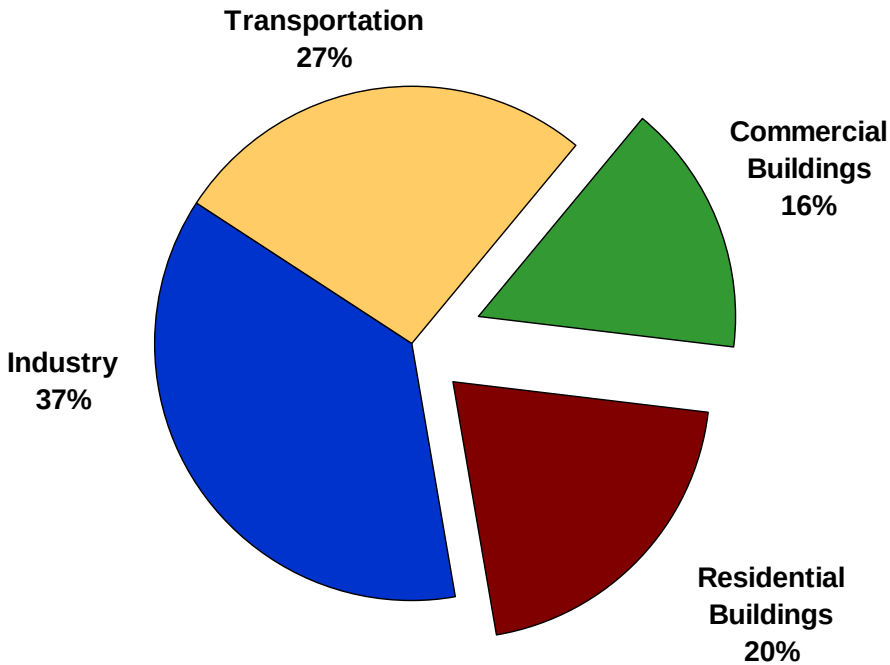
Benefits of Energy Efficient Building Materials

Ted Fox, **Director**
Engineering Science and Technology Division
Oak Ridge National Laboratory
Foxec@ORNL.gov

Oak Ridge National Laboratory

- DOE's largest multipurpose science laboratory
- U. S. largest concentration of unclassified materials research
- U. S. largest energy R&D laboratory
- $850 million budget; 90% from Department of Energy
- Sixteen research divisions – 1450 R&D staff
- 3000 guest scientists and engineers annually
- 20 user facilities

Where Building Energy Is Used



	Residential	Commercial
Space Heating	33%	16%
Space Cooling	10%	12%
Lighting	6%	24%
Water Heating	15%	7%
Refrigeration	9%	4%
Ventilation		5%
Clothes Washer/Dryers	5%	
Cooking Products	5%	2%
Electronics/Office Equip.	5%	6%
Computers	1%	3%
Other	11%	21%

Sources:

•Annual Energy Outlook 2001, Energy Information Administration, December 2000, Department of Energy, BTS Core Databook, July 26, 2002

Exciting New Materials Are Available for Walls and Roofs

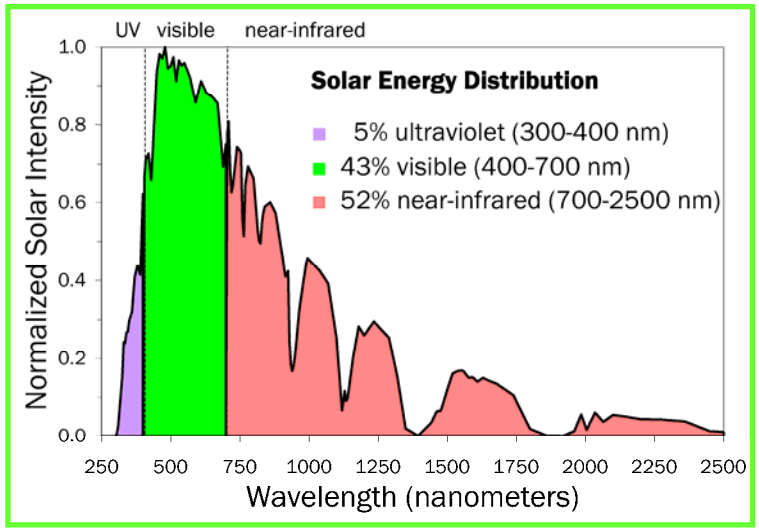
- Highly reflective coatings
- Structural insulated panels
- Aerated autoclaved concrete

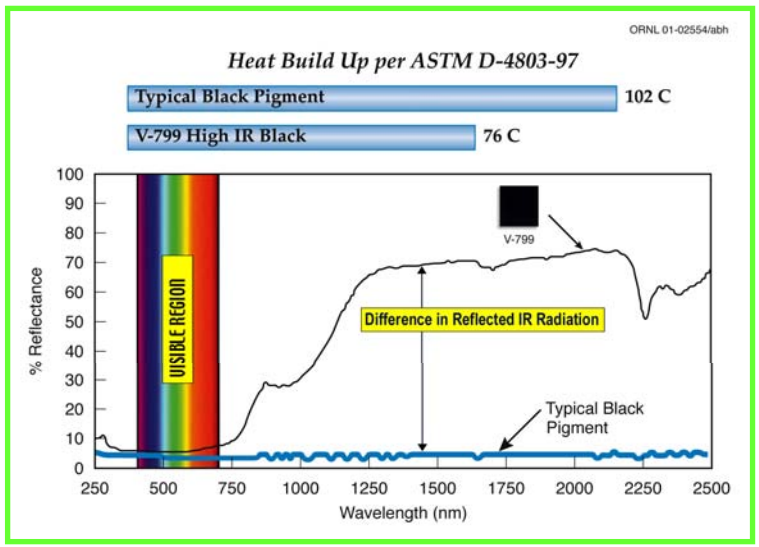
Buildings Technology Center - a DOE National User Facility

Large Scale Climate Simulator

Roofing Test Facility

IR Reflective Colors





Collaborative R&D Between Industry, ORNL, LBNL, and the California Energy Commission

⌘ Project Scope:

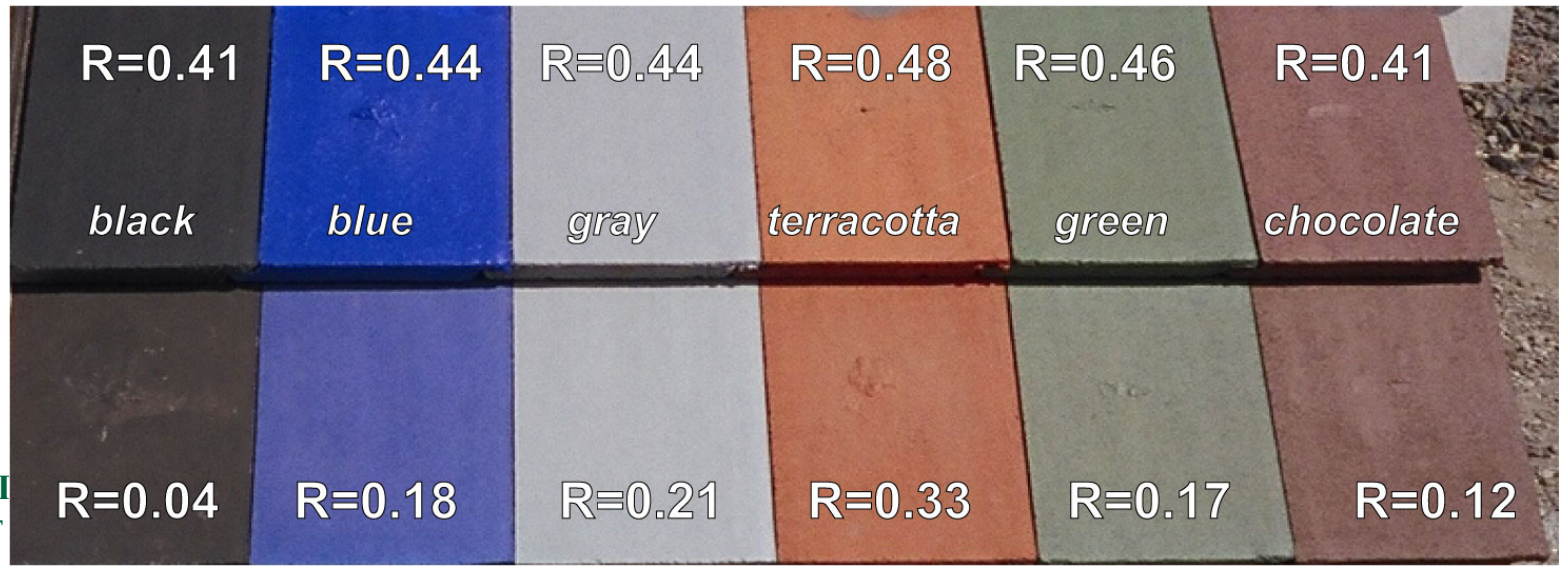
Develop Roofing Products that Reflect a Large Percentage of Infrared Energy

⌘ Potential Benefits (CA):

Electricity savings	**14.8 GWh**
Peak power savings	**9.2 MW**

Example: Development of Cool Roof Tile Coatings

- **Acrylic roof tile coatings suitable for new tiles, retrofits**
- **Color palette meets California's Title-24 requirements for tile (reflectance ≥ 0.40)**



Wall Systems

- **Working with several BTC users developing next generation SIPs**
- **User agreements with industry partners on testing and analyses of ~250 wall systems**

Typical Structural Insulated Panels Are Structural Support Enclosing Insulation

Whole Wall Analysis

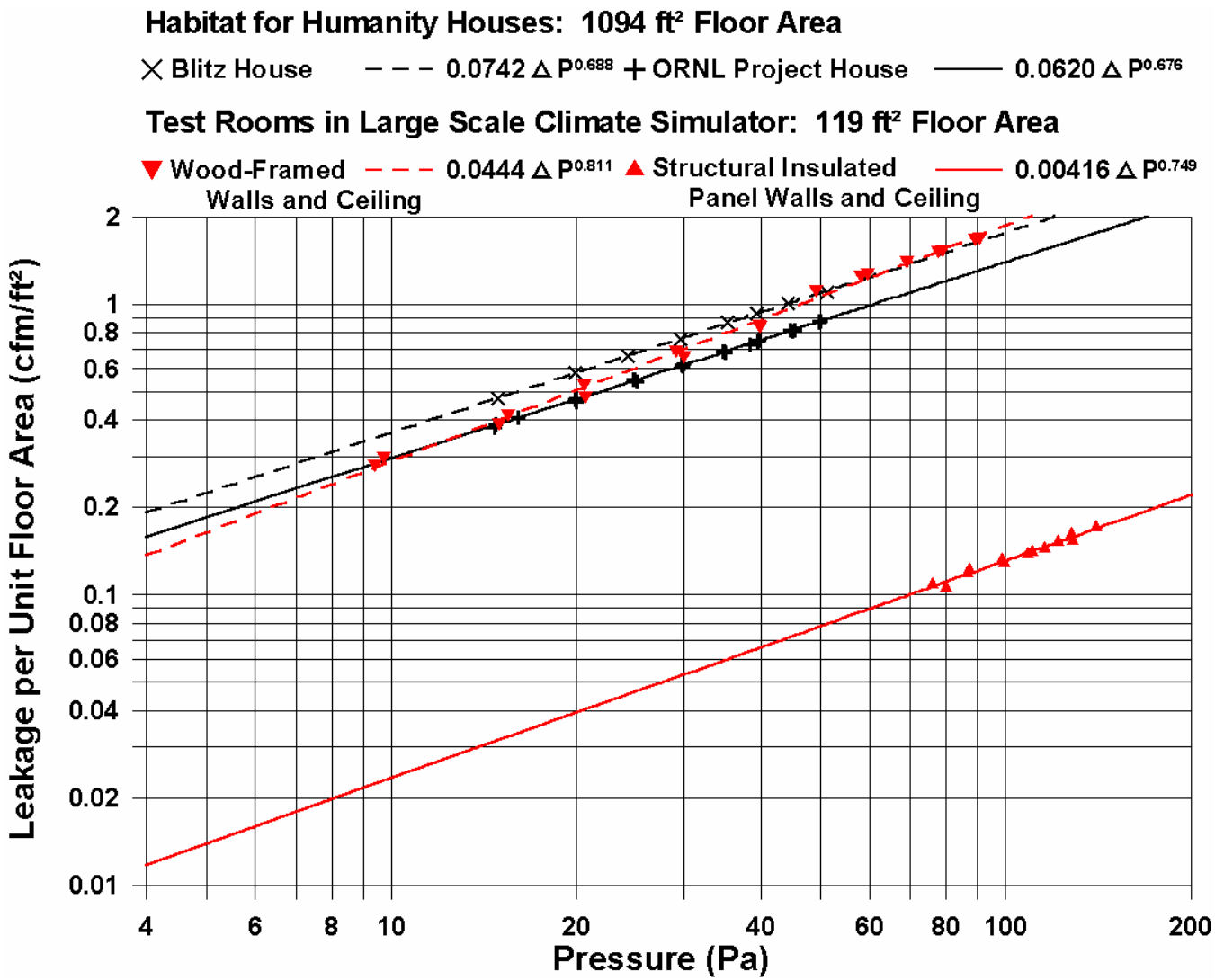
- **Thermal shorts**
- **Thermal Mass**
- **Air tightness**
- **Moisture control**
- **How we test**
  - **Rotatable Guarded Hot Box**
  - **Shroud blower door**
  - **Large Scale Climate Simulator**
  - **Habitat Houses**

We Have Tested Some of These Advanced Materials in a Series of High Performance Homes

Before We Selected the Envelope for ZEH1 We Built a 2 X 6 Test Room in Our Large Scale Climate Simulator . . .

. . . and Built an SIP Test Room, SIP Floor, Wall and Ceiling with Same Inside Ft^2

SIP Test Room 95% More Air Tight than Stick



Same Structural Insulated Panel System Used to Build First Near Net Zero House; Floor, Walls and Roof Installed in 3 Days

ZEH 3 Has Thick SIPS and Geothermal with Desuperheat for Hot Water

SIP ZEH 3- Insulspan

October 15, 2003

Precast Insulated Foundation Panel

Insulated Concrete Form (ICF) Construction

Another New Material Is AAC Which Can Be Made from Flyash, a Very Strong and Versatile Material

I Propose that the U. S. and Kazakhstan Investigate Developing a Building Fabrication Infrastructure

- **Modular high efficient inexpensive housing**
- **Indigenous industry**
- **Indigenous materials**
- **Complete affordable building kits**

Where to Get More Information

- DOE Building Technologies: http://www.eren.doe.gov/building.html
- ORNL Buildings Technology Center: www.ornl.gov/btc

Free Moisture Tool

- DOE Building America: http://www.Buildingamerica.gov