# BUILDING MATERIAL

Performance and Geometry Driving Expansion of the Facade Material Palette

Facade Tectonics FORUM TORONTO

## SPEAKERS

**YVON CHIASSON, ING., P.ENG.**

*Senior Building Science Specialist, Façade Engineering*

Morrison and Herschfield

**ROBERTO BICCHIARELLI**

*Lead Concept Designer – Business Development Manager East, Permasteelisa North America*

**ANTONIO MONSERRAT**

*Sales Manager*

seele

**MICHAEL STEINHUELB**

*Vice President*

seele

**ARTHUR HUARD**

*Principal*

GlassCan Corporation

**JOHN PETERSON**

*Senior Associate*

MacLennan Jaunkalns Miller Architects

MORRISON HERSHFIELD

# *Envelope Impact on Energy Efficiency: Technologies and Concepts*

**Yvon Chiasson ing., P.Eng.**

**May 3rd, 2019**

# Façade Tectonics Forum - Toronto

- Definition and Purpose of Building Envelopes

Building Envelopes are increasingly becoming the most important part of the building and they should not be considered as something you tack onto a building.  The building envelope needs to be the primary focus of the building design because it relates to everything!....

# Evolution of cladding over time

- 1000s year ago, from round roof and wind catcher

# Evolution of cladding over time

- Present day – Cold catcher!


# Recent evolution of cladding!

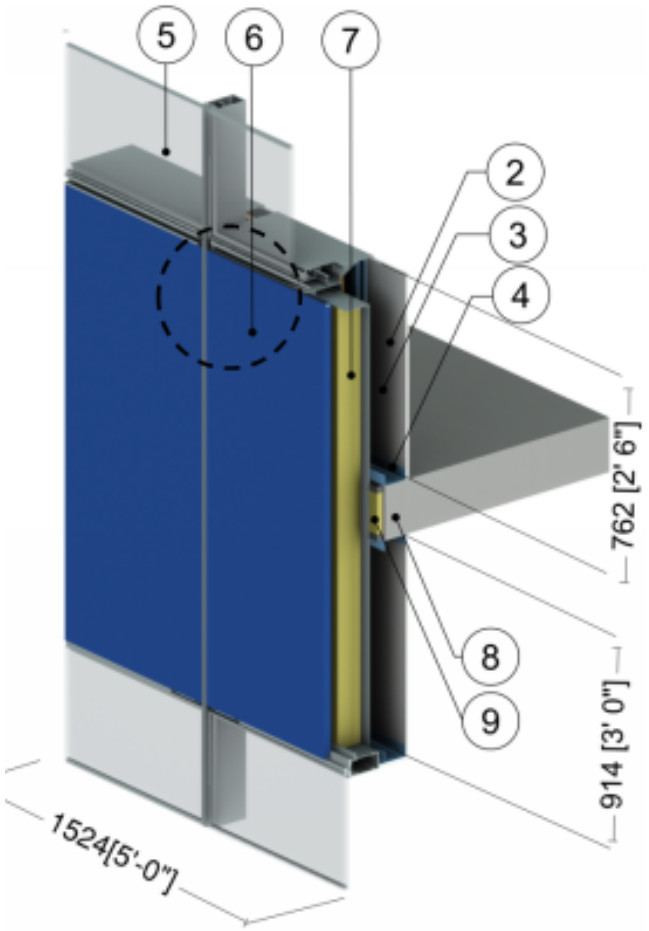
Since the energy crisis of the 70's, the main advancements in cladding have been:

- Introduction of thermally broken frames and other cladding components.
- Improvements in Glass fabrication and Coatings.
- The in-plant manufacturing of cladding components (panelized, unitized, etc…)
  - Unitized curtain wall system was born!

# Where are we now (NA context)?

- Thermally broken systems.
- Different types and sizes of thermal break materials.
- Mainly double glazed IGUs.
- Wide range of IGU spacer types and materials.
- Introduction of gases (argon and others).
- In shop glazing system, including spandrel panel and vision, usually floor height.

# Where are we now (Traditional Curtain Wall)?




R-17 insulation in spandrel

# R-7

Still does not fully address the shortcomings of the opaque panel in a glazing system

Opaque panel is still the “Achilles heel” of the system!

# Where do we need to go? 2030? 2050?

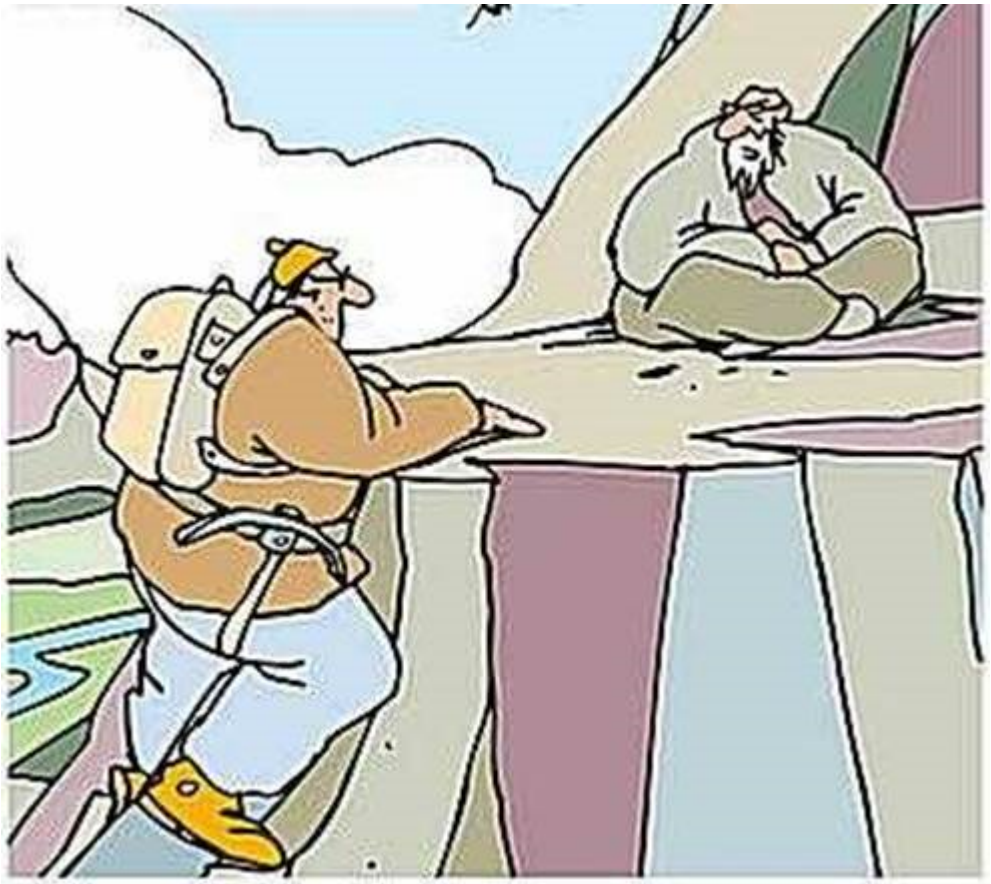
- Step codes, TEDI, and others towards net zero building!
- What are the current technologies available?
  - Triple glazed IGU (standard IGU in Europe)
  - Dynamic glazing/IGU (Chromic family – Photo/Thermo/Electro)
  - Vacuum Insulated Panels (VIP - limited availability in sizes but still costly)
  - Vacuum Insulated Glazing (VIG)
  - Double facade

# Where are we now (NA context)?

- The Glazing Industry and its fascination with Glass!

# What can we do to bridge the gap?

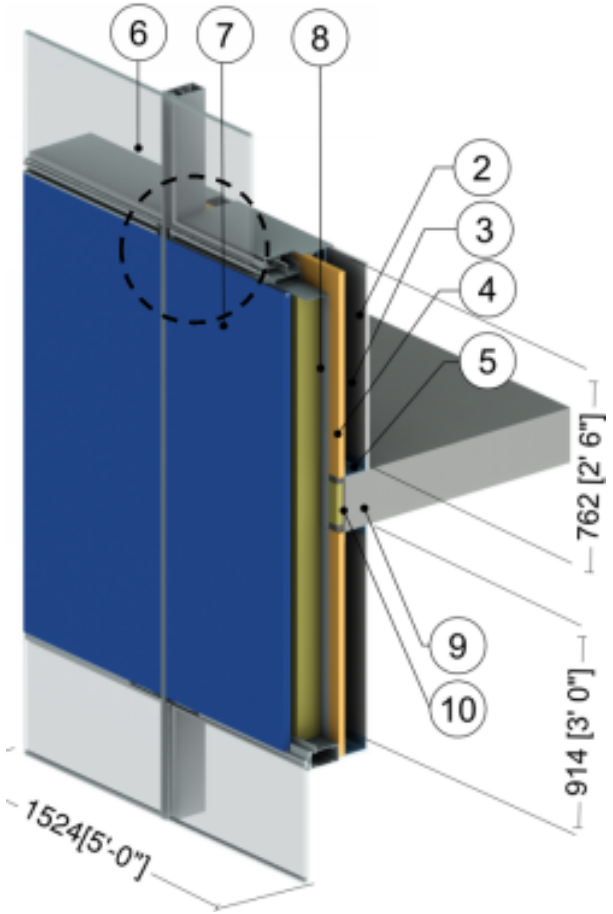
- Time to climb the mountain and go consult with the Guru?



# Try to Improve the weakest link?

- Spandrel panels/opaque panels are the weakest link in the existing glazing systems – the performance of the opaque panels generally dictate the overall performance of the wall assembly.

# Adding more Insulation?




R-17 insulation in spandrel with
R-12 cont. insulation inboard

R-8

R-12 continuous insulation added inboard of the framing only leads to an R-1 improvement!

# Moving forward!

- A new perspective on the construction and installation of unitized glazing system is required!

# How can it be achieved?

Initially, improve the design:

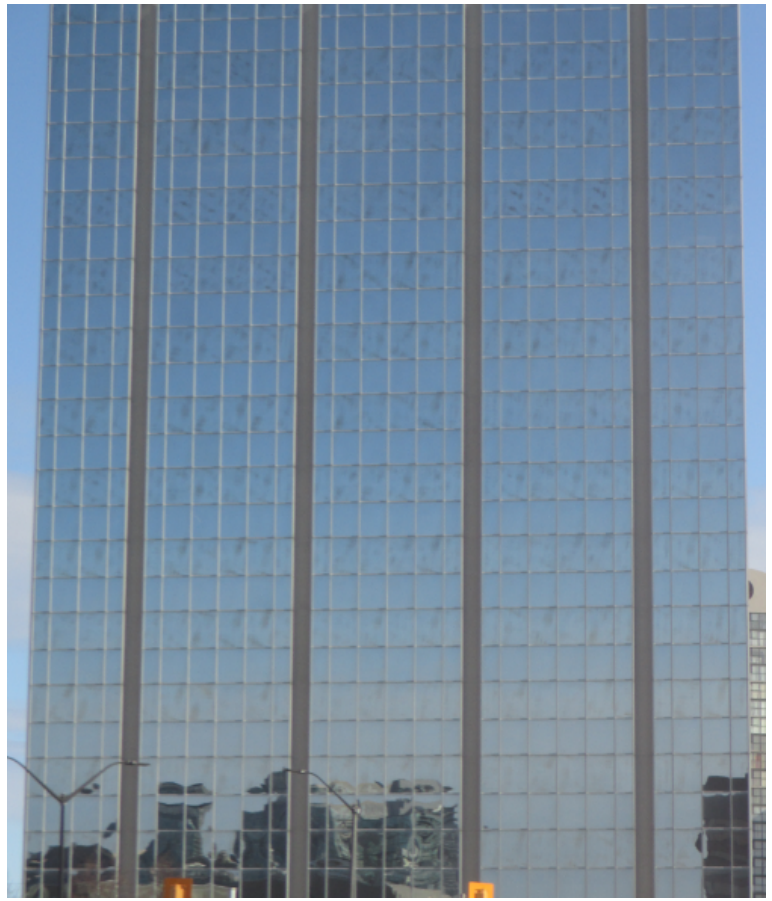
- We need to thermally break the spandrel from the vision area (sharing of verticals should not be encouraged!).
- Decouple spandrel panel from vision area:
  - double stack joints concept.
  - Reduce the number of vertical members exposed to the exterior (larger spandrel panes).
  - Placement of insulation to cover shoulder/curtain wall.
- Optimize performance with VIP panel in metal spandrel/opaque panel.

# How can it be achieved?

As a follow up, improve securement/installation:

- We have tried to stay within the present way of doing things, and trying to adapt the cladding to the existing structure (Structurally efficient).
- Design the best thermally performing cladding and then try to design a way to structurally secure to the building (Thermally efficient).

# Structurally vs Thermally Efficient?

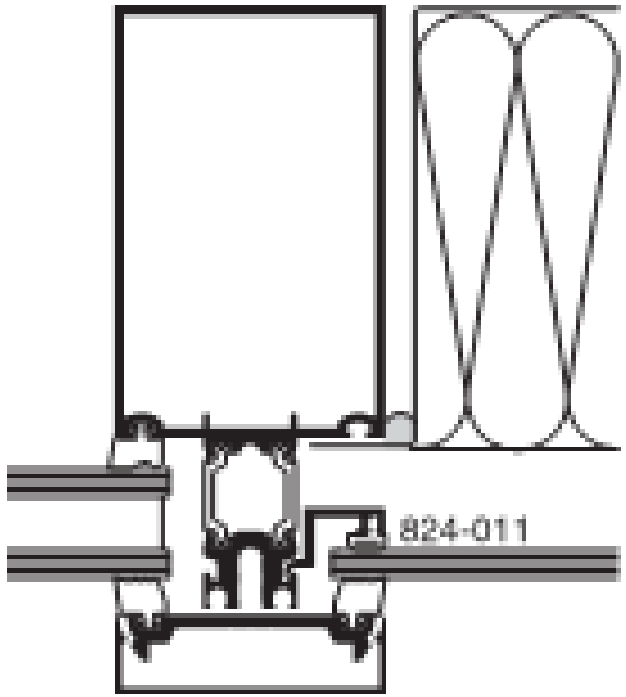


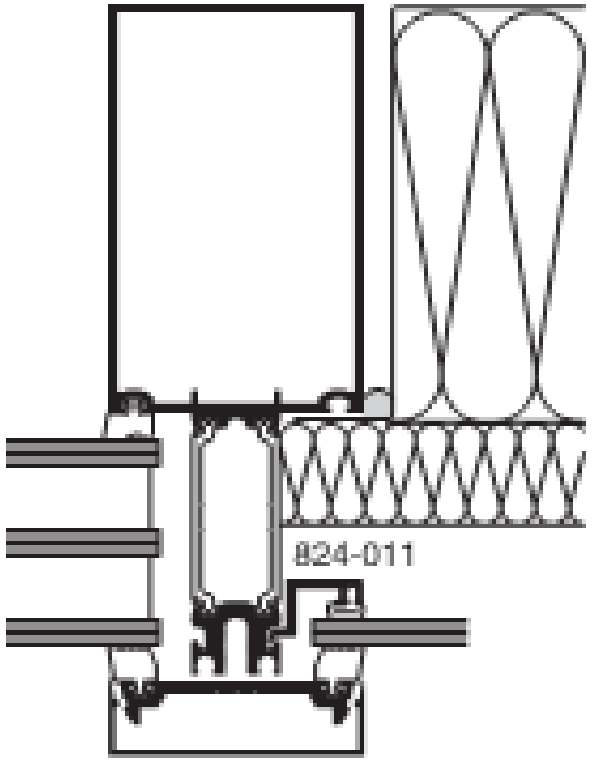
# Different way to look at it?

Goal – reduce thermal transgression into vision area

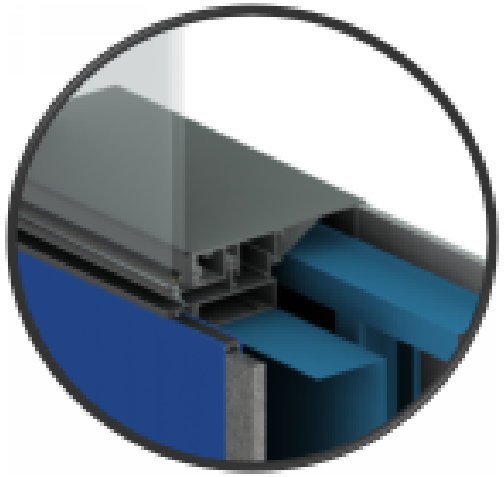
- Reduce number of vertical members
- Install assembly vertically
  - Smaller overall panels for vision area
  - Potentially handled without a crane (part of it anyway)
  - Increase size of spandrel, perhaps 20’ x 5’, staggered from vision above
  - Modify placement of insulation within spandrel
  - Double stack joint, perhaps a better stack joint…..
    - Better Chicken head……turkey head?

# Placement of Insulation

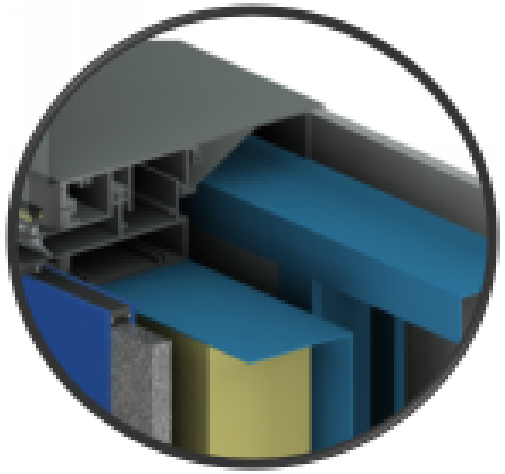


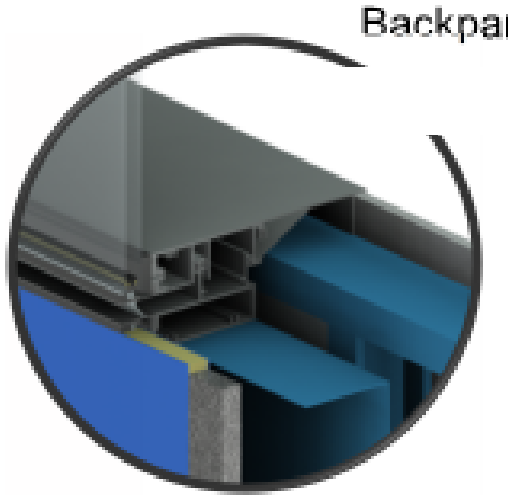
# High Performance Spandrel Panels (VIP)



H1 – Warm Edge Spacer, 0.75" (19 mm) AIM between Glass



H2 – Warm Edge Spacer, 0.75" (19 mm) AIM between Glass with 4" (100 mm) Backpan Insulation




H3 – Rigid Insulation Spacer, 1" (25 mm) AIM between Metal Skins

| Scenario | Insulation R-Value (RSI) | $U_s$ Btu/ft$^2$·hr·°F (W/m$^2$ K) | $R_s$ ft$^2$·hr·°F / Btu (m$^2$ K / W) |
|---|---|---|---|
| H1 | R-29.3 (5.16) | 0.103 (0.59) | R-9.7 (1.71) |
| H2 | R-46.1 (8.12) | 0.098 (0.56) | R-10.2 (1.79) |
| H3 | R-39.1 (6.89) | 0.060 (0.34) | R-16.6 (2.92) |

# Looking towards the past!

Can the 70's way of doing things be just around the corner?

- Precast panels & strip windows?
- Perhaps better if
  - Sandwiched insulated precast panels
  - Thermally broken precast with polyester clips
  - High performance insulation
  - Triple glazed fenestration system
  - R20+ for the system?

# Past and Present!

# What are we waiting for?

Full Steam Ahead…….

But watch out for the icebergs!

# Facade Tectonics Forum - Toronto

THANK YOU!

# *Sustainability: mfree-S* / Close Cavity Façade – Roberto Bicchiarelli

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## *Façade Tectonics Institute Forum*

## *Toronto, May 3rd 2019*

# FTI Forum Toronto: What's now, what next

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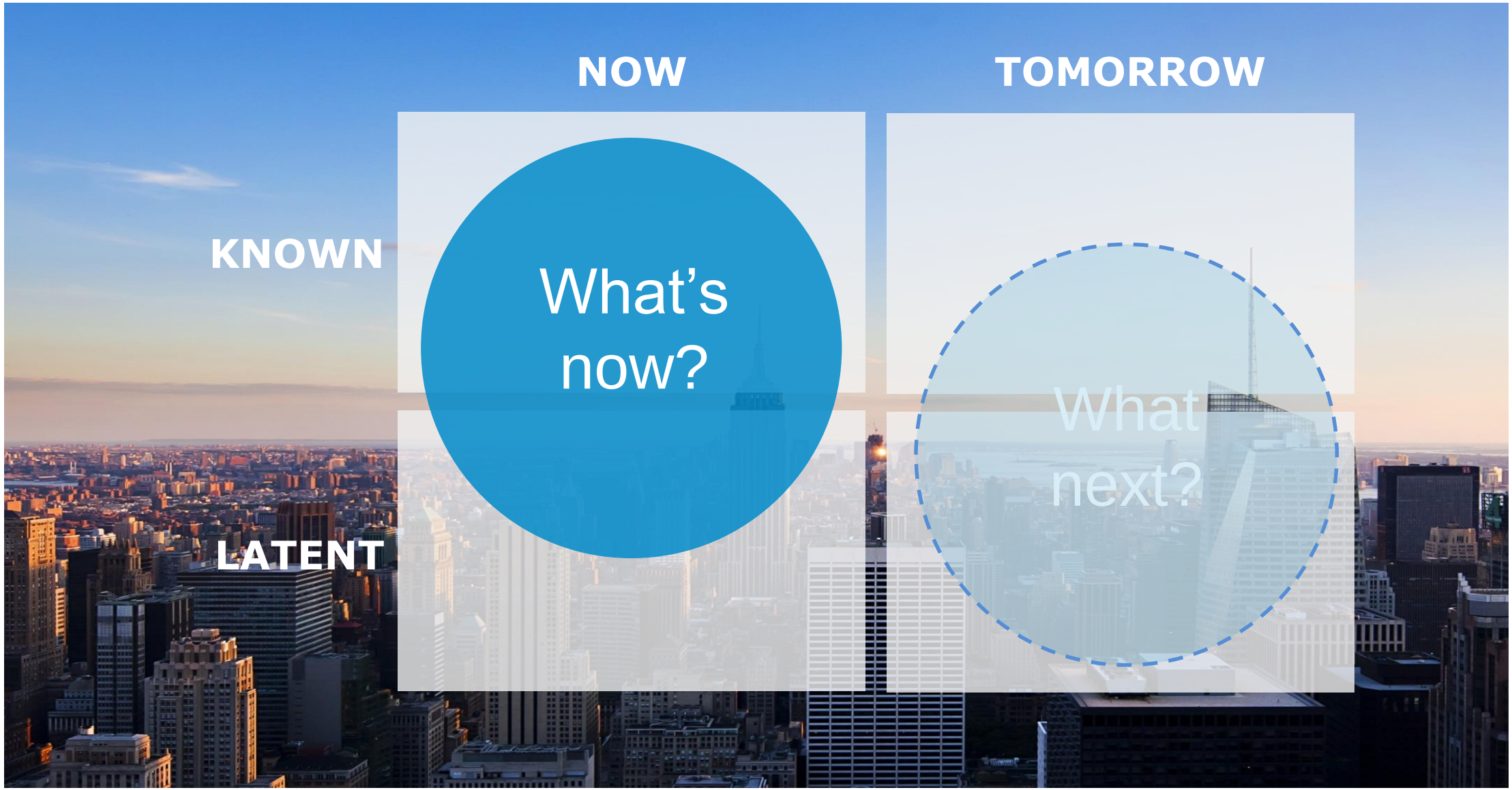

## Today's (business) environment: disruptions – drivers - evolution


Confirmed by:

- Governmental and local regulations
- Main rating-systems
- Public expectations due to increased social accountability

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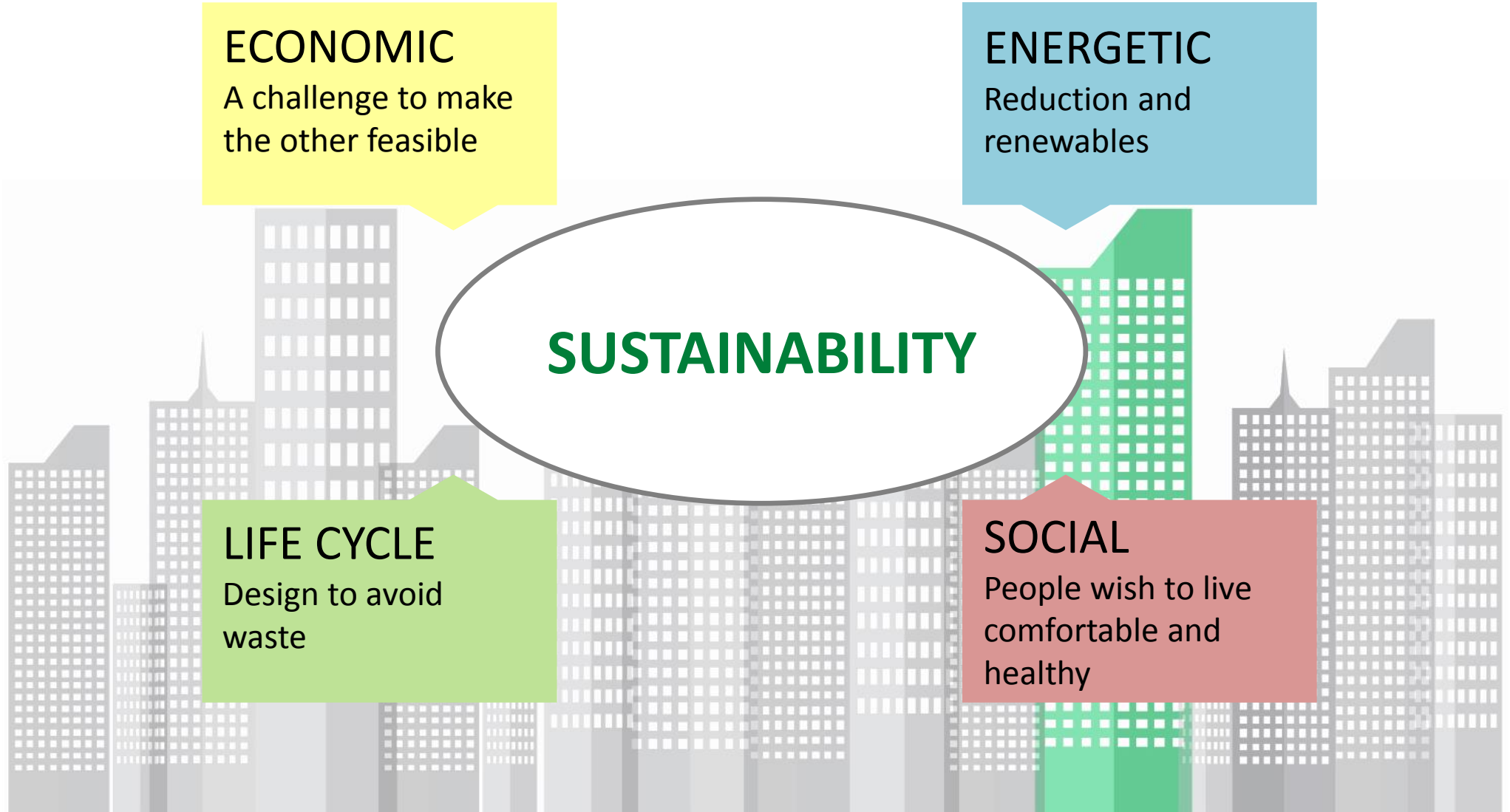
# Today's focus on Sustainability



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## Sustainability


Ref. United Nations Environment Program Sustainable Buildings & Climate Initiative 2009

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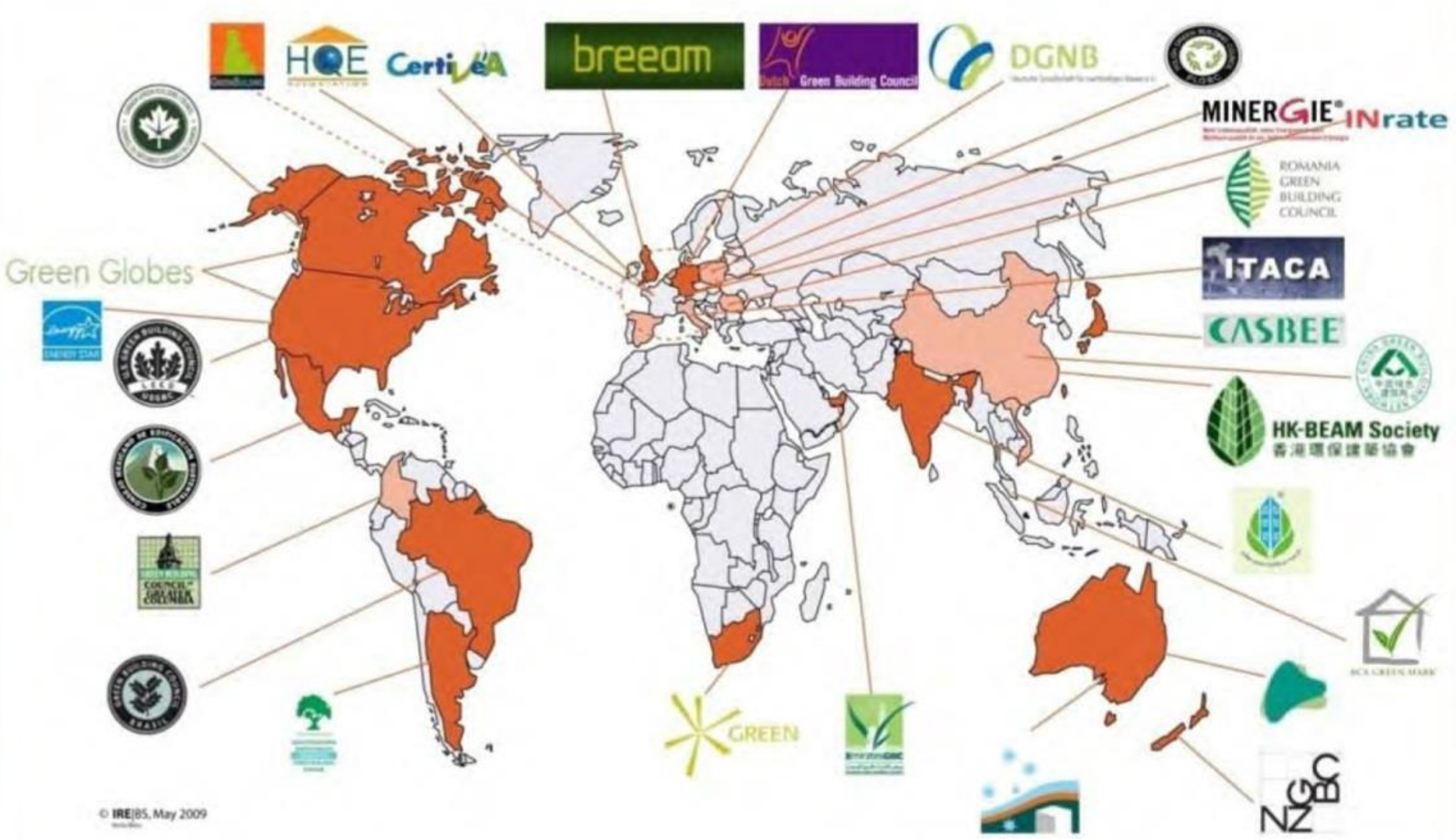
# Environmental and Sustainability Rating Systems



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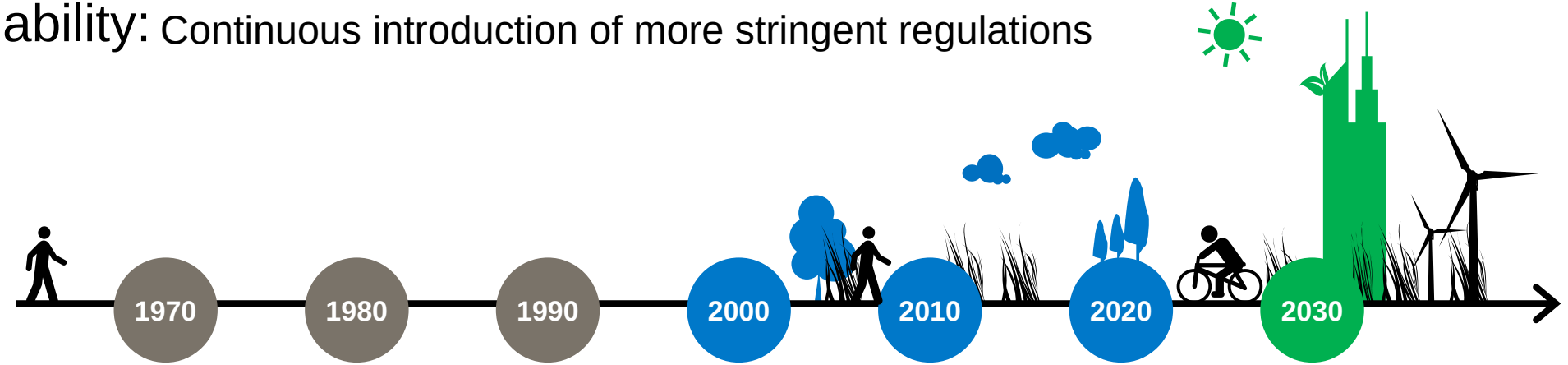
# Sustainability: Continuous introduction of more stringent regulations




- Oil crisis
- Guidelines for rationalised use of energy in buildings
- Architectural trend: full height transparent (glazed) buildings
- Kyoto protocol
- Downdraft / Glare Regulations
- Energy / Green building rating systems & labelling
- % Renewable energy by building
- Kyoto into force
- Stringent acoustic regulations
- Solar heat gain and overheating regulations
- Increasing % towards Zero-Energy for Houses
- Zero carbon neutral building requirements. (IEA Policy Pathway)

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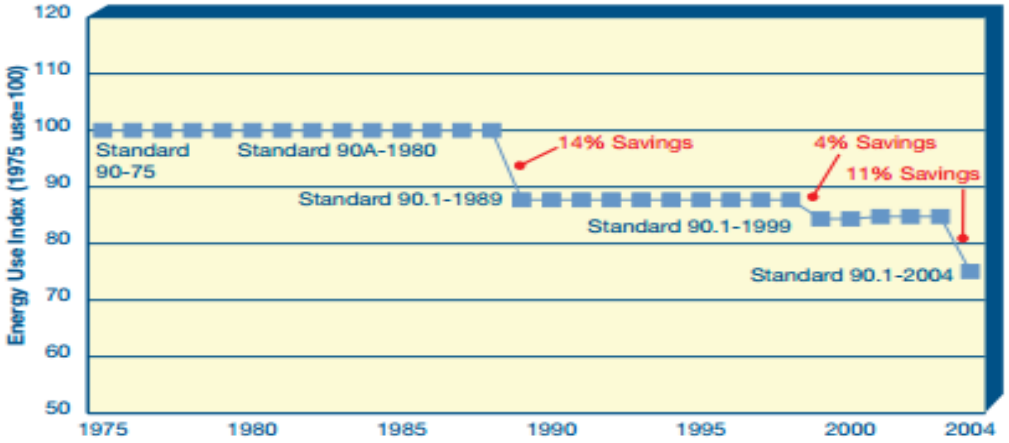
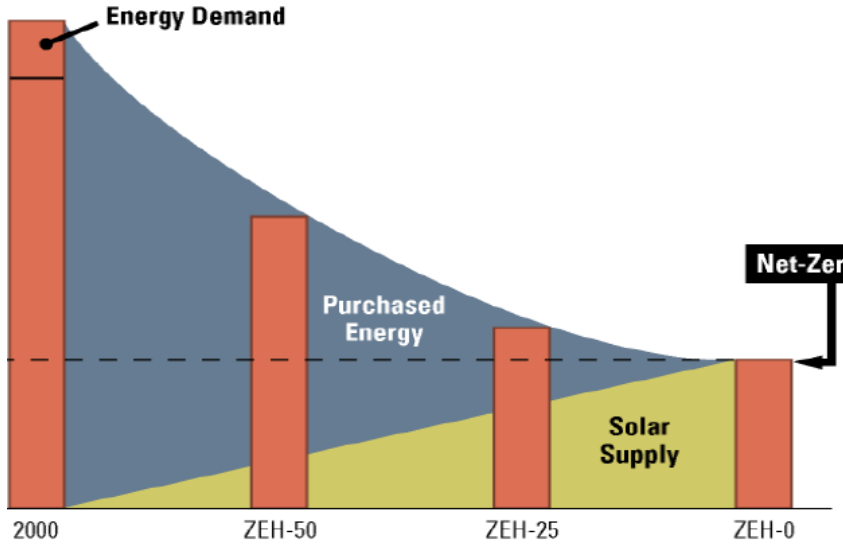
# Sustainability: More stringent energy codes for lower energy consumption




***American commercial energy codes are increasing energy efficiency***

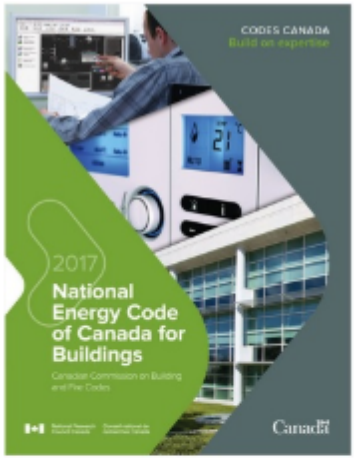



Progression to Full ZEH (US)

**2020 Energy Pro**

ZEH-0 supplies the remaining 30-40% of energy needs from solar electricity and heat

The *National Energy Code of Canada for Buildings 2017* (NECB), published by NRC and developed by the Canadian Commission on Building and Fire Codes in collaboration with Natural Resources Canada (NRCan), sets out technical requirements for the energy efficient design and construction of new buildings. NRC and NRCan are publishing this interim edition of the NECB in response to proposals received that improve the overall energy performance of buildings over the 2015 edition. Modelling for these changes indicates a potential energy efficiency improvement of between 10.3 and 14.4 % over the NECB 2011.




The 2017 edition is an important step toward Canada's goal for new buildings, as presented in the Pan-Canadian Framework, of achieving 'Net Zero Energy Ready (NZER)' buildings by 2030. The NECB 2017 supports this goal by reducing



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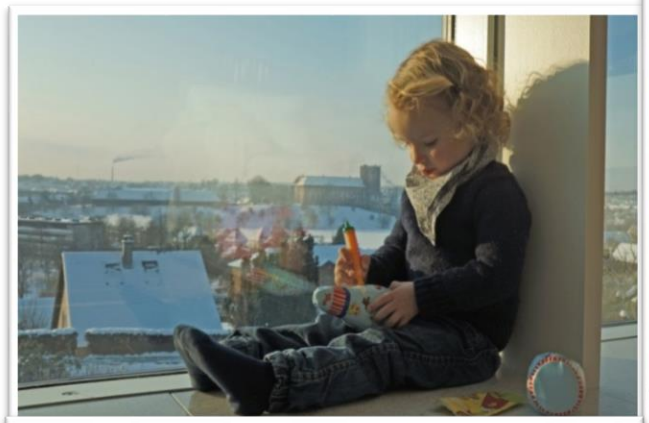
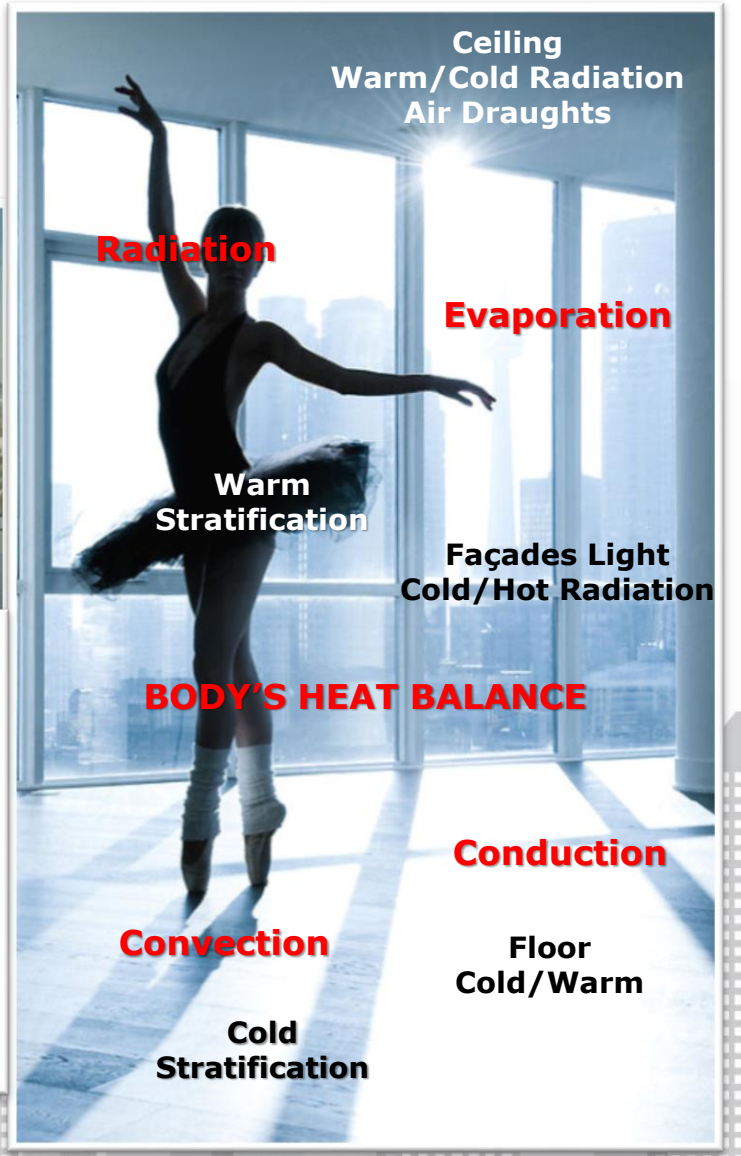
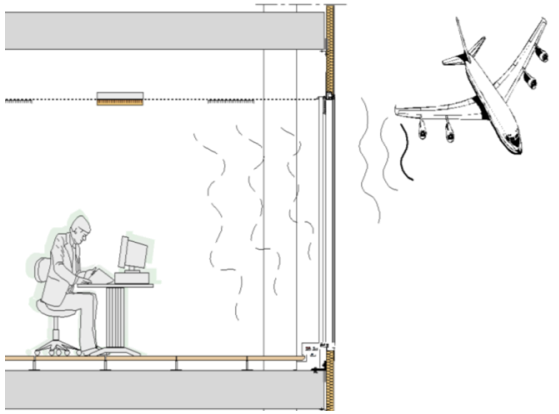
# Sustainability: Comfort





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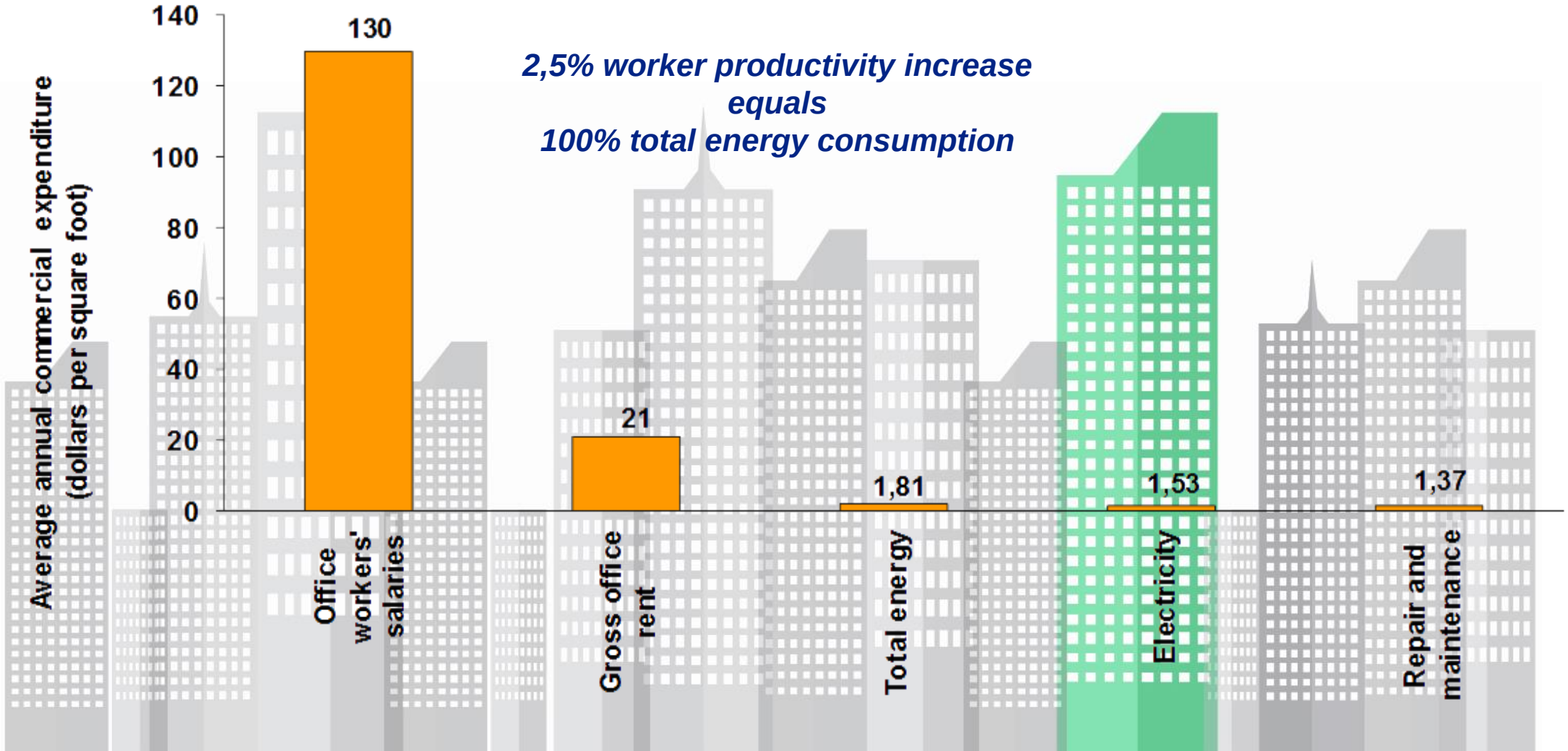
# Sustainability: Comfort

Comfort in office buildings can be a major contribution to social sustainability and efficiency improvement.



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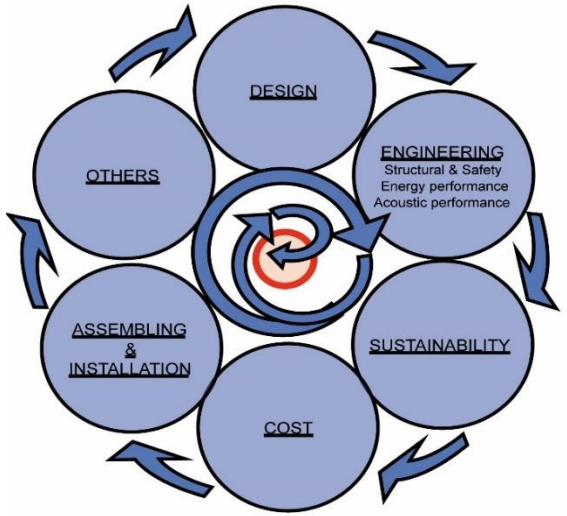
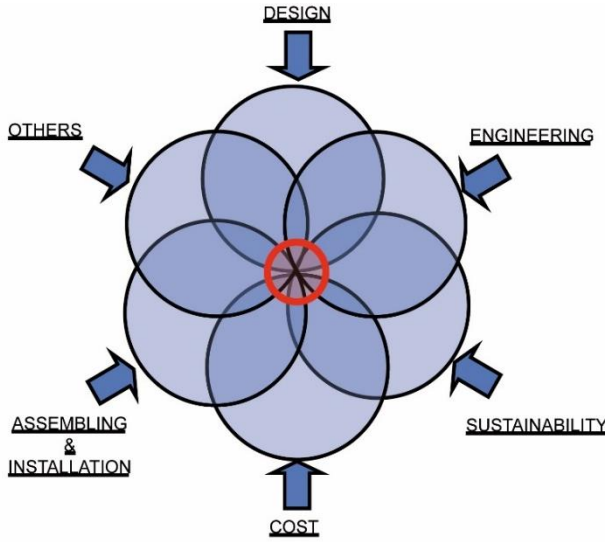
# Sustainability: Relevance of Optimized Design

Conditions for effective and reliable decision making.

- Knowledge (theoretical, empirical, experience …)
- Holistic approach & awareness of effects at the right time.
  - ✓ Isolated specialist knowledge and "too many cooks in the kitchen" causes slow communication.
- Reliable tools and software.
  - ✓ Lack of reliable tools and software in the industry.


Conclusion:

**Holistic design team & Benchmarked tailor made software/tools required.**

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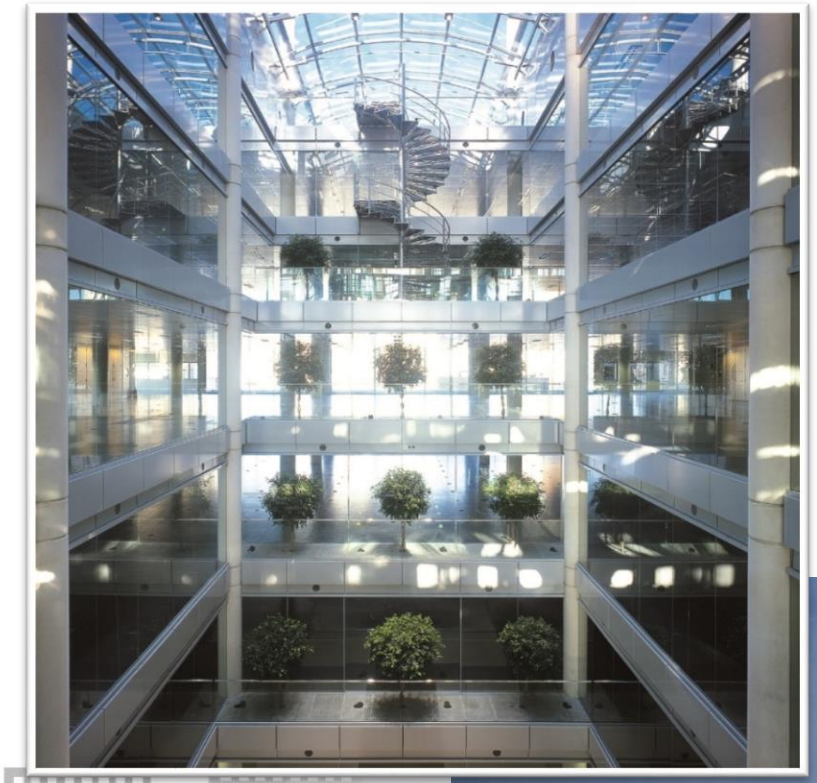
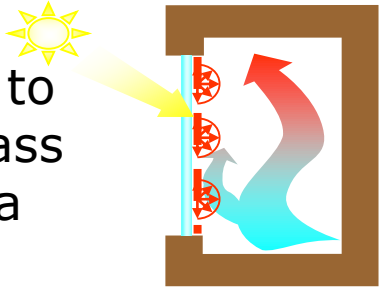
# Sustainability: The evolution of Multi Skin facades



The 90-ties of last century showed a significant change in architecture due to the application of much more clear glass symbolizing a transparent building in a transparent society



European Parlement, Strassburg

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# Sustainability: Double Skin facades innovation inspired by


Direct response to buildings impact on **Climate Change**

Strict **Energy and Environmental Regulations**

Lower overall building **Energy Consumption**


Reduction in building **Carbon Emission** foot print

Direction for **Sustainable** Highrise Buildings

Higher **Human Comfort** targets to enhance productivity

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# Sustainability: The evolution of Multi Skin facades

Interactive Facade

Active Facade

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# Sustainability: The evolution of Multi Skin facades

ADVANTAGES of naturally ventilated facades

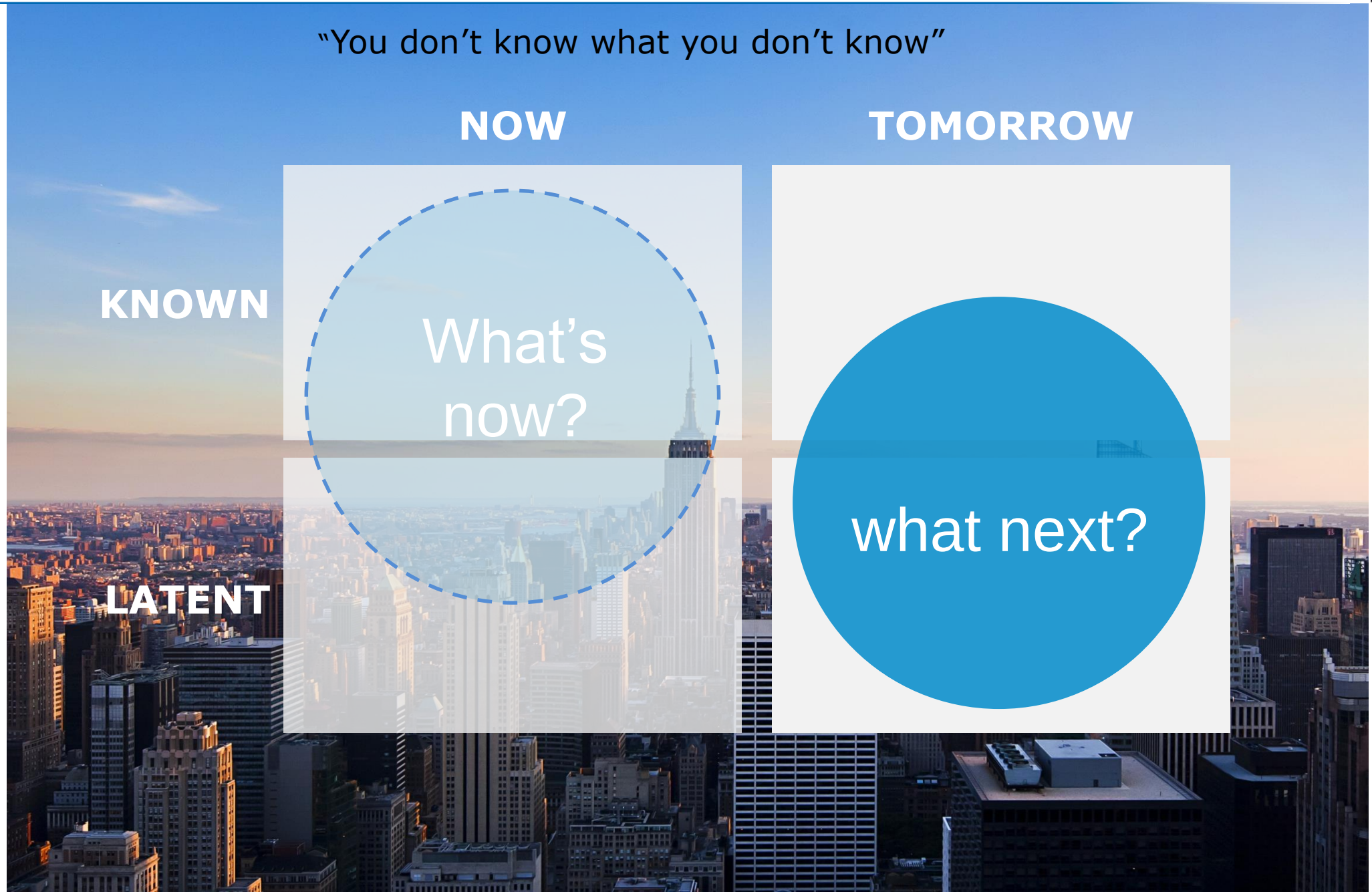
- High contribution to building energy performance
- High visual, acoustic and thermal comfort

DISADVANTAGES:

CHALLENGES:

- No condensation / pollution of cavity
- No maintenance in cavity
- No operable parts for access (more usable floor area)
- Avoidance reduction blind reflection by pollution

# FTI Forum Toronto: What's now, What next



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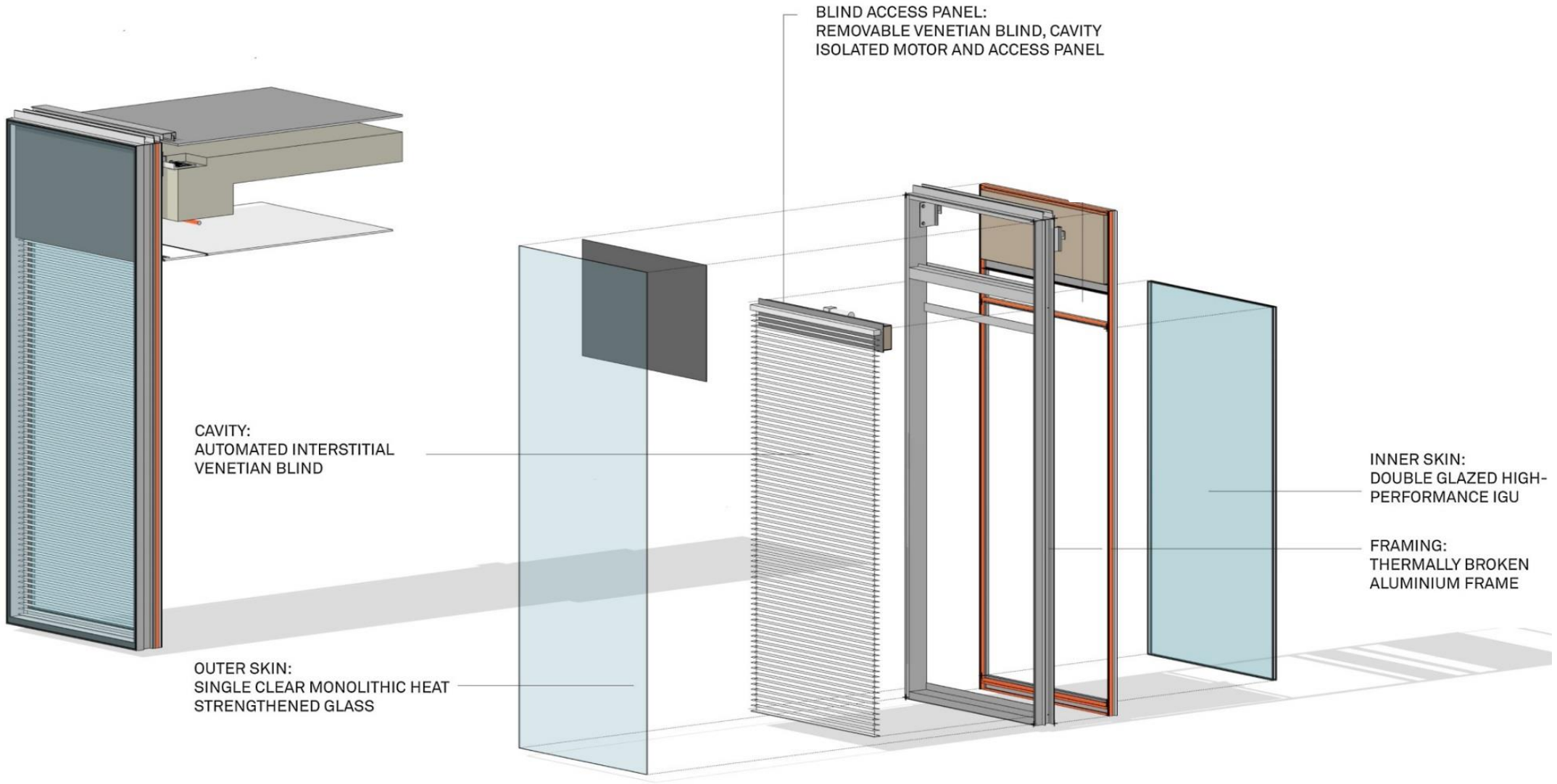
# Sustainability: mFreeS/CCF – Basic Configurations & Benefits



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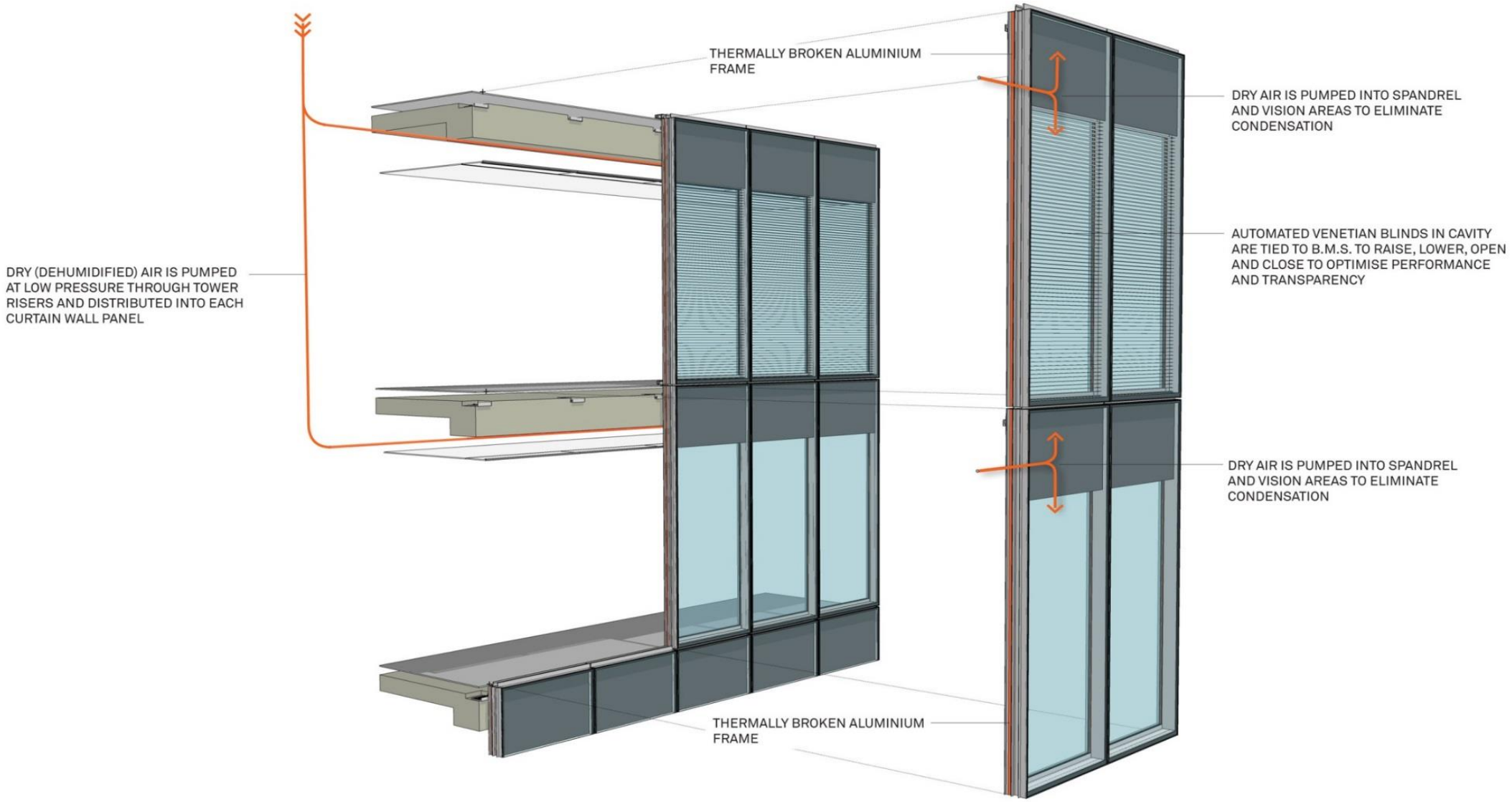
# Sustainability: mFreeS/CCF – Basic Configurations & Benefits



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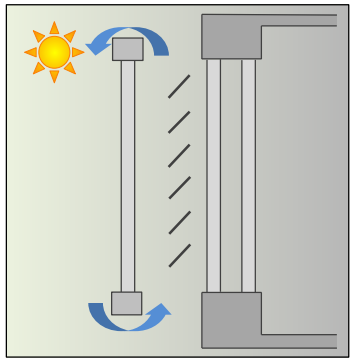
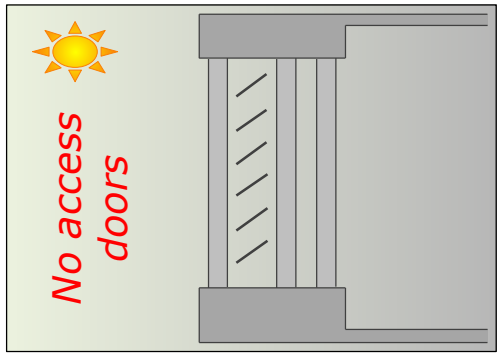
# Sustainability: mFreeS/CCF – Basic Configurations & Benefits

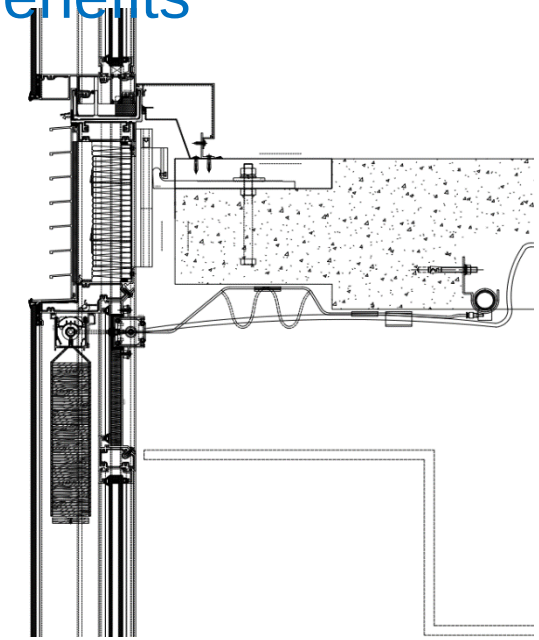
*Interactive and 'respirant' façade w/ internal access doors*



***mfree-S*** $^{CCF}$

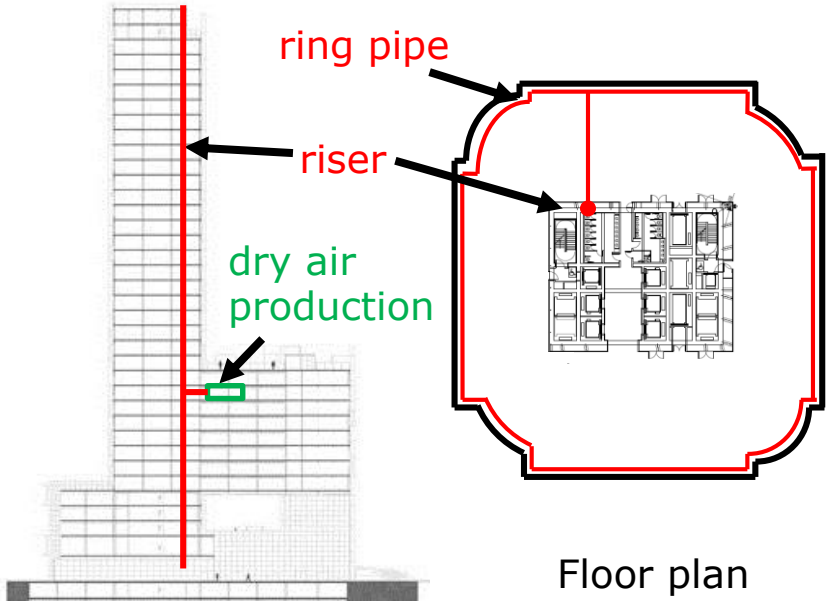
*moisture-dust free*-Sustainable Closed Cavity Façade



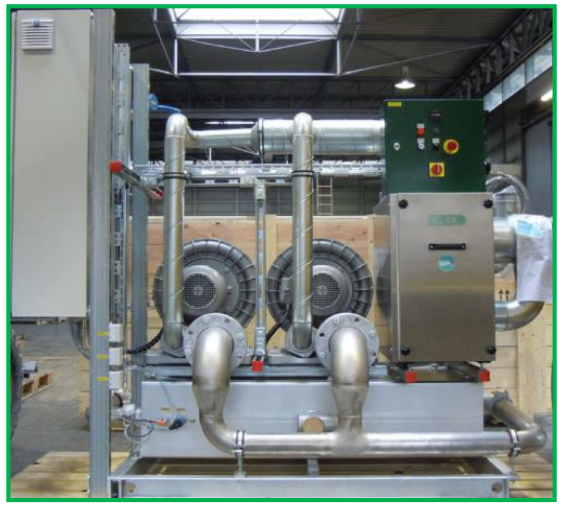



Dry air connection to each façade unit

Piping




Floor plan



Dry air production

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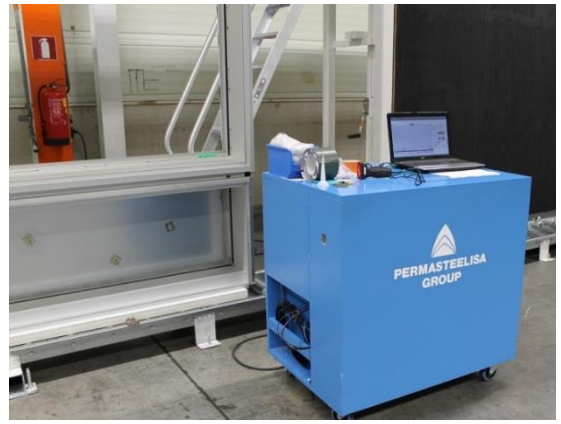
# Sustainability: *mfree*-S$^{CCF}$: Special attendance during assembly and storage

Assembly line

In-factory cleaning of CW unit




Airtightness test
of each CW unit

Security of cavity
condition in storage

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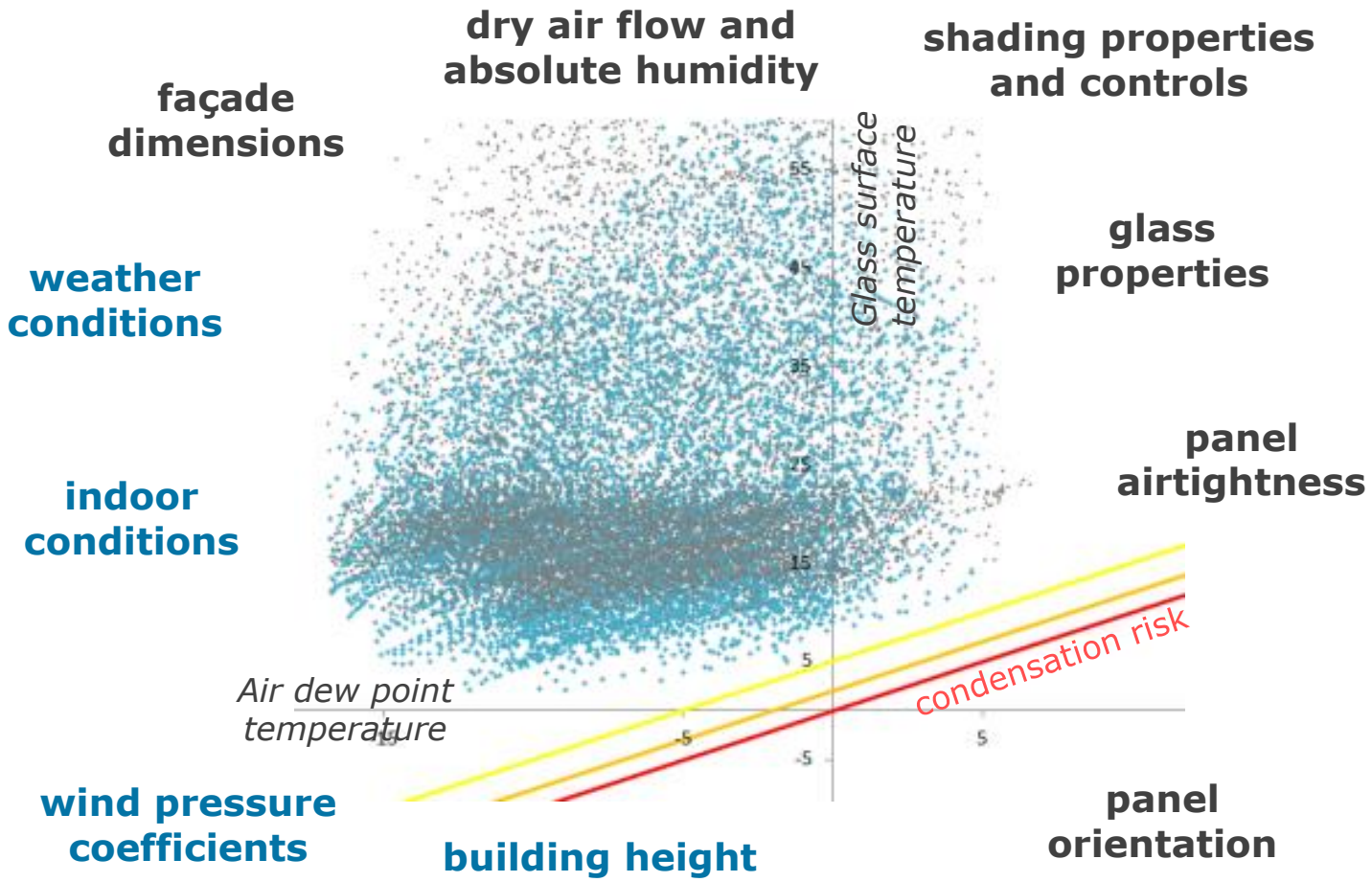
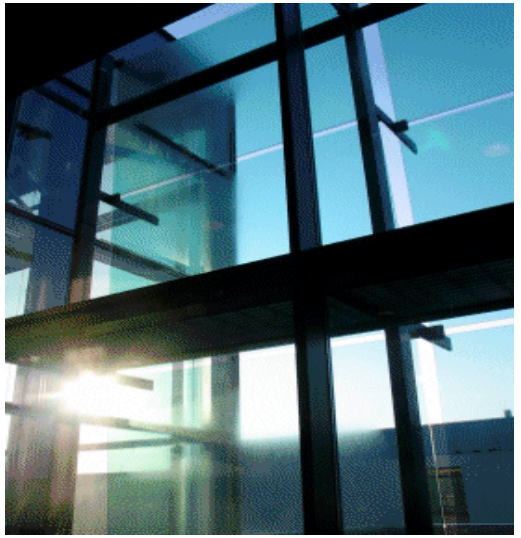
# Sustainability: mFreeS/CCF – Cavity Condensation Risk Analysis




**DSCAT proprietary software tool** → **Detailed prediction of amount of dry air at each moment**

Condensation on external glass of spandrel boxes



Condensation on external glass of naturally ventilated DSF

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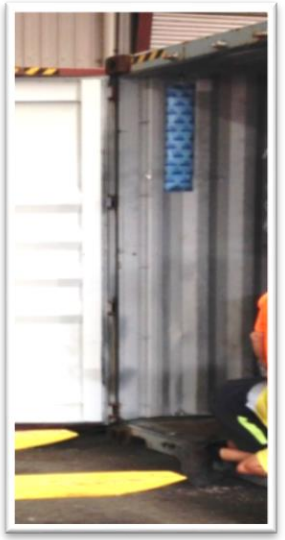
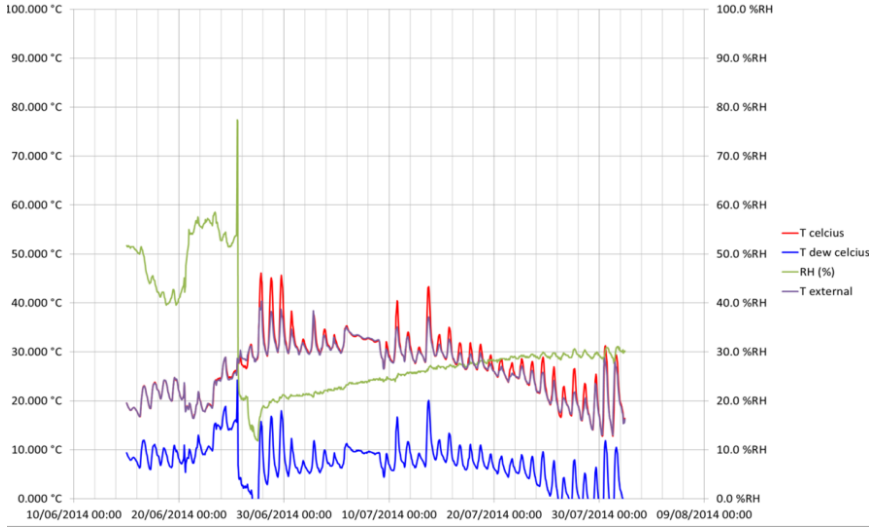
# Sustainability: *mfree*-S$^{CCF}$: Special attendance during assembly and storage

Limited transport duration

Security of cavity condition during pre-installation on site



Shipment inside conditioned container



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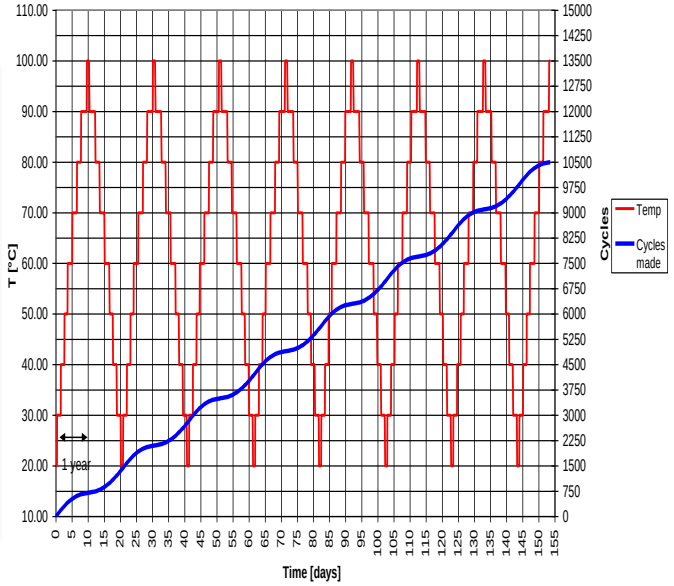
# Sustainability: *mfree*-S$^{CCF}$: Durability assessment / testing of cavity components




Accelerated durability blind test inside hotbox

Outside test centres for long-term full scale blind testing

Advanced façade integrated motor controller to minimise risks of motor failures

Single component failure of shading

Laboratory for assessment of fogging due to Volatile Organic Compounds

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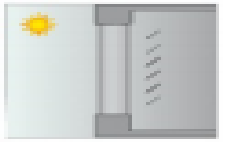
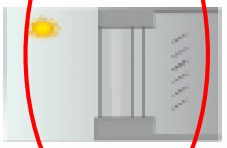
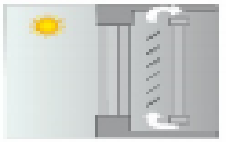
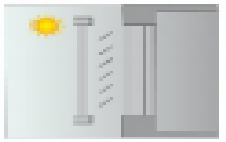
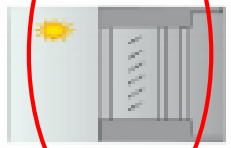
# Sustainability: *Contribution of multi-skin facades (including BCS function) to energy saving*

## Toronto - South facing office room

| | | | | FAÇADE 1 | FAÇADE 2 | FAÇADE 3 | FAÇADE 4 | FAÇADE 5 |
|---|---|---|---|---|---|---|---|---|
| INPUT | CAPSOL EXCELLENT | | Indicative values For comparison only | DGU | TGU | AW | IW | mFree-S |
| | | | |  |  |  |  |  |
| | GLAZING TYPE | | | VNE63 | LowE + LowE | LowE | LowE | LowE |
| OUTPUT (glazing only) Steady state / WIS | NFRC | U [Btu/hr.ft²F] | no blinds | 0.28 | 0.16 | 0.13 | 0.18 | 0.18 |
| | | | blinds | 0.22 | 0.14 | 0.11 | 0.15 | 0.15 |
| | NFRC | SHGC [-] | no blinds | 0.32 | 0.48 | 0.52 | 0.52 | 0.53 |
| | | | blinds | 0.22 | 0.38 | 0.29 | 0.12 | 0.13 |
| | | VT [-] | no blinds | 0.63 | 0.69 | 0.70 | 0.70 | 0.70 |
| | | | blinds | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

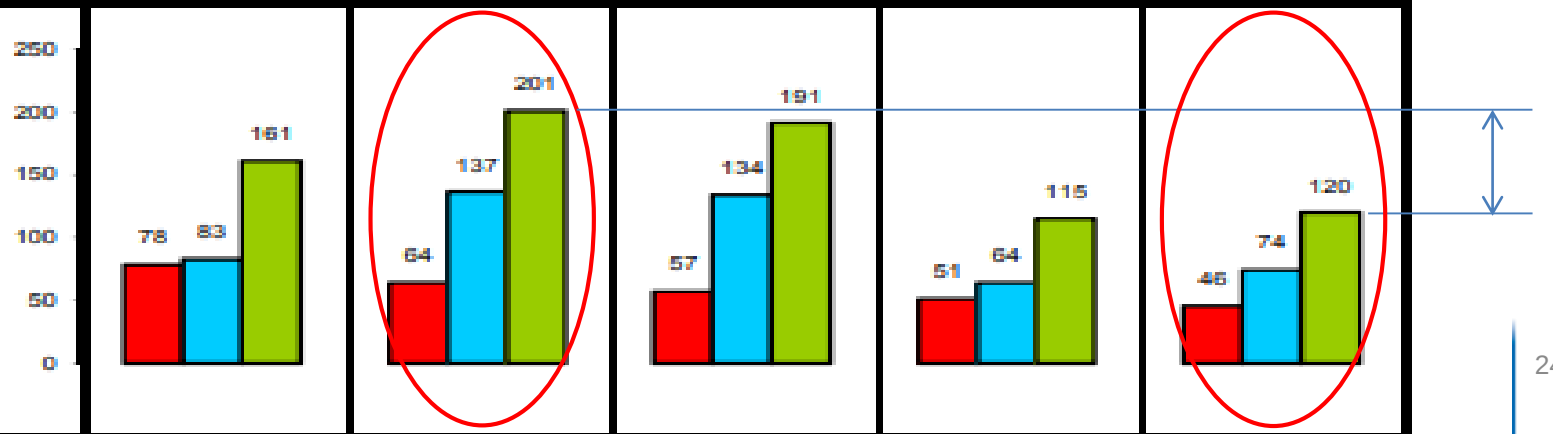
OUTPUT (façade comparison) Dynamic / Capsol Excel(lent)

Yearly total primary energy consumption per square meter of plan [kWh prim / sqm]

RED heating

BLUE cooling

GREEN TOTAL = heating + cooling




**Example:**
**Office building with high internal loads**

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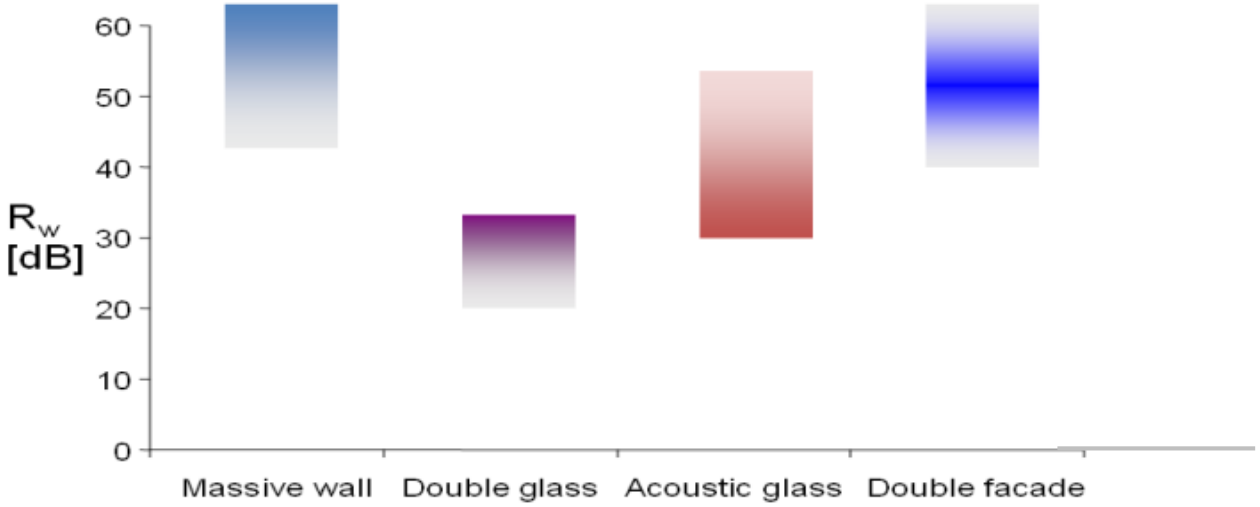
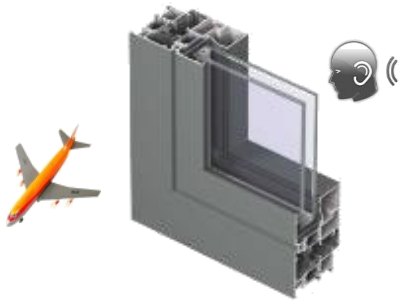
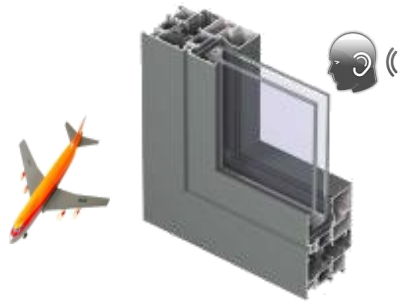
# Sustainability: Contribution of multi-skin facades to acoustic comfort

## Benchmarked bespoke ALABIC calculation tool.



**4-12-4 glazing**
$D_{ls,2m,nT,w}(C;C_{tr})$ =**30(-1;-4)dB**



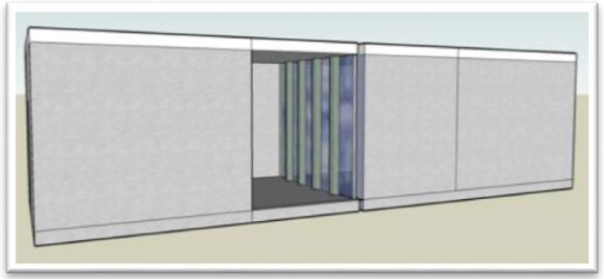
**6-12-44.2 glazing**
$D_{ls,2m,nT,w}(C;C_{tr})$ =**37(-1;-4)dB**

**8-12-8/120/6 glazing**
$D_{ls,2m,nT,w}(C;C_{tr})$ =**46(-1;-4)dB**

***LARGE***

Accredited ***L***aboratory for ***A***coustic ***R***esearch on ***G***lass and *large* ***E***nvelopes

*(certified EN ISO 17025)*



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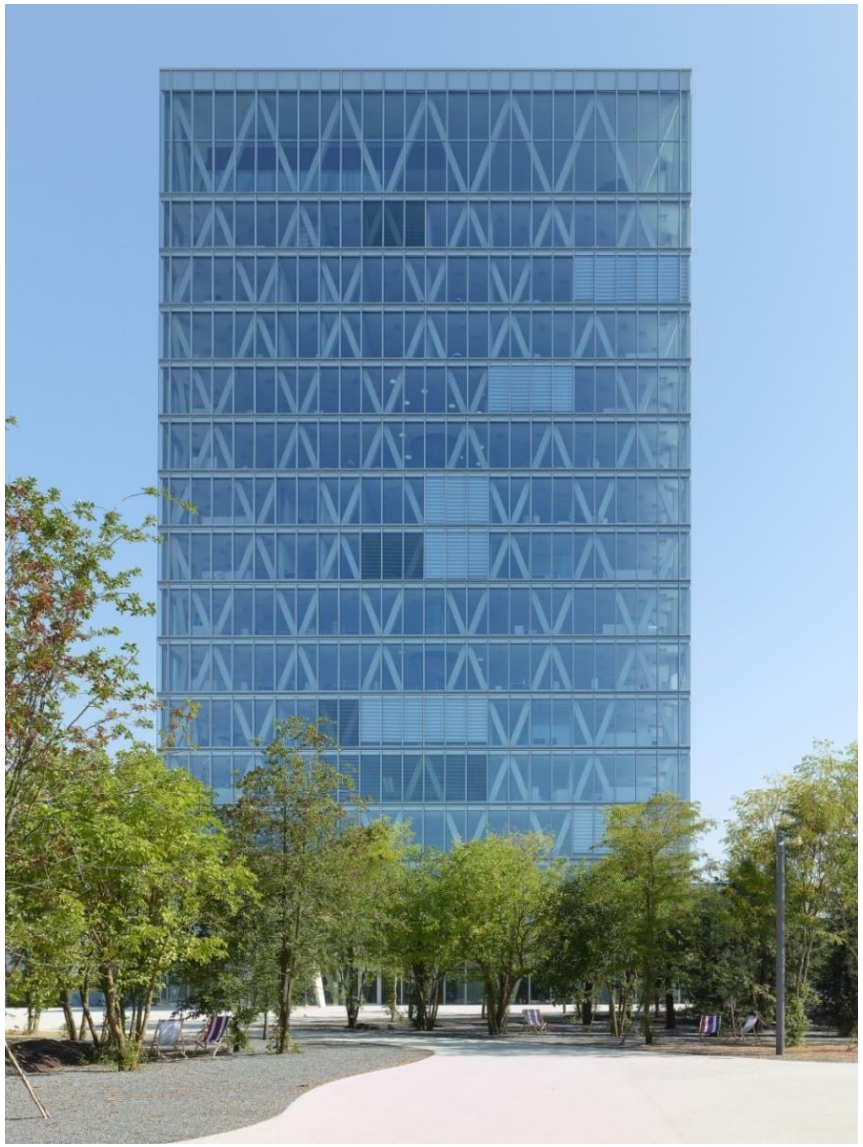
**mfree-S $^{CCF}$ : Some project examples**

Roche Diagnostics, Rotkreuz, CH

**Received Minergie certificate**

MINERGIE®
Higher quality of life, lower energy consumption
Mehr Lebensqualität, tiefer Energieverbrauch



*Burckhardt + Partner AG*

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## mfree-S $^{CCF}$ : Some project examples

UCLH, hospital, London, UK

breeam ★★★★ EXCELLENT

One of First BREEAM Excellent hospitals in the world

Architect: Hopkins
Client: University College London Hospital NHS Trust

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## mfree-S $^{CCF}$ : Some project examples

200 George Street, Sydney, Australia

**200 George street, Sydney, Australia**
Architect:Francis-Jones Morehen Thorp (fjmt)

NABERS ENERGY

green building council australia
5 greenstar
Office Interiors v1.1 2012

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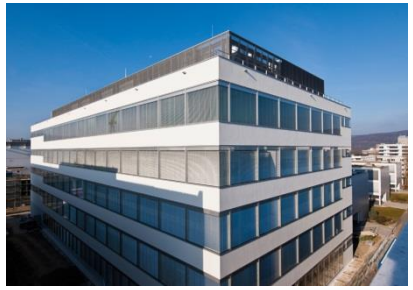
## mfree-S CCF : Some project examples

Switzerland, Liechtenstein, Germany

Roche Diagnostics Ltd, Rotkreuz



Roche Neubau Analytiklabor, Kaiseraugst

Roche Bau 1, Basel

Richti-Areal Baufeld 1, 7, Wallisellen

Flurpark, Zürich

New Operations Control Centre of SBB, Olten

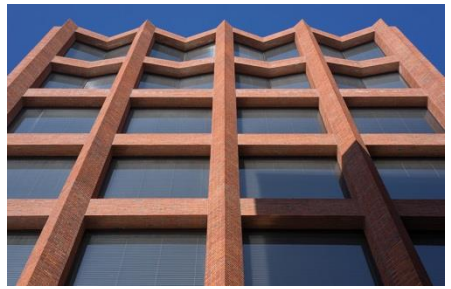
Belvedere, Vaduz

JTI's HQ, Geneva

The Circle, Zürich

Byte, Bern

In Haus 2, Duisburg



Neubau Dräger, Lübeck

LEO, Frankfurt am Main

Hilti Innovations-Zentrum, Schaan

Hilti VGe, Schaan

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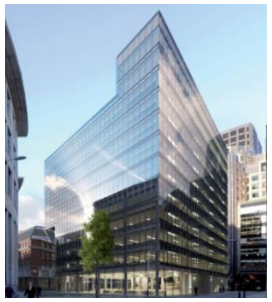
## mfree-S CCF : Some project examples

UK / Asia / Australia / France

UCLH, London

Regent Steet W5S, London

10 Fenchurch Avenue, London



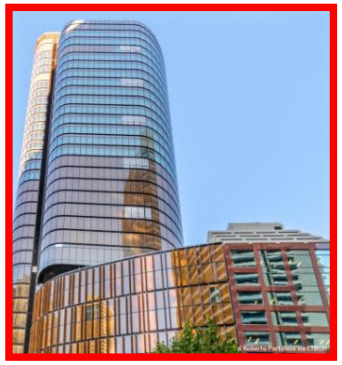
1 Bartholomew Close, London

22 Bishopsgate, London

Francis Crick London

IQL, London

Opple lighting China



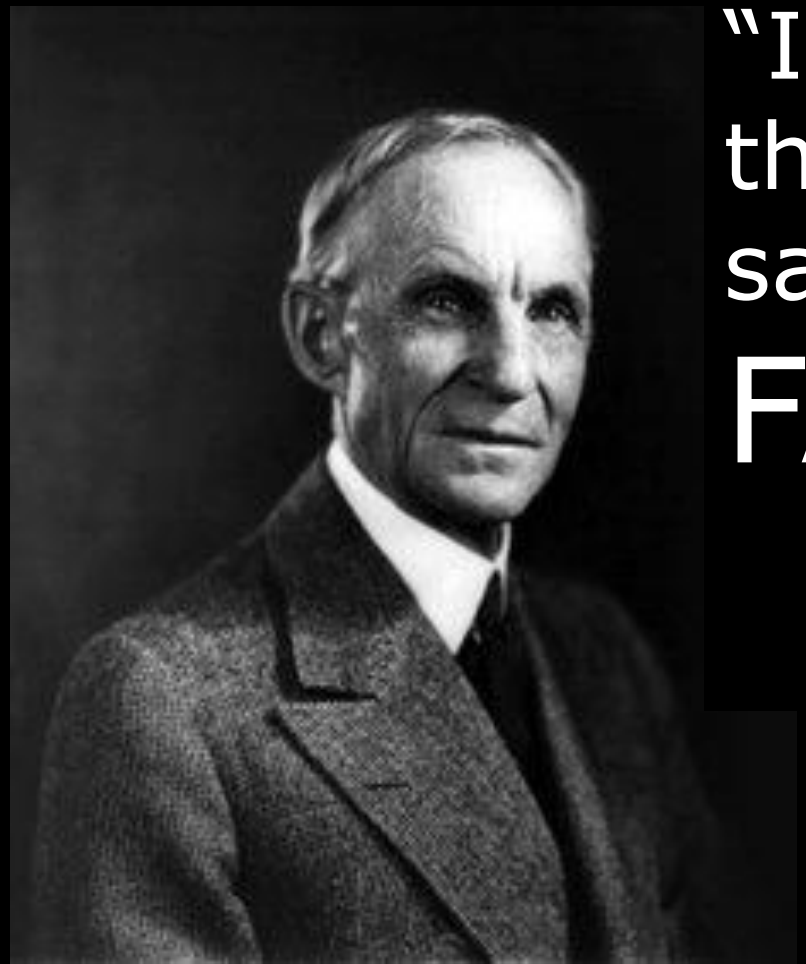
200 George Street, Sydney

100 Mount Street, Sydney

UTS Sydney

Servier Pharma Paris

Knowing what is needed in the future is tough.



"If I had asked people what they wanted, they would have said:

FASTER HORSES..."

Henry Ford

# Thank You for Your Attention!

GARTNER PERMASTEELISA SCHELDEBOUW

www.permasteelisagroup.com

seele

# A Floating Roof for Place Ville Marie, Montreal

03 May 2019, Toronto

# 2 Project team

**Client**
Ivanhoé Cambridge

**Main Contractor**
Pomerleau

**Architect**
Sid Lee Architecture
MSDL

**Engineer**
NCK

**Installation**
2018 – 2019

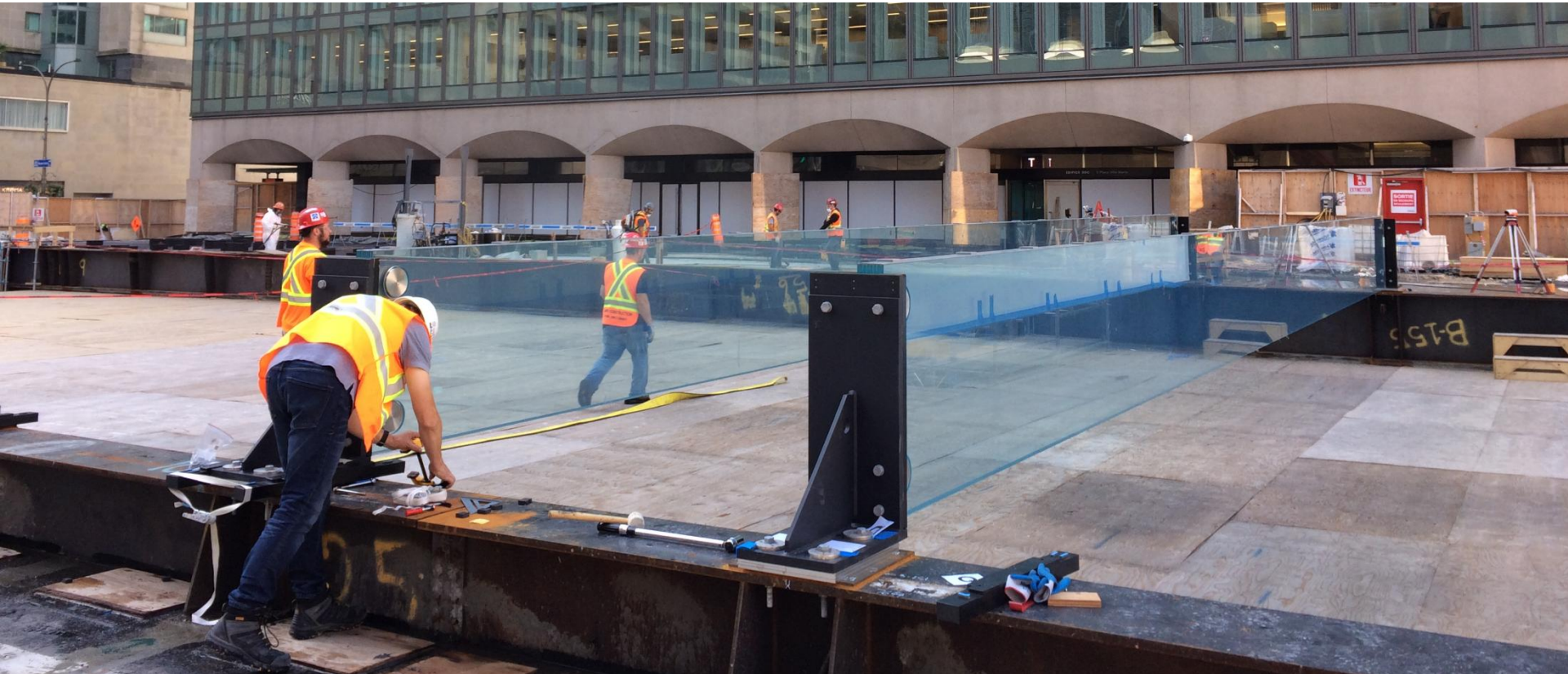
# Scope of Work

Old vs. new design

# 4 Site conditions

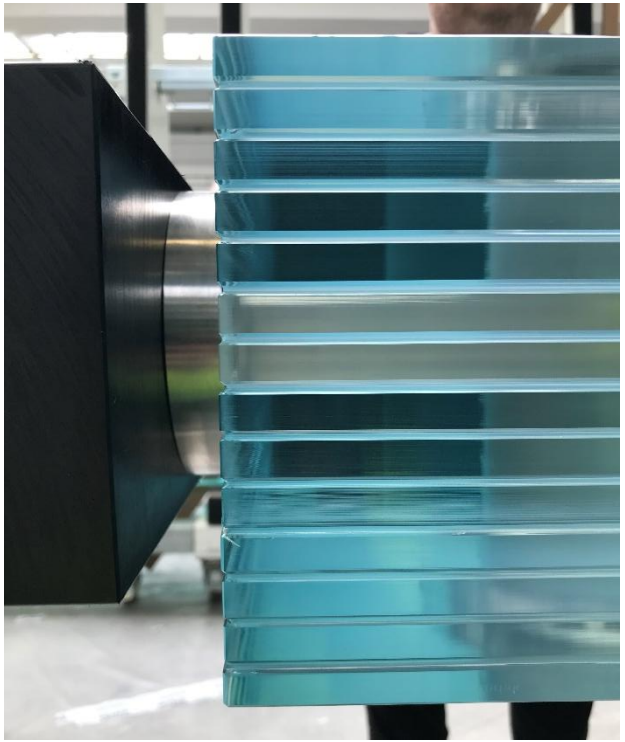

Design, manufacture and installation of a 45m long and 15m wide all-glass roof in the heart of Montreal

# Scope of work



# Manufacture

14-ply glass beam before and after lamination process



15m long x 0.9m deep (50ft x 2.90ft) HS glass beams of 8 x 14mm (0.5”) laminated glass layers. One beam weighs approx. 3,500kg (7,700lbs)

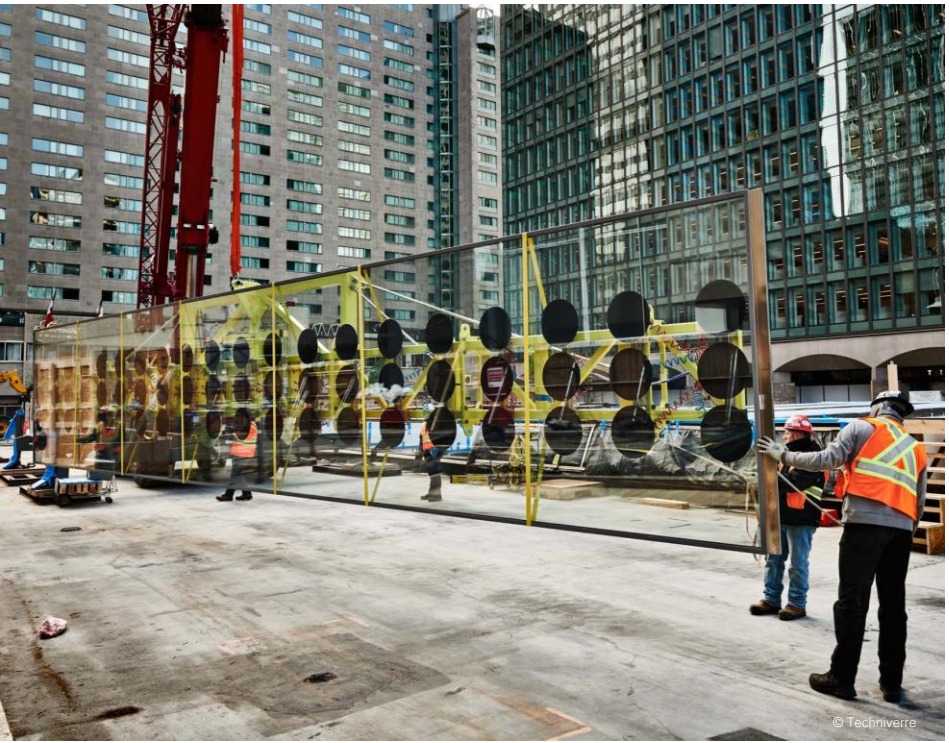
# 7 Manufacture

IGU with perimeter fritting on #4 all around the glass pane


15m x 2.5m deep (50ft x 8.2ft) HS IGU of 3 x 12mm + 20 mm Argon cavity + 2 x 10mm. One panel weighs approx. 5,000kg (11,000lbs)

# Installation

Glass installation





15m x 2.5m deep (50ft x 8.2ft) HS IGU of 3 x 12mm + 20 mm Argon cavity + 2 x 10mm. One panel weighs approx. 5,000kg (11,000lbs)

# Installation

Beam installation

# 10 Logistics

Beam delivery on site

# Installation

# Installation

Extreme conditions

# Installation

Extreme conditions

# Installation

Extreme conditions

# Practical Completion

December 2018

# Practical Completion

December 2018


Opening October 2019

seele

# Thank You.

# Large Panels / Thin Panels

**New Technologies for the Next Generation of facades**

**May 3rd 2019 – Arthur Huard – GlassCan Corporation**

HONEYCOMB IS A TECHNOLOGY THAT HAS BEEN WITH US FOR A WHILE BOTH IN NATURE AND MAN MADE.

.

Paper honeycomb

Bird bone structure

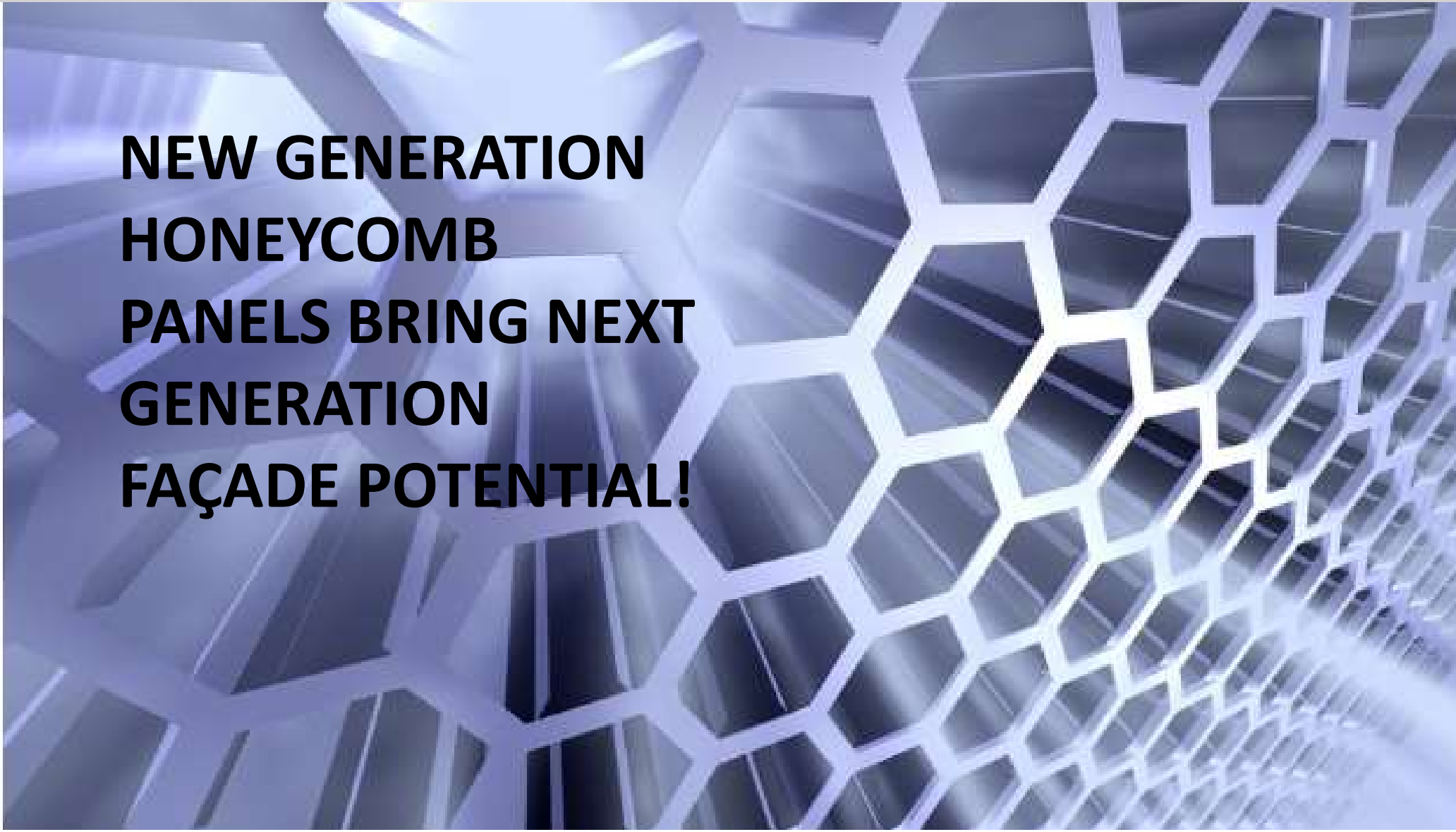
Aerospace applications

Natural honeycomb

The Pantheon dome

# Large Panels

HONEYCOMB STRUCTURES


NEW GENERATION
HONEYCOMB
PANELS BRING NEXT
GENERATION
FAÇADE POTENTIAL!

# NEW GENERATION HONEYCOMB PANELS

- Fully engineered
- Manufactured on continuous lines
- Large sizes
- Lightweight
- Rigid
- Fully tested and fire rated
- Colours & Finishes
- Many uses

# FULLY ENGINEERED

**THICKNESS OF THE ALUMINUM FOIL THAT CREATES THE HONEYCOMB**
**DIAMETER OF THE HONEYCOMB (c)**
**THICKNESS OF THE HONEYCOMB (b)**
**THICKNESS OF THE OUTER AND INNER ALUMINUM SKINS (e1 & e2)**

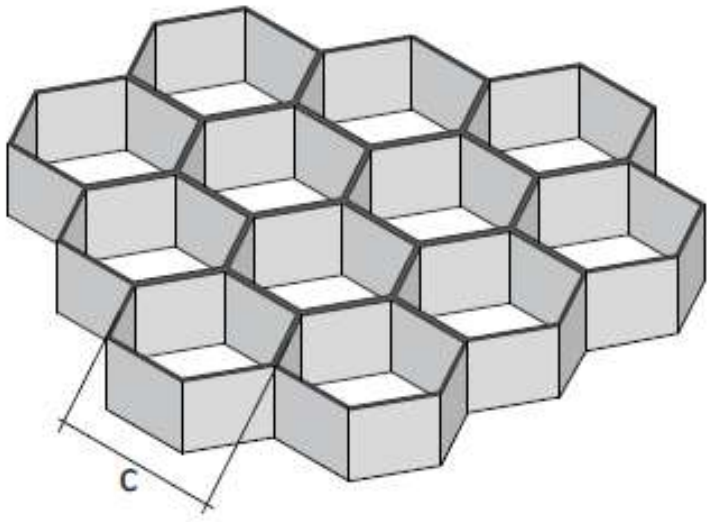



Fig. 1

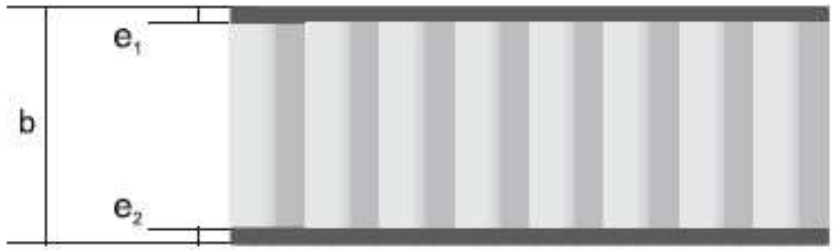
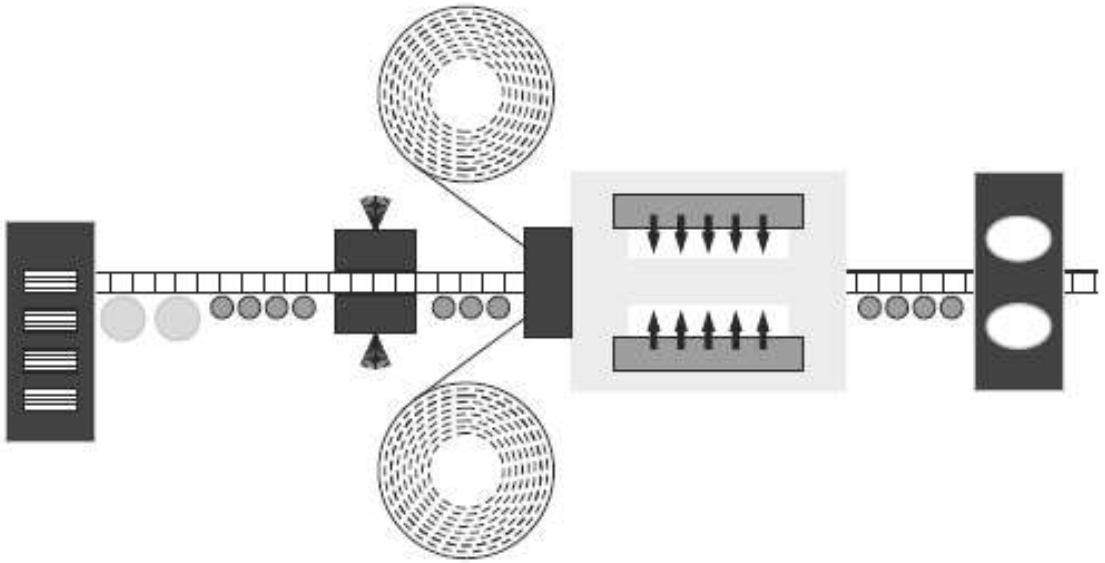



Fig. 2

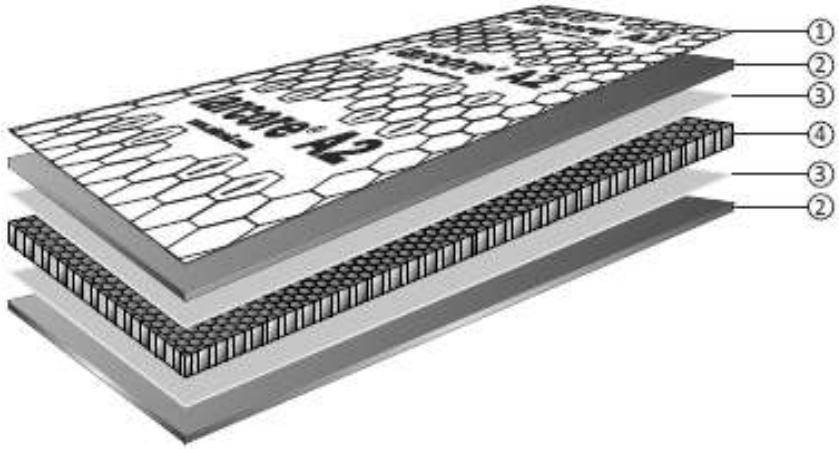
# MANUFACTURED ON A CONTINUOUS LINE

**QUALITY CONTROL**
**FLATNESS CONTROL**
**VARIABLE WIDTHS & LENGTHS**

**Producto - Product**



| | | |
|---|---|---|
| Film Protector | 1 | Protective Film |
| Aluminio | 2 | Aluminum |
| Adhesivo | 3 | Adhesive |
| Núcleo Nido de Abeja | 4 | Aluminium Honeycomb Core |
| Adhesivo | 3 | Adhesive |
| Aluminio | 2 | Aluminum |



# LARGE SIZES

**UP TO 2 METRES W X 15 METRES L**
**50% LESS LABOUR**

# NEW GENERATION HONEYCOMB PANELS

## Lightweight

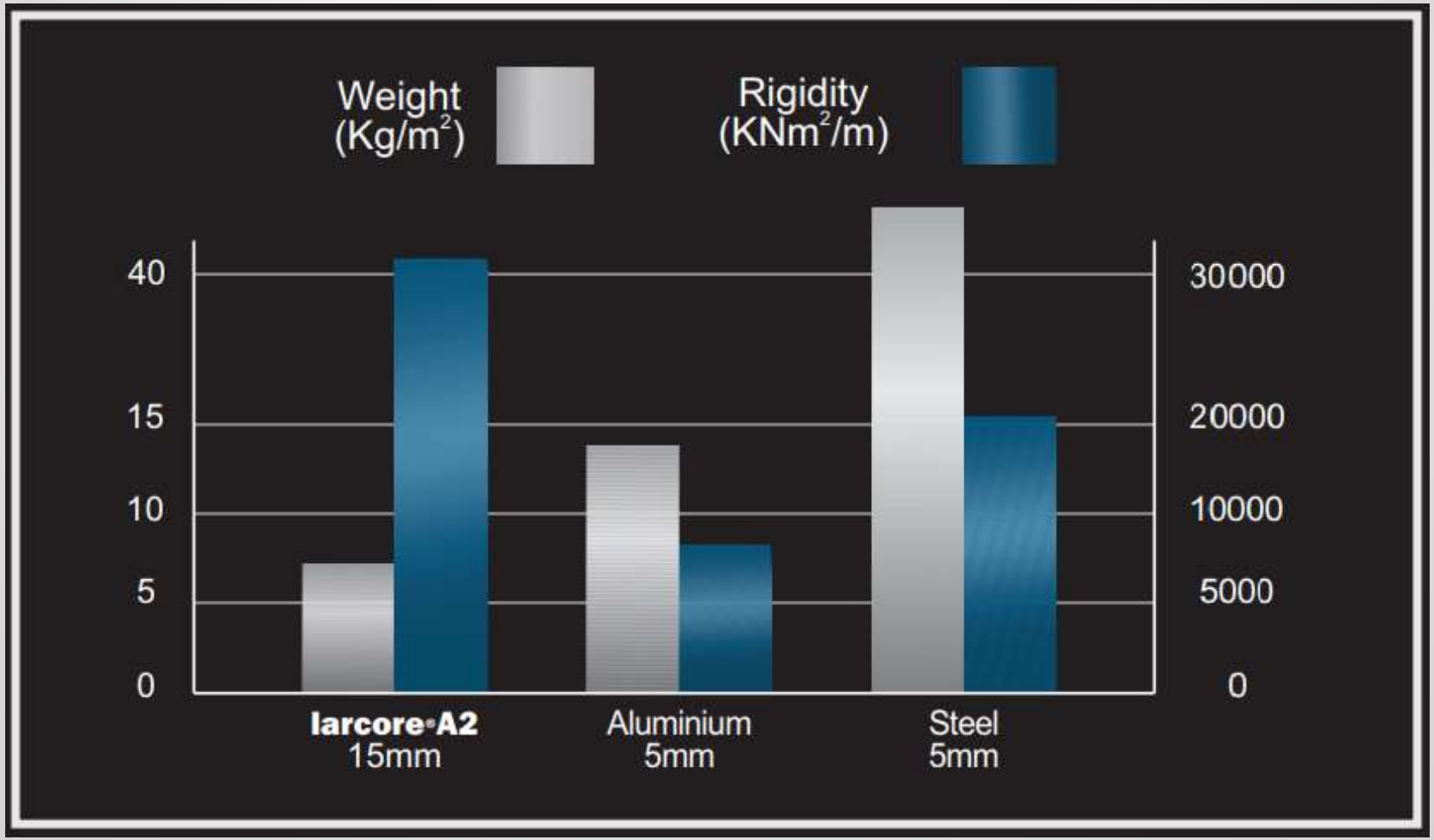
15MM - 5.02 KG SQ M – JUST OVER 1.02 LB SQ FT

20MM - 7.00 KG SQ M – JUST OVER 1.43 LB SQ FT

## Rigid

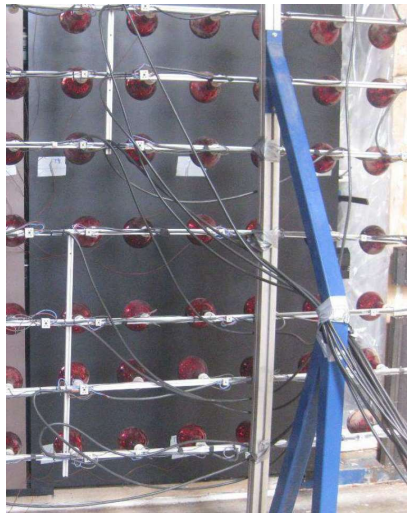
EXPONENTIALLY MORE RIGID AS THE THICKNESS OF THE PANEL IS INCREASED

NO STIFFENERS REQUIRED IN MOST INSTALLATIONS


Weight
(Kg/m²)
Rigidity
(KNm²/m)
40
15
10
5
0
30000
20000
10000
5000
0
Iarcore®A2
15mm
Aluminium
5mm
Steel
5mm

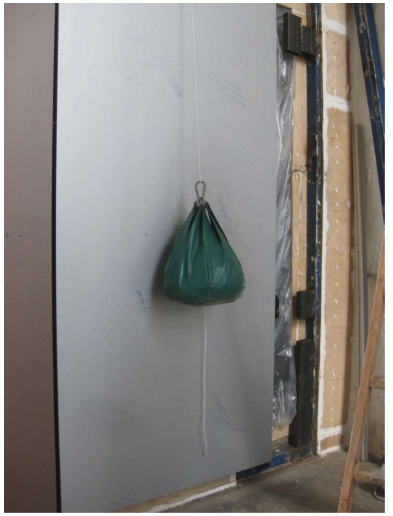
# Fully Tested

Wind load resistance



Resistance to thermal shock

Hard body impact

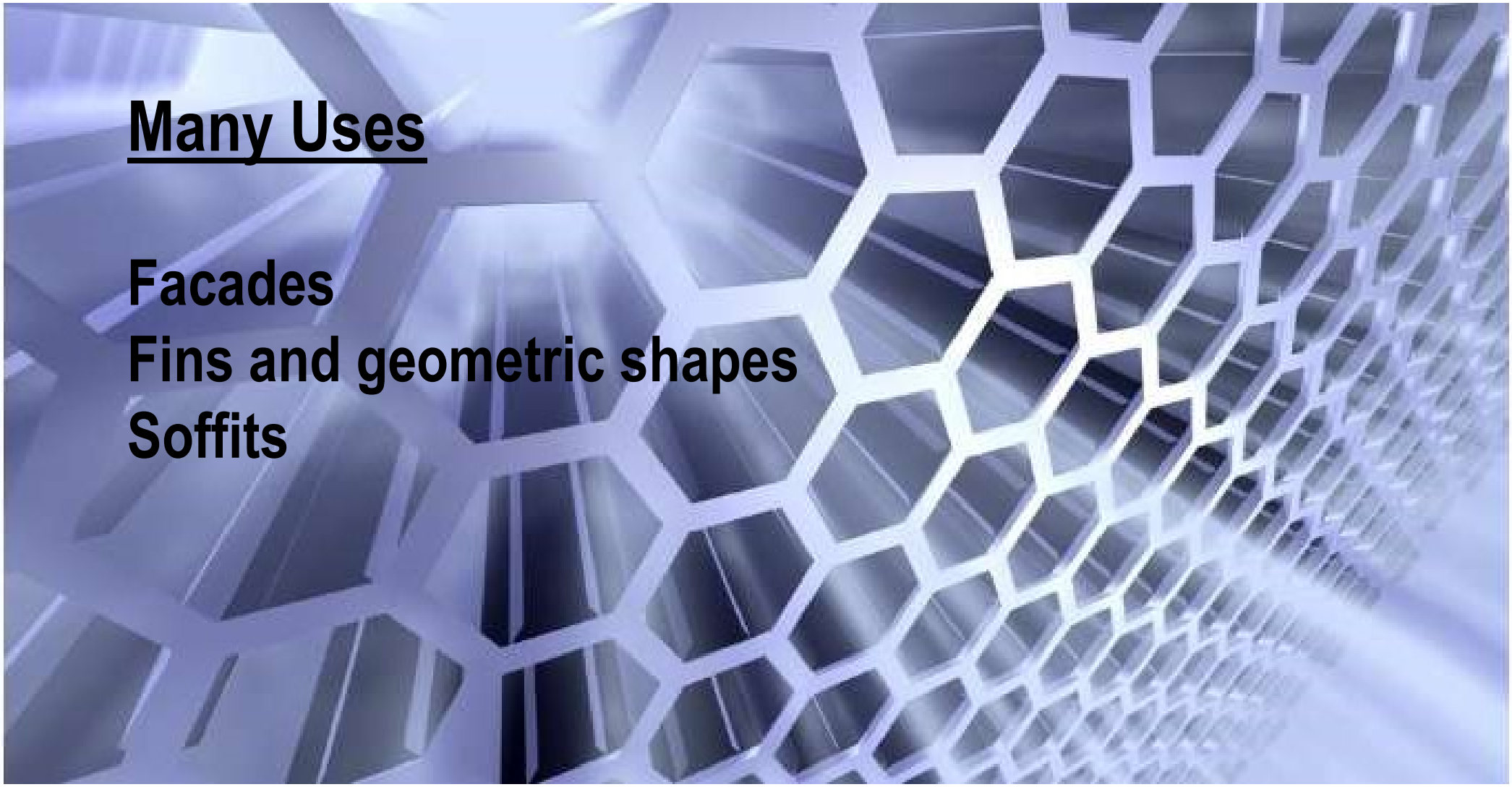


Soft body impact


Fire Rated
A2-s1-d0 (EN)
ULC S135
ASTM E84*
Test results available for review

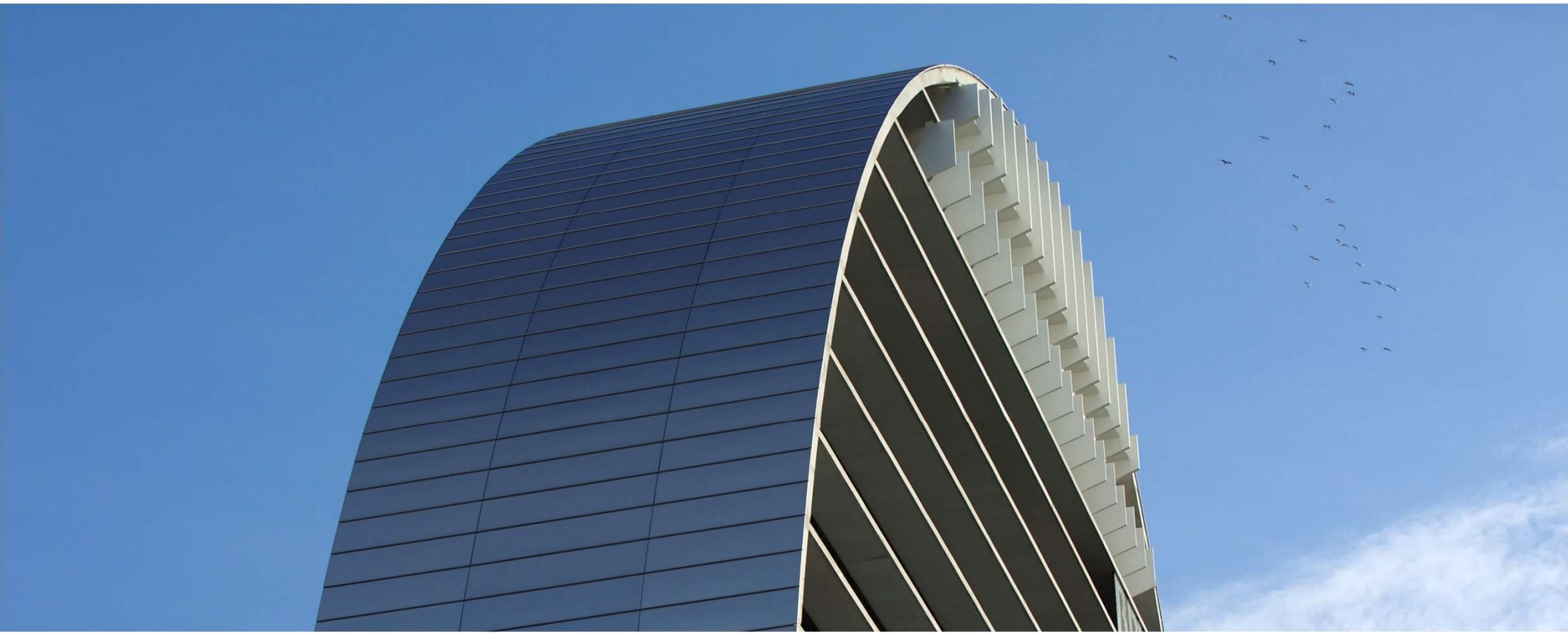
# Colours and Finishes

## Almost beyond imagination


Many Uses
Facades
Fins and geometric shapes
Soffits

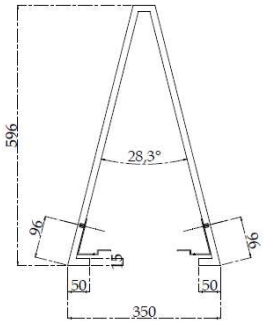
# Facades – 6 metres W x 1.5 metres H

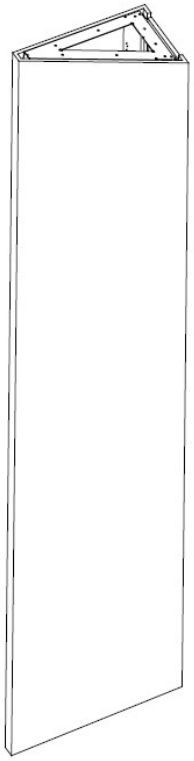
**BBVA HQ – Madrid**
Herzog & De Meuron



# Fins / Geometric Shapes

**FERRAGAMO HQ – Florence**
Beta Progetti



# Soffits

**ZURICH AIRPORT**
Burckhardt + Partner AG

# Finishes – (panel & glass match)

**STEM – UNIVERSITY OF OTTAWA**
Perkins+Will

# ALUMINUM HONEYCOMB PANEL FOR FACADES

| | |
|---|---|
| 1. LIGHTWEIGHT | 0.74 to 1.65psf |
| 2. RIGIDITY | 4.000 to 500.000 kNcm²/m*<br>*bending test according to DIN 53293 |
| 3. FIRE CLASS | A2-s1-d0 (EN) / ULC S135 / ASTM E84*<br>Flame-Spread Index: 0 / Smoke-Developed Index: 0 |
| 4. EXTREMLY FLAT | +/-0.2mm (1/64”) Thickness tolerance |
| 5. JUMBO SIZE | Up to 2x15m / 6.56’ x 48’ |
| 6. ENVIRONMENT | 100% Recyclable |

# Thin Panels

In 1893, James Dewar, a British physicist and chemist, invented the vacuum flask.

From then on, people began thinking how to use this technology on architectural glass.

In 1913, a German, Mr. Zoller, put forward the concept of vacuum glass in his patent for the first time.

# Today

**8 Years of research and development**
**100 Scientists**

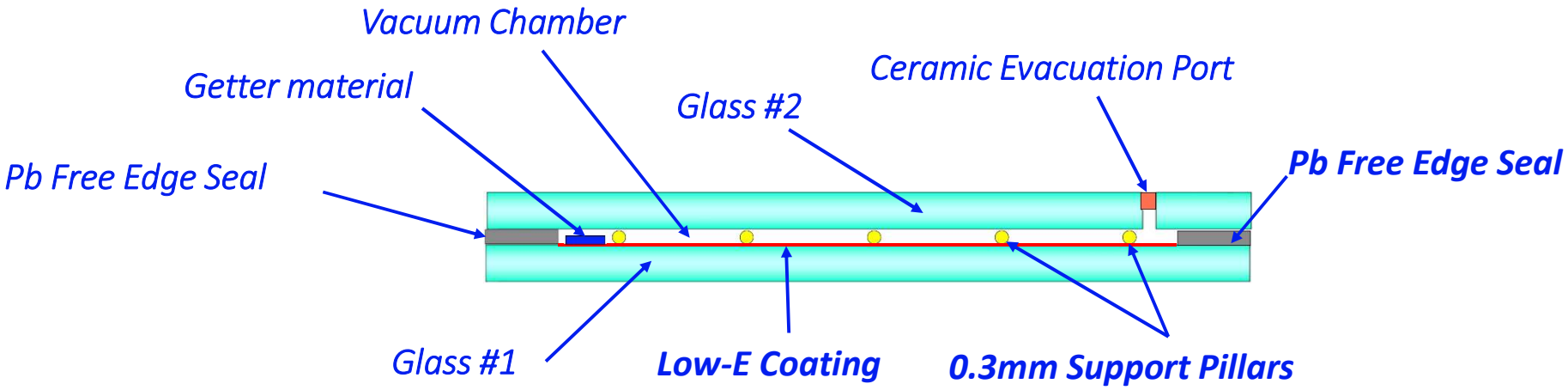
# Thin Panels Vacuum Insulating Glass is Ready to go!

- **- What is a VIG unit?**
- **- Why is VIG ready today?**
- **- A look at the performance numbers.**
- **- VIG in a high performance curtain wall.**

# What is a Vacuum Insulating Glass (VIG) unit?

**VIG is an insulating glass unit with a 0.3mm vacuum gap between the glass panes instead of air or inert gas.**

Structure of Vacuum Insulating Glass



# Why is VIG ready today?

- **Super long life – 25 year Warranty**
- **High compression - Pb free – Low Temperature Sealing Technology**
- **Aesthetically pleasing - 0.3mm Stainless Steel diameter pillars - 60mm spacing**
- **Ceramic Vacuum Port @ $10^{-4}$ Torr**
- **Wind load Tested via ASTM E330 up to 230PSF & E1233 @ 140PSF**
- **Flatness – Monolithic 4mm glass averaged peak-to-valley roller wave distortion of less than 0.001”**
- **Safety (SGCC – certified)**
- **Currently (since 2015) available up to 1.5 x 2.5 soon available 2.0 x 3.2**

# So now the numbers

# Conventional IGU performance values

*Double Silver Low-E*

| Makeup | Thickness | U-Value (R) | SHGC | VLT |
|---|---|---|---|---|
| Air | 1” / 25.4mm | 0.34 (3.0)* | 0.38 | 70% |
| Argon | 1” / 25.4mm | 0.25 (4.0)* | 0.37 | 70% |
| Triple, Air | 1 3/4” / 44.5mm | 0.22 (4.7) | 0.34 | 63% |
| Triple, Argon | 1 3/4” / 44.5mm | 0.19 (5.2)* | 0.34 | 63% |

*Measured at an independent lab
Center of Glass value calculated by Window 7

# Conventional IGU performance values vs VIG

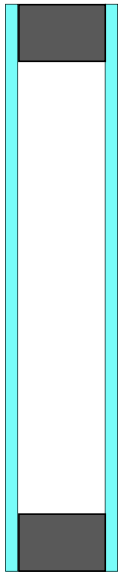
*Double Silver Low-E*

| Makeup | Thickness | U-Value (R) | SHGC | VLT |
|---|---|---|---|---|
| Air | 1” / 25.4mm | 0.34 (3.0)* | 0.38 | 70% |
| Argon | 1” / 25.4mm | 0.25 (4.0)* | 0.37 | 70% |
| Triple, Air | 1 3/4” / 44.5mm | 0.22 (4.7) | 0.34 | 63% |
| Triple, Argon | 1 3/4” / 44.5mm | 0.19 (5.2)* | 0.34 | 63% |
| **VIG*** | **5/16” /8.3mm** | **0.07 (15.4)*** | **0.37** | **70%** |

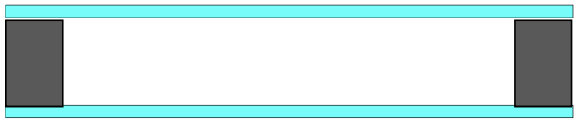
*VIG pillar spacing is 60mm
*measured at an independent lab

# Current IGU Thermal values

*Double silver Low-E IGU with Argon*



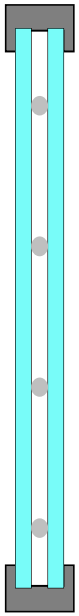
In vertical position
R-Value = 4.0



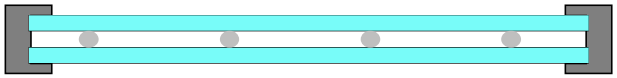
In horizontal position
R-Value = 2.7

# VIG thermal values

*VIG unit*



In vertical position
R-Value = 15.4



In horizontal position
R-Value = 15.4

# VIG & hybrid VIG performance values

| Makeup | Thickness | U-Value (R) | SHGC | VLT |
|---|---|---|---|---|
| Standalone VIG | 5/16” / 8.3mm | 0.07 (15.4)* | **0.37** | **70%** |
| Hybrid, DS | 1 1/8” / 28.5mm | 0.06 (18.0)* | **0.27** | **56%** |
| Hybrid, TS | 1 1/8” / 28.5mm | 0.05 (18.3) | **0.22** | **50%** |

*DS = Double silver Low-E coating
*TS = Triple silver Low-E coating

# Double VIG & hybrid performance values

“Double VIG” = two VIG units with an airspace between.
“Double VIG Hybrid” = Low-E-coated outboard with two VIG units inboard.

| Makeup | | Thickness | U-Value | SHGC | VLT |
|---|---|---|---|---|---|
| Double VIG | Argon | 1 3/16” / 30mm | 0.03 (28.8) | 0.27 | 50% |
| Double VIG | Argon, #4 Low-E | 1 3/16” / 30mm | 0.03 (30.0) | 0.27 | 50% |
| Double VIG | Krypton, #4 Low-E | 1” / 25.4mm | 0.03 (30.2) | 0.27 | 50% |
| Double VIG Hybrid | Argon | 2” / 50.8mm | 0.03 (32.8) | 0.20 | 40% |
| Double VIG Hybrid | Argon, #4 Low-E | 2” / 50.8mm | 0.03 (34.2) | 0.20 | 40% |
| Double VIG Hybrid | Krypton, #4 Low-E | 1 5/8” / 41.3mm | 0.03 (35.1) | 0.21 | 40% |

# Testing performed

**ASTM E1233**

**ASTM E330**

**Pressure cycling and sustained loads performed with no breakage**

**Modified ASTM E2188**

**Acoustics:**

**STC Rating: 33**

**ASTM E90**

**ASTM E413**

**OITC Rating: 32**

**ASTM E1332**

**ANSI Z97.1: Fully tempered**

# North American Energy Codes

**>Energy codes in Canada & USA are becoming stricter.**

**>Lower U-factor requirements are on the horizon.**

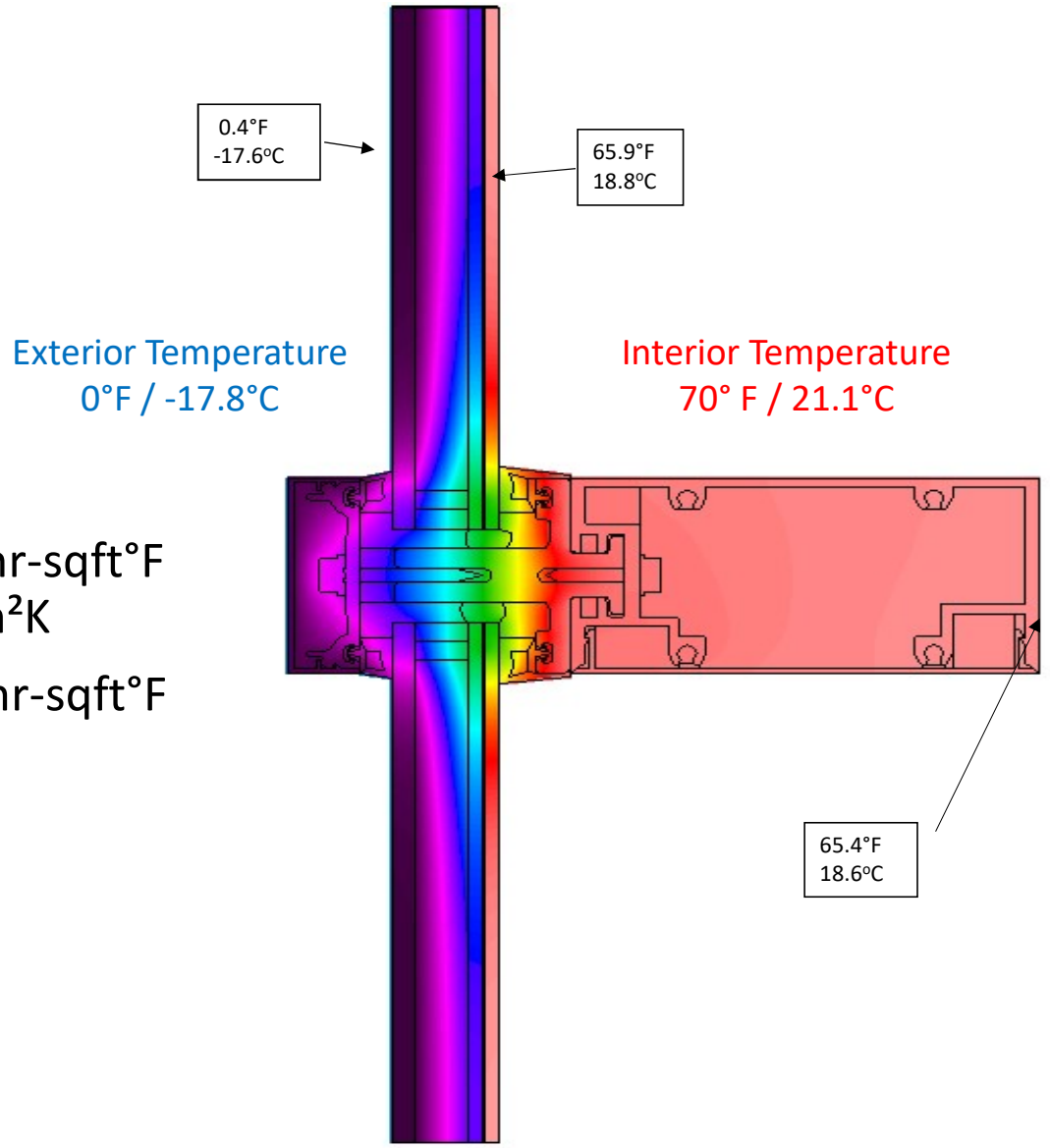
**>Federal, Provincial, State & Territorial governments are collaborating.**

**>Net-zero energy codes for new buildings are coming.**

**>British Columbia has a step code.**

**>The province's goal includes reaching net-zero in new construction by 2032.**

# R-value 10?




- H-VIG -COG U factor (imperial) = .052 BTU/hr-sqft°F
  (metric) = .295 W/m²K
- Assembly U factor (imperial) = .108 BTU/hr-sqft°F
  (metric) = .612 W/m²K
- System R-value = 9.26 → 10.0
- 100°C Delta T

# Vacuum Insulating Glass

Where the window becomes the wall!

# Benefits of VIG

- Improved U-value (R-value)
- Compatible with a multiplicity of Low-E coatings
- Improved SHGC
- Improved noise abatement
- Improved work space comfort
- Increased available work space and property value
- Reduced weight
- Reduced thickness

# Large Panels

Lightweight
Rigid
Fire Rated
Jumbo Sizes
100% recyclable

# Thin Panels

Ready to go
Performance
Longevity
Fully Tested
Window = Wall

# Large Panels / Thin Panels

# Thank You

**New Technologies for the Next Generation of facades**

**May 3rd 2019 – Arthur Huard – GlassCan Corporation**

# BUILDING MATERIAL

Performance and Geometry Driving Expansion of the Facade Material Palette

Facade Tectonics FORUM TORONTO

## SPEAKERS

**YVON CHIASSON, ING., P.ENG.**

*Senior Building Science Specialist, Façade Engineering*

Morrison and Herschfield

**ROBERTO BICCHIARELLI**

*Lead Concept Designer – Business Development Manager East, Permasteelisa North America*

**ANTONIO MONSERRAT**

*Sales Manager*

seele

**MICHAEL STEINHUELB**

*Vice President*

seele

**ARTHUR HUARD**

*Principal*

GlassCan Corporation

**JOHN PETERSON**

*Senior Associate*

MacLennan Jaunkalns Miller Architects