02
Special Meeting Item

Office of the City Manager

CONSENT CALENDAR
July 21, 2020

To: Honorable Mayor and Members of the City Council

From: Dee Williams-Ridley, City Manager

Submitted by: Timothy Burroughs, Director, Planning and Development Department

Subject: Evaluation and Recommended Updates to the Building Energy Savings Ordinance (BESO)

RECOMMENDATION
Refer to City Manager to amend the Building Energy Saving Ordinance (BESO), Chapter 19.81.170 of the Berkeley Municipal Code, to align with building electrification goals, leverage upcoming rebates and incentives, and develop mandatory energy requirements to be phased in.

SUMMARY
BESO is a City of Berkeley ordinance that requires building owners to complete and publicly report building-specific energy efficiency assessments and energy scores. The goal of BESO is to reduce both energy costs and greenhouse gas emissions in Berkeley's existing buildings. BESO uses energy data transparency to allow owners to better manage energy use and encourage investments in energy efficiency upgrades. BESO currently requires that large buildings benchmark energy use annually and conduct an assessment or upgrade every five years. Medium and small buildings must assess or upgrade every 10 years, and single family homes must do so at time of sale, or within one year after sale.

This report provides recommendations informed by the BESO Evaluation Report, by multiple meetings with technical advisors and other stakeholders, and by input from the Berkeley Energy Commission. It balances the urgency of the climate crisis with the economic reality created by COVID-19. In order to accelerate energy efficiency, resilience, and electrification upgrades in homes and buildings, staff propose to return to City Council with an amendment to the ordinance to make BESO better align with building electrification goals, leverage upcoming rebates and incentives, and require the development of mandatory building energy improvements to be phased-in when additional resources to off-set costs for mandatory improvements are available.

The proposed amendment to BESO would be implemented in a phased approach, requiring the development of mandatory energy improvements that would be developed with a stakeholder process. This will allow for a thorough analysis of cost impacts, impacts to equity, and numerous other intended and unintended impacts. If this

recommendation is adopted, staff will develop mandatory measures for Council consideration in the future.

FISCAL IMPACTS OF RECOMMENDATION

There are no direct fiscal impacts to amending BESO to align with electrification goals, leverage rebates and develop mandatory energy requirements. However, there may be fiscal impacts to building owners, subject to BESO, when mandatory energy requirements are phased in. Staff will return to City Council an analysis of costs and benefits to the City and to Berkeley property owners at that time.

CURRENT SITUATION AND ITS EFFECTS

BESO is a City of Berkeley ordinance (No. 7397-NS, Berkeley Municipal Code Chapter 19.81.170) that requires building owners to complete and publicly report energy efficiency assessments and energy scores. When the Berkeley City Council adopted BESO, it required a program evaluation three years after implementation to assess the process and outcomes. The BESO Evaluation Report was conducted by Energy Solutions, an energy consulting firm that designs, implements and evaluates energy programs. This staff report provides recommendations to update BESO informed by this report, and by multiple meetings with technical advisors and other stakeholders, and input from the Berkeley Energy Commission. Since the outreach, meetings, and BESO Evaluation Report were completed prior to the COVID-19 pandemic, staff has also balanced these recommendations with the increased importance of healthy indoor air quality as well as economic and budgetary considerations, to ensure that BESO updates are in-line with a thoughtful and resilient recovery.

BESO Evaluation Report

The BESO Evaluation Report was completed by consultants at Energy Solutions in February 2020. It assessed whether BESO is meeting its goals of being easy, affordable and valuable. As applied to BESO, these goals are 1) ***easy*** administrative procedures for compliance, 2) ***affordable*** requirements that leverage rebates and do not create an undue financial burden, and 3) ***valuable*** outcomes that provide benefits to building owners as well as reductions in greenhouse gas emissions. The evaluation analyzed current program administrative process and data on outcomes as well as actively engaged with key stakeholders, including participants, community partners, the real estate community, the Berkeley Energy Commission, and energy assessors. The evaluation highlighted BESO's need to make improvements to:

- Align with Berkeley's electrification and community resilience's goals
- Leverage the proposed expanded Transfer Tax Rebate Program to incentivize upgrades
- Increase the number of energy upgrades that result from the energy assessment recommendations and improve tracking
- Streamline BESO administrative processes for both staff and the public.

The full report, findings and recommendations are provided in Attachment 1.

Expert Technical Advisory Meetings
Staff had multiple meetings with technical advisors and energy experts and convened technical advisory meetings in late 2019 and early 2020. These included an advisory group with representatives from Natural Resources Defense Council (NRDC), East Bay Community Energy (EBCE), equity partners representing low-income communities, the Berkeley Lab, Bay Area Regional Energy Network (BayREN), architects, contractors, energy efficiency program implementers, and the California Public Utilities Commission (CPUC). These experts weighed in on the opportunities and challenges for updating BESO to add mandatory energy upgrade requirements in addition to the currently required energy assessments. Ultimately, the technical advisory group expressed a favorable recommendation for developing mandatory requirements contingent on whether there could be sufficient rebates to lower costs. Given the rapidly evolving electric heat pump technology and upcoming rebate programs under development, there was consensus that more time was needed to determine the appropriate measures.

Berkeley Energy Commission
The Berkeley Energy Commission developed a sub-committee for the BESO evaluation and updates. They met to review the BESO Evaluation Report and provide comments to staff. On February 26, 2020 the Energy Commission voted unanimously to support staff recommendations for the proposed amendments to BESO. Motion/Second to approve the proposed amendments to BESO (Bell, O'Hare). The motion carried 6-0-0-3 (Ayes: Zuckerman, Bell, Weems Paulos, Stromberg, O'Hare. Noes: None. Abstain: None. Absent: Schlachter Leger, Gil). The Commission reiterated its support for staff recommendations for a phased approach to the proposed development of mandatory upgrade requirements, in order to keep up with changes in technology, upcoming rebates, and equity considerations. In addition, the Commission recommended review of new requirements on a regular basis in light of rapidly evolving technology and changing rebates. It also suggested the inclusion of utility bill information in the energy assessments, which will be considered as part of the assessment improvement.

With BESO, Berkeley has become a leader in the home energy assessment and building labeling sphere, with cities across the nation replicating aspects of BESO in their own communities. BESO has been successful at providing data on the energy use and energy efficiency opportunities of Berkeley's existing buildings. This data is being used to inform the *Existing Building Electrification Strategy* study currently in development and scheduled for completion early 2020. The Strategy is identifying a suite of long and short-term policies to equitably transition all of Berkeley's existing buildings from fossil fuels to clean electricity. The current BESO policy allows large

building owners to access energy use trend data to help manage energy use and comply with California State law. Although there are anecdotal reports of time of sale energy assessments leading to participation in energy upgrade incentive programs, data on exact numbers of participants is not available due to utility program privacy rules.

The BESO program has also faced some challenges. Since its original development, the City's priority has shifted beyond energy efficiency, to include electrification, in response to the Climate Emergency and Fossil Fuel Free goals. Implementation has been constrained by the manual compliance system that consumes much of staff's time and does not provide publicly available building energy data to encourage energy efficiency investments. Staff is currently focused on improving compliance rates for medium and large buildings and launching an on-line application and payment portal for time of sale transactions. An additional challenge has been the inability to measure and track energy upgrade outcomes due to rules that restrict access to utility rebate program participation.

Proposed BESO Update

Staff recommends developing an amendment to BESO to bring to a future Council meeting with these proposed updates:

- Integrate electrification and resilience into the energy assessments to better align with the City's goals.
- Develop new rebates when timing is appropriate and coordinate with state and regional programs to maximize available incentives to reduce costs and encourage energy efficiency and electrification upgrades.
- For all buildings that are being sold, change the energy assessment compliance due date to time of listing, rather than time of sale, and encourage inclusion of the energy report on the Multiple Listing Service (MLS) to provide transparency in the sale process and to serve as a market influence.
- Improve City systems for BESO compliance and online payment of BESO fees for better tracking and improved customer service.
- Expand annual benchmarking reporting requirements to medium-sized buildings and streamline energy assessment requirements for small and medium-sized buildings to time of listing.
- Convene expert advisory teams to develop mandatory requirements for homes (1-4 units) and large buildings (over 25,000 sqft) that leverage rebates and guarantee outcomes.

Table 1 compares the current ordinance and the proposed changes:

Table 1 Current and Proposed BESO Requirements

Building Types	Current	Proposed
Homes 1-4 Units	• Energy Efficiency Assessment at time of sale	• **Electrification** assessment **at time of listing** • **Develop mandatory requirements for phase-in when additional rebates to off-set costs are identified**
Small Buildings (up to 15k)	• Energy Efficiency Assessments every 10 years	• **Electrification** assessment **at time of listing**
Medium Buildings (15k-25k)	• Energy Efficiency Assessment every 10 years	• **Electrification** assessment **at time of listing** • **Annual Benchmarking**
Large Buildings (25k+)	• Energy Efficiency Assessment every 5 years • Annual benchmarking	• **Electrification** assessment every 5 years • Annual benchmarking • **Develop mandatory requirements for phase-in when additional rebates to off-set costs are identified**

*__Bold__ text indicates new requirements.

Developing Mandatory Energy Requirements for Phase-In

While there is agreement on the need to strengthen BESO to catalyze action in light of the climate emergency, there is not yet consensus on what building retrofit requirements would be most cost-effective for different existing building types. Staff proposes to develop mandatory requirements in consultation with experts for homes, large commercial, multifamily and mixed-use buildings. Once mandatory requirements are defined and rebates or other compliance resources to off-set costs are identified, the requirements will be brought to City Council for final approval.

A phased approach to updating the BESO program will both provide significant improvements in the promotion of building electrification in the short-term, and create a pathway to mandatory improvements, encouraging early adoption and investments in electrification. Consultation with expert advisors will allow a thorough analysis of cost impacts, evolving technology, potential impacts from refrigerants, electrical infrastructure needs, workforce capacity, changing incentives, impacts to equity and other unintended consequences. Building electrification technology is rapidly evolving, especially for the existing building retrofit market where steps to electrify differ based on building vintage and existing condition.

The integration of building electrification into the current energy efficiency assessments will require updates to the assessments, assessor training, the development of rebates

and alignment with other incentive programs. Staff has been collaborating with the local Home Energy Score partners to integrate electrification into the assessment and recommendations for single family homes, Development of electrification assessment tools for commercial and multifamily buildings requires additional research and collaboration, as well as the identification of incentives to off-set compliance costs.

Given the projected economic set-backs of COVID-19, staff will provide an analysis of financial impacts to Berkeley businesses, housing market and greater community of any proposed mandatory requirements proposed in Phase 2. The timing for the implementation of these requirements is dependent on the completion of Phase 1 training of assessors, identifying incentives to off-set compliance costs, and the development of mandatory requirements. The process for Phase 2 does not have a designated timeline. Rather, this approach will allow for thoughtful development of requirements that are effective, equitable, and do not further limit access to housing in a tight market, while sending a clear signal to the market that investments in electrification are encouraged and valuable.

Proposed Phases for BESO Update: Electrification with Mandatory Requirement Development

1. **<u>Commercial/Residential 15,000 sqft and above</u>** (Approx. 800 buildings)

   Phase 1 – Prioritize electrification and align with rebates
   - Phase-in benchmarking requirements for 300 additional medium-sized buildings (15,000 to 25,000 square feet).
   - Update energy efficiency assessment tools to prioritize electrification and include electrification recommendations.
   - Train assessors in electrification best practices for commercial, multifamily and mixed-use buildings.
   - Work with utility partners, regional entities, and the State to help create and promote electrification incentive programs to reduce compliance costs for building owners.

   Phase 2 – Develop and implement mandatory energy requirements that leverage incentives for buildings 25,000 sqft and above
   - Identify appropriate exemptions and exceptions to encourage early adaptors and advance equity.
   - Develop mandatory energy requirements through a participatory stake holder process for consideration by City Council.
   - Promote electrification incentive programs to offset compliance costs.

2. **Buildings being Sold** (Approx. 900 buildings per year)

Phase 1 – Require at listing, prioritize electrification and align with rebates

- Update compliance trigger to Time of Listing as opposed to Time of Sale using BayREN's newly created Home Energy Score assessment registry.
- Integrate assessment with MLS to inform the sales process.
- Update the Home Energy Score assessment to include electrification recommendations.
- Train energy efficiency assessors on electrification best practices.
- Promote new electrification rebates to encourage new buyers to invest in electrification.
- Create upgrade tracking and proposed rebate processing system, leverage all available electrification incentives.

Phase 2 – Develop and implement mandatory energy requirements that leverage incentives

- Continue to expand strategic electrification outreach and education.
- Identify and address equity impacts that may further limit access to home purchases in Berkeley.
- Update assessment to identify mandatory measures.
- Develop workforce capacity and equipment supply chain availability.
- Develop mandatory energy requirements for homes with inclusive stakeholder process for Council consideration.
- Implement mandatory requirements that leverage rebates and incentives.

The Phase 1 expansion of assessments to include electrification and training of assessors is already underway for single family homes and could be implemented fairly quickly. The development of electrification assessments and retrofit recommendations for commercial and multifamily buildings will require additional research and vetting with stakeholders. The timing of Phase 2 will be dependent the participatory stakeholder process and on the availability of electrification incentives and financing to offset implementation costs.

Amending BESO to align with electrification and resilience goals, leverage upcoming rebates and incentives, and develop mandatory requirements for phase-in advances a number of Strategic Plan priorities, including creating a resilient, safe, connected, and prepared city, and being a global leader in addressing climate change, advancing environmental justice, and protecting the environment.

BACKGROUND

On March 10, 2015 the Berkeley City Council adopted BMC Chapter 19.81 – the Building Energy Savings Ordinance, with the goal of accelerating energy savings in Berkeley's existing buildings. BESO is a Strategic Plan Priority Project. It advances the

City's goal of being a global leader in addressing climate change, advancing environmental justice, and protecting the environment.

When BESO was adopted, it replaced the Residential and Commercial Energy Conservation Ordinances (RECO and CECO), which required building owners to install a prescribed list of minimum energy and water saving measures at the point of sale or during significant remodels. RECO/CECO needed to be updated, as the prescriptive measures at that time did not meet the criteria of being easy, affordable and valuable. The manual compliance system was cumbersome and did not provide acceptable customer service. The required minimum measures were not affordable, as they did not align with rate-payer funded incentive programs. Finally, the list of measures was not valuable because it did not meet climate action emissions reductions targets and was out of date with building science and code requirements.

The development of BESO was conducted with a multi-year, consensus-based community engagement process that included homeowners, residents, realtors, energy professionals, and the Berkeley Energy Commission. The approach of BESO is to assess each building and determine the best strategy to reduce emissions and energy costs and make that data publicly available to encourage upgrades and inform policy development. BESO currently is required prior to sale of a house or building under 25,000 square feet, and on a phased-in schedule for large multifamily and commercial buildings. The assessments are conducted by registered energy assessors who provide building-specific recommendations on how to save energy and link building owners to incentive programs for energy efficiency upgrades; however, BESO does not currently mandate that any of the recommended upgrades be completed. Information from the building assessments, including energy efficiency scores, has been incorporated into the Berkeley Community GIS Portal, providing transparent access to building energy data.

ENVIRONMENTAL SUSTAINABILITY

The adoption of BESO was a key Implementation Action of the Climate Action Plan (CAP). As of the most recent emission inventory, existing buildings are the second largest greenhouse gas emitter and account for 37% of greenhouse gas emissions in Berkeley. BESO is one of the few city policies that addresses existing building greenhouse gas emissions. Updating BESO to better align with electrification and resilience goals, leverage rebates and incentives, and increase the number of energy upgrades in buildings would further the environmental sustainability and climate goals of the City.

Electrification, or switching from natural gas to highly efficient electric heat pumps is a critical climate action strategy that benefits building occupants. Gas, which is primarily used to heat indoor air and water, is responsible for over 90% of emissions from building energy use. Powering building with electricity reduces indoor pollution and increases health and safety for occupants.

RATIONALE FOR RECOMMENDATION

Integrating building electrification into the energy efficiency assessments will accelerate the transition of buildings away from gas appliances, advancing the City's goals of reducing greenhouse gas emissions and becoming free of fossil fuels. In addition to reducing emissions, buildings that electrify have improved health, safety and occupant comfort. The importance of promoting healthy indoor air quality has been highlighted by recent occurrences such as smoke events during wildfire season and the COVID-19 pandemic.

Taking a phased approach will ensure that the updates to BESO will meet the goals of being easy, affordable and valuable. Building electrification technology is rapidly evolving, especially for the existing building retrofit market where steps to electrify differ based on building vintage and existing condition. The development of requirements that accounts for cost impacts, evolving technology, potential impacts from refrigerants, electrical infrastructure needs, workforce capacity, changing incentives, impacts to equity and other unintended consequences, will ensure policy outcomes that are ***affordable*** for building owners and provide ***valuable*** benefits to occupants and the environment.

The proposed changes to BESO will also improve program administration and customer service, meeting the criteria of making it ***easy*** for customers to comply. Currently BESO is administered with a manual compliance system that consumes significant staff time and does not provide publicly available data to encourage energy efficiency investments. The Office of Energy and Sustainable Development is creating its own online application and payment system to address these administrative challenges.

ALTERNATIVE ACTIONS CONSIDERED

The BESO evaluation and technical advisory meetings identified a range of potential options, from maintaining the current policy to requiring homeowners and building owners to make mandatory upgrades.

Alternative 1- No action. Given the urgency of the climate crisis, this option falls short on accelerating greenhouse gas reductions and does not align with the City's goals of electrification.

Alternative 2- Require a more aggressive timeline for mandatory requirements for homes and large buildings. This option would have high-cost impacts for building owners, since rebates to offset upgrade costs are not yet available, and equipment costs are evolving. Given the projected economic recession due to the COVID-19 pandemic, requiring mandatory upgrades without having incentives in place to off-set costs could further financially burden Berkeley businesses and housing market. In addition, requiring mandatory upgrades too quickly would not allow adequate time to build capacity in the workforce and supply stream for emerging electrification technologies. Finally, this approach would not provide sufficient time to address equity concerns and other unintended consequences.

CONTACT PERSON
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Attachments:
1: BESO Evaluation Report (Energy Solutions)

City of Berkeley

Building Energy Saving Ordinance Evaluation Report

February 11th, 2020

To: City of Berkeley

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1. Executive Summary

As the effects of climate change continue to increase, local governments must enact policies that reduce greenhouse gas (GHG) emissions and encourage resilience in their communities. Buildings are the second largest greenhouse gas emitter in the City of Berkeley and approximately 80% of buildings in Berkeley were built before 1950[i] so addressing the existing building stock is imperative. The Building Energy Saving Ordinance (BESO) is a program designed for this purpose, and after evaluating both the outcomes achieved thus far and the current process of the BESO program, it is clear that improvements need to be made. This evaluation assessed BESO on the criteria of whether it is meeting its goals of being easy, affordable, and valuable, as well how to better align BESO with Berkeley's policy goals of electrification and community resilience.

Overview of findings:

- BESO was originally designed to promote energy efficiency but Berkeley's goals have expanded to include the transition of buildings from natural gas to clean electricity and resilience.
- Changes to incentive programs and privacy issues related to participation rates have hindered Berkeley being able to measure outcomes of the program accurately.
- While the BESO assessment has resulted in valuable information on existing building stock for program planning purposes, conversion rates have not been measurable and are assumed to be low.
- Implementation of BESO is a labor-intensive manual process for both City staff and the public that lacks the appropriate technology.

Based on the findings of this evaluation, a menu of recommendations made by Energy Solutions is included below. The recommendations, categorized by building type, are designed to improve both the outcomes of the program in achieving the City's goals and the program's administrative process. Some of these recommendations may be able to be implemented quickly while others may require more time or additional resources. Given existing staff time and resources, some of the recommendations may not be possible to implement concurrently and will need to be prioritized and phased accordingly.

Type of Recommendation	Recommendations
Outcomes for All Buildings	Update the primary focus of BESO to include electrification and resilience and ensure the ordinance properly reflects the updated goals for all buildings.
	Implement systems and requirements that allow for tracking upgrades and measuring the GHG emission savings, electrification-readiness, and resilience.
	Increase electrification outreach and education for all building types, including developing materials on electrification measures and costs.
	Consider other intervention points to target existing buildings.

Outcomes for Homes (1-4 Units)	Update ordinance requirements to integrate the City Council-proposed expansion of the seismic transfer tax rebate (0.5% of the purchase price) and ensure alignment with efficiency and electrification upgrades.
	Convene technical experts to develop performance standards for electrification upgrades and allow the use of the transfer tax rebate to offset costs and consider mandating upgrades, while addressing any potential equity impacts.
	Consider requiring the Home Energy Score at time of listing rather than at time of sale.
	Continue use of Home Energy Score but require additional electrification-readiness information to be collected during the home energy assessment.
	Investigate free or low-cost assessment tools that could be used for all homes not triggered by the BESO time-of-sale requirements.
Outcomes for Small/Medium Buildings	Prioritize improvements for rental properties with further program development that considers incentives and/or mandatory requirements.
Outcomes for Large Buildings	Develop an energy rating score card to display in the property.
	Ensure building owners have quick and easy access to the most relevant rebate program information for their potential project.
	Include requirement for no-cost/low-cost building tune-up or retro-commissioning measures and track implemented measures and savings.
	Convene a group of technical experts and building owners to develop performance standards based on energy use or greenhouse gas emissions targets with a timeline for requirements.
	Partner with Energy Service Companies (ESCOs) to deliver guaranteed savings.
Process for All Buildings	Continue to build and launch integrated online application processing system for all building types.
	Adjust fees for cost recovery of administrative time.
Process for Homes (1-4 Units)	Formalize exemption threshold of 850 square feet in BESO to exempt buildings between 600 and 850 square feet.
	Increase the time of sale deferral fee to cover additional administrative and enforcement costs.
	Implement a trade professional platform to integrate and streamline key components of the BESO process related to the delivery of assessment and energy upgrade services.
Process for Small/Medium Buildings	Streamline small and medium building requirements by updating the building size categories.
Process for Large Buildings	Utilize the U.S. Department of Energy's Asset Score Reporting template as the assessment data collection tool.

2. Overview

Report Purpose

BESO's Section 19.81.170, Chapter Review and Reconsideration, stipulates that an evaluation should be completed to assess BESO's implementation process and policy outcomes, including:

- Reconsidering extending requirements to all Single Family Buildings starting in 2021;
- Analyzing reporting systems and compliance rates;
- Analyzing the number of energy improvements and amount of energy reduced; and
- Recommending revisions and/or incentive programs to accelerate improvements to low performing buildings as it considers advisable.

This report is intended to comply with the specified evaluation. The evaluation includes a review of both the policy outcomes and administrative processes to make recommendations for improvement. The objectives are summarized as follows.

- *Identify* current barriers and opportunities for BESO;
- *Analyze* the effectiveness of the BESO program for key stakeholders; and
- *Make recommendations* for improvements to both the administrative processes and policy outcomes of BESO to align with City's electrification and resilience goals.

Introduction

On March 10, 2015, the City of Berkeley adopted Berkeley Municipal Code (BMC) 19.81 – the Building Energy Savings Ordinance (BESO) with the goal to accelerate deep energy savings in Berkeley's existing buildings. The adoption of BESO was a key Implementation Action of the Climate Action Plan (CAP). When it was passed, it replaced the Residential and Commercial Energy Conservation Ordinances (RECO and CECO).

RECO and CECO, which had been in effect since the late 1980s, required homes and buildings sold or transferred in Berkeley or undergoing renovations to meet prescriptive energy and water efficiency requirements. The static list of minimum prescriptive measures in RECO and CECO was not achieving deep energy savings and became outdated based on technology changes and code updates. Further, the measures were not tailored to individualized building conditions or designed to maximize savings. A building science approach to energy efficiency requires a performance assessment that looks at all systems within a specific building and how they interact, resulting in performance recommendations with a specific loading order; for example, air sealing must precede attic insulation to maximize efficacy and energy savings. Additionally, as regional incentive programs underwritten by ratepayer funds transitioned to whole building performance improvements, as opposed to individual measures, the RECO and CECO measures were misaligned, potentially preventing building owners from leveraging those funds.

The development of BESO was conducted with a multi-year, consensus-based community engagement process that included realtors, energy professionals, and the Berkeley Energy Commission. BESO essentially replaced the mandatory minimum energy and water efficiency requirements in RECO and CECO with a requirement for property owners to conduct and disclose a site-specific energy efficiency opportunity assessment that provided a roadmap to improvements, incentives, and financing. BESO also included the phase-in of all buildings over 25,000 square feet by a certain date rather than at time-of-sale since these larger buildings don't often transfer ownership.

Building energy performance reports often include:

- Home profile (year built, area, # of bedrooms)
- Details about home's current structure and systems
- Home Energy Score or Energy Star score
- Annual energy use and cost based on energy modeling
- Home's carbon footprint
- Custom energy improvement recommendations

Many of BESO's attributes, like its annual benchmarking requirement and the phased-in compliance schedule for large buildings, and use of Home Energy Score tool[1] for energy assessments for homes are similar to other jurisdictions with the objective of making building energy use, costs, and efficiencies visible to owners, occupants, renters, and potential buyers. However, some programs also require existing buildings to meet specified energy or greenhouse gas (GHG) reduction targets in addition to building energy ratings, assessments, and disclosures. A summary of the different jurisdictions' programs is included in Appendices G & H.

By providing valuable information on energy savings opportunities as well as access to incentive and financing programs, the goal of BESO was to on-ramp building owners to energy efficiency performance improvement programs that are subsidized by utility rate payer funds.[2] Participation in these programs would lower energy costs and reduce greenhouse gas emissions citywide, while providing increased comfort, safety, and health for building occupants. However, due to a number of issues detailed in this report, the ability to track participation in these programs has not been as successful as originally intended.

Climate and Decarbonization Policy Goals

As a key *Implementing Action* identified in the City's Climate Action Plan, it is important that BESO supports emissions reductions goals and resilience policies.

The Climate Action Plan calls for reducing the community's greenhouse gas (GHG) emissions by 80% below year 2000 levels by 2050. The GHG emissions associated with homes and buildings are the second largest source of GHG emissions in Berkeley. Berkeley has been very successful in reducing the amount of energy used in buildings, having achieved a 35% reduction in GHG emissions in buildings below 2000 levels as of 2016 data. Despite these efforts, buildings still account for 37% of GHG emissions in Berkeley.

Since the adoption Climate Action Plan goals in 2009, Berkeley has subsequently committed to more ambitious goals for decarbonization including:

Thus far, Berkeley has set forth a number of policies and goals that advance decarbonization and resilience, including:

- Achieving 100% renewable electricity citywide by 2035
- Reaching the Mayor's pledge and the State's goal for net zero carbon emissions (carbon neutrality) by 2045; and
- Becoming a fossil fuel free city

In an effort to create a more resilient Berkeley in the face of challenges of climate change, the City also adopted the following resiliency goals as part of the Resilience Strategy in 2016:

- Accelerate access to reliable and clean energy
- Adapt to the changing climate

1 A sample Home Energy Score is included in Appendix D.
2 Refers to charges assessed on electric and natural gas bills that specifically fund energy efficiency programs.

By transitioning away from a reliance on natural gas to power buildings through electrification (i.e. switching out natural-gas combustion equipment and appliances for electric-powered equipment and appliances), Berkeley can further reduce GHG emissions in its buildings. Beyond GHG emission reductions, Berkeley must align its existing policies and programs within a resilient and electrification-ready framework in order to prepare the community and its infrastructure for the impacts of climate change. In addition to these goals, BESO should leverage current projects and programs, including:

Existing Buildings Electrification Strategy: The Office of Energy & Sustainable Development is currently working on a report focused on how to equitably transition the existing building stock in Berkeley from natural gas to 100% clean energy (i.e. to electricity).

Transfer Tax Rebate: City Council passed a referral on November 27, 2018 to expand the existing Seismic Transfer Tax Rebate Program[3] for qualifying electrification, energy efficiency, and water conservation retrofits. Staff is currently evaluating options for additional qualifying measures for electrification, resilience/safety, and energy efficiency. This incentive creates multiple opportunities to integrate with BESO that will be further discussed in Section 5.

3. Methodology and Evaluation Criteria

The methodology used throughout the course of this evaluation is summarized in Figure 2 below. Each of the steps is discussed in more detail below.

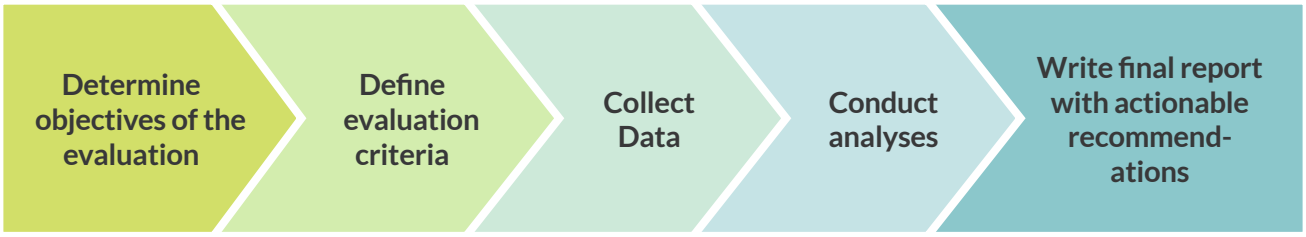


Figure 1: Evaluation Methodology

Evaluation Criteria

The evaluation is predicated on the criteria used for the development of BESO: easy, affordable, and valuable. *Easy* and *affordable* are most relevant to evaluating the administrative processes while *valuable* is most relevant to evaluating the policy outcomes. The criteria and their associated metrics are summarized in Table 1:

3 The City of Berkeley's existing Seismic Transfer Tax Rebate program refunds one-third of the 1.5% transfer tax amount (equal to 0.5% of the value of the home) back to homeowners who make seismic upgrades to their home. More information can be found at: https://www.cityofberkeley.info/Planning_and_Development/Building_and_Safety/Seismic_Transfer_Tax_Guidelines.aspx

Table 1: Evaluation Criteria and Metrics

Criteria	Metric
Easy	Equitably minimize administrative burden (for City staff, building owners, and occupants)
Affordable	Equitably minimize financial burden (for City staff, building owners, and occupants)
Valuable	Maximize emissions reductions Equitably maximize building occupant resiliency Maximize data quality Maximize consistency with state & regional efforts

Data Collection

DATA ON OUTCOMES

BESO outcomes should be measured by energy efficiency upgrades and their resulting GHG emissions reductions or increased resilience potential as a result of energy assessments or disclosure of energy information. The outcomes include:

1. Level of participation in verified efficiency and electrification programs; and
2. Number and extent of verified energy upgrades made to the building.

Due to privacy issues, utility and regional efficiency rebate programs are unable to share disaggregated participation data with the City of Berkeley. Therefore, in order to determine how Berkeley should improve BESO, analysis was conducted on the existing building stock. There are currently three data sources with information related to outcomes: Home Energy Score assessment data collected through BESO, building stock data collected by The Building Electrification Initiative (BEI)[4], and qualitative survey data collected from this evaluation. However, while these are useful data sources, they do not give Berkeley concrete information about how many and what types of people are making upgrades based on the energy information gleaned from BESO, what types of upgrades are being made, and the resulting GHG emissions reductions associated with those upgrades.

DATA ON PROCESS

The effectiveness of BESO is in part dependent on the effectiveness of the process for administration - compliance rates, staff and participant satisfaction, cost-effectiveness and data quality.

The evaluation team reviewed the administrative process of BESO, including workflow diagrams, and conducted an in-person review of the process. This included an overview of the BESO processes for both time of sale and large buildings, estimated staff time needed to work on various aspects of BESO,

4 In 2019, Berkeley partnered with the Building Electrification Initiative (BEI) to conduct a market segmentation analysis that assessed its local building stock for overlapping opportunities to convert heating and hot water systems away from fossil fuels while also providing needed investments to improve health, quality, resiliency, and affordability. The analysis will guide Berkeley in developing new programs and revenue streams that will be needed to equitably accelerate electrification and decarbonization in its community.

and observing staff procedures, including a physical walk between City departments to manually process checks.

To better understand how the process impacted external stakeholders, a series of surveys and stakeholder meetings were conducted to collect feedback from BESO participants, energy assessors, realtors, and the Berkeley Energy Commission.

Conduct Analyses

Once the data were collected, a holistic systems evaluation of administrative workflows were conducted, identifying the most significant challenges and impactful leverage points.

To evaluate the BESO program process, the evaluation team considered the technical, functional, and potential effectiveness to identify opportunities for improvement. Technical effectiveness determines if the system works as designed; if it is reliable, secure, and scalable for the data it currently holds. Functional effectiveness evaluates if the system contains the features and data needed to support the requirements of the program, to reduce administrative burden, and to measure the status of program goals. Functional effectiveness also accounts for whether the system is designed intuitively, or if users are properly trained to utilize its features or access the data. Potential effectiveness determines if the system can support future phases and plans for the program, expand to serve additional stakeholders as users, and if it is sustainable throughout the expected lifetime of the program data, or if the data can be thoroughly transferred to a new system.

Then, potential solutions were identified, and the pros and cons of each solution were weighed based on existing literature, existing programs in other cities, and the evaluation team's decades of institutional knowledge in energy efficiency and distributed energy resources policy and program analysis, design, and implementation, including its use of information systems to streamline and optimize workflows.

4. Summary of Findings

Findings Related to Program Outcomes

In analyzing the program outcomes, the evaluation determined three overarching findings around program outcomes:

Beneficial electrification: Switching from fossil fuels to electricity, where doing so satisfies at least one of the following conditions, without adversely affecting the others:

- Save consumers money over time;
- Benefit the environment and reduce GHGs
- Improve product quality or consumer quality of life; or
- Foster a more robust and resilient grid.

1. **Policy objective has changed from building energy efficiency to beneficial electrification.**[ii]

   The original objective of BESO, as developed in 2015, was to reduce the use of energy use of both gas and electricity use no longer aligns with the more recently adopted Fossil Fuel Free, decarbonization and resilience goals. A policy objective that prioritizes beneficial electrification will ensure the City is resilient in the face of climate change, yet as currently structured, the program does not prioritize the transition to clean electricity or promote switching away from natural gas-based appliances. This is reflected in the fact that the focus of energy assessments for both homes and larger buildings is on energy efficiency rather than on electrification-readiness.

2. **Conversion rates from assessment to energy upgrade have been difficult to measure due to lack of available data**

   BESO was designed to be an on-ramp to public benefit-funded energy upgrade rebate programs. However, lack of access to utility program participation data due to privacy protections and lack of granular building permit data make it difficult to measure specific outcomes of the current program in terms of which buildings are making upgrades, how much energy is being saved, or how many GHG emissions are being reduced. This has made it difficult to ascertain the conversion rate of buildings that progress from assessment to upgrade. However, a review of limited permit data, survey results, and anecdotal evidence indicate rates of adoption of recommended measures is low. For homes, conversion rates appear unaffected by whether the seller includes the energy assessment in the closing packet for the buyer or whether the buyer completes the assessment themselves. Survey results indicated that cost of upgrades was the main reason[5] why building owners did not complete the energy upgrades that were recommended in the energy assessments.

3. **Data from BESO has been useful in informing and shaping policy development.**

   BESO data provides staff with an overview of their existing building conditions which can help inform proposed policies. For example, the Home Energy

Example of Data Collected through Home Energy Score

Primary Heating System Type	Count	Percent
Baseboard	19	1.4%
Boiler	42	3.2%
Central Furnace	1,027	78.3%
Heat Pump	5	0.4%
Mini Split	2	0.2%
Wall Furnace	213	16.2%

5 32 out of 77 BESO participants who responded to the survey indicated that the cost was a reason they had not completed any energy upgrades.

Score data provides specific building characteristics, such as the type of heating systems, efficiency of the water heater and insulation condition. The data, which can be used to identify which homes might be good candidates for upgrades. Annual benchmark data from large buildings allows staff to see monthly energy usage data, including the breakdown between natural gas and electricity usage. These data allow staff to track energy usage over time and understand the load across seasons. Collecting and reporting this data for large buildings is also a State requirement. As more homes and buildings are touched by BESO, the building inventory data will become even more valuable.

Findings Related to Program Process

In analyzing the program outcomes, the evaluation determined two overarching findings around program process:

1. **BESO administrative process is staff-intensive and time consuming.**
   The implementation of BESO has been hampered by a labor-intensive manual process and the lack of a reporting system. Records have been maintained in an ACCESS database that was clunky, unstable, unable to handle large data sets, and had limited reporting functions. As BESO touches more and more buildings, both through the phase-in of larger buildings and the time of sale trigger, Berkeley will continue to struggle with administering the program effectively if it doesn't change its administrative process and software programs. Not only do these issues affect staff, it also creates a less positive experience for building owners, realtors, and energy assessors. Staff is in the process of creating a BESO online application and payment portal that should help to alleviate some of the administrative process issues.

2. **Ensuring compliance is challenging.**
   Enforcement for BESO compliance requires the ability to contact building owners, though staff often only have access to mailing addresses so communication is inefficient and ineffective. The enforcement of time of sale deferrals (Form C) to comply with the BESO assessment requirement after sale is low. Currently, 54% of the Form Cs that Berkeley has on file are expired and many of the mailing addresses have been returned as "undeliverable." In large buildings, building owners are often not aware of the requirements until they are out of compliance because of the difficulty of reaching the building owners by mail. Until compliance rates and communication improve, it will be difficult to add any additional requirements or increase BESO to include more buildings.

Overview of Berkeley's Existing Building Stock

The City of Berkeley is receiving technical support on electrification initiatives from the Building Electrification Initiative (BEI). BEI conducted a market segmentation analysis for the City of Berkeley that took inventory of all the buildings stock in Berkeley based on number of buildings, total square footage, and greenhouse gas emissions. BEI also analyzed BESO Home Energy Score data for homes (1-4 units).

HOMES (1-4 UNITS)

Based on BEI's analysis, there are about 30,000 homes in Berkeley with 1-4 units. These account for 86% of the total number of buildings and 51% of the total building area. All residential buildings (including those with more than 4 units) account for 48% of building-based GHG emissions.

In terms of building age, 89% of single family homes and 85% of 2-4 unit homes were built before 1950. This means that Berkeley's housing stock is largely existing, aging homes potentially with older building systems and appliances.

BEI also analyzed the BESO assessment data collected on over 1,300 homes between 2015 and 2019. The key takeaways from their analysis include:

- There is little variance in heating system type based on the building vintage.
- 78.3% of homes are using central furnaces and 16.2% of homes are using wall furnaces. Wall furnaces are estimated to use more natural gas per square foot than other heating systems.
- 97.5% of homes use natural gas as the primary heating fuel.
- 95.5% of homes do not have a cooling system.
- 98.95% of homes use natural gas for water heating.

SMALL/MEDIUM BUILDINGS

Based on BEI data, there are approximately 3,050 buildings in Berkeley totaling 12.5 million square feet that fall into the small/medium sized building category (less than 25,000 square feet, excluding 1-4 unit homes). This accounts for about 12% of all buildings and 22% of square footage of all buildings in Berkeley. As the requirements stand, these buildings will be phased in to the BESO requirements starting July 1, 2020.

LARGE BUILDINGS

Large buildings are defined as buildings with a gross square footage of 25,000 square feet, or greater. Based on BEI's evaluation, there are approximately 600 large buildings of 21.8 million square feet gross area in Berkeley. These account for 2% of the overall building stock and 27% of the total building area. In terms of building age, 34% of large buildings were built before 1950. All of these statistics present a unique opportunity for the City of Berkeley to upgrade aging infrastructure and they need to ensure that upgrades made by building owners and tenants are in line with the City's electrification and resiliency goals.

5. Analysis and Recommendations

Program Outcome Recommendations for All Buildings

Recommendation #1: Prioritize Electrification and Resilience

Update the primary focus of BESO to include electrification and resilience and ensure the ordinance properly reflects the updated goals for all buildings.

BESO's primary goal of energy savings should be updated to reflect the City's decarbonization goals. Instead of focusing on energy efficiency, the goal should be expanded to include electrification, emissions reduction, safety, and resilience. BESO should be updated to prioritize beneficial electrification for all building sizes and types, where possible. This will also allow BESO to better align with upcoming state and regional rebates for electric appliances and fuel switching technologies.

Policies that promote electrification and resilience help buildings adapt to the impacts of climate change (e.g. extreme heat, flooding, and fires) as well as improve indoor air quality and overall comfort for occupants. By updating BESO to achieve multiple-benefit solutions, BESO can help Berkeley simultaneously mitigate and adapt to a changing climate.

With an updated focus, the City should also consider updating the name of the ordinance. Currently, the phrasing of an "energy saving" ordinance does not encompass the recommended update to the goals of BESO. One suggestion is the Building Resilience and Electrification Ordinance (BREO).

Recommendation #2: Improve Ability to Measure Outcomes

Implement systems and requirements that allow for tracking upgrades and measuring the GHG emission savings, electrification-readiness, and resilience.

The City should update assessments to ensure that they capture GHG savings, electrification, resilience, and safety benefits of the proposed recommendations listed in the report. While PG&E is not able to share participation rates due to privacy concerns, the City should partner with East Bay Community Energy, BayREN and other regional entities who may provide future electrification rebates to better align and capture conversion from assessment to upgrade.

Recommendation #3: Electrification Outreach and Education

Increase electrification outreach and education for all building types, including developing materials on electrification measures and costs.

It will be important to provide education to homeowners, contractors and building managers on electrification and the relevant technologies, including heat pump water heaters, heat pump air heaters, mini splits, induction stoves, and heat pump dryers. Although each building is unique, having a list of common energy upgrades and electrification technologies can provide building owners with a first step to understanding potential energy and electrification upgrades. The list can be categorized by building size/type and should include the technical and economic considerations for the each

measure and estimated costs. Appendix I provides a sample list of measures for large buildings. Similar lists could be developed for homes and other building sizes and types in order to motivate building owners to pursue energy upgrades.

Recommendation #4: Consider Other Intervention Points

Consider other intervention points to target existing buildings.

There are multiple intervention points in the lifespan of a building where changes can occur to target its energy consumption and related systems. BESO utilizes two intervention points – targeting homes and other small/medium buildings at time of sale and targeting all buildings that meet the size threshold of 25,000 square feet or more on a phased-in schedule. In order to accelerate building improvements, Berkeley should consider policies that leverage other intervention points including point of lease/rental, building renovation, building maintenance or major system replacement, and/or building resilience upgrade (e.g. seismic renovation, flood prevention). Other strategies that should be considered to compliment BESO include targeting by building type (e.g. schools, retail, high rise, and multifamily) or geographically targeted strategies that phase in implementation by neighborhood or business district.

Program Outcome Recommendations for Homes (1-4 Units)

Recommendation #5: Integrate Transfer Tax Rebate with BESO

Update ordinance requirements to integrate the City Council-proposed expansion of the seismic transfer tax rebate** (0.5% of the purchase price) **and ensure alignment with efficiency and electrification upgrades.

In November 2018, Berkeley City Council referred staff to expand the Seismic Transfer Tax Rebate Program for qualifying electrification, energy efficiency, and water conservation retrofits. This presents an important opportunity for BESO to ensure that the transfer tax rebate can be applied to upgrades recommended through the BESO assessment, especially for low performing homes. Survey results[6] and feedback from meetings showed strong stakeholder interest in expanding the rebate to include energy-related upgrades. By providing rebates directly, the City will be able to directly track BESO upgrades and outcomes.

The City will need to determine which measures to incentivize through the transfer tax rebate and coordinate with the home energy assessors to ensure that the opportunity for these measures is evaluated in the home energy assessment. When expanding the transfer tax rebate measures, the City should include measures that enhance resilience or promote electrification-readiness. Potential measures could include upgrading an electrical panel, replacing a gas water heater with a heat pump water heater, completing insulation and air sealing alongside a combustion safety test, or installing an automatic gas shutoff valve.

6 52 out of 77 BESO participants and 33 out of 50 realtors who responded to the survey supported or strongly supported expanding the transfer tax rebates to include energy efficiency upgrades.

Administering the expanded transfer tax rebate will take additional staff time to process the rebates. The City should ensure that it can accurately track how many home sales take advantage of the transfer tax rebate being used for electrification upgrades. It is recommended that after three years the City should analyze the data and reevaluate whether to implement mandatory requirements. This will allow staff to better understand the uptake of measures, including understanding which electrification and resilience upgrades are most common and best suited for Berkeley homes, the costs for these measures, and any challenges for implementation.

Recommendation #6: Consider Requiring Electrification or Resilience Upgrades

Convene technical and trade experts to develop performance standards for electrification upgrades and allow the use of the transfer tax rebate to offset costs and consider mandating upgrades, while addressing any potential equity impacts.

To align with Berkeley's updated goals and catalyze electrification-readiness in homes, Berkeley could use the BESO program to require upgrades that focus on electrification, resilience, and energy efficiency and allow the transfer tax rebate to offset costs. Potential mandatory measures, as outlined in Appendix C, could include electric panel upgrades, duct sealing, upgrading insulation, pre-wiring for heat pump water heaters, etc. A home energy assessor could analyze the existing conditions to determine which of mandatory measures are best suited for a home. The homeowner would then be eligible for the transfer tax rebate to help cover the costs of the required upgrades.

Adding mandatory measures would significantly increase the requirements and costs for BESO compliance. To mitigate this, mandatory measure costs should be capped at or possibly slightly above the transfer tax rebate amount. To require mandatory upgrades, the City also needs to be able to handle the increased administrative time, as there would need to be a robust compliance, enforcement and exemption process to allow for homes that require substantial repair work and are sold "as is." Lastly, the City would be losing the revenue associated with the transfer tax if residents were expended all these funds applying them to mandatory upgrades in all transfers. The City should consider the implications of this reduction in transfer tax revenue.

Recommendation #7: Update Ordinance Trigger Point

Consider requiring the Home Energy Score at time of listing rather than at time of sale.

Currently BESO requires a Home Energy Score report be included in the closing packet or to be deferred to the new buyer. Berkeley should consider following the examples of Portland, Oregon and the European real estate market and require a Home Energy Score be completed earlier, at the time of listing, to ensure that it is truly a disclosure and market transformation tool.

This is expected to make home energy usage and potential upgrade opportunities more visible to homebuyers. With this information available at the beginning of the process, homebuyers are able to more readily consider the financial and practical implications of upgrades along with the rest of homeownership costs and benefits, and ultimately may invest more time and money into making improvements.

A time of listing requirement would necessitate integration with the Multiple Listing Service (MLS) to make the Home Energy Score a standard metric that people see for listings, similar to a walkability score. To integrate with the MLS requires agreement and action on the part of Bridge MLS, which may be beyond control of the City.

While it is important that the Home Energy Score is visible at the time of listing, it is also important that the new home buyer, who will be living in the home and making any upgrades, engage with the report and recommendations.

Additionally, the City should ensure that the transfer tax rebate information (see Recommendation #3) along with the assessment are all available together at the time of listing so potential buyers are receiving both sets of valuable information together at once – the areas for improvement and the available rebates to offset costs. If the City decides not to move the energy assessment to time of listing, it should ensure that the online system has features to help staff better track deferrals.

Recommendation #8: Update Data Collected from Energy Assessment

Continue use of Home Energy Score but require additional electrification-readiness information to be collected during the home energy assessment.

Some stakeholders have expressed dissatisfaction with the Home Energy Score, in part because it does not include recommendations focused on electrification. Eliminating the requirement to conduct the assessment was considered as an option in this evaluation. Ultimately, it is recommended that the City should maintain use of the Home Energy Score for several reasons:

- It is a nationally recognized metric, that was developed by the United States Department of Energy;
- It is a consistent metric used by jurisdictions across the United States;
- It uses a scale of 1-10 which is easy to understand for consumers;
- Many assessors are already trained to evaluate homes using the Home Energy Score criteria;
- It has quality assurance built in; and
- It provides important baseline information about homes.

The most impactful change would be to augment the assessment to include additional information. Adding electrification, resilience, and safety information to the assessment would better align with Berkeley's goals and would provide homeowners with information on how to electrify and make their homes more resilient. The City should consider a tool that includes electrification when updating the energy assessment requirements or create a supplemental set of electrification recommendations that could be added to the Home Energy Score report. In order to add electrification-readiness to a report, energy assessors will need to be trained on how to add these elements to their audits and how to make informed, tailored recommendations for electrification and resilience based on the assessed existing conditions of each home.

The specific recommended energy assessment improvements, along with their pros and cons, are listed in Table 2. An example of a report that includes some of this additional information is included in Appendix E.

Table 2: Energy Assessment Improvement Recommendations

Improvement	Pros	Cons
Require assessors to collect data about electrification-readiness and resilience opportunities	• Aggregates data about electrification potential • Provides electrification and resilience recommendations based on building characteristics	• Additional cost for assessment • Additional training for assessors
Identify measures eligible for transfer tax rebate and link recommendations to any additional rebates available	• Ensures that homeowners are using the transfer tax rebate for measures deemed important for electrification and resilience • Provides homeowners a resource to fund or partially fund recommended upgrades	• Risk of defining measures too narrowly • Additional cost for assessment • Additional training for assessors • Additional administrative time to disseminate updated rebate information to assessors
Require recommendations to include range of the cost of upgrade	Makes clear for homeowners how much they might consider spending on upgrades	Costs vary widely, based on existing conditions, market, and may not be accurate
Estimate emission reduction from each upgrade	Helps homeowner understand the environmental impacts they could be making	Estimate may not be accurate
Resilience and gas appliance safety evaluation	Provides safety information to homeowner	• Additional cost for assessment • Additional training for assessors

Recommendation #9: Investigate Assessment Tools for All Existing Homeowners to Encourage Electrification

Investigate free or low-cost assessment tools that could be used for all homes not triggered by the BESO time-of-sale requirements.

To enhance the tools available, Berkeley could research low-cost or free web-based tools that provide energy efficiency and electrification-readiness recommendations for homes. The City should consider encouraging or requiring all single family buildings, not affected by time-of-sale requirements, to use a free, customer-facing tool to understand how best to electrify their home. Tools could use customer input or publicly available data and building energy modeling to recommend a path for the home to reach zero net energy. Recommendations should be based on a home's unique characteristics, include energy use data for the most robust recommendations, and list the most cost-effective home upgrades.

Program Outcome Recommendations for Small/Medium Buildings

Recommendation #10: Consider Mandatory Requirements for Rental Properties

Prioritize improvements for rental properties with further program development that considers incentives and/or mandatory requirements.

Energy-related upgrades are typically challenging to implement in rental properties because of the 'split incentives.' For example, building owners are responsible for purchasing and maintaining key appliances and the building envelope – e.g., heating and cooling, water heaters, insulation, windows – yet renters pay for the energy related to these building components, thereby splitting the costs and benefits across parties. Additionally, there can be a temporal split incentive where renters' duration of occupancy deters their investment in energy reducing measures, even if contributing is possible. With these barriers to upgrades, additional level of attention is needed, especially since over 89% of 5+ unit multifamily buildings are rentals in Berkeley.[7]

One potential opportunity for Berkeley is programmatically integrating with the Rental Housing Safety Program currently under development. The information collected in this checklist and the energy assessments could help inform the prioritization of upgrades, and these upgrades could be implemented either through incentives and/or mandatory requirements. For example, buildings that do not successfully complete the checklist could be subject to mandatory upgrade requirements and those that do could be assigned incentives via an opt-in waiting list. The City of Berkeley staff should consider and evaluate a few potential pilot programs to ensure optimal solutions that avoid unintended consequences, such an increasing rents, displacement, or decreased safety.

Program Outcome Recommendations for Large Buildings

Recommendation #11: Introduce Energy Performance Card for Display

Develop an energy rating score card to display in the property.

Requiring building owners to display a simplified building energy performance scorecard will encourage them to pursue energy efficiency upgrades and, for well-performing buildings, maintain that high performance.

Chicago's new Energy Rating system,[iii] which is a zero to four-star rating system, requires building owners to post their rating in a prominent location on the property and share the rating information at the time of sale or lease listing. New York City also requires building owners to display their energy efficiency grade and score in a conspicuous location near each public entrance to the building. Implementing this program would require time and resources for City staff to determine which features would work best for Berkeley, educate building owners, and ensure compliance.

7 For 5+ unit multifamily buildings, BEI data showed that 463 out of 4,126 low rise and 13 out of 245 high rise units were owner occupied.

Recommendation #12: Educate Building Owners about Relevant Rebates and Programs to Reduce Project Costs

Ensure building owners have quick and easy access to the most relevant rebate program information for their potential project.

Electrifying a building is a cost-intensive, new idea for building owners and it is important for them to understand its impact on occupant comfort as well as capital and operational cost. One of the lessons learned in various benchmarking programs is the importance of significant outreach to and education of property owners about funding opportunities to reduce project costs.[iv] This was also raised as a point of feedback from assessors; they noted that the City did not provide enough information about rebates but that they didn't have the time to search PG&E's website for the information. Because rebates are often changing, reliable information can be difficult to find from the various rebate providers, including PG&E, East Bay Community Energy, BayREN, and other third-party program providers. Additionally, new rebate and incentive programs, which were previously precluded by the California Public Utilities Commission three-prong test rule, will eventually become available for electrification, changing the rebate landscape even further. Once this happens, PG&E will be selecting a third-party program administrator for all their new incentive programs.

The City should work with the new program administrator and other incentive providers to identify a central location for rebate and incentive programs. Then, this central location can be shared with energy assessors and building owners to ensure that building owners are aware of all the resources available to help them make upgrades, including financing options, energy audits, and rebate guides. This information could be disseminated by regularly updating the Berkeley website with tailored links for energy assessors and building owners and/or creating handouts for energy assessors to give to building owners that are regularly updated.

Other jurisdictions have dedicated teams that coordinate meetings between building owners and utilities or protocols in place that facilitate interactions between customers and local utilities. For instance, the City of Vernon, California, offers a customer incentive program where customers who participate in the program have direct contact with the City's gas and electric department. Additionally, projects funded by the Maryland Energy Administration are mandated to participate in incentive programs which helps reduce the payback period and make even large capital investment projects attractive.

Given that the product-based rebate programs often change and run out of funding, it is important that the information provided by Berkeley be constantly monitored and kept up to date. Examples of current product- and savings-based rebates available through PG&E are listed in Appendix J.

Recommendation #13: Require Mandatory/Prescriptive Building Tune-Up Measures

Include requirement for no-cost/low-cost building tune-up or retro-commissioning measures and track implemented measures and savings.

Per the California retro-commissioning guide,[v] retro-commissioning is "a systematic process for improving an existing building's performance by identifying and implementing relatively low-cost operational and maintenance improvements, helping to ensure that the building's performance meets owner expectations." A typical retro-commissioning project consists of planning, investigation, implementation, and handover phases. The deliverable includes a report which includes benchmarking information, energy audit, preliminary savings with project cost, final savings with invoices and recommendations for capital investment. The energy cost savings and non-energy cost savings for retro-commissioning vary from $0.11 to $0.72 per sq. ft. and $0.10 to $0.45 per sq. ft., respectively. The retro-commissioning cost varies from $0.13 to $0.45/sq. ft. and typical payback is less than two years.

As building systems age there are opportunities for no-cost/low-cost measures to keep these systems running as efficiently as possible, which can reduce building energy use. Some cities have already developed or implemented policies that require mandatory retro-commissioning or building tune-ups. For example, Seattle requires building tune-ups every 5 years; New York City requires retro-commissioning every 10 years; Los Angeles and San Jose will also have similar requirements starting in 2021. Additional information on existing building requirements for various cities is provided in Appendices G & H.

Recommendation #14: Set Performance-Based Energy or GHG-Based Targets

Convene a group of technical experts and building owners to develop performance standards based on energy use or greenhouse gas emissions targets with a timeline for requirements.

Benchmarking and energy assessments will help building owners and the City to understand the energy performance of the buildings, but in order to reduce energy use and GHG emissions, the policy should require energy upgrades and promote electrification. Other cities have developed performance-based targets, setting GHG emission thresholds or energy reduction targets based on building use types. As BESO aligns with Berkeley's fossil fuel free future, natural gas based targets should be explored as a path to electrify Berkeley's large building stock. Staff should convene a group of technical experts and building owners to develop performance standards based on energy use or greenhouse gas emissions targets and determine a timeline for those requirements to go into effect.

Recommendation #15: Team Up with Energy Service Companies

Partner with Energy Service Companies (ESCOs) to deliver guaranteed savings.

Working with ESCOs[vi] can reduce initial costs, increase the confidence level of building owners in the economic viability of projects, and ultimately accelerate the energy savings achieved by projects. The City of Berkeley can start an initiative similar to Building Owners and Managers Association (BOMA)'s Energy Performance Contracting (BEPC) Model[vii] to work with ESCOs and large building owners. This type of initiative helps building owners and operators navigate the difficulties in the Energy Performance Contracts by providing information and templates when executing investment-

grade energy efficiency retrofits. These initiatives are independent of funding resources and do not require a performance guarantee to ensure the opportunity is open to all service providers, but are flexible enough to include a performance guarantee as well as measurement and verification if the building owner intends to do so.

Program Process Recommendations for All Buildings

Recommendation #16: Implement Online System

Continue to build and launch integrated online application processing system for all building types.

Prior to this report being written, Berkeley had already contracted with a consultant to implement an online application and payment processing system. Berkeley should continue development of this online platform and should work to ensure the updated solution meets all of their needs, especially as requirements of the ordinance change.

Recommendation #17: Adjust Fees

Adjust fees for cost recovery of administrative time.

Currently, the fees leveraged for BESO applications are not covering the administrative time it takes to process them, particularly for Form C deferrals. Berkeley is conducting a fee study about how to adjust the BESO fees to better reflect staff time. The City should update the fees to more accurately account for administrative time, making sure to consider the time spent on compliance as well as any time saved from the implementation of the online system.

Program Process Recommendations for Homes (1–4 Units)

Recommendation #18: Formalize Exemption Threshold

Formalize exemption threshold of 850 square feet in BESO to exempt buildings between 600 and 850 square feet.

In updating BESO, Berkeley should formalize the exemption to ensure it is clear that buildings between 600 and 850 square feet are exempt from BESO requirements. This will ensure consistency across requirements and minimize the administrative burden of receiving applications for buildings that are exempt.

Recommendation #19: Increase the Deferral Fee to Cover Administration

Increase the time of sale deferral fee to cover additional administrative and enforcement costs.

Currently, over half of the homes required to comply with BESO opt to use the deferral option (Form C) rather than complete the BESO assessment prior to the point of sale. Low compliance rates from expired deferrals are time consuming for staff.

If the City moves to time of listing, the idea is that the energy assessment information will be more readily available to home buyers and the deferral option should be discouraged. Currently, the fee for submitting a deferral is less expensive than it is to comply with BESO. It is recommended that the City make the cost of deferrals commensurate with the time it takes for staff to process and follow-up with non-compliance of deferrals in order to disincentivize deferrals.

The evaluation team also considered eliminating the deferral option for time-of-sale but concluded that it was necessary in order to not delay or derail real estate transactions. It was also noted that if the deferral option is eliminated or restricted, more staff time may be needed to process exemptions.

Recommendation #20: Use Trade Professional Platform to Track Data

Implement a trade professional platform to integrate and streamline key components of the BESO process related to the delivery of assessment and energy upgrade services.

Given that Berkeley is already implementing upgraded software systems, BESO would benefit from enhancing those upgrades to include an online trade professional platform. This platform could connect home and building owners directly with assessors, who could perform their building assessment, and contractors, who could make the improvements recommended through the BESO assessment. An outline of the workflow and details about the features are included in Appendix F.

Program Process Recommendations for Small/Medium Buildings

Recommendation #21: Streamline Small and Medium Building Requirements

Streamline small and medium building requirements by updating the building size categories.

Currently, small and medium building requirements are a combination of the time of sale requirements and the large building requirements. This creates an administrative burden and causes confusion for building owners. To help mitigate this, the categories should be resized and the new requirement should be:

- 850 square feet or below – exempted
- 850-14,999 square feet – time of sale requirement
- 15,000-24,999 square feet – annual benchmarking requirement

This will change the BESO requirements for some medium-sized buildings from a phase-in schedule to a time-of-sale requirement. Although there may be additional time of sale administrative work, this should be mitigated by the new online system. Additionally, it is not expected that these buildings will turn over ownership very often. The streamlined requirements would also require additional buildings to comply with an annual benchmarking requirement but lessen the assessment requirement, which can be cost-prohibitive for small and medium sized buildings. Annual benchmarking will ensure that energy data is collected about these buildings.

Program Process Recommendations for Large Buildings

Recommendation #22: Standardize Data Collection to Improve Building Inventory

Utilize the U.S. Department of Energy's Asset Score Reporting template as the assessment data collection tool.

Currently, BESO allows data collected through the assessments to be submitted in a variety of tools, some of which don't allow for mass data export. Building information and data is then not able to be aggregated and utilized for any sort of analysis. The City should standardize how data is

submitted and what fields are collected, including main business type, year built, age of the building systems, year of last energy audit, year of completed upgrades if any, primary heating and cooling equipment, primary usage, schedule, any change in building usage type and shared or dedicated meter. Berkeley should collect data from assessments through the U.S. Department of Energy's Assets Score Reporting Template since: it is a nationally used tool to collect energy assessment information, Berkeley assessors are familiar with the tool and most already are using it, and it's free and customizable allowing the City to specify the required fields.

6. Conclusion

In order to use BESO as a means to help achieve Berkeley's climate and decarbonization goals, the City needs to update the primary focus of the ordinance and ensure that it can better measure outcomes that target GHG emission savings, electrification-readiness, and resilience. This will require outreach and education to homeowners, contractors, and building managers.

To improve outcomes for homes, Berkeley should align BESO with the City's proposed transfer tax rebate expansion to help finance energy efficiency, electrification, and resilience upgrades and consider requiring homeowners to make mandatory upgrades. To help ensure prospective homeowners understand the energy efficiency of a home, the BESO program should consider moving the trigger point from time-of-sale to time of listing. Additionally, Berkeley should enhance the Home Energy Score report to include an electrification-readiness assessment and investigate other types of assessment tools that encourage electrification.

For small/medium buildings, Berkeley should consider mandatory requirements for rental properties in order to overcome split incentives of upgrades between building owners and building occupants.

In large buildings, Berkeley should consider requiring mandatory building tune-up measures for large buildings and/or set performance-based energy or GHG-based targets. Berkeley should develop an energy rating score card to display in properties that would make energy efficiency more conspicuous. Berkeley should also ensure building owners have quick and easy access to the most relevant rebate program information for their potential projects and would benefit from teaming up with energy service companies.

From a process standpoint, Berkeley should convene different technical experts as part of an advisory group to ensure stakeholders understand electrification and its benefits. Additionally, the City should continue to implement an integrated online application processing system and should work to adjust fees of the program to accurately recover the cost of administrative time. BESO would also benefit from the development of a knowledge database that includes the most prevalent issues and measures for implementation.

To improve specific process issues, Berkeley should formalize the exemption threshold for buildings between 600 and 850 square feet, implement a trade professional platform, update the requirements for small/medium buildings, and utilize the U.S. Department of Energy's Asset Score Reporting template for collecting data about large buildings.

Overall, the City needs to ensure that any updates made to BESO still allow the ordinance to be flexible enough to adapt to changing City goals and respond to the changing technology landscape that is inevitable as electrification becomes more commonplace.

Appendix A: Stakeholder Outreach

The BESO evaluation relied mainly on conversations with City staff as well as stakeholder surveys and meetings. Surveys were sent to BESO participants, realtors, and energy assessors. For participants, 77 respondents answered ten questions covering:

- Building characteristics;
- Overall feedback on the program;
- How valuable the BESO information was;
- Potential updates to the program; and
- General open-ended feedback.

For realtors, 50 respondents answered ten questions covering:

- Overall feedback on the program;
- Open-ended feedback about the energy assessments;
- Energy assessors;
- Potential updates to the program; and
- General open-ended feedback.

Finally, for energy assessors, 5 home assessors and 11 commercial building assessors answered fourteen questions covering:

- Energy assessment tools;
- Overall feedback on the program;
- Value to clients;
- Time to complete an assessment;
- Potential updates to the program; and
- General open-ended feedback

After receiving the results of the surveys, it was clear that the survey questions had been more focused on process than outcomes. For future evaluations, survey questions should be better designed to understand the outcomes that have resulted from BESO.

In addition to surveys, meetings were held with realtors, energy assessors, and the Energy Commission. The realtor meeting was held on November 4, 2019 with approximately 20 realtors in attendance. It lasted for two hours and feedback was collected about what they thought was working and wasn't working with BESO, the feedback they receive directly from homeowners about the information gleaned from BESO, and their thoughts on integrating BESO with the transfer tax rebate.

The assessor meeting was held on November 15, 2019 with approximately 5 home assessors and 8 large building assessors.[8] This meeting also lasted for two hours where the first hour was a joint session and the second hour was split between home and large building assessors. In the home assessor session, feedback was collected about additional energy assessment tools, additional test they could perform, and ways to

8 This accounts for some assessors who perform both home and large building assessments.

streamline the reporting process. In the large building assessor session, feedback focused on increasing outreach about the program, ensuring benchmarking is done by a professional, and their thoughts about improvements to the program. The presentation for the assessor meeting can be found on Berkeley's website.[viii]

Finally, the progress to-date was presented to the Energy Commission on December 4, 2019. There were 7 commissioners in attendance who gave feedback about the lack of outcomes achieved from BESO and the need for major changes to the ordinance.

Appendix B: Current BESO Requirements

BESO has distinct requirements based on building type and size. For large commercial and multifamily buildings, 25,000 was determined as the minimum threshold for annual benchmarking because smaller building do not often have a dedicated building manager available to comply with this requirement. For 1 to 4 unit homes, 4 units was chosen as the ceiling because it is consistent with ratepayer-based public benefits funded programs for homes such as Energy Upgrade California. Finally, for small and medium commercial and multifamily buildings between 850 and 24,999 square feet, the requirement was determined to be a combination of the homes and large building requirements.

Building Size	Requirements
25,000+ sq. ft.	Annual Benchmark Energy Assessment every 5 years
15,000-24,999 sq. ft.	Time of Sale Requirement or Assessment every 8 years Phase-in 7/1/2020
5,000 – 14,999 sq. ft.	Time of Sale Requirement or Assessment every 8 years Phase-in 7/1/2021
850-4,999 sq. ft.	Time of Sale Requirement or Assessment every 10 years Phase-in 7/1/2022
1 - 4 unit homes	Assessment at Time of Sale

1-4 Unit Homes

When 1-4 unit residential buildings are sold, BESO requires that the seller either submit an energy assessment, apply for a deferral, or qualify for an exemption. The BESO application is the same for all cases with different compliance options listed for the applicant to choose.

If submitting an energy assessment, the applicant must hire a registered BESO energy assessor to complete the assessment. Then, the applicant must submit the energy assessment, a BESO application, and a filing fee to the City of Berkeley before receiving a Compliance Form A.

Alternatively, a seller can apply for a deferral. There are two ways to apply for a deferral:

1. ***Transfer responsibility of BESO compliance from the seller to the buyer.*** Submitting a BESO application and filing fee will generate a Deferral Form C that the seller needs to submit to the title company at closing. The buyer then has 12 months from the sale date to comply with BESO requirements.
2. ***New or planned construction.*** If the house sold is new construction or if there is an extensive renovation where all energy-related equipment and at least half the building envelope is replaced, the reporting requirements may be deferred for up to ten years. The seller must submit a BESO application and all applicable permits that will generate a Deferral Form D to be submitted to the title company at closing.

Additionally, there are three ways a seller can qualify for an exemption:

1. ***Qualifying as a High Performance Building.*** The seller must submit a BESO application and proof that the home has completed an energy efficiency incentive program.

2. ***Being in a particular size category.*** A building qualifies for an exemption if it is greater than 25,000 square feet, under 600[9] square feet, or a duplex with both units under 600 square feet each. The seller must submit a BESO application.
3. ***Being a unit within a larger building.*** Units within larger buildings, such as an individually-owned, attached condo, qualify for an exemption. The seller must submit a BESO application.

Small/Medium Buildings

This category applies to buildings less than 25,000 square feet. The phase in schedule for requirements is as follows:

- July 1, 2020: 15,000 – 24,999 square feet
- July 1, 2021: 5,000 – 14,999 square feet
- July 1, 2022: Less than 5,000 square feet

Upon these deadlines, the buildings in each tier must complete an energy assessment performed by a registered energy assessor; this energy assessment must be completed every 10 years. However, if any of these buildings are sold prior to the phase-in deadline, they must comply with the same Time of Sale requirements to which 1-4 units are subject. To determine the type of assessment required for these buildings, consult the BESO website.[ix]

Buildings with an ENERGY STAR score of 80 or above are exempt from the assessment requirement.

Large Buildings

This category applies to buildings equal to or more than 25,000 square feet. The phase in schedule for requirements is as follows:

- July 1, 2018: Greater than 50,000 square feet
- July 1, 2019: 25,000 – 49,999 square feet

Upon these deadlines, the buildings in each tier must complete an Energy Assessment every 5 years and complete an Annual Benchmarking Report through the ENERGY STAR Portfolio Manager;

This category includes certain exemptions and deferrals:

- Buildings with 50% dedicated to industrial or lab uses are exempt;
- Buildings over 25,000 ft2 are exempt at time of sale;
- Verified High Performance buildings are exempt from the assessment requirement;
- Deferral for Long-Term Tenancy under Rent Control is applicable as defined in BMC chapter 13.76;
- Deferral for New Construction or Extensive Renovation is available for recently constructed or extensively renovated buildings that provide sufficient permitted evidence;
- Low Energy Use Deferral is available to large buildings with a verified or certified U.S. EPA ENERGY STAR Portfolio Manager Performance Score of 80 or greater. A verified Score requires completion of the ENERGY STAR Data Verification by a Professional Engineer or Registered Energy Assessor, excluding the Indoor Air Quality section.

9 As of report writing, 600 square feet is the threshold. Berkeley plans to update this threshold to 850 square feet.

Benchmarking exemptions and deferrals:

- Exemption: If more than half of a building or campus is dedicated to scientific experiments requiring controlled environments or for manufacturing or industrial purposes, it is exempt from benchmarking requirements.
- Data Unavailable Deferral: Energy benchmarking can be deferred if:
  a) A building has less than five residential active utility accounts and the Building Owner can demonstrate that a tenant refused data authorization OR
  b) A building occupant demonstrates to the Administrator that such disclosure may result in the release of proprietary information which can be characterized as a trade secret.

Appendix C: Potential Mandatory Measures for Homes (1–4 Units)

Table 3 below outlines potential mandatory measures that Berkeley could require for homes (1-4 Units).

Table 3: Potential Mandatory Measures for Homes (1-4 Units)

Measure Category	Measure
Electrification	Electric service panel upgrade (200 amp)
Electrification	Electrical work required to install electric appliances that replace gas appliances (e.g. 240 outlets)
Electrification	Electric heat pump space heating/cooling (replacing gas on-ly)
Electrification	Electric heat pump water heater (replacing gas only)
Electrification	Induction stove or range (replacing gas only)
Electrification	Heat pump clothes dryer (replacing gas only)
Electrification	Level 2 electric vehicle charging station
Electrification	Solar panel installation
Resilience	Battery storage installation
Resilience	Solar + Storage
Resilience	Combustion Safety Test
Resilience	Automatic Gas Shutoff Valve
Energy Efficiency	Upgrading insulation
Energy Efficiency	Duct sealing

Appendix D: Sample Home Energy Score

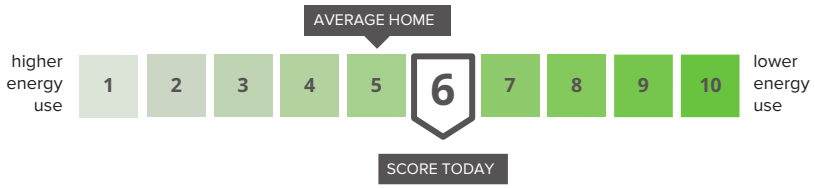
U.S. DEPARTMENT OF ENERGY
Home Energy Score

Know your home. Know your Score.

THIS HOME'S
HOME ENERGY SCORE
6 out of 10

THIS HOME'S ESTIMATED
ENERGY COSTS
$2263 per year

Home Energy Score details



Official Assessment | ID#296958

Home Energy Score is an easy way to see how energy efficient this home is compared to other homes. A higher score is better. This report also contains ways you can make your home more efficient and more comfortable.

HOME PROFILE

LOCATION:
Berkeley, CA,94703

YEAR BUILT:
1904

HEATED FLOOR AREA:
2552 sq. ft.

NUMBER OF BEDROOMS:
4

ASSESSMENT

ASSESSMENT DATE:
10/28/2019

ASSESSOR:

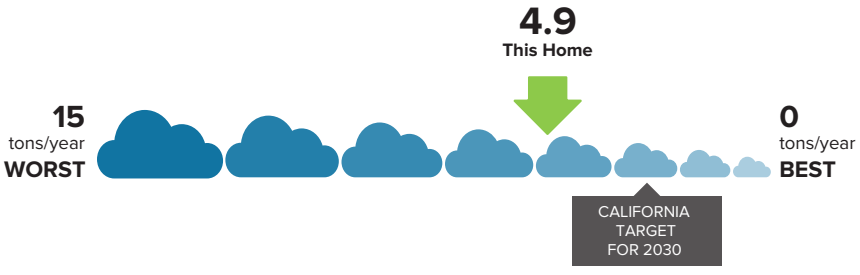
PHONE:

EMAIL:

How much energy is this home likely to use?

Electric	**8127 kWh/year**	**$1674**
Natural Gas	**419 therms/year**	**$589**
	TOTAL ESTIMATED ENERGY COSTS PER YEAR	**$2263**

This home's carbon footprint



BAYREN
Local Governments Empowering Our Communities

Tackle energy waste today!

Enjoy the rewards of a comfortable, energy efficient home that saves you money.

SCORE TODAY
6
out of 10

- [x] Get your home energy assessment. Done!
- [ ] Choose energy improvements from the list of recommendations below.

  Need help deciding what to do frst? The BayREN Home Upgrade Advisors offer free phone consults with independent expert home advisors. **Call 866-878-6008.**
- [ ] Check out **www.bayareaenergyupgrade.org** for information on Energy Upgrade California® programs and fnancing opportunities.
- [ ] Select a contractor (or two, for comparison) and obtain bids.
- [ ] Perform upgrades and enjoy a more comfortable and energy efficient home.

Energy Improvements, customized for your home.

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Attic Insulation	Insulated to R 11	At least 15% leakage reduction from vintage table defaults
Wall Insulation	Insulated to R 00	Insulate ≥ R 13
Heating Equipment	Central gas furnace 90% AFUE	Ductless heat pump ≥ 9.4 HSPF/17 SEER***
Water Heater	Gas storage 78% EF	Heat pump water heater ≥3.24 EF***

***Electrical panel upgrade may be required for gas to electric change-outs.

Appendix E: Sample Energy Report with Electrification

TUNERGY

Your Energy Audit

nyserda
Energy. Innovation. Solutions.
1-866-NYSERDA • www.nyserda.ny.gov

Home
Sample NYSERDA
15 Glenwood St
Albany, NY 12203

Audit Date
Jul 2, 2015
3:01 pm

Audited By
Sandy Michaels
New York Testing
123 Bell Street
Albany, NY 12203
sandy@snugghome.com

Don & Margery -

Thank you for inviting us to do an energy audit on your beautiful home! We've kept your concerns in mind during our inspection and testing. Let's discuss the recommendations found in this report and see what works best for you.

Thanks,
Sandy

Inside Your Report

Powered by Snugg Pro

TUNERGY

Concerns

We listened to you!
As our client, we want to make sure we are addressing all of your concerns for your home. If we have missed any concerns in this report, please let us know right away.

Air Leaks
Air leaks have been noticed around the window frames, and especially around the front door.

Heating system is old
Furnace needs to be replaced for additional comfort and health & safety issues.

Kitchen gets too hot
The primary culprits are the large number of halogen can lights. Replacing these lights with new efficient bulbs will dramatically reduce the heat created by the lighting.

TUNERGY

Solutions for Your Home

Totals

Cost
$ 20,854

Estimated Savings
$ 1,801 per year

This is an estimate of how much you could save starting in Year 1. Savings will only increase as energy prices rise over the years.

Impact of upgrades

Energy Reduction	42%
Carbon (CO2) Savings	9 tons
Equivalent cars removed from the road	1.9/yr

Call us today to ask a question or discuss the next step!

Details	Installed cost	Approximate annual savings	SIR*
Seal Air Leaks	$1,015	$142.43	2.8
Attic Improvements	$1,883	$140.17	2.2
Cooling System	$3,355	$183.8	0.8
Heating System	$6,288	$263.68	0.8
Thermostat Set Points	$170	$197.02	12.7
Upgrade Water Heater	$1,223	$72.75	0.9
Upgrade Lighting	$77	$238.91	21.9
Insulate Walls	$5,508	$493.01	2.7
Refrigerator	$1,336	$68.86	0.9

* SIR is the Savings to Investment Ratio. Simply put, if the SIR is 1 or greater, then the energy savings from the item will pay for itself before it needs to be replaced again. This metric is used to help prioritize the recommendations by financial merit.

TUNERGY

Seal Air Leaks

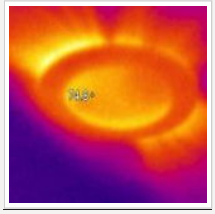
AIR LEAKAGE

Installed Cost
$ 1,015

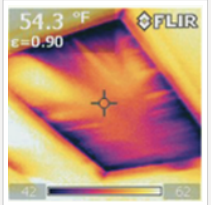
Energy Savings
Approx. $ 142

Why it matters
Air sealing is typically the most cost effective improvement you can make to your home. To properly seal out air leaks, a large fan called a blower door is used to depressurize your house. This makes air leaks easy to find, so corrective measures can be taken. A good air sealing job will dramatically increase the comfort of your home and help you save significant energy.

Good air-sealing and a continuous air barrier between the attic and the home's conditioned (living) space are important, not only to save energy and reduce fuel bills, but also to prevent moisture problems in the attic.



Air leakage at Can Lights:



Air leakage at Attic Hatch:

Seal Air Leaks

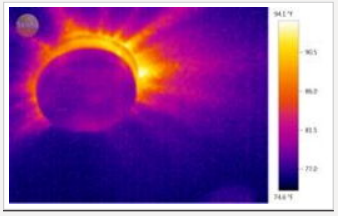
AIR LEAKAGE

Installed Cost
$ 1,015

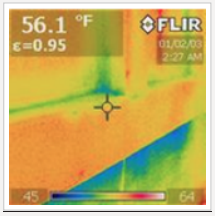
Energy Savings
Approx. $ 142

Why it matters

Air sealing is typically the most cost effective improvement you can make to your home. To properly seal out air leaks, a large fan called a blower door is used to depressurize your house. This makes air leaks easy to find, so corrective measures can be taken. A good air sealing job will dramatically increase the comfort of your home and help you save significant energy.



Air leakage at Smoke Detector:



Air leakage at Windows:

Now & Goal

Details	Now	Goal
Blower Door Reading	3,628 CFM50	2,540 CFM50
Wind Zone	2	N/A
N-Factor	15.0	N/A
Equivalent NACH	0.67 NACH	0.47 NACH
Conditioned Air Volume	21,546 ft^3	N/A
Effective Leakage Area	204 in^2	143 in^2
Equivalent ACH50	10.1 ACH50	7.1 ACH50

Attic Improvements

ATTIC

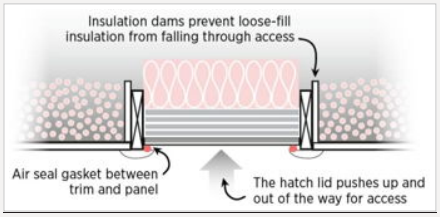
Installed Cost
$ 1,883

Energy Savings
Approx. $ 140

Why it matters

Adding insulation to your attic can lead to a significant reduction in your utility bills. This process is often combined with careful air sealing of the ceiling from the attic side to ensure the new insulation perform at its maximum level.

The current level of insulation in the attic is low and uneven. Taking the R Value to a consistent 49 will vastly improve the comfort and efficiency of your home.



Insulate the Attic Hatch: Openings used for access to the attic such as access panels, doors into kneewalls, or dropdown stairs should be air sealed and insulated.

Now & Goal

Details	Now	Goal
Attic Roof Absorptance	0.92	0.92
Attic Roof Emissivity	0.90	0.90
Modeled Attic Area	1,197 ft^2	1,197 ft^2
Attic Insulation	10 R Value	49 R Value
Radiant Barrier?	No	No

Cooling System

COOLING SYSTEM

Installed Cost
$ 3,355

Energy Savings
Approx. $ 184

Why it matters
Install a more efficient air conditioner or evaporative cooler. Depending on the age of the unit, substantial savings may be gained by replacing it with an Energy Star rated appliance. If it doesn't quite make sense to replace your air conditioner now, be prepared to choose a high efficiency Energy Star unit (14 SEER or higher) when it finally wears out.

If you choose to install / upgrade an AC unit, consider installing an ENERGY STAR rated or higher efficiency unit (14 to 20 SEER). Keep the pad on which the AC unit sits level, shaded and maintain at least one foot from the home and any other obstructions.

Now & Goal

Details	Now	Goal
Cooling Equipment 1		Central AC
Cooling Capacity 1	24,000 BTU/h	24,000 BTU/h
% of Total Cooling Load 1	100 %	100 %
Cooling System Manufacturer 1	Unknown	Unknown
Cooling System Efficiency 1	10.0 SEER	17.0 SEER
Cooling System Model Year 1		2015

Heating System

HEATING SYSTEM

Installed Cost
$ 6,288

Energy Savings
Approx. $ 264

Why it matters
Install a more efficient furnace, boiler or heat pump. Depending on the age of the unit, substantial savings may be gained by replacing it with an Energy Star rated appliance. If you're heating with gas, look for a sealed combustion unit. They're much safer since the exhaust pathway from the unit is sealed and goes directly outside. If it doesn't quite make sense to replace your heating system now, be prepared to replace it with a high efficiency Energy Star unit when it finally wears out.

Upgrade your furnace to a 95-98% efficient, sealed combustion system. You will only be losing 2-5 cents per dollar of heating and you will reduce your risk of carbon monoxide poisoning.

Now & Goal

Details	Now	Goal
Heat Pump Inverter 1		No
Heating Equipment 1		Furnace
Heating Energy Source 1	Natural Gas	Natural Gas
% of Total Heating Load 1	90 %	90 %
Heating Capacity 1	0 BTU/h	50,000 BTU/h
Heating System Efficiency 1	68 AFUE	98 AFUE
Heating System Manufacturer 1	Unknown	Unknown
Heating System Model Year 1		2015
Heat Pump Inverter 2	No	No
Heating Equipment 2	Electric Resistance	Electric Resistance
Heating Energy Source 2		Electricity
% of Total Heating Load 2	10 %	10 %
Heating Capacity 2	100,000 BTU/h	100,000 BTU/h
Heating System Efficiency 2	100 AFUE	100 AFUE
Heating System Manufacturer 2	Unknown	Unknown
Heating System Model Year 2		2015

Thermostat Set Points

THERMOSTAT

Installed Cost
$ 170

Energy Savings
Approx. $ 197

Why it matters
Installing a programmable thermostat (or correctly setting the one you currently have) will help you to use less energy when you're not at home or when you're sleeping.

The location of your thermostat can affect its performance and efficiency. Read the manufacturer's installation instructions to prevent "ghost readings" or unnecessary furnace or air conditioner cycling.

To operate properly, a thermostat must be on an interior wall away from direct sunlight, drafts, doorways, skylights, windows, vents and fans. It should be located where natural room air currents–warm air rising, cool air sinking–occur. Furniture will block natural air movement, so do not place pieces in front of or below your thermostat. Also make sure your thermostat is conveniently located for programming. Energy.gov.

Notes to Homeowners

The improved thermostat settings are the industry standard for energy efficiency. Try these settings to see how they match with your comfort zone, adjust by small degrees if necessary.

Now & Goal

Details	Now	Goal
Heating Setpoint High	68 °F	68 °F
Heating Setpoint Low	68 °F	62 °F
Cooling Setpoint High	75 °F	85 °F
Cooling Setpoint Low	75 °F	78 °F

Upgrade Water Heater

WATER HEATER

Installed Cost
$ 1,223

Energy Savings
Approx. $ 73

Why it matters
High efficient hot water heaters save energy and are safer due to carbon monoxide. Older units run the risk of leaking. Consider replacement if your hot water heater is 13 or more years old.

Tankless water heaters are typically about 20% more efficient than tank-style heaters. If you have hard water, we do not recommend tankless units because minerals from the water can precipitate out inside the heat exchanger, leading to increased maintenance costs.

Now & Goal

Details	Now	Goal
DHW Fuel	Natural Gas	
DHW Type	Standard tank	
DHW Age	21-25	
DHW Location	Garage or Unconditioned Space	
DHW % Load	100 %	100 %
DHW Manufacturer	Unknown	Unknown
DHW Model Year		2015
DHW Energy Factor	56 EF	82 EF
DHW Energy Star	No	Yes

Upgrade Lighting

LIGHTING

Installed Cost
$ 77

Energy Savings
Approx. $ 239

Why it matters
Replacing incandescent bulbs with CFLs or LEDs will save significant energy and replacement costs over time.

Upgrade lighting to CFLs or LEDs. Replace incandescent light bulbs used more than an hour per day with compact fluorescent light bulbs (CFLs), and replace other bulbs with lower-Wattage standard incandescent bulbs. CFLs typically reduce lighting energy use by 75%.

Can lights should be replaced with new LED lights. This will reduce heat gain, save on energy, and prevent any heat related issues with the attic insulation.

Now & Goal

Details	Now	Goal
# of Incandescents	38	4
# of CFLs or LEDs	7	41
% CFL or LED	16 %	90 %

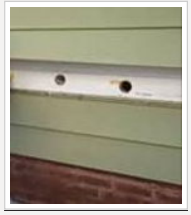
Insulate Walls

WALLS

Installed Cost
$ 5,508

Energy Savings
Approx. $ 493

Why it matters
Insulating your walls can lead to a significant reduction in utility bills. The is done by drilling small holes in the wall cavities either from the inside or outside and filling the space with cellulose, fiberglass, or even foam insulation. If it's time to replace your exterior siding, then be sure to ask your contractor about adding a layer of rigid foam underneath the new sheathing of 1" or more.



Insulate exterior walls:

By “dense packing” cellulose insulation in your wall cavities, air leaks and drafts will be dramatically reduced. To install the insulation, contractors will lightly pry up a few rows of siding of on your house and temporarily remove it. They will then drill a 2” hole in the sheathing for every wall cavity. A blower pushes cellulose insulation at high speed through a hose into the holes, filling the wall cavity. Great care is taken to ensure the cellulose fills into every part of the wall.

Now & Goal

Details	Now	Goal
Exterior Wall Siding	Wood/Fiber Cement siding	
Exterior Wall Construction	Frame	
Wall Cavity Insulation	0 R Value	13 R Value
Wall Continuous Insulation	0 R Value	0 R Value
Modeled Wall Area	2,517 ft^2	N/A

Refrigerator

REFRIGERATOR

Installed Cost
$ 1,336

Energy Savings
Approx. $ 69

Why it matters
Old refrigerators can often cost twice as much to operate as a new refrigerator. Energy Star units can use half the energy as older, less efficient models.

Now & Goal

Details	Now	Goal
Refrigerator Energy Star	No	Yes
Refrigerator Model Year	1990	2015
Refrigerator Manufacturer	Unknown	LG
Refrigerator Usage	840 kWh/yr	461 kWh/yr
Refrigerator Model		LSFS213

Health & Safety

What's This?
These tests are recommended by the Building Performance Institute (BPI). They can help identify potential health and safety concerns in your home.

Install a Low Level Carbon Monoxide Monitor

CO detectors are highly recommended in homes with fuel-burning appliances. The detectors signal homeowners via an audible alarm when CO levels reach potentially dangerous levels.

MOLD & MOISTURE

Moisture control is the key to mold control. Molds need both food and water to survive; since molds can digest most things, water is the factor that limits mold growth. Molds will often grow in damp or wet areas indoors. Common sites for indoor mold growth include bathroom tile, basement walls, areas around windows where moisture condenses, and near leaky water fountains or sinks. Common sources or causes of water or moisture problems include roof leaks, deferred maintenance, condensation associated with high humidity or cold spots in the building, localized flooding due to plumbing failures or heavy rains, slow leaks in plumbing fixtures, and malfunction or poor design of humidification systems. Uncontrolled humidity can also be a source of moisture leading to mold growth, particularly in hot, humid climates.

ELECTRICAL

Have an electrician look at the wall plugs that are located near a water source, to see if a GFCI (ground-fault circuit interrupter) is recommended.

CAZ (combustion appliance zone) test results:

Air Filters

ADDITIONAL NOTES

About this section

Additional notes are miscellanous items that deserve a mention in your home's report.

These mentioned items are not included in the cost or savings of your project.

Why it matters

A dirty filter will slow down air flow and make the system work harder to keep you warm or cool — wasting energy. A clean filter will also prevent dust and dirt from building up in the system — leading to expensive maintenance and/or early system failure. EnergyStar.gov

Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every 3 months.

Water Sense

ADDITIONAL NOTES

About this section

Additional notes are miscellanous items that deserve a mention in your home's report.

These mentioned items are not included in the cost or savings of your project.

Why it matters

On a national scale, if every home in the United States installed WaterSense labeled showerheads, we could save more than $2.2 billion in water utility bills and more than 260 billion gallons of water annually. In addition, we could avoid about $2.6 billion in energy costs for heating water. EPA.gov.

Save water and protect the environment by choosing WaterSense labeled products in your home.

Showering is one of the leading ways we use water in the home, accounting for nearly 17 percent of residential indoor water use—for the average family, that adds up to nearly 40 gallons per day.

Rebates & Incentives

1-866-NYSERDA • www.nyserda.ny.gov

The 10% cashback incentive

When you complete energy efficiency upgrades through the Home Performance with ENERGY STAR program, you will be eligible to receive 10 percent of the cost of eligible upgrades back (up to a maximum of $3,000) after the work is complete.

Your contractor can help you verify that your upgrades qualify for this incentive.

For a full list of energy efficiency improvements that qualify for 10% cash back, download this PDF:
bit.ly/ny-eligible-measures

Assisted Home Performance with ENERGY STAR grants

Depending on household income you can qualify for a grant of up to $5,000 to cover up to 50 percent of the cost of energy efficiency upgrades. In most New York State counties, a family of four with a household income up to about $65,000 will qualify.

Two- to four-unit residential buildings with additional income-eligible households can qualify for a grant of up to $10,000.

To learn more go to:http://bit.ly/ny-assisted-3

Get low-interest financing! Two options:

Option 1: On-Bill Recovery Loans with a 3.49% interest rate

An On-Bill Recovery Loan allows you to have your loan payments built into your utility bill. You'll have no extra bills each month and nothing new to keep track of. Even better: your monthly payments will be calculated not to exceed the expected amount your energy upgrades will save you on energy costs. So your energy savings cover most or all of your payment. Interest rates are subject to change.

When you rent or sell your home, you will have the option to transfer the unpaid balance of loan to the new owners or tenants. If you do choose to transfer the balance, you'll be required to provide notice to the new owner or tenant.

On-Bill Recovery Financing requires a declaration to be signed and filed by NYSERDA. The declaration is not a lien on the property but is recorded to provide notice to others of the obligation under the loan note.

Customers of the following utilities are eligible for On-Bill Recovery Financing: Central Hudson Gas & Electric, Con Edison, Long Island Power Authority, NYSEG, National Grid (upstate NY customers only), Orange & Rockland, and Rochester Gas & Electric.

Option 2: Smart Energy Loans with interest rates as low as 3.49%

Smart Energy Loans offer affordable interest rates, flexible terms and simple repayment options. Paying for a Smart Energy Loan is similar to any other conventional loan. You make monthly payments to NYSERDA's loan servicer by check or automatic bank withdrawals. The current interest rate is 3.49% if you pay via automatic bank withdrawals. Interest rates are subject to change

To apply for financing visit Energy Finance Solution:
http://bit.ly/ny-financing

Financing

About financing

The loan scenario(s) listed are examples only and are not a formal offer of financing. Rates, terms and closing costs and eligibility requirements may vary.

Powersaver 203(k) Streamline

Mortgage loans for those looking to purchase and renovate, or refinance and renovate a home. $3,500 of the loan has to go towards qualifying energy upgrades. Low closing costs.

Terms & Conditions

Minimum Loan	$ 3,500
Maximum Loan	$ 35,000
Min. Cash Down	$ 0
Rate	4.00%
Term	360 months
Min. FICO Score	640
Closing costs	N/A

The Math

Job Cost	$ 20,854
Cash down	$ 0
Loan amount	$ 20,854
Your loan payment: (4.00% @ 360 months)	$ 100
Estimated energy savings	$ 150
Estimated net monthly savings	$ 50

Call Lindsay Olsen at 801-803-5495 or email lindsay.olsen@wjbradley.com to apply today!

Elevations Loan - 5 yr

Terms & Conditions

Minimum Loan	$ 500
Maximum Loan	N/A
Min. Cash Down	$ 0
Rate	3.80%
Term	60 months
Min. FICO Score	580
Closing costs	N/A

The Math

Job Cost	$ 20,854
Cash down	$ 0
Loan amount	$ 20,854
Your loan payment: (3.80% @ 60 months)	$ 382
Estimated energy savings	$ 150
Estimated net monthly cost	$ 232

Free energy advising to help you through the process and low interest rates for 3,5,7,10 and 15 year terms.

Metrics

About the metrics

These metrics are for the whole house in a pre and post-retrofit state.

The 'Baseline' savings numbers will likely not be the same as the actual energy consumption of the home. These numbers are weather normalized and then projected based on the Typical Meteorological Year for the past 30 years (TMY30). In other words, this is the energy consumption of the home for a typical year, not the year that the utility bills were from.

Metric	Baseline	Improved	Saved
Fuel Energy Usage therms/year	2,602	1,450	1,152
Electric Energy Usage kWh/year	16,252	10,963	5,289
Total Energy Usage MMBtu/year	316	182	134
Fuel Energy Cost $/year	1,886	1,051	835
Electric Energy Cost $/year	2,968	2,002	966
Total Energy Cost $/year	4,853	3,053	1,800
CO2 Production Tons/year	23.7	14.4	9.3
Payback years			10
Total Energy Savings			42%
Total Carbon Savings			39%
Net Savings to Investment Ratio SIR			1.7
Net Annualized Return MIRR			7.0%

Heating & Cooling Load Calculations		
Heating Load Btu/hr	70,003 Base	51,544 Improved
Cooling Load: Sensible Btu/hr	40,425 Base	30,096 Improved
Cooling Load: Latent Btu/hr	1,022 Base	1,003 Improved
Winter Design Temperature	7° Outdoor	70° Indoor
Summer Design Temperature	85° Outdoor	75° Indoor

Tech Specs

Property Details

Year Built:	1928
Conditioned Area:	2,394 ft²
Includes Basement:	No
Average Wall Height:	8.5 ft
Floors Above Grade:	2.00
Number of Occupants:	2.0
Number of Bedrooms:	4.0
Type of Home:	Single Family Detached
Front of Building Orientation:	East
Shielding:	Normal
Tuck Under Garage:	No

Appliances

Dishwasher Energy Star:	No
Range Fuel Type:	Natural Gas
Dryer Fuel Type:	Electricity
Clothes Washer Type:	Top Load
Clothes Washer Energy Star:	No
Dishwasher Installed?:	Yes

Refrigerators 1

Refrigerator Age:	22-24
Refrigerator Size:	19-21
Refrigerator Energy Star:	No
Refrigerator Usage:	840 kWh/yr

Lighting

% CFLs or LEDs:	N/A
Total # of Light Bulbs:	45

Attics 1

Insulation Depth:	1-3
Insulation Type:	Cellulose

Walls 1

Walls Insulated?:	No
Exterior Wall Siding:	Wood/Fiber Cement siding
Exterior Wall Construction:	Frame

Foundation

Crawlsp Insulatic	Crawlspace is uninsulated, open, or vented
Foundation: Basement:	50 %
Foundation: Crawlspace:	50 %
Foundation Above Grade Height:	2.0 ft
Basement Wall Insulation:	None or Bare Walls

Windows 1

Window Type:	Double pane
Window: North Area Percent:	20 %
Window: East Area Percent:	20 %
Window: South Area Percent:	20 %
Window: West Area Percent:	20 %
North Overhang Depth:	2 ft
East Overhang Depth:	2 ft
South Overhang Depth:	2 ft
West Overhang Depth:	2 ft

Doors 1

Door 1 Type:	Wood

Doors 2

Door 2 Type:	Wood with Storm

Air Leakage

Blower Door Reading:	3,628 CFM50

Heating & Cooling 1

System Name:	Central
System 1 Type:	Both
Heating Energy Source:	Natural Gas
Age of Heating Equipment:	16-40
% of Total Heating Load:	90 %
Dual Equipment:	Furnace / Central AC
Age of Cooling Equipment:	16-20
Cooling Capacity:	24,000 BTU/h
Heating System Efficiency:	68 AFUE
% of Total Cooling Load:	100 %
Duct Location:	Basement (unconditioned)
Duct Insulation:	No Insulation
Duct Leakage:	15% - Somewhat leaky

Heating & Cooling 2

System Name:	Baseboards
System 2 Type:	Heating
Heating Equipment:	Electric Resistance
Age of Heating Equipment:	16-40
% of Total Heating Load:	10 %
Heating Capacity:	100,000 BTU/h

Tech Specs

Thermostat

Programmable Thermostat Installed:	No
Heating Setpoint High:	68 °F
Heating Setpoint Low:	68 °F
Cooling Setpoint High:	75 °F
Cooling Setpoint Low:	75 °F

Water Heating 1

DHW Fuel:	Natural Gas
DHW Type:	Standard tank
DHW Age:	21-25
DHW % Load:	100 %
DHW Location:	Garage or Unconditioned Space
DHW Temperature Settings:	High (140-150 F)
DHW Energy Star:	No

Pool & Hot Tub

Pool:	No
Hot Tub:	No

Electricity

Provider:	Easter
Highest monthly summer electric bill:	341
Lowest monthly electric bill:	136

Primary Fuel: Natural Gas

Highest monthly winter natural gas bill:	250 Dollars
Lowest monthly natural gas bill:	57 Dollars

Contractor Contact Information

Sandy Michaels
New York Testing
BPI Certified
123 Bell Street

Glossary

Annual Fuel Utilization Efficiency (AFUE) The measure of seasonal or annual efficiency of a residential heating furnace or boiler. It takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.

Annualized Return The return an investment provides over a period of time, expressed as a time-weighted annual percentage. This is the equivalent annual interest rate you would get if you put the same amount of money spent on the energy upgrade into a savings account.

Asbestos Asbestos is a mineral fiber that has been used commonly in a variety of building construction materials for insulation and as a fire-retardant, but is no longer used in homes. When asbestos-containing materials are damaged or disturbed by repair, remodeling or demolition activities, microscopic fibers become airborne and can be inhaled into the lungs, where they can cause significant health problems.

British Thermal Unit (Btu) The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories.

Carbon Monoxide (CO) A colorless, odorless but poisonous combustible gas with the formula CO. Carbon monoxide is produced in the incomplete combustion of carbon and carbon compounds such as fossil fuels (i.e. coal, petroleum) and their products (e.g. liquefied petroleum gas, gasoline), and biomass.

Cashflow When financing energy efficiency improvements, cashflow is the difference between the average monthly energy savings and the monthly loan payment.

Combustion Appliance Zone (CAZ) A contiguous air volume within a building that contains a combustion appliance such as furnaces, boilers, and water heaters; the zone may include, but is not limited to, a mechanical closet, mechanical room, or the main body of a house, as applicable.

Compact Fluorescent Light bulb (CFL) A smaller version of standard fluorescent lamps which can directly replace standard incandescent lights. These highly efficient lights consist of a gas filled tube, and a magnetic or electronic ballast.

Cubic Feet per Minute (CFM) A measurement of airflow that indicates how many cubic feet of air pass by a stationary point in one minute.

Carbon Dioxide (CO2) A colorless, odorless noncombustible gas that is present in the atmosphere. It is formed by the combustion of carbon and carbon compounds (such as fossil fuels and biomass). It acts as a greenhouse gas which plays a major role in global warming and climate change.

Energy Efficiency Ratio (EER) The measure of the energy efficiency of room air conditioners: cooling capacity in Btu/hr dtided by the watts consumed at a specific outdoor temperature.

Energy Factor (EF) The measure of efficiency for a variety of appliances. For water heaters, the energy factor is based on three factors: 1) the recovery efficiency, or how efficiently the heat from the energy source is transferred to the water; 2) stand-by losses, or the percentage of heat lost per hour from the stored water compared to the content of the water: and 3) cycling losses. For dishwashers, the energy factor is the number of cycles per kWh of input power. For clothes washers, the energy factor is the cubic foot capacity per kWh of input power per cycle. For clothes dryers, the energy factor is the number of pounds of clothes dried per kWh of power consumed.

Heating Seasonal Performance Factor (HSPF) The measure of seasonal efficiency of a heat pump operating in the heating mode. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of heat delivered for every watt-hour of electricity used.

Heat Recovery Ventilator (HRV) / Energy Recovery Ventilator (ERV) A device that captures the heat or energy from the exhaust air from a building and transfers it to the supply/fresh air entering the building to preheat the air and increase overall heating efficiency while providing consistent fresh air.

Light Emitting Diode (LED) Lighting An extremely efficient semiconductor light source. LEDs present many ad- vantages over incandescent light sources including lower energy consumption, longer lifetime, improved physical robustness, and smaller size.

Modified Internal Rate of Return (MIRR) This is your return on investment. Roughly speaking, if you invested the same amount of money for this project (listed on this report as the total cost) into a bank account, your equivalent interest rate from all of the energy savings would be the MIRR.

N-Factor A factor of how susceptible your house is to wind, influenced by weather patterns, location, and the number of floors in the home. Used in the calculation of NACH.

Natural Air Changes per Hour (NACH) The number of times in one hour the entire volume of air inside the building leaks to the outside naturally.

Payback Period The amount of time required before the savings resulting from your system equal the system cost.

R-Value A measure of the capacity of a material to resist heat transfer. The R-Value is the reciprocal of the conductivity of a material (U-Value). The larger the R-Value of a material, the greater its insulating properties.

Radon A naturally occurring radioactive gas found in the U.S. in nearly all types of soil, rock, and water. It can migrate into most buildings. Studies have linked high concentrations of radon to lung cancer.

Rim Joist In the framing of a deck or building, a rim joist is the final joist that caps the end of the row of joists that support a floor or ceiling. A rim joist makes up the end of the box that comprises the floor system.

Seasonal Energy Efficiency Ratio (SEER) A measure of seasonal or annual efficiency of a central air conditioner or air conditioning heat pump. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of cooling delivered for every watt-hour of electricity used by the heat pump over a cooling season.

Savings to Investment Ratio (SIR) A ratio used to determine whether a project that aims to save money in the future is worth doing. The ratio compares the investment that is put in now with the amount of savings from the project.

Appendix F:
Potential Trade Professional Platform Workflow & Features

If a trade professional platform were implemented, a potential workflow is outlined in Figure 2 below.

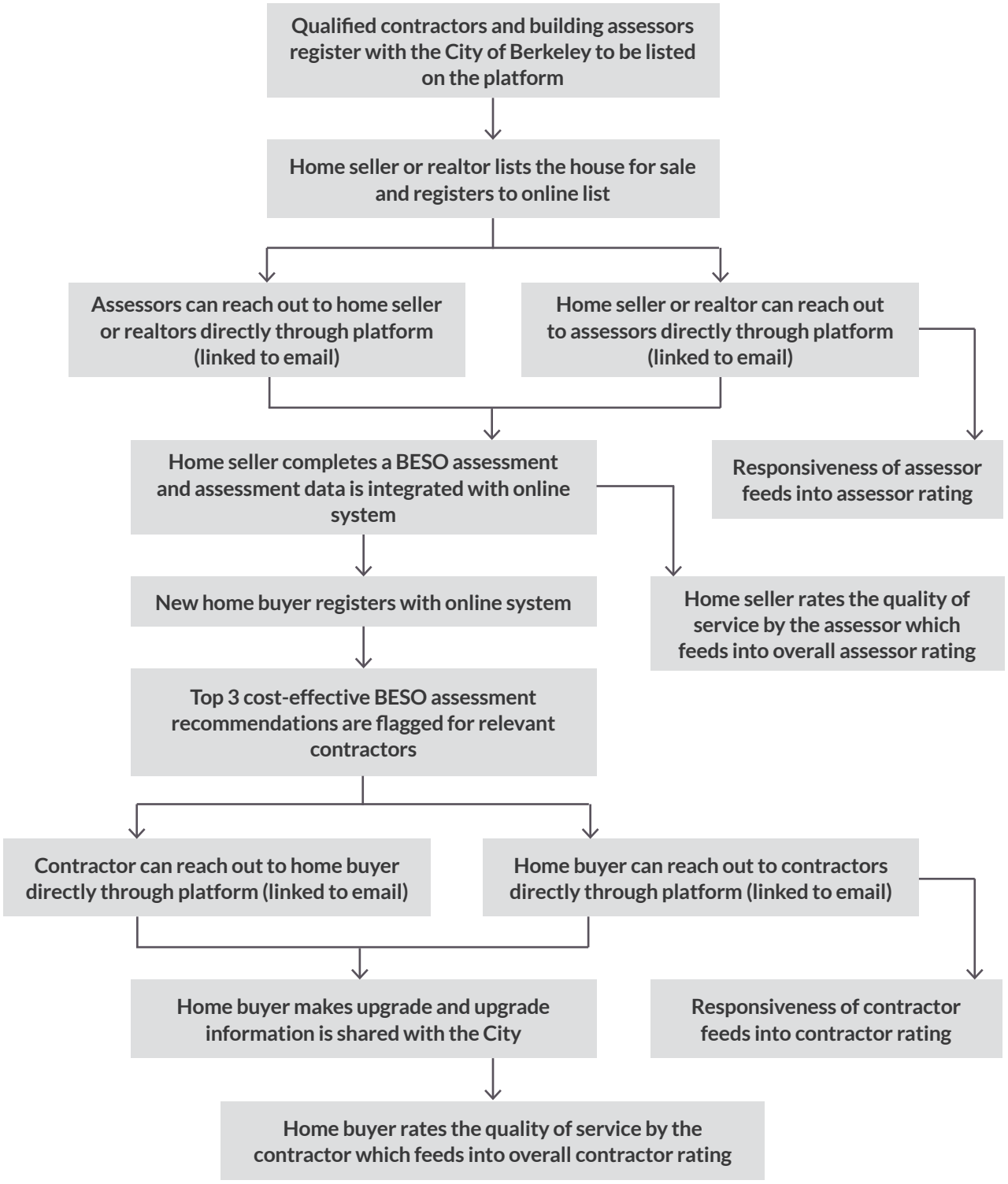


Figure 2: Potential Trade Professional Platform Workflow

Each of the potential workflow features that is associated with an online trade professional platform and their benefits are listed in Table 4 below.

Table 4: Trade Professional Platform Features and Benefits

Platform Feature	Benefits
Qualified contractors and building assessors register with the City of Berkeley to be listed on the platform	• Requires certain qualifications specified by the City • Provides baseline level of quality • Ensures that Berkeley can track whether there are contractors who can perform all possible upgrades recommended through BESO
Home seller or realtor lists the house for sale and registers to online system	• Homeowner or realtor registers to one platform that will contain information about assessors, the assessment completed on the home, and any potential upgrades they might want to make before selling the home
Assessors can reach out to home seller or realtor directly through platform (linked to email)	• Minimizes homeowner or realtor effort needed to determine bid estimate
Home seller or realtor can reach out to assessors directly through platform (linked to email)	• Allows for consumer choice when finding assessors
Responsiveness of assessor feeds into assessor rating	• Incentivizes assessors to respond promptly • Helps ensure home sale process is not hindered
Home seller completes a BESO assessment and data is integrated with online system	• Trade professional platform can be linked to new online application system which ensures multiple aspects of the program are integrated in one online system
Home seller rates the quality of service by the assessor which feeds into overall assessor rating	• Identifies both outstanding and underperforming assessors • Incentivizes assessors to provide quality service
New home buyer registers with online system	• New homeowner can easily see home evaluation information online and the potential upgrades they can make to their home • Ensures the data obtained by seller is consistent with the data that new homeowner receives
Top 3 cost-effective BESO assessment rec-ommendations are flagged for relevant contractors	• While some upgrades may be cost-effective, the upfront cost for the top 3 may vary so it is important to give a variety of options • Using top 3 recommendations gives the home or building owner the option to do one or more upgrades
Contractor can reach out to home buyer directly through platform (linked to email)	• Incentivizes another stakeholder in the BESO process to be involved • Minimizes home or building owner effort needed to determine bid estimate
Home buyer can reach out to contractors directly through platform (linked to email)	• Identifies home or building owners who are motivated to make upgrades • Allows for consumer choice when finding contractors
Responsiveness of contractor feeds into contractor rating	• Incentivizes contractors to respond promptly • Home or building owners receive prompt feedback when the BESO assessment is still fresh in their minds
Home buyer makes upgrade and upgrade information is shared with the City	• Building upgrade data is shared with the City • Data can be used to calculate emissions reductions and track electrification progress
Home buyer rates the quality of service by the contractor which feeds into overall contractor rating	• Identifies both outstanding and underperforming contractors • Incentivizes contractors to provide quality service

Appendix G: Benchmarking and Disclosure Programs

Table 5 below shows certain attributes of benchmarking and disclosure programs across the United States.

Table 5: Examples of Benchmarking and Disclosure Programs[x]

Jurisdiction	No. of Buildings	Area (Million Sq. Ft.)	Average Building size	Penalties?	Compliance Rate
Atlanta	2,900	402	13,862	Yes	NA[10]
Austin	2,800	113	4,036	Yes	NA
Berkeley	257	13.7	5,331	No	NA
Boston	1,600	250	15,625	Yes	73%
Boulder	475	26	5,474	Yes	NA
California	20,573	2400	11,666	Yes	NA
Cambridge	1,100	78	7,091	Yes	95%
Chicago	3,500	900	25,714	Yes	84%
Denver	3,000	360	12,000	No	NA
Evanston	557	45.6	8,187	Yes	NA
Kansas City	1,500	400	26,667	Yes	NA
Los Angeles	14,000	900	6,429	No	NA
New York City	33,147	2800	8,447	Yes	87%
Orlando	826	125.6	15,206	No	NA
Philadelphia	2,900	390	13,448	Yes	91%
Pittsburgh	861	164	19,048	NA	NA
Portland, ME	284	NA	NA	Yes	NA
Portland, OR	1024	87	8,496	Yes	NA
San Francisco	2312	203	8,780	Yes	NA
Seattle	3347	269	8,037	Yes	99%
Washington D.C.	2000	357	17,850	Yes	89%
Washington State	4600	247	5,370	No	N/A

10 Not available.

Appendix H: Performance Requirements in Other Cities

Table 6 below outlines the performance requirements for certain cities' programs across the United States. Berkeley could use these as a guide for requiring mandatory/prescriptive building tune-up measures.

Table 6: Performance Requirements in Other Cities

City	Requirement
Seattle	Requires building tune-ups every five years for commercial buildings 50,000 square feet (sf) or larger, excluding parking.
Los Angeles	Beginning in 2021, privately owned buildings more than 20,000 square feet in the City of Los Angeles must achieve certain efficiency targets or perform audits and retro-commissioning on a 5-year cycle
San Jose	Starting in 2021, if a building demonstrates that it meets key performance standards through yearly benchmarking, it may submit a Performance Verification Report. If a building is not able to meet these standards, it can perform an energy audit, returning, or targeted efficiency upgrade to im-prove performance.
Philadelphia	Mandates all nonresidential buildings 50,000 square feet and larger to either submit a certification of high energy performance to the City's office of Sustainability or conduct tune-up to bring existing building energy systems up to a state of good repair. They also conducted a pilot in city-owned buildings to quantify potential cost savings
New York City	Requires all buildings larger than 50,000 square feet to perform an energy audit and retro-commissioning every 10 years.
Boston	The Boston City policy requires owners of large and medium-sized buildings (>35,000 sq. ft.) to report annual energy and water use while also requiring those buildings to complete a major energy savings action or energy assessment every five years. This requires the building owners report the way they are improving their energy performance which in-cludes by lowering their energy usage, decreasing reliance on fossil fuels or getting an energy assessment. It also requires newly constructed building's report of its energy use for the first full calendar year after receiving a Certificate of Occupancy.

Appendix I: Sample Large Building Measures

Table 7 below shows various examples of large building measures that Berkeley could provide to large building owners in order to motivate them to pursue energy upgrades.

Table 7: Sample Large Building Measures

Measure Type	Measure Description	Strategy
No Cost/Low Cost	• Verify setpoints in consistence with facility requirement • Implement occupied and unoccupied set points • Implement reset strategies based on the space load and or outside condition • Check for economizer operation and modify setpoints to reflect the current facility requirement • Identify and arrest air, water and refrigerant leakages • Implement HVAC unit tune-up to increase the operating efficiency • Identify and implement preventive maintenance procedures • Install timers if appropriate	Building Tune-up/Retune (payback less than 1 year)
Medium cost measures	• Rezone, combine zones or separate zones to make better use of system loading • Calibrate, replace and relocate sensors if necessary • Check and insulate/reinsulate piping and ducting • Install VFDs if the system operates at part load majority of the time. • Check building air leakage and mitigate	Large tune-up (Payback less than 3 years)
Investment grade measures	• Upgrade windows, add window film, add insulation • Conduct envelope and mechanical system air leakage testing and seal the openings. • Recalculate the current cooling and heating load, right size and replace aged equipment • Install cost effective heat recovery devices to reduce the load on the selected system • Install air and water source heat pumps, geothermal heat pump and heat pump water heaters. • Install/upgrade smart control system • Track energy and demand through EMS system and integrate on-demand load curtail strategies	System/equipment replacement and/or ems installation (Payback over 5 years)

Appendix J: Sample of Current PG&E Rebates

Table 8 contains specific examples of current PG&E rebates available under various programs. This list is not exhaustive but this information is an example of what can be used to educate building owners.

Table 8: Select Examples of Current PG&E Rebates

Incentive Type	Measure	Incentive Amount
Product-specific	HVAC Rebates: • VFDs for HVAC fans • Advanced rooftop HVAC controls	• $80/hp for VFDs • Advanced rooftop HVAC controls: up to $1,500 for advanced digital economizer controls; $600 for CO2 sensors; up to $155/ton and $194/ton for enhanced ventilation control for packaged HVAC with and without high efficiency supply fan motors
	Refrigeration Rebates: • Anti-Sweat Heater controls (ASH) • High efficiency refrigeration display cases with special doors • Display cases for open multi-deck replacement	• $25/linear ft for ASH controls • $75/linear ft for refrigeration cases • $175/linear ft and $75/linear ft for low and medium temperature open multi-deck replacements
	Commercial cooling equipment: refrigerators, freezers and ice machines	Up to $350/unit
	Interior high-bay and low-bay LED lighting	Up to $40/ fixture
Custom Retrofit[xi]	Custom incentives are based on calculated kWh, kW, and therm savings; they are determined by whether the savings are to-code, above code, or whole building normalized metered energy	• $0.12/kWh savings for above code and whole building normalized metered energy consumption • $75/kW, $150/kW and $200/kW savings for to code, above code, and whole building metered energy cases, respectively • $0.50/therm, $1.25/therm and $1.75/therm savings for to code, above code, and whole building metered energy cases, respectively
Retro-commission-ing[xii]	One or more of the following measures is used to fine-tune building systems: • Chiller/Boiler optimization; • Reduce ventilation; • Decrease supply air pressure set-point and system rebalancing; and/or • Aligning zone temperature to building's schedule	• $0.06/kWh savings • $0.50/therm savings • $75/on-peak kW savings
Energy Storage and Generation [xiii]	Generation – three-step incentive based on total generation per site: • Waste heat to power, • Combined heat and power (CHP) • Fuel cell (electric only)	Incentive/W generation: • From waste heat: $0.60, $0.50 and $0.40 • From CHP and Fuel Cell: up to $1.20, $1.10 and $1.00
	Storage – five-step incentive based on total storage capacity per site	Incentive/Wh storage: $0.40, $0.35, $0.30, $0.25, $0.20

Endnotes

i BEI Berkeley Market Segmentation Analysis and Discussion.

ii https://beneficialelectrification.com/faqs.

iii https://www.chicago.gov/city/en/progs/env/building-energy-benchmarking---transparency.html.

iv https://www.abettercity.org/docs/06.2012%20-%20Benchmarking%20report%20-%20Final.pdf.

v https://www.cacx.org/resources/documents/CA_Commissioning_Guide_Existing.pdf.

vi https://www.energy.ca.gov/reports/efficiency_handbooks/400-00-001D.PDF.

vii https://www.boma.org/BOMA/Research-Resources/1-BOMA-Reports/BEPCResources.aspx.

viii https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/BESO%20Evaluation%20Recommendations%20-%20Assessor%20Meeting.pdf.

ix https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Assessment%20Requirements%20Chart_current.pdf

x https://emp.lbl.gov/sites/default/files/lbnl_benchmarking_final_050417_0.pdf.

xi https://www.pge.com/en_US/large-business/save-energy-and-money/business-solutions-and-rebates/product-rebates.page.

xii https://www.pge.com/en_US/large-business/save-energy-and-money/facility-improvement/retrocommissioning.page.

xiii https://www.pge.com/en_US/small-medium-business/energy-alternatives/private-solar/understand-the-solar-process.page.