

# Building America and Zero Energy Homes Programs

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# Building America

- Systems Research
- Prototype Homes
- Documentation and Resources
- On-Site Energy (ZEH)
- Community-Scale

# Building America, ZEH, & Energy Star

- Energy Star Homes
  - 30% Less Energy than 93 MEC (heating, cooling, water heating)
  - 15% Less Energy than More Stringent Local Code
  - Space Heating, Space Cooling, Water Heating *only*
  - Recent Lighting Guidelines
- Building America
  - 2004-2005: Reduce *Total* Home Energy Use by at least 40%
  - 2020: Communities of Homes with Zero Net-Annual Energy Use
- Zero Energy Home Program
  - 2004-2005: Integrate Solar into New Homes
  - 2020: Communities of Homes with Zero Net-Annual Energy Use

# Building America & Codes

- Task: Identify and Surmount Code Barriers
- Examples:
  - Tankless water heater EF too low
  - Disallow unvented attic
  - Disallow unvented crawl
  - Vapor-barrier issues
  - Basement insulation issues
- Many Others; Teams Working to Solve

# Building America Teams

- Building Industry Research Alliance
  - [www.bira.ws](http://www.bira.ws)
- Building Science Consortium
  - [www.buildingscience.com](http://www.buildingscience.com)
- Consortium for Advanced Residential Buildings
  - [www.carb-swa.com](http://www.carb-swa.com)
- Industrialized Housing Partnership
  - [www.fsec.ucf.edu/bldg/baihp/](http://www.fsec.ucf.edu/bldg/baihp/)
- Integrated Building and Construction Solutions
  - [www.ibacos.com](http://www.ibacos.com)
- NAHB Research Center
  - [www.nahbrc.org](http://www.nahbrc.org)

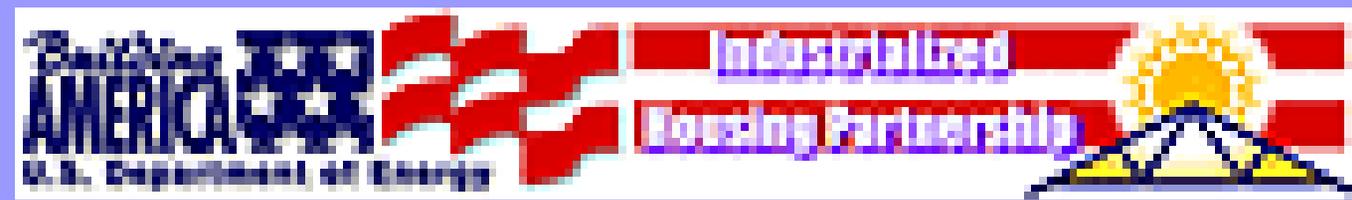
# “Houses That Work”

**Building Science Consortium**

*Architecture and Building Science*

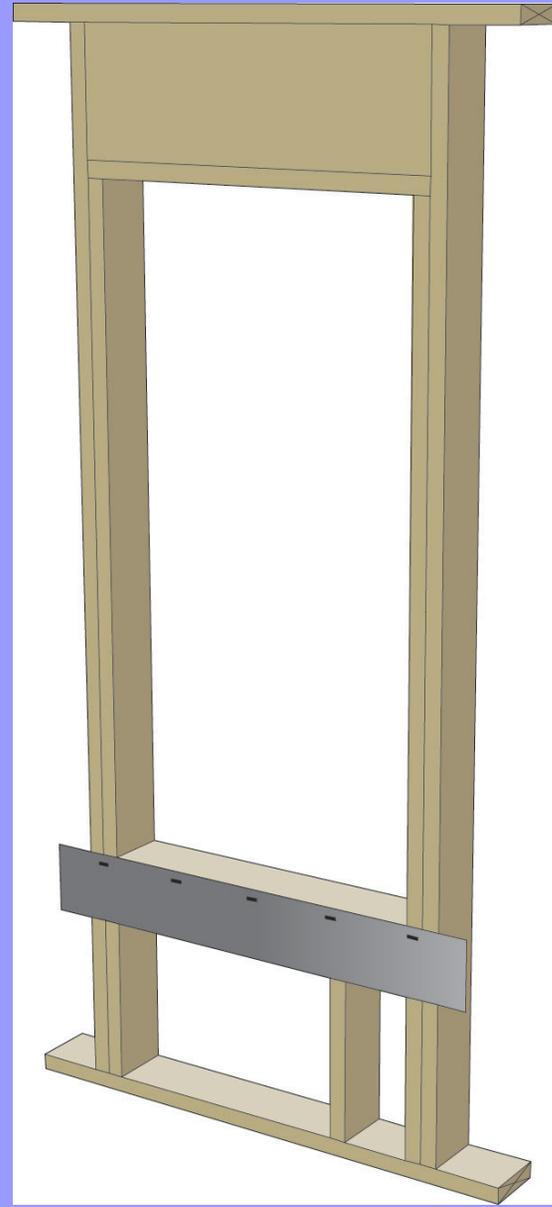


**IBACOS**

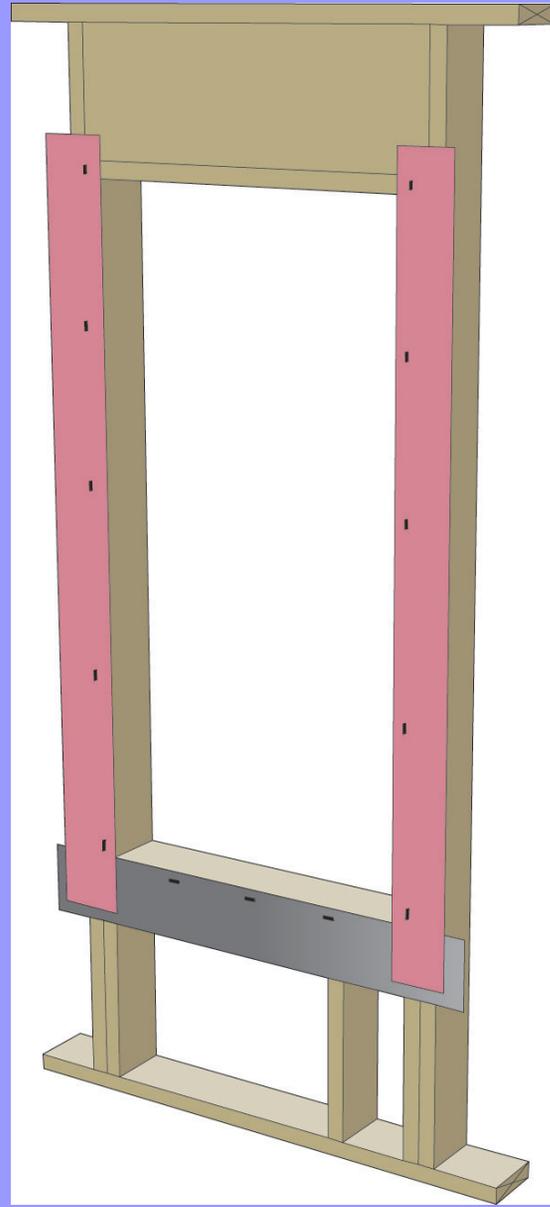


# Systems Research

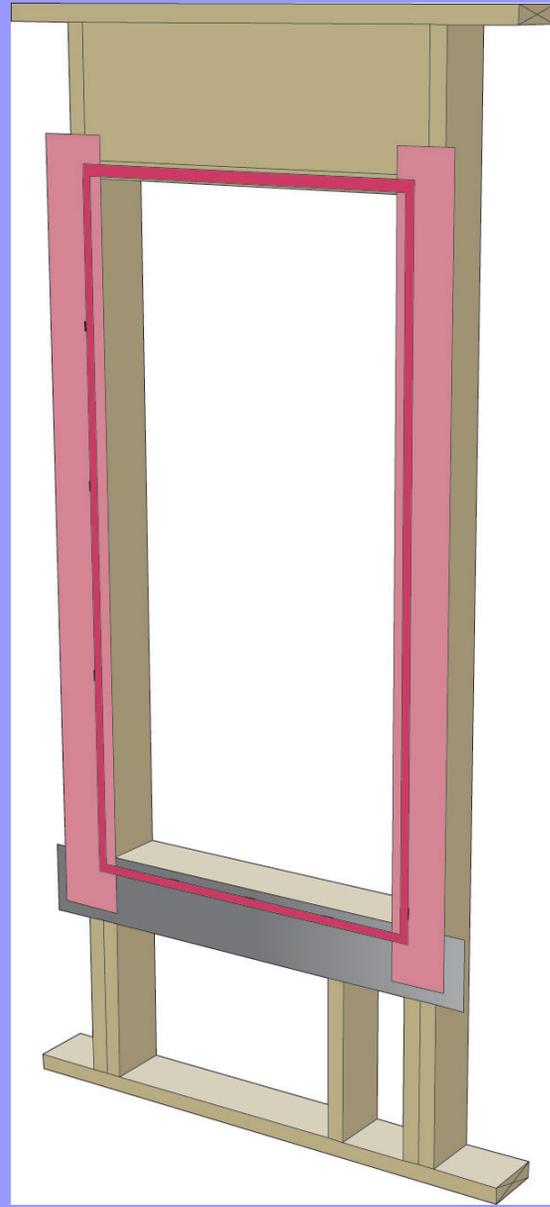
# Window Installation



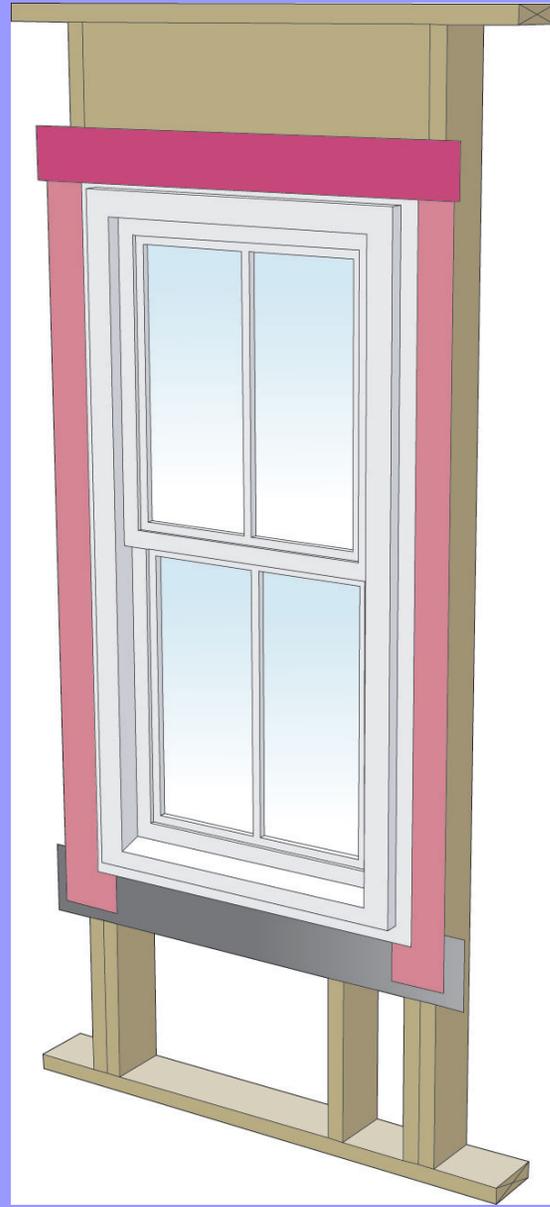
# Window Installation



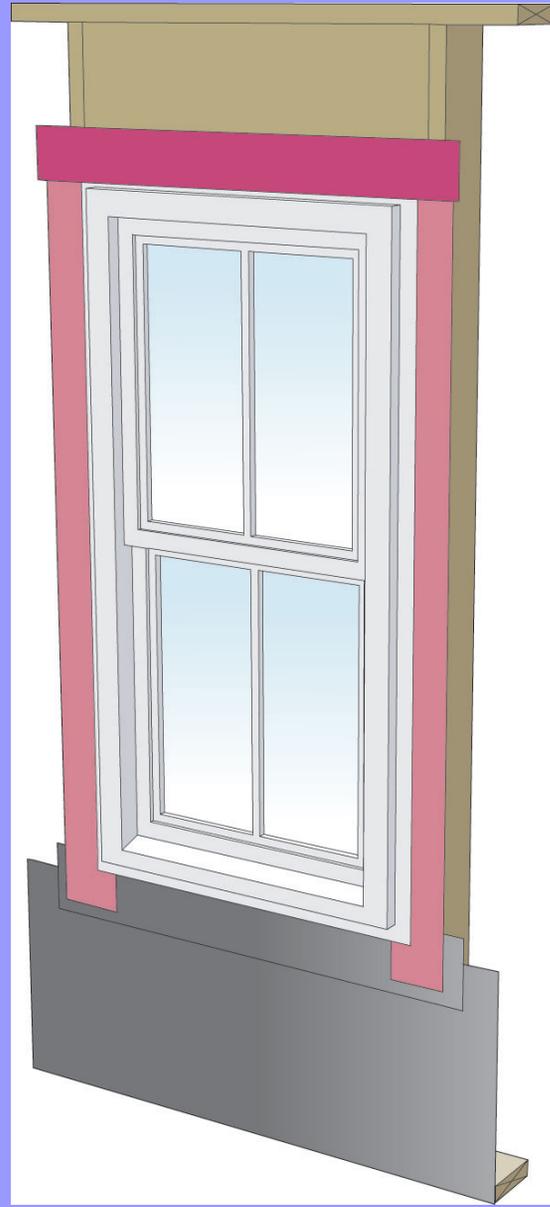
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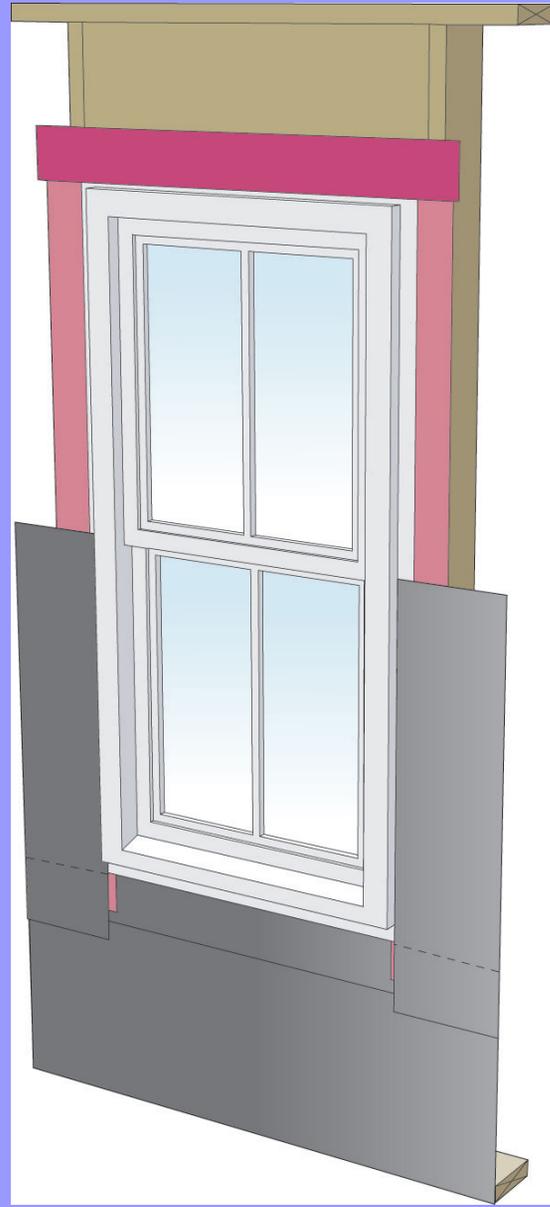
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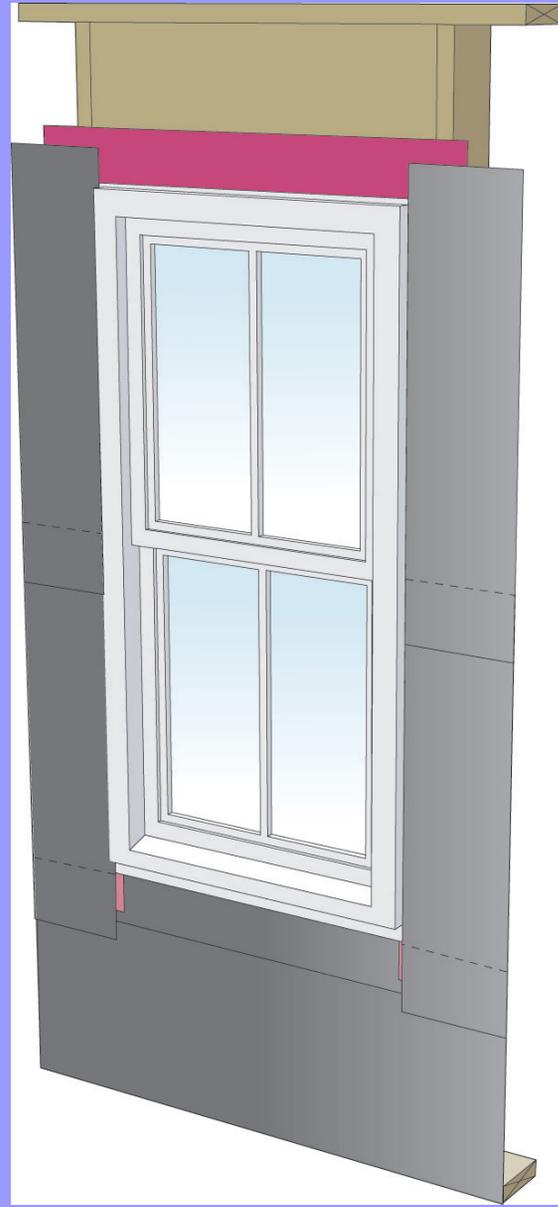
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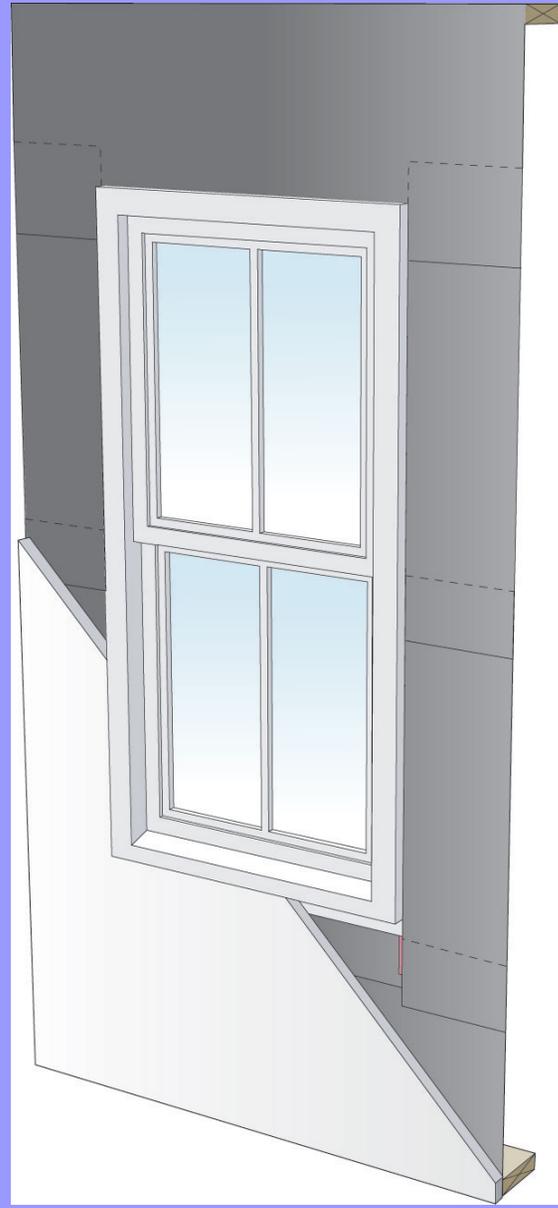
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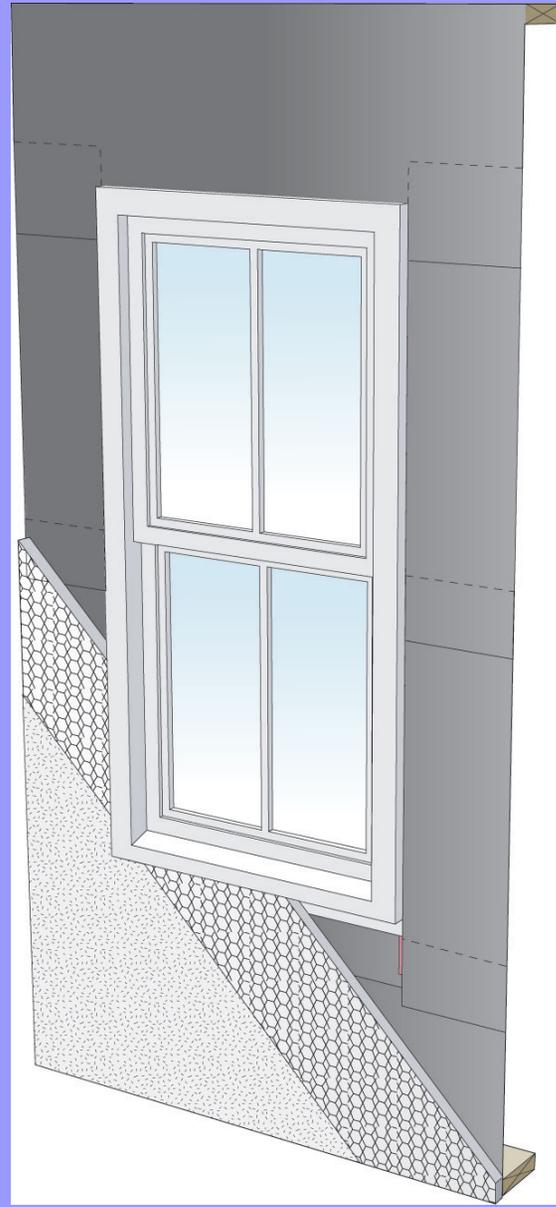
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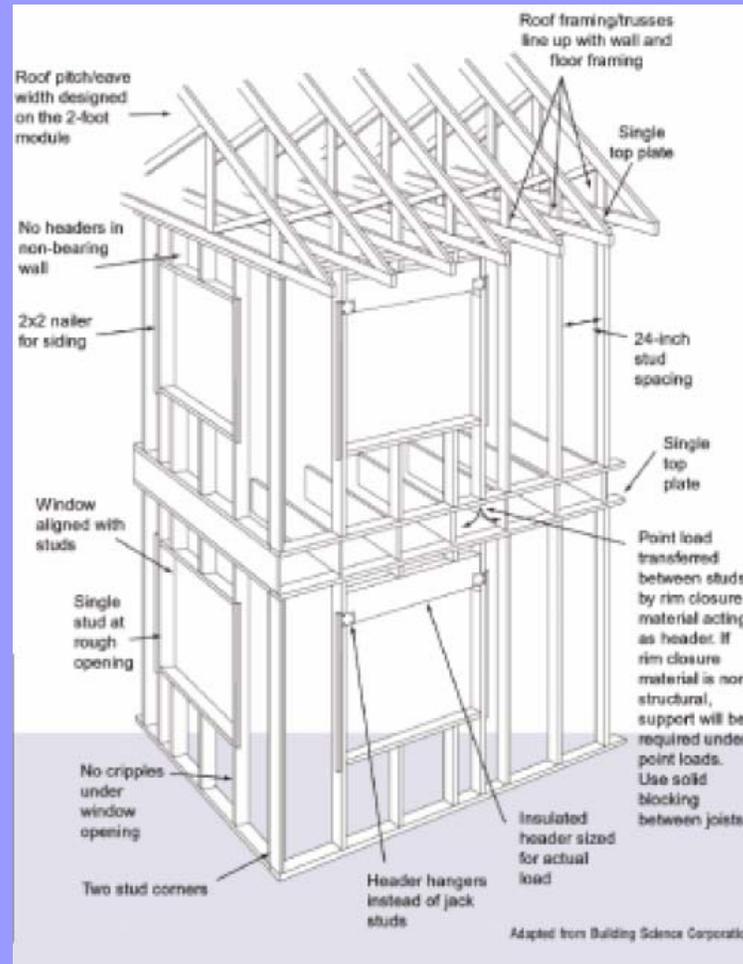
# Window Installation



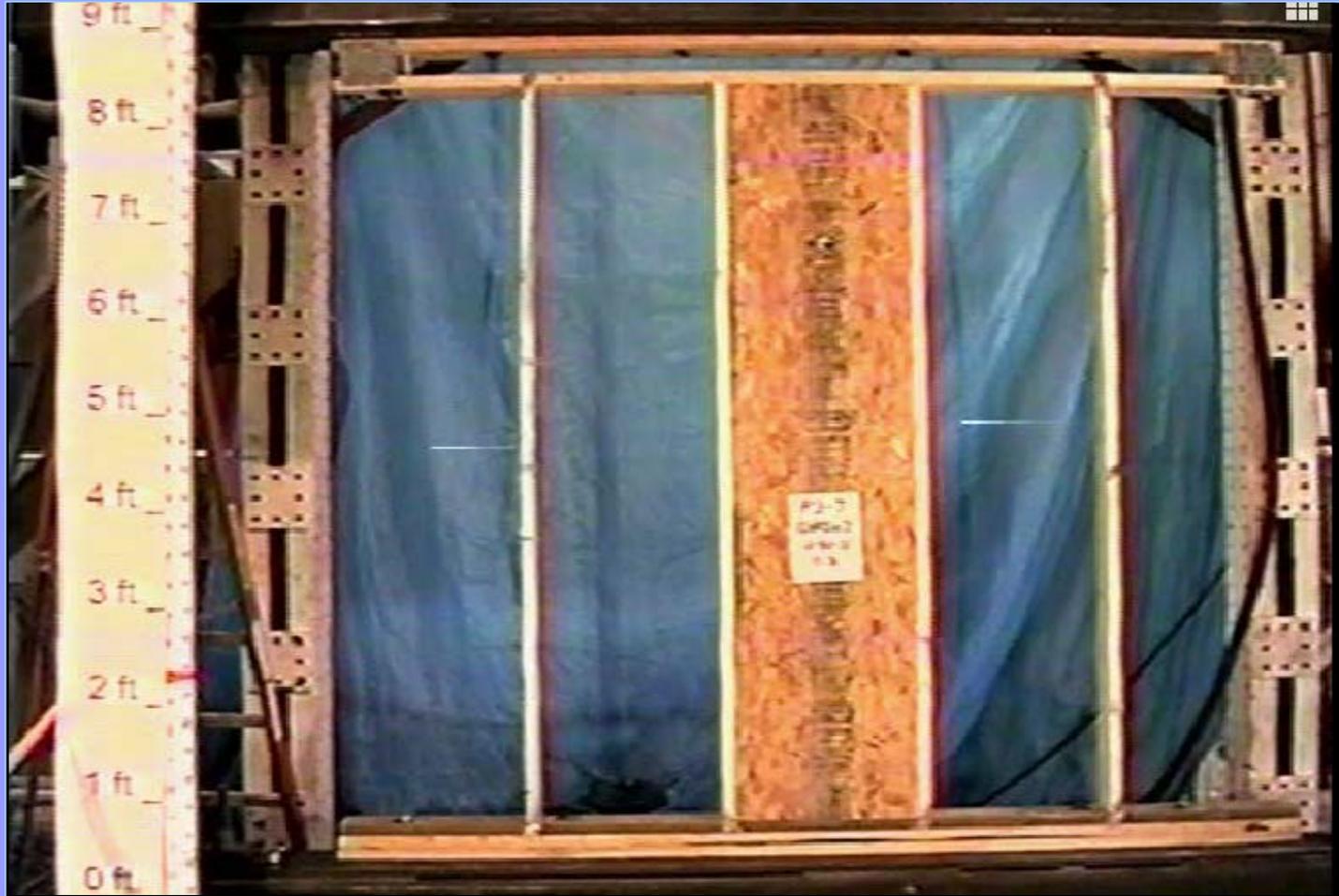
# Window Installation



# Advanced Framing



# Structural Panels

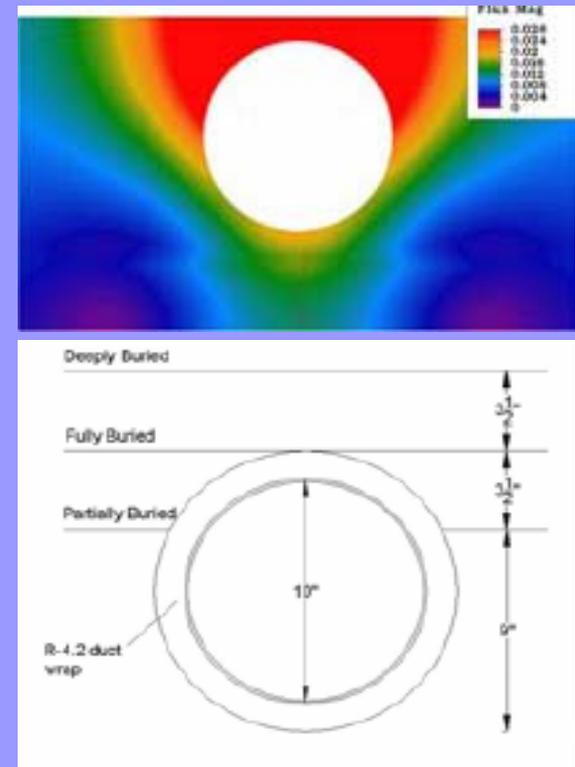


# HVAC

- Typical Systems
  - Compressor Fan Efficiency
  - Air Handler Fan Efficiency
- Alternative Systems
  - Heat Pumps
  - Hydronic
- Register Types & Locations
  - Heating
  - Cooling

# Ducts

- Sealing Ducts
- Ducts Buried in Attic Insulation
- Ducts in Conditioned Space
  - Cathedralized-attic
  - In trusses
  - In dropped ceilings





# Lighting

- Test Rooms
  - Layouts
  - Lighting Quality
  - Design Strategies
- New Fixture Types
  - CFLs
  - Linear Fluorescent
  - LEDs



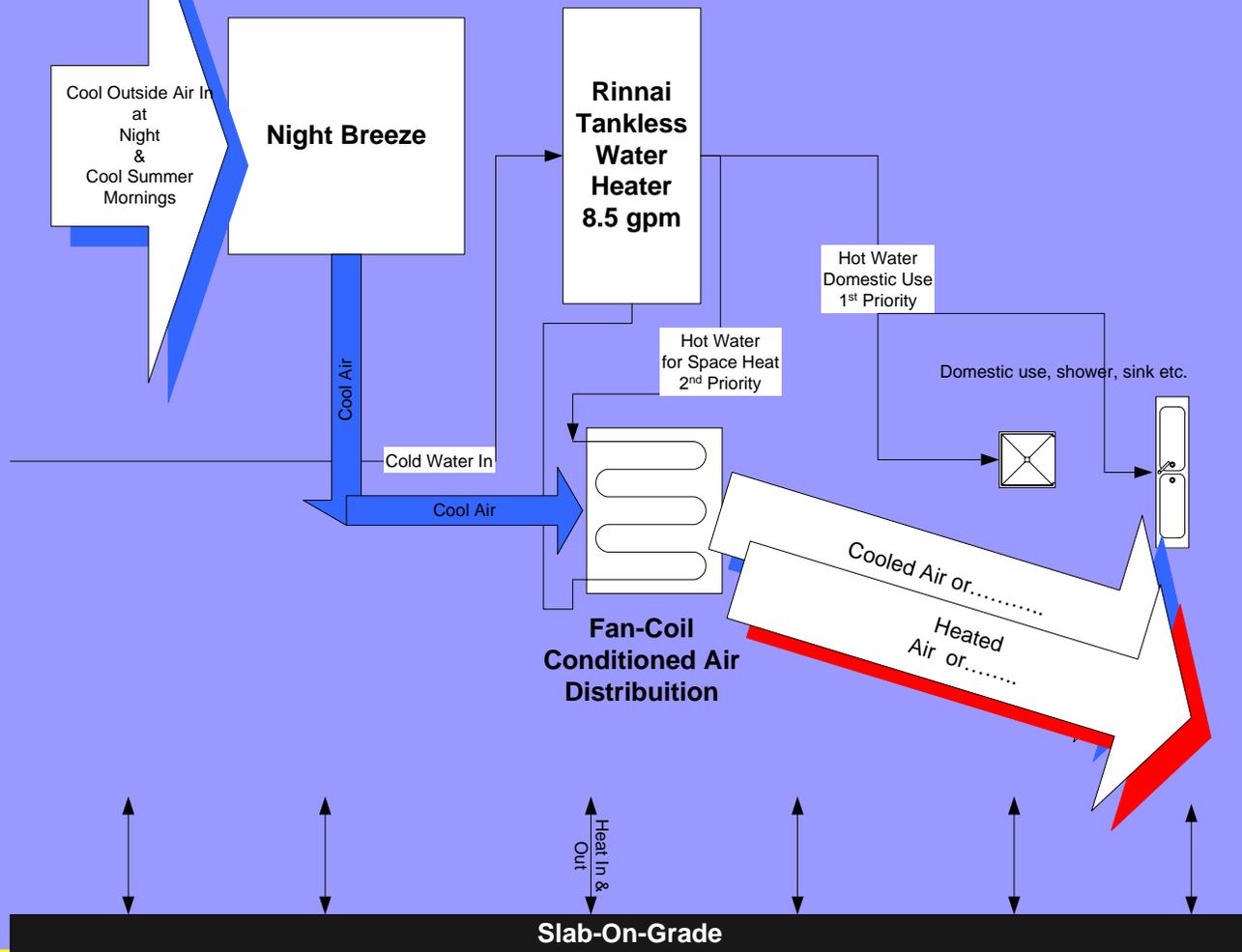
# Prototype Homes

# Example: Schingler Homes

- 40% Whole-House Savings
  - Central Valley, CA
  - Hot, dry climate
- Night Cooling
- Combined-Hydronic Heating/DHW
  - Tankless water heater; doubles for DHW
  - On-demand hot water
- Lighting & Appliances



# 40% Prototype Home: HVAC



# Documentation and Resources

# Construction Protocols

- Framing
- Insulation
- Windows
- HVAC
- Ducts
- PVs
- Moisture
- Ventilation
- Testing
- Inspections

# Construction Guides

- Best-Practices Guides
  - Hot-humid completed
  - PNNL
  - Other climate areas under development
    - Hot dry
    - Mixed dry
    - Mixed humid
    - Cold

# Zero Energy Homes

Communities of Super-Efficient Homes  
With On-Site Solar Generation

# Demonstration Home

# Pardee Ultimate Family Home





**THE ULTIMATE  
FAMILY HOME** 2004

A ZERO ENERGY HOME

NEVADA TRAILS









# Pardee Homes -- Ultimate Family Home

## Floor Area 5300 sqft

### Zero Energy Home Features

#### **ENVELOPE:** (Insulation)

Roof (attic, rafter)	R-38, R-30
Wall (Exterior)	R-21
Floor (above garage)	R-30

#### **GLAZING:**

Windows & French Doors (U-factor, SHGC)	U=0.33, SHGC=0.33
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#### **HVAC SYSTEM:**

Furnace AFUE, A/C SEER	0.95 AFUE, 15 SEER
Duct Insulation / Location	R-6

#### **WATER HEATING:**

Main	Solar ICS
Backup	0.82 EF Tankless
Distribution System	Pipeinsulation; short run; PEX

#### **PHOTOVOLTAIC SYSTEM (PV)**

8.6kW DC

#### **FLUORESCENT LIGHTING**

Mainly fluoresecent/HalogenIR accents

#### **INSPECTIONS AND TESTS**

All features, duct and envelope leakage, air flows

# Water Heating



# Photovoltaic System (PV)



# Fluorescent Lighting

- Typical Problems with Fluorescents
  - Typical replacement wattage is too low
  - Quality, hard-wired, IC-rated, air-tight cans not available
  - Color rendition
- Solutions
  - Good lighting design; Careful choice of fixtures
  - Proper wattages (about 25W for 75W replacement)
  - New down-light cans are coming soon
  - 2700 - 3000°K, 80 or greater CRI











# Energy and Cost Savings

Space Heating	58%
Space Cooling	71%
Water Heating	41%
Appliances	54%
Lighting	53%
reduce kWh by solar contribution	11,568 kWh
Total Reduction in Electricity Use	98%
Total Reduction in Energy Use	86%
Total Reduction in Energy Cost	88%

# ZEH Communities

# What is ZEH? or “Marketable ZEH”

- DOE Program
  - Produce as much energy as consume
  - By 2020 Communities
- Today
  - Demonstration homes
  - Communities: 50% bill reduction
- ConSol
  - 60% bill reduction
  - Net zero annual energy bill

# ZEH Builders

- Pardee Homes, San Diego & Orange Co CA
- Pardee Homes, Las Vegas
- Morrison Homes, Sacramento CA
- Clarum Homes, East PA & Watsonville CA
- Premier Homes, Sacramento

# Why Build ZEH?

- ... Other than reduced dependence on foreign oil, reduced emissions, reduced peak-electricity demand...
- Market Differentiation
- Press Exposure
- Increased Profits

# Pardee Homes

- “Evergreen” Ladera Ranch
- “Santa Barbara” San Diego
- “Bordeaux” San Diego
- “Ventana” Las Vegas
- “Aliso” Las Vegas
- “Palo Verde” Las Vegas
- Several More coming

# Pardee “Soleil”

- Grand Opening last week
- 100 homes
- 10% ZEH Standard
- 30% PV Standard
- ZEH Option



# Morrison Homes

- “Lakeside” Elk Grove
- 10% of Homes (1/Release) is ZEH
- Available as Option
- \$18,000 premium
- Excellent Press
- Excellent Traffic
- Selling All ZEH Lots



# Clarum Homes

- “Shorebreeze” East Palo Alto, CA
- All 20 Homes ZEH
- Sold Out Faster Than Expected



# Clarum Homes

- “Vista Montana”
  - 257 Homes, All ZEH
  - Mix: SF Attached & Detached
  - Affordable, Entry, Move-Up
- Over 60% Sold before Grand Opening
- No Marketing Used
  - Only Press from ZEH

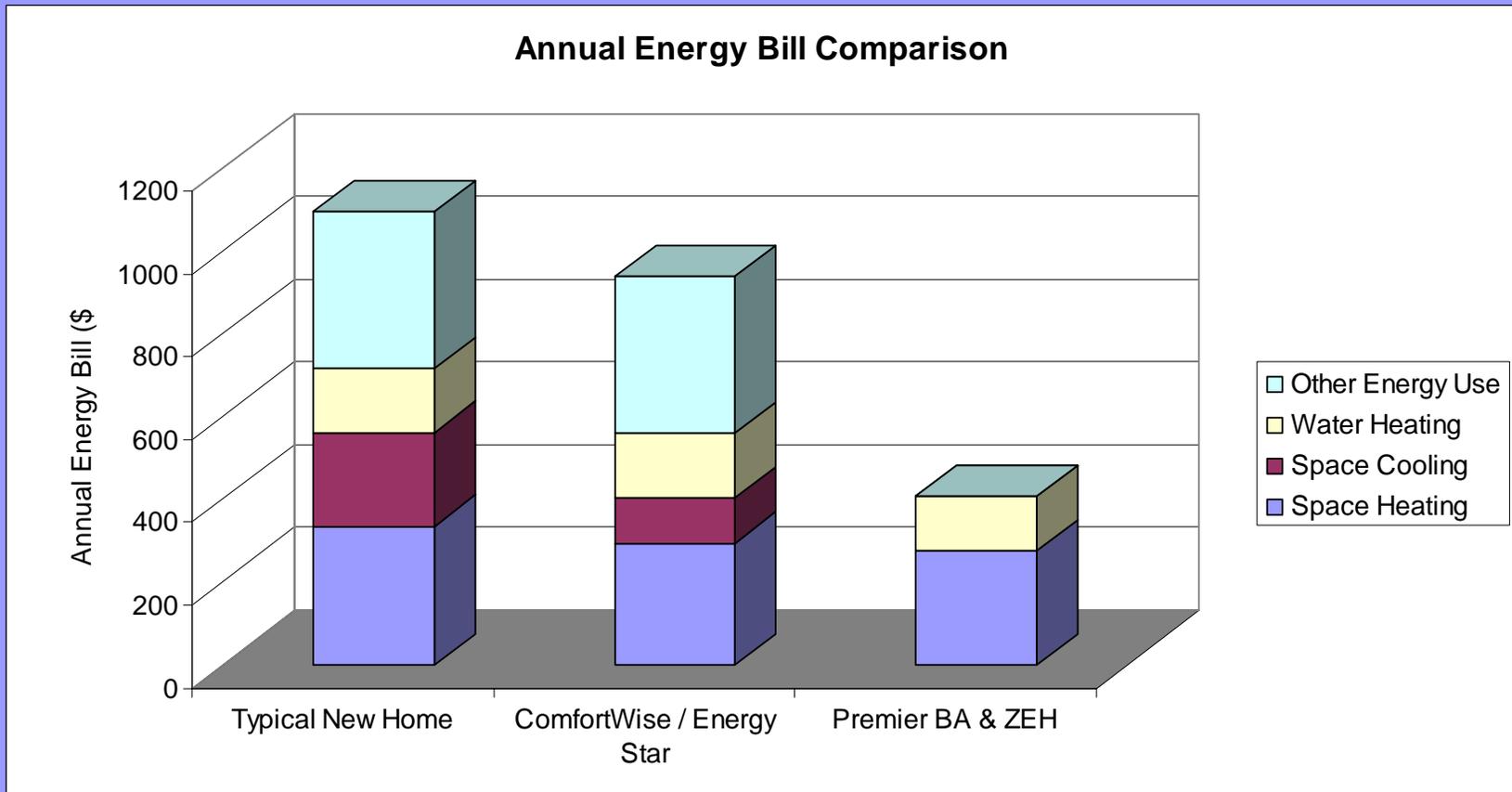


# Premier Homes

- “Premier Gardens” in Sacramento
  - 94 homes, all ZEH
  - Some entry-level homes
  - Excellent press and traffic
  - 350 people on waiting list

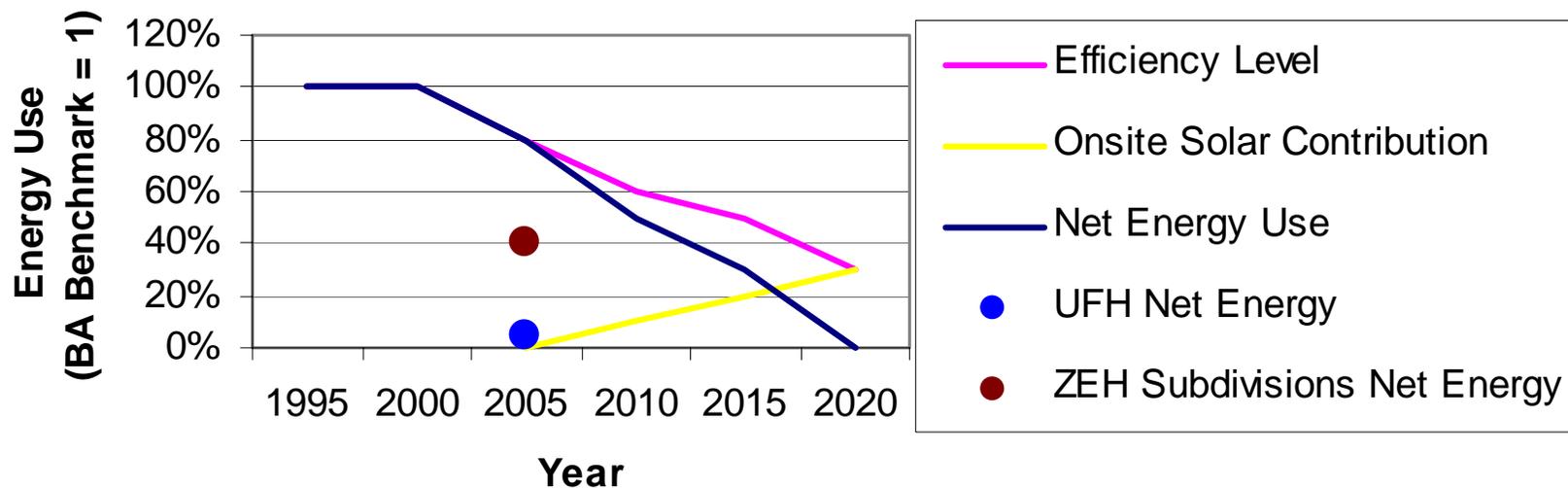


# Typical "ConSol" ZEH: Premier Homes



# Goals and Progress

Building America Goals: BIRA Results



# ZEH Key Elements

- Well Designed Efficiency Package
- State or Utility Buy-Down of PV
- Utility Time-of-Use Rate
  - Not essential, but helpful
  - Positive cash-flow
- Can Pull-Through BA High Efficiencies

# Work Needed

- Energy-efficiency technologies
  - New, better, less expensive
  - Building America, Solar programs
- Integration of Solar
- Market Analysis
  - What will buyers buy? Why? How Market?
- Community Impacts of Distributed Generation

# ZEH Summary

- Huge Energy and Emissions Savings
  - Good for the U.S.
- Margins Are Sustained
- More Expensive Product
- Sells As Well or Better than Energy Star
- Energy Star Sells Faster than Standard

# Community Planning

# Community Planning: Hunters Point Navel Shipyard

- Hunters Point, San Francisco
- Model Project for BA/ZEH



# Hunters Point Shipyard

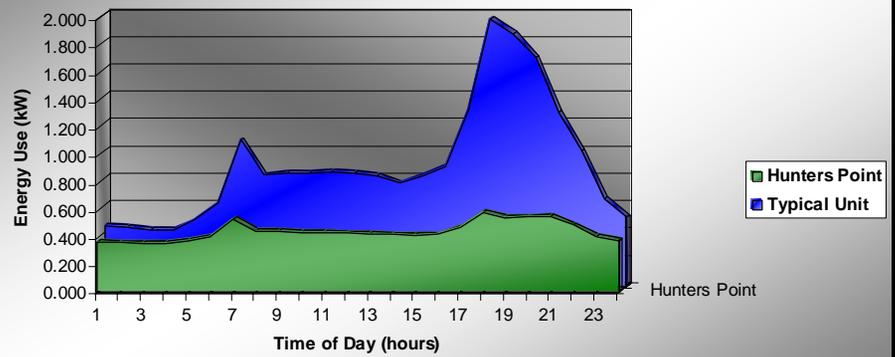
- Multipurpose Community Redevelopment
- 1,600 new Residential Units (Townhomes, Condominiums)
- Mostly Affordable
- Construction Spring 2005
- Problem: Small Electrical Feeder Line

# Hunters Point

- Solution: Reduce Peak Demand

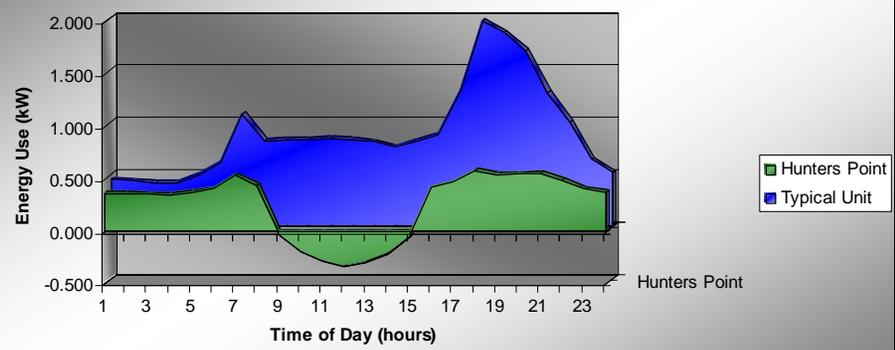
Blue: Typical

Peak Demand: Without Renewables



Green: BA-ZEH

Peak Demand: With Renewables



# Hunters Point

- Builder/Developer Agreed, for All Homes
  - 40% reduction in gas use
  - 80% reduction in electricity use (including PVs)
  - 350% reduction in peak (design-constraint for feeder-line)
  - Train other builders
  - Mass-purchase benefits to other builders

# Resources

- Rob Hammon, ConSol/BIRA
  - [www.ConSol.ws](http://www.ConSol.ws)
  - [www.BIRA.ws](http://www.BIRA.ws)
- [www.buildingamerica.ws](http://www.buildingamerica.ws)
  - Building America
  - Teams (websites on Building America site)
  - Teams' webletters (teams or ORNL)