LIGHT, GLASS &WATER

A BUILDING ENVELOPE FOR THE FUTURE?

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BUILDING ENVELOPE

REPRESENTATION
COMMUNICATION

PROTECTION
FUNCTION

InDeWaG

Industrial Development of Water Flow Glazing

Developing a commercial façade system using water flow glazing, which is able to actively control the thermal stability in the interior spaces, and, in the same time, absorb solar energy, in order to get use of it.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Program, Grant agreement №680441

UNIVERSITÄT BAYREUTH

ETEM

POLITÉCNICA

HTCO GmbH
Strömungsphysik - Strömungssimulation

architectonika studio

Fraunhofer ISE

BOLLINGER + GROHMANN Ingenieure

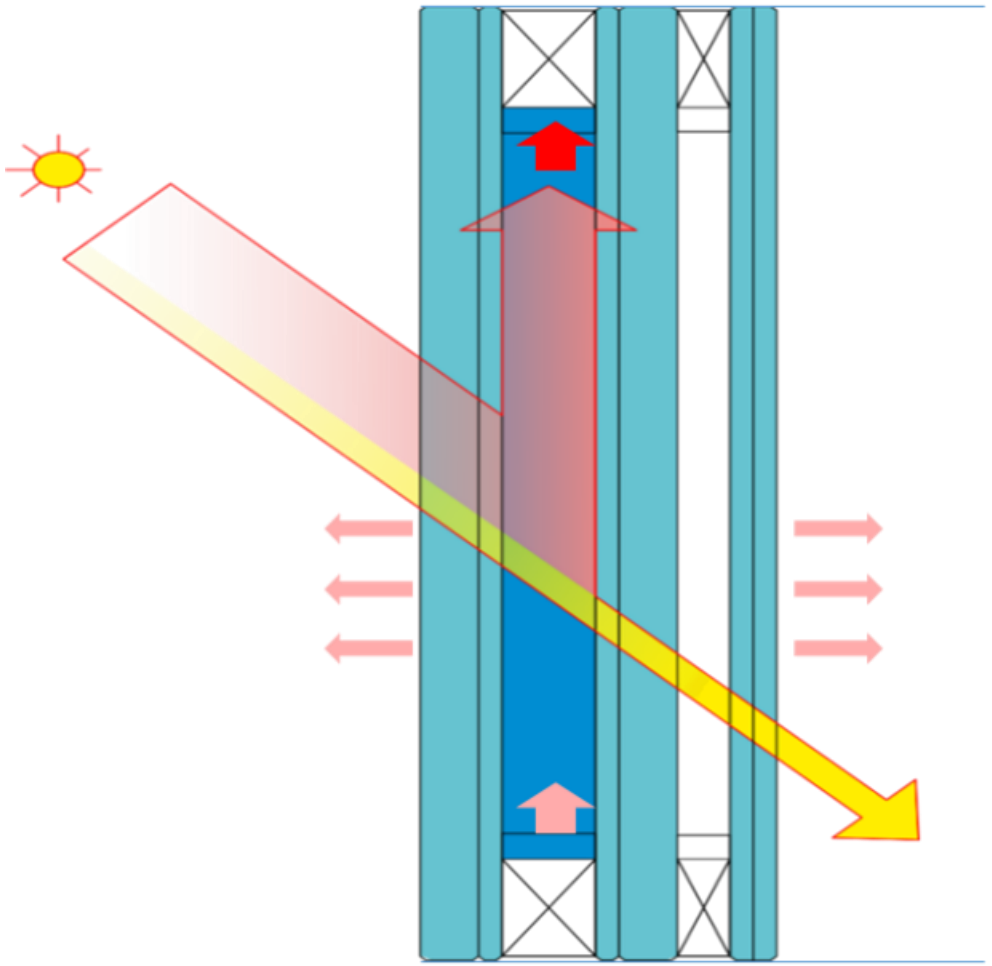
CERVIGLAS

SAVIOR VENTURE CAPITAL

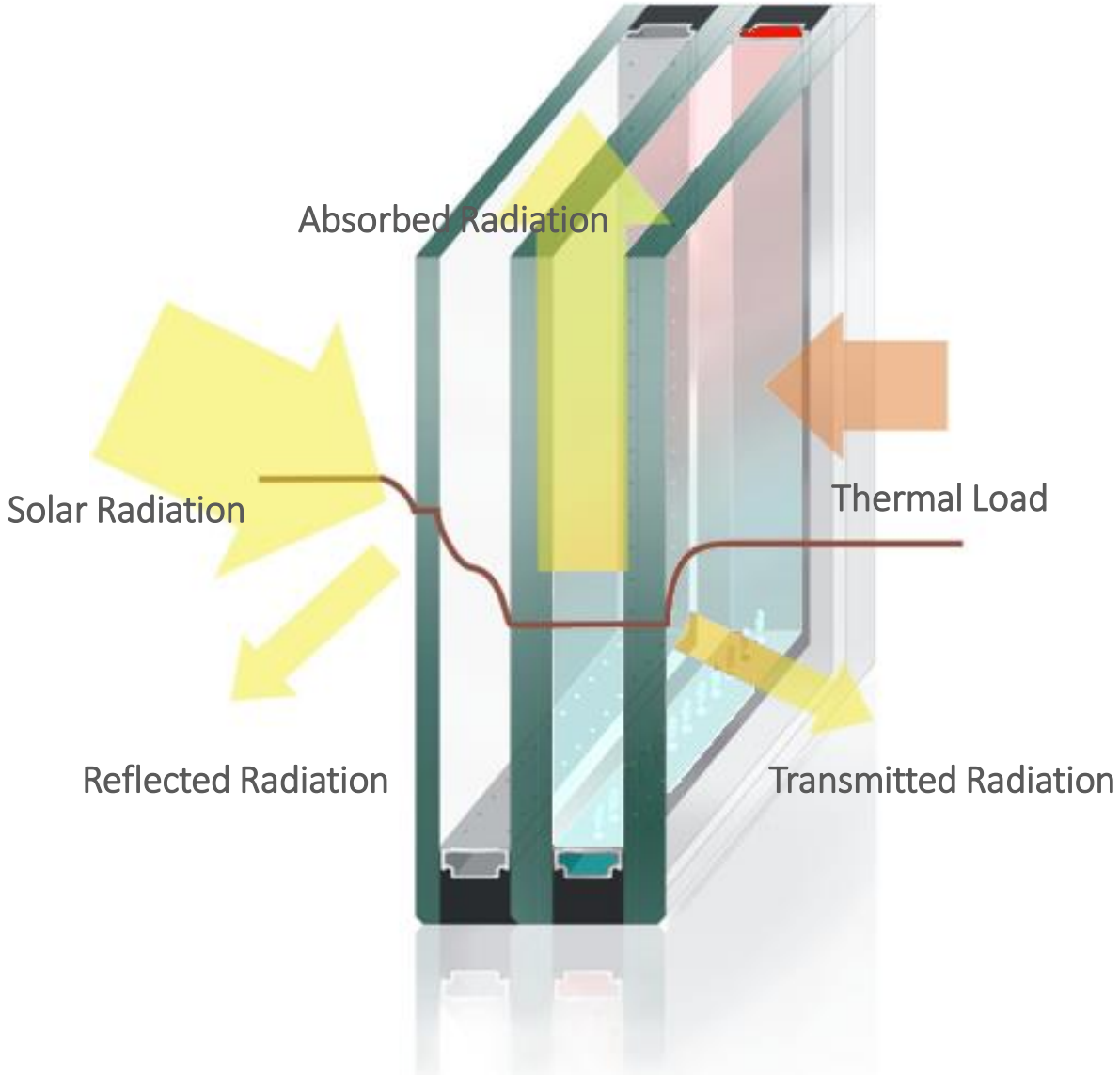
BULGARIAN ACADEMY of SCIENCES 1869

MAIN OBJECTIVES of the InDeWaG approach

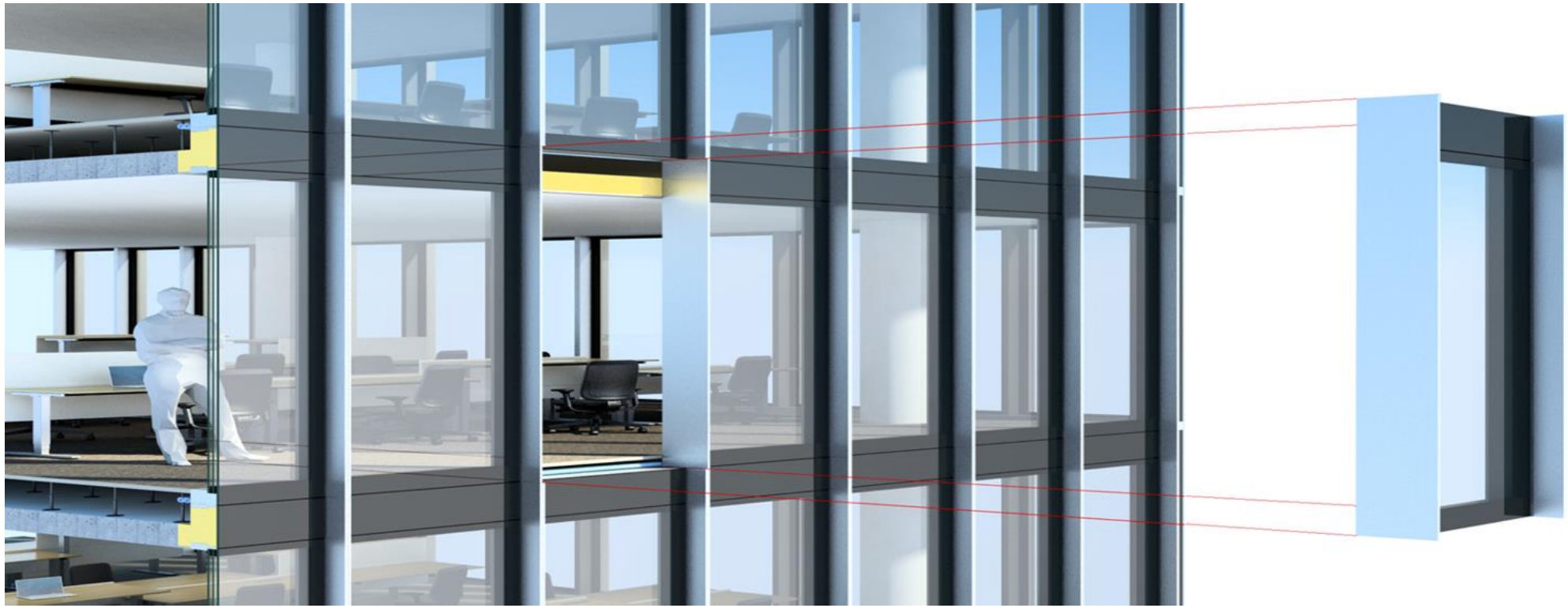
- *Maximum use of daylight*
- *Transparent glass façade*
- *nZEB performance*
- *InDeWaG introduces a new façade system*



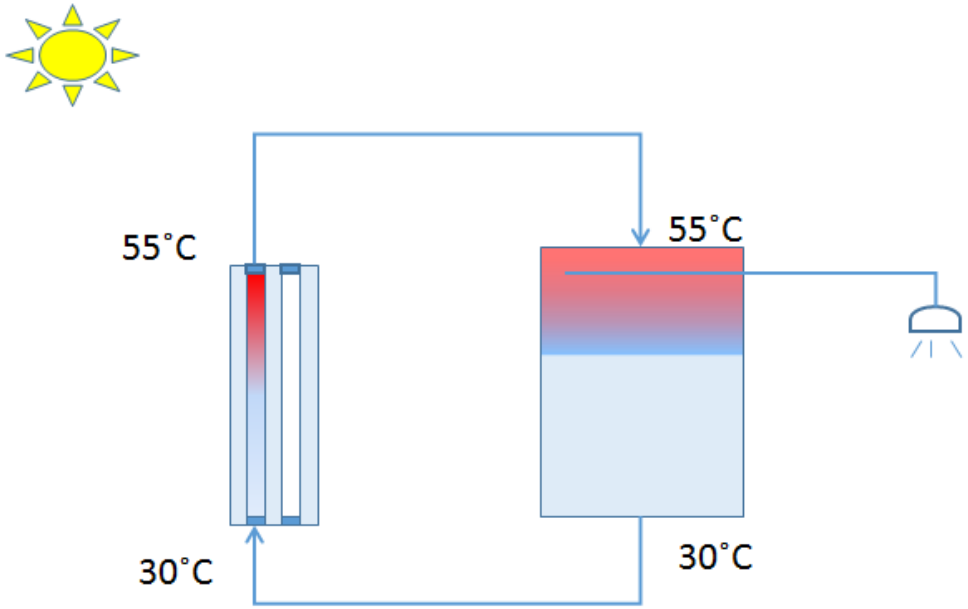
- *Industrial production*
- *Standardized building components*
- *Different climate zones*
- *Minimum HVAC expenses*
- *At least 15% building cost reduction*



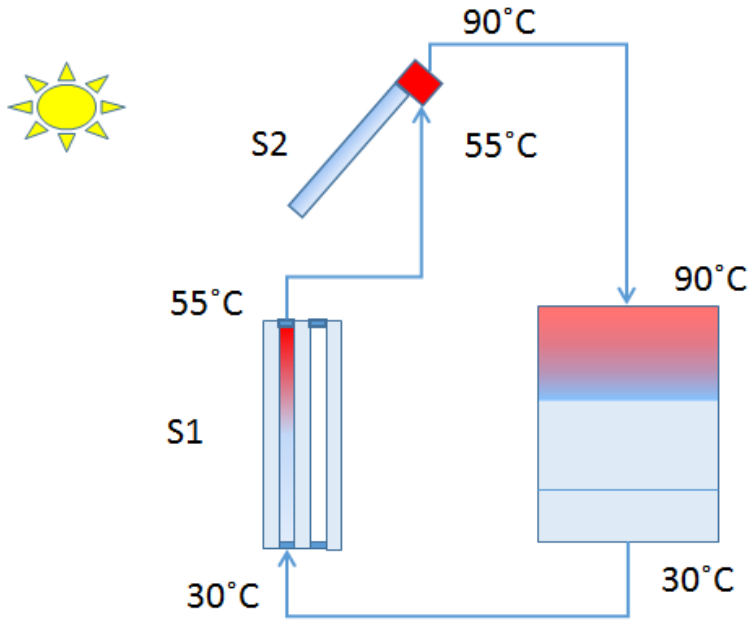
comfort, well-being, health, productivity
through
unitized façade as transparent solar collector or cooling device



DIRECT USAGE



SEASONAL STORAGE



ADVANTAGES

- High Transparency, causing high energy demand and capacity of HVAC systems

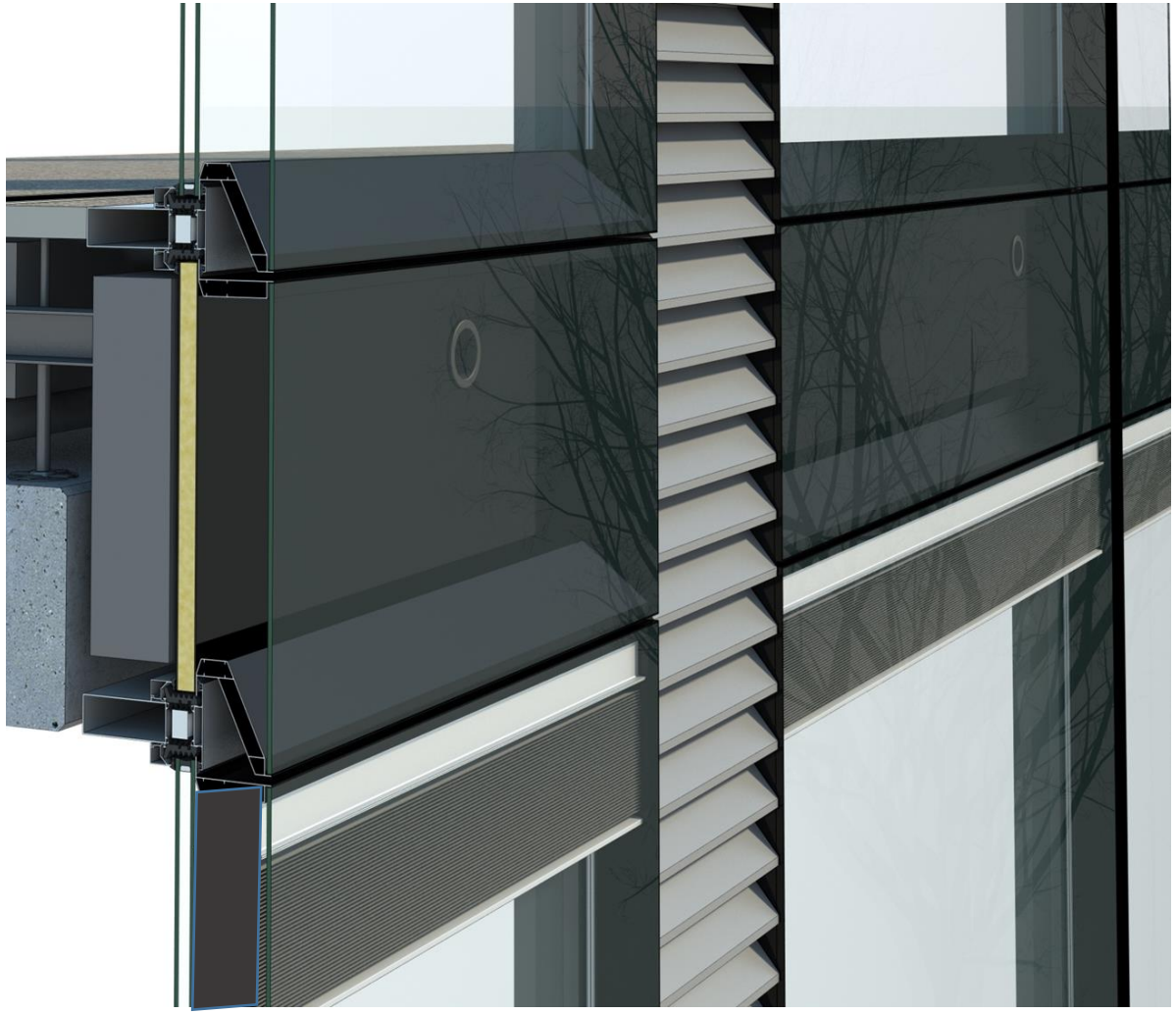
Problem solved!

- Completely integrated, decentralized HVAC unit in the façade envelope

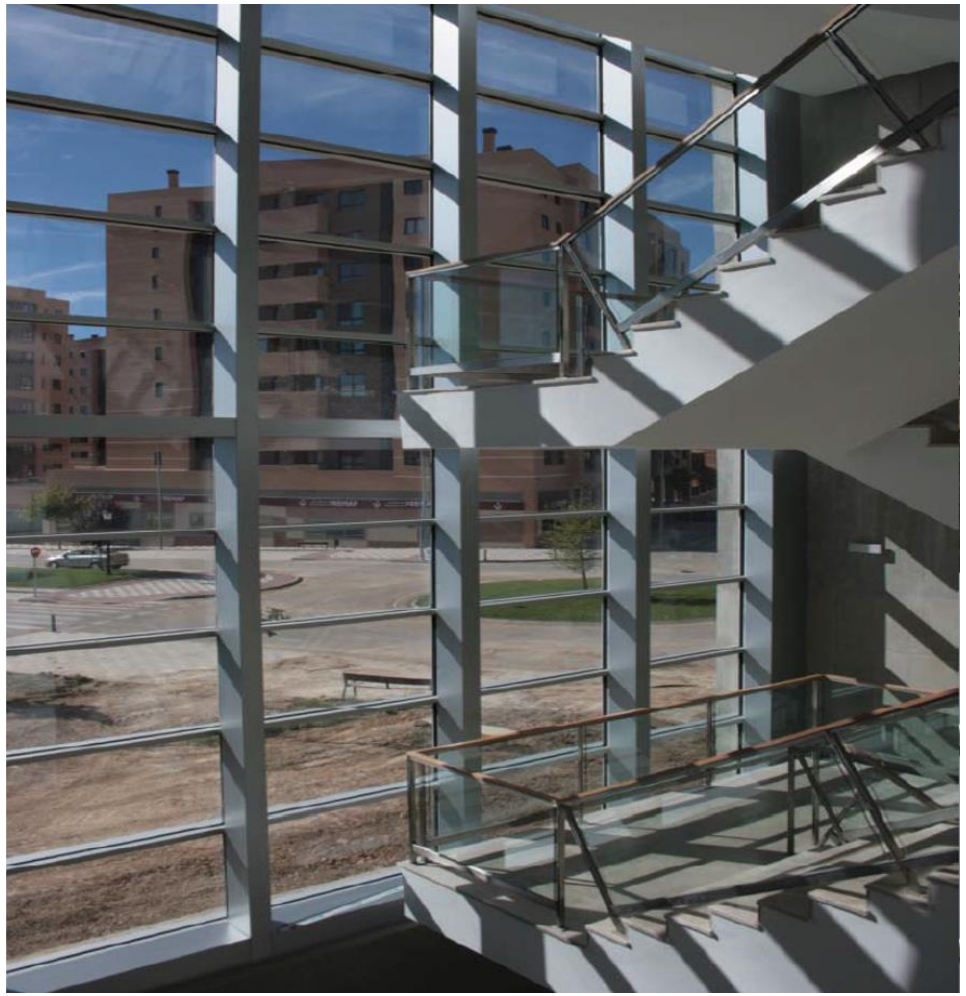
Free internal space!

- Radiant cooling and heating

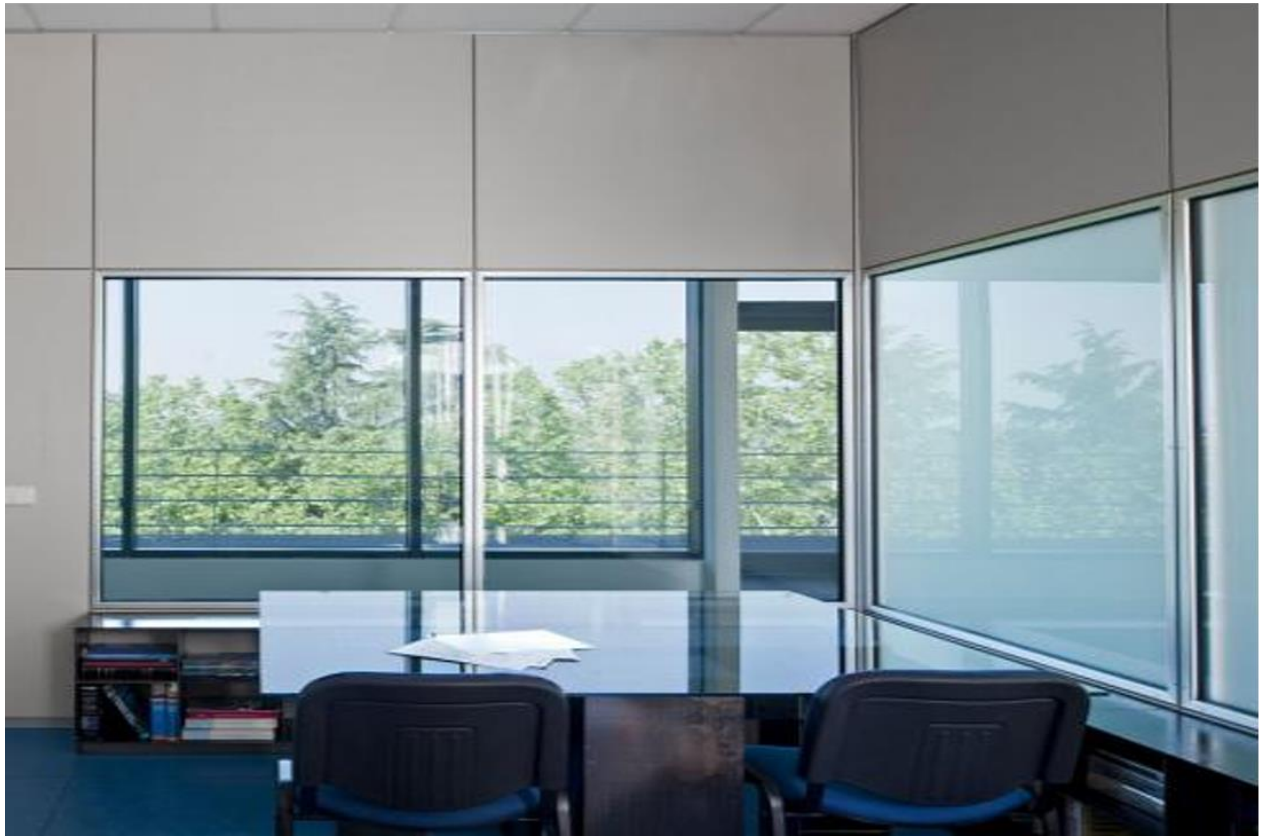
Comfort insured!



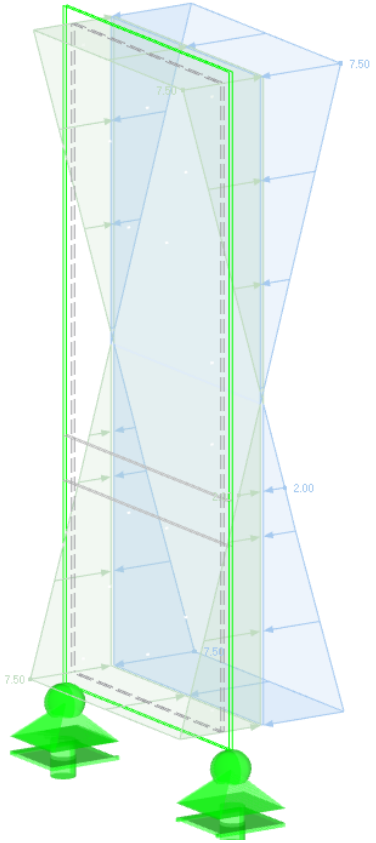
Transparent façade – solar collector



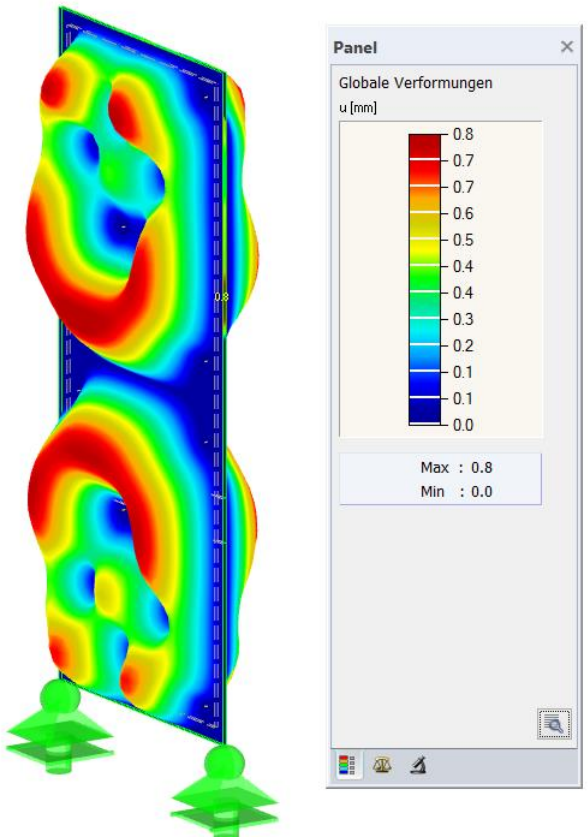
Low temperature heating and cooling partition walls



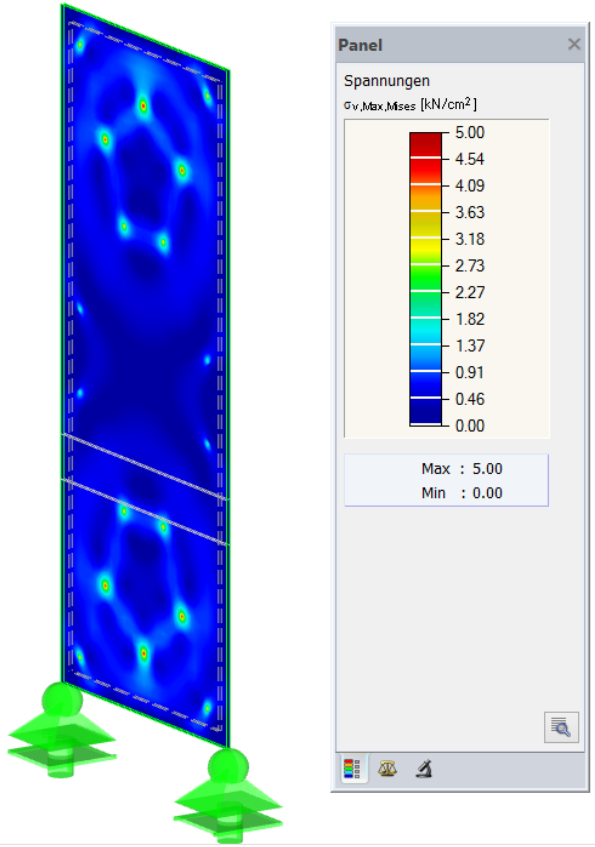
HYDRO-STRUCTURAL DESIGN



Load case vacuum / water pressure

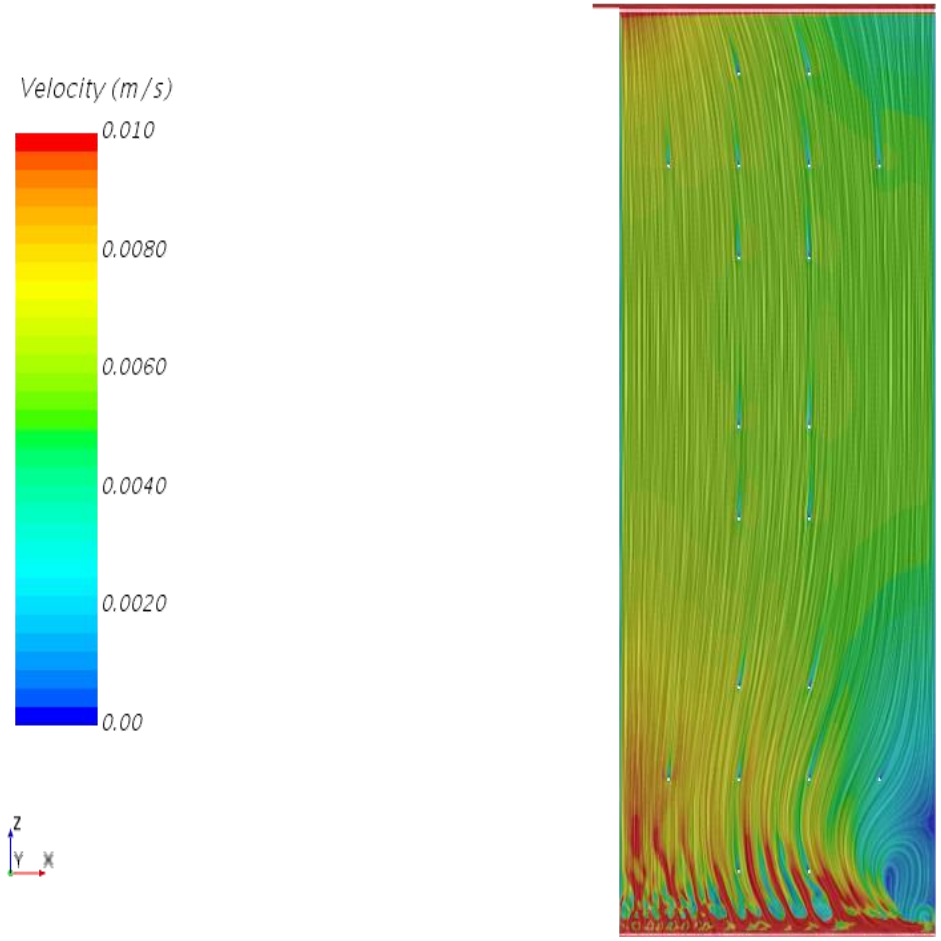


Deformations

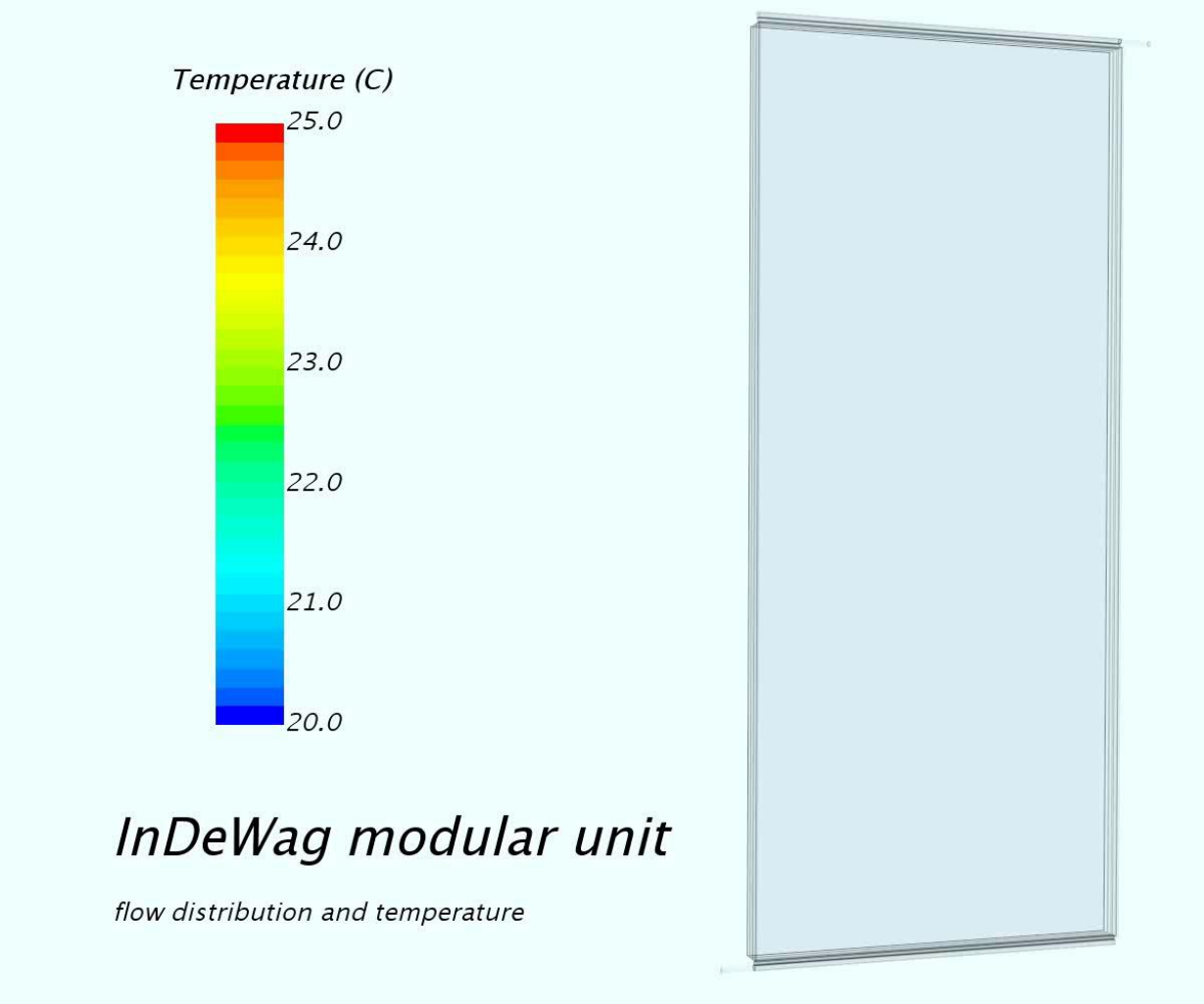


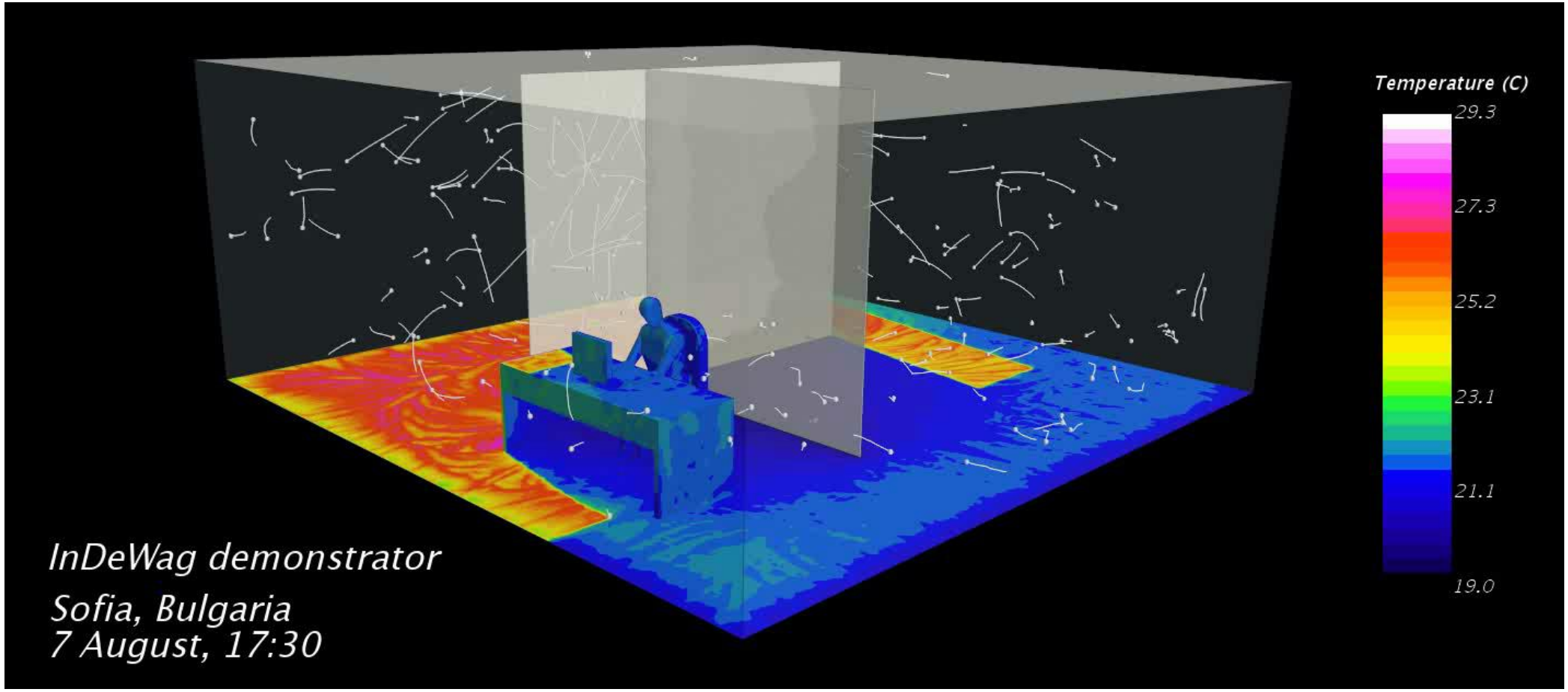
Stress

WATER-FLOW DESIGN -CFD ANALYSIS

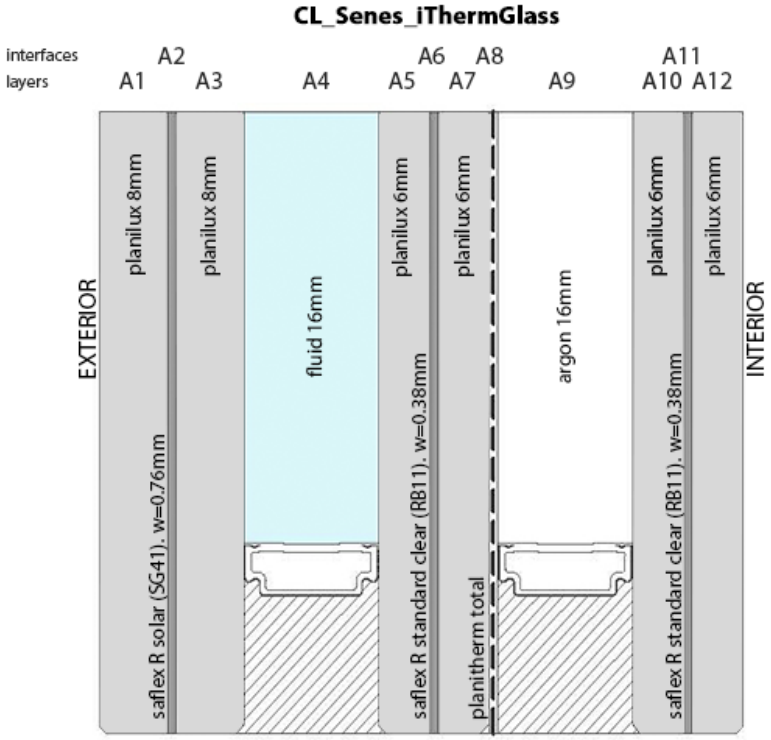


Velocity Distribution in FFG with Round Pillars, 2 l/min per m²




Temperature (C)
29.3
27.3
25.2
23.1
21.1
19.0
InDeWag demonstrator
Sofia, Bulgaria
7 August, 17:30

GLAZING CATALOGUE
dynamic **g**-value – fully transparent facade on/off 0,24÷0,67



$$q_T = U(\theta_e - \theta_i) + U_w(\theta_{INLET} - \theta_i) + g\hat{i}_e$$

Layer	Absorptance			
	Beam		Diffuse	
	Front	Back	Front	Back
A1	0.132	0.017	0.429	0.127
A2	0.031	0.037	0.015	0.040
A3	0.019	0.041	0.000	0.004
A4	0.017	0.047	0.016	0.053
A5	0.000	0.000	0.013	0.093
A6	0.000	0.046	0.012	0.115
A7	0.140	0.016	0.418	0.116
A8	0.030	0.036	0.011	0.036
A9	0.018	0.040	0.000	0.003
A10	0.017	0.047	0.015	0.046
A11	0.000	0.000	0.012	0.099
A12	0.000	0.045	0.012	0.123

Spectral prop		Thermal prop			
Tv	T	Flow	U	U_w	g
0.508	0.204	ON	0.068		0.237
		OFF	1.070		0.670

Glazing from outside to inside:

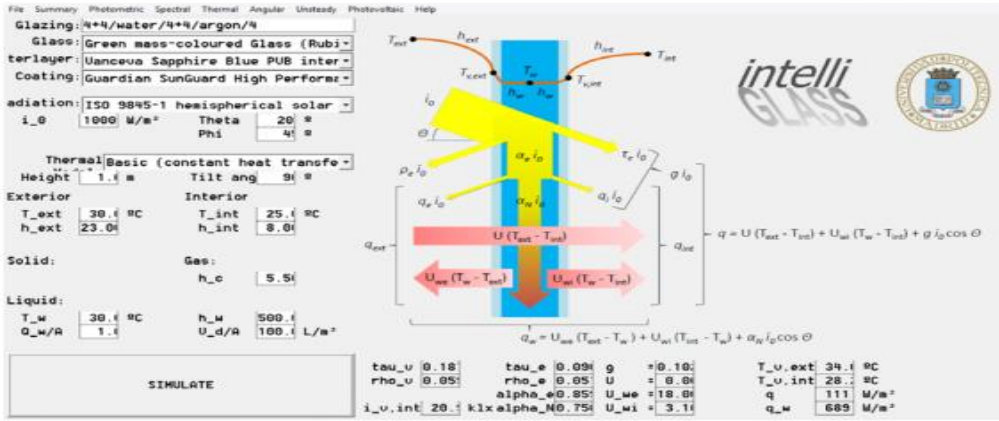
- Laminated glass: 4+4mm thick.
- Water chamber 16mm thick.
- Laminated glass: 4+4mm thick. Vanceva Sapphire Blue PVB interlayer.
- Argon chamber 12mm thick.
- Float glass: 4mm thick.

Solar radiation 1000W/m2.

Theta angle: 20º

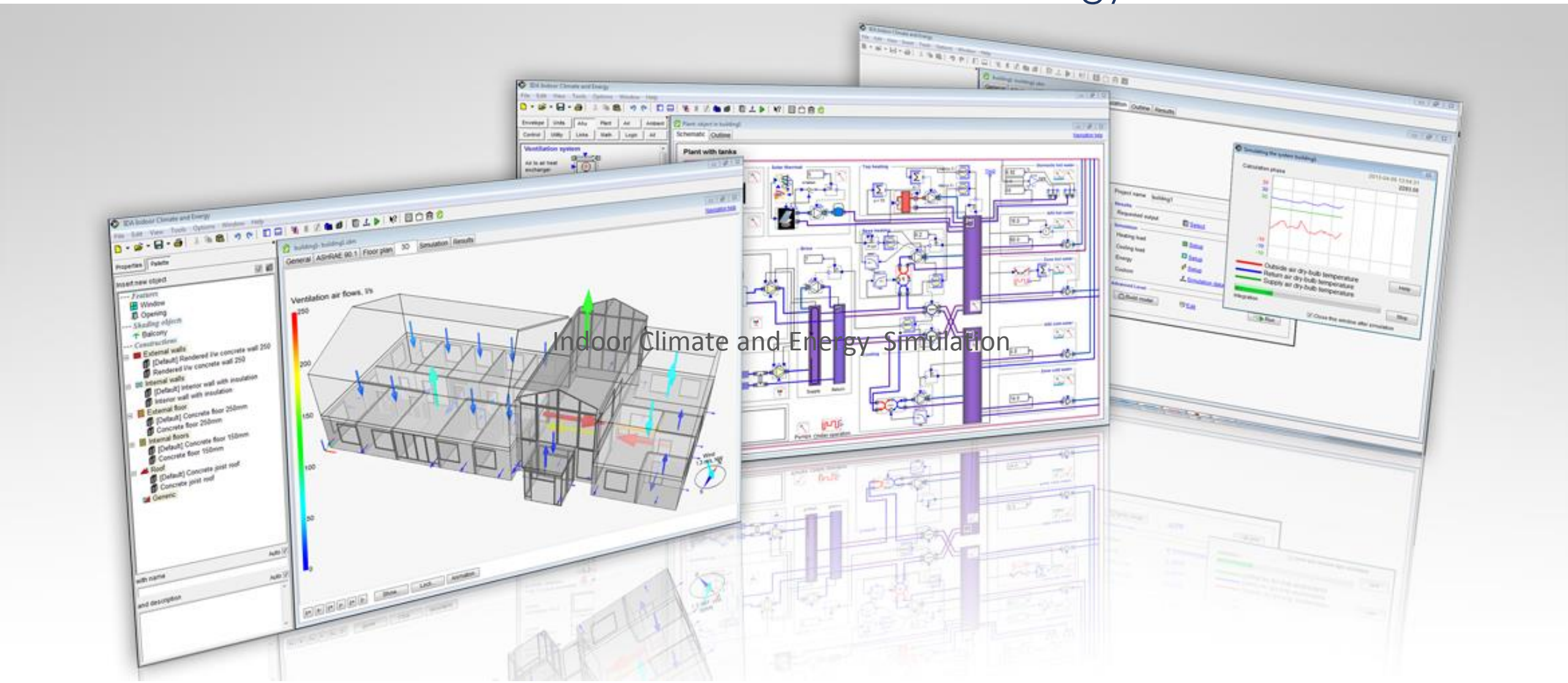
Outside Temperature: 30ºC

Inlet water temperature: 30ºC



THERMAL DESIGN

Simulation software IDA ICE - Indoor Climate and Energy Simulation



Tools for architects and engineers

Making an energy balance for the particular building

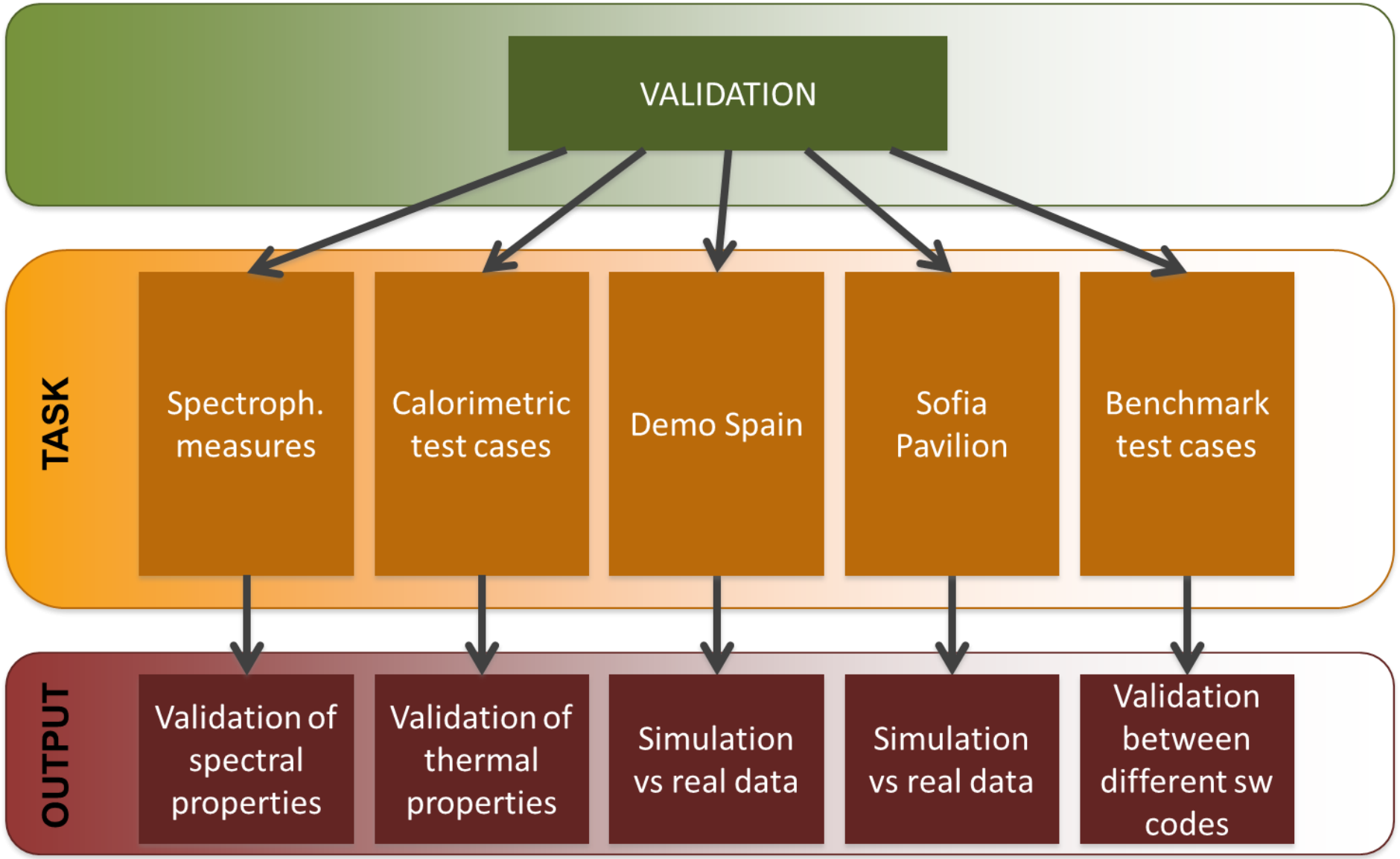
1. Relevant Strategy Choice

   climate zone
   outdoor / indoor boundary conditions

2. Optimization of spectral and thermal properties

   glazing catalogue
   U-value, g-value, spectral properties, color index

VALIDATION


VALIDATION
TASK
Spectroph. measures
Calorimetric test cases
Demo Spain
Sofia Pavilion
Benchmark test cases
OUTPUT
Validation of spectral properties
Validation of thermal properties
Simulation vs real data
Simulation vs real data
Validation between different sw codes

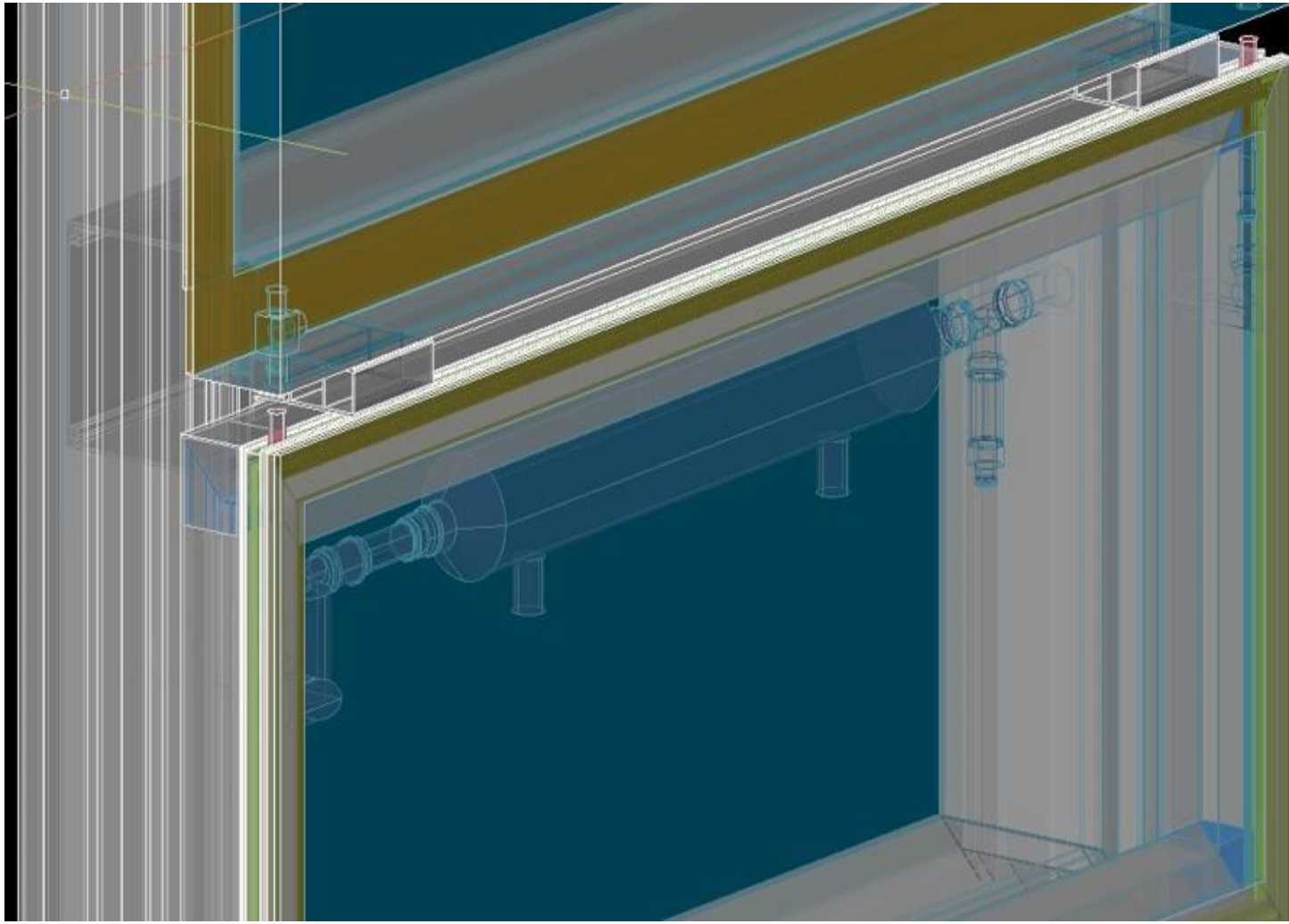
TECHNICAL DESIGN

Façade System Development

Characteristics

- a modular SG façade type scenario, using the frame-in-frame concept, allowing the replacement of the module in case of failure

- hydraulic installation passing through the aluminum profiles (inside the module sections)



TECHNICAL DESIGN

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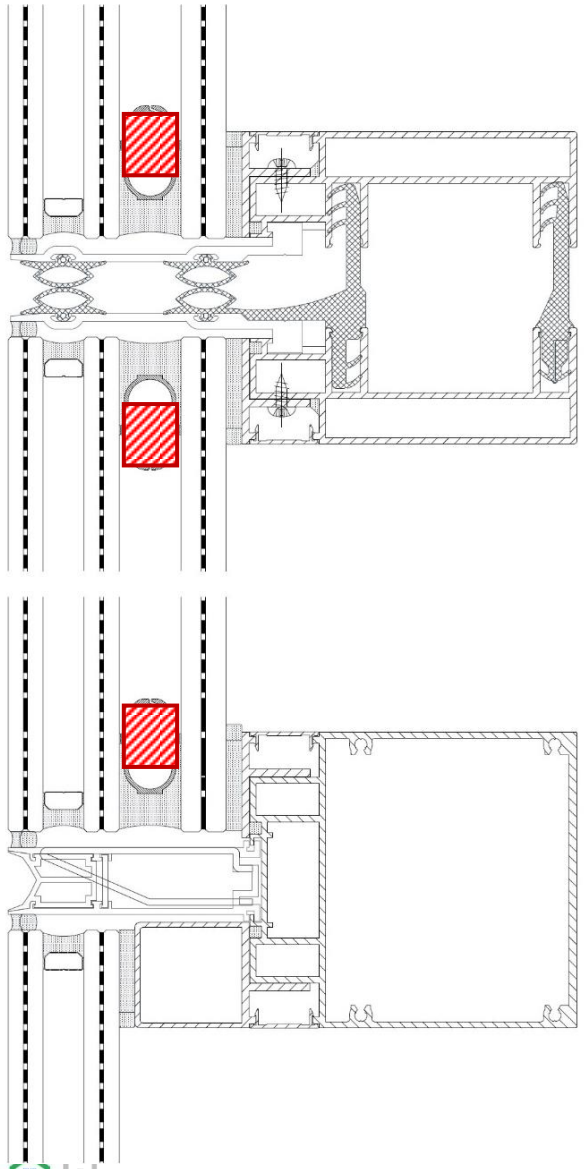

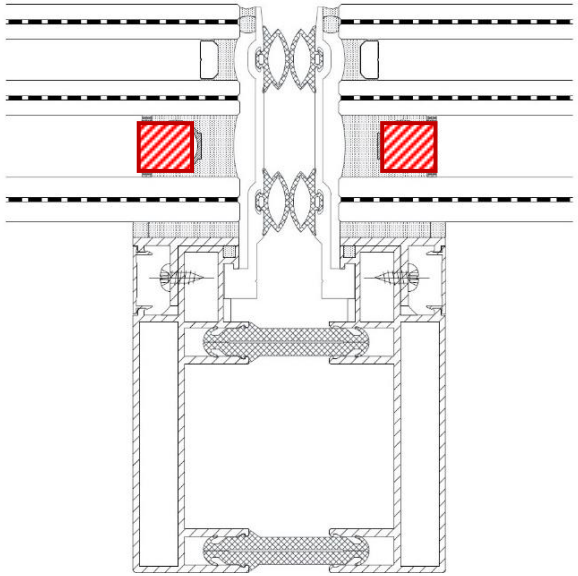

CONSTRUCTION

FULL SCALE WORKING SYSTEM – DEMO PAVILION IN SOFIA

Thank you for your attention!

Serock Poland
14 June 2018