

## Glass R&D Themes

### Reduce the cost of commodity glass

- Energy efficiency and cost      Alternative fuels  
Re-use of 'waste' heat  
More efficient heating
- Raw Materials and composition      Lower melting point compositions
- Labour      Automation

### Value-added Products

- Energy-saving windows      Coatings, vacuum glazing
- Switchable, smart windows      Whole system
- Self-cleaning      Interior applications (bacteria-eating)
- Safety and Security      Interlayer films  
Fire-resistant products

**ALL ARE CLOSELY LINKED TO MATERIAL ISSUES**

## Reduced Energy Loss Through Windows

### U-values ( $W/m^2K$ ):

Single Glazing 5.4

Double Glazing (IGU) 2.8

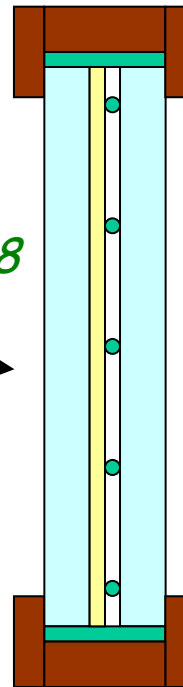
IGU with Low-E and Ar 1.1

Triple Glazing with Low-E and Ar 0.8

Vacuum Glazing 0.3-0.4

Also need to include solar heat gain

Same basic points for other leading edge window technologies:  
eg Switchable, Self-Cleaning, etc.  
And probably in the rest of the industry



### All about Materials Issues

- Spacer material
- Surface condition
- Low-E coating
- Sealing
- Framing

Numerous process issues

- Not the glass it's the additional materials
- Hybrid systems
- Joining technologies