DOCKETED	
Docket Number:	23-HERS-02
Project Title:	Whole-House Home Energy Rating and Labeling Pre-Rulemaking
TN #:	259213
Document Title:	September 18, 2024 Presentation - Home Energy Rating and Labeling Calculation Methods Workshop
Description:	This is the presentation from the Home Energy Rating and Labeling Calculation Methods Workshop on September 18, 2024.
Filer:	Cheng Moua
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	9/19/2024 7:57:16 AM
Docketed Date:	9/19/2024

Good morning and thank you for joining us.

The workshop will begin shortly.

Home Energy Rating and Labeling Program Pre-rulemaking Workshop #2

Calculation Methods

Cheng Moua, Senior Mechanical Engineer, Efficiency Division - Standards Compliance Branch

September 18, 2024

Please Note for Today's Workshop

- Program website: https://www.energy.ca.gov/programs-and-topics/programs/home-energy-rating-and-labeling-program
- CEC Docket **23-HERS-02**
- Subscribe to **"Home Energy Rating and Labeling"** email list at https://public.govdelivery.com/accounts/CNRA/signup/31719
- Presentation will be posted to the docket
- Workshop is being recorded
- Zoom Issues, contact:
  - Zoom (888) 799-9666 ext. 2
  - CEC Public Advisor publicadvisor@energy.ca.gov or by phone (916) 957-7910

How to Speak or Comment

Participants are muted during presentation

Zoom Application

- Click “raise hand” feature

Telephone

- Press *9 to raise hand
- Press *6 to Mute/Unmute

When called upon

- CEC will open your line
- Unmute on your end
- Spell name and state your affiliation

Alternative is to enter questions in the Q&A window

Today's Agenda

1. Opening Remarks and Introduction
2. Calculation Needs and Approach
3. Existing Standards and Tools Landscape
4. Incorporating CA Elements and Decarbonization
5. Balancing Program Complexity
6. Proceeding Major Milestones and General Schedule
7. Break
8. Presentation by David Heslam and Maddy Salzman, Earth Advantage
9. Presentation by Mudit Saxena, Xerohome
10. Public Comments

Opening Remarks

Che Geiser

Efficiency Division, Standards Compliance
Branch Manager

PRC 25942 Home Energy Rating and Labeling Statute

CEC to establish criteria for adopting a home energy rating program which includes…

1. Consistent, accurate, and uniform ratings on a single scale
2. Estimates of potential utility bill savings and measure recommendations
3. Training and certification, and quality assurance procedures for home raters
4. Establishing a centralized database
5. Labeling requirements

Home Energy Rating System Regulations

California Home Energy Rating System (HERS) Program

California Code of Regulations Title 20, Sections 1670 - 1675

Voluntary Whole-house Home Energy Rating and Labeling

Updating the Home Energy Rating and Labeling Program

Major activities to date…

- **October 2023:** CEC approved an Order Instituting Rulemaking to update program
- **November 2023 – Ongoing:** Staff outreach and meetings with stakeholders
- **December 2023 – February 2024:** Staff released a Request for Information solicitating preliminary comments
- **April 2024**: Pre-rulemaking Workshop #1 General Overview

Calculation Methods

Priorities for Establishing Framework

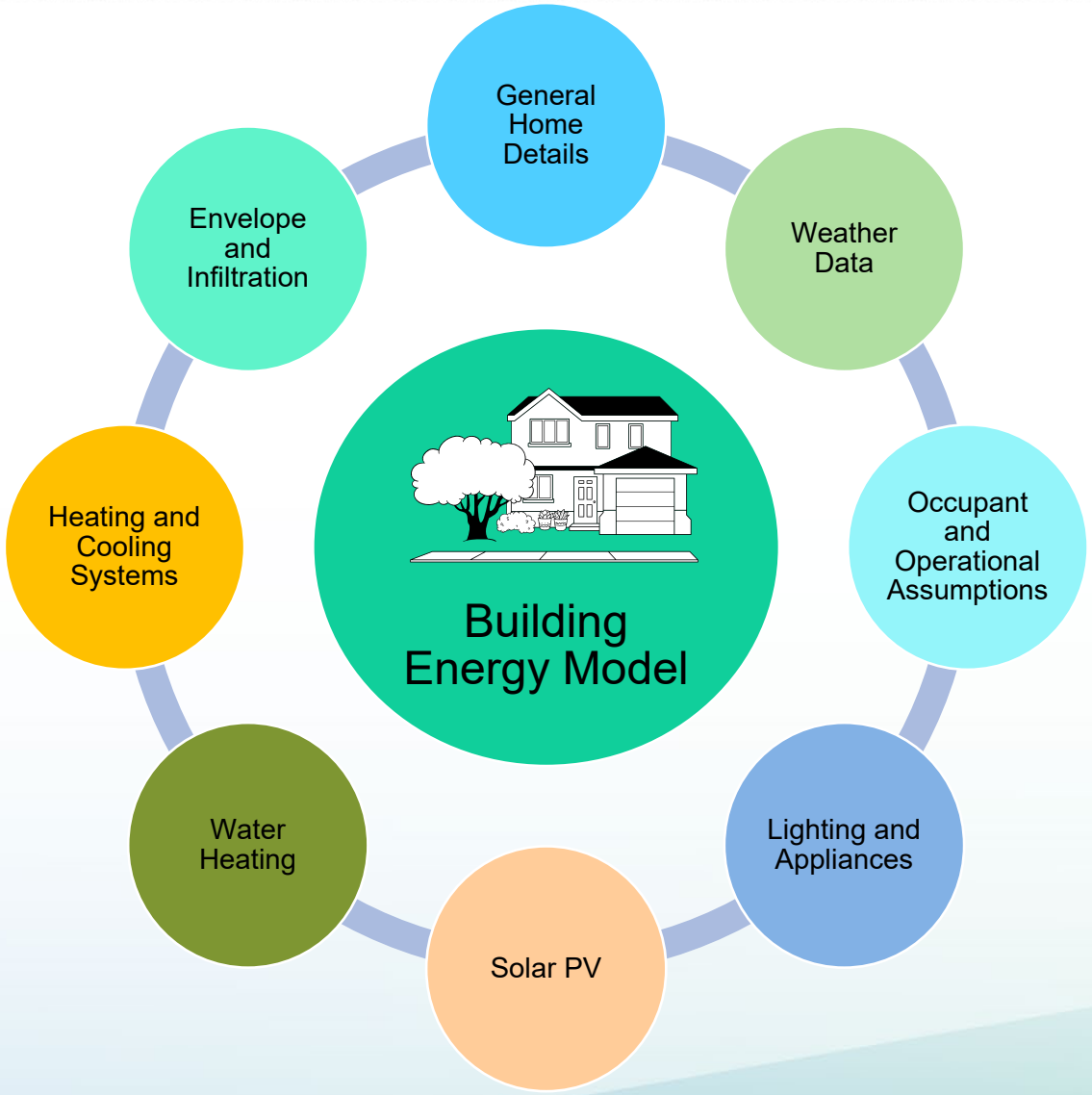
- ✓Producing consistent and reliable estimates
- ✓Easy-to-use software
- ✓Prioritize solution for existing homes
- ✓Identify elements important to CA and how to incorporate
- ✓Leveraging other existing programs, tools, and standards
- ✓Non-proprietary approach for regulations

Calculation Methods Applicable to

Home Energy Label

- Electric and Gas Consumption
- On-site Generation
- Utility Costs
- Greenhouse Gas Emissions
- Making Energy Measure Recommendations

Calculation Methods Applicable to



- Asset ratings focuses on energy performance potential based on location, home characteristics, and energy features
- Makes standard assumptions for occupancy
- Traditionally 8760 hourly simulation
- Single point in time calculation

Calculation Methods Applicable to

Question

- What can be used for…
  - Calculation procedures and modeling rules for each end-use
  - Calculating Solar PV
  - Standard assumptions that must be made for occupancy and operational
  - Reference data sources

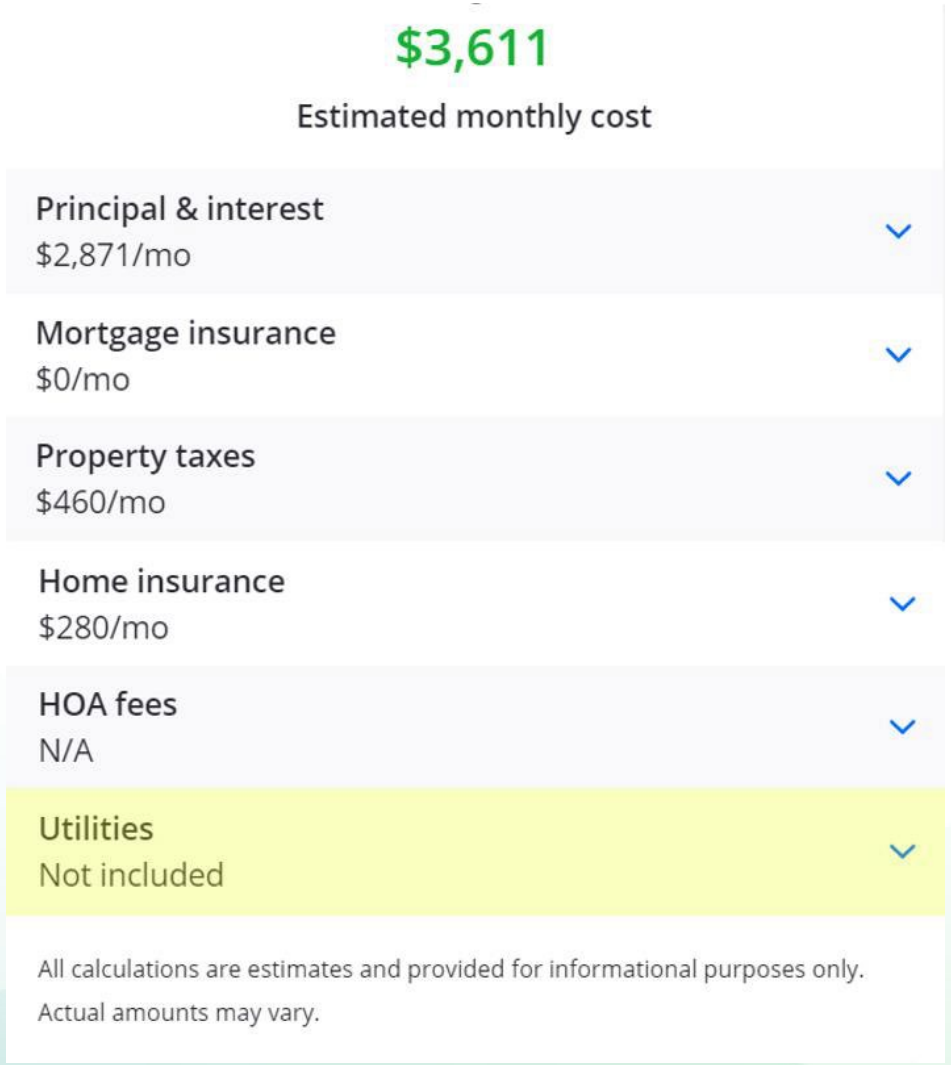
?

Utility Cost Estimates

- CEC is interested in addressing utility cost estimates in MLS with Home Energy Rating and Labeling Program

Central Issue:

- Large variation in rate structures and numbers of utilities across the state



Utility Cost Estimates

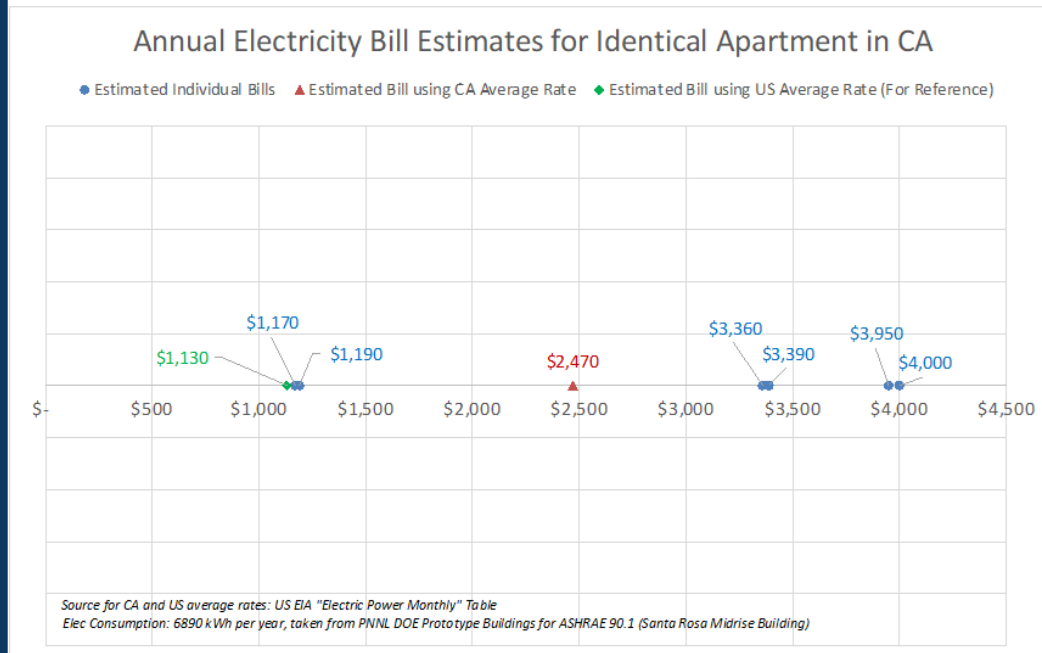
Current Southern California Edison support analysis

Case Study – One House, Many Potential Bills

- In this exercise, we took electric usage data from a representative California home (a mid-rise apartment) and computed the electric bills that would result from that apartment's consumption if it were located in 6 different locations across the state.
  - Assumed electric consumption is 6890 kWh.
  - Hourly consumption data comes from a unit in a prototype mid-rise apartment building (from PNNL's prototype buildings for ASHRAE 90.1).
  - Tiered rates, flat rates, and TOU rates from different providers were all evaluated as "individual bill" options.
- Estimated individual bill results are shown as **blue dots.** These results were compared to annual bill estimates using the CA statewide average rate (**red triangle**) and US average rate (**green diamond**).

Bottom Line: Using the statewide average rate may not be representative. It has a minimum 36% error* and average 50% error for predicting any individual bill in the tested locations.

*Note: This is greater than the 26% difference in utility bills predicted for a home moving from a home energy score of 1 to 10 (Source: actual home label in BayREN program).



Source for CA and US average electric rates: US EIA "Electric Power Monthly" Table
https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

Utility Cost Estimates

CA Utility Allowance Calculator (CUAC) is designed to calculate project-specific utility allowances for affordable housing projects

- Approved tool by CA Tax Credit Allocation Committee, Treasure's Office, maintained by the California Energy Commission
- Estimates utility bills specific to actual utility rates
- Incorporated into CBECC compliance software

Biggest Challenge

- Updating and maintaining the utility rates

Utility Allowance Calculator Results

Apartment Type	Units		Monthly Usage ($/month)				
	Affordable Housing	Market Rate	Electric	Gas	Water	Trash	Total
One Bedroom	29	0	$20.01	$0.00	$0.00	$0.00	$20.01
Two Bedroom	35	0	$23.33	$0.00	$0.00	$0.00	$23.33
Three Bedroom	22	0	$29.65	$0.00	$0.00	$0.00	$29.65

Utility Cost Estimates

Questions

- Should asset rating programs be relied upon to provide reliable utility cost estimates?
- What resolution of energy rates is good enough?
- What are potential challenges and consequences to using more granular rates?

?

Recommended Measures Model

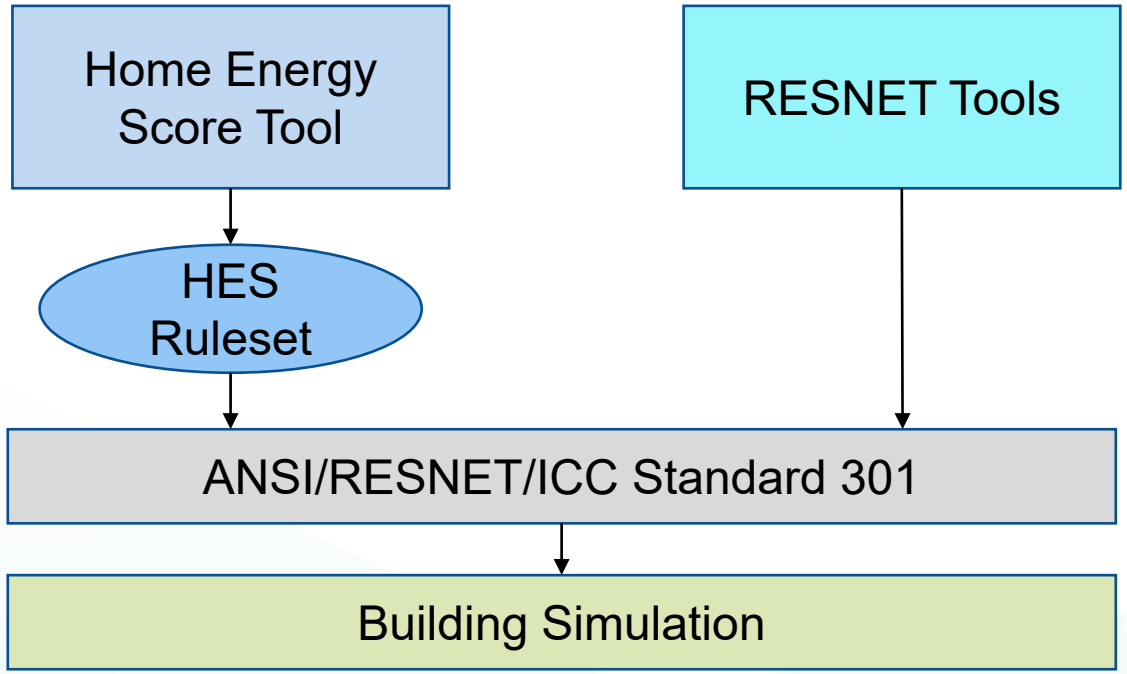
- A list of recommended measures must be generated to improve energy performance of the home.
  - Clear description of cost-effective measures
  - Estimated energy, GHG, and utility cost savings associated with measures
  - Corresponding rating improvement

- A standard method should be developed to ensure consistency in making recommendations for energy improvements across the program

Existing Landscape

- Two widely used asset rating systems
  - DOE's Home Energy Score
  - RESNET Index

- *ANSI/RESNET/ICC 301 Standard*
  - ➢A common denominator for different tools



Existing Landscape

ANSI/RESNET/ICC 301 – Standard for the Calculation and Labeling of the Energy Performance of Dwelling Units

- Aims to provide a consistent and uniform methodology for evaluating energy performance of a home
- Calculation methods for each end-use and includes operational assumptions
- Cost estimate and economic procedures
- Energy Rating Index (ERI) and labeling
- IECC performance pathway for energy code compliance based on ERI

Leveraging the Existing Landscape

CEC is interested in leveraging existing calculation methods, tools, and standards

- Investigating how others differ or align with existing CEC methods for whole building energy modeling, largely comparing to *CA Energy Code Residential Alternative Calculation Method*
- Consider most appropriate methods for pathway forward in modernization of program

Leveraging the Existing Landscape

Questions

- Are there any other vetted standards that can be investigated?
- Has there been any analysis comparing existing calculation methods, tools, or standards?
- What are some of the key differences?

?

Incorporating CA Elements and Decarbonization

- High sensitivity to time of electricity use
- Cleaner energy grid system compared to national average
- Better representation of carbon emission impacts and sending carbon reduction signals
- Encouraging decarbonization measure recommendations

Incorporating CA Elements and Decarbonization

Examples of how CEC has done this in the CA Energy Code by incorporating methods into its tools

- Long-term System Cost Method
  - Values cost to the energy system for every hour of the year
  - Signals varying costs of producing and delivering energy
  - Gives greater weight to energy features that reduce consumption during on-peak hours

- Source Energy Method
  - Defines long-term marginal source energy consumed for every hour of the year
  - Represents the carbon emissions impact of energy features
  - Incentivizes building decarbonization

Incorporating CA Elements and Decarbonization

Questions

- What other elements should be considered and possible methods to incorporate into program?
- Would a similar source energy method be applicable and valuable to an asset rating program?
- Can an hourly source energy be easily incorporated into existing tools?

?

Balancing Program Complexity

Program software tools should be easy to use and aim to keep overall cost of labeling low

- Asset rating is not a full comprehensive energy audit
- Accept that modeling existing buildings will require more default assumptions that may sacrifice some accuracy
- Simplification for the user likely means more procedures and assumptions on the back-end
- Need to identify the highest priority variables that determine minimum input fields required for calculations

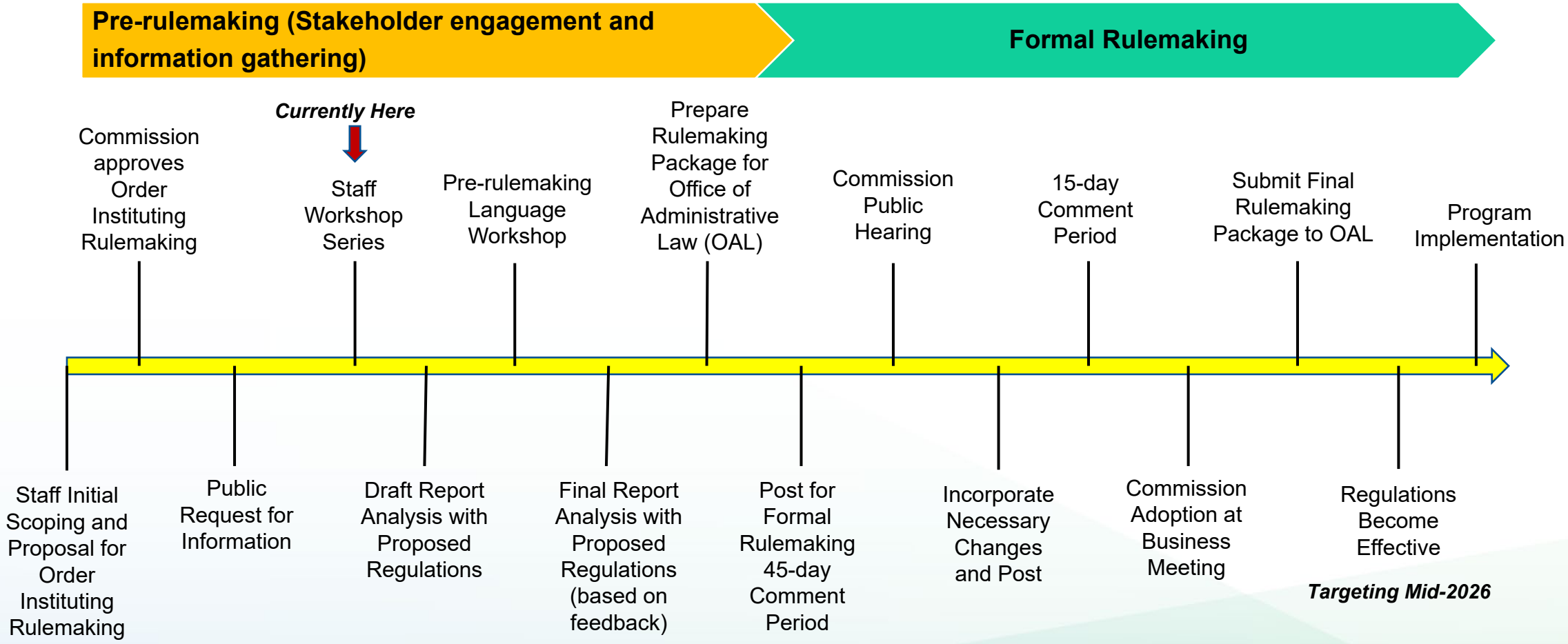
Balancing Program Complexity

Questions

- What are known key variables affecting building energy modeling?
- What studies or sensitivity analysis exist that identify most influential factors?
- How has other existing programs or tools approached balancing accuracy against complexity?

?

Proceeding Major Milestones and Roadmap



Pre-Rulemaking Schedule

Pre-Rulemaking	Schedule
Order Instituting Rulemaking	October 2023
Request for Information	December 2023 – February 2024
Stakeholder Engagement	December 2023 – Ongoing
Four Pre-rulemaking Workshops 1. General Overview 2. Calculation Methods 3. Rating Scale and Label 4. Field Procedures, Rater Certification and Oversight	March 2024 – January 2025
Draft Staff Report, Regulatory Language, and Workshop	October 2024 – June 2025
Final Staff Report and Regulatory Language	July 2025 – August 2025

Questions?

Break

Presentation by David Heslam & Maddy Salzman, Earth Advantage

earthadvantage®

SEPTEMBER 18, 2024

FINDING THE RIGHT TOOL FOR THE JOB

How Oregon and other states use Home Energy Score to facilitate statewide home energy labeling

California Energy Commission

DOCKET HERS-02 PUBLIC WORKSHOP

WHO IS EARTH ADVANTAGE?

- Non-profit focused on advancing an ***informed and humane housing market***
- 10+ years experience helping state and local governments ***develop and implement home energy labeling programs***
- Nationally recognized ***USDOE Home Energy Score® partner*** and quality assurance provider

Our Partners

ON THE CALL TODAY

David Heslam
EXECUTIVE DIRECTOR

- Former high performance home builder in Oregon
- Conducted extensive research on home energy labeling

Madeline Salzman
HEAD OF STRATEGIC PARTNERSHIPS

- Managed HES program at USDOE 2018 - 2022

KEY TAKEAWAYS

01

Other governments in the US have been exploring the ***same questions around home energy labeling*** that California is exploring today.

02

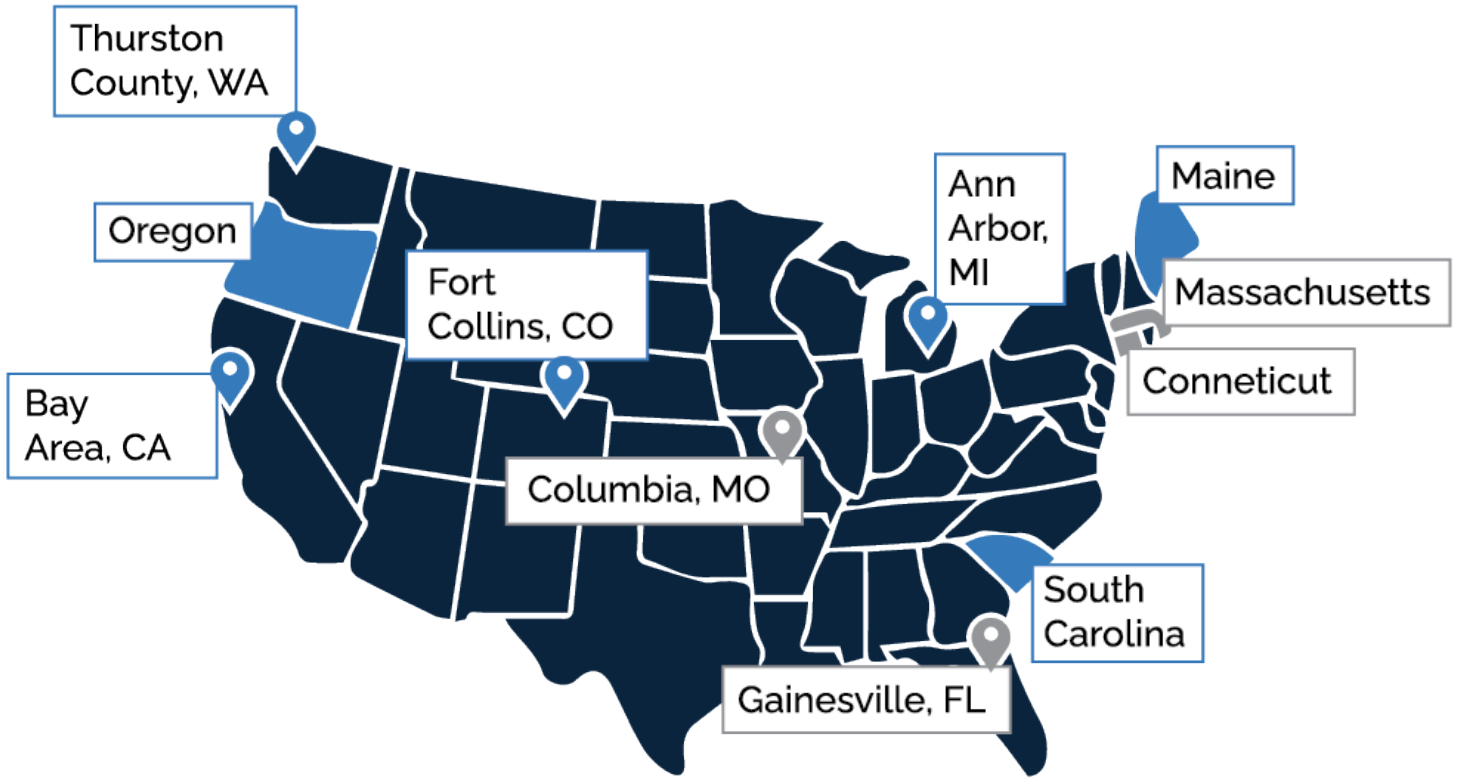
DOE HES is a national standard that available off-the-shelf, provides market consistency, and is ***flexible to meet states' specific needs.***

03

CPUC has supported BayREN in developing a pilot to ***provide HES statewide in California.***

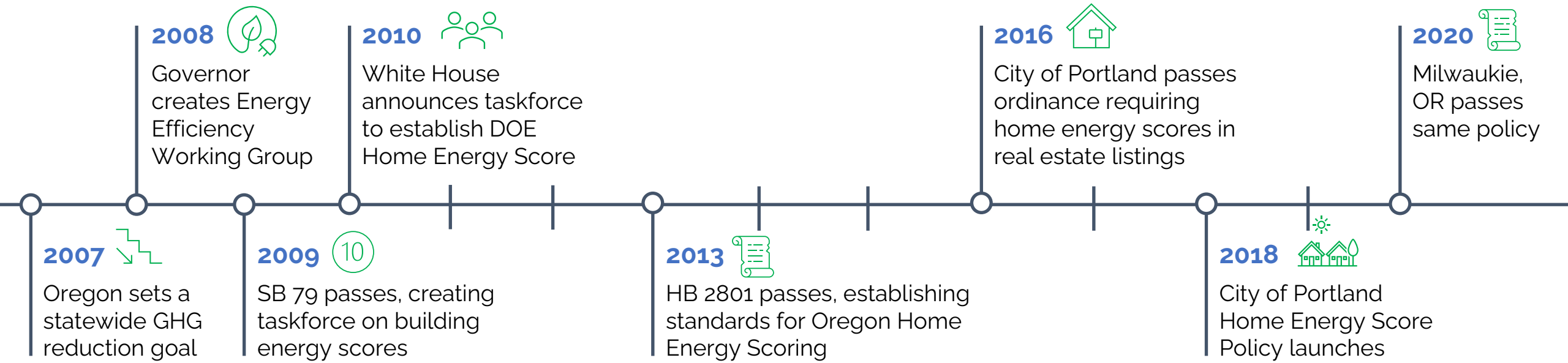
01. CALIFORNIA IS NOT IN THIS ALONE

Generalized Adoption of HES in the US



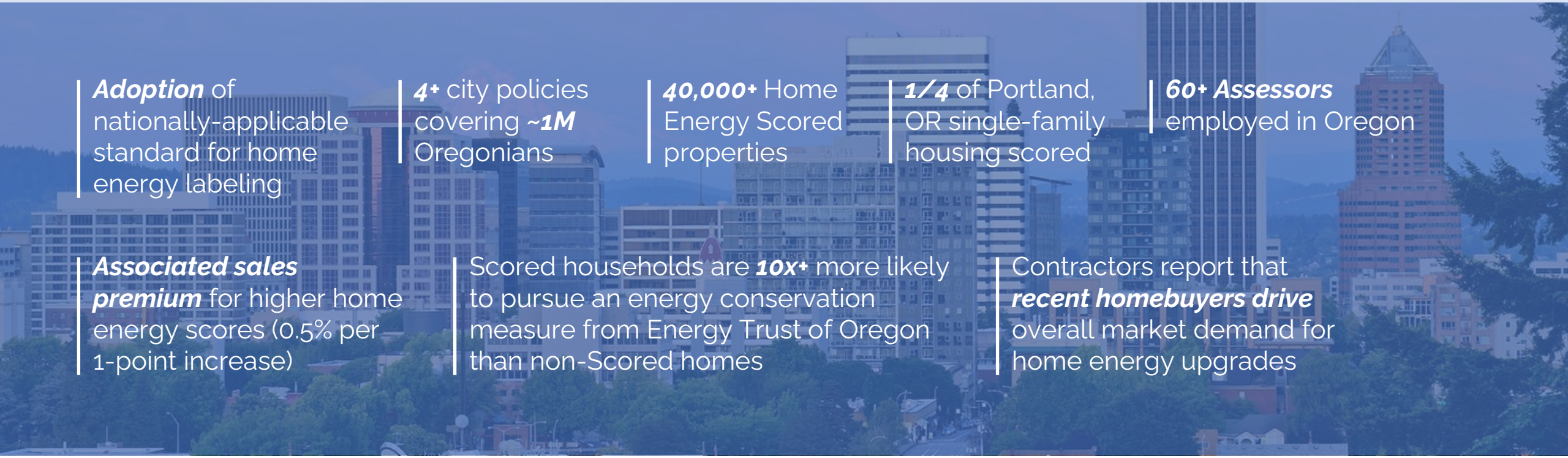
STATE OF OREGON CASE STUDY: TIMELINE

Timeline



STATE OF OREGON CASE STUDY: IMPACTS

Impacts



Adoption of nationally-applicable standard for home energy labeling

4+ city policies covering ***~1M*** Oregonians

40,000+ Home Energy Scored properties

1/4 of Portland, OR single-family housing scored

60+ Assessors employed in Oregon

Associated sales premium for higher home energy scores (0.5% per 1-point increase)

Scored households are ***10x+*** more likely to pursue an energy conservation measure from Energy Trust of Oregon than non-Scored homes

Contractors report that ***recent homebuyers drive*** overall market demand for home energy upgrades

LESSONS LEARNED FROM OREGON'S EXPERIENCE

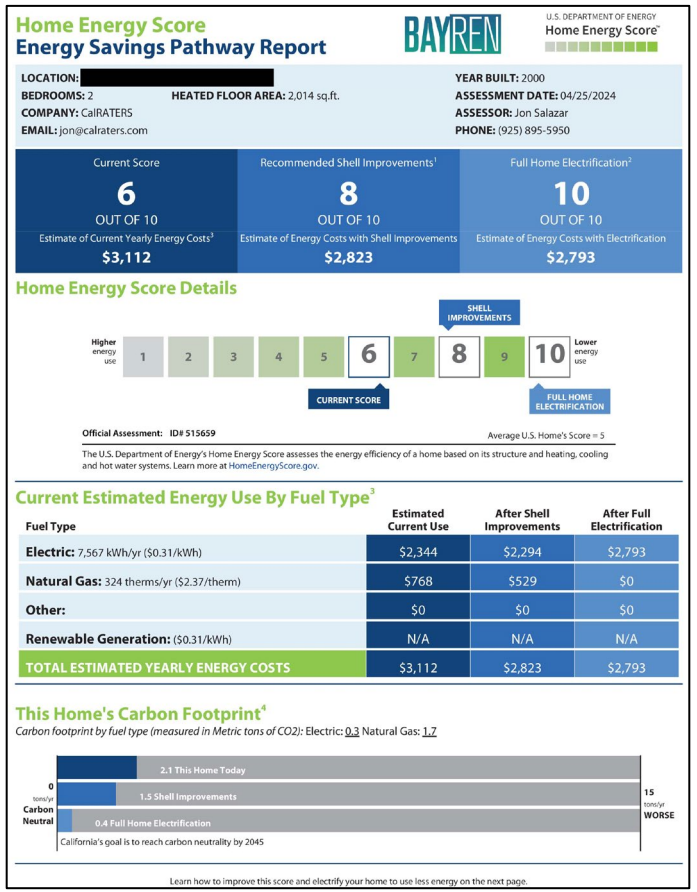
- People don't know what they don't know
- Comparability across homes is key
- People probably don't want to pay extra for a nutrition facts label on each food item, but do appreciate having labels on their food
- Low-income programs can deliver Home Energy Scores for free

02. DOE HES IS BOTH STANDARD AND FLEXIBLE

Why have other states chosen to use HES?

- $10M+ invested by DOE over last decade into HES technology stack, including E+, HPXML, API, & millions invested in 14+ private software tools
- Formal HES partners inform buildout and improvements to tools, protocols
- HES framework provides:
  - ✓ Flexibility for states
  - ✓ Consistency national housing & financing market actors

03. BAYREN'S HOME ENERGY SCORE REPORT



Home Energy Score
Energy Savings Pathway Report

BAYREN

U.S. DEPARTMENT OF ENERGY
Home Energy Score

LOCATION: [redacted]
BEDROOMS: 2 HEATED FLOOR AREA: 2,014 sq.ft.
COMPANY: CalRATERS
EMAIL: jon@calraters.com
YEAR BUILT: 2000
ASSESSMENT DATE: 04/25/2024
ASSESSOR: Jon Salazar
PHONE: (925) 895-5950

Current Score	Recommended Shell Improvements[1]	Full Home Electrification[2]
6 OUT OF 10	8 OUT OF 10	10 OUT OF 10
Estimate of Current Yearly Energy Costs[3]	Estimate of Energy Costs with Shell Improvements	Estimate of Energy Costs with Electrification
$3,112	$2,823	$2,793

Home Energy Score Details

Higher energy use 1 2 3 4 5 6 7 8 9 10 Lower energy use
SHELL IMPROVEMENTS
CURRENT SCORE
FULL HOME ELECTRIFICATION

Official Assessment: ID# 515659
Average U.S. Home's Score = 5

The U.S. Department of Energy's Home Energy Score assesses the energy efficiency of a home based on its structure and heating, cooling and hot water systems. Learn more at HomeEnergyScore.gov.

Current Estimated Energy Use By Fuel Type[3]

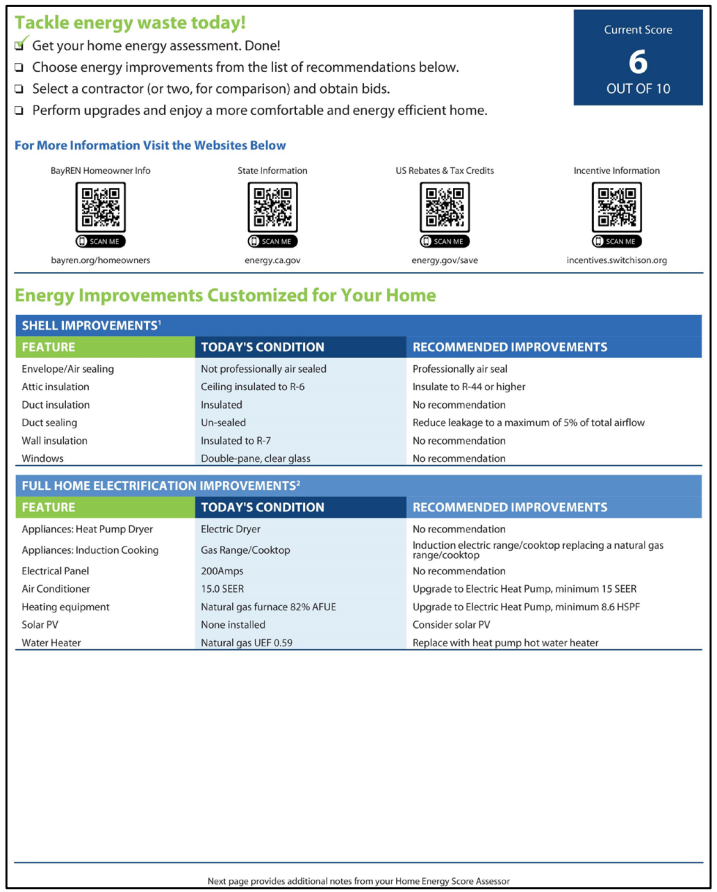
Fuel Type	Estimated Current Use	After Shell Improvements	After Full Electrification
Electric: 7,567 kWh/yr ($0.31/kWh)	$2,344	$2,294	$2,793
Natural Gas: 324 therms/yr ($2.37/therm)	$768	$529	$0
Other:	$0	$0	$0
Renewable Generation: ($0.31/kWh)	N/A	N/A	N/A
TOTAL ESTIMATED YEARLY ENERGY COSTS	$3,112	$2,823	$2,793

This Home's Carbon Footprint[4]

Carbon footprint by fuel type (measured in Metric tons of CO2): Electric: 0.3 Natural Gas: 1.7

0 tons/yr Carbon Neutral
2.1 This Home Today
1.5 Shell Improvements
0.4 Full Home Electrification
15 tons/yr WORSE
California's goal is to reach carbon neutrality by 2045

Learn how to improve this score and electrify your home to use less energy on the next page.



Tackle energy waste today!

- ☑ Get your home energy assessment. Done!
- ❑ Choose energy improvements from the list of recommendations below.
- ❑ Select a contractor (or two, for comparison) and obtain bids.
- ❑ Perform upgrades and enjoy a more comfortable and energy efficient home.

Current Score 6 OUT OF 10

For More Information Visit the Websites Below

BayREN Homeowner Info	State Information	US Rebates & Tax Credits	Incentive Information
SCAN ME	SCAN ME	SCAN ME	SCAN ME
bayren.org/homeowners	energy.ca.gov	energy.gov/save	incentives.switchison.org

Energy Improvements Customized for Your Home

SHELL IMPROVEMENTS[1]

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Envelope/Air sealing	Not professionally air sealed	Professionally air seal
Attic insulation	Ceiling insulated to R-6	Insulate to R-44 or higher
Duct insulation	Insulated	No recommendation
Duct sealing	Un-sealed	Reduce leakage to a maximum of 5% of total airflow
Wall insulation	Insulated to R-7	No recommendation
Windows	Double-pane, clear glass	No recommendation

FULL HOME ELECTRIFICATION IMPROVEMENTS[2]

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Appliances: Heat Pump Dryer	Electric Dryer	No recommendation
Appliances: Induction Cooking	Gas Range/Cooktop	Induction electric range/cooktop replacing a natural gas range/cooktop
Electrical Panel	200Amps	No recommendation
Air Conditioner	15.0 SEER	Upgrade to Electric Heat Pump, minimum 15 SEER
Heating equipment	Natural gas furnace 82% AFUE	Upgrade to Electric Heat Pump, minimum 8.6 HSPF
Solar PV	None installed	Consider solar PV
Water Heater	Natural gas UEF 0.59	Replace with heat pump hot water heater

Next page provides additional notes from your Home Energy Score Assessor

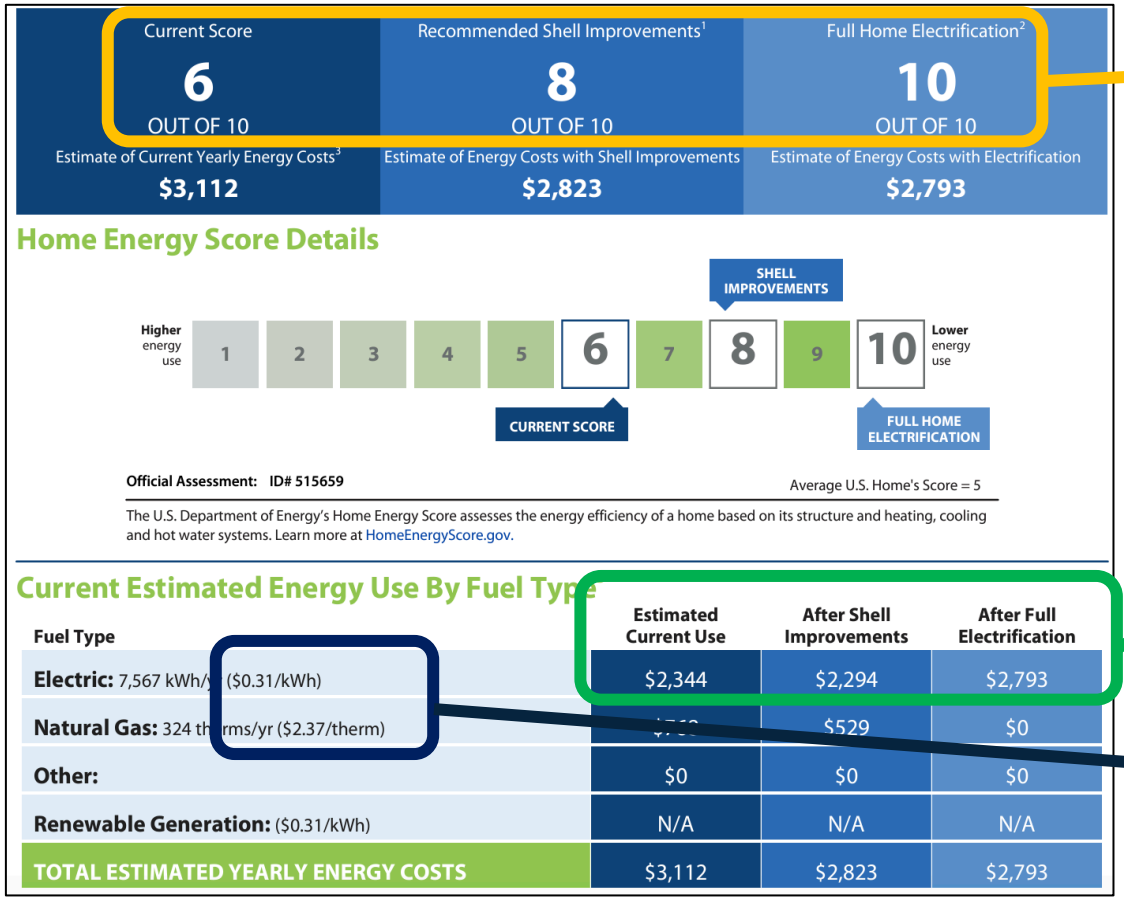
Elements from DOE HES system

- 1-10 score calculation
- Building energy model estimate usage (MMBTU)

Locally-provided elements

- Local utility rates
- Recommendations based on BayREN rebate programs
- Locally available incentives

03. BAYREN'S HOME ENERGY SCORING PROGRAM



Current Score	Recommended Shell Improvements[1]	Full Home Electrification[2]
6 OUT OF 10	8 OUT OF 10	10 OUT OF 10
Estimate of Current Yearly Energy Costs[3] $3,112	Estimate of Energy Costs with Shell Improvements $2,823	Estimate of Energy Costs with Electrification $2,793

Home Energy Score Details

SHELL IMPROVEMENTS

Higher energy use 1 2 3 4 5 **6** 7 **8** 9 **10** Lower energy use

CURRENT SCORE

FULL HOME ELECTRIFICATION

Official Assessment: ID# 515659

Average U.S. Home's Score = 5

The U.S. Department of Energy's Home Energy Score assesses the energy efficiency of a home based on its structure and heating, cooling and hot water systems. Learn more at HomeEnergyScore.gov.

Current Estimated Energy Use By Fuel Type

Fuel Type	Estimated Current Use	After Shell Improvements	After Full Electrification
Electric: 7,567 kWh/yr ($0.31/kWh)	$2,344	$2,294	$2,793
Natural Gas: 324 therms/yr ($2.37/therm)	[illegible]	$529	$0
Other:	$0	$0	$0
Renewable Generation: ($0.31/kWh)	N/A	N/A	N/A
TOTAL ESTIMATED YEARLY ENERGY COSTS	$3,112	$2,823	$2,793

Results pulled from DOE HES API

DOE HES API estimated energy usage results multiplied by BayREN utility rates to result in energy bills estimate

Local utility rates pulled from BayREN

03. BAYREN'S HOME ENERGY SCORING PROGRAM

Energy Improvements Customized for Your Home

SHELL IMPROVEMENTS[1]

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Envelope/Air sealing	Not professionally air sealed	Professionally air seal
Attic insulation	Ceiling insulated to R-6	Insulate to R-44 or higher
Duct insulation	Insulated	No recommendation
Duct sealing	Un-sealed	Reduce leakage to a maximum of 5% of total airflow
Wall insulation	Insulated to R-7	No recommendation
Windows	Double-pane, clear glass	No recommendation

FULL HOME ELECTRIFICATION IMPROVEMENTS[2]

FEATURE	TODAY'S CONDITION	RECOMMENDED IMPROVEMENTS
Appliances: Heat Pump Dryer	Electric Dryer	No recommendation
Appliances: Induction Cooking	Gas Range/Cooktop	Induction electric range/cooktop replacing a natural gas range/cooktop
Electrical Panel	200Amps	No recommendation
Air Conditioner	15.0 SEER	Upgrade to Electric Heat Pump, minimum 15 SEER
Heating equipment	Natural gas furnace 82% AFUE	Upgrade to Electric Heat Pump, minimum 8.6 HSPF
Solar PV	None installed	Consider solar PV
Water Heater	Natural gas UEF 0.59	Replace with heat pump hot water heater

Recommendations via DOE HES API logic to result in Home Energy Score with shell improvements

Recommendations via BayREN logic to support electrification measures

- Inform home with improvements Home Energy Score included on first page of the report

earthadvantage®

SEPTEMBER 18, 2024

THANK YOU!
QUESTIONS?

David Heslam
dheslam@earthadvantage.org

Madeline Salzman
msalzman@earthadvantage.org

Presentation by Mudit Saxena, Xerohome

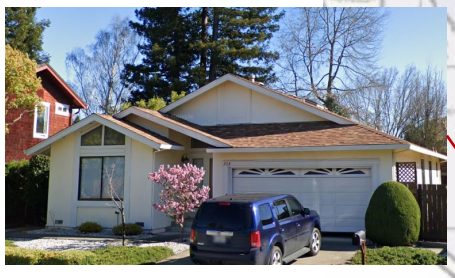
Calculating Utility Bill Impacts

Home Energy Rating and Labeling Calc Methods CEC Workshop

Sept 18th, 2024

Mudit Saxena, CEO, XeroHome™ | MSaxena@xerohome.com

XeroHome™



Each home pays different utility rates
Is in a different climate
Is built / used differently

14.2 Mil homes in CA

9 Mil. single-family

XeroHome™

What Are The Utility Bill Impacts of Heat Pumps?

Key variables impacting HP cost effectiveness

1. Utility rates – electric & gas
2. Existing equipment being replaced
3. Existing envelope condition
4. Usage pattern
5. Climate

XeroHome™

Electric TOU and Gas Rates

Utility Rates

- SCE Electric Rates:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
WINTER - Weekday	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.49	$0.49	$0.49	$0.49	$0.49	$0.37	$0.37	$0.37
SUMMER - Weekday	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.56	$0.56	$0.56	$0.56	$0.56	$0.34	$0.34	$0.34

									Last Update
SCE	TOU-D-4-9PM	Winter	peak	0.43	0.52	0.49			8/2/2023
	Annual Fixed Carge		off-peak	0.31	0.4	0.37			
	$138.70		super-off-peak	0.27	0.36	0.33			
		Summer	peak	0.5	0.59	0.56			
			off-peak	0.28	0.37	0.34			
		AVG	$0.38			**$0.11244**	**$/kBtu**		
SCE	TOU-D-5-8PM	Winter	Peak	0.52	0.61	0.58			8/2/2023
	Annual Fixed Carge		Off-Peak	0.31	0.4	0.37			
	$138.70		Super Off Peak	0.26	0.35	0.32			
		Summer	Peak	0.65	0.74	0.71			
			Off-Peak	0.28	0.37	0.34			
		AVG	$0.38			**$0.11189**	**$/kBtu**		
SCE	TOU-D-PRIME	Winter	Peak	0.6	0.6	0.60			8/2/2023
	Annual Fixed Carge		Off-Peak	0.23	0.23	0.23			
	$156.95		Super Off Peak	0.23	0.23	0.23			
		Summer	Peak	0.6	0.6	0.60			
			Off-Peak	0.26	0.26	0.26			
		AVG	$0.32			**$0.09345**	**$/kBtu**		

- SoCalGas Rates:

		Baseline	Excess	AVG ($/therm)	$/kBtu		Annual Charge		Last Updated
SoCalGas	GR	1.641054	2.121942	1.88	0.018815		$60		8/2/2023

XeroHome™

XeroHome™

Electric TOU and Gas Rates

- In **Irvine, CA**
  - Electricity on avg. costs about $0.36 / kWh (or $0.106/kBtu)
  - Natural Gas costs about $1.88 / Therm (or $0.019/kBtu)

Utility Rates

- SCE Electric Rates:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
WINTER - Weekday	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.37	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.33	$0.49	$0.49	$0.49	$0.49	$0.49	$0.37	$0.37	$0.37
SUMMER - Weekday	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.34	$0.56	$0.56	$0.56	$0.56	$0.56	$0.34	$0.34	$0.34

								Last Update
SCE	TOU-D-4-9PM	Winter	peak	0.43	0.52	0.49		8/2/2023
	Annual Fixed Carge		off-peak	0.31	0.4	0.37		
	$138.70		super-off-peak	0.27	0.36	0.33		
		Summer	peak	0.5	0.59	0.56		
			off-peak	0.28	0.37	0.34		
		AVG	$0.38			$0.11244	$/kBtu	
SCE	TOU-D-5-8PM	Winter	Peak	0.52	0.61	0.58		8/2/2023
	Annual Fixed Carge		Off-Peak	0.31	0.4	0.37		
	$138.70		Super Off Peak	0.26	0.35	0.32		
		Summer	Peak	0.65	0.74	0.71		
			Off-Peak	0.28	0.37	0.34		
		AVG	$0.38			$0.11189	$/kBtu	
SCE	TOU-D-PRIME	Winter	Peak	0.6	0.6	0.60		8/2/2023
	Annual Fixed Carge		Off-Peak	0.23	0.23	0.23		
	$156.95		Super Off Peak	0.23	0.23	0.23		
		Summer	Peak	0.6	0.6	0.60		
			Off-Peak	0.26	0.26	0.26		
		AVG	$0.32			$0.09345	$/kBtu	

- SoCalGas Rates:

		Baseline	Excess	AVG ($/therm)	$/kBtu		Annual Charge		Last Updated
SoCalGas	GR	1.641054	2.121942	1.88	0.018815		$60		8/2/2023

XeroHome™

XeroHome™

Electric TOU and Gas Rates

- In **Irvine, CA**
  - Electricity on avg. costs about $0.36 / kWh (or $0.106/kBtu)
  - Natural Gas costs about $1.88 / Therm (or $0.019/kBtu)
- In **Petaluma, CA**
  - Electricity on avg. costs about $0.38 / kWh (or $0.112/kBtu)
  - Natural Gas costs about $2.50 / Therm (or $0.020/kBtu)
- In **Sacramento, CA**
  - Electricity on avg. costs about $0.15 / kWh (or $0.043/kBtu)
  - Natural Gas costs about $2.50 / Therm (or $0.020/kBtu)

Electric TOU and Gas Rates

- In **Irvine, CA** electricity is ***5.6 times more expensive*** than Natural Gas
  - Electricity on avg. costs about $0.36 / kWh (or $0.106/kBtu)
  - Natural Gas costs about $1.88 / Therm (or $0.019/kBtu)
- In **Petaluma, CA** electricity is ***4.5 times more expensive*** than Natural Gas
  - Electricity on avg. costs about $0.38 / kWh (or $0.112/kBtu)
  - Natural Gas costs about $2.50 / Therm (or $0.020/kBtu)
- In **Sacramento, CA** electricity is ***2.2 times more expensive*** than Nat. Gas
  - Electricity on avg. costs about $0.15 / kWh (or $0.043/kBtu)
  - Natural Gas costs about $2.50 / Therm (or $0.020/kBtu)

XeroHome™

Using BEM to Predicting Savings

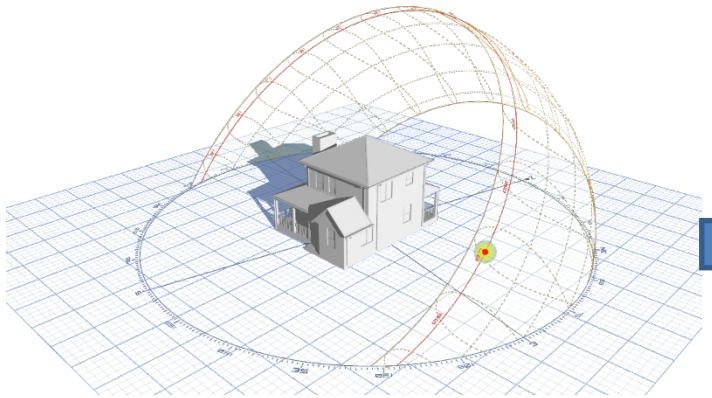
Electric TOU and Gas Rates

Marginal Carbon Intensity

Weather Data

Building Envelope Eff.

Historic energy usage

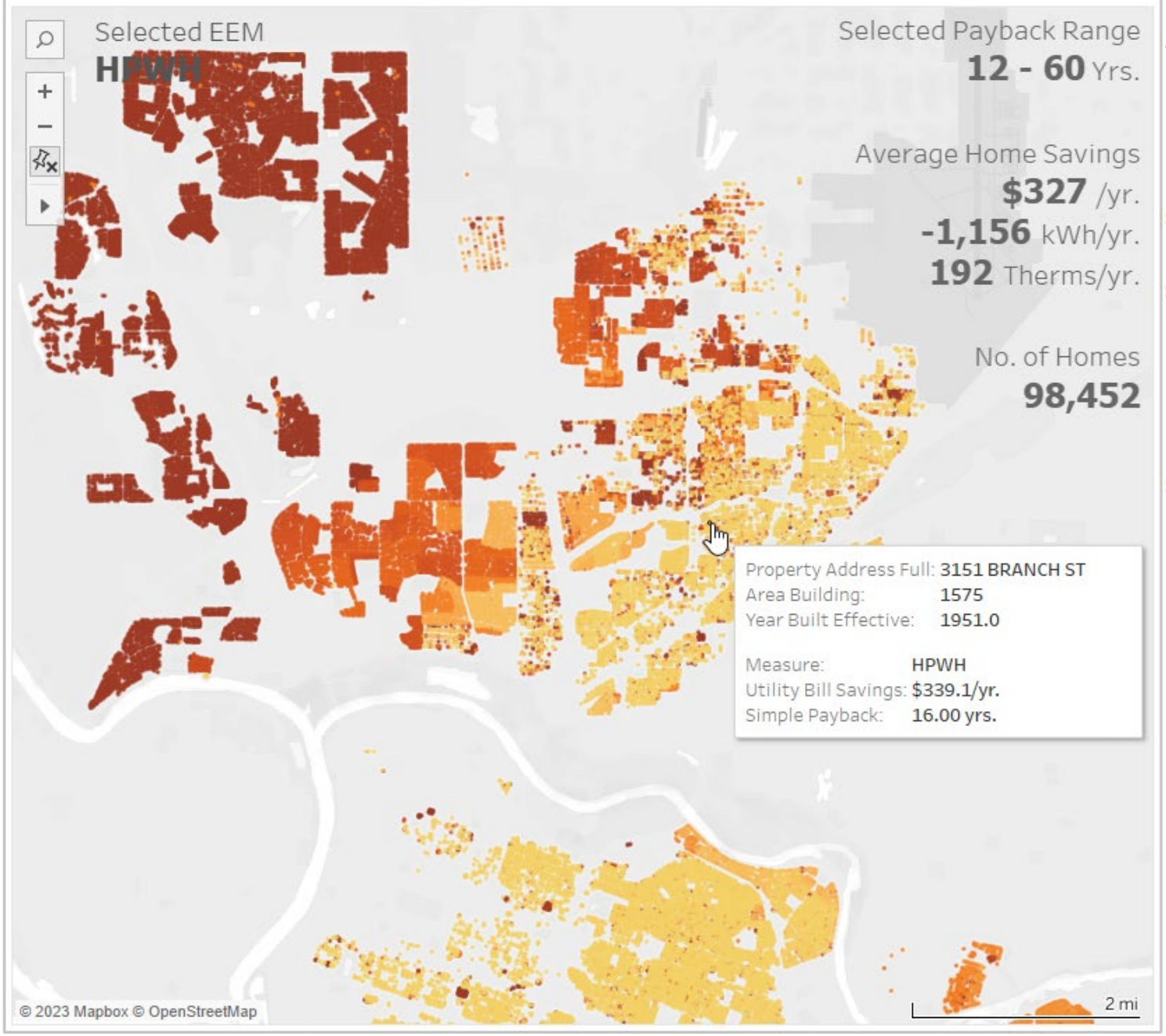


Energy Efficiency & Solar

Heat Pumps

XeroHome™

Sacramento, CA



Year Built Effective

1950.00 2000.00

Area Building

- 750
- 2000
- 4000
- 6000
- ≥ 8000

Select EEM

HPWH

Select Payback Range

0.00 87.00

Include Rebates?

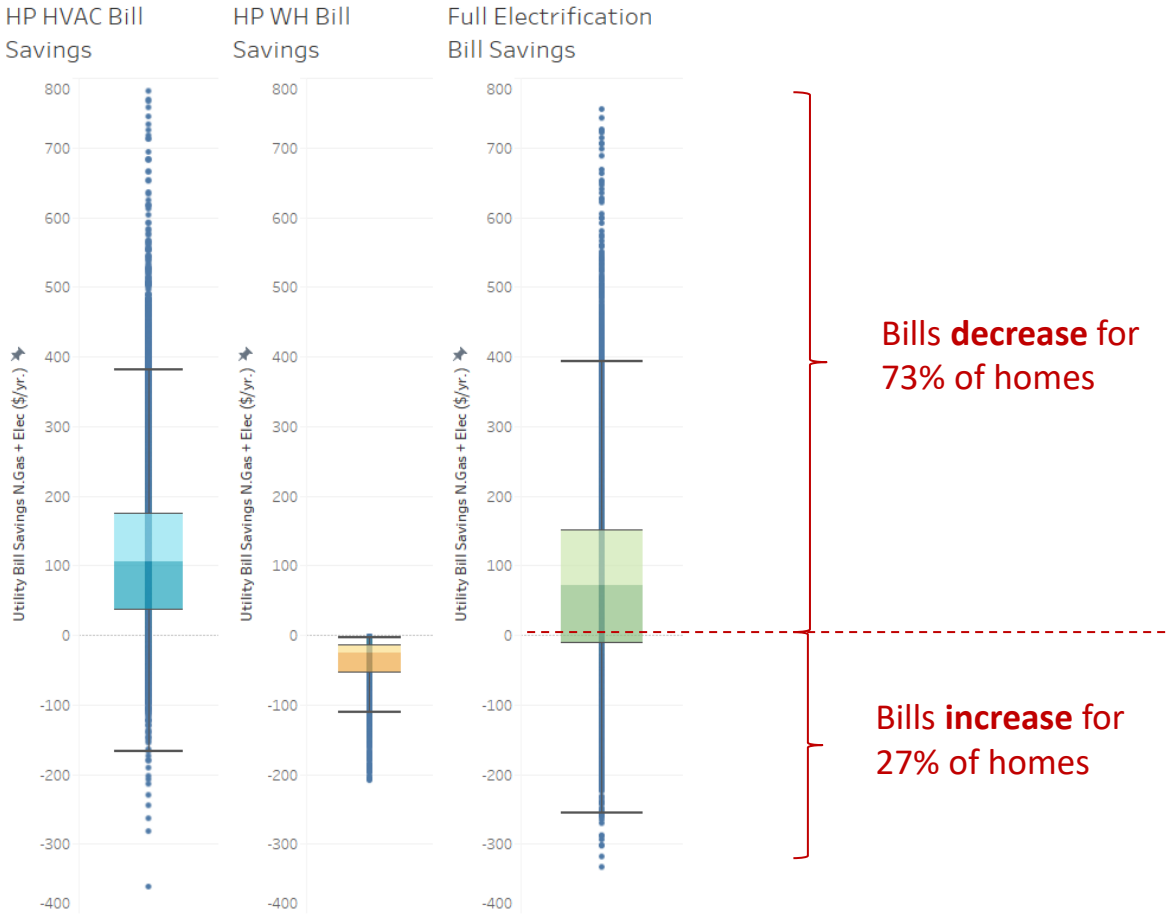
- Yes
- No

Select Confidence Level

- All Badges
- White Badge Only
- Green Badge Only
- Blue Badge Only

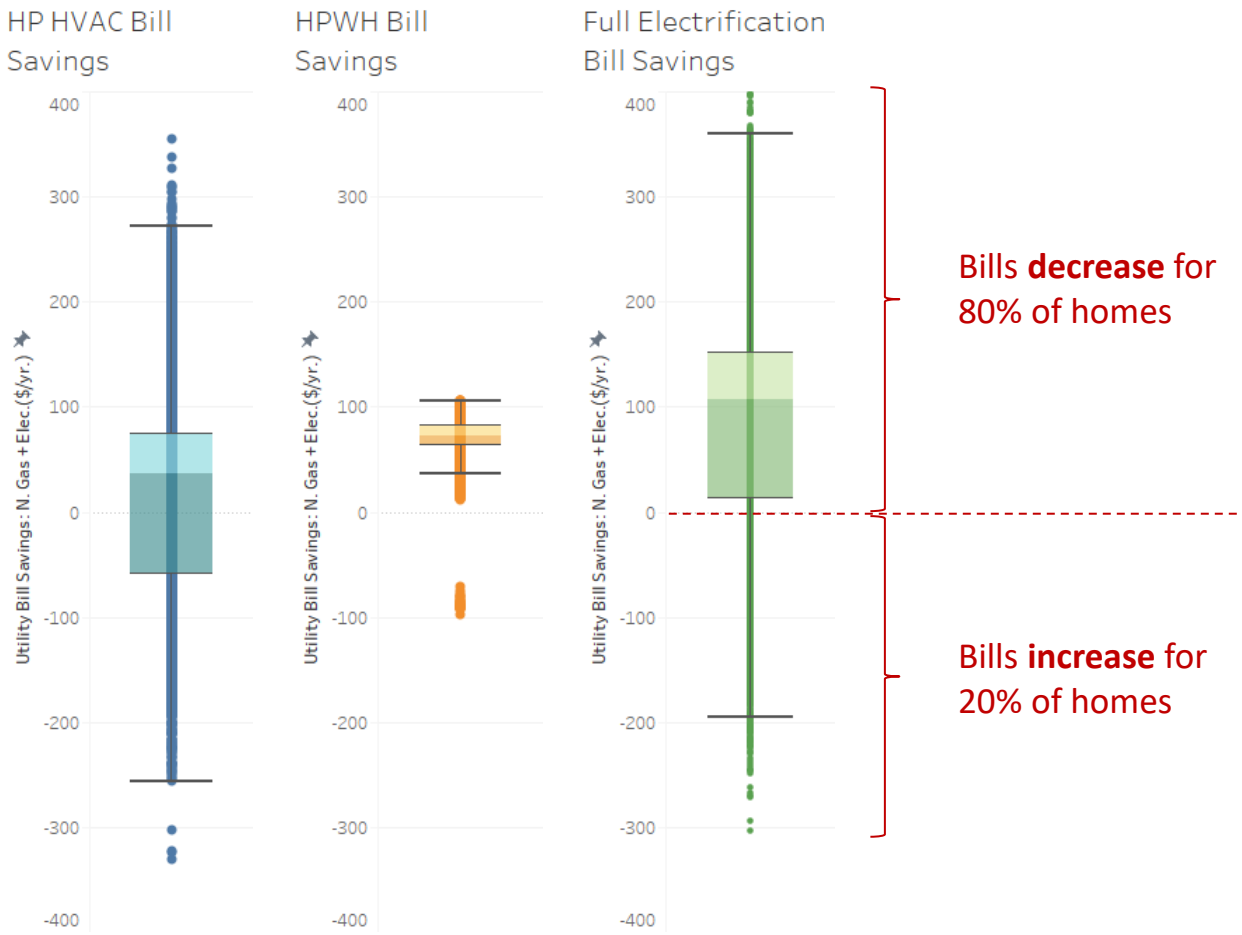
XeroHome™

Irvine, CA
Residential Electrification Analysis



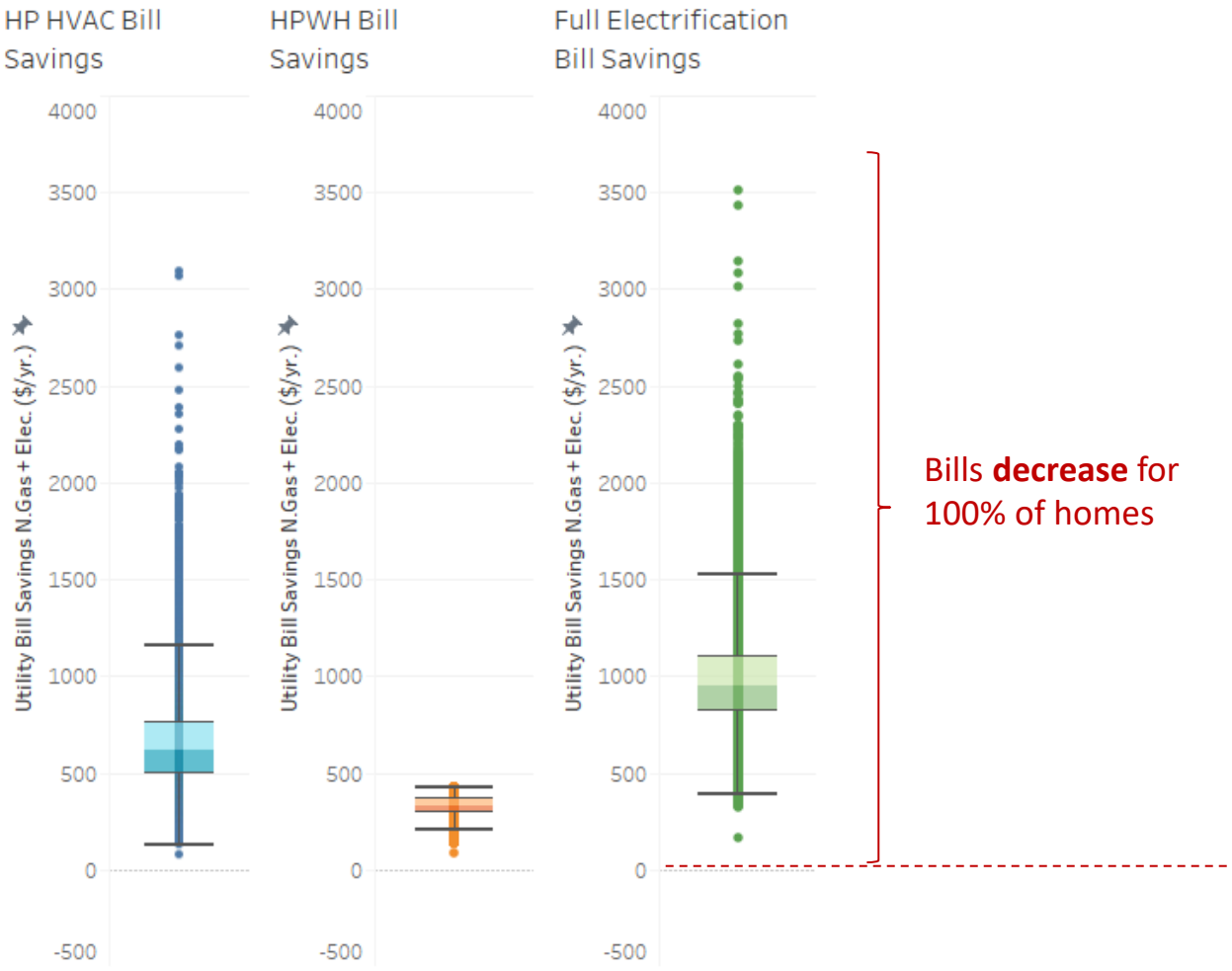
XeroHome™

Petaluma, CA
Residential Electrification Analysis



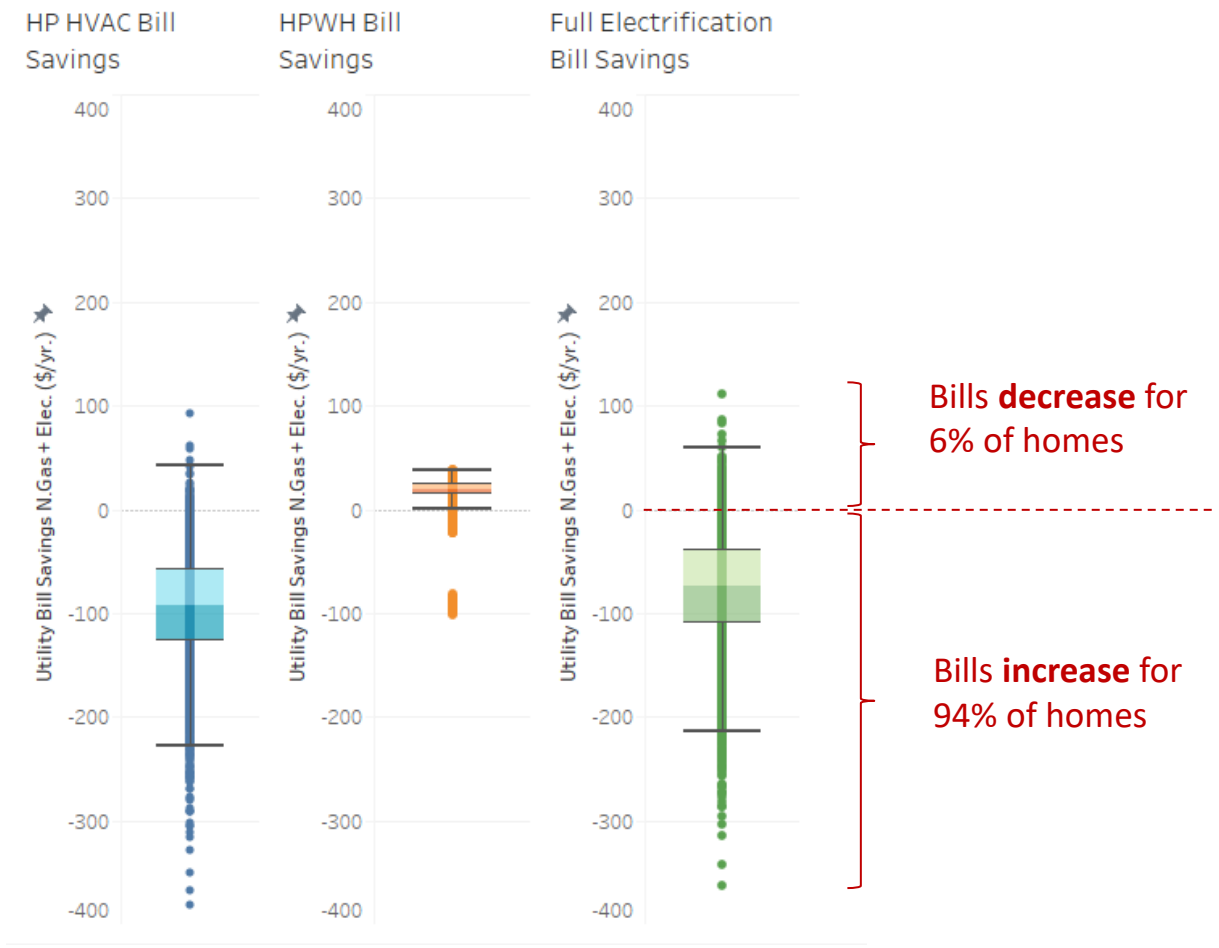
XeroHome™

Sacramento, CA
Residential Electrification Analysis



XeroHome™

San Luis Obispo, CA
Residential Electrification Analysis

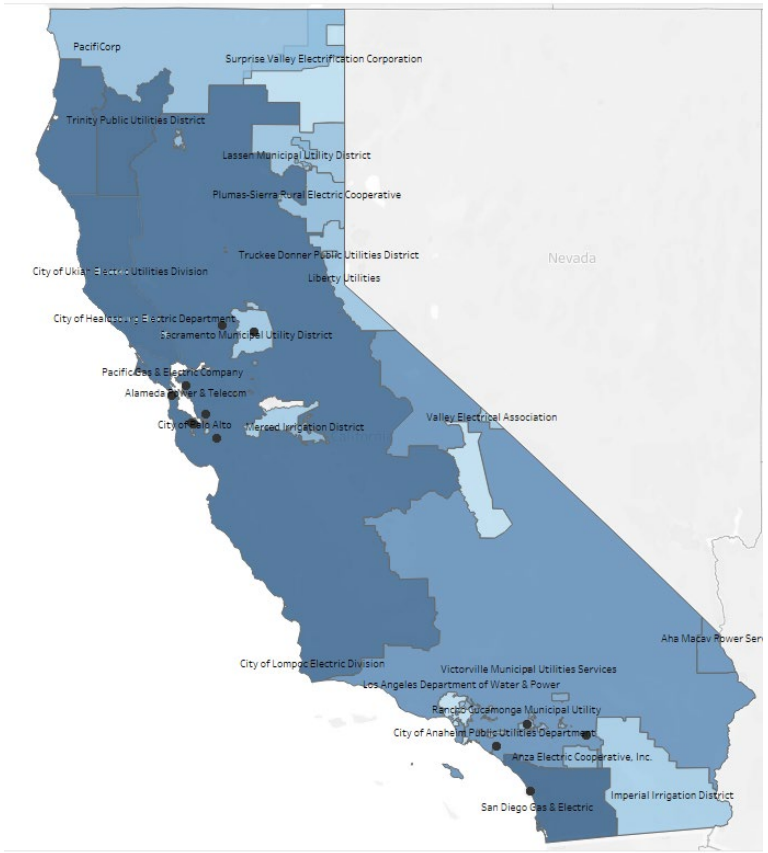


XeroHome™

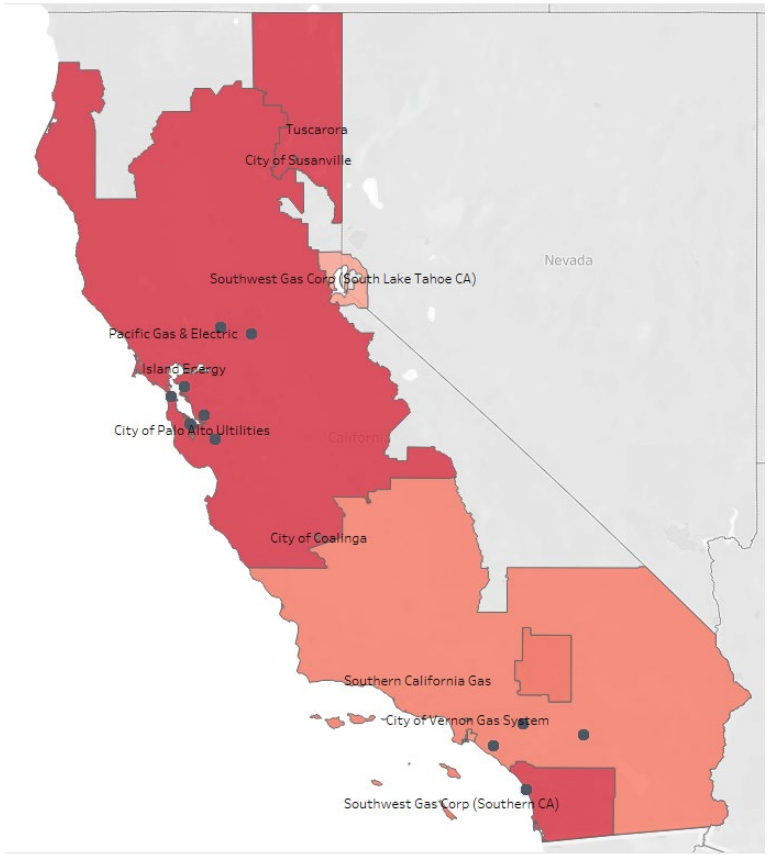
California is a large and diverse state

Utility Rates

Electric Rate



Gas Rate

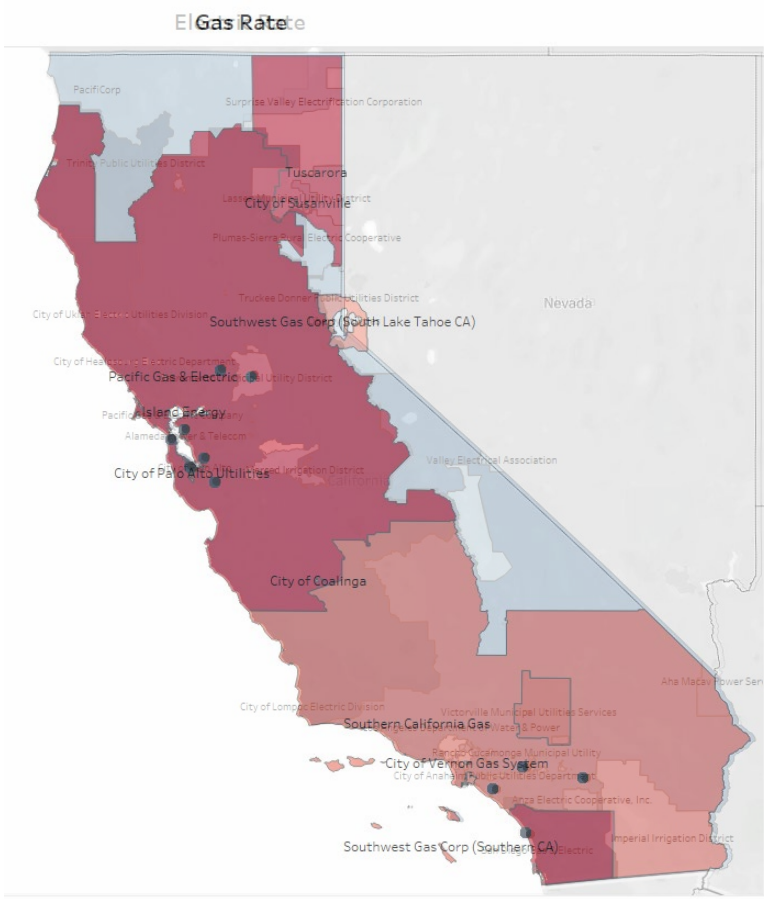


Colors indicate low to high utility rates

XeroHome™

California is a large and diverse state

Utility Rates



Colors indicate low to high utility rates

Chances of a heat pump replacement lowering utility bills … are higher in places where electricity rates are low compared to natural gas

XeroHome™

Ratio of Electric to Natural Gas Rates Across U.S.
(Converted to same units)

Top Half States

Rank		$/therm	$/kWh	Natural Gas $/kBtu	Eletricity $/kBtu	Ratio
1	AK	1.069498	0.2302	0.010697	0.067468	6.307762
2	NE	1.238417	0.2481	0.012387	0.072714	5.870969
3	MI	1.091699	0.1775	0.010919	0.052022	4.764809
4	WI	1.094595	0.155	0.010948	0.045428	4.149811
5	NY	1.57722	0.2204	0.015775	0.064596	4.095145
6	CT	1.772201	0.2465	0.017726	0.072245	4.076186
7	NJ	1.209459	0.1679	0.012097	0.049209	4.068266
8	ID	0.769305	0.1042	0.007695	0.030539	3.969347
9	VT	1.497104	0.2018	0.014974	0.059144	3.9502
10	CA	1.944981	0.2617	0.019454	0.0767	3.943105
11	IN	1.119691	0.1498	0.011199	0.043904	3.920699
12	RI	1.753861	0.232	0.017542	0.067995	3.876527
13	MA	1.973938	0.261	0.019743	0.076495	3.874868
14	NH	1.97973	0.255	0.019801	0.074736	3.774716
15	MN	1.169884	0.1416	0.011701	0.041501	3.547075
16	IL	1.332046	0.1587	0.013323	0.046512	3.491464
17	NM	1.207529	0.1411	0.012078	0.041354	3.42436
18	CO	1.227799	0.1429	0.01228	0.041882	3.410789
19	SD	1.060811	0.1217	0.01061	0.035668	3.362038
20	AS	1.619691	0.1847	0.0162	0.054132	3.341832
21	WV	1.166023	0.1325	0.011663	0.038834	3.330111
22	MT	1.005792	0.1137	0.01006	0.033324	3.312855
23	ME	2.000965	0.2252	0.020014	0.066002	3.298214
24	NV	1.227799	0.1379	0.01228	0.040416	3.291447
25	PA	1.442085	0.1606	0.014424	0.047069	3.263658

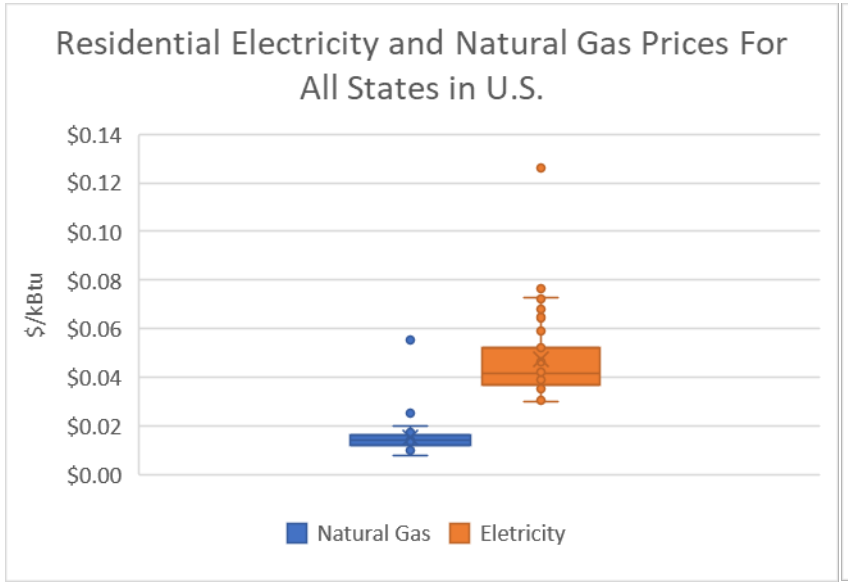
Bottom Half States

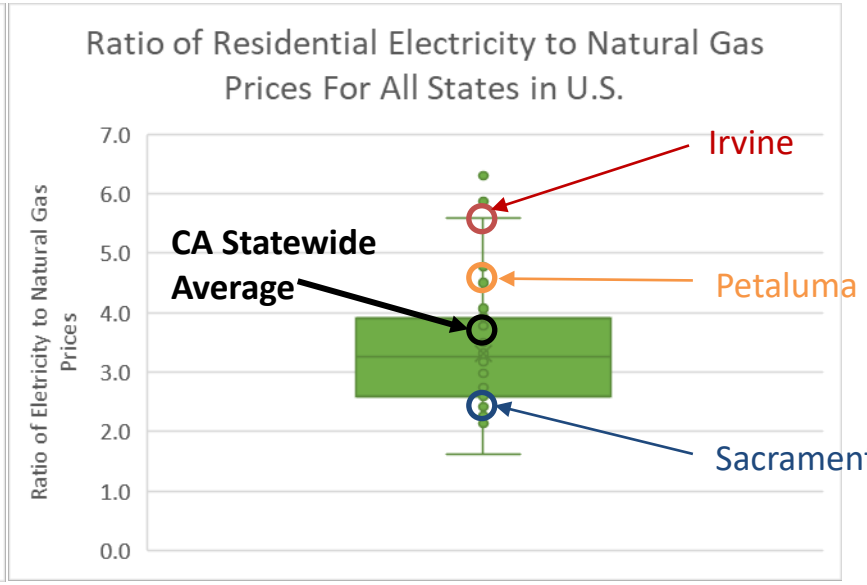
Rank		$/therm	$/kWh	Natural Gas $/kBtu	Eletricity $/kBtu	Ratio
26	OH	1.261583	0.1401	0.012618	0.041061	3.25441
27	UT	1.011583	0.1094	0.010118	0.032063	3.169318
28	IA	1.258687	0.1307	0.012589	0.038306	3.04304
29	ND	1.052124	0.109	0.010523	0.031946	3.036056
30	TN	1.202703	0.1237	0.012029	0.036254	3.014126
31	KS	1.387066	0.1413	0.013873	0.041413	2.985349
32	DE	1.447876	0.1373	0.014482	0.04024	2.779003
33	SC	1.512548	0.1411	0.015129	0.041354	2.733806
34	OR	1.238417	0.1135	0.012387	0.033265	2.685832
35	KY	1.407336	0.1285	0.014076	0.037661	2.67581
36	MS	1.408301	0.1265	0.014086	0.037075	2.632358
37	MO	1.379344	0.1229	0.013796	0.03602	2.611135
38	MD	1.638031	0.1451	0.016384	0.042526	2.595944
39	OK	1.42471	0.1257	0.01425	0.036841	2.585584
40	DC	1.610039	0.142	0.016104	0.041618	2.584652
41	VA	1.554054	0.1352	0.015544	0.039625	2.549532
42	AL	1.675676	0.1439	0.01676	0.042175	2.516638
43	WY	1.293436	0.111	0.012937	0.032532	2.514942
44	TX	1.594595	0.1355	0.015949	0.039713	2.490227
45	LA	1.528958	0.1269	0.015293	0.037192	2.432295
46	WA	1.238417	0.1023	0.012387	0.029982	2.420799
47	GA	1.743243	0.1402	0.017436	0.04109	2.356894
48	HI	5.546332	0.4302	0.055474	0.126084	2.273079
49	AZ	1.719112	0.1302	0.017195	0.038159	2.219508
50	NC	1.660232	0.1208	0.016606	0.035404	2.132299
51	FL	2.529923	0.1392	0.025304	0.040797	1.612434

Data from EIA (Year: 2022)
https://www.eia.gov/electricity/data.php
https://www.eia.gov/naturalgas/

XeroHome™

Ratio of Electric to Natural Gas Rates Across U.S.
(Converted to same units)





Data from EIA (Year: 2022)
https://www.eia.gov/electricity/data.php
https://www.eia.gov/naturalgas/

XeroHome™

Key Takeaways

- Utility rates are an influential driver in estimating energy bills, determining energy efficiency measures, and predicting electrification cost effectiveness.
- When we use energy is equally if not more important, than how much energy we use from a GHG emissions and societal benefits standpoint.
- A one-size-fits-all utility rate for the entire state could lead to inaccurate, misleading and/or environmentally unjust estimations of savings for the Home Energy Rating and Labeling program.

- With advanced analytical tools at our disposal, estimating home energy bills using site-specific utility rates is no longer impractical.

XeroHome™

Thank you
Questions?

Mudit Saxena
CEO & Founder, XeroHome
MSaxena@xerohome.com
Ph: 916-543-7186
https://about.xerohome.com

Public Comments

Closing Remarks

Open comment period ending October 4, 2024

- **E-commenting to CEC Docket 23-HERS-02**
  https://efiling.energy.ca.gov/EComment/EComment.aspx?docketnumber=23-HERS-02

Cheng Moua, P.E.

Senior Mechanical Engineer, Program Lead

cheng.moua@energy.ca.gov

Thank You!