

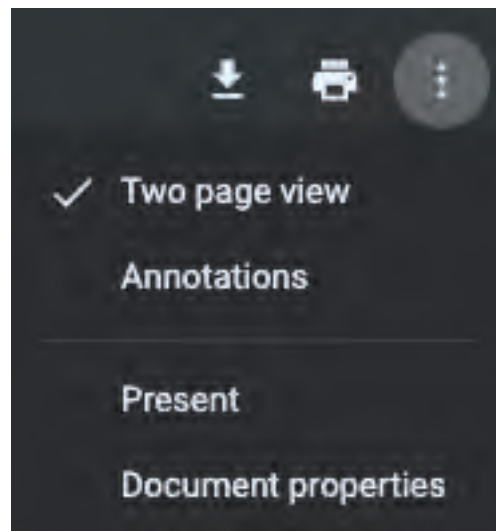
GLASS MAGAZINE®

THE GLASS AND GLAZING AUTHORITY

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GLASS

MAGAZINE®



THE GLASS AND GLAZING AUTHORITY JANUARY/FEBRUARY 2025

ECONOMISTS
CONSIDER
TRADE,
TARIFFS AND
TALENT

WHAT'S AHEAD

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HOW TO
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THE
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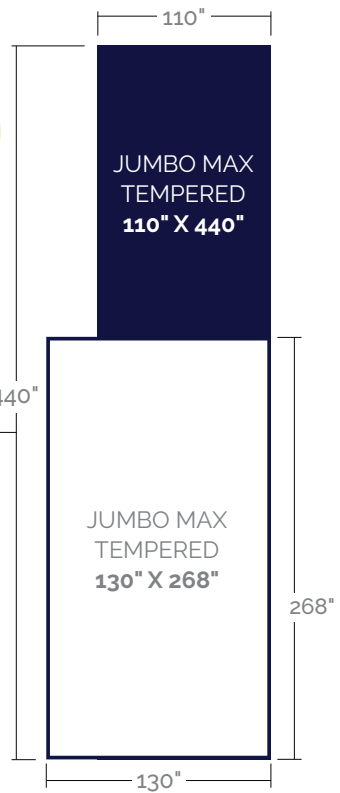
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FEATURES

36. **The 2025 Forecast: Top Takeaways**

The latest construction forecasts reflect a challenging 2024 for U.S. construction, with reasons for optimism in 2025

BY TARA LUKASIK

58. **NGA Is Glass**

2024 Annual Report: How the National Glass Association works for its members

80. **World of Glass**

The decarbonization equation: Manufacturing improvements, more recycling and reuse, and better operational performance

BY KATY DEVLIN, WITH CONTRIBUTIONS FROM NORAH DICK AND RACHEL VITELLO



INSIGHTS

24. **Trendhunter**

Glass in Healthcare to Promote Healing

BY DEVIN BOWMAN

30. **Your Profits**

The Debt Dilemma

BY MARCO TERRY

DEPARTMENTS

- 8. Editor's Notes
- 10. From the NGA
- 12. Glass Advocate
- 16. Glass Informational Bulletin
- 22. News to Know
- 96. Product Solution: Aluflam
- 97. Industry Products
- 100. Suppliers Guide
- 116. Reader Response Center
- 118. Industry Spotlight

ON THE COVER: Glass Magazine celebrates its 75th anniversary in 2025. Throughout the year, Glass Magazine will document this notable anniversary with a look back at the incredible evolution of the glass industry, including a look at longstanding companies, notable product innovations, major industry developments, and more. We begin the celebration with a special 75th anniversary logo, shown on the cover of this issue, and a look back at 75 years of Glass Magazine in the Editor's Notes on page 8.

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BONUS CONTENT

Available at GlassMagazine.com and glass.org.

RECYCLING

NGA relaunches global glass map with manufacturing, fabrication and recycling locations

RESOURCES

New AIA-accredited offerings on thermal bridging, bird-friendly glazing launch within NGA

WORKFORCE DEVELOPMENT

New MyGlassClass offers fabricator training, enhanced user experience

GLASSBLOG



SUSTAINABILITY

Public Spaces Increasingly Focus on Sustainability

By Tammy Schroeder, Linetec, Tubelite and Alumicor



SAFETY

Minimize Glass-Handling Injuries

By Merv Campbell, Omni Cubed



TRENDS

Tough Now, Better Soon?

By Max Perilstein, Sole Source Consultants

PROJECT SHOWCASE



Custom bronze glass from Bendheim serves as a reflective backdrop to a bar in the former Eleanor Belmont Room at the Metropolitan Opera. The room, now renamed the Keebler J. Straz Lounge, was designed by architect GACHOT to be a welcoming environment. Pulp Studio's bespoke glass was used to contribute a sense of elegance, and to add a sense of luminosity reminiscent of the Met's gilded ceilings.

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344 Maple Ave. West, Unit 272
Vienna, VA 22180
P: 703/442-4890

EDITORIAL

Content Director

Katy Devlin • kdevlin@glass.org

Managing Editor

Tara Lukasik

Associate Director,
Comm. & Digital Media
Bethany Stough

Senior Editor

Norah Dick

Digital Media Specialist
Wendy Vardaman

Assistant Editor & Researcher

Rachel Vitello

Production Director
Beth Moorman

Creative Lead

Cory Thacker

Circulation Manager
Jo Ann Binz
jbinz@glass.org

ADVERTISING

Publisher

Emily Thompson

ethompson@glass.org
703/442-4890 ext. 150

Sales Consultant

Tristan Scoffield

tscoffield@glass.org
703/442-4890 ext. 194

Senior Sales Consultant

Chris Hodges

chodges@glass.org
703/442-4890 ext. 131
Cell: 410/459-8619

Suppliers Guide Sales

Tim O'Connell

toconnell@glass.org
703/442-4890 ext. 129

Senior Sales Consultant

Holly Robinson

hrobinson@glass.org
703/988-3164

Media Sales &
Sponsorships Manager

Cameron Francis

cfrancis@glass.org
703/442-4890 ext. 132

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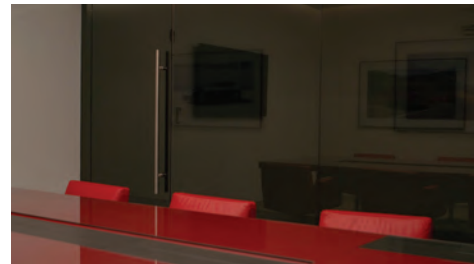
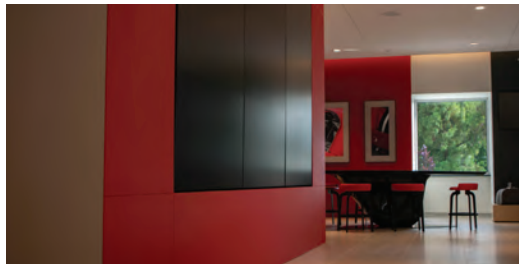
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DRIVING LUXURY BRAND PERFORMANCE WITH GLASS

The Ferrari Cavallino Award-winning dealership in Newtown Square, PA, recently relocated to a newly renovated building designed to embody Ferrari's luxury brand. This transformation features bespoke glass elements fabricated by GGI, including the iconic 'Ferrari Red' back-painted glass wall cladding, crafted from 1/4" low-iron glass with both traditional and satin finishes. Additionally, 1/2" grey tempered glass entrance systems and partitions were installed throughout the dealership. These custom glass applications enhance functionality and sophistication, seamlessly blending visual branding with durability. This renovation project underscores GGI's commitment to ***Bringing Your Creative Visions to Life.***

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75 Years of Glass Magazine



KATY DEVLIN
NGA Vice President
of Content &
Programming
kdevlin@glass.org

2025 marks the 75th anniversary of Glass Magazine. For an impressive three-quarters of a century, the publication that was founded in 1950 as the Glass Dealer, the official newsletter of the National Glass Dealers Association, now the National Glass Association, has been a source of essential industry education and news for the glass and glazing industry. It officially became Glass Magazine in 1984 and has seen the NGA and the industry through 14 U.S. presidents, 11 economic recessions, the rise of the glass skyscraper, tremendous advancement in glass and glazing product solutions and production processes, and more.

In the pages of Glass Magazine, readers learned the impact of industry-shaping events such as Hurricane Andrew and the Oklahoma City Bombing, which drove demand for protective glass solutions. Published through the Great Recession and the COVID pandemic, Glass Magazine provided business owners with need-to-know information to keep

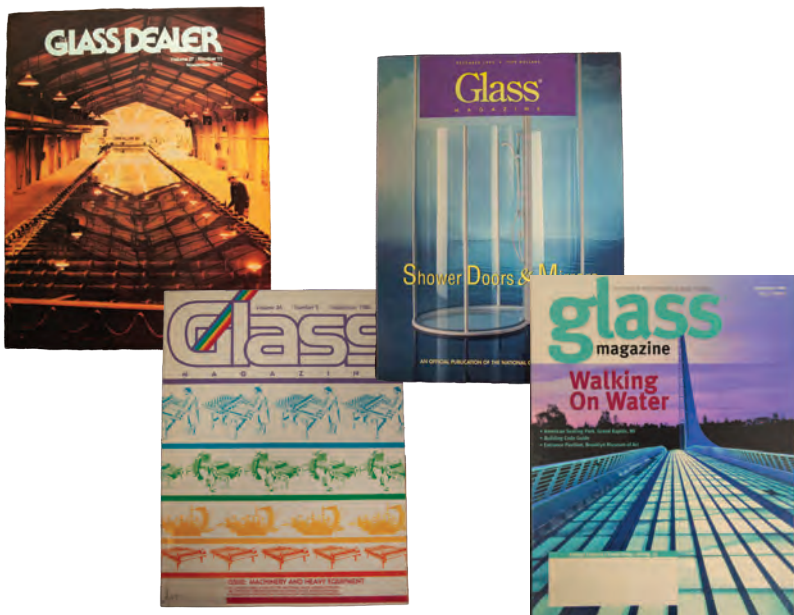
their doors open during unprecedented times. To document top trends and market forces across the industry, Glass Magazine launched in-depth surveys and research reports for all segments, including Top 50 Glaziers, Top Glass Fabricators and World of Glass tracking global float glass production.

Every edition of Glass Magazine is dedicated to providing glass industry readers with information to better their businesses, track market trends and create safer workplaces. We use this platform to highlight how glass, with all of its multi-functional capabilities, is a preferred material for applications across the built environment. We highlight all that glass does—for building performance, for occupant comfort and wellness, and for the environment and the world.

Throughout 2025, Glass Magazine will document this notable anniversary with a look back at the incredible evolution of the glass industry. We will feature glass companies that have celebrated 75 years or more in business. We will look at the major advancements in the industry, with coverage beginning in this edition, where we explore step changes and future development in float glass in the World of Glass annual report beginning on page 80. Plus, keep an eye out for a few other 75th-anniversary surprises from the magazine and the NGA.

Before I close, I want to thank all of you who continue to support Glass Magazine by picking up every issue, passing it along to colleagues, and setting it out on your showroom or lobby tables to show off this industry to customers and project collaborators. Thank you to our contributors—our subject matter experts—who offer valuable insights for the betterment of the industry. And thank you to our advertisers that partner with Glass Magazine to bring this essential glass industry education to readers.

Here's to the next 75 years! ■





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NEED-TO-KNOW INFORMATION FROM THE NGA

NEW MYGLASSCLASS ONLINE PLATFORM FREE FOR NGA MEMBERS

The National Glass Association relaunched its popular MyGlassClass.com online learning platform as part of the association's workforce development initiatives. With over 100 courses, it offers three training paths: glazier training, glazier apprenticeship curriculum, and MyGlassFAB. The relaunched platform features numerous changes to improve user experience and overall site functionality, addressing the needs of all learners.

The NGA Board of Directors announced that all employees of NGA member companies can access MyGlassClass courses at no cost (excluding OSHA and UL courses). ■

REGISTRATION OPENS FOR SPRING NGA GLASS CONFERENCE: CARLSBAD

Registration is open for the NGA Glass Conference: Carlsbad, taking place Feb. 3-6, 2025, at the Westin Carlsbad Resort and Spa in Carlsbad, California. The brightest technical minds behind the glass and glazing industry will gather here to discuss open NGA committee work items, new resource development, and trends and issues facing the industry. Industry members will gather together for important committee work, education and networking, including the optional Golf Scramble and 10th Annual Fun Run. Register at glass.org/event/nga-glass-conference-carlsbad. ■

COMPENSATION AND BENEFITS REPORT WEBINAR FOR FABRICATORS AND GLAZIERS

This members-only webinar reviewed the results from the inaugural NGA Compensation & Benefits Report for Fabricating Companies and Compensation & Benefits Report for Glaziers.

The surveys cover compensation and benefits across some of the most common positions in fabricating and glazing companies, and will help equip decision makers with data they need to better recruit, hire and retain the best workforce. View the webinar at glass.org/event/thirsty-thursday-nga-compensation-benefits-report-fabricators-and-glaziers. ■

NEW AIA-ACCREDITED OFFERINGS LAUNCH WITHIN NGA

NGA launched new AIA-accredited offerings to its library of resources: Thermal Bridging Considerations at Interface Conditions and Key Strategies for Bird Friendly Glazing.

The first presentation discusses how the installation of a fenestration system impacts the thermal performance and air- and water-resistance of a building envelope, highlighting future developments driven by codes and best practices. It also covers the importance of component compatibility and construction considerations for design teams.

The second presentation explores the importance of birds and the sources of avian mortality, focusing on factors that increase the risk of bird

collisions. It covers bird-safe research on making glass more visible to birds, the effectiveness of bird-friendly glazing solutions, testing methods, and trends in legislation.

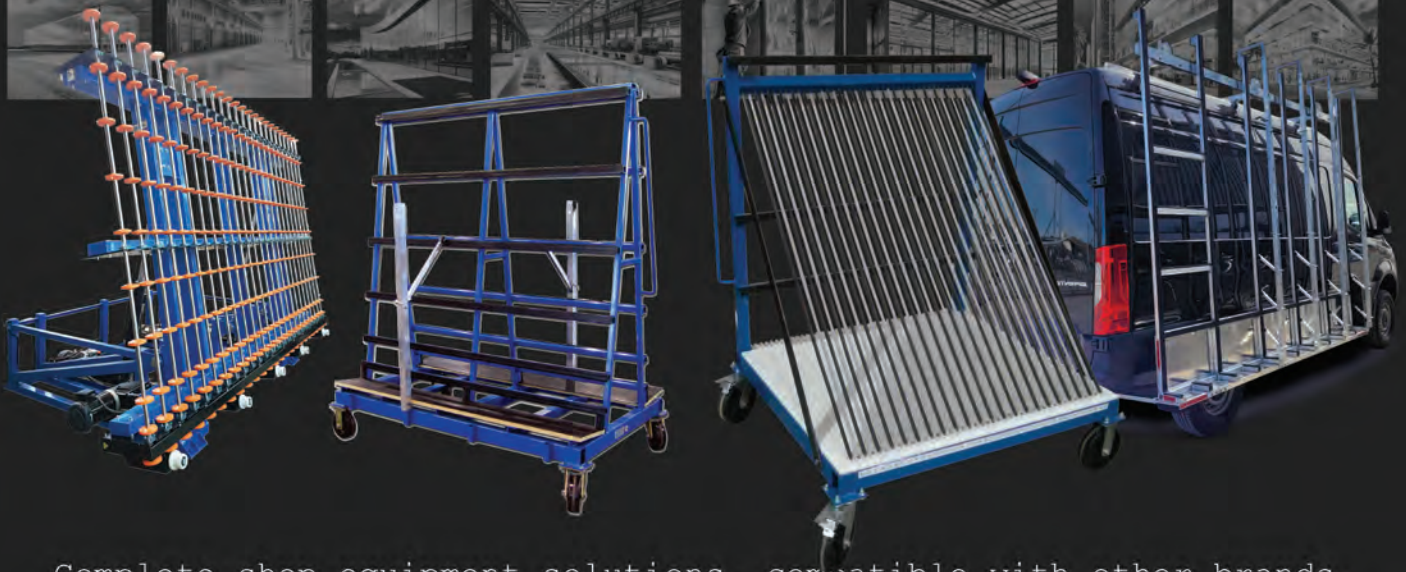
An upcoming presentation—Security Glazing for Schools—will address the different types and applications of security glazing being used in schools as a means to mitigate various threats including forced entry and ballistic resistance. ■

NGA EXPLORES COLLABORATION OPPORTUNITIES WITH AGMCC

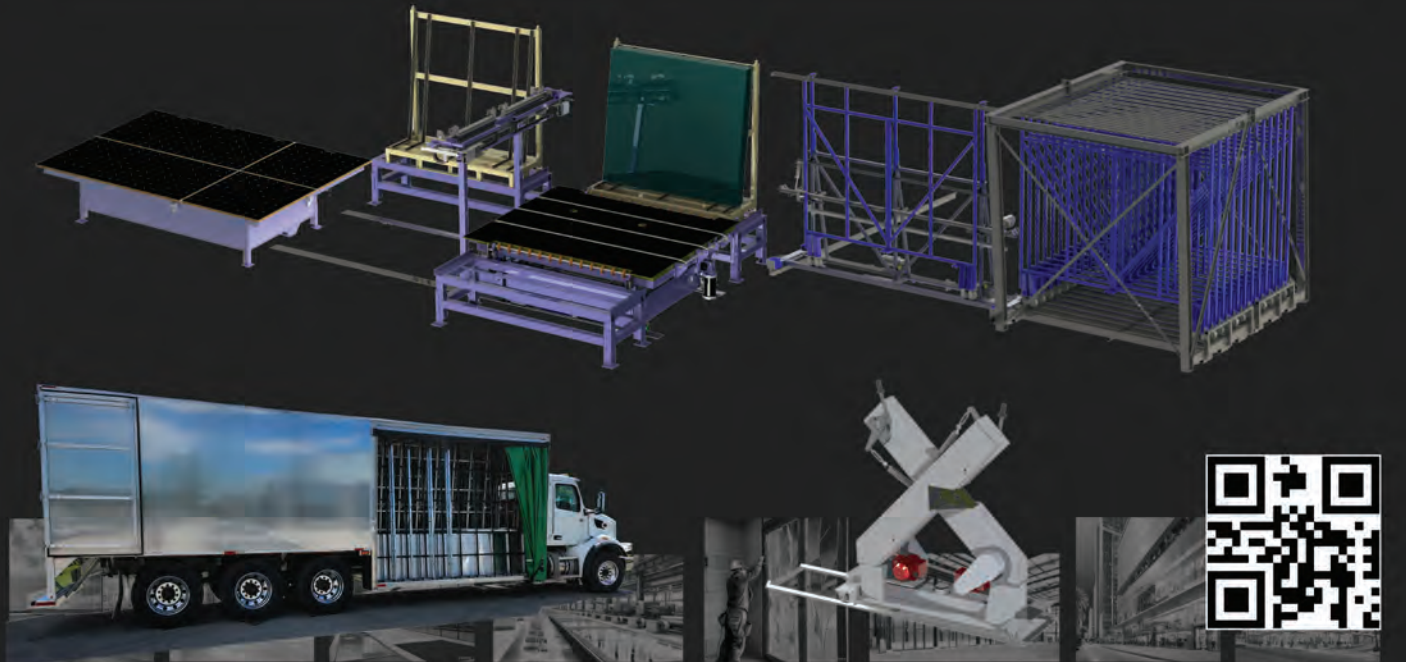
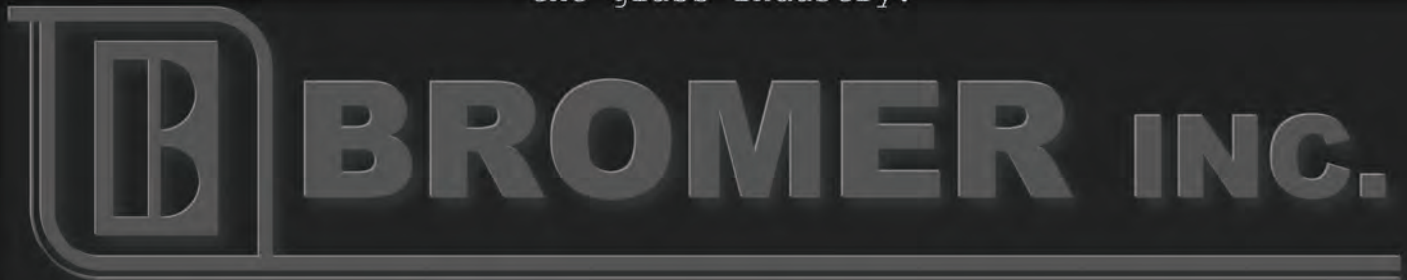
NGA is identifying new collaboration opportunities with the Architectural Glass and Metal Certification Council, which sponsors and coordinates the North American Contractor Certification and Architectural Glass and Metal Technician programs. This follows AGMT's successful live certification testing event on the exhibit floor during NGA's GlassBuild America 2024 trade show.

The two organizations have committed to a second AGMT testing event for GlassBuild America 2025, to be held Nov. 4-6, 2025, in Orlando, Florida. ■

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Glass and Glazing Estimating Essentials Book	BOOK	\$139.95
Glossary of Architectural Glass & Glazing	BOOK	\$49.95
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Products for Energy Applications [FB63-19]	GTP	FREE

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GLASS INFORMATIONAL BULLETIN

Dynamic Glazing

Dynamic glazing is a fenestration product that can change its optical performance properties, such as visible light transmission, near infrared transmission and solar heat gain coefficient. These properties can change based on exposure to different stimuli; some change in response to electrical stimulus (electrochromic), others change in response to absorbed sunlight (photochromic) and some respond to ambient or product temperature (thermochromic). Dynamic glazing can be designed to improve occupant comfort and/or energy performance by capturing useful daylight while controlling glare and unwanted solar heat gain.

Electrochromic glazing

An electrical stimulus is used to change the VLT and SHGC of electrochromic glass. The glass is generally formed by depositing distinct layers of transparent conductive oxides and



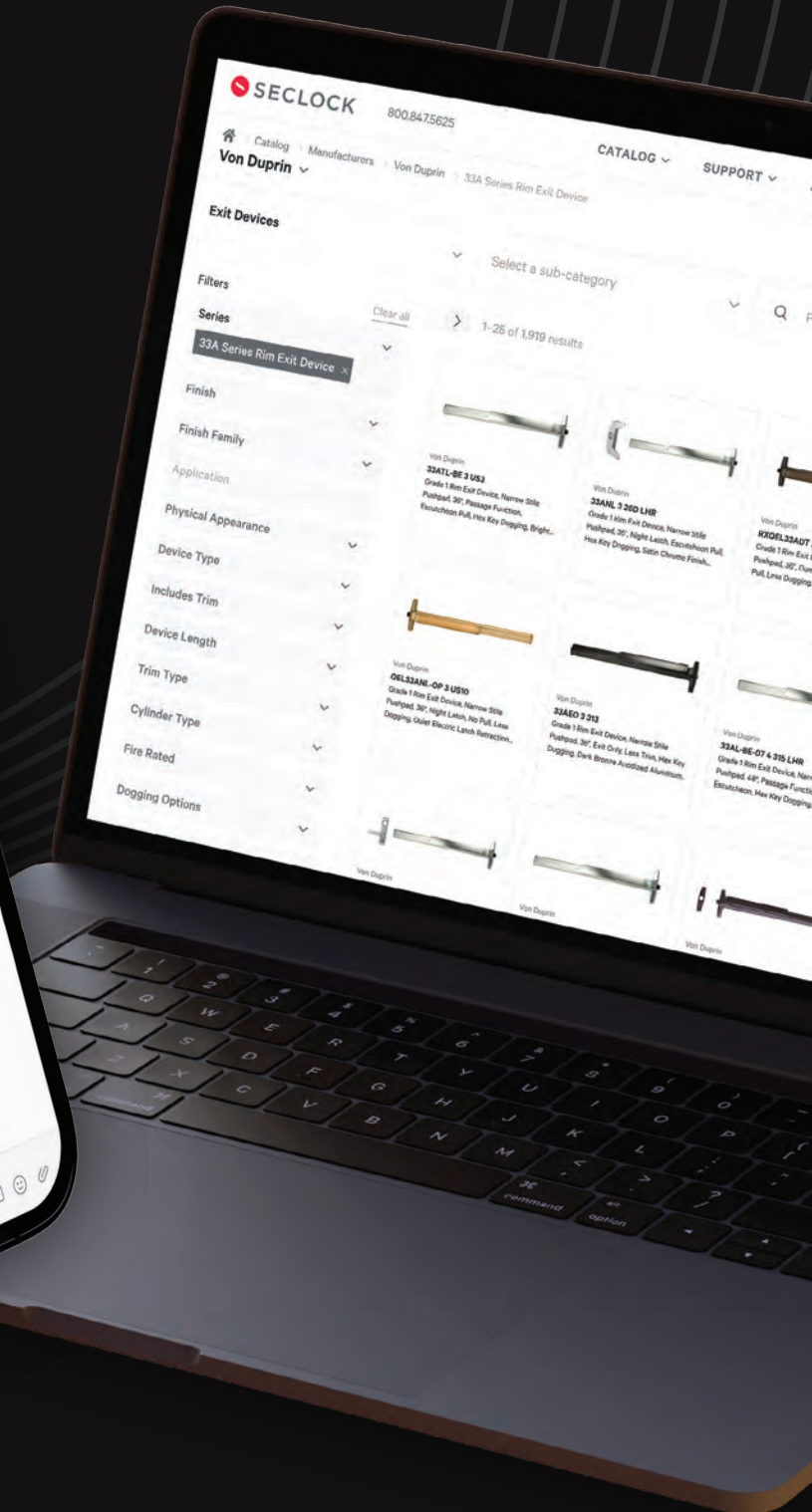
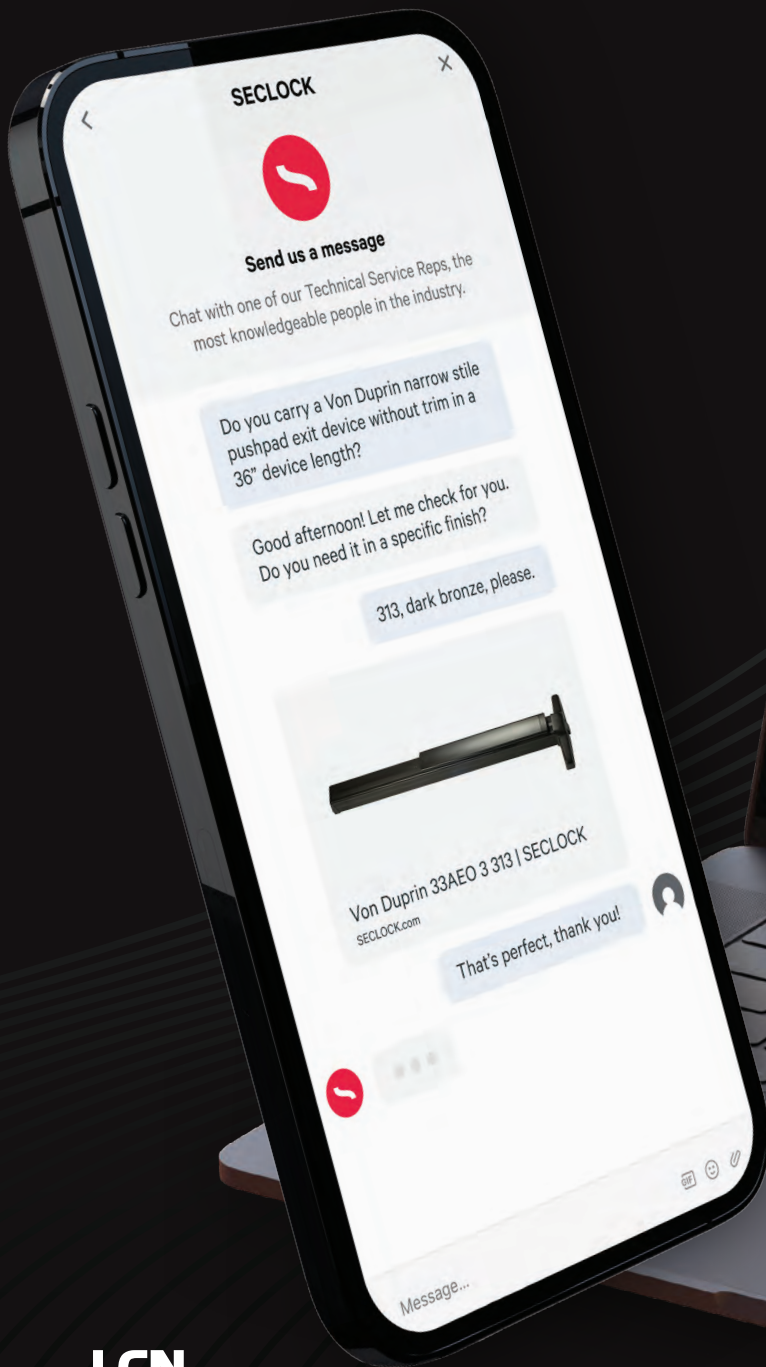
Example of electrochromic glazing in tinted state and clear state. Photos by SageGlass.



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GLASS INFORMATIONAL BULLETIN — DYNAMIC GLAZING

other electrochromic materials onto a float glass substrate. Tinting of the glass occurs with the application of a low-voltage direct current (less than 5 volts), which causes lithium ions to move from an ion-storage layer through an ion-conducting layer, into an electrochromic layer. The presence of ions causes this electrochromic layer to absorb visible light, ultraviolet and near infrared light, in proportion to the number of ions transferred, thus making the glass appear tinted. The glazing can be switched from a highly transparent state to a highly tinted state. Electrochromic glass can be configured to respond to manual control or controlled automatically using sensors for light, temperature, occupancy or time of day.

Photochromic glass

Photochromic materials change their transparency in response to UV light. The glass can be made with integral photochromic compounds or a photochromic film that is laminated between or applied to glass. The main application of photochromic materials is in eyeglasses that change from clear in dim indoor light to dark in bright outdoors.

Liquid crystal glass

Liquid crystal glass is made by encapsulating a liquid-like layer in which organic particles are suspended between two sheets of either polyethylene terephthalate plastic, soda-lime glass or borosilicate glass. These sheets are coated with a transparent conducting oxide, then laminated between two lites of glass using two adhesive layers. Liquid crystal glass may be used as privacy glazing because it transitions from a translucent to transparent state. When power is off,

NGA thanks our task group volunteers for updating this resource: DJ Weil of Trulite, Kayla Natividad of Pilkington, Ted Derby of Intertek, Nicholas Koren of SageGlass, Tom Niziolek of Argotek, Rob Carlson of Tristar, Aaron Thompson of Viracon, Matt Kamper of Woodbridge Glass, and Abbie Legara of Aluminum and Glazing Lines.

the liquid crystals are in a random and unaligned state. They scatter light, which makes the glass appear translucent, thus obscuring direct views and providing privacy. When the voltage is applied, the crystals align, allowing light to pass through and thus appearing transparent.

The light transmission and the SHGC are not modulated in this product, since the light is scattered, not blocked, so it provides little energy or glare control performance. Therefore, this type of dynamic glazing is used most often for privacy in interior applications, such as bathrooms, conference rooms and changing rooms in retail stores.

Sunlight-activated (thermochromic) glass

Sunlight-activated glazing changes its VLT and SHGC properties based on absorbed sunlight, which changes the temperature of the glass. Sunlight-activated glazing is constructed with an extruded thermochromic polyvinyl butyral film. Additives in the film respond to increasing temperature to slowly vary the VLT and SHGC, as well as fading factors when laminated between two lites of glass and exposed to the sun.

Suspended particle device glass

In a similar way to liquid crystal glazing, suspended particle device, or SPD, glass is constructed using two electrically conductive coated plastic layers with an emulsion containing suspended particles placed between the plastic layers forming a film or sheet. This is then laminated between two lites of glass using two adhesive interlayers, one on either side of the plastic film. SPDs are electronically controlled to provide variable tinting. When voltage (approximately 80 volts) is applied to the SPD, the suspended particles align and allow light to flow through unhindered (the clear state). Once the electricity is turned off, the particles revert to a random pattern and block (absorb) light (the tinted state). In the tinted state, SPD only modulates the visible light. The near infrared is not blocked. SPD can be made in the form of a monolithic glass-plastic laminate, or this laminate can be incorporated into insulating glass units with the addition of a solar control low-emissivity glass for improved solar heat gain and insulation value.

Thermotropic glass

Thermotropic glazing is constructed with the active thermal component between lites of glass or plastic. There are three types of thermotropic glazing: reflective, absorbing and light scattering. The VLT of a thermotropic glazing changes when the ambient temperature exceeds a fixed activating temperature set point, so it is an “on-off” temperature activated technology. When this temperature threshold is exceeded, the VLT changes from a highly transparent state to a tinted reflective or light scattering state (depending on the type). ■

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NSG Group Ceases Production at German Float Line

The NSG Group decided to cease production at one of its two float glass lines in Gladbeck, Germany. This is in response to a review of the current and medium-term weak demand situation in the German and wider European glass markets, and adds to the previous announcement about the early closure of one of the group's float lines in Weiherhammer, Germany. The group is confident that European markets will recover over the medium-to-long term, however the exact timing of a potential restart of the line will be decided at a later date. This measure will result in a reduction of the workforce at the site of more than 100 employees.

Assa Abloy Acquires Lawrence Doors

Assa Abloy acquired Lawrence Doors, a U.S. manufacturer of coiling steel doors, grilles and counter shutters. Lawrence Doors was founded in 1925 and has about 120 employees. The main office and factory are located in Baldwin Park, California. Lawrence Doors will be part of the residential business segment within the entrance systems division.

Apogee Enterprises Completes Acquisition of UW Solutions

Apogee Enterprises Inc. completed the acquisition of UW Interco LLC. UW Solutions is a U.S.-based, vertically integrated manufacturer of high-performance coated substrates. The company serves a broad range of customers in end markets, including building products for distribution

centers and manufacturing facilities, as well as premium products for the graphic arts market.

YKK AP America Expands Engineering Center

YKK AP America expanded its engineering center in the Western region; now established at its Los Angeles sales and manufacturing center, which services California, Arizona, Nevada and New Mexico.

The engineering center collaborates with architects and glazing contractors to bring their project visions to life. Focusing on product application, the team works closely with customers to understand the project challenges and performance criteria, and modifies YKK AP systems to meet specific needs.

Şişecam Launches Pioneering Initiative, Shares Strategic Goals in Soda Ash

Şişecam's Plant of the Future platform is an open platform where people can participate and share ideas, with a vision of digitalization and sustainability. Bringing together Şişecam's nearly 90 years of expertise with the competencies of suppliers and technology providers, this initiative aims to foster collaboration and innovation in the industry. Operating under a call-based open innovation model, the Plant of the Future will generate tangible solutions from innovative ideas.

During the World Soda Ash Conference, Şişecam CEO Görkem Elverici outlined the future potential of the soda ash industry and presented

Şişecam's strategy for steering the sector towards sustainable growth. He highlighted the company's growth journey and strategic targets in soda ash, emphasizing the importance of collaboration among industry players.

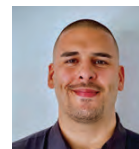
PEOPLE



Thurman



Cook



Cedeño



Zaun

General Glass International promoted *Brad Thurman* to vice president of sales and marketing. In his new role he will oversee the growth and strategic development of GGI's specialty glass and distribution divisions.

GGI also promoted *Scott Cook* to director of sales for the distribution and fabrication divisions and *Victor Cedeño* to field sales representative.

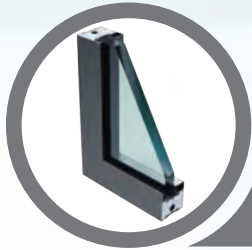
GlasPro Inc. announced that *Todd Zaun* joined its Southern California sales team. Before joining GlasPro, he served as president of Zaun Glass Co., a glazing contractor with decades of experience performing installations. In his role, Zaun developed long-standing relationships with major glass manufacturers and maintained a reputation in the commercial construction, residential construction and entertainments industries. ■

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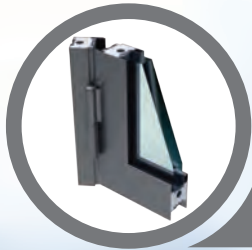


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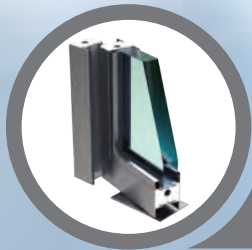
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A multi-story, fire-rated glass curtain wall at the MultiCare Good Samaritan Hospital Dally Tower in Puyallup, Washington, meets building code requirements and design intent. Photo courtesy of TGP.

optimize daylight, soften transitions between spaces and facilitate views of neighboring spaces and the outside—a quality often held in tandem with the benefits of daylighting. From façades to interiors, these systems can meet several building demands, including fire- and life-safety requirements, while supporting a well-lit, patient-focused interior.

Daylit entrances and lobbies with exterior curtain walls

Exterior glass curtain walls allow light to flood the perimeter areas of healthcare facilities, including entrances, lobbies, waiting areas and more. Providing adequate daylight within hospital units can help reduce perceived stress and pain levels, as indicated in a 2005 study in *Psychosomatic Medicine* titled “The Effect of Sunlight on Postoperative Analgesic Medication Use: A Prospective Study of Patients Undergoing Spinal Surgery.” A comparable 2022 study from the *Journal of Interior Design*, “Recognition Memory for Interior Spaces with Biomorph or Non-Biomorph Interior Architectural Elements,” also found that environmental factors, including daylight, reduced anxiety for patients in waiting areas before surgery.

Daylight’s benefits were not lost on the design team behind the Morgan Stanley Adult Emergency Room expansion at New York Presbyterian Hospital. The department sees over 80,000 patients a year, so creating a lobby that could contribute to the mental well-being of patients and their families was crucial.

TRENDHUNTER

DAYLIGHT...STAT

USING GLASS CURTAIN WALLS IN HEALTHCARE SETTINGS TO PROMOTE HEALING AND RESTORATIVE ENVIRONMENTS
BY DEVIN BOWMAN

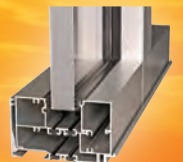
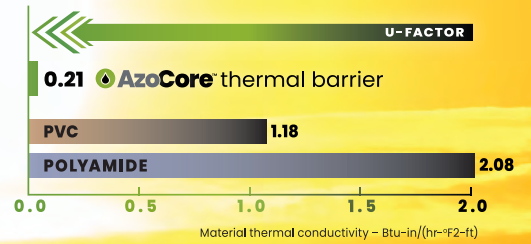
Daylighting is often central to occupant comfort. In healthcare settings, naturally lit interiors can also support patient outcomes. From lowering perceived pain levels to regulating circadian rhythms, daylight can shorten patient stays. It can also help keep medical staff alert and comfortable.

Bringing daylight into a building’s interior requires the finesse of balancing access, glare, potential for overheating and more. Among daylighting options, transparent glass curtain walls are ideal for areas where it is desirable to

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The architects planned an exterior glass curtain wall system comprised of 18.5-foot spans of narrow-profile steel framing. Since steel has approximately three times the strength of aluminum, it maximizes glazing panel size, thereby increasing the amount of daylight allowed in. This system contributes to the well-being of the admitted occupants and the medical staff.

To balance access and glare, the design team used an interior channel glass system to allow the light to diffuse evenly into the treatment areas—as can other decorative glass types. This hospital showcases how glass curtain walls and other glazing assemblies can benefit hospital interiors.

Behind the façade: Benefits of interior curtain walls

Interior curtain wall assemblies allow light transfer between perimeter areas and those deeper inside. They can

DESIGNING WITH TRANSPARENT GLASS CURTAIN WALLS CAN HELP CREATE SPACES THAT SUPPORT PATIENT RECOVERY TIMELINES AND OVERALL MENTAL WELL-BEING.

support visual connectivity and intuitive wayfinding when placed around staircases. For healthcare settings that use smaller, zoned HVAC units, interior glass curtain walls can provide comparable U-values to opaque materials while allowing light transfer. This supports more energy-efficient operation. Interior

curtain walls can also be fire-rated to meet building code requirements.

For example, to meet code requirements for means of egress without sacrificing the benefits of interior curtain walls, the architectural firms behind Dally Tower at MultiCare Good Samaritan Hospital encased the central elevator and stairwell with a fire-rated glass curtain wall. This allowed light from exterior windows and skylights above the stairwell to flow into areas deep within the building. In addition to its fire-resistive rating, this multi-story, steel-framed system also provided a close visual match to adjacent, non-rated assemblies for a seamless design aesthetic.

Elevating interiors and supporting patient outcomes

Designing with transparent glass curtain walls can help create spaces that support patient recovery timelines and overall mental well-being. These systems can also provide daylight access for healthcare professionals to regulate cortisol, melatonin and serotonin secretions, supporting regular circadian rhythms and improving mood.

Curtain walls with large spans of glass also support beautifully designed spaces that feel connected to their surroundings. For large curtainwall spans, designers can also incorporate internal louvers or photovoltaic glass if a project has particular performance requirements. These systems help create pleasantly restorative healthcare spaces. Understanding how glass curtain walls fit within the function of a hospital will help glazing professionals successfully recommend and install systems for these project types. ■

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Devin Bowman is general manager of Technical Glass Products and AD Systems. With nearly

20 years of industry experience, he is actively involved in advancing fire- and life-safety codes and sits on the Glazing Industry Code Committee.

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WHY DO CONSTRUCTION COMPANIES INCUR DEBT? THE MOST COMMON REASON FOR USING DEBT IS TO FINANCE LARGE PURCHASES NEEDED TO OPERATE THE BUSINESS. ALTERNATIVELY, CONSTRUCTION COMPANIES MAY ALSO TURN TO DEBT TO FINANCE GROWTH OPPORTUNITIES.

THE DEBT DILEMMA

HOW MUCH DEBT IS TOO MUCH FOR YOUR BUSINESS?
BY MARCO TERRY

Debt is an essential tool to help companies maintain operations and grow. It is also a double-edged sword that can ruin a company if not managed correctly. Too much debt can push your business to the point of failure. Avoiding a debt problem is much easier than fixing one.

There is no ideal level of debt that works for every economic environment. Furthermore, there is no consensus on what qualifies as a safe level of debt. It's easy to see why so many companies get into trouble. Here are some approaches to managing debt that work well and are simple to apply.

How to look at debt

Why do construction companies incur debt? The most common reason for using debt is to finance large purchases needed to operate the business. Alternatively, construction companies may also turn to debt to finance growth opportunities.

While there may be other reasons to use debt, such as increasing your return on equity, if you are engaging in those strategies, I assume you are working with a qualified adviser.

Debt to operate the business.

Essential to your business, this type of debt is often used for capital expenses. For example, construction companies need vehicles and machinery to operate the business, and these items must be replaced periodically. These purchases are not optional. Without them, you will eventually go out of business.

Few companies have the resources to make these large purchases in cash. They finance these purchases with debt. Consequently, you may need to incur this debt to stay in business.

Debt to grow the business. This type of debt is used to pursue "optional" growth opportunities, which are not essential to staying in business. Instead, you pursue these opportunities to increase your profits. Examples of growth opportunities include expanding into new service areas, launching new products and acquiring other companies.

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Using debt to finance growth carries a higher risk because the opportunities are optional but could have a significant negative impact if they fail.

Prioritizing stability versus driving growth

All business owners aim for lasting stability coupled with significant revenue growth. The problem is that these two objectives are usually contradictory. Growth usually comes at the expense of stability and vice versa.

Typically, a strategy that focuses on significant growth uses debt. Higher debt loads are risky because they increase exposure to serious financial problems. Consequently, this strategy affects your company’s stability.

In contrast, a strategy focusing only on stability minimizes risk and growth potential. The company incurs essential debt only to stay in business, and

growth opportunities are not pursued or financed. This strategy improves stability but at the expense of growth.

Focusing solely on one approach may not be a good long-term choice. Instead, find a balance that works for you.

The slow and steady approach

A preferred strategy is to focus on slow and steady growth. It allows you to concentrate on stability while pursuing growth selectively, keeping risk at bay.

A slow and steady approach requires discipline and patience. It can work well for owners with a long-term horizon who may want to pass the company to the next generation.

Focus on maintaining and improving operations until you spot an opportunity with high reward potential but low risk. This approach limits your use of debt to finance growth since you pursue only the most attractive projects.

Great opportunities don’t come along often, but we all see a few in our careers. And you don’t need many of them to achieve outstanding results.

Don’t underestimate the power of slow growth over the long term. An average growth rate of 5% per year may look unimpressive. However, after 15 years, the business will have doubled in size. Not bad for a small business.

Timeless takeaways

Companies with serious financial problems have some similarities. Many never had a good cash reserve, had loaded up on debt, or both.

Have a large cash reserve. Small companies typically have tight cash reserves. This lack of cash exposes companies to financial problems if something goes wrong. While some business owners see cash reserves as idle money that could be invested in growth, a large cash reserve should be considered a dependable safety net.

Avoid easy debt. Companies can easily get into debt, and several products provide quick financing with minimal documentation. However, there is a catch—these loans are usually expensive, have onerous terms and can be misused. Some companies get additional loans before paying off the previous ones, resulting in several open loans with payments that exceed the company’s ability to pay them. This scenario usually ends badly. ■



Marco Terry is managing director of Commercial Capital LLC, a factoring company and provider

of invoice financing to companies in the glass industry.

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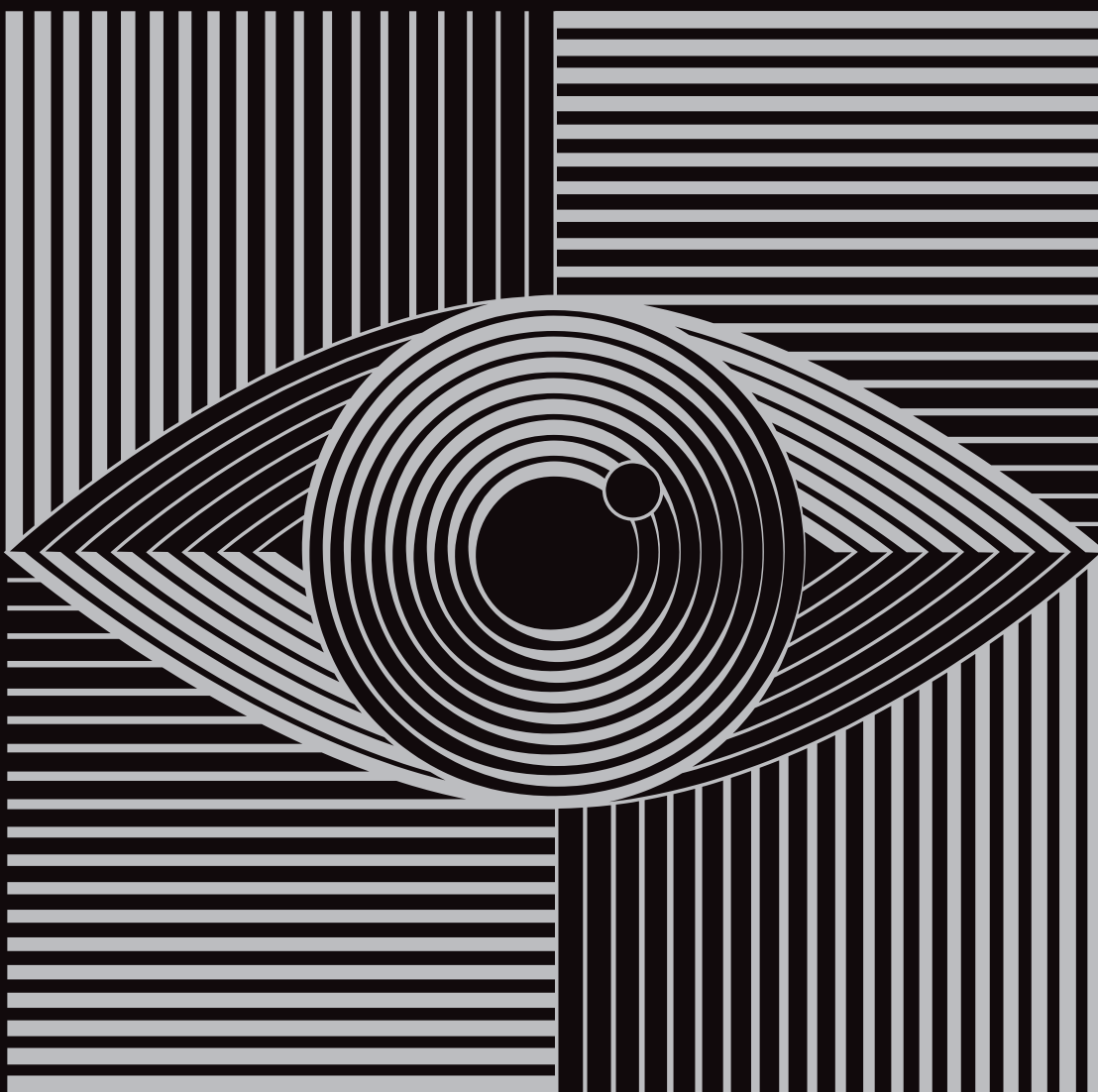
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THE 2025 FORECAST

TOP TAKEAWAYS



Last year presented several significant challenges for the construction industry, particularly in the commercial sector. The industry faces persistent difficulties in attracting and retaining talent, ongoing supply chain disruptions fueled by geopolitical tensions and global economic uncertainties, higher interest rates, economic uncertainty, inflationary pressures, and shifting regulatory hurdles in response to natural disasters and evolving building codes and environmental regulations. Despite these significant hurdles, construction spending crossed \$2 trillion and maintained a balanced trajectory in the first half of 2024, according to a Deloitte analysis of data from the U.S. Census Bureau. And the Dodge Momentum Index, a measure of nonresidential building spending, has been on a steady rise in the second quarter of 2024, reflecting growing confidence in market conditions among owners and developers. →

01

MACROECONOMIC
PERSPECTIVES
AND PROJECTIONS
P. 40

02

NONRESIDENTIAL
CONSTRUCTION
P. 44

03

RESIDENTIAL
CONSTRUCTION
P. 54



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2025 FORECAST

01

Editor's Note: The following is based on forecast presentations from Dodge Construction Network's 2025 Annual Outlook, ConstructConnect's Fall 2024 Economic Outlook, the American Institute of Architects' Consensus Construction Forecast, Deloitte's 2025 Engineering & Construction Industry Outlook, and the annual economic forecast from GlassBuild America 2024 from Connor Lokar, senior forecaster for ITR Economics.

Macroeconomic perspectives and projections

U.S. economy holding its own

"The reasons I feel most positive about 2025 really comes down to the fact that the Federal Reserve has started to cut rates," says Richard Branch, chief economist, Dodge Data & Analytics. "We had the 50 basis point cut from the Fed in September. We had another 25 basis points last week [in November]. We think the Fed will go again in December. That's a full 100 basis points of cuts this year. And we think there's another 100 basis point cut through the course of 2025. By the end of 2025, the Fed's funds rate will be at around 3%."

"We're projecting inflation will be back at 3% to 5% as we move through the rest of the 2020s," says Connor Lokar, senior forecaster, ITR Economics. "You need to make a plan in your business with how you're going to deal with higher inflation and interest rates."

Lower rates to support growth in 2025

With the three major categories—residential, nonresidential and infrastructure—in

totality, Dodge forecasts total construction starts will rise 9% in 2025, to \$1.3 trillion.

"The thing we really need to look at is how are lower rates impacting the economy," says Branch. "We need to process that there's not going to be a massive uptick in construction or economic activity. It's going to take probably about 125, maybe even 150 basis points, in cuts before we start seeing a more consistent growth in the economy the construction market."

Dollar value of projects stabilizing

Branch's optimism on the construction sector is tied into the Dodge Momentum Index, which tracks nonresidential building projects under \$500 billion as they enter the earliest stages of planning. Planning took a step backwards in 2023 over unfounded fears that the economy would go into recession, and developers began slow-walking projects through the planning cycle. The recession didn't materialize, and throughout 2024, the DMI remained reasonably stable, despite a mix of high rates, labor and materials challenges.

"The one big takeaway I have is that this has remained stable for so long," says Branch. "It tells me that developers and owners feel reasonably positive that the conditions for construction will improve in the future, and they want to have projects sitting in the pipeline ready to go for when those conditions improve."

The state of the transition

"How is the election going to impact the forecast? Quite frankly, the truth of the matter is we just don't know," says Branch. "It's a mix of positive and negative for the construction sector." On the positive side, tax cuts could help the bottom line of construction tradespeople across the country. On the negative side, aggressive legislation on undocumented workers could possibly derail any growth potential in construction and manufacturing.

Ken Simonson, chief economist, Associated General Contractors of America, predicts that lessened federal regulations anticipated under the incoming Trump administration could help some

projects start sooner. At the same time, tariffs that President-elect Donald Trump has said he will institute have the potential to cause “a huge spike in prices” and could likely trigger a trade war, says Simonson. “We’d see a lot of projects canceled or at least scaled back.”

A Trump presidency, with a Republican-led Congress, should positively impact the overall construction economy, according to Michael Guckes, chief economist, ConstructConnect, who agrees that a relaxed regulatory environment will promote construction activity, along with lower taxes and the opening of federal lands to development. “These changes could free the construction industry of the regulations that have historically held it back from faster growth,” Guckes says.

“It’s unclear how much legislation is going to move in 2025 now,” adds Simonson. “President-elect Trump can impose tariffs without waiting for Congress, but some of the more drastic steps would require Congressional approval.”

Geopolitical conflicts and trade tensions

Several geopolitical conflicts and tensions could impact the construction industry in 2025. From Middle East tensions impacting oil prices and transportation, agitation between the U.S. and China over trade policies that could disrupt supply chains and increase construction material costs, escalating trade tensions between the U.S. and the European Union, and the ongoing Ukraine-Russia and Israel-Hamas conflicts,

many factors loom that could influence construction project timelines, budgets and availability of resources.

- The 200% tariff imposed by the U.S in March 2023 on aluminum and derivative products from Russia is still in effect.
- The Trump administration is calling for continued tariffs on Chinese products, between 60% and 100%.
- A tax of between 10% and 25% on every product imported from all U.S. trading partners (including Mexico, Canada and the European Union) is also under consideration.

Energy prices and geopolitical tensions are new risks added last year to the matrix that Dodge examines. Last year, Dodge predicted that geopolitical risk would remain intense, with tensions easing in the first three to six months of 2024. This year, Dodge is forecasting a “fairly



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Certain proposed policies risk triggering higher construction costs.”

MICHAEL GUCKES,
CONSTRUCTCONNECT

stable geopolitical situation.” “That’s not saying things will get better or that they’re going to get worse,” says Branch. “Basically, there’s no change from the situation now.”

The high impact of imported materials

New tariffs on imported materials could lead to higher costs, says Guckes. “Certain proposed policies risk triggering higher construction costs,” he continues. “Tariffs on imported construction goods, which would raise the price of these goods, may lead to a second spell of construction inflation.”

“Supplies have been pretty ample, and prices have come down a lot over the past year,” says Simonson. “But all that can be undone if President-elect Trump does impose across-the-board tariffs. When he did that for steel and aluminum—a 25% tariff on steel, 10% on aluminum—the domestic producers immediately matched those price increases. It’s not guaranteed that all prices will go up as much as the tariffs, but you can count on extensive increases.”

Facing the talent shortage

The construction industry continues to struggle with a significant talent shortage, with an average of 382,000 job openings each month from mid-year 2023 to 2024, marking the third consecutive year of increased vacancies.

The industry is also experiencing a shift in skill requirements, with Deloitte projecting that 44% of infrastructure roles are expected to evolve in the next five years. The aging work-

force is another concern; the National Center for Construction Education and Research projects the average age of trades workers will reach 46 by 2030. Younger generations, who have different expectations regarding work environments, are less interested in construction careers. In a 2024 workforce survey, the Associated General Contractors of America found that 50% of new construction industry hires fail to show up or quit shortly after starting.

Concern among contractors

“Quantity of qualified labor continues to be one of the greatest challenges that our industry is seeing and it’s not going to be easily solved, especially if we think about some of the proposed policies by the new administration coming into office next year,” says Guckes. “The construction workforce is very diversified; we benefit from people who come from all over the world. If, for any reason, that pipeline of people is pushed away, then we struggle with an additional supply issue. That means firms will struggle even more so to find enough qualified people.”

The new administration’s immigration policy will also be extremely important, but Trump’s comments on the issue “have not been encouraging” for contractors, says Simonson. “Construction has always relied more heavily than other sectors on foreign-born workers. And if the border really gets shut down more, and if deportations are part of the mix, that’s going to hit construction even harder than other sectors.”



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2025 FORECAST



Nonresidential construction

Commercial starts on the rise

- ↳ For 2025, commercial construction starts in the U.S. are projected to increase and see modest gains, up 7% (\$170 billion) in 2025. — Dodge
- ↳ Spending on nonresidential buildings is projected to increase over 7% in 2024, but then slow to only 2% growth next year. — AIA
- ↳ Nonresidential construction is coming off a strong 2023 and 2024 but is heading for a slowdown in 2025. — ITR Economics

“The good news here is when you look at 2025, recovery is starting to bloom in commercial construction,” says Branch. Commercial construction, closely tied to overall economic activity, is on the rise, with recovery signs becoming evident for 2025. The data includes new construction, additions and alterations, with trends influenced by inflation.

AIA agrees that reconstruction activity will impact the construction outlook moving forward. Surveys conducted by the AIA have discovered that about 50% of billings at architecture firms come from work on existing buildings,

including additions to existing facilities. AIA expects that the reconstruction share of total construction activity will continue to increase in the years ahead.

“With the 2025 construction landscape, there is unpredictability,” says Kristy O’Brien, director of content acquisition, ConstructConnect. “But we’ll be paying close attention to how remodels and repurposing of spaces continue to unfold... and if that continues.”

After soft demand over the past two years, architects are predicting a potential turnaround in 2025, says Kermit Baker, chief economist, American Institute of

Architects. A recent survey by the institute found more than two-thirds of its member firms were “somewhat confident” or “very confident” they will see improved business conditions in the next 12-18 months. “Call me an optimist, but I think we’re beginning to turn the corner,” says Baker. “I think we look to be near bottom and should be seeing things pick up again.”

“If we look forward into 2025 and beyond, we have hundreds of billions of dollars worth of mega projects that we continue to track in our forward-looking databases,” says Michael Guckes. Although some could be

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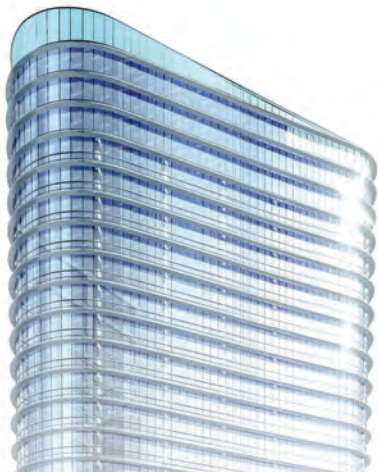
Commercial construction is fairly coincident with overall economic activity.”

RICHARD BRANCH, DCN

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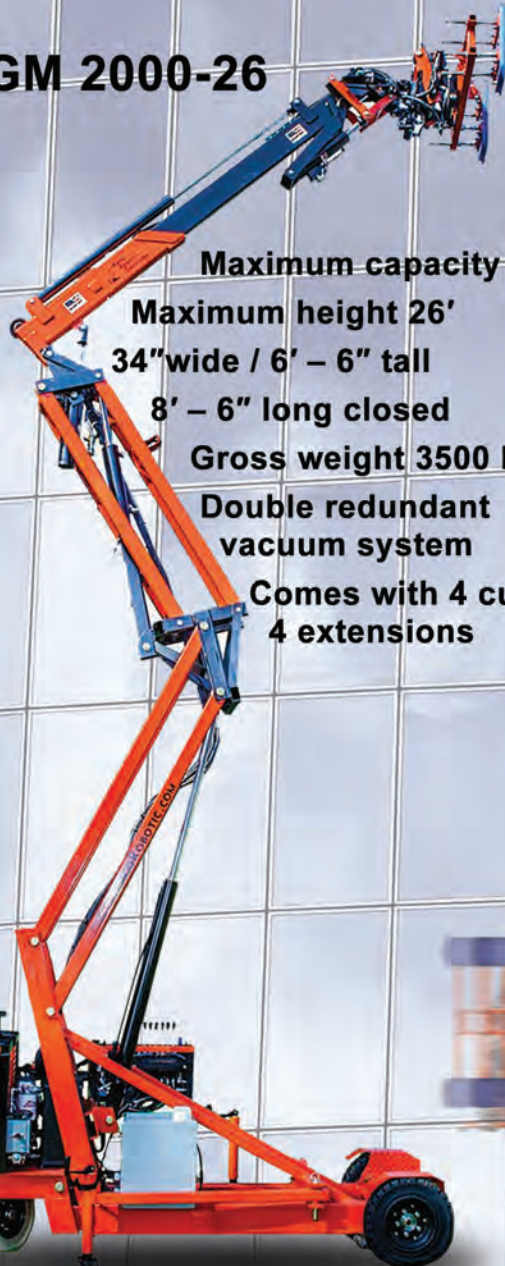
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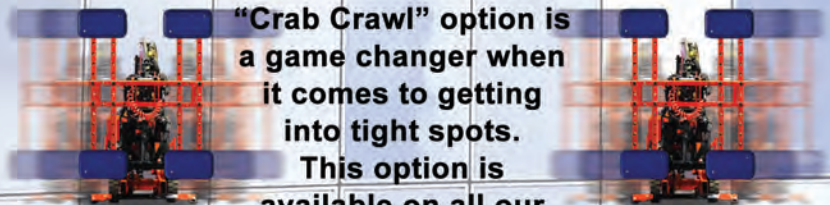
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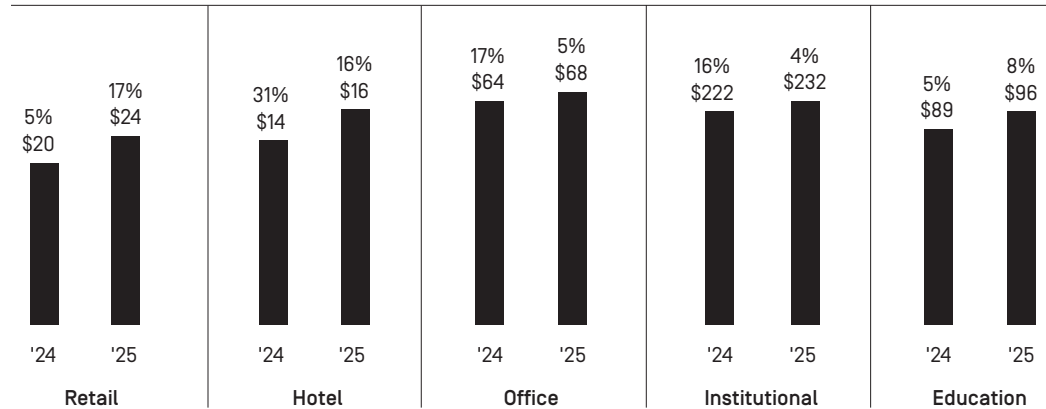
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2025 FORECAST



Commercial Construction Starts (billions of dollars)



Source: Dodge Construction Network

delayed into a future year, Guckes says the inventory of existing mega projects is “very encouraging.”

Some forecasts are projecting a slowdown for nonresidential construction. Nonresidential construction is coming off a strong 2023 and 2024, but is heading for a slowdown in 2025, says Connor Lokar. “Most of you are busy. You are at the top of the business cycle. ... We want you to make sure that we are observing an appropriate amount of caution,” Lokar says. “This is not the Great Recession. This is just a softening.” Lokar believes the market should rebound and “ramp up” in 2026 and 2027.

Retail starts on the road to recovery

↳ Retail construction starts in the U.S. are projected to increase 17% [\$24 billion] in 2025. — Dodge

↳ Shopping-centered construction will be at 25.6% for 2025. — ConstructConnect

Retail construction is rebounding, closely tied to residential development. Typically, retail projects follow

housing starts by about 12 months, but 2024 retail activity grew even though residential starts declined in 2023. This deviation reflects a focus on underserved areas, where developers are accelerating projects to meet demand.

This recovery is expected to continue into 2025, bolstered by mixed-use developments that combine multifamily housing with retail spaces. Growth in multifamily projects, particularly those incorporating retail at ground level, is supporting the retail construction sector’s momentum.

“The strongest linkage between residential and nonresidential is in the retail sector,” says Branch. “It’s about 12 months from breaking ground on single-family to breaking ground on retail. In 2023, residential starts declined, but we have retail growth growing in 2024, with retail activity happening in zip codes that were underserved from a retail perspective. This has changed; developers are trying to get in early and accelerate projects through the planning cycle. I think that trend continues into 2025, and you get the bonus of retail construction from

the traditional 12-month lag.”

Leading retail chains are showing a mix of activity dominated by alterations. Walmart and Target are focused on renovations of older supercenters to appeal to suburban and rural customers, and grocery stores, quick-service restaurants and home-improvement chains like Home Depot, Lowe’s and Harbor Freight are seeing strong activity, closely tied to residential development.

Core office starts to weaken further in 2025

↳ For 2025, core office starts in the U.S. are projected to drop 10%. — Dodge

↳ While traditional office spending has been declining, spending on data centers has been rapidly increasing. U.S. Commerce Department figures peg data center spending as accounting for over 3% of the overall nonresidential building market. — AIA

↳ A focus on artificial intelligence will boost data center construction in 2025, a projected increase of 24% [\$35 billion]. — Dodge



Core office construction is expected to weaken further in 2025, with starts down 30% in square footage compared to 2019. Alterations now make up 50% to 55% of the market, reflecting upgrades from Class B to Class A space. The sector is unlikely to regain pre-pandemic levels in this cycle but may stabilize by 2026, with modest growth afterward.

This trend reflects a long-term evolution, accelerated by the pandemic, similar to the retail sector's transformation after the Great Recession. While the office market has steadily declined since its peak in 1985, it is likely transitioning into a smaller but potentially healthier and more dynamic phase, according to Dodge.

"When we take out data centers from our office forecast, it doesn't look good," says Branch. "But bear in mind, alteration is usually about 30% to 35% of the market, and right now, it's closer to 50% or 55%. I would liken this to what happened to the retail sector after the GFC [Great Financial Crisis]. Many said that retail would die as e-commerce took over, but it

didn't die; it evolved. It's certainly a much smaller sector than it was prior to the GFC, but I would argue that right now the retail sector is actually healthier and more dynamic than it was prior to the Great Recession. I think the same thing happens in office."

AI focus to boost data center construction

Demand for AI, cloud security, backup and national security applications are driving aggressive data center construction growth. A key challenge for future expansion is the high energy demand of data centers. Power availability is becoming a constraint, with companies exploring solutions such as reopening nuclear plants and testing micro nuclear reactors. These factors may limit sustained growth rates beyond 2025.

"What we have for 2026 and forward is more of a plateau for data centers," says Branch. "It's not a decline, but power is a significant issue, and we think this could be a restraining factor to further data center build-out, or at least a continuation of these kind of growth rates once we get past 2025."

Upgrade cycle for hotels began in 2024

↳ Hotel construction starts in the U.S. are projected to increase 16% (\$16 billion) in 2025. — Dodge

↳ Hotel construction spending is forecast to grow 6.6% in 2025. — AIA

↳ For hotels, solid rebounds [28.7%] are expected in 2025. — ConstructConnect

↳ The Q3 2024 U.S. Hotel Construction Pipeline Trend Report reported an 11% increase in projects YOY, with projects scheduled to start construction in the next 12 months and projects in early planning up 17%. — Lodging Econometrics

The hotel sector has shown strong recovery post-pandemic, with occupancy rates returning to 70% and average daily room rates increasing. In 2024, the sector entered an upgrade cycle, evidenced by a 5% increase in square footage but a significant 31% rise in dollar value, highlighting higher-end renovations and rebranding efforts.

Alterations dominate the current cycle, with hotels switching chains (e.g., Marriott to Hilton) or upgrading within brands. This mirrors patterns seen after the Great Recession, where initial upgrades transitioned into new construction. A shift to more new hotel builds is expected to begin in 2025.

"Hotels have been the best news story here in commercial other than data centers," says Branch. "Occupancy rates are pretty much right back where they were prior to the pandemic, and average daily room rates are growing nicely as well."

Hotel construction activity is concentrated in upper-tier and upscale properties, driven by a post-pandemic focus on experience over value, reflecting the strength of leisure and tourism travel. Business travel is also rebounding, supporting growth in extended-stay and mid-market properties without food services.

However, mid-market

Glass Industry Closures and Layoffs

Signs of a slowing market are already starting to emerge in the glass industry. **Vetrotech North America**, a subsidiary of Saint-Gobain, is ceasing its operations in North America, including production at its facilities in Auburn, Washington, and Faribault, Minnesota. The decision was announced in December 2024.

Last month, **Oldcastle BuildingEnvelope** also announced the closing of its Los Angeles-area facility at the end of 2024, resulting in 113 employees being laid off. Earlier this year, **Vitro** closed a plant in Salem, Oregon, laying off 37 of its workers. After 50 years in business in San Marcos, Texas, **Thad Ziegler Glass** shuttered its doors this summer.

PGT Innovations, the third largest private employer in Sarasota County, Florida, announced mass layoffs of over 200 people in Tampa, Florida, and has done a workforce realignment at its Venice facility. In October, **Jeld-Wen** announced it was laying off 152 workers and earlier in the year, Jeld-Wen announced the closing of its Hawkins, Wisconsin, facility affecting 338 employees and Vista, California, resulting in the loss of 110 jobs. Also earlier in the year, **Quanex** closed its facility in Richmond, Kentucky, impacting almost every employee there.



2025 FORECAST

02

hotels with food services are seeing limited activity, potentially due to labor shortages, making it difficult to staff both hotel operations and kitchens. The ongoing upgrade cycle, once initiated, is unlikely to slow down, given the competitive nature of the hotel market. Historically, only major disruptions like the pandemic have paused such cycles.

“I think the good news on hotels is that once that upgrade cycle starts, it’s really hard to stop. It’s a very competitive market and it took the pandemic to kill the last upgrade cycle,” says Branch.

Institutional building starts to ease in 2025

↳ For 2025, institutional construction starts in the U.S. are projected to ease and see

modest gains, up 4% (\$232 billion) in 2025. — Dodge

↳ Institutional construction will see a more than 10% gain in 2024 before slowing to 4% in 2025. — AIA

Institutional construction is expected to ease in 2025, partly due to its tendency to lag the broader market. However, the sector remains robust, supported by diverse and significant projects breaking ground across the country in 2024. While growth may decelerate after a strong 2024, the market is still characterized as healthy and diverse.

“Institutional construction tends to lag the overall market, and that’s part of why you see growth accelerating in 2025,” says Branch. “But

I don’t want to characterize this market as losing momentum, because if you look at the largest projects breaking ground, this is a very healthy market with very diverse projects, coming off a lot of robust activity in 2024.”

Health starts poised for growth

↳ For 2025, healthcare construction spending in the U.S. is projected to see modest gains, up 11% [\$51 billion] in 2025. — Dodge

↳ Healthcare construction, which saw growth throughout the pandemic, is poised for a 7% gain in 2024, and an additional 4% next year. — AIA

↳ Publicly funded healthcare projects may not see a

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softening as soon, or as much, as privately funded projects; however, the market should come back around in 2026. — ITR Economics

- ↳ Hospitals and clinics (6.4%), and outpatient surgery and imaging centers as well as medical offices (13.6%) are expected to have a strong showing in 2025. — ConstructConnect

The healthcare market, divided into clinics, nursing homes and traditional hospitals, shows varied trends. Clinic activity remains steady, resembling the retail sector with urgent care centers often located in commercial hubs. Hospital construction is increasing, driven by the development of hub-and-spoke systems linking clinics and hospitals, as well as mergers and acquisitions in the industry. Meanwhile, nursing homes have seen a 20% decline in square footage since the pandemic, with a shift towards active adult and independent living communities.

Education starts trending up, lab projects slipping

- ↳ For 2025, education construction spending is projected to modestly increase 8% (\$96 billion). — Dodge

- ↳ Much of the projected growth in the overall institutional sector will be generated by the education market, an increase of 4.4% in 2024. — AIA

- ↳ Publicly funded education projects may not see a softening as soon, or as much, as privately funded projects;

however, the market should come back around in 2026.
— ITR Economics

↳ For education, a soft rise [0.5%] is expected in 2025.
— ConstructConnect

The education market—comprising kindergarten to grade 12 schools, colleges and universities, and laboratories—is experiencing mixed trends. Growth for K-12 is supported by favorable demographics in the Sunbelt and Western states (excluding California), offset by weaker growth in the Midwest and Northeast. State funding is expected to dip in 2025, but strong local funding from higher property values should balance this.

Demographic trends for colleges and universities are weak, with high tuition costs prompting more deferred enrollments, though vocational and trade school enrollments are rising. Competitive pressures among institutions to improve facilities create opportunities for construction projects.

Overall, education construction is projected to grow 8%, with K-12 outpacing the average, colleges at the average, and labs and other sectors (libraries, museums) lagging slightly.

“The great thing about the college and university sectors is that it’s very competitive, a lot like the hotel sector in the sense that there’s a race within colleges to have the best facilities and labs,” says Branch. “We saw a big uptick due to scientific initiatives in the wake of the pandemic, and then a bit of a correction happening. Now, lab construction is starting to cycle back.”



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Residential construction

“What’s happening in the residential market is key to understanding what’s going to happen in the nonresidential space,” says Branch. “The demographics are fairly positive. We’re looking at 2.5 million new households, created between 2024 and 2025, so much faster than what we saw just prior to the pandemic. And a lot of this new household formation is taking place in ‘Sunbelt States’ where there’s a lot of pent-up household demand.”

Single-family decelerating into 2025

But this growth couldn’t come at a worse time, says Branch. “The housing market is woefully under-supplied; our measure of the shortage is around 1.2 to maybe 2.2 million units.” Upward pressure on housing prices will keep younger and less-affluent Americans from the single-family side of the residential market, forcing them into the multifamily market.

“Single-family hit a trough back in early 2023 and has been rising steadily since then,” says Branch. “Single-family units this year-to-date through September are up 18%. We expect the fourth quarter for single-family housing to be essentially

flat. New home sales are up around 3% year-to-date for 2024. It looks like construction is a bit ahead of the market, and that’s part of why we have single-family decelerating into 2025.”

Multifamily starts accelerating into 2025

Multifamily construction has been in a slump for the past 21 months, and completions for multifamily have been trending down since then,

but Branch sees multifamily starts accelerating into 2025. “If you look at the multifamily vacancy rate, it’s gone up about 7,500 basis points over the last year,” says Branch. “This is still a fairly robust (and tight) market. Add on crowding out of the market and continued affordability issues on the single-family side, I would offer it can safely absorb more.”

Retail recovery is expected to continue into 2025, bolstered by mixed-use developments that combine multifamily housing with retail spaces. Growth in multifamily projects, particularly those incorporating retail at ground level, is supporting the retail construction sector’s momentum moving forward.

“Multifamily planning projects actually troughed back in November 2023 and have been trending higher since,” says Branch. “It takes somewhere around 17 months for a multifamily project to transit from planning to groundbreaking, so 17 months from November 2023 puts a trough in starts activity in early 2025. We think the planning data is telling us that there could be fairly aggressive growth in 2025 multifamily.” ■

“

Single-family residential construction leads the economy into recovery, and it leads the economy into decline.”

RICHARD BRANCH,
DCN

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


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GLASS

2024 ANNUAL REPORT

NGA MEMBER COMPANY
ENCLOSURES UNLIMITED
INC. PROVIDES THE
DESIGN, FABRICATION AND
INSTALLATION SERVICES
FOR SHOWER ENCLOSURES
AND OTHER RESIDENTIAL
GLASS PROJECTS.



DELIVERING ON
OUR



GOALS

IN

this 2024 annual report, you will see the ways NGA delivered on its four strategic goals:

- **Workforce Development** - Advance the industry as a viable, thriving and exciting career path.
- **Advocate** - Be a strong advocate to promote and defend the glass industry.
- **Educate** - Drive excellence, safety and results through education and training.
- **Promote** - Elevate the image of glass as a safe, healthy, sustainable and inspiring building product.

From amplifying NGA's message at the largest GlassBuild America in 16 years, held in a new location – Dallas, Texas – in 2024 and bringing local high school students to the trade show floor to learn about careers in the glazing and glass building products industry firsthand, to rolling out a new, enhanced online learning experience on the updated MyGlassClass.com platform, and NGA's Board of Directors announcing that all glazing and fabricating courses on MyGlassClass.com are now free to members, NGA is providing more value to members than ever before.

2024 also saw NGA selected for its first federal grant from the Environmental Protection Agency for \$2.1 million and issue its first compensation benchmarking study for glazing and fabricating companies. Looking over this past year and toward the future, it's clear that NGA is raising the bar on its commitment to help members succeed.

Workforce Development

BUILDING THE NEXT GENERATION

NGA ROLLS OUT NEW TOOLS TO RECRUIT, TRAIN AND RETAIN EMPLOYEES

Recruiting

Raising awareness of the glass and glazing industry remains key to eventually easing the labor shortage. “While most people know what an electrician or plumber does, the same cannot be said of glaziers,” says Jenni Chase, vice president of workforce development for NGA. “Similarly, they aren’t aware of the opportunities that the manufacturing and glass fabrication sectors offer.”

To help companies educate the public, particularly young people, about careers in the glass industry, NGA released a recruitment kit that includes “A Guide to Recruiting at High School Career Fairs.” The downloadable resource offers step-by-step instructions for engaging students at career fairs and talking to them about the trade.

As part of its outreach efforts, NGA also held Workforce Development Day at GlassBuild America in Dallas, where 50 students from the local Plano ISD Academy High School visited booths and equipment exhibits to learn about the industry, join in mentoring Q&A sessions at the Main Stage, and visit the Architec-

tural Glass & Metal Technician Certification testing area.

Training

NGA invested heavily in the MyGlassClass.com online learning platform in 2024. The new MyGlassClass.com provides more than 100 online courses for contract glaziers, full-service glass companies and glass fabricators to complement and shorten companies’ hands-on training.

The newest addition to the NGA training suite, MyGlassFAB offers core training for production personnel that they can access on their smartphone to learn about job responsibilities, safety, products and fabrication techniques.

NGA also introduced a package of frameless shower enclosure courses to complement the new Frameless Shower Enclosure Design & Installation Manual. For glaziers, NGA continues to partner with registered apprenticeship providers to offer glazier apprenticeship programs approved by the U.S. Department of Labor. Installers who complete the NGA Glazier Apprentice Curriculum earn a jointly endorsed NGA/National

Center for Construction Education and Research (NCCER) credential indicating a journeyman-level minimum competency reached through knowledge and performance.

“Apprenticeship provides a distinct career path for new installers entering the industry that demonstrates a commitment to best practices and skill development,” Chase says.

Retaining

Training also plays a major role in employee retention, so NGA teamed up with the Architectural Glass and Metal Technician Certification Council to host AGMT certification testing live on the GlassBuild America show floor in Dallas. This marked the first time AGMT testing occurred in a public forum, offering the glazing community a chance to witness the testing process.

“Training, apprenticeship, certification: these all provide companies the opportunity to invest in employee development, which has been proven to positively impact retention,” Chase says. ■

NGA FOUNDATION COVERS APPRENTICESHIP COSTS

The NGA Foundation, through donations from donors like Frameless Hardware Company and the Friese Foundation, covers the cost of the NGA Glazier Apprentice Curriculum for new glazier apprentices. Additionally, the Foundation has funded new MyGlassClass.com courses and supported outreach initiatives, including NGA's recruitment kit and Guide to Recruiting at High School Career Fairs, to promote industry awareness among young people. The NGA Foundation is a 501(c)(3) nonprofit organization where tax-deductible donations can be made for training the industry, advocating on behalf of the industry, and promoting the industry by educating consumers about the many ways glazing and glass architectural products contribute to a safe, healthy, sustainable and inspiring built environment.



Fifty students from Plano ISD Academy High School attended Workforce Development Day at GlassBuild America 2024 to learn about the glass and glazing industry.

FREE TO NGA MEMBERS

At its August 2024 meeting, the NGA Board of Directors voted to offer MyGlassClass.com courses free to NGA members. Free courses will include those in the Glazier Training and MyGlassFAB course catalogs.



THE NGA RECRUITMENT KIT CAN BE FOUND ON GLASS.ORG.

Advocacy and Resources

ADVOCATING FOR ADVANCEMENT

NGA COLLABORATES WITH THE INDUSTRY TO PROVIDE RESOURCES
ADVANCING SUSTAINABILITY, TECHNICAL PERFORMANCE
AND LEGISLATIVE KNOW-HOW

NGA is selected for funding to provide support for material transparency compliance

NGA applied, and was selected, for a \$2.1 million grant by the U.S. Environmental Protection Agency to help support a shift to cleaner construction materials. "Having our grant application selected by the EPA presents a great opportunity for NGA member companies, giving needed resources for our members to provide high-quality information to their customers to support sustainable building," says Nicole Harris, NGA president and CEO.

The grant money will fund NGA efforts over five years to do the following:

1. Aggregate primary flat glass life-cycle inventory data.
2. Create an Environmental Product Declaration generator tool for fabricated glass.
3. Provide EPD development assis-

tance for glass fabricators.

4. Facilitate end-of-life life cycle assessment data collection on architectural glass recycling.

NGA relaunches World of Glass Map

NGA relaunched its World of Glass Map resource on glass.org, which features information about global flat glass manufacturing locations, North American glass fabrication capabilities, and recycling locations for flat glass.

"Glass recycling is becoming a much more important tool for all glass companies to use as we drive toward a more sustainable and circular economy," says Kyle Sword, business development manager, Pilkington North America, NGA Board of Directors member and NGA Recycling Task Group chair. "NGA is beefing up tools like technical papers and the glass map as member resources. The

educational information and content are other benefits that help those members who want to further their recycling efforts, and they are a great example of how the NGA is enabling change in the industry."

Newly created databases help members stay ahead of important legislation

Beyond actively advocating for the glass and fenestration industries on Capitol Hill and around the world, NGA is also tracking legislation that is shaping the present and future of construction. In 2024, the association created, and will continuously update, two databases for North American legislation that affects the industry.

State "Buy Clean" Legislation Database: This database tracks the legislation, materials covered, description of



NGA MEMBER COMPANY BEES INC. PROVIDED THE CURTAIN WALL AND PERFORATED SUNSHADES FOR ONE NORTH HILLS TOWER, RALEIGH, NORTH CAROLINA.

applicable projects and global warming potential, or GWP, limits imposed by states.

U.S. and Canadian Bird-friendly Building Policies Database: This database tracks mandatory and voluntary bird-friendly policies, including what portion of the building must be bird-friendly and how bird-friendly glazing is defined within each policy.

NGA updates over 20 resources, including Glass Technical Papers

NGA staff and volunteers again updated several of the association's resources, including several Glass Technical Papers. NGA volunteers update GTPs through the systematic review ballot process on a five-year cycle, and the association offers over 90 technical papers free to download for everyone at glass.org/store.

NGA collaborates with FGIA and WDMA on new PCR for fenestration assemblies

The association collaborated across the industry with the Fenestration and Glazing Industry Alliance and the Window and Door Manufacturers Association to create a new Product Category Rule for Fenestration Systems.

This PCR gives manufacturers the base document needed to develop EPDs. "This fenestration PCR is more encompassing for the glass and glazing industry and will allow companies to generate their EPDs with the most up-to-date rules for sustainability," said NGA Vice President of Technical Services and Advocacy Urmilla Sowell.



FIND ALL NGA TECHNICAL RESOURCES AT GLASS.ORG/STORE.



SUSTAINABILITY AND RECYCLING RESOURCES



ACCESS THE DATABASES (MEMBER LOGIN REQUIRED)

Glass and Glazing Advocacy Days

NGA GOES TO D.C.

MEMBERS FOCUS ON FOUR POLICY PRIORITIES
DURING THIRD ANNUAL EVENT



NGA hosted members, stakeholders from government agencies and congressional members in Washington, D.C., May 14-15, to discuss top policy priorities and to showcase how the industry contributes to the economy, the workforce and human health.

Policy Priorities

NGA focused on four policy priorities during its time on Capitol Hill.

1. Workforce Development

Advocacy Day participants met with Senator Bernie Sanders' office. Sanders chairs the Senate Committee on Health, Education, Labor and Pensions. Jenni Chase, vice president of workforce development at NGA, made the case with Sanders' office staff to encourage the passing of a Senate bill similar to H.R. 6655: A Stronger Workforce for America

Act, which increases funding to train and upskill workers (the bill passed in the House of Representatives).

"We need to give potential employees access to tools to get trained," says participant Rick Locke, NGA chair and owner/president of Montana Sash & Door.

2. School Security

Securing schools from forced entry remains a major issue in the U.S. Advocacy Days participants shared how glazing products can help harden school buildings and delay an attacker's entry.

Advocacy Days participants spoke with the office of Senator Marsha Blackburn, who introduced Senate Bill 1107: Securing Aid for Every School Act, which allocates funds for school safety and security.

3. High-performance glazing

Participants also made the case to

extend the Section 48 tax credit of the Internal Revenue Code that incentivizes the use of electrochromic glass, and expand the definition of the section to include other high-performance glazing options.

Speaking to Senator Mitt Romney's office, Helen Sanders, general manager of Technoform Glass, explained that heat pumps—which receive more incentives than fenestration—require high-performance glazing to effectively reduce heating and cooling loads of buildings, underlining the need to incentivize the use of high-performance glazing to achieve energy-efficient buildings.

4. Bird-friendly glazing

Bird-friendly glazing can help prevent the nearly 600 million bird deaths each year due to glass collisions. Advocacy Days participants spoke with the office of Representative Morgan Griffith, who



NGA MEMBERS MEET WITH LAWMAKERS TO ADVOCATE FOR THE GLASS INDUSTRY.

41

MEETINGS WITH CONGRESSIONAL REPRESENTATIVES

20

STATES REPRESENTED BY INDUSTRY MEMBERS

introduced the Federal Bird Safe Buildings Act in 2023; the legislation would require bird-safe glass be installed in new General Services Administration buildings.

Tangible results

Three NGA members attended a meeting with the legislative aide for Senator Ed Markey. Markey co-sponsored an updated bill to extend the tax credit deadline less than one month after this meeting. The legislative aide sent a follow up message regarding the influence of NGA's visit and one-pager: "It was wonderful to meet with NGA members and listen to their priorities, including extending the tax credit. This feedback, along with other stakeholders, was helpful in putting together Dynamic Glass 2.0."

A fall return to D.C.

NGA staff and consultants returned to Capitol Hill in September and met with federal legislators to discuss expanding the investment tax credit for high-performance windows. Currently, Section 48 of the Internal Revenue Code includes an investment tax credit only available for electrochromic glass. NGA requested to expand the types of high-performance windows eligible for the investment tax credit to include other types of dynamic glass, as well as triple glazing and vacuum insulating glazing. NGA also requested an extension on the credit's deadline, which is set to expire on Jan. 1, 2025.

"Our day in Washington was even more productive than expected," says NGA Vice President of Advocacy and Technical Services, Urmilla Sowell. "We had meetings with the offices of many Congressional members and leaders of

the Finance and Ways and Means Committees. Each office was very receptive to our message and asked meaningful questions. We received encouragement and constructive feedback from those we met with."

What attendees had to say

"It was an eye-opening experience on Capitol Hill. There is still a lot to be done, but it's good to know that the glass industry is doing its part in affecting legislation that could lead to meaningful change. We are a passionate bunch with deep knowledge that our legislators need." - Diana San Diego, Safti First

"What a truly amazing group of people that I am humbled to participate with. This group made an impact today, for sure."-Joe Kaiser, Herzog Glass

Education

ADDRESSING TOP CHALLENGES

—

NGA CONFERENCES, WEBINARS AND MORE ADDRESS LABOR, PRODUCT INNOVATIONS, INDUSTRY HEADWINDS, ARCHITECT OUTREACH AND MORE



In 2024, NGA developed content and resources to help glass companies tackle their top challenges, allowing them to build more profitable businesses.

Labor topics headline NGA events in 2024

Companies' biggest ongoing concern is labor—specifically finding, training, keeping and protecting employees. NGA's key events and several Thirsty Thursday webinars in 2024 offered educational programming focused on labor.

HIGHLIGHTS:

Recruiting and training the next generation

Education programming in 2024 focused on workforce development content to help glass companies find, recruit and train the next generation of industry workers.

During GlassBuild America, attendees of the Glazing Executives Forum were privy to a workshop session on recruiting in high schools, while the Main Stage featured a session on setting up internal training programs, and the keynote from Emily Pilloton-Lam, executive director of the nonprofit Girls Garage. During the Women in Glass + Fenestration event at the Main Stage, Nicole Calhoun, a leadership consultant, offered insights and strategies for developing mentorship programs.

Mental health and addiction-recovery support

Workers in construction have higher rates of opioid addiction and suicide than most industries. Part of creating a safe work environment in glass involves finding ways to support employees struggling with mental health concerns or addiction.

In 2024, NGA teamed up with Cal Beyer, CWP, SAFE Project, to bring these life-saving topics to the glass industry. Beyer and Dave Argus of Karas & Karas Glass addressed opioid addiction during the BEC Conference in March and returned in October to the GlassBuild Main Stage to educate company owners on building an addiction recovery-safe workplace.

Bringing glass education to the architectural community

As part of its core mission, NGA “envisions a future where glass is the preferred material for enhancing spaces where people live, work, learn, play and heal.” In pursuit of this mission, NGA targets numerous educational offerings to architects.

NGA accelerated its architect education in 2024, emphasizing:

- The high-performance potential



WINDOW REPLACEMENT SERVICES FROM NGA MEMBER COMPANY ARGO GLASS & WINDOWS. THE COMPANY OFFERS A VARIETY OF RESIDENTIAL AND COMMERCIAL REPAIR AND REPLACEMENT SERVICES.

- of glass and glazing
- The role of glass in occupant health and wellness
- The importance of early project collaboration with glass and glazing team members
- The wide-ranging functionalities of glass, from security to aesthetics
- New technologies in glazing façade design and construction.

ARCHITECT EDUCATION HIGHLIGHTS FROM THE YEAR:

Glass and Glazing Design Academy

NGA continued its partnership with Architectural Record to provide AIA-accredited continuing education through the Glass and Glazing Design Academy, which highlights the latest advancements in glass and glazing technology. The academy includes articles, webinars

and presentations, and is approved for 8 AIA learning units.

Blueprint for Collaboration at GlassBuild

NGA's popular Blueprint for Collaboration program drew architects, engineers and other glass industry leaders for a day of glass industry-focused content accredited for 5 AIA learning units at GlassBuild America.

More new or updated AIA presentations

NGA's advocacy and technical team also leads a host of NGA member volunteers in developing and maintaining curated presentations. In 2024, NGA released an updated version of its popular presentation, The Value-Added Performance of Coated Glass. In addition, members now have access to three new presentations: Key Strategies of Bird-Friendly Glazing,

Thermal Bridging Considerations at Interface Conditions and Security Glazing for Schools.

NGA members may view the full suite of presentations within the online Member Dashboard at glass.org/aia-approved-presentations-architects.

Spotlight on industry trends

Glass industry leaders look to NGA to provide insights and updates on industry trends and forecasts that could affect their companies. Content across all NGA platforms targets innovations, forecasts, market headwinds and more.

HIGHLIGHTS:

Market headwinds and opportunities

2024 increased NGA's efforts to provide content delving into market trends that could impact glass and fenestration companies. Connor Lokar of ITR Economics returned to GlassBuild America for a keynote during the Glazing Executives Forum and a presentation on the GlassBuild Main Stage. Additionally, Window + Door continued its partnership with John Burns Research and Consulting to produce the quarterly Window & Door Manufacturers report, with survey consultant Chris Beard presenting during GlassBuild and a quarterly update during a Thirsty Thursday.

AI and automation

Automation and artificial intelligence technologies are quickly advancing in the glass industry. Glass Performance Automation Days provided educational presentations from machinery equipment and software suppliers looking at how digitalization is changing glass fabrication.

The use of AI was also a centerpiece of education during the year, with Stefanie Couch, founder of Grit Blueprint, speaking on the topic at the BEC Conference, the Glazing Executives Forum and during a Thirsty Thursday webinar.

Events

EVENTS FOR ALL AUDIENCES

—

NGA SERVES EVERY INDUSTRY SEGMENT THROUGH A RANGE OF SUCCESSFUL EVENTS



GlassBuild America Goes Big in Dallas

For All in Glass and Fenestration

NGA welcomed more than 9,400 registrants to GlassBuild America: The Glass, Window & Door Expo, Sept. 30 through Oct. 2 in Dallas, the largest edition in 16 years. Attendees experienced a massive show floor, where 535 exhibitors showcased their products and services over 200,000 net square feet.

For the first time, NGA hosted the show in Dallas. “We anticipated an event in Dallas that put renewed emphasis on the innovation and advancements of the glass, glazing and fenestration industries as well as provided fresh solutions for the challenges at hand,” says Nicole Harris, NGA president and CEO.

GlassBuild 2024 also hosted the 18th NGA Glazing Executives Forum, the third

annual Blueprint for Collaboration, and featured a full roster of education and events on the GlassBuild Main Stage. For the first time, Architectural Glass & Metal Technician certification testing occurred during the show. Another first-time addition to the event, 50 local students from Plano ISD Academy High School attended to talk with exhibitors, listen to Main Stage sessions, and tour the AGMT rigs to see the career opportunities available in the glass and fenestration industries.

The next GlassBuild America will take place Nov. 4-6, 2025, at the Orange County Convention Center in Orlando, Florida.

BEC Conference draws glaziers to Nashville

For Glaziers

The 2024 BEC Conference returned to Nashville in March. The event kicked off

with two State of the Industry keynotes from Troy Johnson, president of Harmon Inc., and Ricardo Maiz, president of Vitro Architectural Glass.

Several sessions spotlighted technological advancements in glazing, including AI, robotics in construction and using technology to better collaborate during projects. The other main theme of the conference was people—finding workers, training them, keeping them and supporting them.

GPAD targets fabricator factory advancements

For Glass Fabricators

GPAD, or Glass Processing Automation Days, directly followed the BEC Conference. Held every other year, the event drew an audience of glass fabricators for two days of education



GLASSBUILD AMERICA 2024 WAS ITS BIGGEST EDITION IN 16 YEARS IN A NEW HOST CITY OF DALLAS, TEXAS.

transparency standards, updated codes and opportunities for advocacy. Attendees also heard three case studies of notable glazing projects in the host city of Milwaukee.

Glazing Executives Forum spotlights risk, forecasts, technology and more

For Glaziers and Glass Installers

The Glazing Executives Forum on Sept. 30 drew more than 220 attendees for discussions on AI, risk forecasting, estimating best practices and more. The event also included a meeting of the NGA Installing Committee and the return of economic forecaster, Connor Lokar of ITR Economics.

Additionally, for the first time, the Glazing Executives Forum offered workshop tracks that allowed attendees to split into smaller groups to meet and converse directly with experts in the field about specific industry topics. Tracks included: AI at Your Glazing Company, Shower Enclosures Solutions Share and Effective Recruitment Strategies.

Blueprint for Collaboration demonstrates the best of high-performing products and design team dynamics

For Architects, Designers and Engineers

The third annual Blueprint for Collaboration was held for the first time in conjunction with GlassBuild America. Programming offered up to 5 AIA learning units on topics addressing high-performance glass products, a case study in collaboration, codes and standards for architects, and construction forecasts.

about factory advancements. During the event, machinery, equipment and software suppliers offered insights on how fabricators can address their biggest challenges, including labor, quality control, plant productivity and more.

Automation took center stage at GPAD, which also featured talks on AI, product launches, glass distortion, tempering, lamination and fabrication.

NGA Glass Conferences draw technical leaders

For Glass Fabricators & Suppliers

NGA Glass Conferences bring together glass technical and advocacy leaders to continue the development of essential industry resources; discuss need-to-know code, standard and regulatory topics that affect industry companies; and network among peers.

NGA hosted the NGA Glass Conference: Isle of Palms | Charleston in February and the NGA Glass Conference: Milwaukee in August. At each conference, about 100 technical and advocacy leaders in glass gathered for meetings for the NGA Advocacy, Fabricating and Forming Committees, in addition to important educational presentations and panels.

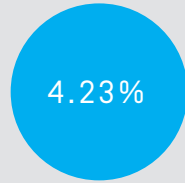
The Isle of Palms meeting included discussion of NGA's collaborations with the Department of Energy, a practice session for the association's Glass & Glazing Advocacy Days, and a workshop on laminating best practices. Other highlights included a comprehensive look at new codes and standards, and a panel discussion on spandrel glass.

In Milwaukee, attendees continued their NGA Committee work and addressed additional topics on advancements in vacuum insulating glazing, material

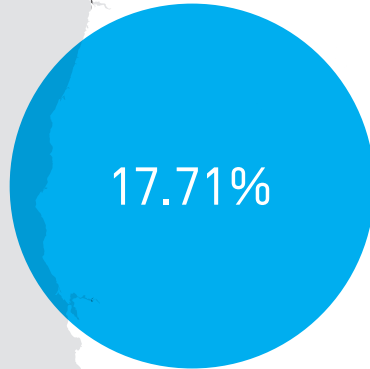
Community

WE ARE NGA

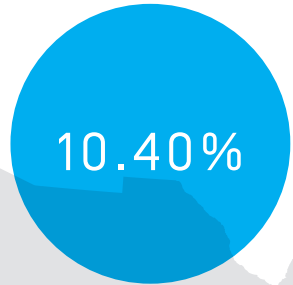
MEMBERS AND VOLUNTEERS
STRENGTHEN THE ASSOCIATION AND GIVE US
A UNITED VOICE



CANADA



WEST



SOUTHWEST



INTERNATIONAL

NGA FOUNDED

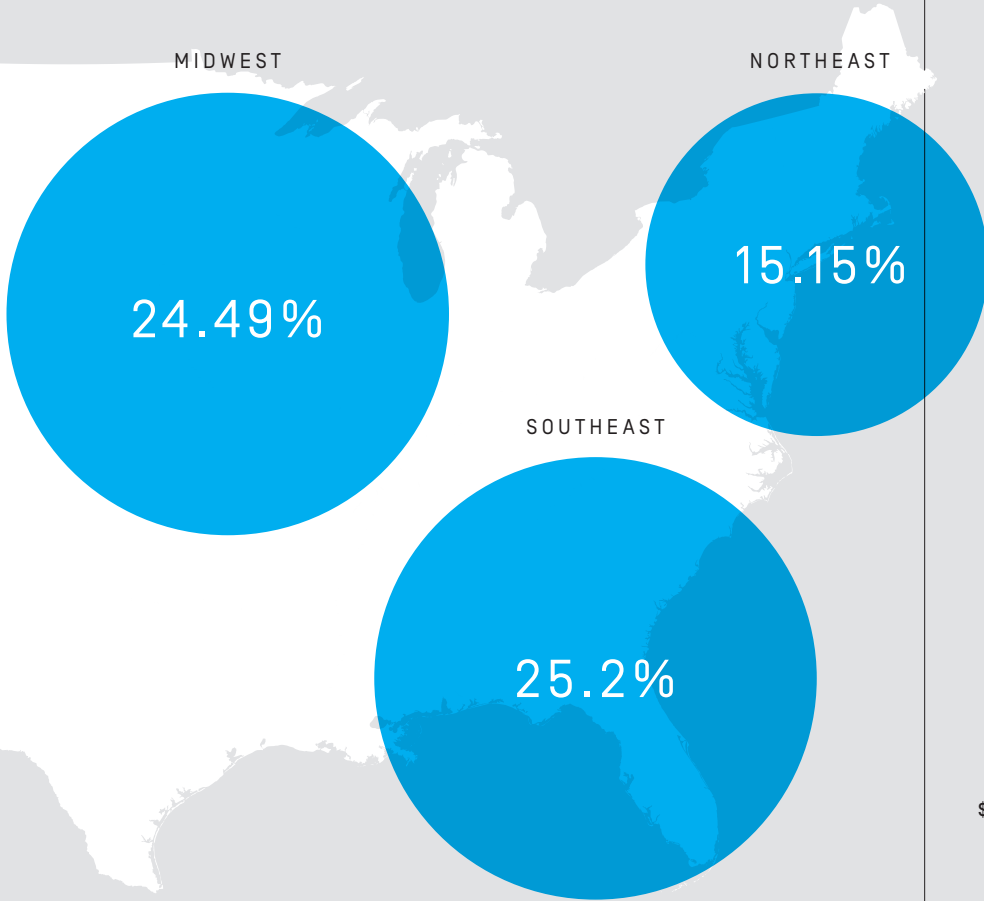
1948

MEMBER COMPANIES

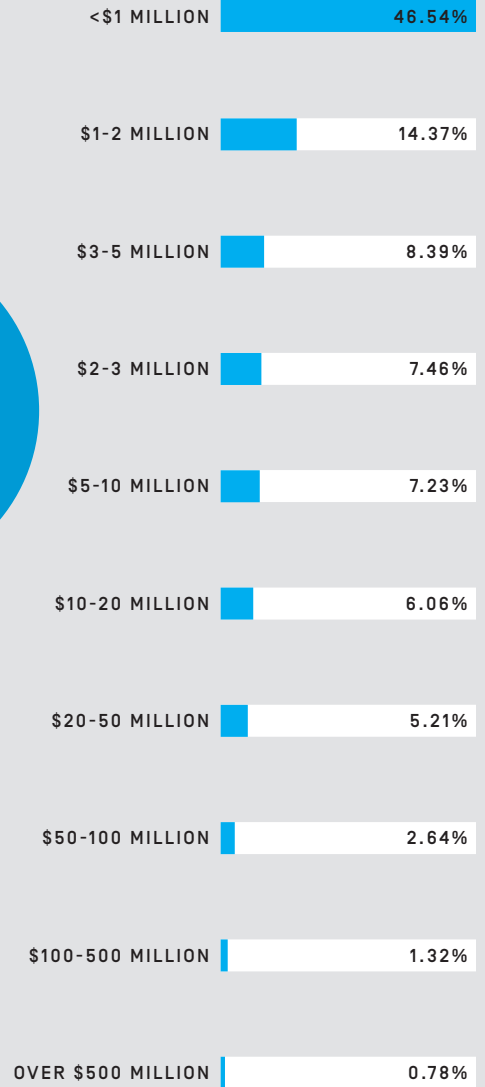
1,800

MEMBERS BY THE NUMBERS

NGA represents members from companies of all sizes across the entire U.S. and abroad.



ANNUAL REVENUE



NEW MEMBERS

00+

164

NGA welcomed 164 new member companies in 2024. Read the full report to see the list of new companies.

*AS OF OCT. 24, 2024

VOLUNTEERS AND TASK GROUPS

Thank

MEET THE 2024-25 BOARD OF DIRECTORS

Rick Locke, Chair, Montana Sash & Door, Bozeman, Montana
Ron Crowl, Immediate Past-Chair, FeneTech, a Cyncl company, Aurora, Ohio

Tim Kelley, Chair-elect, TriStar Glass Inc., Catoosa, Oklahoma

Jim Stathopoulos, Treasurer, Ajay Glass Co., Canandaigua, New York
Silas Koonse, Koonse Glass Co. Inc., Columbia, Missouri

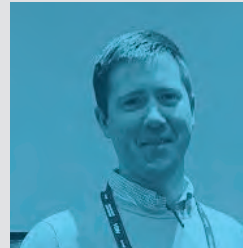
Courtney Little, Ace Glass, Little Rock, Arkansas

Jodi Martinez, AllStar Glass Inc., Spokane Valley, Washington

Syndi Sim, Q-railing, Tustin, California
Tara Brummet, Vitrum Industries, Langley Township, British Columbia, Canada

Taylor Anderson, Anderson Aluminum Corp., Columbus, Ohio
Vipul Bhagat, Skyline Design, Chicago, Illinois
Mark Seeton, Vitro Architectural Glass, Pittsburgh, Pennsylvania

VOLUNTEER OF THE YEAR



Aaron Thompson
Principal research engineer, Viracon

Thompson serves as chair of the NGA Fabricating Committee and has been involved in NGA activities for more than 15 years.

HARRY MILES AWARD



Chuck Wencil
Viracon

Wencil, who has worked for 50 years as a glass processing engineer at Viracon, is the sixth recipient of the Harry Miles Award of Excellence.

TASK GROUPS

35

VOLUNTEER HOURS

284



SEE THE LIST OF NGA'S COMMITTEE AND TASK GROUPS.

you.

NGA thanks its dedicated volunteers for their tireless efforts and time to advance the industry.

NGA also recognized three members—who have recently announced plans for upcoming retirements—for their longtime participation and volunteerism: David Evans, quality manager, Guardian Glass North America; Tim McGee, sales manager, Glass Coatings & Concepts LLC; and Bill Sullivan, president/CEO, Brin Glass Co.

MEMBER BENEFITS

- MyGlassClass.com courses for glaziers and fabricators are free to members
- 50+ safety bulletins
- 120+ technical and advocacy downloads
- Codes and standards Q+A
- AIA-certified presentations
- Exclusive educational webinars
- Downloadable workforce development toolkits
- Downloadable resources from the American Subcontractors Association
- All NGA downloadable resources in the NGA Store are free to members
- And more

NGA-AFFILIATED CHAPTERS

NGA has endorsed the following regional glass associations as affiliated chapters:

- California Glass Association
- Colorado Glazing Contractors Association
- Connecticut Glass Dealers Association
- Houston Area Glass Association (a division of TGA)
- Massachusetts Glass Dealers Association
- Mid-Atlantic Glass Association
- Minnesota Glass Association
- Texas Glass Association
- TGA North Texas Division (a division of TGA)
- Utah Glass Association
- Washington Glass Association



NGA'S RESOURCE HUB CONNECTS YOU WITH THE RESOURCES WE HAVE FOR OUR MEMBERS AND THE INDUSTRY!

Publications and more

NGA AMPLIFIES INDUSTRY MESSAGES

WEBSITES, NEWSLETTERS, MAGAZINES, SOCIAL MEDIA AND MORE SERVE AS EFFECTIVE CHANNELS FOR SHARING THE LATEST INDUSTRY NEWS, ENGAGING WITH OUR MEMBERS AND EDUCATING THE INDUSTRY

NEWSLETTERS

Through both digital and print assets, NGA reaches its members and the glass, glazing and fenestration industries at large by the tens of thousands. No matter if you prefer to read your news on paper or on screen, NGA has an option for you to stay up to date about the latest industry happenings and engage with colleagues on LinkedIn, Instagram and Facebook.

Glass Magazine Weekly

Emailed each Tuesday, Glass Magazine Weekly delivers the latest news, trends and more to nearly 9,000 inboxes.

Average open rate: 49.87%

Window + Door Weekly

Emailed each Wednesday, Window + Door Weekly delivers the latest news, trends and more to 7,500+ inboxes.

Average open rate: 51.06%

Advocacy & Technical Services Update

Emailed twice per month, this newsletter shares the latest initiatives and information from the association's technical team with 7,500+ inboxes.

Average open rate: 37.45%

NGA Member Update

Emailed twice per month, this newsletter details NGA's and the industry's top headlines to 8,600+ inboxes.

Average open rate: 38.98%



SUBSCRIPTIONS AVAILABLE TO GLASS MAGAZINE'S MAGAZINE AND NEWSLETTER



SUBSCRIPTIONS AVAILABLE TO WINDOW + DOOR'S MAGAZINE AND NEWSLETTER

WEBSITES

Page views

Glass.org + glass.org/store

704,887

WindowandDoor.com

471,145

GlassMagazine.com

430,666

MyGlassClass.com + Absorb
MGC classes

255,852

GlassBuild.com +
MapYourShow

597,965

*page views from November
2023-October 2024

SOCIAL MEDIA

The National Glass Association, GlassBuild America, Glass Magazine and Window + Door amplify messages through social media channels on Facebook, LinkedIn and Instagram.

MAGAZINES

Glass Magazine

Published eight times per year, Glass Magazine is the glass and glazing authority, reaching architects, glaziers, fabricators and more.

Key reports:

- Top 50 Glaziers
- Top Glass Fabricators
- Glass Magazine Awards
- Architect's Guide

Average readership per issue
56,210



Window and Door

Published six times per year, Window + Door examines the entire supply chain of the fenestration industry, from source to sale.

Key reports:

- Industry Pulse
- Top Manufacturers
- Window + Door Awards
- Window & Door Industry Survey, in partnership with John Burns Research and Consulting

Average readership per issue
47,019



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 S.R.L. • KERAJET S.A. • KEUSCH GLASS, INC. • KEY GLASS, LLC • KEYSTONE CERTIFICATIONS, INC. • KEYTECH NORTH AMERICA • KIMZEY SOFTWARE SOLUTI
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 COMPONENTS CANADA INC. • LISEC AMERICA, INC. • LITESENTRY-SOFTSOLUTION-STRAINOPTICS • LOCKHEED ARCHITECTURAL SOLUTIONS, INC. • LOIRE US, I
 INC. • M3 GLASS TECHNOLOGIES • M3 GLASS TECHNOLOGIES - THERMOTEC • MACHINES AND WHEELS, INC. • MADICO • MAINSTREET COMPUTERS LLC • MAN
 INC. • MAPES ARCHITECTURAL PANELS INC. • MAPLE CITY GLASS, INC. • MAPPI AMERICA, INC. • MAPPI INTERNATIONAL S.R.L. • MARC PREVOST MACHINE
 CORP. • MCGRORY GLASS • MCINTYRE GLASS • MCKEEGAN EQUIPMENT & SUPPLY COMPANY • MECAL S.R.L • MECAL USA, INC • MEDINA GLASS CO. • MEGAWIN
 CONSTRUCTION SUPPLY (MCS) • MIDDLESEX GLASS • MIDWAY GLASS & METAL INSTALLERS INC • MIDWEST GLASS & MIRROR CO. • MIDWEST GLASS FABRI
 LLC • MODERN GLASS COMPANY • MODERNFOLD • MOFFAT GLASS • MOMENTIVE PERFORMANCE MATERIALS • MONMOUTH GLASS • MONTANA SASH & DOOR • M
 INDUSTRIES • MOTION WINDOWS • MOULE'S CALIFORNIA GLASS, INC • MOULE'S FOOTHILL GLASS, INC • MOUNTAIN HOME GLASS • MOUNTAIN MESA, LLC •
 FASTENERS • MURFIN COMMERCIAL BUILDING PRODUCTS LLC • MUSCOGEE GLASS • MY SHOWER DOOR • MYGLASSTRUCK.COM BY DEMOUNTABLE CONCEPTS,
 WORKS, INC. • NAUGATUCK WINDOW & GLASS • NC GLAZING & FABRICATION, LLC • NETOM ENTERPRISES, LTD. • NEW ENGLAND HOME & GLASS • NGERN MA BU
 GLASS INDUSTRIES, INC. • NORTHERN GLASS CO., INC. • NORTHLITE GLASS & MIRROR INC. • NORTHSTAR CONTRACTING INC • NORTHWEST GLASS LLC • NO
 FACADES • NU-VU GLASS, INC. • NVOY ARCHITECTURAL PRODUCTS INC. • OAHU METAL & GLAZING • OAK CLIFF MIRROR & GLASS • OCEAN DOOR AUTOMATION I
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 USA • OZCELIK MACHINERY • OZONE OVERSEAS PVT LTD. • PACHA GROUP INC • PACIFIC COAST GLAZING INC • PACIFIC MIRROR & GLASS • PACKERLAND GLAS
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 INC. • PITMAN GLASS CO., INC. • PMC SOFTWARE INC. • POLARIS SOFT CLOSE HINGE • POLY EXTRUSIONS INC • PORTA INSTALLERS SC LLC • PRATT GLASS EN
 BENDING CORP. • PRECISION GLASS INDUSTRIES • PRECISION WALL SYSTEMS, INC. • PREFERENCE NORTH AMERICA INC • PRELCO, INC. • PREMIER GLASS • P
 GLASS SYSTEMS • PRODIM USA • PROLITE GLASS & MIRRORS INC. • PULP STUDIO, INC. • PVPEOPLE.NET • QCOMP TECHNOLOGIES • QDP (QUAN DAT & PA
 SERVICE • QUALITY POWDERCOATING • QUANEX BUILDING PRODUCTS • QUATTROLIFTS • QUICK FABRICATION • R & R GLASS SALES & SERVICE • R & R WIND
 SERVICES • RED RIVER GLAZING, INC. • RED'S AUTO GLASS, INC. • REED RUBBER PRODUCTS • REFLECTIONS GLASS CO. • RELIABLE GLASS • RELIABLE GLAS
 ENGINEERING • RICK'S AUTO GLASS & STOREFRONT, INC. • RIGHTWAY GLAZING INC. • RINOX MIDWEST USA • ROBINSON GLASS CO., INC. • ROCHESTER DAVI
 FENESTRATION, INC. • ROYAL GLASS, LLC • RUSTON GLASS & MIRROR CO., INC. • RUTHMANN REACHMASTER NORTH AMERICA LP • RYAN ENGINEERING • S&G
 SAINT-GOBAIN • SAINT-GOBAIN GLASS FRANCE - BU SGG INTERNATIONAL • SALEM FABRICATION SUPPLIES • SALEM FABRICATION TECHNOLOGIES GROUP INC
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MANUFACTURING IMPROVEMENTS +

MORE RECYCLING AND REUSE +

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SUSTAINABILITY STEP CHANGE



WORLD OF GLASS

2025 REPORT

THE

DECARBONIZATION EQUATION

BY KATY DEVLIN

WITH CONTRIBUTIONS FROM NORAH DICK AND RACHEL VITELLO

The glass industry has witnessed several step changes in manufacturing in the last 100 years—the global adoption of the float glass process following its invention in 1952; the standardized use of insulating glass following the energy crisis of the 1970s; and the introduction of glass coatings (beginning with low-emissivity) in the 1980s. But what comes next? What is the next step forward for flat glass? These

were the questions Glass Magazine posed to industry leaders during the global glass event *glasstec 2024*, held Oct. 22-25, 2024, in Düsseldorf, Germany, where two sustainability themes emerged: decarbonization and circularity.

How can the global glass industry, in all segments, address the need to reduce embodied and operational carbon? The answer, per glass manufacturing leaders, requires improvements in three areas: manufacturing, recycling and reuse, and

installed product performance. And it requires the participation and investment of companies across the industry.

“We need to take responsibility,” says Sisecam CEO Görkem Elverici. “We believe that in order to envision, design, discover, innovate and implement the solutions of the future, we must move forward together. In our rapidly changing world, industries that rely on traditional/conventional methods must adapt to this transformation.”

Something

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STAGE 01-

DECARBONIZING MANUFACTURING

Glass manufacturing is an energy-intensive business. An estimated 78% of embodied carbon in an insulating glass unit comes from the glass manufacturing process itself, according to the Efficient Windows Collaborative. Reducing carbon during this process can have the biggest impact on the industry's overall carbon emissions.

Reducing embodied carbon has become a key focus of glass manufacturers, with companies such as NSG Group aiming for a 30% reduction in emissions by 2030 and carbon neutrality by 2050. In pursuit of these efforts, NSG Group introduced Pilkington Mirai in 2023, which is manufactured using a combination of alternative fuel, high recycled glass content and 100% renewable electricity, according to the company.

"We developed a glass that truly does have a lower carbon footprint," says Stephen Weidner, president and head of Architectural Glass North America & Solar Products at NSG Pilkington. "We've changed the chemistry of the glass itself. The glass does have a lower carbon footprint."

While NSG succeeded in proof of concept for Mirai, the access to fuel and supply chains don't yet exist to allow for continuous production. "The logistics and supply chains are being developed, but it's going to take several years,"

says Weidner. "We wanted to prove to ourselves that the technology does exist for lower carbon glass."

Turkey-based float glass manufacturer Sisecam is also aiming for carbon neutrality by 2050. To meet its goals, officials announced at glasstec its Plant of the Future platform to bring together glass producers to discover step change solutions in production. Sisecam's Elverici says of the platform: "Plant of the Future will not only transform Sisecam's production operations and processes but also offer significant opportunities for advancing the industry. ... As we progress toward our goals of operational excellence, optimization, digitalization and sustainability, this platform will generate practical, well-designed and innovative solutions. In doing so, it will create an ecosystem where we envision together, design together, implement together, operate together and in return grow together, paving the way for collective development with all of our stakeholders."

Manufacturers say they are accelerating investments in float production efficiencies. Saint-Gobain officials report the company has reduced carbon emissions by 4,000 tons since 2021 by boosting oxygen in the float process, waste heat recovery, renewable energy and optimizing furnace design. The company achieved a "20% improvement in energy

performance with each refurbishment and a 5% reduction in energy required to melt one ton of glass from 2017 to 2023," according to officials during glasstec. The company is also exploring alternative melting technologies, such as a 30% hydrogen-fire glass melting, being tested at a plant in Germany.

Vitro Architectural Glass has targeted carbon reduction and lower GWP through more efficient use of batch material, furnace efficiency and design improvements, energy-efficient lighting and regulating equipment, and supplier improvements, according to officials. The company also continues to look to oxy-fuel furnace technology, which melts glass raw materials mixing pure oxygen (instead of air) with natural gas, significantly improving energy and environmental performance. "This technology reduces energy consumption in glass-melting furnaces by as much as 20% and greenhouse gas emissions by 50%," per company statements.

Glass Magazine spoke with American-based glass manufacturer and fabricator Cardinal Glass Industries, which is also investing in plant improvements to reduce embodied carbon. "Cardinal is actively pursuing new technologies that will allow us to have one of the lowest carbon glasses manufactured today. Currently, our legacy float plants have all achieved minor source of emissions

status. In addition, we will have the three float lines purchased in 2021 become minor source status by 2027,” says Bowie Neumayer, vice president of sales and marketing.

Guardian Glass also introduced a low-carbon glass, Nexa, following a research and development project at the company’s Bertrange, Luxembourg, plant. The manufacturing process maximizes cullet from internal and external sources, helping to reduce embodied carbon by 30%, according to Guardian statements.

Additionally, the company released new EPDs in 2024 for glass produced in the United States, demonstrating the effect of decarbonization improvements in recent years. According to the new data, Guardian’s domestically produced glass offers a 23% reduction in GWP from the NGA’s 2019 EPD value and 24% lower than the company’s 2018 EPD. Driving such improvements in the U.S. is, in part, the Low Embodied Carbon Material Standard from the General Services Administration, which sets a performance threshold for materials, calling for products that are in the top 20% of GWP performance, according to EPD data.

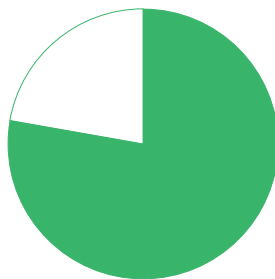
While manufacturers are looking to take bigger steps to decarbonize, many small improvements at the manufacturing level also make an impact, says Alan Kinder, Guardian’s director of the commercial segment. “You don’t always have to wait for a massive cold tank repair to make changes. At our Kingsburg, California, plant we implemented a sleep mode on our coater, as it takes a lot of energy to turn it on and off. Now there is less energy required to fire it back up,” he says. “That saved the equivalent of 1,000 kilowatt light bulbs a year. By itself, it’s not revolutionizing the market. But when you implement it over 25 different float plants, and have 100 smaller initiatives at each, it makes a difference. Rain drops make puddles when we start to talk about those trends.”

BY THE NUMBERS

86

MILLION TONS

According to a 2021 report in the journal Nature, glass manufacturing of all types produces at least 86 million tons of carbon dioxide every year.

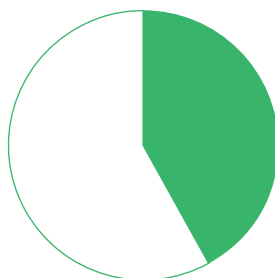


According to the Efficient Window Collaborative, about **78%** of the embodied carbon in an IGU comes from manufacturing flat glass lites, specifically, the batch melting process, where raw materials must be brought to 3,000 degrees Fahrenheit.

1,430

KG

The National Glass Association’s Flat Glass Environmental Product Declaration, or EPD, released in 2019, reports the average global warming potential for flat glass is 1,430 kilograms. Global warming potential, or GWP, is a measure of the carbon required to create a product.



About **42%** of demand for glass goes to flat glass, according to a 2019 article in the Journal of Industrial Ecology.



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COMPARATIVE ANALYSIS



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STAGE 02-

REUSE + RECYCLING

Carbon emissions from glass can be greatly reduced when glass is recycled, beginning in the production process. Melting cullet in a furnace requires significantly less energy than melting raw materials, so the more cullet manufacturers can incorporate into the float melting process, the lower the energy costs.

Float manufacturers have long used cullet from their internal processes in melting furnaces. Glass that comes off the line that doesn't go out to customers is made into cullet and pulled back into the process. According to Glass for Europe estimates, 75% to 80% of cullet used in glass manufacturing in Europe comes from such internal processes. The challenge for glassmakers is increasing cullet from other sources—offcuts from customers and from end-of-life glass products, according to glassmakers.

Saint-Gobain is taking on this challenge at its Aniche, France, location through the introduction of a cullet sorting process. The plant has targeted a goal of using 50% cullet in the furnace infeed for a reduction in carbon emissions of more than 6,000 metric tons per year. Achieving the goal requires not only using all cullet from internal production but also



Hegla IGU deconstructing machine, on display at the glass technology live area at glasstec. Photo by Messe Düsseldorf / ctilmann.

incorporating cullet from customer offcuts and from already fabricated products, either in fabrication facilities or end-use products from an existing building.

Sourcing clean cullet from existing

products proves most challenging for the float process as it must be pure to ensure consistent, high-quality glass production. It requires developing new processes for manufacturers and their fabricator customers, and, down the

“Our development work was based on the question of how it is possible to deal with imperfect panes and use glass in a way that conserves resources and is efficient at the same time”

line, potentially building contractors and recyclers. It also calls for new equipment. For Saint-Gobain, “the cullet sorting project involves investing in a cullet sorting and control line to remove impurities that otherwise make it unsuitable for flat glass production,” according to company reports.

During glasstec, machine supplier Hegla showed a technology for deconstructing IGUs so the glass can be recycled back into flat glass rather than being downcycled or sent to landfill. “Our development work was based on the question of how it is possible to deal with imperfect panes and use glass in a way that conserves resources and is efficient at the same time,” says Heinrich Ostendarp, managing director of Hegla, in a company announcement. The machine, IG2Pieces, automatically separates IGUs and enables the panes to be reused. Fabricators can use it in their own facilities, to separate rejected units for reprocessing, or the machine could be employed for high-quality, end-of-life products.

Ostendarp says he expects demand to increase for recycling and reuse of existing glass lites, as the market targets lower CO2 emissions and reduced costs. “In the future, I can imagine that new interest groups will examine the issue. In some cases, IGUs will then be separated directly on the construction site. Suppliers and buyers will come together via software platforms. I also envision new glass products, including IGUs made from fully recyclable panes. In terms of energy prices, melting will become more attractive. The demand for type-specific shards for the float tank is already high today.”

BY THE NUMBERS

2.5%

According to reports from AGC Glass Europe, an increase of 10% more cullet in glass manufacturing cuts energy consumption by 2.5%.

340 tons

According to estimates from Glass for Europe, 1.1 ton of cullet can save 1.3 tons of raw materials, reducing CO2 emissions by 340 tons.

50%

CULLET GOAL

In 2022, Glass for Europe estimated that on average, batches included 26% recycled cullet, with some floaters aiming for 50% cullet as a goal.

75%+

In Europe, 75% to 80% of cullet is internal, according to Glass for Europe. About 20% to 25% is pre-consumer and just 0% to 5% comes from end-of-life cullet.



STAGE 03-

REDUCING OPERATIONAL CARBON

In 2024, VIG began to dominate the conversation about highest-level performing glass products. “VIG is what IG was to monolithic,” says Guardian’s Kinder. “VIG is the next evolution in glass.”

Several glass manufacturers announced new investments in the segment, including Guardian. In March 2024, Guardian and VELUX Group announced a joint development agreement for the manufacture of tempered VIG. “We’re not waiting for the market to be ready,” says Kinder, noting that higher costs and production limitations continue to be a hindrance for widespread adoption. “There is a strong belief at the Department of Energy level that VIG is the future. ... We’re engaging right now. We’re asking, ‘what do we need to do to be impactful in that business?’”

Meanwhile, Vitro announced its VacuMax VIG that offers “wall-like R-values up to R-20,” according to company officials. Additionally, the company is working to bring VIG manufacturing to North America. “We need America-based manufacturing,” says Vitro’s Fernando Diez, global vice president of marketing. “VacuMax is currently manufactured overseas, and if we want to go massive with it, domestic manufacturing is key.”

NSG Group has been at the forefront



Buildings account for approximately 40% of the total energy use in the U.S. Improving facade performance can reduce building energy consumption. Pictured is the Marion Fire Station in Marion, Iowa, designed by OPN Architects, with low-emissivity glass from Vitro to maximize daylighting and thermal performance. Photo courtesy of Vitro.

of VIG, producing the Spacia product for more than 30 years. “We have quietly installed in the U.S. dozens and dozens of buildings reglazed with Spacia,” says Weidner, with much of it going to reglazing of projects—replacing old monolithic lites with high-performance

VIG. “This dramatically improves the existing façade, just by changing the glass,” he says.

Additionally, the U.S. has seen the emergence of LuxWall as a domestic producer of VIG. In October 2024, the company announced it raised \$51

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STAGE 03 -
REDUCING
OPERATIONAL
CARBON

million in funding to scale up production at its newly opened factory in Litchfield, Michigan. The money will also go to the construction and expansion of a second factory in Detroit and a research and development facility in Ypsilanti.

“With 50% of building stock still single-pane windows, and 25% of the energy used to heat and cool them lost through windows, the market opportunity for LuxWall is massive, and LuxWall technology is primed to help significantly reduce carbon emissions from the built environment,” says Cindi Bough, managing director at the venture capital firm Climate Investment.

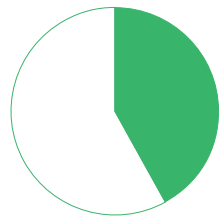
Looking ahead, Saint-Gobain also plans to commercially launch a new VIG line in 2025. During glasstec, the company announced its VIG line INSIO, which stands for insulation, innovation and optimization. The company showed the first prototypes of its new range of vacuum insulating glazing and hybrid VIG.

At Cardinal, “we are evaluating various VIG technologies and how they may fit in the residential industry,” says Neumayer. “They do offer the next step in thermal performance, but at the same time, have variability in materials, aesthetics, durability, cost and availability.”

BY THE NUMBERS

50%

50% of building stock still use single-pane windows, and 25% of the energy used to heat and cool them is lost through windows, according to Climate Investment.



According to the U.S. Department of Energy, buildings consume approximately 40% of the total energy used in the U.S.

10+ R-Value

VIG provides thermal insulating values closer to that of a solid wall. Manufacturers report starting values of about R-10, with some companies increasing performance to R-20.

10x Higher

A triple low-e IGU offers 10 times higher thermal performance and solar control properties, when compared to monolithic glass, according to a report from Siseecam in the World Economic Forum.



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SOLAR DEMAND ON THE RISE

STEEP GROWTH OF THE SOLAR PANEL MANUFACTURING MARKET CAUSES QUESTIONS ABOUT GLASS SUPPLY

BY THE NUMBERS

4x increase

in manufacturing

U.S. solar panel manufacturing capacity topped 31 GW in 2024, a four-fold increase since 2022, according to the Solar Energy Industries Association's Q3 2024 report.

75 GW

of new capacity

The U.S. solar industry has added 75 GW of new capacity to the grid in the previous two years, representing over 36% of all solar capacity built in U.S. history, according to SEIA.

1.5M homes

Since the IRA passed in 2022, nearly 1.5 million American homes have installed solar, according to SEIA.

The solar panel manufacturing market has continued its healthy growth since the passage of the Inflation Reduction Act in 2022 incentivized both the production and purchase of clean energy equipment. Solar panels, also called photovoltaic panels, use glass, and both NSG Group and Vitro Architectural Glass have supply agreements with First Solar, a solar panel manufacturer.

Canadian Premium Sand also plans to open a patterned glass facility in Selkirk, Manitoba, Canada, to supply solar panel manufacturing, and announced in November 2024 that the company is also pursuing plans to open a patterned glass facility in the U.S., repurposing a former glass manufacturing facility to produce 4 gigawatts per year of solar glass. The company has established CPS Glass USA Corp., a wholly owned U.S. facility, as part of this new venture.

Anshul Vishal, vice president, corporate development, says their customers have a few interests regarding glass production, other than supply. Some customers have started asking for thicker glass, due to the increasing intensity of hail in certain regions of North America. "What we're hearing is a lot of solar projects are having difficulty with expensive

insurance policies and that's to do with hail damage and the cost of replacing glass," says Vishal.

New entrants faced with concerns over supply chain transparency

Manufacturers are also concerned with the supply chain of materials. One reason is that the IRA incentivizes use of domestic materials over overseas imports, says Vishal. Another reason is increased regulatory interest in "the carbon footprint of the products and traceability of the supply chain going up a few levels," he says. "As all of the new facilities that have been announced for solar panel manufacturing come online in the next year, we suspect there will be a lot more scrutiny on the supply chain."

Vishal doubts that the North American glass industry will be able to supply this new sector due to capacity. CPS Glass by itself will be able to supply, at most, 20% market share, he says; part of the barrier remains the cost of glass manufacturing in North America. When the solar panel market reaches 80 GW in capacity, Vishal says this would require billions in investment in glass manufacturing to supply the industry. "I think there's always going to be imports coming in, just because of the size of the market," he says. ■

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Left: Alufam fire-resistant 45-minute vision doors with transom windows at the Allen Institute for Brain Science in Seattle, Washington. Photo: Nick Merrick, Hedrich-Blessing.

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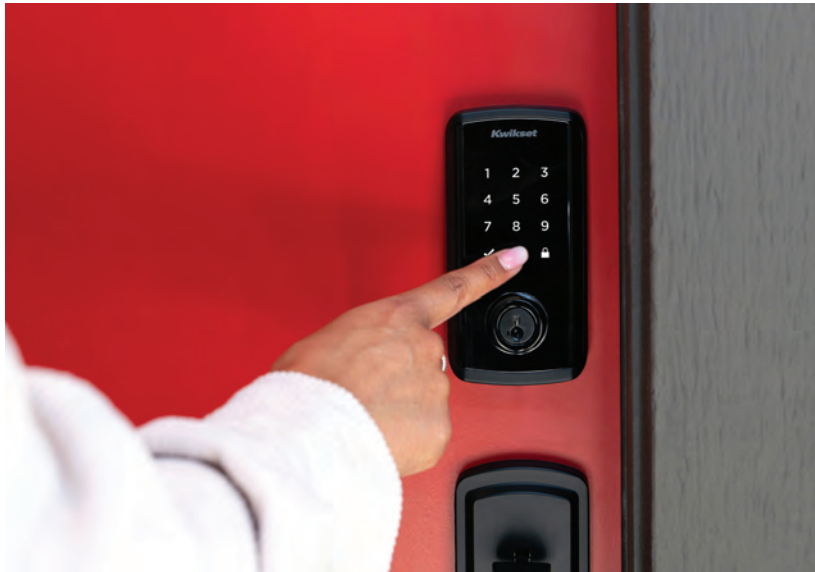
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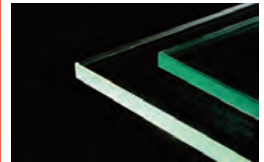
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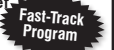
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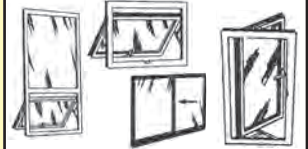
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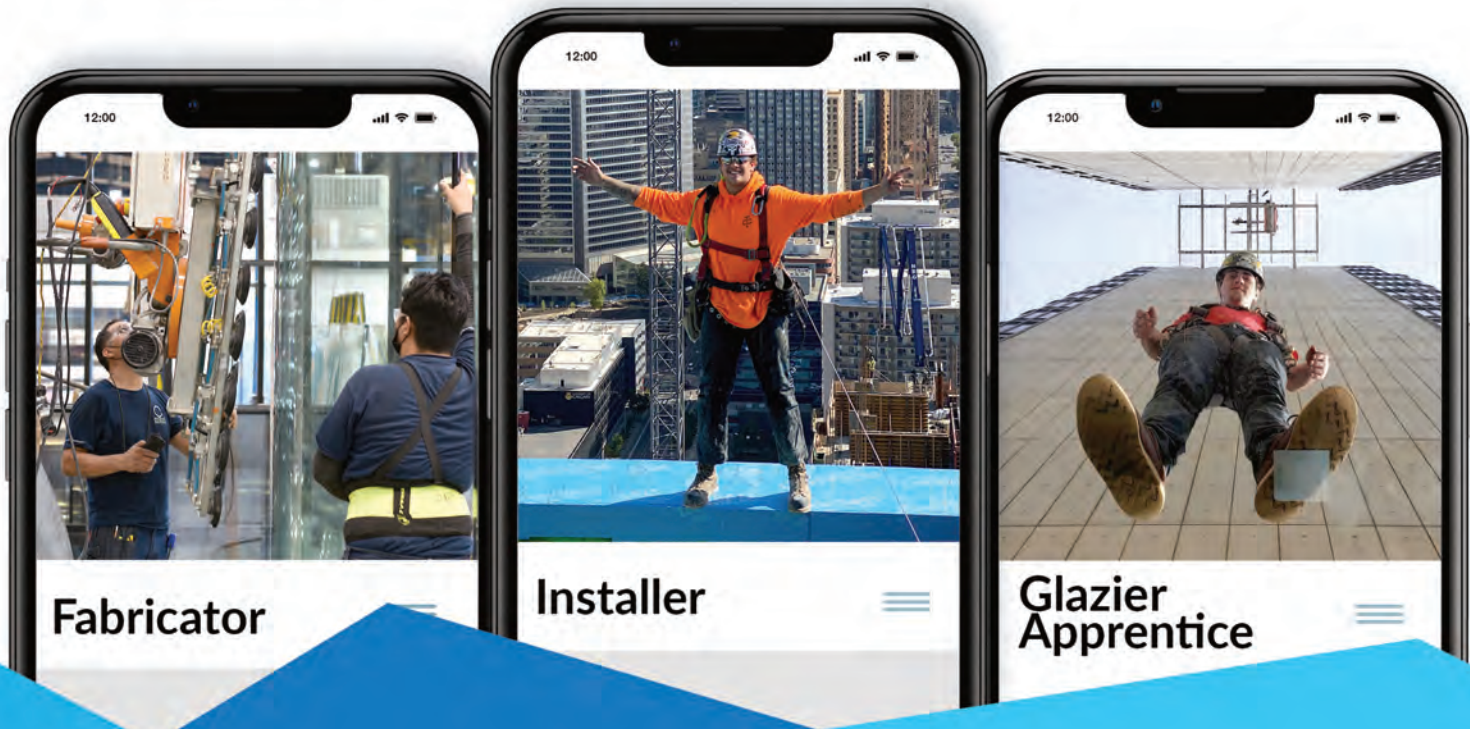


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Students listen as Pilloton-Lam presents at GlassBuild America 2024.



More information, resources on recruiting young people

The National Glass Association supplies resources on workforce development, including three toolkits that range on topics such as a guide to career fairs, onboarding, and manufacturing career recruitment and training. All of these resources can be found at glass.org by navigating to the Education tab and then Resource Toolkits.

BUILDING THE NEXT GENERATION

YOUNG PEOPLE DOING IMPACTFUL WORK, ONE BUILD AT A TIME
 BY RACHEL VITELLO

This year’s GlassBuild America once again brought labor into the spotlight. During one of GlassBuild’s Main Stage sessions—Building the World We Want to See: Building the Next Generation—Emily Pilloton-Lam shared her experiences working with young people on construction projects to serve local communities. Pilloton-Lam is the founder and executive director of the nonprofit Girls Garage, a design and construction school for girls and gender-expansive youth ages 9 to 18, as well

as an architectural designer, builder, educator and author.

“I believe that young people are incredibly talented and underestimated when it comes to being able to do real-life impactful work,” says Pilloton-Lam.

Teaching high school in North Carolina, Pilloton-Lam created a one-year program where students built projects and structures to fill community needs, including a farmers’ market in an agricultural town. Students fully designed and researched the project and presented ideas to the town. “This project came together like a homework assignment,” says Pilloton-Lam. “They were out every day, building the project together. It was incredible, everyone wanted to see this come to life.”

As an added bonus, 10 businesses started because they now had a venue to sell their products. “The point is to have the opportunity to build something that you’re proud of, the feeling of pride and

contribution to your community,” says Pilloton-Lam.

In another project, students fully built two tiny homes at Opportunity Village in the California Bay Area to address the housing shortage. During this project, she noticed that young women were as talented, creative and technically knowledgeable as any other student, but there was a dynamic of self-censoring themselves and social negotiation. Pilloton-Lam started working with small groups of young women to create an intentional and welcoming environment just for young women—and out of this, Girls Garage was born. “If we’re going to build a truly equitable and beautiful world, it has to be inviting to everyone,” she says. “A truly equitable and diverse community.”

More information on Girls Garage and other initiatives by Pilloton-Lam can be found at emilypilloton.com. ■

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