Building Practices in the Northwest: What Does the Data Say?

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Dan Wildenhaus | Mekha Abraham
Who We Are

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BetterBuilt\textsuperscript{NW} –
Program Coordination Lead

Mekha Abraham
BetterBuilt\textsuperscript{NW} –
Data & Research Lead
What is BetterBuilt\textsuperscript{NW}?
What is BetterBuilt\textsuperscript{NW}?

BetterBuilt\textsuperscript{NW} is a resource center designed to support and promote energy-efficient home building in the region.
BetterBuilt\textsuperscript{NW} Goals

1. Encourage reliable energy savings with modeling protocols
2. Develop advanced building science knowledge transfer
3. Provide market growth support
4. Improve and streamline data collection
Building Practices in the Northwest: What Does the Data Say?
Audience Feedback

We think you are the subject matter experts in the room!

WE WANT YOU
The 40 by 30 Goal

Reduce carbon dioxide emissions at least 40% by 2030 from 2005 levels. This target is consistent with the U.S. emissions targets for the 2030 time frame established as part of the Paris Agreement on climate change.

The Paris Agreement

Progress tracker: Work programme resulting from the relevant requests contained in decision 1/CP.21 (version of 22 October 2018)

Paris Agreement: essential elements

https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
The 40 by 30 Goal

In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO₂ emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range).

https://www.ipcc.ch/sr15/
The 40 by 30 Goal

KEY TARGETS FOR 2030:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share for renewable energy
- At least 32.5% improvement in energy efficiency

Session Mission

The Climate Community has determined that to achieve our climate goals of limiting global temperature increase to 1.5°C, we need to reduce our carbon emissions by 40% by the year 2030.

- How are building practices in the Northwest currently contributing to this goal?
- How far along is our building stock coming?
- How much harder we need to push to get our Residential New Construction efforts to meet this target?
BetterBuilt\textsuperscript{NW} Data Goals

- Energy Savings
- Market Trends
- Code Proposals
- Long Term Planning
BetterBuilt\textsuperscript{NW} Data & Programs

**National**
- ENERGY STAR
- RESNET \textsuperscript{HERS} INDEX
- ZERO ENERGY READY HOME
- Passive House Institute
- LEED

**Regional**
- Built Green
- EPS
- earth advantage
- Utility Incentive
Regional Activity

Home Certifications in 2017 by Program
Energy Equivalency Studies

19-25% energy savings compared to code\textsuperscript{1}

38-42% energy savings compared to code\textsuperscript{2}

\textsuperscript{1}2017 Oregon Residential Specialty Code
\textsuperscript{2}2015 Washington State Energy Code
Current Trends in the Northwest
Housing Projections

Northwest Annual Single Family New Construction

2020-2030: 50,000 new single family homes annually in Northwest

Source: Seventh Power Plan, Northwest Power and Conservation Council
Population Growth

2015 - 2035 (Projected)

<table>
<thead>
<tr>
<th>State</th>
<th>Population</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>2.1 M</td>
<td>1.3%</td>
</tr>
<tr>
<td>WA</td>
<td>8.5 M</td>
<td>0.9%</td>
</tr>
<tr>
<td>OR</td>
<td>4.7 M</td>
<td>0.8%</td>
</tr>
<tr>
<td>MT</td>
<td>1.1 M</td>
<td>0.5%</td>
</tr>
<tr>
<td>NW</td>
<td></td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Source: Seventh Power Plan, Northwest Power and Conservation Council
Housing Forecast

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Size</td>
<td>Avg. Size: 2.5</td>
<td>Avg. Size: 2.4</td>
</tr>
<tr>
<td>Population</td>
<td>14.5 million</td>
<td>15.8 million</td>
</tr>
<tr>
<td>No. of Homes</td>
<td>5.9 million</td>
<td>6.5 million</td>
</tr>
</tbody>
</table>

600,000 new homes

Source: Seventh Power Plan, Northwest Power and Conservation Council
Population Matters!

Washington Population Growth Rate by County

http://worldpopulationreview.com/states/
Washington Population Density by County

Washington Population Growth Rate by County
Oregon

Oregon Population Density by County

Oregon Population Growth Rate by County
Idaho

Idaho Population Density by County

Idaho Population Growth Rate by County
Montana

Montana Population Density by County

Montana Population Growth Rate by County
2017 Northwest Activity

2017 NW Single Family New Construction - # of Homes

2017 NW Single Family New Construction - GHG Emissions

Permitted Homes

Baseline GHG Emissions
2017 Northwest Activity

2017 NW Single Family New Construction - # of Homes

- 82% (34,839) Code Homes
- 17% (7,479) Above Code Homes
- 1%* (394) High Performance Homes

GHG Savings*: 4% (6,435)
*20% avg GHG saving per home

2017 NW Single Family New Construction - GHG Emissions

- 82% (149,873) Code Homes - GHG Emissions
- 14% (25,740) Above Code Homes - GHG Emissions

GHG Savings*: 4% (6,435)
2017-18 Northwest Activity

NW Single Family New Construction - # of Homes

<table>
<thead>
<tr>
<th>Year</th>
<th># of Homes</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>42,712</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>45,217</td>
<td>6%</td>
</tr>
</tbody>
</table>

NW Single Family New Construction - GHG Emissions

<table>
<thead>
<tr>
<th>Year</th>
<th>GHG Emissions</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>183,742</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>187,932</td>
<td>3%</td>
</tr>
</tbody>
</table>
2017-18 Northwest Activity

NW Single Family New Construction

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>82% (34,839)</td>
<td>79% (35,604)</td>
</tr>
<tr>
<td>High Performance Homes</td>
<td>17% (7,479)</td>
<td>20% (9,132)</td>
</tr>
<tr>
<td>Above Code Homes</td>
<td>82% (149,873)</td>
<td>79% (147,978)</td>
</tr>
<tr>
<td>Code Homes</td>
<td>3% decrease</td>
<td>3% increase</td>
</tr>
</tbody>
</table>

NW Single Family New Construction - GHG Emissions

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<tbody>
<tr>
<td>GHG Emissions</td>
<td>14% (25,740)</td>
<td>17% (30,365)</td>
</tr>
<tr>
<td>High Performance Homes - GHG Emissions</td>
<td>3% increase</td>
<td></td>
</tr>
<tr>
<td>Above Code Homes - GHG Emissions</td>
<td>3% decrease</td>
<td></td>
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<tr>
<td>Code Homes - GHG Emissions</td>
<td></td>
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2017-18 Construction Trends: Washington

Above Code Homes
Above-Grade Wall Total Cavity Insulation
2017-2018

- 2015 WSEC: R-21 (Wood Frame Wall)
- Average NW Passive House Level: R-42

BetterBuiltNW
2017-18 Construction Trends: Washington

Above Code Homes Window U-Value 2017-2018

- **Average NW Passive House Level:** U-0.16
- **2015 WSEC:** U-0.30 (Fenestration)
2017-18 Construction Trends: Washington

Above Code Homes Infiltration ($ACH_{50}$) 2017-2018

- **Average NW Passive House Level:** 0.6 $ACH_{50}$
- **2015 WSEC (Option 2a):** 3.0 $ACH_{50}$
- **2015 WSEC (Option 2b):** 2.0 $ACH_{50}$

% of Units
0% 5% 10% 15% 20% 25% 30% 35%
0-0.5 0.5-1 1-1.5 1.5-2 2-2.5 2.5-3 3-3.5 3.5-4 4-4.5 >4.5
Future Trends in the Northwest
2030 Projection – Current Trends

NW Single Family New Construction

- 20% of homes above code*
- with 20% average GHG savings

2030 Target
40% GHG reduction

*Assume historical level of code changes (1-3% savings per year)
What If? *Doubling Efforts*

**NW Single Family New Construction**
**2030 Projection - Double Above Code Homes**

- **GHG Emissions - MTCO²**
- **# of Homes**
- **2010 Baseline GHG Emissions**
- **Code Homes - GHG Emissions**
- **Above Code Homes - GHG Emissions**
- **GHG Savings**
- **Total Permitted Homes**
- **Above Code Homes**

*Assume historical level of code changes (1-3% savings per year)*
What If? *Tripling Efforts*

NW Single Family New Construction
2030 Projection - Triple Above Code Homes

- 2010 Baseline GHG Emissions
- Code Homes - GHG Emissions
- Above Code Homes - GHG Emissions
- GHG Savings
- Total Permitted Homes
- Code Homes

2030 Target
40% GHG reduction

*Assume historical level of code changes (1-3% savings per year)
What If? A Passive House Future

NW Single Family New Construction
2030 Projection - 50% Passive House Construction

- 2010 Baseline GHG Emissions
- Code Homes - GHG Emissions
- Above Code Homes - GHG Emissions
- GHG Savings
- Total Permitted Homes
- Code Homes
- Above Code Homes

2030 Target
40% GHG reduction

2030 Target
50% of above code* homes ramped up to PH level** by 2030

*Assume historical level of code changes (1-3% savings per year)
**Assume 35% GHG savings with PH level home
What If? A Passive House Future

NW Single Family New Construction
2030 Projection - 75% Passive House Construction

- 2010 Baseline GHG Emissions
- Code Homes - GHG Emissions
- Above Code Homes - GHG Emissions
- GHG Savings
- Total Permitted Homes
- Code Homes
- Above Code Homes

2030 Target
40% GHG reduction

**Assume historical level of code changes (1-3% savings per year)**

**Assume 35% GHG savings with PH level home**

75% of above code* homes ramped up to PH level** by 2030
What If? A Passive House Future

NW Single Family New Construction
2030 Projection - 100% Passive House Construction

- 2010 Baseline GHG Emissions
- Code Homes - GHG Emissions
- Above Code Homes - GHG Emissions
- GHG Savings
- Total Permitted Homes
- Code Homes
- Above Code Homes

2030 Target
40% GHG reduction

*Assume historical level of code changes (1-3% savings per year)
**Assume 35% GHG savings with PH level home

100% of above code* homes ramped up to PH level** by 2030
Challenges of Advancing Code

What impact(s) will codes have on “above code programs?”

Who is working on our codes?
Typical Code Change Process

YEAR

2010  2018  2021

2009 IECC

2015 IECC

Normalized Energy Use

Code Home
Typical Code Change Process

Normalized Energy Use

YEAR

2010 2018 2021

2009 IECC

2015 IECC

Baseline Home

Code Home
Typical Code Change Process
Typical Code Change Process
Is this pathway enough?

![Graph showing incremental improvement compared to targets.

- Residential: 100% (2006), 82.7% (2009), 76.1% (2012), 65% (2015), 56% (2018), 48% (2021), 39% (2024), 30% (2027), 30% (2030).
- Commercial: 100% (2006), 86.8% (2009), 82.0% (2012), 65% (2015), 56% (2018), 48% (2021), 39% (2024), 30% (2027), 30% (2030).

Target: 8.75% savings compared to the 2006 WSEC
- Residential: 100% (2006), 91% (2009), 83% (2012), 74% (2015), 65% (2018), 56% (2021), 48% (2024), 39% (2027), 30% (2030).
- Commercial: 100% (2006), 86% (2009), 74% (2012), 64% (2015), 55% (2018), 47% (2021), 41% (2024), 35% (2027), 30% (2030).

Target: 14% savings compared to each previous code
- Residential: 100% (2006), 86% (2009), 74% (2012), 64% (2015), 55% (2018), 47% (2021), 41% (2024), 35% (2027), 30% (2030).
- Commercial: 100% (2006), 86% (2009), 74% (2012), 64% (2015), 55% (2018), 47% (2021), 41% (2024), 35% (2027), 30% (2030).

NOTE: The table above is not included in the 2015 Report to the Legislature.
Lead the charge
Code Participation

Five Modes of Arts Participation

- Ambient
- Observational
- Curatorial
- Interpretive
- Inventive

Amount of Creative Control

None — Total — None
Policy On Our Side
OR: Executive Order 17-20

FOUR KEY CONCEPTS:

1. Energy efficiency leadership in state owned/leased buildings

2. Targets for state-wide building codes & appliance standards

3. Existing Buildings / Retrofits and affordable housing

4. BEEWG – Made up of staff from ODOE, BCD, PUC, DAS, OHCS

"In reviewing the energy conservation standards, the director shall consider the target standards described in the Architecture 2030 organization’s 2030 Challenge and may consider other available nationally recognized energy conservation…"

Directive 4C – Zero Energy Ready Homes (as described by the DOE Zero Energy Ready Home program)
The Department of Commerce, working with the WSU Energy Program, the State Building Code Council, and others, will develop, and implement to the extent possible and consistent with state and federal law, a new statewide program to significantly improve the energy performance of both our public and private buildings, taking into account existing state and utility efforts.

70% Reduction in energy use in buildings by 2030, compared to 2006.
DISCUSSION
Discussion

What do we need to do in order to get closer to 2030 targets?

- More electric homes?
- Carbon fees/pricing?
- More advanced codes?
- Better marketing and sales of above code home programs?
- Priority permitting type programs?
THANK YOU

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