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
Enlist energy storage systems and host-pumped water heaters that shift the energy use of the house from peak periods to off-peak periods. Utilities moving to time-of-use pricing associate the grid to meet the state's climate-change goals and help homes reduce energy bills.

HEALTHY INDOOR AIR QUALITY
Enable using highly efficient filters that trap hazardous particulates from both indoor air and cooking and improve kitchen ventilation systems. Minimizing air circulating inside out of the home while filtering out allergens and other particles makes the home healthier.

BUILDING ENVELOPE
Strengthen insulation in attics, seal and insulate 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.

The 4th Annual California Building Energy Modeling Symposium
CalBEM 2019
November 13 & 14
Sacramento, CA
**Story of California Solar**

- Cost ($/W)
  - 2007: $10.94
  - 2008: $10.63
  - 2009: $10.16
  - 2010: $9.15
  - 2011: $8.19
  - 2012: $6.54
  - 2013: $5.77
  - 2014: $5.28
  - 2015: $4.81
  - 2016: $4.54
  - 2017: $4.09
  - 2018: $3.86
  - 2019: $3.84

- Cumulative Capacity (MW)

---

**Battery Credit & Incentives**

<table>
<thead>
<tr>
<th>Currently Displayed: Generation as of 10/9/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Step Status</td>
</tr>
<tr>
<td>Active Step</td>
</tr>
<tr>
<td>Step Opening Date</td>
</tr>
<tr>
<td>Days in Step</td>
</tr>
<tr>
<td>Authorized Collections</td>
</tr>
<tr>
<td>Realizations</td>
</tr>
<tr>
<td>Authorized Rollover</td>
</tr>
<tr>
<td>Allocated Funds</td>
</tr>
<tr>
<td>Available Funds</td>
</tr>
<tr>
<td>Small Residential Storage</td>
</tr>
<tr>
<td>Energy Storage**</td>
</tr>
</tbody>
</table>
ZNE Cookbook
Getting to Zero Forum
October 11, 2019

Presenters:
Ian Hammon-Hogan, Co-Founder at BIRAenergy

Optimized ZNE Feature Packages

• Three CEC Prototypical Homes
  o 2100 ft², 1-story ("small")
  o 2700 ft², 2-story ("medium")
  o Multifamily: 8-Plex (~1000 ft²)

• Cost Optimized Features Sets
  o Energy, CO₂, Cost
  o Mixed Fuel & All Electric
  o Guide to Compliance and Beyond
  o With and Without Batteries
  o All 16 CZs
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 CO₂

What It Won’t Do

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

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

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

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 Cost-Optimized Features
  o Best-Case Alternative Packages
  o Impacts of Efficiency Packages – Peak, CO2, Grid
  o Impacts on Customers' Energy Costs and Energy Use
  o TOU Tariffs, Energy Sources, Energy Storage
# Schedule

<table>
<thead>
<tr>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Databases Completed:</td>
<td>• End November – Mid December:</td>
<td>• End December – Project</td>
<td>• December – January Initial</td>
</tr>
<tr>
<td>Features Pool, Feature</td>
<td>Complete Simulations</td>
<td>Report Phase 1</td>
<td>Post Processing</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Currently Simulating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Story Home in 16 CZs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**New Homes Sales & Marketing**

**Getting to Zero Forum**

October 11, 2019

**Presenters:**

Nick Brown, President at Build Smart Group
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

CA Clean Energy Homes: Features

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

Heat Pump Class Content

1. **Introduction**
   - Purpose, goals, and overview of the training

2. **Heat Pump Technology**
   - Typical residential heat pump system designs,
   - heat pump operational efficiency, important new technologies

3. **California Regulations that Affect Heat Pumps**
   - CO₂ emissions and complying with 2019 Title 24,
   - Part 6 Energy Code and how it affects the economics of installing residential heat pumps

4. **Heat Pump System Energy Use Modeling**
   - Comparing the relative economics of owning and operating different residential heat pump systems

5. **How to Discuss Heat Pumps with Clients**
   - The pros and cons: addressing objections and misconceptions

6. **Class Wrap Up**
   - Summary and follow-up question-and-answer session
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

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
Reach Codes
Getting to Zero Forum
October 11, 2019

Presenters:
Chris Kuch, PE, Reach Codes at Southern California Edison
Decarb/Electrification Reach Code “Flavors”

All-Electric Ready
- Promotes customer choice
- Step towards future Decarb/Electrification Reach Codes

Efficiency Focus
- Fuel Neutral
- Energy Savings: 12-20% on ALL buildings

Emissions Focus – Walk
- All-Electric Preferred
- Energy Savings: 12-20% on mixed fuel buildings

Emissions Focus - Run
- 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

<table>
<thead>
<tr>
<th>Measure</th>
<th>Incremental Cost (2020 PVS)</th>
<th>Incremental Cost (2020 PVS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Heat Pump vs Gas Furnace/Split AC</td>
<td>($2,770)</td>
<td>$620</td>
</tr>
<tr>
<td>Heat Pump Water Heater vs Gas Tankless</td>
<td>($1,120)</td>
<td>$1,120</td>
</tr>
<tr>
<td>Electric vs Gas Clothes Dryer$</td>
<td>($428)</td>
<td>$920</td>
</tr>
<tr>
<td>Electric vs Gas Cooking$</td>
<td>$0</td>
<td>$1,800</td>
</tr>
<tr>
<td>Electric Service Upgrade</td>
<td>$500</td>
<td>$800</td>
</tr>
<tr>
<td>In-House Gas Infrastructure</td>
<td>($1,870)</td>
<td>($550)</td>
</tr>
<tr>
<td>Site Gas Infrastructure</td>
<td>($25,000)</td>
<td>($900)</td>
</tr>
<tr>
<td>Total First Cost</td>
<td>($30,788)</td>
<td>$3,710</td>
</tr>
<tr>
<td>Present Value of Equipment Replacement Cost</td>
<td>$1,266</td>
<td>$1,266</td>
</tr>
<tr>
<td>Lifetime Cost Including Replacement &amp; Financing of First Cost</td>
<td>($5,349)</td>
<td>($11,872)</td>
</tr>
</tbody>
</table>

---

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