#### **Making Buildings More Energy Efficient**

The Building Technologies Office's FY 2016 Budget Request – March 12, 2015



#### **Energy Efficiency &** ENERGY **Renewable Energy**

**U.S. DEPARTMENT OF** 

**Roland Risser Director, Building Technologies Office** 

#### **Office of Energy Efficiency and Renewable Energy**

#### **EERE Mission:** To create and sustain American leadership in the global transition to a clean energy economy

- High-Impact <u>Research</u>, <u>Development</u>, and <u>Demonstration</u> to Make Clean Energy as Affordable and Convenient as Traditional Forms of Energy
- Breaking Down Barriers to Market Entry



Reduce building energy use by 50% compared to the

"business-as-usual" energy consumption projected by the 2010 Annual Energy Outlook



#### **Delivering Energy-Efficient Solutions**









#### **Building Technologies – FY2016 Funding Opportunity Announcements**

- Advanced Building Energy Materials FOA (\$30M)
- Buildings Energy Efficiency Frontier and Innovation Technologies (BENEFIT) FOA (\$23M)
- Solid-State Lighting FOA (\$12.5M)
- Commercial Buildings FOA Programs and Technology Solutions for Small and Medium-Sized Buildings (\$10M)
- Building America FOA Residential Technology Solutions (\$15M)
- Commercial Energy Codes FOA (\$10M)



# Research and O Repoper Drive Innovation



#### **BENEFIT FOA FY16: Technologies and Energy Savings Targets**

riority Technology reas	Energy Savings Potential by 2040 (Quads/Year)	Savings by 2040 equivalent to annual GHG emissi <b>178,000,000 cars</b>
ater Heating	0.8	<pre>     = 1,000,000 cars     </pre>
ontrols	1.1	
Air-Sealing	1.6	
Daylighting	0.17	
Commercial Roofs	0.12	
ynamic Windows nd Window Films	0.4	U.S. DEPARTMENT OF

**Case Study: Energy Efficient Supermarket Refrigeration with low HFCs** 

#### **Business**

Hillphoenix (Conyers, GA)

#### Lab Partner

Oak Ridge National Lab (Oak Ridge, TN)

#### **Commercialized Technology**

"Advansor" Supermarket Refrigeration System

#### **Major Industry Breakthrough**

Refrigeration System that uses 75% less hydrofluorocarbons (HFCs), lowers energy consumption by 25%



A DOVER ) COMPANY

Hilphoenix

Advansor System is tested in the ORNL research & integration facility.



**Case Study: Liquid Sprayable Sealant Lowers Heating Load** 

Business: Dow Chemical (Midland, MI)

Lab Partner: Oak Ridge National Lab

#### **Commercialized Technology:**

"LIQUIDARMOR" Sprayable Flashing and Sealant

#### **Major Industry Breakthrough:**

75% reduction in the amount of time it takes to seal gaps around penetrations, while improving seal quality and lowering heating load by 10 – 35%





Liquid Armor sealant comes in residential and commercial formulations. It adheres to most construction materials.



#### FY16 FOA: Advanced Building Materials Manufacturing R&D

## **Non-Vapor Compression**

- **Goal:** Improved *materials* for non-vapor compression refrigeration and HVAC systems
- Impact: Major energy savings and zero GHG emissions



## **Building Envelope**

- **Goal:** Control the flow of heat, light, and moisture through the building envelope *a transformative shift*
- Impact: Major energy savings and increased comfort





## **Business**

Philips Lumileds (San Jose, CA)

# PHILIPS

## **Commercialized Product**

LED LUXEON TX package

## Major Industry Breakthrough

Lowered manufacturing costs to record 150 lumens per dollar in 2014, while improving color





#### LED Market Penetration Grows 90x from 2008 - 2013



U.S. LED lighting - A-Type Lamp (replacement for the standard incandescent bulb) (\$/kilolumen)

U.S. LED lighting - A-Type Lamp (replacement for the standard incandescent bulb) (million installed lamps)



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CUMULATIVE LED LIGHTS INSTALLED (MILLIONS)

#### Market growth far outpacing that of a typical household product



**Years Since Market Introduction** 



Solid-State Lighting FY 2016 Plans, FOA, and Cost Targets

#### Proposed FY 2016 Lighting R&D (\$21,000,000)

- Cost target for LEDs in FY 2016 is 160 lumens/\$
- FOA: Innovations in LED and OLED Core Technologies, Product Development, and Manufacturing



LED Bulb

### Major Difference in Lighting R&D (-\$4,800,000)

- LED deployment moved to the Commercial program
- Minimum efficiency standards moved to the Standards Program



Commercial OLED Offerings





## **Business**

Regency Centers (Santa Ana, CA)

## Initiative

The Lighting Energy Efficiency in Parking (LEEP) Campaign

## Major Industry Breakthrough

Energy savings slashed by **88%** after installing best in class LED fixtures equipped with a state-of-the-art wireless control system









### **Commercialized technology**

EnergyPlus and OpenStudio – open source modeling software

#### **Business adopters**

- Trane (Davidson, NC)
- Carrier (Farmington, CT)
- Autodesk (San Rafael, CA)
- Sefaira (New York, NY)

#### **Business applications**

- High-performance HVAC design
- Rapid energy modeling simulation in the cloud
- Architectural/engineering apps for early-stage design
- Tablet app for commercial building auditing



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lew Yo	k Office						🗑 Manage Team
3	Baseline Concept ABSIS ft <sup>2</sup> Office Weather location New York Oby Central Park, NY, US	HVAC System Type Four Pipe FCU	٥	Chiller Design Capacity 212.3 ton	Boller Design Capacity 216.0 MBh	Total Air Handling Capacity Needed 14314 cfm	Design Capadity for Heat Rejection 283.1 ton
HVAC System	Envelope Internal Condit	tions		Plant Sizing Peak	Loads		
				Expand All   Collapse All		Area weight	
				Expand All   Collapse	AE		Area weights
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Sefaira Systems application for early-stage HVAC design



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## 95% of floor space

Small-Medium Commercial Buildings are a hard to reach, but large market that needs energy efficiency solutions

## **National scale-up**

Demonstrate and nationally scale-up technology and market solutions into selfsustaining programs

## **Build off previous success**

Scale up solutions from previous FY13 FOA, like packages of technologies that work together effectively for specific business types (e.g. supermarkets)









#### **Business**

Southern Energy Homes (Addison, AL)

#### Initiative

**Building America** 

#### **Major Industry Breakthrough**

Attic insulation technique using densely packed blown fiberglass

#### **Market Impact**

With widespread adoption, this attic insulation method could save homeowners over **6 trillion Btus by 2030**, equal to **\$190 million** in energy bill savings





An employee at Southern Energy Homes uses dense pack blown fiberglass insulation





#### FY16 FOA: Reduce Risk for Homebuilders through Building America



## Goal

Reduce the risk to build highly energy efficient homes

## **Plan of Action**

Develop and demonstrate technology solutions that target the three highest priority market challenges:

- 1. Moisture Management for High Performance Envelopes
- 2. Optimized Low-Load Comfort Solutions
- 3. Improved Indoor Air Quality Solutions



## Staged Upgrade Goal:

Reach more U.S. households by lower cost, staged retrofits

## Staged Upgrade Impact:

Significantly larger national energy savings











## **60** covered product categories

#### Consumer



**Commercial and Industrial** 



Lighting



Plumbing



## **90%** of residential

## **60%** of commercial

## **30%** of industrial



## **Standards since 2009**

#### 29

final rules for more than 30 products

#### \$480 billion

of energy bill savings for consumers by 2030 (projected)

#### 2.2 billion

metric tons of reduced CO<sub>2</sub> emissions by 2030 (projected)



#### **Equivalent to 250 Billion**

gallons of gasoline *not* consumed <sup>25</sup>

## 2016 Goal

Reduce CO<sub>2</sub> emissions by 3 billion metric tons cumulatively by 2030 through efficiency standards set between 2009 and 2016



## **Residential Codes (Ongoing FOA)**

 Projects focused on residential energy code compliance rates and best practices for measuring results

## **Commercial Codes (FY16 FOA)**

- Currently no quantitative methods that analyze energy savings impact of commercial building codes
- Goal: Develop reliable, repeatable methodologies that can be applied by different states to objectively assess the cost and benefits of increasing code compliance



#### **BTO Ecosystem in Action: The Journey of LED Technology**

# Research & Development



Solid-State Lighting Program drives down cost and increases efficacy of LEDs Market Stimulation



Lighting Energy Efficiency in Parking (LEEP) Campaign increases market uptake of LEDs

2006 - present

2013 - 2015

2014 - ??

**Standards** 

& Codes

Proposed

savings

amendment to

ASHRAE 90.1

code offers 30%

energy efficiency



#### The need for

# Smart Buildings

#### **Grid Modernization - Scaling Transaction-Based Controls**

#### **Mission for Next-Generation Buildings**

- Operating at optimum energy efficiency over their lifetimes; interact with electric grid
- Real-time measurement and verification of building systems
- Lower overall building operating costs and higher asset valuation
- Cyber security decisions are clear

#### Vision

- Develop and deploy cost effective solutions for industry to manage energy consuming assets more easily and efficiently
- Utilize solutions to enable optimum building energy efficiency and performance, on-site renewable generation, and standardized financial transactions

Research, Development and Deployment



Improve Operational Efficiency of Building Systems



Manage End-Use Loads



Help Integration of Renewables



Accommodate Millions of Electric Vehicles U.S. DEPARTMENT OF ENERGY



Help to Maintain Reliability Energy Efficiency & Renewable Energy

#### FY 2016 Budget Summary Table

Dollars in Thousands	FY 2014 Enacted	FY 2015 Enacted	FY 2016 Request	FY 2016 vs FY 2015
Transportation	614,955	602,000	793,000	+191,000
- Vehicle Technologies	289,737	280,000	444,000	+164,000
- Bioenergy Technologies	232,290	225,000	246,000	+21,000
- Hydrogen and Fuel Cell Technologies	92,928	97,000	103,000	+6,000
Renewable Electricity	449,524	456,000	645,200	+189,200
- Solar Energy	257,058	233,000	336,700	+103,700
- Wind Energy	88,126	107,000	145,500	+38,500
- Water Power	58,565	61,000	67,000	+6,000
- Geothermal Technologies	45,775	55,000	96,000	+41,000
End-Use Efficiency	617,449	642,000	1,029,587	+387,587
- Advanced Manufacturing	180,471	200,000	404,000	+204,000
- Building Technologies	177,868	172,000	264,000	+92,000
- Federal Energy Management Program	28,248	27,000	43,088	+16,088
- Weatherization and Intergovernmental Activities	230,862	243,000	318,499	+75,499
Corporate Support Programs	231,513	237,000	255,200	+18,200
Subtotal, Energy Efficiency and Renewable Energy	1,913,441	1,937,000	2,722,987	+785,987
- Use of Prior Year Balances	-2,382	0	0	0
- Rescission of Prior Year Balances	-10,418	-22,805	0	NA
Total, Energy Efficiency and Renewable Energy	1,900,641	1,914,195	2,722,987	+808,792
30		ENE	RGY Rene	wable Energy

## THANK YOU

#### Learn more about our programs at Buildings.Energy.Gov

#### More Questions? Email Roland.Risser@ee.doe.gov

