

Flexible by Design: Rethinking Performance Standards for Single-Family Electrification & Resilience

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ABSTRACT

As climate action intensifies, key policy approaches such as building performance standards (BPS) have emerged as a key lever for reducing emissions and driving energy upgrades, though most BPS efforts focus on large commercial and multifamily buildings. This leaves a gap in addressing emissions from existing single-family homes, which represent a significant share of urban building emissions. Applying performance or resilience standards to this sector brings unique challenges including legal barriers, real estate industry resistance, limited homeowner awareness, and competing priorities across energy, resilience, affordability, health, and safety.

This paper explores how flexible policy approaches can address emissions from single-family homes, using the City of Berkeley's Building Emissions Savings Ordinance as one of the first time-of-sale resilience standards. Drawing on the City's experience and BEI's technical advising work across several cities, we analyze how political dynamics, community feedback, and implementation feasibility shape policy design. We argue that adaptive, flexible approaches grounded in stakeholder input and implementation realities, including iterative policy design and a flexible credit-based framework that allows homeowners to choose from multiple compliance pathways, are essential for this sector. This paper offers practical lessons for policymakers navigating the tension between ambition and feasibility. These include building from existing local policy infrastructure, grounding policy design in building stock and emissions modeling, engaging the real estate ecosystem early, designing implementation strategies that support affordability while advancing climate goals, and leveraging intermediaries such as BEI to help translate ambitious policy goals into effective local implementation.

Introduction

Cities across the United States are grappling with how to reduce emissions and improve climate resilience in existing single-family homes. Despite growing momentum for building decarbonization, policies targeting homes remain challenging due to individualized ownership and decision-making, limited homeowner awareness, remediation needs, lack of capital, and difficulty establishing standardized performance metrics (Walker et al., 2023). While robust policy approaches exist for larger commercial and multifamily buildings, such as combining building codes with building performance standards (BPS), single-family homes require different

strategies (ACCC 2021).¹ Single-family homes account for roughly 68% of occupied U.S. housing units (EIA 2023), representing a major opportunity for emissions reductions. However, traditional building codes, while critical at new construction or major renovation, often miss incremental opportunities to improve energy performance, electrify equipment, or enhance resilience, motivating complementary policies that operate outside standard code triggers.

Recognizing this, the City of Berkeley, California (Berkeley) adopted its Existing Buildings Electrification Strategy in 2021 (OESD 2021), which outlines pathways to decarbonize existing buildings--primarily low-rise residential--by 2045. The strategy identifies Time-of-Sale (TOS) policies as a key implementation mechanism. Berkeley's housing stock is predominantly single-family homes (61% of buildings and 33% of total built square footage) (BEI 2018), making this sector central to the city's climate strategy. While large buildings remain critical to address as well, 51% of Berkeley's annual building emissions come from the residential sector, and 23% from single family homes (Figure 1). Much of this stock is older and has not undergone major upgrades (OESD 2021), reinforcing the importance of policies that target existing homes.

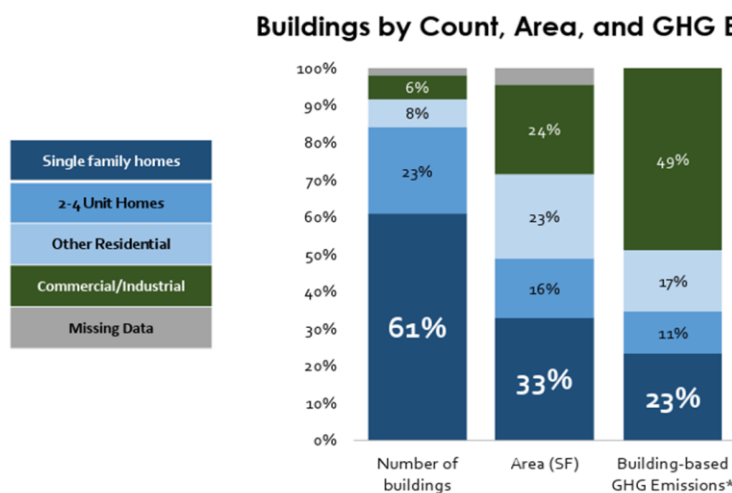


Figure 1. Berkeley's Building Typologies & Comparison to GHG Emissions. *Source:* City staff presentation to Environment and Climate Commission. The number of buildings and total square footage were pulled from the Building & Housing Stock Analysis (BEI 2018) and GHG emissions based on the City's 2020 GHG Inventory (OESD 2023).

TOS policies leverage property transactions as moments to provide information and encourage upgrades to energy efficiency, electrification and resilience (Roy 2018). Because transactions already involve inspections, financing, and negotiations, they create a natural point to influence decision-making and reflect costs and values through sale price or escrow arrangements. This is why TOS triggers have historically been used in cities for requirements such as safety inspections, sewer lateral replacements, and now energy use information

¹ BPS policies set progressive emissions or energy reduction targets over time, and have been adopted in over a dozen jurisdictions nationwide, including in four states: Washington, Oregon, Maryland, and Colorado. (IMT 2025) While large buildings are still complex, they often have dedicated resources for retrofits, access to technical expertise, and the capacity to conduct cost and energy analyses to identify efficiency opportunities that enable BPS policy emissions targets to be feasible. (ACCC 2025)

(LegalClarity Team 2026).

Berkeley first passed its Building Emissions Saving Ordinance (BESO) in 2015, requiring energy assessments at TOS (OESD 2023). These assessments describe existing building systems, estimate energy costs, and identify upgrade opportunities. These reports are publically available and provided to prospective buyers during the real estate disclosure process, enabling visibility into the home's energy performance and potential upgrades before purchase.

Over time, Berkeley has continued to refine BESO based on program evaluation, data collection, and a deeper understanding of the city's emissions profile, housing stock, and homeowner retrofit decision-making. In 2025, Berkeley amended BESO to include a Resilience Standard requirement, marking the next phase of this evolution. Rather than mandating specific measures, the policy establishes a flexible, credit-based system that allows homeowners to choose from a menu of resilience, electrification, and energy efficiency improvements that reflect both climate priorities and individual household needs (BESO 2025).

Berkeley intentionally framed these new requirements as a Resilience Standard to reflect the interconnected nature of climate resilience and emissions reductions.² The Bay Area faces a range of climate-related hazards and disruptions, including more frequent extreme heat events, wildfire risk and smoke infiltration, earthquakes, increasingly severe storms, and utility-initiated Public Safety Power Shutoff (PSPS) events. Recognizing that homeowners face multiple, overlapping risks, the City designed the standard to encourage upgrades that can address these challenges while delivering multiple benefits such as lower energy costs, improved energy assurance, increased comfort, healthier indoor air quality, and reduced greenhouse gas emissions. By creating a single framework that values a range of resilience and decarbonization measures, Berkeley aims to better align and accelerate investments that strengthen both homes and communities.

BESO Resilience Standard Policy Overview (OESD 2026)

Energy assessment required at time of listing and either verification of installed resilience upgrades or a deferral to buyer required by sale date. Single-family homes and duplexes listed after January 2026, with a phase-in of homes with three- to four-units in January 2028

Requirements

- Complete a Home Energy Score
- Complete upgrades from a credit-based list of resilience, electrification, and efficiency measures to meet a minimum of 6 credits (Table 1). Measures include:
 - Electrification Measures: Heat pump water heater, heat pump HVAC, electric or induction range, EV charger, electric clothes dryer.
 - Energy Efficiency Measures: Window replacement, wall insulation, attic insulation, high Home Energy Score, HVAC duct improvements, whole-house fan, floor/crawlspace insulation, air sealing.

² Berkeley integrates climate and resilience updates to Council annually, aligning with intersections identified across the Climate Action Plan, Local Hazard Mitigation Plan, and Resilience Strategy. The Resilience Strategy defines resilience as: "...ability of the community to survive, adapt and thrive no matter what acute shock or chronic challenge it experiences. Advancing Berkeley's resilience requires working together to identify solutions that have multiple benefits and address multiple challenges at once" (City of Berkeley, 2016).

- Electric-Ready Measures: Smart service panel, electrical service panel upgrade, pre-wiring & 240V receptacles
- Resilience, Health & Safety Measures: Knob-and-tube replacement with pre-wiring of 240V receptacles, solar PV, battery energy storage system, greywater system.
- If the seller defers upgrades to the buyer, an escrow deposit of \$5,000, split between the buyer and seller, must be submitted to Berkeley and refunded to the buyer upon verification of upgrades within 2 years of the sale date

Key Components

- Includes a heat pump exemption, where homes that verify installation of an electric heat pump for water heating, space heating or both are exempt from additional upgrades
- Previously completed upgrades can count toward compliance, ensuring homeowners are not penalized for early action
- Exemption for first-time homebuyers enrolled in income-qualified program
- Clear one-page guidance on each upgrade measure will considerations, guidance, and available incentive program information

This paper explores the Resilience Standard as a case study in designing TOS policies to achieve climate goals. It will outline how Berkeley developed and refined the policy over time, the process that shaped the Resilience Standard, and key considerations for other jurisdictions including policy durability, stakeholder engagement, and strategies to support housing affordability while advancing climate objectives.

Building the Foundation

Local Requirements at Time-of-Sale

Prior to BESO, Berkeley had TOS requirements that buyers and sellers had to complete at time of property transfer, which included a partial transfer tax rebate program if seismic retrofits are completed, as well as Private Sewer Lateral (PSL) replacement (City of Berkeley 2026a; City of Berkeley 2026b). Berkeley also implemented the Residential Energy Conservation Ordinance (RECO) in the 1980s, which required a prescriptive list of basic efficiency upgrades at TOS, such as low-flow water fixtures, water heater and piping insulation, lighting replacement and weather-stripping. Together, these requirements helped establish a long-standing time-of-sale compliance framework and a working relationship between Berkeley and the real estate community. This existing precedent ensures that Berkeley can communicate local requirements clearly and implement the policy without significantly disrupting property transactions.

Embedded Iteration

The BESO ordinance has evolved over time, incorporating new information, improved compliance systems, and data-informed approaches. In fact, BESO itself was the next step in the

policy evolution replacing their first effort, RECO. Following the adoption of the Climate Action Plan (CAP) in 2009 which established a goal of 80% reduction in community-wide emissions by 2050, City staff analyzed the impact of RECO and found the list of measures was minimal. Additionally, RECO did not align with a whole-building approach, the current codes, a rapidly cleaning grid, nor the ratepayer-funded incentive programs offered by the Bay Area Regional Energy Network (BayREN). When BESO replaced RECO in 2015, it moved to a whole-home energy assessment framework, emphasizing the need for data collection, transparency, and the identification of electrification and efficiency opportunities in ways that were financially feasible for new homeowners.

Evolution of Time-of-Sale Energy Requirements in Berkeley

- **1987 Residential Energy Conservation Ordinance (RECO)** required homes to complete 11 minimal energy efficiency measures at time of sale, transfer, or major renovation.³
- **2009 Climate Action Plan** developed a roadmap for achieving the 2006 voter-approved Measure G to establish the mandate of 80% reduction in community-wide emissions by 2050. This inspired an evaluation of the impact of RECO and what other policy approaches may be successful.⁴
- **2015 Building Energy Saving Ordinance (BESO)** replaced RECO, and required a whole-home energy assessment at time-of-sale.
- **2020 BESO Evaluation & Amendment** included moving requirements to time-of-listing and directed staff to develop resilience upgrade requirements for Council consideration.
- **2021 Existing Buildings Electrification Strategy** which recognized time-of-sale as a key pillar in addressing existing building emissions.
- **2025 BESO Resilience Standard** requires homeowners to choose from a credit-based set of measures to complete at time-of-sale, including energy efficiency, electrification, and climate resilience upgrades.

The original text of the 2015 BESO ordinance included a section to reconsider how to approach upgrade requirements for single family homes, a crucial step to achieve the city's ambitious climate goals:

E19.81.170 Chapter Review and Reconsideration. *The City Council, with advice from the Berkeley Energy Commission, shall, within 3 years of the effective date of this*

³Berkeley also had the 1993 Commercial Energy Conservation Ordinance (CECO), which required a similar set of minimal measures to be completed at time of sale for commercial buildings (OESD 2025). This was also replaced by BESO in 2015, which now encompassed both residential and commercial requirements in one ordinance. BESO includes benchmarking and audit requirements for large buildings, and will also be reevaluated to integrate upgrade requirements in the coming years (BESO 2025).

⁴ This emissions reduction goal has been updated to achieve net zero emissions by 2045 or sooner, as part of Berkeley's participation in the Race to Zero campaign (OESD 2025).

Chapter, evaluate implementation and outcomes and reconsider extending requirements to all Single Family Buildings starting [...] The Berkeley Energy Commission shall then report on its evaluation and recommendations to the City Council.

Berkeley intentionally included this explicit directive for ongoing evaluation and adjustments, including the eventual embedding of upgrade requirements on top of the initial energy assessments once sufficient data was collected. Berkeley reiterated the directive for upgrade requirements in the 2021 BESO Amendment and adjusted it to include “resilience upgrades” (BESO 2025). This proactive approach to ensuring policy iteration is a useful best practice that other cities should consider in their climate-related policies to ensure effectiveness and advancement over time.

Assessments to Action

By 2025, the ongoing evaluation and adjustments to the original TOS policy primed Berkeley’s TOS ecosystem for transforming the energy assessment requirement into energy upgrade requirements. The assessment requirement mainly relies on a tool called the Home Energy Score, developed by the U.S. Department of Energy (U.S. DOE 2019), that uses building science whole-home modeling to provide a 1 to 10 score that reflects the efficiency of a home, where a 10 represents the most energy efficient homes. Home Energy Score assessors collect over 40 data points on a home, including information on the building envelope such as roof, foundation, walls, insulation, windows and energy systems such as heating, cooling, hot water. Since 2015, over 4,000 Home Energy Score reports have been completed in Berkeley, covering around 17% of single family homes⁵. The data provided by the Home Energy Score enabled City staff to understand energy usage in Berkeley homes, including insulation levels, estimated fuel usage, and equipment type (Roy et al. 2018).

Berkeley’s experience illustrates the importance of establishing a strong policy foundation grounded in iterative design, robust data collection, and engagement with local market actors. While the city’s early adoption of prescriptive TOS policies and close collaboration with realtors supported BESO’s success, other jurisdictions can replicate these principles by designing policies that are adaptive and evidence-based. Residential TOS energy disclosure policies have gained momentum in several U.S. cities as a strategy to address existing housing stock. Examples include Austin’s Energy Conservation Audit and Disclosure ordinance, which requires an energy audit before sale, Portland’s requirement to disclose a Home Energy Score at listing, and Minneapolis’ energy performance information disclosure incorporated into its existing Truth-in-Sale of Housing program (MEEA 2019). While these policies are primarily disclosure-based and intended to inform buyers and stimulate voluntary upgrades, BESO is distinctive in coupling the TOS trigger with mandatory compliance requirements and a flexible pathway that integrates both decarbonization and climate resilience objectives.

⁵ As of May 14, 2026, 4,149 Home Energy Scores have been completed and reported to the City, including 3,702 for single-family homes, based on Berkeley’s compliance tracking database.

Clear Policy Objectives

The last ingredient that supported a smooth policy development process was the clarity with which City staff articulated the policy's objectives to stakeholders, and the policy's alignment with broader city plans and climate goals. For example, City staff developed equity guardrails in the Existing Buildings Electrification Strategy (OESD 2021) report that apply to any and all new policy approaches Berkeley pursues. The equity guardrails guided the development of BESO-specific policy objectives that City staff shared with stakeholders throughout the policy development process (OESD 2023). These included:

- Accelerating building electrification upgrades
- Promoting early compliance with BESO
- Aligning with available rebate, incentive, and technical assistance programs
- Ensuring smooth sales process
- Providing flexibility in required upgrades

Clearly defined policy objectives helped keep discussions with stakeholders focused and grounded while also providing a framework to guide policy design and final decision-making.

Policy Impact

One of Many Levers

TOS requirements are most effective when paired with complementary policies, such as local reach codes, which extend beyond state energy code requirements. In Berkeley and other Bay Area cities, reach codes primarily govern new construction and major renovations, creating opportunities for deep upgrades but missing many homeowner decision points related to smaller retrofits, equipment replacement, or incremental efficiency improvements that deliver lower bills, improved comfort or increased resilience.

A flexible TOS requirement, combined with a whole-home assessment, helps fill this gap by surfacing upgrade opportunities outside major renovations. This can include lower-cost efficiency measures, access to rebate programs, informed contractor guidance, and long-term planning for decarbonization and equipment replacement over time. By providing information at a critical decision point, TOS policies can better inform investment decisions that improve energy performance and resilience.

The importance of multiple policy levers has increased as legal and political challenges have limited some regulatory approaches. For example, affordability concerns led to a statewide pause on reach codes under AB130 (Takemura 2025), and Berkeley's prohibition on natural gas infrastructure in new construction (June 2020–January 2024) was repealed after a Ninth Circuit ruling (Driskell 2024). In this context, the Resilience Standard offers a flexible approach to advance upgrades across existing homes while aligning with regional policies such as the Bay Area Air District's appliance standard targeting NOx emissions from water heaters and furnaces (BAAD 2026). This policy alignment and proactive education prepares homeowners for these requirements and encourages early adoption of compliant technologies.

Scale of Impact

In Berkeley, TOS requirements reach roughly 2-3% of single-family homes each year, (500-600 single-family homes annually) (OESD 2023). While limited in annual reach, these transactions accumulate over time to produce meaningful coverage of the housing stock. The new requirements combined with compliance tracking will also support improved analysis of emissions, energy savings, and resilience outcomes from the policy moving forward. However, the impact of TOS policies varies with local housing market dynamics, and jurisdictions must balance expected reach with administrative feasibility.

TOS policies are most effective when aligned with existing regional requirements from the Air District as well as incentive programs, ensuring homeowners can take advantage of available rebates. Early and sustained coordination through engagement, outreach, and compliance processes can enhance emissions reductions, housing quality, and resilience outcomes of the policy.

Impact on the Real Estate Market

The real estate sector in Berkeley initially raised concerns about the policy's impact on the sale process. In response, City staff engaged with these stakeholders throughout policy development, emphasizing collaboration, administrative streamlining, and practical compromises. Meetings with the Bridge Association of Realtors' Government Relations Committee and a realtor virtual event with over 150 participants provided valuable input on policy options. Explicit language in the original ordinance to develop upgrade requirements for Council consideration proved critical, shifting the conversation from whether requirements should exist to how they could be implemented in a practical and collaborative manner. Berkeley also benefits from a subset of mission-aligned real estate professionals who actively support energy transparency efforts.

Market research suggests growing demand for energy-efficient homes, with 70% of builders and 64% of remodelers reporting customers are willing to pay a premium for green homes, and 84% indicating energy savings, improved air quality and comfort outweigh the upfront cost (NAHB and Dodge Data 2020). The Resilience Standard maintains the Home Energy Score requirement to support transparency and guide upgrades, as its recommendations align closely with the list of upgrade measures (Table 1).

Affordability

Berkeley climate action efforts have worked to ensure that affordability and social equity are considered equally important to achieving emissions reductions in local policies. Staff and stakeholders discussed the impact to affordability in the city during policy development, particularly if the policy would increase sale prices, impact utility bills, or create an additional barrier to homeownership, which remains out of reach for many.

Studies show energy efficiency information can influence home sale prices. (Pigman et al. 2022; Nadel 2025). However, Berkeley's housing market is already exceptionally

competitive, with the average sale price of a single-family home exceeding \$1 million⁶ (City of Berkeley 2025). So, while energy information can help inform buyers and sellers, it is unlikely to be the deciding factor in whether a home sells. This high-cost context underscores the importance of ensuring buyers and sellers have access to cost-informed information about modeled energy bills, potential upgrades, and long-term operating costs. The energy assessment provides this information to help support more informed decision-making while maintaining flexibility for homeowners to plan improvements over time.

Berkeley also built in a few key policy components to constrain costs to home buyers and sellers, and ensure the flexibility offered from the list of measures would align with homeowner priorities and budget. These included:

- Exemption for first-time homebuyers enrolled in income-qualified programs,
- Condominiums and Accessory Dwelling Units (ADUs) are exempt from the Resilience Standard to ensure more affordable homeownership options remain accessible,
- Credits awarded for past work, to ensure early action is not penalized,
- Two-year timeframe to complete upgrades, including a potential extension to three years to ensure sufficient time for buyers to consider and implement,
- Several lower-cost upgrade options as well as credit for health and safety measures like knob-and-tube wiring replacement that may already be required for insurance or code enforcement,
- Efforts to align and navigate buyers and sellers to available incentives to bring down the cost of compliance, and
- The ability for the buyer to receive their deposit at time of contractor agreement to ensure funds are available on hand to go towards retrofits, rather than waiting for reimbursement.

In addition to these efforts to make the policy flexible and feasible, the list of measures includes energy efficiency upgrades, which will likely deliver energy bill savings to the homeowners or any future tenants of the home.

Policy Development Process

Stakeholder Engagement

Stakeholder engagement was a central part of the policy design process. City staff worked with a Technical Advisory Committee (TAC) of building decarbonization experts and industry representatives to explore potential upgrade pathways, the appropriate credit structure, and implementation issues. This committee advised City staff over multiple meetings during 2023–2024 and included building decarbonization experts from local, state, and federal organizations, including PG&E, Ava, California Energy Commission, the Berkeley Lab, Building Decarbonization Coalition, and contractors and architects.

Engagement also extended beyond technical experts, collating feedback throughout 2023

⁶The median single family home price has been above \$1 million since at least 2021, (\$1,265,000 in 2025 (City of Berkeley 2025)).

and 2024 (OESD 2025). City staff engaged with a range of stakeholders, including: real estate stakeholders, such as the local Association of Realtors, its Government Relations Committee and membership, and local real estate offices; City entities, including the Berkeley Rent Board, City Council, Green Building Coordination Team, and three City commissions through public meetings; and community organizations, including the Berkeley Neighborhoods Council, Property Owners Association, Citizens' Climate Lobby, and Sierra Club.

One focus area of these conversations was helping stakeholders understand how the flexible system would work in practice, and what compliance could look like for both sellers and buyers, given that the policy affects both groups at a critical point in the property transaction process. Real estate brokers and title companies were also engaged to minimize potential friction in transactions and ensure disclosure processes were clear and streamlined. Based on stakeholder feedback and community priorities, City staff refined the credit system to better reflect the costs and practical considerations of different upgrades.

For example, City staff initially assigned electric panel upgrades fewer credits because they do not directly reduce emissions or energy use and can sometimes be avoided to lower stress on the grid. Stakeholder feedback highlighted that these upgrades can be costly for homeowners. In response, the City Council revised the measure allowing electric panel upgrades to receive full credits, recognizing its role in enabling future electrification while keeping overall compliance costs manageable. City staff also included guidance on avoiding unnecessary panel upgrades in the accompanying educational resources on the City website (OESD 2026).

Modeling and Stakeholder Input

Berkeley used a combination of quantitative modeling and stakeholder input to determine the final set of measures and related “credits” for each measure. This process enabled the integration of multiple perspectives and considerations, and allowed for data-driven decisions and scenario modeling to design as robust, defensible, and flexible a list as possible. All the measures had to be permanent fixtures in the home and verifiable through the permitting process, which helped narrow down the list of measures to a final set of options.

City staff, in collaboration with the Building Electrification Institute (BEI) and Steven Winter Associates (SWA), collectively referred to as the policy team, developed a matrix of cost, energy, and emissions modeling for the universe of potential measures. They built the matrix upon estimates from previous analyses on Berkeley’s housing stock, retrofit scenarios, and cost estimates (BEI 2018; BEI 2023) and translated them into concise summaries for the TAC to refine and adjust the list based on this information. Energy and emissions modeling helped ensure the list of measures could deliver emissions and resilience outcomes aligned with City goals. The cost analysis ensured the lowest-cost compliance pathway remained accessible and the stakeholder engagement ensured that BESO reflected the local market, building practice, and implementation realities in the final design.

This modeling approach helped Berkeley to combine clear prescriptive options (a list of eligible upgrades with assigned credits) with an overall performance orientation toward resilience and decarbonization outcomes. A prescriptive menu is critical to easier homeowner navigation, while also strengthening the policy’s legal defensibility since the policy does not require the installation of specific equipment, rated efficiencies, or fuel type, while modeling ensures aggregate climate outcomes remain achievable.

Modeling Inputs

Evaluation Criteria

- **Emissions & Energy Savings:** For all possible measures, the policy team pulled emissions savings modeling from the statewide Cost Effectiveness Explorer tool whose studies underpin statewide energy codes and reach code development (Local Energy Codes 2023). SWA provided supplemental estimates based on their national retrofit work. The TAC considered emissions savings to ensure different combinations of measures listed would advance electrification or achieve energy savings, per the policy objectives.
- **Installation Cost:** The policy team estimated all-in cost (including equipment and labor) for each measure to develop a broad estimate of the cost to comply. This information was available at a regional level through the TECH Clean California program data,⁷ while others were estimated by a technical consultant and reviewed by the TAC (TECH Clean California 2026). SWA provided supplemental estimates based on their national retrofit work.
- **Additional Considerations:** If a particular measure aligned with the policy objectives and City's climate goals in other ways, staff assigned bonus credits to the measure. This included measures like induction ranges that directly improve indoor air quality and overall health and safety, and extra credits for more efficient equipment for certain measures like a heat pump versus an electric resistance dryer.

Typical BESO Typologies

- Using data collected from 2015 to 2023 in the Home Energy Score tool from the BESO energy disclosure requirement, the team was able to pull together three typical BESO typologies: a smaller single-family home, a higher-performing home, and a typical duplex. The team then created a set of assumptions for the existing conditions of the home, including current fuel type and equipment type. These scenarios then fed into what measures would be applicable to a typical BESO home.

Modeling Outputs

Measure Package Scenarios

- The team was then able to model scenarios for each typology of which measures may be applicable to the home, which combination of lower-cost measures would bring the home into compliance, and what single measure would be the easiest to achieve compliance.

The model enabled City staff to consider different homeowner decision-making pathways and ultimately supported the development of the escrow deposit amount to align closely with the lowest-cost compliance pathway for typical BESO homes. At the time of passage, the easiest and

⁷ TECH Clean California is a statewide program launched in 2021 to accelerate clean space and water heating technology adoption across California homes. TECH Clean California publishes anonymized and aggregated program data to promote market transformation (TECH Clean California, 2026).

lowest-cost pathway to meet BESO’s resilience standard was to install a heat pump water heater, with a median cost of \$6,700-\$7,900 in Alameda County.⁸

Policy Components

Final List of Measures

After stakeholder engagement and policy development, Berkeley finalized the Resilience Standard, which the City Council unanimously adopted in March 2025 (BESO 2025). The policy applies to homes listed for sale after January 1, 2026, and requires sellers to verify installation of measures from Table 1 totaling at least six credits, including heat pumps, electrical panel upgrades, solar plus storage, and other efficiency improvements. The credit structure reflects a balance between resilience outcomes, emissions reductions, and the cost, complexity and feasibility of implementation.

Table 1: BESO Resilience Standard Measures Summary by Measure Type⁹

Measure	Credits	Considerations
Electrification Measures		
Heat Pump Water Heater	6 (Full)	<i>Easiest single-measure compliance pathway, given lower cost and heat pump exemption. Reduces emissions.</i>
Heat Pump HVAC	6 (Full)	<i>Reduces emissions significantly. Represents significant investment.</i>
EV Charger	2	<i>Does not directly achieve emissions or energy savings but saves transportation sector emissions and represents a significant investment in the resilience of the home.</i>
Electric Clothes Dryer	2 (Heat Pump Dryer); 1 (Electric Resistance Dryer)	<i>Reduces emissions. Level of credits based on differing efficiencies of models.</i>
Electric or Induction Range	2	<i>Reduces emissions and provides air quality improvement benefits.</i>
Resilience, Health & Safety Measures		
Battery Energy Storage System	3	<i>Contributes to the energy resilience of the home and offers energy savings and grid management benefits.</i>
Solar PV (Only)	3	<i>Does not achieve direct energy or emissions savings, but offsets energy bill impacts of electrification and offers renewable energy to the grid.</i>
Knob & Tube Wiring Replacement	6 (Full)	<i>Replacement must include pre-wiring of 240V receptacles. Resolves health and safety threats and provides opportunity</i>

⁸ Based on BayREN Home+ participation data (January 2020 to March 2024) and TECH Clean California (July 2021 to November 2024) within Alameda County, accessed 12/31/2024. (TECH Clean California 2026).

⁹ Current measures and associated credits listed in the BESO Administrative Regulations as of March 12, 2026. (BESO 2025)

		<i>to install wiring to enable future electrification.</i>
Greywater System	1	<i>Does not achieve direct energy or emissions savings, but contributes to lower water usage, a top priority for resilience in the Bay Area.</i>
Energy Efficiency Measures		
High Home Energy Score (9 or 10)	2	<i>Provides compliance credit toward overall home energy performance.</i>
Window Replacements	4 (76-100% windows replaced); 2 (50-75%)	<i>Reduces emissions. Level of credits based on the portion of windows replaced.</i>
Wall Insulation	4 (76-100% walls insulated); 2 (50-75%)	<i>Reduces emissions. Level of credits based on the portion of walls insulated.</i>
HVAC Duct Improvements	2	<i>Includes sealing and insulating or replacing ducts. Reduces emissions through improved HVAC system distribution.</i>
Attic Insulation	2	<i>Efficiency benefits of improved building shell.</i>
Floor/Crawl Space Insulation	1	<i>Efficiency benefits of improved building shell.</i>
Air Sealing	1	<i>Efficiency benefits of improved building shell.</i>
Whole-House Fan	2	<i>Reduces emissions through improved HVAC system distribution and provides energy efficient cooling.</i>
Electric-Ready Measures		
Electrical Service Panel Upgrade	6 (Full)	<i>Does not achieve direct energy or emissions savings but enables future electrification. Strategies are available to avoid panel upgrades and lessen the impact on the grid.</i>
Smart Service Panel	6 (Full)	<i>Does not achieve direct energy or emissions savings but enables future electrification. Offers additional grid management benefits.</i>
Prewiring & 240V Receptacles	2 (three or more receptacles); 1 (at least two receptacles)	<i>Does not achieve direct energy or emissions savings but enables future electrification.</i>
Excluded Measures		
Fireplace inserts, gas shutoff valves, smart thermostats, demand flexibility program participation, health & safety hazard remediation, window plug-in heat pumps, ventilation upgrades		<i>While these were considered during stakeholder engagement, these measures did not meet policy objectives, were not verifiable through the permitting process, or not permanent fixtures in the home.</i>

Critical Policy Implementation

A distinctive feature of Berkeley's approach is the escrow deposit compliance option: if the seller does not complete the required upgrades at sale, the seller can defer them to the buyer. A \$5,000 escrow deposit, split evenly between buyer and seller, is submitted to Berkeley at sale

and refunded once the buyer completes the upgrades within two years of the sale. This allows buyers to integrate Resilience Standard requirements into existing renovation plans while enabling time-sensitive sales to proceed smoothly. The escrow also motivates homeowners to invest in upgrades rather than risk forfeiting the deposit, which, if uncompleted, is redirected to low-income electrification and resilience programs. This process was inspired by the City's Private Sewer Lateral program, which similarly uses escrow deposits to ensure compliance (City of Berkeley 2026).

A critical component of BESO implementation is dedicated staff, refined compliance, code enforcement, and data-tracking processes, as well as proactive engagement with residents about available incentives.¹⁰ City staff developed one-page guides on the BESO website detailing eligible measures, benefits, and incentive programs (OESD 2026). These resources reduce confusion, support informed decision-making, and increase compliance while helping homeowners complete retrofits according to their timelines and budgets.

Conclusion

Berkeley's Resilience Standard demonstrates how time-of-sale policy can move beyond disclosure and become a meaningful implementation strategy for reducing emissions and improving resilience in the single-family housing sector. This paper shows how Berkeley built on an existing foundation of policies and processes, paired technical analysis with stakeholder engagement, and designed a flexible credit-based framework that translates broad climate goals into an actionable point of intervention in a highly decentralized homeownership market. While the policy reaches only a portion of homes each year, it does so at a critical decision point—when buyers and sellers are already making investments and planning future upgrades—allowing impacts to compound over time.

Early implementation suggests the policy is beginning to operate as intended. BESO TOS implementation began January 1, 2026, and in the first five months the program issued 78 certificates of compliance, including 15 new heat pumps installed in 2026 to prepare homes for sale. During the same period, 138 home sales included escrow deposits to support post-purchase upgrades. Since January, three buyers have already received refunds after completing qualifying upgrades post-purchase, including knob-and-tube replacement and 240V outlet installation to enable future all-electric appliance adoption.

This policy case study offers several best practices for other jurisdictions: start from existing local conditions and policy infrastructure, ground requirements in building stock and emissions modeling, engage the real estate ecosystem early, consider affordability implications in implementation design, and balance clear outcomes with flexibility for homeowners. For cities seeking to reduce emissions and strengthen resilience across the single-family sector, Berkeley provides a practical framework and a compelling example of using time-of-sale as a strategic policy trigger.

¹⁰ The BESO program is staffed by two full-time equivalents, although this capacity is shared across all BESO requirements, including time-of-sale and large buildings.

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