

Highlights of PNNL Building America Activities

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March 2, 2011

Introduction

- ▶ For the past 10 years PNNL has assisted the BA program market transformation activities by producing documents that disseminate BA research to practitioners and consumers.
 - Lead – Michael Baechler
- ▶ Last year, with ARRA funding, a research program on deep energy retrofits and high performance new homes was initiated with ARRA funding.
 - Lead – Subrato Chandra
- ▶ ORNL is a key PNNL collaborator in both efforts.
 - ORNL Leads – Pat Love and Roderick Jackson

Example Documents – Case Studies

1 GRUPE HOMES | Curitiba, Brazil
 Grupe Homes, a Brazilian construction company, built 100 homes for low-income families in Curitiba, Brazil. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

2 NEW TRADITION HOMES | Lancaster, Colorado
 New Tradition Homes, a Colorado-based construction company, built 100 homes in Lancaster, Colorado. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

3 SOUTH CHICAGO WORKFORCE | SPC Home
 South Chicago Workforce, a Chicago-based construction company, built 100 homes in South Chicago, Illinois. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

4 RURAL DEVELOPMENT INC. | Oakville, Ontario
 Rural Development Inc., a Canadian construction company, built 100 homes in Oakville, Ontario. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

5 KACIM HOMES | Southwest of Frick Park, Pittsburgh, PA
 Kacim Homes, a Pennsylvania-based construction company, built 100 homes in Southwest of Frick Park, Pittsburgh, PA. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

6 BOB WINGO COMPANIES | Madison, Wisconsin Greenbelt
 Bob Wingo Companies, a Wisconsin-based construction company, built 100 homes in Madison, Wisconsin. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

7 HABITAT FOR HUMANITY | Lakeland Habitat for Humanity
 Habitat for Humanity, a national construction organization, built 100 homes in Lakeland, Florida. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

8 TOMMY WILLIAMS | Longport Village
 Tommy Williams, a Florida-based construction company, built 100 homes in Longport, Florida. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

9 ARTISTIC HOMES | Zero-Energy Homes
 Artistic Homes, a Florida-based construction company, built 100 homes in Florida. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

10 JOHN WESLEY MILLER | Airway Park Det. Apt.
 John Wesley Miller, a Florida-based construction company, built 100 homes in Airway Park, Florida. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

11 PULTE HOMES/DEL WEBB | Las Vegas, Nevada
 Pulte Homes/Del Webb, a Florida-based construction company, built 100 homes in Las Vegas, Nevada. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

12 PULTE HOMES | Chicago
 Pulte Homes, a Florida-based construction company, built 100 homes in Chicago, Illinois. The project was completed in 2008 and received the 2009 GreenSource Award for Best Green Building. The homes are built with sustainable materials and feature energy-efficient appliances and lighting.

MIXED HUMO
 BLUE SEA CONSTRUCTION CO. LLC
 BOB WINGO COMPANIES

Example Document – Marketing Assistance

Air Sealing

A *New Guide for Contractors to Share with Homeowners*

Remodelers, retrofitters,
weatherization contractors –

Bring this guide with you when you visit
homeowners to show them:

- ➔ What to expect from an energy audit.
- ➔ Where the worst air leaks are and how you'll fix them to save the homeowner time, energy, and money.
- ➔ Why a test-in/test-out by a trained professional is important for safety and energy savings.
- ➔ How air sealing can make a home more comfortable, healthy, and durable.



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www.buildingamerica.gov

Example Documents – Best Practices



Research on Deep Retrofits & New Housing

- ▶ Team -- PNNL, FSEC, WSU, PSU, GTI, Calcs-Plus, Florida –Hero, Northwest EnergyWorks

+

ORNL and Southface

- ▶ **Goals:**

- 50 High quality retrofits that save >30%; 12 to be metered
- Evaluation of retrofitted homes in military bases and in the Portland metro area to identify effective strategies
- Performance evaluation of four HERS ≤ 0 homes
- Affordable high performance homes and DHP evaluations
- Side-by-side Lab Homes on PNNL campus



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Residential Deep Energy Retrofit Research Project



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[EERE Buildings Technologies Program](#)

Looking for Participants

Are you interested in saving money on your utility bills? Do you wish your home used less energy and was more comfortable? If you are considering major renovations to your house this spring, such as reroofing, residing, repainting the interior, or replacing your heating/cooling system, windows, or plumbing system, you may be especially interested in this website!

The Pacific Northwest National Laboratory (PNNL) research team and associated subcontractors are looking for homeowners to participate in a research project funded by the U.S. Department of Energy, to save 30% or more on their annual utility costs through home efficiency retrofits. The PNNL team can help you make energy retrofitting affordable, now and in the long run by identifying incentives available through local utilities and other local, state and federal sources, and providing a free home energy assessment and free technical assistance. In addition, your house will be part of a PNNL research study that can help inform the nation about best practices for residential retrofits.

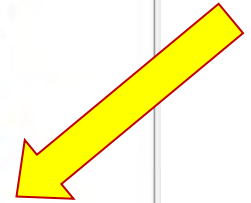
PNNL is looking for homes that meet the following criteria:

- Home was built prior to 2005. The home must be at least 5 yrs old.
- The homeowners do not allow smoking inside the home. (Smoking is allowed if limited to porches, patios, or other outdoor areas of the home.)
- The homeowners do not have business (other than small home office) or other unusual energy-intensive equipment in the home.
- The homeowners primarily use a central heating and cooling system. Wood stoves,

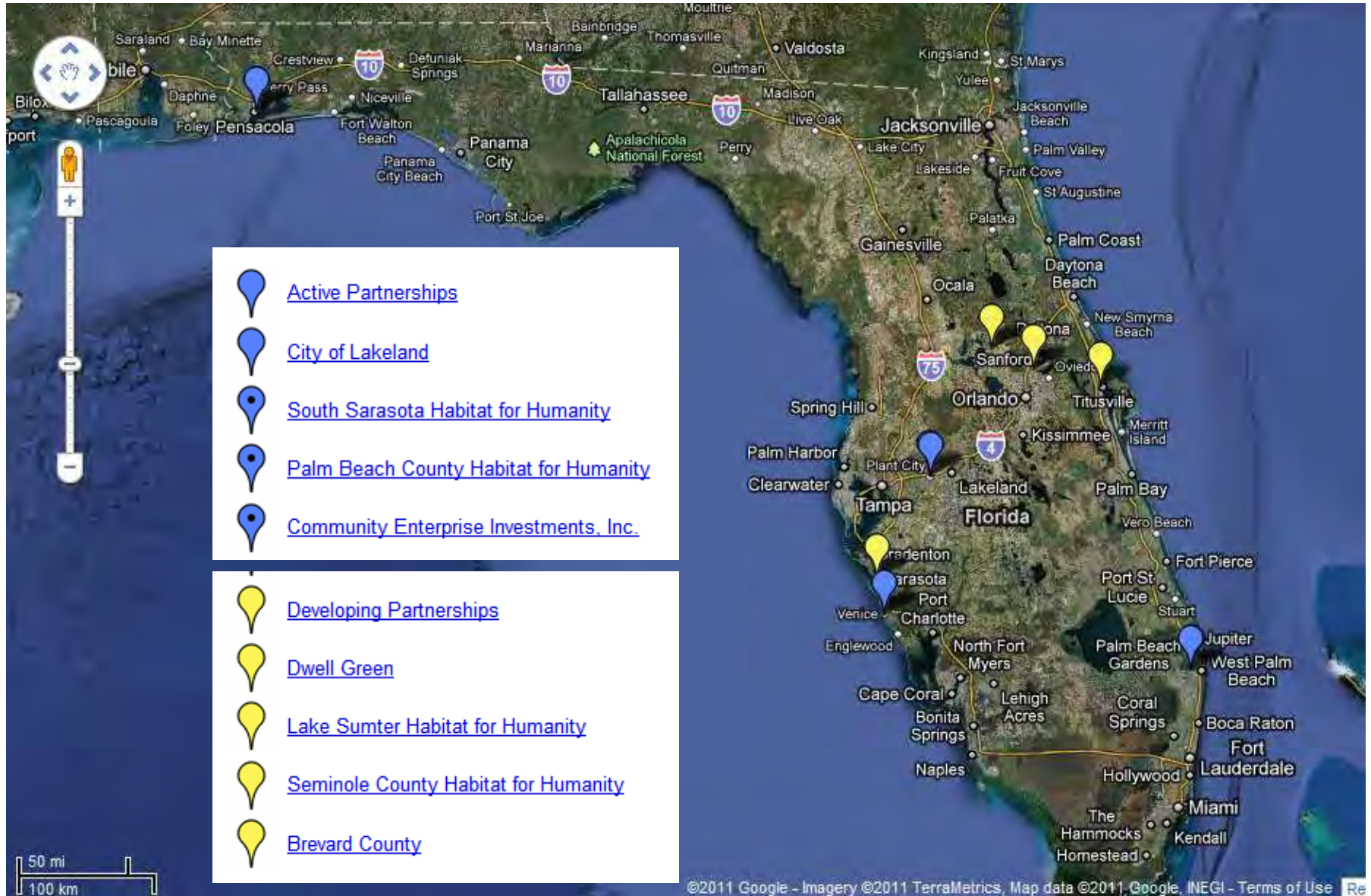
Get Involved

To participate in the Residential Deep Energy Retrofit Research Project, please complete this brief [informational questionnaire](#) and return it to us via email. A member of our research team will contact you to discuss the details of participation.

Common questions are addressed in the [FAQs](#).



Deep Energy Retrofits in Florida - FSEC



Typical Pre-Retrofit Issues

- Filthy coils & leaky plenums
- Poorly sealed AHU closets or restricted flow
- High levels of duct leakage
- Missing & compressed attic insulation
- Large wall penetrations to attic & exterior
- Windows unable to fully close or leaks around frame
- Porches and garages converted to living space



Case Study – HFH Sarasota, FL - Calcs-Plus

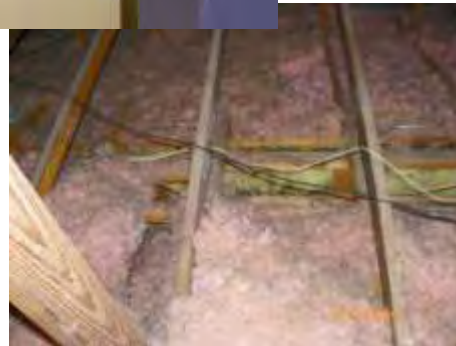
- 1978, 1,814 sq. ft.
- Uninsulated wall, R-19 ceiling
- AHU in attic
- ACH 50=31
- Duct Leak to Out @25Pa =115 cfm
- Unoccupied



Problems Uncovered



- Air pathways connecting attic to cond. space via interior walls at dropped ceiling areas
- Holes in wall
- Gaps around window frame



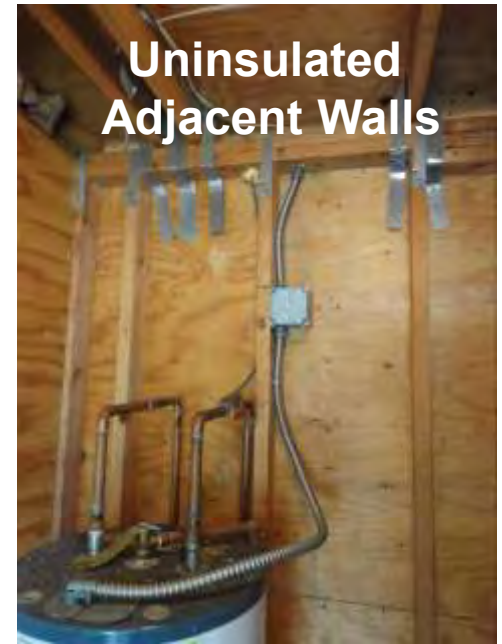
Pre-Retrofit Example

- 1250 ft², 1960 3 bed/2 bath
- Central Florida
- Slab on grade, block construction
- Test-In HERS Index 178
- Target HERS Index 89
- **50% Improvement**
 - **Attic insulation, window and HVAC replacement, appliances, & lighting**



Pre-Retrofit Example

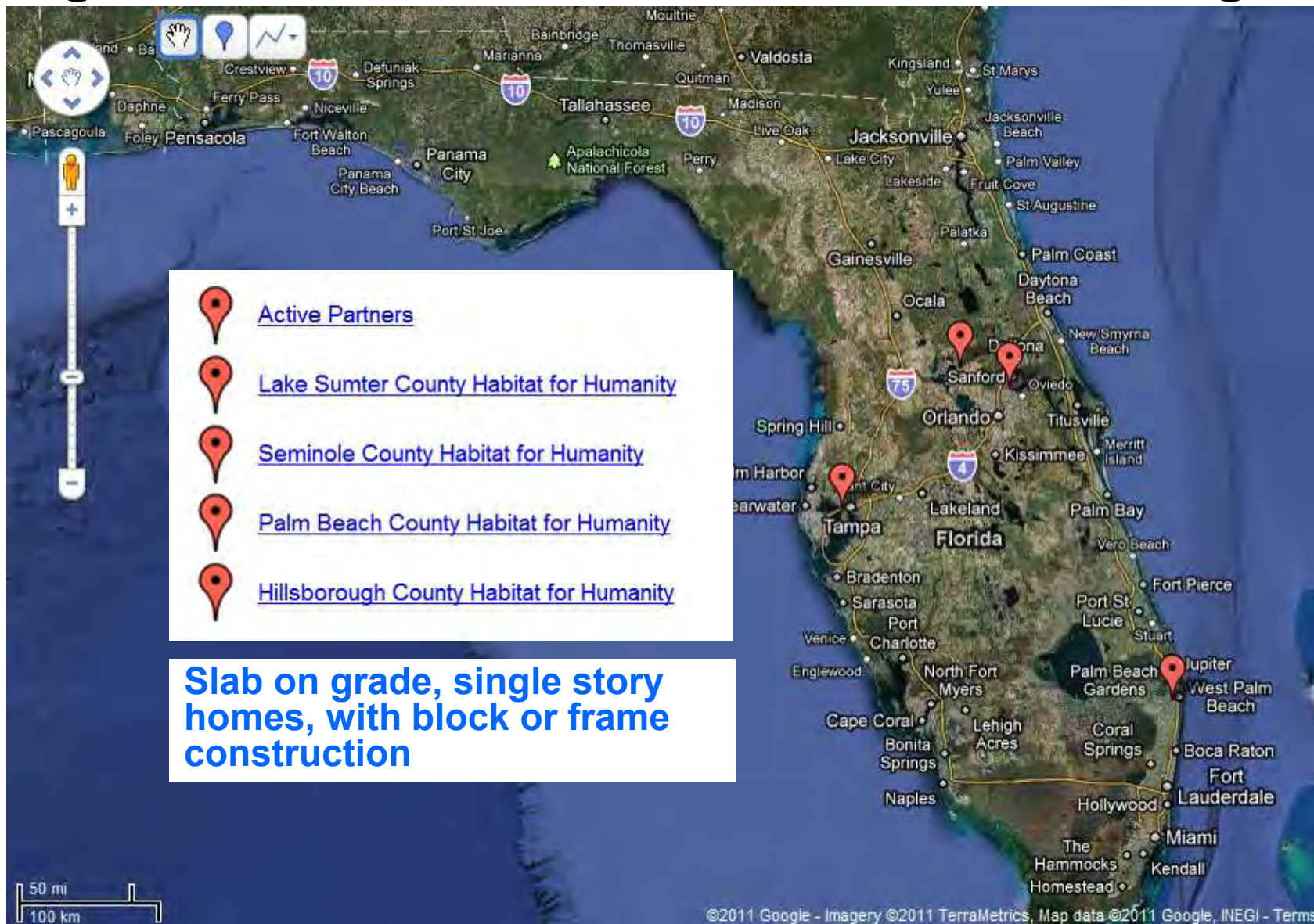
- 1373 ft², 2003 3 bed/2 bath
- South Florida
- Slab on grade, frame construction
- Test-In HERS Index 97
- Target HERS Index 63
- **35% Improvement**
 - HVAC, HP water heater, window film, appliances, lighting



High Performance New Home Prototypes

- ▶ Habitat for Humanity Prototypes in Florida – FSEC
- ▶ Monitor performance of 4 HERS ≤ 0 prototypes– FSEC
- ▶ Habitat for Humanity Prototypes and billing analysis in WA – WSU. Includes identifying best practices and lessons learned. Evaluation of foam sheathing board and ductless heat pumps on prototypes through metering
- ▶ Evaluation of two new manufactured homes with ductless heat pumps - Northwest Energy Works (N.E.W.). Metering to be done by Ecotope

New Construction High Performance Affordable Housing



New Construction Partner

- Hillsborough County Habitat (Tampa)
- 1100 ft², 3 bed/2 bath, slab on grade, frame construction
- Anticipated HERS index
 - With gas = upper 60's
 - All electric = low 60's



New Construction Partner

- Lake Sumter County Habitat
- 3 houses – (2BR/1bath, 3BR/1.5 bath, & a 4BR/2 bath)
- Slab on grade, frame construction
- Anticipated HERS Index = Mid 60's



Four HERS \leq 0 homes monitored by FSEC

Tommy Williams, HERS -2



G.W. Robinson, HERS -3



Tommy Williams, HERS -1



KB Homes, HERS 0



Side-by-side Lab Homes

- ▶ Combined funding from DOE-BA, DOE-Fenestration, DOE- OE (smart grid) and BPA programs
- ▶ Graham Parker, PNNL, PI for the DOE Fenestration and BPA funded efforts and site manager for this task
- ▶ Two flexible double-wide, ~1,500 sq. ft. manufactured homes to be sited at PNNL with full utility hook ups by summer 2011.
- ▶ First year experiment is to evaluate high performance windows compared to standard current stock

Thank You

