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

Emerging Technologies (ET)

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Emerging Technologies (ET) Mission

The Emerging Technologies (ET) Program's Mission:

Supports applied research to accelerate the development and initial commercialization of technologies and systems capable of substantially reducing primary energy use through improved:

- Solid-State Lighting (**Jim Brodrick**)
- HVAC, Water Heating and Appliances (**Tony Bouza**)
- Windows & Envelope (**Karma Sawyer**)
- Sensors and Controls (**Joe Hagerman**)
- Building Energy Modeling (**Amir Roth**)

Tech-to-Market & SBIR programs are managed by **Bahman Habibzadeh**.
George Hernandez serves as the Chief Engineer.
Leon Fabick and **Jim Payne** are Technical Project Officers based in Golden, CO.

ET Mid-term and Long-term Goals

Goals: Emerging Technologies	Mid term (2020)	Long term (2030)	Potential Energy Savings in 2030 (TBTU Saved)
Lighting	33%	65%	4,318
HVAC	12%	24%	2,934
Water Heating	19%	37%	1,484
Appliances	14%	29%	2,571
Envelope (Opaque)	12%	25%	3,048
Windows	4%	9%	1,102
Sensors and Controls	9%	18%	2,214

Goals: Emerging Technologies	Mid term (2020)
Building Energy Modeling	Double gross square footage designed with the help of building energy models.

The BTO Prioritization Tool (P-tool) was used to generate these energy savings potential numbers which assume maximum adoption potential.

ET Barriers & Strategies

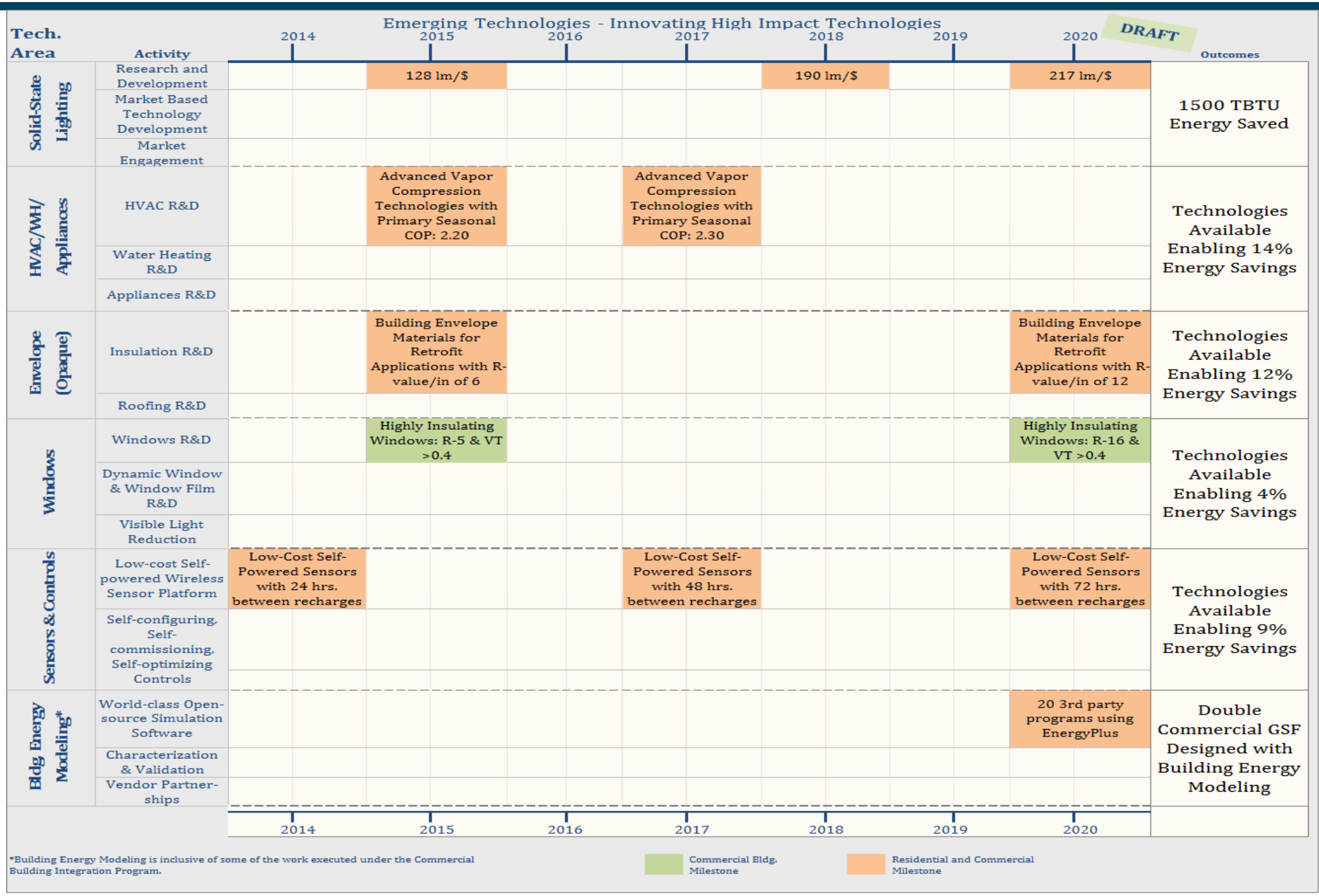
Key Barriers

- High cost or limited performance of commercially available technologies.
- Inadequately funded private research.
- Lack of efficiency test protocols or reliable information on performance of new technologies.
- Market barriers to introduction of new technologies.

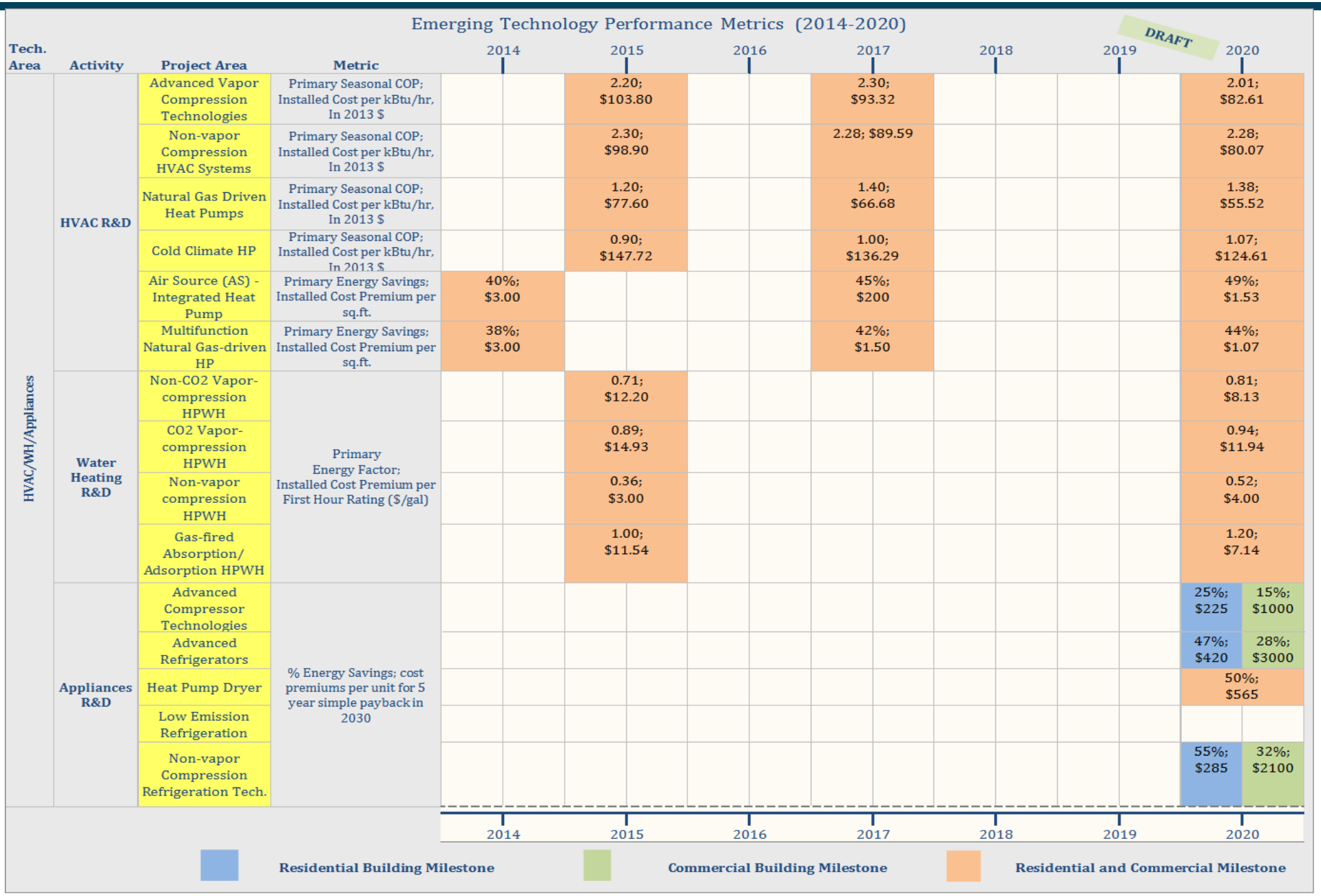
Strategies

- Engage industry stakeholders in sector and technology analyses to select cost and performance targets and identify emerging opportunities.
- Fund competitively selected research and development efforts to achieve key targets of technology roadmaps/MYPPs and fund "off roadmap" technologies & approaches.
- Dedicated support to develop design tools and standardized test methods, and to support technology commercialization.
- Competitively selected and merit reviewed research to fill gaps in MYPP and to support early stage, exploratory R&D.

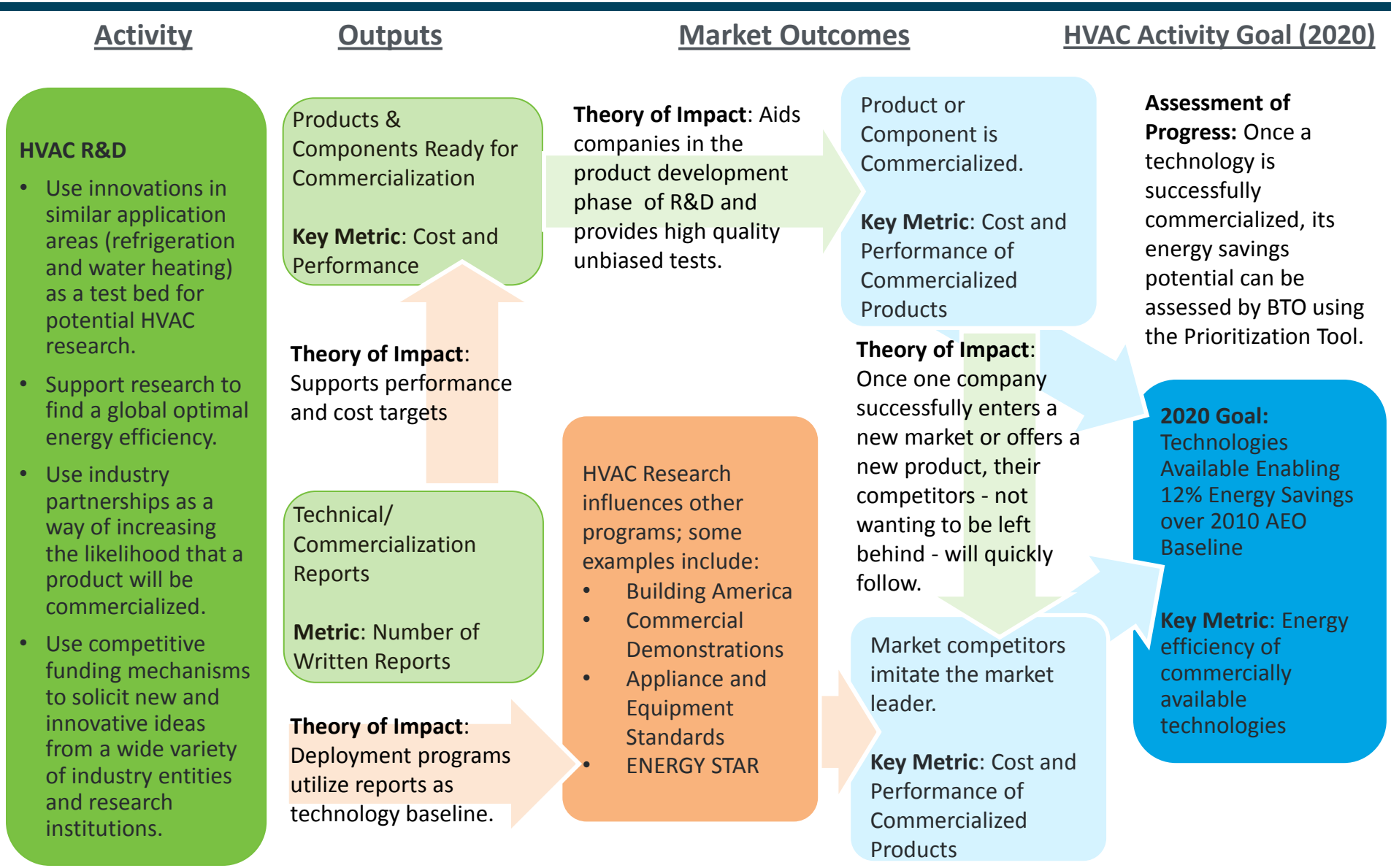
ET Multi-Year Program Plan: Representative Performance Targets



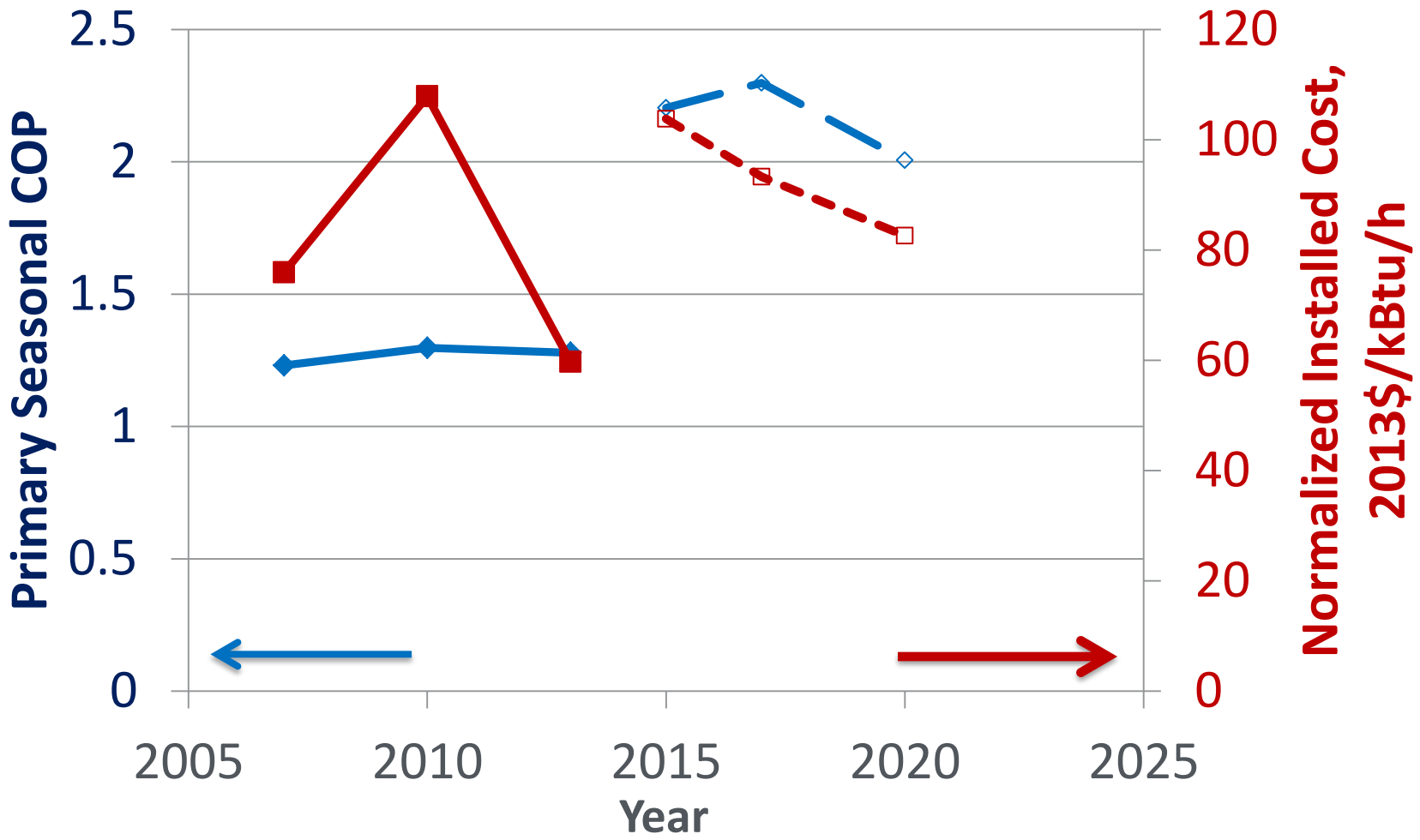
ET: HVAC R&D


Emerging Technology Performance Metrics (2014-2020)
DRAFT
Tech. Area
Activity
Project Area
Metric
2014
2015
2016
2017
2018
2019
2020
HVAC/WH/Appliances
HVAC R&D
Advanced Vapor Compression Technologies
Primary Seasonal COP; Installed Cost per kBtu/hr, In 2013 $
2.20; $103.80
2.30; $93.32
2.01; $82.61
Non-vapor Compression HVAC Systems
Primary Seasonal COP; Installed Cost per kBtu/hr, In 2013 $
2.30; $98.90
2.28; $89.59
2.28; $80.07
Natural Gas Driven Heat Pumps
Primary Seasonal COP; Installed Cost per kBtu/hr, In 2013 $
1.20; $77.60
1.40; $66.68
1.38; $55.52
Cold Climate HP
Primary Seasonal COP; Installed Cost per kBtu/hr, In 2013 $
0.90; $147.72
1.00; $136.29
1.07; $124.61
Air Source (AS) - Integrated Heat Pump
Primary Energy Savings; Installed Cost Premium per sq.ft.
40%; $3.00
45%; $200
49%; $1.53
Multifunction Natural Gas-driven HP
Primary Energy Savings; Installed Cost Premium per sq.ft.
38%; $3.00
42%; $1.50
44%; $1.07
Water Heating R&D
Non-CO2 Vapor-compression HPWH
Primary Energy Factor; Installed Cost Premium per First Hour Rating ($/gal)
0.71; $12.20
0.81; $8.13
CO2 Vapor-compression HPWH
0.89; $14.93
0.94; $11.94
Non-vapor compression HPWH
0.36; $3.00
0.52; $4.00
Gas-fired Absorption/ Adsorption HPWH
1.00; $11.54
1.20; $7.14
Appliances R&D
Advanced Compressor Technologies
% Energy Savings; cost premiums per unit for 5 year simple payback in 2030
25%; $225
15%; $1000
Advanced Refrigerators
47%; $420
28%; $3000
Heat Pump Dryer
50%; $565
Low Emission Refrigeration
Non-vapor Compression Refrigeration Tech.
55%; $285
32%; $2100
2014
2015
2016
2017
2018
2019
2020
Residential Building Milestone
Commercial Building Milestone
Residential and Commercial Milestone

HVAC R&D: Outputs, Outcomes and Metrics

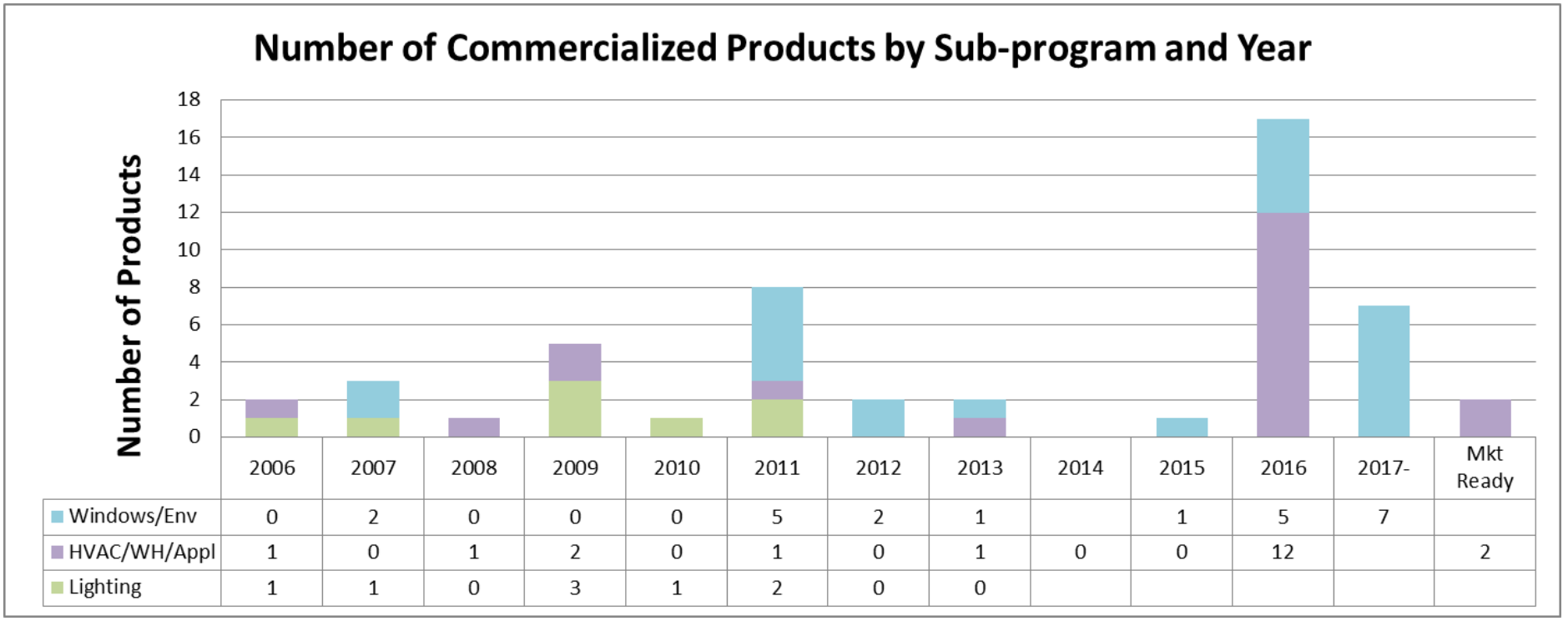


Example: Tracking Progress on Advanced Vapor Compression Technologies



- Solid symbols are typical values for residential central air conditioning units; open symbols are targets.
- The additional cost associated with historical and projected technologies is due to up front incremental cost of significant efficiency improvements. This cost would be expected to decrease over time as indicated by the graph.

ET: Commercialization Track Record



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017-	Mkt Ready
Windows/Env	0	2	0	0	0	5	2	1		1	5	7	
HVAC/WH/Appl	1	0	1	2	0	1	0	1	0	0	12		2
Lighting	1	1	0	3	1	2	0	0					

Historic Information on Product Commercialization from PNNL Technology Tracker, April 2012
"Commercialized" is defined as – available for purchase and has been sold to at least one party in the United States

Desired Outcomes from ET Projects:

- Commercialized, energy-efficient, cost-effective technologies
- Regular patents
- Refereed journal publications

ET Priorities for FY15 and Beyond

A number of funding mechanisms will be used:

Funding Opportunity Announcements:

- Topics formulated to achieve performance & cost targets in MYPP and roadmaps
- "Incubator" topics for early-stage, off-roadmap technologies & approaches

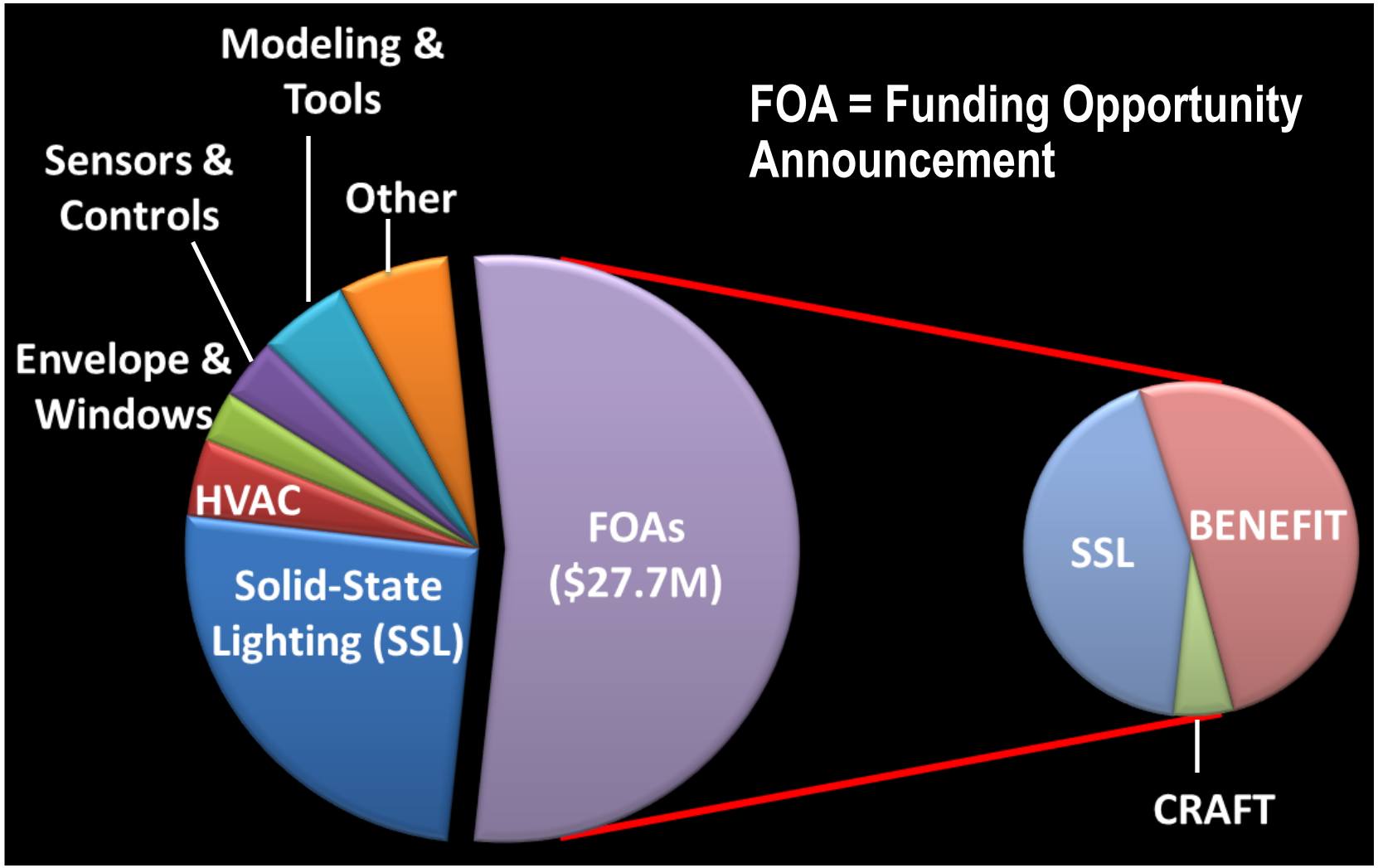
Lab "Enabling" Funding:

- Capitalize on lab capabilities
- Fill in gaps in the MYPP
- Provide facilities & expertise to industry, e.g., to overcome the "valley of death" to achieve successful commercialization
- Develop and maintain design tools
- Develop standard test methods for non-covered products
- Conduct early-stage R&D

Lab Calls (if funding available):

- Conduct R&D on solicited and unsolicited topics
- Conduct scoping studies and provide analytical assistance

FY14 Funding for BTO Emerging Technologies (ET)



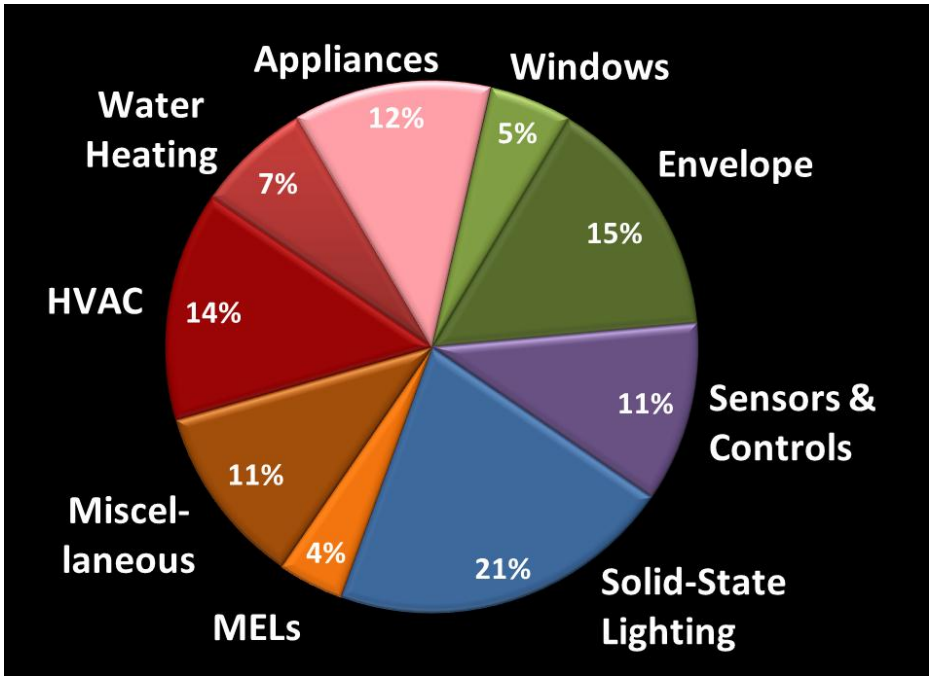
***ET FY14 Budget: $51.9M**

BENEFIT = Building Energy Efficiency Frontiers and Incubator Technologies

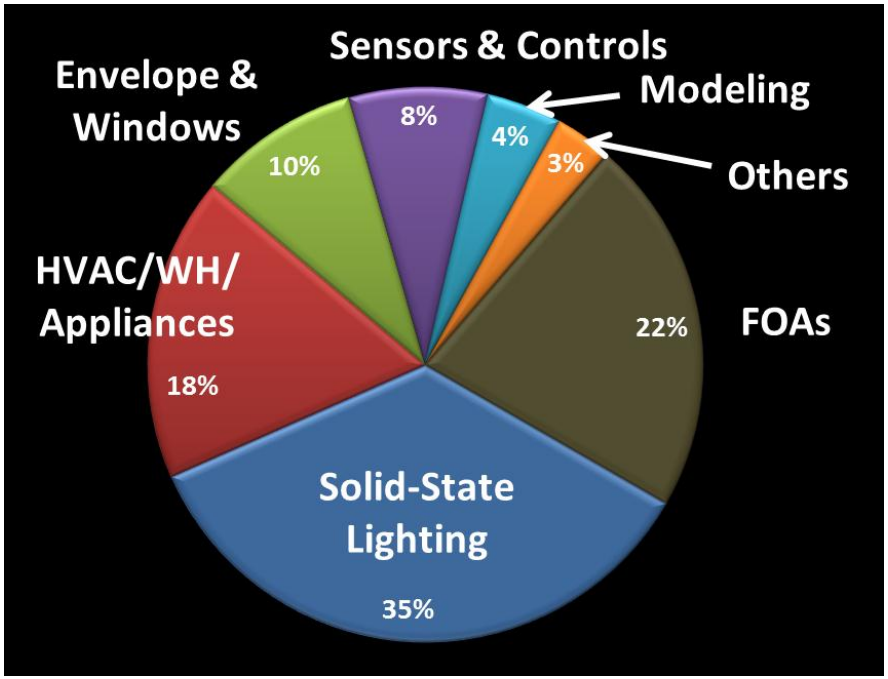
CRAFT = Certification and Rating of Attachments for Fenestration Technologies

ET Funding vs. Projected 2030 Primary Energy Savings

2030 ET-Enabled Primary Energy Savings



All ET Funding (FY14 + Carry-Over)



Future funding priorities will try to balance the portfolio to reflect the energy savings opportunities.

BTO Emerging Technologies

CREATING THE NEXT GENERATION OF ENERGY EFFICIENT TECHNOLOGY

- Buildings Home
- About
- Emerging Technologies
  - Appliances Research
  - Building Envelope Research
  - Windows, Skylights, & Doors Research
  - Space Heating & Cooling Research
  - Water Heating Research
  - Lighting Research
  - Sensors & Controls Research
  - Building Energy Modeling
  - Max Tech & Beyond Design Competition
  - Buildings to Grid Integration
  - Codes & Standards
- Residential Buildings
- Commercial Buildings
- Appliance & Equipment Standards
- Building Energy Codes

Advancing the Next Generation of Windows and Building Envelope

A new roadmap presents strategies for overcoming technical and market challenges.

READ MORE

The Emerging Technologies team partners with national laboratories, industry, and universities to advance research, development, and commercialization of **energy efficient and cost effective building technologies**. These partnerships help foster American ingenuity to develop cutting-edge technologies that have less than 5 years to market readiness, and contribute to the goal to reduce energy consumption by at least 50%.

RESEARCH AND DEVELOPMENT

- Improve the energy efficiency of **appliances**, including refrigerators, washers, and dryers.
- Reduce the amount of energy lost through the **building envelope** and **windows, skylights, and doors** by developing innovative materials and equipment.
- Increase the cost effectiveness and energy efficiency of building **space heating and cooling** and water heating technologies.
- Target improvements in the efficiency, performance, lifetime, and quality of light from both organic and inorganic light emitting diodes through **solid state lighting research**.
- Develop **sensors and controls** to help building operators better adapt energy use to

GET UPDATES

Sign up to receive news and events from BTO

FUNDING OPPORTUNITIES

- Request for Information: Commercial Building Technology Deployment
- Apply: Commercial Buildings FOA-0001084
  - Webinar: Commercial Buildings FOA
- Apply: BENEFIT FOA-0001027
  - Webinar #2: BENEFIT FOA
- View all EERE Funding Opportunities

UPCOMING WEBINARS

Advanced Energy Retrofit Guides: Healthcare Facilities

April 17, 1:00-2:30 PM EST

NEWS

APRIL 16, 2014

DOE Announces Webinars on Fuel Cells at NASCAR, an Advanced Energy Retrofit Guide for Healthcare Facilities, and More

APRIL 15, 2014

Top 4 Energy Department Inventions Saving You Energy & Money at Home

More

EVENTS

BTO Peer Review

April 22-24, 2014

[13] **http://energy.gov/eere/buildings/creating-next-generation-energy-efficient-technology**