



# High Performance Homes

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Oregon Department of Energy

# Outline

- HPH Basics – what and why
- Incentive Program Details
- Technical Requirements
  - Shell
  - HVAC
  - Renewables
- Examples
  - Oregon
  - Outside USA (if time)

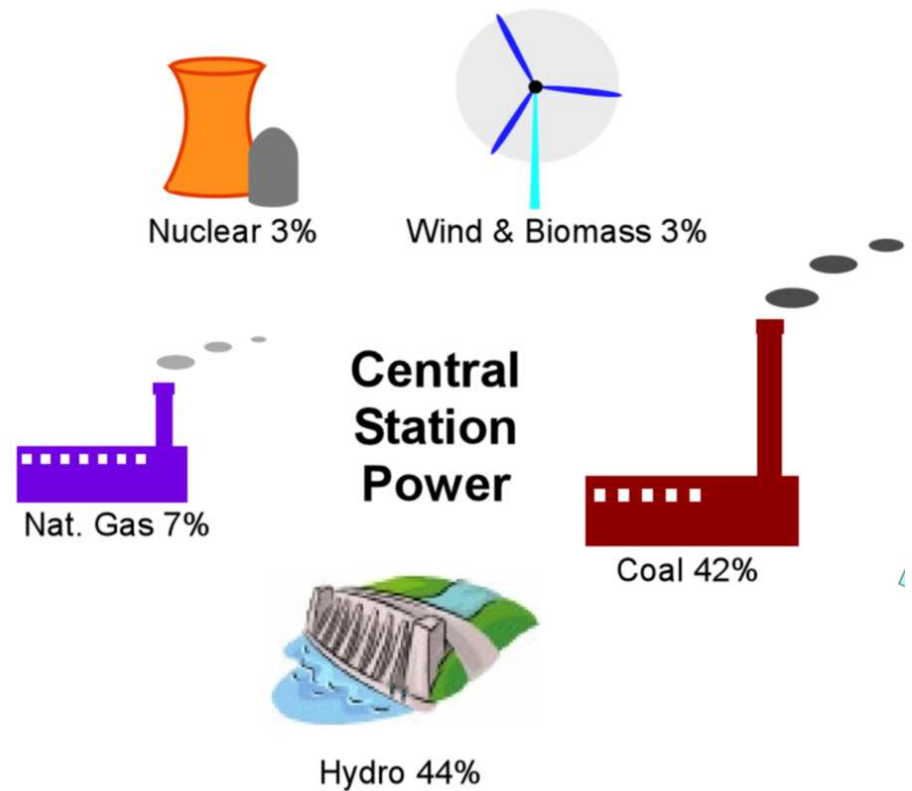
# **Oregon High Performance Home**



# Oregon Energy Use

In 2008  
Oregonians will  
spend **over** \$12  
Billion on energy\*.

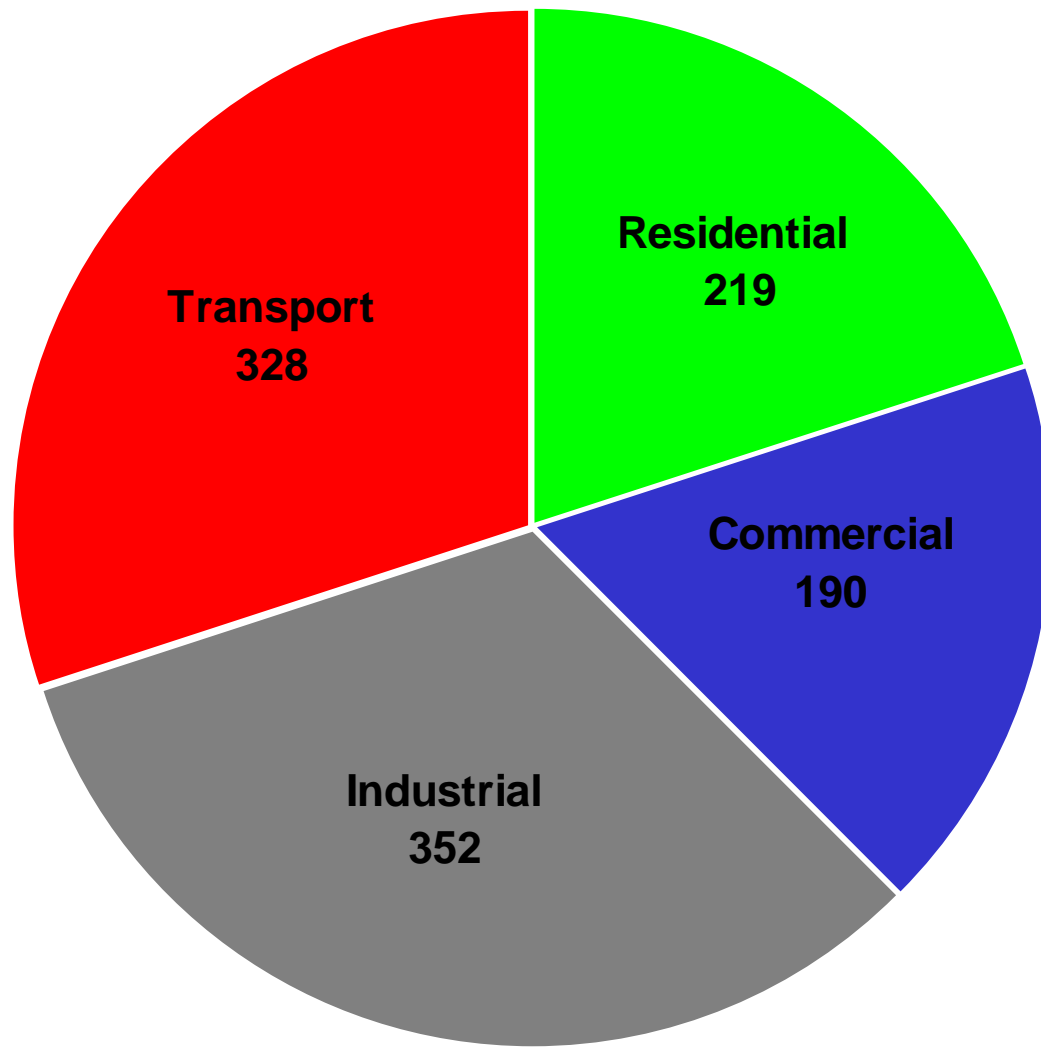
Most of this  
money leaves our  
state.



Oregon Electric Energy Mix

\*All fuels and energy types

# Each market will adapt differently



Homes are 100 commitments for energy

What is built today will significantly affect how our future economy

Trillion Btu/yr

# Homes are Energy Contracts

- Homes we build today are 100+ year contracts for energy and resources.
- Building high performance homes is like paying local builders for clean energy.



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# House versus Car



CO2	550,000 lbs	340,000 lbs
NOX	2,100 lbs	1,100 lbs
Water	3.6 million gal	10,000
Money	\$45,000	\$50,000

Approximate values based on average consumption for existing homes and new cars in Oregon.

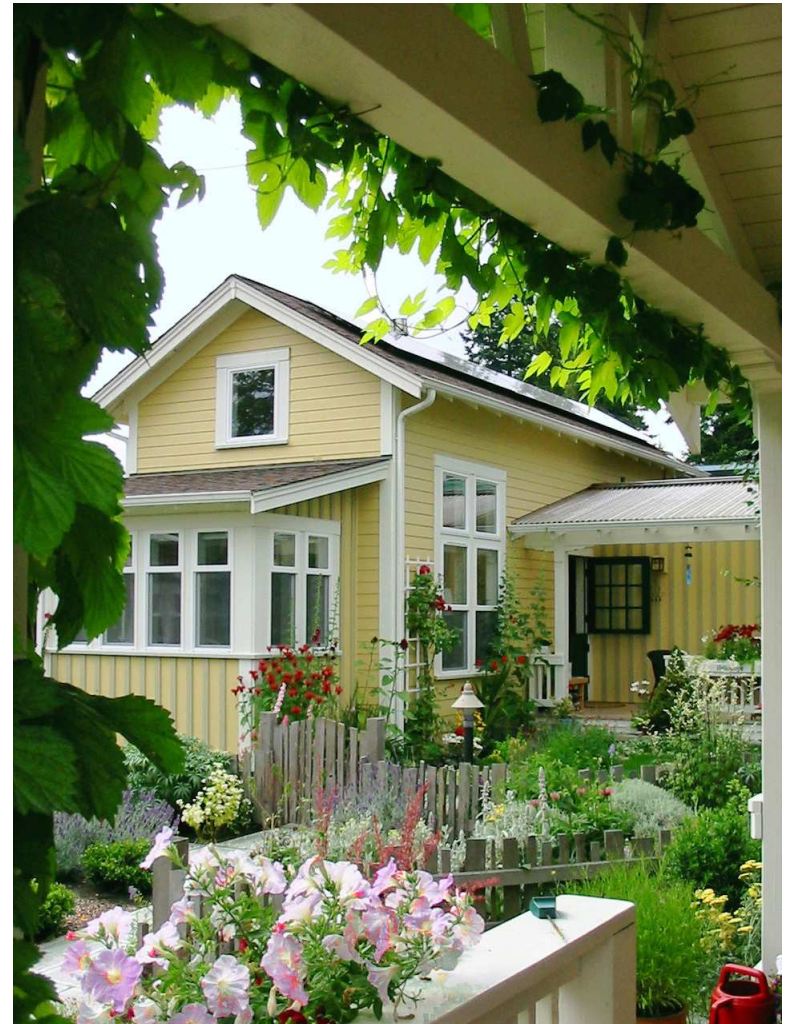
# Oregon's 2008 Energy Code

- Primary New Requirements
  - Energy Star Windows
  - R30 Floor
- Plus One more Energy Feature
  - Ducts sealing
  - High efficiency heating system
  - Energy recovery
  - Renewables



# Three Key Requirements

- Low heat loss shell
- Top efficiency heating system
- On-site renewable energy system



# High Performance Home Features

- Indoor Air Quality
- Daylighting
- Low Energy Use
- Sustainable Materials
- Community and Livability Focus



# Oregon HPH Builder Tax Credits

- Shell and HVAC **\$3,000**
- Up to **\$9,000** for renewables



# Federal Tax Credits

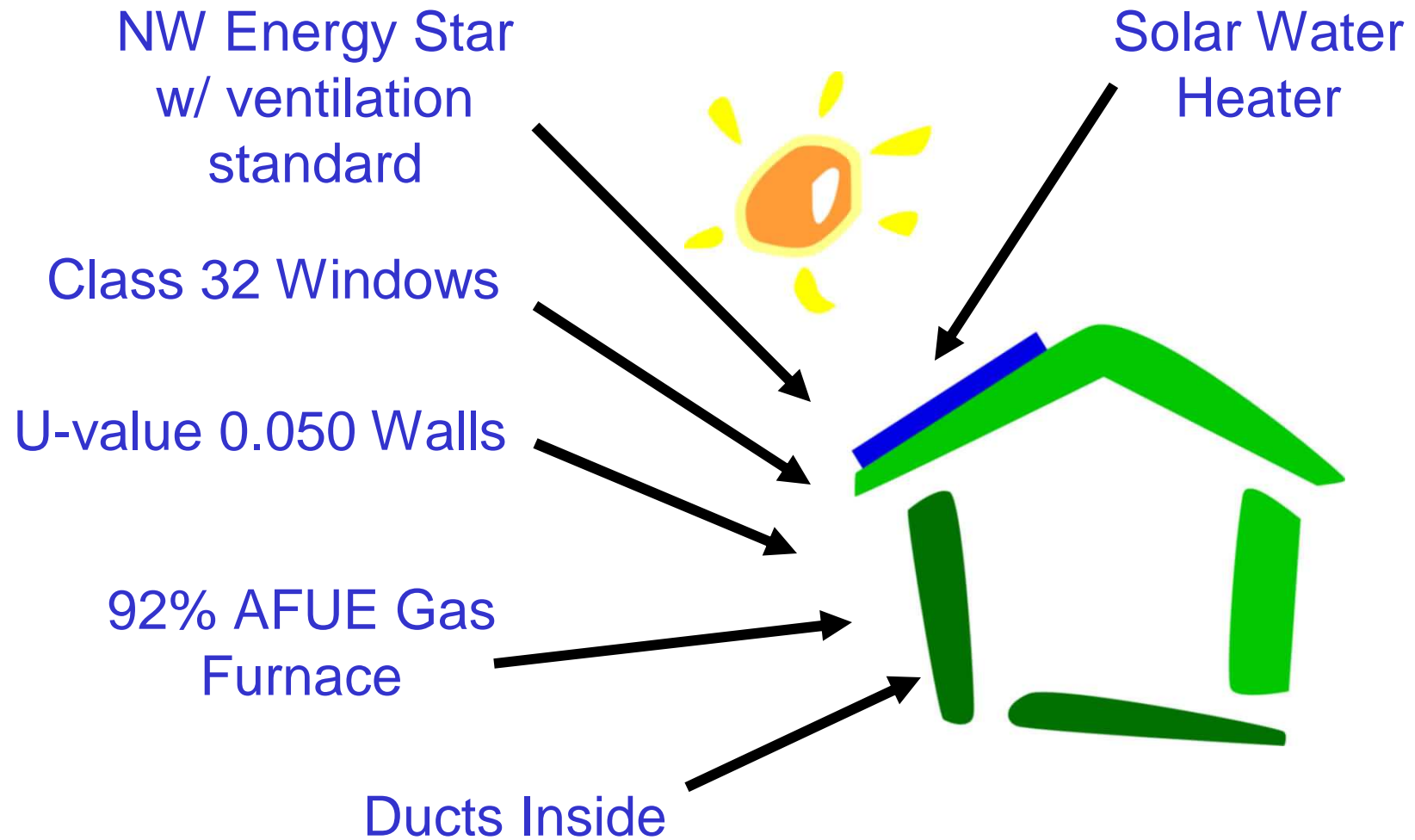
- Builder
  - \$2,000 to the Builder if home is certified to be 50% above IECC 2004 standard (about 30% above OR code)
- Homebuyer
  - Solar Water Heating 30%, to \$2,000
  - Solar Electric 30%, to \$2,000



# Utility incentives Oregon

- Energy Trust – PGE, PacifiCorp
  - \$2.00/W up to \$10,000 for Solar Electric
  - \$0.40/kWh up to \$1,000 for Solar Thermal
  - Energy Star + Fed up to \$1,000
  - HVAC Incentives
- Public Utilities
  - Varies with local utility

# Example HPH – Key Features



# Example – Builder Costs

• Energy Star+ Insulation	\$1,000
• Wall 0.050 Btuh/ft <sup>2</sup> -F	\$3,000
• 92% Variable Speed Furnace	\$1,500
• Ducts Inside	\$1,000
• Tested Ventilation	\$500
• Solar Water Heater	\$7,500

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**Total less than \$17,000**

# Example – Sale Price

\$17,000 Extra Cost



+ \$4,000 Builder Profit  
(24% margin)



= \$21,000 Price  
Increase





# Example – Incentives

Fed EE tax credit	\$2,000
State HPH tax credit Efficiency, Solar H2O	\$4,500
Energy Trust	\$2,000

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**Total** **\$8,500**



# Example – New Sale Price

\$21,000 Extra Cost



- \$8,500 Incentives



= \$13,500 Price Increase



# Example HPH – Ownership Cost

Mortgage Increase (6% on \$13,500)	\$81
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Energy Savings	-\$40
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Mortgage Tax Savings	-\$16
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<b>Net Homeowner Cost</b>	<b>\$25</b>
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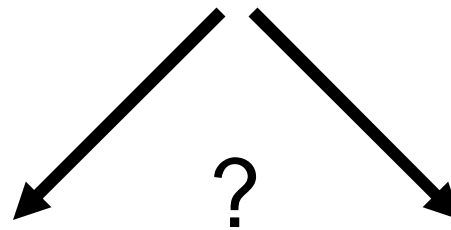
extra per month



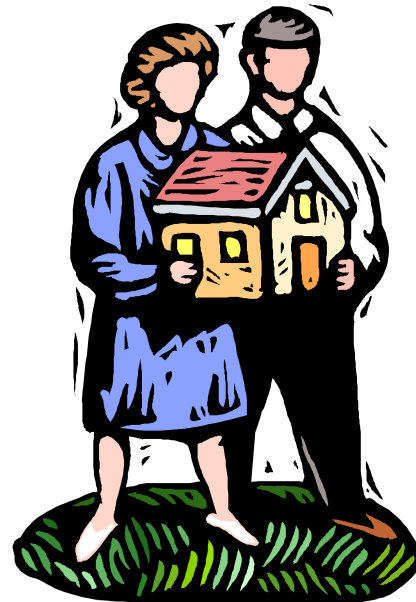
# Example HPH – Homeowner Value

6% - 30yr

\$25 Extra Cost per month



\$17,000 of improvements



\$4,200 of improvements



# Leveraging Equity

Assumption = House sells in 5 years  
for \$7,000 more than market.



This is equal to earning a  
**51%**  
annual rate of return

# Homebuyer also gets Fed Tax Credits

- Solar Water Heating  
30%, to \$2,000
- Solar Electric  
30%, to \$2,000

**This equipment would have to be sold as a separate line item to be eligible for a consumer tax credit from the federal government**



# Builder Benefits

- Increased Profit (example = \$4,000)
- Builder Recognition
- Potentially Faster Home Sales
  - Lennar Homes sold 2 months quicker



**CENTEX Homes - Avignon, California**

2 month quicker sale  
saves **\$3,000** on a  
\$200,000  
construction loan

# Homebuyer Benefits

- Global Warming 400 Tons
- Energy Savings **\$36,000** over 30 yrs
- Comfort superior
- Air Quality continuous fresh
- Resale value secure
- Local Economy improved
- Homebuyer Equity **30-80%** (5 yr return)
- Fed Tax Credits up to **\$4,000**

Redmond, OR - 30 years - 7¢/kwh, \$1/therm



# State of Oregon Benefits

- Less imported energy
- Support local businesses
- Advance technology
- Leverage up to **\$6,000** of federal tax credits
  - \$2,000 for home builder
  - \$4,000 for homebuyer (solar tax credit)

# **Incentive Program Details**

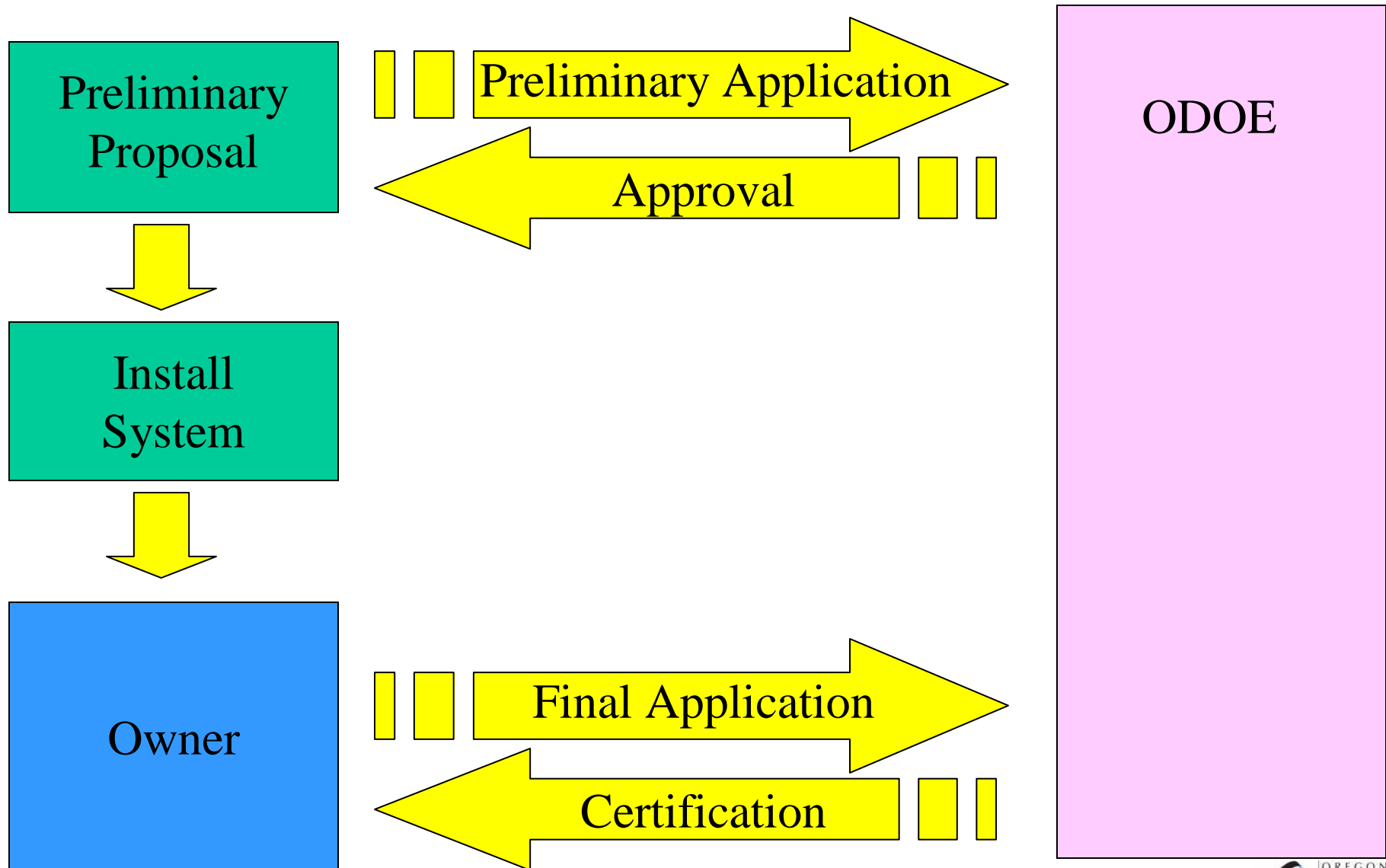
# Eligibility

Dwelling unit constructed by a licensed builder under the Oregon Residential Specialty Code with its own space conditioning and water heating systems and intended for sale to an end-use homebuyer.

# Application Process

- Currently the HPH tax credit requires the homebuilder to apply first **before** the project (this may change next year).
- Application review charge for either renewable energy system or HPH is \$200 regardless of size or complexity.

# Business Energy Tax Credit



# BETC - Pass Through Option

- Owner releases right to tax credit in exchange for third party payment
- HPH Pass Through Rate
  - Partner gets use of the full credit
  - Homebuilder gets payment of 87% of the value of the tax credit
- ODOE does **not** guarantee partners for projects

# ENERGY STAR® Certification

Home facility must be certified through the ENERGY STAR® Homes Northwest program

A third party inspector certified by the Oregon Department of Energy to submit homes for certification is required.

**[www.northwestenergystar.com](http://www.northwestenergystar.com)**

For more information and a list of certified home verifiers in Oregon.

# Renewable System Verification

Most renewable energy systems must be verified for proper installation by a tax credit certified technician.

**[www.oregon.gov/energy](http://www.oregon.gov/energy)**

For more information and a list of tax credit certified technicians



# **Technical Requirements**

**Building Shell**

# Shell Requirements

A qualifying facility must incorporate **all** of the following elements that are in addition or exception to ENERGY STAR® Homes Northwest requirements.

# Ceilings

- Ceilings:  $U \leq 0.030$  (e.g. R-49 attic)

# Walls

- Walls: above grade  $U \leq 0.050$  (e.g. R-21 cavity insulation plus R-3 continuous foam insulation, insulated concrete form, Structural Insulated Panel),
- Walls: below grade  $U \leq 0.060$  (e.g. R-21 cavity insulation)

# Floors

- Floors: above grade  $U \leq 0.025$  (e.g. R-38 batt/blanket insulation between floor joists 16" o.c. over vented crawl),
- Floors: on grade, [slab edge] perimeter R-15 min. 2 feet vertical or combined vertical/horizontal – heated slab also requires R-10 foam board under slab. (This matches ENERGY STAR® Homes Northwest requirements.)

# Windows

- Windows and glass doors:  $U \leq 0.32$  (weighted average).
- Exception: solar glazing that is part of a Renewable Energy Facility used to qualify the home as a High Performance Home may have a higher U-factor.

# Glazing Limit = 16%

- Glazing area: glazing to floor area ratio  $\leq 16\%$ . (including windows, skylights, and glass doors considered as glazing in the code).
- UA Trade-off tool may enable this fraction to be slightly increased

# Shell Tightness

- **Shell tightness: 5.0 ACH50 Pa confirmed by blower door test**





# UA Trade-Off Tool

- Predefined list of materials
- Automatic calculation



## Oregon High Performance Home UA Trade Off Calculator



OREGON  
DEPARTMENT OF  
ENERGY

This spreadsheet allows a builder to demonstrate their design has the same or lower heat loss than is required to meet the Oregon High Performance Home Standard. Enter all surfaces of the proposed home. Components of the same construction can be grouped together (i.e. you don't have to list each window, wall individually, just get the total area correct). Glazing includes all windows, skylights and doors with more than 2.5 square feet of glass.

Proposed Home UA Value	307.0	Btu/hr-F
High Performance Home UA Value	273.4	Btu/hr-F
Net Difference	33.6	Btu/hr-F

Percent of target **112%**

Floor Area	2,200	ft2
Wall Area	2,500	ft2
Windows	15.9%	
Skylights	0.4%	
Total Glazing	16.3%	

# **Technical Requirements**

## Heating System

# No ducts outside

- HVAC system and air ducts shall be incorporated into conditioned space, or forced-air ductwork shall be eliminated.

# HVAC System Requirements

- Gas Furnace
  - Two-stage
  - AFUE 0.92 or greater
- Gas Boiler
  - AFUE 0.88 or greater
- Central AC (if installed)
  - SEER  $\geq$  14
- Heat Pump
  - Air source, ducted heat pump HSPF  $\geq$  8.5
  - Ground Source COP  $\geq$  3.0
  - Ductless mini-split with inverter drive, no incorporated electric backup heat, sized and installed as per ENERGY STAR® Homes Northwest specifications

# Additional Requirement

Pick at least one option from the following three HVAC system options

**Green Building  
Upgrade**

**Ventilation  
Upgrade**

**On-demand gas  
water heater  
upgrade**

# Green Building Upgrade

- Earth Advantage
  - Indoor Air Quality
  - Sustainable Material Selection
  - Job site recycling
- Green Building Program Recognized by the Oregon Department of Energy

# On-Demand Water Heater Upgrade

- $EF > 0.80$  for primary water heating
- Following conditions where this upgrade is **not** allowed:
  - Water heater is used for space heating (see boiler requirements)
  - Water heater is preheated with a solar water heating system



# Water Heating

- Gas
  - 0.61 EF for tanks  $\leq 60$  gallons  
(due to increase Jan 1, 2009)
  - 0.60 for tanks  $> 60$  gallons
- Electric
  - 0.93 EF for tanks  $\leq 70$  gallons
  - 0.92 for tanks  $> 70$  gallons
- Includes secondary water heating equipment that backs up solar domestic water heating facilities.

# **Technical Requirements**

**Onsite Renewable  
Energy**

# Renewable Energy Requirement

- 1.0 kWh of energy production from on-site renewable energy system for every square foot of conditioned floor space.
- Savings estimated using site conditions (size, shading, tilt, orientation, wind, etc.)
- Credit based on RETC rates but only limited by cumulative value of \$9k

# Renewable Worksheets

- Application has optional worksheets for renewable energy systems
  - Solar PV
  - Solar Water Heating
  - Solar Space Heating
  - Ground Source Heat Pumps
  - Wind
  - Other

# Solar PV

- \$3/Watt
- Must be TCCT verified w/ 2-year full warranty from contractor
- Must have a Total Solar Resource Fraction (TSRF) not less than 75%
- kWh production adjusted for TSRF

# Solar H2O

- \$0.60 per kWh saved
- OG-300 certified systems only
- Must be TCCT verified w/ 2-year full warranty from contractor
- Must have a Total Solar Resource Fraction (TSRF) not less than 75%
- kWh production based on for TSRF

# Passive Solar

- Meet prescriptive requirements
  - 0.55 or better SHGC glass, 50% solar glazing, thermal storage, open floor plan, ect.
- Solar Glazing doesn't need to meet Energy Star requirements.
- Submit plans and elevations

# Ground Source Heat Pump

- COP must be  $> 3.5$
- Savings based on system size
- Must be TCCT verified w/ 2-year full warranty from contractor



# Wind

- \$2.00 per kWh saved
- Savings based on site conditions

# Examples

Oregon 2007 HPH

# Tom Wash & Company, Portland

- Two 1650 ft<sup>2</sup> Homes
- 2x6 Adv Frame
- Ducts inside
- Gas Furnace and water heater
- 2.5 ACH<sub>50</sub>
- 56 ft<sup>2</sup> Solar Water Heater



**\$10,000 estimated  
incremental cost**

**\$4,320 Credit**

# Bilyeau Homes, Salem

- 1340 ft<sup>2</sup>
- GSHP with HRV
- 2x6 Adv Frame Wall with R5 and vented Rain screen
- 2kW PV
- 40 Tube ST



Pringle Creek – High Performance Home

**\$33,000 estimated  
incremental cost**

**\$10,710 Credit**

# Ruhoff Construction, Eugene



**\$13,800 estimated  
incremental cost**

**\$4,500 Credit**

# SunTerra Homes, Bend

- 2x6 adv frame w/ foam and cellulose
- Air-water heat pump coupled to radiant floor
- Passive solar



**\$12,070 estimate  
incremental cost**

**\$4,518 Credit**