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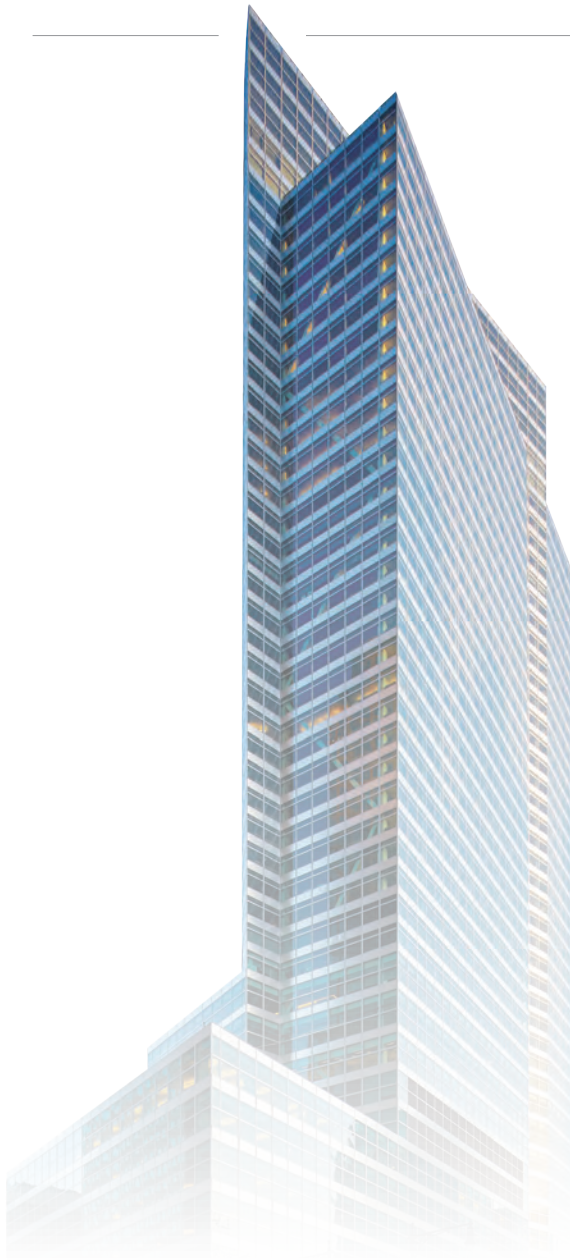
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THE 22ND
CENTURY**

**ENERGY
BACKSTOPS**

APRIL 2020

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HIGH-PERFORMANCE BUILDING IS NO LONGER OPTIONAL. BUILDING CODES REQUIRE IT. OWNERS AND OCCUPANTS INCREASINGLY DEMAND IT. AND OUR GLOBAL SUSTAINABILITY DEPENDS ON IT.

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On the cover: High-performance design is on display at UCLA's Marion Anderson Hall in Westwood, California. The project, designed by Pei Cobb Freed & Partners and associate architect Gensler, features a glass-enclosed atrium flooded with natural daylighting, and a high-performance glazed exterior with low-emissivity glass from Viracon and a thermal curtain wall system from Arcadia. Giroux Glass was the glazing contractor. Photo by Brian Peregrina, Giroux Glass.

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HISTORY

Take a look at glass manufacturing through the years, from batch furnaces to float

CORONAVIRUS

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GLASSBLOG



TECHNOLOGY 10 Questions for Manufacturers Looking to Upgrade

By Chris Kammer, A+W
Software North America



EFFICIENCY What's Your Bottleneck to Success?

By David Vermeulen,
Technical Glass
Products



FORECAST Coronavirus and What Could be Next

By Max Perilstein,
Sole Source
Consultants

PROJECT NEWS



Featured in e-glass weekly. To submit projects, write Wendy Vardaman at wwardaman@glass.org. **Pictured:** Premier Medical Plaza in Little Rock, Arkansas, with Vitro glass and a Diamon-Fusion International protective coating. ACE Glass Manufacturing treated the glass pre-installation.

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Embrace Calls for Performance Solutions



KATY DEVLIN
Editor-In-Chief
kdevlin@glass.org

New requirements for better performing, more sustainable and thermally efficient glass and glazing products represent an important opportunity for the industry, said Apogee CEO Joe Puishys during his keynote address at the 2020 Building Envelope Contractors Conference. The event, organized by the National Glass Association, drew about 680 registered attendees to Nashville March 1-3.

“I want to address what’s going on with the regulatory environment—the trends toward efficiencies,” Puishys said. “I am a fan of regulation for selfish reasons. It is hugely helpful to the quality players in the industry. ... The higher the standards, the better for quality players.”

Increasingly stringent codes allow industry companies to promote and sell better performing products, and they open the door for new technologies that may have previously struggled to gain foothold in the market. “At the end of the day, higher technology products don’t get [value-engineered] out of ultimate building decisions,” Puishys said.

“

INCREASINGLY STRINGENT CODES ALLOW
INDUSTRY COMPANIES TO PROMOTE AND SELL
BETTER PERFORMING PRODUCTS.

”

Additionally, emerging requirements for higher performance of existing buildings will allow industry companies to capitalize on new opportunities in renovation. “Consider the size of the market of existing buildings today. [It] is 100 times the size of [the market] for curtain wall glass and windows [that are installed] each year in new construction. Yet, we are all chasing the new construction world,” he said.

Many industry-leading companies say they are embracing the challenges and opportunities that come with the continued push for performance. A recent survey of National Glass Association technical committee members asked respondents about their companies’ role in bringing the glass and window industry forward to meet the needs of the future buildings that are net zero, intelligent, adaptive and more. Thirty-six percent of respondents report their companies are leading the way, or are in sync with others, in creating this future vision; 44 percent said they are currently behind but recognize the need to catch up.

This issue of Glass Magazine dives into current and future performance demands and solutions, beginning with the in-depth report, Glass & Metals 501: The Architect’s Guide to Glass and Glazing Performance on pages 44-59. The report covers roadblocks to performance and presents important payback considerations, looks at the wide range of high-performance product solutions, and addresses emerging topics such as thermal bridging and energy modeling. In addition to the report, get a closer look at envelope backstop requirements on page 30, and read an architect’s perspective on sustainable façade trends for the 22nd Century on page 20. ■



Project: United States Courthouse in Los Angeles

Architect: SOM Architecture

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NEED-TO-KNOW INFORMATION FROM THE NGA

What Does the New Decade Hold for the Glass and Glazing Industry?

The National Glass Association asked Annual Conference 2020 attendees what we as an industry need to pay attention to in this new decade. Here are some of the insights:

- The industry needs to continue progress on energy-saving advantages of glass, including triple glazing.
- We need to stay vigilant on development of energy efficiency codes, environmental laws and sustainability.
- The glazing industry needs to work to make smart glass and energy-efficient glass more affordable and educate architect and building owners on their benefits.
- We should focus on how to best communicate between the different trades and streamline product selection.
- We must tackle environmental issues such as bird safety and recycling of glass and glazing products.
- We need to ensure window-to-wall ratios are protected and promote the benefits of glass in the building envelope.
- We must advocate for utilizing glass in building facades as well as interiors.

Tell us what you think. Please email us at ngapress@glass.org.

NGA Publishes Flat Glass EPD

The National Glass Association announced the publication of an Environmental Product Declaration for flat glass products sold in the U.S.

The declaration is valid for five years for clear, low-iron and tinted glass products that have been manufactured in an unprocessed annealed state. Glass that has been coated, heat-treated or undergone any secondary processing is not within the scope of this declaration.

The content of the declaration includes:

- Product definition and physical building-related data
- Description of how the product is manufactured
- Details of raw materials and material origin
- Life Cycle Assessment results.

Commissioned by the NGA, the EPD covers flat glass produced by the four member companies of the NGA's Forming Committee. The member companies that participated in the study are AGC Glass North America, Guardian Industries, NSG Pilkington and Vitro Architectural Glass. The flat glass EPD can be downloaded at glass.org.

Association Expands Continuing Education for Architects

The NGA is an American Institute of Architects-accredited provider of Continuing Education System, or CES, credits. For glass companies, the association allows members to give these presentations in person to potential customers, business partners and others. Presentations include:

- Fire-Rated Glazing Today
- Multi-Cavity Insulating Glass Units
- Introduction to Insulating Glass
- Laminated Glass 101
- Heat-Treated Glass 101
- Introduction to Decorative Glazing
- Protective Glazing 101

For architects and industry professionals, the NGA partnered with Architectural Record to develop the Glass & Glazing Design Academy.

NGA's accredited AIA presentations are now available in an on-demand, multimedia format through the Glass & Glazing Design Academy. The online academy helps architects understand the performance, design considerations and benefits of the many glazing and glass building products available today.

Learn more at glass.org under the Resources tab.



GLASS INFORMATIONAL BULLETIN

Function of PIB Primary Sealant in IGU

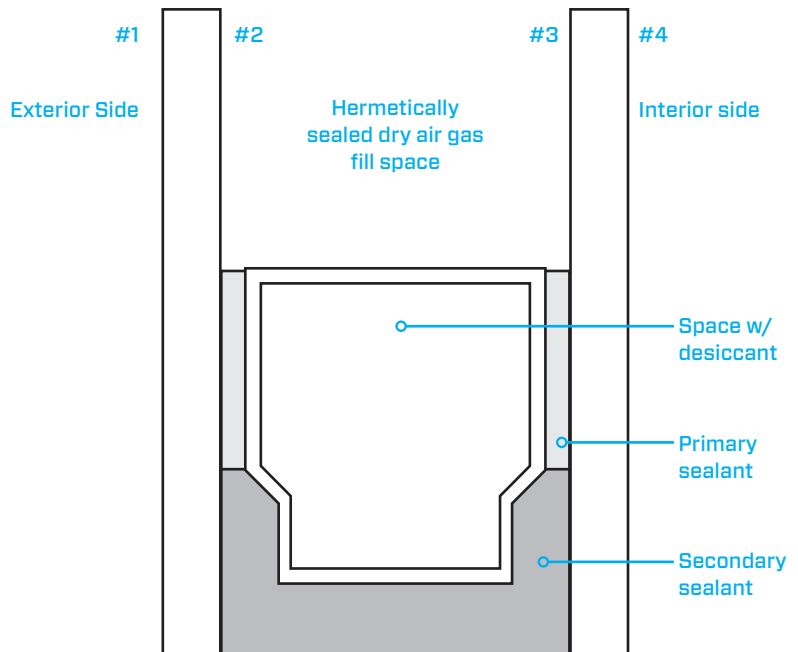
Many insulating glass units produced today use a dual seal system made up of a spacer, a primary sealant and secondary sealant. The most important function of the primary sealant is to maintain gas tightness and minimize moisture ingress into the unit. Polyisobutylene, or PIB, is applied as a seal between the spacer and the glass.

PIB primary seal formulations are permanently thermoplastic and move (stretch and compress) with the pumping action induced by changes in the cavity pressure caused by changes in environmental conditions (temperature, barometric pressure, wind load).

Atmospheric pumping cycles

In the summer, especially in insulating glass units with absorbing coatings or tinted glass, the gas in the cavity can become hotter than when fabricated, thus increasing the pressure within the cavity. The edge seals will expand (glass edges move apart) and the glass will deflect in order to equalize pressure with the exterior. When the cavity cools, the reverse happens. This creates a “pumping” action where the seals are stretching and compressing along with changes in atmospheric conditions.

Polyisobutylene primary sealants are not structural in nature and do not hold the lites of an IG unit together through these atmospheric “pumping cycles.” The IG unit design depends



Typical insulating glass unit.

on the secondary seal for structural performance. The secondary sealant is a structural elastomeric material (such as silicone, polyurethane or polysulfide) and is designed to control the extension of the typical edge seal atmospheric loads on an IGU.

Moisture ingress

The diffusion of moisture or gas through PIB is a function of the cross-sectional area (smaller area = lower diffusion) and path length (contact width on

the spacer) of the sealant (longer the diffusion path = slower diffusion). When stretched, the PIB has higher cross-sectional area and lower path length.

Excessive pressure on the IGU edge through high atmospheric loads or inadequate edge seal design for the application may force the primary sealant into the sight line, and excessive opening of the space between the glass and the spacer can overstretch the primary sealant and disrupt or deform the seal, leading to an increased rate of

GLASS INFORMATIONAL BULLETIN—FUNCTION OF PIB PRIMARY SEALANT IN IGU

moisture ingress and/or gas leakage. While PIB is a good barrier to moisture vapor, edge seal systems with PIB are not impervious to liquid water.

Limitations of the primary sealant

Primary sealants such as polyisobutylene are not structural but do have limited adhesion properties and may act as process aids in the manufacture of IG units to hold the spacer in position, provide shear and tensile strength for unit handling, and to fix the IGU during the cure process of the secondary sealant.

PIB squeeze out (“creep”)

Movement of the PIB past the spacer which results from pressure applied to the edges of the IGU after or during installation is PIB Squeeze Out.

Primary sealant infringement within the as-fabricated insulating glass unit should not exceed $\frac{1}{8}$ inch (3.0 millimeters) anywhere along the sightline except at corners, where the primary sealant squeeze out may exceed $\frac{1}{8}$ inch (3.0 millimeters).

Applied pressure at the edge of the IGU can come from a variety of sources including:

- pressure from a drive-in gasket
- a pressure plate framing system
- daily pumping action of the IG unit with changes in temperature and barometric pressure
- elevation changes.

Applied pressure will result in PIB movement over the life of an IGU. PIB movement can be an aesthetic issue, but no data exists to indicate how this may impact the durability of an IG unit.



PIB migration.

PIB migration

PIB migration is progressive or continuous flow of PIB into the vision area of the glass that results from a change in rheology (decrease in viscosity) of the material after installation.

The change in rheology may be attributed to a variety of causes including:

- solvation or breakdown of the PIB by incompatible glazing components
- degradation of the PIB due to environmental exposure including temperature and UV.

In addition to excessive movement into the vision area, it may also manifest as excessive pooling at the spacer.

Caution should be given to determine if the visible condition of displaced PIB is due to PIB migration or PIB squeeze out. Further analysis may be required to



PIB squeeze out, or “creep.”

determine if there has been a change in rheology of the PIB, which can be determined by removing the IG unit and conducting tests on the PIB.

Performance and quality

Primary sealant formulation ingredients must be carefully chosen and monitored for quality and the manufacturing process must be controlled so that a consistent product is provided to the IGU manufacturer. A reliable primary sealant manufacturer can provide information about their product's performance and reliability for a given application.

This bulletin was developed by the NGA Fabricating Committee in cooperation with FGIA. For additional PIB sealant diagnosis, refer to NGA/IGMA TB-1250-2019 Polyisobutylene (PIB) Primary Sealant available at glass.org/store and at glassdocs.com. ■



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Coronavirus Shakes Construction and Manufacturing Sectors

Even before the coronavirus outbreak began to spread throughout the U.S. last month, the country's manufacturing and construction sectors were already beginning to feel its effects. According to Reuters, U.S. factory manufacturing slowed in February, responding to supply chain disruptions, and early projections for construction in 2020 have been adjusted downward.

Hartung Acquires NWI Seattle Operation; Glasswerks Retains NWI Yuma, Arizona

Hartung Glass Industries acquired



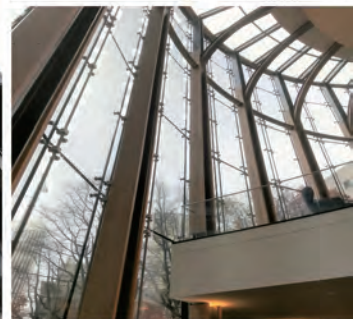
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100 percent of the assets of the Seattle location of Northwestern Industries from South Gate, California-based Glasswerks. Glasswerks announced the acquisition of NWI in early January, and Northwestern Industries Arizona, located in Yuma, Arizona, will remain as a division of Glasswerks.

Under the terms of the agreement, NWI Seattle will continue to operate from its current location and facility for up to another 12 months beyond the previously announced timeline of February 2020.

"While our primary interest in this acquisition was the Yuma, Arizona, operations, we wanted to find a solution that allowed for a seamless transition



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that kept everyone employed, including the Northwestern Industries Seattle facility,” says Randy Steinberg, president, Glasswerks. “We’ve accomplished this through this agreement with Hartung. Hartung is a great industry partner and Northwestern Industries Seattle is in great hands as Glasswerks can now focus attention and resources in growing Northwestern Industries Arizona’s

capabilities and position in Southern California, Arizona, Texas, Utah, Colorado and Nevada markets.”

Southern Wholesale Glass Expands

Southern Wholesale Glass expanded its facilities in Americus, Georgia, to support the growing demand of the company’s products and services throughout the southeastern U.S.

The multimillion-dollar expansion project will include the addition of 20,000 square feet of manufacturing space along with a truck and parts shop. This new space will be equipped with a second tempering line that features a state-of-the-art tempering oven. The fabrication department will grow by adding a third CNC machine and a 14-spindle glass polishing and mitring edger, an automated insulating glass sealer and automated cutting line.

Madico Celebrates Grand Opening of Manufacturing Facility in Florida

Madico, a manufacturer of materials-based solutions, opened a new 25,000-square-foot manufacturing facility in Tampa Bay, Florida.

Madico employs more than 200 people, with 75 new employees hired in 2019 as part of its growth initiatives. In 2017, Madico purchased the manufacturing facility in Pinellas Park, Florida, which is significantly larger than the combined former locations in St. Petersburg, Florida, and Woburn, Massachusetts. Including the acquisition of the building, Madico has invested more than \$40 million into the Florida site, say company officials.

NSG’s Solar Glass Float Furnace in Vietnam Starts Operation

NSG Group launched operations of a float furnace to produce transparent conductive oxide coated glass for solar panels, located at the company’s facility in Ho Chi Minh City, Vietnam. The previously dormant float furnace was upgraded as part of the plan announced in May 2018 to expand production capacity of TCO glass to support the growing solar market.

The restarted float furnace is one of the two lines at NSG Vietnam Glass Industries Ltd. located near Ho Chi Minh City. TCO glass production at VGI has been positioned to support a long-term supply agreement with First Solar, a provider of comprehensive photovoltaic solar systems.

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AGC and Citrine Informatics Collaborate to Develop New Glass Technology Using AI

AGC Glass Europe and Citrine Informatics are collaborating to use artificial intelligence to accelerate the development of next-generation glass. Citrine Informatics is a technology platform that harnesses the power of AI to bring new materials to market faster, and capture materials-enabled product value.

There is currently high global demand for optimizing optical and mechanical properties for strong scratch and abrasion-resistant glass in the automotive and communication industries. The purpose of the collaboration is to look for innovative solutions to meet this ever-higher glass performance demand faster than ever before.

Economics Expert Touches on Trade, Labor, Immigration at FGIA Annual Conference

During the 2020 Fenestration and Glazing Industry Alliance Annual Conference in February, economics expert John Manzella led a roundtable discussion about issues including trade, the Trans-Pacific Partnership, the United States-Mexico-Canada agreement and automation.

Manzella reported that markets outside the U.S. and Canada represent 80 percent of the world's purchasing power and 95 percent of its consumers. Trade supports one in five U.S. jobs and increased household income by more than \$18,000 per 2016 data, he said. "I've always been a big advocate of trade, and the U.S. is one of the biggest beneficiaries of globalization," said Manzella. "Nearly half our exports are sold to our free trade agreement partners but that is only 6 percent of the population. The key is to knock down barriers with other countries and level the playing field."

Tecglass Installs the Largest Digital Printer for Glass in the Middle East

Based on a deal signed with Technical Glass and Aluminium Co. last year, Tecglass's Vitro Jet FS24 digital printer with Side Kinetix technology developed in the company's Lalin plant will be installed in the United Arab Emirates.

Measuring 130 by 472 inches, the Vitro Jet FS24 is designed to optimize printing on super-sized glass. Thanks to the special movement of the print head parallel to the support table, Side Kinetix technology is specifically engineered to always print along the long edge of the glass, making the Tecglass digital printer an effective tool for on-demand client customization of glass 40 feet in length, in the shortest time possible.

**From Jan. 28 to press time March 13. Read these stories, and others, in their entirety at GlassMagazine.com.*

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Behavior health facility in Monterey, California, by NBBJ.

BUILDING FOR THE 22ND CENTURY

Two projects demonstrate the trends that will enable high-performance, sustainable buildings for tomorrow

BY STACEY HOOPER



Lately, I've been thinking about the almost 90-year-old Empire State Building. I've been reflecting on its use of steel prefabrication to optimize schedule; the sheer scale of manpower and strategy required to successfully pull off its 18-month construction schedule with beautiful and crafted results; the resiliency of its construction as it evolves into this next century with a recent innovative deep energy retrofit.

At NBBJ, we are in the midst of designing a 55,000-square-foot behavior health facility in Monterey, California, that shares an architectural ethos with the Empire State Building. Although the project is not a skyscraper, not an office building, nor constructed of steel, it demonstrates, as does the Empire State Building, trends that could carry the construction industry into the 22nd century.

1. Prefabrication driven by performance

The project in Monterey is a prefabricated mass timber structural system, with the added goals of prefabricating the wall

and window systems. Driving the use of prefabrication for the Monterey project are a reduced schedule and quality control. The project also includes considerations for carbon reduction, biophilic connection for supporting the health of building occupants, minimized site disruption, solving for complexity before getting into the field to minimize risk and addressing the concerns over the current shortage of unskilled labor.

The most challenging part of NBBJ's Monterey project has been the exterior wall. The team was tasked with strategizing systems that reinforced the prefabrication strategy, ensured the quality of space and elegance of the timber details, and met longevity goals for high-performance systems. An early placeholder in our budget was a unitized curtain wall. This met the criteria of prefabrication but did not present the integrated alignment with the overall quality of this space or performance criteria desired for the envelope.

I feel increasingly disappointed in the static and resistant nature of the industry to not

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The 90-year-old Empire State Building, which was retrofitted with new glass in 2010.



only embrace increased performance of its glazing systems, but also support flexibility and customization that looks to the future. This is an opportunity to craft these envelope systems utilizing technological advancement.

2. Need for new partnerships

In the spirit of exploring how to best leverage prefabricated strategy throughout the Monterey project, we asked: how can we reduce structural redundancy between systems that have the integrated potential to support one another? How can we be smart about prefabricating our alternative window and solid wall systems with pre-installed weather barriers, insulation and smart gasketed joints to eliminate site sealant between systems, reduce risk and reduce thermal bridging to elevate building performance? It is only through asking these questions, provoked by detailed design sketches, that we found our own atypical

subcontractor partner.

New industry partnerships illustrate the power of shedding industry silos. The stewardship between architects, builders, product manufacturers, higher education, incubators and yet-to-be-determined industries outside of construction will propel our future. In 2010, the Empire State building leveraged the power of creative partnerships. Its hallmark glass retrofit was in part a President Obama-era funded green tech company from Silicon Valley that implemented the glass retrofit.

3. New technologies

We are in an age of revolutionary technology and digital fabrication. This is what drives innovative and imaginative industry partnerships to realize more complex, efficient and high-performance building façades, built faster than ever before.

In the case of the Monterey project, technology-driven manufacturing

enables a unique opportunity in support of the project ideals. But machines and technology are only tools. It's how we think about their application that matters in addressing a project's aspirations, complexity and high performance. This is the intersection that transcends time and continues to be where opportunity aligns with the realization of beautifully integrated, high-performance design.

4. Resiliency and our future

We are often asked to build projects that will last to become 75- to 100-year-old buildings. In Monterey, the importance of quality construction and the ability to easily maintain the building, coupled with conversations about passive survivability in an age of increased rolling blackouts and wildfires play a central role in project design. The Empire State Building tells us that, with retrofitting, well-built buildings can extend their lives well beyond the 100-year benchmark.

Our future is affordable living wall systems that can evolve over time, enabled by the technologies of the near-term future. These systems can actively give back to the environment, participating in our urban ecosystems with positive contribution toward human health, sustainability and beauty.

I remain optimistic that our construction strategies will evolve further in the next 90 years than they have since the Empire State Building was built. I'm inspired by the emergence of these new partnerships. It sets a powerful example of what's possible and has the added benefit of supporting good stewardship in our built environment by breaking down silos and challenging the status quo of the industry. ■

Stacey Hooper is principal at NBBJ in Los Angeles and a board member for the Facade Tectonics Institute, a nonprofit member organization pursuing resilience and sustainability goals in buildings and urban habitat through the pervasive influence of the building skin. She can be reached at shooper@nbbj.com.



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Visit GlassMagazine.com to read *All in the Family: Part 1*, “5 key considerations for family business owners ready to sell to the next generation.”

MANAGEMENT

ALL IN THE FAMILY: PART 2

Sell a company to the next generation

BY MARCO TERRY



Part I of the “All in Family” article series, presented in March, looked at several key considerations for business owners looking to sell to family members. It covered determining company direction, addressing management plans, pricing and more. Once those topics are discussed, an owner must determine the method and financing of the sale.

Stock sale or asset sale

Generally speaking, there are two ways to buy a company. The simplest way is a stock sale. In a stock sale, the owners sell their company stock to the buyers. Once the buyers acquire all the stock, they own the business.

An alternative method is an asset sale. In this scenario, the company sells its assets—tangible and intangible—to the

buyers. The buyers often assume all the debt as well. However, the new entity does not inherit any potential and unknown future liabilities.

Both options have legal and tax ramifications. However, I have always preferred asset sales. In an asset sale, unknown liabilities—for example, potential future lawsuits—stay with the old corporate shell. Thus, the new generation starts with a clean slate.

This decision is complex. An owner should be sure to get proper legal and tax advice. Depending on their situation, this decision could affect the new generation’s chances of getting financing.

Get the financial house in order

Before looking for financing, an owner must get their company’s financial affairs in order. An owner should ensure their

The text "Pilkington Spacia™" in a white, sans-serif font, positioned within a blue, rounded rectangular background element that is part of a larger graphic element in the middle of the page.

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accounting books are correct, keep an eye on receivables and track payables carefully, and make sure all taxes are up to date—especially payroll taxes.

Owners should advise the incoming generation to do the same with their personal finances and taxes.

Financing the transaction

If an owner has followed the previously outlined steps, the financing part of the transaction should be relatively straightforward. Most acquisitions have three financing components:

1. Seller financing

Sellers often issue a loan to buyers to help them buy the business. Technically, this type of financing can cover 100 percent of the cost of buying the business. However, it typically covers 20 percent to 40 percent of the cost. The remainder is usually covered through a combination of external financing and

buyer's equity.

Sellers can create any type of loan, as long as it is legal. However, an owner can also use seller financing as a tool to help the next generation. The owner can offer a preferential rate, extended terms and other accommodations.

2. Term loan

The second component of most transactions is a term loan. Transactions of less than \$5 million use Small Business Administration-guaranteed loans. Transactions for more than \$5 million need to use conventional banks or specialty lenders.

SBA-backed loans provide very attractive rates to small business owners. These loans have the same underwriting and qualification requirements as normal bank loans. However, the SBA guarantee ensures they are available to small business owners. Note that SBA loans require the buyers make an equity investment.

3. Equity

As part of most transactions, buyers invest their funds as equity. Transactions that have an external lender usually have an equity requirement. SBA-backed loans require that buyers invest 10 percent of the transaction value using their own funds. That amount can be lowered to 5 percent if the buyers can get seller financing and if the seller is willing to take a standstill on the seller financing note.

Business sales and transfers are complex transactions. Owners should engage the services of competent legal, tax and financial experts before proceeding. ■

Marco Terry is managing director of Commercial Capital LLC, comcapfactoring.com, a factoring company and provider of invoice financing to companies in the glass industry. He can be reached at 877/300-3258.

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Playful Balance

The architects selected a combination of PAC-CLAD Reveal panels and HWP panels to add visual interest to the façade. "The intent was to find a balance between the texture and proportion of the two profiles, using the tighter, undulating panel as an accent."

-Eric Requist, Senior Project Architect, Ellis Architects

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ENVELOPE BACKSTOPS IN THE ENERGY CODES

BY TOM CULP



THE BOTTOM LINE

A new type of requirement is coming in the latest energy codes that places limits on what can be “traded off” to meet performance requirements. Calls for envelope backstops will require a minimum level of envelope performance no matter what else is done in the building. The implications—both positive and negative—are significant for the glass and glazing industry.

Source: The National Glass Association's Technical and Advocacy Team

All energy codes provide at least two different compliance paths: prescriptive and performance. For fenestration, prescriptive compliance simply means satisfying the required U-factor and SHGC, as well as staying under an overall cap on window-to-wall ratio (generally 40 percent). This is simple but lacks flexibility. To use higher window area or different designs, the performance path must be used to show that the proposed building meets the same overall energy performance while allowing flexibility between individual components (better performance in one item can offset worse performance in another). In general, the

full performance path allows everything to be “traded off”—windows, walls, roofs, lighting, HVAC, hot water—as long as the building shows the same overall energy performance.

However, a new type of requirement is coming in the latest energy codes that places limits on what can be traded off: envelope backstops, which require a minimum level of envelope performance no matter what else is done in the building. These backstops will limit how much high-efficiency HVAC, lighting and other systems can be used as a trade-off against envelope components, including window area. The implications—both positive and negative—are significant for the glass and glazing industry.

The good and bad

Proponents of envelope backstops point out that they limit value engineering and trading off performance in longer-life elements such as windows and walls for shorter-life elements such as lighting and HVAC systems. Simply put, envelope backstops will help prevent building owners from value engineering out features such as low-emissivity glass, thermally broken frames, gas fill, better spacers, dynamic glazing and sunshades. Not only does this help the glass and glazing industry to continue to sell the highest-performance value-added products, but it also offers benefits in terms of highest levels of thermal comfort and condensation resistance.

Conversely, opponents of backstops point out that backstops go against the philosophy of performance-based standards and integrated design—that what matters is the overall building performance, not how the project team gets there. For the glass and glazing industry, there is a potential negative impact on window area for highly glazed buildings, even if they demonstrate superior energy performance. This can cause severe unintended consequences with reduced views and daylighting, leading to worse health outcomes, productivity, and value for building occupants and owners. In the end, designers need



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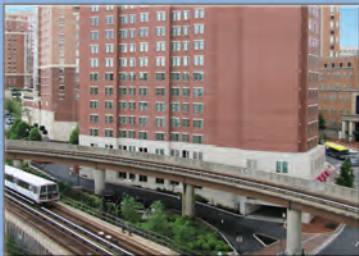
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How backstops work

The specific way envelope backstops work is that, first, the designer must show compliance of the overall building energy performance including everything—envelope, HVAC, lighting, hot water. Second, the designer must show that the proposed envelope performance is no more than a certain percentage worse than a prescriptive envelope. The simplest way to comply is to use window systems that meet the prescriptive U-value and SHGC. But, that doesn't work if the building needs to use more than 40 percent glass, as anything above that must be made up for in performance path trade-offs.

Code requirements

ASHRAE 90.1 will not have an envelope backstop in the 2019 version, but has finalized an addendum that will be published shortly. Industry code representatives negotiated with the committee for a version that preserves the envelope against value-engineering, while also allowing glazed façades necessary for high-performance buildings to maximize occupant health and well-being.

The proposed envelope performance factor, calculated by the Department of Energy's COMcheck compliance software, may not exceed the baseline envelope by more than 15 percent in multifamily, hotel/motel, and dorms and 7 percent in all other building types—and remember, the overall building must also meet the overall energy performance requirement. COMcheck includes not only the opaque wall and fenestration U-factor, but also includes the impact from orientation, shading, daylighting, dynamic glazing and thermal mass to encourage the correct overall design. In terms of glazing area, the limits were established by modeling to allow approximately 70 percent WWR (window-to-wall ratio, including vision area but not spandrel area) with prescriptively compliant windows, and

perhaps up to 90 percent WWR with good orientation, shading and higher-performance windows.

Although adoption of this is still several years out for most states, New York City just started using this backstop based upon the COMcheck envelope performance factor. Unfortunately, some early adopter states jumped the gun, and use a less flexible method. Washington state has a backstop that allows 20 percent leeway in the overall area-weighted average U-factor of the entire façade, known as UA, compared to the baseline requirement using either 30 percent WWR without daylighting or 40 percent WWR with daylighting. This is overly simplistic with no credit for proper orientation, shading or dynamic glazing, but still allows up to approximately 50 to 70 percent WWR with better windows and overall envelope.

Regrettably, Massachusetts just implemented an even more rigid backstop with zero percent leeway on the UA value. In addition to ignoring orientation and shading, this only allows up to 40 to 55 percent WWR, even with better windows and overall envelope. This number does not count spandrel area so it offers more glazed area than it seems, but spandrel also has a difficult time meeting the same requirements as opaque wall. Curtain wall is still a viable option, but the highest-performance glazing and framing are an absolute requirement. Massachusetts is considering further updates for next year, so there is the possibility to correct the technical shortcomings.

In summary, with envelope backstops, the days of just throwing in high-efficiency HVAC and LED lighting to allow 90 percent WWR with standard double glazed low-E products are coming to an end. On the other hand, the solution is relatively simple—with or without backstops, the industry must continue to promote high-performance glazing and framing as the solution. ■

Tom Culp is owner of Birch Point Consulting LLC and code consultant for the National Glass Association.

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MOCK-UP TESTING

Uncover wall system performance issues before it's too late

BY STEVEN SAFFELL



AAMA 501.5, Test Method for Thermal Cycling of Exterior Walls, on a two-story mock-up. Photo courtesy of Architectural Testing.



THE BOTTOM LINE

Verify the performance of the design and the installation method of fenestration systems before costly and time-consuming problems surface. Tests conducted on mockups of representative sections are often the best approach to validating finished performance.

When a large commercial fenestration system is installed, modifications to correct any deficiencies in design, manufacturing or installation procedures discovered after the fact can be inconvenient and costly. Performance and testing requirements are therefore one of the most important parts of commercial building envelope or curtain wall specifications.

Most standard types of wall systems have been tested and often third-party certified, and have a history of satisfactory performance, making further testing for a specific job unnecessary. However, custom designs are a different matter. For unproven wall designs with new and previously untried features, tests may be not only warranted but highly advisable as the only means of verifying performance.

In particular, the performance characteristics of greatest concern are structural performance under wind loading and the ability of the wall to prevent water penetration during heavy rainstorms.

The best option in mock-up testing

There are three possible ways to test:

in the laboratory, onsite during or immediately after actual construction, or on a special mock-up before construction begins.

Of these, a preconstruction mock-up test scheduled well in advance of the final system manufacture should identify any design and fabrication deficiencies. It should also identify any problems related to integration with the wall or the joints between multiple units or sections and non-conforming installation procedures. Thermal cycling and condensation evaluations as well as testing for wind-induced and seismic building movement may also be performed on the same mock-up. This provides relatively inexpensive insurance that the exterior wall will perform as intended.

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Preparing a mock-up

It is essential that the wall test mock-up be a faithful, full-size representation of the job-specific design, using the same methods of anchorage, the same type of glass and the same sealants, gaskets, perimeter caulking, splices and frame intersections. As far as practicable, the building frame which supports the wall should also be simulated. The identical anchorage system—the steel angles, clips, shims, brackets, bolts and welds—should be employed.

The area of wall represented by the mock-up should include the most critical and vulnerable conditions. The normal choice of areas to be represented encompasses two floors and extends two “bays” wide. A better choice would include a corner construction near the bottom of the building. The best, but also the most complex and expensive, would be representative corner construction from the top of the building, which is subject to the greatest pressures. Note that a single story only one bay wide is an inadequate sample.

Testing standards and accreditation

To aid in curtain wall design and specification, AAMA CWM-19, Curtain Wall Manual, an FGIA standard, addresses many aspects of curtain wall design, specification, testing and installation, allowing architects and specifiers to customize project-specific performance and testing requirements. AAMA CWM recommends following ASTM E2099-14(e1), Standard Practice for the Specification and Evaluation of Pre-Construction Laboratory Mockups of Exterior Wall Systems, which addresses mock-up design and construction and references performance tests in separate ASTM, FGIA or other industry publications.

AAMA 501-15, Methods of Tests for Exterior Walls, another FGIA standard, is a good general reference that provides an overview of mock-up and/or field testing. It provides a comprehensive guide specification to cover all such testing protocols and options—the most well-known of which are diagnostic methods for finding leaking in fully installed glazing.

Note that AAMA test protocols all require implementation by an AAMA-accredited Field Testing Agency to ensure the use of well-maintained and calibrated equipment by qualified and trained personnel using established procedures under a documented QC system, as described in ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories. Requirements of the program are detailed in the Procedural Guide, AAMA LAP-3, Laboratory Accreditation Program Operations Manual - Laboratories and Test Agencies Performing Onsite Testing of Fenestration Products.

Steven Saffell is technical director of the Fenestration and Glazing Industry Alliance. He can be reached at ssaffell@fgiaonline.org.



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FINISHING TRENDS TO WATCH

From blue-green hues to tactile textures, check out what's driving advancement in finishing for architectural aluminum products

BY TAMMY SCHROEDER



01

Blues and greens

Predicting which colors people will want to see is a valued business. Blue and green hues dominate 2020's color of the year selections: PPG's "Chinese Porcelain"; Sherwin-Williams' "Naval"; AkzoNobel's "Tranquil Dawn," a "soft, near-gray shade with just a hint of green"; and The Color Marketing Group's "Electrum," a "green-influenced gold metallic."

Already predicting 2021, The Color Marketing Group has declared a pale-blue "Mist" as the North American market's key color. And, unrestricted to just one annual

color, Valspar shared a dozen nature-inspired color options ranging from "Utterly Blue" to "Secluded Garden."

02

Biophilic beauty

Design trends also show a more intentional shift to deepen the connection between people and their built environment with the natural environment. Following these biophilic principles, wood, terra cotta and marble patterned finishes can be applied to architectural aluminum products to mimic the beauty and warmth of the genuine material without the actual maintenance.

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Metal systems finished with Linetec's Bordeaux Anodize. Photo courtesy of Metal Design Systems.

For example, replicating a global forest of wood species choices, finishing providers can apply fresh-cut, aged or distressed wood looks. And while terra cotta, marble and natural stone masonry may be out of reach for many building designs, some finishing providers can now convey the elegance of these luxurious materials and achieve a similar appearance on aluminum wall panels and trim.

03

Tactile textures

Finishes also can enhance the biophilic and sensory experience with textured

coatings. Terra cotta painted colors gain authenticity with a gritty, stone-like feel. Wood grain finishes find added depth and simulated grain without fear of splintering.

04

Sparkle and shine

Drawing inspiration from a sunlit creek or a clear night sky, mica and metallic coatings bring sparkle, shimmer and shine to almost any color. A dynamic finish choice, the reflective quality of these specialty coatings appears to change throughout the day and the seasons. This vibrant, dimensional

attribute can be added to whites, neutrals and pastels, as well as to black, bright and jewel colors.

05

Rich and resilient

Rich tawny tones are recommended complements to the trending greens and blues. When true copper is impractical, Copper Anodize finish on aluminum can present an economical, close impression. Unlike real copper, the anodize will not patina, retaining its elemental metallic look.

The strength of anodize is its high-performance durability. Until recently, its weakness has been the very limited color range. Bordeaux Anodize now adds a rich, burgundy color to the palette. Like Copper Anodize, Bordeaux Anodize provides the versatility to meet either a contemporary or historic aesthetic, while delivering industry-leading performance.

06

Custom creations

When one of the 50,000 colors available still does not quite match, finishers with an in-house blending laboratory can scan samples to match anything from a piece of metal to a swatch of fabric, and then formulate the recipe to apply it.

Choosing the right color is largely an aesthetic, and often subjective, decision. Specifying, producing and applying a finish to match the chosen color combines performance-driven, technical expertise as well as artistically minded creativity.

Tammy Schroeder, LEED Green Associate, serves as marketing manager at architectural metals finishing company Linetec. She can be reached at tammy.schroeder@linetec.com or 800/236-2589.



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TIME TO ADOPT NEW TECHNOLOGY

BY JOE ERB



A variety of new technologies have proliferated in the broader building and construction space in recent years. Commercial glass and glazing professionals must be continuously adapting, utilizing these technologies to meet evolving demands. Depending on a company's role in the industry, doing so might require reengineering glass packages, swapping in new higher-performance component parts, or learning new glazing and installation techniques.

All of that might sound disruptive or even risky. But “business as usual” doesn’t cut it these days.

There are a few reasons why commercial glass and glazing professionals should be actively investigating new technology to drive their businesses forward:

1. Codes keep changing

National Glass Association Code

Emerging technologies such as automated equipment can make for greater manufacturing efficiencies and long-term cost savings, among other benefits.

Consultant Tom Culp wrote a great piece earlier in the year outlining challenges and opportunities for commercial glass professionals when it comes to the battle for the wall. As of this writing, we’re winning that battle—and it’s because our industry has worked successfully with code committees to develop attainable performance goals in large-format glazing and curtain wall applications.

But codes don’t get less stringent, only more so. The next generation of high-performance glass and glazing will require the continued adoption of low-emissivity coatings, warm-edge spacers and other technology that help deliver outstanding thermal performance required to meet codes. If companies haven’t already, it’s time to fully embrace



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these technologies and their impact on performance.

2. The labor shortage continues

Technology can help companies manage the ongoing labor shortage for companies in all segments. On the plant floor, high-speed automation can save labor in the manufacturing process. Commercial builders and glaziers looking to alleviate labor concerns on the jobsite should be

investigating how new tech can help, too. Some experts expect that robotics, laser scanning, 3D printing and more will be common in commercial construction within the next decade. For glaziers wanting to stay at the cutting edge, it's never too early to investigate how these types of solutions can help.

3. Attitudes are evolving

The adoption of new technology

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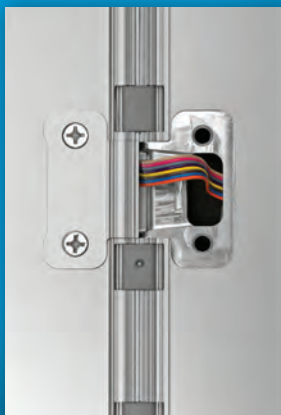
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“

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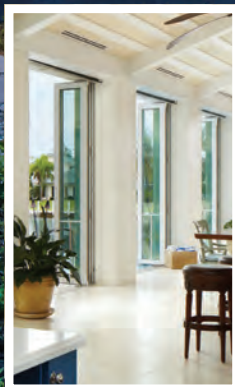
requires organizations to be open-minded. Recently, attitudes have been changing toward new innovations in the commercial space.

For example, some commercial builders are exploring alternative materials for structural framing. Cross-laminated timber is one of those emerging materials, which has a smaller environmental impact than steel or concrete and can provide some thermal efficiency benefits. Elsewhere, there's been good opportunity for vinyl and composites in punched opening commercial window applications. It wasn't long ago that vinyl would have been unthinkable here, but the material has proven itself in terms of structural performance. The industry will see more open-mindedness across the entirety of the commercial construction space as buildings of the future seek to become more efficient in every aspect. ■

Joe Erb is the commercial sales specialist for Quanex Building Products, quanex.com. He can be reached at joe.erb@quanex.com.

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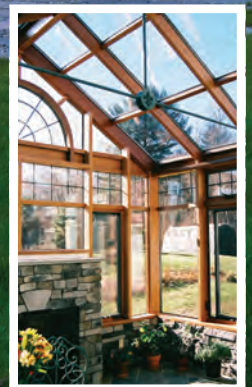
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CLEAR PERFORMANCE SOLUTIONS





THE ARCHITECT'S GUIDE TO GLASS AND GLAZING PERFORMANCE **BY KATY DEVLIN**

High-performance building is no longer optional. Building codes require it. Owners and occupants increasingly demand it. And our global sustainability depends on it, say industry sources. “Anyone who can see the data on climate can see that something has to change when it comes to carbon emissions. We need to do it quickly,” says Josh Wignall, director of marketing, EFCO Corp.

The glass and glazing industry is ready to help architects bring their projects—new and old—to the next level of building performance. “[Our industry] has the technology. We just have to make sure we prioritize it,” Wignall says.

To achieve high-performance targets, jurisdictions must adopt and enforce the newest, more stringent energy codes, project teams must work more collaboratively to design and construct buildings that meet performance goals, and team leaders and building owners must prioritize performance and be willing to invest in available solutions, sources say. “There are systems on the market that can meet the most stringent energy requirements. They are just not being used,” adds Helen Sanders, strategic business development, Technoform.

The following pages present “Glass & Metals 501: The Architect’s Guide to Glass and Glazing Performance.” The guide takes a closer look at baseline energy code updates and provides information about glass and glazing products to meet new requirements. It presents key considerations for glass and glazing performance from industry experts, and examines the cost-benefit analysis of building for performance.

Glass & Metals 501 is part of Glass Magazine’s six-part series “All About Glass and Metal: A Guide to Glazing for Architects and Specifiers.” The complete series provides an in-depth look at specification and design for glass and glazing. It begins with “Glass and Metals: 101: An Introductory Guide to Glazing for Architects and Specifiers” and continues through “Glass & Metals 601: The Architect’s Guide to Complex Façades.” It covers topics ranging from specifications to interior glass, to protective glazing and more. To access the complete series, visit glass.org/store.

JW MARRIOTT, NASHVILLE

PHOTO BY CHAD BAUMER, COURTESY OF TECHNOFORM.

HIGH-PERFORMANCE SOLUTIONS:

Nashville’s new standout 33-story JW Marriott tower touts a curving façade that combines high-performance glass with thermally broken framing. It features YKK AP’s YWW 50T Window Wall MegaTherm

aluminum framing system with Technoform polyamide thermal barriers, and insulating glass from Viracon: VRE1-38 with 44 percent reflectance for the tower, and VE1-2M with 70 percent VLT and 11 percent reflectance for the podium.

THE PLAYERS: Architects, Smallwood, Reynolds, Stewart, Stewart & Associates (Smallwood) and Arquitectonica; general contractor, Skanska USA; glazing contractor, Custom Enclosure Solutions (CES); curtain wall supplier, YKK AP; thermal barrier supplier, Technoform; glass fabricator, Viracon.



01

PERFORMANCE & PAYBACK



If glass and glazing solutions are readily available, why aren't they being used to their fullest potential on every project? Glass and glazing industry experts point to a range of hurdles that stand in the way of performance, including cost, and outline the opportunities for payback in terms of people, energy costs and more.

AFFORDABILITY & EFFICIENCY

Cost often stands in the way of performance.

Perhaps the biggest roadblock to high-performance building design and construction is cost, say industry officials. “The biggest hurdle for our industry—for our nation as a whole—to driving performance to the next level is commitment,” says EFCO’s Wignall. “We must commit to achieving certain levels of thermal performance. We need to overcome the cost-benefit paradigm. We have the technology that can get us to net zero, but are people willing to pay?”

High-performance glass and glazing products are often taken out of projects due to higher upfront costs, sources say. “Specs often start off with high-performance systems. Design teams are interested in thermally broken systems, but because of cost they are value engineered out,” says John Cox, project executive, Giroux Glass.

Reduce costs with more standard high-performance solutions.

Glass and glazing companies have developed a range of high-performance solutions that are achievable and affordable. “With a standard thermally broken window and curtain wall systems, you can achieve good edge-of-glass [performance] using standard low-E. You can do it. You just need to know what is available,” says Technoform’s Sanders.

To keep costs down, Viracon Technical Resources Manager Alissa Schmidt recommends that architects “stay within the realm of typical 1-inch insulating glass systems and stay

within an average module size. Not varying systems, not going with unique shapes, can help with pricing,” she says. For glass coatings, she recommends designers work with suppliers to find the most affordable low-emissivity glass for the project. “Tinted substrates are also an option. There is minimal cost to go with basic tint,” she says.

Performance pays back.

High-performance façades can translate to lower heating, cooling and lighting costs, while offering improvements for occupants. This is true on new construction and, in particular, on retrofits. “It’s not a huge investment to update the envelope. The paybacks can be major. You can improve occupancy comfort, save on your energy bill, reduce the loads on the air conditioning or heating. This can save a lot of money, and you’ll see increases in lease rates and property values,” Wignall says.

PERFORMANCE FOR PEOPLE

Glazed high-performance façades make for productive, healthy occupants.

Building occupants are healthier and perform better when they are granted access to views and are comfortable in terms of daylighting levels and temperature. Studies on occupant comfort show increased healing times for patients, improved test scores among students, and decreased absenteeism and increased productivity among office workers. “We can’t underestimate the importance of daylighting and its ability to improve health and happiness within

the workplace,” Wignall says. “People can’t sit in a brick box with no light.”

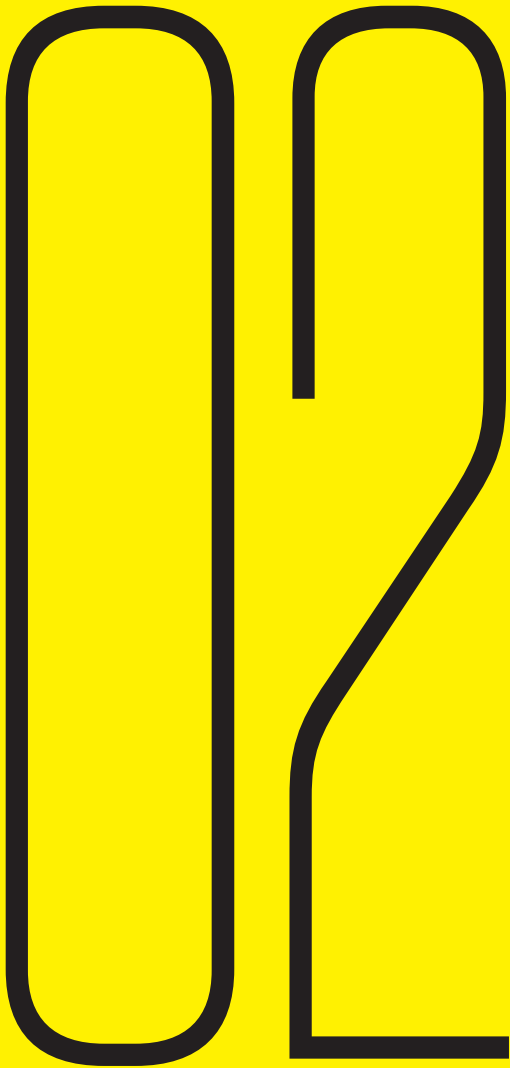
Occupant costs dwarf operational costs.

Because people in healthier buildings miss fewer days of work, perform tasks more efficiently and stay in their jobs longer, owners and employers can see notable paybacks. Employers see productivity improvements and building owners can charge higher lease rates.

Too often, building managers and owners don’t factor people into the building performance equation. However, it’s the people who represent the costliest aspect of running a building, says Stephen Selkowitz, former senior advisor for building science, and former group leader of the Windows and Envelope Materials Group in the Building Technology and Urban Systems Division of Lawrence Berkeley Lab. He estimates that occupancy costs reach about 100 times the cost of energy.

People need daylight—just not too much.

Although building occupants need access to daylighting and views, too much daylight leads to glare and heat gain, which negates the potential occupant comfort benefits. “One of the biggest misconceptions I see is the automatic, if not subconscious, assumption that all-glass façades lead to better daylight and views,” says Galen Burrell, director of lighting design at View Inc. “However, the reality is that there can be too much of a good thing, and so we should focus on optimizing daylight rather than maximizing it. Unchecked sunlight can create various comfort issues associated with excessive glare and heat. As a result, blinds get closed and generally remain closed, and the entire value proposition of daylight and views get lost.”



GLASS & GLAZING PERFORMANCE



Misconceptions about glass and glazing performance, lack of high-quality modeling and a siloed approach to design and construction all impede performance goals. To meet and exceed expectations, industry experts recommend project teams clearly understand the various performance values of glass, consider the relationship between the glazing and the rest of the façade, ensure correct modeling from the start, and more.

EFFICIENT GLASS AND GLAZING

Performance values must include the glass and the framing.

The biggest misconception in glazing system performance is that it's all about the glass. Performance values for the glass must be considered in concert with values for the framing system to develop whole-system performance values.

"To many, glass seems to be the most obvious factor in performance, but the opposite is true," says Anthony Intintoli, architectural sales representatives for YKK AP. "You have to find the right glazing system and framing system to achieve the desired high performance."

Look beyond center-of-glass U-factor.

Center-of-glass (COG) thermal performance values, U-factors, can't be used alone to determine the performance of a complete glazing system. "The COG U-factor makes up only part of a window's performance," says Technoform's Sanders. "It is necessary to look more broadly at the window system, including the edges: the frame and edge of glass. ... You can have a great center of glass value, but if you don't match that with thermal performance in the framing, you're going to have performance issues, condensation issues."

Storefronts and curtain walls perform differently.

Framing systems are designed to meet different structural, water and air performance requirements depending on their application. These differences translate to varying high-performance

methods and thermal performance targets. For example, curtain wall systems can be made wider, thus allowing for improved thermal elements such as multi-cavity insulating glass units, or larger and more complex thermal breaks. "With a storefront, you're typically not going to achieve the performance as you would with a curtain wall," says EFCO's Wignall. "You usually see pour and debridge thermal breaks in storefront; you will typically have fewer opportunities for glass in terms of thickness."

Performance and aesthetics can be at odds.

At times, performance and aesthetic goals are at odds on projects. In recent years, this has been the case with trends toward ultra-clear, less reflective glasses that can create challenges with solar heat gain and glare. "This is a big hurdle when it comes to glass performance," says Viracon's Schmidt. "It's important to work with glass suppliers to find a compromise. How much are you willing to sacrifice in terms of appearance to achieve performance goals? We can come up with solutions for a building that meets renderings but still performs."

BEYOND THE GLAZING

Connection points matter.

A project can feature the highest performing glazing system options, but if thermal performance doesn't carry over

to the connection points, the façade won't meet its goals. "We see big issues around the interfaces," says Sanders. "This is where the thermal bridging happens."

To tackle the problem, Sanders recommends project teams model the interfaces. "The models have to be well detailed. They need to say who is responsible for doing what. And, we have to measure the performance—take infrared pictures of the buildings," she says.

Glass and glazing performance can't be siloed.

Next-level façade and building performance comes when glazing systems are integrated into the full building. "Every building, every façade is going to be different," says Tom Culp, code consultant for the National Glass Association and owner of Birch Point Consulting. "You have to look at everything together—the glazing with the shading. Are you going to incorporate sunshades? Automated blinds? Are you going to do things with a double wall? Are you going to tie in daylighting controls? We have to think more broadly, beyond just two panes of glass."

Automation and smart building management make a difference.

Occupants often stand in the way of performance goals. "On day one, building performance might be perfect. But that can change quickly if people in the building don't understand how it should be used—if they are not operating windows, shading, at the right times," says Selkowitz. Automated systems that control shading, lighting, HVAC and more ensure the building performs as it should. However, facility managers, as well as occupants, should be educated on why the automated systems are working as they are, Selkowitz says. ➡

MODELING AND TESTING

Thermal modeling is complex work. Glazing system manufacturers can help.

When calculating system performance values, seek assistance of suppliers. “Many manufacturers offer advanced thermal analysis to help demonstrate the performance of framing systems,” says YKK AP’s Intintoli.

When completing performance calculations, it is essential to make calculations based on the specific products chosen for the system. Not all systems, despite the similarities, perform alike. “You need to be careful that you’re doing good modeling, and that the actual modeling is featuring the products you’re using,” says Selkowitz.

Modeling software has its limits.

For most projects and glazing systems, computer modeling can provide a good general picture of glazing system performance. “If you’re using off-the-shelf products—fixed external shading, or simple motorized shading—a good model run by a competent engineer should be able to do that. But, as you get into switchable glass, light shelves and other more complex systems, there is more risk involved,” Selkowitz says.

Complex systems call for performance mockups and testing.

Performance modeling can only take a project team so far. For complex projects, Selkowitz recommends teams look to performance mockups that study energy and thermal performance, daylighting and occupant comfort. Doing so can identify potential problems before it’s too late, he says.





ORANGE COUNTY GOVERNMENT CENTER, GOSHEN, NEW YORK

HIGH-PERFORMANCE

SOLUTIONS: Built in 1967 and severely damaged by Hurricane Irene in 2011, the Orange County Government Center needed a complete revitalization. In a \$74 million upgrade, the project team renovated two-thirds of the existing structure, vastly improving thermal performance of the envelope, while adding 80,000 square feet of new construction. EFCO curtain wall and

storefront were selected for the renovated sections as well as the new addition. The project features EFCO Series 5600 curtain wall, 433 storefront and D502 Thermastile entrance doors.

THE PLAYERS: Architect, Clark Patterson Lee (CPL); general contractor, Holt Construction Corp.; glazing contractor, Forno Enterprises Inc.; glazing systems supplier, EFCO Corp.



CODES & STANDARDS



New updates to the energy codes continue to push for higher performing products. Increasingly, projects will need to feature glass and glazing with next-level performance attributes, such as improved framing, warm-edge spacers, argon gas fill and fourth surface low-emissivity coatings. The new code also includes stronger daylighting requirements, including demand for more controls and toplighting.

TRANSLATING CODE REQUIREMENTS TO GLAZING SYSTEM SOLUTIONS

Each new edition of the baseline energy codes brings increasingly stringent requirements for windows, particularly in terms of thermal performance. In the previous 15 years alone, ASHRAE 90.1 U-factors for windows reduced between 20 and 60 percent, depending on the climate zone.

The newest version of the baseline energy code, ASHRAE 90.1-2019, was approved in October 2019, and it continues its trend toward increased energy performance in glass and glazing systems. Among the updates include another 5 to 17 percent reduction in U-factor. In many cases, this creates roughly a “zone shift” between the 2016 and 2019 versions—what was required in Zone 7 will move to Zone 6, Zone 6 to Zone 5, etc. “This will give the industry more confidence about the practicality of the requirements. If you currently already have the product for one zone, it will not be a difficult push to provide that product in the next zone,” says Tom Culp, code consultant for the National Glass Association and owner of Birch Point Consulting.

In general, the new code marks a push for improved framing, warm-edge spacers, argon gas fill and fourth surface low-emissivity coatings. The new code also includes stronger daylighting requirements, including demand for more controls and toplighting.

Looking ahead, Culp points to several code trends to watch: envelope backstops, thermal bridging requirements and verified performance.

Envelope backstops require a minimum level of envelope performance, no matter what else is done in the building.

“The backstops would limit how much high-efficiency HVAC, lighting and hot water systems can be used as a trade-off against envelope components, including window area,” says Culp. “These new backstops will not be in ASHRAE 90.1-2019 or 2021 IECC, but are being enacted in New York City, Massachusetts and Washington state.”

Also on the horizon are thermal bridging requirements. Thermal bridging refers to the more thermally conductive—or thermally inefficient—sections or components of a system or wall. Identifying and addressing the thermal bridges on a system will improve whole-system performance. “In the New York City energy code, architects are going to have to make drawings that show all the thermal bridges with details that quantify transmission,” says Dan Piselli, director of sustainability at FXCollaborative. “At first, there will be no requirement, just documentation. ... In the next code cycle, they’re going to have performance requirements.”

Calls for verified performance will require project teams to prove their building lives up to energy and thermal performance targets after occupancy. A big driver of this is outcome-based codes. However, some developers and building owners are also adding contract clauses to withhold a portion of the payment until verified performance goals have been met. “We have started to see performance-based contracts. A team gets a base fee, and then gets more or less than that based on building performance,” says LBL’s Selkowitz.

HOW DO INDUSTRY COMPANIES HELP ARCHITECTS REACH PERFORMANCE TARGETS?

—YKK AP ARCHITECTURAL
SALES REPRESENTATIVE
ANTHONY INTINTOLI

First, we must make sure architects have identified the right glazing system for the application. For example, they should not be using a storefront system for a multi span opening. Second, we ask what level of performance is needed. If an architect is just looking to meet building codes, we can help them identify the right product that can meet that. If they are looking for higher performance, like passive house, which is becoming more popular, we will start building on the performance criteria (i.e. meeting a U-value of 0.17).

The balance that architects must strike is between application and performance. Our goal is to help them find the right glazing system to meet the performance.

HOW CAN ARCHITECTS MAXIMIZE CURTAIN WALL EFFICIENCIES AND PERFORMANCE IN THE NEW ERA OF ENERGY CODES?

—DAVID BANUELOS, MANAGER OF THE ARCHITECTURAL SERVICES DEPARTMENT AT C.R. LAURENCE.

Architects are feeling the pressure to design sustainable buildings because of ASHRAE 90.1-2019 standards and demanding local building codes like California Title 24. These energy conservation initiatives come as no surprise, seeing as buildings account for roughly 40 percent of energy usage in the United States.

Thermal performance is one of the most important considerations when working with curtain wall systems. Reducing cooling loads during the summer and heating loads during the winter is the priority. This is accomplished by mitigating heat transfer through the building envelope resulting in low U-factors.

Typical curtain walls incorporate 1-inch insulating glass and a thermal break point. In response to evolving energy codes, manufacturers are now offering 2-inch triple pane insulating glass, as well as systems with two to three thermal break points to further reduce U-factors. Triple pane insulating glass is very effective at mitigating heat transfer and is ideal for colder climates. Due to the added weight and cost, however, it's best suited for low-rise applications.

Manufacturers have found additional ways to improve thermal performance. The latest curtain wall systems incorporate a polyamide pressure plate, which

is an upgrade to standard aluminum pressure plates. The polyamide plate acts as a low-conductivity thermal bridge that helps significantly reduce curtain wall U-factors.

Regarding insulating glass, customers have the option of filling it with gas to improve its thermal properties. Argon is the most common gas used in this type of application. Krypton gas is the next step up and works best where there is a thin gap between glass lites, which is the case with triple pane glazing. The most cutting-edge gas available today is xenon. It has the highest density of the insulating gasses and is very effective at reducing heat transfer. Xenon is recommended for buildings aiming to achieve LEED Platinum or Gold certification.

As previously mentioned, California Title 24 has set a new standard for energy codes, and jurisdictions across the United States are expected to follow suit. Manufacturers should verify that their curtain wall system is Title 24 compliant to ensure optimal thermal performance.





MEC HEADQUARTERS, EAST VANCOUVER, BRITISH COLUMBIA, CANADA

HIGH-PERFORMANCE SOLUTIONS: Essential to design goals for the MEC Headquarters in East Vancouver was to maximize the amount of incoming natural light to reduce energy consumption and environmental impact. CRL-U.S. Aluminum's Series HP3253 High Performance Triple Glaze Curtain Wall outfits a large portion of the building's façade. The system features dual thermal barrier technology, employing two fill and debridge pockets, and three thermal break points. This delivers potential U-factors of 0.32 to 0.17. Additional systems include CRL's Series 7200 Windows; Custom Fabricated Sunshade Systems that help minimize solar heat gain; and NFRC rated Series 750-T High Performance Thermal Doors.

THE PLAYERS: Architect, Proscenium Architecture + Interiors; general contractor, Ventana Construction Corporation; glazing contractor, Flynn Canada Ltd.; glazing system supplier, C.R. Laurence Co.

ZONE 8

Triple glazing

All of Alaska is in Zone 7, except for the following boroughs in Zone 8: Bethel, Dellingham, Fairbanks N. Star, Nome, North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, Yukon-Koyukuk

ZONE 6

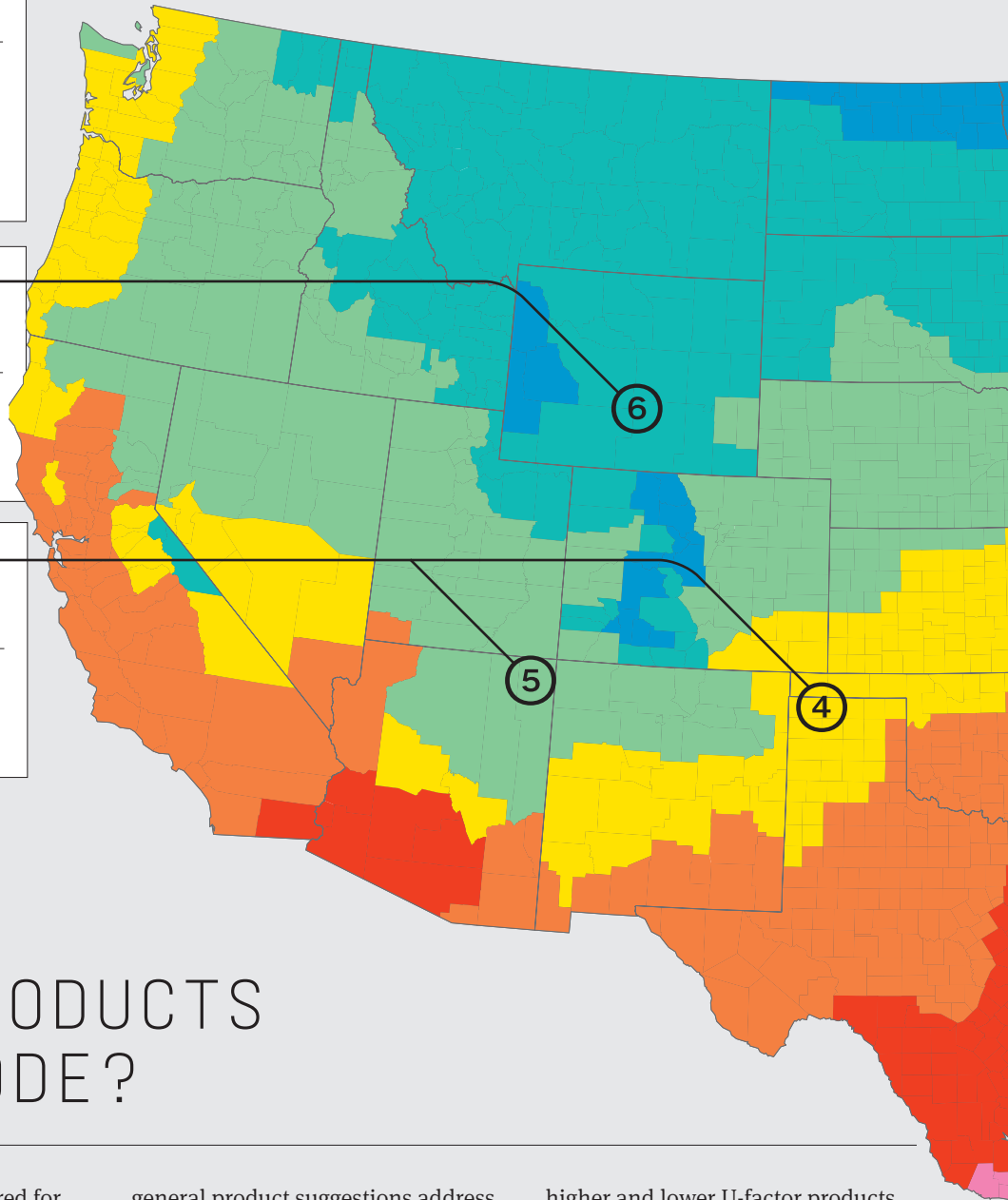
Low-E double glazing with thermally broken frame and three of the following:

Argon // Warm-edge spacer //
High-performance thermal break //
A 4th surface low-E (in addition to the 2nd surface low-E)

ZONES 4 5

Low-E double glazing with a thermally broken frame and two of the following:

Argon // Warm-edge spacer //
High-performance thermal break //
A 4th surface low-E (in addition to the 2nd surface low-E)



WHAT PRODUCTS MEET CODE?

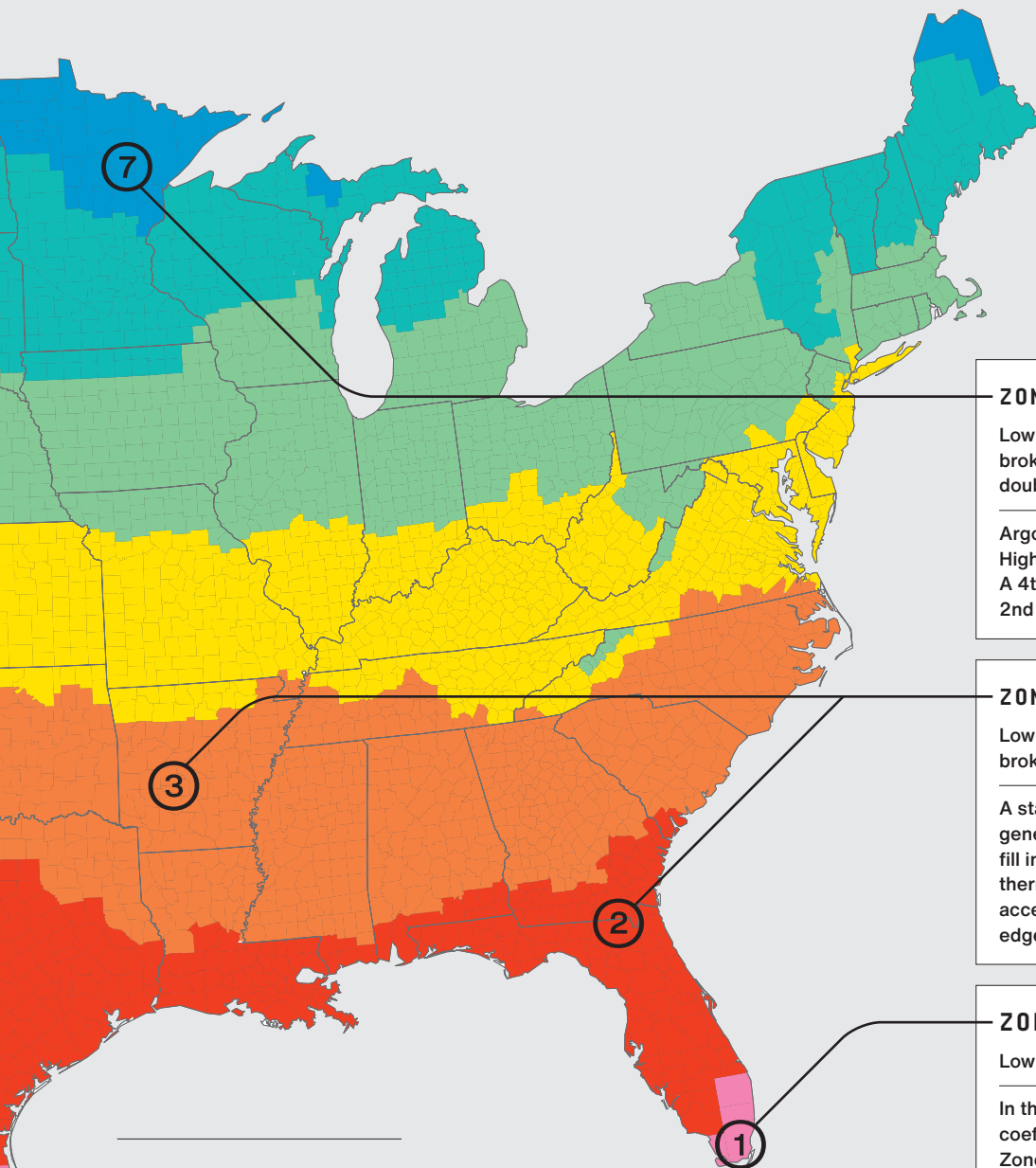
What, roughly, will be required for glazing products to meet the U-factor requirements outlined in ASHRAE 90.1-2019?

Culp offers a general idea of the potential glazing solutions to meet U-factor requirements in descriptions above. Note, architects will also need solar control products to meet SHGC requirements. Additionally, the

general product suggestions address performance attributes for curtain wall, window wall, and storefront, and, secondarily, sliding operable windows. Awning, vent and casement operable products will have more difficulty complying. In those cases, it will be necessary to add extra features, or use area-weighted averaging for the façade, which will balance out

higher and lower U-factor products.

Product assembly descriptions are provided to offer a general idea of what high-performance systems might be required in the various zones. Actual U-factor and SHGC ratings will depend on the specific frame, spacer and low-E product choices. Do not rely on this for actual compliance.



ZONE 7

Low-E double glazing with a thermally broken frame and all of the following, in double glazing, or move to triple glazing

Argon // Warm-edge spacer //
High-performance thermal break //
A 4th surface low-E (in addition to the
2nd surface low-E)

ZONES 2 3

Low-E double glazing and a thermally broken frame

A standard thermally broken frame will generally meet requirements with no gas fill in the IGU. Additionally, in Zone 2, a thermally improved frame would likely be acceptable with an argon-filled or warm-edge IGU.

ZONE 1

Low-E double glazing

In the latest update, solar heat gain coefficient requirements changed for Zone 1. Systems also will need to meet a lower SHGC of 0.23.

ABOVE: Map ©ASHRAE, www.ashrae.org. Used with permission from 2016 ASHRAE Standard-90.1. Map has been recreated by Glass Magazine and does not include the Marine, Dry and Moist region divisions.

ONLINE: To access the complete six-part guide, "All About Glass and Metal: A Guide to Glazing for Architects and Specifiers," visit glass.org/store.

UCLA'S MARION ANDERSON HALL, WESTWOOD, CALIFORNIA

HIGH-PERFORMANCE

SOLUTIONS: The centerpiece of UCLA Anderson School of Management's new Marion Anderson Hall is a glass-enclosed atrium flooded with natural daylighting. The atrium features $1\frac{3}{16}$ -inch high performance STC-rated laminated glass, which consists of $\frac{1}{2}$ -inch low-iron glass, a .030 PVB interlayer and a .030 acoustical PVB interlayer. The project also features a high-performance glazed exterior with Starphire insulating glass with Viracon VRE13-59 low-emissivity coating, and a thermal Arcadia T500 (OPG3000) curtain wall system. Photo by Brian Peregrina, Giroux Glass.

THE PLAYERS: Architect, Pei Cobb Freed & Partners; associate architect, Gensler; atrium glass fabricator, Glasswerks; exterior glass fabricator, Viracon; curtain wall supplier, Arcadia; glazing contractor, Giroux Glass.





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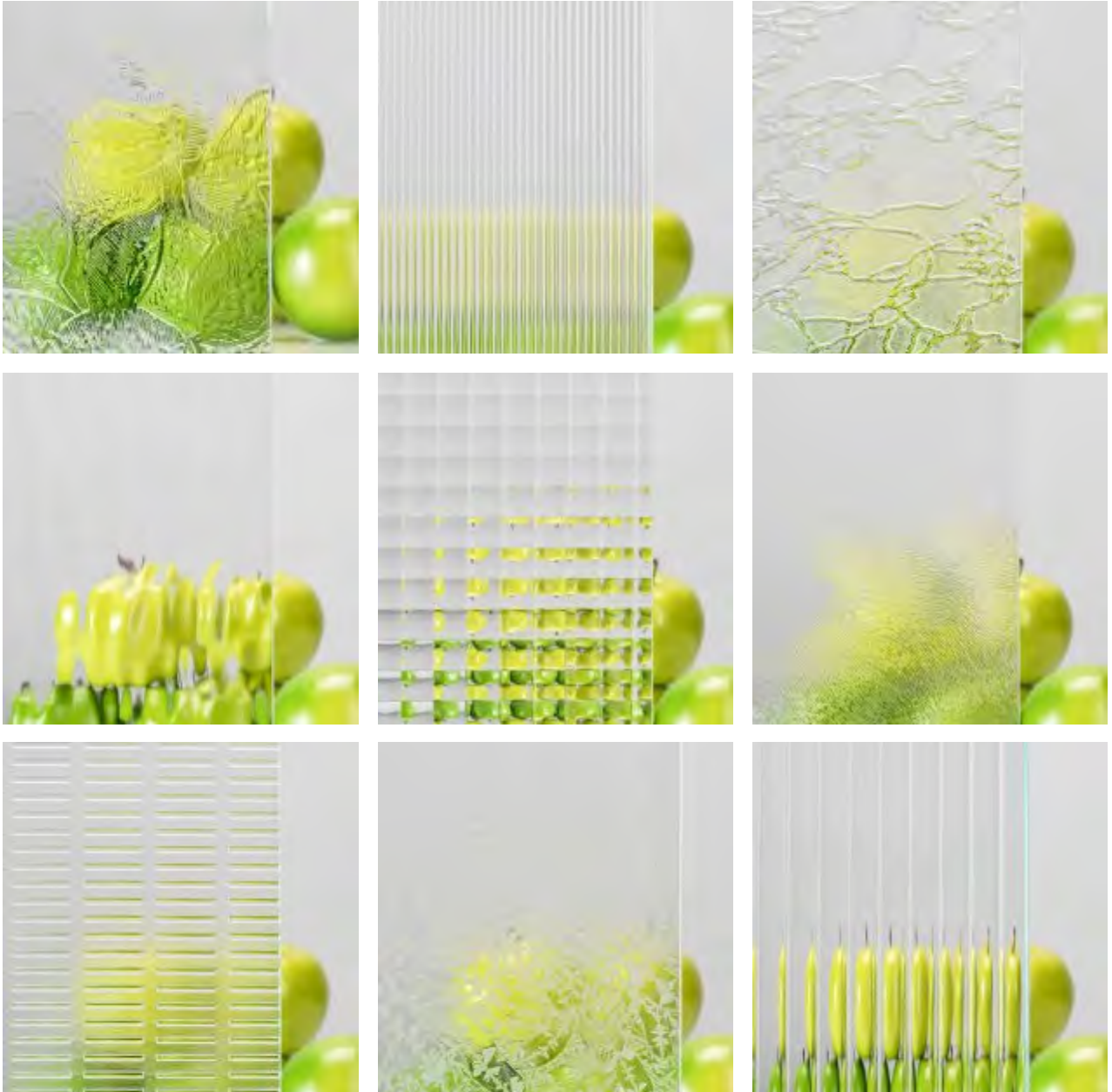
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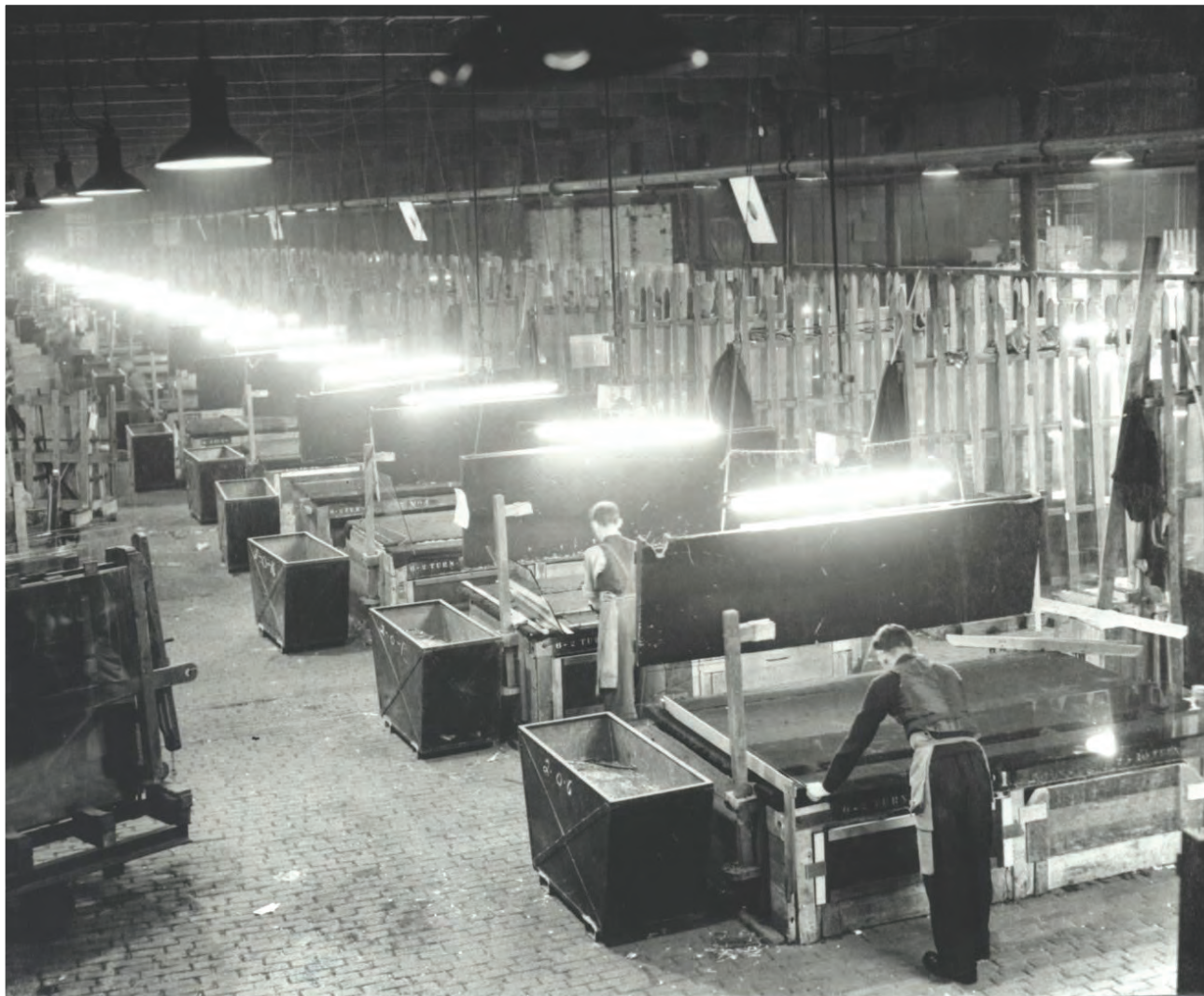
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U.S., WITH AN EYE
TOWARD INNOVATION
AND CHANGE
BY KATY DEVLIN



Above: Workers polishing glass at individual cutting tables. Left: Groundbreaking at the Rossford, Ohio, glass plant.

The pages of Glass Magazine often tell the stories of the ever-evolving and expanding possibilities of architectural glass. Glass can be jumbo, bent or dynamic. Glass can be clear, modern and minimalist; decorative, colorful and expressive. It is structural; it is protective. But no matter its final application, today's architectural glass shares one common starting point: a 2,800-degree furnace and a bath of molten tin. These fiery beginnings are part of the enormous and energy-intensive float glass production process.

Today, more than 1 million tons of float glass are produced annually at over 450 plants around the world.

Manufacturers in the United States operate 24 plants with a total of 38 lines. This includes the historic NSG Pilkington float glass plant in Rossford, Ohio, situated on the banks of the Maumee River adjacent to Toledo "Glass City," Ohio.

In August 2019, NSG Pilkington opened the doors of its Rossford plant to attendees of the National Glass Association's Fall Conference. The 1.7-million-square-foot plant, with about 1 million square feet in use, includes two float glass lines, running 24/7. Visitors learned the long and rich history of the Rossford plant, which traces the advancements of glassmaking

in the U.S. And they toured the plant's current operations, which demonstrate the industry's advancements over the decades.

120 years in Rossford

Glass production began at Rossford in 1898, when entrepreneur and glassmaker Edward Ford established the Edward Ford Plate Glass Company on the 173-acre site. Ford introduced plate glass manufacturing to northeast Ohio and, in doing so, establishing the town of Rossford. (Rossford is named after Ford and his wife, Caroline Ross.)

"There was nothing here at that time—nothing but railroad tracks and

ROSSFORD WAS ONE OF THE FIRST PLANTS IN THE U.S. TO MOVE TO FLOAT GLASS

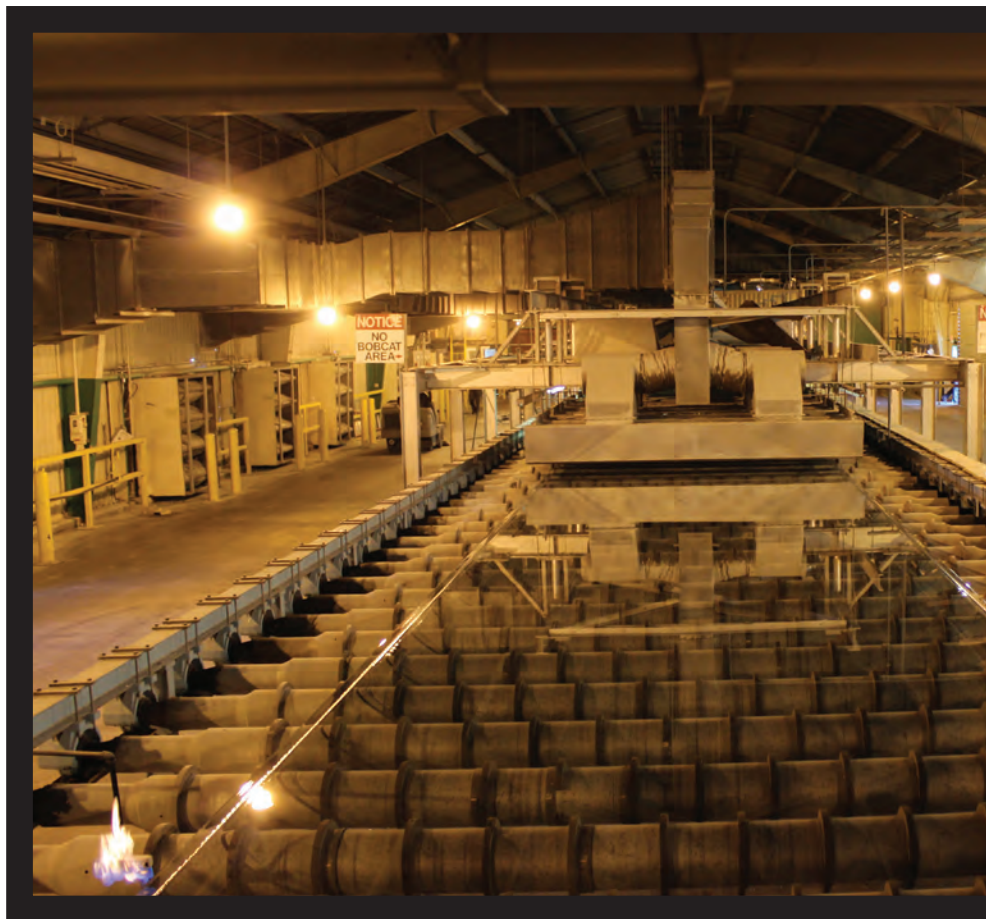


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— A photo timeline of glass manufacturing

— A video of the float process



a river,” says David Imbrogno, Rossford plant manager. “This facility had its own power plant, its own general store, all right here.”

The original Rossford plant produced glass in batches using individual furnaces, rather than through a continuous process. In batch plate glass manufacturing, raw materials for a single batch were melted in the furnace and the resulting molten glass was poured, or pulled, onto a large iron surface. The glass was then painstakingly polished on both sides.

It was a time- and labor-intensive process, says Kyle Sword, manager of business development for NSG Group. “A single piece of plate glass would take 8 hours to make. Seven workers would be at the cutting table, polishing the glass. The cost was tremendous.”

In the early decades of the 20th century, the plate glass process evolved.

Manufacturers moved to rolled glass manufacturing, allowing them to abandon the smaller batch furnaces in favor of larger furnaces. Imbrogno estimates that the Rossford plant had between eight and 15 batch furnaces in the early decades of production, before moving to only three large furnaces.

Rolled glass manufacturing improved production efficiencies. It allowed glassmakers to better serve rising demand for glass in windscreens for the burgeoning automotive market and for windows in the skyscrapers popping up in cities across the U.S. The next major advancement in manufacturing wouldn't come until float glass was introduced decades later.

The great float innovation

British engineer Sir Alastair Pilkington developed the modern float



glass process in 1952. It marked a step change for the glass industry. With float manufacturing, companies moved to a continuous process that allowed them to produce more glass at a much higher quality with a fraction of the people.

Rossford was one of the first plants in the U.S. to move to float glass production, building its first line in the mid-1960s, says Imbrogno. At the plant, the early days of glassmaking required thousands of workers—10,000 at its peak, he says. Today, the plant employs 500, only half of whom are dedicated to the float process.

A float glass line is an impressive sight. It stretches more than 1,100 feet—roughly the length of three football fields. Production begins at the “hot end” of the line, where raw batch materials are loaded into the melting furnace. The batch consists of 60 percent sand,

20 percent lime dolomite, and 20 percent soda and sulfate.

The raw batch also features glass cullet—crushed and broken glass recycled from the finished end of the float line. The cullet further accelerates melting, reducing the amount of energy required up to 20 percent. The raw materials are melted in a large furnace, with temperatures of 2,800 degrees.

From the furnace, the molten glass enters a narrow channel before flowing into the tin bath, which is the critical component of Sir Alastair Pilkington’s game-changing innovation. In the tin bath, the molten glass floats atop about 2 inches of molten tin, like “oil on water,” says Sword. The glass spreads evenly across the surface of the tin. The absolute flatness and parallel nature of the upper and lower surfaces of the glass provide the high quality and clarity of float glass,

which was impossible to achieve with the previous plate glass method.

Rollers pull the “ribbon” of glass through the bath. The speed of the rollers determines the thickness of the glass, with faster speeds producing thinner glass. Today’s modern float lines can produce glass in thicknesses of less than .3 millimeters for thin display glass up to 22 millimeters for heavy glass applications.

The ribbon of flat, pristine glass emerges from the bath and enters the annealing lehr, an 800-foot-long process in which the temperature of the glass cools dramatically, decreasing from 1,100 degrees to room temperature. After annealing, the glass is scored and cut to size before moving to the end of the line.

Float manufacturing is continuous. Once a furnace is fired and the first ribbon of glass is pulled, the line will produce several hundred tons of glass

daily for 15 years or more until repairs or rebuilds are required.

Switching production from one type of glass to another—from one thickness or tint to another—requires that operators make slow adjustments to the batch or to the roller speed, and the ribbon of glass will gradually change. The intermittent glass made between processes will be made into cullet.

Producing high-quality glass on a modern float line requires constant monitoring, tweaking and adjustment, says Sword. “As much as we like to think of it as a science, it’s more of an art,” he says. “We are manipulating molten glass—floating it on a tin bath. We are trying to make a product that looks perfect. We have to be good at knowing the equipment, keeping it functioning properly, to do it right. ... There are things we can’t automate; things that require we look at how the glass is performing [on the line], watch the glass stretch, observe the external changes.”

Steady advancement

The fundamentals of float production remain unchanged from its original invention. However, industry companies have advanced and improved the process to meet customer needs, increase productivity and reduce required workforce.

People

A key focus of improvements is people. Manufacturer advancements, such as measurement technologies and cameras, pull more people off the line directly, increasing safety while improving efficiency and quality. “We have gone from having manufacturing operators to manufacturing technicians,” Imbrogno says. “We have some workers on the floor doing inspections, but most are in air-conditioned control rooms. We don’t need a lot of people to do it. They don’t need to be in the heat.”

Prevention

The extreme conditions of a float line and the continuous nature of production create dangerous conditions if something goes wrong. A problem or interruption in production

at any stage of the process requires immediate intervention. For example, a disruption at the “cold” end of the line, perhaps with glass cutting, would require workers to stop the continuous flow of the glass ribbon by breaking it, over and over, until operations are able to resume. Problems at the hot end are even more dangerous. Glass leaks can cause catastrophic damage at a float plant, putting employees at risk and forcing companies to halt production.

Manufacturers have greatly improved the safety of float production by focusing on preventative maintenance and developing backup systems. “Everything is preventative and predictive,” he says. “We are monitoring and responding to trends in the production instead of responding to emergencies.”

Efficiency

Because the glassmaking process requires such tremendous energy, manufacturers have worked consistently in recent decades to improve the efficiency of the process. For example, manufacturers cycle heat in the furnace, firing burners on alternating sides every 15 minutes. This ensures the air in the furnace is always heated, allowing for continuous melting and improving efficiency.

Another major development has been the introduction of oxygen fuel combustion technologies. Increasing the amount of oxygen fuel allows manufacturers to run more efficiently with lower emissions. The Rossford plant features the first oxygen-fired furnace in the U.S., built in 1989. Today, it is just one of two oxy-fuel float furnaces in the country.

Longevity

Better materials and operations contribute to plant longevity. “Everybody is getting more life out of their furnaces,” says Sword. Part of this is necessity due to the capital outlay required, Sword says. The initial investment for a float line is \$250 million. Companies have made improvements to production to make those lines last longer through better maintenance and more extensive repairs.

Product innovations

The float process allowed for numerous innovations, such as efficient coatings, expanded tint options, ultra-clear options and thinner substrates.

Imbrogno points to how the trend in the automotive sector for lighter, more efficient vehicles pushed manufacturers to produce thinner glass. In architectural glass, trends to heavy glass for showers, railings and more required floaters to develop thick glass that continues to remain free from imperfections. This corresponded with calls for increased transparency, opening the door to low-iron ultra-clear glasses.

Some float lines also include coating processes, in which metallic pyrolytic coatings are applied through chemical vapor deposition. Most common coatings include low-emissivity coatings, anti-reflective and self-cleaning.

On the horizon are even higher-efficiency products with advanced performance, says Sword. “People want aesthetics and performance, and they want functionality,” he says. “They want to let the light in, to have display options, to change colors, to generate electricity.”

Advancing through history

The Rossford glass plant has witnessed incredible advancements in its 120-year history. That trend to innovation is unlikely to change, as the industry continues to advance and glassmakers continue to step up, say Imbrogno and Sword.

Despite the proliferation of advanced glass products down the supply chain, the root of the process will still be the furnace of molten glass and a tin bath. Sword says he anticipates float manufacturing will remain the primary method of glassmaking for the foreseeable future.

“The embodied carbon of float production might force a change—float manufacturing is still energy-intensive,” Sword says. “If someone figures out a more efficient way to melt raw materials and float the glass, we might see a change. But right now, there is no better way.” ■



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PRODUCTS

01



AIA PRODUCT PREVIEW

The AIA Conference on Architecture 2020, to be held in Los Angeles, will welcome over 650 exhibitors this year, including glass and glazing suppliers. Readers can find a preview of some of the glass and architectural metal products that will be debuted and showcased at this year's conference. Booth numbers reflect those posted by the AIA at press time. For more information, visit aia.org.

02



03



1. Arnold Glas

Arnold Glas will showcase its Ornilux bird-friendly glass, now available in expanded sizes. Since mid-2019, Ornilux has been available in sizes up to 126 inches by 472 inches. The previous max size was 102 inches by 197 inches. The company will also feature mock-ups demonstrating its “Design Your Coating” service, which allows a single insulating glass unit to be designed as a graded/blended coating. Booth #S-1813
805/895-9436 | ORNILUX.COM

2. Bacon's Architectural Products

Bacon's Architectural Products will exhibit SimSteel, which offers the look of expensive steel doors and frames. SimSteel doors and frames are finished in virtually any color paint or variation of bronze anodized finish. The framing system measures 1 ¼ inches by 4 ½ inches, offering similar narrow sightlines; it can accommodate ¼-inch- and ⅜-inch-thick glass. Booth #S-1353
217/356-6471 | BASIMSTEEL.COM

3. C.R. Laurence

C.R. Laurence will debut the Unitized Glass Railing System, a new and more efficient way of fabricating and installing glass railing systems. Base shoe units are glazed in state-of-the-art manufacturing facilities and then shipped to the jobsite, ready to install. Installers can simply set the unitized railing into core-drilled holes and attach the cap rail. Long 180-degree glass spans with no vertical lines are possible. Booth #S-1237
800/421-6144 | CRLAURENCE.COM

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01



02

Guardian SunGuard SNX 51/23 coating on clear glass. Photo by Dean Riggott Photography.



03



04

1. dormakaba

On display for dormakaba will be its GP Series Glass Panic Hardware. The series includes its panic devices, including the GP 1000 Series top latching bolt with manual and electric strikes, fail safe or fail secure; and the GP 1100 Series bottom latching panic with manual strikes. The company will also exhibit its GP 1000 Series top locking deadbolt; GP 1100 Series bottom locking deadbolt; and GP 1300 Series vertical deadbolt with top or bottom, or both top and bottom, locking bolt options. Booth #S-2501 and S-2601LL 855/365-2407 | DORMAKABA.US

2. Guardian Glass

Guardian Glass will exhibit its Guardian SunGuard low-emissivity coatings. These coatings offer outstanding appearance and energy performance, according to the company. SunGuard coated glass features advanced sputter-coating technology to maximize light and reflect heat. Applications include windows, roofs, glazed façades and more. The company will also display its InGlass portfolio of interior glass; UltraClear low-iron glass; and Bird1st glass, the company's bird-friendly glass. Booth #S-1301 855/584-5277 | GUARDIANGLASS.COM

3. Safti First

Safti First will showcase SuperClear 45-HS-LI, a 45-minute rated fire protective low-iron specialty glazing that meets hose steam. It is listed and labeled by UL and Intertek for large sizes in fire protective doors, sidelites, openings and transoms. This 3/4-inch fire protective glass offers superior optical clarity without the use of wires or amber tints, while offering a 90 percent visible light transmission. Booth #S-2223 888/653-3333 | SAFTI.COM

4. YKK AP America Inc.

The YKK AP America YSD 600 TUH impact-rated low threshold sliding glass door enables architects and contractors to incorporate accessible designs into projects built for impact or hurricane resistance. The YSD 600 TUH is particularly suited for multifamily, hotels, condominiums and multi-purpose buildings. All panels, fixed and operable, provide a shop-fabricated option and can be pre-glazed in the shop. The YSD 600 TUH utilizes YKK AP's ThermoBond Plus thermal break technology. Booth #S-1423 678/838-6000 | YKKAP.COM



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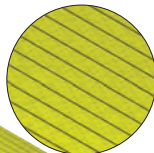
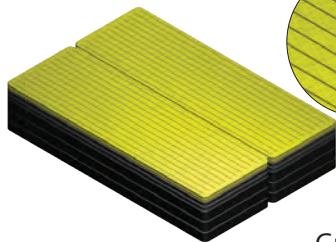
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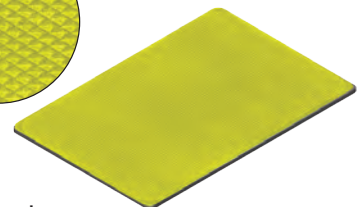
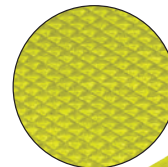
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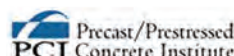
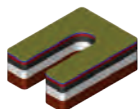
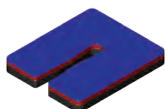
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Blair



Johnson



Danese

American Insulated Glass

American Insulated Glass expanded its leadership and management teams. The company promoted *Clint Blair* to vice president of operations and hired *Darin Johnson* as part of the management team and as regional operations manager. AIG also hired *Daniel Danese* for the newly created position of commercial products director for the company's Detroit

fabrication plant.

Blair joined AIG in 2017 as general manager, with more than a decade of experience in sales leadership and business development. He has played a significant role in supporting the

company's strategic plan to expand its geographical footprint and fabrication capabilities, increasing the number of AIG locations from two to six in less than two years.

Johnson will oversee operations for AIG in Alabama, Florida, Georgia, Michigan, North Carolina and Tennessee.

In his new role, Danese will support the expansion of this recently acquired fabrication facility, formerly Great Lakes Glass Distributors, to better serve the needs of the commercial glazing market in this region.



Randisi

Consolidated Glass Holdings

Consolidated Glass Holdings promoted *Chris Randisi* to vice president of architectural sales. In his new position, Randisi will lead the sales teams for the CGH architectural glass division, comprising J.E. Berkowitz,

Dlubak Specialty Glass, Solar Seal and Columbia Commercial Building Products. Most recently, Randisi was director of national accounts and architectural specifications for CGH. He previously served as Mid-Atlantic regional sales manager for J.E. Berkowitz, and held architectural sales roles with Guardian Industries, Shildan Group and Armstrong World Industries.



Fochs Jr.

Linetec

Linetec promoted *Jeff A. Fochs Jr.* to vice president of sales and marketing. He reports directly to Linetec's president, Jon Close, who previously held this position. In his new role, Fochs will oversee Linetec's national outside sales, inside sales and marketing teams. He also will continue to serve as the East Central regional sales manager.



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Graboyes Commercial Window and Glass Solutions

Graboyes Commercial Window and Glass Solutions promoted several employees, including *Lou Filippone*, who was promoted from director of business development to vice president and general manager.

Jim DelRossi, journeyman foreman, joins the management team as general superintendent. DelRossi will be responsible for working closely with project foremen in the field in support of preconstruction requirements as well as day-to-day execution of work. *Jim Coppola*, journeyman foreman, who recently joined Graboyes from Almond Glass Works in Camden, New Jersey, also joins Graboyes' management team, as a project manager. Coppola will work closely with the company's project foremen and the project teams of its customers to support preconstruction requirements as well as day-to-day execution of work.

Mike Kent, formerly a Graboyes' logistics specialist, was promoted to assistant project manager. Kent will partner with and support operations, as well as provide support to the accounting and human resources functions. *Andrew Balas*, estimator, assumes the role of virtual design manager. In his new role, Balas will continue to support estimating, CAD and service while also assisting with business development, especially regarding the company's BIM/Revit-based services, including façade design and building envelope coordination.



Harris

Techniform

Techniform welcomed *Jennifer Harris* as inside sales manager. Harris will be responsible for managing the company's sales and estimating teams. She will also manage the administrative and training details for the team.

Harris will be responsible for keeping customers updated about Techniform's increasing capacities by creating updated brochures and social media posts, organizing marketing, attending and exhibiting at tradeshow and meeting customers.



Settlemyre

Kalwall Corp.

Kalwall Corp. named *Paul "Wes" Settlemyre* to the team as southeast regional sales manager.

The Southeast Region includes Alabama, parts of Arkansas, Florida, Georgia, Kentucky, Louisiana, North Carolina, Puerto Rico, South Carolina and Tennessee. Settlemyre, who has over 20 years of experience in client relationship development, account management and team building, is responsible for sales and technical support for clients.



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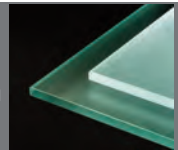
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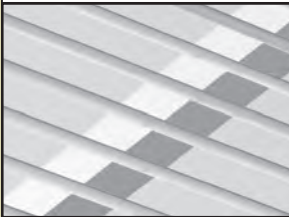
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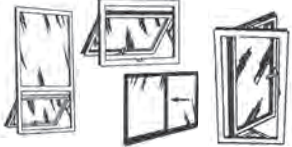
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Companies from all parts of the glass and glazing industry have implemented innovative, out-of-the-box ideas to improve business from the ground up. Here's an Idea showcases these sometimes small behind-the-scenes ideas that can make a big impact on a company's bottom line. If you have an idea that you would like to share, contact Norah Dick, ndick@glass.org.

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YKK AP SEEKS ACADEMIC PARTNERSHIP TO DEVELOP CONSTRUCTION TECH

YKK AP America is looking to make Industry 5.0 a reality, with some help from academia. The company began a partnership with Carnegie Mellon University's Computational Engineering and Robotics Laboratory last May with the purpose of developing technology to counteract the entrenched skilled labor shortage.

The company's researchers, along with CMU researchers, led by professor Kenji Shimada, are investigating the application of robotics and IT for the installation of fenestration products at jobsites. "A more diverse methodology such as collaboration with multidisciplinary partners, including academia, can only increase the chances of solving big problems," says Oliver

Stepe, president of YKK AP.

Finding a research partner

YKK AP reviewed several potential research partners before deciding on CMU. "CMU has a strong culture that values academic-industrial collaboration," says Stepe. "To our knowledge it is the first university to establish a degree program on [artificial intelligence] and has an overall strength and core competency on AI and robotics."

Research and development

The results of the collaboration are still in an "incubator stage," says Stepe. "The team is assessing existing digital transformation and/or automation technologies that may already exist in

the marketplace but have not yet been applied to building and construction," he says.

Future plans

The company hopes that the collaboration results in some "quick wins" before the company expands the project and adds more researchers, says Stepe. "We see the need for digital transformation as a bigger topic that can benefit society as a whole and have been outspoken and transparent on the topic," he says. "This initiative is in firm alignment with our corporate philosophy, The Cycle of Goodness, which states that no one can prosper without rendering benefit to others, a concept not unlike Andrew Carnegie's own philosophies." ■



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