

Berkeley Funding Gap Analysis for Residential Building Decarbonization

Completed July 2022, Updated February 2023

FIREFLY
ENERGY CONSULTING

AEAA
ASSOCIATION FOR
ENERGY
AFFORDABILITY

Table of Contents

- **Executive Summary**
- **Phase 1:** Analysis of Total Costs
- **Phase 2:** Identification of Existing Funding Streams
- **Phase 3:** Gap Assessment and Net Cost Analysis
- **Phase 4:** City Mechanisms to Raise Funds
- **Key Findings and Recommendations**
- **Appendix**



Executive Summary



Executive Summary | Project Background

Background and Summary of Project

The Building Electrification Institute (BEI) and the City of Berkeley worked together in 2021-2022 to assess the comprehensive costs of equitable building decarbonization in Berkeley, including important health and safety investments that can be a significant barrier to decarbonization, and to review the regional funding sources available as of July 2022. At the time, existing funding sources for energy efficiency, electrification, affordable housing, and health programs in the Bay Area were not documented in a single place and it was unclear if programs could be paired together. **The goal of the analysis is to help Berkeley staff and their partners understand the landscape of existing funding sources and envision creative ways to braid funding sources, as well as to identify new potential funding sources, to accelerate equitable building decarbonization.**

Through this process, BEI and Berkeley staff determined that dedicated funding for comprehensive decarbonization upgrades is critical to realize an equitable transition that does not increase housing costs or exacerbate health disparities. Additionally, new funding sources will be needed to fill in the gaps from existing programs. Fortunately, more funding is on the way with the the 2023 California budget and enactment of the 2022 Inflation Reduction Act.



Executive Summary | Project Goals

- **Identify existing local, regional, state, and federal funding sources** that are available to Berkeley residents, particularly those with low and moderate incomes, for comprehensive building efficiency, electrification, health, safety, and resiliency needs.*
- **Understand how these programs work**, particularly for funding streams related to housing quality, health, and other non-energy specific sources.
- **Identify opportunities to pair or stack these funding sources** to increase impact and ensure comprehensive housing needs are met.
- **Identify the gaps in existing funding sources and where new funding sources may be needed** to ensure the costs of decarbonization are not borne by those who can least afford them, including best practices from other regions.

This analysis estimates the gap in public funding necessary to support a comprehensive and equitable building decarbonization transition.



Executive Summary | Guiding Principles

The City of Berkeley is committed to creating healthy, affordable, climate resilient, and carbon-free homes for all.

- The City recognizes that “**equitable decarbonization**” of buildings extends beyond electrification to address comprehensive housing needs, including health, safety, deferred maintenance, energy efficiency, weatherization, and electric readiness retrofits.
- **Comprehensive building decarbonization offers vast opportunities to improve quality of life and economic self-sufficiency**, particularly for low- and moderate-income residents in Berkeley.

Benefits of an Equitable Decarbonization Transition



Improved health outcomes and lower health-related expenses



New high road job opportunities*



Potential to expand affordable housing and renter protections



Potential to decrease utility bills and energy burden



Divest from fossil fuels and invest in a clean, local economy

Executive Summary | Analysis Approach

Achieving the benefits of equitable building decarbonization are not guaranteed and will require significant planning and public investment. **To support the planning process, BEI and Berkeley made several key decisions about the analysis approach:**

Calculating the Costs:

- **The analysis intentionally includes comprehensive health, safety, and electric readiness upgrade costs.** Many buildings are deemed ineligible for program funding due to deferred maintenance or other health and safety investment needs, exacerbating existing inequities in housing quality and access to clean energy.
- **This analysis assesses total investment costs rather than incremental (or additional) costs** compared to gas system replacements. While most building owners will replace equipment by 2045, some upgrades may happen earlier due to potential state and regional policies. Some building owners will need help covering total costs to ensure they do not go out of business or pass these costs on to renters.

Addressing the Funding Gap:

- **Berkeley city staff determined that public investments should be prioritized to cover total costs for all low-income housing and most costs for moderate-income housing.*** This is a values-based decision based on the community priorities in Berkeley.
- **Berkeley staff are particularly concerned about the risk of increasing housing cost burdens, gentrification, and displacement** becoming exacerbated by decarbonization, especially if they pursue policies that burden low- and moderate-income (LMI) households with upgrade costs. Public investments should therefore flow to LMI communities to limit potential harm and prioritize health and safety benefits to those communities.

*Some moderate-income households may benefit from low- or no-interest financing products that could help cover a portion of retrofit costs.

Executive Summary | Analysis Approach (Cont.)

Health & Safety Retrofits: Why were these costs included?

- **Many homes must address health and safety repairs first** before energy efficiency and electrification retrofits can be implemented. For example, mold and asbestos may need to be remediated before installing new equipment in various parts of the building, or the roof may need to be replaced to ensure structural soundness before installing new equipment.
- **Anywhere between 20% and 60% of program applicants may be deemed ineligible for energy incentive programs**, including both federal weatherization and utility incentives programs, because they must first address health and safety repairs, which perpetuates existing inequities.*
- **Low- and moderate-income households typically have a higher prevalence of health and safety upgrade needs** than market rate homes.**
- **Berkeley's Existing Building Electrification Strategy (BEBES) prioritizes equitable building decarbonization** and sets guidelines that that the City prioritize its support for homes that have the highest need.***

*Source: Benshoff, L. 2022. "A low-income energy-efficiency program gets \$3.5B boost, but leaves out many in need." National Public Radio. May 13, 2022.

**Estimates adopted from national industry assumptions about upgrade costs in LMI residential buildings, and adjusted based on input from AEA and City's Housing Department on prevalence and severity by building type.

***November 2021. [Berkeley's Existing Building Electrification Strategy](#)

Executive Summary | Benefits of Decarbonization

The benefits of comprehensive building decarbonization in Berkeley include:

- **The creation of at least 600-1,000 local clean energy sector jobs annually.** With complementary policies, Berkeley can also help ensure these are high road jobs.*
- **Address longstanding health, safety, and resilience needs in Berkeley buildings.** There is a large backlog of investment needs in Berkeley's housing stock, particularly in low- and moderate-income buildings. Electrification also provides the opportunity to add cooling to buildings as summers get hotter due to climate change.
- **Potentially lower energy bills.** Upgrades can lower energy bills for residents, especially as gas prices become more volatile.
- **Better indoor and outdoor air quality.** One recent study estimates that residential gas use is costing Californians roughly \$3.5 billion per year in negative health outcomes as a result of indoor and outdoor air pollution.**
- **More affordable housing.** Public investments can be paired with housing protections to preserve and increase housing affordability.
- **Invest in creating a local clean energy economy.** Comprehensive building decarbonization would create a \$2-2.5 billion local market in Berkeley, redirecting investments away from fossil fuels and toward clean energy.

Executive Summary | Project Phases

**Phase 1:
Cost Analysis**

What is the total cost to equitably decarbonize Berkeley's housing?

**Phase 2:
Existing Funds**

What funding sources exist that cover relevant costs?

**Phase 3:
Gap Analysis**

What is the gap remaining in costs currently being covered?

**Phase 4:
Opportunities**

What are other ways a city can raise funds to support this transition?

Executive Summary | Key Findings

- **Although many incentive programs exist in the Bay Area, a significant funding gap remains to support comprehensive and equitable decarbonization of residential buildings in Berkeley.** This is in part due to programmatic rules that prevent or limit “double dipping” between funding sources and a lack of options for health, safety, and electric readiness upgrades.
- **As of July 2022, there is an estimated \$20,000–\$40,000 funding gap per housing unit in Berkeley, with low-income housing consistently facing larger funding gaps,** at almost \$4,000/unit more on average. Based on preliminary analysis, funding from the federal Inflation Reduction Act could help cover between \$8,000-\$20,000 for eligible low-income households, depending on household income level and energy savings, but will not reach all Berkeley buildings. Additional funding is also expected from the 2023 California budget.
- **Significantly fewer funding sources exist for health and safety repairs as compared to funding for energy upgrades.** Health and safety upgrades are often required before completing efficiency and electrification upgrades. Low- and moderate-income units face higher need for these repairs, and therefore higher costs for decarbonization.
- **There is currently no funding to upgrade knob and tube wiring in the Bay Area,** which is prevalent in Berkeley’s older building stock and is a critical precursor for full home electrification.

Executive Summary | Key Findings (Cont.)

- **Berkeley will need to invest an estimated \$40 million per year through 2045 to cover the total costs of decarbonizing all of its low- and moderate-income residential buildings through comprehensive upgrades.*** Upcoming investments from the Inflation Reduction Act and the 2023 California budget will help cover a portion of this gap, but gaps are likely to remain for electric readiness, health, and safety upgrade costs.
- **Moderate-income households face unique funding challenges** because they are not eligible for many low-income programs but are still likely unable to afford the full cost of retrofits.**
- **With the right planning, Berkeley's investments in comprehensive building decarbonization could reduce housing disparities, improve public health, and reinvigorate the local economy.** There are many potential benefits from investing in comprehensive building decarbonization beyond reducing greenhouse gas emissions.
- **Comprehensive building decarbonization costs must be evaluated against the costs of continued use of gas appliances and investment in aging gas infrastructure.** While no comprehensive study exists on the ongoing costs of the current gas system, investing in comprehensive building decarbonization would redirect billions of dollars that are currently flowing into the construction and maintenance of fossil fuel infrastructure, and would reduce significant public health and safety costs from air pollution and other risks from gas systems.

Executive Summary | Recommendations

In the near-term, BEI recommends that Berkeley take the following steps:

- 1. Coordinate existing funding.** Enhance coordination across city departments to pursue upcoming federal and state funds, particularly with the Housing Department, and work with regional program administrators to better understand implementation needs for these funds.
- 2. Seek opportunities to access and raise more funding.** Pursue competitive grants and opportunities to raise city and/or regional funds, potentially in collaboration with neighboring cities and local community groups.
- 3. Advocate for improved program design and funding.** Partner with other cities and groups to advocate to state agencies and utilities to increase funding for LMI homes; improve program design to include comprehensive upgrades and increase accessibility to renters and disadvantaged communities; and enhance coordination across programs.

Over the long-term, funding equitable building decarbonization will require:

- 1. Increased energy incentives for LMI households,** particularly for multifamily buildings (5+ units), and the design of programs that include or can be stacked with funding for health, safety, and electric readiness upgrades.*
- 2. Expanded affordable housing funding.** For regulated affordable housing, existing programs must be expanded to require energy efficiency and electrification measures, in addition to health and safety measures. New programs are also needed to support comprehensive decarbonization retrofits in unregulated affordable housing that will prevent costs from being passed through to LMI renters.**
- 3. City funds to complement state and federal funding sources.** Although new state and federal funding is on the way, a growing number of cities are raising their own funds, which is critical to provide a stable funding stream that will support equitable building decarbonization over the long-term.

*Energy efficiency retrofit costs for low-income homes of 1-4 units are currently estimated to be fully covered by existing programs.

**Regulated affordable housing refers to housing that receives an explicit government subsidy and has regulated rents, while unregulated affordable housing does not receive any subsidies or have any regulations governing its rental levels yet is lower cost than other properties due to location, property characteristics, and/or amenities.

Berkeley Funding Gap Analysis: Phase 1

Analysis of Total Costs



Phase 1 | Analysis of Total Costs

1. Cost Analysis

What is the cost to equitably decarbonize Berkeley's housing?

2. Existing Funds

What funding sources exist that cover relevant costs?

3. Gap Analysis

What is the gap remaining in costs currently being covered?

4. Opportunities

What are other ways a city can raise funds to support this transition?

Overview of Berkeley's Building Stock

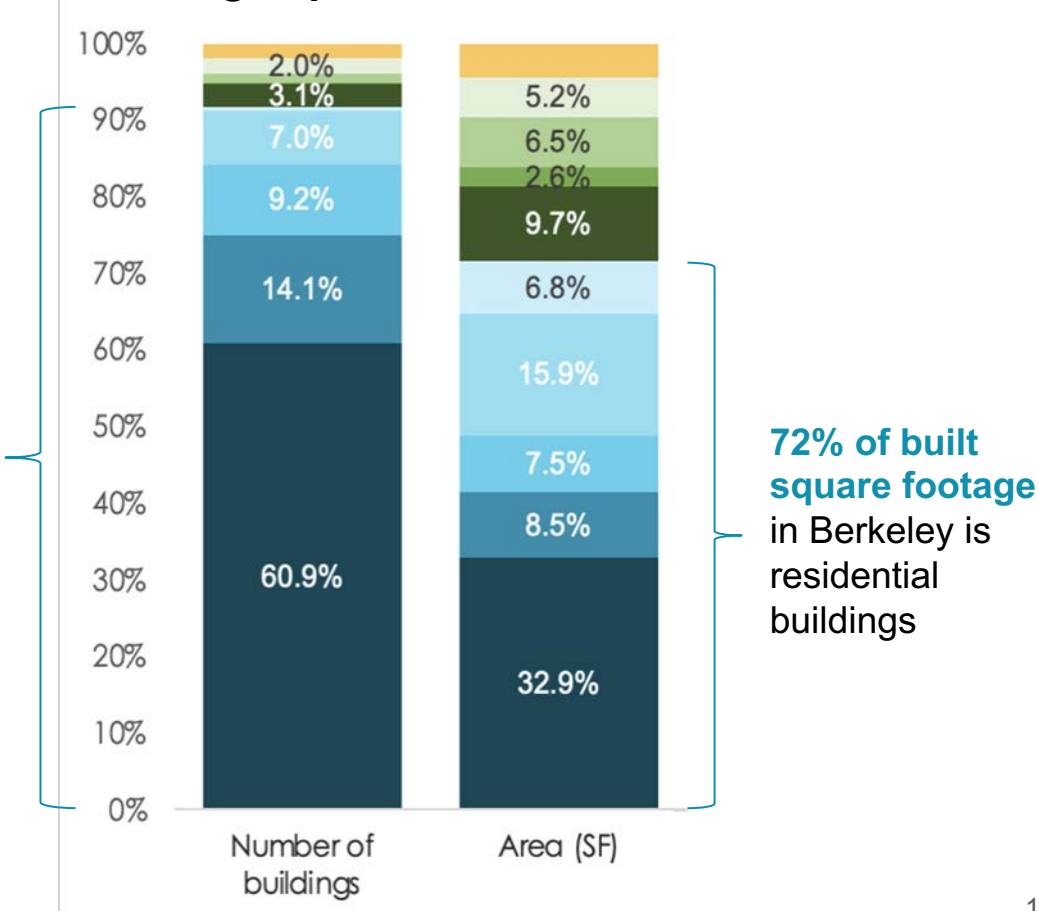
This analysis focuses on residential buildings, which account for over 90% of Berkeley's building stock and roughly 70% of built square footage.

Summary of Building Typologies

Typologies	Number of Units	Number of Stories	Total buildings*	Total square feet (SF)
1 Commercial, low rise	Any	Up to 3	1,083	8,279,496
2 Commercial, mid-high rise	Any	4+	38	2,268,880
3 Industrial	Any	Any	426	5,567,934
4 Institutional (non-residential)*	Any	Any	720	4,476,671
5 Single family homes	1	Up to 3	21,582	28,200,352
6 Duplexes	2	Up to 3	5,013	7,253,688
7 3-4 family homes	3-4	Up to 3	3,246	6,428,229
8 5+ unit multifamily, low rise	5+	Up to 3	2,476	13,620,735
9 5+ unit multifamily, mid-high rise	5+	4+	182	5,797,275
Missing Data	n/a	n/a	666	3,794,381
TOTAL			35,432	85,687,641

92% of buildings in Berkeley are residential and 61% are single family homes

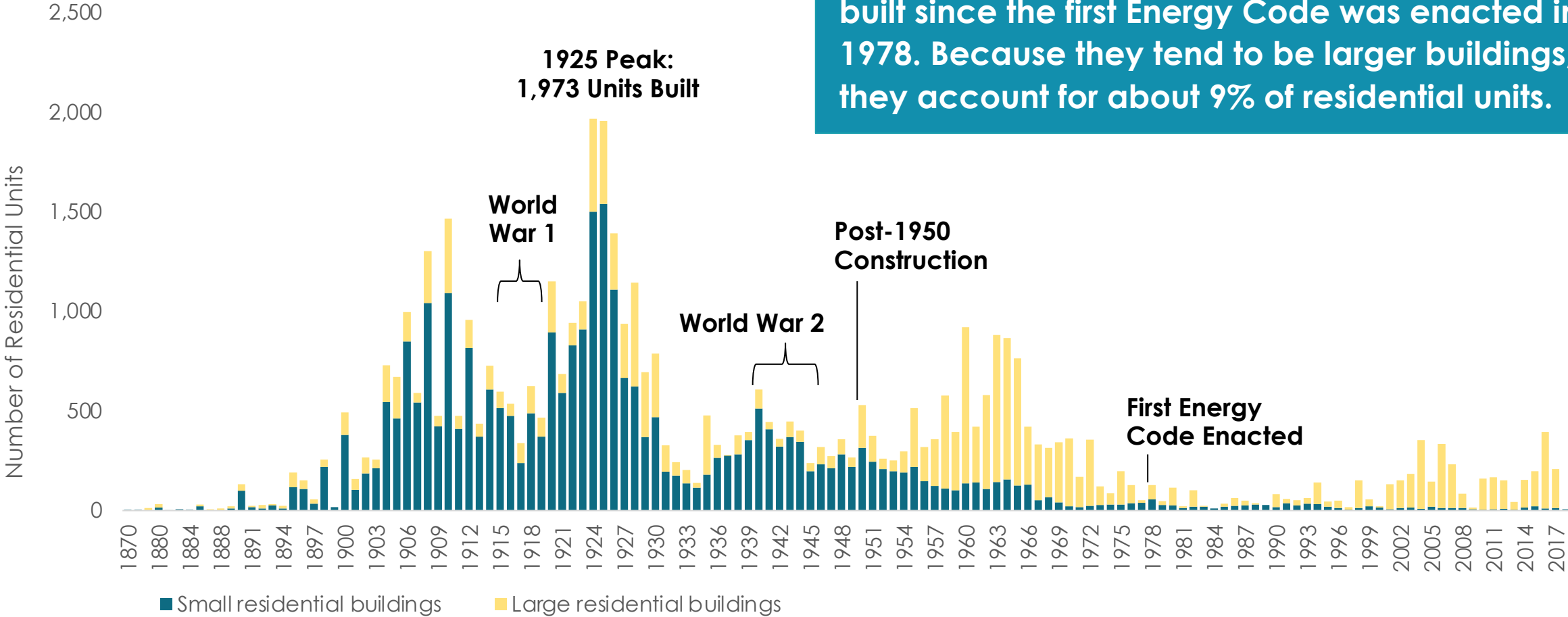
Buildings by Count and Area



Source: Building inventory developed by BEI for [Berkeley's Building & Housing Stock Analysis](#), which summarized data from County tax assessor, BESO energy disclosure and CoStar data.

Overview of Berkeley's Building Stock

Residential Units, Year Built

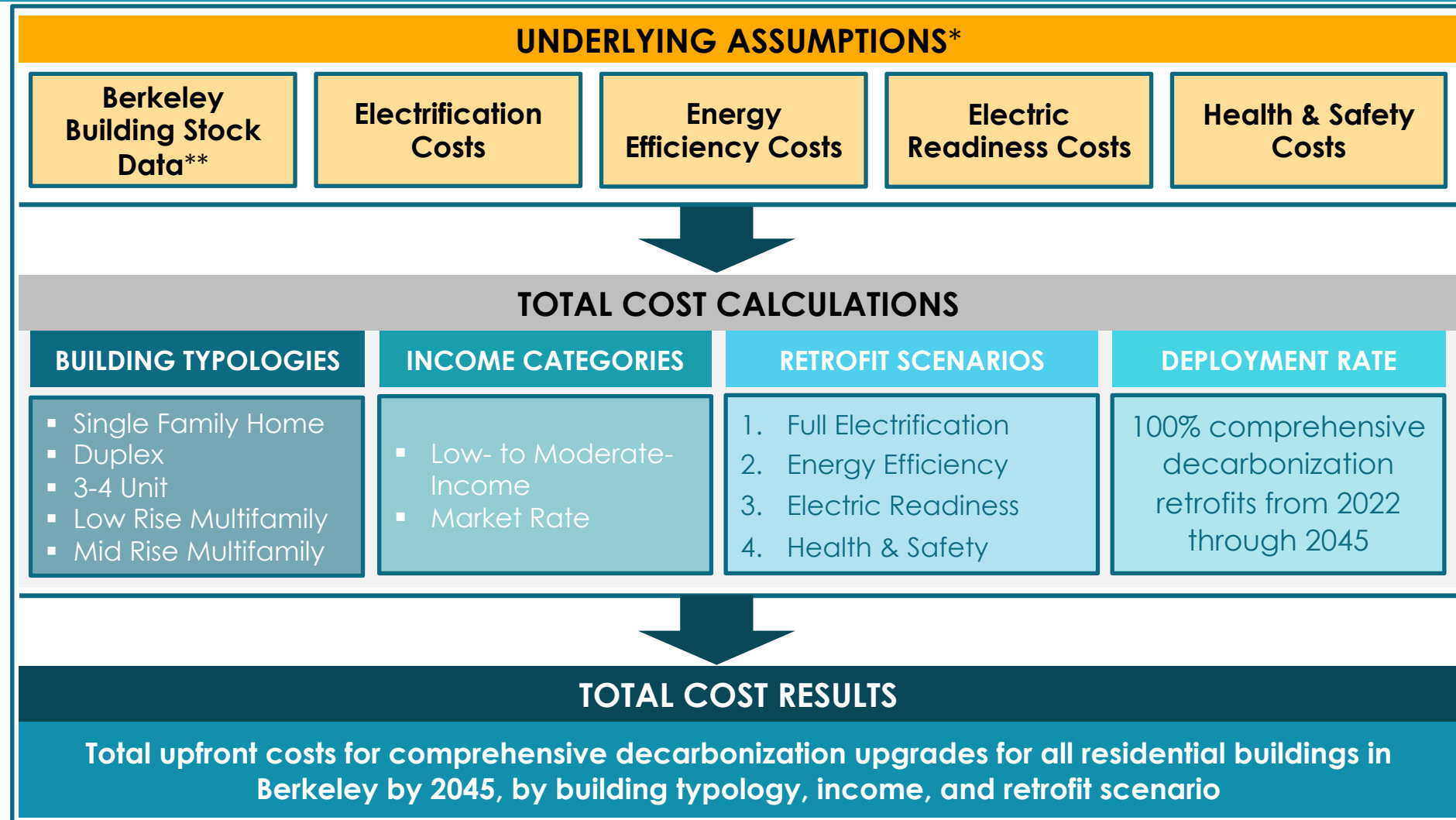


Only 3% of Berkeley's residential buildings were built since the first Energy Code was enacted in 1978. Because they tend to be larger buildings, they account for about 9% of residential units.

Total Cost Modeling | Methodology Overview

Explanation of Total Cost Modeling Methodology

This analysis collected cost assumptions for five building typologies, separated by two income categories, and included four comprehensive decarbonization upgrade scenarios (which are defined further on slides 21-22).* The total cost results represent a deployment rate of achieving 100% residential building decarbonization by 2045.

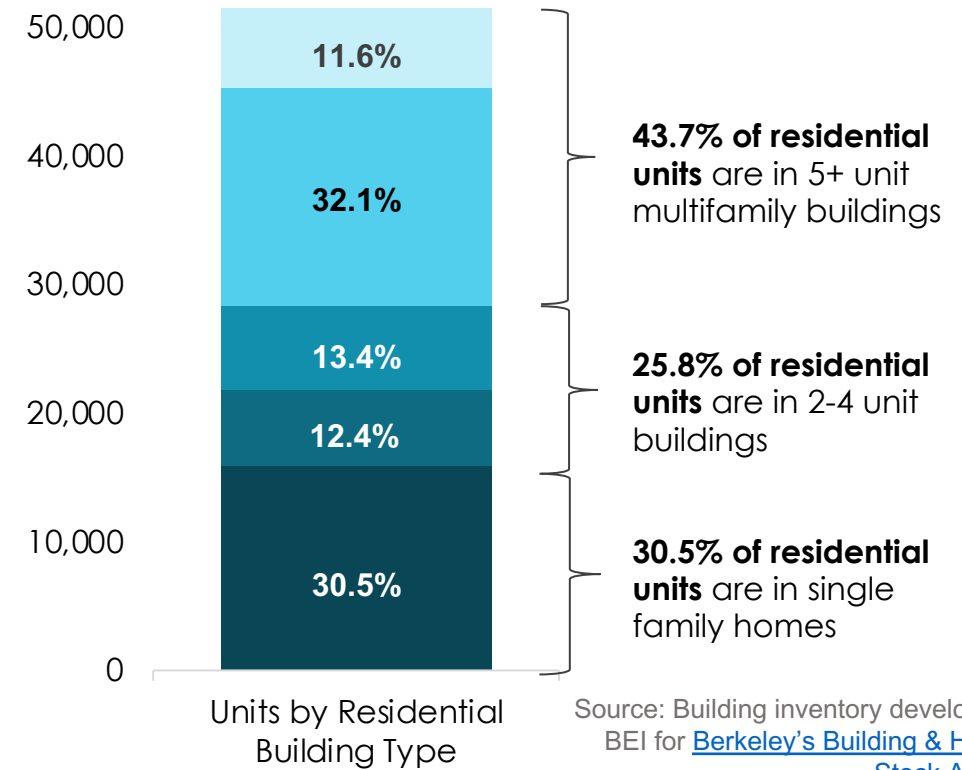
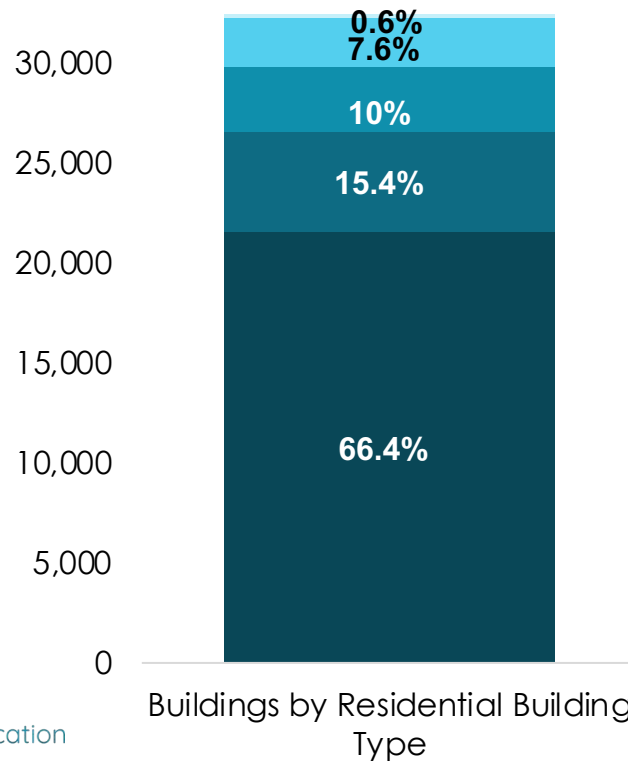


Total Cost Modeling | Building Typologies

There are just over 27,000 residential buildings in Berkeley. Nearly two-thirds are single family homes, which account for just under one-third of total residential units, with the remainder in duplexes, 3-4 family homes, and multifamily buildings.

Residential Buildings and Units by Building Type

- 5+ multifamily, mid- high-rise
- 5+ multifamily, low rise
- 3-4 Family Home
- Duplex
- Single Family Home



Total Cost Modeling | Income Categories

Building Typology by Income Category

Building Type	# of Buildings	Low-Income (LI)	Moderate-Income (MI)	TOTAL: Low- to Moderate-Income (LMI)
Single Family Homes	16,156	8%	36%	44%
Duplexes	5,013	18%	51%	69%
3-4 family homes	3,246	23%	60%	83%
Low Rise Multi-Family	2,476	33%	51%	84%
Mid Rise Multi-Family	182	60%	25%	85%
Total	27,073			
Total LMI Buildings	15,496			
Total Market Rate Buildings	11,577			

Overview of Approach: Residential buildings were broken down into income categories using demographic data by census tract. This is an important distinction given the reality that buildings serving LMI residents may have different retrofit needs, and therefore different total costs, than market rate buildings, and because they may need different types of financial support to cover these costs.

Income levels were defined in this analysis as follows, based on available data and assumptions:

- **Low-income (LI)** is defined as a household earning less than 200% of Federal Poverty Level (FPL), approximately \$52,000 for a family of four in Berkeley in 2019.
- **Moderate-income (MI)** is defined as households earning more than 200% of the FPL but less than 80% area median income (AMI), approximately \$89,000 for a family of four in Berkeley in 2019.
- **Low- to Moderate-income (LMI):** To calculate the total gross costs, this analysis assumed that LI and MI housing would have similar needs and combined the costs into an “LMI” category.
- **Medium- to high-income** is defined as households earning more than 80% of AMI and assumed to be living in market rate housing.

Total Cost Modeling | Retrofit Scenarios

The four retrofit scenarios used for total cost modeling are defined in the table below.

Scenario	Retrofits Included	Methodology
Full Electrification	<p>Heat Pumps to replace fossil fuel fired HVAC system – assumed variable speed ASHP</p> <p>Heat Pump Water Heating – Assumed 80 gallon</p> <p>Electric Cooktop – assumed induction</p> <p>Electric Clothes Dryer – assumed heat pump technology, not electric resistance</p>	<ul style="list-style-type: none"> • Cost assumptions adopted from E3's Residential Building Electrification in CA study ("E3 Study") for single family homes and low-rise multifamily buildings, and RMI's analysis from Berkeley's Existing Building Electrification Strategy (BEBES). Adjustments made to assumptions based on Association for Energy Affordability (AEA) experience implementing Bay Area retrofits as program service providers. • Included 25% cost increase to account for unforeseen implementation costs and potentially higher labor costs in the future under a high road labor strategy, per AEA recommendation. • Assumed slight decrease in electrification capital costs over 20 years based on NREL analysis.
Energy Efficiency	<p>Air Sealing</p> <p>Insulation</p>	<ul style="list-style-type: none"> • Cost assumptions adopted from E3 Study and BEBES Analysis. Adjustments made based on AEA's experience implementing Bay Area retrofits as program service providers.
Electric Readiness	<p>Electrical Panel Upgrades</p> <p>Knob and Tube Replacement</p>	<ul style="list-style-type: none"> • Knob and tube wiring replacement costs and prevalence by building type estimated from interviews with Berkeley electricians and City's Housing Department
Health and Safety	<p>Basic Retrofit: Smoke detectors, ventilation improvements, pest infestations, asthma triggers, and slip and fall hazards.</p> <p>Deep Structural Retrofit: Electrical repairs, fire hazards, indoor air quality, roof repairs, and other structural defects in the home</p>	<ul style="list-style-type: none"> • Estimates adopted from national industry assumptions about upgrade costs in LMI residential buildings. Adjusted based on input from AEA and City's Housing Department on prevalence and severity of health and safety issues by building type

Total Cost Modeling | Retrofit Scenarios

Health & Safety Retrofits: Why were these costs included?

- **Many homes must first address health and safety repairs first** before energy efficiency and electrification retrofits can be implemented. For example, mold and asbestos may need to be remediated before installing new equipment in various parts of the building, or the roof may need to be replaced to ensure structural soundness before installing new equipment.
- **Low- and moderate-income households typically have a higher prevalence of health and safety upgrade needs** than market rate homes.*
- **Anywhere between 20% and 60% of program applicants may be deemed ineligible for energy incentive programs**, including both federal weatherization and utility incentives programs, because they must first address health and safety repairs, which perpetuates existing inequities.**
- **Berkeley's Existing Building Electrification Strategy (BEBES) prioritizes equitable building decarbonization** and sets guidelines that that the City prioritize its support for homes that have the highest need.***

*Estimates adopted from national industry assumptions about upgrade costs in LMI residential buildings, and adjusted based on input from AEA and City's Housing Department on prevalence and severity by building type.

**Source: Benshoff, L. 2022. "A low-income energy-efficiency program gets \$3.5B boost, but leaves out many in need." National Public Radio. May 13, 2022.

***November 2021. [Berkeley's Existing Building Electrification Strategy](#)

Total Cost Modeling | Deployment Rate

Baseline growth rate (dark blue line) achieves Berkeley's decarbonization goals:

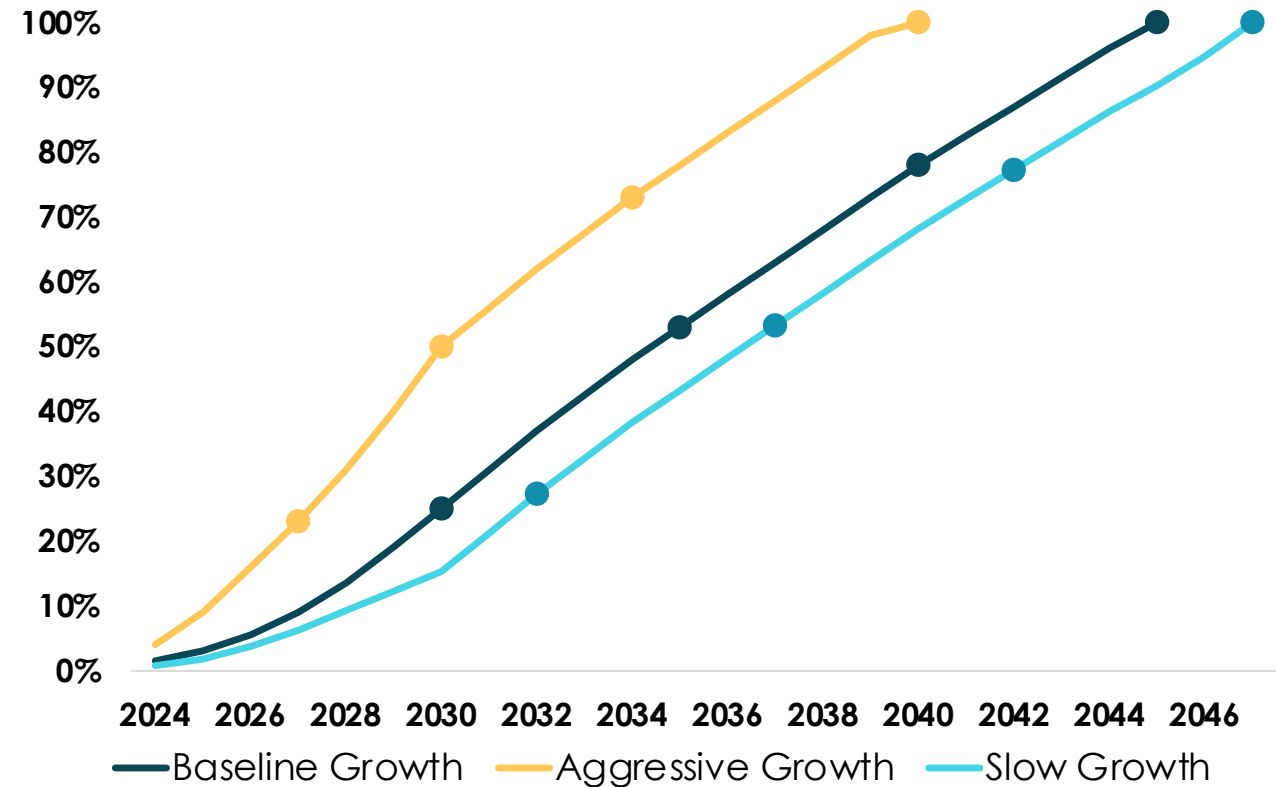
- 25% of buildings by 2030
- 75% of buildings by 2040
- 100% of buildings by 2045

Alternative growth rates:

- **Aggressive growth rate** (gold line) achieves 50% building decarbonization by 2030.
- **Slow growth rate** (light blue line) ramps up more slowly and only achieves 90% decarbonization by 2045.

The baseline growth rate was used for cost calculations, while the alternatives allow for comparison of policy options.

Comparison of Three Considered Deployment Rates



Total Cost Modeling | Deployment Rate

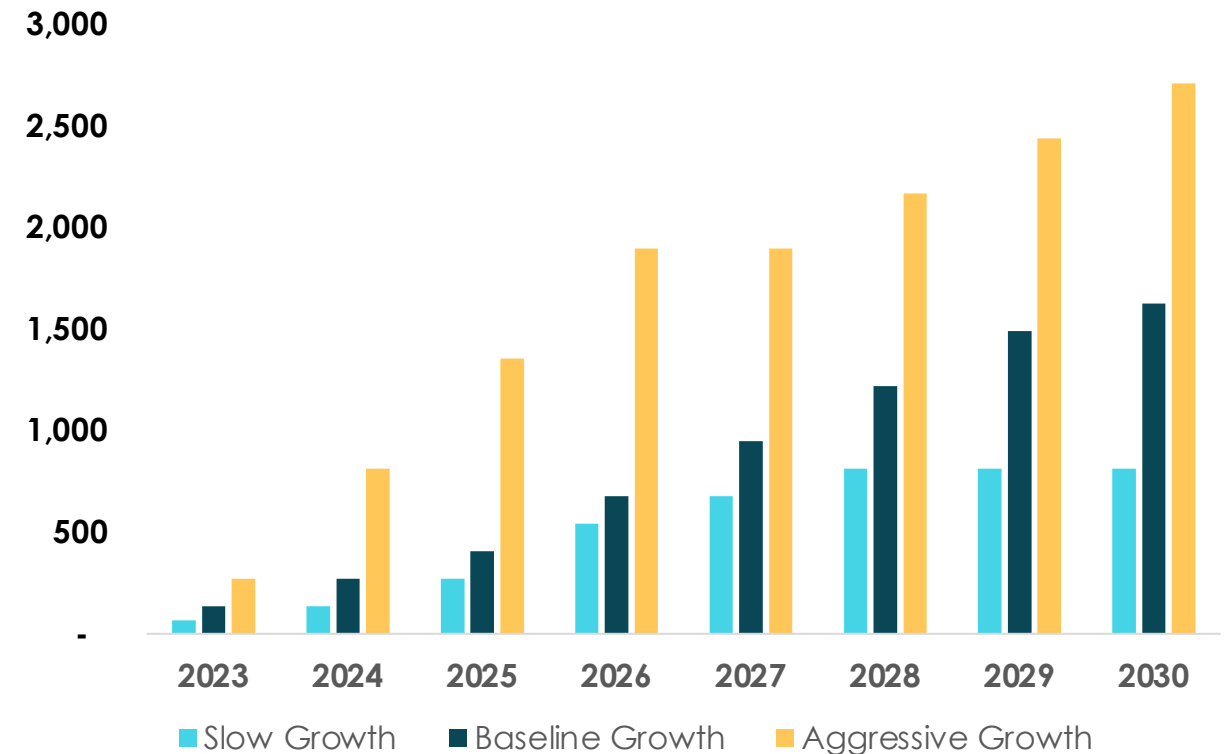
Under the baseline deployment rate:

- 1,500 residential buildings in Berkeley will be retrofitted annually by 2030.
- Deployment rate gradually drops to achieve 100% retrofitted by 2045.

Under the aggressive deployment rate:

- Requires more than 2,500 residential retrofits annually by 2030.
- Deployment rate increases quickly to achieve 50% of retrofits by 2030, then slowly decreases to achieve remaining 50% from 2030-2040.

Number of Buildings Retrofitted Annually by Deployment Rate, 2023-2030



Total Cost Modeling | Summary of Cost Assumptions

The average retrofit costs per unit across the residential building types are included below:

Building Typology	Retrofit Scenario	Income	Cost per Unit
Single Family Homes	Full Electrification	Both	\$33,970
	Energy Efficiency	Both	\$5,170
	Electric Readiness*	Both	\$8,130
	Health & Safety*	LMI Avg	\$10,125
Market Rate Avg		\$875	
Duplex	Full Electrification	Both	\$20,075
	Energy Efficiency	Both	\$3,300
	Electric Readiness*	Both	\$7,855
	Health & Safety*	LMI Avg	\$6,470
Market Rate Avg		\$670	

Building Typology	Retrofit Scenario	Income	Cost per Unit
3-4 Unit Building	Full Electrification	Both	\$20,405
	Energy Efficiency	Both	\$3,100
	Electric Readiness*	Both	\$9,280
	Health & Safety*	LMI Avg	\$6,075
Market Rate Avg		\$630	
Low Rise Multifamily	Full Electrification	Both	\$20,405
	Energy Efficiency	Both	\$2,475
	Electric Readiness*	Both	\$7,700
	Health & Safety*	LMI Avg	\$5,000
Market Rate Avg		\$875	

Building Typology	Retrofit Scenario	Income	Cost per Unit
Mid Rise Multifamily	Full Electrification	Both	\$19,155
	Energy Efficiency	Both	\$3,135
	Electric Readiness*	Both	\$7,075
	Health & Safety*	LMI Avg	\$5,000
Market Rate Avg		\$875	

Overview of Approach: This analysis assumes that 100% of residential buildings will need full electrification and energy efficiency upgrades. However, for the electric readiness and health and safety scenarios, the assumed retrofit need varies. See next slide for details on those two scenarios.

*Given the cost assumptions for these retrofit scenarios vary by level of need (see next slide), these totals reflect the average cost of these retrofit scenarios for each building type.

Total Cost Modeling | Summary of Cost Assumptions

Electric Readiness Assumptions, Knob & Tube Replacement Need by Building Type

Knob & Tube Replacement	Single Family Homes	Duplex	3-4 Units	Low Rise Multifamily	Mid Rise Multifamily
100% Needed*	5%	10%	15%	10%	10%
50% Needed	15%	20%	30%	25%	20%
10% Needed	30%	40%	35%	30%	35%
0% Needed	50%	30%	20%	35%	35%

Assumes 80% of all building types would need panel upgrades, based on BEBES analysis (see slide 21 for more details). Assumptions do not differentiate by income category.

Health & Safety Assumptions, Retrofit Need by Building Type and Income Category

Income Category	Retrofit Package	Single Family Homes	Duplex	3-4 Units	Low Rise Multifamily	Mid Rise Multifamily
Low- to Moderate-Income	Deep Retrofit	25%	25%	30%	30%	25%
	Basic Retrofit	75%	75%	70%	70%	75%
Market Rate	Deep Retrofit	0%	0%	0%	0%	0%
	Basic Retrofit	25%	30%	30%	35%	35%

*This table includes estimates of the portion of each building typology that will need 100% of the knob and tube system replaced, only 50% replaced, 20% replaced, or no knob and tube replacement needed. For example, it is estimated that 5% of SFHs will need 100% replacement. See slide 21 for the sources of these estimates.

Total Cost Modeling | Results

Total upfront costs range from \$2–\$2.5 billion to decarbonize all of Berkeley’s residential buildings by 2045.

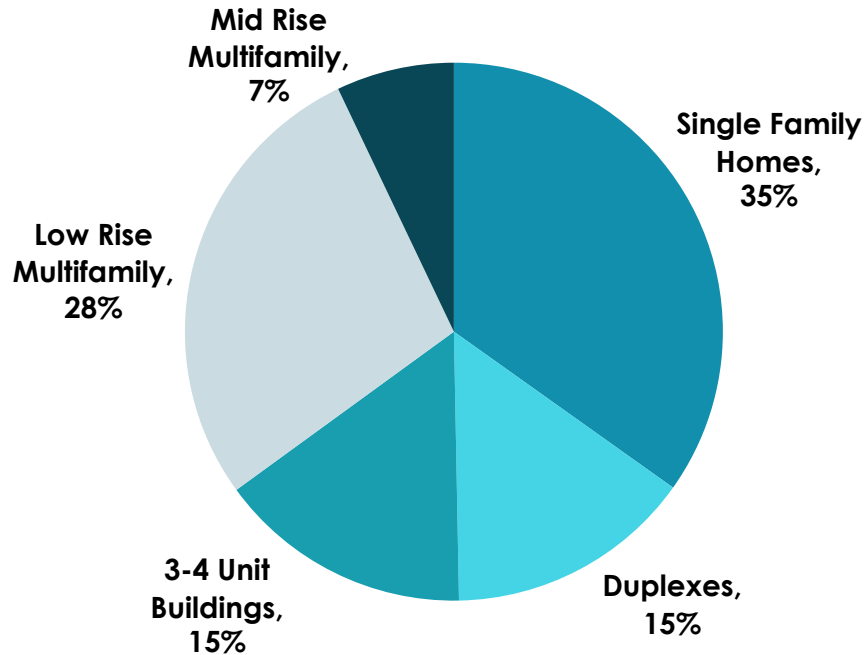
Total Costs – Baseline Deployment Rate (nominal 2022 \$ millions, rounded)

Retrofit Scenario	Single Family Homes	Duplexes	3-4 Unit Buildings	Low Rise MF	Mid Rise MF	Total Costs
Full Electrification	\$ 510	\$ 185	\$ 185	\$ 360	\$ 90	\$ 1,330
Energy Efficiency	\$ 85	\$ 35	\$ 30	\$ 50	\$ 15	\$ 215
Electric Readiness	\$ 120	\$ 70	\$ 85	\$ 135	\$ 35	\$ 445
Health & Safety	\$ 80	\$ 45	\$ 50	\$ 85	\$ 20	\$ 280
Total	\$ 795	\$ 335	\$ 350	\$ 630	\$ 160	\$ 2,270

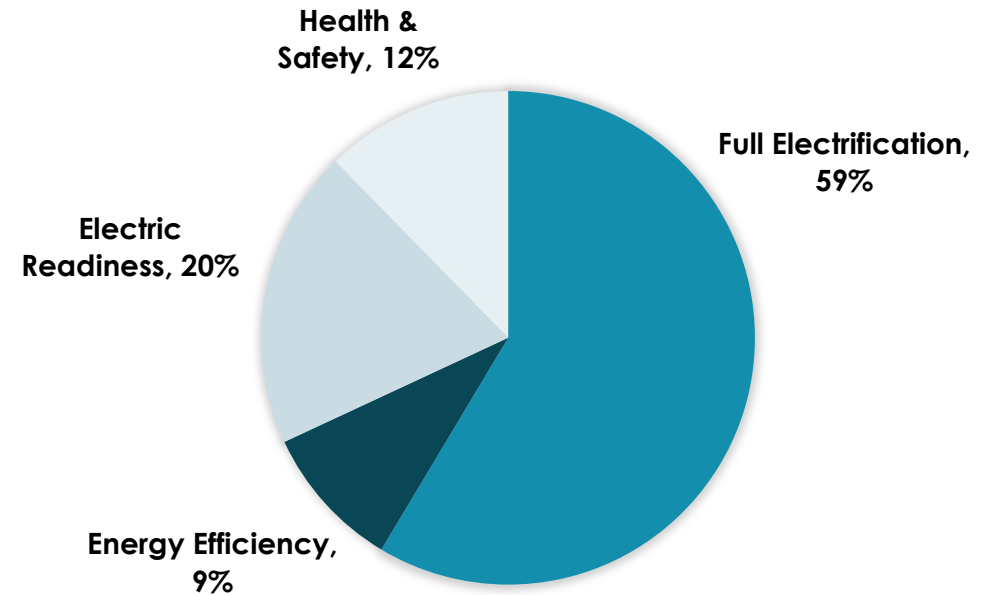
Total Cost Modeling | Results

Single family homes account for the greatest total citywide costs, which is roughly proportional to the number of single family units in Berkeley. Full electrification upgrades account for the greatest proportion of total retrofit costs.

Total Citywide Retrofit Costs by Building Typology



Total Citywide Retrofit Costs by Retrofit Scenario



Total Cost Modeling | Key Takeaways

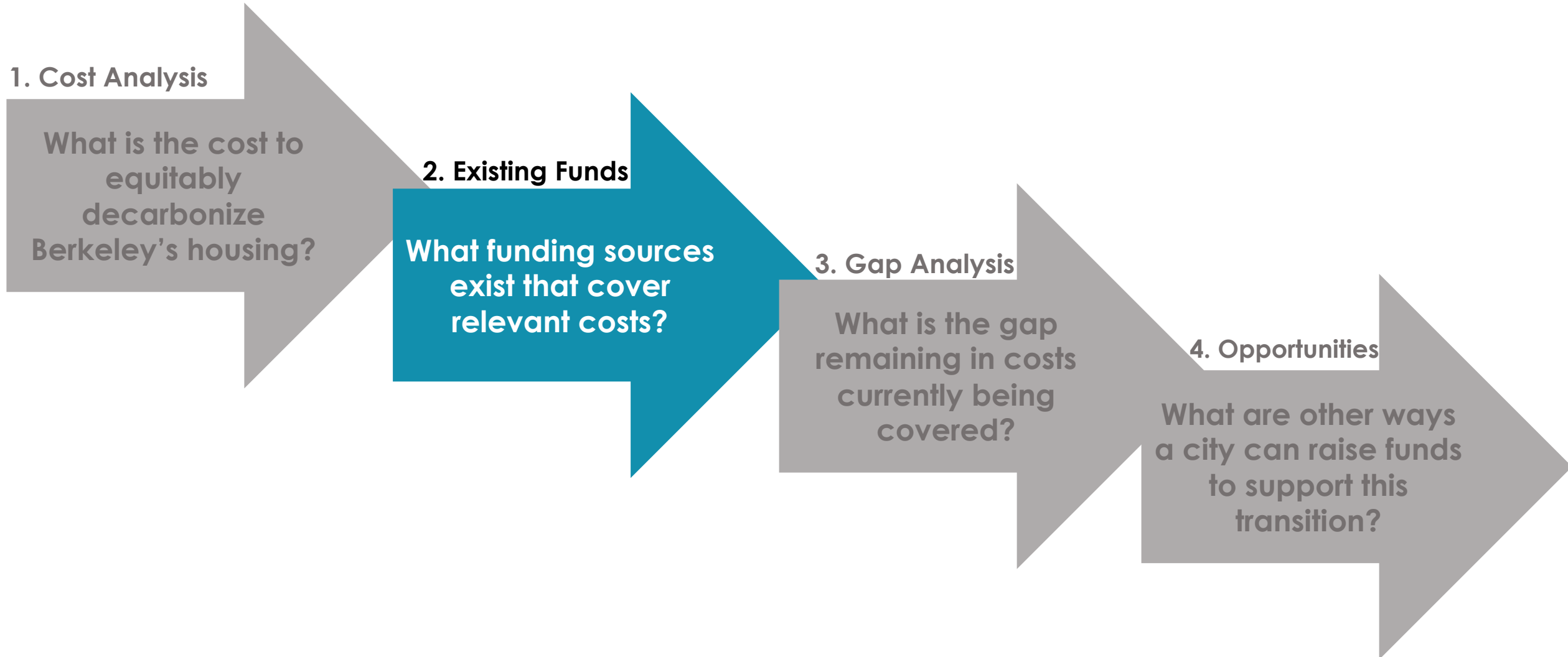
- **The cost assumptions and results are based on best available data, reports, and industry interviews**, but may shift over time as decarbonization efforts progress.
- **The analysis assesses total investment costs, rather than incremental costs compared to gas equipment replacements**, because some upgrades may not align with natural replacement cycles and certain building owners will likely need help covering the total costs of upgrades.
- **Electrification upgrades are the primary driver of total decarbonization costs, accounting for 59% of total citywide costs** to decarbonize Berkeley's residential buildings.
- **Electric readiness work is also a major cost contributor, representing 19% of total costs.** Electric panel upgrades* and replacement of knob and tube wiring account for roughly equivalent costs citywide.
- **Health and safety costs contribute significantly at 13% of total citywide costs.** This includes minor upgrades such as ventilation improvements, asthma hazards, and fall prevention, as well as structural retrofits that may be necessary in some buildings, such as roof repairs.
- **Costs by building typology are roughly proportional to their percentage of residential units within Berkeley.** Single family homes account for 30% of Berkeley's residential units and 35% of total costs, while low rise multifamily account for 32% of residential units and 28% of total costs.

Berkeley Funding Gap Analysis: Phase 2

Identification of Existing Funding Streams



Phase 2 | Identification of Existing Funding



Existing Funding | Methodology Overview

Phase 2: Identification and Analysis of Existing Funding Sources

Step 1

Identify existing local, regional, state, and federal funding sources that are available to cover costs across the four retrofit scenarios

Step 2

Analyze programs by implementation model, income eligibility, and ability to be stacked

Step 3

Conduct interviews with several program implementers and service providers to ground truth eligibility criteria, stacking rules, practical implementation realities, and existing barriers

Step 4

Categorize promising funding opportunities

Existing Funding | Methodology Overview

To identify and categorize existing funding sources, the BEI team:

- **Documented 33 programs** across the local, state, regional, and federal levels that were available as of July 2022. Not all programs documented were relevant or reliable as funding streams for the purpose of our analysis, but the BEI team retained all programs in a master list for future reference.*
- **Categorized programs as “promising” if:**
 - Program had a firm approved funding stream
 - Program funded eligible activities for decarbonization (i.e., full electrification, energy efficiency, electric readiness, or health and safety)
 - Berkeley households were eligible
 - Program deemed “usable” and “accessible” by on the ground contractors
- **Conducted six interviews** with key stakeholders active in Bay Area decarbonization projects, including the California Energy Commission, BayREN, StopWaste, and Green and Healthy Homes Initiative. Interviews helped identify relevant programs, how funding streams work for end users, whether funding streams can be combined or “stacked” (which is relatively uncommon), and other recommendations for improvement.

Existing Funding | Promising Incentive Programs

Funding Source*	Program Overview	Funding Source	Building Type	LMI Prioritized?	Comments
BayREN's Home+	Offers cash rebates for technology specific incentives to electrify and for certain energy efficiency measures.	Regional	1-4 Units	No	Importantly, it can be layered with TECH, another program providing substantial electrification incentives.
BayREN's Bay Area Multifamily Building Enhancement (BAMBE)	Provides multi-family building owners with technology specific incentives to electrify and for certain energy efficiency measures.	Regional	MF	Yes	Importantly, it can be layered with TECH, another program providing substantial electrification incentives.
Technology and Equipment for Clean Heating (TECH) Initiative	Provides generous incentives to both single family and multi-family homes and provides funding for panel replacements.	State	SFH + MF	TBD	Note that BEI's analysis was completed in early 2022 before market rate TECH incentives were largely depleted and reduced. Incentive amounts listed in this presentation reflect the first round of TECH incentive amounts.
PG&E's Energy Savings Assistance (ESA) Program	Provides weatherization and energy efficiency services to low-income households in multifamily buildings.	Utility	MF	Yes	Based on industry interviews, this program is currently cumbersome and difficult to use optimally, although is currently being redesigned.

Existing Funding | Relevant Competitive Grants

Berkeley can supplement existing funding streams for decarbonization with competitive grants. Many will require partnership with other city agencies or local community organizations.

Grant Source*	Program Overview	Funding Source	LMI Prioritized?	Comments
Choice Neighborhood Planning and Implementation grants (HUD)	HUD program can fund both the planning and implementation of affordable housing new construction and rehabilitation projects, inclusive of energy efficiency and renewable energy measures.	Federal	Yes	Eligible applicants for implementation grants include a Public Housing Agency (PHA), local government, or tribal entity as a lead applicant, with non-profit or for-profit developers eligible as co-applicants.
Healthy Homes Production Program (HUD)	HHP program provides successful applicants with funding to address multiple environmental and health related hazards within low-income rental and/or owner-occupied housing.	Federal	Yes	The HHP program can fund the identification of health-related housing issues and remediation activities in the home, based on HUD's Healthy Homes Principles. This includes but is not limited to: water leaks, holes in floors, signs of pests, and dangerous electrical wiring).
Lead Hazard Control Programs (HUD)	The Lead-Based Paint Hazard Control (LBPHC) Grant Program and the Lead Hazard Reduction Grant (LHR) Program provide support for the remediation of lead-based paint hazards within privately owned rental and/or owner-occupied housing	Federal	Yes	Applicants can apply for HHP supplemental funding to address health and safety hazards outside of lead-based hazards.

*Grant sources as of July 2022. Additional federal funding is likely to become available after this date.

Existing Funding | Relevant Competitive Grants (Cont.)

Grant Source*	Program Overview	Funding Source	LMI Prioritized?	Comments
Affordable Housing and Sustainable Communities Program	Funded by the state of California's cap-and-trade revenues to invest in land-use, housing, transportation, and land preservation projects to support infill and compact development that reduce greenhouse gas (GHG) emissions	State	Yes	An additional \$300 million in funding was outlined within the Governor's Budget Proposal, released in January 2022, for the California 2022 State Budget.
CA Air Resource Board Supplemental Environmental Projects (SEPs)	SEPs must improve public health, reduce pollution, increase environmental compliance, and bring public awareness to neighborhoods most burdened by environmental harm.	State	Yes	This is a program funded by penalty payments, and thus the amount of funding for the competitive grant opportunity varies.
TECH Quick Start Grants	Quick Starts Grants (QSG) provide funding to localized projects that seek to implement innovative strategies in deploying heat pump space and water heating technologies.	State	Likely	Eligibility for the second round of QSG funding has yet to be determined. It is expected that the application for QSG funding will be released during the summer of FY22, between June-July.
Transformative Climate Communities (TCC)	The TCC program funds projects that aim to reduce greenhouse gas emissions, improve public health and environmental benefits, and expand economic opportunity within an eligible community.	State	Yes	Projects focusing on solar installation, energy efficiency, and appliance electrification are eligible for funding.

*Grant sources as of July 2022. Additional federal funding is likely to become available after this date.

Existing Funding | Sources with Limited Applicability

For this analysis, the team identified several additional sources of funding but relied less heavily on them because of their limited applicability in Berkeley. These included:

- **Low Income Weatherization Program (LIWP):** Very flexible and useful program for low-income multifamily retrofits, however buildings are only eligible if they are located in state-designated Disadvantaged Communities. Only one census tract in Berkeley currently qualifies for this designation, meaning this program will have limited reach.
- **Weatherization Assistance Program (WAP), including additional funds from the Low-Income Energy Assistance Program (LIHEAP):** This federal program provides funding to weatherize low-income households, but has limited total available funding (even in economic recovery years such as 2021 and 2009). It is also challenging to implement in multifamily buildings due to onerous income limits and verification requirements.
- **Go Green Financing and other financing programs:** While financing programs can be helpful in providing access to low-cost financing or longer-termed financing products for market rate buildings, the BEI team did not assume financing is a viable way to fund LMI building retrofits.

Existing Funding | Key Takeaways

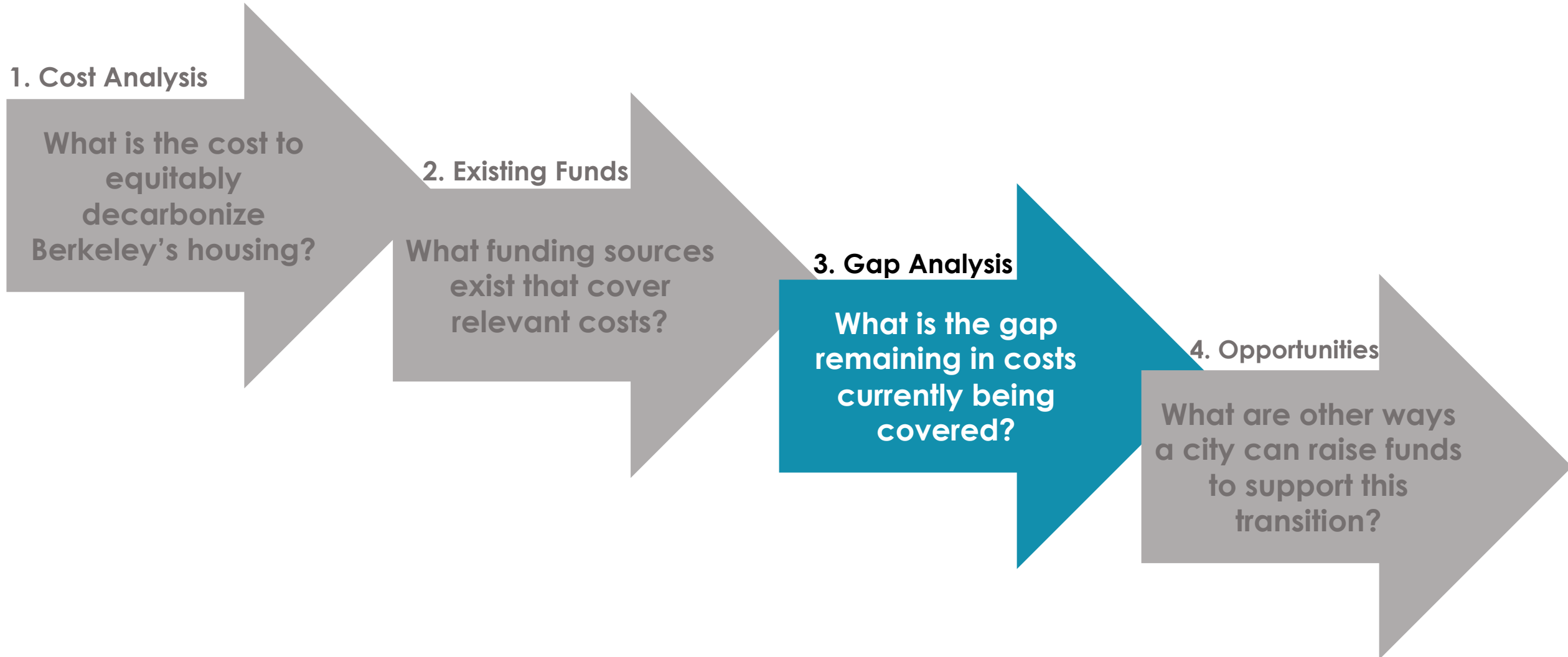
- **There are many funding sources for energy efficiency and full electrification retrofits in the Bay Area**, although programmatic rules about not “double-dipping” sources limits how often these incentives can be combined.
- **Significantly fewer sources of funding exist for health and safety repairs** that are often required before completing efficiency and electrification upgrades. The programs that do exist generally fund the development and maintenance of affordable housing and homeless services, which are often under-funded and in high demand. In order to pursue these funds for decarbonization retrofits, City sustainability staff will need to coordinate with their local housing department staff.
- **There is no funding to upgrade knob and tube wiring**, which is prevalent in Berkeley’s older building stock and is a critical precursor for full home electrification.
- **There are many moderate-income households*** in CA who may not be able to afford the costs of retrofits to their homes, yet they are also not eligible for many low-income programs.

Berkeley Funding Gap Analysis: Phase 3

Gap Assessment and Net Cost Analysis



Phase 3 | Gap Analysis and Calculation of Net Costs



Gap Analysis | Methodology Overview

Phase 3: Funding Mapping and Gap Analysis

Step 1

Map funding programs onto building type, income category, and retrofit scenario

Step 2

Calculate optimal combination of existing, stackable funding sources, by building type, income category, and retrofit scenario

Step 3

Calculate the total remaining funding needed to decarbonize Berkeley's residential buildings by building type, income category, and retrofit scenario

Step 4

Determine the percentage of costs that public funding should cover, by income category, to ensure equitable access to electrification

Gap Analysis | Step 1: Mapping

Explanation of Mapping Methodology

The Project Team analyzed the rules and documentation for each program to identify eligibility across income, retrofit types or technology, and geography, as well as any caps on the amount of funding available. This process was also informed by AEA’s expertise implementing these programs in the Bay Area.*

Example of Mapping Funding Sources to Retrofit Scenario, Building Typology, and Income Category

	Applicable Scenarios	1-4 units		Low Rise MF		Mid Rise MF	
		Market	LI	Market	LI	Market	LI
Energy Programs							
LIWP	Electrification, Energy Efficiency	N	N	N	Y	N	Y
Bayren Home +	Electrification, Energy Efficiency	Y	Y	N	N	N	N
Bayren BAMBE	Electrification, Energy Efficiency	N	N	Y	Y	Y	Y
PG&E ESA	Energy Efficiency	N	N	N	Y	N	Y
Federal WAP	Energy Efficiency	N	Y	N	Y	N	Y
PG&E Multifamily Energy Saving Program (MESP)	Electrification	N	N	Y	Y	Y	Y
TECH	Electrification	Y	Y	Y	Y	Y	Y
Housing Programs							
HOME	Health & Safety, Electric Readiness	N	Y	N	Y	N	Y
CDBG	Health & Safety, Electric Readiness	N	Y	N	Y	N	Y
Permanent Local Housing Allocation	Health & Safety, Electric Readiness	N	Y	N	Y	N	Y

*Given that most existing low-income programs set the income threshold at a household earning less than 200% of the FPL, moderate-income households do not qualify for these programs. Therefore, for the purpose of funding availability assessments, they were grouped in with market rate households rather than low-income households. See slide 20 for details on how each income category was defined.

Gap Analysis | Step 2: Calculate Optimal Combination

The BEI team then calculated the optimal combination of incentives for each building typology by:

- Reviewing program documentation and findings from interviews to determine how funding can be stacked.
- Averaging health and safety costs and knob and tube retrofit costs for each building typology.

Note: See slide 34 for details on TECH program, which now has lower incentive amounts since the analysis was completed.

Example of Calculating the Optimal Funding Combination for Mid-Rise Multifamily Buildings (rounded)*

Gross Costs - Mid Rise Multifamily		Applicable Funding Sources					
		Low-Income			Market Rate		
Full Electrification		MESP	TECH	BAMBE	MESP	TECH	BAMBE
HVAC	\$ 251,830	\$14,000	\$56,000	\$28,000	\$14,000	\$56,000	\$28,000
Water Heating	\$ 140,000	\$8,400	\$50,400	\$28,000	\$8,400	\$50,400	\$28,000
Cooktop	\$ 72,240			\$9,800			\$9,800
Clothes Dryer	\$ 72,240			\$7,000			\$7,000
Total Cost	\$ 536,305	\$22,400	\$106,400	\$72,800	\$22,400	\$106,400	\$72,800
Remaining Gap		\$357,105			\$357,105		
Energy Efficiency		ESA	BAMBE		MESP	BAMBE	
Roof Insulation	\$ 39,920						
Air Sealing	\$ 47,910	\$56,000		\$21,000	\$2,800	\$21,000	
Total Cost	\$ 87,830						
Remaining Gap		\$31,830			\$66,830		
Electric Readiness		TECH			TECH		
Knob & Tube	\$ 78,960						
Panel Upgrade	\$ 119,170						
Total Cost	\$ 198,130						
Remaining Gap		\$158,930			\$158,930		
Health + Safety		HOME / CDBG	PLHA		HOME / CDBG	PLHA	
Average Market Rate	\$ 24,500	\$0		\$0	\$0		\$0
Average Low-Income	\$ 140,000	\$0		\$0	\$0		\$0
Remaining Gap		\$140,000			\$24,500		
TOTAL GAP FOR MID RISE MULTIFAMILY		\$687,860			\$607,360		

*See Appendix for details on all building typologies.

Gap Analysis | Step 3: Total Net Costs

All building types face a significant gap in funding for decarbonization upgrades, with a range of roughly \$20,000 to \$40,000 per unit.

Low income, single family homes face the highest funding gap per unit, while mid-rise multifamily buildings face the highest funding gap per building.

Total Gap in Costs Covered by Existing Programs per unit (rounded)

	Single Family Homes		Duplex		3-4 Unit		Low-Rise Multifamily		Mid-Rise Multifamily	
	Low-Income	Market	Low-Income	Market	Low-Income	Market	Low-Income	Market	Low-Income	Market
Full Electrification	\$ 26,400	\$ 26,400	\$ 25,000	\$ 25,000	\$ 38,400	\$ 38,400	\$ 112,000	\$ 112,000	\$ 357,100	\$ 357,100
Energy Efficiency	\$ -	\$ 2,700	\$ -	\$ 1,700	\$ -	\$ 1,900	\$ 3,800	\$ 13,800	\$ 31,800	\$ 66,800
Electric Readiness	\$ 5,300	\$ 5,300	\$ 10,100	\$ 10,100	\$ 19,400	\$ 19,400	\$ 50,400	\$ 50,400	\$ 158,900	\$ 159,000
Health & Safety	\$ 9,000	\$ 900	\$ 10,600	\$ 1,300	\$ 18,200	\$ 1,900	\$ 40,000	\$ 7,000	\$ 140,000	\$ 24,500
Total Gap per Building	\$ 40,700	\$ 35,300	\$ 45,700	\$ 38,100	\$ 76,000	\$ 61,600	\$ 206,200	\$ 183,200	\$ 687,800	\$ 607,400
Avg Gap per Unit	\$ 40,700	\$ 35,300	\$ 22,850	\$ 19,050	\$ 25,333	\$ 20,533	\$ 25,775	\$ 22,900	\$ 24,564	\$ 21,693

Gap Analysis | Step 4: Determine Cost Coverage

- The City of Berkeley’s priority is for **100% of retrofit costs to be covered for both low- and moderate-income (LMI) households.**
- **There are ~15,500 LMI residential buildings in Berkeley,** however it is possible that not all moderate-income households will need 100% of gap covered.
- This analysis **assumes that market rate households will be able to fund or finance retrofits without supplemental funding** above and beyond existing incentives and low-cost financing available through state and utility programs.

Building Typology by LMI Share

Building Type	# of Buildings	Low Income Buildings (<200% FPL)	Moderate Income Buildings (80% AMI; >200% FPL)	LMI Percentage of Total Building Typology
Single Family Homes	16,156	1,229	5,879	44%
Duplexes	5,013	894	2,565	69%
3-4 Units	3,246	757	1,937	83%
Low Rise Multifamily	2,476	806	1,274	84%
Mid Rise Multifamily	182	110	45	85%
Total	27,073	3,796	11,700	

Gap Analysis | Total Net Cost Results for LMI Buildings

Total Gap in Costs Covered for LMI Buildings (rounded billions of dollars)

Building Type	Low Income Buildings	Moderate Income Buildings	Total
Single Family homes	\$ 50.0	\$ 261.8	\$ 311.8
Duplexes	\$ 40.8	\$ 127.5	\$ 168.3
3-4 family homes	\$ 57.6	\$ 151.1	\$ 208.7
Low Rise Multi-Family	\$ 166.2	\$ 275.4	\$ 441.6
Mid Rise Multi-Family	\$ 75.7	\$ 32.3	\$ 108.0
Total	\$ 390.3	\$ 848.2	\$ 1,238.4

The total funding gap for LMI residential buildings ranges from **\$1.1 to \$1.4 billion by 2045**, or \$40-\$60 million annually through 2045.

The total gap for moderate-income buildings is nearly twice as high as the gap for low-income buildings.

This is because these buildings have similar retrofit needs, but are not eligible for many of the low-income incentives.

Gap Analysis | Key Takeaways

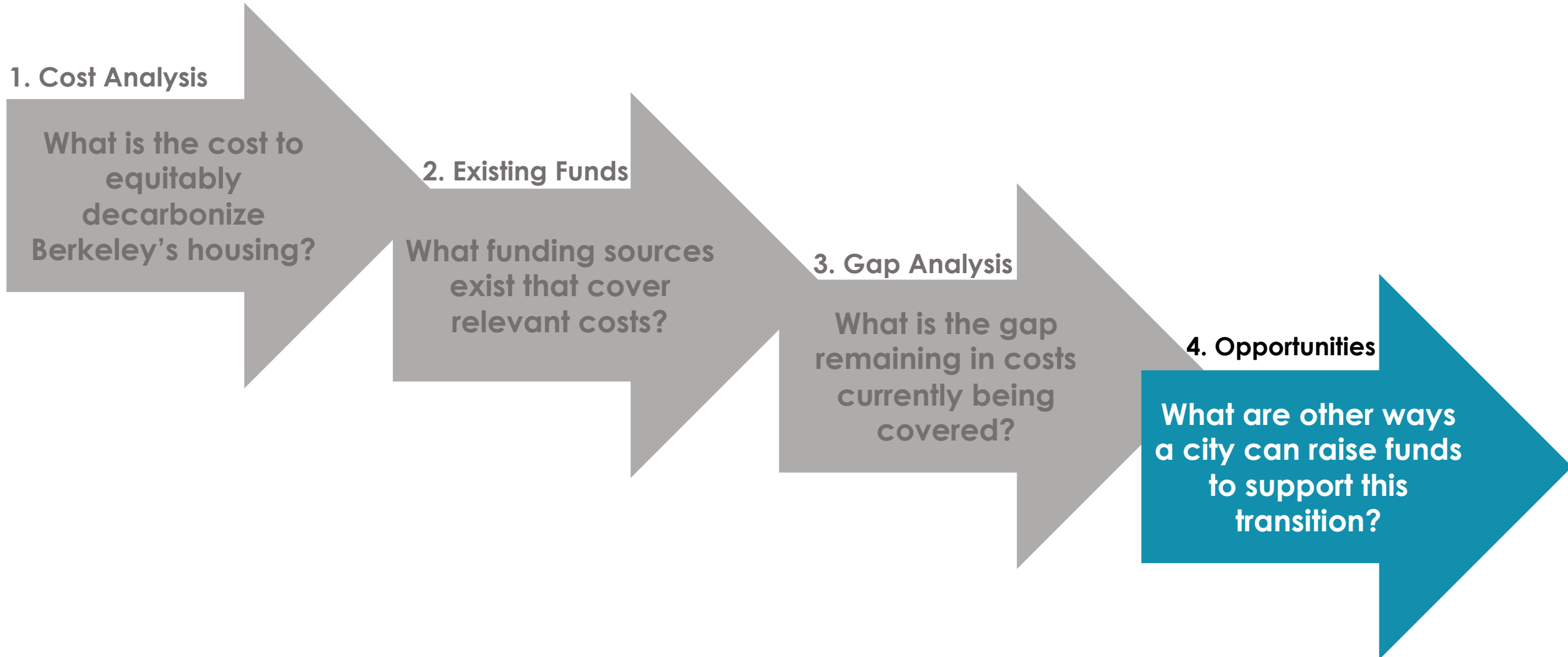
- **All building types face a significant gap in funding for decarbonization retrofits, with a range of \$20,000 to \$40,000 per unit.**
 - Low-income housing consistently faces larger funding gaps at almost \$4,000/unit more on average.
- **There is minimal funding available for electric readiness and health & safety upgrades.**
 - California's TECH program includes funding for panel upgrades, although funding was quickly depleted and incentives were reduced.
 - Most funds that can be used for health and safety are either housing agency-controlled funds that are usually in short supply, or competitive grants that a city must apply for.
- **Energy efficiency costs for low-income homes of 1-4 units are estimated to be fully covered** across BayREN's HOME+, PG&E's ESA, and WAP/LIHEAP programs.
- **Incentives available for full electrification upgrades are roughly the same for LMI and market rate buildings,** despite the fact that market rate buildings may have more capital to invest in upgrades.
- **Many federal and state programs for low-income buildings only focus on the very low-income,*** resulting in a larger funding gap for moderate-income households that are not eligible for state and federal low-income programs yet may still be unable to afford the full cost of comprehensive decarbonization upgrades.

Berkeley Funding Gap Analysis: Phase 4

City Mechanisms to Raise Funds



Phase 4 | City Mechanisms to Raise Funds



Cities Can Raise Their Own Funds

Cities must match policy requirements for building decarbonization with supportive funding and technical assistance to avoid housing displacement.

Cities can impose a variety of fees and taxes to help cover funding gaps and raise funds for additional climate initiatives.

Before exploring new revenue sources, city staff should approach potential efforts with a thoughtful set of core values and answer the following questions:

- Why are the revenues needed? What will they be used to pay for?
- Is the collection and use of the revenue equitable, or will this exacerbate existing inequities?
- What do impacted communities think and what ideas do they have about proposed revenue collection and expenditure?

Revenue Options | Collection Mechanisms

Property

- Value creation fee
- Developer impact fee
- Real estate transaction fee
- Property tax

Transport

- Traffic congestion pricing
- Shared ride fee
- Vehicle efficiency fee
- Parking fees

Utilities

- Energy consumption tax
- Carbon content tax
- Utility franchise fee

Business

- Direct sales (tax or fee on consumer)
- Indirect sales (tax or fee on retailer)
- Tax on high salaries

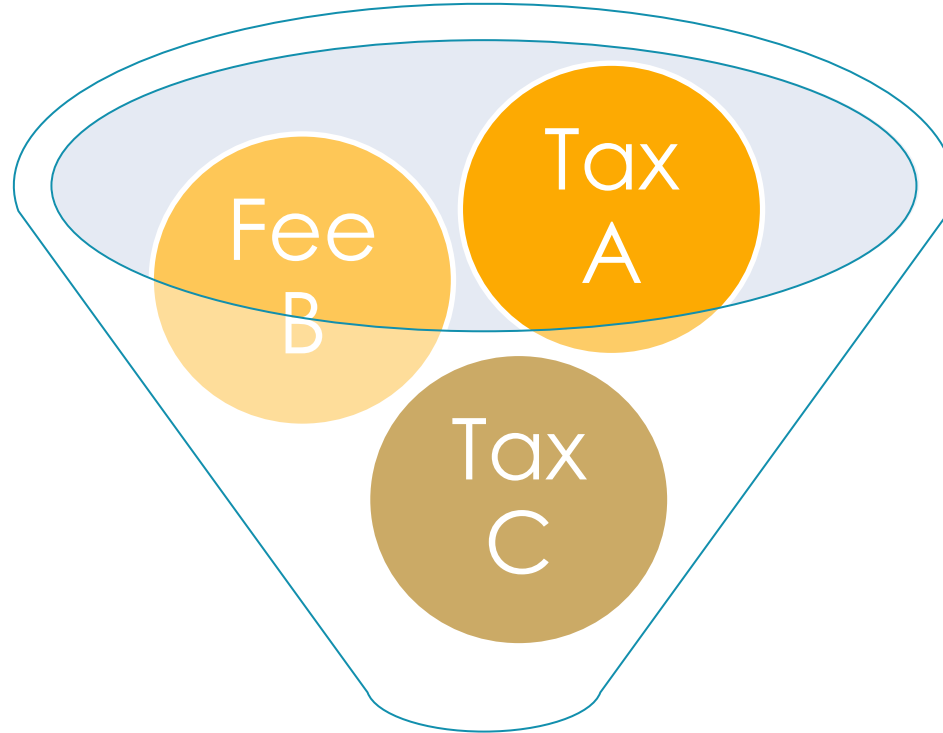
Note: Tax and fee can be used interchangeably in some jurisdictions; the most commonly used terms are cited above. States may prohibit some of these and others may require legislative changes.

Revenue Options | Examples From Other Cities

City or Jurisdiction	Type of Fee/Tax	Date Adopted	Annual Revenue	Comments
Ann Arbor	Property tax (Community Climate Action Millage)	Nov 2022	\$6.5M	Passed by city council; will be on the ballot in Nov
Boulder	Utility consumption fee (Climate Action Plan Tax)	2007	\$1.8M	Considering revised climate tax to increase funding to \$5M
Denver	Retail sales tax (Climate Protection Fund)	2020	\$45M	Extensive stakeholder process
Iowa City	Property tax, TIF	2020-2022	varies	Ad hoc measures to fund climate action plan activities from year to year
Minneapolis	Utility Franchise fee	2018	\$2M	LA also recently renegotiated their franchise agreement
Portland	Tax on big box retailers (Portland Clean Energy Fund)	2018	\$60M	3-year campaign with EJ focus
San Francisco	Shared Ride Fee	2019	\$30-35M	Many cities have instituted such a tax but SF's provides for lower fees for clean vehicles
Seattle	High salary tax (JumpStart)	2020	\$230M	Also has affordable housing focus
Washington State	Real Estate Excise Fee	2020	\$425M over 2 years	Affordable housing focus exclusively

Revenue Options | Tax & Fee Approval Process

Questions to be Assessed:



Overview of Approval Process for Taxes/Fees:

- Stakeholder engagement process
- Mayoral and City Council approval
- Ballot Initiative

Case Study | Portland Clean Energy Fund

The Portland Clean Energy Fund (PCEF) is producing ~\$60 million in annual revenue for green jobs and healthy homes with required investments in frontline communities (people of color and low-income Portlanders).

Organizing Process

- Members of frontline communities held the primary leadership, strategy, and public speaking roles.
- Supported by over 200 community organizations, including affordable housing and homelessness service providers and advocates, and a variety of religious organizations.
- 3 years of organizing led to 65% approval on ballot in 2018.

PCEF Taxation Structure*



Paid for
1% surcharge
for corporations with
\$1 BILLION
annual national retail sales
and **\$500,000**
in annual Portland retail sales

ONLY AFFECTS
the largest corporate
retail chains in the city
(Trump just cut
corporate taxes by 40%)

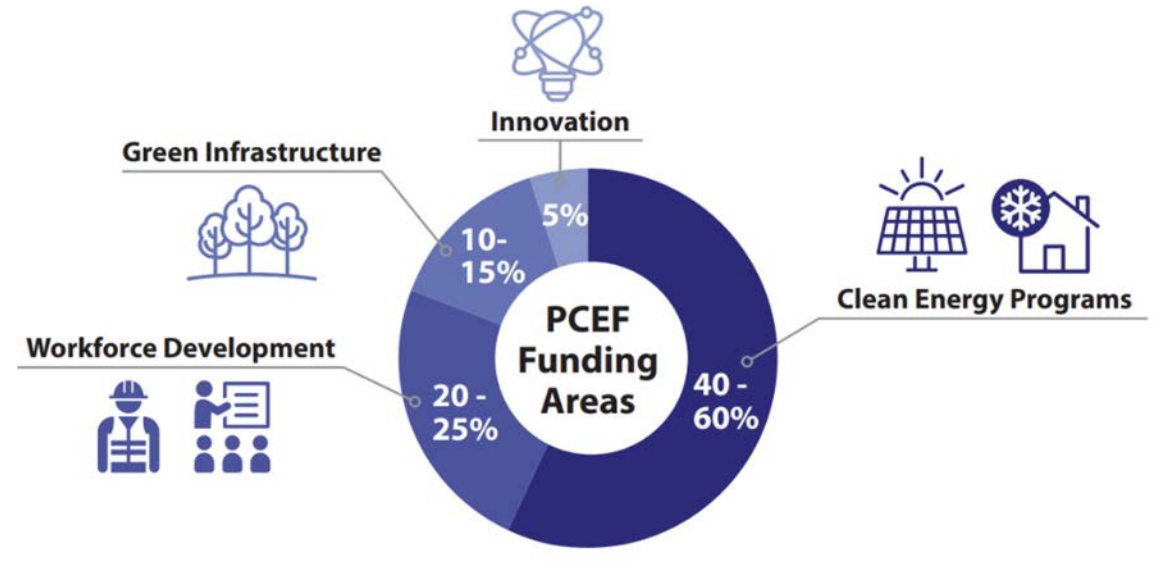


Case Study | Portland Clean Energy Fund

Implementation

- The nine-member PCEF Committee is comprised of experts and community members who reflect the racial, ethnic, and economic diversity of Portland.
- The Committee reviews funding proposals, makes recommendations to the Mayor and City Council, and is responsible for assessing how effective the Clean Energy Fund is in achieving the goals of the initiative.
- Portland's City Council approves funding decisions.
- The PCEF is housed at the Portland Planning and Sustainability Office and has several staff people managing the Fund on a day-to-day basis.
- In 2021, the Committee reviewed 140 grant applications totaling \$30 million in requests, awarded 45 grants worth nearly \$9 million, and approved mini grants (up to \$5,000) to 60 nonprofits.

PCEF Funding Allocation Areas*



*Source: [Portland Clean Energy Fund](#), July 2020.

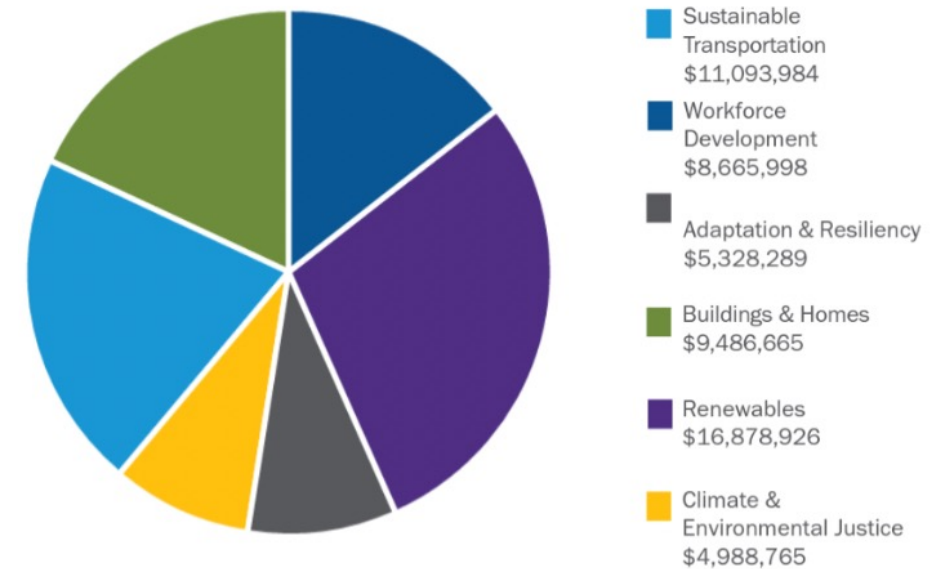
Case Study | Denver Climate Protection Fund

Denver's Climate Protection Fund (CPF) is producing \$40 million in annual revenue for climate action and workforce development, with a goal of 50% of investments in Denver's most vulnerable communities.*

Organizing Process

- Denver's mayor launched a Climate Action Task Force with mandate to examine the 80x50 Climate Action Plan, identify gaps and funding needs to achieve goals, and recommend revenue sources.
- The Climate Action Task Force presented findings to City Council that it would cost \$3.4B to reduce the city's emissions by 60% by 2030, and recommended a tax on retail sales (with basic goods exemptions).
- In August 2020, City Council voted 11-2 to approve Ballot Measure 2A, the Climate Protection Fund sales tax.
- In November 2020, 64% of voters approved Ballot Measure 2A.

2021 Committed CPF Expenditures**



Case Study | Denver Climate Protection Fund

Implementation

- Denver's Office of Climate Action, Sustainability and Resilience (CASR) will manage the funds and annually publish documentation of expenditures, metrics, and community projects.
- CASR staff doubled in 2021 and is expected to double again by end of 2022 to handle CPF programs and projects.
- Within CASR, teams include Climate Action, Resource Management, Communications and Engagement, and Finance and Administration.
- CASR is currently launching a \$41 million building electrification incentive program designed with ongoing input from community and workforce groups.

CPF Revenue Projection*



*Source: [Climate Protection Fund Five-Year Plan](#), Nov 2021.

Revenue Options | Key Considerations

When designing a climate revenue mechanism, there is a need to balance two important factors: Gaining support from voters and the ability to effectively deploy funds.

Get Voters Excited:

- Explain clearly what needs the funding will go toward
- Explain why these needs are priorities
- Climate concerns may not be enough to generate broad support and can be paired with other goals (racial equity, workforce development, health, etc.)

To Ensure Successful Implementation:

- Funding needs to be dedicated to specific uses and protected from non-approved uses
- Ensure efficient and thoughtful evaluation of spending proposals
- Provide adequate oversight
- Communicate the investments and results

Phase 4 | Key Takeaways

To help cover the funding gaps associated with building decarbonization, cities can:

- **Raise their own funds to support climate action**, which provides:
 - Flexibility over how to spend these funds and address gaps in existing funding streams.
 - The opportunity to create policies and programs to meet specific community needs and interests.
 - The ability to design funds that can sustain long-term, transformational investment and local outcomes.
- **Co-create these funding mechanisms with communities and stakeholders**
 - Identify community priorities that will resonate with community (and voters).
 - Consider dual goals and benefits such as jobs, health, and housing to increase public support.
 - Clearly articulate how the funding will be spent and the benefits to specific communities.
- **Consider how to design implementation to ensure success**
 - Ensure funding is dedicated to specific uses and is protected from non-approved uses.
 - Ensure adequate resources for staffing and managing the funds.
 - Create criteria for equitably allocating funds, reporting structures, and accountability.

Key Findings & Recommendations

Project Summary



Key Findings

- **Although many incentive programs exist in the Bay Area, a significant funding gap remains to support comprehensive and equitable decarbonization of residential buildings in Berkeley.** This is in part due to programmatic rules that prevent or limit “double dipping” between funding sources and a lack of options for health, safety, and electric readiness upgrades.
- **As of July 2022, there is an estimated \$20,000–\$40,000 funding gap per housing unit in Berkeley, with low-income housing consistently facing larger funding gaps,** at almost \$4,000/unit more on average. Based on preliminary analysis, funding from the federal Inflation Reduction Act could help cover between \$8,000-\$20,000 for eligible low-income households, depending on household income level and energy savings, but will not reach all Berkeley buildings. Additional funding is also expected from the 2023 California budget.
- **Significantly fewer funding sources exist for health and safety repairs as compared to funding for energy upgrades.** Health and safety upgrades are often required before completing efficiency and electrification upgrades. LMI units face higher need for these repairs, and therefore higher costs for decarbonization.
- **There is currently no funding to upgrade knob and tube wiring in the Bay Area,** which is prevalent in Berkeley’s older building stock and is a critical precursor for full home electrification.

Key Findings (Cont.)

- **Berkeley will need to invest an estimated \$40 million per year through 2045 to cover the total costs of decarbonizing all of its low- and moderate-income residential buildings through comprehensive upgrades.*** Upcoming investments from the Inflation Reduction Act and the 2023 California budget will help cover a portion of this gap, but gaps are likely to remain for electric readiness, health, and safety upgrade costs.
- **Moderate-income households face unique funding challenges** because they are not eligible for many low-income programs but are still likely unable to afford the full cost of retrofits.
- **With the right planning, Berkeley's investments in comprehensive building decarbonization could reduce housing disparities, improve public health, and reinvigorate the local economy.** There are many potential benefits from investing in comprehensive building decarbonization beyond reducing greenhouse gas emissions.
- **Comprehensive building decarbonization costs must be evaluated against the costs of continued use of gas appliances and investment in aging gas infrastructure.** While no comprehensive study exists on the ongoing costs of the current gas system, investing in comprehensive building decarbonization would redirect billions of dollars that are currently flowing into the construction and maintenance of fossil fuel infrastructure, and reduce significant public health and safety costs from air pollution and other risks from gas systems.

Recommendations | Short-Term Actions

BEI recommends the following actions for Berkeley to consider in the near-term:

1. Coordinate Existing Funding

- Enhance coordination with Berkeley Housing Department to proactively pursue federal and state housing funds.
- Work with regional program administrators to better understand needs for disbursement of state and federal funds.
- Collaborate with EBCE to ensure that Berkeley homes are included in new electrification program.

2. Seek Opportunities for More Funding

- Review and pursue competitive grant opportunities (see slides 35-36).
- Pursue opportunities to raise city and/or regional funds in collaboration with neighboring cities and local advocacy community groups. Leverage and/or replicate existing regional collaboration models such as Joint Power Authorities (JPAs) and BayREN.

Recommendations | Short-Term Actions (Cont.)

3. Advocate for Improved Program Design and Increased Funding

- Advocate to PG&E to ensure that the Energy Savings Assistance (ESA) program is appropriately redesigned to be more accessible.
- Partner with other cities and local groups to advocate to the CPUC on topics such as inclusive utility financing, funding for decarbonization of LMI homes, and improving coordination across programs.

Spotlight: Inclusive Utility Financing

Inclusive utility financing, also known as tariffed on-bill financing, is a potential opportunity to increase access to financing for renters or low-income households. Under this model, utilities create a special tariff that allows them to invest in (and collect revenue from) specific eligible investments in a building in their service territory. The utility pays for all upfront costs of the building upgrade and recovers its investment through a charge on the utility bill attached to the utility meter. There is no loan, lien, or debt with the transaction for the building owner or tenant and is not dependent on household income or credit score. Ensuring equitable outcomes will require strong customer protections, such as guarantees that the energy cost savings exceed any new costs added to the customer's utility bill.*

Recommendations | Long-Term Solutions

Building on this research, BEI offers the following potential long-term solutions to consider when planning for an equitable building decarbonization transition. While the most appropriate solutions will vary by location and utility, some ideas will be applicable across all contexts.

1. Incentives must increase coverage to LMI households for energy efficiency and electrification retrofits, particularly for low- and mid-rise buildings.*

- These incentives need to be appropriately designed, fully funded, and optimized for pairing with other programs.
- Where possible, rate-based programs should be pursued that leverage utilities' low cost of capital to make direct investments in LMI households.
- Develop low-cost financing programs for non-LMI households, leveraging private sector capital and using loan loss reserve funds or other credit enhancements.

Recommendations | Long-Term Solutions (Cont.)

2. Affordable housing funding must be significantly expanded to incorporate decarbonization goals.

- For regulated affordable housing,* agencies should provide direct funding to housing programs with mandates to integrate energy efficiency and electrification measures.
- Cities and states must identify or create sources of funding for health and safety retrofits to complement LMI utility programs.
- All types of programs need to work collaboratively to better support and invest in unregulated affordable housing.*
- Build on the pioneering work of Green & Healthy Homes and expand efforts to better leverage health funding.

3. City funds can be raised to achieve some portion of equitable decarbonization, but likely will not fill entire funding gap. A mix of additional state and federal funding and financing sources will be needed.

Appendix



Appendix | Phase 2 Gap Calculations Tables

Calculating the Optimal Funding Combination for Single Family Homes (rounded)

Gross Costs - Single Family Home		Applicable Funding Sources			
		Low-Income		Market Rate	
Full Electrification		BayREN Home+ with TECH	PG&E	BayREN Home+ with TECH	PG&E
HVAC	\$ 22,890	\$3,900		\$3,900	
Water Heating	\$ 4,700	\$3,100	\$300	\$3,100	\$300
Cooktop	\$ 2,800	\$300		\$300	
Clothes Dryer	\$ 3,580	\$300		\$300	
Total Cost	\$ 33,970	\$7,600	\$300	\$7,600	\$300
Remaining Gap		\$26,370		\$26,370	
Energy Efficiency		WAP/LIHEAP	BayREN Home+ ESA	BayREN Home+	
Roof Insulation	\$ 2,350		\$1,500	\$1,500	
Air Sealing	\$ 2,820		\$950	\$950	
Total Cost	\$ 5,170	\$6,610	\$2,450	\$2,450	\$2,000
Remaining Gap		\$0		\$2,720	
Electric Readiness		TECH		TECH	
Knob & Tube	\$ 3,875	\$2,800		\$2,800	
Panel Upgrade	\$ 4,255				
Total Cost	\$ 8,130	\$2,800		\$2,800	
Remaining Gap		\$5,330		\$5,330	
Health + Safety		WAP			
Average Market Rate	\$ 875				
Average Low-Income	\$ 10,125	\$1,165			
Remaining Gap		\$8,960		\$875	
TOTAL GAP FOR SINGLE FAMILY HOME		\$40,660		\$35,295	

Where multiple funding programs could be applied to cover a cost, the gold highlight indicates which program(s) would achieve the maximum coverage, including programs that could be stacked together.

Appendix | Phase 2 Gap Calculations Tables

Calculating the Optimal Funding Combination for Duplexes (rounded)

Gross Costs - Duplex		Applicable Funding Sources			
		Low-Income		Market Rate	
Full Electrification		BayREN Home+ with TECH	PG&E	BayREN Home+ with TECH	PG&E
HVAC	\$ 17,990	\$7,800		\$7,800	
Water Heating	\$ 9,400	\$6,200	\$600	\$6,200	\$600
Cooktop	\$ 5,595	\$600		\$600	
Clothes Dryer	\$ 7,165	\$600		\$600	
Total Cost	\$ 40,150	\$15,200	\$600	\$15,200	\$600
Remaining Gap		\$24,950		\$24,950	
Energy Efficiency		WAP	BayREN Home+ ESA	BayREN Home+	
Roof Insulation	\$ 3,000		\$3,000	\$3,000	
Air Sealing	\$ 3,600		\$1,900	\$1,900	
Total Cost	\$ 6,600	\$13,220	\$4,900	\$4,000	\$4,900
Remaining Gap		\$0		\$1,700	
Electric Readiness		TECH		TECH	
Knob & Tube	\$ 7,200				
Panel Upgrade	\$ 8,510	\$5,600		\$5,600	
Total Cost	\$ 15,710	\$5,600		\$5,600	
Remaining Gap		\$10,110		\$10,110	
Health + Safety		WAP			
Average Market Rate	\$ 1,340				
Average Low-Income	\$ 12,940	\$2,335			

Appendix | Phase 2 Gap Calculations Tables

Calculating the Optimal Funding Combination for 3-4 Unit Homes (rounded)

Gross Costs - 3-4 Unit Homes		Applicable Funding Sources			
		Low-Income		Market Rate	
Full Electrification		BayREN Home+ with TECH	PG&E	BayREN Home+ with TECH	PG&E
HVAC	\$ 26,980	\$11,700		\$11,700	
Water Heating	\$ 18,750	\$9,300	\$900	\$9,300	\$900
Cooktop	\$ 7,740	\$900		\$900	
Clothes Dryer	\$ 7,740	\$900		\$900	
Total Cost	\$ 61,210	\$22,800	\$900	\$22,800	\$900
Remaining Gap		\$38,410		\$38,410	
Energy Efficiency		BayREN Home+	ESA	BayREN	
Roof Insulation	\$ 4,225	\$4,500		\$4,500	
Air Sealing	\$ 5,070	\$2,850		\$2,850	
Total Cost	\$ 9,295	\$7,350	\$6,000	\$7,350	
Remaining Gap		\$0		\$1,945	
Electric Readiness		TECH		TECH	
Knob & Tube	\$ 15,075				
Panel Upgrade	\$ 12,770	\$8,400		\$8,400	
Total Cost	\$ 27,845	\$8,400		\$8,400	
Remaining Gap		\$19,445		\$19,445	
Health + Safety		HOME / CDBG		HOME / CDBG	
Average Market Rate	\$ 1,890	\$0		\$0	
Average Low-Income	\$ 18,220	\$0		\$0	

Appendix | Phase 2 Gap Calculations Tables

Calculating the Optimal Funding Combination for Low Rise Multifamily Buildings (rounded)

Gross Costs - Low Rise Multifamily		Applicable Funding Sources					
		Low-Income			Market Rate		
Full Electrification		MESP	BAMBE	TECH	MESP	BAMBE	TECH
HVAC	\$ 71,950	\$4,000	\$8,000	\$16,000	\$4,000	\$8,000	\$16,000
Water Heating	\$ 50,000	\$2,400	\$8,000	\$14,400	\$2,400	\$8,000	\$14,400
Cooktop	\$ 20,640		\$2,800			\$2,800	
Clothes Dryer	\$ 20,640		\$2,000			\$2,000	
Total Cost	\$ 163,230	\$6,400	\$20,800	\$30,400	\$6,400	\$20,800	\$30,400
Remaining Gap		\$112,030			\$112,030		
Energy Efficiency		ESA	BAMBE		MESP	BAMBE	
Roof Insulation	\$ 39,920	\$16,000	\$6,000		\$800	\$6,000	
Air Sealing	\$ 47,905						
Total Cost	\$ 87,825	\$16,000	\$6,000		\$800	\$6,000	
Remaining Gap		\$71,825			\$81,825		
Electric Readiness		TECH			TECH		
Knob & Tube	\$ 27,540						
Panel Upgrade	\$ 34,050	\$11,200			\$11,200		
Total Cost	\$ 61,590	\$11,200			\$11,200		
Remaining Gap		\$50,390			\$50,390		
Health + Safety							
Average Market Rate	\$ 7,000						
Average Low-Income	\$ 40,000						
Remaining Gap		\$40,000			\$7,000		
TOTAL GAP FOR LOW RISE MULTIFAMILY		\$274,245			\$251,245		

Appendix | Phase 2 Gap Calculations Tables

Calculating the Optimal Funding Combination for Mid Rise Multifamily Buildings (rounded)

Gross Costs - Mid Rise Multifamily		Applicable Funding Sources					
		Low-Income			Market Rate		
Full Electrification		MESP	TECH	BAMBE	MESP	TECH	BAMBE
HVAC	\$ 251,830	\$14,000	\$56,000	\$28,000	\$14,000	\$56,000	\$28,000
Water Heating	\$ 140,000	\$8,400	\$50,400	\$28,000	\$8,400	\$50,400	\$28,000
Cooktop	\$ 72,240			\$9,800			\$9,800
Clothes Dryer	\$ 72,240			\$7,000			\$7,000
Total Cost	\$ 536,305	\$22,400	\$106,400	\$72,800	\$22,400	\$106,400	\$72,800
Remaining Gap		\$357,105			\$357,105		
Energy Efficiency		ESA	BAMBE		MESP	BAMBE	
Roof Insulation	\$ 39,920	\$56,000	\$21,000		\$2,800	\$21,000	
Air Sealing	\$ 47,910						
Total Cost	\$ 87,830						
Remaining Gap		\$31,830			\$66,830		
Electric Readiness		TECH		TECH			
Knob & Tube	\$ 78,960	\$39,200		\$39,200			
Panel Upgrade	\$ 119,170						
Total Cost	\$ 198,130	\$39,200		\$39,200			
Remaining Gap		\$158,930			\$158,930		
Health + Safety		HOME / CDBG	PLHA		HOME / CDBG	PLHA	
Average Market Rate	\$ 24,500	\$0	\$0		\$0	\$0	
Average Low-Income	\$ 140,000	\$0	\$0		\$0	\$0	
Remaining Gap		\$140,000			\$24,500		
TOTAL GAP FOR MID RISE MULTIFAMILY		\$687,860			\$607,360		



BEI Building
Electrification
Institute

CITIES DRIVING CHANGE