Flipping the Script on New Homes

Getting to Zero Forum

October 11, 2019

Presenters:
Ian Hammon-Hogan, Co-Founder at BIRAenergy
Nick Brown, President at Build Smart Group
Chris Kuch, PE, Reach Codes at Southern California Edison

Moderator:
Will Vicent, Southern California Edison

Agenda

10:35 – 10:45	Welcome & Introductions	Will
10:45 – 10:55	Zero Net Energy Cookbook	Ian
10:55 – 11:05	New Homes Sales & Marketing	Nick
11:05 – 11:15	Reach Codes	Chris
11:15 – 11:30	Q&A	All

Title-24, Part 6 Overview

SOLAR PHOTOVOLTAIC SYSTEM

Promote installing solar photovoltaic systems in newly constructed residential buildings. The systems include smart inverters with optional battery storage. This will increase the self-utilization of the electricity generated to power the home's electricity loads including plug-in appliances. California is the first state in the nation to require smart systems on homes.

DEMAND RESPONSE COMPLIANCE OPTIONS

Encourage battery storage and heat pump water heaters that shift the energy use of the house from peak periods to off-peak periods. Utilities moving to time-of-use pricing assists the grid to meet the state's climate change goals and helps homes reduce energy bills.

HEALTHY INDOOR AIR QUALITY

Enable using highly efficient filters that trap hazardous particulates from both outdoor air and cooking and improve kitchen ventilation systems. Moving air around and in and out of the home while filtering out allergens and other particles makes the home healthier.

BUILDING ENVELOPE

Strengthen insulation in attics, walls and windows to improve comfort and energy savings. Keeping the heat out during the summer and warm air during the winter makes a home more resilient to climate change.

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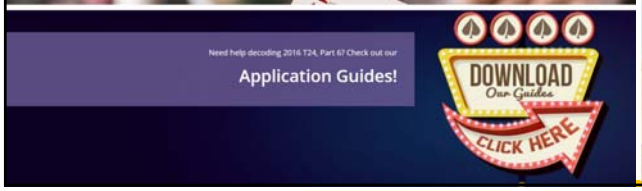
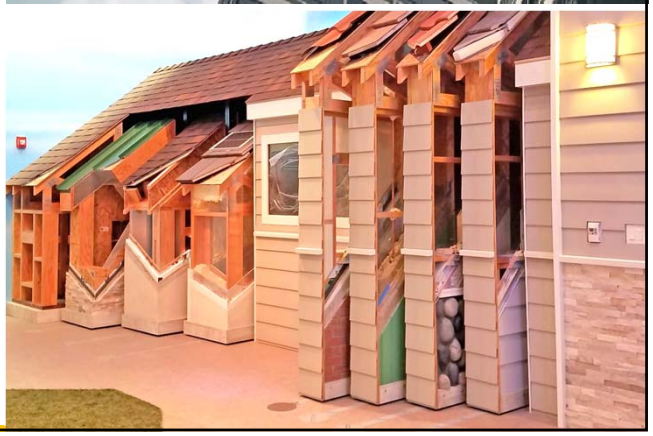
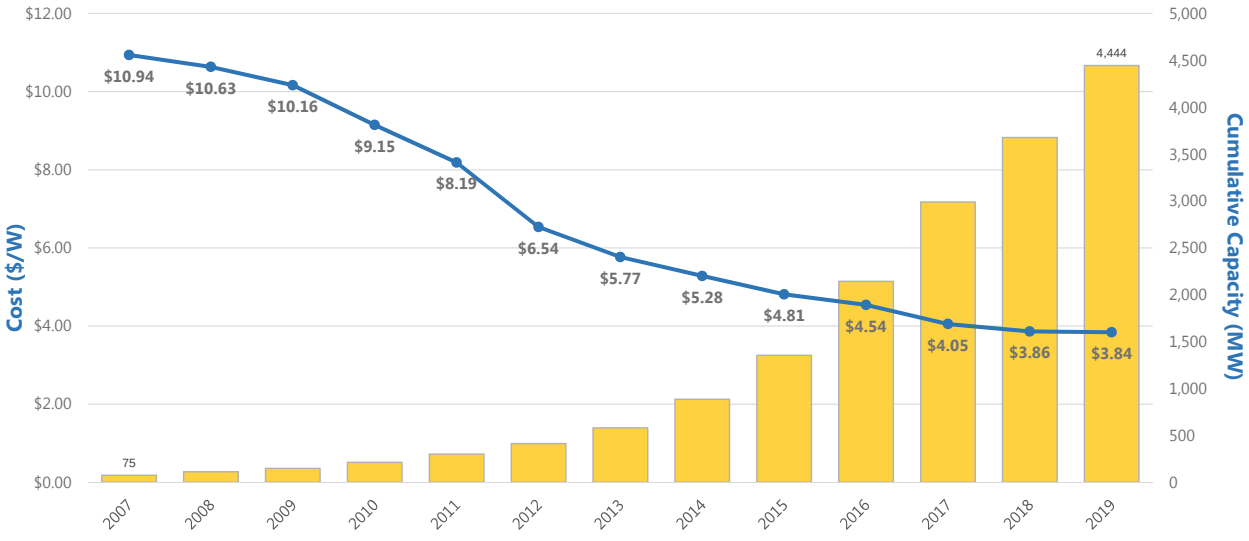




Story of California Solar



Battery Credit & Incentives

Currently Displayed: Generation as of 10/9/2019

	CSE	SCE	SCG	PG&E
Step Status	Open	Open	Open	Open
Active Step	1	1	1	1
Step Opening Date	May 1, 2017	May 1, 2017	May 1, 2017	May 1, 2017
Days in Step	891	891	891	891
Authorized Collections	$5,718,173.52	$13,464,605.80	$3,796,734.23	$16,757,415.49
Reallocations	$224,890.99	$239,370.61	$728,797.86	$6,092,276.66
Authorized Rollover	$0.00	$0.00	$0.00	$0.00
Allocated Funds	$1,316,400.00	$7,846,774.70	$2,164,800.00	$6,816,426.00
Available Funds	**$4,626,664.51**	**$5,857,201.71**	**$903,136.37**	**$16,033,266.15**
Small Residential Storage	**Step 5**	**Step 5**	**Step 5**	**Step 5**
Energy Storage**	$0.25/Wh	$0.25/Wh	$0.25/Wh	$0.25/Wh

ZNE Cookbook

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Optimized ZNE Feature Packages

- Three CEC Prototypical Homes
  - 2100 ft^2, 1-story ("small")
  - 2700 ft^2, 2-story ("medium")
  - Multifamily: 8-Plex (~1000 ft^2)
- Cost Optimized Features Sets
  - Energy, CO_2, Cost
  - Mixed Fuel & All Electric
  - Guide to Compliance and Beyond
  - With and Without Batteries
  - All 16 CZs

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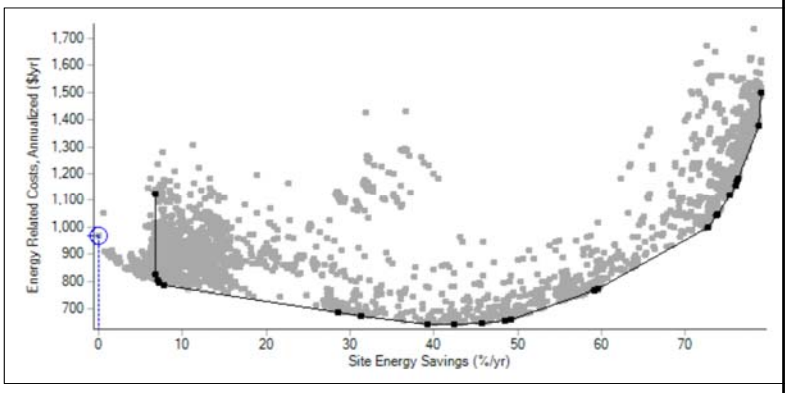
What It Will Do

- Guide to Optimal Features to Meet T24 or ZNE
- Cost-Effective Energy Efficiency Package with and without Battery
- Policy Trajectory
  - o ZNE
  - o Grid
  - o CO_2



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What It Won't Do

- Substitute for Title 24 Calcs
- Guarantee Lowest-Cost Features
- Rank Feature Cost-Effectiveness
- Be Specific to Your Home

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Overall Plan

- Database of Key Features: Cost Effective, Underutilized
- Determine Feature Costs - Obtain from Industry
- Simulate Characteristic Homes (BEopt)
- Simultaneously Optimize Enhancements to Base Package for Cost vs.
  - o Energy
  - o Carbon Dioxide
  - o Compliance
- Data for Post Processing

Category	Energy Efficiency Feature
Attic	R-38 blow-in cellulose + R-13 fiberglass batts under roof deck
Attic	R-38 blow-in cellulose + R-19 fiberglass batts under roof deck
Attic	R-38 under roof deck closed cell spray foam unvented
Attic	R-38 under roof deck fiberglass batts unvented
Attic	R-49 blow-in cellulose
Building Infiltration	Air-Sealing to 3ACH50
CLOTHES WASHER & DRYER	Standard washer, standard gas dryer
CLOTHES WASHER & DRYER	Energy Star washer & gas dryer

Costing

- Survey (Example)

Category	Energy Efficiency Feature	1-Story	2-Story	Multifamily
Attic	R-38 blow-in cellulose + R-13 fiberglass batts under roof deck	$3,853	$2,870	$8,210
Attic	R-38 blow-in cellulose + R-19 fiberglass batts under roof deck	$4,053	$3,055	$8,560
Attic	R-38 under roof deck closed cell spray foam unvented	$13,680	$8,880	$24,275
Attic	R-38 under roof deck fiberglass batts unvented	$4,245	$3,953	$18,010
Attic	R-49 blow-in cellulose	$2,918	$2,055	$5,390
Building Infiltration	Air-Sealing to 3ACH50	$2,835	$3,645	$10,800
CLOTHES WASHER & DRYER	Standard washer, standard gas dryer	$1,438	$1,438	$11,507
CLOTHES WASHER & DRYER	Energy Star washer & gas dryer	$1,518	$1,518	$12,147
CLOTHES WASHER & DRYER	Energy Star washer and electric heat pump dryer	$1,838	$1,838	$14,707
COOKING RANGE	Standard natural gas	$550	$550	$4,400
COOKING RANGE	Standard electric	$607	$607	$4,858

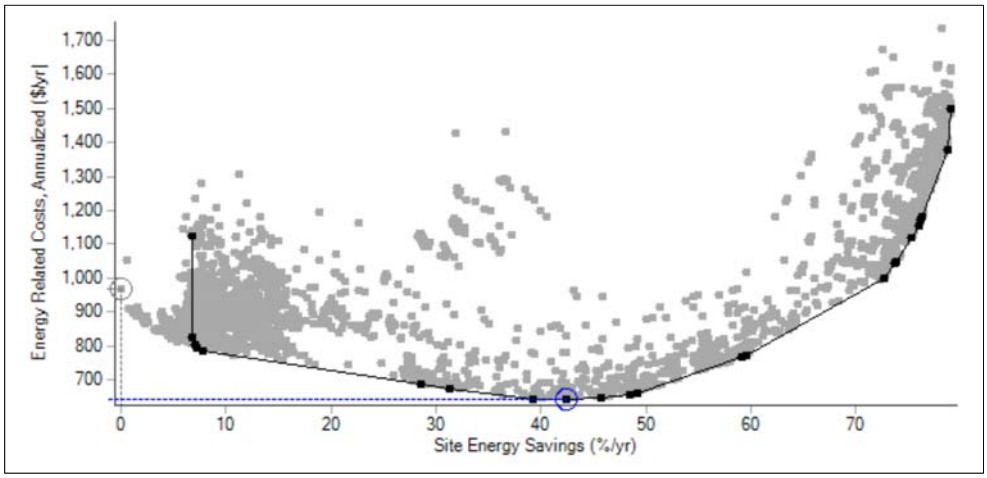
Simulation Parameters

1,152 Total Building Energy Simulations

- Medium 1-story, Large 2-story, Small Apartment Complex
- Single Orientation
- 16 California Climate Zones
- 3 Savings Metrics – Energy, Carbon, Compliance
- All-Electric and Mixed Fuel
- TOU Rates (Electric utility predominate per CZ)
- PV – None, with Battery, without Battery

Optimization

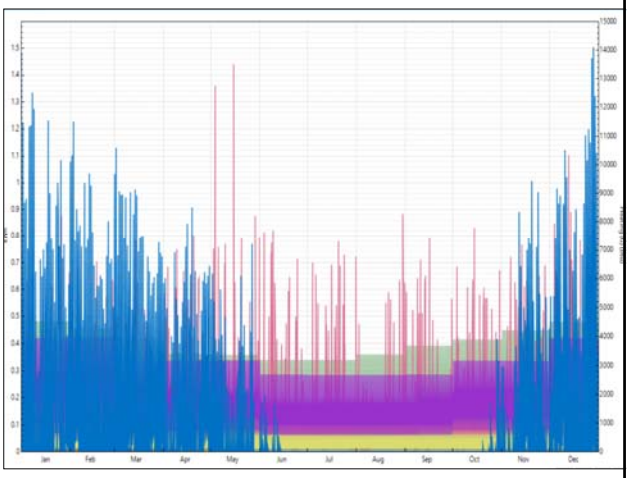
- Each result category will have a cost-optimized package of EE & PV features.



Analytics

Databases Used In Cookbook & Other Analyses

- Key Energy Efficiency Features
- Current Feature Costs – From Industry
- Hourly Simulation Data
  - o With & Without PV
  - o With PV, With and Without Batteries
  - o Peak Data – Grid Impacts
  - o TOU Tariffs:
    - Consumer Costs
    - Producing Desired Financial Pressures on Use Behavior



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Uses

- Assist Industry in Complying with 2019 Title 24 Energy Code
  - o Demonstrate Cost-Effectiveness
    - Individual Features & Packages
    - Feasibility & Practicality of Complying with Code
- Develop Metrics and Data to Guide Industry
  - o Most Optimized Features
  - o Best-Case Alternative Packages
  - o Impacts of Efficiency Packages – Peak, CO_2, Grid
  - o Impacts on Consumers' Energy Costs and Energy Use
    - TOU Tariffs, Energy Sources, Energy Storage
- Assist Utilities in Strategy & Program Planning
  - o Load, Energy Use, Peak Usage, CO_2 Production

Schedule

October	November	December	January
• Databases Completed: Features Pool, Feature Costs • Currently Simulating 1-Story Home in 16 CZs	• End November – Mid December: Complete Simulations	• End December – Project Report Phase 1	• December – January Initial Post Processing

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New Homes Sales & Marketing

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Selling Clean Energy Homes Workshops

- **Audience:** homebuilder Sales & Marketing teams
- **Message:** differentiation between new and used homes never been greater
- **Challenge:** break out of your sales rut with new features

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CA Clean Energy Homes: Features

- High Performance Building Shell
- Quality Construction
- Build Tight & Ventilate
- Efficient Systems
- On-site Energy Production

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Reactions to Training

"I'd keep paying my current electric bill to get all the advantages of a brand new clean energy home, but it's an added bonus that it saves the homeowner money too."

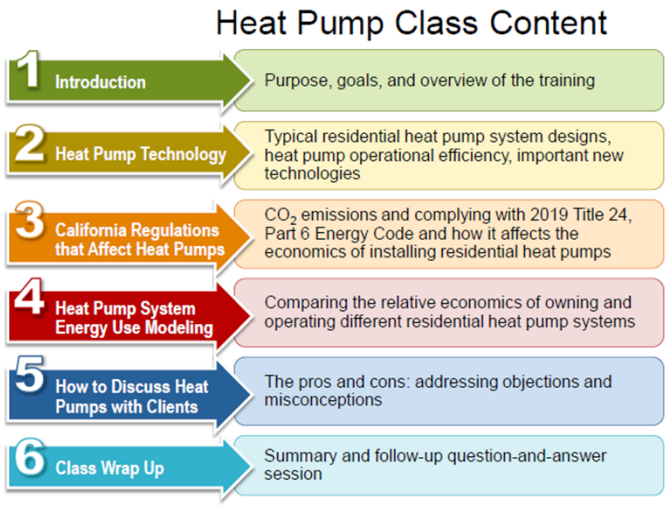
- Pardee Homes Sales Agent

"I think this is a game changer for those homebuilders who embrace innovation and choose to go beyond the code."

- Williams Homes President

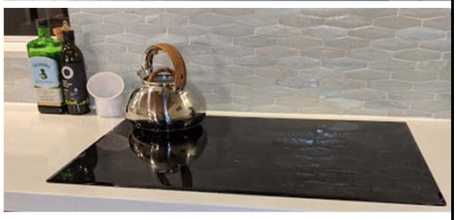
Heat Pump Training

- **Audience:** HVAC contractors & engineers, builders
- **Message:** heat pumps have compelling value proposition
- **Challenge:** breaking industry inertia, disproving myths



All-Electric Modeling Training

- **Audience:** energy consultants, MEP engineers
- **Message:** (1) technologies are ready to build all-electric; (2) here's how to model them; (3) compliance impact
- **Challenge:** inertia, preconceptions



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Supporting Code Changes

- Homebuilding industry is:
  - anti-regulation
  - anti-change
  - hard to reach
- Code changes must be cost-effective OR health & safety justified
- Training must be:
  - Properly targeted at key opportunities
  - High quality
  - Know your audience

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Reach Codes

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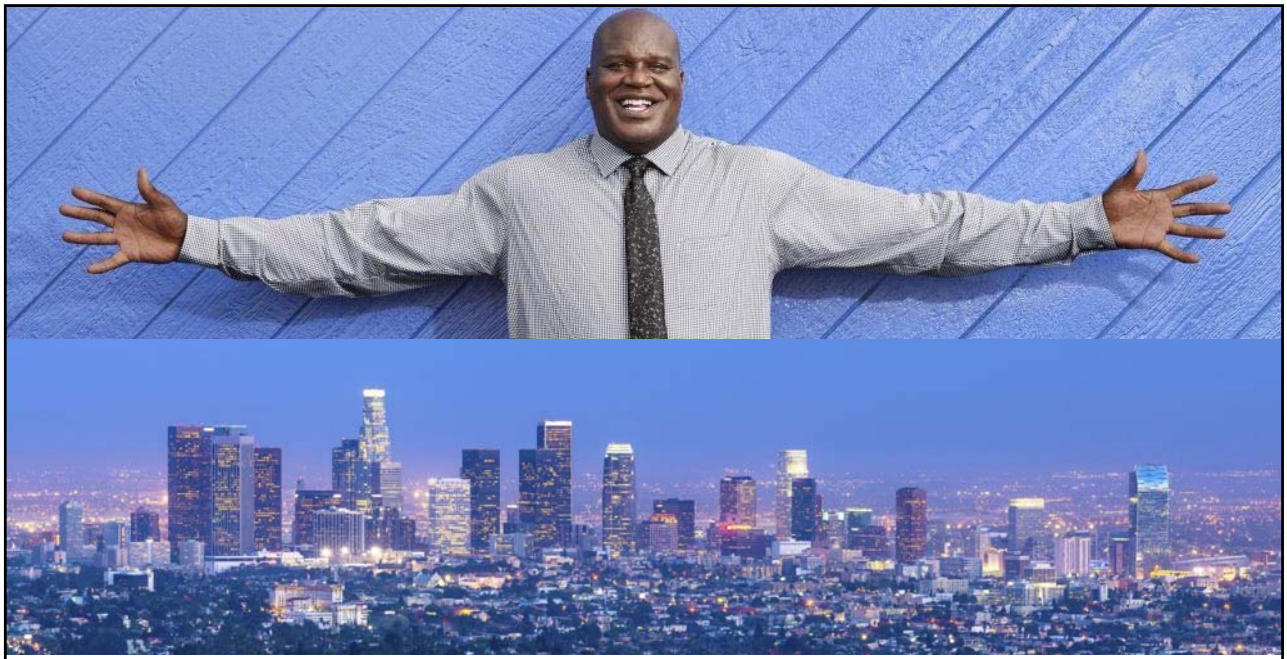
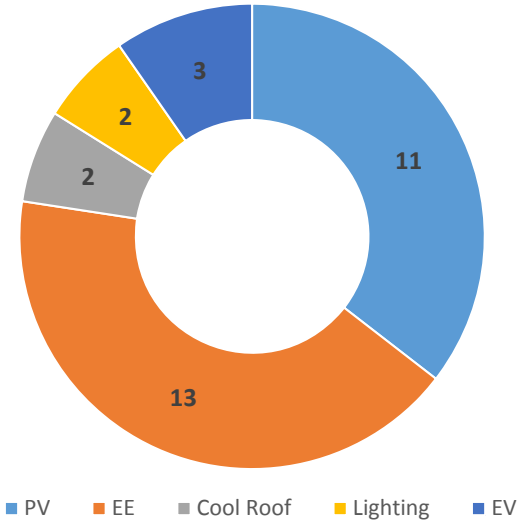


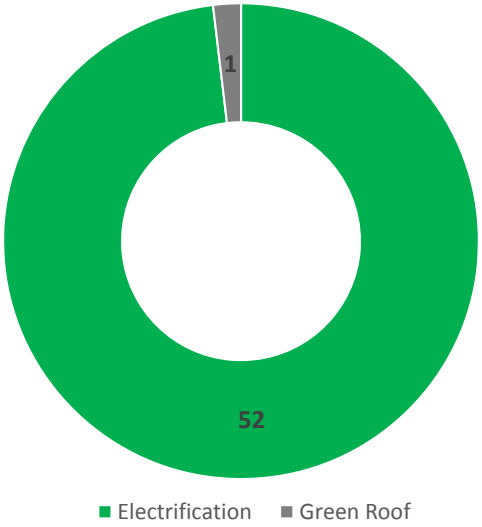
2016 Code Cycle

31 Adopted Reach Codes



2019 Code Cycle

53 Proposed Reach Codes



Decarb/Electrification Reach Code "Flavors"

All-Electric Ready	Efficiency Focus	Emissions Focus – *Walk*	Emissions Focus - *Run*
• Promotes customer choice • Step towards future Decarb/Electrification Reach Codes	• Fuel Neutral • Energy Savings: 12-20% on **ALL** buildings	• All-Electric Preferred • Energy Savings: 12-20% on mixed fuel buildings	• All-Electric Preferred • Energy Savings: 20-40% on mixed fuel buildings

GHG Savings

Low-Rise Residential New Construction Costs

Table 6: Incremental Costs – All-Electric Code Compliant Home Compared to a Mixed Fuel Code Compliant Home

Measure	Incremental Cost (2020 PV$) Single Family[1]				Incremental Cost (2020 PV$) Multifamily[1] (Per Dwelling Unit)			
	Low	High	Typical (On-Bill)	Typical (TDV)	Low	High	Typical (On-Bill)	Typical (TDV)
Heat Pump vs Gas Furnace/Split AC	($2,770)	$620	($221)		Same as Single Family			
Heat Pump Water Heater vs Gas Tankless	($1,120)	$1,120	$0					
Electric vs Gas Clothes Dryer[2]	($428)	$820	$0					
Electric vs Gas Cooking[2]	$0	$1,800	$0					
Electric Service Upgrade	$200	$800	$600		$150	$600	$600	
In-House Gas Infrastructure	($1,670)	($550)	($800)		($600)	($150)	($600)	
Site Gas Infrastructure	($25,000)	($900)	($5,750)	($11,836)	($16,250)	($310)	($3,140)	($6,463)
Total First Cost	***($30,788)***	***$3,710***	***($6,171)***	***($12,257)***	***($20,918)***	***$4,500***	***($3,361)***	***($6,684)***
Present Value of Equipment Replacement Cost			***$1,266***				***$1,266***	
Lifetime Cost Including Replacement & Financing of First Cost			***($5,349)***	***($11,872)***			***($2,337)***	***($5,899)***

[1]Low and high costs represent the potential range of costs and typical represents the costs used in this analysis and determined to be most representative of the conditions described in this report. Two sets of typical costs are presented, one which is applied in the On-Bill cost effectiveness methodology and another applied in the TDV methodology.
[2]Typical costs assume electric resistance technology. The high range represents higher end induction cooktops and heat pump clothes dryers. Lower cost induction cooktops are available.

www.LocalEnergyCodes.com

- Cost Effectiveness Studies
- Model Ordinance Language
- Staff Report Templates
- Presentation Materials

Q&A

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