: Annual 2100 sq ft Single Family Home Emissions Across End Uses (kg/CO₂e-yr)					
BUILD Climate Region	Space Heating	Water Heating	Cooking	Space Cooling	PV
North & Central Coast	767	752	82	1	(537)
South Coast	201	752	82	223	(879)
Central Valley	1,671	752	82	1,012	(1,578)
Southern Desert	6	752	82	1,075	(1,342)
Mountains	2,562	752	82	22	(690)

Appendix Table 8: Annual 2700 sq ft Single Family Home Emissions Across End Uses (kg/CO₂e-yr)					
BUILD Climate Region	Space Heating	Water Heating	Cooking	Space Cooling	PV
North & Central Coast	728	837	90	10	(626)
South Coast	217	837	90	290	(1,048)
Central Valley	1,810	837	90	1,282	(1,919)
Southern Desert	29	837	90	1,252	(1,594)
Mountains	2,663	837	90	65	(826)

Appendix Table 9: Annual 6960 sq ft Multifamily Home Emissions Across End Uses (kg/CO₂e-yr)					
---	--	--	--	--	--



BUILD Climate Region	Space Heating ⁶⁴	Water Heating	Cooking	Space Cooling	PV
North & Central Coast	659	4,069	565	83	(2,898)
South Coast	63	4,069	565	1,085	(4,875)
Central Valley	2,073	4,069	565	3,548	(8,284)
Southern Desert	1	4,069	565	3,184	(5,909)
Mountains	4,303	4,069	565	324	(3,770)

6.4 Potential Incentive Allocation Schema

Energy End Use	Technology	Varying by Climate Region?
Space Heating	Heat Pump HSPF > 10	Yes
Water Heating	Heat Pump WH Tier 3 ⁶⁵	Yes
Space Heating & Cooling	Induction Cooktop & Electric Stove Solar Thermal ⁶⁶	No

Energy End Use	Technology	Varying by Climate Region?
Space Cooling	Heat Pump SEER >=16	Yes
On-Site PV Storage	Electric Batteries	No

⁶⁴ Space heating emissions from new single-family homes in the North & Central Coast, South Coast, and Southern Desert climate regions exceed those of significantly larger new multifamily homes. While this may seem counter-intuitive, multifamily dwelling units have lower space heating loads (and higher cooling loads) because they have higher occupancy density compared to typical new single-family homes. The space conditioning equipment in new multi-family homes are also expected to have lower duct losses than those in new single-family homes, since single-family homes are built with attics, where most HVAC system duct losses occur.

⁶⁵ Defined in [NEEA's HPWH Qualified Products List](#)

⁶⁶ Solar thermal performance specification to be determined. BUILD will be aligned with and complement other incentive programs. For solar thermal technologies fully incentivized by other programs, they may be removed from eligible technologies as part of SB 1477. Alternatively, SB 1477 incentive may be offered in an amount that covers any gap cost for solar thermal technologies.



Space Heating & Cooling	Low GWP Refrigerants ⁶⁷	No
Water Heating	Low GWP Refrigerants ⁶⁸ Demand Response Control for Water Heating ⁶⁹	No
Any	Design Assistance	No

6.5 Alternative Allocation Schema

Per-Subdivision Incentive Design: To maximize support for developers seeking to build all-electric homes, BUILD incentives may be disbursed at the subdivision level. Subdivision developers make strategic decisions regarding natural gas line extensions that are a significant component of the BUILD program architecture. Subdivision developer participation in BUILD may lay the groundwork for future decarbonization programs. The charts below details new subdivision starts expected in California during the BUILD program period.

Appendix Table 12: Estimated Annual New Subdivision Starts⁷⁰	
BUILD Climate Region	Number of Subdivisions
North & Central Coast	771
South Coast	20,318
Central Valley	12,085
Southern Desert	675
Mountains	305
TOTAL	34,153

⁶⁷ Low GWP refrigerant specification TBD

⁶⁸ Ibid.

⁶⁹ Consistent with 2019 Title 24 requirements for demand flexible water heating

⁷⁰ According to [2018 CA Department of Real Estate subdivision filings](#)