

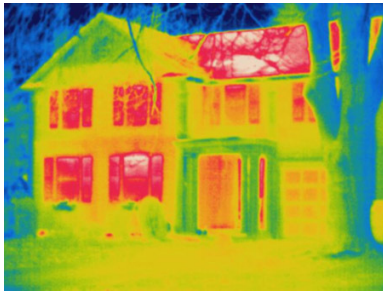
# Highly Insulating Windows for Utility Energy Efficiency Programs

CEE Industry Partners Meeting  
September 16, 2010

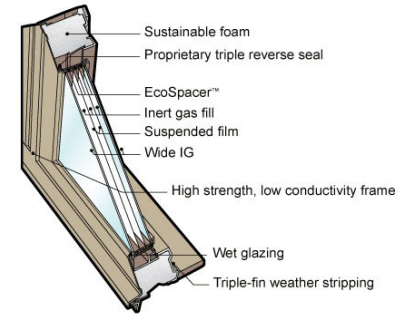
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# Why highly insulating windows?

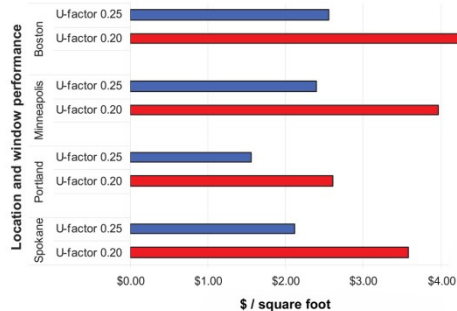
## *Four topics*



**1. A large amount of energy flows through windows**



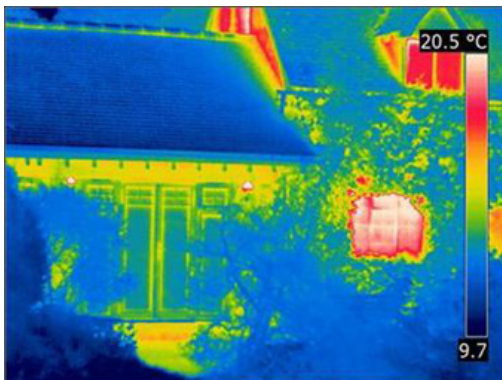
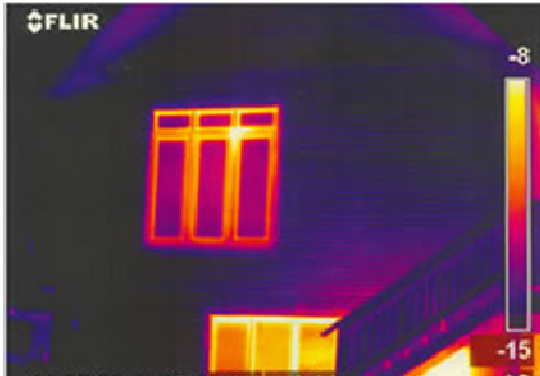
**2. New technology delivers better cost / performance**



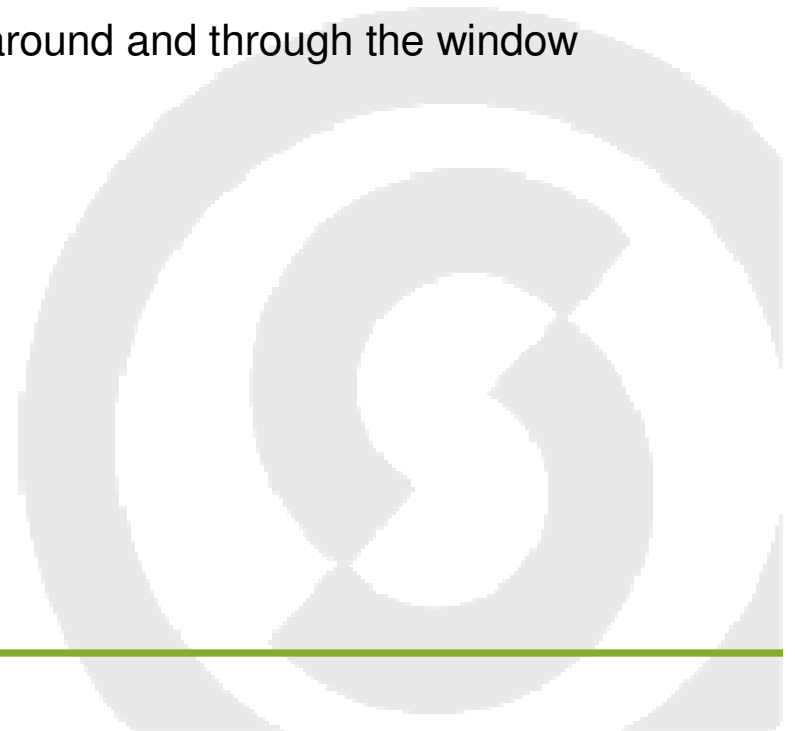
**3. Cost-effectiveness**

**4. Opportunities for utility programs**

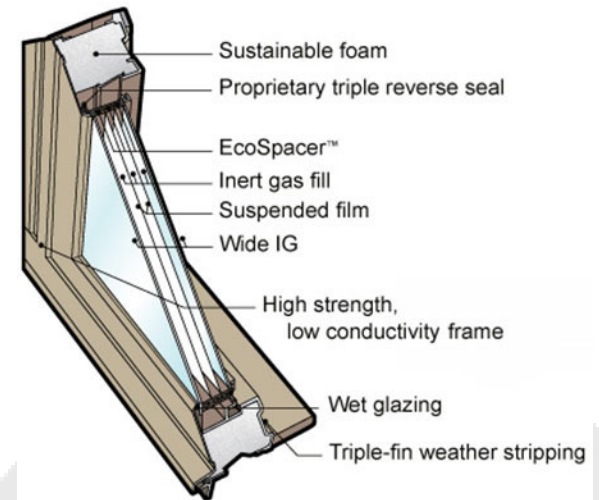
## Existing windows *A major factor in building energy use*



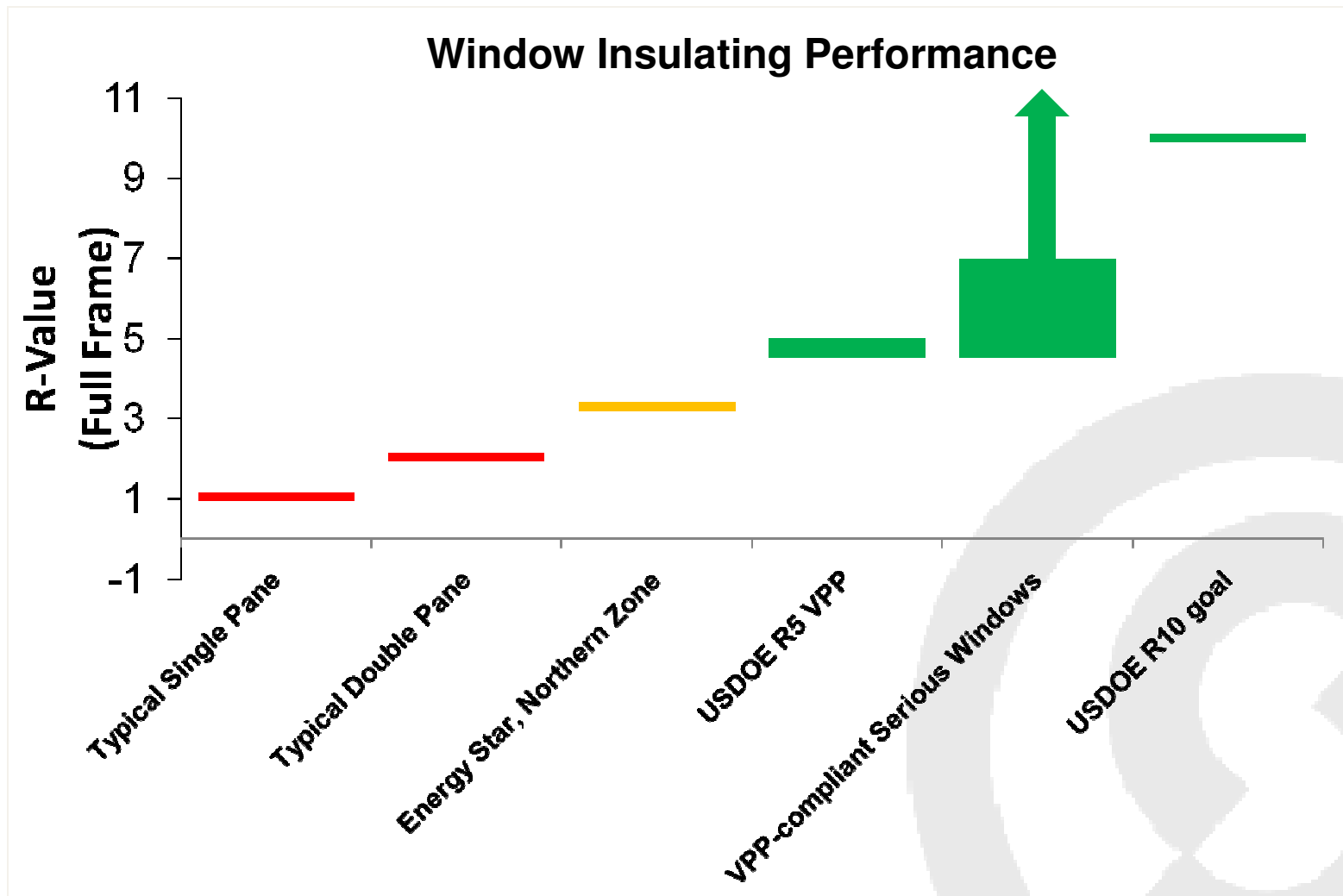
- **Windows are responsible for ~30% of heating and cooling loads**
  - Thermal transfer through the window
  - Solar heat gain
  - Air infiltration around and through the window



- **The industry, supported by US DOE, is working on major gains in window performance and cost**
- **Highly insulating (R5) windows are here now**
  - DOE's Volume Purchase Program
  - Available today from many suppliers
  - Incremental cost target of <\$5/sqft
  - Still small volume
- **Very highly insulating (R10) windows**
  - DOE aiming for low incremental cost by 2015
  - Serious Materials currently makes windows up to R-11
- **Dynamic glazing for solar control**
  - Passive heating (winter) & reduced cooling energy and peak loads
  - Dynamic Solar Heat Gain Coefficient, e.g., ranging from ~0.1 to ~0.5
  - Need for significant cost reductions over next few years
- **Note: The right window for Chicago is not the right window for Houston**
  - Chicago needs much more passive heating; Houston needs to manage AC loads
  - See, e.g., ENERGY STAR's climate zones for windows

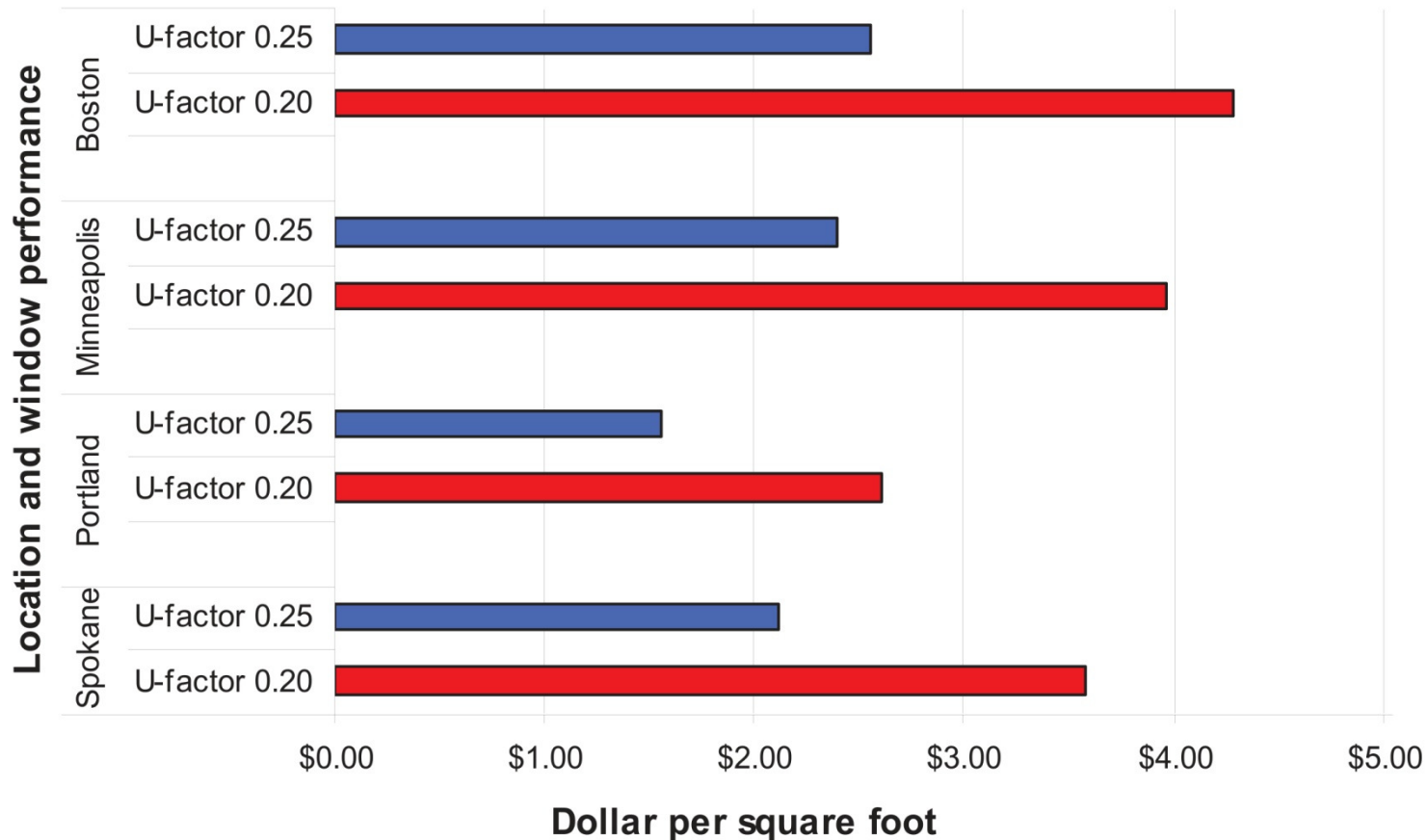


\* Triple weather stripping offered in casement and awning frame styles. Double weather stripping is included in all other frame styles.



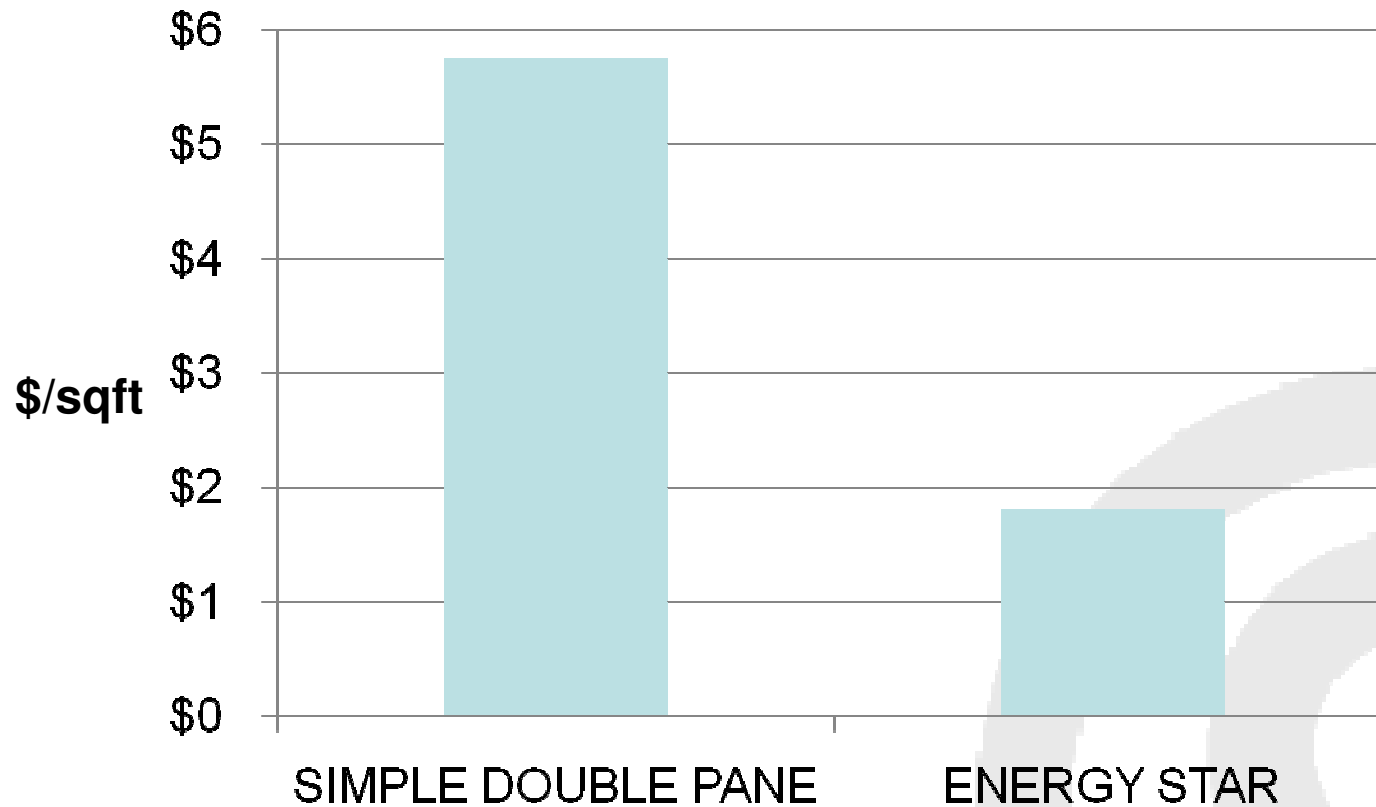
- **Volume Purchase Program**
  - US DOE developed a specification for highly Insulating (R-5) windows
  - RFP in December 2009; manufacturer proposals in February 2010
  - Products available from Spring 2010
- **Highly insulating:**
  - NFRC certified
  - R-4.54 (U-0.22) for operable windows
  - R-5.0 (U-0.2) for fixed windows
  - *Note: ENERGY STAR northern zone requires R-3.3*
- **Other critical window attributes**
  - Structural rating: AAMA Residential 25 Performance grade or greater
  - Air infiltration: < 0.3
  - Product warranty: glass: 10 years; other: 20 years
  - No requirement for Solar Heat Gain Coefficient
- **~40 qualified vendors listed on DOE's VPP website**
  - [www.windowsvolumepurchase.org](http://www.windowsvolumepurchase.org)

## Heating and cooling energy savings relative to ENERGY STAR



Source: DOE Update "Glass Expo Midwest" 2010  
8% annual discount rate, 25 year time horizon

### Chicago heating and cooling savings of VPP relative to ENERGY STAR and simple double pane



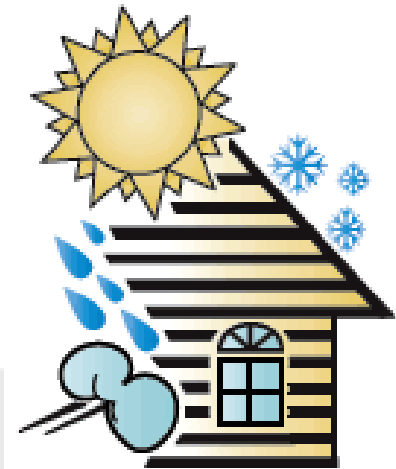
Source: N Petermann, ASE, "Window energy savings estimates for Chicago, July 2010.  
3% annual discount rate, 20 year time horizon

- **Baseline windows**
  - e.g., ENERGY STAR, simple double pane?
  - Air infiltration of existing windows
- **Building characteristics**
  - Orientation & shading (for solar heat gain)
  - Wall, ceiling, floor insulation; HVAC efficiency
  - Occupant behavior
  - Etc
- **Energy costs**
  - Current and escalation
- **Financial parameters**
  - Discount rate and maximum lifetime considered
- **Cost-effectiveness test / objectives**
  - TRC, PAC, etc
  - Deep cost-effective energy retrofits, or only the highest payback measures
  - Consideration of lower forward costs, where market transformation is expected



## Solid precedent: Cost-effective highly insulating (R-5) windows are now used in WAP

- **The Weatherization Assistance Program requires measures to be cost-effective**
- **Illinois Home Weatherization Assistance Program**
  - Consideration of R-5 windows required updating the statewide WAP audit tool
  - CEDA\* now specifies R-5 windows in WAP, since late 2009
  - Lower performing windows generally not used
  - Several manufacturers actively supply
- **Pennsylvania Weatherization Assistance Program**
  - PA adopted a statewide R-5 WAP requirement in August 2010
  - Replacements of broken windows must meet DOE VPP R5
  - Any window can be replaced with DOE VPP R5 if total installed cost is <\$20.70/square foot
  - Analysis in support of PA's policy was prepared by USDOE and LBNL



*Windows Work for  
Weatherization*

\* Community and Economic Development Association of Cook County

- **Tens of millions of windows will be sold this year**
  - **Without utility or other support, probably few will be VPP or higher**

### **Utility programs could help change that:**

- **Rebates for purchasers of highly insulating windows**
  - Based on incremental savings of R-5 or higher vs baseline windows
  - This could greatly reduce consumers' first cost hurdle
- **Co-fund WAP for households in which investment cap is exceeded**
  - WAP has an investment cap of \$6,500/household
  - This keeps windows (and other high capital cost measures) from being fully used
- **Whole Home Programs**
  - Include windows as part of whole home approach due to interactive effectiveness with other efficiency measures, and consider the up-front savings of down-sizing HVAC
- **Other ideas?**

- **Can windows be cost-effective?**
  - Yes – especially when full benefits are assessed, including reduced air infiltration, and both gas and electric savings
  - Particularly cost-effective if program design causes people who were planning to install windows to upgrade to highly insulating R-5 windows
- **Can windows be important as part of a whole home strategy?**
  - Yes - Reducing air infiltration can lower heating and cooling loads, reducing the required size of furnaces and boilers
- **Do highly insulating windows have non-energy benefits?**
  - Jobs in local manufacturing and installation
  - Improved occupant comfort
- **Can including windows in utility programs motivate consumers?**
  - Yes - Unlike efficiency measures people don't see or interact with, many people care about new windows for looks, reduced drafts, easy operation
  - As a result, windows can attract consumers to energy efficiency programs



Serious Materials is here to work with you

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