



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

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

# **Window R&D, EPA ENERGY STAR, and Future for Windows - Transforming Market to Triple Panes**

## **NWDA Winter Meeting at ATI, York PA** **26 January 2009**

**Marc LaFrance**

**Technology Development Manager**

**Building Technologies Program**

**Office of Energy Efficiency and Renewable Energy**





## Electric Power Generation

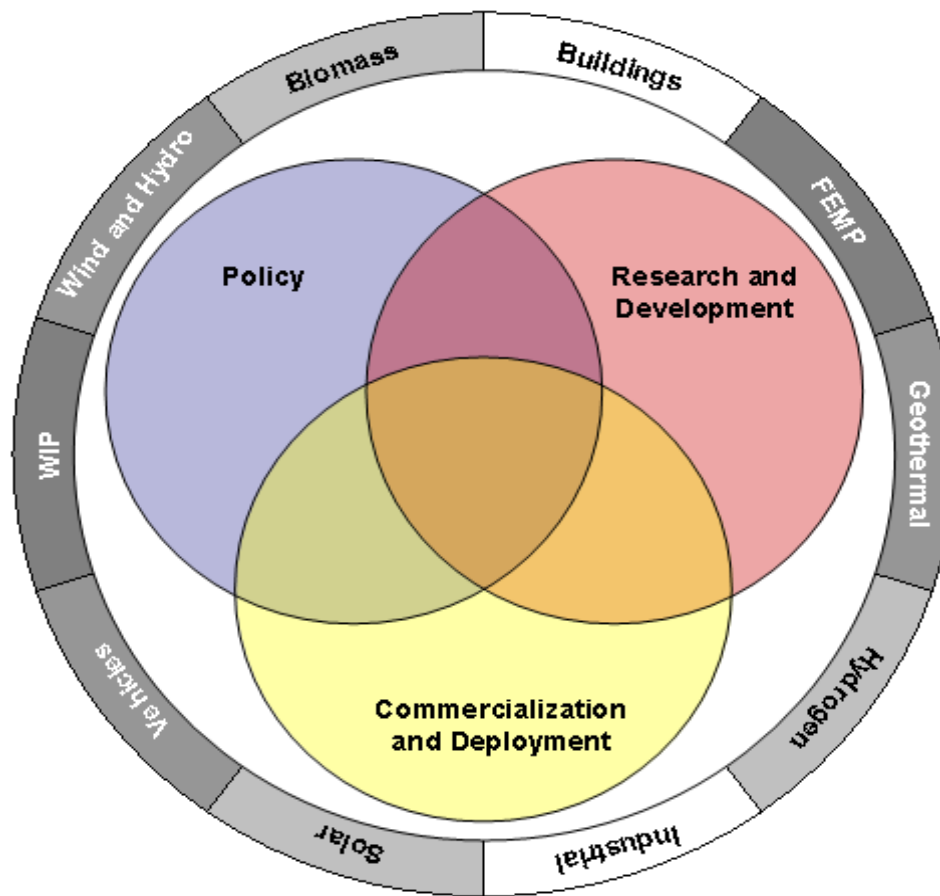
- Geothermal
- Solar
- Wind
- Hydropower & Advanced Water Power

## Advanced Transportation

- Biomass
- Fuel Cells
- Advanced Vehicles

## Energy Efficiency

- Buildings
- Industrial
- Federal Energy Management
- Weatherization and Intergovernmental

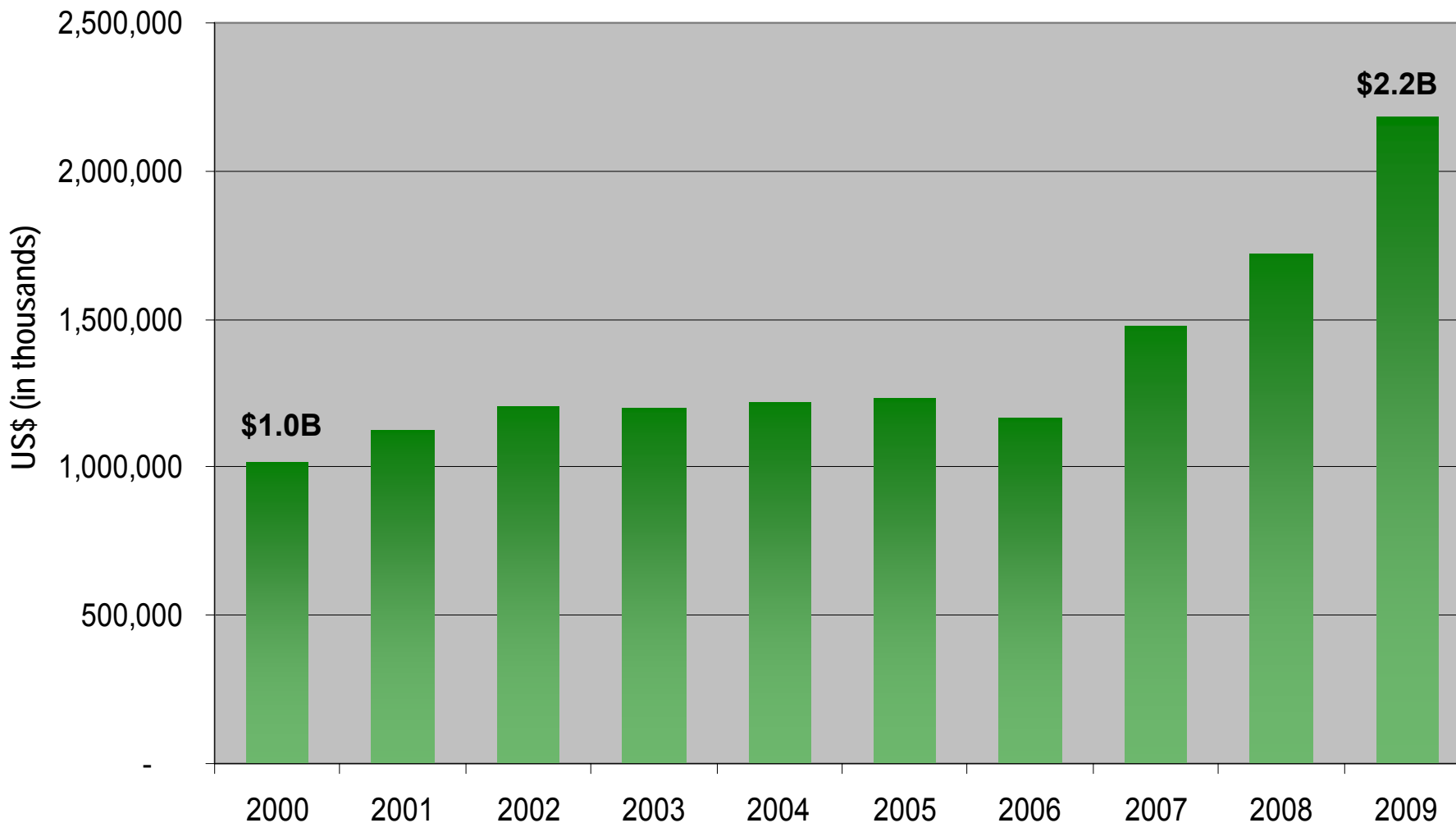


## Mission Statement

To develop cost competitive technology, facilitate commercialization and deployment to the marketplace



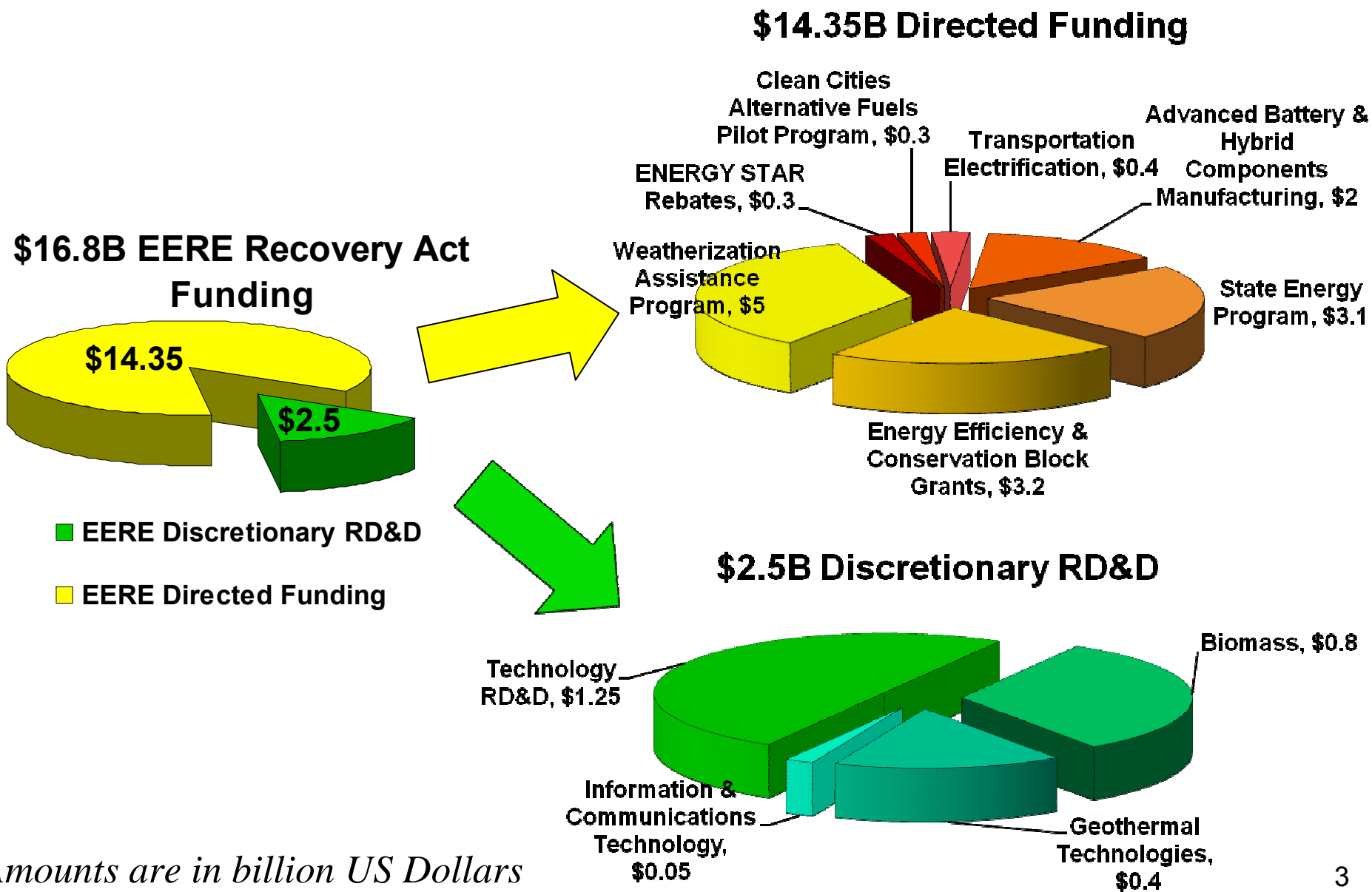
# EERE Budget History (2000-2009)



In addition to FY09 funding, EERE received \$16.8 billion in funding through the American Recovery and Reinvestment Act of 2009



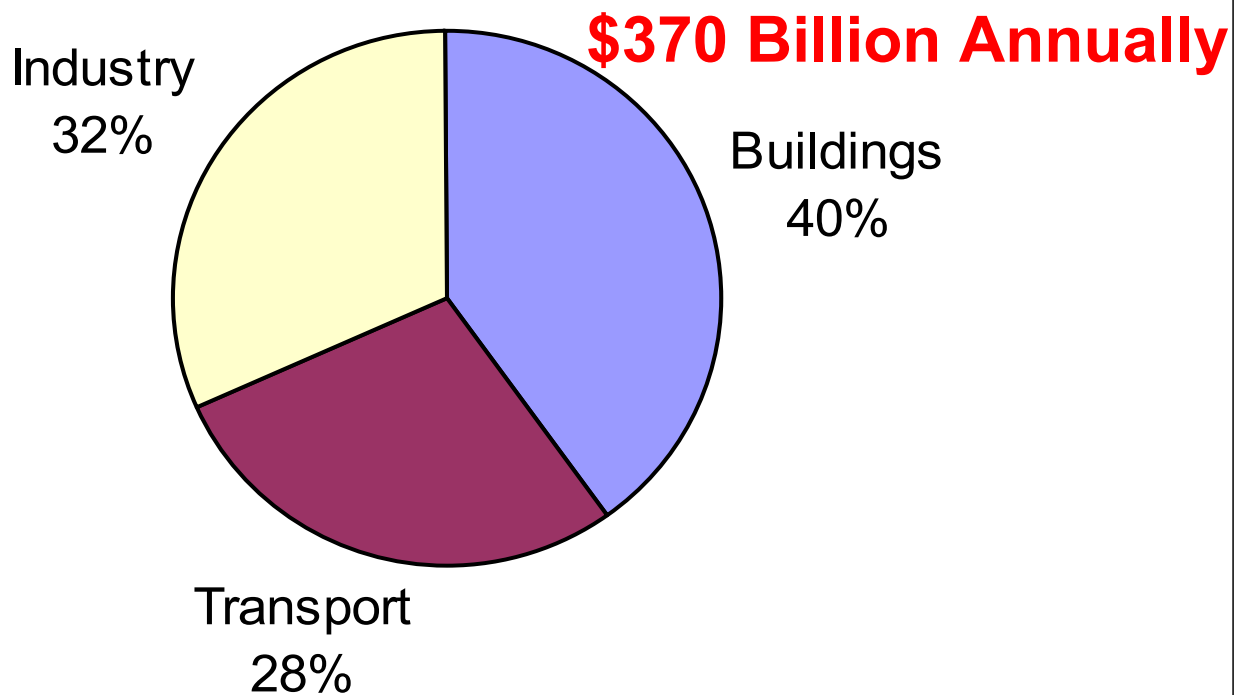
# EERE Recovery Act Funding



Amounts are in billion US Dollars

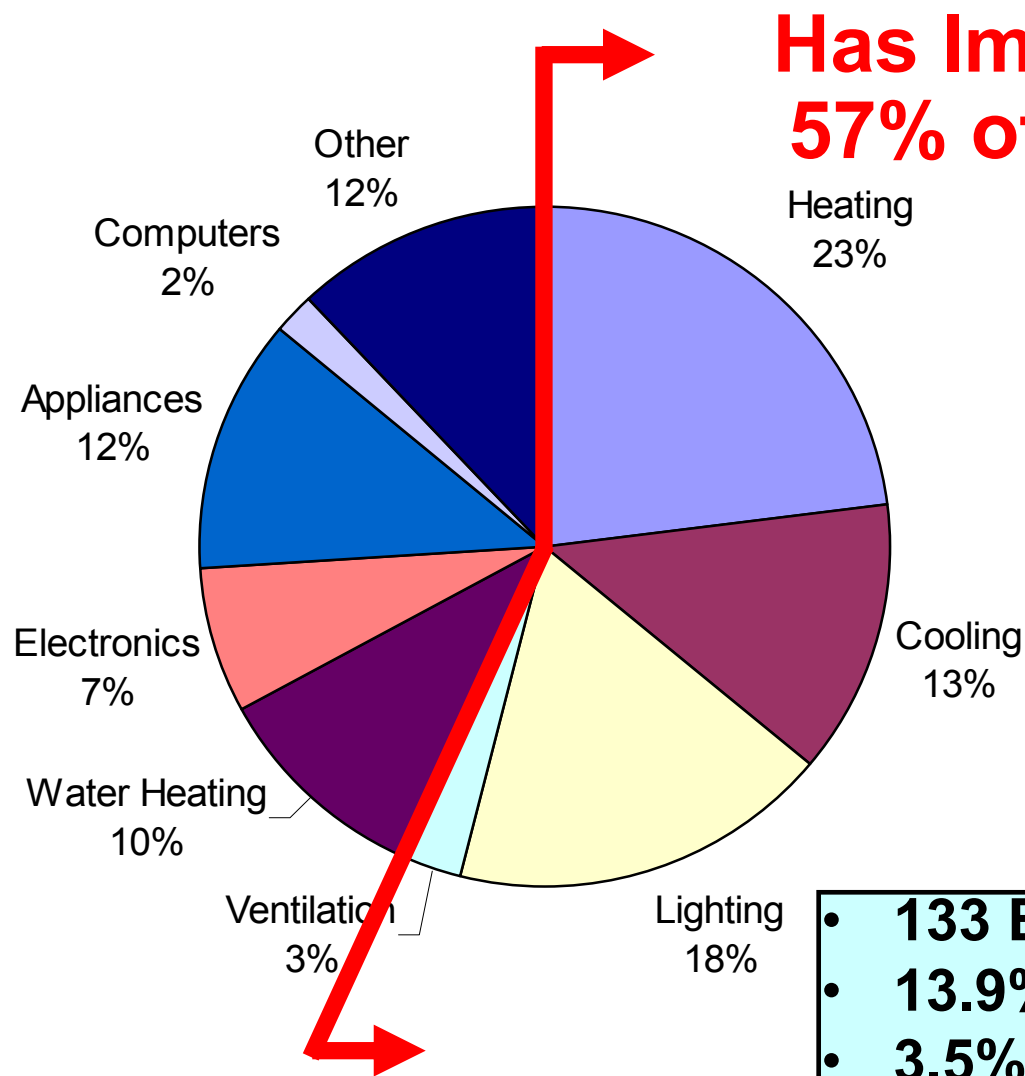


**Electricity – 72% for Buildings**  
**Natural Gas – 55% for Buildings**





# Building Consumption – Envelope Relationship



**Has Impact on 57% of Loads**

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



Net-Zero Energy Buildings by 2025

Net-Zero Energy Homes by 2020

Low incremental cost.





# Next Generation of Windows

- **Highly Insulating**
  - Goal U value 0.10 (SI U value 0.56)
  - Possible vacuum glazings
- **Dynamic solar control**
  - Passive heating
  - Dramatic peak cooling reduction
  - Market ready, prices will drop with more investment



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





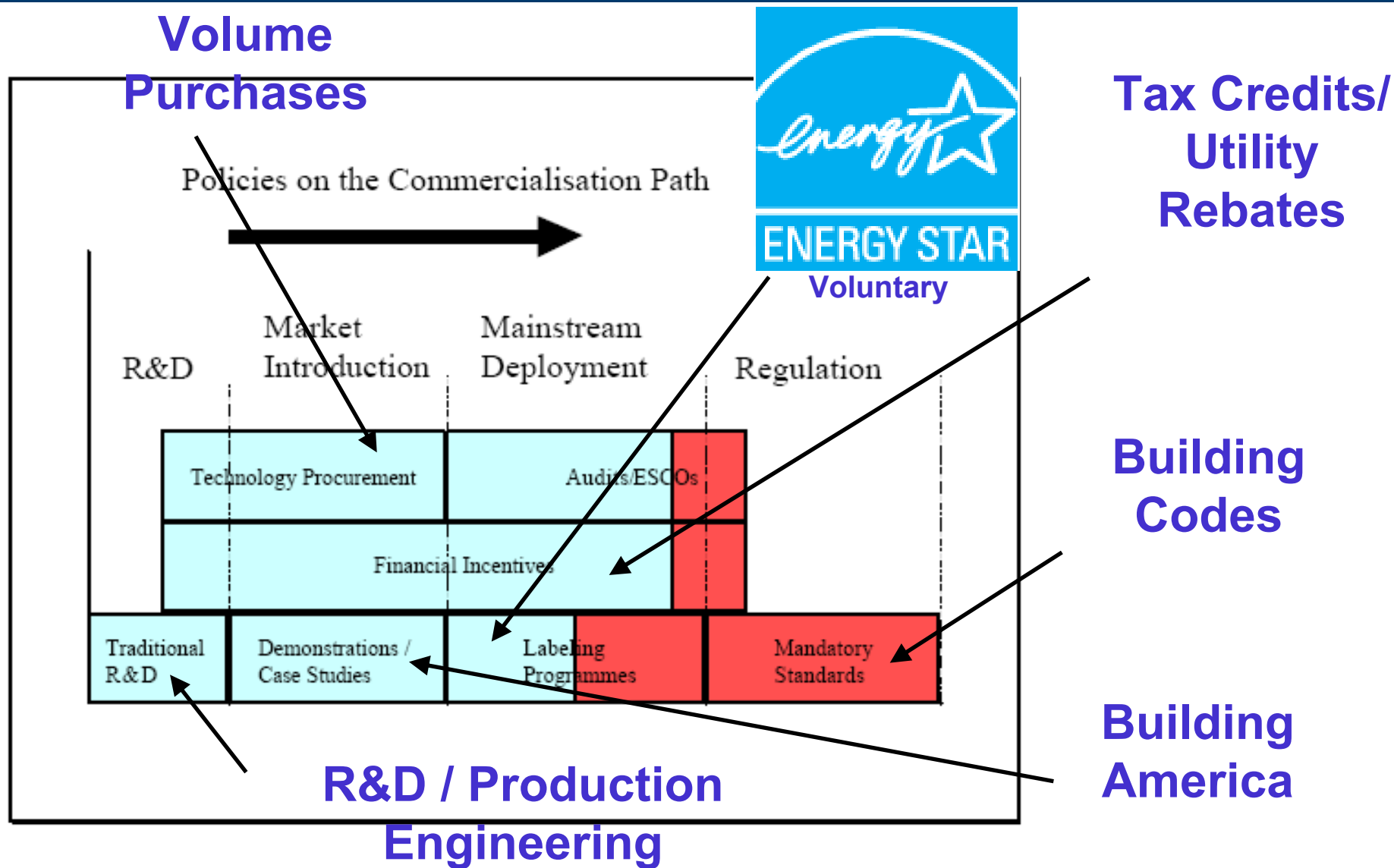
# Total Building Envelope and Window R&D Budget

	<b>Administration Budget Request</b>	<b>Enacted Appropriations</b>	
<b>FY04</b>	5.1M	8.2M	
<b>FY05</b>	5.0M Windows <b>0 Envelope</b>	5.8M Windows 2.8M Envelope	
<b>FY06</b>	5.0M Windows <b>0 Envelope</b>	*3.8M Windows (*earmarks) 2.9M Envelope	
<b>FY07</b>	4.7M Windows 2.4M Envelopes	4.7M Windows 2.4M Envelope	
<b>FY08</b>	4.7M Windows 2.4M Envelopes	4.7M Windows 2.4M Envelope	
<b>FY09</b>	5.2M Windows 3.4M Envelopes	5.5 Windows 4.5 Envelope	
<b>FY 10</b>	<b>10.5M Windows</b> 5.5M Envelope	<b>Core</b> <b>10.5M Windows</b> <b>5.5M Envelope</b>	<b>ARRA</b> <b>~ 20M</b> <b>~15M</b>





# Efficiency Policies for Windows





## ENERGY STAR for Windows – Effective January 2010

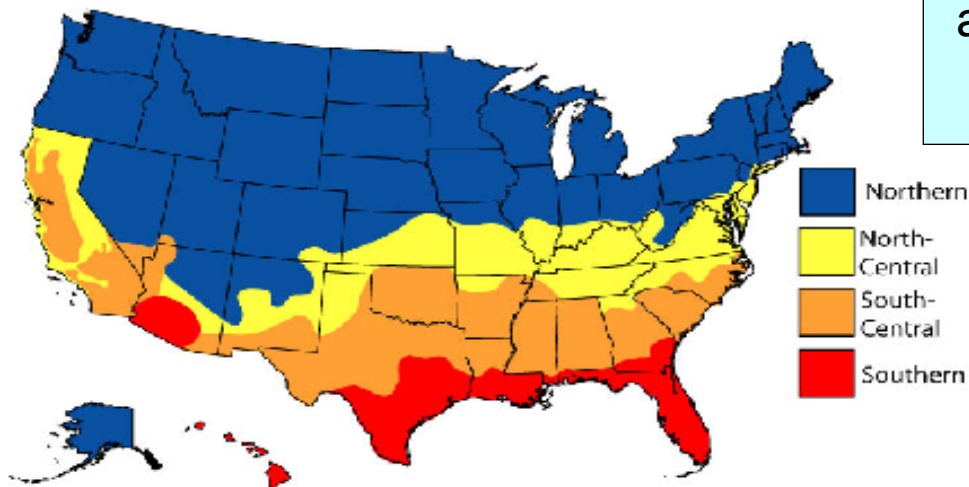
### ENERGY STAR® Qualification Criteria for Residential Windows, Doors, and Skylights

Windows				Doors			Skylights		
Climate Zone	U-Factor <sup>1</sup>	SHGC <sup>2</sup>		Glazing Level	U-Factor <sup>1</sup>	SHGC <sup>2</sup>	Climate Zone	U-Factor <sup>1</sup>	SHGC <sup>2</sup>
Northern	≤ 0.30	Any	Prescriptive	Opaque	≤ 0.21	No Rating	Northern	≤ 0.55	Any
	≥ 0.31	≥ 0.35	Equivalent Energy Performance	≤ ½-Lite	≤ 0.27	≤ 0.30	North-Central	≤ 0.55	≤ 0.40
	≥ 0.32	≥ 0.40		> ½-Lite	≤ 0.32	≤ 0.30	South-Central	≤ 0.57	≤ 0.30
North-Central	≤ 0.32	≤ 0.40				Southern	≤ 0.70	≤ 0.30	
South-Central	≤ 0.35	≤ 0.30							
Southern	≤ 0.60	≤ 0.27							

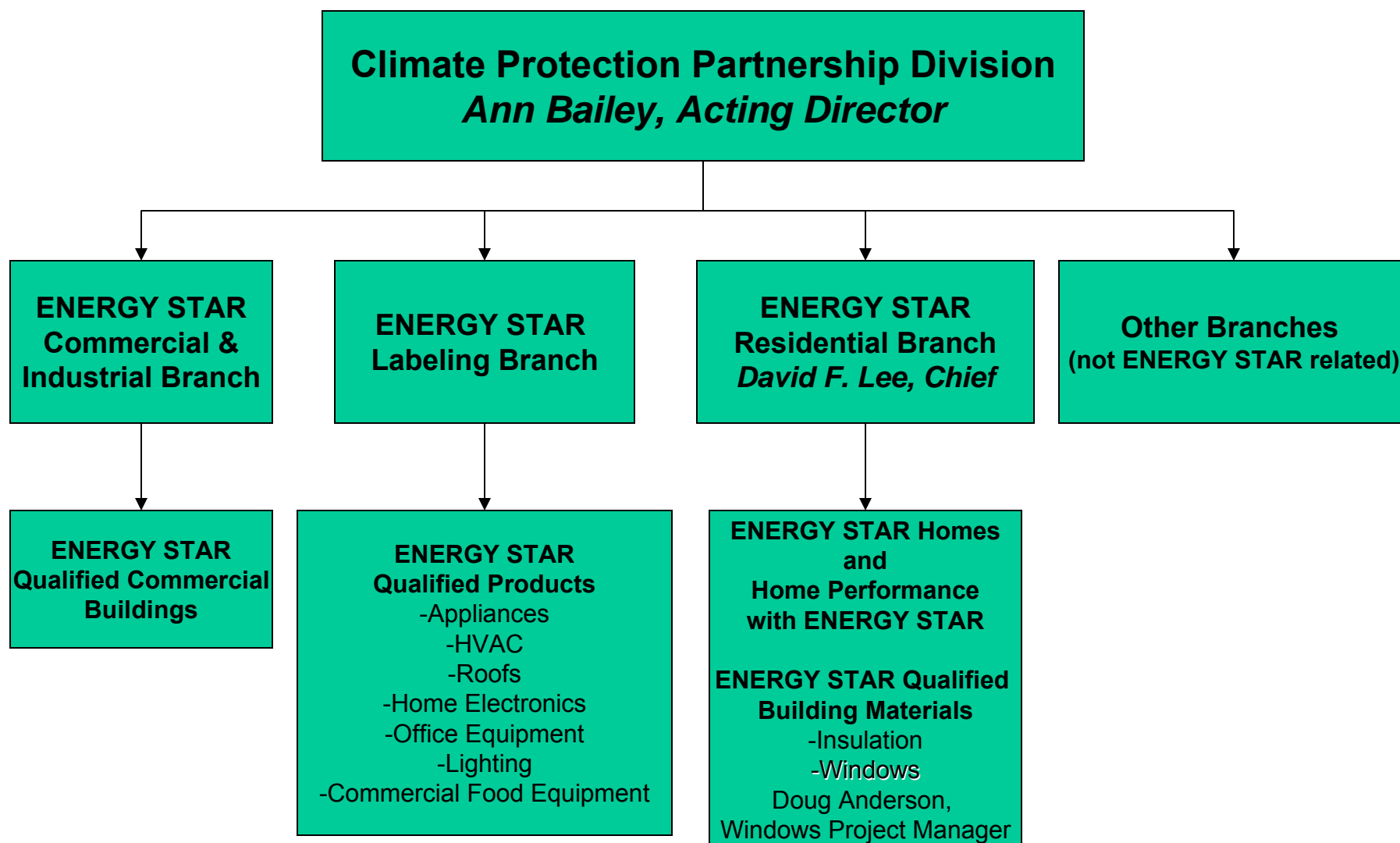
<sup>1</sup> Btu/h.ft<sup>2</sup>.°F

<sup>2</sup> Fraction of incident solar radiation

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 202-343-9350



# EPA ENERGY STAR Organization Chart





# 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**

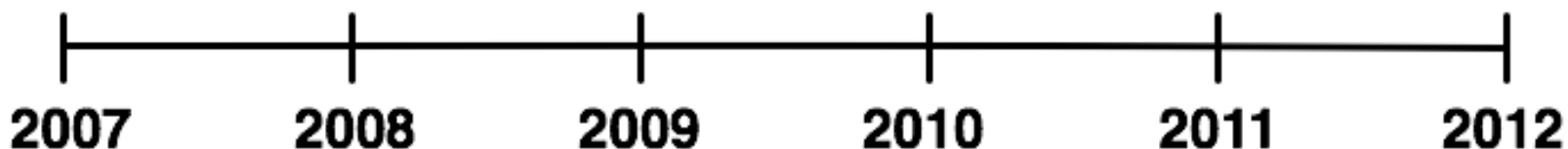
**Technology Procurement/Volume Purchases  
– Multifamily/Public Housing/Condo, Builders, etc**

**Develop  
advanced utility  
program specs**

**Utility programs for advanced  
windows**

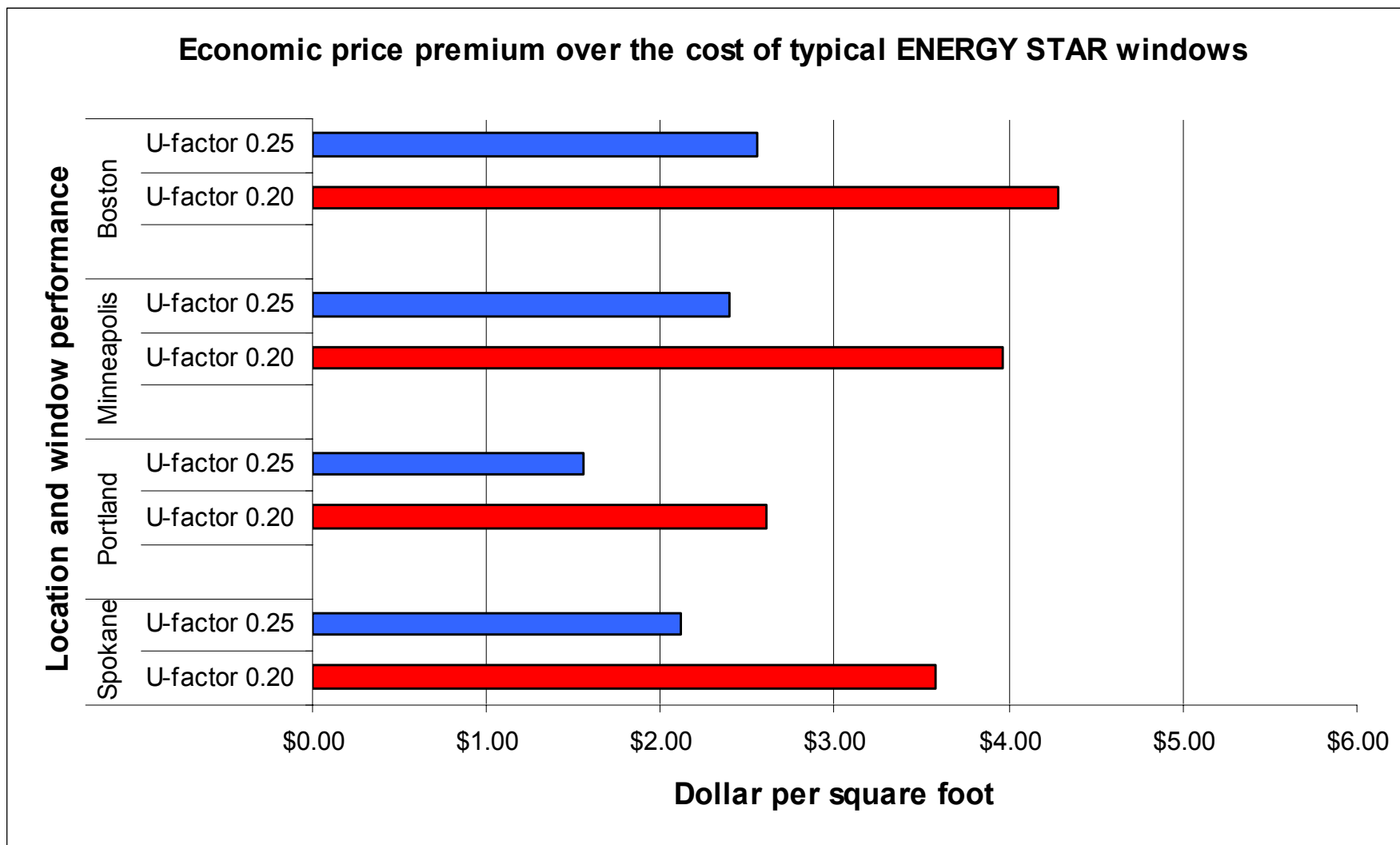
**ENERGY STAR spec  
revision**

**New ENERGY STAR / Phase II**





8% annual discount rate, 25 years time horizon





## 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





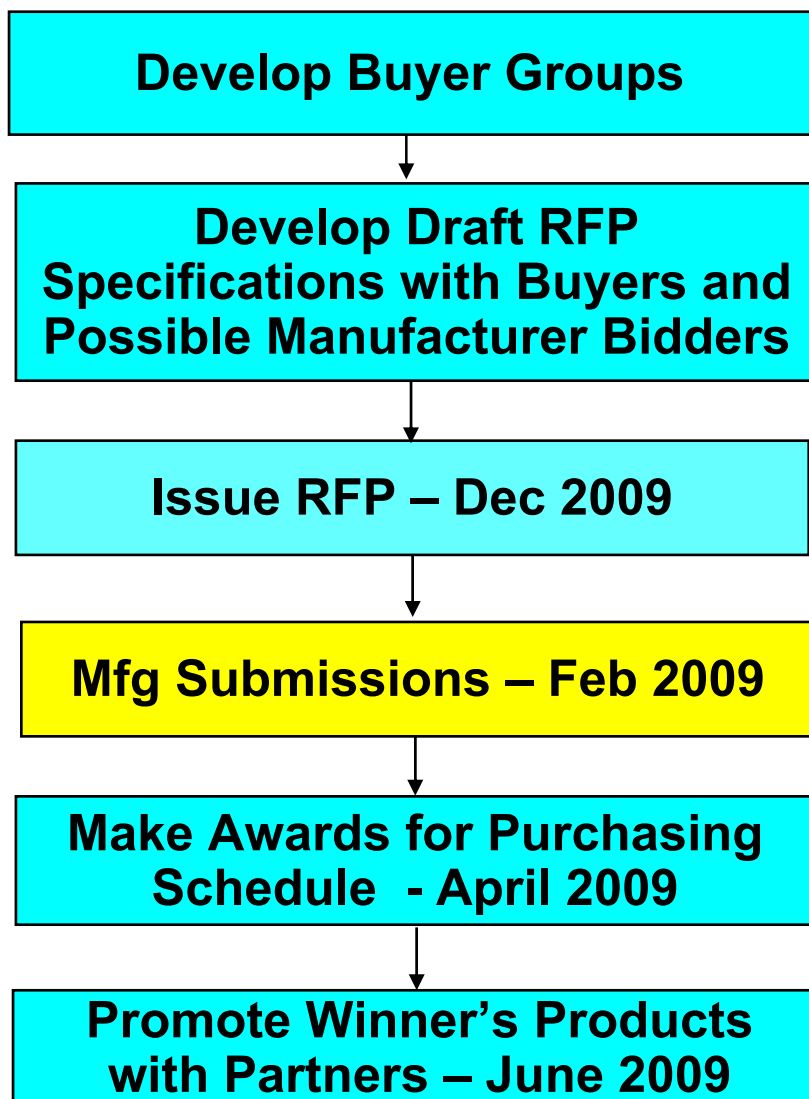
## Highly Insulating R5 Production Engineering Solicitation

- 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/ft<sup>2</sup> compared to conventional double pane low e
- Multiple paths to market, window companies and IGU sales
- Product availability 12 – 24 months
- Second round RFP closed Aug 18<sup>th</sup>
- 50% cost share requirement
- Strong response, evaluation underway





# R5 (~U 0.2) and Low E Storm Volume Purchase





- **Apartment and Office Building Association of Metropolitan Washington (AOBA)**
- **Build America Industrialized Housing Partnership (BAIHP)**
- **Community and Economic Development Association of Cook County, Illinois (CEDA)**
- **Common Wealth of Massachusetts**
- **Clayton Homes**
- **Consortium for Energy Efficiency**
- **Curtain Wall Design & Consulting (CDC)**
- **Davis Energy Group**
- **Energy Trust of Oregon**
- **Fenestar**
- **Habitat for Humanity**
- **IBACOS**
- **Jordan, Knauff & Company**
- **Midwest Energy Efficiency Alliance (MEEA)**
- **National Community Action Foundation (NCAF)**
- **NP Group, Inc**
- **Northwest Power and Conservation Council**
- **Palm Harbor Homes**
- **Pierce and Associates**
- **Systems Building Research Alliance (SBRA)**
- **The Window Man**
- **Youthbuild USA**
- **ZETA**



## Examples of Articles - VP Program in Major Trade Press



From: [BUILDER 2010](#) | Posted on: January 4, 2010 12:28:00 PM

### Greener Windows at a Nicer Price

DOE hopes to make energy-efficient windows more economical through

By: [Jenny Sullivan](#)

High-performance windows could become more affordable for builders and homeowners. Department of Energy (DOE) effort to lower costs goes as planned.



### Volume Purchase Program: Music to our Ears

Dec 1st, 2009 | By [DWM Mag](#) | Category: [Collins, the Trend Tracker](#)

I had a conversation recently with a consultant working on the Department of Energy (DOE) Highly Insulating (R-5) Window and low-E Storm Window Volume Purchase Program. The purpose of this program is to facilitate volume purchases of highly energy efficient windows. The U-factor equivalent of an R-5 is .2, significantly lower than the .3 U-factor required for the tax credit. The goal of this program is to bring volume buyers together with window manufacturers, creating a virtual market for high volumes of energy efficient windows. By

## Targeted Buyers Groups

- Associations
- K-12 Schools
- Public Housing
- Local/State Agencies
- Weatherization
- Federal Government
- Builders/Contractors
- Non-profits
- Universities



## **2009-2010 Fenestration Tax Credit**

- Raised limit for home improvements to \$1500
- Increased to 30 percent of product cost
- Does not cover installation costs
- Removed individual caps on windows and doors
- Established U-factor and SHGC at 0.30 or less
- Took effect February 17, 2009, through end of 2010



## Typical Northern Climate – Performance

	Bldg Codes	Previous Energy Star	New Energy Star		Tax Credit	(Jan 2008 Proposed) Phase II Energy Star	R5 RFP
U Value	0.35	0.35	0.30	0.32	0.30	0.2 – 0.24	0.22
SHGC	Any	Any	Any	≥0.4	<b>≤0.30</b>	≥ 0.35 - ≥ 0.55	≥0.3



## DOE Encourages High Solar Heat Gain in the North

- Energy savings is our primary goal, peak is important but secondary unless it is a major issue
- Promoting or maintaining manufacturing base of high solar heat gain glazings are essential for triple pane windows of the future (two low e surfaces), need modest SHGC and VT
- Heating mitigation is tied to Energy Security, electricity not nearly as much
- Low SHGC  $\neq$  Energy Efficiency in the North, many efficiency advocates do not know this due to successful marketing of low SHGC products
- **Maine and Texas should not have the same glass!!**



## Proposed Future for ENERGY STAR from R&D Perspective

- Wait longer for phase II analysis and let triple pane market mature (new products likely 6 – 18 months)
- Pursue window film and low e storm program for lower cost retrofit options – large disparity of products
- DOE to support EPA in moving ahead with Phase II ENERGY STAR criteria
- DOE originally proposed in 2008 a U value 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 Window in the Future**

- Could extend tax credits 2011 – 2013 for triples
- Utility Rebate Programs 2010 – 2013
- To keep policy easy, require low U values (0.20 – 0.24) with any SHGC requirement
- Stimulus program makes sense for the whole country
- Energy Policy only needs to address critical technology development problem (Low U values for mixed and cold climates)

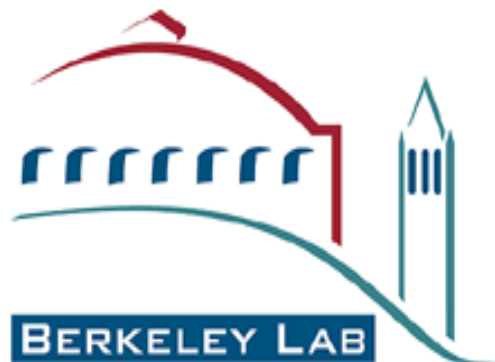


## Current Technical Support Activities

- **Tools**
  - Rating/Design Software
  - Decision tools, RESFEN
  - Residential Handbook
  - Commercial Handbook
- **Knowledge Base (Education)**
  - Efficient Windows Collaborative
  - Education to manufacturers/consumers
  - Commercial web page
  - Evaluation of commercial tools by users (builders, designers, suppliers, etc)
- **Industry Support**
  - International Optics Database
  - Assistance with tools to users
  - Durability studies
  - NFRC Documentation
  - NFRC, ASHRAE, ASTM, & ISO participation/leadership
  - International Std. Harmonization



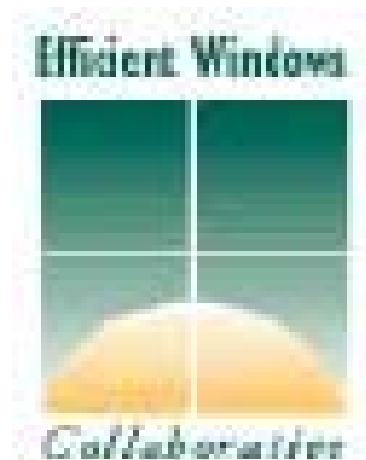
## DOE Assists with Technical Support Activities



<http://windows.lbl.gov/software>



[www.nfrc.org](http://www.nfrc.org)

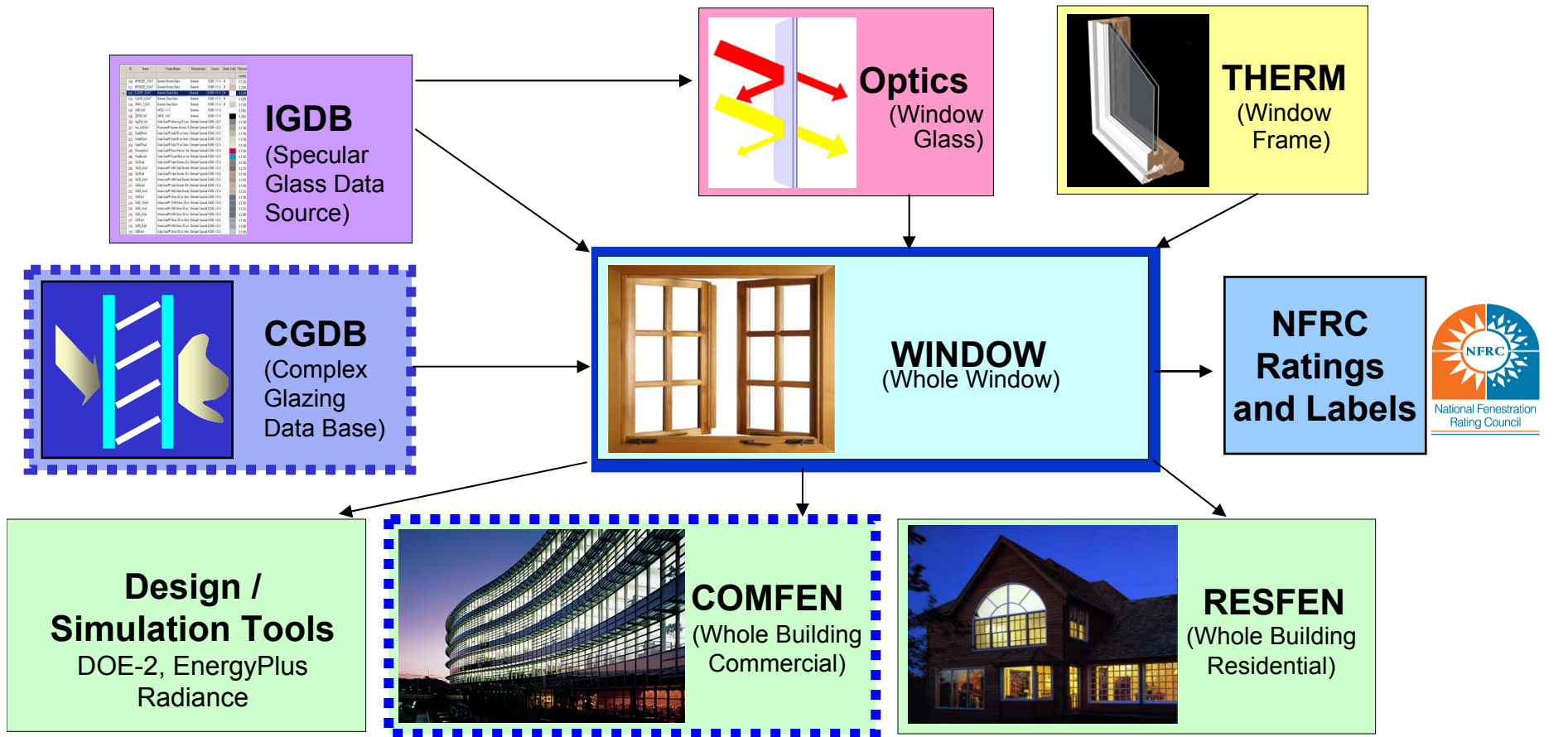


[www.efficientwindows.org](http://www.efficientwindows.org)

- Full range of software support tools, education materials and expansion to new product categories
- Continued financial support to assist industry in rating and promoting efficient product

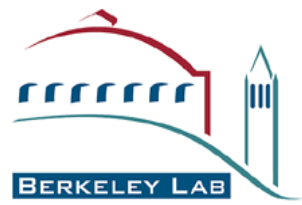


U.S. Department of Energy  
**Energy Efficiency and Renewable Energy WINDOW6 Software Suite**  
 Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable



- Design tools for advanced products
- **ISO 15099 Compliant**
- NFRCC Ratings

<http://windows.lbl.gov/software>





<http://www.commercialwindows.org>

Scenario	Orientation	Window Area	Daylight Controls	Interior Shades	Exterior Shades	Window
1	South	15%	No Controls	No	None	Double Low-E Clear
2	South	30%	No Controls	Yes	None	Single Clear
3	South	45%	No Controls	No	Deep Overhang	Double Clear
4	South	60%	No Controls	No	Shallow Overhang	Double Bronze Tint

**How to Perform a Comparison**

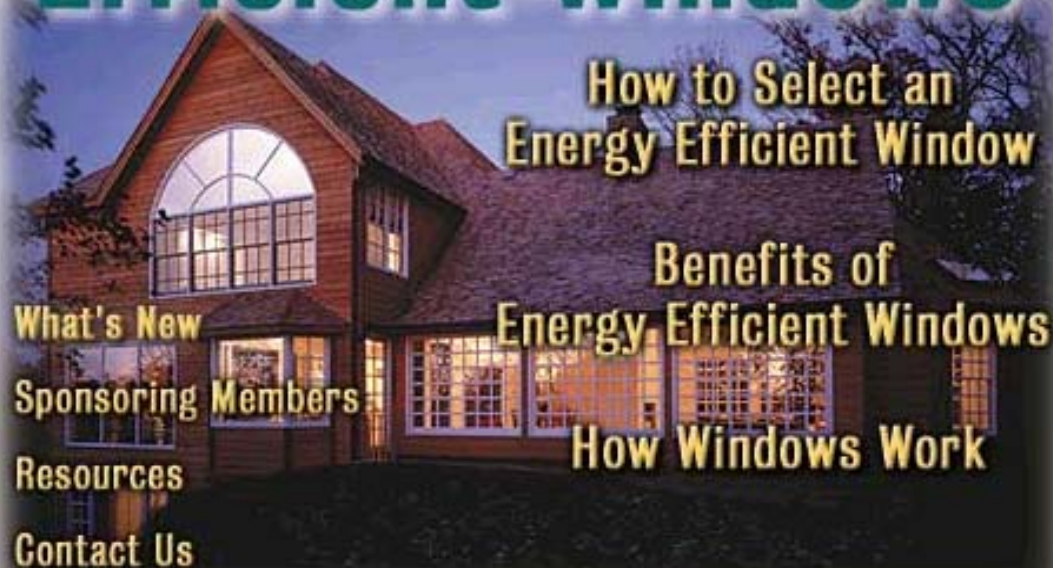
1. Choose the design conditions for each of the 4 scenarios in which to compare.
2. If you need more information regarding the design conditions, [click here](#).
3. Click the Compare Design Conditions button to see the results for annual energy, peak demand, carbon, daylight illuminance, glare, and thermal comfort.
4. Once the results are displayed, you can modify the design conditions to view other comparisons.



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# Efficient Windows



This web site provides unbiased information on the benefits of energy-efficient windows, descriptions of how they work, and recommendations for their selection and use. EWC members have made a commitment to manufacture and promote energy-efficient windows. Take a look to learn more!

The Efficient Windows web site is sponsored by the Efficient Windows Collaborative (EWC) with support from the U.S. Department of Energy's Windows and Glazings Program and the participation of industry members.

**Over 40,000 users per month**

**[www.efficientwindows.org](http://www.efficientwindows.org)**



## Final Remarks

- The USA has initiated unprecedented investment in energy efficiency and renewable energy
- New technology will be essential to achieve zero energy buildings – major investment with Stimulus Funding
- Fenestration industry can play a major role in implementation and new product development
- Need greater incentives for 2011 – 2013 time frame to support R5 windows



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## Contact Information

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[www.eere.doe.gov](http://www.eere.doe.gov)

**FROM EPA**  
**The Renovation, Repair, and Painting Rule**  
**(RRP)**

On March 31, 2008, EPA issued a final rule under the authority of § 402(c)(3) of the Toxic Substances Control Act (TSCA) to address lead-based paint hazards.

Under the rule, beginning on April 22, 2010, contractors performing renovation, repair and painting projects that disturb lead-based paint in **homes, child care facilities, and schools built before 1978** must be certified and must follow specific work practices to prevent lead contamination.

## Rule Scope

- Excludes:
  - Renovations that affect only components that have been determined to be free of lead-based paint.
  - Activities that disturb under 6 ft<sup>2</sup> interior or 20 ft<sup>2</sup> exterior. ***This excludes window replacement, demolition, and projects involving prohibited practices. (This means window replacement activities requires this training and certification.)***
  - Work done by individuals in housing they own and occupy.
- Opt-out provision:
  - Homeowners may opt out of rule requirements if:
    - they occupy the housing to be renovated,
    - the housing is not a child-occupied facility, **and**
    - no child under age 6 or pregnant woman resides there.

# Contractor Requirements

- **Pre-Renovation Education**
  - Provide Information
  - Post Informational Signs as required
- **Firm Certification**
  - To be certified to perform renovation or dust sampling firms must submit an application and fee to EPA
  - Certifications are good for 5 years.
  - Certification allows the firm to work in any non-authorized state or Indian tribal area.
- **Certification of Renovator and Dust Sampling Technicians**
  - Dust Must take 8-hour accredited training course
    - Individuals with certain previous training can take a 4-hour accredited refresher course
    - Course certificate serves as certification (no application to EPA required)
  - Refresher training is required every 5 years
  - Certification allows the renovator or sampling technician to work in any non-authorized state or Indian tribal area.

## Training Summary

- Work Practice Standards for Interiors and Exteriors
- Cleaning Work Practice Standards
- Cleaning Verification
- Recordkeeping and Enforcement

### Important Dates:

#### – **October 2009**

- Renovation firms may begin applying for certification

#### – **April 22, 2010**

- Training providers must be accredited
- Renovation firms must be certified
- Renovators and dust sampling technicians must be certified
- Work practices must be followed

Recommendation:

At least get job supervisors trained ASAP to over-see other workers.

**More Information:**

**Lead:** <http://www.epa.gov/lead/>

**Lead in Renovation:**

<http://www.epa.gov/lead/pubs/renovation.htm>

**List of Training Providers by State:**

<http://www.epa.gov/lead/pubs/trainingproviders.htm>