Zero Energy Ready Home

The Road Ahead

SAM RASHKIN
Chief Architect
Building Technologies Office
Before we Begin...

Zero is a Reverse Engineering Process

Brand

Promise
ZERH = Six Brand Promises

- Optimized Enclosure
  - FUTURE READY

- Water Protection
  - MOISTURE READY

- Advanced H+AC+H
  - COMFORT READY

- Indoor Air Quality
  - HEALTH READY

- Efficient Comps
  - TECH READY

- Solar Ready
  - ZERO READY
# ZERH Staircase

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>HERS 85-90</td>
<td>HERS 70-80</td>
<td>HERS 65-75</td>
<td>HERS 55-65</td>
<td>HERS 48-55</td>
<td>HERS 35-45</td>
</tr>
<tr>
<td>ZERH</td>
<td>PHIOUS+</td>
<td>ZERH</td>
<td>PHIOUS+</td>
<td>ZERH</td>
<td>PHIOUS+</td>
</tr>
</tbody>
</table>

**HERS Ratings**
- **IECC 2009**: HERS 85-90, HERS 70-80, HERS 65-75, HERS 55-65, HERS 48-55, HERS 35-45
- **IECC 2012**: HERS 70-80, HERS 65-75, HERS 55-65, HERS 48-55, HERS 35-45

**Energy Efficiency Features**
- HVAC QI with WHV
- Water Management
- Independent HERS Verif.
- EPA Indoor Air Package
- Optimized Duct Location
- Eff. Comps. & H₂O Distrib.
- Solar Ready

**Water Management**
- HVAC QI with WHV
- Water Management
- Independent HERS Verif.
- EPA Indoor Air Package
- Optimized Duct Location
- Eff. Comps. & H₂O Distrib.
- Solar Ready

**Additional Features**
- Independent HERS Verif.
- EPH Verif.
- Water Management
- Solar Ready
- Ultra-Efficient Enclosure
- ZERH
- PHIUS+

**Optimized Duct Location**
- HVAC QI with WHV
- Water Management
- Independent HERS Verif.
- EPA Indoor Air Package
- Optimized Duct Location
- Eff. Comps. & H₂O Distrib.
- Solar Ready
ZERH Strategy

Efficiency & Performance First!

- **Optimize Efficiency:**
  - Enclosure
  - Components
  - Solar Ready

- **Do No Harm:**
  - Moisture Protection
  - Assured Comfort
  - Comprehensive IAQ

- **Renewable Optional:**
  - On-Site
  - Micro-Grid
  - Utility
  - Offsets

Annual Energy Use

Minimum Code Home | Zero Energy Ready Home | Zero Energy Home

0
Wouldn’t it be great to know what leading experts would look for in a new home that performs to their expectations?
Well now you do.

When building performance professionals are polled, they overwhelming choose homes that meet Department of Energy Zero Energy Ready Home specifications.
ZERH Sample Projects in Pipeline

- Mandalay Homes: 3,000 Units in Prescott, AZ
- Caliber Wealth Dev.: 3,000 MF Units in Phoenix
- Capstone: 200 Units in Flagstaff, AZ
- LendLease: 500-Acre Community in Denver
- HF2M: 3,000 Unit Community in Fort Collins
- Meritage Homes: 4 Subdivisions (CA, AZ, FL)
- Garbett Homes: 300+ Homes in Salt Lake City
- Parallel Housing: 91 Units on Atlanta Belt Line
- Stapleton: 10% Min. Phase 10 in Denver
- Modular Plants in VT (VerMod) and DE (ZeMod)
Response to question about the secret of his success:

“I skate to where the puck is going to be, not where it has been.”

Wayne Gretsky
Canadian Hockey Player
Where is the housing ‘puck’ going to be?

- Informed Homebuyers
- Fault Detection and Diagnostics (FDD)
- Off-Site Production
- Disaster Resistance
Use of Internet for Home Buying

<table>
<thead>
<tr>
<th>Informed Homebuyers</th>
<th>Fault Detection and Diagnostics</th>
<th>Off-Site Production</th>
<th>Disaster Resistance</th>
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<tbody>
<tr>
<td>71%</td>
<td>80%</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>77%</td>
<td>84%</td>
<td>89%</td>
<td>88%</td>
</tr>
<tr>
<td>79%</td>
<td>87%</td>
<td>90%</td>
<td>90%</td>
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<tr>
<td>80%</td>
<td>90%</td>
<td>89%</td>
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<tr>
<td>84%</td>
<td>87%</td>
<td>88%</td>
<td>90%</td>
</tr>
<tr>
<td>87%</td>
<td>90%</td>
<td>90%</td>
<td>92%</td>
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</tbody>
</table>

Source: National Association of Realtors®

Content
Informed Buyers…

…will know a lot more about Thermal Defects
Minimize Thermal Defects:

- Maximum Framing Factor 8%
- Ratchet up Air Tightness
  (1-2 ACH50 instead of 1.5-3 ACH50)
Informed Buyers...

...will know a lot more about

Advanced Windows
Why Advanced Windows

<table>
<thead>
<tr>
<th>Window 15% of Wall Area</th>
<th>Wall R-Value with Windows w/Varied Wall Insulation Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Value</td>
<td>R-0</td>
</tr>
<tr>
<td>0.30</td>
<td>R-5</td>
</tr>
<tr>
<td>0.20</td>
<td>R-5</td>
</tr>
<tr>
<td>0.15</td>
<td>R-5</td>
</tr>
<tr>
<td>0.10</td>
<td>R-5.5</td>
</tr>
</tbody>
</table>

* In Cold Climates

**Sources:**

“Holes in the Wall: To Improve the Energy Performance of Walls, Look at the Total R-Value,” Journal of Light Construction, February 2014;
Multi-Assembly R-Value / U-Value Calculator – Cascadia Windows and Doors;
Michael Blasnik Presentation, 2014 ACI Conference
Informed Buyers...

...will know a lot more about Advanced Windows
Future ZERH Requirements

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<td>High-R Windows:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• R-3 Climate Zones 1-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• R-5 Climate Zones 4-5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• R-7 Climate Zones 6-8</td>
<td></td>
<td></td>
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Informed Buyers...  

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...will know a lot more about Moisture Risks
Informed Buyers...

...will know a lot more about

Moisture Risks
Moisture Management:

• Capillary Break Between Footing and Foundation Stem Wall

• Mandate Low-Risk Wall Assemblies (e.g., IRC Assemblies with Exterior Insulation or Systems Built Walls such as SIPs, ICFs, ICPs, etc.)
Informed Buyers…

…will know a lot more about Health Risks
IAQ Measures:

- HRV or ERV in Cold Climates
- ERV in Humid Climates
- High-Capture Efficiency Kitchen Exhaust
- Smart Ventilation w/On-Board Diagnostics
### Informed Homebuyers

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...will know a lot more about **True Cost**

- **Monthly Utility Bill**
- **Monthly Mortgage**
- **CODE**
- **ZERO**

**Lower True Cost**
Informed Buyers…

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<tr>
<td>$61,179</td>
<td>$121,706</td>
<td>$115,622</td>
<td></td>
</tr>
<tr>
<td>$20,000</td>
<td>$40,000</td>
<td>$66,766</td>
<td></td>
</tr>
<tr>
<td>Affordable</td>
<td>Custom</td>
<td>MF</td>
<td>Production</td>
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</table>

Average 30-Year Savings
All Tour of Zero Homes 2013-2017

~$108,000
Engage Transaction Players:

- Underwriters
  (Reduced Interest Rates, EEMS)

- Insurance Companies
  (Reduced Cost Insurance)

- Appraisal Associations
  (Training and Tools for Appraisers)

- State Housing Agencies
  (Qualified Action Plan Incentives)
Fault Detection and Diagnostics…

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…will drive

Quality HVAC
Fault Detection and Diagnostics

| Informed Homebuyers | Fault Detection and Diagnostics | Off-Site Production | Disaster Resistance |

...will drive

Quality HVAC
Quality HVAC:

- Fault Detection and Diagnostics
- High-Efficiency HVAC
- Variable Capacity HVAC
- Integrated RH Control
- Smart Optimized Comfort Control Systems
Housing: Low Productivity

Labor Productivity Index

Housing: Glacial Innovation

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1877: Wood Frame House, Omaha, NE

2015: Typical Wood Frame Structure
Housing: Visibly Poor Waste

- Informed Homebuyers
- Fault Detection and Diagnostics
- Off-Site Production
- Disaster Resistance
Why Off-Site Production

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**Trade Partner:**

- Availability
- Quality
- Training
- Cost
- Productivity
- Waste
## Integrate w/Off-Site Production:

- Kit Manufacturers
- Panelization Manufacturers
- Modular Manufacturers
Disaster Resistance

- Informed Homebuyers
- Fault Detection and Diagnostics
- Off-Site Production
- Disaster Resistance

![Map showing disaster risk and property information](image)

- Number of Single Family Homes & Condos: 318,838
- Natural Disaster Risk Score: 45
- Home Value: $555,730
- 3-Year Price Appreciation: 10%
- 10-Year Price Appreciation: 3%
- Avg Property Age: 36
## Disaster Resistance

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Hurricane Harvey Aftermath: Houston, TX
## Disaster Resistance

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**Hurricane Irma Aftermath: Homestead, FL**
## Insurance Cost

### Relative to Base Flood Elevation (BFE)

<table>
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<tr>
<th>Premium at 4 Ft. Below BFE</th>
<th>Premium at BFE</th>
<th>Premium at 3 Ft. Above BFE</th>
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<tbody>
<tr>
<td>$9,500/year</td>
<td>$1,410/year</td>
<td>$427/year</td>
</tr>
<tr>
<td>$95,000/ 10 Years</td>
<td>$14,100/ 10 Years</td>
<td>$4,270/ 10 Years</td>
</tr>
</tbody>
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**Disaster Resistance**

- Informed Homebuyers
- Fault Detection and Diagnostics
- Off-Site Production
- Site Production

**Buyers Will Know**

- Resilience
- Disaster Resistance
- Informed Homebuyers
- Fault Detection and Diagnostics
- Off-Site Production
Disaster Resistance

Informed Homebuyers

Fault Detection and Diagnostics

Off-Site Production

Disaster Resistance

FORTIFIED Home™

FORTIFIED Home™ is a third-party certification program specifying design and construction standards to increase a home's resilience and deliver superior performance during tropical storms and hurricanes. The FORTIFIED Home™ program has three levels of designation – Bronze, Silver and Gold – that build upon each other.

INSURANCE DISCOUNTS: 6% - 8%*

Bronze: Strengthen the Roof System
Minimizes the risk of water getting into the home and of the roof detaching from the walls.

INSURANCE DISCOUNTS: 13% - 15%*

Silver: Strengthen the Windows & Doors
Minimizes the risk of wind entering the home and causing a roof failure. Also effective at reducing the risk of water getting into the home.

INSURANCE DISCOUNTS: 16% - 19%*

Gold: Strengthen the Structural System
Creates a continuous load path that ties the roof to walls, walls to floors, and floors to the foundation. The most effective way to minimize structural risks from high winds.
Disaster Resistance:

- ‘Fortified Homes’ Certification
- Integrated Pest Management
Questions?

Thank You

For More Information:

https://buildings.energy.gov/zero/

https://energy.gov/eere/buildings/zero-energy-buildings