U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Residential Buildings Integration (RBI) Peer Review – Partnership Session

Joan Glickman, Acting Program Manager

joan.glickman@ee.doe.gov

April 17, 2019

RBI Partnerships Track Agenda

8:30 am	**Introduction** [Joan Glickman]
8:45 am	**Existing Partnerships** (15 min presentation & 5 min Q&A for each)

- **Better Buildings Residential Network** [Jonathan Cohen]
- **Home Performance with ENERGY STAR** [Steve Dunn]
- **Home Energy Information Accelerator** [Maddy Salzman]
- **Zero Energy Ready Home** [Sam Rashkin]
- **Solar Decathlon** [Holly Carr]

10:30 am	**Break** [15 minutes ONLY]
10:45 am	**Rethinking Our Partnership Strategy** [Joan Glickman]
11:15 am	**Facilitated Discussion** [Walt Zalis]
12:30 pm	**Adjourn**

RBI's Partnerships & Outreach

- RBI partnership/outreach efforts under review today:
  - ✓ Home Performance with ENERGY STAR
  - ✓ Better Buildings Residential Network
  - ✓ Home Energy Information Accelerator*
  - ✓ Zero Energy Ready Home
  - ✓ Solar Decathlon
- Home Energy Score & Scoring Tool reviewed as part of the Data & Tools Track this week
- Better Buildings Residential Program Solution Center not being reviewed, due to time limits and likelihood of discontinuing support.

* NOTE: The Home Energy Information Accelerator is ending in FY19; however, RBI's work on real estate will continue to be supported.

RBI Overview

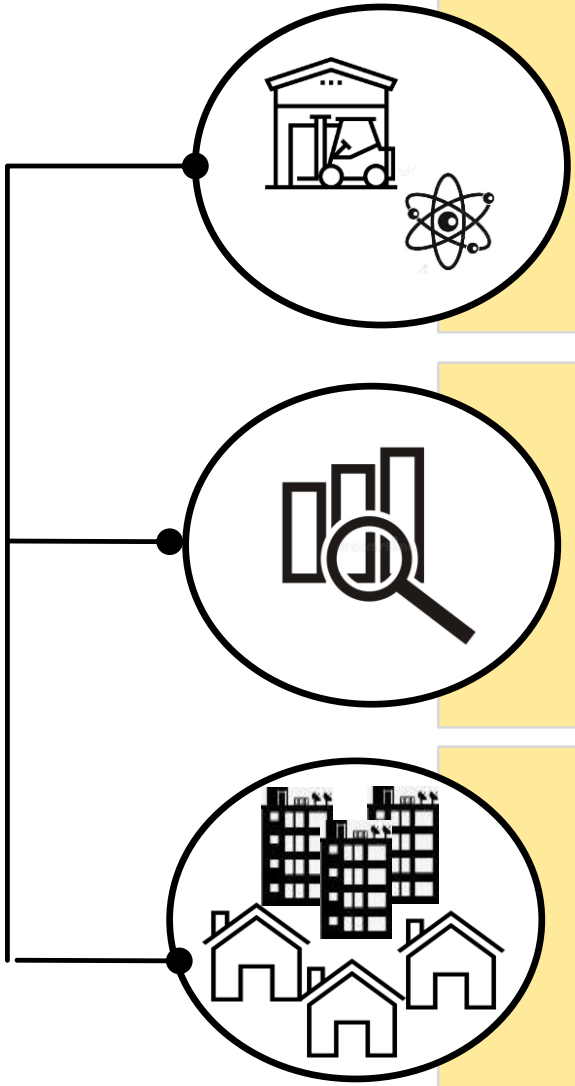
Vision

- An energy-efficient U.S. residential housing stock that uses substantially less non-renewable energy to meet heating, cooling, hot water and ancillary energy needs, while interacting optimally with the grid, local renewable energy sources, and plug-in electric vehicles.

Mission

- Improve, validate, and accelerate use of high-performing and grid-interactive energy efficiency systems in the residential sector.

RBI Key Areas of Work



RESEARCH & DEVELOPMENT

Improve and validate energy efficient envelope and HVAC technologies, including new methods to manufacture, assemble, install, and ensure the long-term energy performance of such systems.

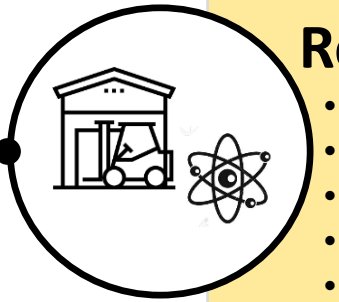
TOOLS

Develop analytical and data tools that improve the effectiveness of, and speed investment in, residential energy efficiency.

PARTNERSHIPS

Pilot test, evaluate, and advance solutions that deliver significant energy savings and are likely to scale given widespread consumer appeal.

RBI Key Projects



Research & Development

- Advanced Building Construction
- Grid Interactive Efficient Buildings
- Resiliency
- Smart Technologies, Automated Default Detection
- Healthy Homes

✓ Research has largely focused on new single family homes

Tools

- **Home Energy Scoring Tool**
- Single EnergyPLUS Calculator
- **Building America Solution Center/Technical Resources**
- **Data/Analytical Tools (e.g., REStock, UrbanOpt)**
- Workforce Training Resources

✓ Interested in strengthening our work on data & analytics

Partnerships

- **Home Performance with ENERGY STAR**
- **Home Energy Score**
- **Zero Energy Ready Homes**
- **Better Buildings Residential Network**
- **Solar Decathlon (Design & Build)**
- Challenges/Prizes
- Community-Based Technical Assistance

✓ Partnerships have largely focused on utilities and builders

Partnerships to Date

RBI Activity	Targeted Stakeholders and/or Partner Types											
	Building Industry	Utilities	Building Trades	State/Local Government	NGOs	Real Estate	Manufacturers	K-12 & Universities	Financing	Retailers	Homeowners	Other
Home Performance w/ES		**X**	**X**				x				x	
Home Energy Score		**X**	x	**X**		x			x		x	
Building America	**X**		x				x	x				x
Residential Network		**X**	x	**X**	**X**							x
Solar Decathlon								**X**			x	
Home Energy Information Accelerator					**X**	**X**			x			
Zero Energy Ready Homes	**X**		x			x					x	
Technical Resources	**X**		**X**							x	x	x
ABC	**X**		x	x	x	x	**X**	x	x			x

Partnership Review

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Zero Energy Ready Home

Building Technology Office – Residential Building Integration
Sam Rashkin, Chief Architect
samuel.rashkin@ee.doe.gov

Project Summary

Timeline:

Start date: 2013

Planned end date: 2025

Key Milestones

1. 2018: 3,000+ Certified Homes
2. 2018: 2X Growth for past 3 years
3. 2025: 50,000 Certified Homes (Hand-Off)

Budget: **Total Project $:**

- DOE: ~$1.65 Million Last 3 Years
- DOE FY19 Budget: $550K
- FY19 Cost Share: Industry stakeholders contribute training, meetings, events, travel

Key Partners:

Thrive Home Builders	Palo Duro Homes
Mandalay Homes	RESNET
Garbett Homes	EEBA
Insight Homes	EPA ENERGY STAR
Habitat for Humanity	EPA Indoor airPLUS

Project Outcome:

Validate proven innovations from DOE Building America Program that deliver 40-50% savings above 2009 IECC while managing related moisture, comfort, and IAQ risks. Ultimately, ZERH will transform the housing market to high-performance homes so energy efficient all or most annual energy consumption can be offset with renewable energy. This will result in substantial economic, health, security, and job benefits for communities and our nation.

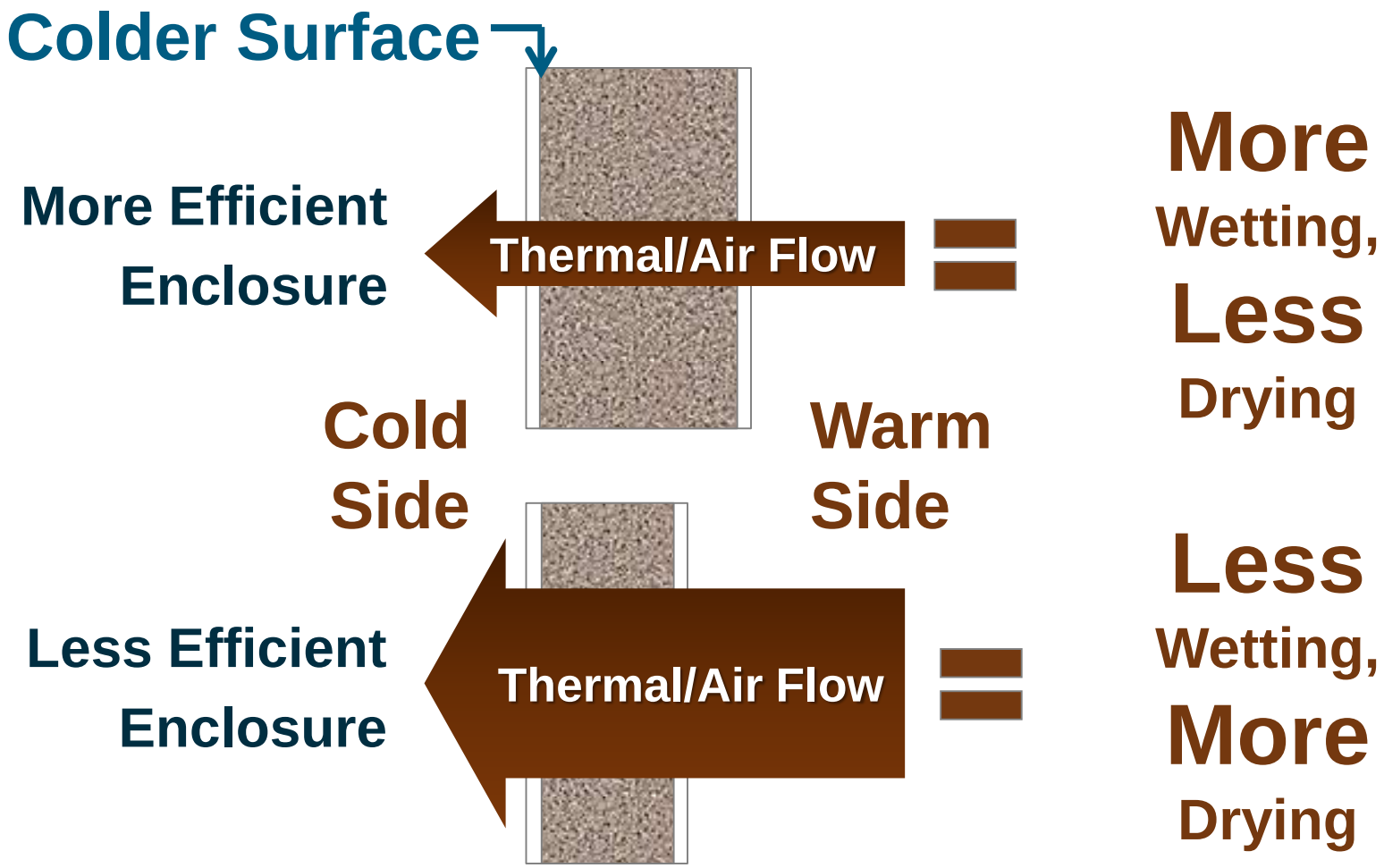
Team:

Newport Partners, LLC

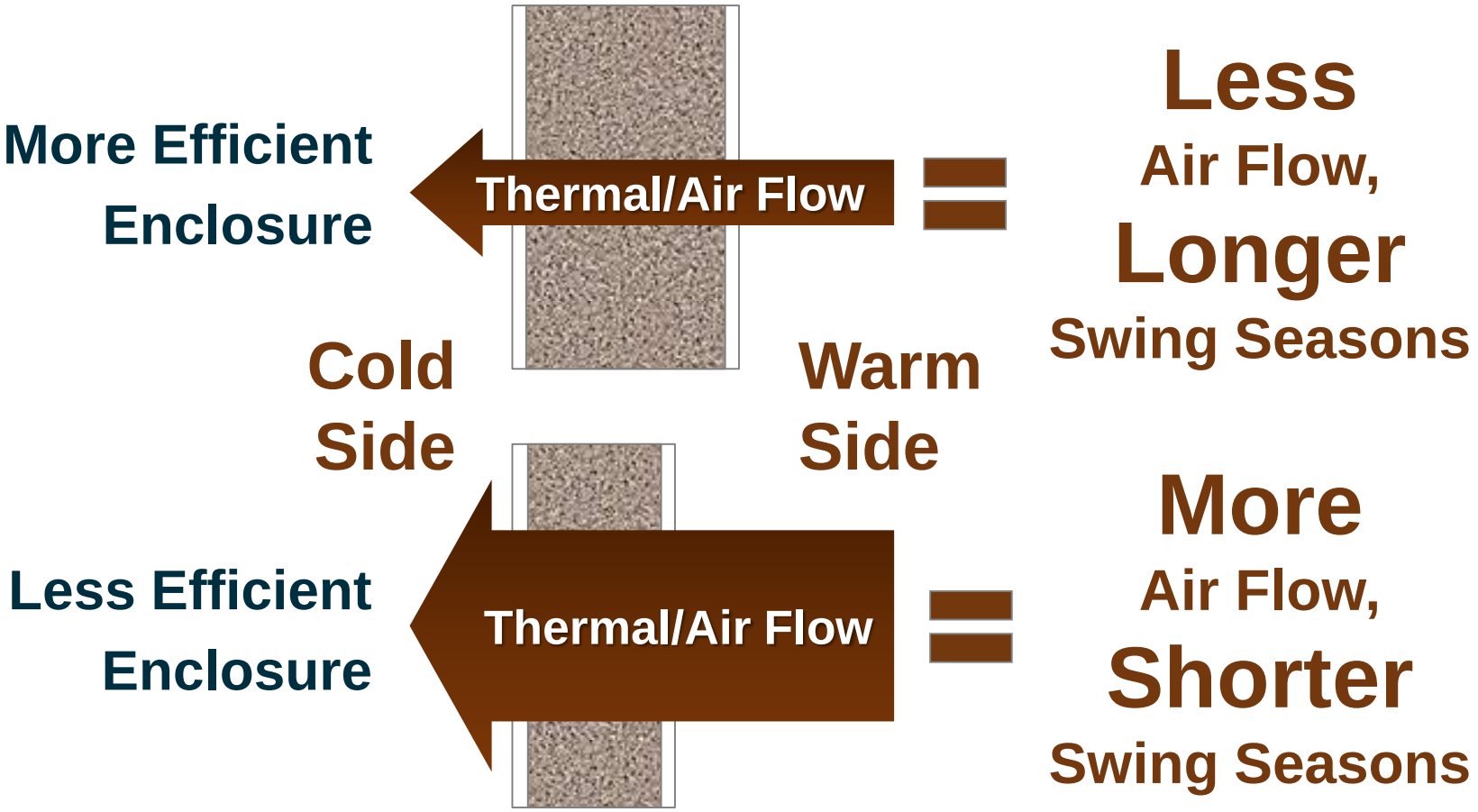
Challenge: Energy Efficiency Related Risks

1. Moisture
2. Comfort
3. Indoor Air Quality

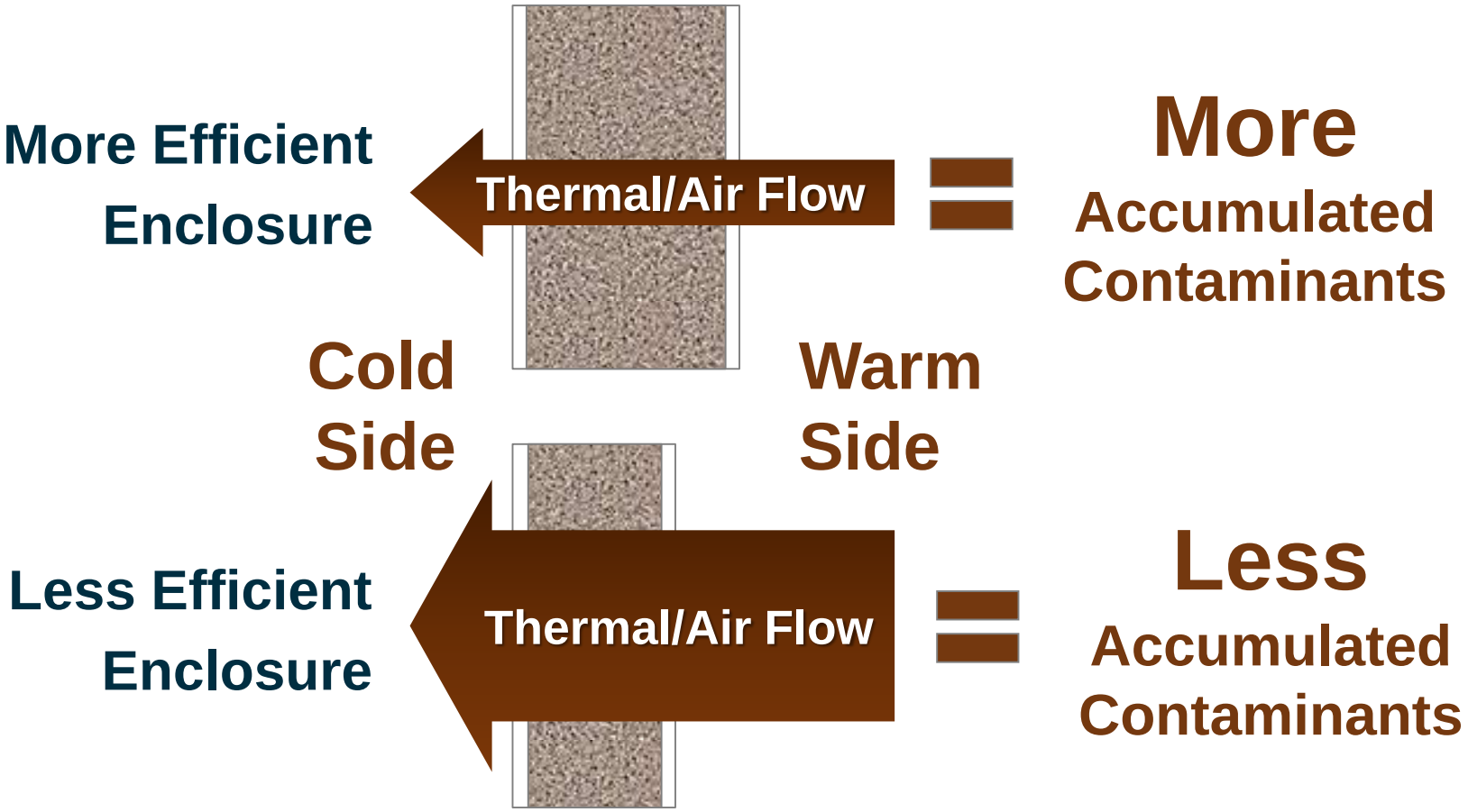
Challenge: Greater Moisture Risk



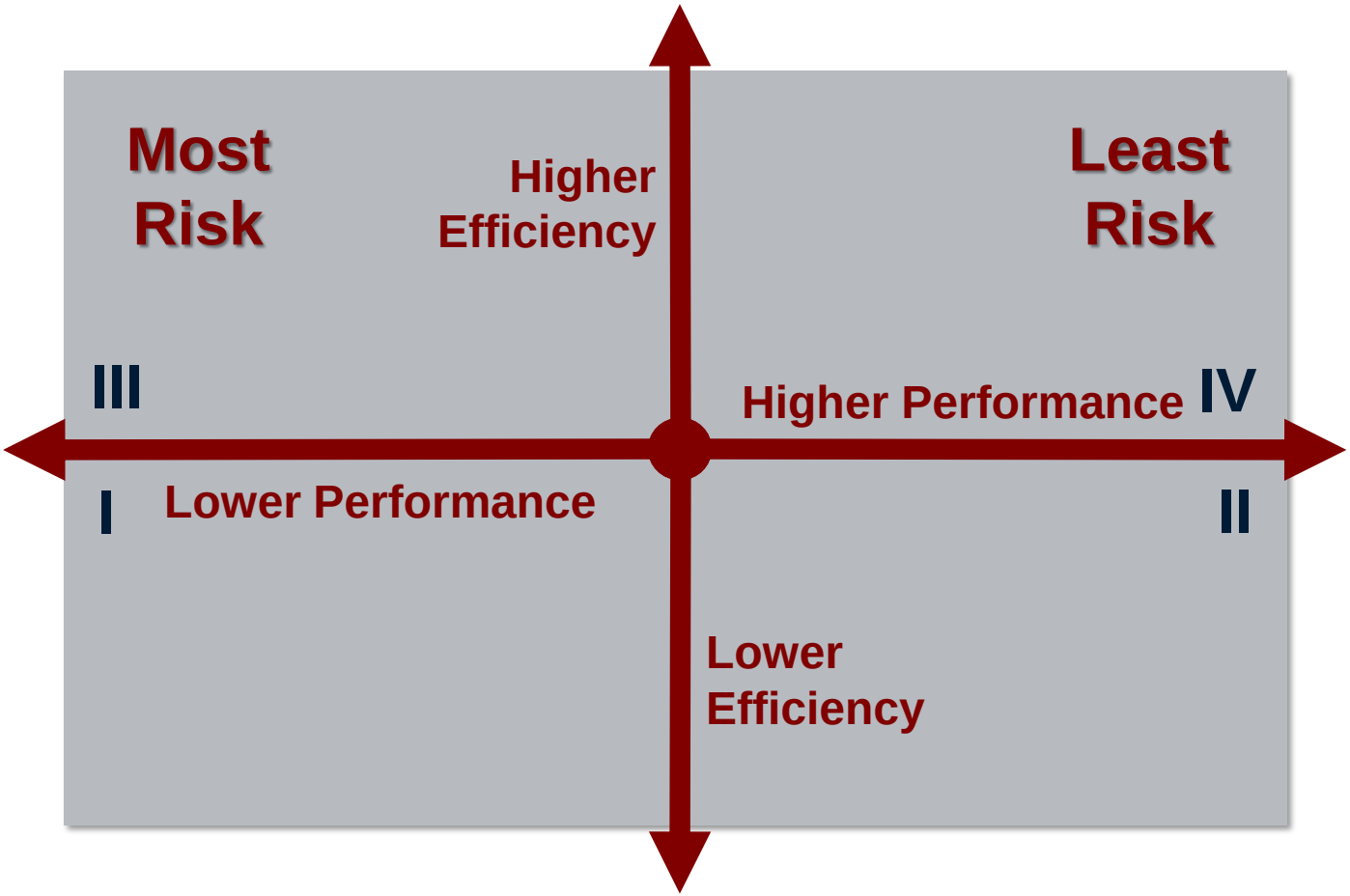
Challenge: Greater Comfort Risk



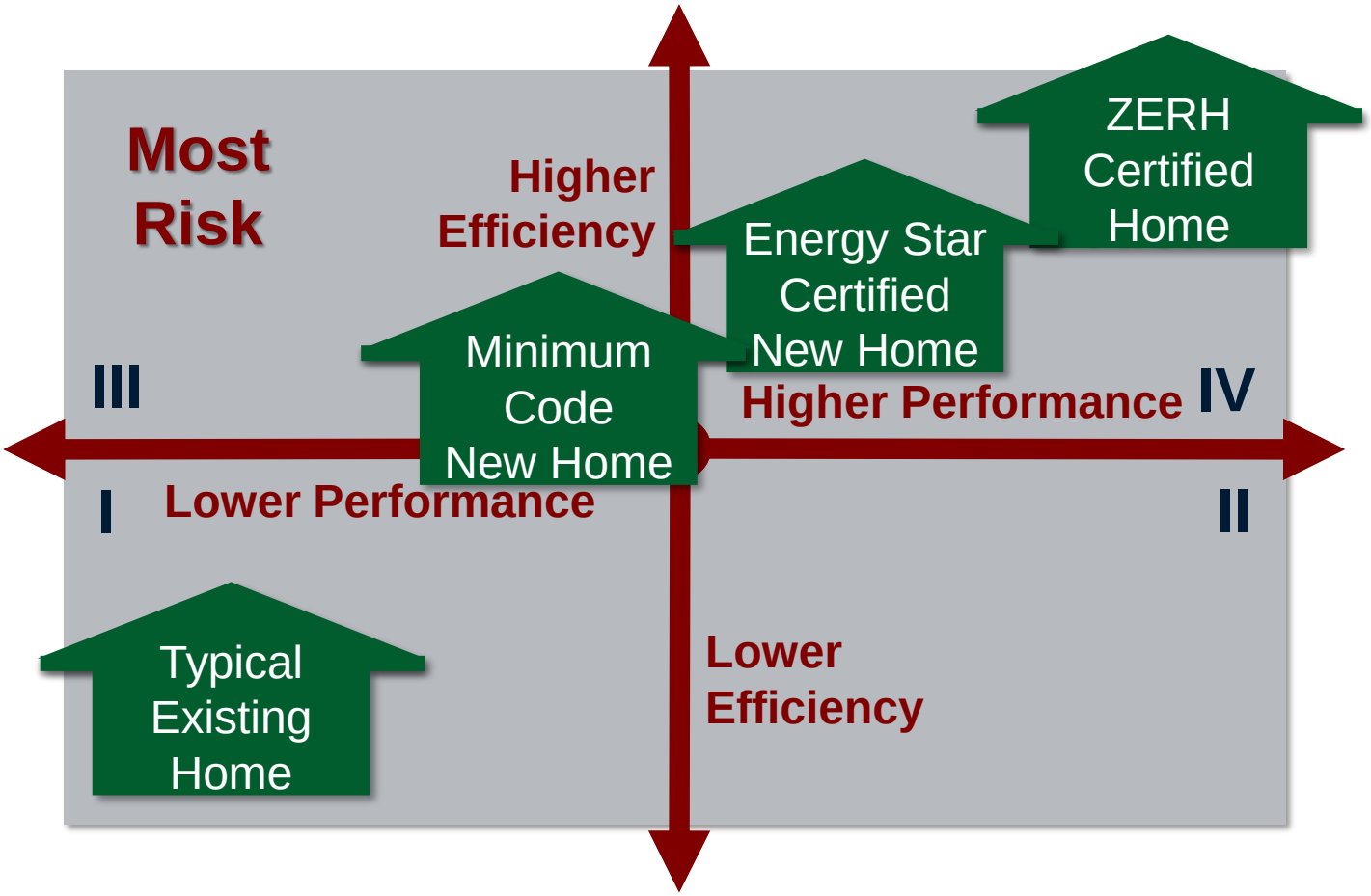
Challenge: Greater Indoor Air Quality Risk



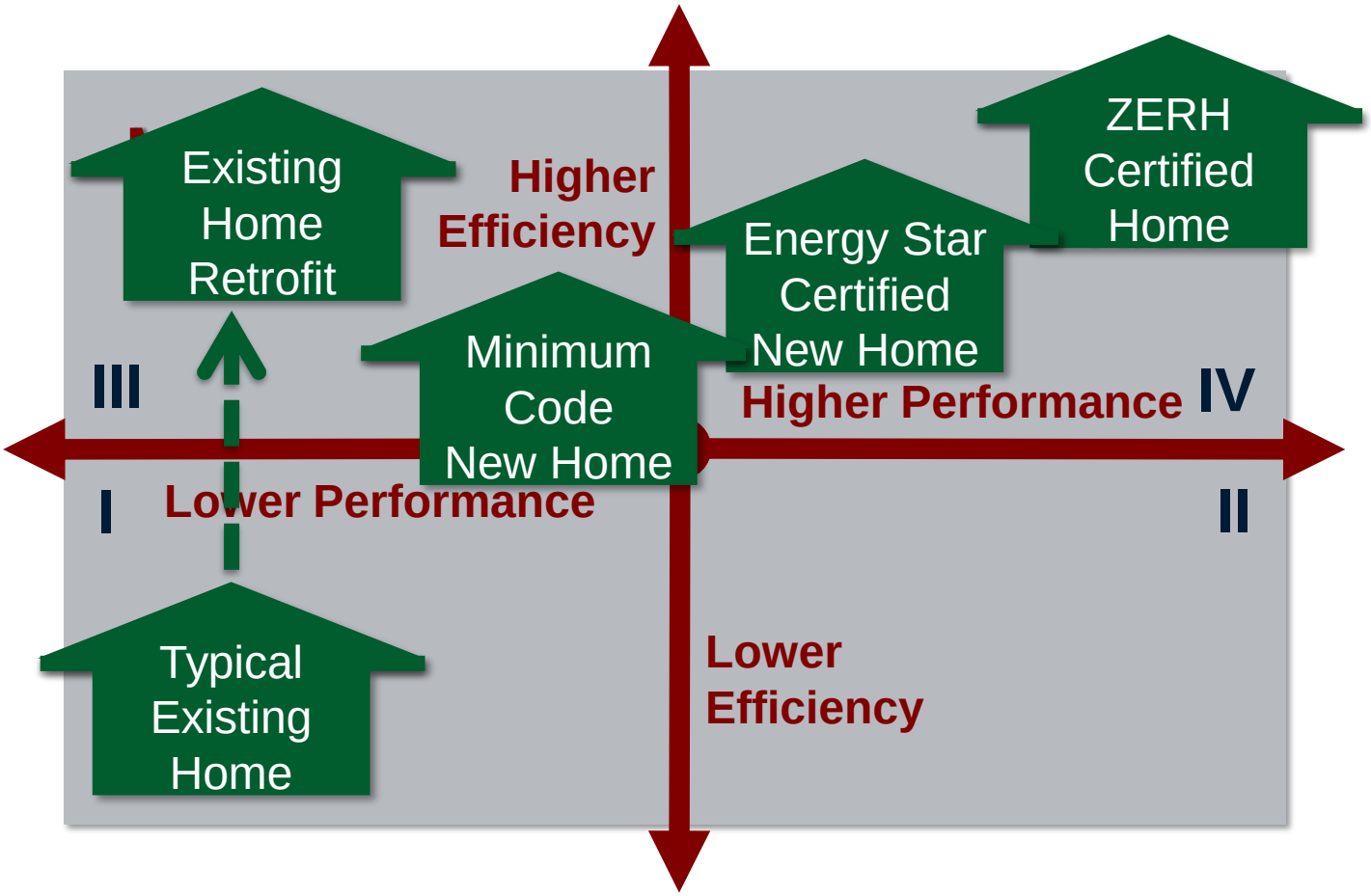
Challenge: Summary



Challenge: Summary



Challenge: Summary



Scope: Present

Whole-House Energy Efficiency Package

Step One: Optimize Efficiency	Step Two: Do No Harm	Step Three: Ensure Zero Ready
Energy Efficient Enclosure	Comprehensive Water Protection	Solar Ready Construction
Energy Efficient Components	Ensured Comfort System	
	Comprehensive Indoor Air Quality	

Scope: Future

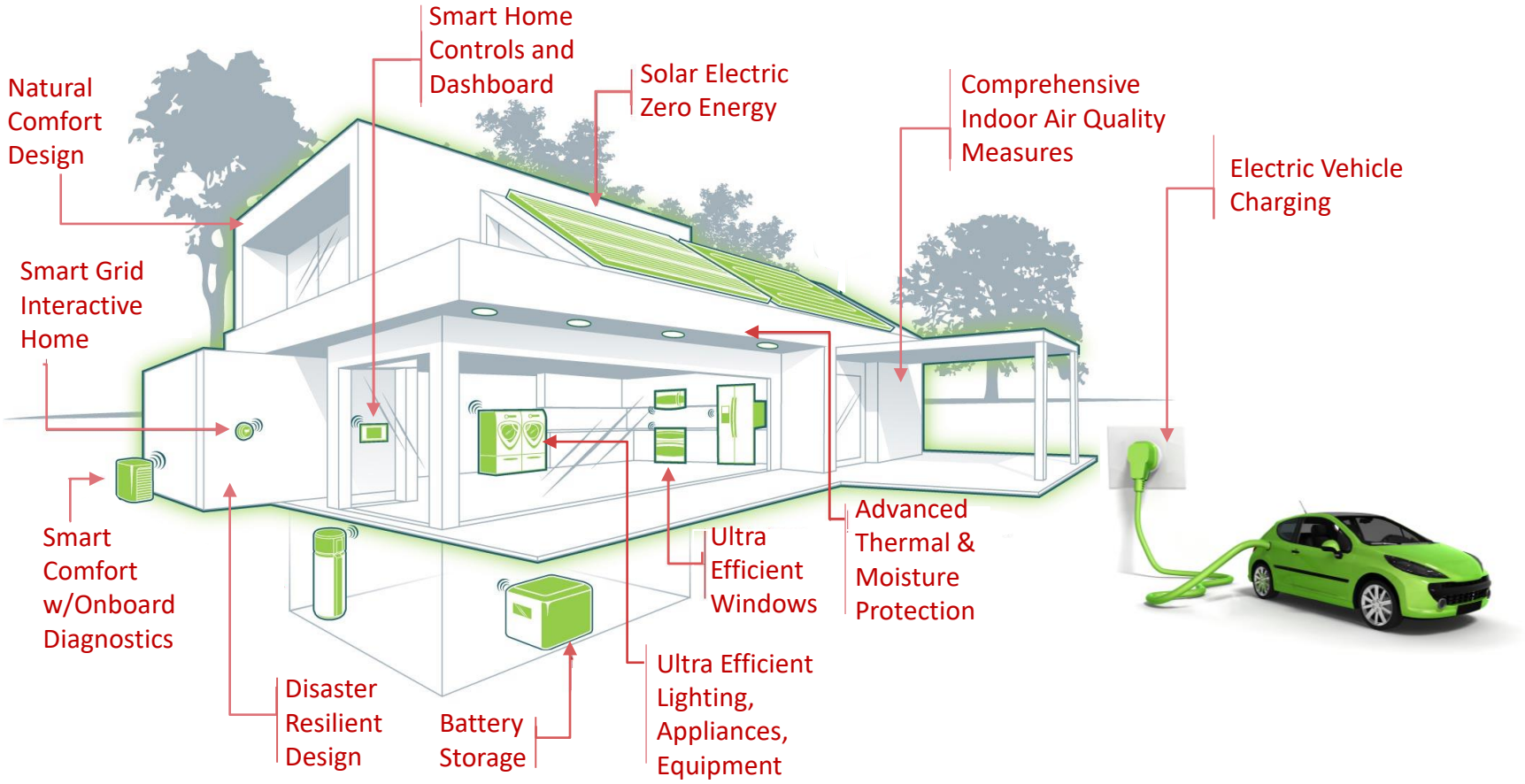
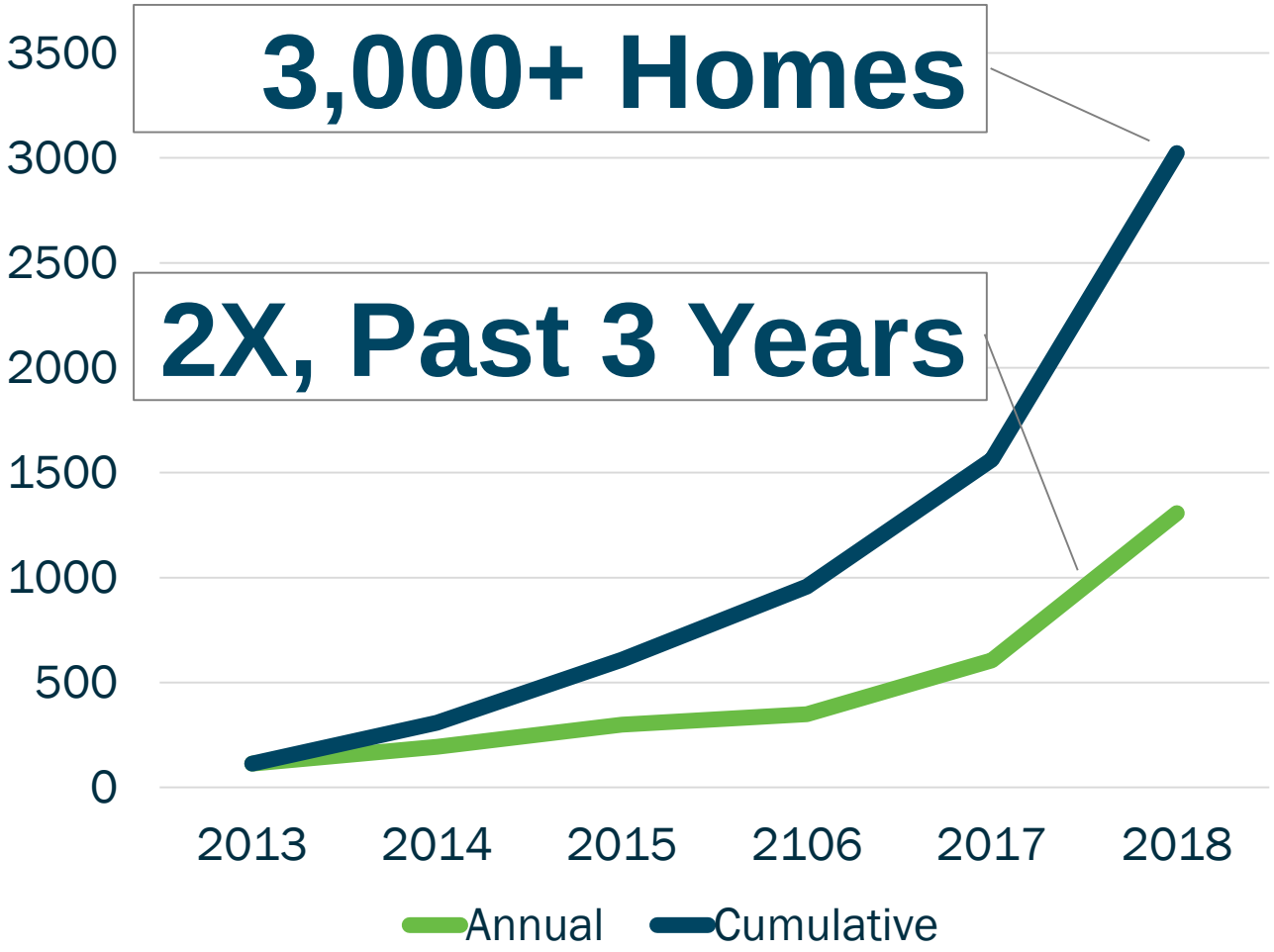
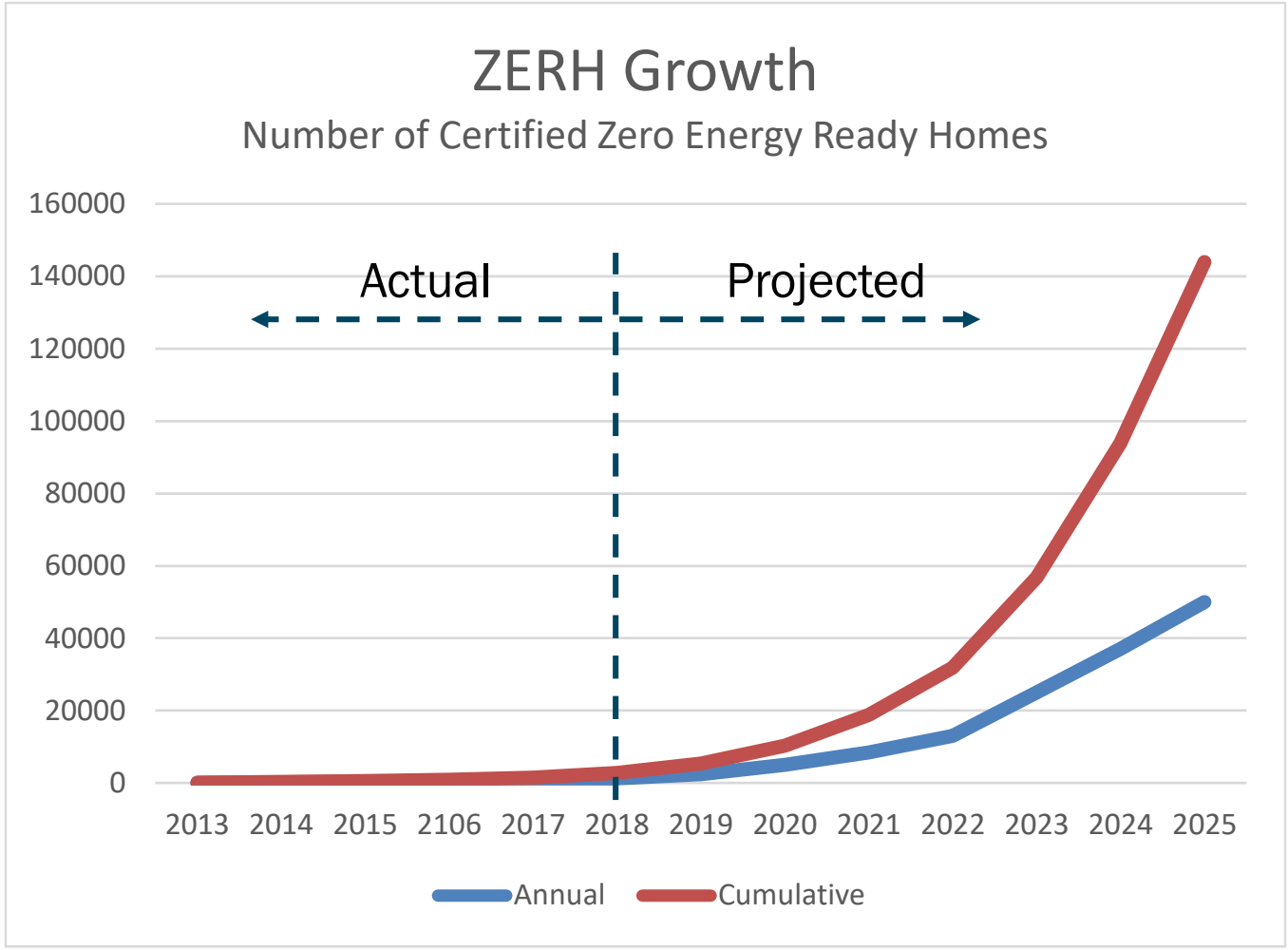


Image Source: http://www.santamonicapropertyblog.com/more-green-building-codes-in-january/

Impact


3,000+ Homes
2X, Past 3 Years
3500
3000
2500
2000
1500
1000
500
0
2013
2014
2015
2106
2017
2018
Annual
Cumulative

Impact


ZERH Growth
Number of Certified Zero Energy Ready Homes
160000
140000
120000
100000
80000
60000
40000
20000
0
Actual
Projected
2013
2014
2015
2106
2017
2018
2019
2020
2021
2022
2023
2024
2025
Annual
Cumulative

Impact

2030 Projected Impacts:*

- **~$150 Billion** Utility Bill Savings
- **~1 Million** Job-Years of Work
- **~1,100 MMTCe** <Carbon Emissions

* Impacts based on internal DOE analysis assuming 30% high-performance new homes by 2030

Collaboration, Coordination, and Integration

Collaboration, Coordination, and Integration

Housing Innovation Award Application

- Images
- Testimonials
- Energy Savings
- Floor Plans/Stats

DOE Tour of Zero: Whatley by Insight Homes

Home » DOE Tour of Zero: Whatley by Insight Homes

"No more trips to the hospital!!!"

Homeowner

HIGH PERFORMANCE HOME SUMMIT 2019

EEBA. OCTOBER 1-3 \ DENVER, CO

Collaboration, Coordination, and Integration

ZER Incremental Cost	Houston (CZ2)	Atlanta (CZ3)	Baltimore (CZ4)	Chicago (CZ5)
	$2,065	$6,094	$5,993	$5,368
Mortgage Threshold (30 Years)	$10,980 ✓	$15,563 ✓	$23,305 ✓	$20,619 ✓
Resale Threshold (12 Years)	$5,576 ✓	$7,903 ✓	$11,835 ✓	$10,472 ✓
Consumer WTP (4%)	$9,139 ✓	$9,690 ✓	$10,130 ✓	$13,874 ✓
First Cost Threshold (0%)	$0 ✗	$0 ✗	$0 ✗	$0 ✗

ZE Incremental Cost	Houston (CZ2)	Atlanta (CZ3)	Baltimore (CZ4)	Chicago (CZ5)
	$15,488	$20,069	$18,674	$23,125
Mortgage Threshold (30 Years)	$26,715 ✓	$35,927 ✓	$49,118 ✓	$45,414 ✓
Resale Threshold (12 Years)	$13,567 ✗	$18,245 ✗	$24,945 ✓	$23,063 ✓
Consumer WTP (4%)	$9,139 ✗	$9,690 ✗	$10,130 ✗	$13,874 ✗
First Cost Threshold (0%)	$0 ✗	$0 ✗	$0 ✗	$0 ✗

Source: *'The Economics of Zero Energy Homes: Single Family Insights,'* Rocky Mountain Institute, 10/18

Collaboration, Coordination, and Integration

What	Who
Tracking Growth	RESNET Registry
Peer Review	EEBA (Builder Roundtable)
	RESNET (Rater Roundtable)
	Industry at IBS (Industry Partner RT)
Consumer Awareness	Net Zero Energy Coalition
	Industry
Training	REEO's
	Building Science NGO's
Affordable Housing	Habitat for Humanity
	Enterprise Green Communities
	State QAPs
Codes	Oregon Governor's Energy Office
	California Energy Commission
	New England Stretch Codes

Project Plan and Schedule

Key Activity	2018	2019						2020	
	Nov – Dec.	Jan - Feb	March-April	May - June	July - Aug	Sept-Oct	Nov-Dec	Jan-Feb	March-April
Outreach	• 2 HIA Media Articles • HIA Winner Press Release • Newsletter	• RESNET Conf. • IBS Conf. • HFH Conf. • B4 Conf. • Consumer video • Newsletter	Announce 2019 HIA Newsletter Customizable 'Experience' Fact Sheets	• HPC Conf. • NAHB Spring Board • Website Update • Newsletter	• Westford Bldg Sci. Sym. • 30 HIA Profiles for 'Tour of Zero' • Newsletter	• EEBA Conf. • PHIUS Conf. • Hsg. Innov Awards -EEBA • Newsletter • Tour of Zero update	• HIA Winner Press Release • Newsletter	• IBS Conf. • RESNET Conf.	• Newsletter
Account Management	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry	• Contact Vital Few: - Builders - HERS Raters - Industry
Operations	Tracking Data EPA Coord. PHIUS Coord. NZEC Coord.	• Tracking Data • EPA Coord.	• Tracking Data • EPA Coord. • LEEDH Coord. • NZEC Coord.	• Tracking Data • EPA Coord. • PHIUS Coord.	• Tracking Data • EPA Coord. • NZEC Coord.	• Tracking Data • Annual Report • EPA Coord. • LEEDH Coord.	• Tracking Data • EPA Coord. • PHIUS Coord. • NZEC Coord.	• Tracking Data • EPA Coord. .	• Tracking Data • EPA Coord. • LEEDH Coord. • NZEC Coord.
Roundtable Peer Review Meetings	• Agenda/Host Innovation Partner RT • Agenda for HERS Rater RT	• Innovation Partner RT at IBS • HERS Rater RT at RESNET	• Innovation Partner RT Report • HERS Rater RT Report	•	• Agenda for Leading Builder RT	• Leading Builder RT at EEBA	• Leading Builder RT Report	• Innovation Partner RT at IBS • HERS Rater RT at RESNET	• Innovation Partner RT Report • HERS Rater RT Report
Training	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD	• Presentations TBD • Webinars TBD
Technical Specs	• Answer Questions	• Answer Questions • Revise MF HW	• Answer Questions	• Answer Questions	• Answer Questions	• Answer Questions • Coord with ESF one-MF	• Answer Questions	• Answer Questions	• Answer Questions • v2 Spec plan
Housing Innovation Awards (HIA)	• Debrief for Continuous Improvement • Sponsor Feedback Anal. 2019 HIA Plan	• Coord. Venue with EBBA • Revise Application • Identify Vital Few	• Send Out Applications • Recruit Jurors • Recruit Vital Few to Apply	• Apps Due • Review Apps • Select Winners	• Convene Judging for Grand Award Winners • Announce Winners	• HIA Awards event - EEBA • Evaluate HIA Program • Add winners 'Tour of Zero'	• Debrief for Continuous Improvement • Sponsor Feedback Anal • 2020 HIA Plan	• Coord. Venue with EEBA • Revise Application • Identify Vital Few	• Send Out Applications • Recruit Jurors • Recruit Vital Few to Apply

Thank You

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Solar Decathlon

Project Summary

What is Solar Decathlon®?: A collegiate competition, comprising 10 contests, that challenges student teams to design and build highly efficient and innovative buildings powered by renewable energy.

Timeline:

Start date: October 2018

Planned end date: January 2021

Key Milestones

1. 2019 Design Challenge Weekend, April 12-14, 2019
2. 2020 Design Challenge Weekend; 4/17-19/2020
3. National Showcase on National Mall, June 25 - July 5, 2020.

Budget:

Total: $4.5 M

Project $ to Date: $1 M

DOE: $1 M

FY19 Cost Share: 100%

Key Partners:

National Renewable Energy Laboratory
Smithsonian Folklife Festival
Participating schools
Sponsors, Affiliates, Jurors

Project Outcomes:

- Collegiate student teams design (and build) highly efficient buildings powered by renewable energy.
- Build public awareness of zero energy buildings and benefits.
- Contribute to BTO goal to reduce the average energy use per square feet of all U.S. buildings by 30% by 2030.

Team:

National Renewable Energy Lab (NREL) + subcontractors

Meeting the Challenge

Problems

- Collegiate design students are not prepared to design, build and retrofit buildings to the performance levels needed to meet BTO energy reduction goals.
- The public is not aware of advances in building design and technology that are available and cost-effective today.

STRATEGIES		**SOLUTIONS**
GROW SUPPLY of building professionals who can ***design, build and advocate for*** highly efficient buildings powered by renewable energy.		College students design (and build) highly efficient buildings powered by renewable energy.
GROW DEMAND from building owners, tenants, builders, real estate agents and other stakeholders who understand the benefits of these structures and can ***ask*** for them.		Public celebration of zero energy design and student building innovation on the National Mall before projected crowds of more than 700,000 people.

Solar Decathlon: A History of Impact

The U.S. Department of Energy Solar Decathlon® is a **collegiate competition** challenging student teams to design and build highly efficient **buildings powered by renewable energy**.

Established in

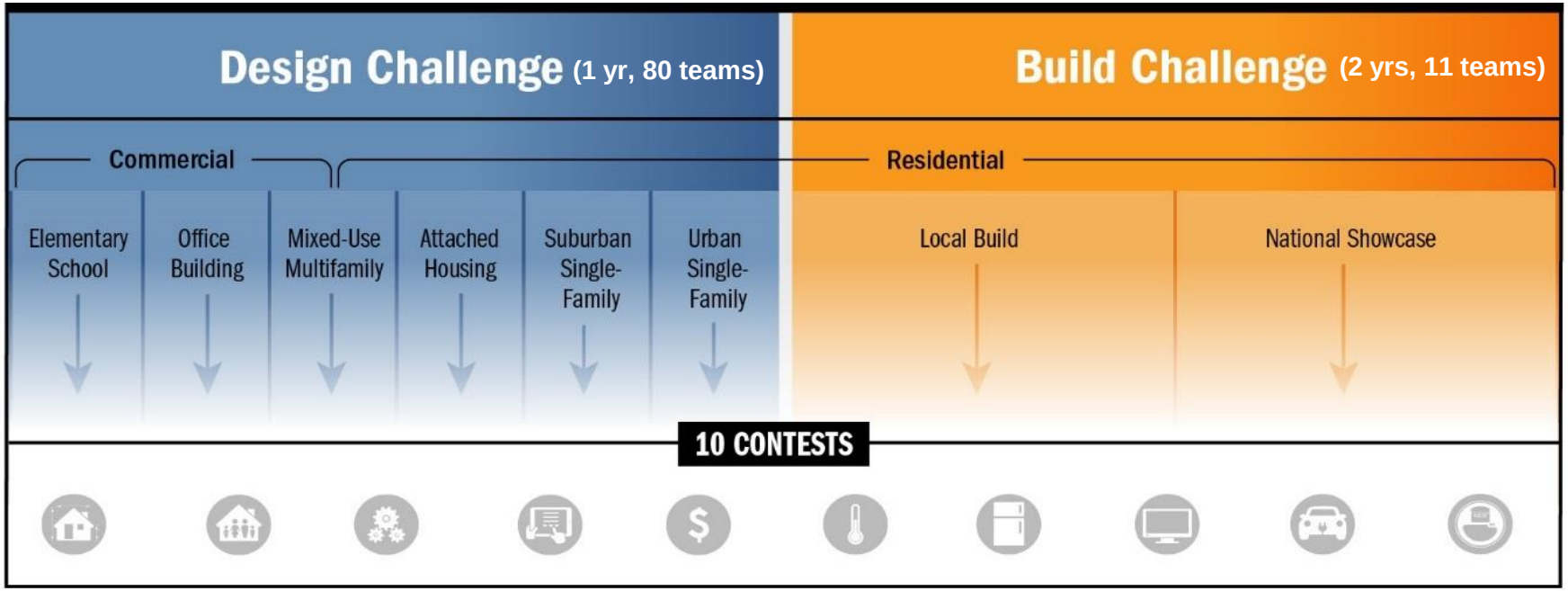
2002

20,000

participating students

5 international competitions

New Solar Decathlon: Exploding our Impact



April 12-14, 2019
Design Challenge Weekend

April 17-19, 2020
Design Challenge Weekend

June 1–21, 2020
Solar Decathlon Community Exhibition Month

June 25–July 5, 2020
National Showcase at Smithsonian Folklife Festival

700,000+ visitors

Design Challenge Weekend

- Building Science education
- 45 finalist teams, over 300 students and faculty
- Student presentations before juries
- NREL zero energy office building tours
- Networking & career events
- **New!** Solar Decathlon Film Festival
- Division and Grand Winners named

National Showcase

- Summer 2020, National Mall, Washington DC
- Partnership with Smithsonian Folklife Festival
  - Over 700K visitors expected
  - 11 teams
    - 6 U.S., 5 international
    - 6 homes, 5 exhibits (Local Build)
    - Education program

Building the Zero Energy Workforce

Thomas Simpson

Lena Burkett

Nathan Kahre

Peter Schneider

DIGIBILT

DOE and now NREL

Thrive Builders

Faithful + Gould

Integrating, Collaborating, Coordinating

- **Solar Decathlon Affiliates (in development)**
  - Trade organizations and others with shared goals and stakeholders
- **Solar Decathlon Design Partners pilot (in development)**
- **Collaboration with Solar Energy Technology Office (SETO)**
  - Education at National Showcase
  - Solar District Cup advisory

BECOME A
SOLAR DECATHLON
AFFILIATE

U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

Better Buildings®
U.S. DEPARTMENT OF ENERGY

SOLAR ENERGY
TECHNOLOGIES OFFICE
U.S. Department Of Energy

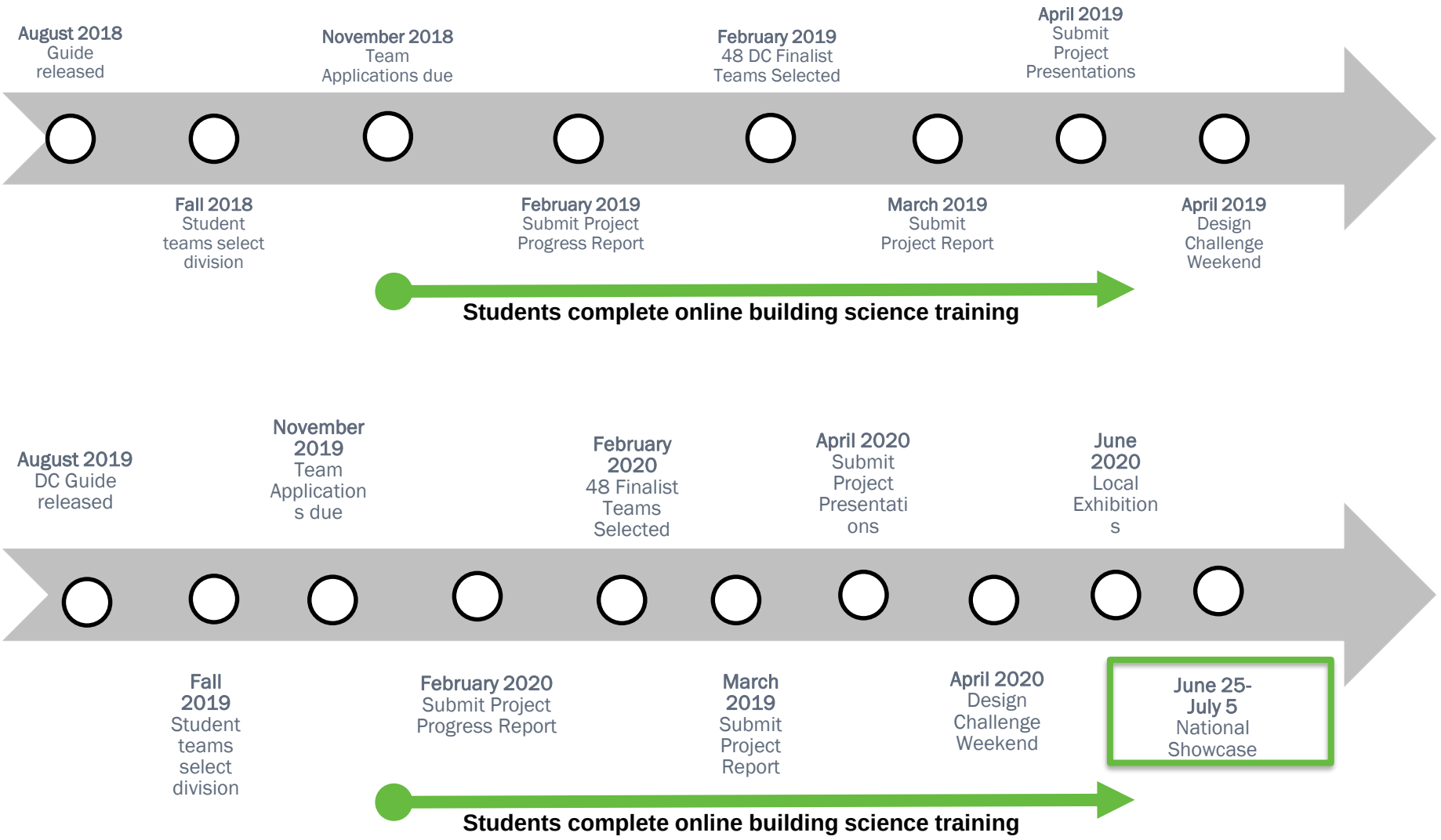
U.S. DEPARTMENT OF ENERGY
SOLAR DISTRICT CUP
COLLEGIATE DESIGN COMPETITION

Thank You

U.S. Department of Energy
Holly Jamesen Carr, Acting Director Solar Decathlon
holly.carr@ee.doe.gov 202-287-1409

REFERENCE SLIDE

Project Plan and Schedule



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Home Performance with ENERGY STAR

BTO Residential Buildings Integration Program
(contract support team: Allegheny Science & Technology and Northbound Solutions)
Steve Dunn, Program Manager
720-356-1527 | steve.dunn@ee.doe.gov

Project Summary

Timeline:

Start date: 2001 – 2009 (EPA), 2010- Present (DOE)

Planned end date: ongoing

Key Milestones

1. Annual Reporting, January, 2019
2. HPwES - HES voluntary integration strategy, April, 2019
3. 2019 ENERGY STAR Awards, April 11, 2019

Budget:

Total Project (FY 17-19)

- DOE: $2.2M
- FY19 Budget: $600,000
- FY19 Cost Share: $n/a

Key Partners:

HPwES Sponsors	EPA - ENERGY STAR
HPwES Contractors	Home Energy Score Partners & Assessors
Home Performance Coalition	BPI

Project Outcome:

The goal of **Home Performance with ENERGY STAR** is to help homeowners make energy efficiency improvements to their homes through trusted networks of contractors and local Sponsors. Participating contractors receive training in weatherization, building science, and HVAC quality installation. Residential EE improvements achieve energy savings and can improve home comfort and durability. Contractors perform post-installation inspections and diagnostics to verify measures were properly installed, and document improvements completed. All participating contractors are subject to quality assurance reviews by the Sponsor to ensure program standards are met.

Team: Allegheny Science and Technology; Northbound Solutions

Challenge: Improve the Efficiency, Durability and Comfort of the Nation's Housing Stock

Problem Definition:

- **Much of the U.S. housing stock of 83 million single-family and 30 million multi-family are older, inefficient homes**
  - Energy losses and reduced comfort result from inadequate insulation, air penetration and leakage, inefficient heating and cooling systems and appliances. Occupant behavior and improper maintenance are also factors.
- **Households spend $219 billion annually on energy costs in the residential sector, which represents 21.8% of US energy consumption** (EIA 2015)
  - Many households experience high energy bills and comfort, health and physical/safety hazards in their homes.
- **Improving the efficiency of existing homes could reduce annual energy consumption by up to 30% per home.**
  - DOE provides expertise to achieve cost-effective savings in existing homes, including advanced technologies, program design, workforce specifications, and analytical tools and data

Solution

Home Performance with ENERGY STAR (HPwES) improves the energy efficiency of homes while also improving the comfort, durability and health of the Nation's housing stock.

- **HPwES Sponsors and Contractors deliver whole-house solutions to increase the energy performance and comfort of existing homes**
  - **Sponsors** recruit and train qualified home improvement contractors and consultants that perform home performance assessments and improvements
  - **Energy assessments** identify and prioritize efficiency improvements (e.g., air sealing/insulation, HVAC system and appliances) and perform combustion safety tests
  - **HPwES Contractors** perform improvements that reduce home energy use by 25% or more

Scope

Home Performance with ENERGY STAR utilizes a whole-house approach to deliver energy saving improvements that are cost-effective for homeowners and align with utility goals. The program delivers home upgrades through a network of Local Sponsors and participating contractors.

Barriers addressed:

- **Trained and qualified residential EE workforce**
- Minimum standards and criteria for installation of measures, including quality assurance requirements and criteria
- **Marketing and driving demand by engaging customers**
- **Rigorous health and safety protocols** to ensure occupant safety and integrity of the home and mechanical systems

Program Innovations

- Integration with income-qualified programs to serve **low-income households**, including multifamily housing units
- Offering **completion certificates** and certifications to document HPwES improvements
- **Recognition** of leading Sponsors and Contractors (ENERGY STAR Awards, Century Club)
- **Partnerships with industry** to develop a trained Home Performance workforce, offer technical assistance and training and introduce advance technologies (e.g., smart thermostats, air source heat pumps)
- Piloting **remote assessment and remote quality assurance** methodologies to streamline review processes and improve outcomes

Impact

Alignment with BTO / RBI Goals

- HPwES demonstrates retrofits with 20-30% energy savings in single and multifamily homes in multiple climate zones of the U.S. Provides program model for making energy upgrades to existing homes, including low-income
- HPwES incorporates rigorous standards for assessment and diagnostics, installation of retrofit measures, and quality assurance benchmarks for the home performance industry
  - Workforce includes traditional home improvement trades (e.g., HVAC, remodelers, windows/siding, roofing, plumbing, electrical)
- Sponsors integrate advanced technologies and building retrofit systems (e.g., heat pumps, smart thermostats, data management software and tools (e.g., HPXML)
- Sponsors leverage DOE tools/resources/expertise (Solution Centers, measure guidelines, HPXML, Home Energy Score)

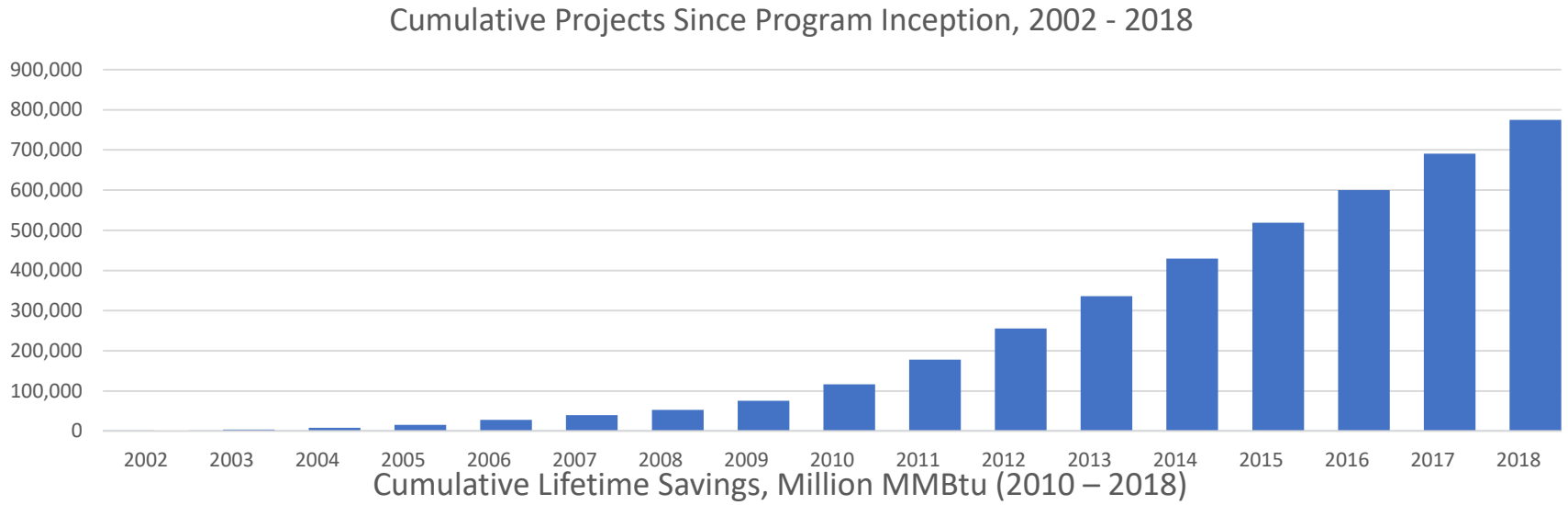
Program Impact

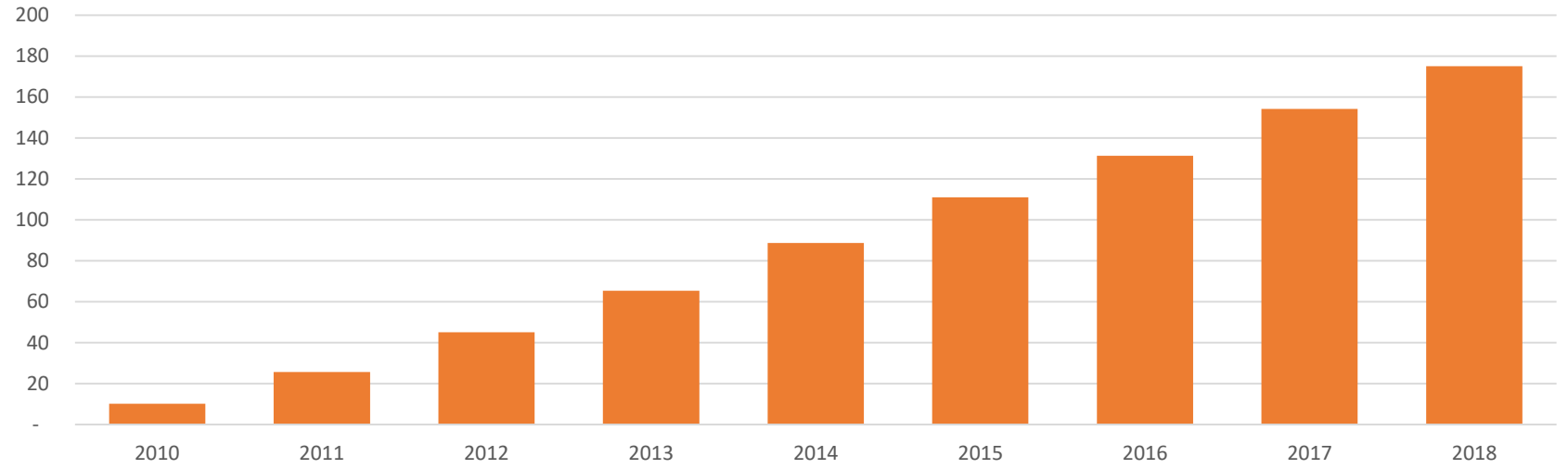
- 25% average reduction in household energy consumption
- $400+ savings per household per year
- Saves households 1.7 million MMBtu, $35M annually (2018)
- Lifetime savings (2010 - 2018): 175 million MMBtu

HPwES 2018 Program Impact

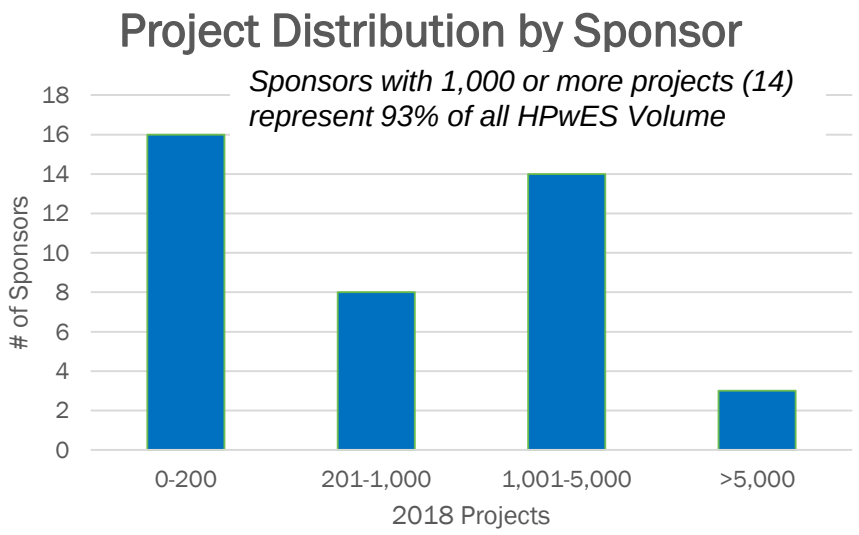
- # of Local Sponsors: **41**
- # of Participating Contractors: **1,400**
- # of retrofit projects **86, 660**
- Average project size **$5,700**
- Total Sponsor + household investment: **$375 million / year**
- Cost of saved energy: **5 - 7 cents / kWh (LBNL)**

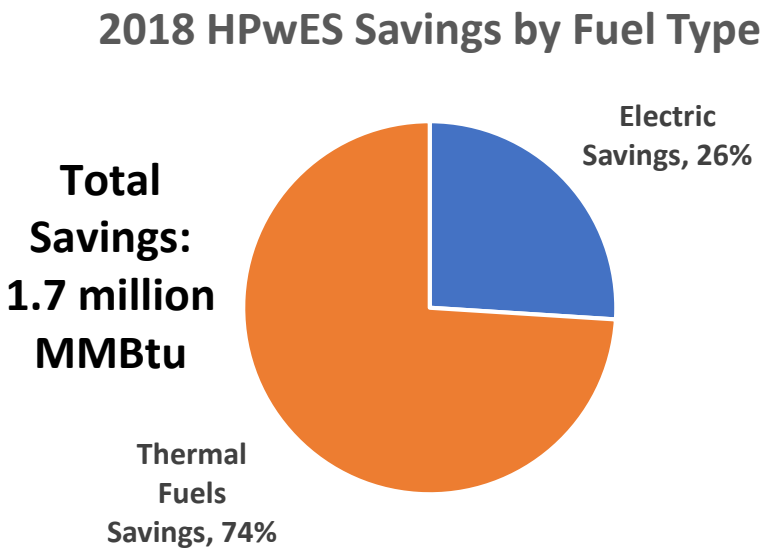
HPwES Impact: Cumulative Total Projects and Lifetime Energy Savings

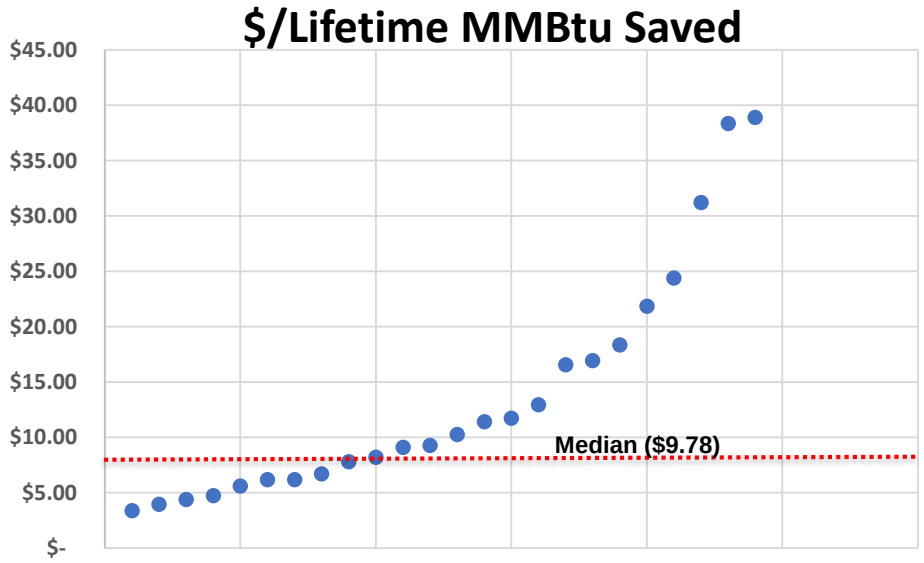


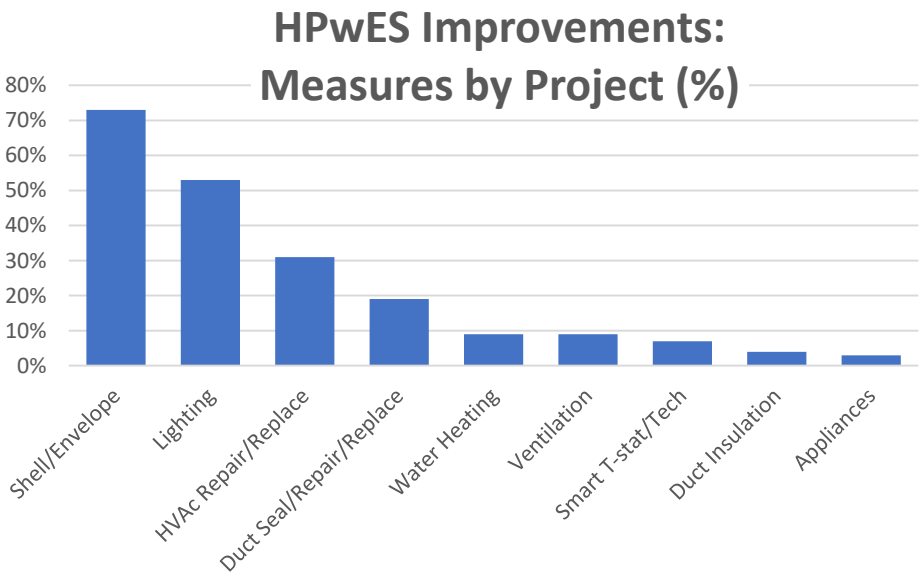


HPwES Program Impact: 2018 Sponsor and Measure Data





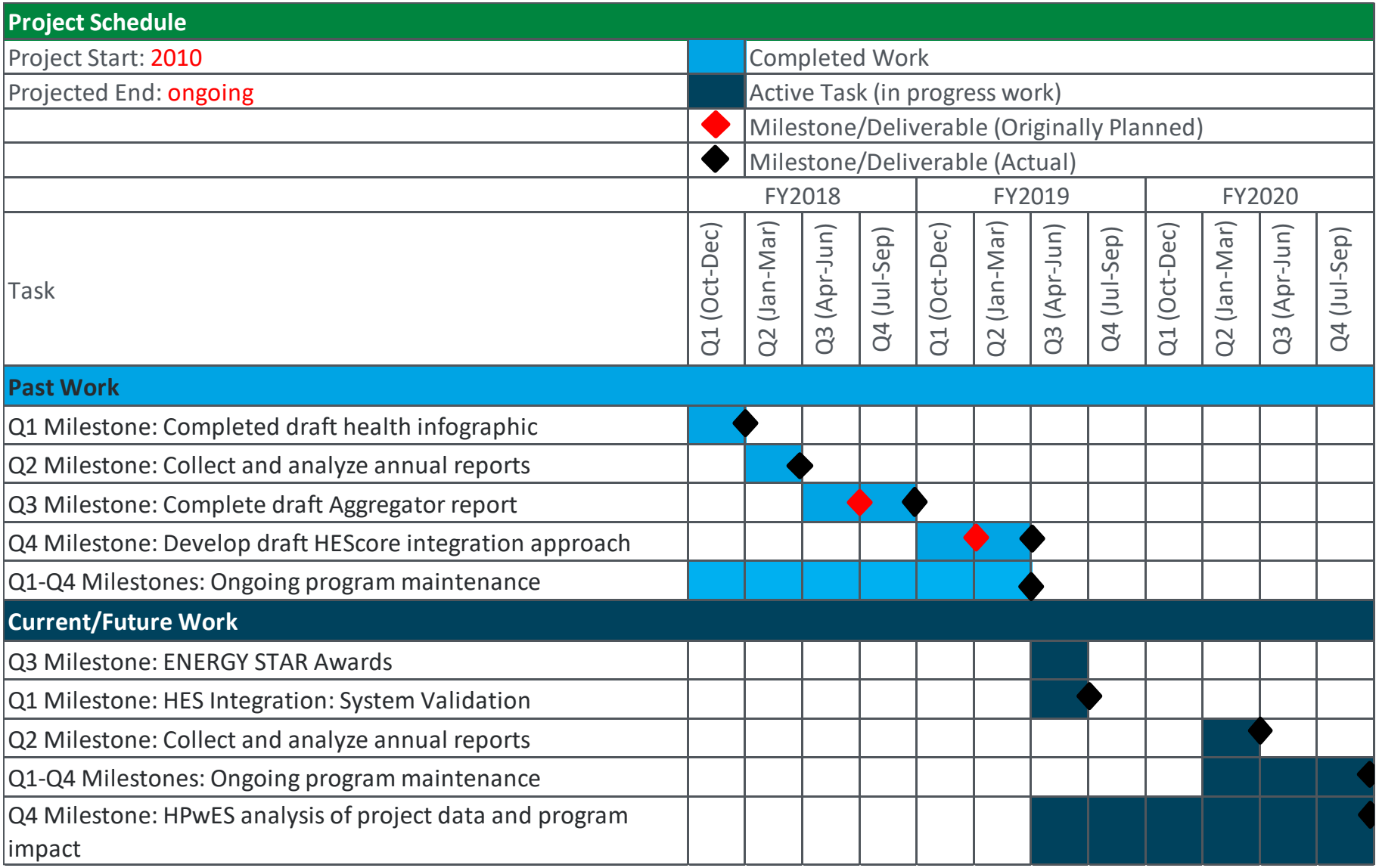




Collaboration, Coordination, and Integration

- **Collaboration**
  - EPA – ENERGY STAR Awards, Website, Program Design
  - Home Performance Coalition
    - Policy, best practices, data standards, training, annual/regional conferences
  - Building Performance Institute
    - Home Performance Standards – representative on Single Family Standards Technical Committee and member of Working Group 9 - HPXML
  - Healthy Homes / Indoor Air Quality
    - Home performance working group; health and home performance literature review
- **Coordination with External Stakeholders**
  - HPC / Efficiency First / BPI: industry input and feedback, contractor feedback, barriers assessment
- **Program Integration**
  - HPwES -- Home Energy Score Integration
  - Home Energy Labeling and Certification Systems
    - Created a BPI-2101-compliant certificate of completion template for HPwES
  - DOE Building Science / Program Design Resources
    - Better Buildings Residential / Building America Solution Centers

Project Plan and Schedule



Thank You

Home Performance with ENERGY STAR

Steve Dunn, Program Manager

720-356-1527 | steve.dunn@ee.doe.gov

www.energystar.gov/hpwes

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Residential Buildings Integration:

Jonathan Cohen, Lead, Better Buildings Residential Network

Jonathan.cohen@ee.doe.gov

Project Summary

Timeline:

- Start date: April, 2013
- Planned end date: Ongoing

Key Milestones:

1. 380 members since 2013; 33 in past year
2. 1813 Participants in 20 webinars in past year

Context:

- $500M ARRA program, 41 grantees was origin
- Feedback: Grantee network very valuable
- Expanded network scope nationally afterward

Key Partners:

CLEAResult	Vermont Energy Investment Corporation (VEIC)
NYSERDA	Building Performance Institute
All HPwES Sponsors	Michigan Saves
City and County of Denver	Green & Healthy Homes Initiative
Wisconsin Energy Conservation Corporation (WECC)	ACEEE - American Council for an Energy-Efficient Economy

Project Outcome:

- The Better Buildings Residential Network connects energy efficiency programs and partners to share best practices and learn from one another to increase the number of homes that are energy efficient.
- Membership is free & open to organizations committed to increasing home energy upgrades.
- Benefits include Peer Exchange Calls 2x/month; Tools, templates, & resources; Recognition in media, materials; Speaking opportunities; Voluntary member initiatives, and one-on-one access

Challenge

Problem:

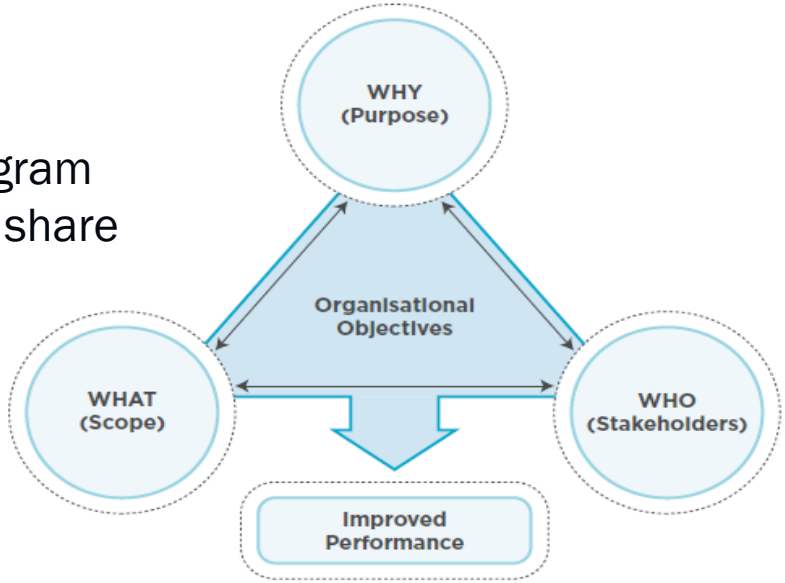
- The residential energy efficiency (EE) field is fractured, uncoordinated, localized, & lacks cohesiveness to plan & learn from mistakes in the past.
- A lack of central repository existed to provide institutional memory, coordinate residential EE programs, & be a resource clearinghouse to avoid reinventing the wheel.

Goal:

- Serve as a national residential EE hub, have DOE serve as convener, & honest broker.
- Develop programs, materials, & events based on work by BBRN members, RBI, labs, & to achieve more effective upgrades.

Outcome:

- Stakeholder engagement is essential to program success, and serves as a two-way vehicle to share resources, learn about innovation, new opportunities and early warnings.



Scope

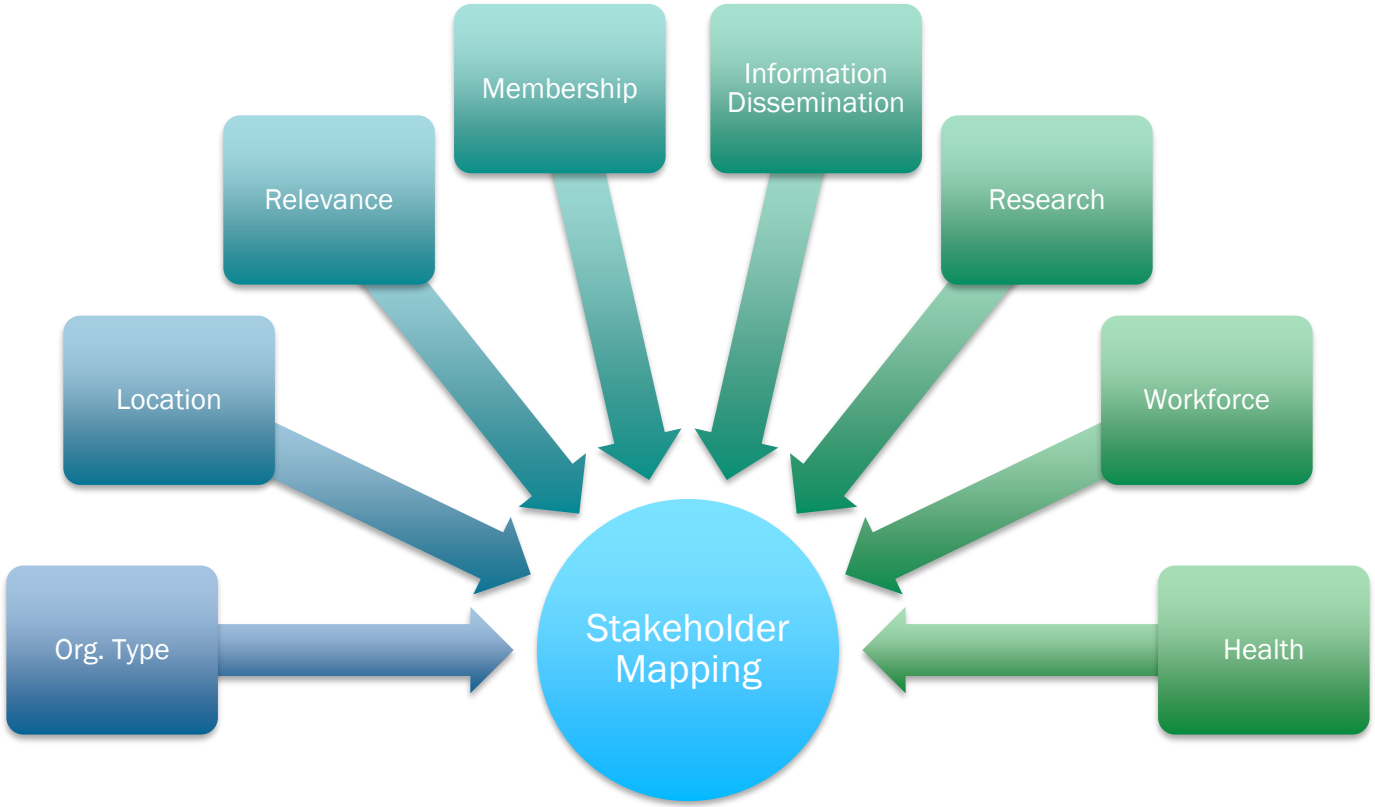
- Barriers in the residential EE field include ignorance of what has come before and the resources available to do this work
- Ignorance is the enemy of innovation, leads to reinventing the wheel
- EE staff operate in isolation with limited training & resources

The Better Buildings Residential Network is the only RBI national, ongoing vehicle for stakeholder engagement with residential EE programs and partners.

- Overcomes barriers of institutional memory, limited resources, & innovation;
- Builds on lessons learned through Home Performance with Energy Star, as well as the Recovery Act's $500M Better Buildings Neighborhood Program's numerous residential EE programs;
- Peer Exchange Calls, structured for interaction;
- Provides resources for EE staff: Better Buildings Summit, Home Performance Coalition national & regional conferences, ACEEE Health, Energy & Environment Conference, BECC, NIH Health in Buildings Conference; Solution Center guided tours;
- All aspects of residential EE covered: EE program soup to nuts.

Big Tent Umbrella - Stakeholder Engagement

- State & local governments; Program implementers; Contractors; Nonprofits; Utilities; Financial institutions; Researchers; Evaluators, etc.
- Learn, meet, collaborate, & share lessons learned, as well as feedback.



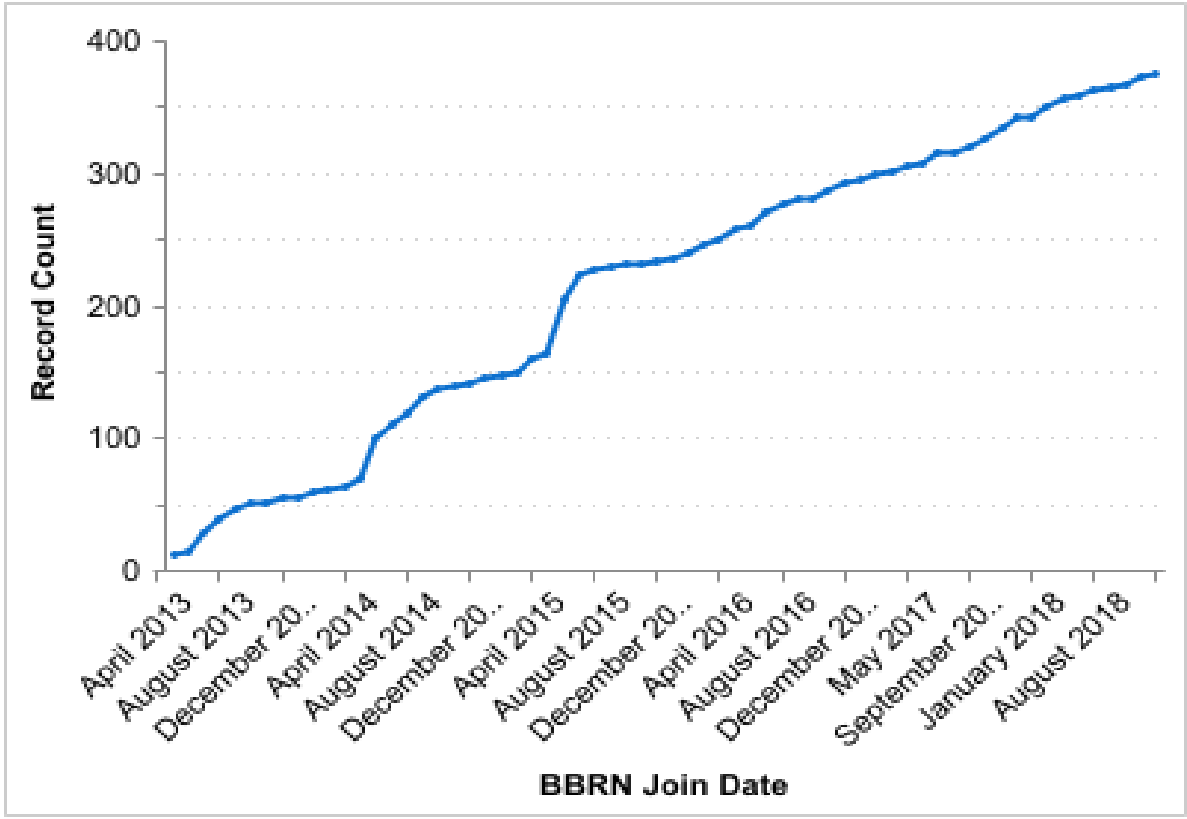
Impact

Membership Growth:

- 381 members since 2013
- 33 in past year

Reporting Upgrades:

- 2014: 27,563
- 2015: 39,664
- 2016: 53,971
- 2017: 71,011
- 2018: 224,217



Social Media:

- If RBI did great work in a forest but nobody heard it, did it happen?
- Twitter (4,252 followers); Facebook (169,383 followers); LinkedIn (873 followers)
- ~15 posts each month to all three platforms
- New members receive sample newsletter articles & Tweets that can be copied & posted verbatim about membership in their welcome email

Collaboration, Coordination, and Integration

Examples:

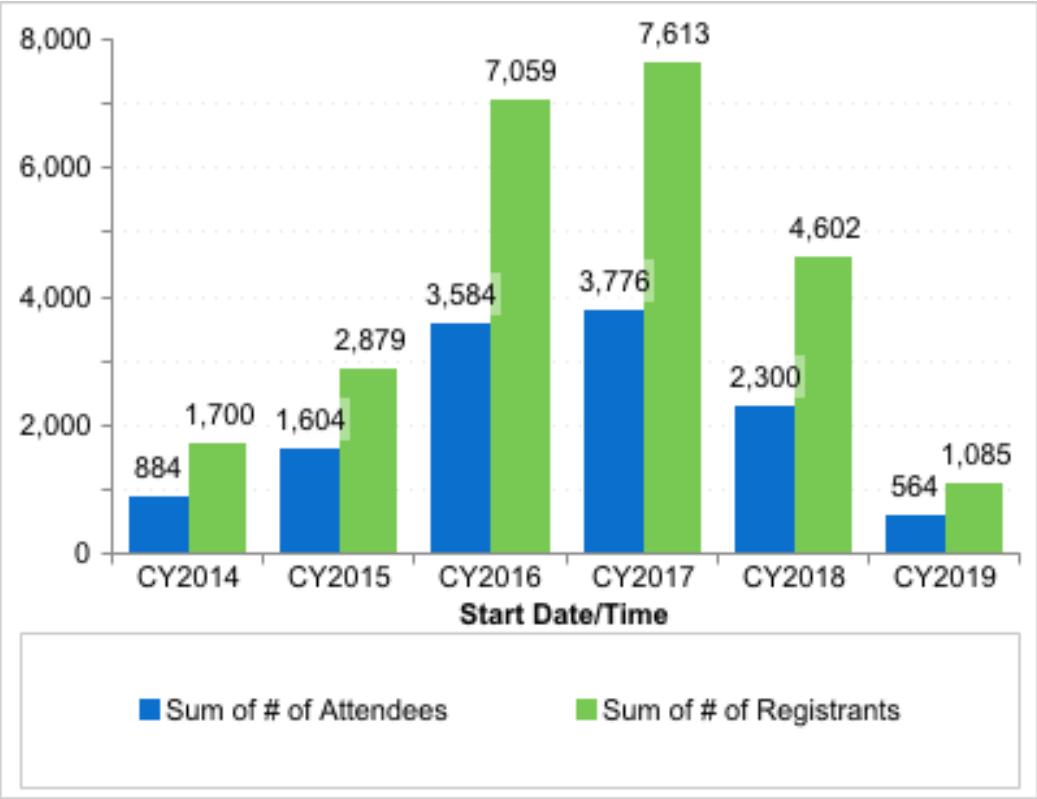
- Home Performance with ENERGY STAR (HPwES) Sponsors all members
- HPwES Contractor of Year Awardees on Peer Exchange Calls, newsletter, social media
- National Labs featured in 2-part Peer Exchange Call series, additional calls
- Home Energy Score featured on real estate Peer Exchange Calls, social media
- Building America in social media, newsletter

Leadership:

- Better Buildings Summit Planning Committee
- NEEP Home Energy Management Systems
- NIH Health in Buildings Conference Track Co-Chair
- ACEEE BECC Session Lead
- ACEEE Health, Energy & Environment Advisory Committee, Session Lead
- Southern Sustainability Directors Network Technical Advisory Committee

Peer Exchange Calls

Bi-weekly calls **connect** energy efficiency programs:



20
Calls in last year

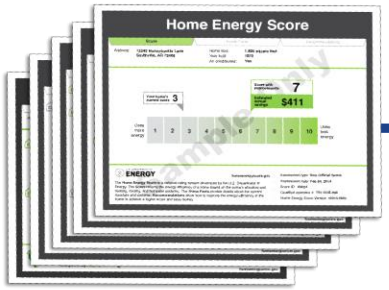
1813
Participants

"This is my first peer exchange call, and I've found the information really helpful as I'm diving into the multifamily tool for our program."

-Laura Palombi, Michigan Saves

Coordination With Other RBI Programs

The Better Buildings Residential Network acts as a **hub** for **support and promotion** of Residential Building Integration **programs** via **events,** Peer Exchange Calls, outreach, newsletter, social media, fact sheets, toolkits.



Home Energy Score

Better Buildings Summit

HOME PERFORMANCE WITH ENERGY STAR

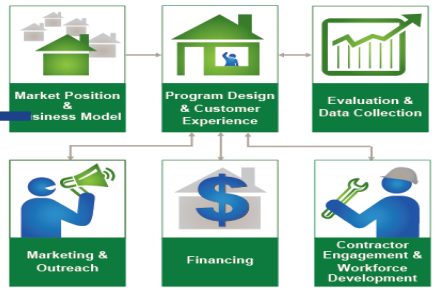
Better Buildings U.S. DEPARTMENT OF ENERGY

Residential Network

Better Buildings NEIGHBORHOOD PROGRAM

*Partners joined when grant program ended

New and existing residential energy efficiency programs



Residential Program Solution Center

Project Plan and Schedule

Activities	2019			
	Jan - March	**April - June**	**July - Sept**	**Oct - Dec**
New Member Outreach	▪ Recruit 3-5 members	▪ Recruit 3-5 members	▪ Recruit 3-5 members	▪ Recruit 3-5 members
Peer Exchange Calls, more	▪ Hold six Peer Exchange Calls	▪ Hold six Peer Exchange Calls	▪ Hold five Peer Exchange Calls	▪ Hold four Peer Exchange Calls
Social Media	▪ RBI weekly posts to Twitter, LinkedIn, Facebook+	▪ RBI weekly posts to Twitter, LinkedIn, Facebook+	▪ RBI weekly posts to Twitter, LinkedIn, Facebook+	▪ RBI weekly posts to Twitter, LinkedIn, Facebook+
Publications (RBI Dispatch, Lessons Learned fact sheets, case studies, toolkits, BB Bulletin, BTO Digest, etc.)	▪ Engage RBI team for content, edit, publish ▪ Draft, edit, publish Lessons Learned Fact Sheet ▪ Draft, edit, submit to BB Bulletin, BTO Digest	▪ Engage RBI team for content, edit, publish ▪ Draft, edit, publish Lessons Learned Fact Sheet ▪ Case study ▪ Draft, edit, submit to BB Bulletin, BTO Digest	▪ Engage RBI team for content, edit, publish ▪ Draft, edit, publish Lessons Learned Fact Sheet ▪ Draft, edit, submit to BB Bulletin, BTO Digest	▪ Engage RBI team for content, edit, publish ▪ Draft, edit, publish Lessons Learned Fact Sheet ▪ Draft, edit, submit to BB Bulletin, BTO Digest
Events (Better Buildings Summit, ACEEE Health, BECC, HPC, etc.)	▪ BB Summit weekly meetings, sessions, speakers ▪ Organize prep calls, set agendas	▪ BB Summit weekly meetings, sessions, speakers ▪ Organize prep calls, set agendas	▪ BB Summit weekly meetings, sessions, speakers ▪ Organize prep calls, set agendas	▪ BB Summit weekly meetings, sessions, speakers ▪ Organize prep calls, set agendas
Stakeholder Engagement (WIP, HUD, etc.)	▪ Interagency Health & EE Working Group ▪ EERE/WIP Low & Mod Income WG ▪ NEEP Home Energy	▪ Interagency Health & EE Working Group ▪ EERE/WIP Low & Mod Income WG ▪ NEEP Home Energy	▪ Interagency Health & EE Working Group ▪ EERE/WIP Low & Mod Income WG ▪ NEEP Home Energy	▪ Interagency Health & EE Working Group ▪ EERE/WIP Low & Mod Income WG ▪ NEEP Home Energy

Thank You

Better Buildings Residential Network

Jonathan Cohen, Lead, Better Buildings Residential Network

jonathan.cohen@ee.doe.gov

energy.gov/eere/bbrn

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Better Buildings Home Energy Information Accelerator

U.S. Department of Energy & Elevate Energy
Madeline Salzman, Acting Technology Manager
202-586-2540 | madeline.salzman@ee.doe.gov

Project Summary

Timeline:

Start date: May 2015

Planned end date: May 2019

Key Milestones

1. Build It Green case study, November 2016
2. City of Portland ordinance; December 2016
3. Council of MLSs Home Energy Information Guide, May 2017
4. Residential Green & Energy Efficient Addendum, May 2017
5. Green Building Registry™ launch, January 2018
6. Accelerator Toolkit launch, August 2018

Budget:

Project Cost Last 3 Years: $300k

- DOE: ~$300k
- FY19 Annual Budget: ~$100k
- FY19 Cost Share: N/A

Key Partners:

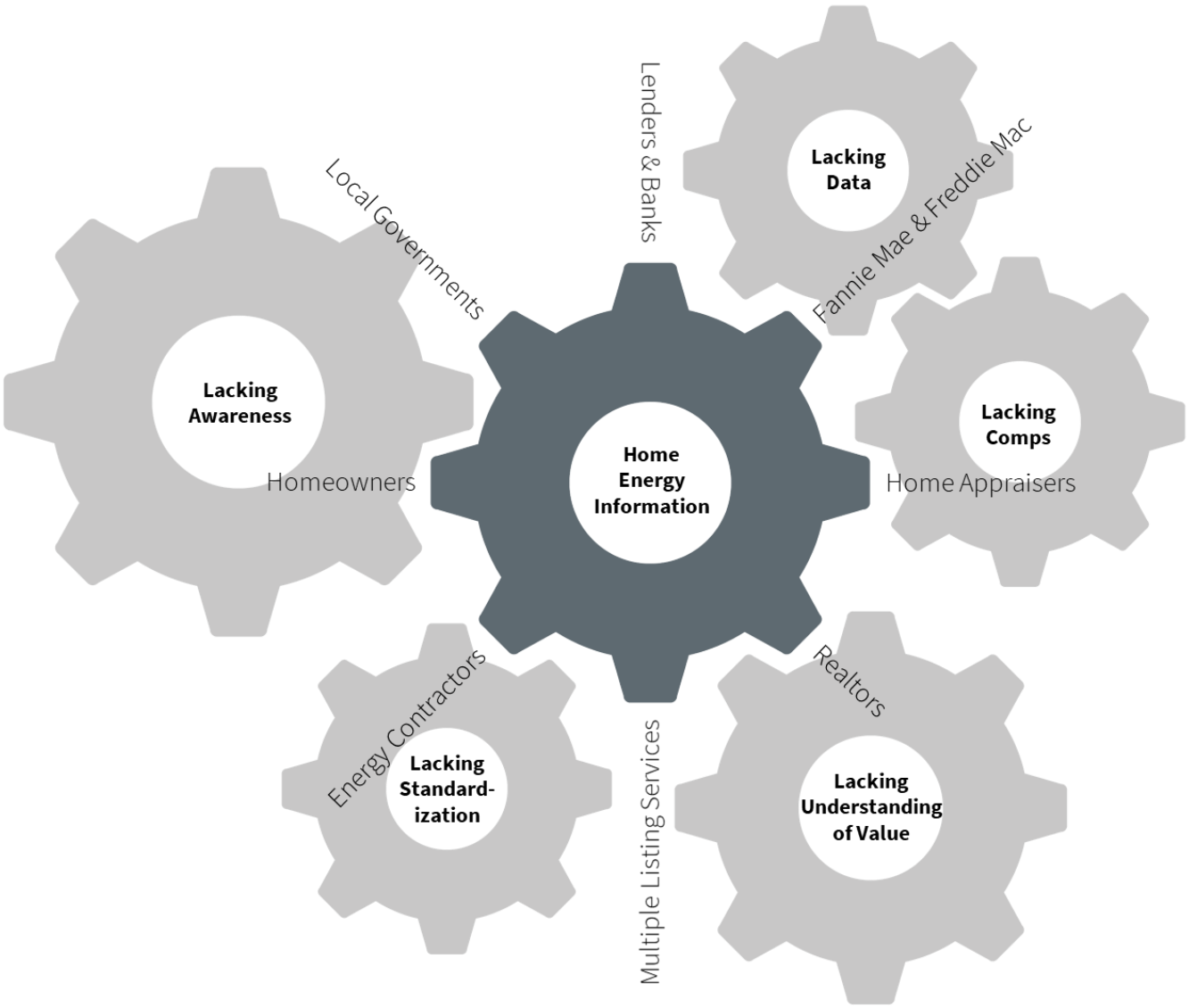
Northeast Energy Efficiency Partners	Council of Multiple Listing Services
Earth Advantage	Real Estate Standards Organization
National Association of REALTORS®	Regional Multiple Listing Service
Appraisal Institute	NASEO
Home Performance Coalition	Green Button Alliance
City of Portland, Oregon	State of Colorado
City of Chicago, Illinois	State of California

Project Outcome:

The Home Energy Information Accelerator was designed to expand the availability and use of reliable home energy information at relevant points in residential real estate transactions. It functioned as a collaborative effort among national organizations, federal agencies, and regional, state, and local leaders in real estate and energy efficiency. Accelerator Partners developed and demonstrated replicable, sustainable approaches that make energy related information – useful data that is often missing from the home buying process – easily available to home buyers and sellers through multiple listing service (MLS) and other reports.

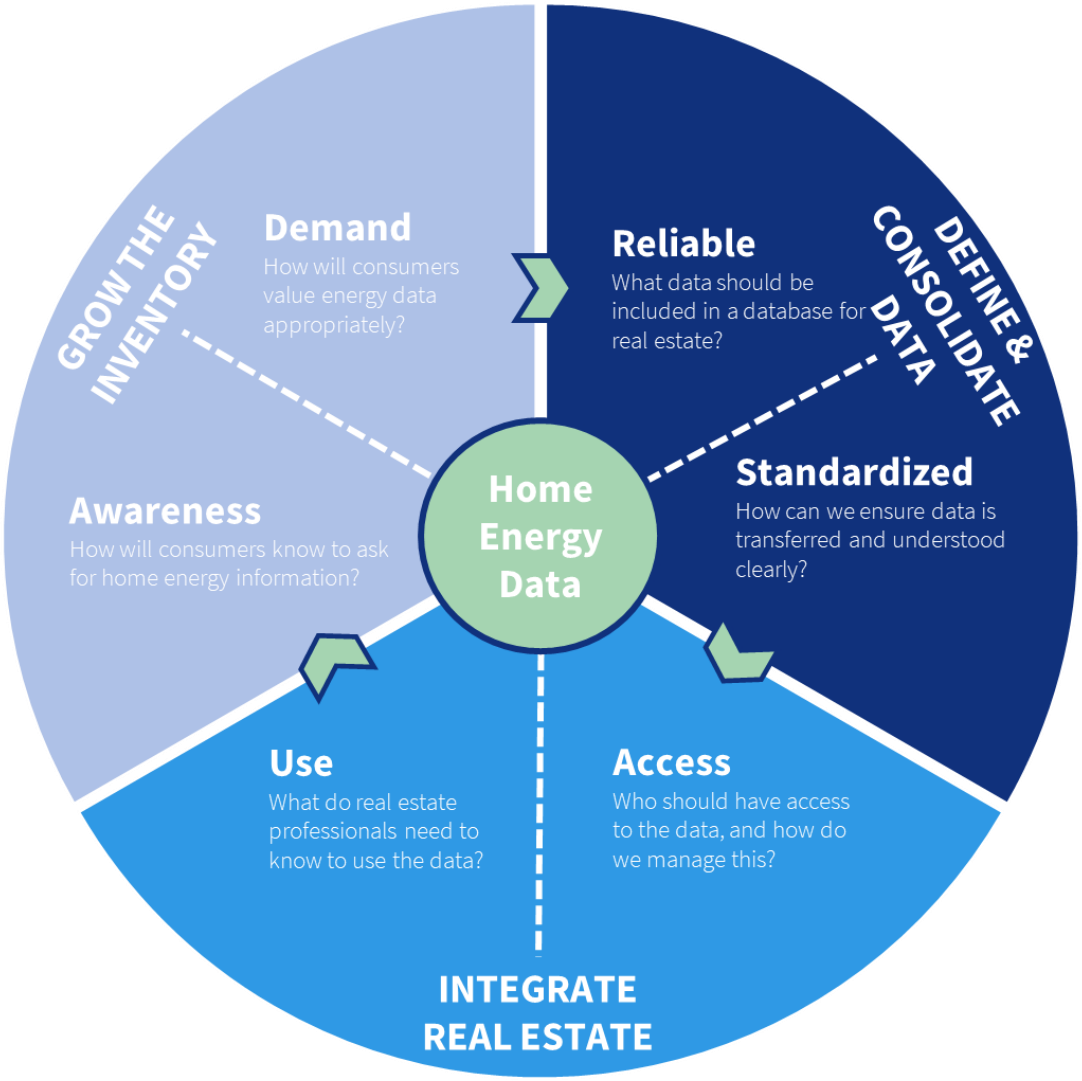
Team: Elevate Energy

Challenge



- Mortgage lenders and underwriters lack data to base energy efficiency financing.
- Appraisers lack comps data to attribute value to energy efficient homes.
- Realtors and MLSs lack building science knowledge base.
- Energy contractors lack data standardization needed for aggregation.
- Homeowners and local governments lack awareness about best-fit efficiency upgrades and benefits.
- **Result: Efficiency is persistently undervalued in the residential real estate market.**

Scope



Developed content in each major effort, including:

- ✓ Guidance materials
- ✓ Examples from the field
- ✓ Technical Language

Five pilot locations worked on efforts across these areas:

1. Portland, Oregon
2. Chicago, Illinois
3. Northeastern States
4. State of California
5. State of Colorado

National partners developed guidance, training, and outreach materials to assist pilot locations and others.

Impact

Accomplishments Defining & Consolidating Data

- ✓ Created HPXML Translator for Home Energy Score.
- ✓ Established proper use of RESO's Green Verification fields for variety of residential label programs.
- ✓ Created Green Verification databases built off of DOE's SEED Platform®: Green Building Registry™ and Home Energy Labeling Information eXchange (HELIX).

Accomplishments Integrating Real Estate

- ✓ Connection built between Green Building Registry™ and Regional Multiple Listing Service (RMLS) in Portland, Oregon.
- ✓ Link between eCompliance tool and Midwest Real Estate Data (MRED) MLS.
- ✓ Established opt-in and opt-out language for sharing home energy information across programs.
- ✓ Over 7,500 real estate professionals trained on home energy information throughout the country.

Accomplishments Growing the Inventory

- ✓ Over 10,000 Home Energy Scores populated within green verification data aggregators. Over 80,000 Home Energy Scores conducted in regions with access to these data aggregators.
- ✓ 30% increase in utility bill inclusion in MRED real estate listings in Chicago since 2014.
- ✓ Roughly 60% compliance rate among homes in RMLS with Home Energy Scores.

Collaboration, Coordination, and Integration

Coordination within EERE

- ✓ Coordination with WIP on State Energy Program (SEP) grant toward funding HELIX data aggregator.
- ✓ Coordination with BTO's SEED Platform® team on developing residential use case basis for HELIX and Green Building Registry™.
- ✓ Coordination with Home Energy Score team on building direct auto-population linkages between database and aggregators.
- ✓ Coordination with Home Upgrade Program (HUP) Accelerator on usage of HPXML data standard.

Coordination with Relevant Stakeholders

- ✓ Partnerships with nationally relevant stakeholders: National Association of REALTORS®, Appraisal Institute, CoreLogic, Real Estate Standards Organization, National Association of State Energy Officials, Council of Multiple Listing Services, Home Performance Coalition, etc.
- ✓ Partnerships with regional leaders and stakeholders necessary to creating the "turning gear"
- ✓ Continued partnership work with Fannie Mae, Freddie Mac, Rocky Mountain Institute, and others on better enabling financing products based on data.

Culminating Toolkit

Better Buildings®
U.S. DEPARTMENT OF ENERGY

Home Energy Information Accelerator: Toolkit to Bring Home Energy Data to the Real Estate Market

AUGUST 2018

U.S. DEPARTMENT OF ENERGY

References

Appraisal Institute's Residential Green & Energy Efficient Addendum

- https://www.appraisalinstitute.org/assets/1/7/ResidentialGreenandEnergyEfficientAddendum.pdf

Better Buildings Home Energy Information Accelerator Toolkit:

- https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/HEIA%20TOOLKIT%20080918.pdf

CMLS's Home Energy Information Guide

- https://c.ymcdn.com/sites/members.councilofmls.org/resource/resmgr/docs/news/HEIG/HEIG2017.pdf

Green Building Registry

- https://www.greenbuildingregistry.com/

HELIX

- https://neep.org/home-energy-labeling-information-exchange-helix

RESO Data Dictionary

- https://www.reso.org/data-dictionary/

Project Plan and Schedule

Current and Future Work

- Promotion and awareness building on Better Buildings Home Energy Information Accelerator
  - Effort throughout FY19
- Continued Technical Assistance for pilot regions
  - Front-loaded effort with TA on survey and evaluation design for PDX program
- White paper on home energy labeling reach in underserved markets
  - Missed opportunities for low-income, renters, manufactured homes, multifamily, etc.

Home Energy Information Accelerator Project Schedule													
Project Start: May 2015		Completed Work											
Projected End: May 2019		Active Task (in progress work)											
	◆	Milestone/Deliverable (Originally Planned)											
	◆	Milestone/Deliverable (Actual)											
		FY2017				FY2018				FY2019			
Task		Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Past Work													
City of Portland Council vote		◆											
CMLS's Home Energy Information Guide			◆	◆									
AI's Residential Green Addendum				◆									
Green Building Registry Launch in PDX						◆							
Accelerator Toolkit Launch									◆				
Current/Future Work													
Technical Assistance on PDX Survey										◆			
Finished Underserved Markets Paper											◆	◆	

Thank You

U.S. Department of Energy
Madeline Salzman, Acting Technology Manager
202-586-2540 | madeline.salzman@ee.doe.gov

Additional RBI Work

Home Energy Score Accomplishments

U.S. DEPARTMENT OF ENERGY
Home Energy Score

Program Stats

- ✓ 115,000+ Home Energy Scores
- ✓ 550+ Assessors nationwide
- ✓ 31+ states with at least 1 Score
- ✓ 30+ active Partner organizations
- ✓ 12+ software tools using the API
- ✓ 3+ linked mortgage lending products
- ✓ 2 linked home energy information databases for automatic data population
- ✓ 1 MLS populating Home Energy Scores in listings
- ✓ System infrastructure for nationwide pickup and use

Average Home Energy Scores from 100,000 sample:

4.7

Score Today

7.3

Score with Improvements

Associated average annual savings potential:

22%

Energy

$600

Energy Bills

Statewide Partnerships

OREGON DEPARTMENT OF ENERGY

DOER Massachusetts Department of Energy Resources

NYSERDA

energize CONNECTICUT

MISSOURI Department of Economic Development

Nationwide Partnerships

IDENERGY

ASHI · BPI · InterNACHI

CLEAResult®

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

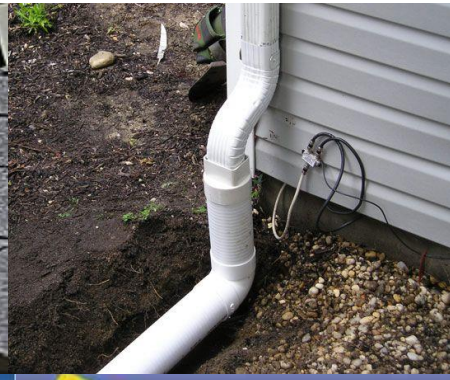
Home Improvement Expert

Building Technology Office – Residential Building Integration

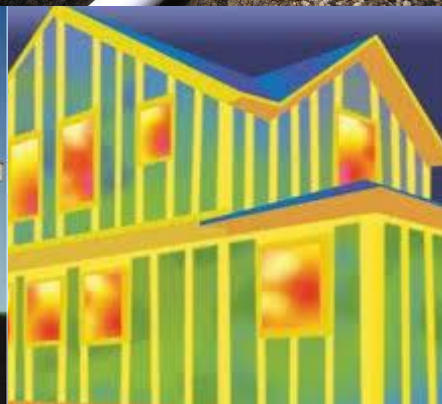
Sam Rashkin, Chief Architect

samuel.rashkin@ee.doe.gov





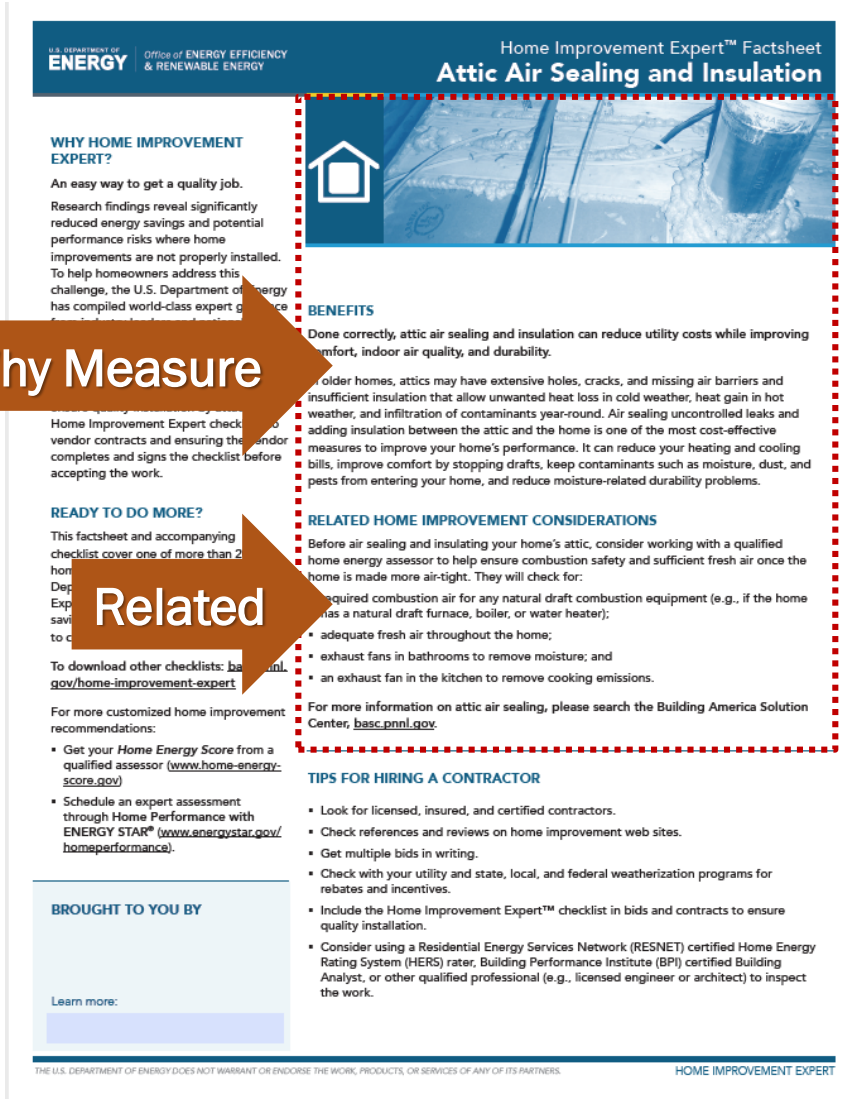


Consumer Home Upgrade Data

Projects	Projects Reported (000s)	Average Expenditures ($)	Total Expenditures (Millions $)
Systems and Equip.			
HVAC	3,819	5,878	22,445
Water Heater	3,551	976	3,467
Exterior Projects			
Room Additions	726	23,799	17,280
Siding	968	5,054	4,893
Windows/Doors	3,772	3,442	12,808
Insulation	1,356	1,483	2,010
Total	**14,192**		**62,903**

Source: ***"Improving America's Housing 2019,"*** The Joint Center for Housing Studies of Harvard University (2019)

Home Improvement Expert (HIE) Factsheet: Front



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Home Improvement Expert™ Factsheet

Attic Air Sealing and Insulation

WHY HOME IMPROVEMENT EXPERT?

An easy way to get a quality job.

Research findings reveal significantly reduced energy savings and potential performance risks where home improvements are not properly installed. To help homeowners address this challenge, the U.S. Department of Energy has compiled world-class expert g[illegible] Home Improvement Expert check[illegible] vendor contracts and ensuring the vendor completes and signs the checklist before accepting the work.

READY TO DO MORE?

This factsheet and accompanying checklist cover one of more than 2[illegible] hom[illegible] Dep[illegible] Exp[illegible] savi[illegible] to c[illegible]

To download other checklists: ba[illegible]nl.gov/home-improvement-expert

For more customized home improvement recommendations:

- Get your ***Home Energy Score*** from a qualified assessor (www.home-energy-score.gov)
- Schedule an expert assessment through **Home Performance with ENERGY STAR®** (www.energystar.gov/homeperformance).

BROUGHT TO YOU BY

Learn more:

BENEFITS

Done correctly, attic air sealing and insulation can reduce utility costs while improving comfort, indoor air quality, and durability.

In older homes, attics may have extensive holes, cracks, and missing air barriers and insufficient insulation that allow unwanted heat loss in cold weather, heat gain in hot weather, and infiltration of contaminants year-round. Air sealing uncontrolled leaks and adding insulation between the attic and the home is one of the most cost-effective measures to improve your home's performance. It can reduce your heating and cooling bills, improve comfort by stopping drafts, keep contaminants such as moisture, dust, and pests from entering your home, and reduce moisture-related durability problems.

RELATED HOME IMPROVEMENT CONSIDERATIONS

Before air sealing and insulating your home's attic, consider working with a qualified home energy assessor to help ensure combustion safety and sufficient fresh air once the home is made more air-tight. They will check for:

- [illegible]quired combustion air for any natural draft combustion equipment (e.g., if the home [illegible]as a natural draft furnace, boiler, or water heater);
- adequate fresh air throughout the home;
- exhaust fans in bathrooms to remove moisture; and
- an exhaust fan in the kitchen to remove cooking emissions.

For more information on attic air sealing, please search the Building America Solution Center, basc.pnnl.gov.

TIPS FOR HIRING A CONTRACTOR

- Look for licensed, insured, and certified contractors.
- Check references and reviews on home improvement web sites.
- Get multiple bids in writing.
- Check with your utility and state, local, and federal weatherization programs for rebates and incentives.
- Include the Home Improvement Expert™ checklist in bids and contracts to ensure quality installation.
- Consider using a Residential Energy Services Network (RESNET) certified Home Energy Rating System (HERS) rater, Building Performance Institute (BPI) certified Building Analyst, or other qualified professional (e.g., licensed engineer or architect) to inspect the work.

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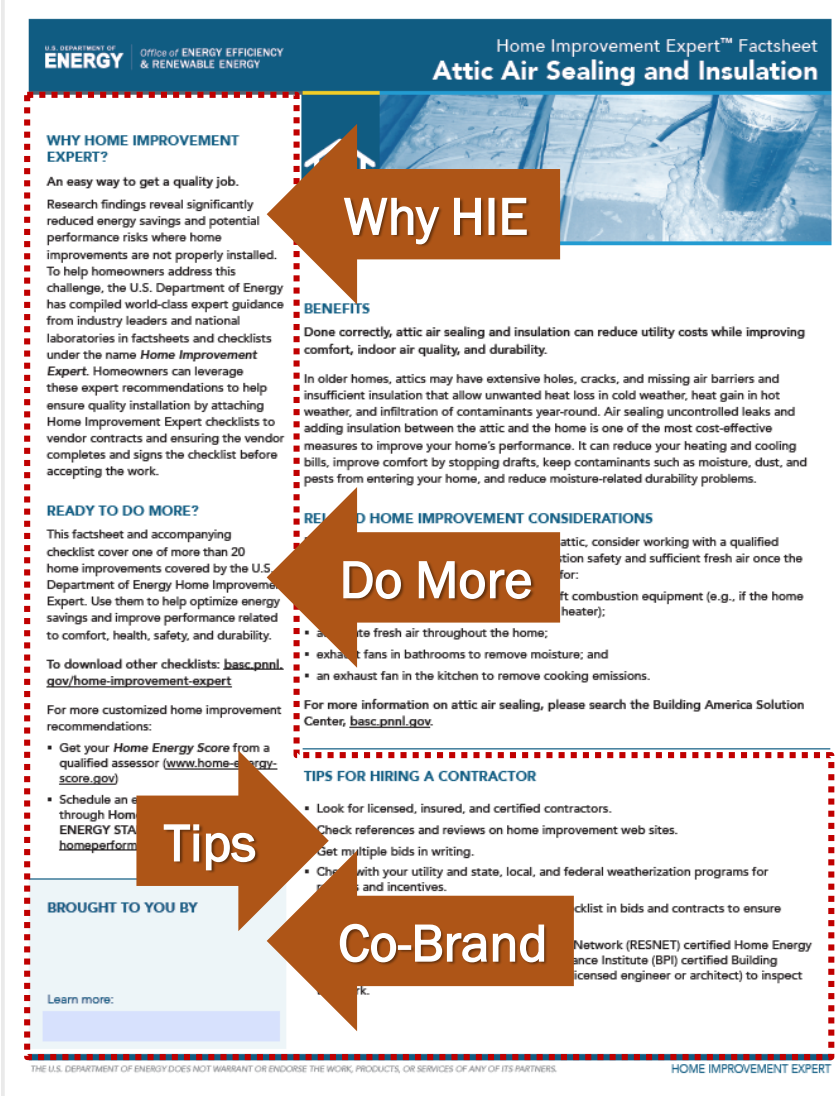
HOME IMPROVEMENT EXPERT

Why Measure

Related

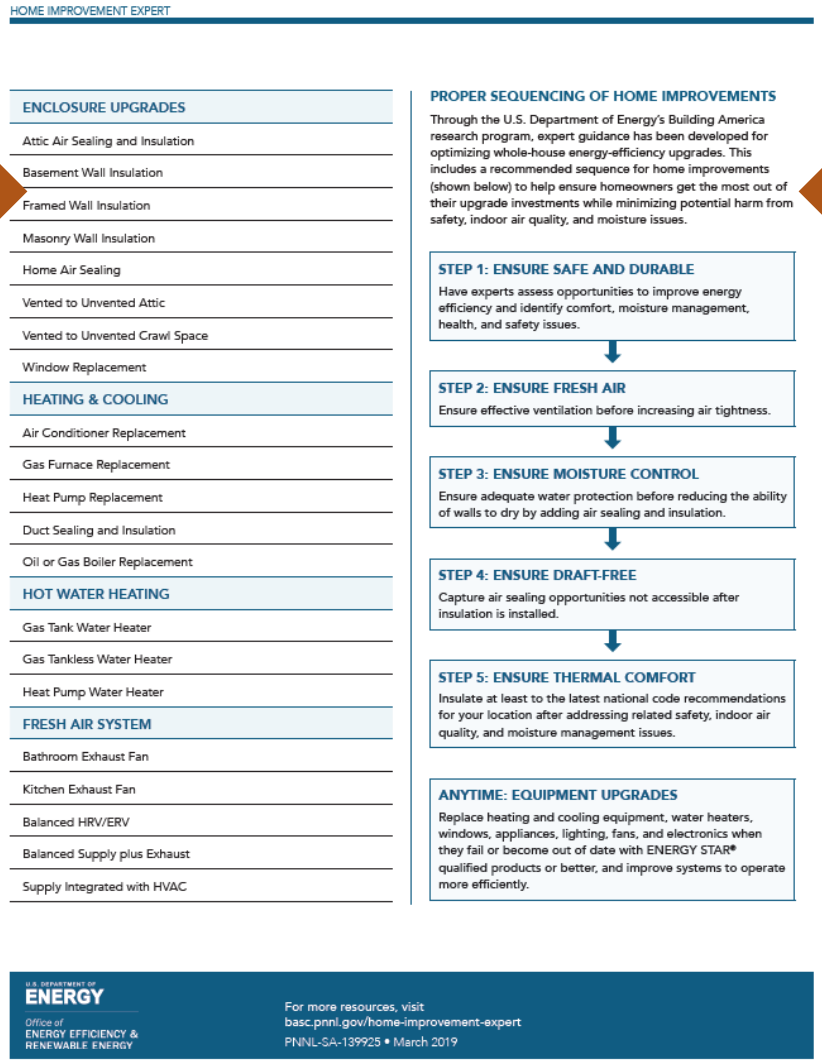
Home Improvement Expert (HIE) Factsheet: Front



Home Improvement Expert (HIE) Factsheet: Back

List of Checklists

Proper Sequencing



HOME IMPROVEMENT EXPERT

ENCLOSURE UPGRADES
Attic Air Sealing and Insulation
Basement Wall Insulation
Framed Wall Insulation
Masonry Wall Insulation
Home Air Sealing
Vented to Unvented Attic
Vented to Unvented Crawl Space
Window Replacement
HEATING & COOLING
Air Conditioner Replacement
Gas Furnace Replacement
Heat Pump Replacement
Duct Sealing and Insulation
Oil or Gas Boiler Replacement
HOT WATER HEATING
Gas Tank Water Heater
Gas Tankless Water Heater
Heat Pump Water Heater
FRESH AIR SYSTEM
Bathroom Exhaust Fan
Kitchen Exhaust Fan
Balanced HRV/ERV
Balanced Supply plus Exhaust
Supply Integrated with HVAC

PROPER SEQUENCING OF HOME IMPROVEMENTS

Through the U.S. Department of Energy's Building America research program, expert guidance has been developed for optimizing whole-house energy-efficiency upgrades. This includes a recommended sequence for home improvements (shown below) to help ensure homeowners get the most out of their upgrade investments while minimizing potential harm from safety, indoor air quality, and moisture issues.

STEP 1: ENSURE SAFE AND DURABLE
Have experts assess opportunities to improve energy efficiency and identify comfort, moisture management, health, and safety issues.

STEP 2: ENSURE FRESH AIR
Ensure effective ventilation before increasing air tightness.

STEP 3: ENSURE MOISTURE CONTROL
Ensure adequate water protection before reducing the ability of walls to dry by adding air sealing and insulation.

STEP 4: ENSURE DRAFT-FREE
Capture air sealing opportunities not accessible after insulation is installed.

STEP 5: ENSURE THERMAL COMFORT
Insulate at least to the latest national code recommendations for your location after addressing related safety, indoor air quality, and moisture management issues.

ANYTIME: EQUIPMENT UPGRADES
Replace heating and cooling equipment, water heaters, windows, appliances, lighting, fans, and electronics when they fail or become out of date with ENERGY STAR® qualified products or better, and improve systems to operate more efficiently.

U.S. DEPARTMENT OF ENERGY
Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

For more resources, visit
basc.pnnl.gov/home-improvement-expert
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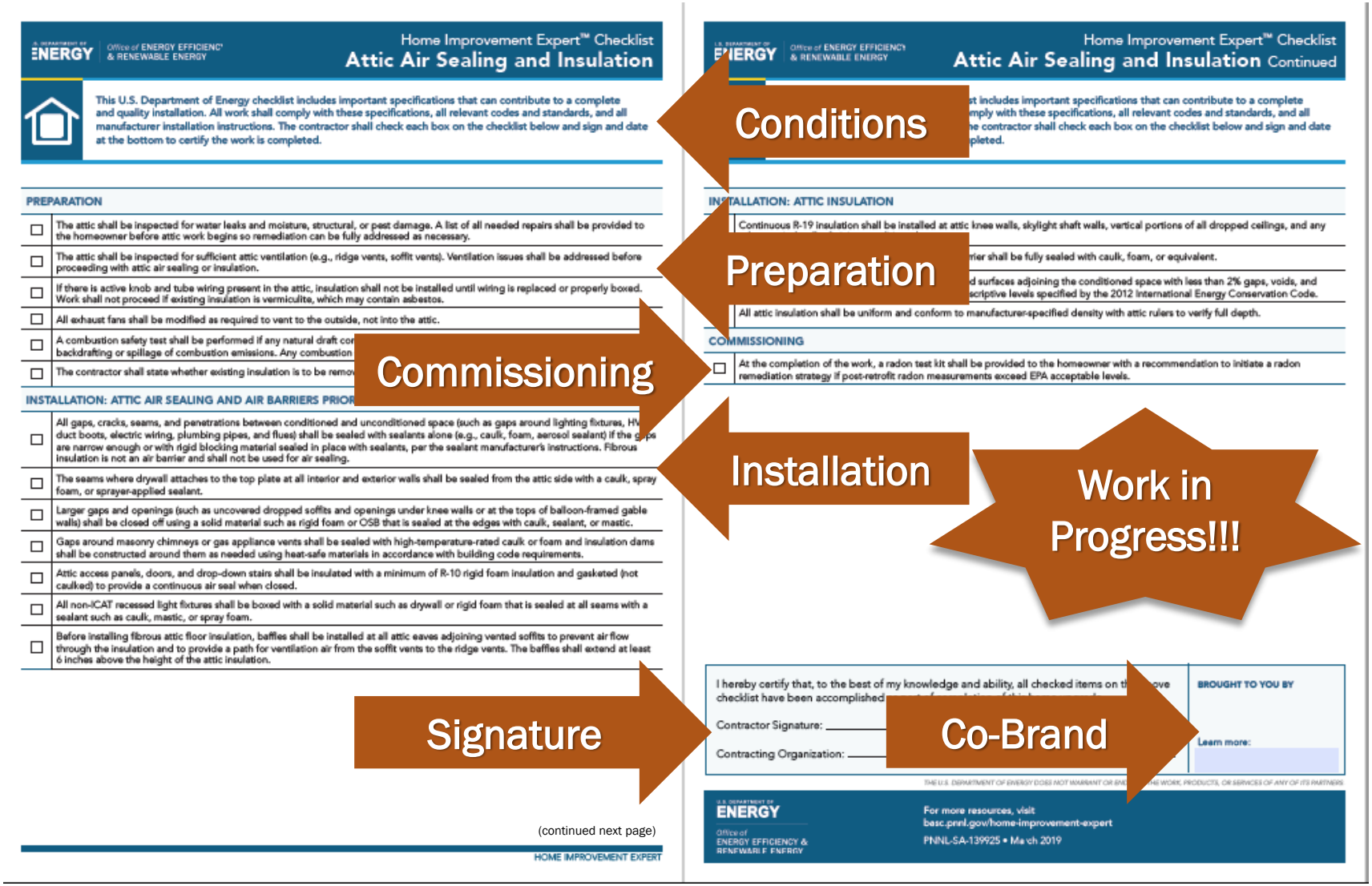
Home Improvement Expert (HIE) Checklist



HIE Industry Partner Commitment

Big Box Partners/Efficiency Programs:

- Disseminate and strongly recommend customers purchasing upgrades use DOE Checklists
- Promote HIE Checklists on Web/Advertising

Manufacturing Partners:

- Include HIE Checklists with Product Information
- Promote HIE Checklists on Web/Advertising

Contractors:

- Promote HIE Checklists to consumers
- Only associate HIE with checklist compliant work

HIE Estimated Impact by 2030

Assumptions:

- **Market Penetration:**
  (of 14 Million Home Improvements)
  - 7% by 2022 = 1 Million Homes/year
  - 33% by 2030 = 4.5 Million Homes/year
- **Avg. Energy Savings:**
  $120/yr./QI Home Improvement
- **15-year Life**
  per Home Improvement

2030 Impact:

- **~10s Millions**
  QI Home Improvements
- **~$10s Billions**
  Energy Savings
- **~Millions**
  Job-Years Work
- **~Millions Tons**
  Emission Reductions

HIE Status

- Version 1 Content Complete
  - 21 home improvement categories
- Integrated with Building America Solution Center
- Website Launched (https://basc.pnnl.gov/home-improvement-expert)
- Online Partnership Agreement
- Online Quarterly Reporting for Partners