# Building Technologies Office
# Emerging Technologies
## Windows and Building Envelope

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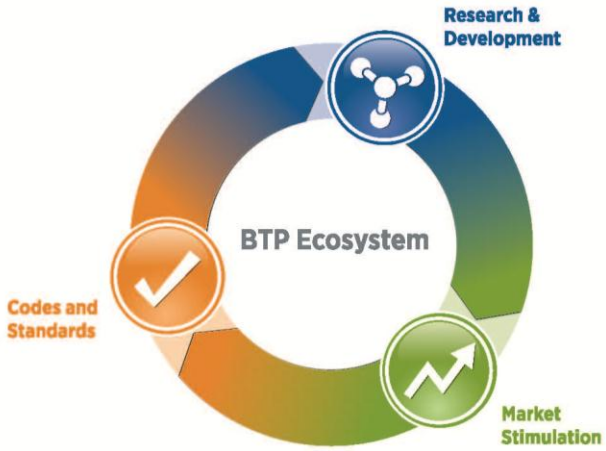
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

# Building Technologies Office— Strategy & Programs

BTO's **mission** is to develop, demonstrate, and accelerate the adoption of technologies, techniques, tools and services that are affordable and enable high performing, energy efficient residential and commercial buildings




## Codes & Standards

- Provide input for model building codes; provide support to for code adoption and compliance
- Establish energy use standards for appliances and equipment through a transparent public process.

## Emerging Technologies (ET)

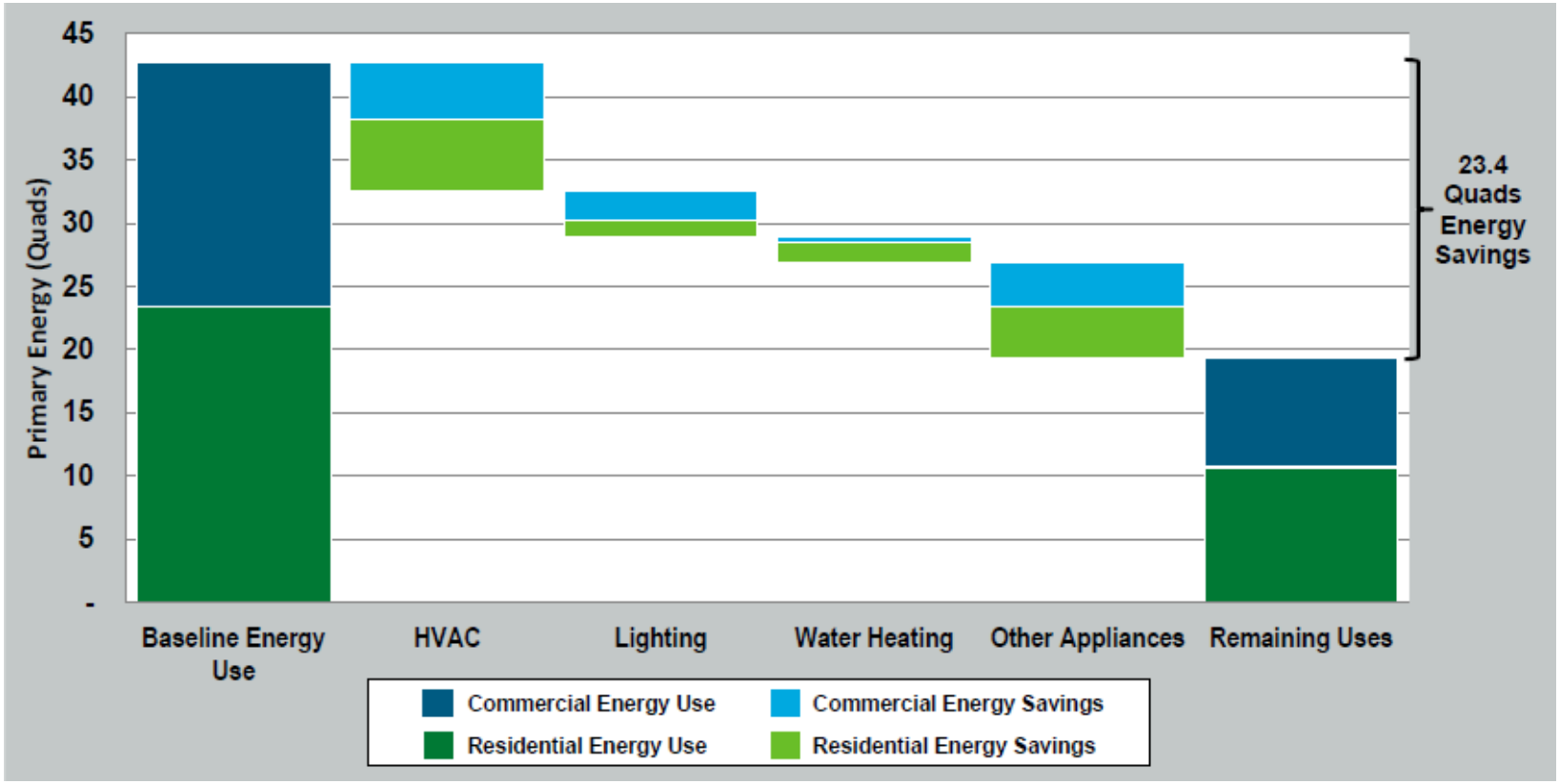
- Develop cost-effective, high-impact building technologies: Lighting, HVAC, Windows & Envelope, Sensors & Controls, Appliances & Equipment

## Commercial Buildings Integration (CBI)
## Residential Buildings Integration (RBI)

- Partner with private sector to demonstrate technologies and solutions
- Demonstrate market relevant strategies that enable 20-50% energy savings
- Accelerate market adoption

# Anticipated Building Technology R&D Progress

## Overall BTO Goal: 50% reduction in building energy use by year 2030



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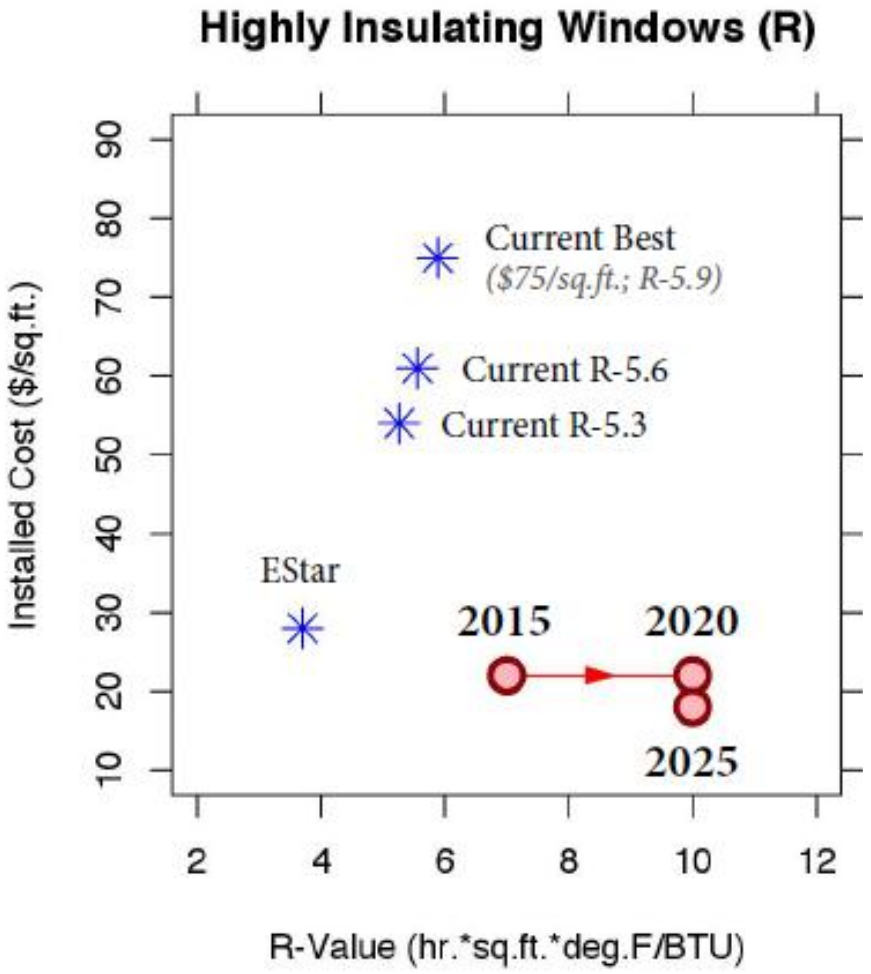
# Primary Energy Consumption in Building Envelope (2010)

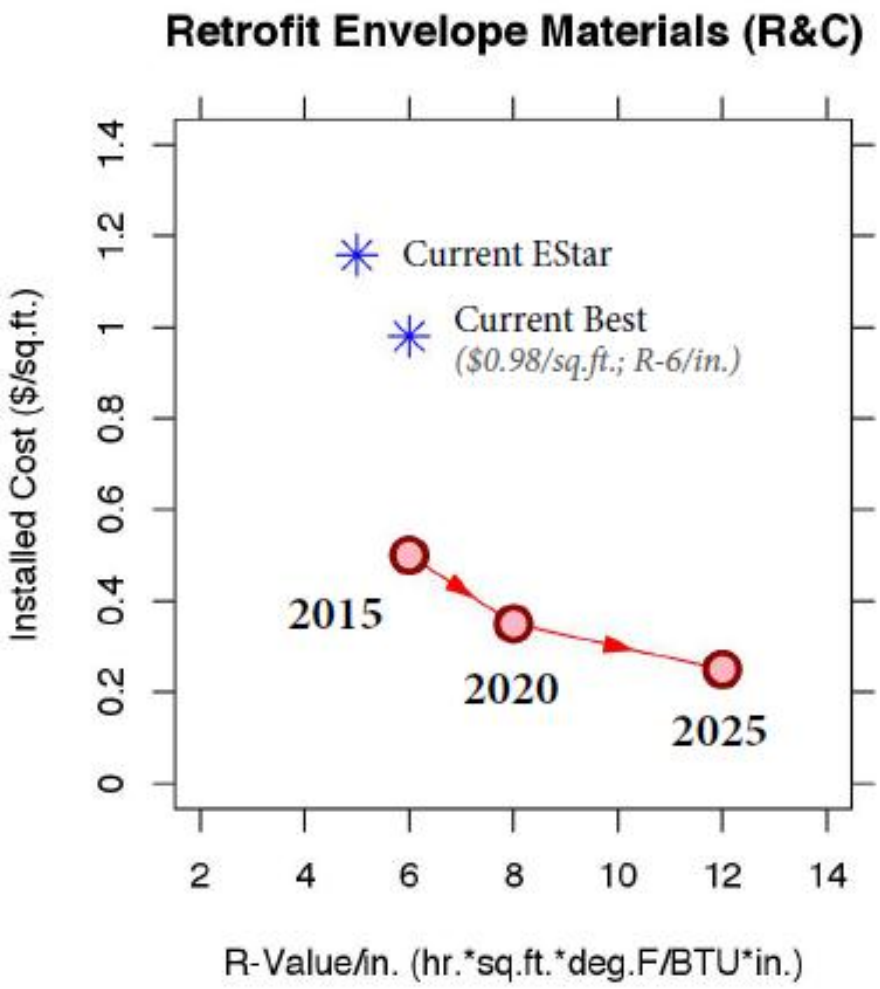
**23% of the total Energy Savings is projected to be from windows and Building Envelopes which is 5.3 quads**

- **Envelope : 4.2 Quads**
- **Windows : 1.1 Quads**

| Building Component | Residential (quads) | | Commercial (quads) | |
|---|---|---|---|---|
| | Heating | Cooling | Heating | Cooling |
| Roofs | 1.00 | 0.49 | 0.88 | 0.05 |
| Walls | 1.54 | 0.34 | 1.48 | -0.03 |
| Foundation | 1.17 | -0.22 | 0.79 | -0.21 |
| Infiltration | 2.26 | 0.59 | 1.29 | -0.15 |
| Window (conduction) | 2.06 | 0.03 | 1.60 | -0.30 |
| Window (solar heat gain) | -0.66 | 1.14 | -0.97 | 1.38 |

# Some Cost and Performance Targets at 2025



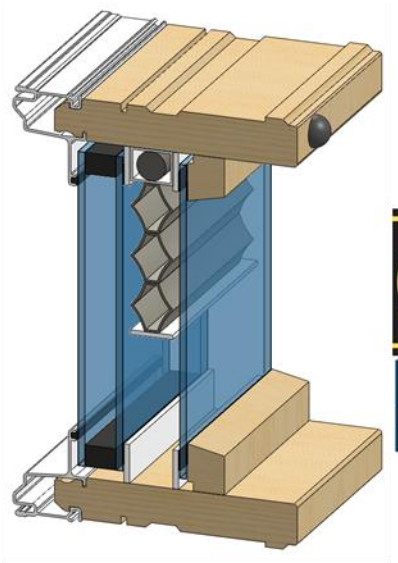



# Windows R&D Priorities

| Technology | 2025 Cost Target | 2025 Performance Target |
|---|---|---|
| **Highest Priority R&D Areas** | | |
| R-10 Windows | Projected installed cost premium over 2010 base:<br>Residential: $\leq$ \$6ft$^2$<br>Commercial: $\leq$ \$3ft$^2$ | Residential : R-10; $V_T > 0.6$<br>Commercial: R-7; $V_T > 0.4$<br>Comparable weight and thickness to currently installed base |
| **High Priority R&D Area** | | |
| Dynamic Windows | Projected installed cost premium compared to standard IGU:<br>Windows: <\$8/ft$^2$<br>Window Films: <\$2/ft$^2$ | • $\Delta$SHGC >0.4<br>• $V_T$ bleached state > 0.6 (residential) and > 0.4 (Commercial) |
| Visible light redirection (Commercial) | Projected installed cost premium <\$5/ft$^2$ over standard window or blind installation including the cost of sensor and lighting | Reduce lighting energy use by 50% for a 50-ft floor plate |

# Highlight of Current Windows R&D Projects

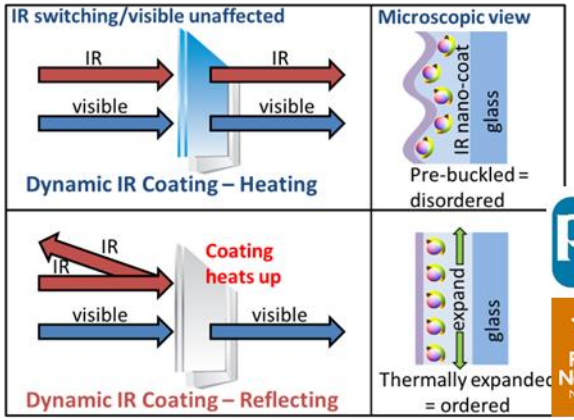
- Dynamic windows
- Smart shadings
- Highly insulated windows
- Windows attachment



Pella

BERKELEY LAB

NREL
NATIONAL RENEWABLE ENERGY LABORATORY




Attachments Energy Rating Council
AERC
CERTIFIED FOR WINDOWS AND DOORS

PPG

Pacific Northwest NATIONAL LABORATORY

Bright Mode

Cool Mode



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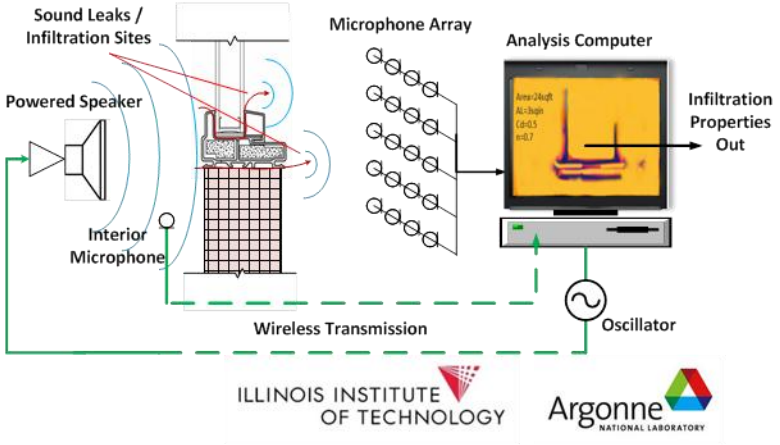
# Building Envelope R&D Priorities

| Technology | 2025 Cost Target | 2025 Performance Target |
|---|---|---|
| **Highest Priority R&D Areas** | | |
| Building envelope material | <$0.25 /ft$^2$ projected installed cost premium, including material and labor | • R-12/inch thermal insulation material for retrofitting walls<br>• Meets durability requirements<br>• Minimizes occupant disturbance |
| Air-sealing technologies | <$.05/ft$^2$ finished floor projected installed cost | A system capable of concurrently regulating heat, air and moisture flow to achieve:<br>• Residential < 1 ACH50<br>• Commercial: <0.25 CFM75 / ft$^2$ (5-sided envelope) |
| **High Priority R&D Area** | | |
| Highly insulating Roofs | Projected installed cost increase <$1/ft$^2$ over standard roof costs | Energy use reduction equivalent to doubling current ASHRAE R-values |

# Highlight of Current Building Envelope R&D Projects

- Cool roof
- Highly insulated envelope
- Air sealing





PS-clay composite foam board made in July factory trial. CO2/Ethanol blowing agent





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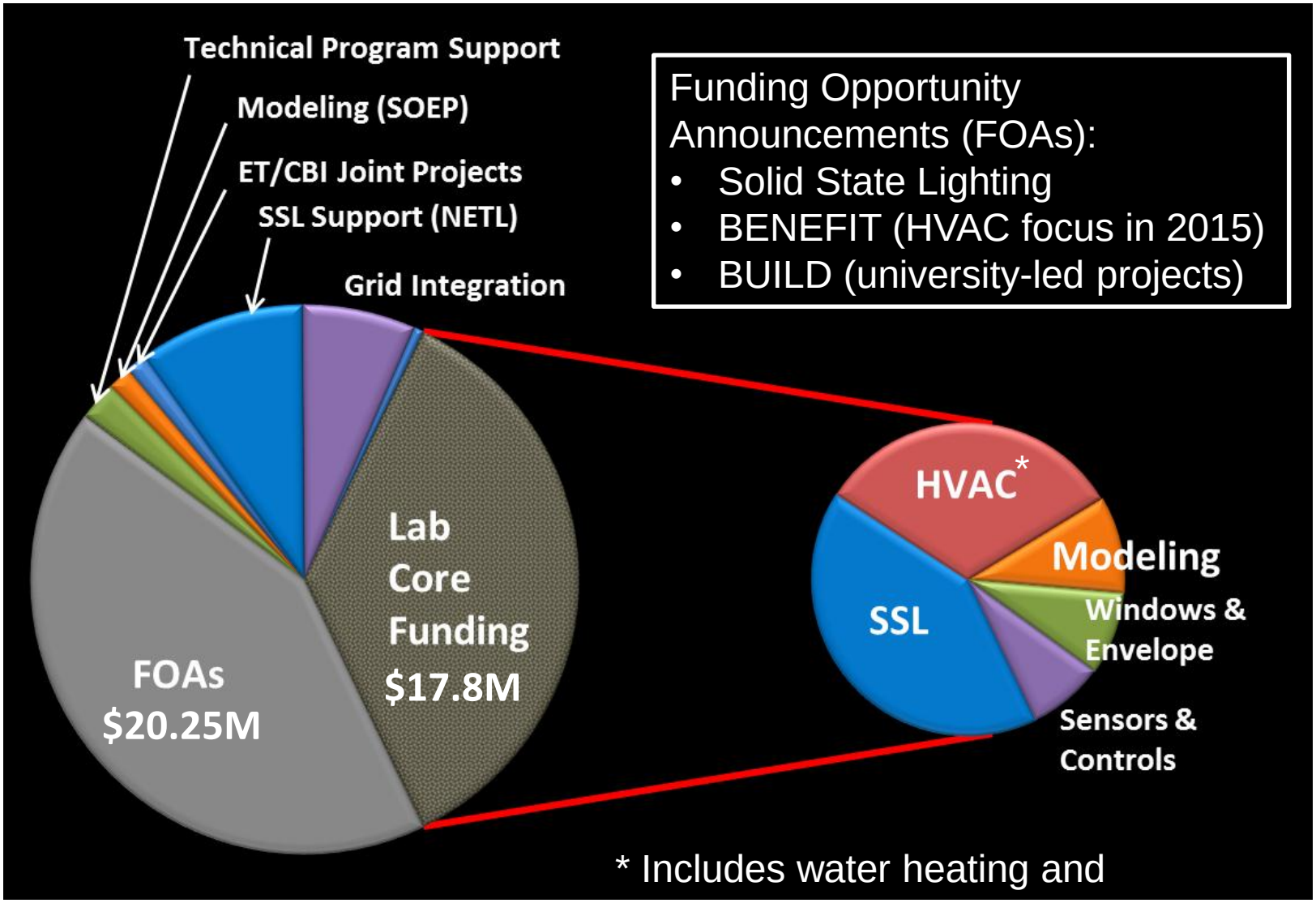
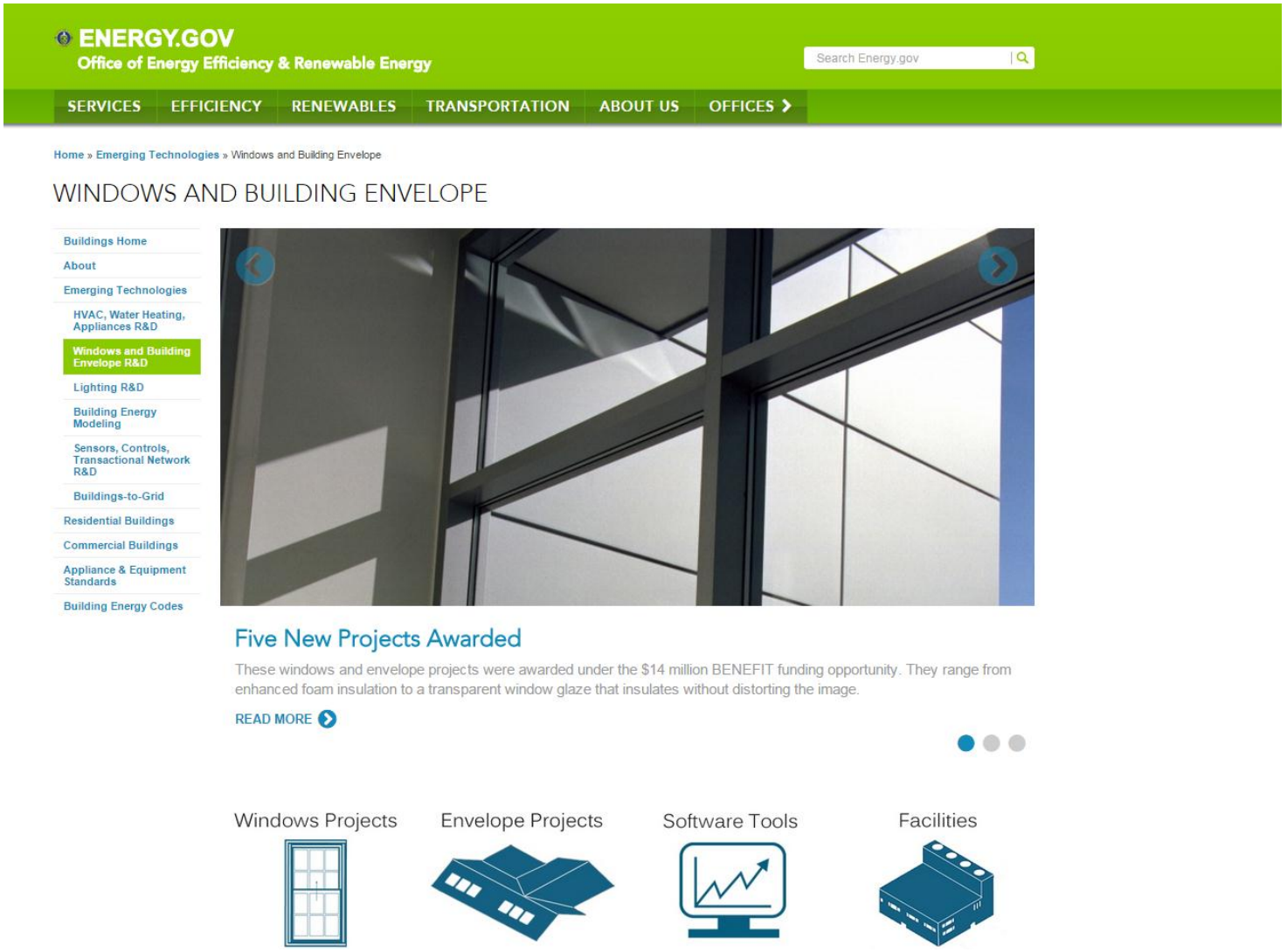
# FY15 Emerging Technologies Funding Distribution



# What Is the Next Step

- Revisit Windows and Building Envelope goals
  - MYPP (2015)
  - Roadmap (2016)
- Pursue the path to achieve the targets
  - FOA, CRADA, SBIR
  - Core project with labs
- Promote market adoption of highly energy efficient technologies
- Think out of the box
  - Active envelops instead of Passive
  - Seamless perimeter instead of windows and envelope
  - Smart windows and shadings

# Where to Find More Information




http://energy.gov/eere/buildings/windows-and-building-envelope