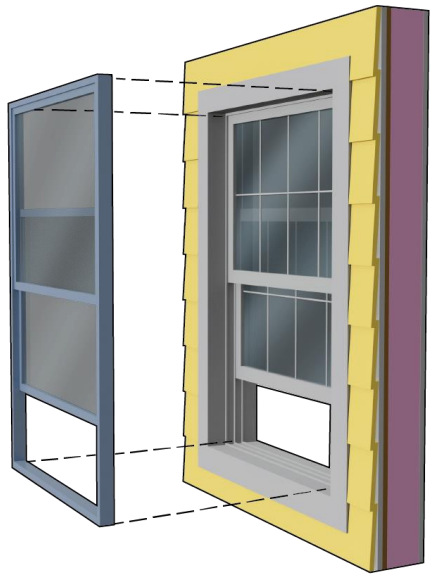
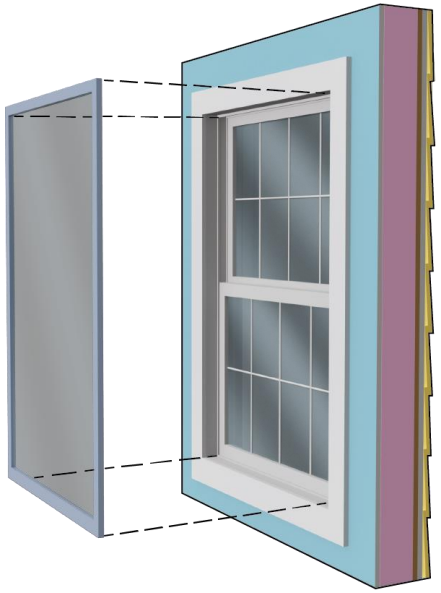
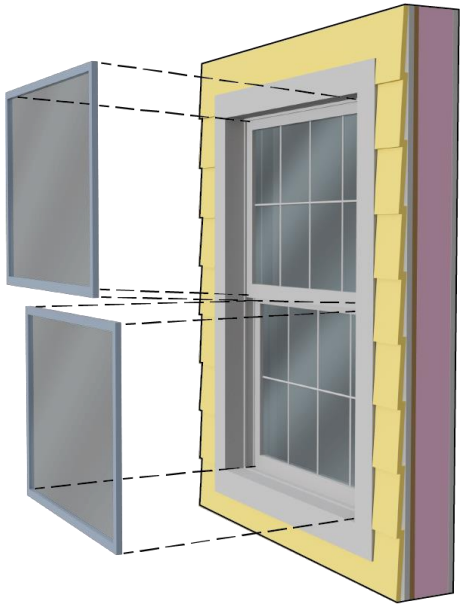
Storm Window and Insulating Panel Campaign







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WBS # 1.4.2.3

https://www.energy.gov/eere/buildings/storm-window-and-insulating-panel-campaign

Project Summary

Objective and Outcome

The SWIP Campaign aims to accelerate the adoption of modern, high-performance storm windows and insulating window panels (sometimes called window inserts or secondary glazing) to deliver energy savings and comfort in residential buildings at a fraction of the cost of full window replacement.

Team and Partners

PNNL collaborates with the following organizations who make up the SWIP Organizing (planning) Committee.

AERC Attachments Energy Rating Council
ENERGY STAR
Weatherization Assistance Program SINCE 1976
Efficiency Vermont
cee Center for Energy and Environment
neea
PAWS PARTNERSHIP FOR ADVANCED WINDOW SOLUTIONS

Stats

Performance Period: FY23 (Ongoing FY21-FY24+)

DOE budget FY23: $484K, Official Cost Share: $0K

Milestone 1: Complete program playbook and technical resource packet

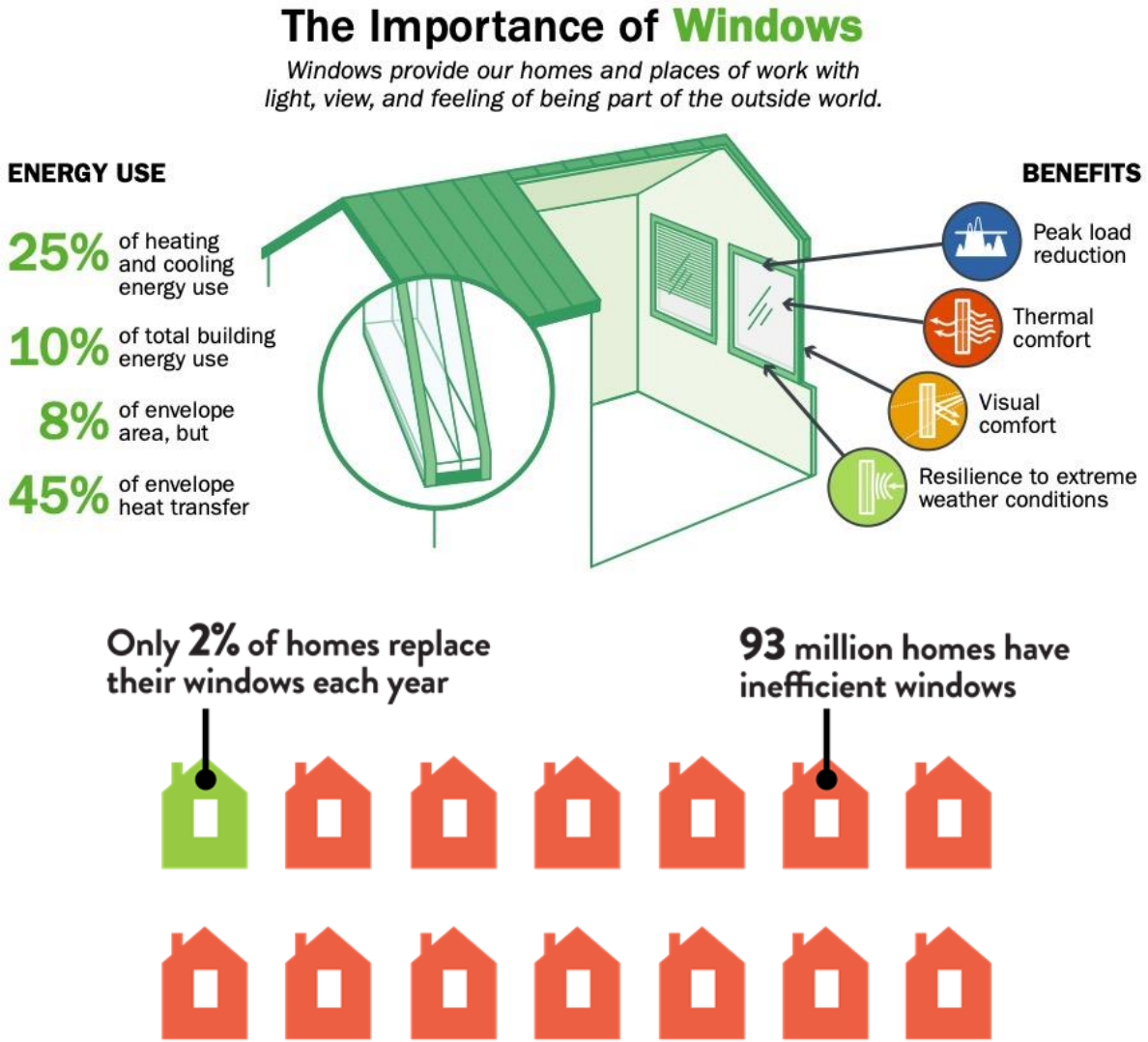
Milestone 2: Stakeholder/Partner Participation

Milestone 3: Outreach

Milestone 3: Host Recognition event

Problem

- Windows comprise only 8% of a home's exterior, yet contribute to 45% of envelope heat transfer[1].
- Windows account for around 25% of a home's heating/cooling energy use[1].
- >50% of homes have inefficient windows[2]. However, replacing all windows in a home can be cost-prohibitive, and only 2% of homes replace their windows each year.
- Modern storm windows and insulating panels are a cost-effective alternative to full window replacement, but they are not widely adopted in the market.



1. Harris, 2022
2. DOE-EIA, 2015

Alignment and Impact

EERE/BTO's vision for a net-zero U.S. building sector by 2050

Support rapid decarbonization of the U.S. building stock in line with economywide net-zero emissions by 2050 while centering equity and benefits to communities

- ✓ Increase Building Energy Efficiency
- ✓ Prioritize Equity, Affordability, and Resilience
- ✓ Reduce Residential Carbon Footprint and Energy Consumption

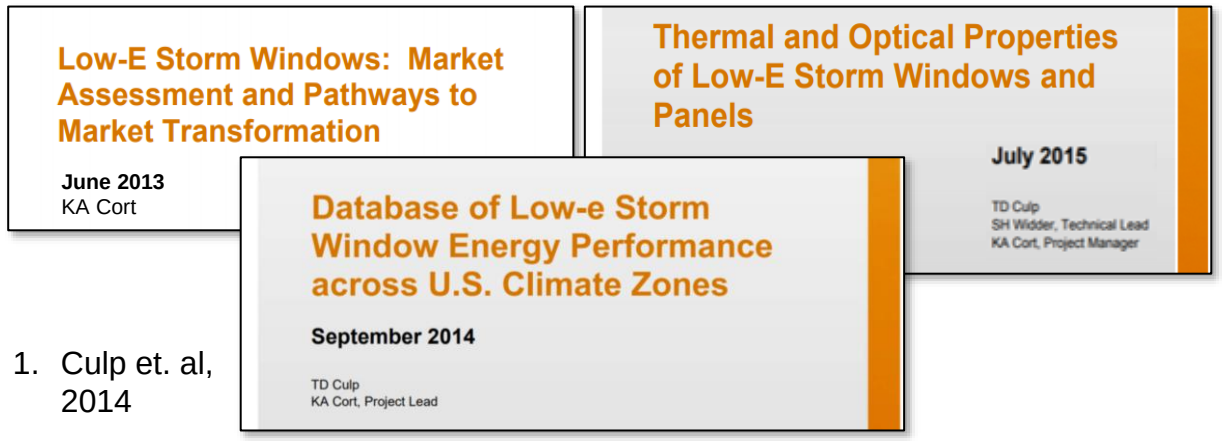
How the SWIP Campaign Addresses EERE/BTO's vision:

- Window improvements are necessary to realizing the energy savings associated with building decarbonization efforts
- High-performance storm windows and insulating panels provide comparable energy savings to full window replacement
- Storm windows and insulating panels are particularly applicable in low-income and weatherization assistance programs

Approach: Modern Storm Windows and Insulating Panels

Storm Windows and Insulating Panels

- Field demonstrated energy savings
  - 10–30% year-round savings[1]
  - Improved u-factor (pyrolytic low-emissivity coating), creates dead air space, air sealing of prime window, and solar control coatings
- Cost-effective
  - Similar savings to double-pane replacement, roughly 1/3 of the cost[1]
  - Savings-to-investment ratio (SIR) > 1 in most climate zones[1]
- New energy ratings
  - ENERGY STAR Certified Storm Windows (ES product search tool)
  - AERC Residential Storm Windows (AERC product search tool)



1. Culp et. al, 2014

Barriers to Adoption

Identify Crisis (Lack of Awareness) – Low awareness of this measure's benefits and where it fits into energy efficiency programs.

- Few utility programs offer incentives
- Few weatherization program include it
- Home performance contractors do not consistently include it in their portfolio of offerings

Stigma/Misinformation – Storm windows suffer from an image problem due, in part, to

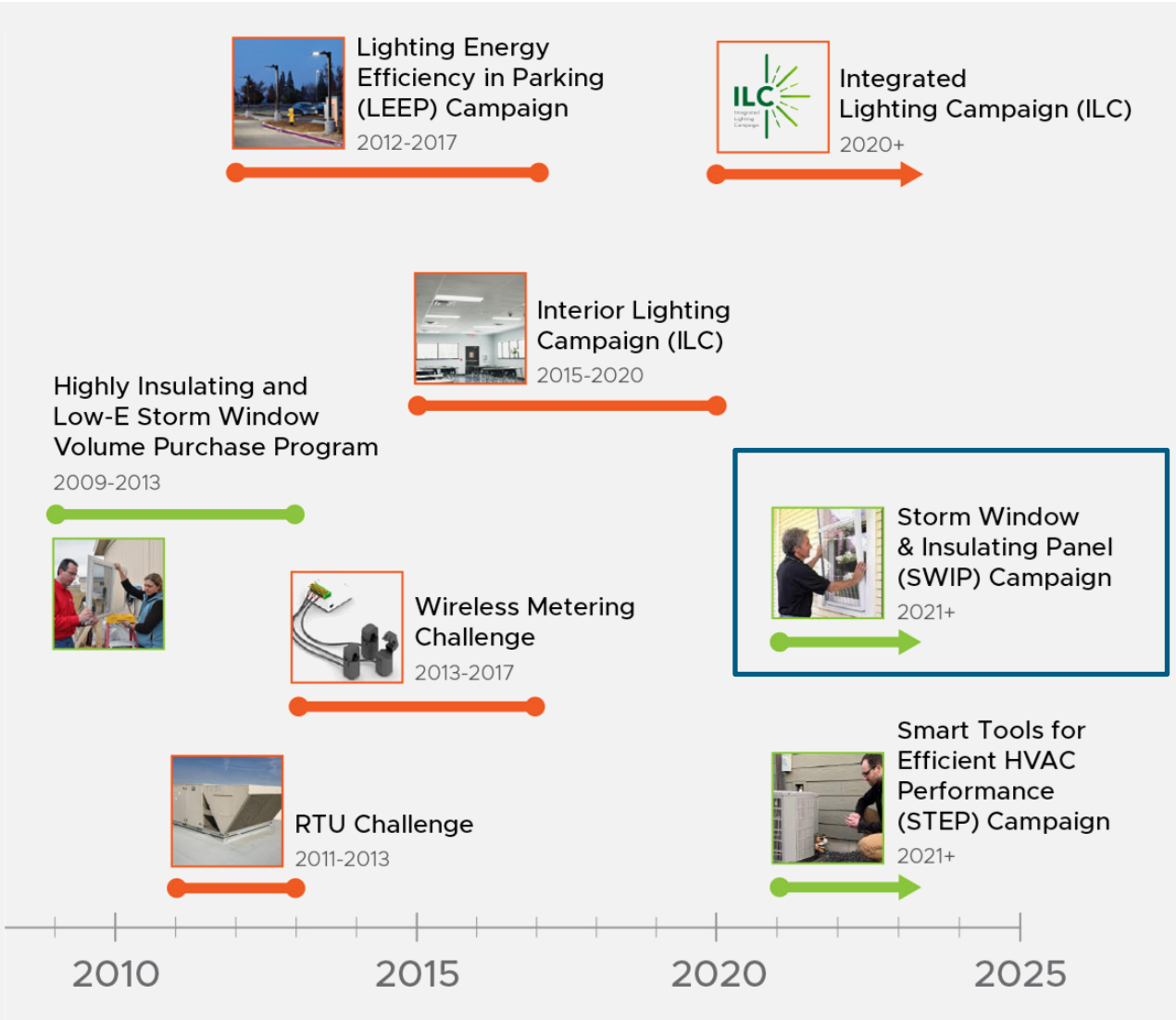
- Unattractive, inoperable storm windows of the past
- Misinformation regarding applicability, payback, program acceptance, and condensation

Broad Visibility Lacking - Ratings and Labels not well known (e.g., Retail visibility, AERC, Energy Rating, Home Energy Score)

Industry Structure – Most manufacturers of secondary panels are also primary window manufactures, which generate higher profit margin. These manufacturers have little incentive to "market" secondary glazing products.

Approach: Technology Campaign

Timeline of recent PNNL led technology competitions



Technology Campaigns

- Aim to increase adoption of underutilized energy efficiency technologies already in the market
- Translate success from commercial sector campaigns to the residential sector

Storm Window and Insulating Panel Campaign

- Support utilities in developing programs
- Help weatherization organizations include storm windows and insulating panels when cost-effective
- Encourage manufacturers to get products rated through AERC and ENERGY STAR
- Recognize successful adoption

SWIP Campaign Organizers

AERC Attachments Energy Rating Council
ENERGY STAR
Weatherization Assistance Program SINCE 1976
Efficiency Vermont
cee Center for Energy and Environment
neea
PAWS PARTNERSHIP FOR ADVANCED WINDOW SOLUTIONS

Defining Success for the SWIP Campaign

Utilities and Program Implementers

- ✓ Broad adoption of AERC-rated and ENERGY STAR storm windows in utility and energy efficiency programs

Weatherization Organizations

- ✓ Energy audit tools properly characterize performance of modern storm windows and insulating panels
- ✓ WAP network regularly installs high-performance storm windows when cost-effective

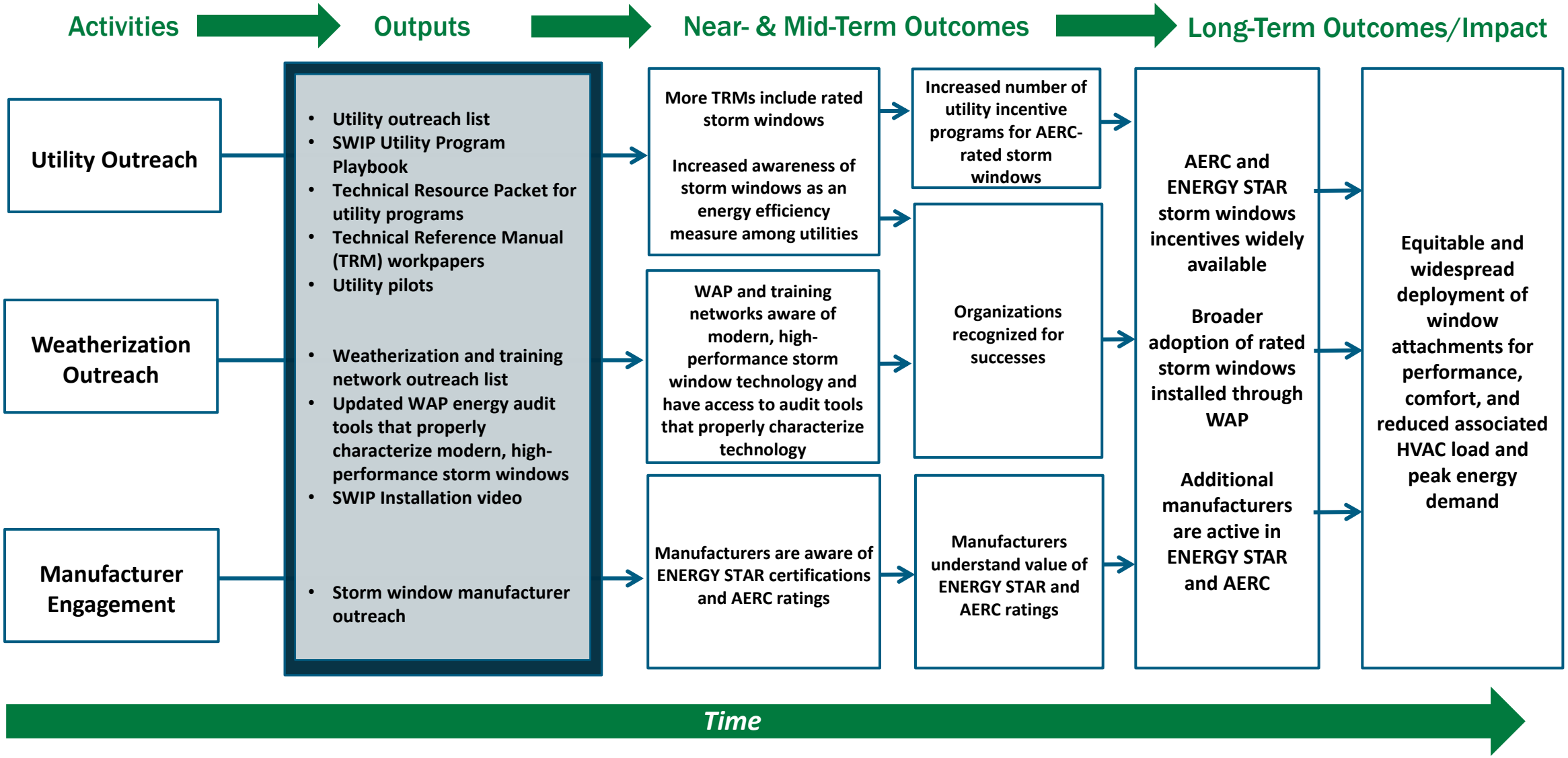
Manufacturers

- ✓ AERC and ENERGY STAR have sustainable storm window programs with highly-engaged manufacturers

Project Risks & Mitigation:

Frequent collaboration and engagement with critical stakeholders helps ensure that all partners are working towards shared goals, and mid-term changes in strategy can be made if needed.

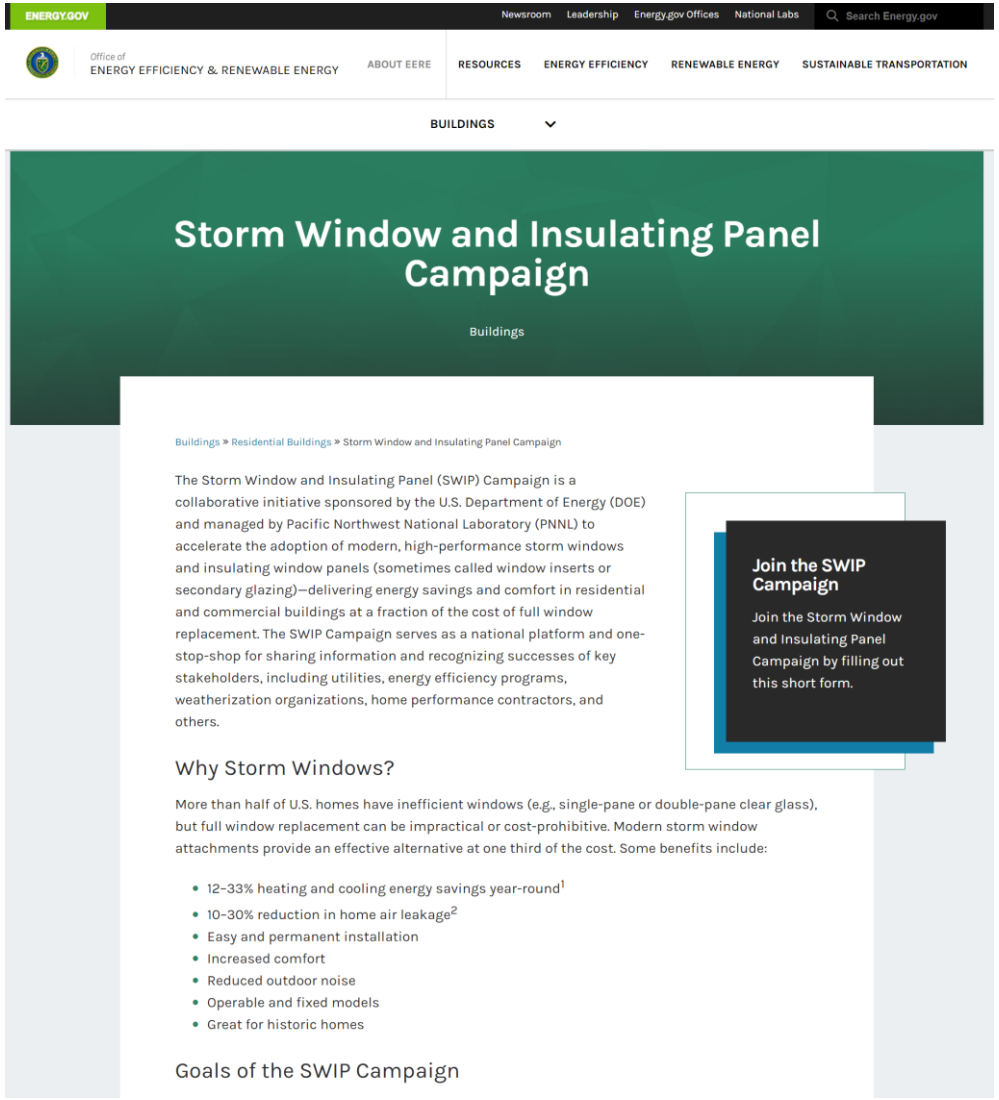
Approach: SWIP Campaign Logic Model



Approach: Summary of Metrics

Activities	Near-Term Outcomes	Mid-Term Outcomes	Long-Term Outcomes
Utility Outreach	- Total # of states that have rated storm window measures in their TRM (15) - Total # of utilities that incentivize rated storm windows (7)	- Increase # of utilities providing incentives for energy-rated storm windows and insulating panels	- Rated storm windows and insulating panels are widely adopted into utility and energy efficiency incentive programs (Y/N)
Weatherization Outreach	- # of WAP grantees and subgrantees engaged with the Campaign (2) - # of WAP training centers participating in the Campaign (2)	- Increase # of WAP agencies including rated storm windows in their energy audits - Increased # of rated storm windows installed through WAP program	- All WAP audit tools properly characterize high-performance storm windows (Y/N)
Manufacturer Engagement	- # of storm window manufacturers engaged in SWIP Campaign (6)	- Increase # of new manufacturers with AERC-rated or ENERGY STAR certified products	- AERC and ENERGY STAR have sustainable storm window programs with highly-engaged manufacturers

Progress: Resource Development



Resources developed to increase awareness and build body of knowledge

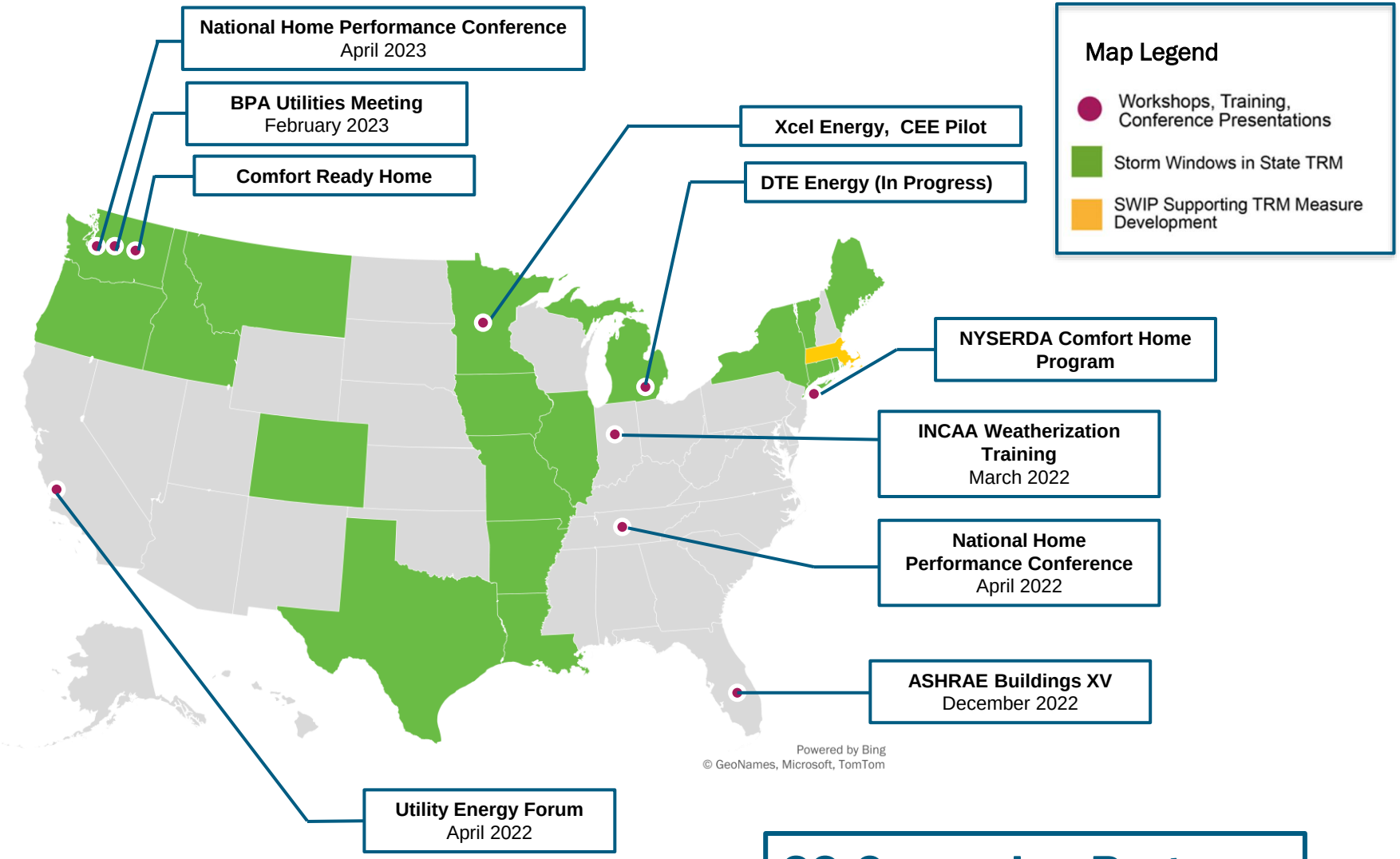
- "One-stop-shop" website launched to consolidate resources
- SWIP utility program playbook
- Technical reference manual development
- Energy auditor/contractor decision tree
- Consumer marketing flyer
- SWIP Campaign introduction video and installation video

www.energy.gov/eere/buildings/storm-window-and-insulating-panel-campaign

Progress: Raising Awareness

Virtual Outreach Events

- ✓ NCAP Webinar
- ✓ NASCSP Winter Conference
- ✓ Better Buildings Webinars
- ✓ International Energy Program Evaluation Conference
- ✓ Weatherization Trainers Consortium
- ✓ CLEAResult Training
- ✓ AERC Fall Meeting
- ✓ SWIP Residential Storm Window Summit



29 Campaign Partners

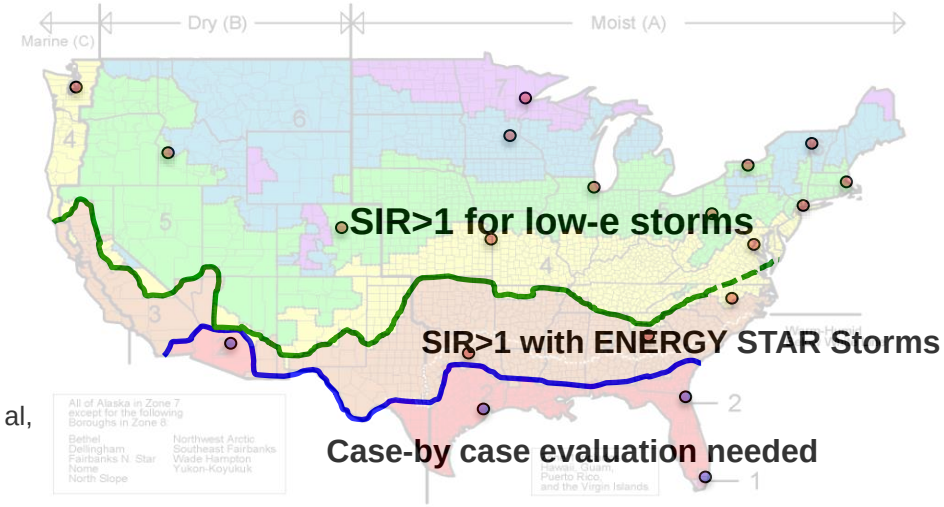
Progress and Future Work: Weatherization

Progress

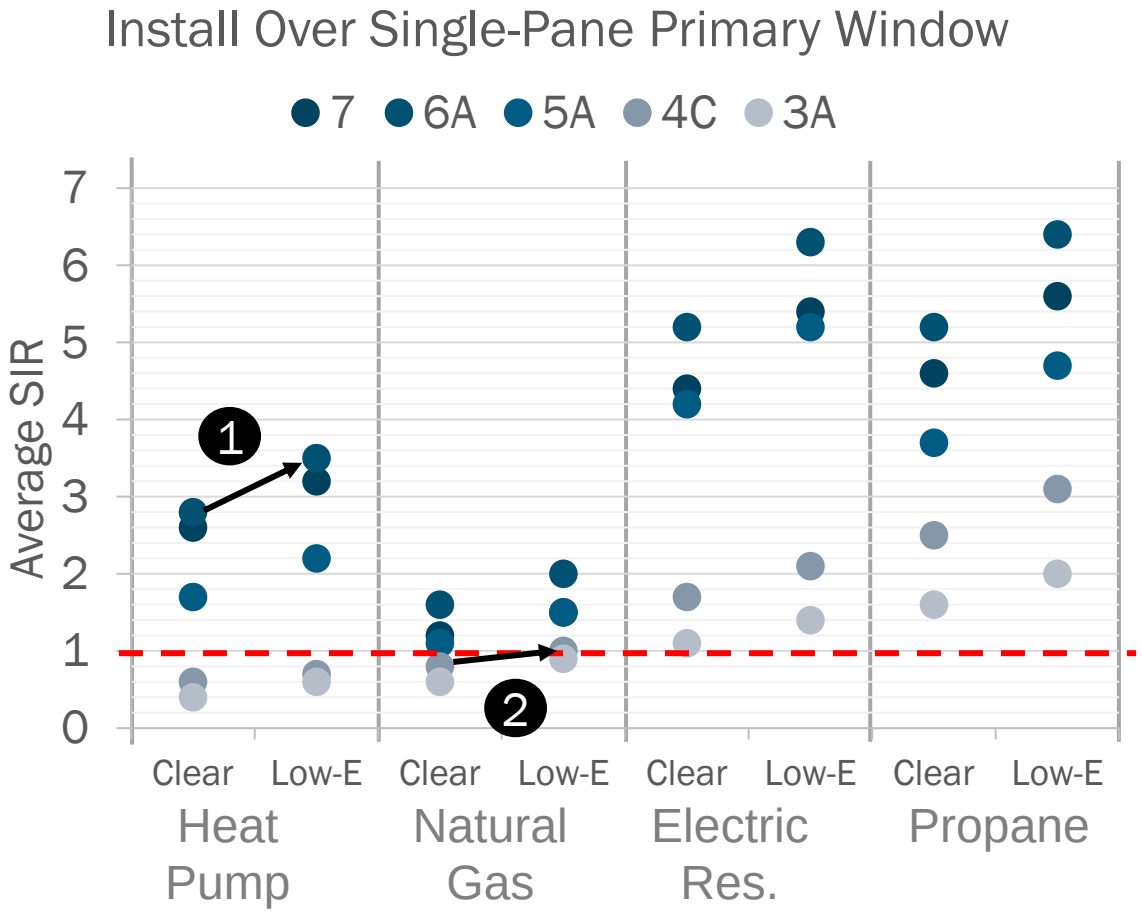
- Actively engaged with WAP Trainers' Consortium
- Supported improved characterization of low-e storm windows in Weatherization Assistant v10
- ASHRAE Buildings XV Paper published on low-e storm window application in manufactured homes

Future Work

- Continue building awareness through conferences, weatherization training centers, case studies
- Reach out to grantees/subgrantees transitioning to WAv10



1. Culp et. al, 2014



1. SIR increase, moves up ECM priority list
2. SIR increase past cost-effectiveness threshold (SIR>1)

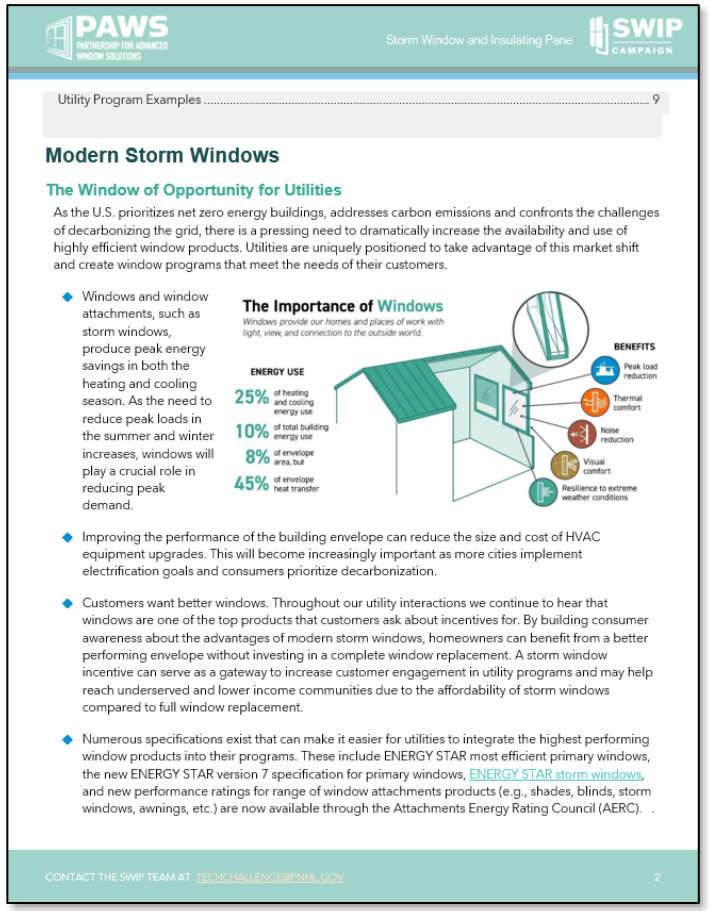
Progress and Future Work: Utility Programs

Progress

- 2 new TRMs now include energy-rated storm windows (TX, AR)
- Xcel Energy (Minnesota) Pilot
- Utility program playbook
- Other resources
  - Window improvement decision tree
  - Re-brandable marketing collateral

Future Work

- Continue outreach efforts
- Support existing programs
- Case study on findings from Minnesota pilot
- Recognize exemplary partners



PAWS Partnership for Advanced Window Solutions — Storm Window and Insulating Pane — SWIP Campaign

Utility Program Examples 9

Modern Storm Windows

The Window of Opportunity for Utilities

As the U.S. prioritizes net zero energy buildings, addresses carbon emissions and confronts the challenges of decarbonizing the grid, there is a pressing need to dramatically increase the availability and use of highly efficient window products. Utilities are uniquely positioned to take advantage of this market shift and create window programs that meet the needs of their customers.

- Windows and window attachments, such as storm windows, produce peak energy savings in both the heating and cooling season. As the need to reduce peak loads in the summer and winter increases, windows will play a crucial role in reducing peak demand.

The Importance of Windows

Windows provide our homes and places of work with light, view, and connection to the outside world.

ENERGY USE

25% of heating and cooling energy use

10% of total building energy use

8% of envelope area, but

45% of envelope heat transfer

BENEFITS

Peak load reduction

Thermal comfort

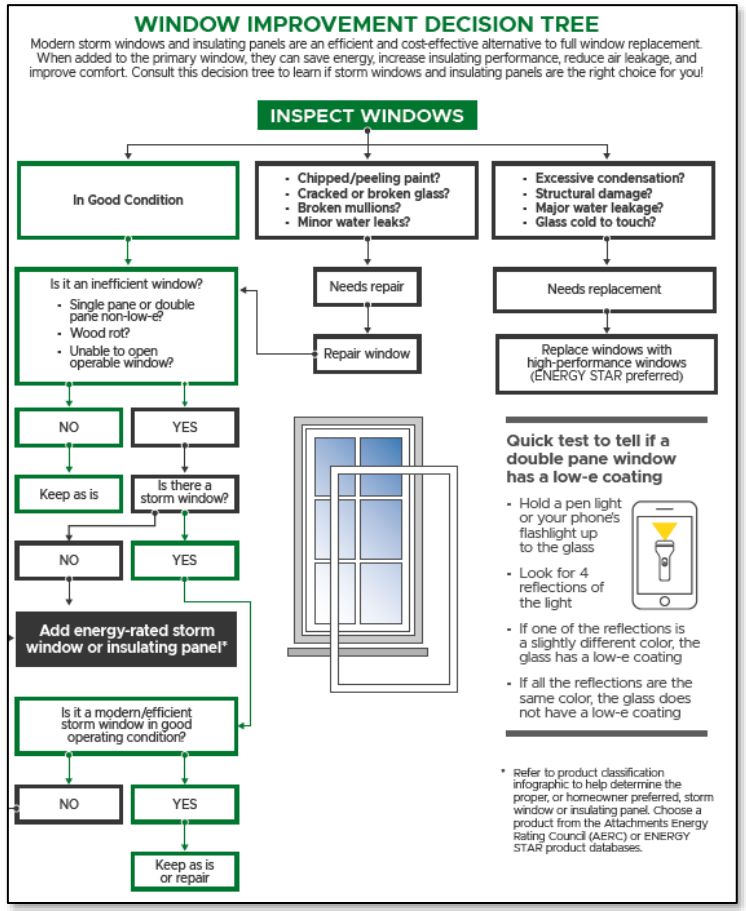
Noise reduction

Visual comfort

Resilience to extreme weather conditions

- Improving the performance of the building envelope can reduce the size and cost of HVAC equipment upgrades. This will become increasingly important as more cities implement electrification goals and consumers prioritize decarbonization.
- Customers want better windows. Throughout our utility interactions we continue to hear that windows are one of the top products that customers ask about incentives for. By building consumer awareness about the advantages of modern storm windows, homeowners can benefit from a better performing envelope without investing in a complete window replacement. A storm window incentive can serve as a gateway to increase customer engagement in utility programs and may help reach underserved and lower income communities due to the affordability of storm windows compared to full window replacement.
- Numerous specifications exist that can make it easier for utilities to integrate the highest performing window products into their programs. These include ENERGY STAR most efficient primary windows, the new ENERGY STAR version 7 specification for primary windows, ENERGY STAR storm windows, and new performance ratings for range of window attachments products (e.g., shades, blinds, storm windows, awnings, etc.) are now available through the Attachments Energy Rating Council (AERC).

CONTACT THE SWIP TEAM AT TECHCHALLENGE@PNNL.GOV 2



WINDOW IMPROVEMENT DECISION TREE

Modern storm windows and insulating panels are an efficient and cost-effective alternative to full window replacement. When added to the primary window, they can save energy, increase insulating performance, reduce air leakage, and improve comfort. Consult this decision tree to learn if storm windows and insulating panels are the right choice for you!

INSPECT WINDOWS

- In Good Condition
  - Is it an inefficient window?
    - Single pane or double pane non-low-e?
    - Wood rot?
    - Unable to open operable window?
    - NO → Keep as is
    - YES → Is there a storm window?
      - NO → Add energy-rated storm window or insulating panel*
      - YES → Is it a modern/efficient storm window in good operating condition?
        - NO → Keep as is or repair
        - YES
- Chipped/peeling paint?
  - Cracked or broken glass?
  - Broken mullions?
  - Minor water leaks?
  - → Needs repair → Repair window
- Excessive condensation?
  - Structural damage?
  - Major water leakage?
  - Glass cold to touch?
  - → Needs replacement → Replace windows with high-performance windows (ENERGY STAR preferred)

Quick test to tell if a double pane window has a low-e coating

- Hold a pen light or your phone's flashlight up to the glass
- Look for 4 reflections of the light
- If one of the reflections is a slightly different color, the glass has a low-e coating
- If all the reflections are the same color, the glass does not have a low-e coating

* Refer to product classification infographic to help determine the proper, or homeowner preferred, storm window or insulating panel. Choose a product from the Attachments Energy Rating Council (AERC) or ENERGY STAR product databases.

Storm Window Programs and Pilots

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Xcel Energy®

P.U.D.

CLEAResult®

ComfortReadyHOME

Obstacles & Lessons Learned

Stakeholder Group	Obstacles and Lessons Learned
Utilities	• Limited interest • Supply chain challenges (need more rated products, long lead times, inflation, etc.) • Timing – utility program cycles • Need to explore incorporation into utility-managed low-income, multifamily, renter programs • Sector is slow to change
Weatherization	• Modern, high-performance storm windows not characterized properly in auditing tools • Misconception that weatherization agencies don't do windows • Weatherization Trainers Consortium, training centers, and grantees are the best pathways to scaling adoption
Manufacturers	• Large manufacturer exited storm window market in Dec '22 • Distribution moving to online-only • Need to develop value proposition for getting products rated

Summary of Major Accomplishments

Building Awareness

- Raised awareness through multiple conference presentations targeting utilities and program implementers, weatherization, and contractors
- Hosted a virtual Residential Storm Window and Insulating Panel Summit
- Developed “one-stop-shop” website on Energy.gov to house SWIP resources and share campaign news

Utility Programs

- Supported addition of low-e storm windows measures to Texas and Arkansas state TRMs
- Technical assistance for utilities and implementer staff: Comfort Ready Home, Comfort Home Pilot, Xcel Energy, Chelan PUD, CLEAResult

Weatherization

- Worked with ORNL and WAP to improve characterization of low-e storm windows in new, web-based version of Weatherization Assistant

Thank You

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WBS # 1.4.2.3

REFERENCE SLIDES

Project Execution

	FY2022				FY2023				FY2024			
Planned budget	$451,945				$520,103							
Spent budget	$449,620				$167,229							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Past Work												
Deliver a webinar on SWIP at a large event			◆									
Go - No Go: Define campaign framework and engage organizing committee				◆								
Current/Future Work												
Utility outreach material complete					◆							
SWIP campaign outreach							◆					
SWIP campaign recognition event								◆				
Go - No Go: SWIP campaign stakeholder partner participation								◆				

Team

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