PH Production Homes
HERS in the Way?

Image: New Town Builders
PH Production Homes
HERS in the Way?

• Denver, CO (6020 HDD, 679 CDD)
• New Urbanist, Infill Builder
• Net Zero Energy Home Option (HERS 0) @ Cost Parity
• Declining PV (7 kW avg.) Subsidies
• Seeking Shell Efficiency Upgrade
### PH Production Homes

**HERS in the Way?**

<table>
<thead>
<tr>
<th>Shell Aspect</th>
<th>Initial Design</th>
<th>HERS 40 House</th>
<th>Passive House</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation</td>
<td>South</td>
<td>East</td>
<td>South</td>
</tr>
<tr>
<td>Basement Floor</td>
<td>R24</td>
<td>R0</td>
<td>R24</td>
</tr>
<tr>
<td>Basement Walls</td>
<td>R30</td>
<td>R22</td>
<td>R30</td>
</tr>
<tr>
<td>Walls</td>
<td>R38</td>
<td>R38</td>
<td>R40</td>
</tr>
<tr>
<td>Roof</td>
<td>R96</td>
<td>R48</td>
<td>R96</td>
</tr>
<tr>
<td>Windows</td>
<td>Dbl Pane, Low-SHG</td>
<td>Dbl Pane, Low-SHG</td>
<td>Tri Pane, Tuned</td>
</tr>
<tr>
<td>$ACH_{50}$</td>
<td>3.0</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td>Exhaust Only</td>
<td>80% HRV</td>
<td></td>
</tr>
</tbody>
</table>
# PH Production Homes

## HERS in the Way?

<table>
<thead>
<tr>
<th>Result</th>
<th>HERS 40 House</th>
<th>Passive House</th>
<th>Savings</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating (Rem/Rate)</td>
<td>30,600 kBTU/yr</td>
<td>11,300 kBTU/yr</td>
<td>19,300 kBTU/yr</td>
<td>63%</td>
</tr>
<tr>
<td>Heating (PHPP)</td>
<td>50,886 kBTU/yr</td>
<td>9,381 kBTU/yr</td>
<td>41,505 kBTU/yr</td>
<td>82%</td>
</tr>
<tr>
<td>HERS Score</td>
<td>40</td>
<td>34</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>
PH & Open Building
The Shell Matters!

Image Source: OPEN Prototype Home - Building the Future
www.MadeForOne.com
What About Cooling?

Source: Passive Houses in Mediterranean Climates, PHI
What About Cooling?

Peak Loads: Seville, Spain, Standard Construction

Source: Passive Houses in Mediterranean Climates, PHI
What About Cooling?

Peak Loads: Seville, Spain, Passive House

Source: Passive Houses in Mediterranean Climates, PHI
US Night Cooling Potential

Figure 4: Favorable climates for ventilation cooling
Passive House Lessons

1. PH is not a “Bolt-On” Solution
2. IDP is Essential
3. Simple is Better
4. “Fresh Air Heating” is Tricky
5. Distribution in Multi-Family is Harder
6. Orientation & Solar Gains Matter
7. Shading Matters, A LOT
8. So Does Slab Insulation!
9. DHW is Significant (Solar Thermal!)
10. Solar Thermal can Overheat PH’s
11. Monitoring Should Be >1 Year
Renewables
What’s Working?

**Denmark** 5,574,000 pop.
Wind: >200 MW (19%)
Solar: >4 GW (30%, 8 years early!)
Renewable Target: 100% by 2050
2013: No gas or oil heaters in new homes
2016: No gas or oil heaters replaced

**Germany** 82,000,000 pop.
Solar: >30 GW (3%), Wind: >30 GW (8%)
8 of 17 Nuclear Plants Closed, all by 2022
2012: 25% Renewable Electricity
Renewable Targets: 2020 35%, 2050 80%

**California** 38,000,000 pop.
Solar ~2GW (1%), Wind: 5.5 GW (5%)
Renewable Targets: 2010 20%, 2020 33%

Image: [www.reddit.com](http://www.reddit.com)
Passive House vs NZE
Efficiency / Renewables

Net Zero Energy

PH + FiT

Image: Passivhaus Institut (PHI)
Net Zero Energy
The Consumption Still Matters!
Net Zero Energy
The Consumption Still Matters!
Net Zero Energy
The Consumption Still Matters!
Net Zero Energy
The Consumption Still Matters!
Passive House
The Way of the Future!

19th Century

20th Century

21st Century

image source: Albert, Righter and Tittmann Architects
From Experiment to Adoption
The CEPHEUS Project
(Cost Efficient Passive Houses as a European Standard)

- EU Sponsored, 1998 - 2000
- 221 Units Constructed & Monitored
- 14 Locations in 5 Countries
From Experiment to Adoption
The CEPHEUS Project
(Cost Efficient Passive Houses as a European Standard)

Goals

• Demonstrate technical feasibility at low extra cost
• Study investor-purchaser acceptance and user behavior
• Test the implementability of the Passive House quality
• Provide opportunities for the public to experience Passive House
• Give development impulses for the further design of energy- and cost-efficient buildings
• Create the preconditions for broad market introduction of cost-efficient Passive Houses
• Achieve cost-effective climate neutrality (Hannover-Kronsberg sub-project)
• Present at the EXPO 2000 World Exposition in Hannover
• www.cepheus.de
From Experiment to Adoption
The CEPHEUS Project
(Cost Efficient Passive Houses as a European Standard)
From Experiment to Adoption
The CEPHEUS Project
(Cost Efficient Passive Houses as a CAllifornia Standard)

LET'S DO THIS!!!
Thanks! Questions?

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www.essentialhabitat.com