What is Building America (BA)?

- National Department of Energy program
  - *Marketable, cost-effective* net-Zero Energy Homes (ZEHs) by 2020
- Today’s near-Zero Energy Homes
  - Advanced energy efficiency
  - Solar energy technologies
  - Utility bill reductions >50%
  - Goal: 40%-70% energy efficiency savings plus savings from solar
What is BIRA?

- Building Industry Research Alliance
  - Collaborative team; over 100 industry partners
  - Led by ConSol
- One of six Building America teams
  - Only West Coast team
  - Only team that is part of the building industry

Building America Research Process

House designs are compared to the “BA Benchmark” to predict savings level.
Benefits of Building ZEHs with BA

• Monetary benefits
  – Cost savings from making the best materials and equipment choices
  – Reduced risks, increased productivity, and fewer callbacks
  – Sells faster than competition

• Additional benefits
  – Competitive advantage in the marketplace
  – Customer satisfaction and referrals
  – Beneficial to the environment

Las Vegas, Nevada – Building America’s Hot Dry Climate Zone
### Pathway to ZEH in the Hot Dry Climate Zone

![Graph showing source energy savings vs. mortgage costs.]

### What features are currently being used?*

*based on 2006 IECC standards

<table>
<thead>
<tr>
<th>Building Features</th>
<th>Appliance Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Insulation: R13 batts, 2x4, 16&quot;o.c.</td>
<td>Refrigerator: Standard</td>
</tr>
<tr>
<td>Ceiling Insulation: R30 fiberglass</td>
<td>Cooking Range: Gas</td>
</tr>
<tr>
<td>Infiltration: 6.0 ACH50</td>
<td>Dishwasher: Standard</td>
</tr>
<tr>
<td>Foundation: Slab, uninsulated</td>
<td>Clothes Dryer: Gas</td>
</tr>
<tr>
<td>Window Type: 0.39 U-value, 0.39 SHGC</td>
<td>Clothes Washer: Standard</td>
</tr>
<tr>
<td>Air Conditioner: SEER 13</td>
<td>Hardwired Lighting: 10% CFL</td>
</tr>
<tr>
<td>Furnace: AFUE 80%</td>
<td></td>
</tr>
<tr>
<td>Water Heater: Gas standard (59%)</td>
<td></td>
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<td>Ducts: Typical, R4.2</td>
<td></td>
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</table>
2006 IECC Achieves 30% Savings

Current Building America goal: 50% energy efficiency savings

What can be done to improve efficiency?

- Increased ceiling insulation
- Adding a radiant barrier
- Better sealing for a tighter envelope
- Improved windows (U-value & SHGC)
- Energy Star appliances
- Fluorescent lighting
- High efficiency heating and cooling systems
- Improved water heater
- Improved duct insulation & location
### 40% Features Comparison

<table>
<thead>
<tr>
<th>Feature</th>
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<th>40% Savings</th>
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<tr>
<td>Radiant Barrier</td>
<td>None</td>
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<td>Energy Star</td>
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</tr>
<tr>
<td>Hardwired Lighting</td>
<td>10% CFL</td>
<td>50% CFL</td>
</tr>
<tr>
<td>Air Conditioner</td>
<td>SEER 13</td>
<td>SEER 14</td>
</tr>
<tr>
<td>Furnace</td>
<td>AFUE 80%</td>
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</tr>
<tr>
<td>Water Heater</td>
<td>Gas standard (59%)</td>
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<tr>
<td>Ducts</td>
<td>Typical, R4.2</td>
<td>Improved, R8</td>
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### 50% Features Comparison

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<tr>
<td>Infiltration</td>
<td>6.0 ACH50</td>
<td>3.0 ACH50</td>
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<tr>
<td>Foundation</td>
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<tr>
<td>Window Type</td>
<td>0.39 U-value, 0.39 SHGC</td>
<td>0.35 U-value, 0.35 SHGC</td>
</tr>
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<td>Refrigerator</td>
<td>Standard</td>
<td>Energy Star</td>
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<td>100% CFL</td>
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<td>Air Conditioner</td>
<td>SEER 13</td>
<td>SEER 14</td>
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<td>Furnace</td>
<td>AFUE 80%</td>
<td>AFUE 92.5%</td>
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<tr>
<td>Water Heater</td>
<td>Gas standard (59%)</td>
<td>Gas tankless (80%)</td>
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<tr>
<td>Ducts</td>
<td>Typical, R4.2</td>
<td>Inside conditioned space</td>
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</table>
Savings Levels at 40% and 50%

- **Source Energy Use (MBtu/yr)**
  - Building America Benchmark: 267.1 MBtu
  - 40% Energy Efficiency Savings: 155.9 MBtu
  - 50% Energy Efficiency Savings: 131.3 MBtu

- **Misc. (E)**
- **Lg. Appl. (E)**
- **Lights (E)**
- **Heat Fan (E)**
- **Cool Fan (E)**
- **Cooling (E)**
- **Heating (G)**
- **Hot Water (G)**
- **Lg. Appl. (G)**
- **Misc. (G)**

- **41.6% Annual Source Energy Savings**
- **50.8% Annual Source Energy Savings**

Options to Further Improve Savings

- **OVE/External Insulation/SIP walls**
- **MELs Reduction**
- **Geothermal heat pump**
  - Trench/bore system
  - Water main system
- **Solar**
  - Passive heating
  - Hot water
  - Photovoltaics (PV)
  - PVT
OVE Walls (Optimum Value Engineered)

Uses engineering principles to minimize material usage while meeting model building code structural performance requirements

Less framing provides room for more insulation

External Foam Insulation

Water-Resistive Barrier
Structural Bracing
Insulation

- Provides more R-value per inch than batts
- Acts as a thermal break between studs and outside air
SIPs (Structural Insulated Panels)

MELs Reduction (Misc. Electric Loads)

- Feedback display
- “Green switch”
- “Smart strip”
- Efficient electronic devices (TVs, etc.)
Benefits

- Heat & cool savings up to 70%
- Lower install costs
- Lower maintenance costs
- Reduced pumping
- Reduces mechanical space
- No roof penetrations
- No combustion
- Longer system life
- Provides source of revenue
- Flexible & easily expandable
- Uses GeoExchange technology
Financial Benefits

- **WaterGrid** utility owned, installed and maintained
- No first cost to developer/owner
- No water supply system costs
- No wastewater system costs
- No HVAC/DHW system costs
- Lower user energy costs
- Secondary treatment for use on-site and off-site (parks, etc.)
- Owner/user pays metered water use rate or a flat fee to utility

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Passive Solar Heating/Cooling

- Window orientation
- Overhangs
- Shading
  - Landscaping
  - Exterior
  - Interior
- Mass
- Controls (night cooling)
SDHW (Solar Domestic Hot Water)

Can be implemented in hot climates using a direct or indirect system

PV Panels (Photovoltaic)

BIPV (Building Integrated) shown here

May not be cost effective for the homeowner unless combined with efficiency measures
PVT (PV-Thermal)

Utilizes previously wasted heat generated by PV system
ZEH Example

Includes:
- SIPs walls
- Geothermal heat pump
- PVT
- 25% reduction in MELs

4.5 kW PV system offsets all remaining energy needs; however, such a large system is not currently cost effective.

Peak Reduction from EE & PV

No East, Eleven South, And Seven West
ZEH Cost Effectiveness

• 50% efficiency measures
  – Currently developing cost effective strategies with builders in the Hot Dry Climate Zone
• PV/PVT Systems
  – Can be cost effective when combined with efficiency measures and available incentives
• Other advanced systems
  – May not be cost effective currently but will be soon as energy costs continue to rise and mature market costs develop

Thank You!

Questions?
Rob Hammon, Ph.D.
Principal, ConSol