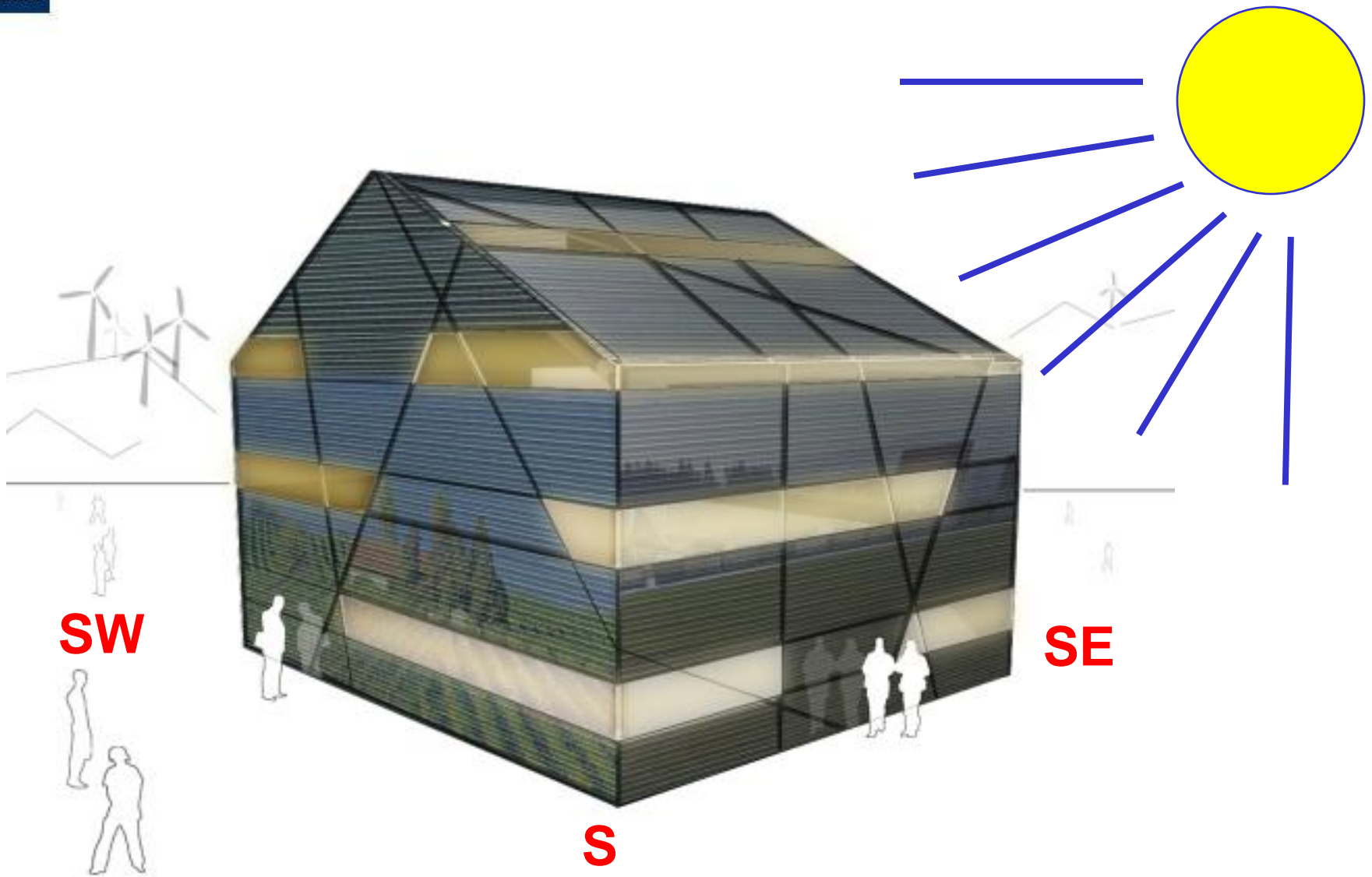




BUILDING INTEGRATION OF SOLAR COLLECTORS

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On Roof Installation



Flat plate collectors – **ON ROOF**



Source:Wagner &Co /ESTIF

On Roof Installation - Piping



Pipe penetration through the roof



Flat plate collectors – **ROOF INTEGRATED**



Flat plate collectors – **ROOF INTEGRATED**



Source: Conergy AG /ESTIF

Flat plate Collectors – Roof Integrated



Source: S.O.L.I.D., Austria

Flat plate Collectors – Roof Integrated



Source: S.O.L.I.D., Austria

Flat plate Collectors – Roof Integrated



Flat plate Collectors – Roof Integrated



Source: Teufel & Schwarz, Austria

Flat plate Collectors – Roof Integrated



Source: Teufel & Schwarz, Austria

Evacuated Tube Collectors – Building Integrated



Evacuated Tube Collectors – Building Integrated



Evacuated Tube Collectors – Building Integrated



Evacuated Tube Collectors – Building Integrated

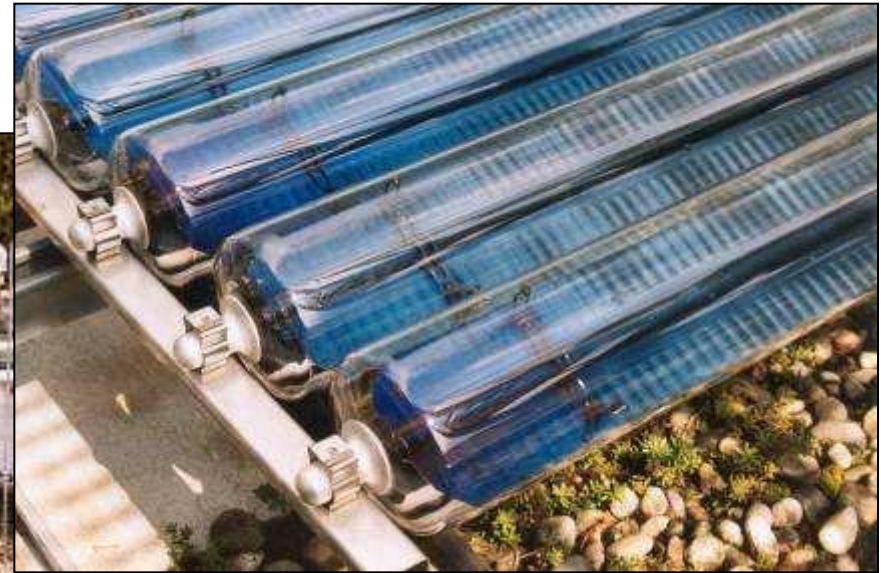


Evacuated Tube Collectors – Building Integrated



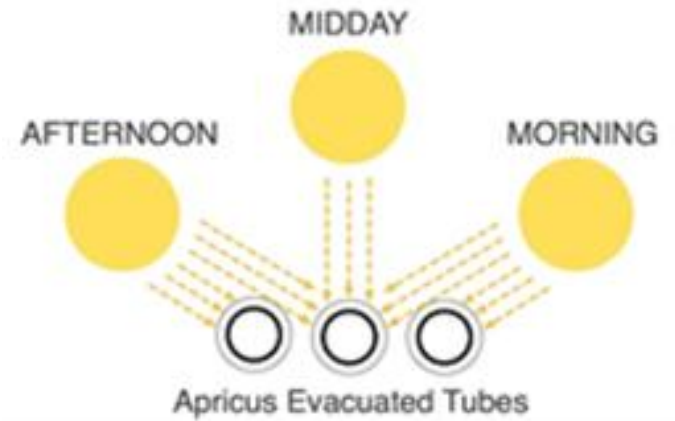
Hinin

Evacuated Tube Collectors on Flat Roofs



Source : Fraunhofer ISE

Evacuated Tube Collectors on Flat Roofs



Flat plate collectors – Installation on a flat roof



Evacuated tube collectors

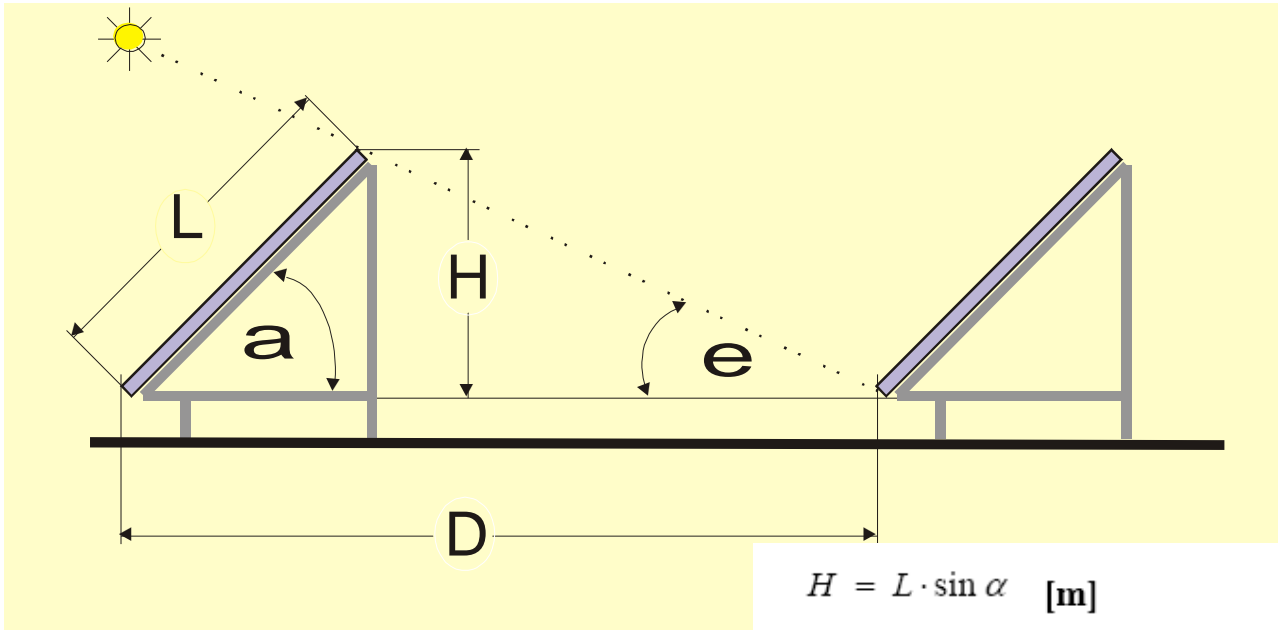


Source: Himin, Jinan College of Transportation

Flat plate collectors – **Installation on a flat roof**



Distance between the collector rows (calc)



$$H = L \cdot \sin \alpha \quad [\text{m}]$$

$$D = \frac{L \cdot \sin[180 - (\alpha + \varepsilon)]}{\sin \varepsilon} \quad [\text{m}]$$

D Distance between the rows of collectors [m]

L Collector length [m]

H Collector height [m]

α (a) Collector inclination [°]

ε (e) Incident solar radiation angle [°]

Building Integration



Source: S.O.L.I.D.

Building Integration



Facade Integration in a Historical Building

Design Study



Pre-manufacturing



Prefabricated Facade Elements for Retrofit



Source: gapsolution

Prefabricated Facade Elements for Retrofit



Facade Integration of Solar Collectors



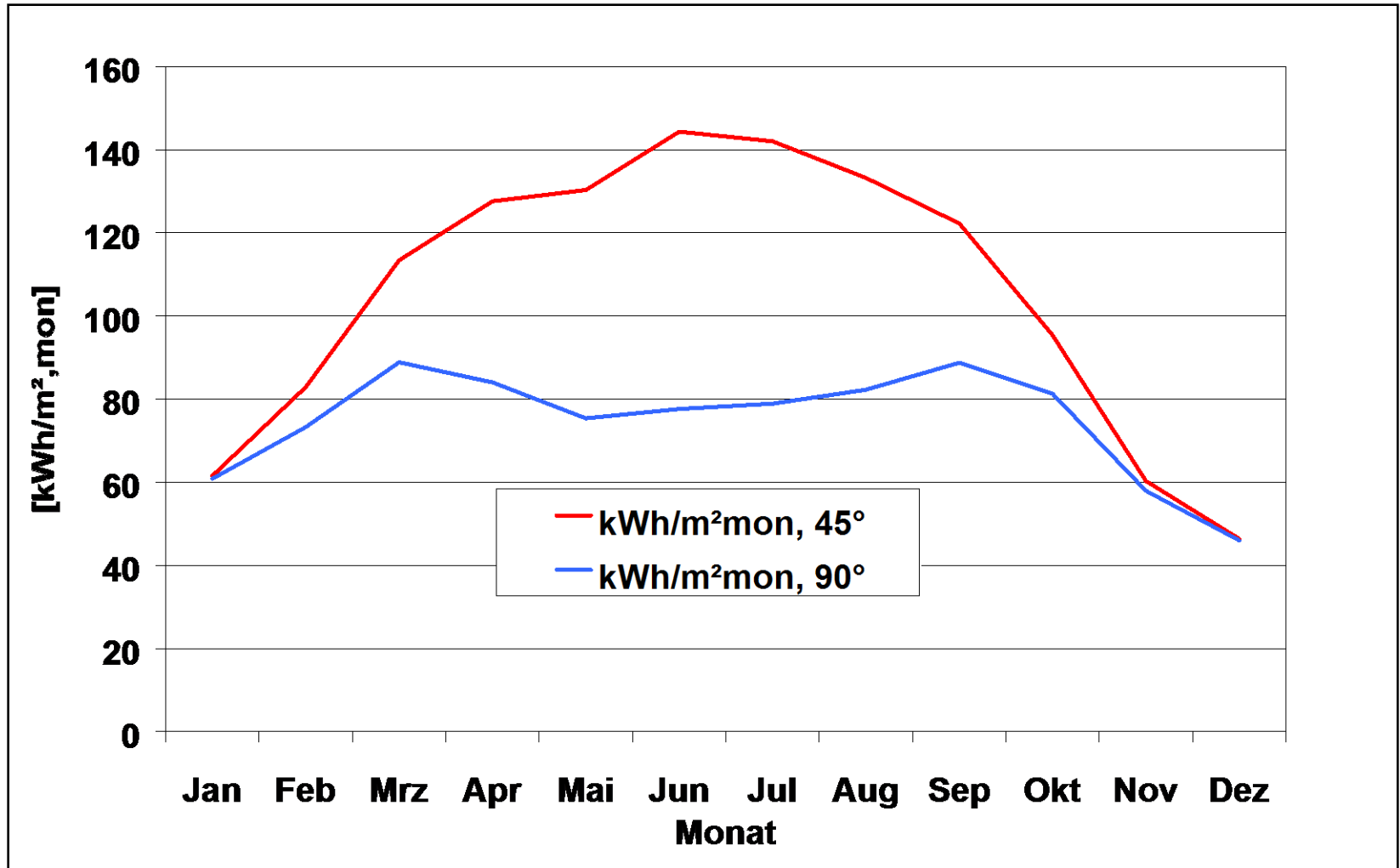
Multy functional façade



Arch. Praschl

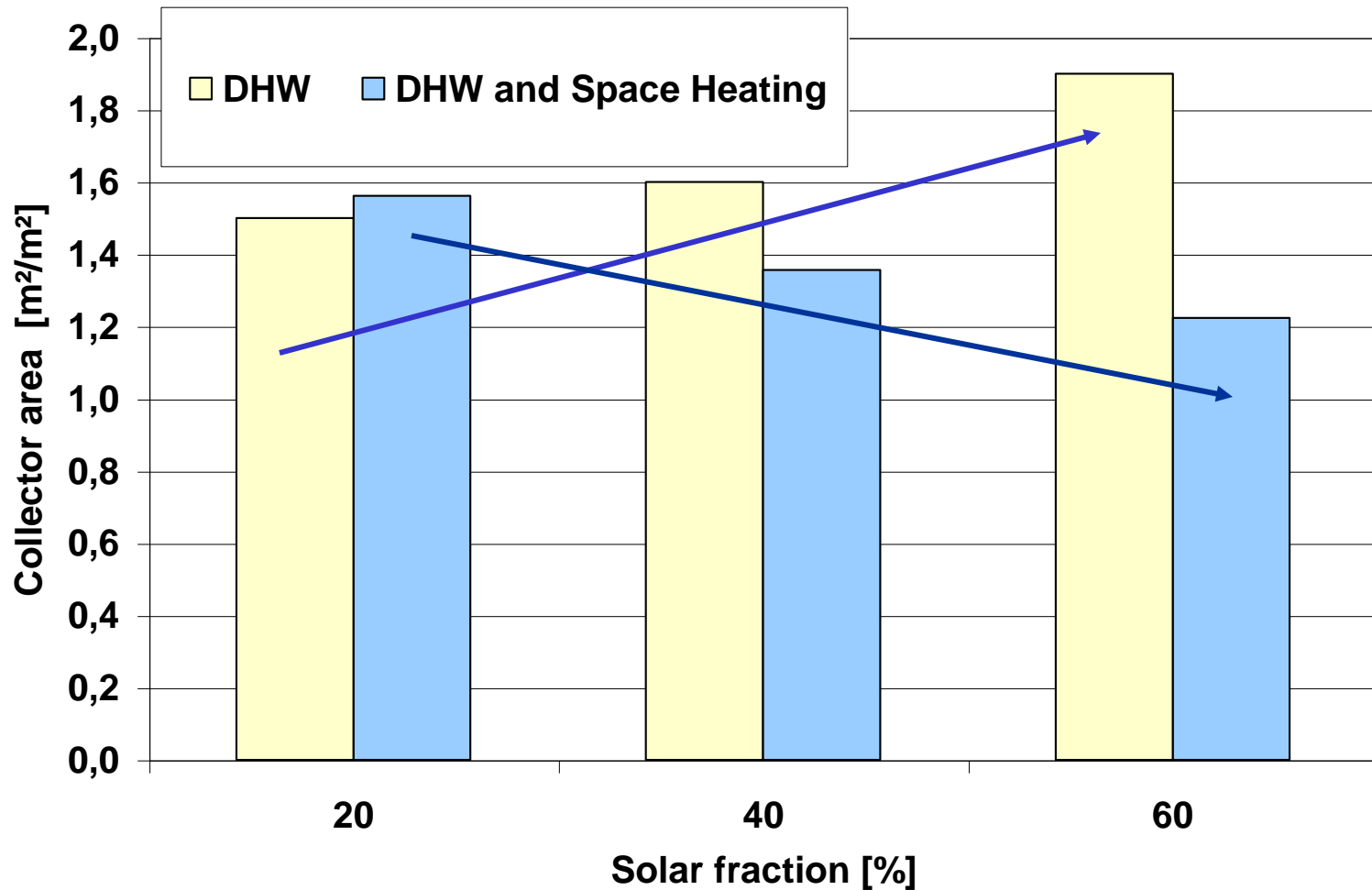
Facade Integration of Solar Collectors





Meteonorm Data, Graz

Necessary Increase of Collector Area compared to Roof Installation (45°)



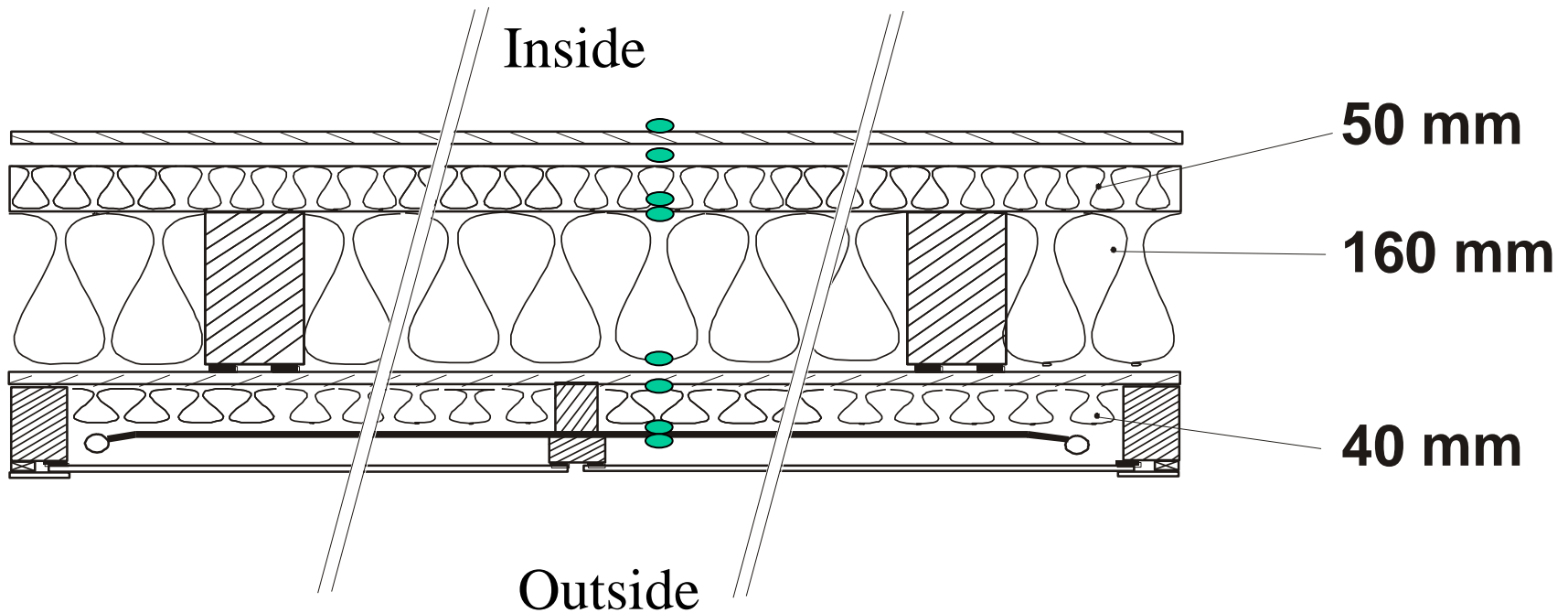
Test Façade 1



Timber construction

55 m² collector area, 3570 l space heating storage tank, 500 l dhw tank

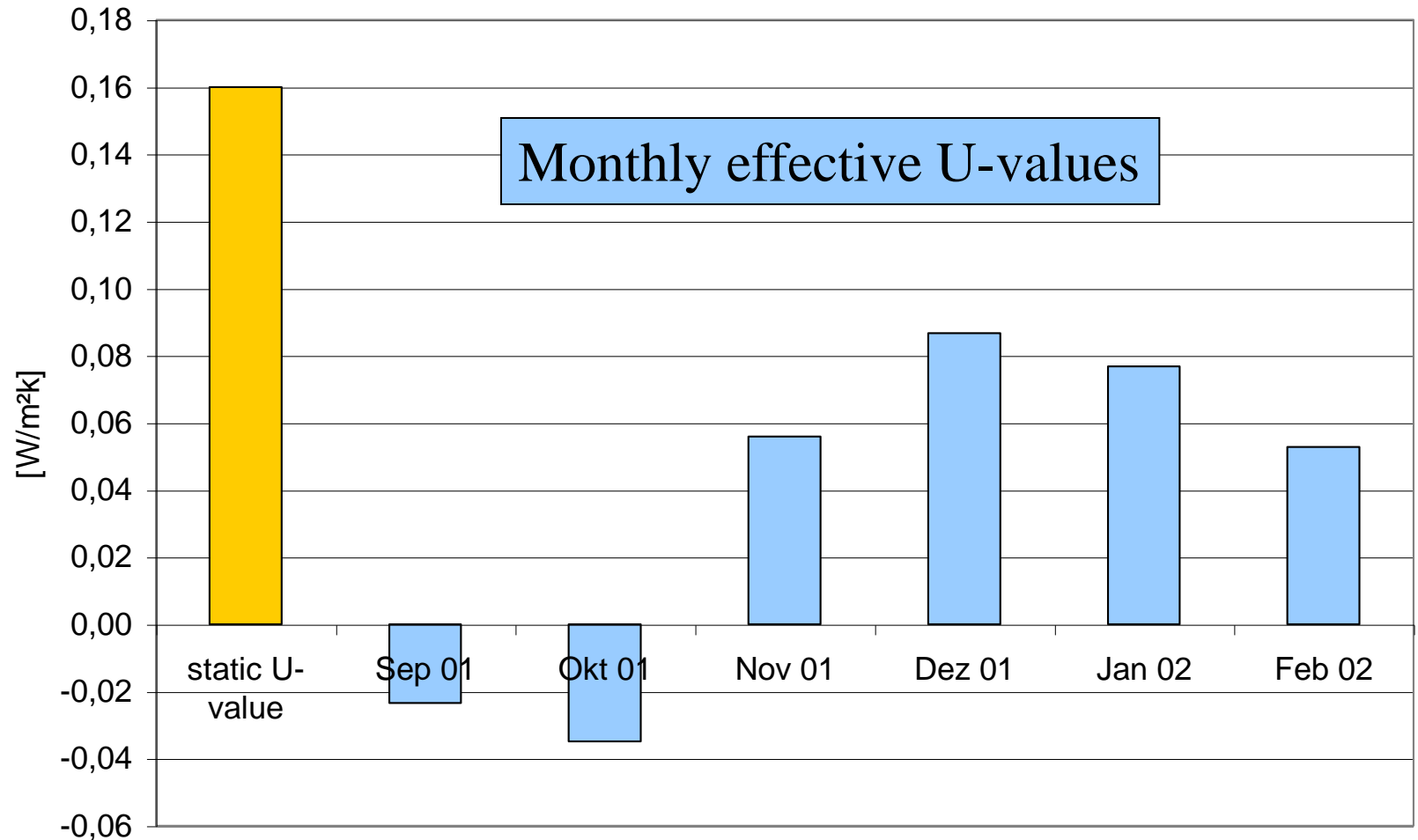
Wall Construction



Vapour barrier: $sd = 0,8 \text{ m}$ (airtight, open for vapour)

● Temperature and humidity sensors

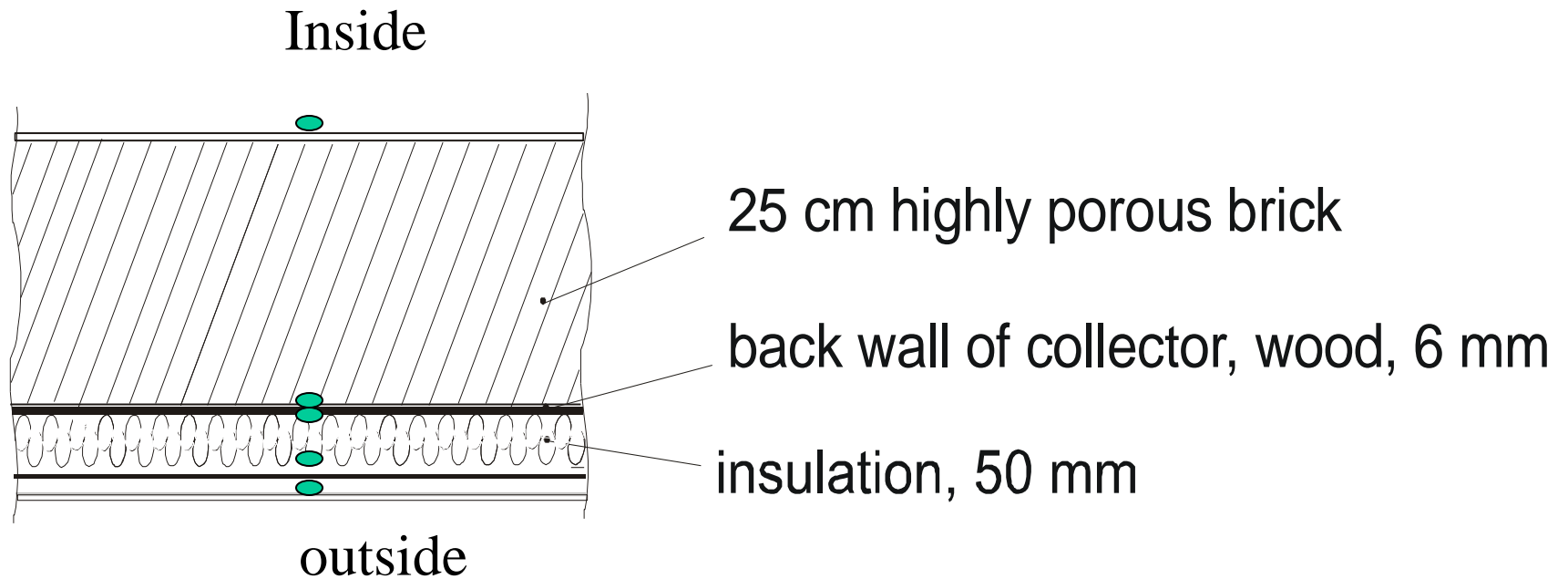
Timber construction: U-value of the wall



Test Façade 2: Massive Wall

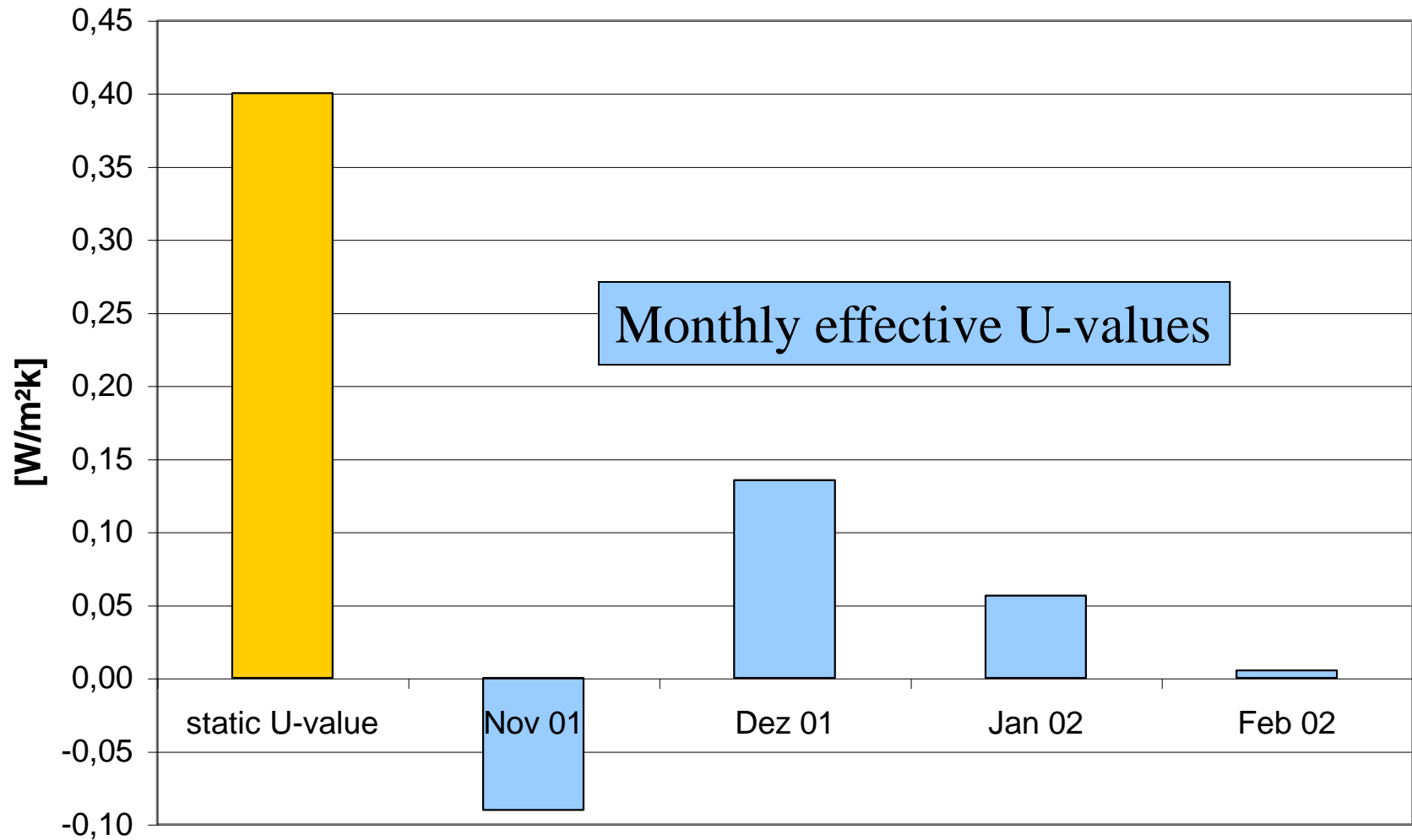


Wall Construction



- Temperature and humidity sensor

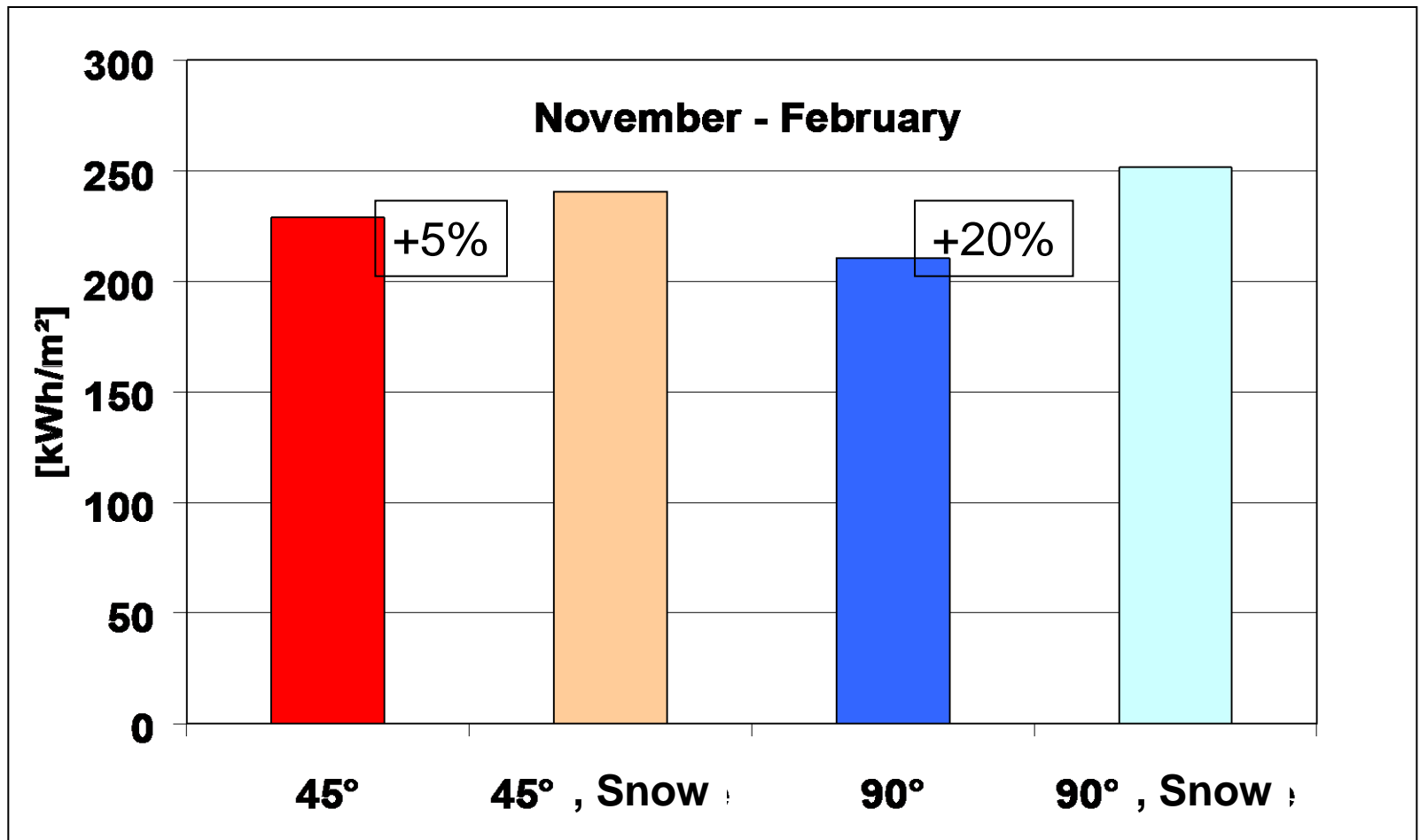
Massive construction: U-value of the wall



Effect of Snow Reflection?



Irradiation, Snow Reflection

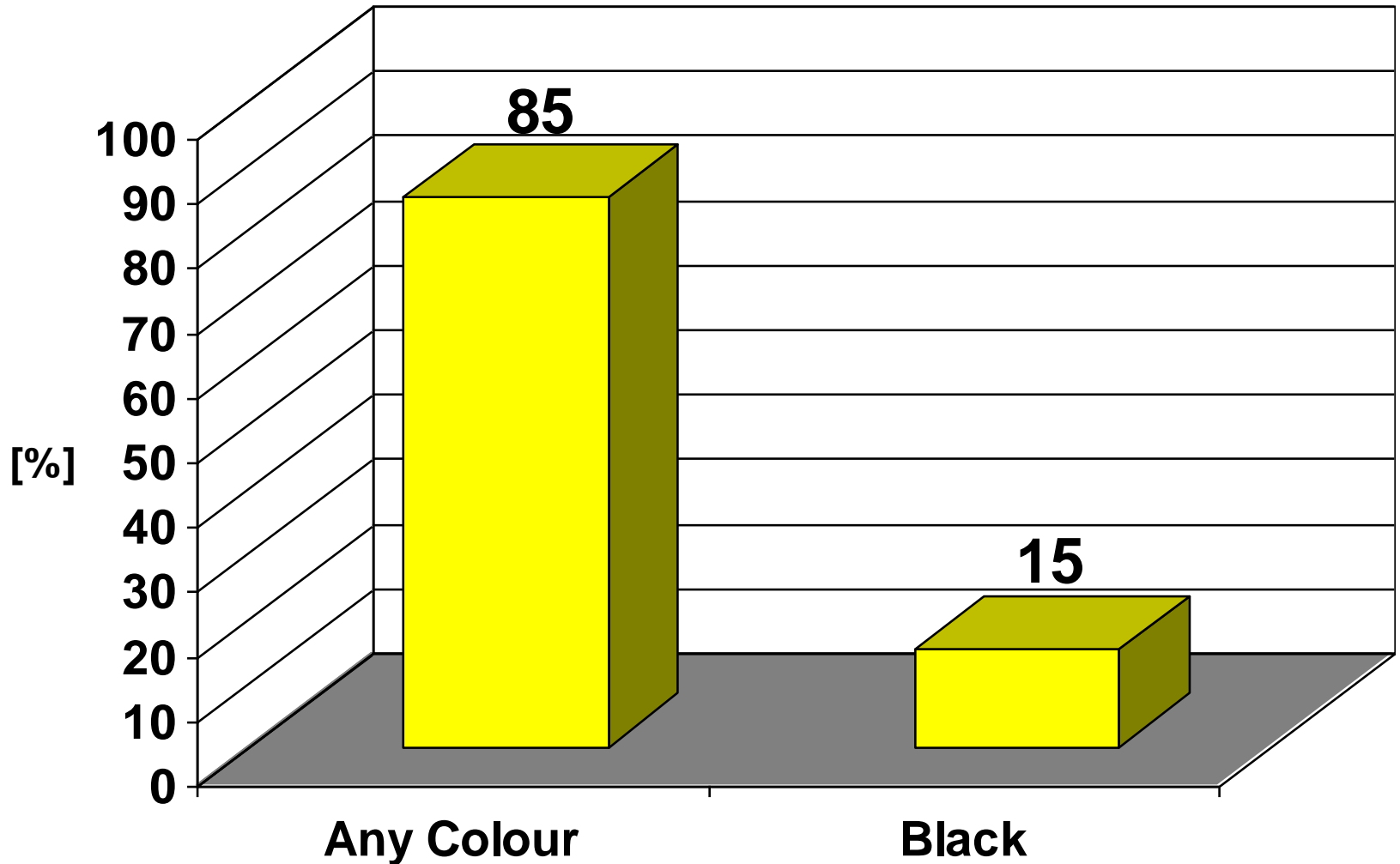


Meteonorm Data, Graz

Colored Absorbers ?



Survey amongst Architects



Colored Absorbers

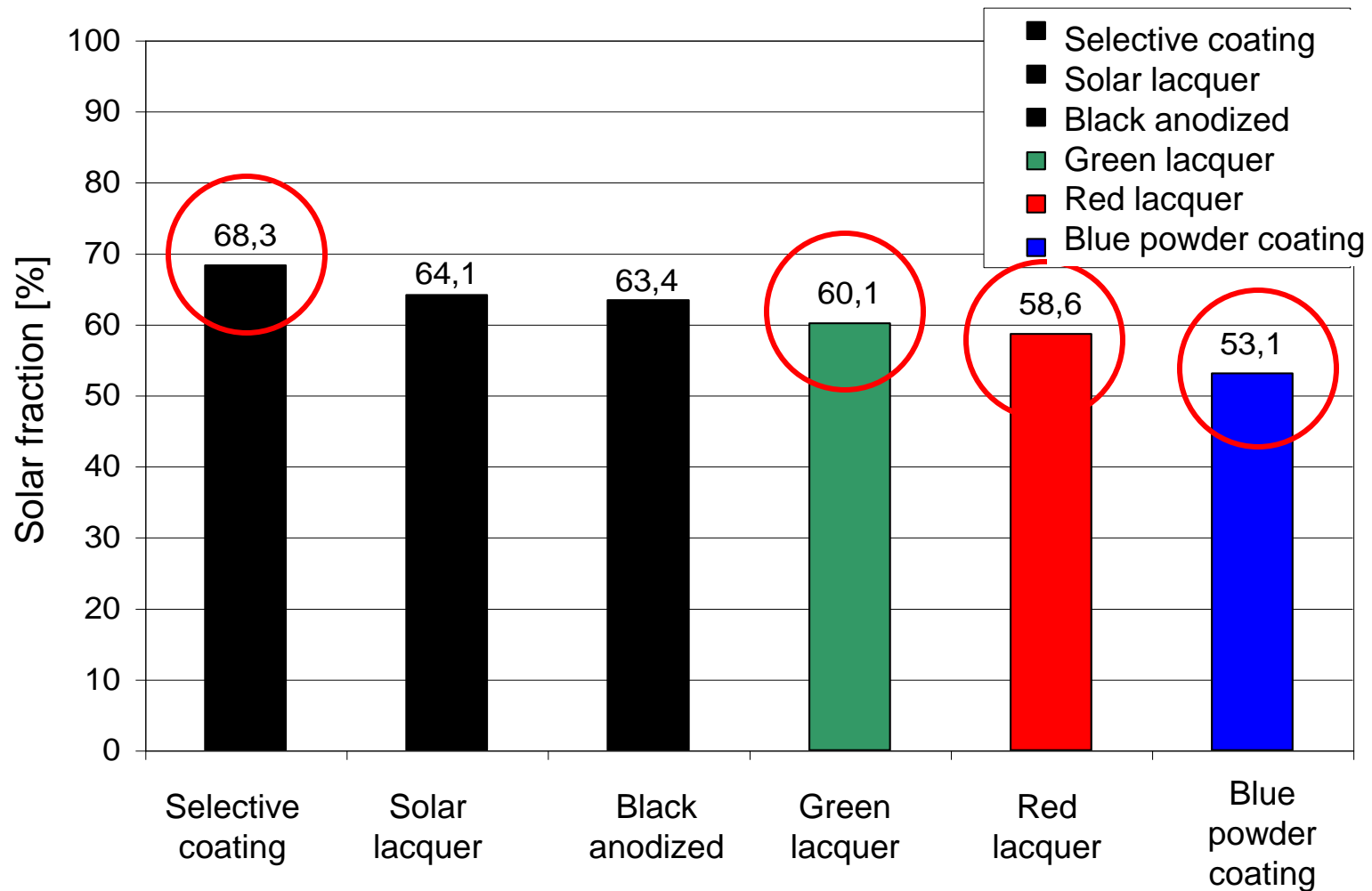


Colored Absorbers

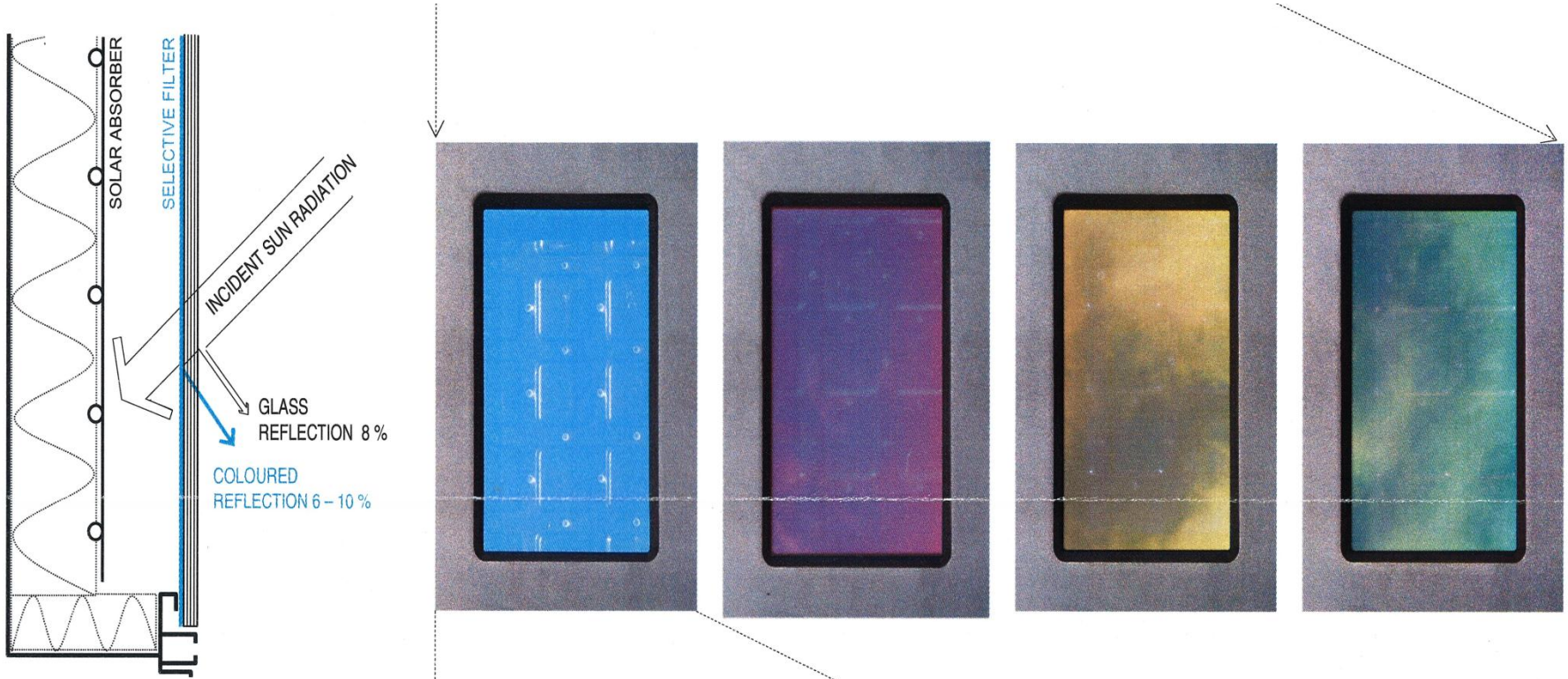


Simulation Results

Colored Absorber, Solar Fraction



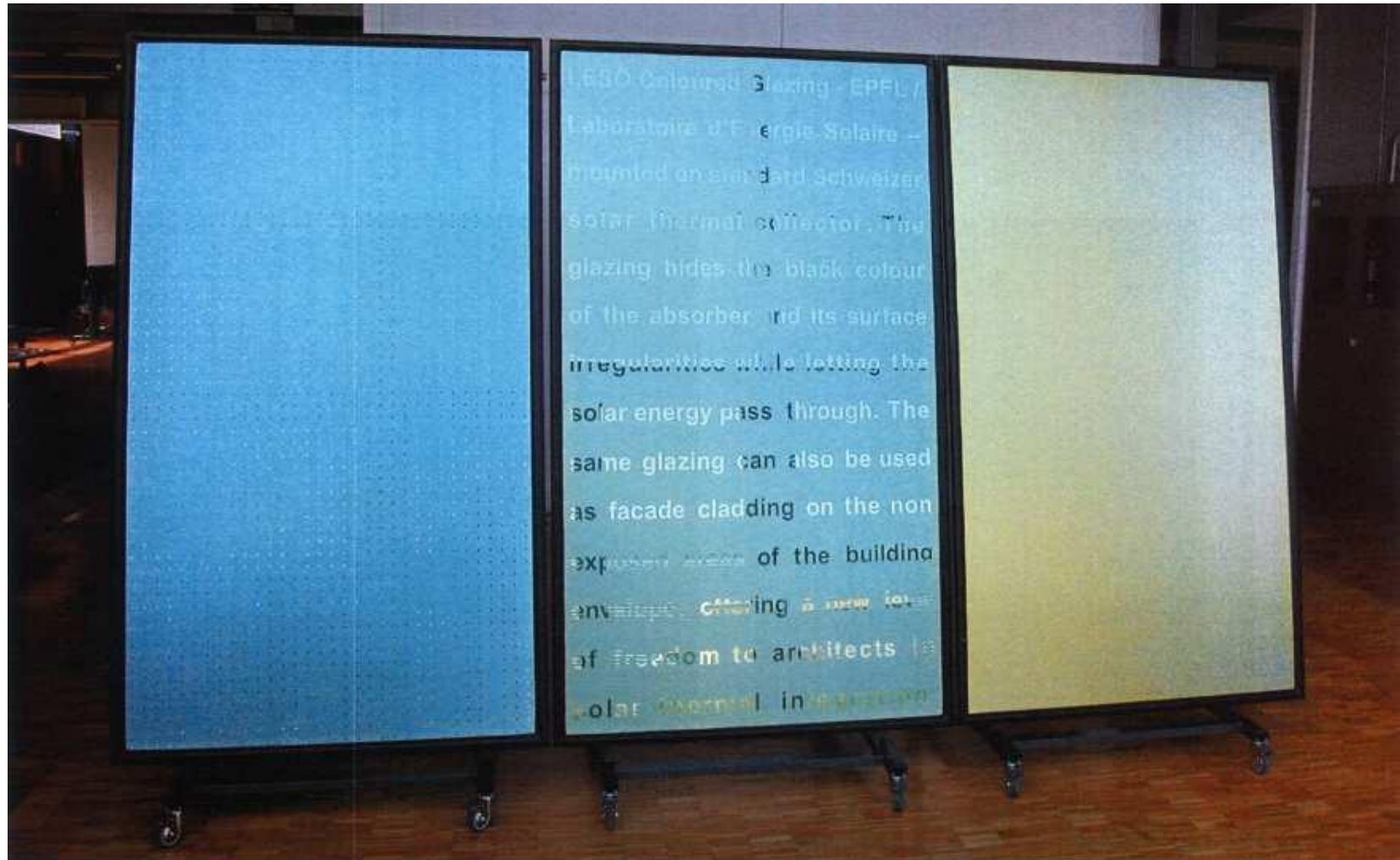
Colored Glass



Standard extra white solar glass with different selective filter colours (inner side) in front of black absorber.

Source: EPFL Laussanne, CH

Colored Glass



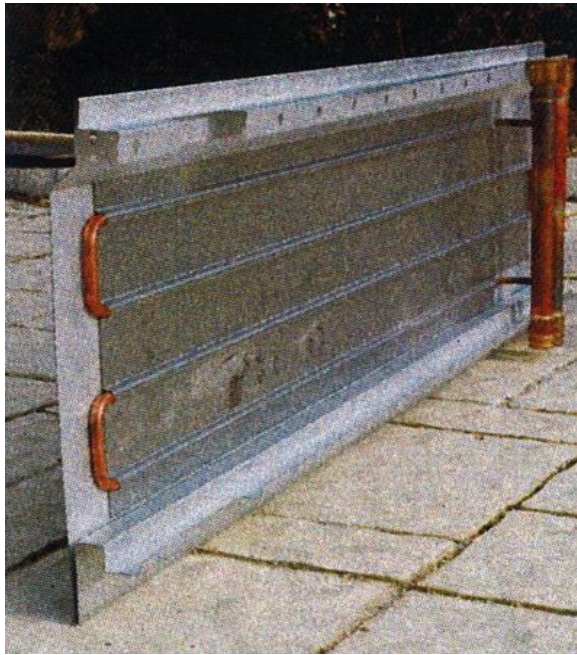
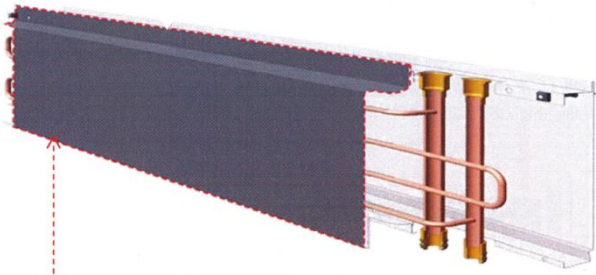
Source: EPFL Lausanne, CH

Colored Glass



Source: Maria C. Munari Probst, EPFL Laussanne, CH

Uncovered Metal Absorber



Source: Maria C. Munari Probst, EPFL Laussanne, CH

Space Heating of Factory Buildings



Source: Solution