

GLASS MAGAZINE®

THE GLASS AND GLAZING AUTHORITY • APRIL 2022

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BUILD FOR TOMORROW WITH GLASS

THE ARCHITECTS' GUIDE TO HIGH-PERFORMANCE FAÇADES

DECORATIVE SOLUTIONS FOR DESIGN AND WELLNESS

HOW GLASS CAN SAVE THE WORLD

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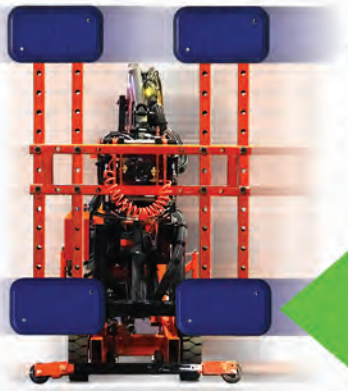


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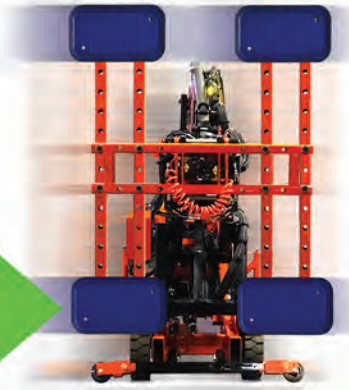


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FAYETTEVILLE HIGH SCHOOL IN FAYETTEVILLE, ARKANSAS. PHOTO COURTESY OF KAWNEER.

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390 Madison Ave. in New York City features a dramatic chamfered corner that is highlighted with a back-lit wood-grain glass soffit created by GGI using Alice direct-to-glass printing on low-iron glass, laminated with SentryGlas ionoplast interlayer. Features Walters, a division of the Walters Group, worked with design architect Kohn Pedersen Fox Associates to create a custom engineered system to bring the design team's concept, and one of the most prominent design features, to fruition. Photograph provided by Bernhard Kristinn, courtesy of GGI.

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BIG MOVES
The $3.45 Billion OBE Deal
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PROJECT SHOWCASE



Featured in Glass Magazine Weekly and on GlassMagazine.com. To submit projects or case studies, write Norah Dick, ndick@glass.org. Pictured: The public art installation, Windward Light, designed by Heavy, Urban Systems, is modeled after a mother bird, protecting everyone under the eight-foot canopy. Located in Calgary, Alberta, this new installation features Goldray Glass's dichroic glass. For the installation, Goldray hand-fabricated 230 pieces of glass. Each piece was a different size and shape, and each was manufactured, marked, organized, and carefully packaged so that when they arrived at site, they could be installed in the right order. Photo by Ron Eliovitz.

Glass Magazine® (ISSN 0747-4261), Volume 72, Number 3, is published eight times annually in January/February, March, April, May/June, July, August, September/October and November/December by the National Glass Association,344 Maple Ave. West, Unit 272, Vienna, VA 22180; 703/442-4890. There is no charge for subscriptions to qualified requestors in the United States. All other subscriptions will be charged $49.95 in the U.S., and $79.95 outside the U.S. Periodicals postage paid at Vienna, Va., and other mailing offices. POSTMASTER: Send changes of address to Glass Magazine®, Subscriptions,Box 460, Congers, NY 10920. Canada Post: Publications Mail Agreement #40612608. Canada Returns to be sent to Bleuchip International, P.O. Box 25542, London, ON N6C 6B2. For all subscription inquiries, please call 1-800-765-7514. ©2022 National Glass Association. All Rights Reserved. Printed in the U.S.A.

GLASS MAGAZINE

Published by the NGA NATIONAL GLASS ASSOCIATION with GANA

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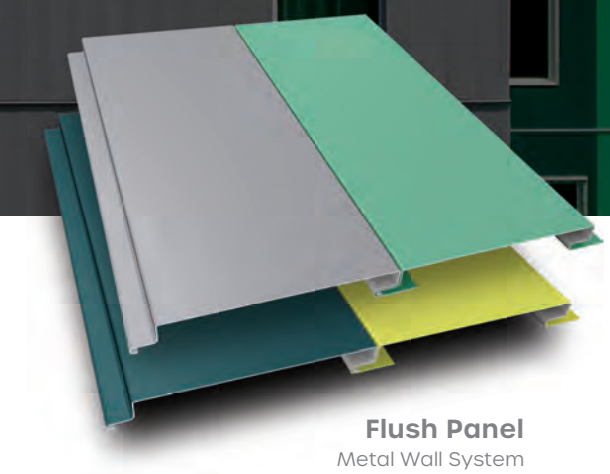
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Healthy Dose of Color

PAC-CLAD Flush panels provide pops of playful color: Stripes of Patina Green, Teal and custom Parakeet Yellow against a field of neutral Cityscape Gray create a cheerful backdrop for an outdoor courtyard where guests can relax and play.

Ronald McDonald House, Cincinnati Installing contr. (walls): Neiheisel Steel Architect: GBBN Architects
General contractor: Messer Construction Photo: hortonphotoinc.com



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Glass Can Save the World



KATY DEVLIN
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The tag line for the National Glass Association's International Year of Glass activities boasts a bold claim: glass can save the world. While the sentiment may seem audacious, it's also true.

Glass is central to the way people communicate. Consider the ultra-thin glass touch screens on our mobile devices or the glass fiber optic cables that allow for near-instantaneous connection and collaboration across the globe. Glass has revolutionized science and medicine. Chemically resistant glass vials are used to safely store and deliver life-saving medications and vaccines. Through its optical properties, glass is opening a window to understanding the cosmos. The highly reflective mirrors on the recently launched James Webb Space Telescope can withstand the frigid temperatures and harsh environment of space, while tracking the history of the universe. And, perhaps most relevant to the world's pressing climate concerns, glass is essential in building a sustainable future. It makes solar energy generation possible; it is recyclable; it is necessary in achieving net-zero performance in buildings.

It is for these reasons, among many others, that the United Nations declared 2022 the International Year of Glass, known as IYOG 2022. The year will celebrate how glass can "aid the development of more just and sustainable societies" and recognize "the most recent scientific and technical breakthroughs," according to IYOG organizers. "With its unparalleled versatility and technical capabilities, glass in its many guises has fostered innumerable cultural and scientific advancements," they say.

Arguably, the largest "world-saving" intervention of glass comes from its role in combatting climate change. Glass has a major role in the "big picture strategy" in reducing carbon emissions of buildings, according to building scientist and window expert Stephen Selkowitz, who spoke during the NGA Glass Conference: Long Beach, held in January. Selkowitz is principal, Stephen Selkowitz Consultants, and affiliate for Lawrence Berkeley National Laboratory, where he served as senior advisor for Building Science and group leader for the Windows and Envelope Materials Group in the Building Technology and Urban Systems Division.

Buildings account for about 40 percent of total worldwide carbon emissions, between building operations and emissions related to building materials and construction, according to estimates from the U.S. Energy Information Administration. When embodied carbon is also taken into consideration, the building sector's emissions increase to closer to half of total emissions, says Selkowitz.

"This is a crisis. We have major carbon and energy challenges ... and buildings are about 50 percent of the problem," Selkowitz says. "If we want to solve the big picture global problems, buildings have to be a part of the solution ... and if we are going to come up with better buildings, we need better windows."

Selkowitz continues, "yes, glass can save the world. But how do we do it?"

This issue of Glass Magazine takes a closer look at this question: how can glass save the world? The Architects' Guide, "The High-performance Façade Equation" beginning on page 38, addresses the wide range of factors affecting the performance of glass façades. It covers the issues of thermal bridging and daylighting, and spotlights advancements in next-generation, high-performance insulating glass. Additionally, the "Flat Glass Recycling" feature on page 50 offers insights on the sustainability and manufacturing efficiency opportunities in glass recycling.

For additional information on IYOG 2022, visit glass.org/IYOG. ■



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YOUR ASSOCIATION AT WORK

NEED-TO-KNOW INFORMATION FROM THE NGA

NGA CELEBRATES WOMEN IN GLASS

NGA recognized Women in Construction Week, or WIC Week, March 6-12, by profiling notable women leaders in the glass industry. WIC Week is an initiative of the National Association of Women in Construction, and raises awareness and celebrates the work of women in the construction industry across the country.

During the week, NGA published interviews with Denise Baker, president, Spring Glass and Mirror Ltd.; Ashley Klein, president, AK Glazing Contractors Inc.; Jodi Martinez, vice president, Allstar Glass Co.; Kayla Natividad, architectural technical services engineer, NSG Group and Kristin Thomas, vice president of operations, Tab Glass & Window Corp. Visit glass.org or glassmagazine.com to read the WIC Week interviews. ■

GUARDIAN'S DARIJO BABIC JOINS NGA BOARD

The National Glass Association has announced that Darijo Babic, director of architectural glass at Guardian Glass, Auburn Hills, Michigan, has joined the NGA board of directors. Babic replaces Guardian's Chris Dolan, who was serving as the primary glass manufacturer representative for the 2021-22 NGA board term. Dolan announced his retirement from Guardian Glass in late January after 31 years with the company. Babic will take office effective immediately and serve through October 2022. ■

NGA PROVIDES RESOURCES TO PROMOTE THE INTERNATIONAL YEAR OF GLASS 2022

2022 has been declared the International Year of Glass, or IYOG 2022, by the General Assembly of the United Nations. The National Glass Association is leading IYOG 2022 efforts for architectural glass in the United States to promote the solutions glass provides to the built environment and to highlight the glass industry as an exciting and rewarding career to the next generation of workers.

Earlier this year, NGA launched a webpage, glass.org/IYOG, dedicated to IYOG 2022 activities and resources. Along with a one-of-a-kind, interactive timeline of the history of glass in architecture, the web page features a calendar of global events celebrating IYOG 2022, as well as blogs, webinars and toolkits on topics of importance to the architectural glass community and its stakeholders.

NGA has also created two unique digital badges to promote awareness of IYOG 2022 and the importance of glass in our built environment. NGA members and others in the industry can download one or both of the digital badges at glass.org/IYOG to use on their own websites, customer materials, employee recruitment ads and more. ■



"WORK HARD AND LISTEN TO EVERYTHING AND EVERYONE AROUND YOU. FIND A MENTOR, OR SOME MENTORS, AND USE ANY FEAR OR UNCERTAINTY AS FUEL TO BE GREAT. READ A LOT AND STRIVE TO BE A LIFELONG LEARNER. BE PATIENT AND KIND TO YOURSELF AND EVERYONE AROUND YOU."

-JODI MARTINEZ, VICE PRESIDENT, ALLSTAR GLASS CO., ON ADVICE TO WOMEN JUST ENTERING THE GLASS INDUSTRY.

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Leaders Look to Glass to Protect Children and the Environment at NGA Glass Conference: Long Beach

Industry technical leaders met Jan. 24-26, for the NGA Glass Conference: Long Beach. Key topics on the agenda included school security, daylighting and eye health, current and future IGU technologies, glass recycling and sustainability, and the 2022 International Year of Glass.

The three-day conference, hosted by the National Glass Association, included meetings of the NGA Advocacy, Forming and Fabricating Committees, which made progress on many of their current projects and resources under development. The Installing Committee will gather in March at the BEC Conference in Nashville.

Forming

The Forming Committee presented updates on several sustainability initiatives, including refining the reporting of glass products in Health Product Declarations, developing the Embodied Carbon in Construction Calculator as a tool for benchmarking sustainability data, ASHRAE 189.1 global warming potential discussions and new implementation dates and metrics for the Buy Clean California Act.

Advocacy

The Advocacy Committee meeting began with a discussion on the presentation Physiological Impacts of Light on Human Health & the Implications of Glazing. A task group was established to discuss next steps on how to engage the glazing industry given new research showing the importance of daylight on children's eye development.

New and proposed legislation with funding allocated for infrastructure energy efficiency initiatives was reviewed, including the Build Back Better Blueprint, Energy & Covid Relief Act of 2020, American Rescue Plan Act, and the Infrastructure Investment & Jobs Act.

Fabricating

Within the Fabricating Committee, the GANA Glazing Manual 50th anniversary edition is undergoing review to be republished at the end of 2022. A new NGA Glossary of Architectural Glass & Glazing Terms has been developed and will be available for download from the NGA website.

The tempering segment reviewed updates to glass-related ASTM standards from the last year, including two new standards, C1908-21 Standard Test Method for Pummel Adhesion Testing of Two-ply Laminated Architectural Glass and C1914-21 Standard Test Method for Bake and Boil Testing of Laminated Glass. The desire to determine if surface polishing and/or edge grinding following tempering reduces the glass strength was reignited, and a proposal for testing and calculations will be developed for review. Finally, a new resource, Best Practices for Heat Soaking, will be developed.

The mirror segment is working on a new Mirror Design Guide, and the decorative segment continues to develop resources for a new Decorative Glazing Manual.

Within the protective glazing segment, the School Security task group drafted a new Active Shooter test standard for glazing, which is currently at ballot at ASTM. Additionally, the NGA Best Practices for Bird Friendly Glazing Design Guide is now referenced within GSA P100 Facilities Standards for the Public Buildings Service, updated October 2021. The fire-rated glazing segment is reviewing a new technical paper on the additional challenges faced by fire-rated glazing beyond fire resistance and fire protection.

The laminating segment is pursuing the enhancement of laminated glass deflection tables as published in the NGA Engineering Standards Manual for interior wall partitions. The content will eventually be added to the NGA Heavy Glass Door Design Manual and potentially the NGA Laminated Glazing Reference Manual.

The energy segment discussed possibilities for new educational resources based on the Thermal Bridging Considerations at Interface Conditions Design Guide, including recommending the Installing Committee's Specifications task group consider how thermal bridging should be addressed in specifications. New resources will be developed on the topics of thermal comfort and the status of code adoptions across the states, comparing historical and current versions of ASHRAE vs IECC model energy codes. The Windows PCR will be extended based on discussion that it is still important and relevant to the industry.

The insulating segment began with a presentation on New IGU Technologies for Carbon Reduction and Zero Net Energy. New insulating glazing task groups were formed to address a number of timely topics that impact application use and challenges, including bent IGUs and secondary sealants in IGUs. ■

GLASS INFORMATIONAL BULLETIN

Products for Energy Applications

Insulating glass can play a significant role in the energy performance of a building. When installed in a fenestration system such as a window, curtain wall, skylight or storefront, there are two characteristics which drive the energy performance of an IGU: thermal transmittance (U-factor), and solar heat gain coefficient (SHGC), which measures how much of the sun's radiative energy is transmitted through the window. The relative importance of SHGC and U-factor, and the specification for performance, depend to a considerable extent on the specifics of the building design and type as well as the climate zone.

It is also important to note that both SHGC and U-factor have a significant influence on thermal comfort of occupants near the façade. When designers are making glazing product choices, thermal comfort as well as energy performance should be considered. The following glazing products or components represent strategies designers can use to improve the energy performance of building envelopes based on the need to optimize U-factor or SHGC, or both.



Insulating glass units featuring warm-edge spacer. Photo courtesy of Quanex Building Products.

Dual IGU

Conventional insulating glazing units consist of two glass panes separated by a cavity filled with air. To improve the energy performance of a conventional IGU, the following additions can be made: type of low-emissivity coating, cavity gas fill material (inert gas or vacuum), spacer material, number of cavities of an IGU, use of dynamic glazing and use of a ceramic frit pattern.

Low-e coatings

Low-e coatings have been developed to minimize the amount of ultraviolet and infrared light that can pass through glass without compromising the amount of visible light that is transmitted. There are two different types of low-e coatings: passive low-e coatings and solar control low-e coatings. Passive low-e coatings are designed to maximize solar heat gain into a home or building to create the effect of "passive" heating and reduce reliance on artificial heating. Solar control low-e coatings are designed to limit the amount of solar heat that passes into a home or building for the purpose of keeping buildings cooler and reducing energy consumption related to air conditioning.

Gas fill

Traditionally, an IG unit is filled with plant air. There are options available for other fill gases (argon, krypton, xenon) that lead to an improved U-factor as a result of the lower conductivity of the gas.

Vacuum insulating glazing

In vacuum insulating glazing, or VIG, two glass panes are hermetically sealed together around the edges, separated by microspacers, and the air between the glass panes is extracted. The vacuum is very effective at minimizing conduction and convection heat losses, lowering the U-factor at a very thin cavity depth.

Warm-edge spacers

Warm-edge spacers, which hold the glass panes apart in an insulating glass unit, have been specifically designed to reduce the thermal transmittance across the edge of glass. Warm-edge spacers

GLASS INFORMATIONAL BULLETIN—PRODUCTS FOR ENERGY APPLICATIONS

are generally composed of materials that are of lower conductivity than aluminum (e.g. stainless steel, plastic with backer material, silicone-foam matrix with backer material, extruded butyl matrix) or a hybrid of a non-metallic material and thin-gauge metal such as plastic hybrid stainless steel.

The thermal conductance of a spacer depends on the shape and thickness of the material, not on the conductance of the bulk material itself. The overall conductance of the edge is determined by:

- the amount of sealant used (more sealant results in higher conductance and higher U-factor)
- the amount and type of desiccant used (more desiccant results in higher conductance)
- the extent to which the edge of glass is buried into the frame (the greater the edge bite on the glass for captured framing systems, the lower the conductance and lower U-factor)

Triple IGU

The distinguishing characteristic of a triple IGU is two sealed air spaces. Triple IG units are normally specified in cold climates because of the increase in the insulating value or lowering of the U-factor of the unit as compared to a dual IG unit.

Ceramic frit

A silkscreen or digitally printed pattern of ceramic frit on the glass can improve energy performance (SHGC) of the IGU. By changing the color and amount of coverage the designer can fine-tune the energy performance. Ceramic frit can also be combined with low-e coatings to further improve energy performance.

Technologies Contributing to Controlling U-Factor and/or SHGC

	SHGC	U-Factor
Low-e Coatings	major contribution	major contribution
Gas Fill		major contribution
Vacuum Insulating Glazing	minor contribution	major contribution
Warm Edge Spacer	minor contribution	major contribution
Triple IGU	minor contribution	major contribution
Ceramic Frit	major contribution	
Dynamic Glazing	major contribution	
Energy Control Window Films	major contribution	minor contribution
Solar Shading Devices	major contribution	

Dynamic glazing

A dynamic glazing product is a fenestration product that has the fully reversible ability to change its optical performance properties, such as visible light transmission, near infrared transmission and SHGC. These properties can change based on the exposure to different stimuli:

- electrochromics change in response to electrical stimuli
- photochromics change in response to absorbed sunlight, primarily UV
- thermochromics respond to ambient or product temperature.
- The ability to modulate these properties provides for a building envelope that adapts to the outside environmental conditions or user requirements and provides higher energy performance by capturing useful daylight while controlling glare and unwanted solar heat gain.

Energy control window films

Window film is a very thin, high-performance polyester (PET) film made up of multiple layers applied to improve energy performance by reducing heat and glare, increasing insulation, redirecting light or blocking UV radiation. This leads to a variety of films that range from dark to clear, highly reflective, or spectrally selective films that focus on rejecting infrared heat.

Solar shading devices

Solar shading devices are generally affixed to the exterior of the building to prevent direct sun penetration at certain times of the day and year. These shading devices are generally used as a method of solar control in combination with fenestration with solar control low-e insulating glazing. Often solar shading devices are static, but some are operable, with components that change angle following the position of the sun in the sky in order to maintain optimum shading performance. ■

Editor's note: *This article is excerpted from the Products for Energy Applications Glass Technical Paper developed by the Technical Services Division of the NGA. Scan the QR code for the complete version of the GTP at glass.org/store.*

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KPS Capital Partners to Acquire Oldcastle BuildingEnvelope in $3.45 billion deal

KPS Capital Partners LP announced that, through a newly formed affiliate, it has signed a definitive agreement to acquire Oldcastle BuildingEnvelope Inc. from CRH plc for approximately $3.45 billion in cash.

Completion of the transaction is expected in mid-2022 and is subject to customary closing conditions and approvals, according to a KPS release. OBE is North America's leading vertically-integrated manufacturer, fabricator and distributor of architectural hardware, glass and glazing systems. The company has over 6,700 employees and operates 84 manufacturing and distribution facilities in five countries, according to the release.

Raquel Vargas Palmer, co-managing partner of KPS, said in the release, "We are thrilled to acquire North America's largest provider of architectural hardware, glass and glazing systems. OBE is the only 'one-stop shop' for every critical product a glazing industry customer needs, and the company serves attractive, growing end-markets. We intend to drive profitable growth by providing the company with the financial resources to invest in commercial and operational excellence."

Liz Haggerty, president and chief executive officer of OBE, said in the release, "The entire OBE management team looks forward to partnering with KPS as the company begins its journey as an independent company. KPS has



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Cricursa Faces Bankruptcy, Potential Acquisition

Spanish newspaper El Nacional reported that glass fabricator Cricursa has been in bankruptcy proceedings since December 2021 and faces liquidation. The company is carrying almost $68 million in debt, according to the report, due to business conditions caused by the pandemic. Cricursa is headquartered in Barcelona.

In February, another Spanish newspaper, La Cronica, reported that Tvitec, a glass fabricator based in Cubillos del Sil, Leon, Spain, is one company among several investors that has shown interest in buying all, or part, of Cricursa. As of press time, Tvitec made an official offer to purchase the company. Visit GlassMagazine.com for updates on the story.

AGC Glass Europe Plans Closure of Two Auto Glass Plants

AGC Glass Europe announced intentions to close two automotive glass plants in Europe: its Wegberg Plant located in Germany, and its Fleurus plant located in Belgium.

The Wegberg plant closure will affect 84 employees within the next two years. The decision to close the plant is based on the amount of continued pressure the automotive market has been under, compounded by a variety of factors related to Covid and supply chain.

The Fleurus plant closure will affect 187 workers. The company is considering a gradual shutdown over the next year. AGC Glass cites similar reasons for closing the plant.

Saint-Gobain Divests Glass Fabrication Business in Estonia

Saint-Gobain entered into an agreement for the sale of its regional glass fabrication business Baltiklaas OÜ in Estonia to Polar Glass OÜ, a subsidiary of Barrus AS, the largest glued laminated timber manufacturer in Estonia and supplier to window and door producers.

Şişecam Acquires Refractory Manufacturer Refel

Şişecam will acquire the Italian company Refel, a refractory materials manufacturer. Refractory materials are used in the construction of glass melting furnaces and are crucial for the timely commissioning of investments in accordance with



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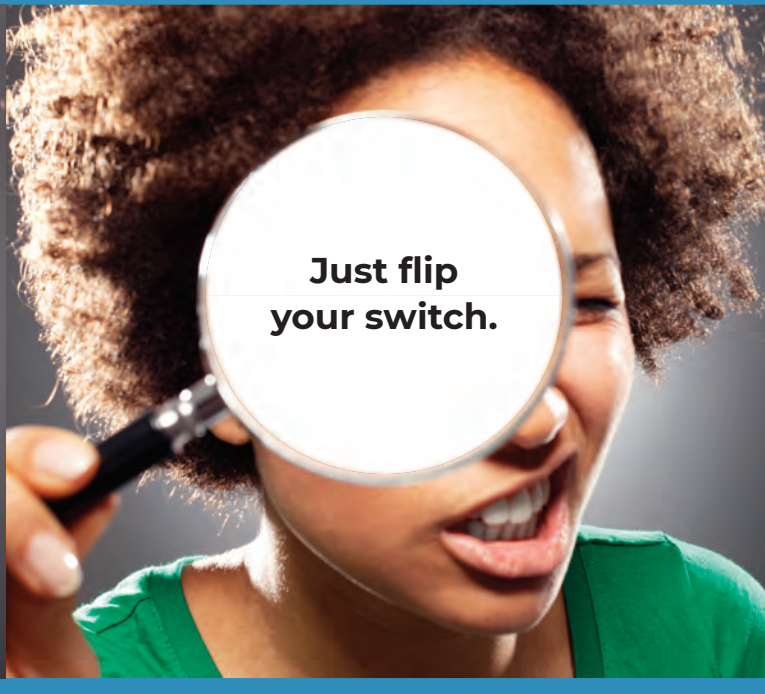
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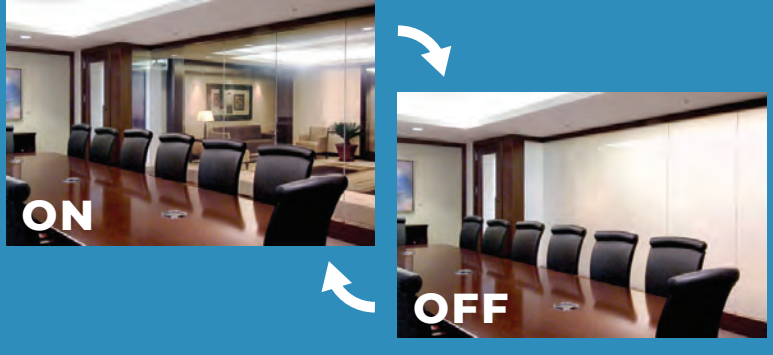
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planned schedules. With this acquisition, Şişecam aims to eliminate risks related to the disrupted supply chain and secure its refractory supply in order to realize its new investments in glass manufacturing on schedule, according to company officials.

Şişecam Chairman of the Board Prof. Ahmet Kırman says, "The world has entered a period of great change. No country or sector has escaped unscathed after the onset of the global pandemic. This new era is characterized by volatile conditions globally. The ability to adapt effectively to changing conditions due to breaks in the supply chain is now one of the most important competencies that we should all have. In such an environment, companies that have sufficiently prepared to adapt quickly to ever-changing conditions to meet their goals will continue to develop and grow. ... Securing the supply of critical materials is absolutely imperative today during this time of widespread supply chain disruptions."

One of the most critical issues for glass furnace investments and cold repairs to be completed in accordance with planned schedules is refractory materials supply, according to officials.

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Multinational Company GMM Acquires 52 Percent of Bavelloni Shares

Bavelloni SpA and GMM, which is controlled by the Consilium SGR private equity fund, signed an agreement giving GMM control of 52 percent of Bavelloni's shares. GMM is a multinational company based in Gravellona Toce, Italy, and supplies machinery for stone cutting, milling and polishing.

GMM and Bavelloni SpA will create an industrial group with more than $100 million of turnover and about $10 million of EBITDA, with 400 employees, 6 production plants and 8 direct subsidiaries.

The group will integrate their respective technologies in an annual production of over 800 machines that



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will consist of three main business units: stone with the GMM brand, glass with the Bavelloni brand and fabrication materials with the Techni Waterjet brand.

PEOPLE NEWS

YKK AP America Inc. announced changes to its manufacturing leadership team.

Industry veteran and manufacturing executive *Rick Farmer* has been hired to serve as vice president of commercial manufacturing. *Greg Hultquist*, formerly vice president of manufacturing operations, has been appointed to vice president of manufacturing strategy. Under their leadership, the company will continue to invest in improvements and expansion in the U.S. market to fulfill its purpose of building a better society through architectural products, say officials. Farmer comes to YKK AP with more than twenty years of experience in manufacturing operations within the industry, most recently with Viracon Glass.

Chief Executive Officer and Co-Founder of **Goldray Glass** *Cathie Saroka* is stepping down from her role, transitioning to executive chair, and handing over her CEO responsibilities to *Michael Saroka*.

Michael previously held the role of Goldray's chief operating officer. Having grown up in the glass industry, he has embraced his journey of working his way up through Goldray Glass to become a leader and innovator in the industry. This has earned him the reputation of being a hands-on leader who brings integrity, passion, and a deep understanding of the industry.

FutureVu Brands Inc., the operating umbrella for brands in architectural, glazing, energy and security retrofit markets, named *Rebecca Weiner* chief marketing officer and *Joe Mauldin* vice president of sales. One of FutureVu's five subsidiaries, Impact Security, named *Steve Champlin* vice president of sales.

Weiner and Mauldin will play an essential part in providing support for the FVB subsidiaries, supporting revenue growth initiatives while working collaboratively with brand presidents to deliver solutions to customers at the highest levels of integrity and efficiency. ■

Most-clicked news items from Feb. 2 to press time March 3. Read these stories, and others, in their entirety at GlassMagazine.com.



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01



02



TRENDHUNTER

VERSATILITY IN DESIGN AND WELLNESS WITH DECORATIVE GLASS

BY SPENCER RAYMOND

The role of decorative glass in building and design is increasingly multifunctional, beyond simply beautifying or adding dimension to finished spaces. Decorative glass can fulfill a multitude of roles, providing stylish and eye-catching designs as well as enhanced safety, energy efficiency, even protection for birds who might mistake clear glass for open sky.

The emphasis on biophilic design and sustainability continues to grow from design trends from previous years with nature-inspired colors, patterns and designs becoming even more refined and covetable. Moreover, we're seeing a subtle merge of retro, natural and "Zen" elements in 2022 interior design trends.

Let's look at what's currently trending.

01— DESIGNS THAT MIMIC

A skeuomorphism is an imitation of an object intended to represent the original. Simply put, it is the art of digitally creating a design that mimics a physical object using shadows, gradients and other visual attributes that help create the illusion of depth. For example, an iron grid pattern for a shower enclosure or entrance door without the heavy weight or maintenance of true iron grids or metal work.

Digitally printed designs can be made to effortlessly mimic a range of popular materials, such as marble, stone, tile, fabric, woodgrain or metal work to achieve the desired aesthetic without





01—At 390 Madison in New York City, a wood grain design on glass is backlit at night for a dramatic visual effect.
02—(Top) The first-floor check-in lobby at the Emory Musculoskeletal Institute in Atlanta features glass partitions with digital imaging of skeletal designs with blue fade. (Bottom) Emory MSK also specified custom wall cladding, which is the immediate view for patients when the elevator doors open on floors 2, 3, 4 and 5.

the maintenance and cleanliness issues inherent with these material surfaces. These designs and faux finishes are frequently implemented as backsplashes, shower enclosures, doors, partitions, or even in full-scale art designs.

02—
COMPLEX STATEMENTS

Decorative glass can effortlessly enhance a building's overall feel and intent, providing striking visuals unique to the aesthetic or mood being promoted. This can be realized using faux finish designs, corporate branding, custom artwork, or by integrating a range of color transitions and digital fades, and more. Done with care, results



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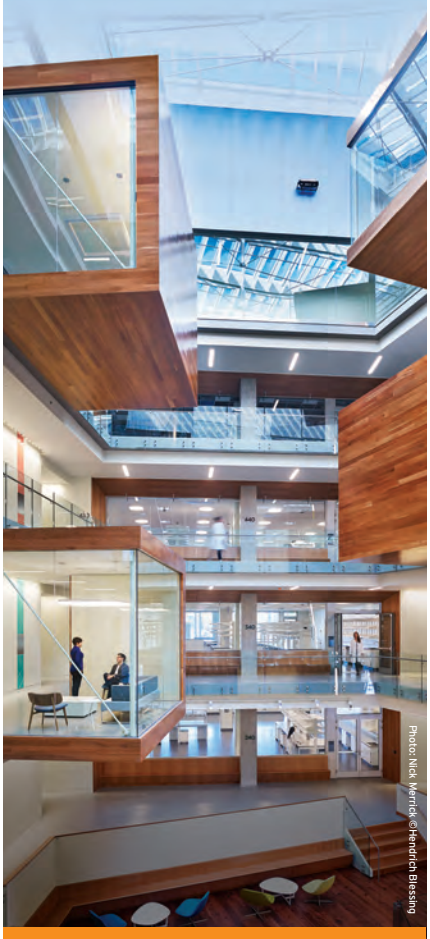


Photo: Nick Merrick @Hendrich Blessing

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Satin etched tempered glass was incorporated in Steelcase office furniture designs to ensure social distancing and privacy.

are distinctive, evocative, and provide a much-needed touch of personalization.

Trending applications include back-painted and direct-to-glass printing on low-iron and satin-etched glass—or both for wall cladding for lobbies, elevator banks and office interiors, including partitions and interior operable glass wall systems.

The Emory Executive Park Musculoskeletal Institute in Atlanta is a good example of how to utilize digital imaging in glass to both establish a feel for the organization while providing informational and directional guidance to visitors and patients.

03— MULTI-FUNCTIONALITY

Few materials offer the versatility and multi-functionality of glass. This is especially important in a post-pandemic culture with an increased need and emphasis on healthier surface materials. Owners and architects seek materials that are easier to clean, durable and can be frequently disinfected without compromising the function or aesthetic.

Decorative glass meets all those criteria and more with a broad range of glass types and fabrication processes to satisfy a multitude of performance requirements, such as energy efficiency, daylighting or enhanced privacy, sound control and bird glass protection.

For example, glass partitions and operable glass wall systems are being used to achieve the look and feel and social benefits of an open-space concept while maintaining health considerations for employees. Additionally, designers are taking company culture and enhanced communication tools to the next level with glass wall cladding and white-boards—or should we say "glassboards," since these can be back-painted any color imaginable or digitally painted with logos and custom designs. Oversized glassboards that take up entire walls are being used to turn wasted wall space into functional spaces that encourage creativity and team communication.

As designing for wellness continues to trend upward, architects and designers are looking for versatile, durable and easy-to-clean material surfaces. They are looking to achieve open space concepts and flexible interior designs while also providing physical separation. These concerns will continue to be a driver for specifying glass—including decorative glass types—to create healthier living and workplace environments. Gone are the days when decorative glass was just for looks, and fire-rated glazing systems were an interior designer's worst nightmare. The aesthetics and functionality of decorative glass solutions are driving sales and a higher level of profitability for the glazing community. ■

Spencer Raymond is product manager for GGI. He can be reached at sraymond@generalglass.com.



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The Cesar Pelli-designed McKinney & Olive project in Dallas features surface treatment for glass on its floor-to-ceiling windows. Photo by Michael Lyon, courtesy of EnduroShield.

PROTECTION FOR GLASS DURING CONSTRUCTION

BY JOE SCHIAVONE



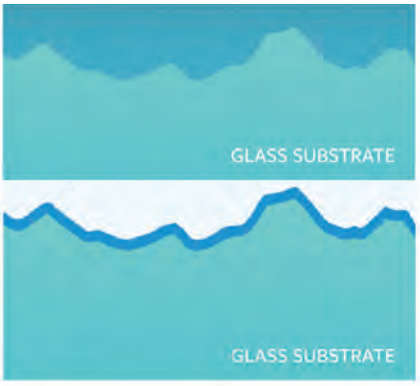
Glass can become contaminated on a building site during construction. The main culprits are concrete slurry and cement dust, which if left unchecked, can cause etching and pitting, necessitating costly replacement. To minimize risk of damage and to ensure glass is intact for the final builders' clean, it needs to be protected on the jobsite.

Protection products

Applied film on the exterior façade

This type of protection is either applied as a film or sprayed on with an airless sprayer onto the exterior façade. It does a good job with full protection against concrete slurry spills and scratches. However, the protective films or sprays require manual installation on the exterior of the building and are labor-intensive, both on the install and upon removal, and only provide protection through the construction phase of the project.

Applied film or airless sprayer applications make sense on one- or two-story buildings. However, taller structures would require equipment and extensive labor to achieve coverage, and after-completion disposal of the film can be expensive and not environmentally friendly.



Top: "hills and valleys" of the glass substrate filled with the silicone-based coatings. Bottom: the organosilane derivative coatings, bonding to the hills and valleys of the glass.

Liquid-based coatings

Silicone-based coatings

Silicone-based protective coatings can be applied either in the factory or after the glass has been installed. The coatings bond to the surface of the glass—most silicone-based products smooth the "hills and valleys" of the glass substrate, making it slippery and flat.

The coatings have water-repellent properties and help with soil buildup. Some also have oil-repellent properties. Most of the silicone-based coating products on the market require a one- to three-coat process to apply their product and may require maintenance application every one to two years. As with applied film, this could end up costing more in labor and would only be cost-effective on a one- or two-story building.

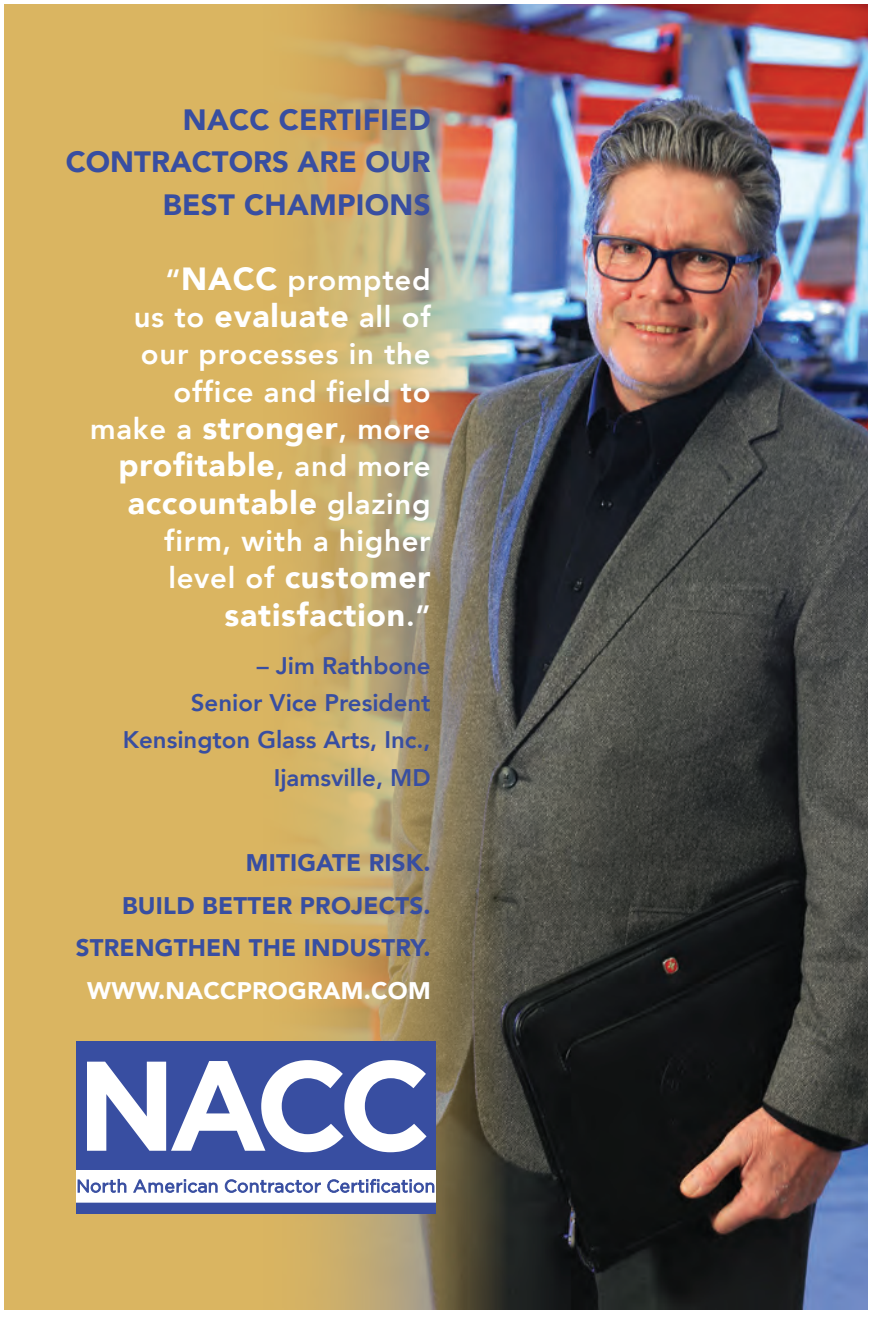
Organosilane derivative

Organosilane derivative coatings can be applied in the factory or onsite before or after installation. The nanotechnology has both hydrophobic and oleophobic properties. It is a one-coat product that can be applied manually or with an automatic applicator, and it bonds to the hills and valleys on the surface of the glass. The coating doesn't require any yearly additional coats to maintain the integrity of the product's functionality, and it bonds to anodized aluminum as well as stainless steel.

Organosilane derivative coatings protect against cement slurry, staining and etching onto the glass and metal surfaces. They will also provide benefits after construction, protecting the glass against building runoffs, staining and corrosion, with low-maintenance and easy-clean advantages for many years.

Polymeric resin

This product has both hydrophobic and oleophobic properties and offers good protection during the construction phase. It provides good protection; however, the excess polymer residue would need to be removed from the surface after the construction phase, which requires considerable additional labor, and often the residue removal is so difficult that it also removes the product as well.



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How to pick the right product

Ask for verifiable test reports for every specification as part of the submittal process. Companies that can produce test reports to quantify their claims would be best suited to meet the specifications of any project. The size, makeup and parameters of a project would have to be considered.

Additionally, project managers should ask the following questions: What is the application method? Is there maintenance involved? Is it labor-intensive? What is the ROI? How long has the product been used, and do they have both new and long-standing projects and case studies supporting their technology?

Finally, be sure to read the fine print on the warranty. What does it entail? Does it require maintenance for the warranty to be valid? Not all companies hold themselves to the same standard and therefore not all warranties are equal.

Look for a product with the longest-lasting water and oil repellency that does not require revitalizer products to maintain the coating and warranty. Choosing a company and product that are reputable is very important in the construction industry. One bad choice could put the whole project at risk for damage or failure. Do your homework and discovery before you make a choice. ■

Joe Schiavone, CSI, CDT, is North American sales manager for EnduroShield. He can be reached at jschiavone@enduroshield.com.





Glazing system mock-up testing. Photo courtesy of Intertek.

TESTING IN THE SPECS

MANAGE RISKS AND REDUCE COSTS WITH DETAILED CONSIDERATIONS FOR MOCK-UP AND QC TESTING

BY MATT JOHNSON



Project specifications are tools just as important as any hammer, saw or driver. But as important as they may be to building a project, specifications are equally important risk management and money-saving tools. Careful attention to specifying proper components and their interactions is essential to quality building practices and identifying what happens when systems conflict.

Testing considerations

A strong example is found in mock-up and quality assessment testing. Field testing specification details vary widely. They can range from generic specifications simply based on the number of units for testing, to detailed and phased assessments with prescribed methods and means. Each may have its place, but a quick exercise in picking apart some details of a field-testing specification can show how good specifications can realize positive cost and risk returns.

Start with what is being tested. Mock-up and field-testing protocols typically focus on completed assemblies. But those assemblies include multiple elements—cladding, joinery, sealants, the glazing system itself and more. It is often easiest to review all elements in a single test. And where the testing results in a pass, that approach works well.

But what if a failure occurs? Project specifications that do not address the potential for failure of a mock-up or QC test can leave trades, suppliers and manufacturers in unsettled or potentially adverse positions. Where testing specifications do not call for a

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sequenced and isolated regimen, the forensic benefits of testing can be lost. This means a failure results, not only in a loss of time due to the failure, but the added delay and cost required to find the responsible element or system.

The number of units to be tested is also an essential specification. The typical "representative sample" tends to prove too vague to realize value or savings. Field-testing specifications that fail to provide detailed testing identifiers for number and configuration types often leave gaps in quality reviews that can eliminate the benefit of the monies paid to test in the first place.

So too for timing. A single mock-up of one configuration at the start of a project may be informative, but also not reflective of what happens in the field during the push to meet project deadlines. Specifications that do not provide for testing throughout the project, in phases or exposures, place a lot of faith in that single event to ensure quality throughout an entire job.

A plan for failures

Perhaps most important, seldom do specifications address failures and remediation. Despite best intentions, barriers are immediately erected when a mock-up or field test fails. Unless the specifications establish a process for forensic investigation and cost sharing, the risk of delay and lack of cooperation grows uncontrolled. The failure to specify post-failure testing cost responsibility can equally drive the parties apart and toward their respective lawyers.

Before going farther, it is important to acknowledge that no one here is being unrealistic. Not every job requires detailed project specifications addressing field-testing protocol. Project specifications also cannot account for every circumstance or potential issue. Where they are present, however, careful assessment of specifications will play an important role in the risk management of any project.

That management starts with a careful review. Looking to what is included is important, but so too is identifying what

> “EARLY INVOLVEMENT CAN OFTEN IDENTIFY ISSUES BEFORE THEY HAPPEN AND AVOID LATER SPECIFICATION AND TESTING CONFLICTS.”

might be missing. Project or system needs may warrant testing that is more or less rigid. This is not a situation where second-guessing the drafter is needed. Rather, experience is a valuable teacher, and asking about testing can not only ensure early thought goes into the proper testing approach, but also make a better trade partner.

Supplier collaboration

Getting buy-in to the testing specification from all necessary parties is also essential. Manufacturers and suppliers often require notice before testing of their products as a condition to maintain warranty or later product support. Provide that notice early. Pre-project notice of specifications can not only protect later remedies; it also provides the chance to rely on the expertise of those whose systems are going to be used. Early involvement can often identify issues before they happen and avoid later specification and testing conflicts.

Spec review

Finally, a careful review of the testing specification allows for the identification of contract issues. Terms that identify responsibility for complying with specifications should be carefully considered to ensure they are not too broad. Further, costs for field testing, consultants and remediation should be specifically spelled out in the underlying agreement as well. Consider having a form contractual addendum that addresses field-testing responsibility as an easy way to be prepared to respond to a builder’s preprinted form agreements.

Like any good tool, specifications are only useful with careful consideration into how and when they are used. Early thought toward field-testing specifications may seem minor, but it provides the best opportunity to avoid the cost and relationship harm that can result when failures occur. ■

Matt Johnson is a member of The Gary Law Group, prgarylaw.com, a Portland, Oregon-based firm specializing in legal and risk issues facing manufacturers of glazing products. He can be reached at matt@prgarylaw.com.





At an AGC Interpane facility, an automated insulating glass line with Super Spacer from Quanex. Photo by Rene Müller.

TIME TO RE-FOCUS

AS THE FENESTRATION INDUSTRY WORKS THROUGH PRODUCTION BACKLOGS, SATISFYING DEMAND MEANS MORE THAN SIMPLY GETTING ORDERS OUT THE DOOR

BY JOE ERB



Production backlogs are an ongoing problem for commercial glass manufacturers. And for anyone doing business in 2022, this probably feels like familiar territory.

Demand across the fenestration space is up, all while supply chain challenges continue to hamper the ready availability of raw materials. Optimizing inventory and deepening your understanding of your production capabilities aren't just priorities. They're table stakes for doing business.

Doing all of this requires a lot of focus from manufacturers—so much so, that it has the potential to draw attention away from other critical parts of a fabricator's business. But as we continue working through an unprecedented stretch in our industry's history, there are a few other goals I think are worth placing equal weight on achieving. Let's explore a couple of them.

Clearing a higher and higher bar

The White House announced in January the formation of the New Buildings Performance Standards Coalition, and it could have some big implications for the performance expectations of commercial glass in some of the country's biggest municipalities. The coalition includes 33 state and local governments—including just about every "big city" you could name—with the goal of enacting policy or regulations to spur building energy improvements by 2024. It's an aggressive target (perhaps overly so), but it's indicative of the kinds of changes we're going to continue seeing in the commercial construction space.

> "IT'S PERHAPS MORE IMPORTANT NOW THAN EVER TO DEMONSTRATE THE HIGH LEVELS OF PERFORMANCE COMMERCIAL GLASS PRODUCTS CAN ACHIEVE WHEN THE RIGHT TECHNOLOGIES ARE DEPLOYED."

Now, I'm a believer that commercial glass can be an integral part of modern, efficient and sustainable architecture. Most of the folks with whom I associate in our industry believe the same thing. Glass façades can provide striking architectural appeal, along with tangible occupancy benefits like daylighting, enhanced views, biophilia and energy efficiency.

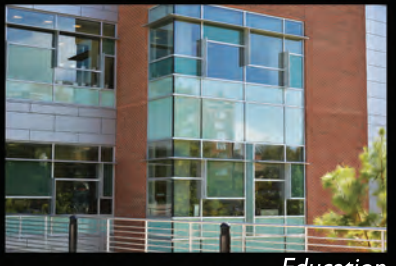
But it's no secret highly glazed buildings have their detractors, and as builders look toward achieving new targets, shrinking the window-to-wall ratio in new construction is certainly something that will be on the table. That's why it's perhaps more important now than ever to demonstrate the high levels of performance commercial glass products can achieve when the



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> "EMPLOYEES MAY BE SUFFERING FROM BURNOUT. AND IT MAY FEEL LIKE THERE'S TIME FOR NOTHING ELSE ON YOUR SHOP FLOOR BUT PRODUCTION."

right technologies are deployed. True warm-edge spacer technology combined with the right low-e coatings can help create highly efficient double and triple pane insulating glass capable of meeting modern performance targets. Meanwhile, high-performance commercial vinyl formulations continue gaining traction as builders demand efficiencies that traditional metallic options struggle to achieve—it's an ideal choice for punched opening and window wall applications.

These are some of the things today's commercial glass fabricators need to keep in mind as demand shifts and major sustainability efforts in big cities become increasingly commonplace.

Making time for maintenance

Delivering on these performance standards requires sound production practices that ensure insulating glass panels have been assembled consistently and correctly. It requires taking the time to make sure all critical equipment is fully functional and operating as intended.

But for manufacturers, busy season has functionally lasted for the past year and a half. This has been a challenge for a range of reasons. It can be easy to miss quality control measures as things move quickly at all hours of a shift. Employees may be suffering from burnout. And it may feel like there's time for nothing else on your shop floor but production.

That last part, though, is only as true as you make it—and it's critical to make time for important, routine maintenance tasks that keep production equipment running smoothly. Putting them on the back burner can lead to problems that can cost you later on. Neglected or improperly calibrated cutting equipment and glass washers, for example, means you're sending poorly cut, rough-edged glass into your production line or touching up dirty glass coming out of the washer. And if you're like any forward-thinking fabricator, you've probably made some significant technological investments in your business over the past few years. What you get out of those investments is only as good as what you put into them. Dirty glass will lead to aesthetic issues; rough glass could lead to glass breakage/failures. That's why it's important to make time for all the routine maintenance tasks that can influence product quality and long-term field performance.

Digging out from production backlogs is a priority for any commercial glass manufacturer—but in doing so, it's important we don't lose sight of other goals critical to our collective success. ■

Joe Erb is commercial sales specialist for Quanex Building Products.

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The basics: The newly designed Central Subway Station in San Francisco features a fire rated glass floor on the surface of Union Square. This glass floor acts as a lightwell and designed to improve wayfinding by welcoming commuters into the concourse level.

As commuters travel 70 feet below ground to reach the station's platform, each level is connected by fire rated glazing to allow light to flow through each floor. Fire rated glazing was also applied to the glass elevator enclosures to maximize the amount of light traveling through the station.

The players: DLR Group | Kwan Henmi are the architects of the Central Subway Station. Tutor Perini is the general contractor responsible for the construction, with SFMTA managing the project. ACR is the glazing contractor responsible for installing the fire rated glazing provided by SAFTI FIRST®. SAFTI FIRST®'s fire rated floor includes a walkable glass surface provided by Pulp Studios and artwork designed by Hughen/Starkweather, a collaborative team comprised of San Francisco artists Jennifer Starkweather and Amanda Hughen.

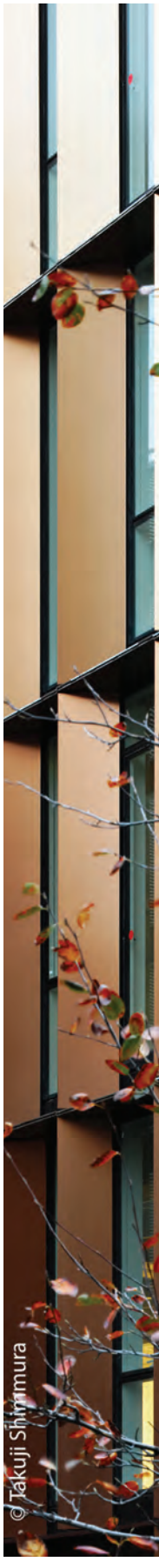
The glass and systems: SAFTI FIRST® provided a 2-hour fire rated floor system and 2-hour elevator enclosure. The GPX® FireFloor System is a complete fire resistive glass and framing assembly that meets ASTM E-119/UL 263 up to 2 hours. The floor brought in light and openness while providing maximum protection against smoke, flames and radiant heat. The elevator uses SuperLite® II-XL 120 in GPX® Architectural Series Framing providing floor-to-ceiling transparency that meets ASTM E119/UL 263/CAN S101 up to 2 hours.

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THE HIGH-PERFORMANCE FAÇADE EQUATION

By Katy Devlin



Right: The BNP Curve in Paris features a more than 100,000-square-foot façade that allows the interior to be flooded with natural daylight. The insulating glass includes transparent and highly selective solar control glass from Saint-Gobain and warm-edge 16-millimeter Super Spacer Triseal Premium Black Plus from Edgetech/Quanex Building Products. The architect was Chartier Dalix Architects. Photo by Takuji Shimmura.



The high-performance façade equation is a challenge to solve. Design and project teams must weigh myriad factors to develop façade systems that meet next-level energy efficiency requirements, optimize whole-building performance, provide a healthy and comfortable environment for occupants, achieve increasingly important sustainability and carbon-reduction goals, meet budget, and more.

The good news for the building industry is that glass and glazing technologies exist to meet even the most stringent performance goals. "We can get to the point where the façade glazing systems can be better than the insulating opaque wall for any location, any orientation, any glass area," according to Stephen Selkowitz, principal, Stephen Selkowitz Consultants, affiliate, Lawrence Berkeley National Laboratory, speaking during a presentation at the January NGA Glass Conference: Long Beach. However, meeting the wide-ranging goals for performance comes with mighty challenges. "This is not easy," and it can be expensive, says Selkowitz.

Glass Magazine's 2022 All About Glass & Metals: Guide for Architects takes a closer look at three essential elements to the high-performance façade equation. Part 1: Performance, explores the often-overlooked topic of thermal bridging in the façade; Part 2: Products, looks at innovations in insulating glass technologies; and Part 3: People, considers balancing daylighting and glare to optimize occupant comfort and wellness.

This article is part of the National Glass Association's and Glass Magazine's in-depth All About Glass & Metals series for architects and specifiers. The complete series also addresses considerations for protective glazing, interior glass, glass and glazing specifications, complex façades and more. View and download at glass.org/store.

1– PERFORMANCE





■ *The Importance of Thermal Bridging*

Source: Adapted and excerpted from the "Thermal Bridging Considerations at Interface Conditions Design Guide," published in January by the National Glass Association and available for download at glass.org/store.

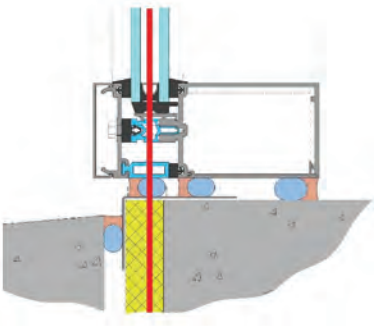
"Thermal bridging is a big deal. It is the silent degrader," said Helen Sanders, leader in strategic business development for Technoform, during the meeting of the energy group of the NGA Fabricating Committee at the NGA Glass Conference: Long Beach held in January.

Thermal bridging occurs when building exterior cladding or structural components with higher thermal

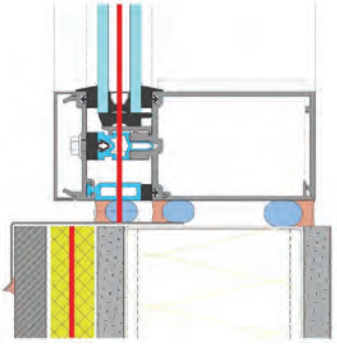


The interior of the new Fayetteville High School in Fayetteville, Arkansas, is illuminated by 28,000 square feet of curtain wall and 14,000 square feet of storefront glass, creating an open, airy design that helps foster a healthy environment for students and teachers. Exterior sunshades, Versoleil SunShade - Outrigger System from Kawneer, provide daylighting controls. The project also features high-performance curtain wall, 1600 Wall System 1, Trifab VersaGlaze 451T Stick and SS systems, and entrances, all from Kawneer. The design team included Hight Jackson Assoc., Marlon Blackwell Architects, and DLR Group. Photos courtesy of Kawneer.

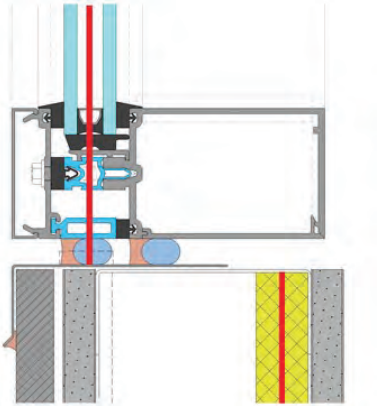




Efficient: Well-aligned glazing without conductive bypasses (thermal line illustrated in red).



Regular: Misaligned glazing and minor conductive bypasses (thermal line illustrated in red).



Poor: Cavity-insulated and conductive bypasses (thermal line illustrated in red).

conductivity penetrate or bypass insulation, thus creating a path of least resistance for heat transfer. For example, a steel beam or balcony penetrating the wall insulation will create a path for heat transfer. This pathway could lead to heat loss and decreased energy efficiency as well as potential cold points that can lead to condensation within the building envelope on exposed, interior surfaces.

"We're not talking about thermal bridging in the frame. That is accounted for with U-factor," described Tom Culp, owner of Birch Point Consulting, during the conference. "This [is] about how [heat transfer] bypasses insulation in a building. ... It's about alignment between the wall and the windows."

In wall assemblies, metal penetrations can significantly reduce the effective R-value of the wall insulation. For fenestration assemblies, the potential for thermal bridges may occur where the window framing meets the surrounding wall if the surrounding insulation layer is bypassed.

THERMAL BRIDGING IN THE CODES

Model energy codes typically address the performance of individual components in the building envelope. This includes the U-factor and solar heat gain coefficient of fenestration products as well as the R-value of opaque wall construction and roofing assemblies.

Model energy codes typically have not addressed the intersections of these components or penetration of the insulation; however, as they increase in overall stringency, some codes are beginning to address thermal bridging. For example, the Seattle Energy Code increases the amount of continuous insulation required in opaque wall construction based on percent area of metal penetrations compared to a wall with minimal metal penetrations (or thermal bridging). Energy codes in Vancouver and New York City require that thermal bridging details be identified on drawings and be accounted for in all performance modeling.

Most notably, ASHRAE 90.1 has been working on comprehensive new requirements to mitigate thermal bridges in many areas including roof edges, parapets, intermediate wall edges, balconies, masonry shelf angles, and the wall-to-fenestration intersection. These requirements will apply to colder regions (ASHRAE's climate zones 4-8) and are anticipated to be included in the 2022 edition of ASHRAE 90.1, which will also be referenced in the 2024 International Energy Conservation Code (IECC).

HOW TO ACCOUNT FOR THERMAL BRIDGES

The energy codes account for thermal bridges in two ways: simple prescriptive strategies and more complex modeling.

The simple approach can be deduced to a basic concept of a "thermal line" or "thermal plane." Just as designers and engineers look for a continuous line connecting the constructions to form the primary air and water barriers, they should also now look to construct a continuous thermal line connecting the insulating materials across the transition details from fenestration to surrounding construction to create a "thermal barrier" between components. This results in different simple prescriptive strategies, shown in the diagrams at left.

STRATEGIES TO CONSIDER

For fenestration assemblies, whether a punched opening window or a curtain wall, the concept of a "thermal line" leads to the ideal scenario: alignment of the insulating glass units, thermal breaks within the frame, and insulation in surrounding construction without any significant bypasses. This ideal is not always possible when considering the many functional design requirements regarding structural support, water management, etc. However, better alignment will generally result in less thermal heat loss and an improved (lower) psi-factor.

The simplified prescriptive requirements proposed for ASHRAE 90.1



Condensation can result when frames are installed with the thermal break in the frames is forward of the thermal line in the surrounding wall, allowing cold air to meet the frames to the interior of the thermal break.

also try to encourage this practice of alignment and/or a continuous thermal line as much as possible. ASHRAE 90.1's primary requirement is to align the glazing layer within 2 inches of the wall continuous insulation (e.g. mineral wool or insulating foam board), or within 2 inches of the exterior side of the cavity insulation where there is no continuous insulation. Ideally, thermal breaks within the frame are also aligned with the glazing, and the benefit from doing so will be reflected in the lower U-factor rating for the product.

Aligning the glazing system and the wall insulation is not always possible because of functional considerations such as structural design or simply for design aesthetics. Therefore, ASHRAE 90.1 also includes other options for recessed windows or offset construction. In that case, the goal is to continue the thermal line from the continuous insulation to the window framing, covering any exposed area with insulating material with R-value greater than 3 or thermal conductivity less than 3.0 Btu·in/h·ft2·°F (this would also include the option to mount the fenestration within a wood buck). It is not required that the insulation be under the frame, as careful consideration must be given to the attachment and support of the window, as well as proper water drainage.

In all cases, the intent is to maintain a continuous thermal line, as much as possible, to minimize interruption of the thermal line, thus creating "thermally bridged" details. However, there are many other issues that must also be considered at the same time.

MORE FROM THE DESIGN GUIDE

Download the complete design guide at glass.org/store for definitions of the two thermal bridging characterizations, linear and point; a breakdown of complex thermal bridging modeling; diagrams and photography depicting thermal bridging concepts; and strategies for edges and perimeters. The guide also explores the responsibility of designers to indicate thermal lines in construction drawings, and the responsibility of fenestration industry companies to provide an overall energy rating for a glazing system.

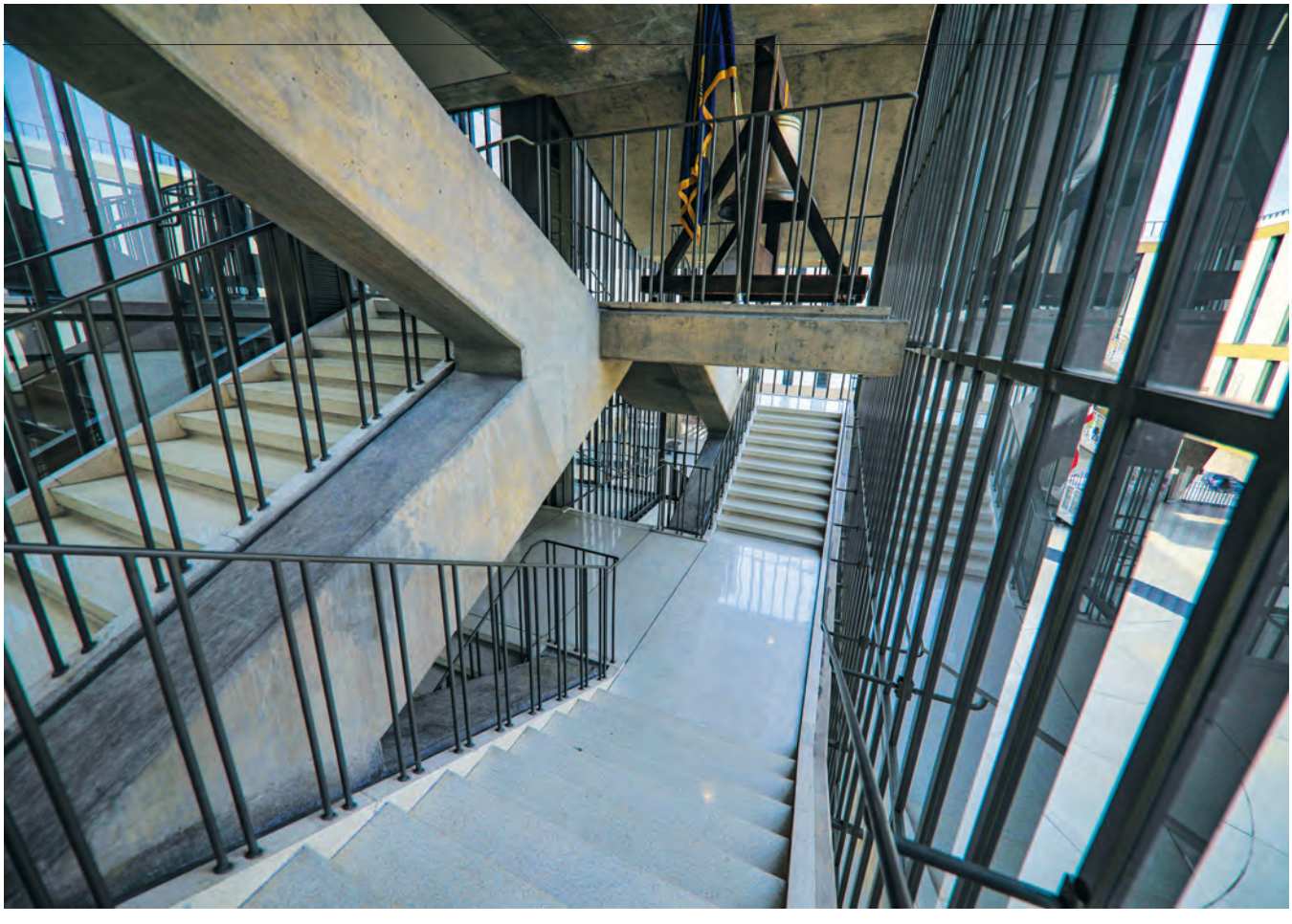
TASK GROUP MEMBERS

The design guide was developed by the following task group volunteers:

- Technical Glass Products (Chuck Knickerbocker, chair)
- AGC Interpane (Steve Dean)
- Allstar Glass Company LLC (Nathan Breazile)
- Birch Point Consulting LLC (Tom Culp)
- dormakaba (Meagan Lang)
- Dow (Stanley Yee)
- Giroux Glass Inc. (Gregory Wright)
- Heartland Glass (Garrity Gerber)
- Intertek (Ted Derby)
- Jones Paint and Glass (Brian Clark)
- Kawneer North America (Chris Giovannielli, Sneh Kumar, Greg McKenna, Henry Taylor, Ivan Zuniga)
- Mesko Glass & Mirror (George Mesko)
- Oldcastle BuildingEnvelope (Ben West, Rick Wright)
- St. Germain's Glass (Mike McCabe)
- Steel Encounters (Derek Losee)
- Viracon (Aaron Thompson, Fabricating Committee chair)
- Wausau Window & Wall Systems (Steve Fronek)
- Woodbridge Glass (Matt Kamper)

2—PRODUCTS

■ *New IGU Technologies for Carbon Reduction and Zero Net Energy*



Source: This article is based on a presentation at the NGA Glass Conference: Long Beach by Stephen Selkowitz, principal, Stephen Selkowitz Consultants, affiliate, Lawrence Berkeley National Laboratory.

The last year has witnessed increasingly ambitious plans from organizations on the global, national and state levels to meet carbon-neutral, net-zero goals in the next several decades. These plans look at "how we get to 2030, 2040, 2050 with some variant of carbon neutral, or net zero, or half reductions in carbon," according to Stephen Selkowitz, principal, Stephen Selkowitz Consultants, affiliate, Lawrence Berkeley National Laboratory, speaking during the NGA Glass Conference: Long Beach.

To reduce carbon emissions and meet these benchmarks, the building sector must be addressed. "Buildings are about 50 percent of the problem [with emissions] when you look at embodied energy and carbon in construction," Selkowiz says. "If we're going to solve the big-picture global and national energy and carbon problems, buildings are going to have to be part of the solutions. ... And windows are a big part of this."

OPPORTUNITIES IN RETROFIT

Window performance improvements are often focused on new construction. However, Selkowitz says the existing building stock provides the largest opportunity for performance improvements on a wider scale.

"If we're going to get to 2050 [emissions goals], we have to address existing buildings. We can't build our way out of this with new construction. Something like 50 percent or more of buildings that will exist in 2050 are already here now, and most of them are single- or double-glazed. So, we need to be thinking about how we retrofit," Selkowitz says.

Consider, if all existing commercial windows in the United States were replaced with highest-performance integrated façade systems, the market would go from a cost of $20 billion a year to a savings of $15 billion a year, says Selkowitz. "This is if you can magically change every building in the country, which isn't going to happen," he says. But it begins to demonstrate the potential savings that are possible when the industry focuses on existing buildings.

INSULATING GLASS INNOVATIONS

The glass industry offers numerous solutions to improve the performance of insulating glass in buildings. "Can we make the IGUs better thermally? We can play with coatings, with glazings, with the system, and to some degree with the whole building," Selkowitz says.

Existing: Double glazing represents about 89 percent of the market today. Triple and quad IGUs are in the market, but are often used only in the coldest climate zones. In the United States "in residential, triples have about 3 percent market share. I'm guessing it's less in the commercial space," Selkowitz says.

Emerging: Emerging IGU technologies include vacuum insulating glazing, or VIG, and thin triples, which consist of double glazing with a thin-glass interior lite. The technologies can be paired with additional improvements, as well. Low-emissivity coatings can be applied to VIG and to thin triples, with thin triples featuring up to two low-e coatings, and gas fill can be added to the thin triples.

"VIG has been around in a limited form for 20 years. There are some very good products out now, but there's not a lot of market impact," Selkowitz says. "There is a lot of new buzz in terms of hybrid [VIG], new R&D, new generation. That will hopefully make [the products] cheaper."

Thin triples look to achieve the next-level performance of traditional triple IGUs, but deliver a product that is not as heavy, not as wide, and will fit in the existing pocket of a normal sash. "With the thin triple, you get about an R-8 center of glass," says Selkowitz. "If you've got a slightly larger glass package, you can put two pieces of thin triple and get R-14. ... This is great news. You can get an R-14 center of glass with a VIG, or with a quad glazing."

Future: Looking ahead, Selkowitz identifies promising future IGU solutions, including two low-e vacuum hybrid units, which is an IGU that features VIG on one side of the unit. Insulating Aerogel is also promising.

"The [Department of Energy] has been putting a lot of research dollars into Aerogel in the last couple of years," Selkowitz says. There are products out now that are highly insulating, but they are "granular diffusing," which means they have a hazy white translucent appearance. "If you want clear Aerogel, you'll have to wait a bit longer," he says.

Left: Vacuum insulating glazing was critical to the restoration of the 1955 Eero Saarinen-designed "Bird Cage" at the Milwaukee County War Memorial. The Bird Cage is a double cantilever staircase enclosed with a glass and steel curtain wall. The project features Pilkington Spacia VIG from NSG Group, which offers thermal performance improvements and a thin profile that allowed the glass to be incorporated into the original, restored curtain wall system. The restoration project architect was HGA Architects and Engineers, the preservation consultants, Preserve LLC, and the glazing consultant and contractor, Restoric LLC.

3—PEOPLE

Maximize Daylight, Minimize Discomfort and Glare



The JST Production and Engineering Center in Harrisburg, Pennsylvania, touts a sustainable design using laminated timber, deep roof overhangs, flow-through ventilation and a floor-to-ceiling glass exterior, composed of 40 percent glass. The façade features a new hybrid aluminum and wood veneer framing system. YKK AP created a three-inch veneer wall system that would match the existing size of the timber beams; a new die was manufactured to do so. A horizontal aluminum tube was then set above and below the casement window, so that YKK AP's YES SSG TU Vented Window could be set into the curtain wall pocket for easy installation. The design team included Ryuichi Ashizawa Architects and architect of record Arcari+Iovino Architects. Photo by Jana Bannan Photography.



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All About Glass & Metals: Guide for Architects

Source: Adapted and excerpted from the NGA Daylighting Glass Technical Paper, available at glass.org/store.

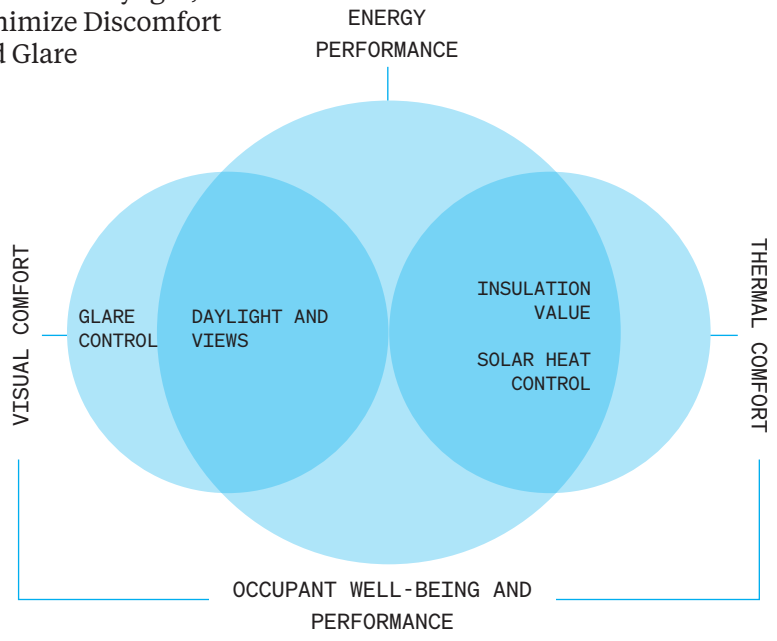
Daylight has qualities that cannot be replicated by electrical light. The changing intensity, direction and color of natural light connect building occupants to the weather, season and time of day. Views through windows can stimulate the well-being and productivity of building occupants. With careful design and daylighting controls, daylighting can also substantially reduce lighting energy use.

The potential for daylighting and views is largely a function of orientation, window placement and window area, as well as the windows' visible transmittance. However, daylight admission must be balanced with glare control and thermal comfort.

If solar radiation causes discomfort and glare, this may not only mean an unwelcome side effect to daylighting. It can actually eliminate its benefits. As pointed out by officials from Lawrence Berkeley National Laboratory, "the classic problem that plagues side-lit perimeter spaces is that occupants sitting nearest the window will lower the shades to avoid thermal discomfort from direct sun or visual discomfort from glare." Often, shades are left lowered for long periods of time, which can eliminate much of the useful daylight and view.

The task is to reduce contrasts and allow daylight to reach deeper into the space. As a general rule of thumb, direct sun should be blocked from falling on occupants and task surfaces, especially if computers are involved. This is partly a matter of interior design and shading devices, but glazing design can already achieve much on its own. For instance, glazing can be separated into glazing for daylighting and glazing for views while daylight is redirected by means of light shelves. Top lighting fenestration such as roof monitors can be another means of controlled daylight access.

Maximize Daylight, Minimize Discomfort and Glare



Advanced glazing for daylight control is available with electrochromic coatings or between-glass blinds. Finally, orienting glazing along an east-west axis typically reduces the potential for glare and allows for more even light conditions throughout the day.

THE COMPLEXITY: A SCIENCE OR AN ART?

Daylighting design remains an art as much as a science. One reason is that discomfort glare is difficult to quantify and predict since it is highly dependent on the occupant's direction of view and task. Few studies have been conducted to derive models that could help with such predictions. Add to this the unpredictability of occupant behavior (e.g. in terms of operating interior shading devices) and it becomes apparent that in many cases experience is still the surest guide.

In addition, some of the most effective daylighting strategies include a combination of shading, surface coloring and interior design features that is rather complicated to model in its entirety. Scientific tools can be a great help, but what really allows designers to push the envelope is innovation informed by experience.

Finally, good daylighting design also relies on the art of teamwork among the different disciplines. For example, electrical and lighting engineers should be involved early in the process of daylighting design so that architects can take their knowledge and experience into account.

The complexities of daylighting should not intimidate designers into ignoring its promises. Whether simple design tools or advanced strategies are used, any improvement in façade design for the purpose of daylighting can save energy as long as thermal performance is taken into account. Aside from energy savings, it is a central goal for architects and building owners to provide occupants with stimulating and comfortable work or learning spaces. With this goal in mind, priority attention to advanced glazing and façade design is well worth the effort.

MORE DAYLIGHTING RESOURCES

Download the complete Daylighting Glass Informational Bulletin in the NGA store, glass.org/store. The full document provides additional information on modeling options to simulate daylighting, links to resources on daylighting from the National Institute of Building Science, Lawrence Berkeley National Laboratory and more.

The NGA also developed the document, "Benefits of Decorative Glass in Daylighting Applications," also available for download at glass.org/store. ■

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In the United States, approximately 25 percent* of flat glass is recycled as glass cullet to be used for production of flat glass or in other industries.

The rest is landfilled.

FLAT GLASS RECYCLING: IT'S POSSIBLE, IT'S PROFITABLE, AND IT'S NECESSARY TO ACHIEVE ENERGY EFFICIENCY TARGETS IN GLASS MANUFACTURING

BY KATY DEVLIN

* FOR 2018 FLAT GLASS PRODUCTION AND RECYCLING, ACCORDING TO INFINITE RECYCLED TECHNOLOGIES.

"EVERY YEAR, WE HAVE A POTENTIAL FEED STOCK OF AN ESTIMATED 7.5 MILLION TONS OF GLASS THAT IS READY TO GO BACK INTO PRODUCTION THAT WE'RE NOT USING," ACCORDING TO JEREMIAH WATSON, CEO OF INFINITE RECYCLED TECHNOLOGIES, IN A PRESENTATION AT NGA GLASS CONFERENCE: LONG BEACH IN JANUARY.

Increasing rates of recycling for flat glass offers benefits to companies, the industry and the environment. However, significant challenges remain, including education gaps about what can be recycled and how, disconnect between the glass and recycling industries, and a near complete lack of recycling of flat glass products that have reached their end of life in the field.

"The glass recycling business is good, but we are missing opportunities," says Curt Bucey, executive vice president of Strategic Materials. "Our biggest limitation right now is getting enough feed stock. There is almost no place in the nation where we aren't looking for more material. We need to get the message out that glass recycling is important."

Why recycle flat glass?

Industry experts point to several key benefits of flat glass recycling, starting with limited raw materials. "With the realization that all raw materials are limited (even glass' raw materials are limited: sand, lime or calcium carbonate, and soda ash), recycling of finished products becomes more and more important and urgent," says Luc Moeyersons, manager for Belgium-based Lami-Solutions.

Second, "recycling flat glass saves energy in the glass melting process," according to Bertrand Cazes, secretary general of Glass for Europe, also during a presentation at NGA Glass Conference: Long Beach.



PREVIOUS SPREAD: GLASS CULLET FOR RECYCLING. **PICTURED HERE:** STRATEGIC MATERIALS INC. RECYCLING OPERATIONS AT THE FUYAO GLASS AMERICA MORAINE, OHIO, FACILITY. SMI PROCESSES THE GLASS AND RETURNS IT BACK TO FUYAO'S MANUFACTURING PROCESS. PHOTOS COURTESY OF SMI.


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According to Cazes, manufacturers can achieve a 2-to-3 percent reduction in energy consumption for every 10 percent of recycled glass cullet used in the batch. Looking another way, 1.1 tons of cullet can save 1.3 tons of raw materials and reduce CO_2 emissions in glass manufacturing by 340 tons, he says. "This is only focusing on manufacturing. If you look upstream at the mining for raw materials that aren't used, you're achieving much higher CO_2 savings," he says.

Finally, recycling can provide a cost savings for glass companies. For manufacturers, savings come through reduced energy use. "Cullet is used continuously in float ovens to reduce the oven bath temperature and emitted CO_2," says Moeyersons. "Adding 40 percent cullet allows [manufacturers] to reduce the oven temperature to 1,150 degrees Celsius, down from 1,600 degrees Celsius."

Down process companies can also see cost savings through recycling. "Whatever a company is paying to send waste glass to landfill, we will come in [at a lower cost] to take it for recycling," says Bucey. "You're doing the right thing and it doesn't cost you."

How is flat glass recycled?

"The first place we'd like to go with recycled cullet is back into flat glass," says Bucey.

However, the flat glass sector has the highest quality requirements for cullet, presenting challenges in "how we collect, sort, and treat the glass to achieve the highest levels we can with the cullet," says Cazes.

Within the flat glass industry, there are three origins of cullet: internal cullet (offcuts in the plant itself); pre-consumer cullet (offcuts in the downstream fabrication process); and end-of-life product (glass from an old car windshield or an old window that has been dismantled), describes Cazes. The vast majority of cullet used in flat glass is internal, coming from offcuts in the plant itself. In Europe, 75 to 80 percent of cullet is internal; 20 to 25 percent is pre-consumer; just 0 to 5 percent comes from end-of-life cullet, Cazes says.

Resources

National Glass Association Glass Technical Papers, "Recyclability of Architectural Glass" and "The Reusability and Recyclability of Mirror Products," available at glass.org/store.

—

"The Need for Recycling to Enhance Our Supply Chain, The European Experience," presentation by Bertrand Cazes, secretary general of Glass for Europe, delivered at the NGA Glass Conference: Long Beach.

—

"Recycled Glass…It's Not Waste, It's the Future," presentation by Jeremiah Watson, CEO, Infinite Recycled Technologies, delivered at the NGA Glass Conference: Long Beach.

—

Technical blog, "Architectural Glass Laminating Guide – Part 10: Laminated Glass – Recycling," by Luc Moeyersons, manager for Belgium-based Lami-Solutions, available through GlassMagazine.com.

If glass isn't used in flat glass, it can be recycled in other industries, including container glass, fiberglass, highway beads, countertops, ceilings and walls, and more, says Bucey. "Bead is a big market for us," he adds. "The bead industry takes it and turns it into little round spheres about the size of the head of a needle. Those are sprinkled onto the lines of the highway to make the lines more visible."

What is status of flat glass recycling?

In the United States as of 2018, approximately 10 million tons of flat glass was manufactured, but only an estimated 25 percent was recycled as glass cullet, says Watson, and "not all of that is going back into flat glass," he says.

In Europe, on average, float plants are running with approximately 26 percent of recycled cullet. "Five years ago, we were at 20 percent, which shows how quickly things are progressing," Cazes says. "This is an average. There are float plants in Europe running with 40 or 50 percent of cullet in a batch. Though that also means there are others that are much lower."

Can fabricated glass be recycled?

Almost all types of fabricated glass can be recycled, says Bucey. "In general, I don't think we've ever turned down material because of coatings, because they are laminated or because they are [insulating glass]," he says. "It might affect the economics, if it has to go through additional processing. And in some cases, it limits our markets. But it doesn't affect the recyclability."

Watson agrees, though notes that there is a lot of confusion in the market over the recyclability of fabricated glass. "Many think that window glass is not recyclable. It certainly is recyclable. In fact, our whole business is built around recycling not just window glass, but laminated, architectural glass, IG units, etc.," he says. "The confusion can be cleared up. But we just need some stability and viable resources."

Moeyersons broke down the ways various types of fabricated flat glass can be recycled for re-use in float glass in a technical blog published in February. (Visit GlassMagazine.com to access the full blog.) For example, ceramic band, found in mainly automotive applications, can be present at a limited percentage in cullet and will burn off in the float oven. Insulating units must be disassembled prior to re-use. The spacers must be removed prior to recycling. However, the sealants—silicone/polyisobutylene/polysulfide—will burn off in a float oven so long as it meets certain threshold limits, Moeyersons says.

Coated glasses can be used, but some coatings may affect the final color of the glass. Meanwhile, for laminated glass, the glass cullet itself can be re-used. However, the PVB itself might prove more difficult to recycle as "after crushing



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laminated glass, 4 percent of the glass fragments remain on the PVB," Moeyersons says. "Introducing glass fragments to a PVB extruder would damage the inside of the extruder and block the PVB melt filter."

What contaminants should glass companies avoid sending out for recycling?

The first contaminant to avoid is any type of metal. "Aluminum can create infusible particles on the glass ribbon, making it unfit for sale and non-recyclable in flat glass furnaces. Stainless steel contains nickel that can create 'spontaneous' glass breakage in tempered glass; tungsten can lead to deposits that make the glass not sellable. And lead can lead to deposits that can attack the glass," explains Moeyersons, in the blog.

Additionally, watch out for borosilicate glass and ceramic glasses, such as those used for fire-rated architectural applications, appliances or fireplace products. Consult with manufacturers of these specialty glass products to participate in their specific recycling programs with safeguards to segregate according to the glass type. Other "doubtful products" include digitally printed glass, smart glass and electronic mirrors, says Moeyersons.

In general, "to evaluate product quality and ensure good separation of the various contents, float glass producers use, and prefer to use, official recycle companies," says Moeyersons.

Where does the industry go next?

For the glass industry to increase the amount of recycled cullet used in flat glass manufacturing, Cazes recommends focusing on pre-consumer and end-of-life cullet. He attributes the European glass industry's recent increase in use of cullet to improvements in collecting pre-consumer cullet "by working with fabricators and processors to make sure all offcuts are separated in separate bins and collected regularly, directly by float glass manufacturers themselves. The truck comes, delivers the glass, goes back with cullet. That's the easiest way," he says.

However, the greatest potential gains can come "by focusing on end-of-life glass," Cazes says. Less than 5 percent of end-of-life glass is recycled in Europe, he says, and only a negligible amount of that recycled cullet is used in flat glass.

The picture is similar in the U.S. market, says Bucey. "Most fabricators are recycling. The area that isn't recycling is window replacement," he says. "I would love to figure out how we get the message out that we can use this glass. Instead of companies paying for landfill, pay for recycling. If you have a high-rise where you're getting ready to rip out old windows, put a roll-off box onsite. Once it's done, we'll pick it up."

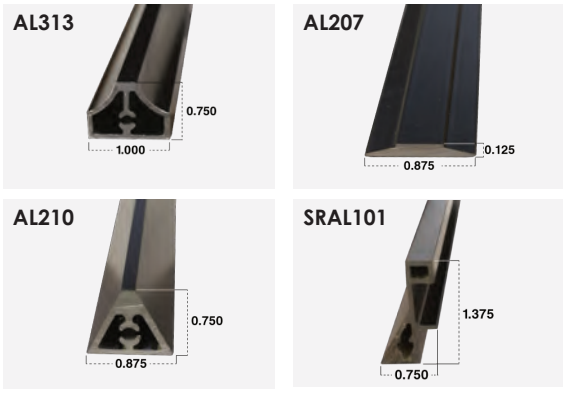
No matter the path, sources are confident that flat glass recycling will continue to grow. "The industry is working hard, because it is considered essential for the future of our industry," says Cazes. "It's our sustainability credential, and it's an essential [part of] de-carbonizing our own manufacturing environment." ■

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Learn more

Scan the QR code to watch a video from NGS to learn how Sun Control and All Season Window Films help improve building efficiency. Visit filmsandgraphics.com, or call 866-470-0585 for more information.

01



02



03



01. Tools
Hypertherm, a U.S.-based manufacturer of industrial cutting systems and software, changed the name for its HyPrecision and Echion waterjet pumps. It is rebranding intensifier-based pumps as DynaMAX to unify the naming of its products. In addition to the new DynaMAX name, systems will now begin with a 3 or 5 depending upon the performance, features or technology of a particular model. This prefix will be followed by the horsepower number and, for pumps engineered with Hypertherm's patented predictive technology, a "P" suffix.
603/643-3441 | HYPERTHERM.COM

02. PPE
Magid unveiled its new line of personal protective equipment specially engineered to serve the unique needs of the glass industry. Offerings include Magid's M-Gard cut-resistant line with AeroDex Technology. Garments with AeroDex technology integrate new fibers and yarn wrapping techniques for lighter-weight PPE that won't trap heat. These cool, comfortable tops, chaps, aprons and neck guards are designed to protect especially vulnerable areas like neck, underarms, upper inside legs and wrists.
800/867-1083 | MAGIDGLOVE.COM

03. Scanner
Faro Technologies Inc. updated its Focus Swift Mobile Scanner that adds improved semi-mobile workflows with color capture capabilities. The Focus Swift enables scanning for large projects and complex areas. With this update the Focus Swift enables users to capture 10- to 20-second colorized anchor scans to provide greater accuracy and detail in important areas. This update integrates the Ricoh Theta Z1 360-degree camera, allowing users to colorize their anchor scans—and with the new color feature, the point cloud detail and visualization are increased.
800/736-0234 | FARO.COM

AIA PRODUCT PREVIEW

The AIA Conference on Architecture 2022 will take place June 21-25 in Chicago. As of press time, over 200 companies are set to exhibit. This section presents a preview of glass industry products on display at the event. Visit glassmagazine.com for additional AIA products.

01





02



03

01. Entrance system
Frameless Hardware Co. will exhibit its Advance Series Herc-Door Frameless Door Rail System, which is designed, engineered and manufactured in the U.S. Advance Series Herc-Door rail and patch fittings provide glaziers and fabricators faster, easier installations with accelerated lead times. Other features include new crisp corner design, and increased glass bite that improves holding strength and aesthetics. Booth #1738.
888/295-4531 | FHC-USA.COM

02. Aluminum Railings
DesignRail aluminum railings combine the durability of aluminum with innovative design details to ensure lasting beauty, structural integrity, affordability and low maintenance, says exhibitor Feeney Inc. Clear or custom tinted tempered glass panels are pre-cut to fit the final opening measurements, and are easily inserted into vinyl lined slots in the top rail and bottom rail. No special mounting hardware is required. Booth # 1862.
800/888-2418 | FEENEYINC.COM

03. Sunshade
Kawneer will exhibit its next-generation sunshade platform, which is now more versatile with the addition of Versoleil Outrigger SunShades. Pre-engineered for multiple curtain wall systems, the versatile system offers dozens of combinations of outriggers, louver blades and fascia caps to provide increased aesthetics, maximum shading and energy-saving potential. Booth #2818.
724/776-7000 | KAWNEER.COM

Bullet-resistant systems
(not pictured)
Action Bullet Resistant will exhibit their bullet-resistant windows and doors, as well as the company's blast-resistant windows and doors, and non-bullet-resistant storefronts and architectural metal systems. Booth #4873.
800/962-8088 | ACTIONBULLET.COM

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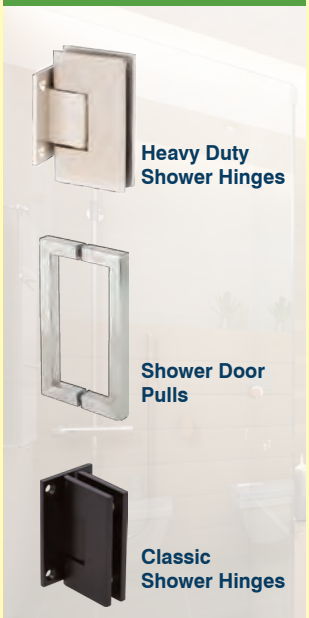
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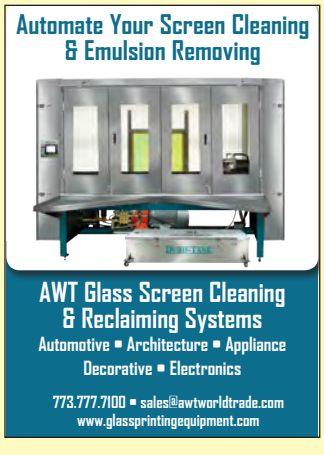
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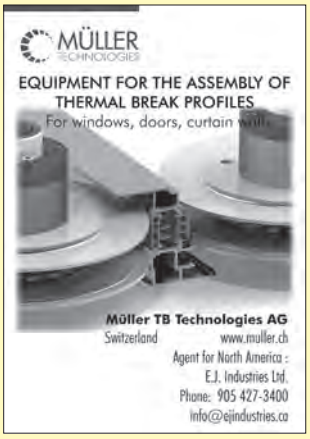
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Industry Spotlight profiles people across the glass and glazing industry, showing off the work of individuals while demonstrating the range of exciting careers in glass. To suggest someone to profile, write to Associate Editor Norah Dick, ndick@glass.org.

WANT WOMEN IN THE WORKPLACE? BE FLEXIBLE.



Attendees at Women in Manufacturing Winter Leadership Conference. Learn more about the organization at womeninmanufacturing.org.

Labor is a perennial issue in the glass industry, further exacerbated recently by supply chain and logistical issues. The need to recruit and retain workers is urgent. One part of the labor pool remains underrepresented: women. No one is perhaps more aware of this than Allison Grealis, president and founder of The Women in Manufacturing Association. The organization works to empower women workers and strengthen the manufacturing sector.

Glass Magazine's Associate Editor, Norah Dick, spoke with Grealis to discuss the unique challenges and opportunities workplaces face after the onset of the pandemic.

Q How have working conditions for women changed during the pandemic?

More women stepped back and left the workforce, making tough decisions about work-life integration. They had to look at affordability as well—even when childcare reopened, women had to make a tough evaluation: "Does my paycheck match with what I'm going to be outputting?"

On the flip side, companies have been forced to get more progressive, pretty quickly. We're seeing more flexible working arrangements, the opportunity for individuals to job-share, and to have more flexible work shifts. Many women are still working remotely in 2022, and so can be connected to home life. The pandemic has caused a lot of positive solutions related to flexibility.

Q What kinds of flexibility can companies offer women and other employees?

Some companies allow people to still be active in the workforce, just not at the pace of full-time. One option is job-sharing, where employees hold the same, or similar, job title responsibility, but one person might work Monday-Wednesday-Friday, and the other person might work Tuesday-Thursday. There's still coverage, and shared responsibilities, but there's two contributors leading to the success of that one position. Job-sharing can look different company to company.

Companies are also offering unique schedules. They have looked at schedules to allow someone to start the workday, for example, after morning drop-off has happened for kids. And then they allow them to end their day before afternoon pickup—it's called the "working mom's" schedule but it's not just for moms; we know there's male parents that want to be involved or need to be involved in the daily routine of their kids.

Q How can companies retain more women employees?

We see companies embarking on "returnship" programs—accelerated programs for people who were previously in the workforce, which quickly teach them skills that allow them to plug immediately into the needs for the company. Moms that took a step back to have children, or individuals that took a step back for lots of different reasons, these accelerated programs have really helped, and they have had good retention rates.

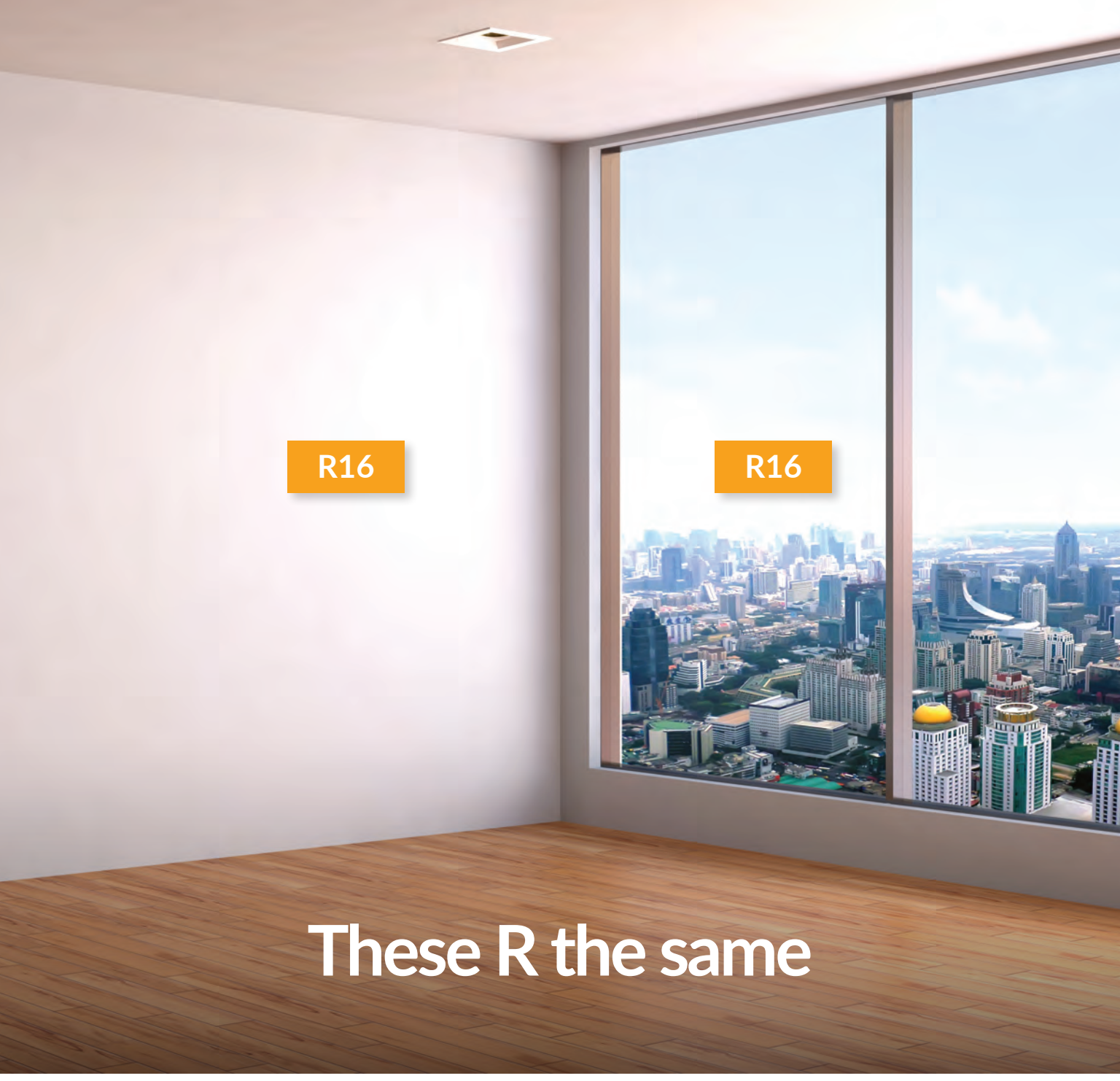
In addition, the research we have conducted shows that mentoring is highly desired and highly effective for retaining women in the industry. Sponsorship of employees is critical—it's important to advocate for that person's advancement and opportunities at your company. ■



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