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The Launch of the Partnership for Advanced Window Solutions: Give the People What They Want, Great Window Solutions!

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ABSTRACT

Windows account for 25% of residential HVAC energy use and 45% of building envelope heat transfer, despite only making up 8% of the surface area. In order to meet carbon reduction targets, the nation will need to substantially reduce building energy use, which will require improving window performance in both new and existing buildings. However, efficient window products have been slow to advance despite technological innovations. In response, the U.S. Department of Energy (DOE) has joined forces with regional energy efficiency alliances and national labs to launch the Partnership for Advanced Window Solutions (PAWS), a national collaborative focused on transforming the windows market with a broad, aggressive set of strategies to adapt, replicate, and widely deploy a full range of advanced glazing, window, and window attachment solutions. PAWS builds on previous market transformation programs to aggregate market demand and reduce product costs, with a strong focus on sector-wide collaboration to achieve aggressive goals. This paper outlines recent PAWS efforts to develop new utility and regional market transformation programs, refine energy ratings, ENERGY STAR specifications, and building energy codes. It provides updates on emerging window technologies and recent findings from field demonstrations focused on novel highly insulated windows. It outlines future PAWS efforts to replicate success and scale these window solutions to meet national carbon reduction goals, and via retrofits, enhance the viability and cost effectiveness of regional decarbonization programs. Through technology, policy, and partnerships, the PAWS collaborative is emerging as a central hub for a national windows market transformation.

Introduction

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. At the national, state and local level, public and private organizations are now laying out a series of aggressive targets and goals over the next 10-30 years for the performance of new and existing buildings, in terms of energy use and carbon emissions. A more recent overlay to these efforts adds the priority to decarbonize the grid, with a preeminence on building performance, since over 70% of electricity is used in residential and commercial buildings. Since 75% of the projected 2050 building stock exists today, achieving these goals will require a new focus on deep retrofit of existing buildings at the same time we strive for dramatic reductions in energy use in all new construction.

Do windows matter as we begin to address these complex energy and carbon challenges? How should we address the challenge of window performance in new construction and retrofit? At the macro level, the annual and cumulative energy and carbon impacts of inefficient windows are significant. Nationally, windows account for ~4 Quads of energy use each year, about 10% of all building energy use (Hart et al. 2019). This represents ~200Mt of CO2 and costs building owners more than $50 billion each year. At the individual building level, windows are essential to the well-being and day-to-day living of occupants, yet most existing windows are poor energy performers. In homes and commercial buildings, windows are typically the weakest link in a building's envelope.

In a typical new home, windows constitute only 8-10 percent of the surface area, yet account for 40-45 percent of the peak heat loss in winter and add to cooling peaks and discomfort in summer. Switching from code compliant, double pane low-e window in a new home to new R5 window solutions can save between 7 and 16 percent of a home's energy use, depending on climate. In older homes, retrofitting single glazed windows with R5 windows can provide much larger energy savings. In commercial buildings the iconic image of a highly glazed façade of an office building often comes with high energy bills, large peak cooling loads, glare, and thermal discomfort. Ben Evans, federal legislative director at the U.S. Green Building Council, which runs the LEED green building certification system, recently explained that "Buildings are responsible for 40% of carbon emissions in the U.S. We're not going to meet our climate goals unless we do more about buildings." Figure 1 below shows the oversized energy impact poor performing windows have on the energy usage of a home along with the multitude of benefits that accrue when high performance window solutions are utilized.

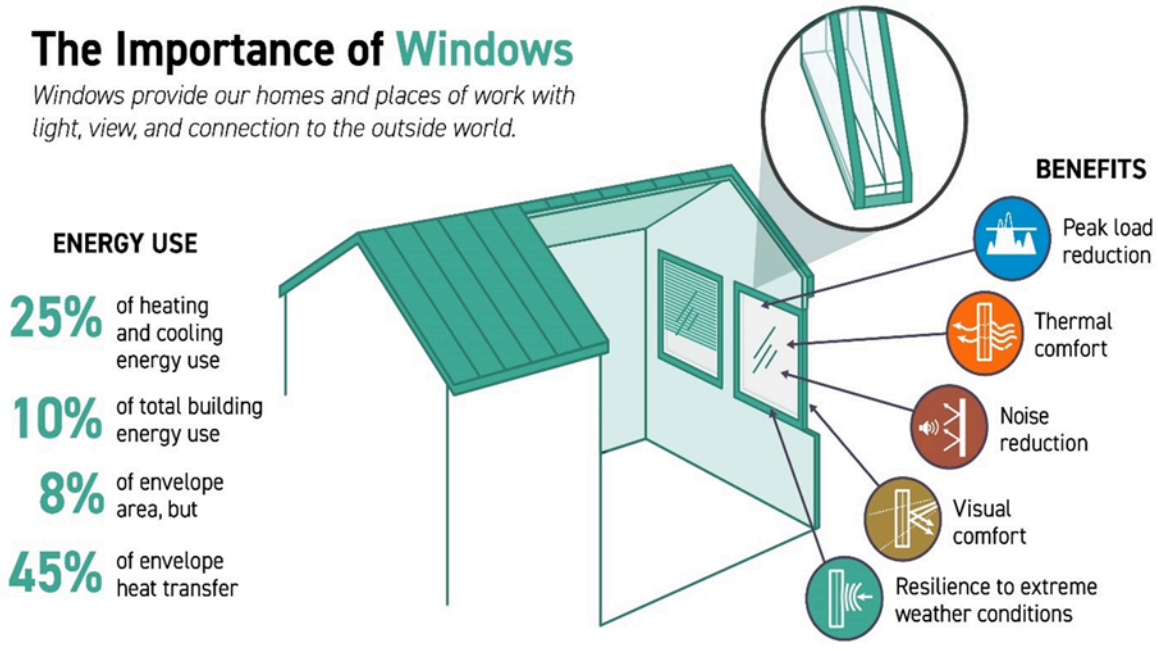


Figure 1. The Importance of Windows in Typical New Home (*Source*: Berkeley Lab)

Yet homeowners and building owners recognize the importance of their windows. They want quality windows that enhance their comfort, connection to the outdoors, and help reduce their energy bills and carbon emissions. In 2021, a window-replacement job was among the top five home projects in terms of return-on-investment, according to national estimates by Remodeling Magazine. Yet many building owners are unaware or do not understand the oversized impact poor performing windows can have on the energy use of a building's HVAC system and occupants' overall comfort and well-being. Moreover, in the world of energy efficiency, high performance windows and attachment products have long been a neglected tool in the energy efficiency toolbox as the technology has lagged far behind other technologies as a solution to improve building energy performance. In addition, utilities have been more focused on shorter term energy paybacks. Some new high-performance window options e.g. thin triple windows, are available as niche, low volume, and therefore expensive products. Improved window attachments can reduce window heating and cooling loads and improve comfort but consumers and their architects remain unaware of these advances and the potential to improve the comfort and energy savings of their homes and buildings. Builders typically select code minimum for new homes to minimize first cost and few high-performance products are installed in retrofit applications. Policy makers often raise the concern of high first cost for window replacement thus less funding resources are allocated to window programs including limited utility incentives. Yet, 7.1 million households get some quantity of new windows or doors per year due to consumer high interest and old dysfunctional windows that have long past their useful life. This large market share is a ripe opportunity to promote high performance windows that can be highly cost effective for their increased marginal cost and to get consumers to replace more windows.

Windows do matter to building occupants and as an element in national energy policy so what can be done to change current practice? Against this background of slow technological advances, and demand for new policies for reduced carbon emissions from buildings, the formation of a new national market transformation collaborative, the Partnership for Advanced Window Solutions (PAWS), is intended to address this complex challenge. The mission of PAWS is to provide the "nerve center" between existing efforts and launch new ones where needed. Through collaborative research and programs, PAWS aims to aggregate market demand, reduce product cost, quantify benefits, and accelerate the adoption of advanced windows and window attachments. Transforming window markets will support advanced building codes in new construction and promote retrofit strategies necessary to achieve aggressive carbon reduction and net zero energy building goals. It will also help us to make the right investments at the right time. Figure 2 below shows that if HVAC systems are addressed before a building's envelope, then often the HVAC systems are oversized. Investments should be sequenced with building envelope measures addressed first which then results in reduced HVAC needs.

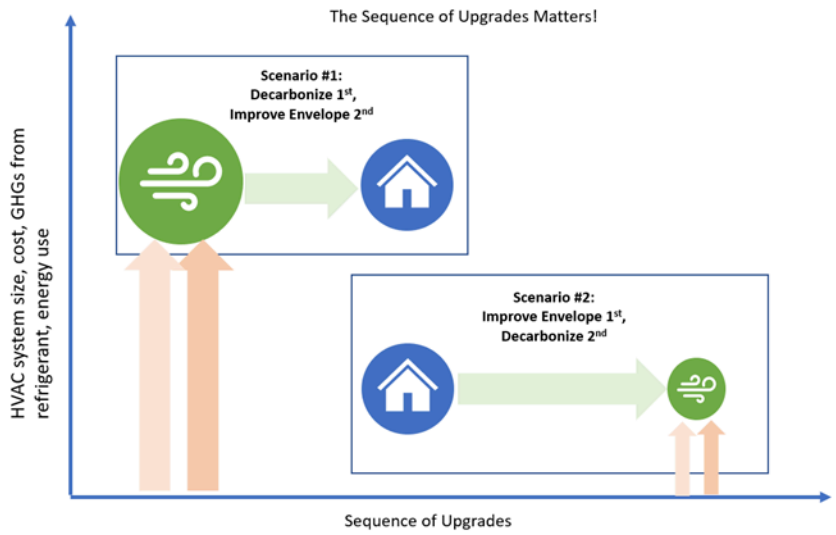


Figure 2. The Importance of the sequence of building upgrades

PAWS builds on previous market transformation programs to aggregate market demand and reduce product costs, with a strong focus on sector-wide collaboration to achieve aggressive goals. At the 2018 ACEEE Summer Study on Efficiency in Buildings, Selkowitz et. al. presented a preliminary market transformation strategy, which employs a technology push, with demand-side and supply-side measures for the market introduction and adoption of the highly-insulating "thin-triple" glass product. At the 2020 ACEEE Summer Study Hart et. al, reported on progress toward implementing this supply-push/demand-pull strategy, including field demonstrations and collaborative partnerships focused on leveraging these efforts to scale up market transformation efforts. Now that this collaboration is fully launched, PAWS intends to try to orchestrate and guide a broad range of market transformation activities to provide opportunity and momentum to push the market for high performance window solutions across the valley of death and into high volume, mainstream market applications.

Setting the Table: PAWS Builds on Technology Solutions and Market Resources Already Within the Windows Market

Ongoing Investments in RD&D

For many years research by the national labs supported by DOE's Building Technologies Office (BTO) has focused on reducing energy intensity and cost for window technologies, while maintaining or enhancing occupant comfort, productivity, and product performance. Several of the national labs have conducted RD&D on advanced windows and their components and tested the installation, performance and builder and owner acceptance of these technologies. Table 1 summarizes a sampling of recent DOE and national lab-led field validation research efforts that demonstrate advanced performance for a range of window and window attachment technologies

(e.g., high-r windows, low-e storm windows, secondary commercial glazing, insulated shades, and exterior shades). These advanced window solutions have been demonstrated for a broad range of applications and climate zones as shown in Table 1.

Table 1: Summary of RD&D Conducted by National Labs on Window Solutions

Technology	Study	Baseline Description	Findings
High-R Window Replacement Energy-Saving Potential	LBNL study of energy simulated savings potential of thin triple glazing (Hart et al. 2019)	Typical windows based on NFRC-certified products	• 16% annual savings in heating-dominated climates • 12% annual savings in mixed climates • 7% annual savings in cooling-dominated climates
High-R Thin Glass Triple-Pane Window Replacement	PNNL Lab Homes side-by-side triple-pane study (Widder et al. 2012)	Double-pane, clear-glass, aluminum-framed windows	• 12% annual savings in Richland, Washington • 11.6% heating savings/18.4% cooling savings
Highly insulating Triple-Pane Window Replacement	PNNL Lab Homes side-by-side triple-pane study (Hunt et al. 2021)	Double-pane, clear-glass, aluminum-framed windows	• 18% annual savings in Richland, Washington • 12% heating savings/28% cooling savings
Exterior and Interior Low-e Storm Panels	PNNL Lab Homes: Exterior and Interior Low-e Storm Panels (Knox and Widder 2014; Petersen et al. 2015)	Double-pane, clear-glass, aluminum-framed windows	• Annual average savings percentage of • 10.1±1.4 • Annual average savings percentage of 7.8±1.5 (covering 74% window area)
Exterior Low-e Storm Windows	Chicago case study with LBNL (Drumheller et al. 2007)	Six low-income homes; single-pane wood-framed windows	Low-e storm windows showed: • 21% reduction in overall home heating load • 7% reduction in overall home air infiltration • Simple payback of 4 to 5 years
Exterior Shades	PNNL Lab Homes side-by-side triple-pane study (Hunt and Cort 2020)	Double-pane, clear-glass, aluminum-framed windows and compared to interior vinyl blinds	• 10% cooling savings when compared to interior vinyl blinds • 20% cooling savings when compared to home with no shading on same windows
Interior Insulated Shades	PNNL Lab Homes: Double- and triple-cell cellular shades (Cort et al. 2018)/ (Peterson et al. 2016)	Double-pane clear glass windows with vinyl blinds	• Cooling HVAC = 10-25% savings • Heating HVAC = 7-18% savings
Interior Insulated Shades	ORNL Test Home: Single- and double-cell cellular shades (Bhandari et al.)	Vinyl venetian shades over code window	• HVAC Energy Savings (heating) ranging from 9-23% in room-by-room comparison
Commercial Secondary Glazing	NREL Test of single- and double-pane secondary glazing for commercial buildings (Kiatreungwattana and Simpson 2021)	Single-pane windows in Federal building	Energy Savings by percentage U-value and HVAC capacity reduction (Denver, CO study area) • 17- 30% lower U-value • 5 -16% lower SHGC • 10-19% heating capacity reduction

LBNL = Lawrence Berkeley National Laboratory; NFRC = National Fenestration Rating Council; NREL = National Renewable Energy Laboratory; ORNL = Oak Ridge National Laboratory; PNNL = Pacific Northwest National Laboratory

Advances in Window Solution Technologies

This market transformation effort is aided by the technological improvements across all window categories that are enhancing the comfort and energy efficiency of homes and buildings and deliver these enhancements with lower costs and greater durability. In particular, there have been innovations in both the primary and secondary windows markets in recent years, enabled, in some cases, by technology advancements and volume production practices from other industries. Manufacturers are designing products that meet high performance criteria, and the PAWS program is working with these manufacturers in order to grow the market space for these high-performance products. There are currently 138 manufacturers in the U.S. that have certified product lines with specifications that meet the proposed ENERGY STAR Version 7 specification. Technology advances in recent years have allowed manufacturers to achieve higher performing products in many ways. Most high-performance products harness one or a combination of the following components.

- **Room Side Low-e Coating.** Historically, higher performing window products utilize a low-emissivity (or low-e) coating on the exterior of the window to block ultraviolet and infrared light but allow visible light to pass through. Newer high-performance windows utilize the same coating on all four glass surfaces of the window, including the interior. This approach typically reduces the U-factor of a window by 0.04.

- **Third Insulated Glass Unit (IGU):** Triple glazing has been around for a while, but at higher costs. Traditional triple glazing also previously required redesign of the window frame due to the heavier, wider IGUs. As a consequence, builders and manufacturers have avoided mass adoption of these products and they have remained a niche product. Recent technology advances have allowed manufacturers to develop triple pane products that are thinner and lighter. One new variant of the traditional triple glazed window is designed as a drop-in replacement for R3 windows. These units are called “thin-triple IGUs” and result in an R-8 IGU. When used as a drop-in replacement for an R3 window, the window’s overall performance will increase to about R5 without any redesign of the window frame. A key feature of this design is how it uses a thin layer of glass that floats within a ¾" - 1" IGU. Most IGU manufacturing equipment can process 1.6mm glass with simple equipment tuning and as thin as 0.7mm with more significant modifications. The availability of the thin glass down to 1.6mm is common in the US and availability of glass down to 1.0mm has recently increased because of its use in TVs and computer monitors, which makes this emerging technology more affordable and feasible for window manufacturers.

- **Improved Spacers:** Window spacers are the strips of plastic, metal, or foam that separate glass panes in a window. Older windows typically have metal spacers with poor insulating properties. Improved non-metal spacer designs have hit the market in recent years and are designed to improve the overall efficiency of window products by reducing heat loss at a window’s perimeter.

- **Thermally Improved Foam-Filled Frames:** Some manufacturers have found success by insulating their window products’ frame with either spray foam or push-in foam. Like

improved spacers, this approach improves the product's thermal efficiency by reducing heat loss at the window perimeter.

- **Gas Fill:** Gas-filled windows provide an additional layer of insulation and increase windows' overall efficiency. Manufacturers use either krypton or argon for gas fills. Argon is a relatively inexpensive gas fill option commonly used in efficient window technologies. Krypton is a better insulator, but its cost has proven to be volatile in recent years making it a less attractive option for manufacturers.

Advances in Window Solution Costs

The cost of windows is a function of all the above features but, even as high-performance windows remain more expensive than lower-performing windows, affordable options do exist today. As noted by EPA in the ENERGY STAR version 7.0 specification proposal and shown in Figure 3 below, performance – as measured by U-factor "…is not a main driver for cost" and many vinyl triple-pane windows lines achieving U-0.22 or lower are available at prices comparable to far less efficient vinyl double-frame windows. These data indicate that delivering economical high-performance windows to market is not dependent upon additional scientific and engineering breakthroughs but is more dependent upon sustained demand and volume production.

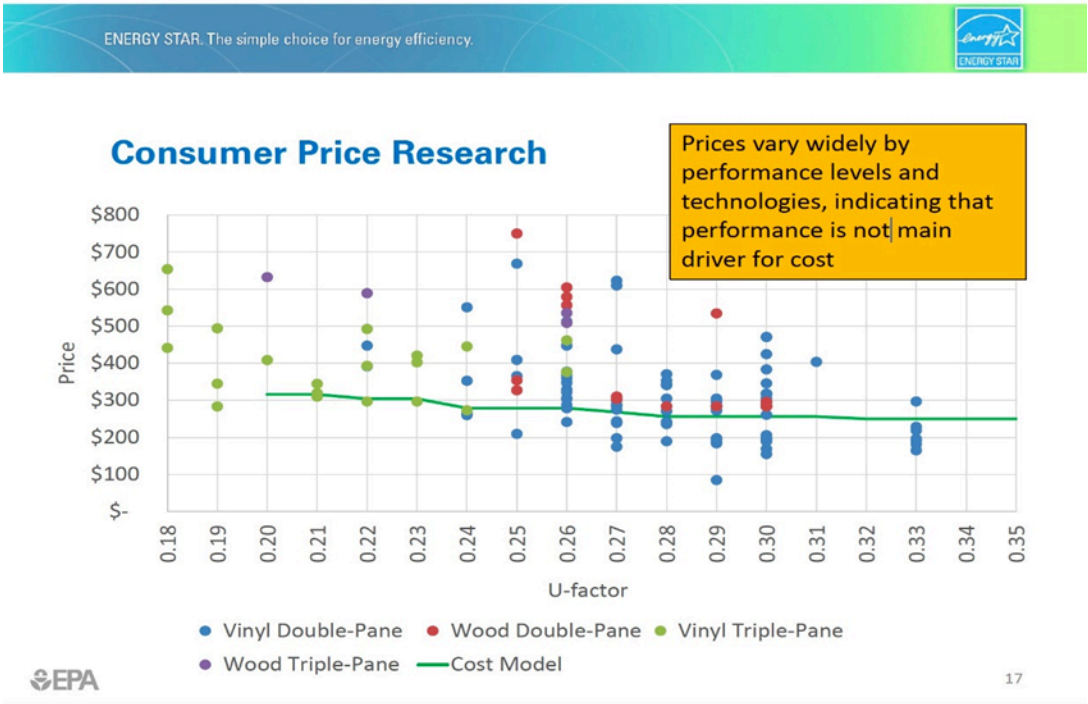


Figure 3: ENERGY STAR Version 7 Specification Proposal - Windows Price Research

Market Infrastructure Components in Place

ENERGY STAR – Market Differentiation

Key infrastructure components that are necessary to growing this market are also well established and primed to support the adoption of higher performing window products. For residential and multifamily markets, the ENERGY STAR specification plays a key role in helping consumers and builders choose a higher performing product. The current specification (version 6.0) has been in place since January 2015 and, combined with the effect of code changes, has a market share close to 90%. The new version 7.0 specification referenced in the introduction is in process and will likely be adopted in the summer of 2022 with expected implementation twelve months later in the middle of 2023. The new specification sets the bar at 0.22 U-value in the Northern Zone as a prescriptive value and offers energy equivalent tradeoffs with variations in Solar Heat Gain Coefficient (SHGC). Other regions have less dramatic changes proposed for U-values but do include shifts in SHGC. Exhaustive research and analysis by the EPA and the national labs indicate that better performing products are available, offering consumers increased resiliency against extreme weather events and significant energy savings from energy use reductions. Despite challenges presented by the pandemic and supply chain issues, many manufacturers, suppliers, and other market actors are preparing for the specification change to ensure qualified product is available. The change from the version 6.0 to 7.0 specification is a significant improvement for efficiency and the market. Utilities and regional energy efficiency organizations will need to pivot quickly to help consumers realize these gains and stay ahead of codes.

Ratings and Certification – Market Differentiation

Selecting an energy efficient window that is best suited for building type, climate, orientation, space function, thermal and visual comfort, appearance, and budget can be a challenge. It is critical that accurate and credible rating and certification procedures be available in the right format to different user groups, e.g. homeowners, contractors, architects, and engineers to help differentiate these critical performance attributes. PAWS is working with existing partners to promote and extend existing rating and certifications where they meet market needs and will help to improve these tools and databases where they are insufficient.

The windows market also already has two well-established and robust rating organizations for both primary windows, the National Fenestration and Ratings Council (NFRC), and for attachment products, the Attachments Energy Rating Council (AERC). NFRC-certified products are independently tested, certified, and labeled to help consumers make purchasing decisions and compare product thermal properties. NFRC calculation procedures, and particularly the International Glazing Data Base, IGDB, maintained and updated in partnership with Lawrence Berkeley National Laboratory (LBNL) are widely used in the commercial glazing industry although rating and certification procedures have not yet had the same impact in commercial construction as they have had in residential applications. NFRC is also beginning a re-launch of a windows selection tool, the Efficient Windows Collaborative website, to provide accessible guidance to promote selection of more efficient window products for new and retrofit applications. PAWS plans to partner further with NFRC to build new connections between

manufacturers and the energy efficiency community to help build consumer awareness on the role efficient windows play in comfort and saving energy.

AERC serves the window attachments market for both commercial and residential products. They offer a comprehensive rating, labeling, and certification program for a variety of products including commercial secondary windows, low-e storm windows, blinds, cellular shades, shutters and awnings. They also support the development of utility programs targeting these products with work to include window attachment measures in state technical resource manuals (TRMs) where listing and savings rates are typically required for utility programs to include them as measures in programs. This connection to utilities is important in order to successfully educate consumers about the impacts of window attachments and other high-performance window products in their homes and buildings. PAWS is actively working to further connect with utilities on high-performance window offerings, and connect with AERC's ongoing marketing support to build consumer awareness on the benefits of these products.

Growth in mandatory decarbonization policies increase need for cost-effective solutions for low carbon buildings

Growth of net-zero and Passive House certifications continues to grow along with local and state policies mandating building carbon reductions and increased consumer awareness. Increasingly builders and owners are looking for ways to meet these new, aggressive targets with affordable products and with a supply chain that can deliver in a timely fashion. Currently, many builders find it easier and cheaper to order triple pane windows from Europe because advanced products are very difficult to source and buy in the US. With building codes advancing across the country, improved windows are becoming a crucial component of reaching aggressive decarbonization policy and goals that are driving those codes.

Utilities are looking for new efficiency opportunities

The changing utility landscape offers the windows market new opportunities as a technology for targeted incentives. As lighting savings has waned, many utilities are looking for new products and innovative program designs to push to their customers to help reach aggressive energy saving targets. For new construction, some utilities and efficiency programs are testing thin triple pane windows with production builders as a tool for builders to reach better-than code program targets and access federal tax credits more easily. The value proposition for builders includes an easier install compared to heavier, traditional triple pane windows and more efficient windows allow for possible trade-offs with opaque wall insulation requirements. For homeowners, thin triple windows offer a quiet, more comfortable home with a product that reduces their energy costs and provides high resale value.

Historically, window programs have been challenging for utilities to implement because of their high upfront cost, despite frequent requests from customers for window rebates. As technology advances and costs come down for higher performing window products, this cost-effectiveness equation becomes more favorable. Utilities that have been unable to support window programs in the past are recognizing the potential for expanding their portfolio to

include these products and achieve savings in a previously untapped product category. High performance window products can be integrated into low-income weatherization programs or coupled with air source heat pump (ASHP) retrofits to tighten the homes envelope and allow for smaller HVAC system installs. As mentioned, new homes programs are well suited to include incremental window rebates for higher tiers of performance, and upstream program models can provide discounts at the distributor level to influence the retrofit market which is generally more challenging to target.

A few utilities are having success with window retrofit programs. The Energy Trust of Oregon has long invested in retrofit windows for homeowners and Eversource has developed a successful multifamily program that bundles a window rebate with other building owner engagement. Regionally, market transformation programs in the Northwest, Illinois, and Minnesota are in the program development phase. These programs will build on work by Northwest Energy Efficiency Alliance (NEEA) and the Center for Energy and the Environment working upstream in the market with production builders, manufacturers and their supply chains and aiming to leverage the new version 7.0 ENERGY STAR specification to help accelerate homeowner and builder adoption.

Utilities and state regulators are beginning to acknowledge the necessity and value in quantifying non-energy benefits for energy efficiency measures. This presents a significant opportunity for windows in particular. Customers value window products for numerous reasons besides energy efficiency, and often upgrade their windows for these reasons. Noise reduction, increased comfort, and condensation concerns are all important selling points for high-performance windows, and there is growing scientific evidence of the importance of light on human health and wellbeing. By quantifying non-energy benefits, utilities can utilize a much more appealing cost-effectiveness equation and provide more generous rebates to their customers. Similarly, windows can play an important role in climate resiliency. High performance windows deliver greater resiliency and thermal comfort during demand response events resulting in greater customer retention in distributed energy resources (DER) programs. As managing climate risk becomes a higher priority for consumers, utilities can emphasize the benefits that window retrofits present to minimize vulnerability, adding to the long list of non-energy benefits that windows provide.

Why Aren’t High-Performance Window Solutions Taking Off Yet?

Despite significant research and development, window product technical innovations, market infrastructure advances, and customer desire for quality windows, the market for higher performing windows solutions has been slow to grow. **The problem appears to be a very fragmented market, despite pockets of innovation and activity.**

- Manufacturers require higher demand before they invest in scaled production that will lead to subsequent price reductions.
- To date, the prices for these products remain high, and difficult to source for builders and consumers that can afford them, due to limited production.

- For new construction, supply chain uncertainty has many builders reluctant to broadly shift to high performance windows even as they acknowledge that buyers appreciate the benefits.
- Many utilities can't run programs until prices decline because of cost effectiveness requirements.

There are many organizations that play a role in the adoption of high-performance windows and attachments, but they are not aligned.

DOE and Efficiency Organizations are Supporting a New National Window Initiative

US DOE BTO continues to fund energy efficient windows R&D that, in the past, has resulted in new window and attachment products and new design tools to support decision making. In an expanded market transformation effort, DOE is supporting and collaborating with various organizations to launch the national **Partnership for Advanced Window Solutions (PAWS)** collaborative, including the national labs, windows industry, supporting trade groups, energy advocates, utilities, and market transformation organizations to accelerate the availability of these products and increase their adoption. Through PAWS, DOE and its partners are taking the next step, building upon the foundational technical work already completed, to create a more streamlined and efficient channel for market adoption of high-performance window solutions.

Because this market and its players are fragmented, and in some cases misaligned, PAWS is working to realign and build awareness of work that already exists, finding pathways to socialize and adapt tools, resources, and programs for other regions and partners. PAWS is also identifying missing components to high-performance windows market transformation efforts, as well as additional market barriers that have not been addressed. PAWS serves as a centralized point of collaboration – a high-performance windows market nerve center - to build resources across multiple organizations to help bridge the market gap.

The PAWS collaborative builds on lessons learned from past market transformation programs to accelerate the program scope and impacts. PAWS targets a multitude of windows market obstacles:

- Market-related obstacles (e.g. cost or supply chain issues - builders want to purchase an efficient product but cannot procure those product options from their existing supply chain.)
- Technical obstacles (e.g. uncertainties in product performance, or durability)
- Supply and demand obstacles (e.g. a company will invest in developing a new efficient product, but the education and awareness to build market demand is not there).

PAWS will function as a partner, broker, and advocate to identify each of these market obstacles and then work with collaborators to create market viable solutions. PAWS is partnering with utilities, state and local government, builders, manufacturers, regional energy efficiency offices, and NGOs with a building efficiency mission. Partners and programs will be driven by market needs, funding availability, partner engagement levels, and their ability to replicate programs. As the PAWS mission states:

Through collaborative research and programs, PAWS aims to aggregate market demand, reduce product cost, quantify benefits, and accelerate the adoption of advanced windows and window attachments. Transforming window markets will support advanced building codes in new construction and promote retrofit strategies necessary to achieve carbon reduction and net zero energy building goals.

PAWS Opportunities

Three priority technology opportunities are initially being addressed by PAWS and its partners:

1. Increase Demand for R5 Insulating Windows for residential markets, both new construction and renovation/replacement. The initial market focus is residential, but will be expanded to commercial building applications.
2. Storm Windows and Insulating Panels for residential and commercial retrofits where window replacement isn't affordable or practical.
3. Solar Control Solutions with Shades and Blinds to reduce cooling energy use and peak cooling loads, enhance thermal comfort, and provide resilience during power failures. Automation options that can link shading deployment to smart building and electric grid initiatives will be explored and promoted.

To move this work forward, PAWS has organized the collaborative's activities into five key areas and Working Groups that will allow members to focus on progress in each area.

Table 2: Summary of PAWS Key Areas/Working Groups

Ratings, Codes & Certifications
 	
Utility & Program Collaborations
	● ENERGY STAR specification support
	● Field performance validation
	● Building code body coordination
	● Working with utilities on Windows programs
	  o Residential and Commercial
	  o New and Retrofit
	  o Attachments and Windows

Stakeholder Campaigns & Initiatives	● Ongoing support to DOE technology campaigns ● Coordination with manufacturers/technical support ● Public awareness campaigns/consumer outreach
Data & Tools	● Energy savings tools ● Financial program tools to support investment ● Document comfort, resilience ● Training programs
Incentives, Rebates & Tax Credits	● Policy support ● Program design

Each focus area has a set of opportunities and resources to leverage and build upon, as well as near term strategies and deliverables that will ultimately be used by other Working Group members to drive adoption. One simple example includes the Ratings, Codes and Standards Working Group. The group is initially focused on gaining support and momentum for the upcoming ENERGY STAR version 7.0 window specification change, a critical market infrastructure piece for primary windows, doors, and skylights. PAWS and the Working Group has served as an efficient way to gather and share key information, centralize stakeholder comments, and increase support for the specification change. In turn, the Utility and Program Collaboration Working Group will use the new specification momentum and resources developed by PAWS members to collaborate with utilities and regional market transformation programs to launch awareness programs and provide consumers with incentives that drive adoption of more efficient windows. PAWS collaborators will develop a bank of resources with useful regional metrics to assist utilities in the design and implementation of these window programs.

A parallel example exists on the window attachments side. AERC invests in the analysis and work associated with ensuring that window attachment products are included in state technical resource manuals (TRMs). They have a utility workgroup that works to help build programs targeting attachments products. Utilities have resources in both areas to help think through the development of programs targeting both primary and secondary window products. PAWS and AERC's work also gives them access to utility program managers who have experience in running programs and can help them adapt a program for their territory. The goal is to create a hub of resources and experience that can be more easily and quickly deployed, easing greater market adoption for high performance window solutions.

Conclusion

Because the building construction and window industry in the United States is a mature market with significant inertia where fundamental changes take time, a market transformation-driven effort is needed to accelerate the change to meet national and regional carbon reduction policies and goals. PAWS is one such effort. There is a significant breadth of activities that PAWS is focused on and there is a growing number of national and regional partners that will collaborate to make it happen working with:

- Utility programs
- Manufacturers
- Builders
- Market Transformation Partners

PAWS invites more market transformation organizations and players active in the building envelope and windows markets to work together in driving market advancement for high performance windows. Through technology, policy, and partnership efforts, the PAWS collaborative is emerging as a central hub for a national windows market transformation.

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