BEC CONFERENCE™

MARCH 2-4, 2025
LAS VEGAS
GLASS.ORG

Don’t Get Left Behind…

Trends That Are Changing the Glass Industry

Suresh Devisetti — VP, Global Product & sector Management — Guardian Industries

Alan Kinder — Director of Commercial Demand Creation — Guardian Industries

Why should your company care about trends?

Anticipate, & minimize external business-environment changes with negative impacts

Why should your company care about trends?

Identify new opportunities to create differentiation, maximizing business value in response external changes

What’s driving these changes you feel?

AWARENESS OF NEW NEEDS

REGULATIONS & STEWARDSHIP

COST & EFFICIENCY PRESSURES

RISK MANAGEMENT

GEOPOLITICAL CHANGES

What’s driving these changes you feel?

AWARENESS OF NEW NEEDS

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COST & EFFICIENCY PRESSURES

RISK MANAGEMENT

GEOPOLITICAL CHANGES

Customers throughout the value chain are asking for products & services that do more & do it better.

What’s driving these changes you feel?

AWARENESS OF NEW NEEDS

REGULATIONS & STEWARDSHIP

New building requirements are proliferating, & existing performance levels are increasing

COST & EFFICIENCY PRESSURES

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Post-covid inflation and supply chain disruptions putting more pressure than ever on costs

What’s driving these changes you feel?

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GEOPOLITICAL CHANGES

The frequency and amplitude of changes make short-term & long-term planning challenging

What’s driving these changes you feel?

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GEOPOLITICAL CHANGES

Reduced EU manufacturing/ construction demand, potential tariffs, & other conflicts

Shaping the Future of Architectural Glass:
3 Transformative Trends Driving Change

Advanced Glazing Performance

Digital Transformation

Supply-Chain Adaptation

Advanced Glazing Performance

- Thermal Performance
- Solar Performance & Light Transmission
- Laminated glass
- Bird Friendly Glass
- Lower-Embodied Carbon Glass

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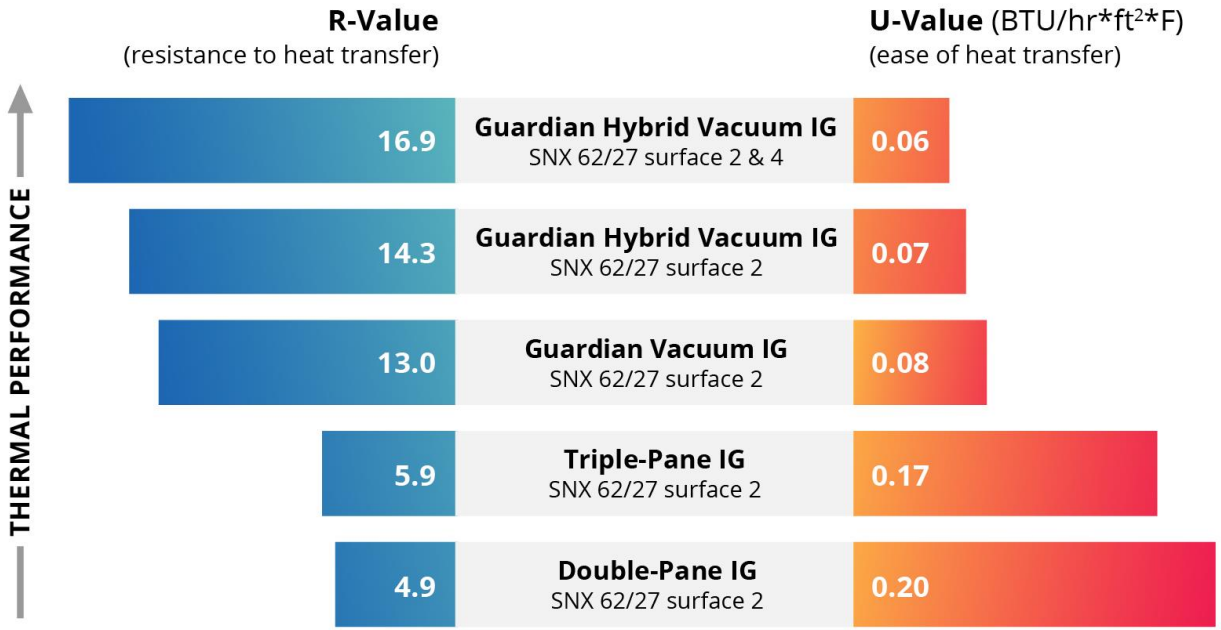


Upgrading America's Glazing for Modern Expectations

Outdated Windows Pose Challenges to Future Compliance in US

- Roughly 96 million homes (80% of all U.S. homes) have R-1 & R-2 windows (DOE estimate), translating to 6B square feet of inefficient residential windows.
- An estimated 2 billion square feet of single-pane windows exist in commercial buildings.

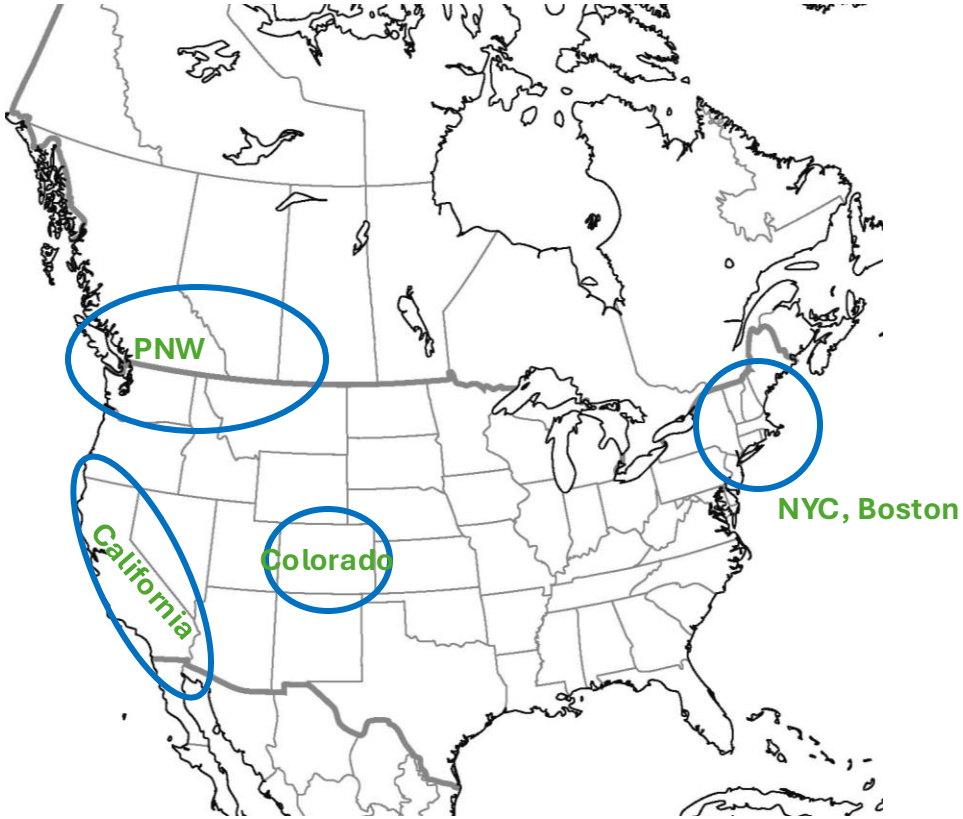
Buildings are one of the Biggest Energy Consumers

- Responsible for 31% of national greenhouse gas emissions, buildings are a major contributor to climate change (EPA)

Upgrading Presents a Substantial Opportunity

- 3% conversion represents $7B revenue for window manufacturers and fabs annually.
- Advanced IGUs can reduce operational carbon emissions in buildings by 25-35%

Regional codes continue to advance and will help with High Performance IGUs



Energy Star and ASHRAE in US and CAN not expected to change in 2027/2028

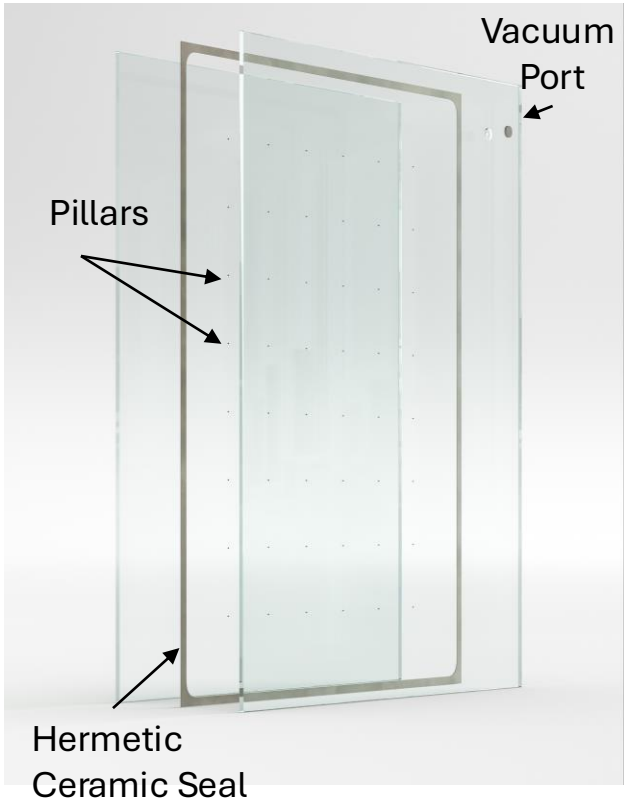
Local codes are driving need in several regions

- NYC: Local Law 97 carbon reduction
- Boston/Mass: stretch code driving triple and 4th surface ITO adoption
- Colorado: Local code pushing lower u-value techs
- California: expecting code change, more progressive than most states
- Vancouver, Seattle: low u-value codes in place, not at triple yet

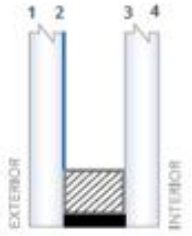
Rumored changes include California(u-value) and Chicago(carbon) and Cambridge(carbon).

Guardian Vacuum IG™

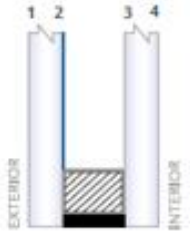
Glass technology that insulates like a wall



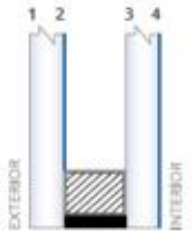
Traditional IGU Thermal Performance Enhancements



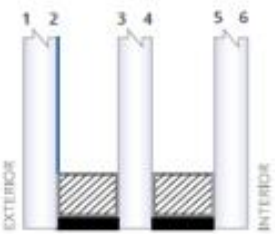
1 low-E coating
1 air-filled cavity
U-Value: 0.29



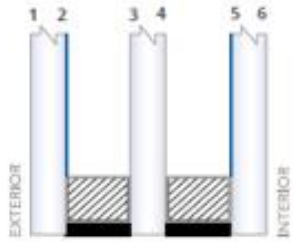
1 low-E coating
1 argon-filled cavity
U-Value: 0.24



2 low-E coatings
1 argon-filled cavity
U-Value: 0.20



1 low-E coating
2 argon-filled cavities
U-Value: 0.18



2 low-E coatings
2 argon-filled cavities
U-Value: 0.12

Vacuum Insulating Glazing Thermal Performance

R Value (1 / u-value) (1 / BTU/hr/ft2/F)	0°	15°	30°	45°	60°	90°
VIG with LowE: 4mm / Vacuum / 4mm	13	13	13	13	13	13
Traditional IG with LowE: 6mm / 0.5” Air / 6mm	2.3	2.4	2.5	2.7	3.0	3.4

Vacuum Insulating Glazing Maintains Thermal Performance at any angle

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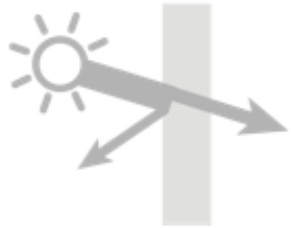
Simon Frasier University Student Union Building
Vancouver, BC
Perkins + Wil

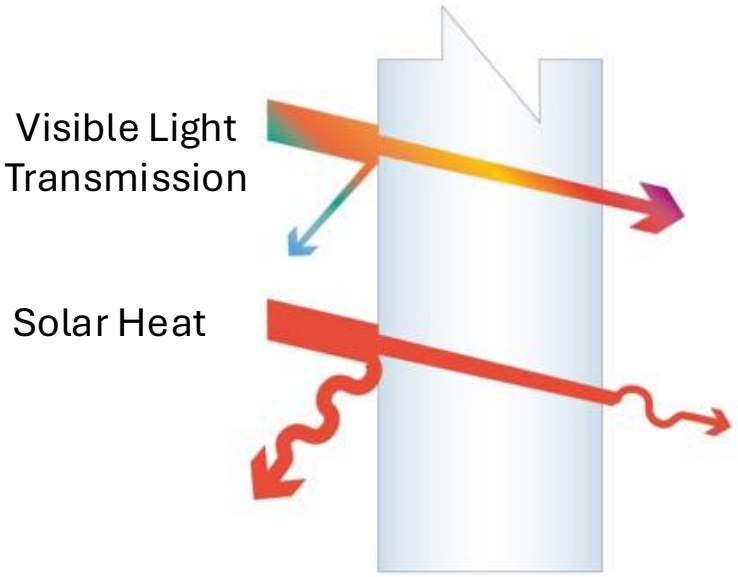
Finding the Balance Between Natural Light Transmission, Neutrality and Solar Control

Architectural requests continue to focus on glazing design that enhances daylighting with material selections that offer increased visible light transmission and greater color neutrality

Simultaneously, the push for energy efficiency, occupant comfort, and sustainability goals is requiring glass performance to further minimize heat gain with lower SHGC values.



Triple Silver Coatings Maximize the Light To Solar Gain Ratio (LSG)



62% VLT

÷

0.27 SHGC

=

2.31 LSG

AWARENESS OF NEW NEEDS

REGULATIONS & STEWARDSHIP

Wayne State University
Mike Ilitch School of Business
Detroit, MI
SmithGroup

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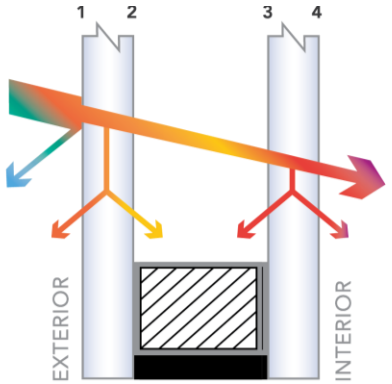
Triple Silver Coatings Advancements



¼" Glass | ½" Air Space | ¼" Glass | Coating on Surface 2 as Applicable

Visible Light Transmission	80%	60%	68%	50%	66%	62%	48%	60%	51%	33%
	No Coating 0.74	0.42	SN 68 0.38	0.34	SNX 70+ 0.28	SNX 62/27 0.27	SNR 50 0.25	SNX 60+ 0.25	SNX 51/23 0.23	SNR 35 0.17
Light-to-Solar Gain Ratio (LSG)	1.09	1.42	1.80	1.48	2.35 *Enhanced color neutrality	2.31	1.90	2.41 *Enhanced color neutrality	2.18	1.92

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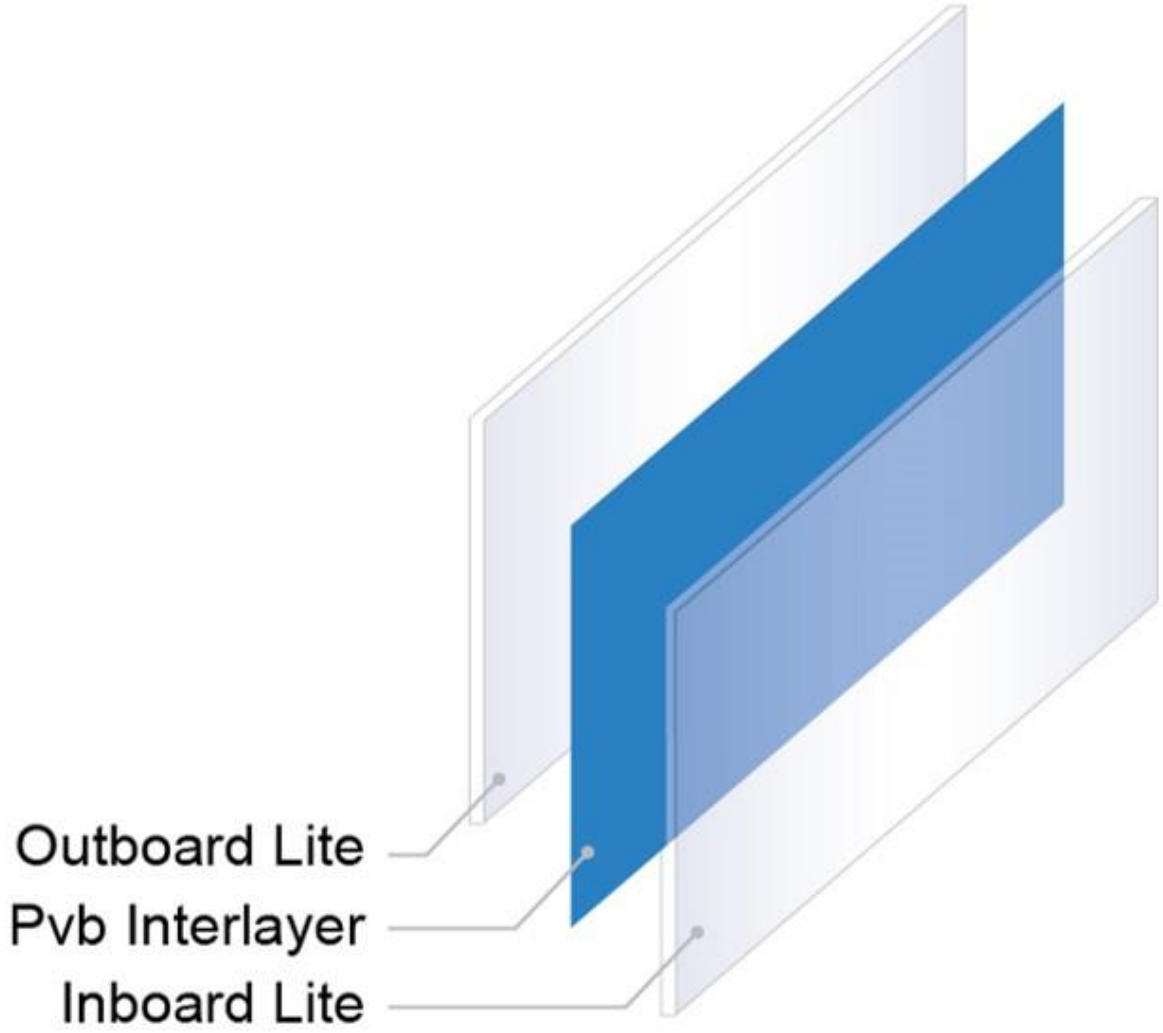


Rising Demand for Laminated Glass

Key Benefits for Modern Construction

Safety & Fall Protection

ANSI z97.1 and CPSC 16 CFR1201, Human Impact, Railings, Barriers

Weather & Natural Events

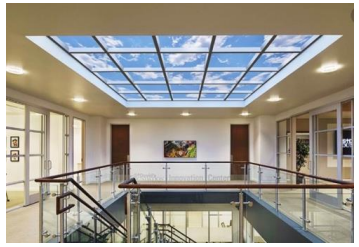
Hurricanes, Tornadoes, Earthquakes

Ballistic, Blast, & Forced Entry

Government, Embassy, Military, Schools

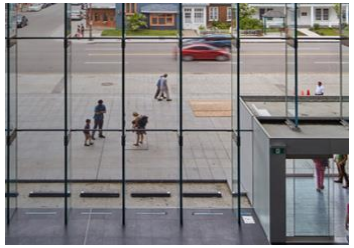
Unique Aesthetics

Colored interlayers, digital print, privacy, mesh and fabric



Overhead Glazing

Skylights and canopies



Structural

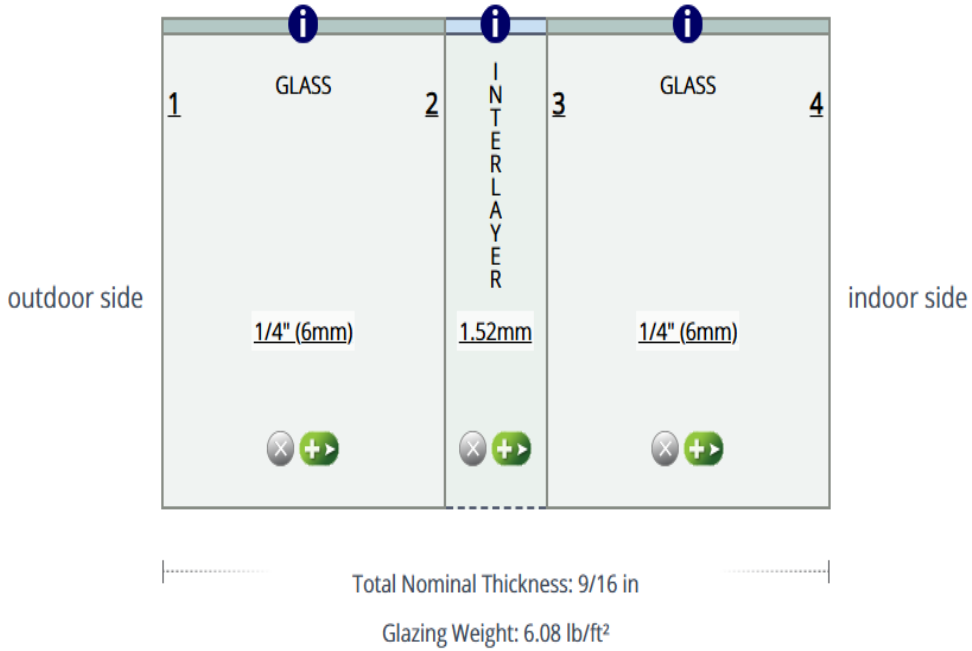
Glass Fins, Iconic entries, sports and recreation, transit terminals

Acoustics

Healthcare, Transit Oriented Developments, Hospitality

Understanding the Customization & Sophistication in Laminated Glass Processing

- Understand the specific level of protection you are trying to meet
- Impact on size and weight of the glazing unit.
- Center-of-glass vs total systems performance expectations
- Costs associated with complexity
- Annealed vs Heat-Treated Glass?
- Surface placement of treatments and coatings.
- Optical quality and managing distortion
- Engineered solutions
- Exposed edges?



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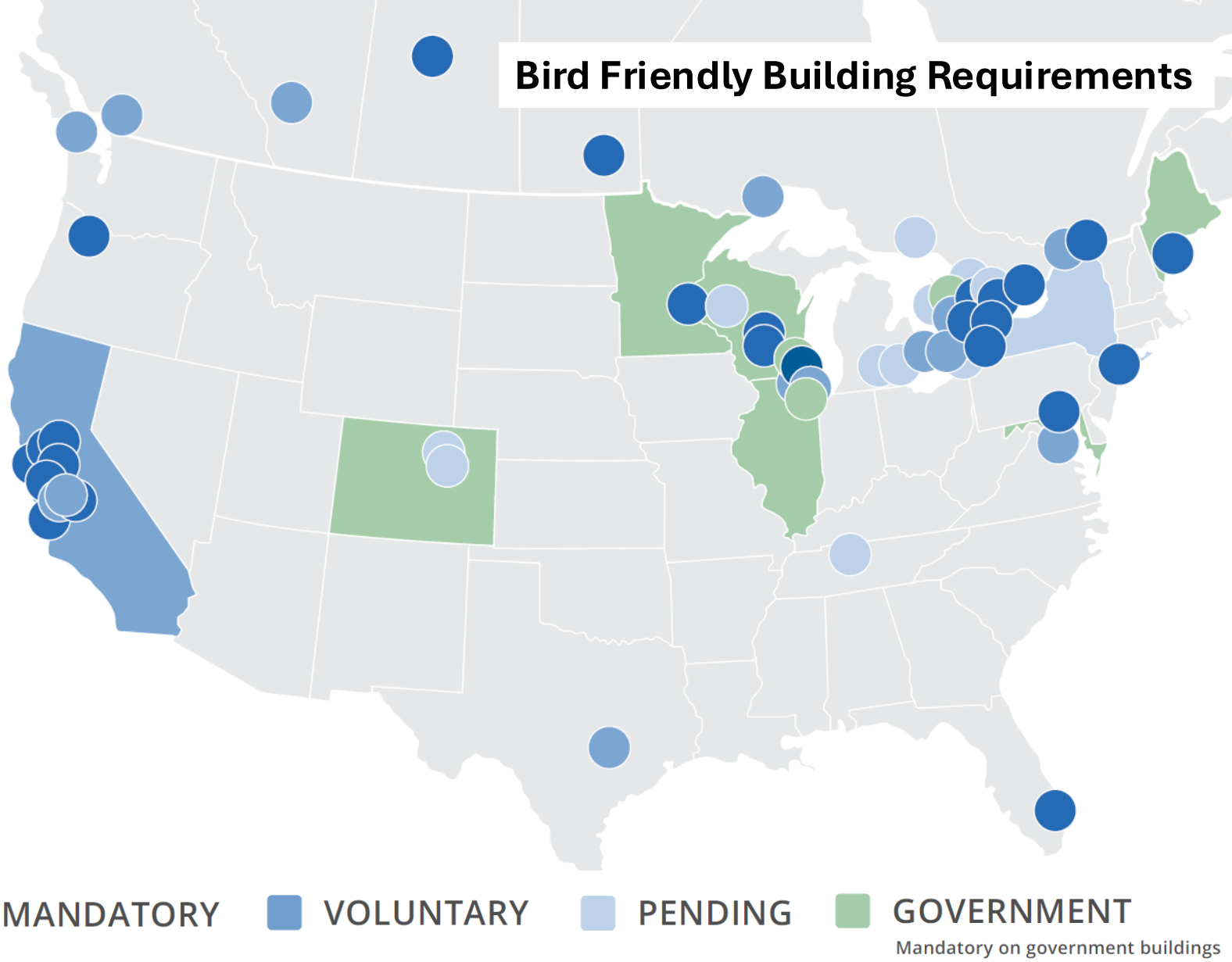
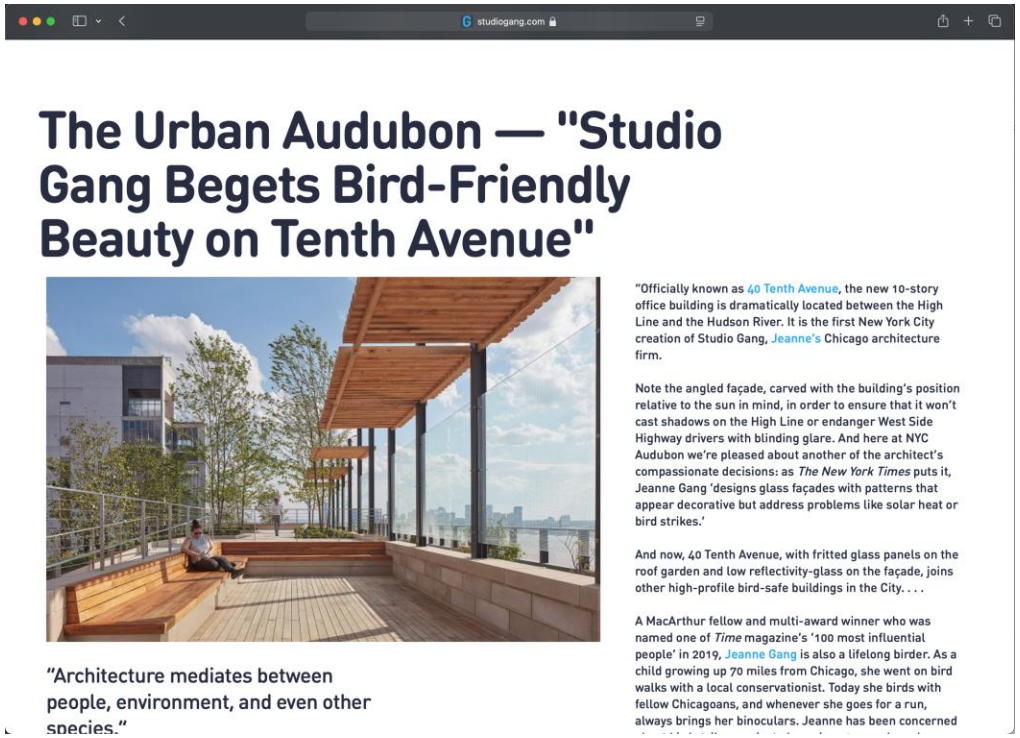


Public Awareness & Customer Demand is Growing



studiogang.com

The Urban Audubon — "Studio Gang Begets Bird-Friendly Beauty on Tenth Avenue"

"Officially known as 40 Tenth Avenue, the new 10-story office building is dramatically located between the High Line and the Hudson River. It is the first New York City creation of Studio Gang, Jeanne's Chicago architecture firm.

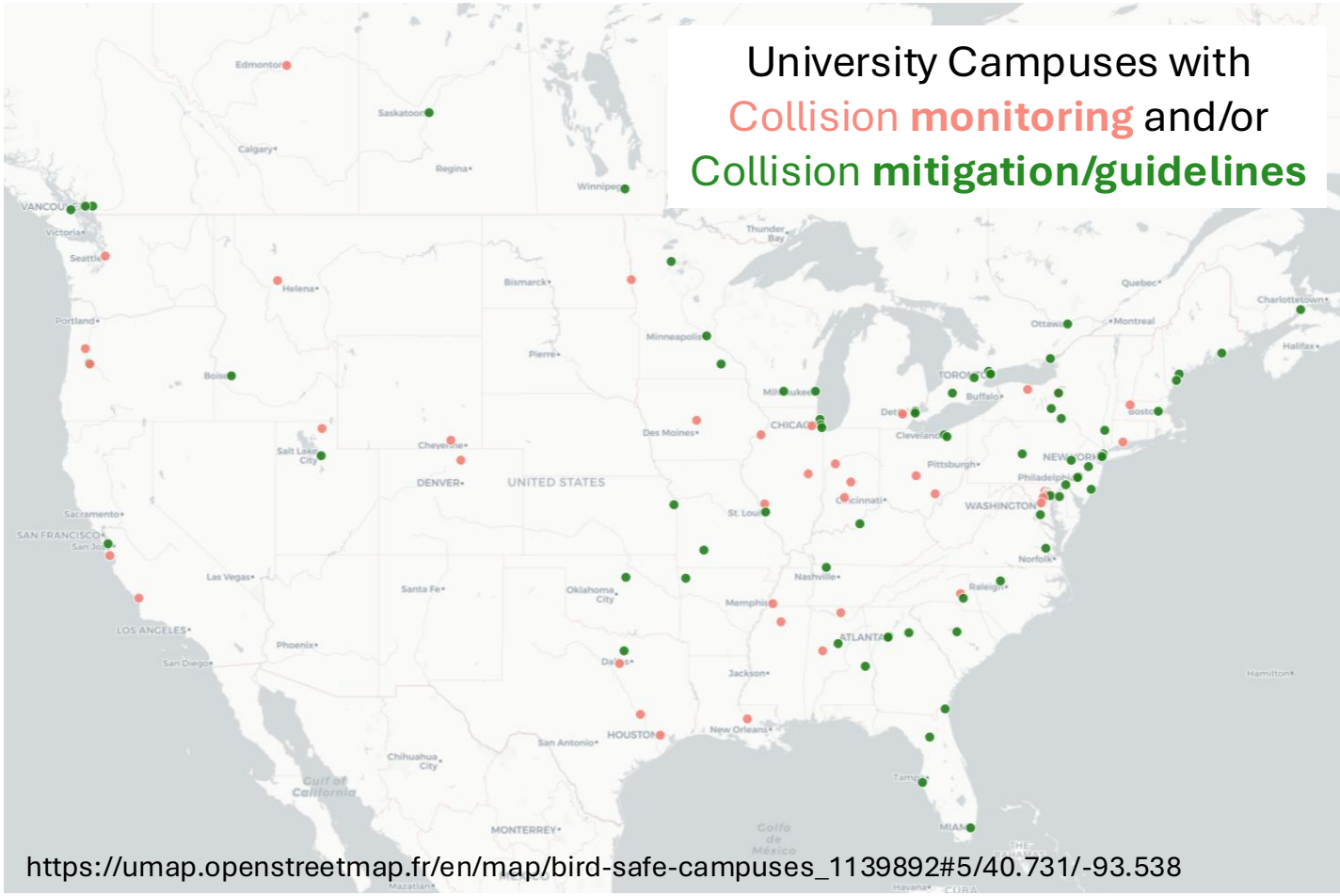
Note the angled façade, carved with the building's position relative to the sun in mind, in order to ensure that it won't cast shadows on the High Line or endanger West Side Highway drivers with blinding glare. And here at NYC Audubon we're pleased about another of the architect's compassionate decisions: as *The New York Times* puts it, Jeanne Gang 'designs glass façades with patterns that appear decorative but address problems like solar heat or bird strikes.'

And now, 40 Tenth Avenue, with fritted glass panels on the roof garden and low reflectivity-glass on the façade, joins other high-profile bird-safe buildings in the City. . . .

A MacArthur fellow and multi-award winner who was named one of *Time* magazine's '100 most influential people' in 2019, Jeanne Gang is also a lifelong birder. As a child growing up 70 miles from Chicago, she went on bird walks with a local conservationist. Today she birds with fellow Chicagoans, and whenever she goes for a run, always brings her binoculars. Jeanne has been concerned

"Architecture mediates between people, environment, and even other species."

https://studiogang.com/now/the-urban-audubon-studio-gang-begets-birdfriendly-beauty-on-tenth-avenue/



https://umap.openstreetmap.fr/en/map/bird-safe-campuses_1139892#5/40.731/-93.538

AWARENESS OF NEW NEEDS

REGULATIONS & STEWARDSHIP

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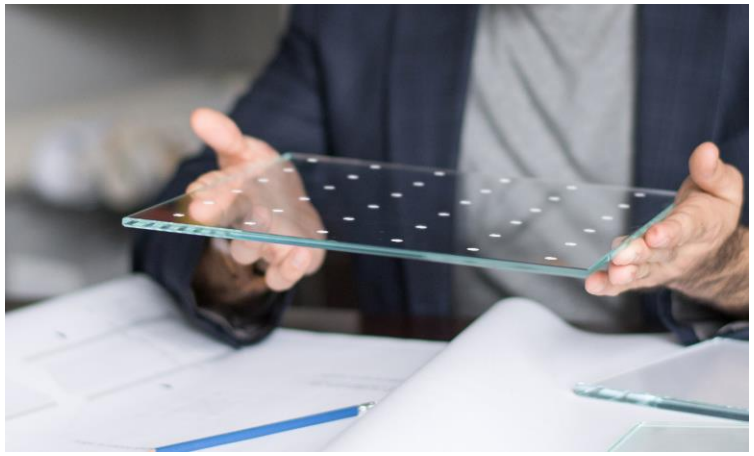
Response: New Portfolio of Products

Fritted Glass



Human visibility: *Moderate/high*

Etched Glass

Human visibility: *Moderate*

UV-Reflecting Glass

Human visibility: *Least visible*

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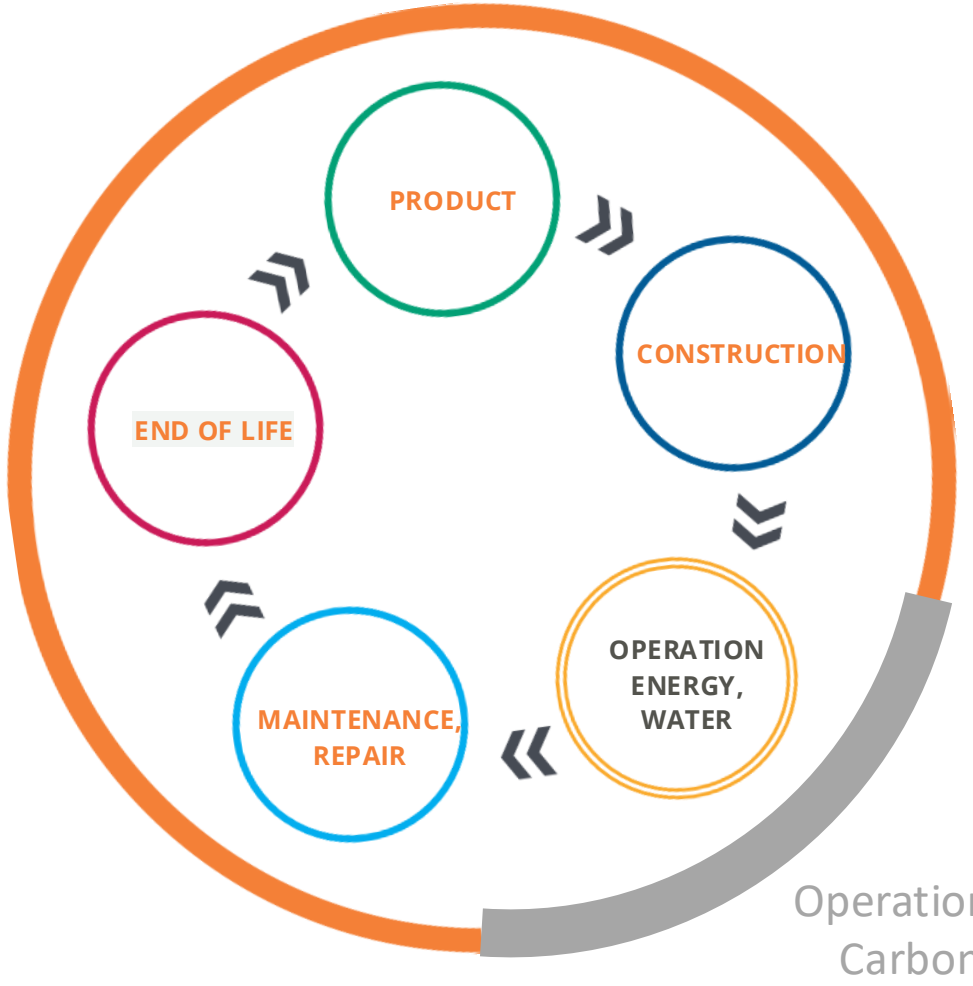

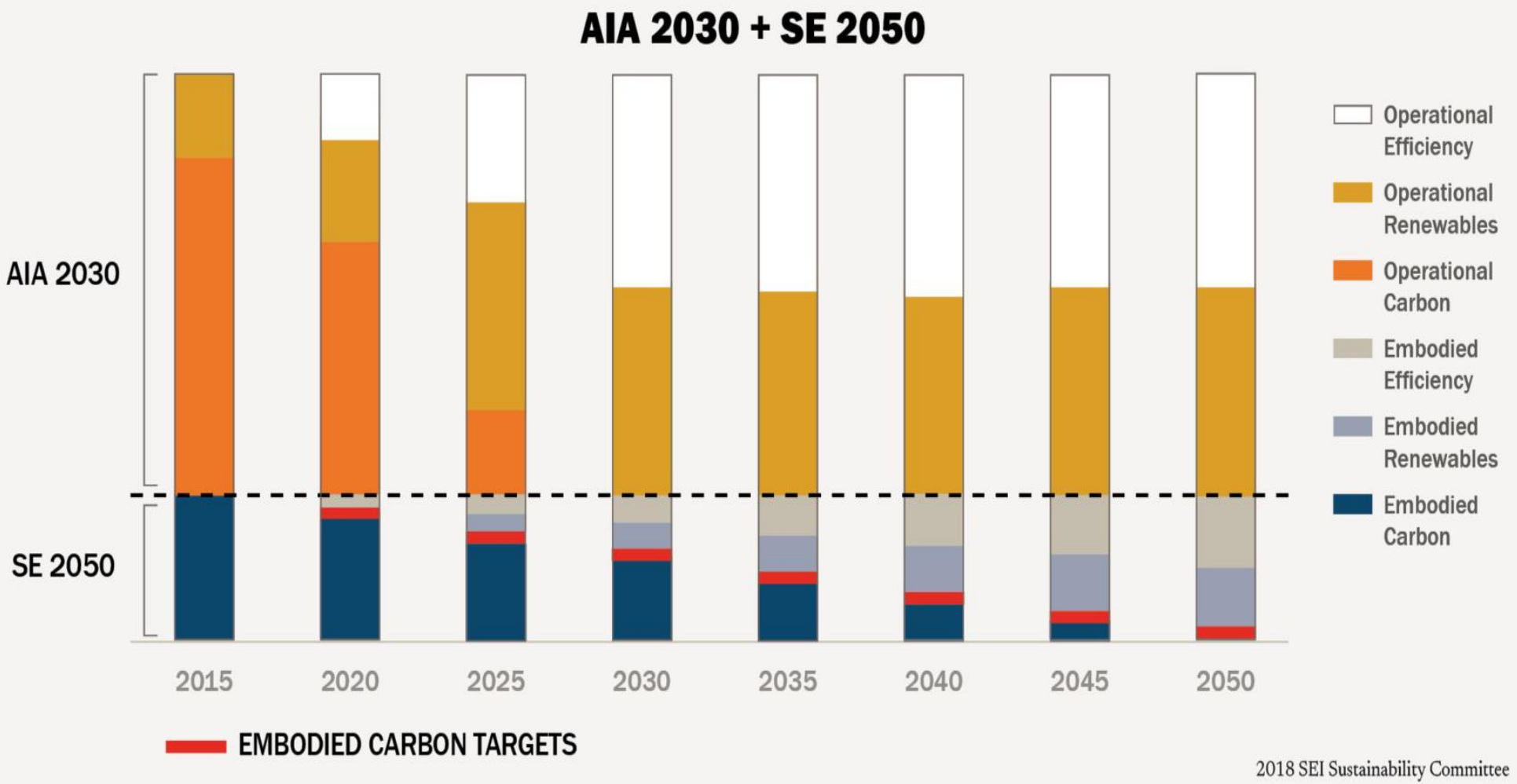

https://www.dlrgroup.com/idea/se-2050-commitment/

& many more...

AWARENESS OF NEW NEEDS

REGULATIONS & STEWARDSHIP

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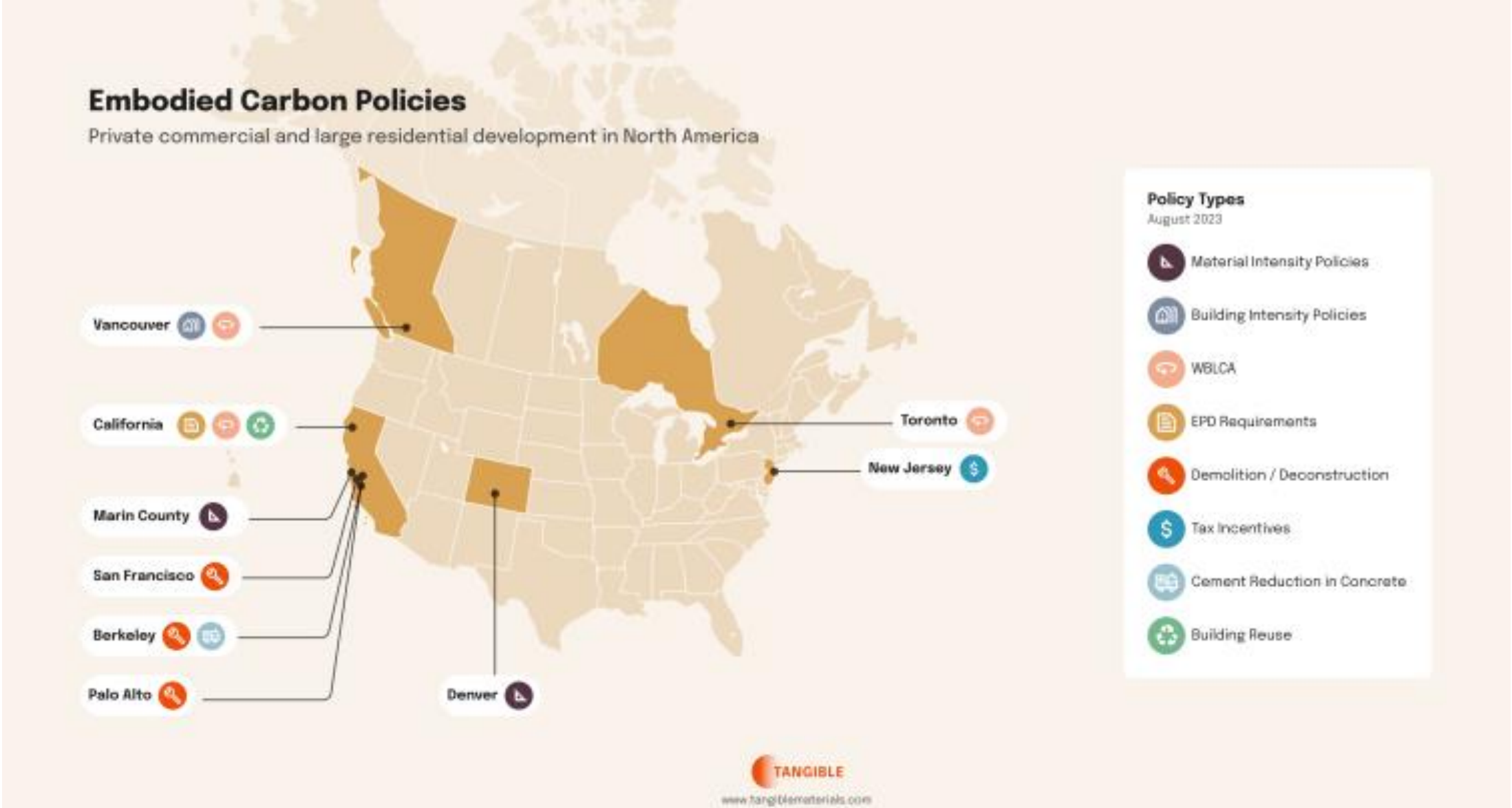


https://carbonleadershipforum.org/tangible-next-era-building-codes/

Guardian NEXA™

NEXA 6

- 6.38 CO2e/m2 for 4mm glass
- 91% Light transmission
- 88% Solar Factor
- 55%+ glass cullet content

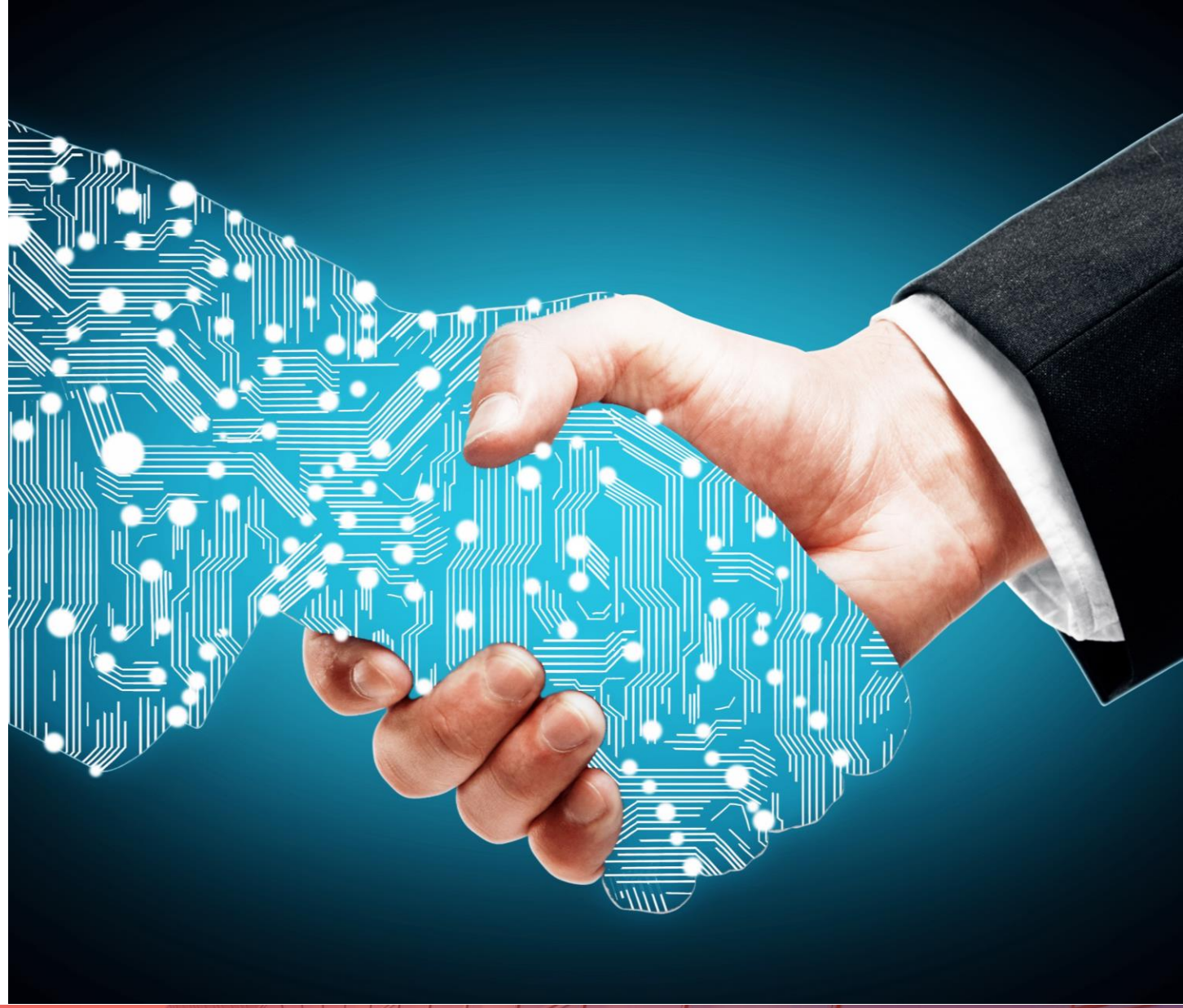
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

UPDATED Environmental Product Declarations for glass portfolio

Digital Transformation

Evolving Business for the Digital Age

- Rate of change for business transformation increasing rapidly
- Rapid Technological Advancements
- Enhanced Customer Engagement and Experience
- AI and Automation
- Data-driven decision making
- Creating New Ways to Deliver Value

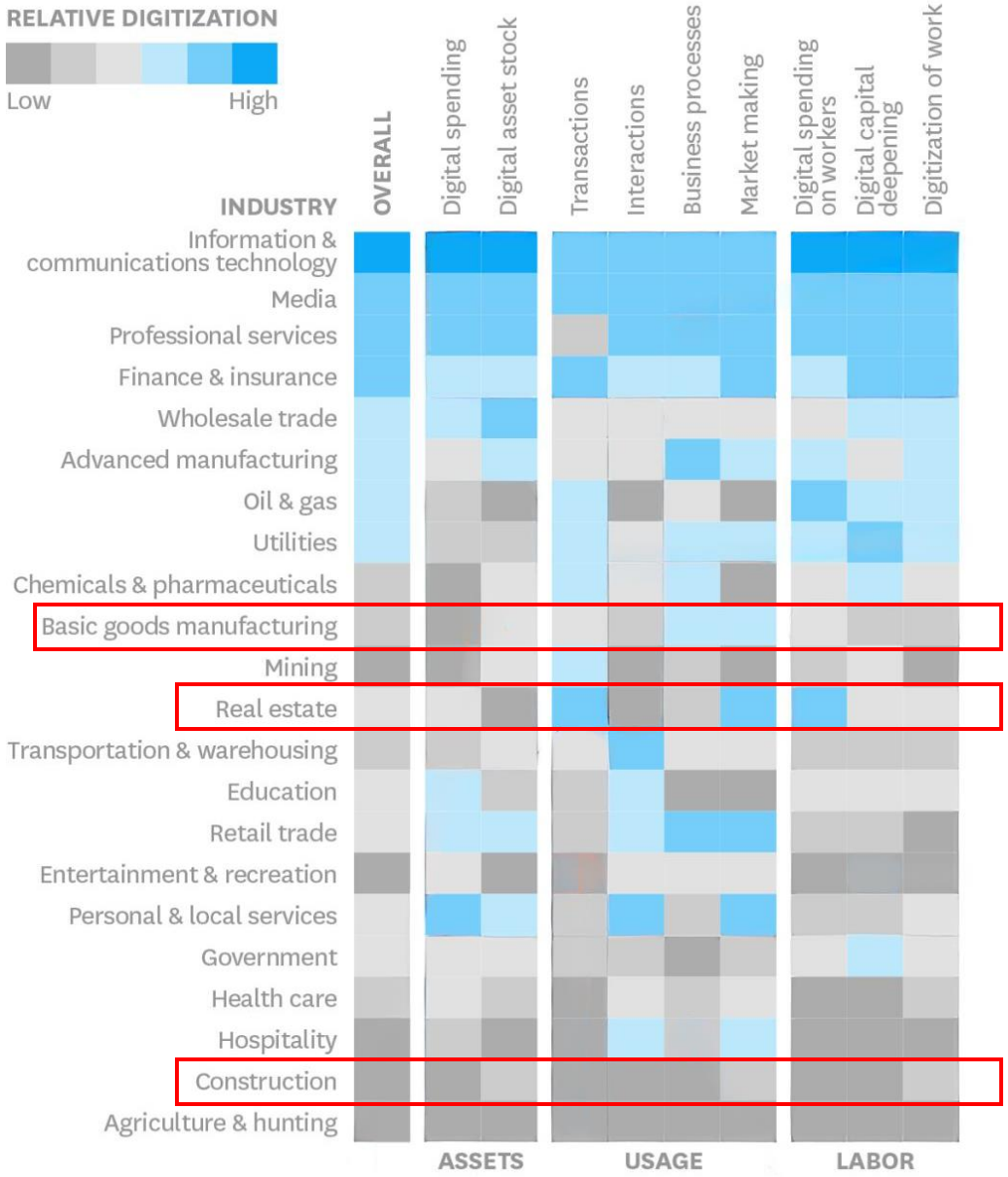


COST & EFFICIENCY PRESSURES

RISK MANAGEMENT

AWARENESS OF NEW NEEDS

How digitally advance is the construction sector?



SOURCE DATA ANALYSIS AND EXPERT INTERVIEWS CONDUCTED BY THE MCKINSEY GLOBAL INSTITUTE

https://whatfix.com/blog/digital-transformation-by-sector/

Not very.

That is why we are feeling pressure to change/improve

COST & EFFICIENCY PRESSURES

RISK MANAGEMENT

AWARENESS OF NEW NEEDS

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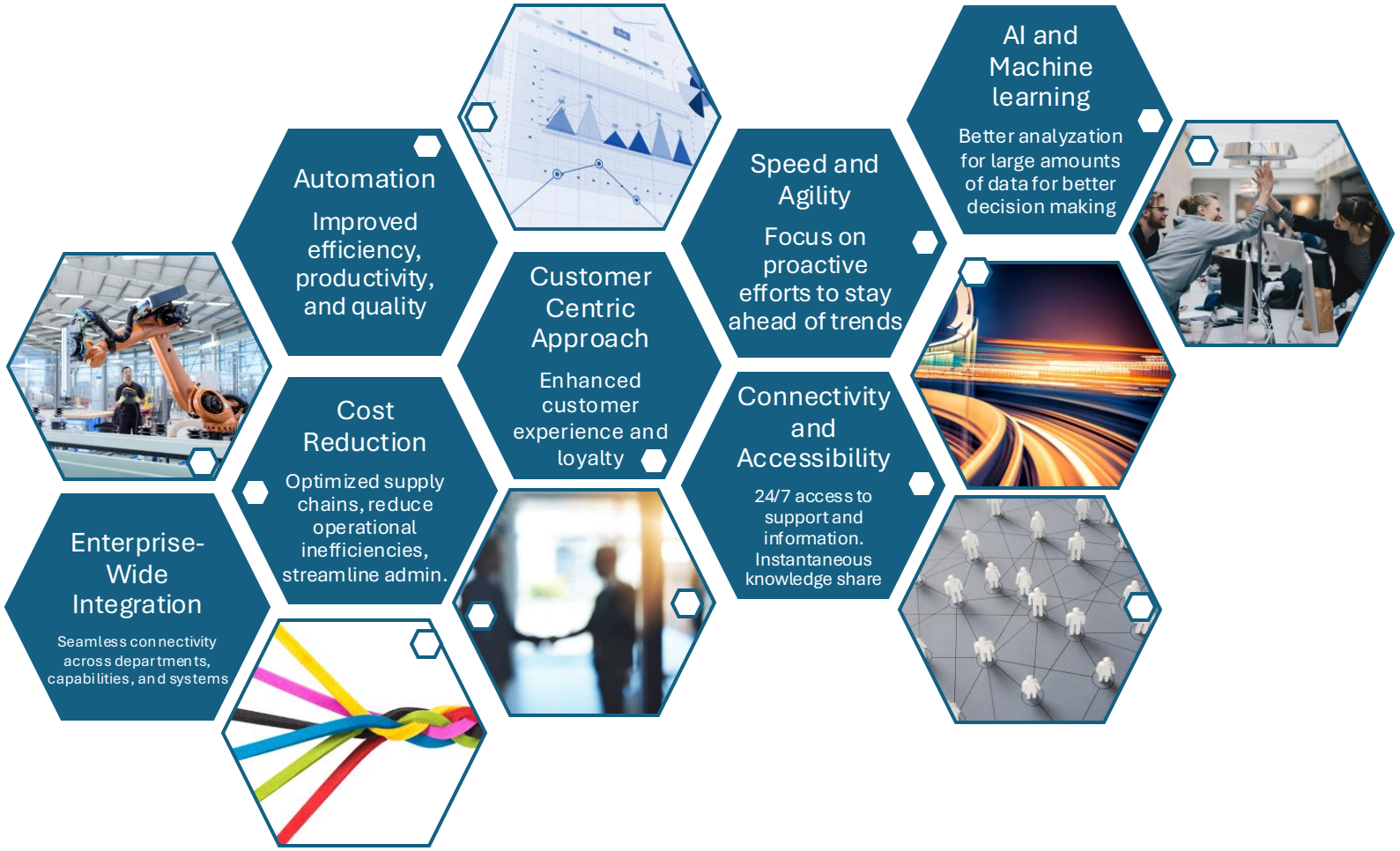
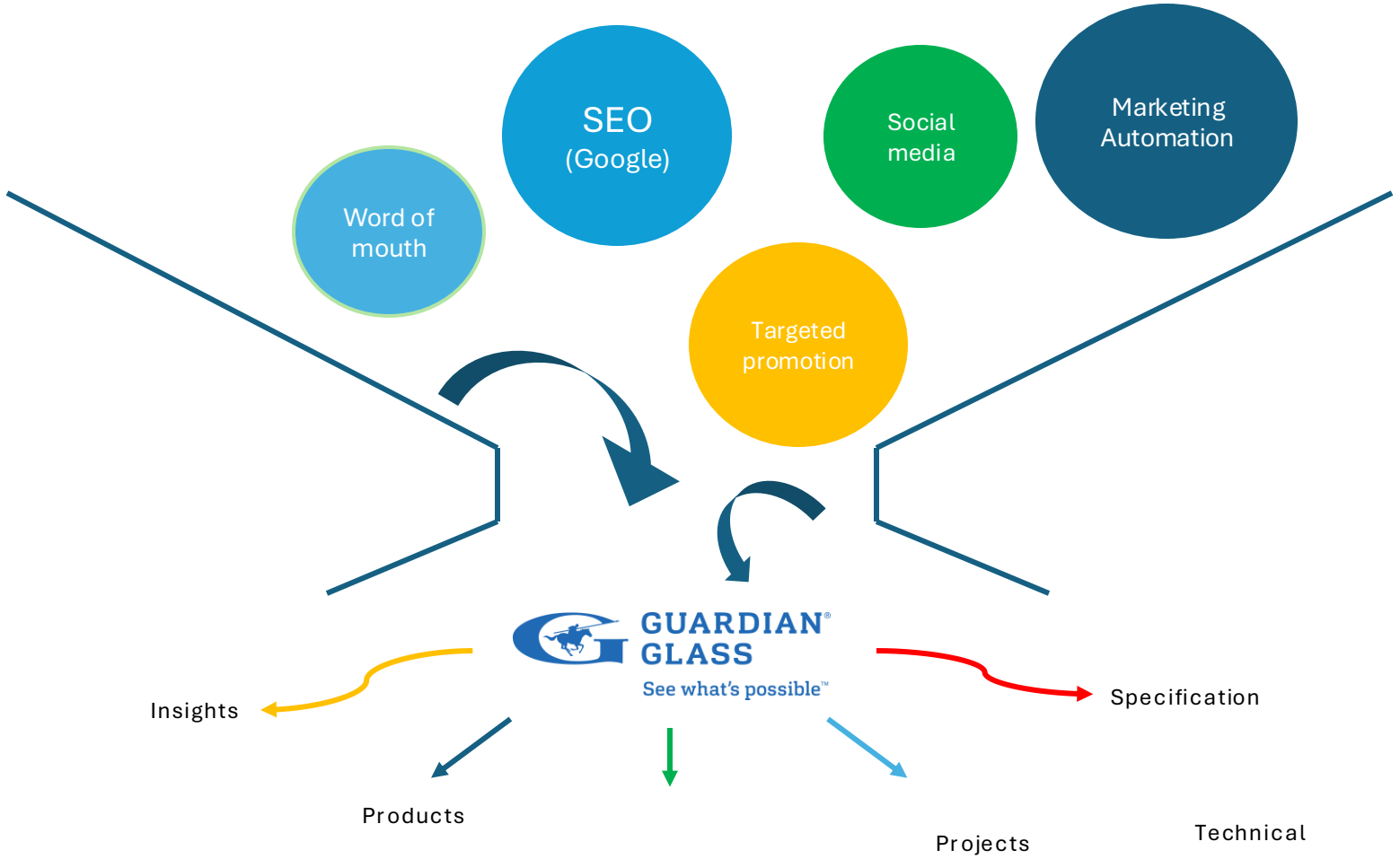
Digital Transformation Reimagines Business Processes



Improved Customer Engagement



Supply-Chain Adaptations

- Global Market Dynamics
- Risk Mitigation
- Adaptability and Responsive to Changes
- Strengthening supply-chain relationships

COST & EFFICIENCY PRESSURES

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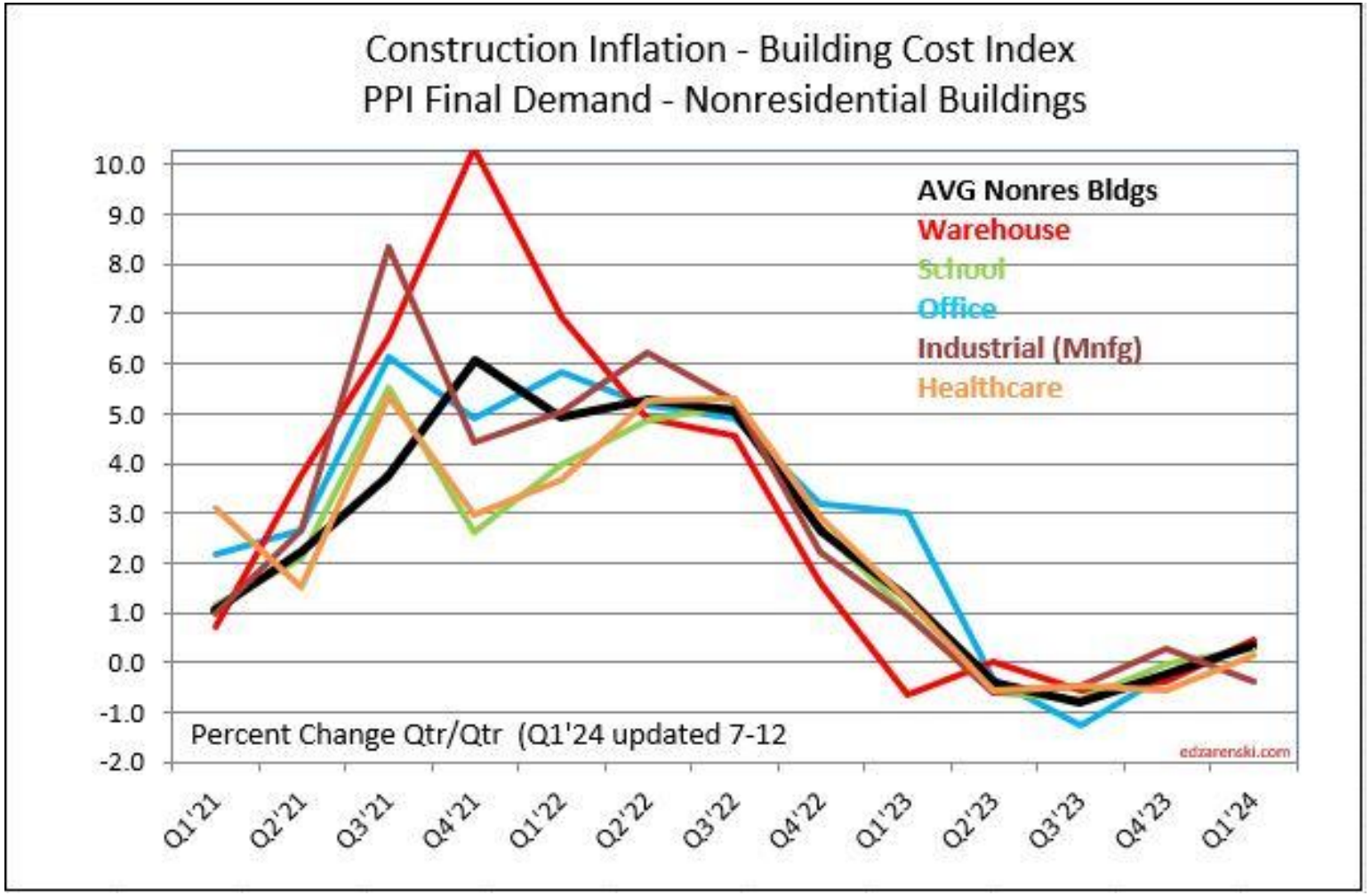


https://edzarenski.com/category/inflation-indexing/

US Glass Industry Import and Export Trade

Glass Industry Trade

Country	US Imports		US Exports	
	KMTs	$$MM	KMTs	$$MM
Canada	90	$75-100MM	640	$700-800MM
Mexico	235	~$225MM	305	~$300MM
China	780	$750MM*	Negligible	
EU	184	~$150MM	30	~$25MM
Malaysia	219	~$225MM**	Negligible	

** China Imports to the US 53% solar 18% Automotive 29% Architectural*
*** ~150K MT increase of solar pattern lites in 2024*
Source: Global Trade Atlas(S&P), Internal reporting and internal analysis of government reported import/export data

Global Market Dynamics
Understanding the Risks and Rewards

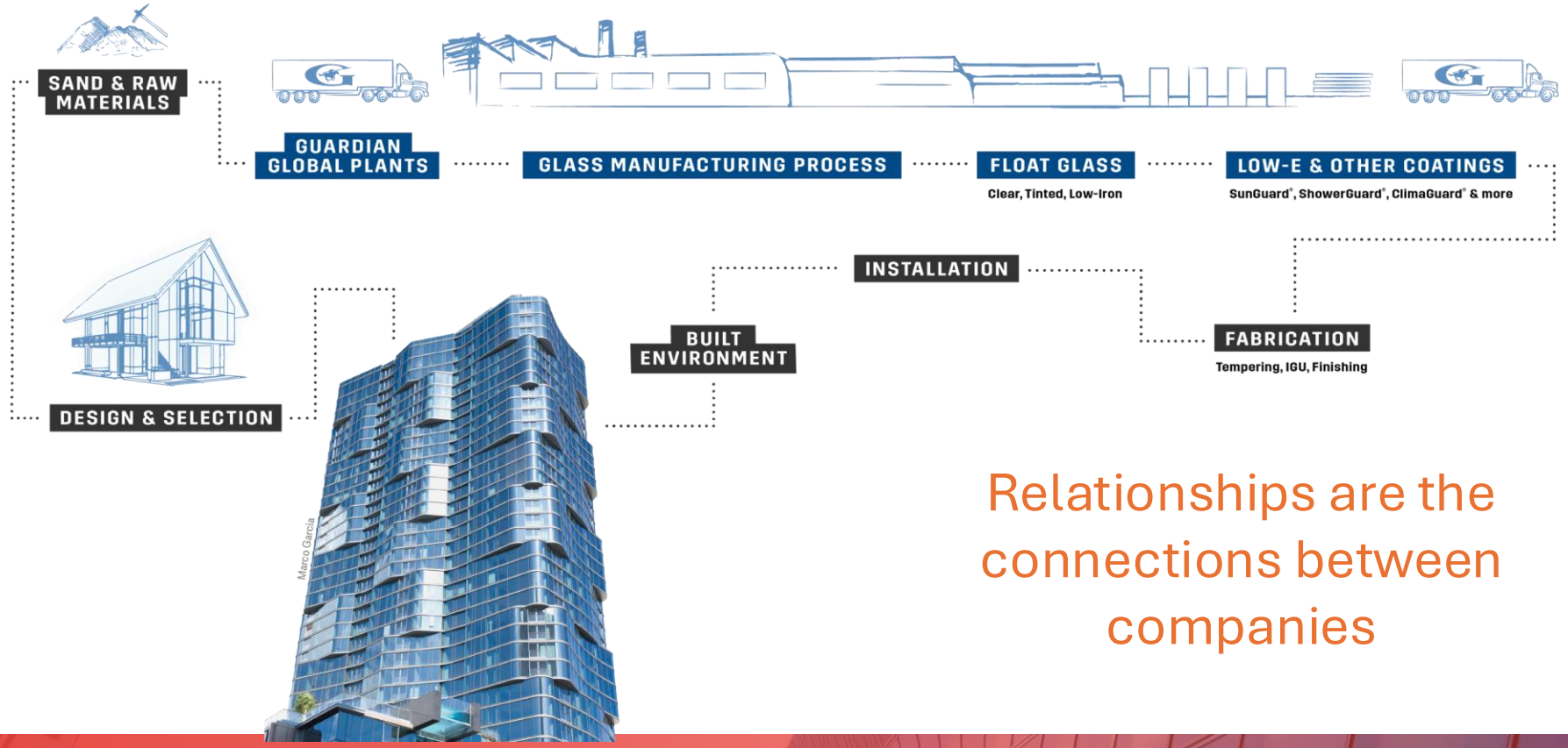
- ✓ Expanded sourcing options
- ✓ Innovative and specialized products
- ✓ Greater demand opportunities
- ✓ Cost advantages
- ✓ Shared knowledge
- ✓ Supply chain redundancy

- ≠ Tariffs and Trade Barriers
- ≠ Supply chain disruptions
- ≠ Economic volatility
- ≠ Quality control standards
- ≠ Environmental or Stewardship challenges

Beyond the Network

Building a Stronger, Smarter Supply Chain System

Interconnected businesses chasing a common goal



Relationships are the connections between companies

COST & EFFICIENCY PRESSURES

RISK MANAGEMENT

GEOPOLITICAL CHANGES

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Staying Ahead

The Power of Differentiation

- Enhance customer and vendor relationships through unique value propositions
- Stay ahead of evolving building codes, regulatory pressures, and trends that influence demand
- Embrace innovation, advanced technologies, and stewardship
- Invest digitalization for a competitive advantage
- Support professional development and employee well-being
- Adapt, evolve, and strive for continuous improvement

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This presentation was prepared for NGA’s BEC Conference keynote speech on March 3rd, 2025. The data and material contained herein are provided for informational purposes only. No warranty, express or implied, is made.