PERFORMANCE SYSTEMS DEVELOPMENT | We Speak Building
Navigating the Rapids
Steering New Homes Programs Through Energy Code Changes
OUR PANEL

• Kathy Greely
  *SVP Program Services, PSD*

• Mike Turns
  *Director of Codes & New Construction, PSD*

• Dan Wildenhaus
  *Building Science Manager, TRC*

• Ben Adams (in absentia)
  *VP, Strategic Development, MaGrann*

• Matt Christie
  *Associate Director, TRC*
..the growing pressure to address climate change has put a spotlight on codes as a critical lever for states and cities when trying to cut carbon emissions that are fueling climate change. Buildings account for roughly 40% of the energy used in the U.S. and over one-third of carbon emissions. Without addressing the building stock, climate action and energy policy goals are simply not achievable. The good news is that substantive improvements in building energy codes are attainable in the near term.
THE PARADOX OF CODE CHANGES

Good for the planet....

...bad for New Homes
Program savings
Code Change Impacts In Pennsylvania

Normalized Energy Use

2009 IECC

2015 IECC

Baseline Home

Code Home

YEAR

2010

2018

2021
Code Change Impacts In Pennsylvania

Normalized Energy Use

- 2009 IECC
- 2015 IECC
- Baseline Home
- Code Home
- Eligible Home

YEAR

2010 2018 2021
Code Change Impacts In Pennsylvania
IMPACTS OF CODE CHANGES

- Reduce savings per home
- Change qualification criteria (% Savings over Code, ES Version)
- Decrease the “lift” for program participation

- Effect on Participation
- Effect on Savings
IMPACTS OF CODE CHANGES

Less Participation & Savings

More Participation & Savings
CRITICAL DECISIONS FOR IMPLEMENTERS

• *How* to change qualification criteria and savings baseline

• *When* to change qualification criteria and savings baseline

• Incremental change vs. cliff
Changing Times in PA

Mike Turns
The Importance of Data

Homes
- 2009 Avg kWh Sv: 3.15K
- 2009 Total kWh Sv: 2,208,170.71
- 2015 SOC: 0.35
- 2015 Total kWh Sv: 1,654,973.23

2015 Avg kWh Sv: 2.36K

Homes

psdconsulting.com
Structuring the Rollout

• What is the date of the code change?
• When do regulators require an updated savings baseline?
• Update eligibility requirements (e.g. 15% savings over code) at the same time?
  – Gradual phase-in? 5%, 10%, 15% over code?
  – By permit date or submittal date?
Working with Evaluators

- Reference home approval
- Rollout dates
- Software versions

<table>
<thead>
<tr>
<th>Climate Zone 5</th>
<th>2009 IECC</th>
<th>2015 IECC with PA Amendments</th>
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<tbody>
<tr>
<td><strong>Insulation and Fenestration</strong></td>
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<td>15/19</td>
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<td>Unvented crawl space R-value</td>
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<td>15/19</td>
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<tr>
<td>ACH50</td>
<td>7.0</td>
<td>5.0 (PA amendment)</td>
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<td><strong>Ducts</strong></td>
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<tr>
<td>Insulation</td>
<td>R-8 supplies in attics</td>
<td>R-8 in attics (supplies &amp; returns)</td>
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<tr>
<td></td>
<td>R-6 everywhere else</td>
<td>R-6 everywhere else</td>
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<td></td>
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<tr>
<td>High-efficacy</td>
<td>50%</td>
<td>75%</td>
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</table>
• Communicate with software companies to incorporate changes in program-specific requirements/baselines
• Consider state-specific code amendments
• Equipment efficiencies:
  – RESNET defaults ≠ current federal minimums
• Will take time and maybe money
Multiple Programs in the Same State

• Work with utilities and evaluators for alignment
Communicating Program Changes

• More like turning a ship than a dinghy
  – Start communicating change ~1 year in advance
    • e-newsletters
    • Conversations with major participants

• Staged phase-ins can reduce participation drop-offs
Critical Support for Builders and Raters

- Provide information on items that impact gas or electricity, depending on the utility
- Utilize data to identify lowest-hanging fruit, e.g.
  - Heat pump water heaters
  - Envelope air leakage
  - Mechanical ventilation
Northwest Home Certification Programs

What we do with data

Dan Wildenhaus
Regional Activity

Homes Certified in 2017 by Program
Savings Estimate Methodology

Modeled Saving $s + Interpolated Saving $s = NW Regional Saving $s
Savings Estimate Methodology

**HEATING FUEL**

**CERTIFICATION TIER**

**CLIMATE ZONE**

**STATE**

**INTERPOLATED SAVINGS**

### ORHZ1 Gas
- **State:** OR
- **Climate Zone:** HZ1
- **Heating System:** Gas

<table>
<thead>
<tr>
<th>Tier</th>
<th>Therms</th>
<th>kWh</th>
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<td>Tier 3</td>
<td>85</td>
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<td>Tier 2</td>
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<td>Tier 1</td>
<td>37</td>
<td>115</td>
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### WAHZ2 Electric
- **State:** WA
- **Climate Zone:** HZ2
- **Heating System:** Electric

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<td>Tier 1</td>
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NW New Homes By the Numbers…

7,873 net homes received
9,866 certifications

13.2 million kWh savings

825,000 therms savings

*Total homes certified before netting out due to program overlaps.
## Home level data from EPS

<table>
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<th>BW</th>
<th>BX</th>
<th>ETO-640S 3.30 Primary Heating Equipment SEER</th>
<th>ETO-640S 3.31 Primary Heating Equipment COP</th>
<th>ETO-640S 3.32 Primary Heating Equipment Brand</th>
<th>ETO-640S 3.33 Primary Heating Equipment Model Number</th>
<th>ETO-640S 3.35 Primary Heating Equipment Location</th>
<th>ETO-640S 3.36 Primary Heating Equipment ECM</th>
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<td>Gas</td>
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<tr>
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<td>-</td>
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<td>Rheem</td>
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<td>912SC48B6S17</td>
<td>Garage or open crawl sp</td>
<td>No</td>
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<td>Gas</td>
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</table>

<table>
<thead>
<tr>
<th></th>
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<td>0.95</td>
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<td>Rinnai</td>
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<tr>
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<td>0.96</td>
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<td>GEH50DEE1J5C1</td>
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<td>0.95</td>
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<td>0.95</td>
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<tr>
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<td>Storage</td>
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<td>0.95</td>
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<td>0.95</td>
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<td>0.95</td>
<td>Conditioned Area</td>
<td>Bradford White</td>
<td>RE350S6</td>
<td>Conditioned</td>
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</tbody>
</table>
Local Gov’t Work
What is BetterBuilt\textsuperscript{NW}?

Non-profit representing over 140 utilities and energy efficiency organizations

The acceleration and adoption of energy-efficient products, services and practices

A suite of resources that supports key energy efficiency measures and residential New Construction

Website, staff, marketing, and the Home Efficiency Forum
Where this started?

Local Technical Assistance Toolkit

ACEEE acts as a technical assistance advisor to numerous local governments and authorities by providing analyses on the potential for energy efficiency and presenting policy opportunities. This toolkit was developed as a result of our experience working with local policymakers, program managers, and community stakeholders. The tools are designed to respond to needs of local governments and others engaged in advancing energy efficiency at the local level. Many of these tools are aimed at enabling action on low-cost, high-impact policies that will allow communities to achieve lasting energy savings.

The resources below summarize several of the programs and policies being implemented in local communities around the country. They include links to introductory information and technical assistance resources for each topic area. These resources are continually evolving as we identify additional local needs, develop new strategies, and improve upon existing ones. If you do not find the tool you need, please let us know. Need more help? Fill out this form and send it to us. For resources related to state policy please see the State Technical Assistance Toolkit.

Local Energy Planning
Local Government Lead by Example
Local Government-Utility Partnership Strategies
Community Resilience Planning
Local Energy Efficiency Policy Calculator (LEEP-C)
Where we work

Data Resources
- Construction monitor
- ACEEE roll-up/stakeholder database
- Statewide e-permitting websites
- Dodge data county level forecasts
- NAHB dataset
- Oregon Office Economic Forecasts
Example Methodology

Jurisdiction Selection
- Baseline statistics gathered
- Prioritization
- Recommendations
- Approval

Initial Contact Strategy
- Soft touch connection through contact
- Conduct opportunity survey for likely needs through one-on-one interviews
- Identify key stakeholder groups
- Determine next steps

Policy Development
- Neutral market assessment
- Engage in meetings and workshops
- Coordinate stakeholders
- Technical advisor

Exit Strategy
- Hand over to local groups
- Feed data into Code Innovation Database and ACEEE database

Monitoring and Evaluation
- Develop M&E Plan
- Conduct monitoring
- Provide final evaluation impact
Effective Incentives

OCCURANCES OF INCENTIVES, NATIONALLY

INCENTIVE OPTIONS OFFERED

- Density & Height Bonus: 23
- Tax Credits: 36
- Rebates: 18
- Loans: 9

INCENTIVES OFFERED NATIONALLY

Density & Height Bonus: 45
Tax Credits: 20
Rebates: 7
Loans: 32
Outputs

Builder Survey Questions
Kickoff Meeting Agenda

Partnership Guide
Policy Examples
Case Studies
Outputs


January 29, 2019

NEEA New Homes

Passive House Analysis

Prepared by TRC
May 25, 2018
SANDEN CO2 REFRIGERANT HEAT PUMP WATER HEATER AT FUTUREFIT HOME
Case Study by Tad Everhart, Tad Everhart Energy Advisor LLC

Abstract
Residential heat pump domestic water heating systems (HPDHW) use synthetic refrigerants with high global warming potential (GWP). In the 1980s, Japanese engineers developed an alternative HPDHW technology known as “Eco-Cube” that uses CO2 for refrigeration, a naturally occurring gas with global warming potential (GWP) 2,000 times less than synthetic. Oregon’s plumbing code requires hot water heating systems to be listed and labeled by an approved agency (such as Underwriters Laboratories UL). Although it is not yet UL listed, the City of Portland allowed us to install the CO2 HPDHW system as an alternate material through its Alternative Technology Advisory Committee process.

Permitting Process
There were two steps in the process. First, the ATIAC heard our testimony and reviewed our evidence and recommended our technology. Second, the building official granted our appeal and permitted us to install a Sanden Eco-Cube. The entire approval process took just over two months. We submitted our written application and the required $150 fee to the ATIAC. Within one month, ATIAC held a hearing on our application and allowed our in-person testimony. Within two weeks, ATIAC informed us that it would recommend we be allowed to install our system, and it gave us a written recommendation and posted it on its website. We then submitted our written building code appeal and the required $100 fee, and within one week, the City of Portland informed us that our appeal was granted and posted the appeal summary on its website.

Project Description
Even after retrofitting our home (remodeling for the future) to the super-efficient Passive House Standard in 2005, we still needed a small amount of space heating. And retrofitting did not change our need for domestic hot water. An “active” heating system like HPDHW fits well with our plan: efficient, affordable, and electric to make use of renewable energy and avoid combination of fossil fuels. When installed, it will satisfy both our space heating and hot water needs.

Codes

Innovation

Database

Search Code Innovations

Enter a keyword to search for code innovations.

Search

Table: Code Requirements

<table>
<thead>
<tr>
<th>Code Requirement</th>
<th>Compliance Path</th>
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</thead>
<tbody>
<tr>
<td>2011 OHS C M1302.1 Requires appliances to be listed and labeled by an approved agency (e.g. UL)</td>
<td>City of Portland building code appeal based on ATIAC’s recommendation (see below); administrative ruling by City staff, followed by written, online approval.</td>
</tr>
<tr>
<td>2011 OHS C M104.11 allows alternative materials, design and methods of construction and equipment when the materials or work offered is equivalent</td>
<td>Written application to City’s ATIAC, ATIAC in-person hearing, and ATIAC’s written recommendation to approve.</td>
</tr>
</tbody>
</table>

Resources:

- Oregon Residential Specialty Code
- Oregon Plumbing Specialty Code
- Laboratory Assessment of Sanden GAU
- Mechanical Code
- Oregon Mechanical Specialty Code
- Oregon Reach Code
- WSU Case Study on CO2 Refrigerant HPDHWs

BetterBuilt NW
Ratings, Programs and Code

Ben Adams
Residential Energy Codes are Improving Faster!

This map shows the progress of residential energy codes across the United States as of August 10, 2016. The codes are improving faster and are color-coded to indicate the version of the International Energy Conservation Code (IECC).

- **IECC 2015**: Latest version, indicating the most stringent energy standards.
- **IECC 2012**: Previous version.
- **IECC 2009**: Earlier version.
- **IECC 2006**: Even earlier version.
- **Earlier or No Statewide Code**: Areas where no statewide energy codes are in place.

The map highlights the percentage improvements in energy efficiency over time, with blue states showing positive improvements and red states indicating areas where energy codes have been reduced.

Sources: RMI & BCAP
### HERS Based Incentives and Code Change

#### 2016 Participation Levels & Incentives Summary

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<tr>
<th>HERS Score Incentive</th>
<th>70-61</th>
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<tr>
<td>EfficiencyCrafted®</td>
<td>$300</td>
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<tr>
<td>EfficiencyCrafted®</td>
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<td>$1,225</td>
<td>$1,975</td>
</tr>
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</table>

**Incentive Notes:**
- **EfficiencyCrafted®** homes include:
  - Compliance with sections 2.6 & 4 of the ENERGY STAR® Home Performance Checklist (Version 3.1, exterior as needed).
  - Minimum of 3.0 HERS Score, Klan & M-7.0 HERS Test
  - All supplies and returns equal at 0.5 HERS
  - Incentive includes a minimum of 1.0
  - DSVC, ventilation compliance with program-announced quality certification (e.g., home)
  - If 1.5½ LPM (LPM) 75% for indoor air and 80% for indoor air

- **ENERGY STAR® Certified** homes:
  - Compliance with section 2.6 & 4 of the ENERGY STAR® Home Performance Checklist (Version 3.1, exterior as needed).
  - Minimum of 3.0 HERS Score, Klan & M-7.0 HERS Test
  - All supplies and returns equal at 0.5 HERS
  - Incentive includes a minimum of 1.0
  - DSVC, ventilation compliance with program-announced quality certification (e.g., home)
  - If 1.5½ LPM (LPM) 75% for indoor air and 80% for indoor air

**EfficiencyCrafted® plus ENERGY STAR® Certified** includes:
- All EfficiencyCrafted® measures listed above.
- All ENERGY STAR® Certified.

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**Contact Information:**
- **Call:** 1-877-777-5506
- **Email:** info@EfficiencyCraftedHomes.com
HERS Based Incentives and Code Change

HERS Score Distribution by Year

~15% Increase in code
~4% Drop in savings
Savings Based Incentives and Code Change

AEP Ohio EfficiencyCrafted
New Homes 2018 Program Summary

Incentive Levels

<table>
<thead>
<tr>
<th>Incentive Level</th>
<th>Single Family and Multi-Single Family</th>
<th>Multi-Family</th>
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<tr>
<td>ENERGY STAR Certified</td>
<td>$300.00 + $0.12/kWh</td>
<td>$260.00 + $0.12/kWh</td>
</tr>
</tbody>
</table>

~10% Increase in savings
Next code change in 2019

Building Type Definitions

- **Single Family** – A structure containing one or two single-family dwelling units with a separate external entrance for each unit.
- **Multi-Single Family** – A structure containing three or more dwelling units with separate external entrances and no more than one dwelling unit located above another unit.
- **Multifamily** – All other structures up to five floors above grade or above garage regardless of entrance configuration. In all cases, the structure must meet the criteria for “ENERGY STAR Certified Homes” according to the EPA ENERGY STAR Multifamily New Construction Decision Tree available at energystar.gov.

For more information call (877) 771-5506 or email info@EfficiencyCraftedHomes.com
Rater Feedback

- Preparedness
- Training
- Consulting
- New Business
- Appreciation
- Understanding
- Permit Grab

- Enforcement
- ENERGY STAR
- Skepticism
- Trades
- Cost
- Blame
- Watering Down