



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

DOE Windows R&D Program Highly Insulating Windows Webinar

28 July 2010

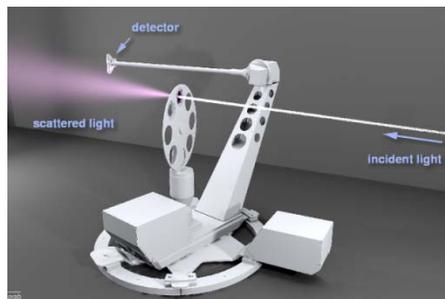
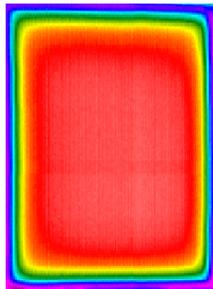
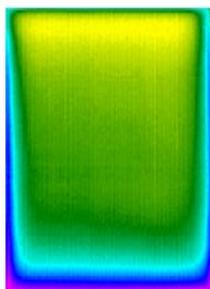
Christian Kohler
Windows and Daylighting Research Group
Lawrence Berkeley National Lab





LBL Windows and Daylighting Group

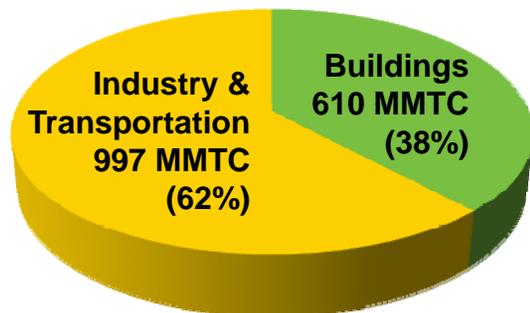
- 10-15 researchers dedicated to windows research. Mostly DOE funded.
- Engaged with industry since 1976
- State-of-the-art user facilities for testing and evaluation
- Software used by over 8,000 users worldwide



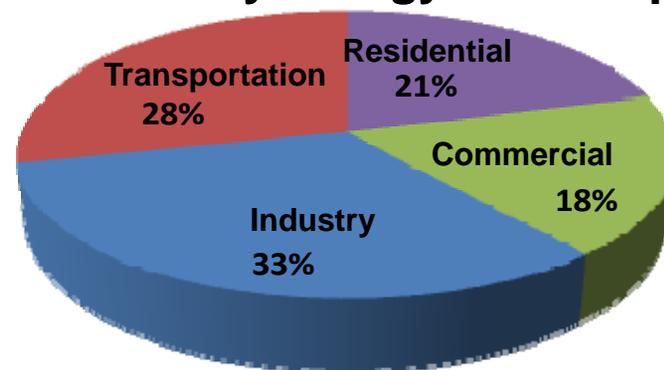


US Building Energy Use and Carbon Emissions

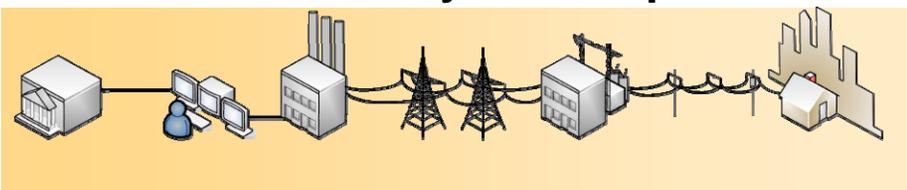
38% of U.S. Carbon Emissions



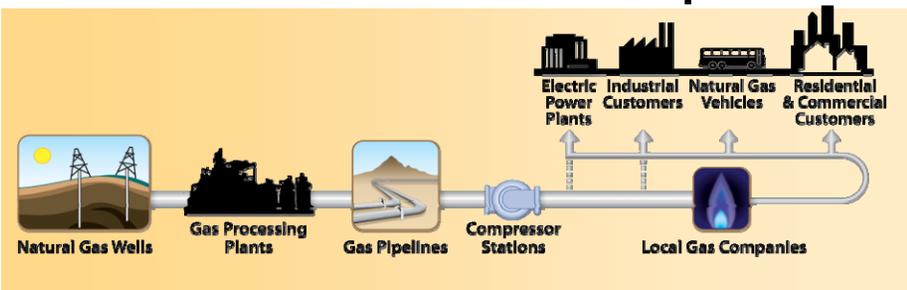
39% of U.S. Primary Energy Consumption



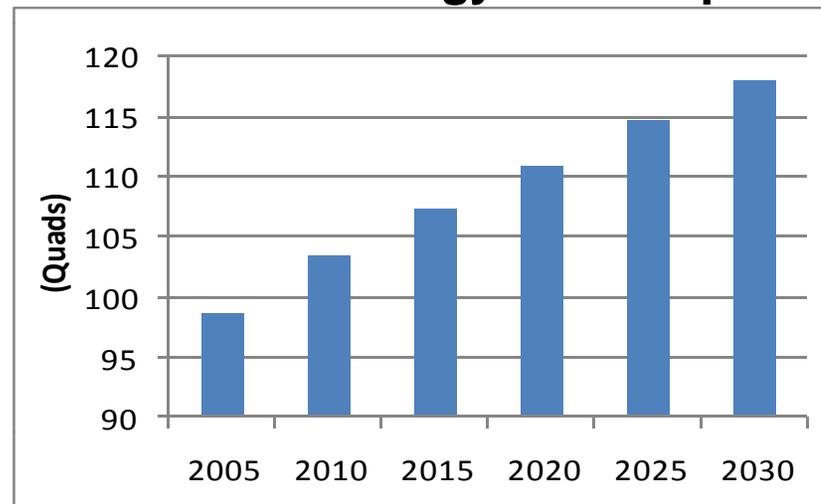
72% of U.S. Electricity Consumption



54% of U.S. Natural Gas Consumption



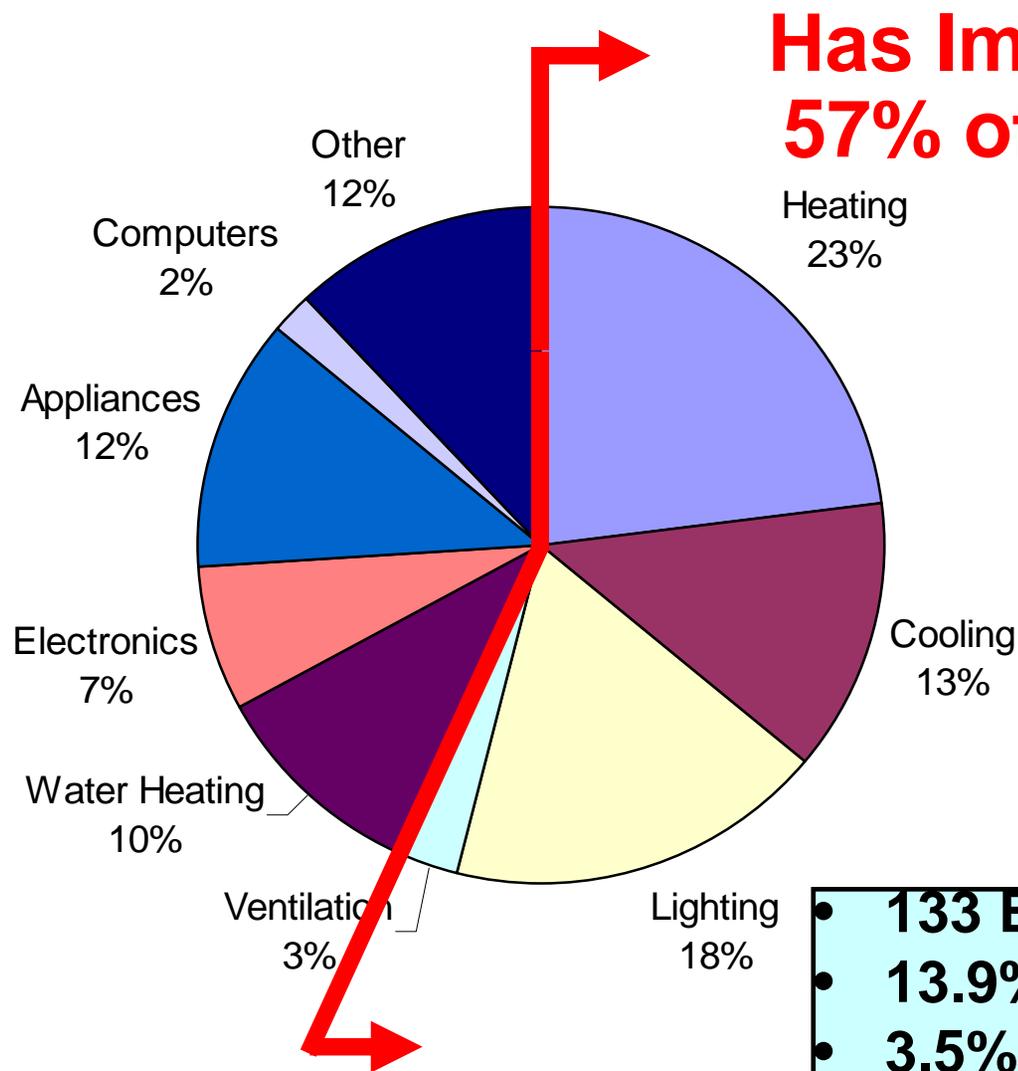
Total U.S. Energy Consumption



Sources: BED 2009; AEO 2010



Building Consumption – Envelope Relationship



Has Impact on 57% of Loads

- **133 Billion \$/yr**
- **13.9% US Energy**
- **3.5% Global Energy**



Next Generation of Windows

- **Highly Insulating**
 - Goal U value 0.10 (SI U factor 0.56)
 - Possible vacuum glazings
- **Dynamic solar control**
 - Passive heating and dramatic peak cooling reduction, SHGC 0.53 – 0.09
 - Market ready, prices will drop with more investment
 - Many new projects underway, competitive market in 2012 - 2014



Prototype – Concept Window
(Highly Insulating and Dynamic
U factor 0.18 (SI U value 1.0)
SHGC 0.04 – 0.34)
Low cost unsealed center lite



Integrated Programs to Reduce Price of Highly Insulating Windows

Building America demonstrations/ production housing for easy markets

High-performance specs in LEED for Homes & NGBS

**Production Engineering RFP – 50%
Cost Share**

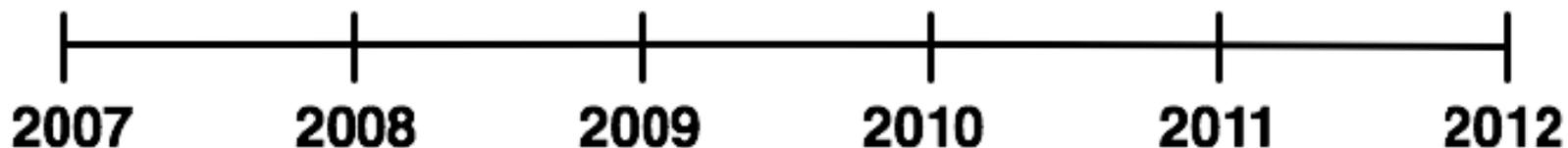
**Technology Procurement/Volume Purchases
– Multifamily/Public Housing/Condo, Builders, etc**

**Develop
advanced utility
program specs**

**Utility programs for advanced
windows**

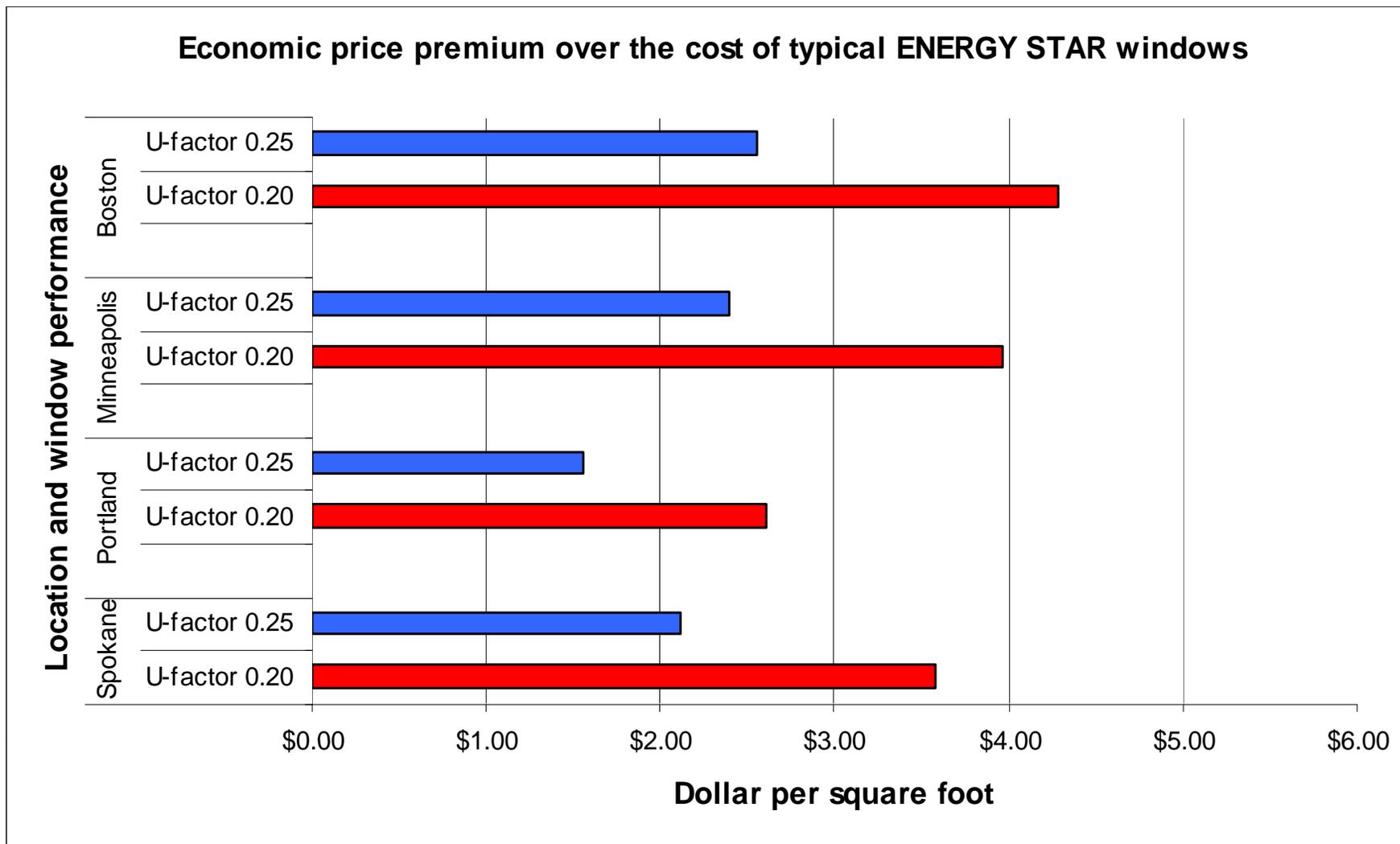
**ENERGY STAR spec
revision**

New ENERGY STAR / Phase II





8% annual discount rate, 25 years time horizon





Highly Insulating R5 Production Engineering Solicitation

- DOE Selected GED Integrated Solutions in partnership with PPG, and other major window companies
- Goal – Affordable R5 (U value of 0.22 or less for operable window and 0.20 or less for fixed window) with price premium less than \$4/ft² compared to conventional double pane low e
- Multiple paths to market, window companies and IGU sales
- Product availability 12 – 24 months
- Traco recently selected for commercial product





Oak Ridge National Laboratory / Building America Window Whole Demonstrations

- Highly Insulated Window Demonstrations
- System affects – central ducts, reduced HVAC capacity, improved comfort
- Future project – highly insulating ($>R5$) and dynamic control





Proposed Future for ENERGY STAR from R&D Perspective

- DOE to support EPA in moving ahead with Phase II ENERGY STAR criteria
- Could consider Super Star approach, advanced criteria sooner, longer time for current Energy Star
- DOE originally proposed in 2008 a U factor of 0.2 to 0.24 for Northern Climates with SHGC > 0.35 in the 2013 to 2014 timeframe



Key Policy Needed to Support Highly Insulating and Dynamic Windows in the Future

- Utility Rebate Programs 2010 – 2015
- To keep policy easy, require low U factors (0.20 – 0.24) with any SHGC requirement
- Energy Policy only needs to address critical technology development problem (Low U factors for mixed and cold climates); could be extended to dynamic glass for significant impact in hot and mixed climates, SHGC < 0.10



R value vs U factor

- DOE has used R value for non technical audiences for many years (e.g. Congressional Budget Requests)
- Window energy performance should only be specified as NFRC whole window U factors
- For general reference R is the inverse of U factor
- We use R5 as a general program name and to get the attention of consumers that understand R values better. We have R10 - R20 walls and R30 – R50 attics for code in some locations but window performance is generally around R2 - R3
- While there are many technical measurements concerns, there is a huge difference in performance
- We also know some window companies have advertised very high R values such as R15 but they are referring to center of glass performance, thus if DOE thinks R5 is a big step forward there needs to be more examination of center of glass claims



Final Remarks

- The availability of affordable triple pane windows is a major milestone in the commercialization of highly insulating windows
- Integrated policies can play a major role in transforming the market place
- Accurate whole window performance is a significant element to allow for program effectiveness
- The DOE, LBNL, and private industry research partners will play a major role in the future availability of the next generation of window technology



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