2013 CEE Industry Partners Meeting: Residential Windows Working Group

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DOE's Building America Low-E Storm Window Adoption Program

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- Consortium for Energy Efficiency (CEE)
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Problem and Opportunity

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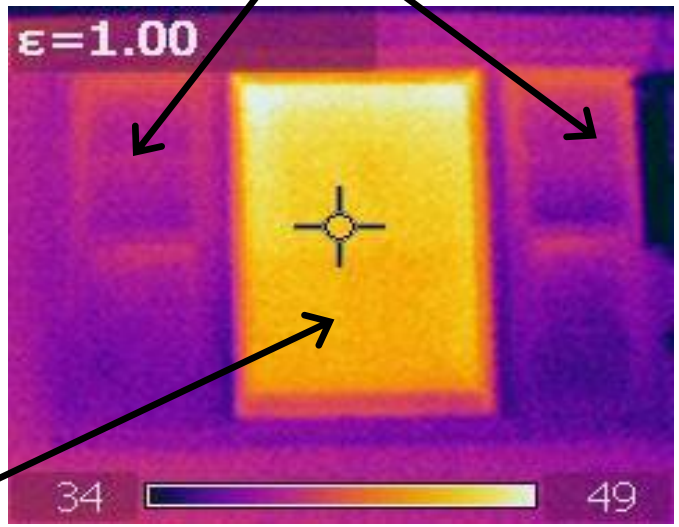
Problem

- Windows account for large percent of home's heating and cooling loads
- 19 billion ft^2 of existing windows, ~40% with single pane glass
- ~47 million homes with single glazing, another ~46 million with double pane clear
- However, many homeowners are either unwilling or unable to justify upfront cost and longer payback of full window replacement

Opportunity

- **Low-E Storm Windows** offer affordable way to ***insulate*** and ***air seal*** existing windows
- Applicable to existing homes and buildings
- Meets savings-to-investment ratio payback threshold for most weatherization programs
- Easy installation

With Low-E Storm Windows



Original single pane window
(light color = heat loss)

Building America's Market Transformation Activities FY 2013

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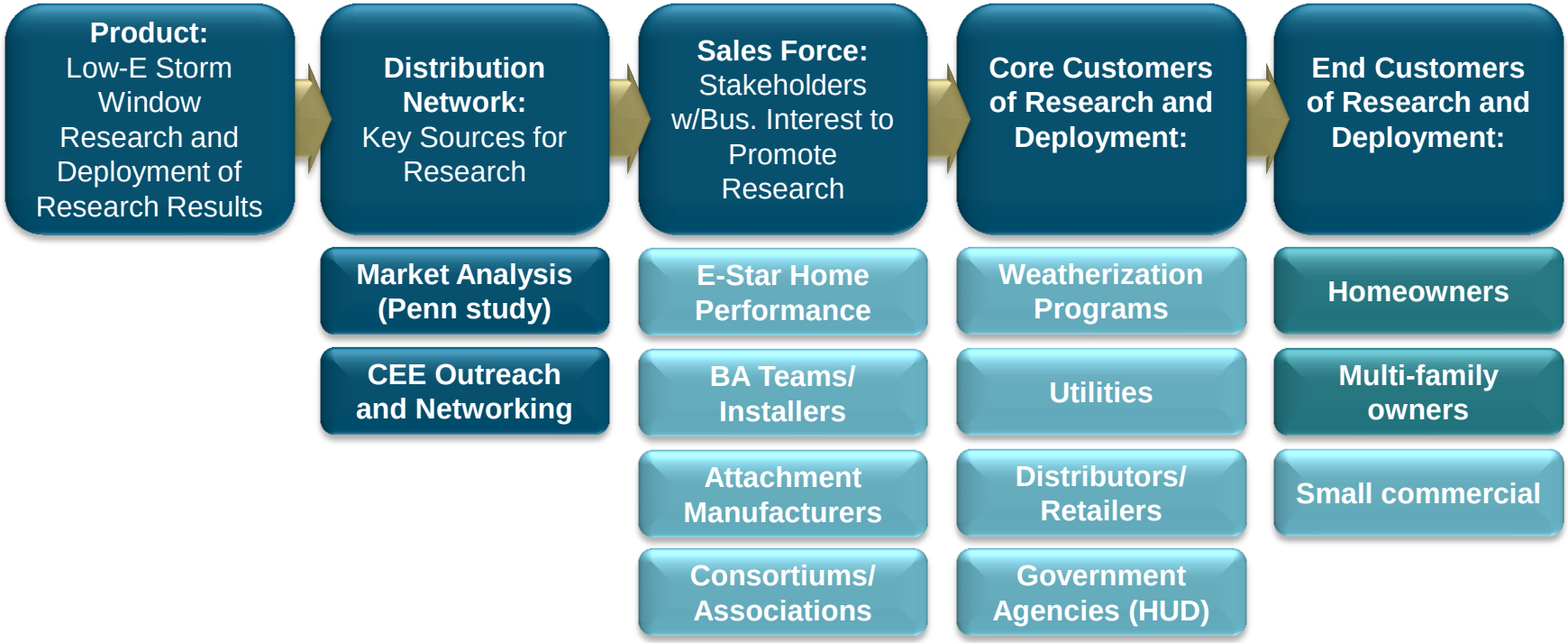
Market Transformation Progress

- Validate benefits, fill in data gaps
- Identify avenues for market transformation
- Begin developing networks and strategies
- Tailor building models to reach core customers

1. Lab Homes
2. Model Analysis
3. Market Assessment
4. Outreach
5. DOE Rating Support



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Data ranges today—PNNL research to fill gaps

	Single-Pane Window	Double-Pane Replacement window	Clear Storm Window	Preliminary Low-E Storm Window Data
Cost Range of window	--	$200 - $500	$70 - $125	$80 – $150
Installation cost	--	$100 - $500 per window	$2 (DIY) to $60 per window	$2 (DIY) to $60 per window
SIR compared to single pane	--	< 1 (not qualified for WX programs)	<1 to 1.2 (usually not qualified)	1.4 - 2.2 in PA Higher in colder climates. Well qualified.
Average HVAC Energy Cost Savings compared to single pane		11 – 35%	5 – 20%	12 – 33%
U-factor (Btu/hr ft2 F)	0.84	0.30 – 0.35	0.50	0.36
SHGC	0.63	0.25 – 0.30	0.56	0.48
Air leakage (cfm/ft2)	1 – 4	0.1 – 0.3	0.3	0.1 - 0.3

Lab Homes Experiments

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Preliminary Heating Season (2 weeks)

- Average of 10.3% whole-house energy savings (± 2.3 % with 95% confidence).
- HVAC savings were 14.7 % ± 3.7%. As the study progresses, more data will give this number more significance.

Preliminary Cooling Season

- Ongoing

Model Analysis (NEAT)

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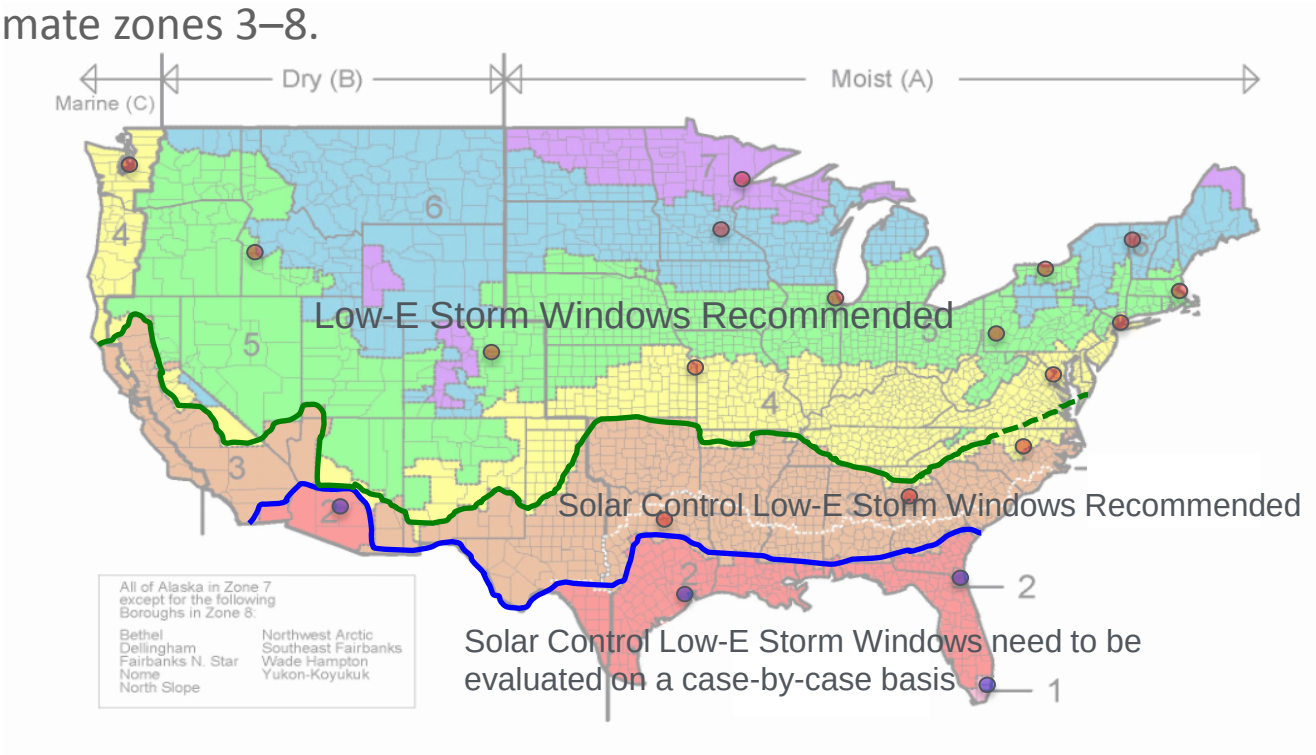
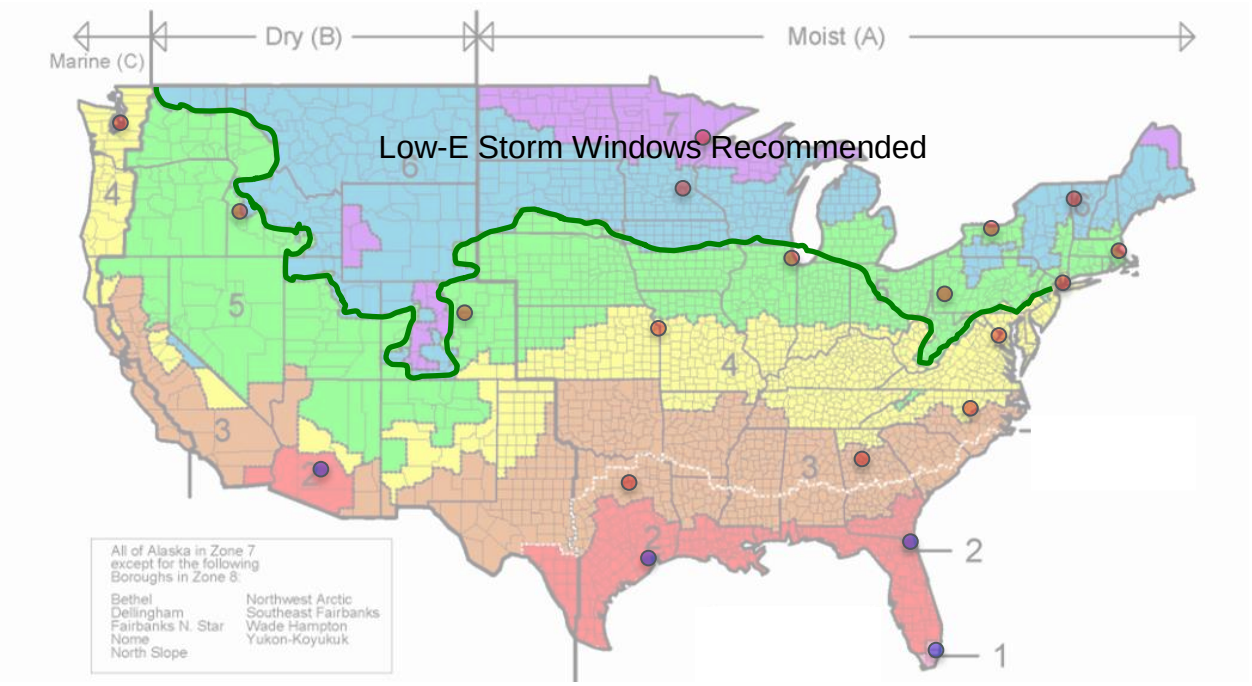
- Using conservative assumptions, low-E storm windows were found to always be cost-effective (i.e., savings-to-Investment Ratio, SIR, greater than 1) when installed **over single-pane windows** and **double-pane (clear) metal-framed windows** in climate zones 3–8.



- SIR ranged from 1.2 to 3.2 across the different locations analyzed.
- SIR will be higher in areas with higher heating fuel costs (including electrical resistance or propane heating), and with leakier primary windows.

Model Analysis (continued)

- Low-E storm windows were also found to be cost-effective when installed **over double-pane (clear) wood or vinyl framed windows** in climate zones 6–8, and in eastern parts of zone 5 where higher heating fuel costs exist.



- SIR ranged from 1.1 to 1.9 across the different locations analyzed.

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Market Transformation Pathways Identified

Sales Force: Stakeholders w/Business Interest to Promote Research

- Window Attachment Manufacturers
- Installers/Home Performance Contractors
- Energy-Efficiency Consortiums/ Associations
- BA Teams/ BB Teams/CBI Teams
- Federal Energy Management Program (FEMP)

Core Customers of Research and Deployment:

- Weatherization Programs
- Utilities
- Distributors/ Retailers
- Federal Agencies Managing Residential Stock
- Standards and Rating Organization (e.g., Energy Star)

End Customers of Research and Deployment:

- Private Homeowners/ Occupants (Not Low-Income)
- Multifamily owners
- Low-Income Homes and Public Housing
- Federally Owned Residential Stock
- Applicable Commercial (Small Buildings, Lodging, Nursing Homes, Dormitories)

Market Assessment

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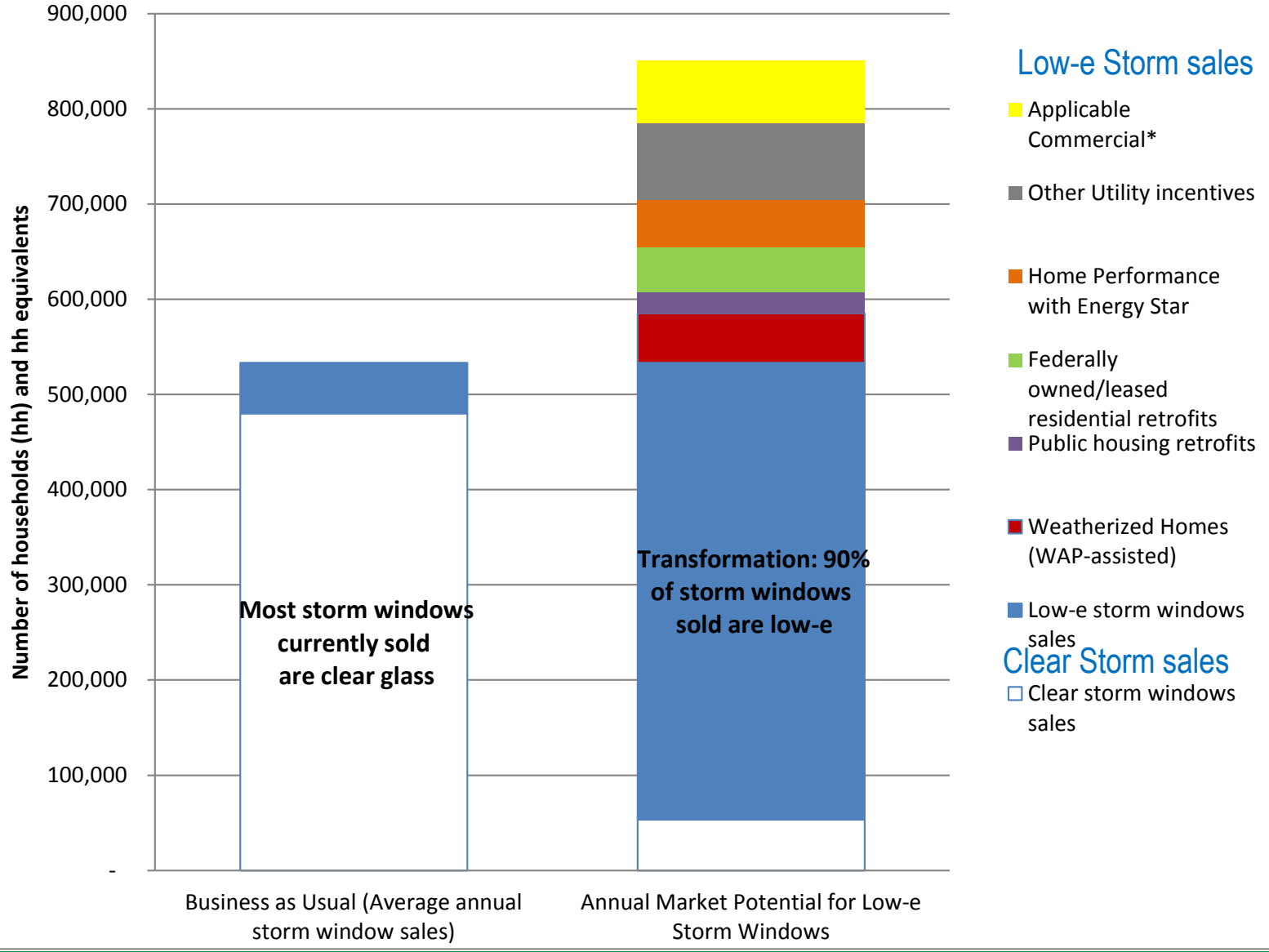
Barrier	Strategy/Pathway to Overcoming Barriers
Identity Crisis	CEE, Weatherization programs, Utilities, Codes and rating organizations
Stigma	Utilities, CEE, WAP, and Federal agencies
Not recognized by rating systems	Codes and rating organizations: NFRC, Building America's CSI team, ENERGY STAR (EPA/DOE), Home Energy Score (DOE)
Do-it-yourself (or not)	Weatherization programs, Home Performance with ENERGY STAR, Federal Energy Management Program (FEMP)
Potential code and building rating barriers	Building America's Codes and Standards Innovation (CSI) Team
Industry structure	No specific strategy identified

Market Potential



Discussion

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References:

Low-e Storm Windows: Market Assessment and Pathways to Market Transformation. K.A. Cort. July, 2013. PNNL-22565, Pacific Northwest National Laboratory.

Task ET-WIN-PNNL-FY13-01_5.2: Low-E Storm Windows NEAT Analysis of Individual Zones. Thomas Culp and K.A. Cort. PNNL-SA-96778. July, 2013.

Preliminary Lab Home Results – Final Results forthcoming winter, 2014.