Going Mainstream with Home Energy Ratings by Leveraging Site-Specific Data in California

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ABSTRACT

Globally, home energy asset ratings and labeling programs have long been proclaimed as a panacea for bringing energy efficiency – and now clean energy – to the mainstream. Reliable, consistent, and consumer-friendly ratings promise to provide a way for energy characteristics to be valued through the real estate transaction process. Ultimately, bridging the massive amounts of public subsidies currently being invested in clean energy to stand-alone private investments is needed to create a viable long-term home energy asset rating program. Local, state, and national efforts in the United States have made progress with these systems with a range of success, and by using a range of methods. However, today, America's home energy rating systems remain at a distance from successful energy performance certificate programs established and proven in Europe from countries like Denmark, Germany, and France.

In 2024, the largest state in the union will administer a public rulemaking to adopt a consistent, accurate, and uniform rating system based on a single statewide rating scale. California law requires the California Energy Commission (CEC) to establish criteria for adopting a statewide home energy rating and labeling program for residential dwellings. The program must promote accurate ratings to protect consumers while including estimates of utility bill savings, providing home improvement recommendations, and setting requirements for labeling procedures. This paper discusses CEC's authority and its aspiration to update regulations to implement a home energy rating and labeling program that is modern, meets the needs of consumers, and helps move the state towards achieving load flexibility and climate action goals.

Background

The CEC serves as California's primary energy policy and planning agency, as established by the Warren-Alquist Act (1974). Since the 1990s, the CEC has recognized the need for having a standardized home energy rating system which the state, utility incentive programs, and others could rely upon to communicate the value of energy efficiency. California Public Resources Code (PRC) section 25942, titled Home Energy Rating Program, directed the CEC to "*establish criteria for adopting a home energy rating program for residential dwellings*", among other things. The program must include (1) consistent, accurate, and uniform ratings based on a single statewide scale; (2) estimates of utility bill savings and recommendations on energy efficiency improvements; (3) training and certification procedures for home raters; (4) a centralized reporting database; and (5) effective labeling that meets the needs of consumers.

In response to this directive, the CEC promulgated regulations establishing the California Home Energy Rating System (HERS) Program in 1999. In 2008, the CEC amended the HERS regulations to fully implement the Home Energy Rating and Labeling Program (CCR). The intention of the regulations is and has always been to assist homeowners, homebuyers, renters, the real estate industry, mortgage lenders, and others in understanding home energy costs.

Participation in the program is voluntary. Ideally, a rating made pursuant to the regulations could be used as a means to compare the energy efficiency or energy features of a home as compared to other homes and cost-effective energy efficiency recommendations would also be provided to encourage homeowners to act and save money on their energy bills. However, despite efforts to establish the Home Energy Rating and Labeling Program, it has been mostly unsuccessful in gaining momentum due to a variety of issues. Mainly, efforts failed to effectively communicate actionable information to the average consumer, and therefore resulted in limited market value for parties generating ratings.

The regulations for the voluntary Home Energy Rating and Labeling Program have not been updated since 2008 and the supporting tools are out of date. Since inception, priorities have largely shifted to improving other components of the California HERS Program. These have included focusing on mandatory regulations for field verification and diagnostic testing to support the California Energy Code. However, given a vastly different landscape for home energy rating programs from 2009 and current climate action goals, the state of California is now taking steps to revitalize the Home Energy Rating and Labeling Program.

Home Energy Rating Programs

The landscape for home energy rating programs has evolved and these programs are now often suggested as a key component to bringing energy efficiency to the forefront in battling climate change within the residential building sector. Home energy rating programs are especially emphasized as a solution for the existing building stock. While tightening energy codes is one strategy that has been used to improve energy efficiency and promote clean energy in newly constructed homes, most jurisdictions struggle with how to tackle improving energy efficiency in existing homes, which make up the majority of the residential building stock. Moreover, a large portion of existing homes were built before the emergence of energy codes[1]. The strategy to address existing homes has mainly been through utility incentive and rebate programs and public subsidies to encourage energy efficiency improvements.

Home energy ratings programs, voluntary or mandatory, have been deployed locally, through nationwide and federal programs, and internationally. The ultimate goal of most of these programs is to recognize and bring market value for energy efficiency features among homes. Consumer interest in climate action has been steadily increasing, leading to important use-case opportunities for home energy ratings especially during real estate transactions. After mortgage payments, or rental payments, utility bills are the next largest ongoing housing cost (Brannon 2023). This cost remains largely unknown to buyers and renters and is therefore difficult to include in the calculus around real homeownership costs. In addition, this presents a risk to the mortgage lenders. Having greater transparency around utility bills could provide for reduced loan defaults. An effective home energy rating program could provide a pathway for the real estate industry to recognize and adopt the idea that energy efficiency and energy assets should be fundamental to residential valuation criteria. Such a program can benefit the following parties in the following ways:

[1] More than 75 percent of existing homes and commercial buildings in California were built before the first California Energy Code that was adopted in 1978.

- **Home occupants:** Brings awareness of a home's energy features, provides a means to shop and compare home energy costs, provides additional information for budgeting for home occupancy, assists in qualifying for energy financing opportunities, and identifies immediate cost-effective energy improvements.
- **Home sellers:** Provides facts about the energy characteristics of home, provides opportunity to add appraisal value if home is efficient, identifies opportunities to make home more attractive.
- **Builders:** Demonstrates energy features of homes substantiated by a recognized third-party, differentiates homes from the competition, brings value to energy saving features that have been embedded into construction practices from code updates or otherwise.
- **Lenders:** Improves risk assessment by more fully accounting for total cost of ownership, provides a tool that can be used to qualify for energy efficiency mortgages.

At a high-level, the home energy rating process usually starts with a site visit from the rater (other terms like accessor and inspector may be used interchangeably) to perform a home assessment and collect the field data. They are guided by program forms or other tools to ensure necessary building attributes are captured and energy features of the home are properly translated to create a model. Other items may also be collected like energy bills, and field testing such as duct and envelope leakage tests may be performed. The data collected is then entered into an approved modeling software that creates the rating and report. The software typically does this by performing an hourly energy simulation and applying defined methodologies that compare the results with the rating of other homes. The comparison is described by a rating or score. The model could be fine-tuned by the user by entering additional data and evaluating for potential energy efficiency improvements. A report including the rating and labeling is issued. It is important that the report and labeling be presented in a clear and effective manner, to be easily understood by the layperson. The report typically includes the rating or score, summary of energy efficiency features, energy usage and utility cost estimates, greenhouse gas emissions estimates, recommendations for energy improvements with estimated savings, and any other useful information that the program wants to convey to the homeowner.

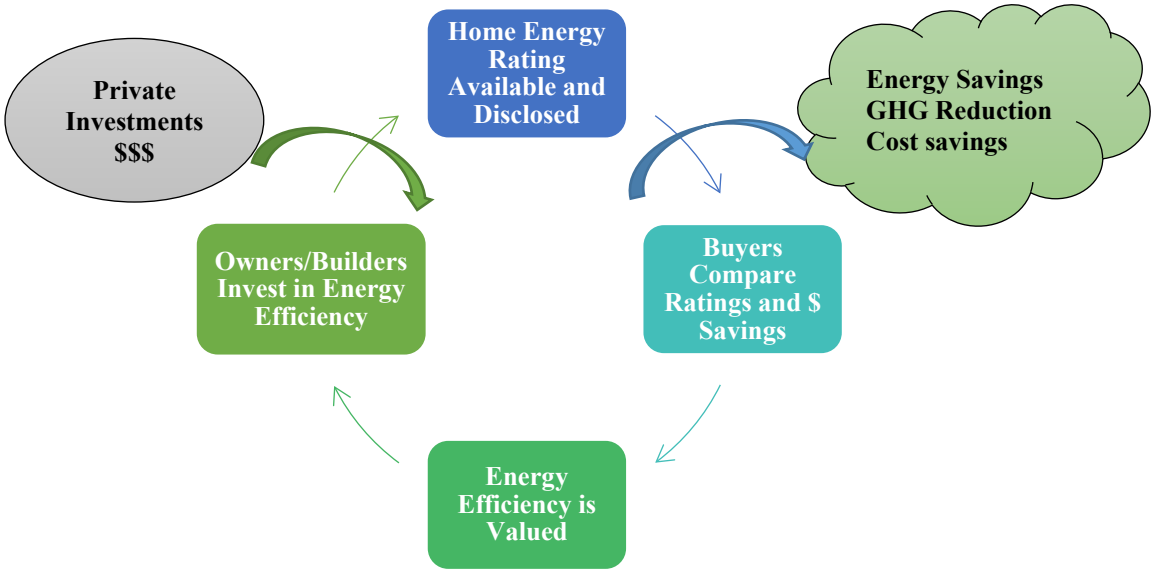

Figure 1: An Effective Home Energy Rating Program

Updating and Improving California's Program

In October 2023, the CEC instituted a rulemaking proceeding with the goal to revamp and modernize California's Home Energy Rating and Labeling Program (23-HERS-02). This strategic move has since been met with overwhelming support from the public, support from the builder community, and has sparked interest from numerous countries and economies that are interested in collaborating with the state[2]. This receptivity and collaborative spirit, locally, nationally and globally, promise to offer California a wealth of experience, lessons learned, and a renewed confidence making responsible use of existing authority. At the time of this writing (May 2024) substantial work lies ahead.

Learning from the Past

The CEC's Home Energy Rating and Labeling Program as it functions now is perceived as fairly complex and features components beyond conventional home energy rating programs, potentially contributing to its lack of widespread adoption. The approval criteria, which set the methodology for a home energy rating, largely mirrored the approval criteria for California's Energy Code compliance software. This means the minimum requirements to create a model required a significant number of inputs and a well-trained software user. While this complexity was intended to enhance precision and accuracy in ratings and estimates, it also results in lengthy processing times for data gathering and software modeling. Not only does this make it expensive to create a rating, the time and process for the field work, as well as the added time adding to the cost of obtaining a rating, could be seen as intrusive. Additionally, as compared with a conventional home rating program, the comprehensive program demands increased training and certification for raters and any individuals involved, along with rigorous oversight procedures. California's past program utilized a rating scale from 0 to 250, with 100 representing a home built to the 2008 California Energy Code and 0 indicating a net zero energy home – this is not easily understood at first glance by a layperson. The detailed energy information provided in the report, while informative, could overwhelm many homeowners due to its technical nature.

Objectives for the Future Program

Driving the update to California's Home Energy and Labeling Program is a desire to develop a consistent, accurate, and uniform home energy rating system based on a single statewide rating scale. However, the CEC recognizes that consumer communication doesn't stop at California's borders. To improve odds of success, California will have to establish a program that respects and compliments the diverse and complex landscape of home energy rating programs that currently exist.

By statute, California's Home Energy Rating and Labeling Program is directed to include reasonable estimates of potential utility bill savings, and reliable recommendations on cost-effective measures to improve energy efficiency – a directive that has been particularly challenging considering the diversity of housing stock in a state with over 14 million homes, and

[2] Majority of the public comments received are in strong support of CEC instituting the rulemaking to update the Home Energy Rating and Labeling Program and can be found in CEC Docket 23-HERS-02.

very large number of utilities with very complex rate structures. Foundational characteristics for the labeling program coming from both statute and stakeholder feedback include:

- Dollar estimates of utility bills and potential utility bill savings (required by statute)
- Consistent rating or score that is easily understood by the layperson (required by statute)
- Recommendations for cost effective home improvements (required by statute)
- Environmental impacts
- Sources for applicable rebates and/or grants to reduce the upfront cost of the recommended home improvements

Additionally, an effective program will aim to:

- Provide concise and effective labeling (required by statute)
- Simplify the process and program requirements for the layperson (may sacrifice some accuracy for now, with improvements over time)
- Aim to lower cost impact to consumers

Home energy rating tools have progressed since CEC's Home Energy and Labeling program was first developed and have garnered attention in different areas of the world. For instance, U.S, federal Department of Energy's (DOE) Home Energy Score is used within cities in California and other states, adopted by local jurisdiction programs and other entities. For example, the DOE Home Energy Score employs a straightforward scale of 1 to 10, requires only a relatively short amount of time to complete the home assessment, and requires no specialized tools (HES). Another home rating system, the RESNET's HERS Index, is primarily used for newly constructed homes and has long been recognized by federal government and mortgage industry programs. RESNET cites having rated over 4 million homes to date. In Europe, the European Union mandated the Energy Performance Certificates scheme in 2006. The Danish Energy Agency (DEA) complied with the mandate by requiring homes to obtain an EPC label at new construction and when an existing home is sold or rented in Denmark. Over 40 percent of total housing stock in Denmark has received an DEA EPC label (DEA EPCs). Aside from home energy ratings tools themselves, technology has significantly enhanced with many tools and software applications available that can be leveraged to help simplify and automate processes.

By empowering consumers with knowledge about the efficiency of homes for sale or rent, the impacts of energy features on their prospective utility bills, and savings associated with various potential improvements, the CEC is confident that consumers will place more value on energy-saving features. In a study conducted by the Danish Energy Agency it was found that buyers were willing to pay more for more efficient homes (Brand 2018). Utility bills across the state have been steadily climbing, rendering energy efficiency gains a more significant impact on the total cost of home ownership or rental. Fifty-one percent of household annual energy consumption comes from heating and air conditioning, with an additional 18 percent coming from water heating (EIA 2023). Using heat pumps for heating, air conditioning, and water heating will significantly reduce the annual utility budget – and cost of ownership (Wilson 2024). It is expected that as consumers begin to recognize the financial benefits of energy-efficient homes, the value of these homes will surpass that of similar but inefficient homes. In the

marketplace, over time this should lead to greater adoption of the improvements and technologies that not only reduce greenhouse gas emissions but also save consumers money.

Challenges to Successful Implementation

There are several challenges to successful implementation of a Home Energy Rating and Labeling program. Some key challenges identified by the CEC through meeting with stakeholders, seeking information via a Request for Information (RFI), and hosting a public CEC workshop (Workshop) to date include:

- **Simplicity in Labeling:** Labeling is often too complex is unlikely to be read by consumers. For example, in a 2011 survey of homeowners that participated in the first year of the EPC program in England and Wales only 45 percent were aware of available grants to reduce the cost of improvements – largely attributed to the EPC not having been read by the homeowners (Bjørneboe 2018).
- **Accuracy of Utility Bill Estimates:** The estimated utility bills must be of reasonable accuracy, and reflective of local conditions, in order for the labeling to be meaningful and actionable to consumers. Some caveats will need to be provided to account for utility bill differences attributed to behavioral differences as well as plug load differences between individuals, and the impacts of weather.
- **Availability of Utility Rate Schedules:** In order for utility bill modeling to be accurate, rate schedules from throughout the state must be entered into a database, made publicly available, and updated regularly. There is currently no widely available database that aggregates all utility rates within the state.
- **Energy Modeling:** The Home Energy Rating and Labeling program must use software that is made easily available and allows for modeling of utility rates for individual homes based on a limited number of inputs. This software may be a CEC produced software, it could be from another source, or multiple sources, built to specifications set by the CEC. It could be existing software or a modified version of existing software. For the program to function, modeling run times must be reduced in comparison to existing software such as CBECC-Res.
- **Home Energy Rating – Inspections:** Implementing a program to administer inspections throughout the state in a consistent manner is paramount to program success. A statewide program must account for the needs of all Californians. There are existing programs in some jurisdictions (the Bay Area Regional Energy Network, for example, offers a program including home inspections) that may serve as good models for a statewide offering. Alternatively, it might be possible to adjust the program so that a homeowner/realtor provide a limited number of inputs to develop a rating but give resulting rating less ‘weight’ than a rating performed by a professional.
- **Adoption by Real Estate Market:** To give realtors easy access to home energy ratings the Multiple Listing Service (MLS) used in the real estate industry for listing homes will need to include fields for these ratings.

Conclusion

California has long been at the forefront of climate action and clean energy, establishing itself as a global leader in energy efficiency and energy policy. As the largest economy in the United States and the fifth largest in the world, California's initiatives in energy efficiency and clean energy have made a significant impact on a global scale. Despite ranking second highest in energy consumption among states (behind Texas), California's per capita energy use is lower than that of all other states except for Hawaii, due to its energy initiatives and long-term investments.

The CEC has long recognized the importance of supplementing the economic model for energy efficiency to include both public subsidies and stand-alone for-profit models. California's effort to revamp the Home Energy Rating and Labeling program aspires to seed an expansion of investment in energy efficiency and clean energy in close collaboration with industry leaders. By working collaboratively with stakeholders and leveraging innovative solutions, the program can be brought up to date and be effective, as proven by other existing programs today. The CEC anticipates this will not be an easy task and expects that full implementation of updates will take time. Nonetheless, the CEC is committed to the effort due to the significant impact this initiative can have in meeting climate change goals.

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