

HOW SEALANTS & ADHESIVES CONTRIBUTE TO MODERN & SUSTAINABLE GLASS FAÇADES

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About H.B. Fuller | KÖMMERLING

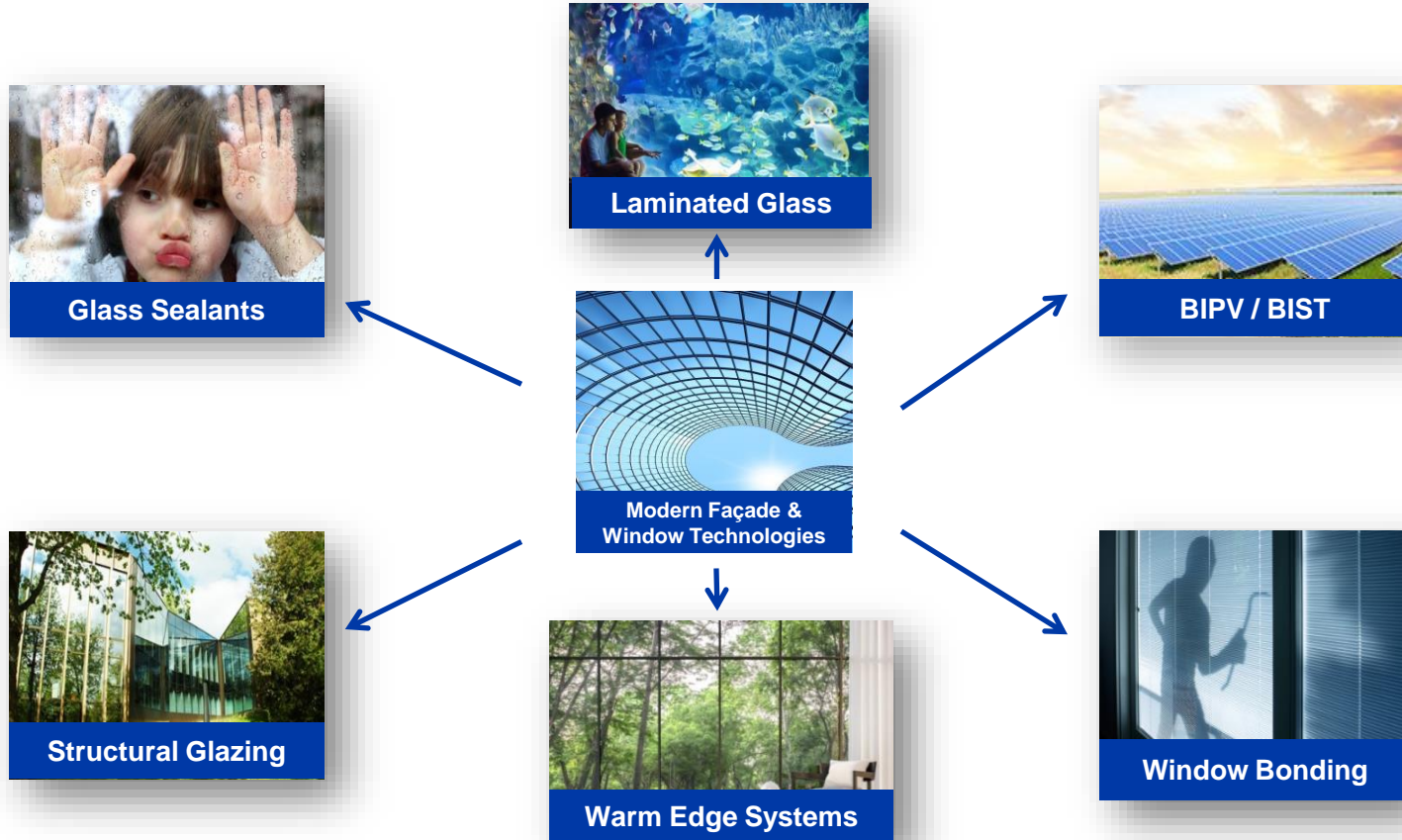
- H.B. Fuller | KÖMMERLING is the global market leader of adhesives and sealants for insulating glass applications, focused on continuous development of technical products and application solutions.
- We provide high performance sealant systems with unique bonding solutions for energy-efficient residential construction to modern glass façades.
 - Insulating Glass Sealants
 - Warm-Edge Spacer Systems
 - Structural Glazing Solutions
 - Window Bonding Technologies
 - Wet Lamination of Glass



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Modern Façade Technologies



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Sustainable Products in modern Architecture

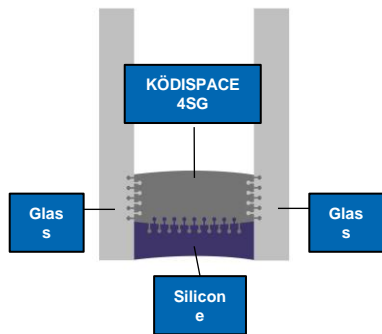
Construction

40% of global CO₂ emissions attributable to construction and building sector



H.B Fuller | Kömmerling sealants for high-tech façade solutions – the ideal balance of aesthetic appeal, long term performance and energy efficiency

Energy Efficiency



Ködispace 4SG enables the production of providing superior gas tight IGUs ensuring long-term energy efficiency

Energy Saving



H.B Fuller | Kömmerling technology allows the integration of additional functions to the IGU

Energy Generation



H.B. Fuller high performance **silicones** enables the production and mounting of BIPV technology

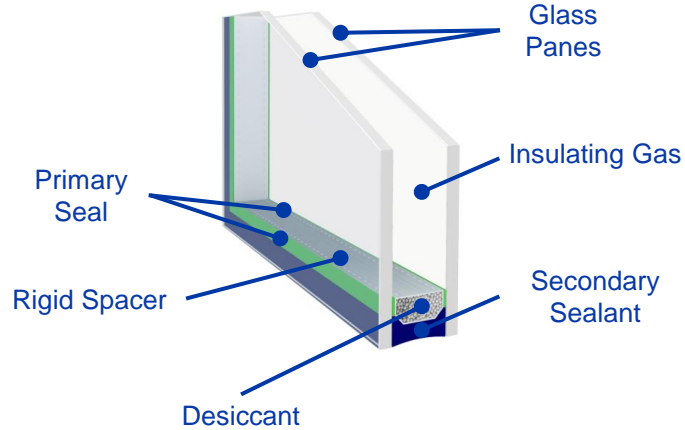


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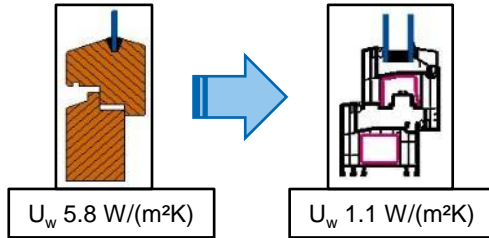
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Insulating Glass Minimizes Operational Carbon...

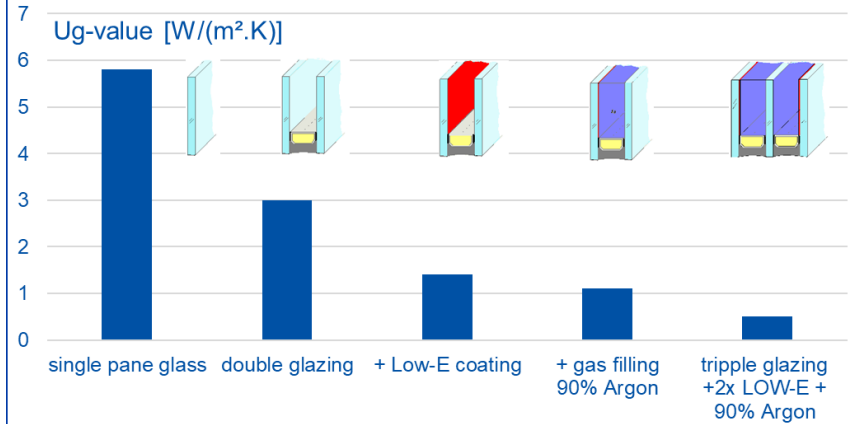
Standard IGU



Cold bridging



Energy Savings with IGU for heat and cooling of buildings



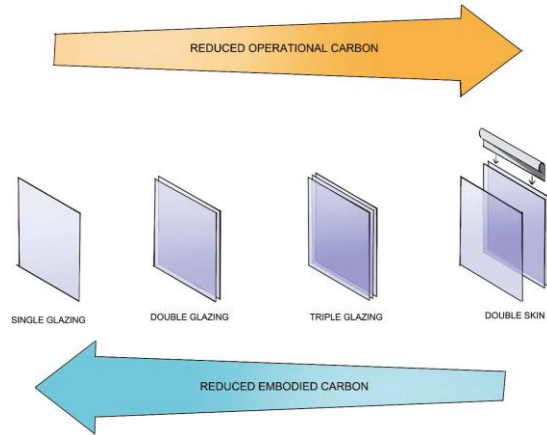
Savings of heating oil / year 720 l

CO2-Emission savings / year 1950 kg

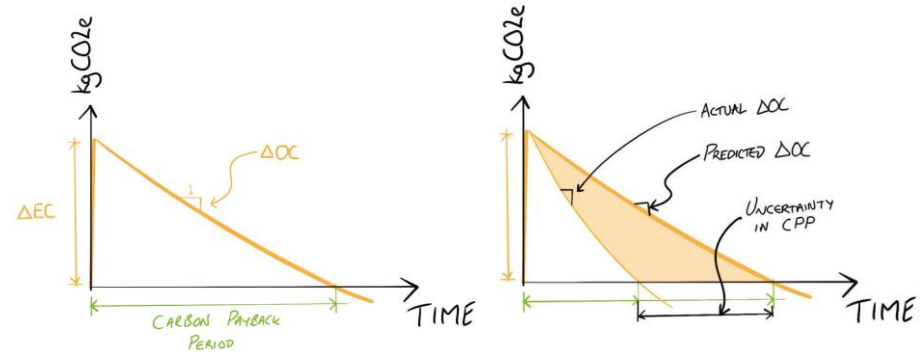
20 m² glazing surface of the building
(e.g. residential family home)

...but Increases Embodied Carbon

- Operational vs. embodied carbon



- Estimated and actual service life assessment



* Balancing embodied and operational carbon in building envelope design – Will Wild, Arup

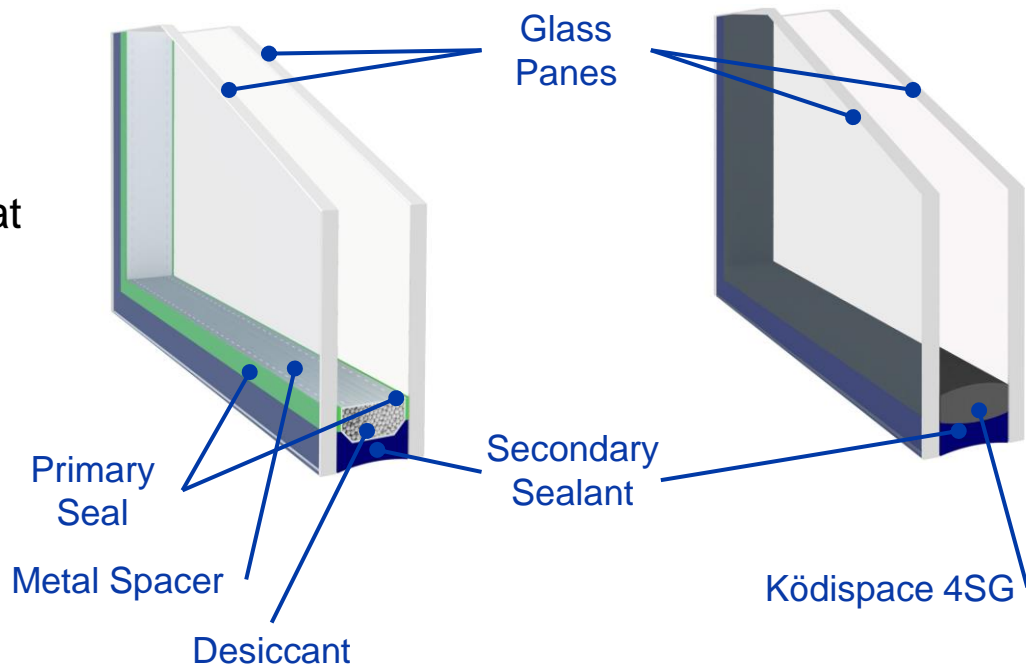
Increased IGU complexity and premature failure increase carbon cost



need to significantly increase the service life of an IGU

Thermoplastic Spacer in Insulating Glass

- Replaces spacer, desiccant, and primary sealant
- Extrudable spacer deposited directly on glass
- Amenable to shapes and large format IG
- Can utilize any common secondary sealant
- Warm edge performance
- Spacer-in-a-drum

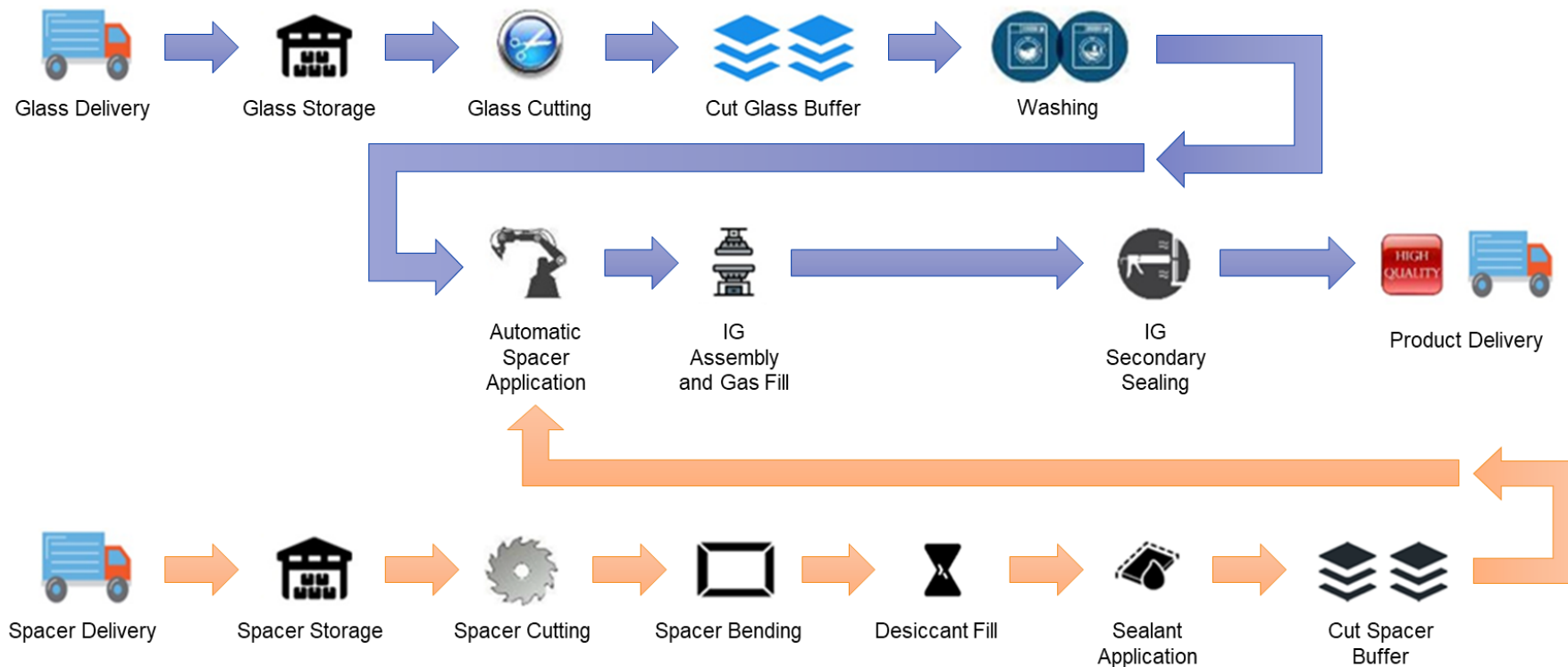


Manufacturing and Operational Carbon Advantages

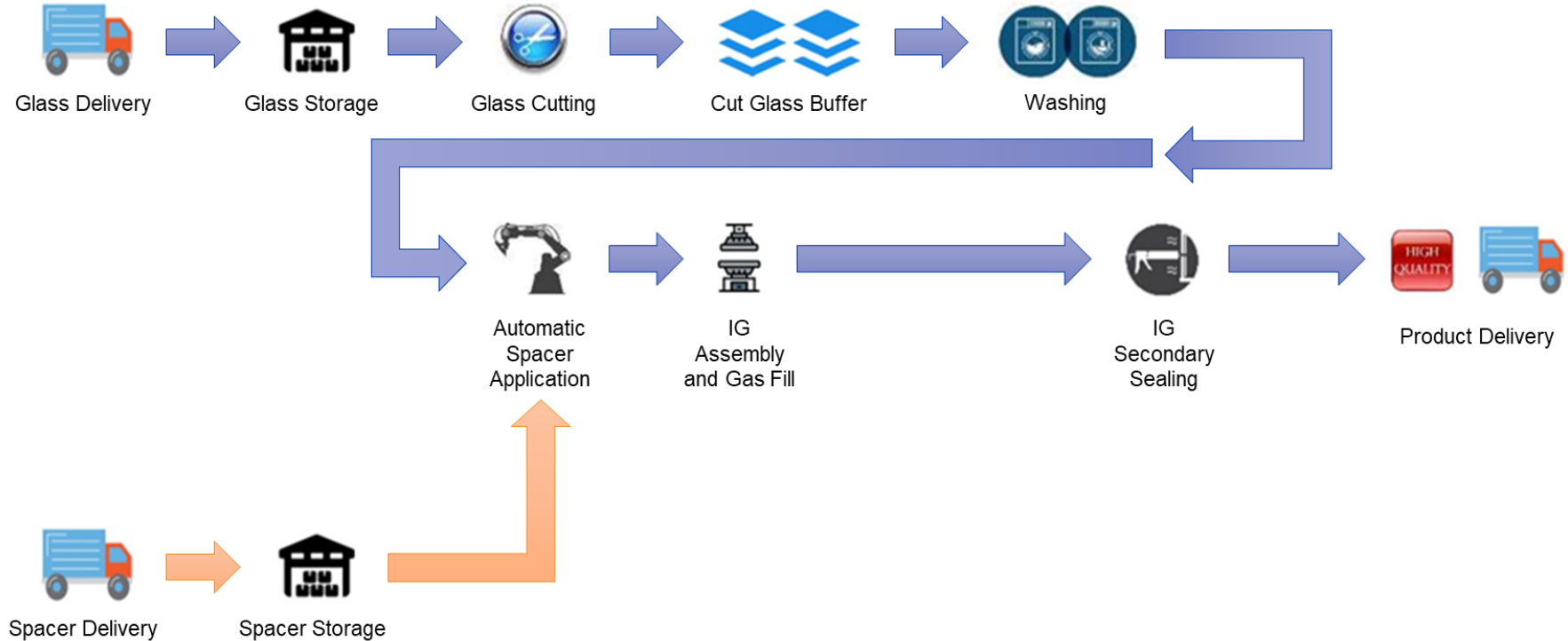
- Fewer process steps and faster manufacturing
 - No sorting IG frames
 - No spacer reel or color changes
 - Continuous production – no drum change down time
- Reduced warehouse space needed
 - 4SG replaces fixed spacer widths
 - No more connectors, corner keys, hardware
- Reduced waste
 - No spacer cutting waste
 - No desiccant spills
 - No bending errors
- Fewer machines and equipment
 - Spacer bender, PIB extruder, desiccant filler, spacer hanger, etc



Typical Box Spacer IG Production Process – 15 Steps

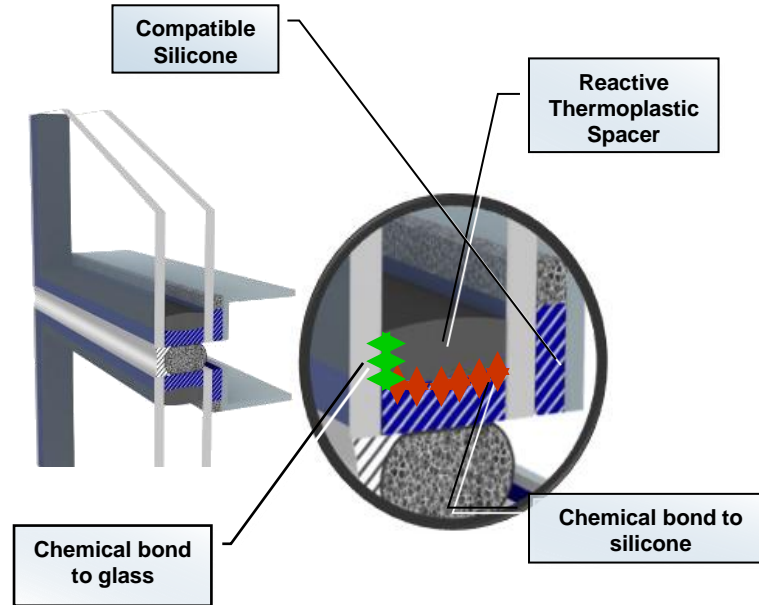


Typical Ködispace 4SG IG Process – 10 Steps



Ködispace 4SG – The State-of-the-Art TPS

- **Reactive** TPS
 - Chemical bond to glass & silicone
 - Internal crosslinking
 - Higher service temperature
 - Resistance to incompatible glazing materials
 - Permanently elastic and bonded edge seal
- Structural glazing approved
- In the field since 2009
- Extensively tested/certified



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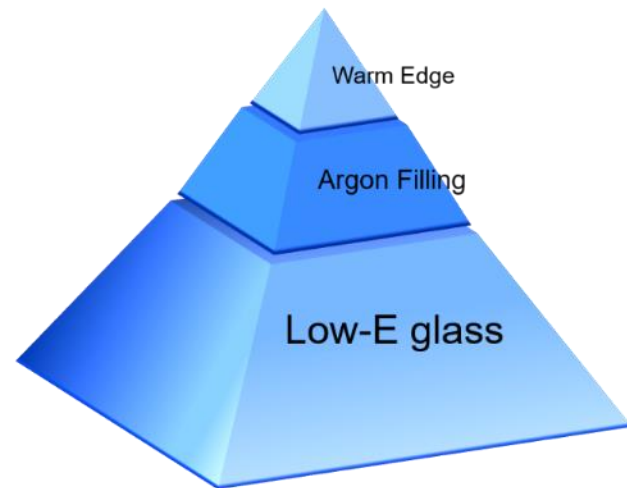
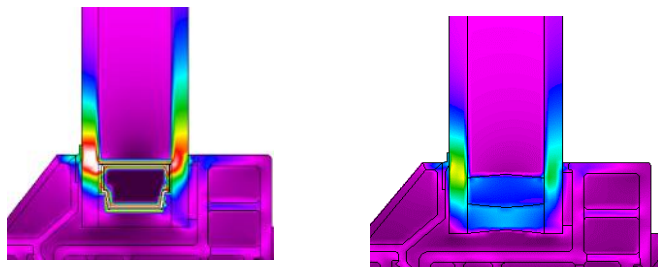
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Thermal Performance for the Long Run

Warm Edge Performance

- Best U-values are achieved by minimizing thermal loss
- Minimized heating/cooling of the insulating glass edge, creating a more comfortable interior space
- Reduced condensation and mold spores
- Reduced cooling /heating costs, CO2 emissions, and overall environmental impact

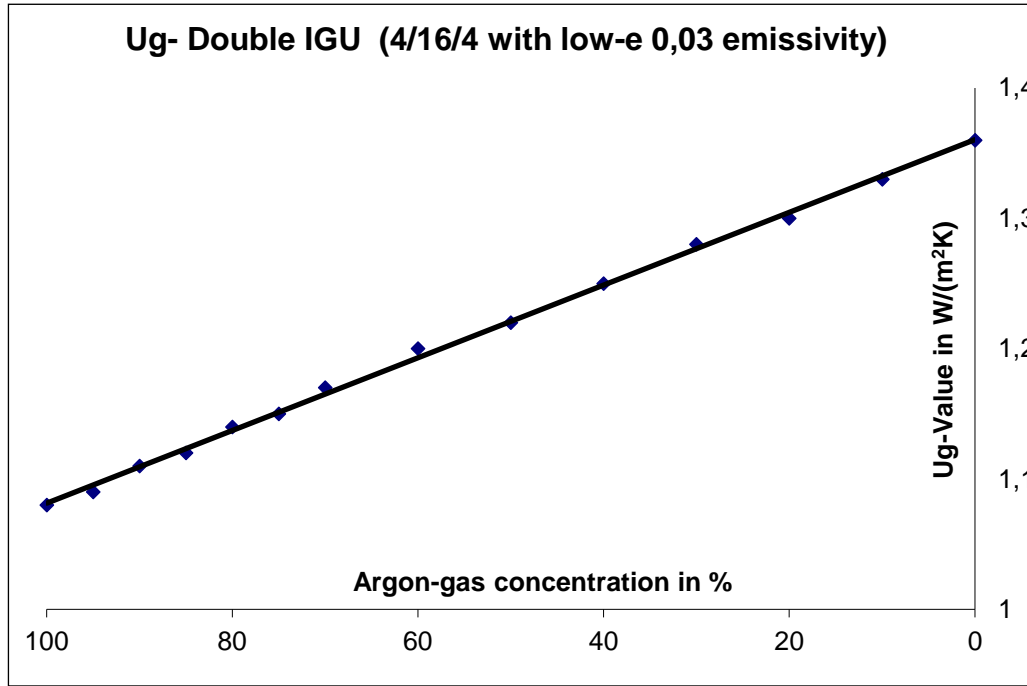
This performance should be maintained for the life of the IGU



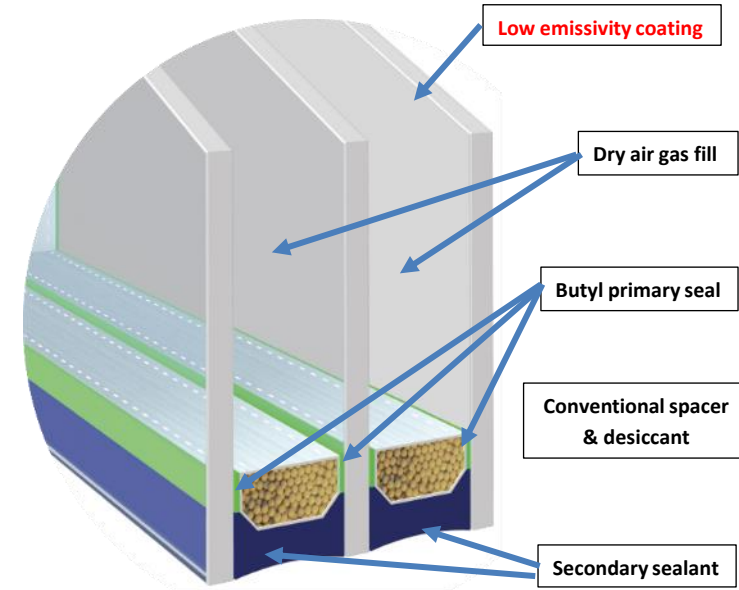
Long term gas tightness is the key for long term energy efficiency !



The Insulation Consequence of Moisture Ingress and Gas Loss



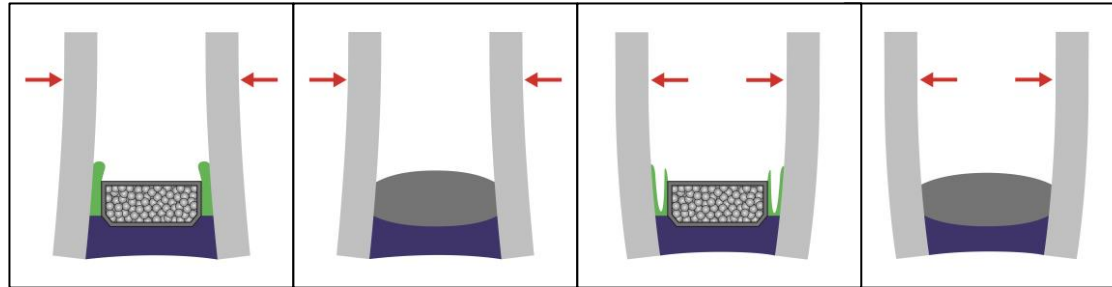
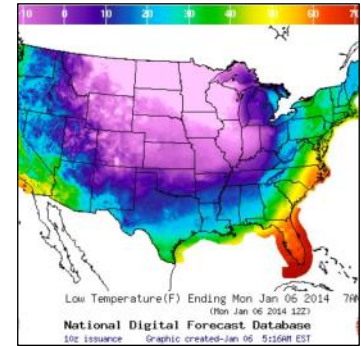
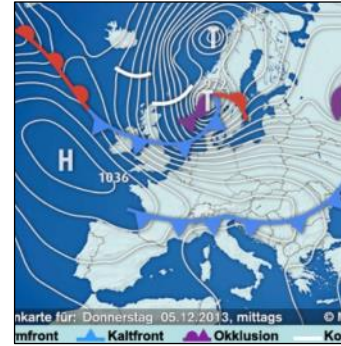
A Correlation of Ug values against argon gas concentration



Significant impact of moisture on the performance of some metalised type coatings (i.e. Low-E coatings)

The Importance of Elasticity

- Stress results in strain in an IG unit
- Rigid spacer systems compensate through glass deflection and primary seal deformation
- Ködispace 4SG can elastically deform and minimize glass movement during environmental stress



Improved stress and strain distribution = minimized chance of failure = longer lifetime



Ködispace 4SG - Long Term Durability

Life Time Expectation of IGUs with Different Spacer Materials*

Aluminum Spacer

Hybrid Spacer #1

Hybrid Spacer #2

Foam Spacer

Ködispace 4SG

> 50 years

*based on multiple EN1279 part 3 tests

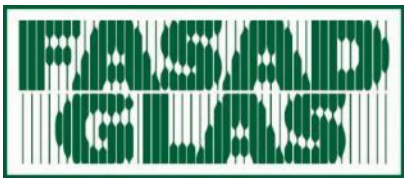


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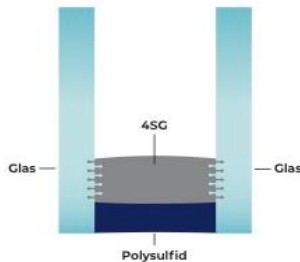
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Building Envelopes for the Future

Volvo Innovation Centre, Torslanda, Sweden



GLASGRUPPEN
Klimatsmart glas för en ljus framtid



= Perfect Match

- ✓ significantly increased IGU service life
- ✓ 50% Lower Carbon Footprint
- ✓ Sustainability at its maximum !

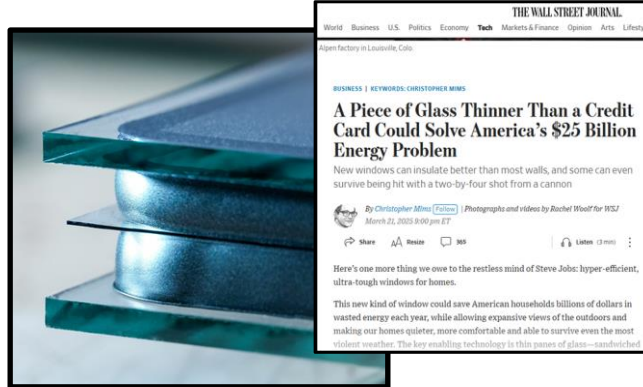


Ködispace 4SG Delivering a Sustainable Future

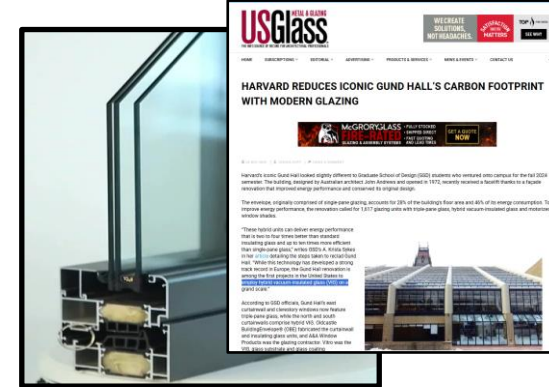
- State of the art thermal performance fit for future



Smart Glass



Triple Thin



Hybrid VIG

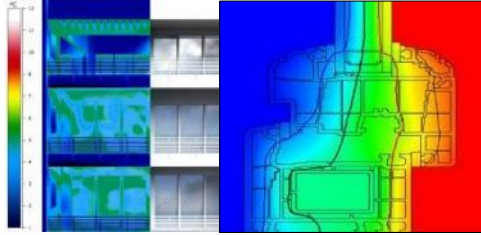
**Already working today
for the demands of tomorrow!**



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Ködispace 4SG – Enabling the Most Carbon-Efficient Facades



- Energy and Carbon-Efficient Buildings
 - Exceptional **gas retention** over extended life cycles
 - Exceptional **mechanical stability** under torsion, shear and lateral loads and stable at **elevated temperatures**
- Innovative Shapes & Maximum Transparency
 - **Innovative** shaped designs and cold bent insulated glass
 - Incredibly **accurate spacer location** for coated and deleted specifications with robot applications
- Multifunctional Building Envelopes
 - **Compatibility** assessed with standard use secondary, structural and weather sealants
 - Design guidance from our experienced technical team



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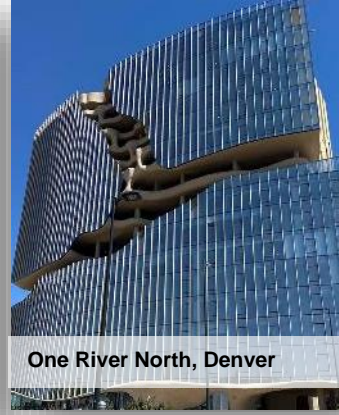
References all around the World - #4SGplanet



Sales Force Tower, Chicago



Haikou Duty Free Mall, Hainan/China



One River North, Denver



Chadstone Center, Melbourne



Amazon, Seattle



Serlachius
Museum, Finland



The Sphere, Las Vegas



TÜV Süd, Munich



LG Headquarter, Seoul



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Thank you!



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