A new generation of building envelopes

Functional optimization and architectural integration

Dr.-Ing. Winfried Heusler SCHÜCO-International KG / Germany

A new generation of building envelopes

Functional optimization and architectural integration

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Functional optimization and architectural integration

	Sustainability Issues		
	Environmental	Economic	Social
			
raw materials			
manufacturing			
on site construction			
use and maintenance			
renovation			
demolition			
recycling			

… through the building`s life cycle

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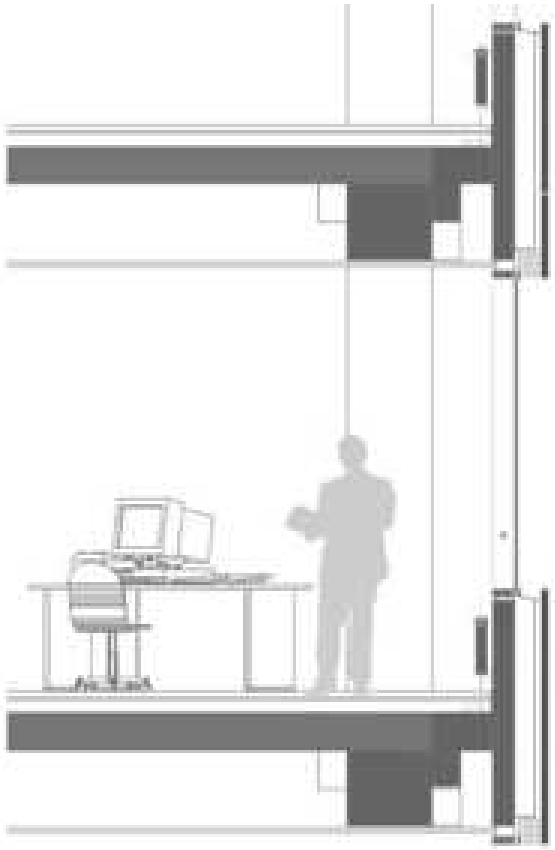
A new generation of building envelopes

Functional optimization and architectural integration

Energy-efficient and sustainable Buildings

Functional Optimization



- heating

- cooling

- ventilation

- lighting

… minimising of energy consumption

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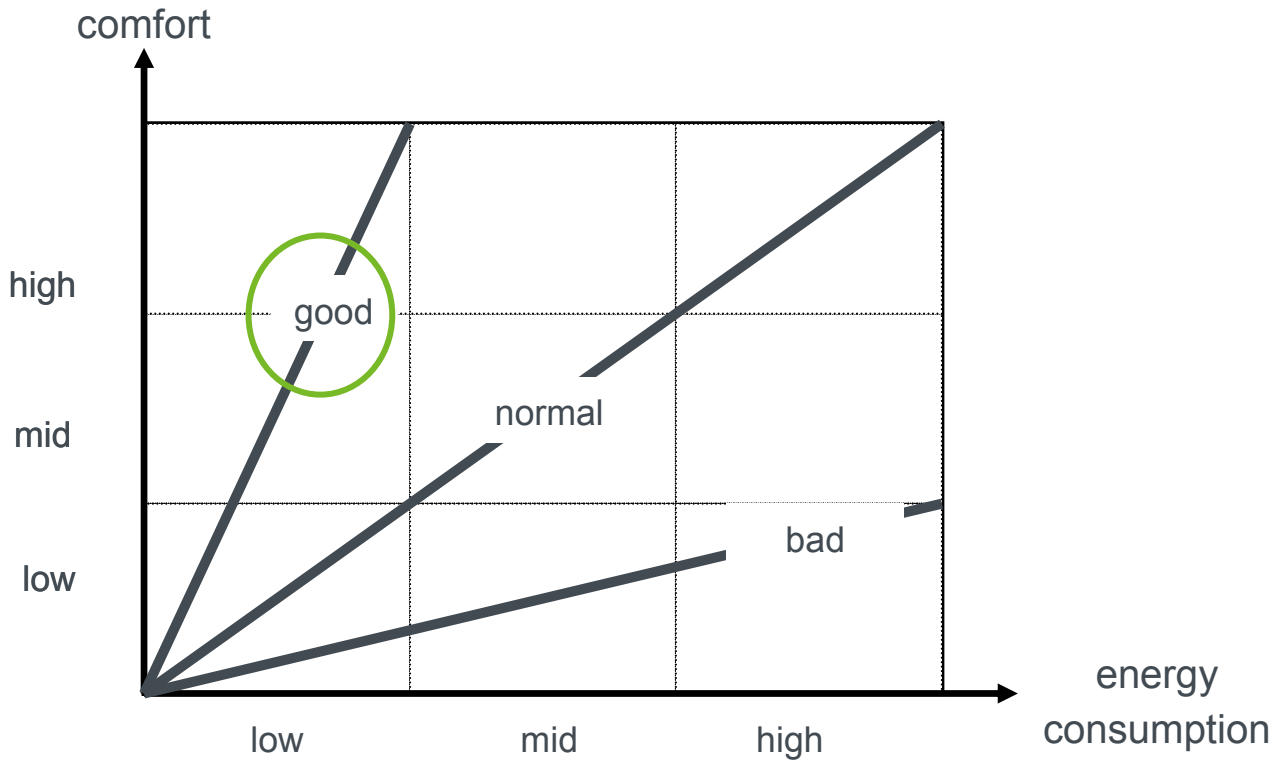
Energy-efficient Buildings

Goal: improving the energy/comfort ratio



… maximizing energy-efficiency

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Energy-efficient and sustainable Buildings

Improving the planning process and concept development

General requirements:

- building type
- user requirements
- budget limits
- site / climate
- regulations / standards

Holistic design approach

- building structure
- interior: fitting out
- mechanical services: HVAC
- building envelope

… maximizing energy-efficiency and sustainability

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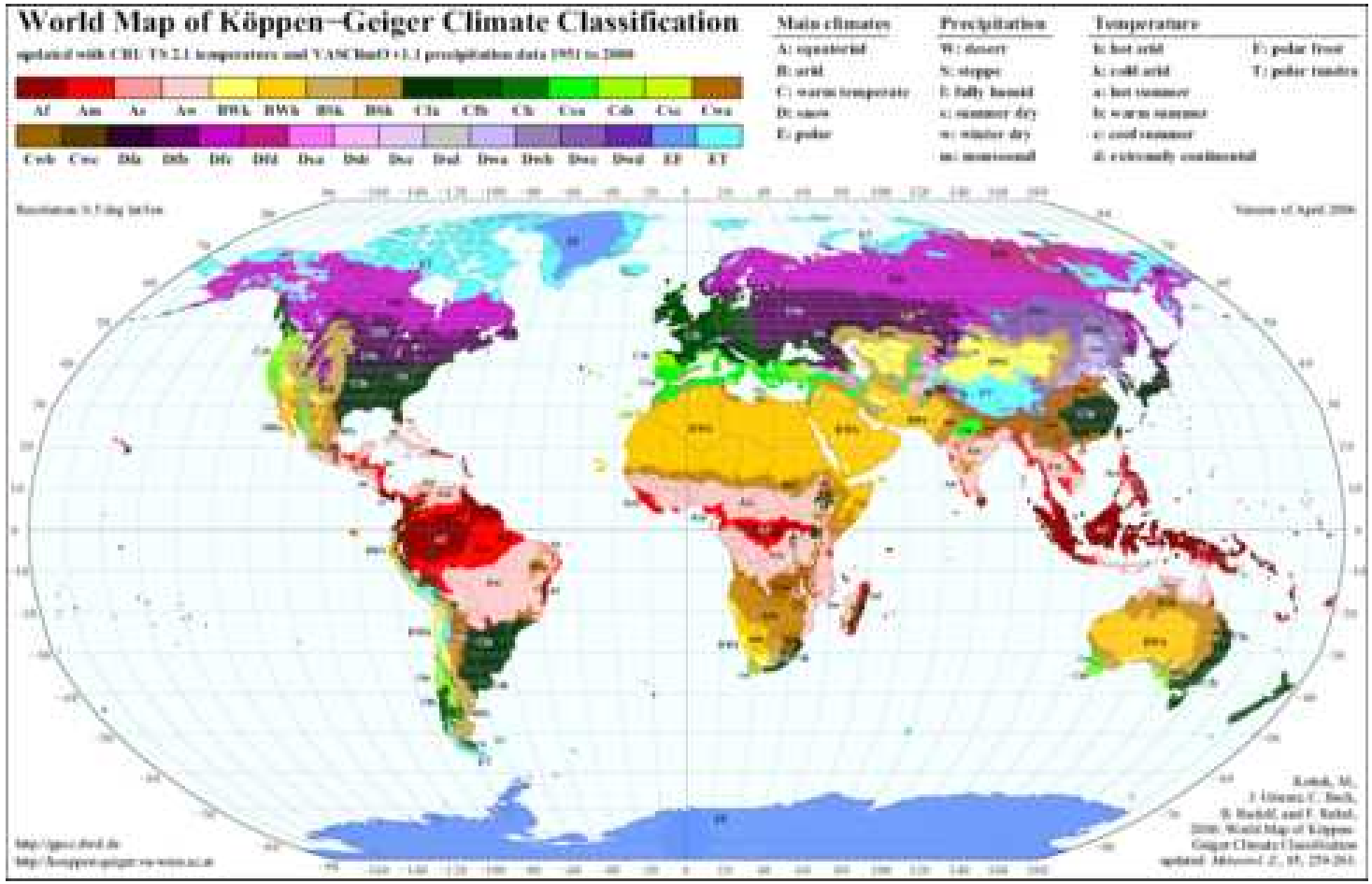
Energy-efficient and sustainable Buildings

Influence of macro climate



… local climate does not suit every building concept !

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Energy-efficient and sustainable Buildings

Functional Optimization (micro climate)

... not every location suits the use of natural ventilation

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Energy-efficient and sustainable Buildings

Functional Optimization (micro climate)

... not every location suits the use of daylight and solar energy

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Energy-efficient and sustainable Buildings

Functional Optimization (user-requirements)

... not every building-type (residential, non-residential, museum, school, laboratory...) suits the use of natural ventilation & daylight

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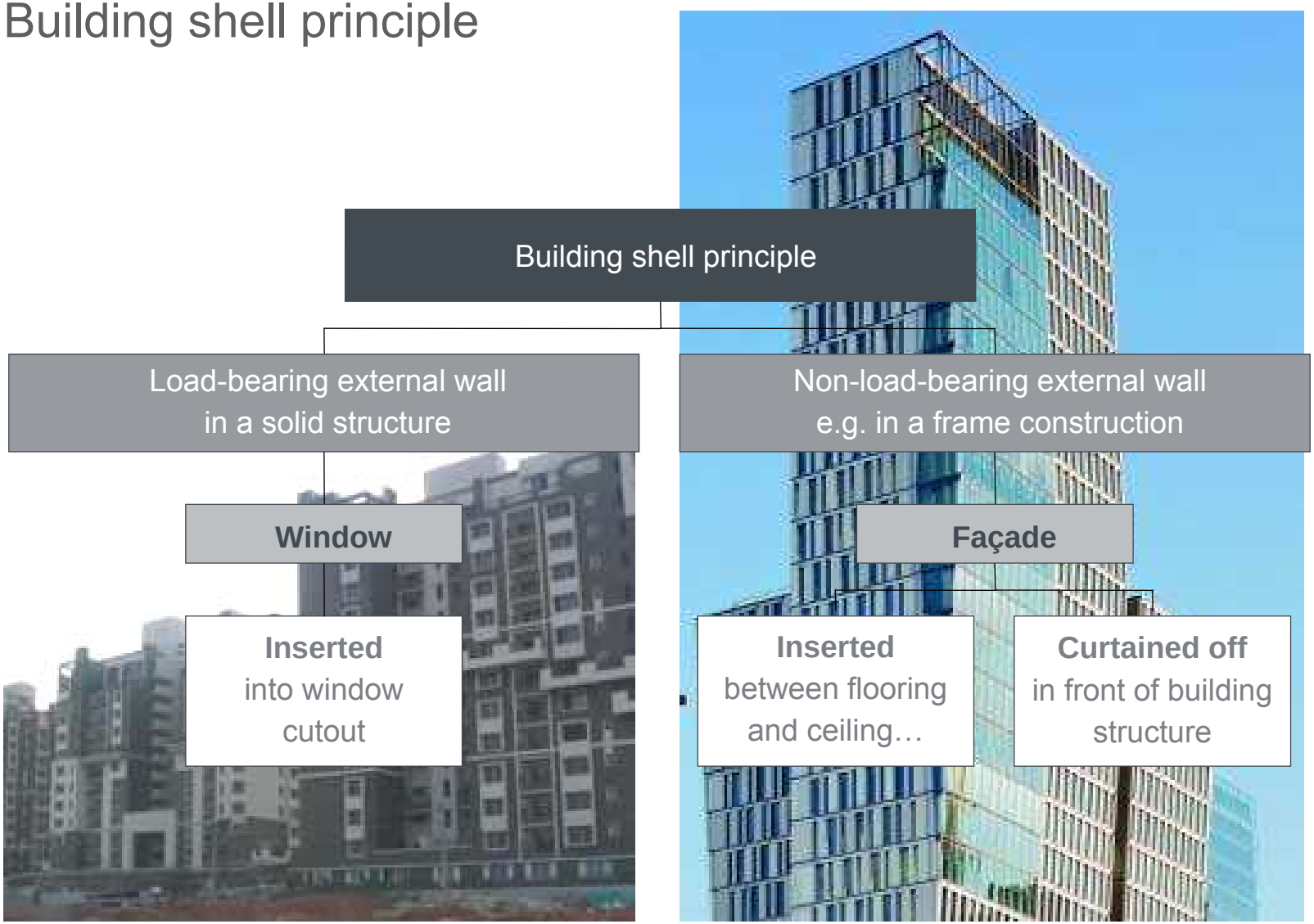
Functional Optimization of Building Envelopes

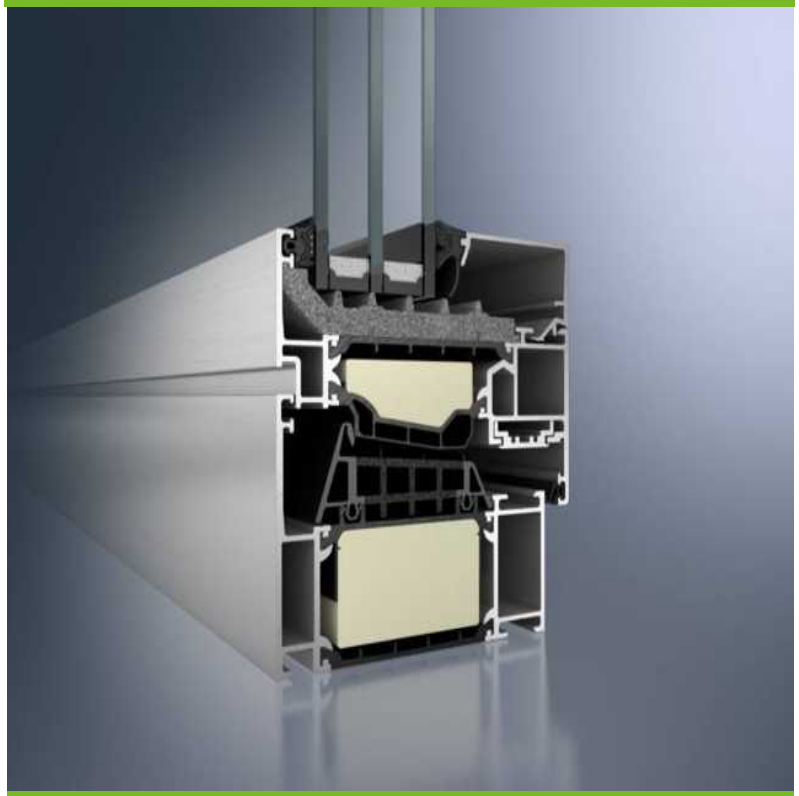
Building shell principle



Functional Optimization of Building Envelopes

New thermal standard for windows

AWS 90.SI+



U_f = 1,0 W/(m²K)

AWS 112.IC

U_f = 0,8 W/(m²K)

….reduction of energy consumption

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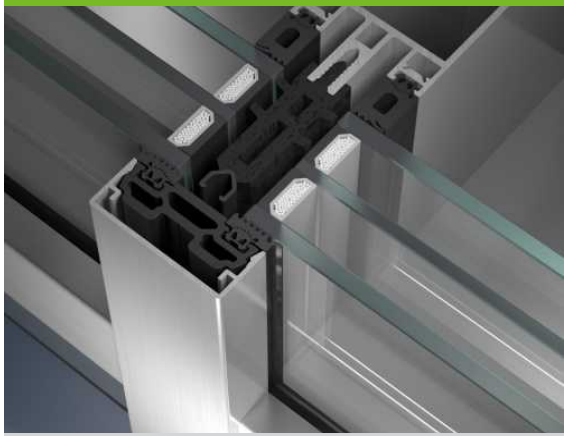
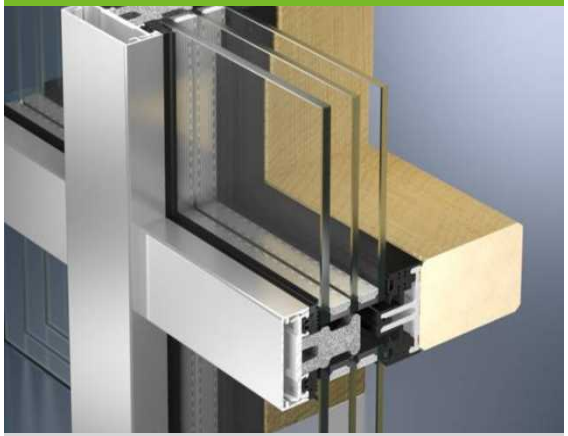
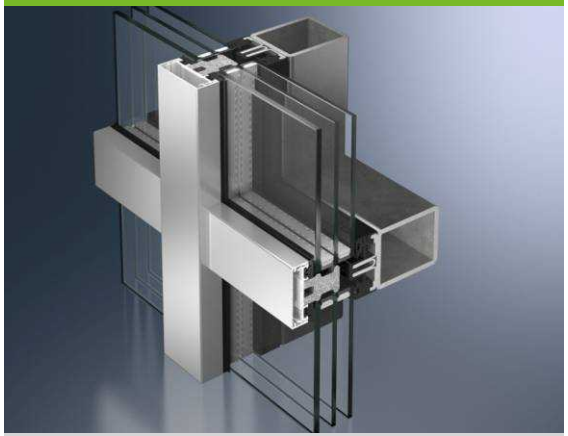
Functional Optimization of Building Envelopes

New thermal standard for façades

FW 50⁺.SI FW 60⁺.SI	AOC 50 TI.SI AOC 60 TI.SI	AOC 50 ST.SI AOC 60 ST.SI
		
Mullion / transom façade	Timber add-on constr.	Steel add-on construction

Uf ≤ 0.8 W/m²K (including the screw factor) and Ucw ≤ 0.8 W/m²K

Maximum glass load and patented screw guide,
particularly for the area of application with triple glazing

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Functional Optimization of Building Envelopes

Thermal insulation and sun shading (multifunctional)

….reduction of cooling load

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Functional Optimization of Building Envelopes

Example using fixed solar shading

Dienst Uitvoering Onderwijs en Belastingdienst
Nl-Groningen (2011)
Design: UNStudio / Amsterdam

… react to daily and seasonal weather conditions …

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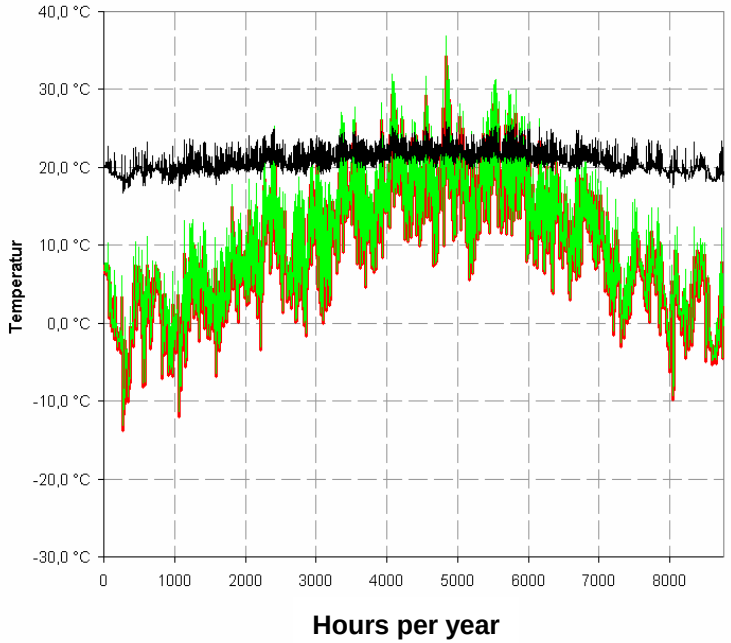
Functional Optimization of Building Envelopes



… local conditions are changing …

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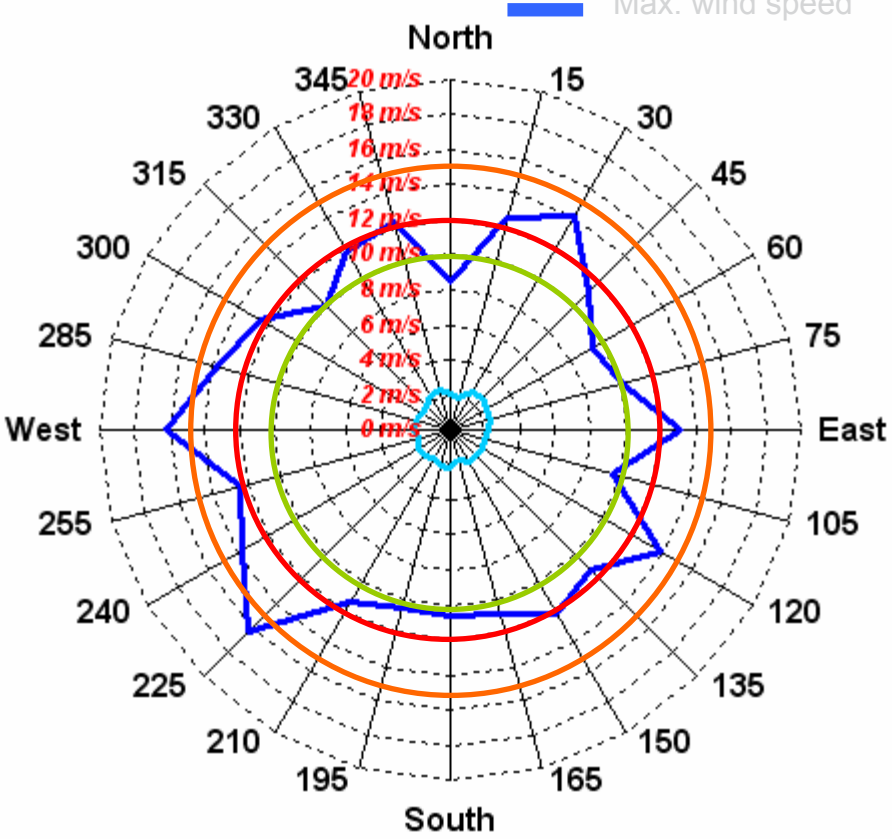
Functional Optimization of Building Envelopes

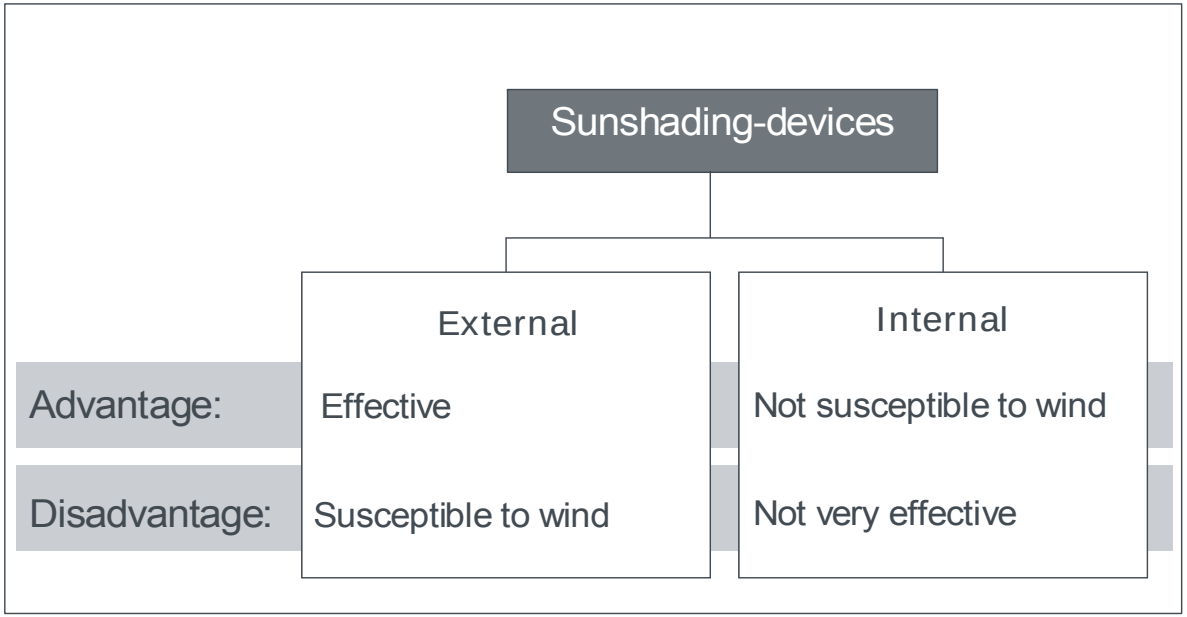
Example using movable blinds

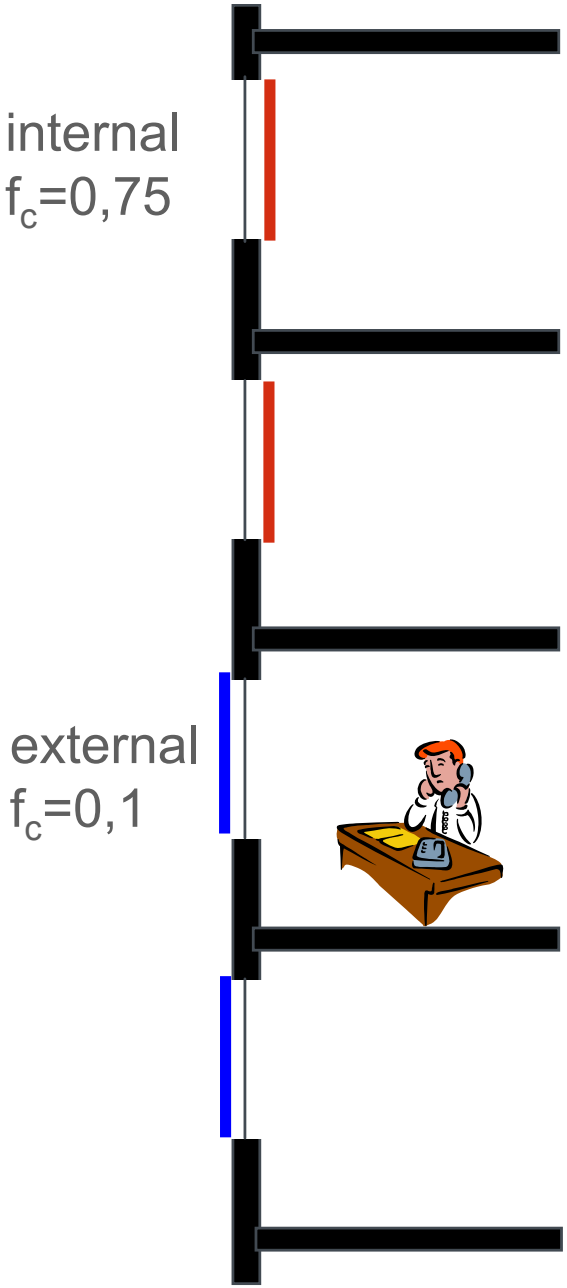


- Limit of z-formed SCHÜCO blinds (15 m/s)
- Limit of rounded-edge SCHÜCO blinds (12 m/s)
- Limit of flat SCHÜCO blinds (10 m/s)

Sun-shading-devices

Movable blinds





Sun-shading-devices

Movable blinds

Functional Optimization of Building Envelopes

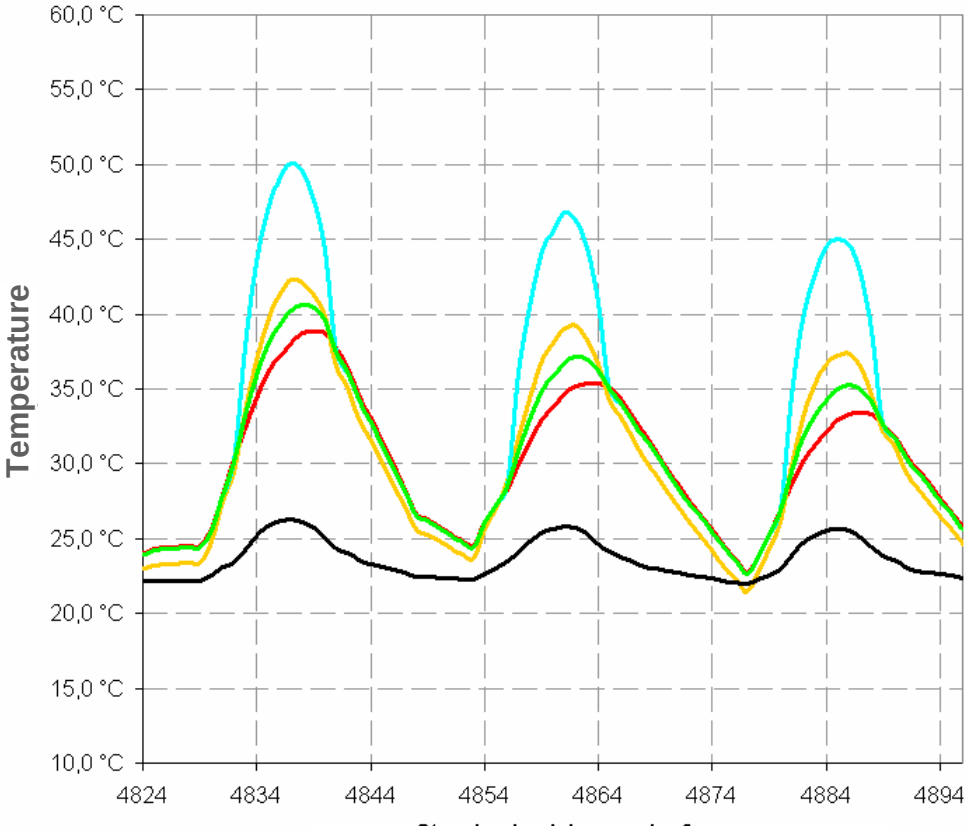
Double-skin-facades with movable blinds

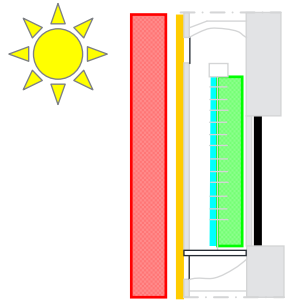
Double-skin façades are characterized by a second glazing either in front or behind the actual building façade.

The cavity accomodates the sun shading system (protected against wind and dust).

Calculations for double-skin façade

Temperature flow in south façade, typical day in summer





- Outside temperature
- Surface temperature of outer glazing
- Surface temperature of sunshading blinds
- Average air temperature behind sunshading blinds
- Surface temperature of inner glazing

Functional Optimization of Building Envelopes

Advanced concept: hybrid type

single-skin area (with fixed louvres)

- ventilation

double-skin area (movable sun-shading)

- daylight (overcast sky)
- visual connection

… the respective benefits come into play as and when required

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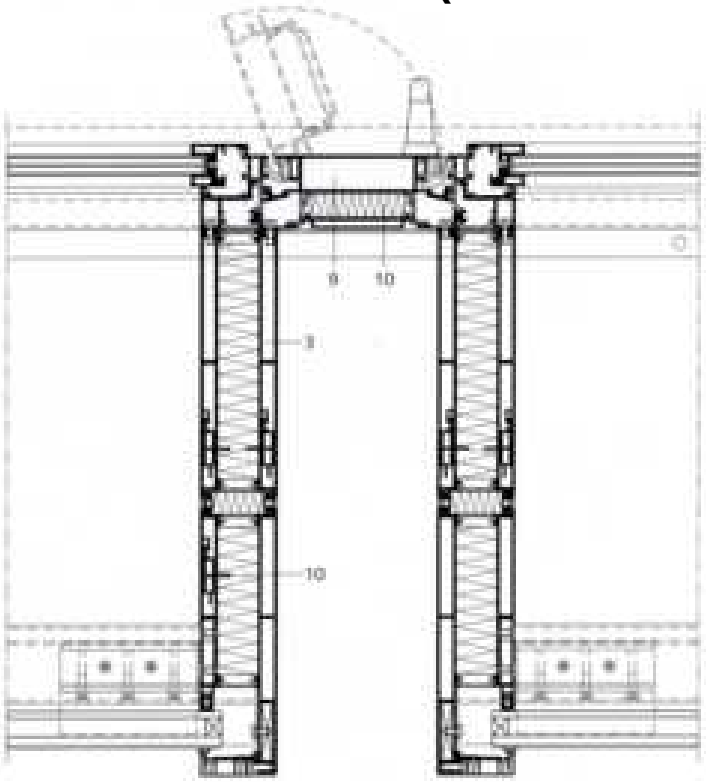
Hybrid façade

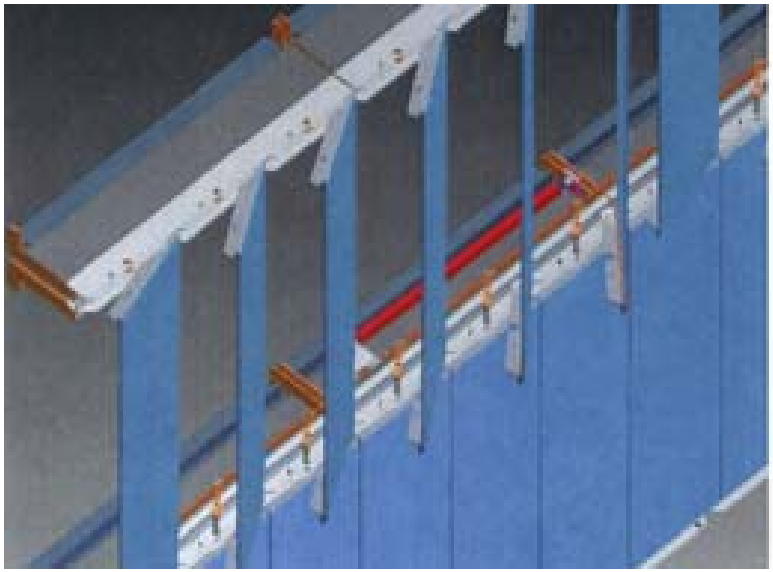
Reference projects

Dutch Embassy / Berlin
Arch. Rem Koolhaas (Rotterdam / Nl)



Functional Optimization of Building Envelopes

Temporary double-skin-facade



… made from movable glass louvres (semi-transparent)

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Sun-shading-devices

Movable blinds

… SCHÜCO E²-Façade (CTB-Solar-Shading) …

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Sun-shading-devices

Movable blinds CTB

Brillux Offices
D-Münster (2010)
Design: Vervoorts & Schindler Architects / Bochum

Active use of natural resources

Windows and façade modules ProSol TF

… on our way to Mike Davies` polyvalent wall

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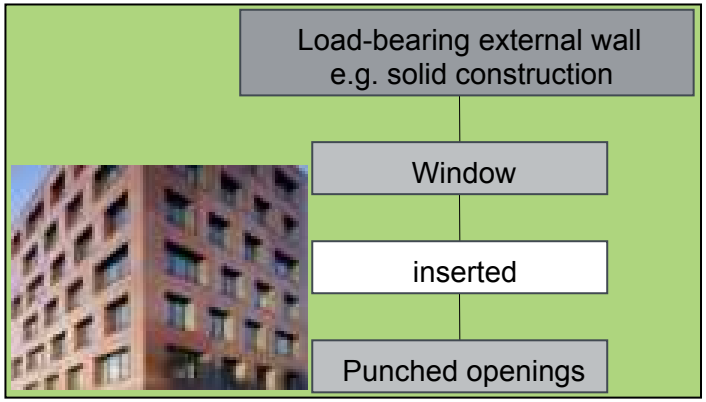
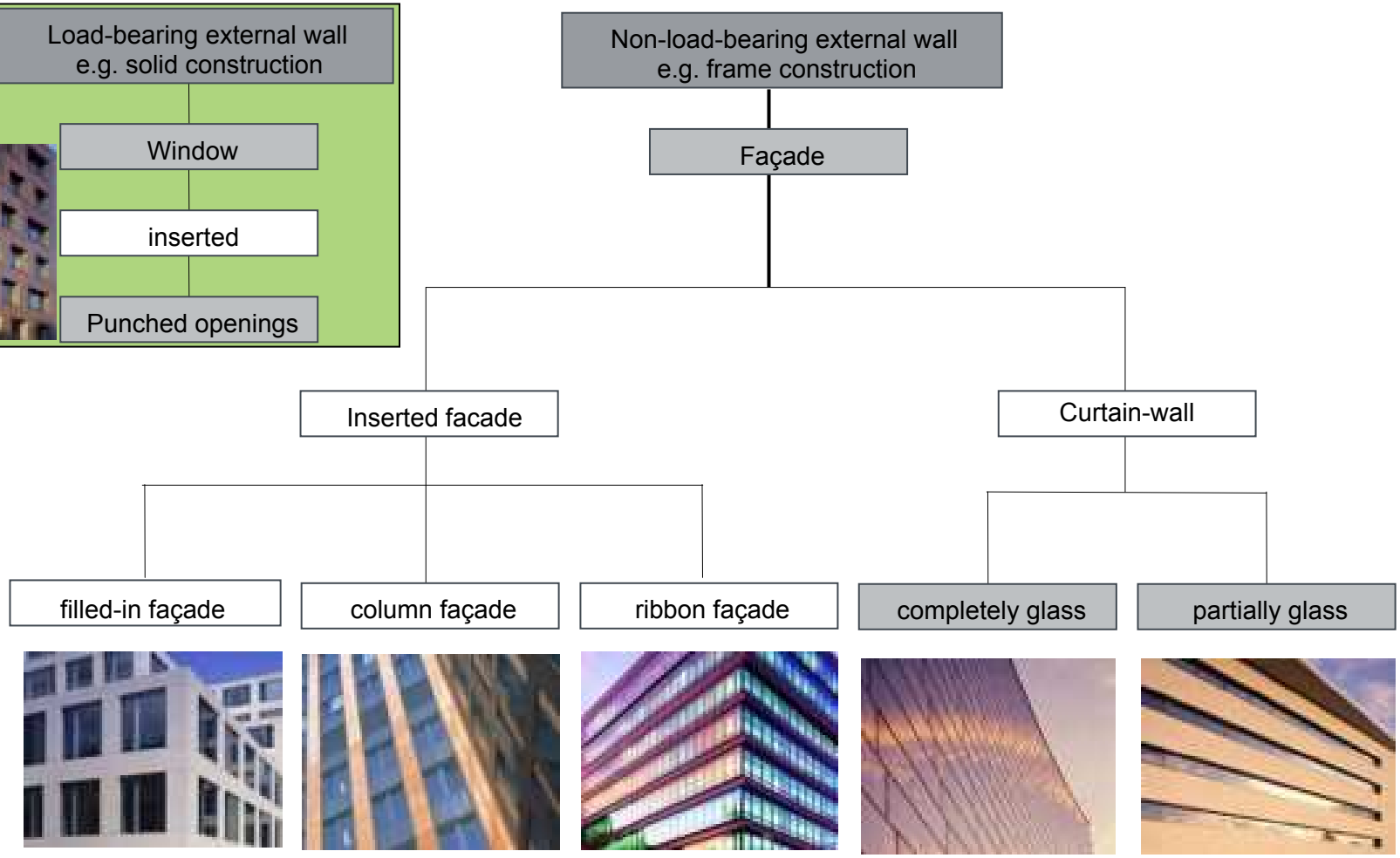
A new generation of building envelopes

Functional optimization and architectural integration

Architectural integration of components

Structural and installation principles





… appearance nearly independent of structural and installation principles

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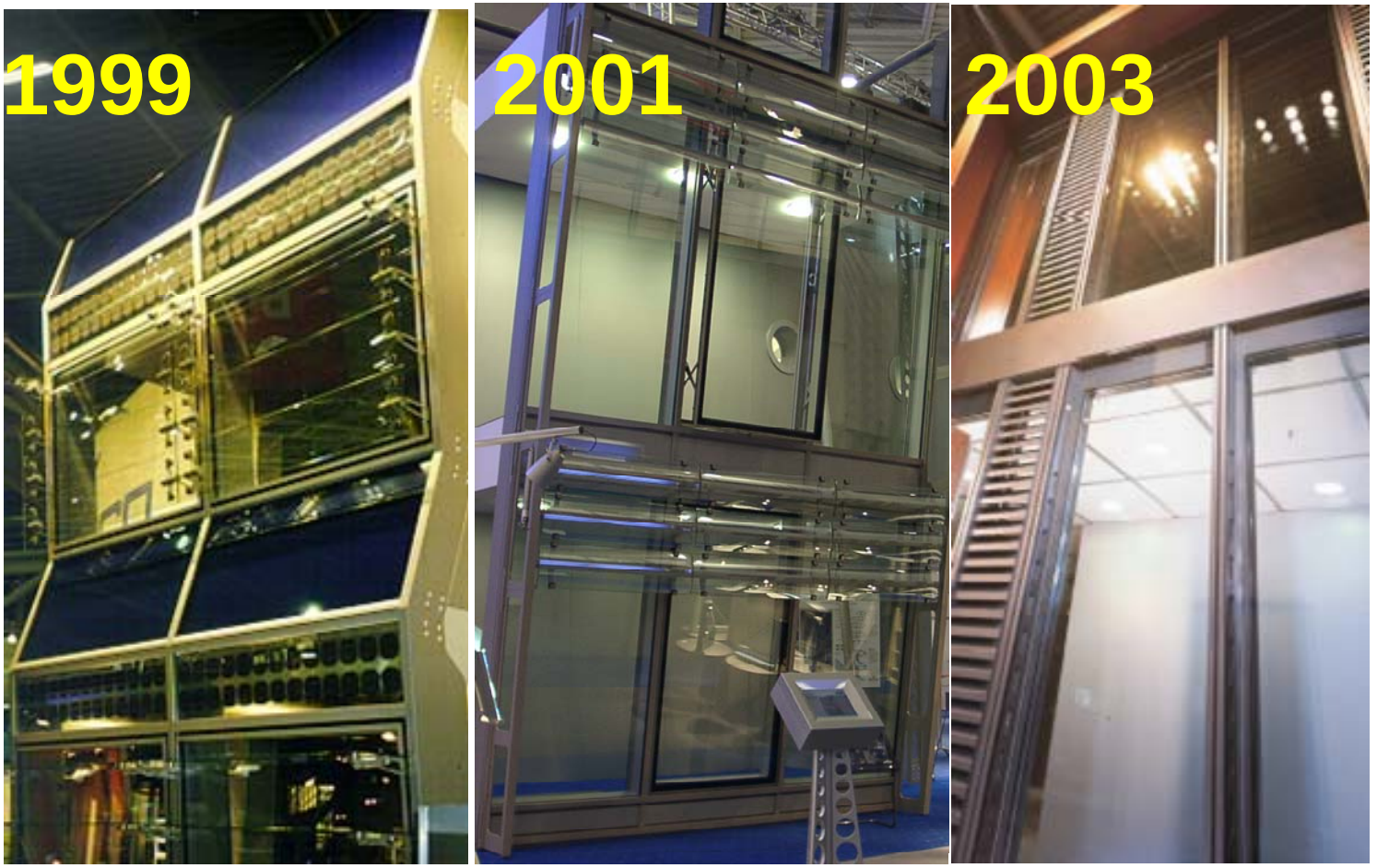
Architectural integration of components

Advanced concepts



1999 – 2003: SCHÜCO`s Concept-Facades

Architectural integration of components

Advanced concepts

2005: SCHÜCO`s Hybrid-Facade

Architectural integration of components

Advanced concepts

2007: SCHÜCO`s E^2-Facade

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Architectural integration of components

Advanced concepts

2009: SCHÜCO`s 2^{O}-Concept

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Architectural integration of components

Façade design

Science Center Medizintechnik Otto Bock
Grädinger Architekten / Berlin
D-Berlin (2009)

… material, colour, proportions, transparency, value and style

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Architectural integration of components

Façade design (interior)

… material, colour, proportions, transparency, value and style

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Architectural integration of components

Façade design (interior)

… material, colour, proportions, transparency, value and style

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Architectural integration of components

Façade design (interior)

… material, colour, proportions, transparency, value and style

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Architectural integration of components

Façade design (interior)

… material, colour, proportions, transparency, value and style

Architectural integration of components

Advanced concepts

2011: SCHÜCO`s E³-Building

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Functional optimization and architectural integration

International references

Lotos, PL-Gdansk (2006)

Planung
ARCH-DECO Sp.zo.o.

Elementierte Doppelfassade als
Sonderkonstruktion mit Royal S 70.HI
System FW 50+

International references

Kranhaus1, Köln (2010)

International references

Extension of the Hasso Platner Institute
D-Potsdam (2010)

Planung / Design
Mark Braun Architekten, Berlin
Päschke Architekten, Berlin

Elementfassade (Sonderkonstruktion)

International references

Citadele administrative and office building complex
LV-Riga (2010)

Planung / Design
GMP, D-Hamburg
Vincents Arhitekti, LV-Riga

FW50^{+}
Royal S 65
ALB passive

International references

Kristall Residential Tower
D-Hamburg (2011)
Design: ASTOC Architects / Cologne

International references

Q1, ThyssenKrupp Quartier
D-Essen (2010)

Planung / Design
JSWD Architekten, D-Köln

International references

Office building U15 Assago
I-Milan (2011)
Design: Cino Zucchi Architetti / Milan

International references

Head Office EDP
P-Porto (2011)
Design: APEL Architctura / Porto

International references

Coffee Plaza
D-Hamburg (2010)
Design: Richard Meier & Partners / New York

International references

Nuova Cittadella dell`Edilizia
I-Marghera - Venezia (2011)
Design: Caprioglio Associati, Mestre, Italy

International references

Hotel Porta Fira
E-L`Hospitalet de Llobregat (2010)
Design: Toyo Ito Architecs / Japan

International references

Torre Telefonica Diagonal ZeroZero
ES-Barcelona (2011)
Design: EMBA Estudi Massip-Bosch Arquitectes

International references

Torre Telefonica Diagonal ZeroZero
ES-Barcelona (2011)
Design: EMBA Estudi Massip-Bosch Arquitectes

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Functional optimization and architectural integration

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Functional optimization and architectural integration

General requirements:

- functional use / building usage
- user requirements
- budget limits
- site / climate
- regulations / standards

Holistic design approach:

- building structure
- building Interior works
- building services engineering
- building envelope

… building envelope as a part of an integrated design concept

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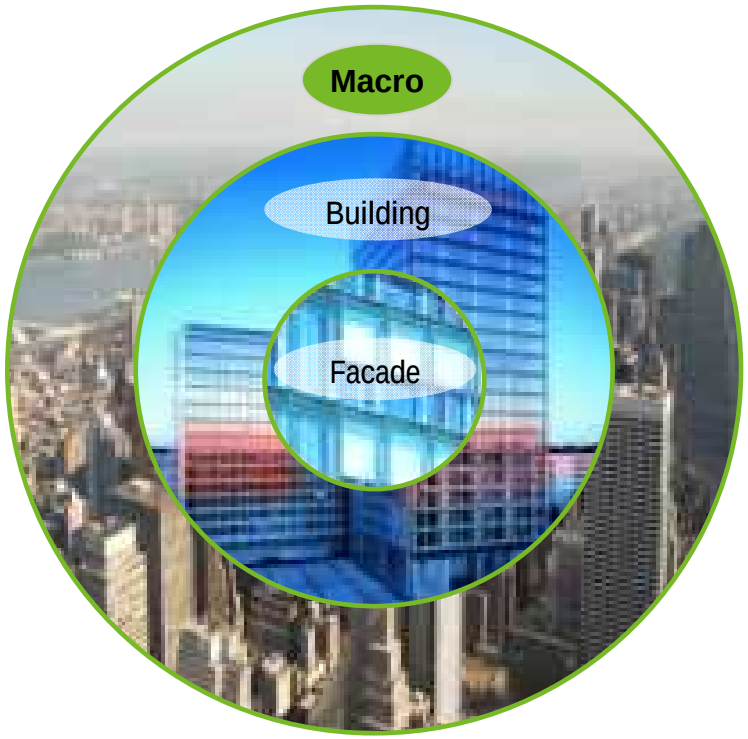
Functional optimization and architectural integration



Reduce heat loss

- thermally broken profiles in windows and facades
- use of insulated glass units
- use of natural ventilation when possible

Optimise solar gain

- passive and active shading systems
- daylighting, maximise glazing area as appropriate
- automatic control of shading and lighting systems

Maximise active use of solar energy

- solar thermal and PV systems where possible

…will ensure the goal of sustainability moves a step closer

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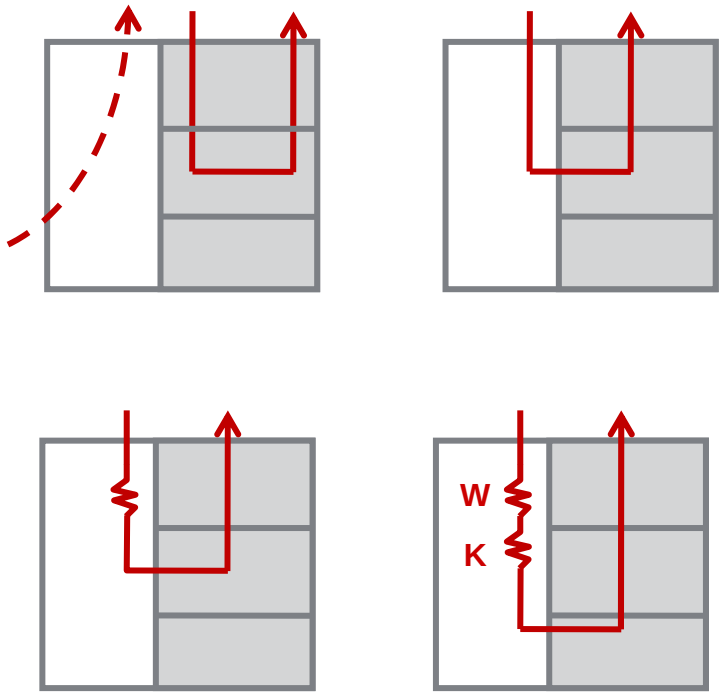
Functional optimization and architectural integration



Alternative solution: the atrium

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Sapphire Tower
TR-Istanbul (2011)

Alternative solution: the sky-garden

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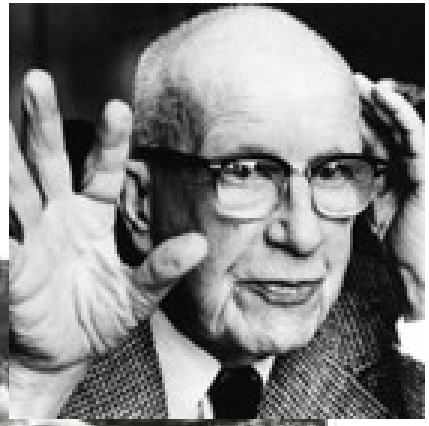

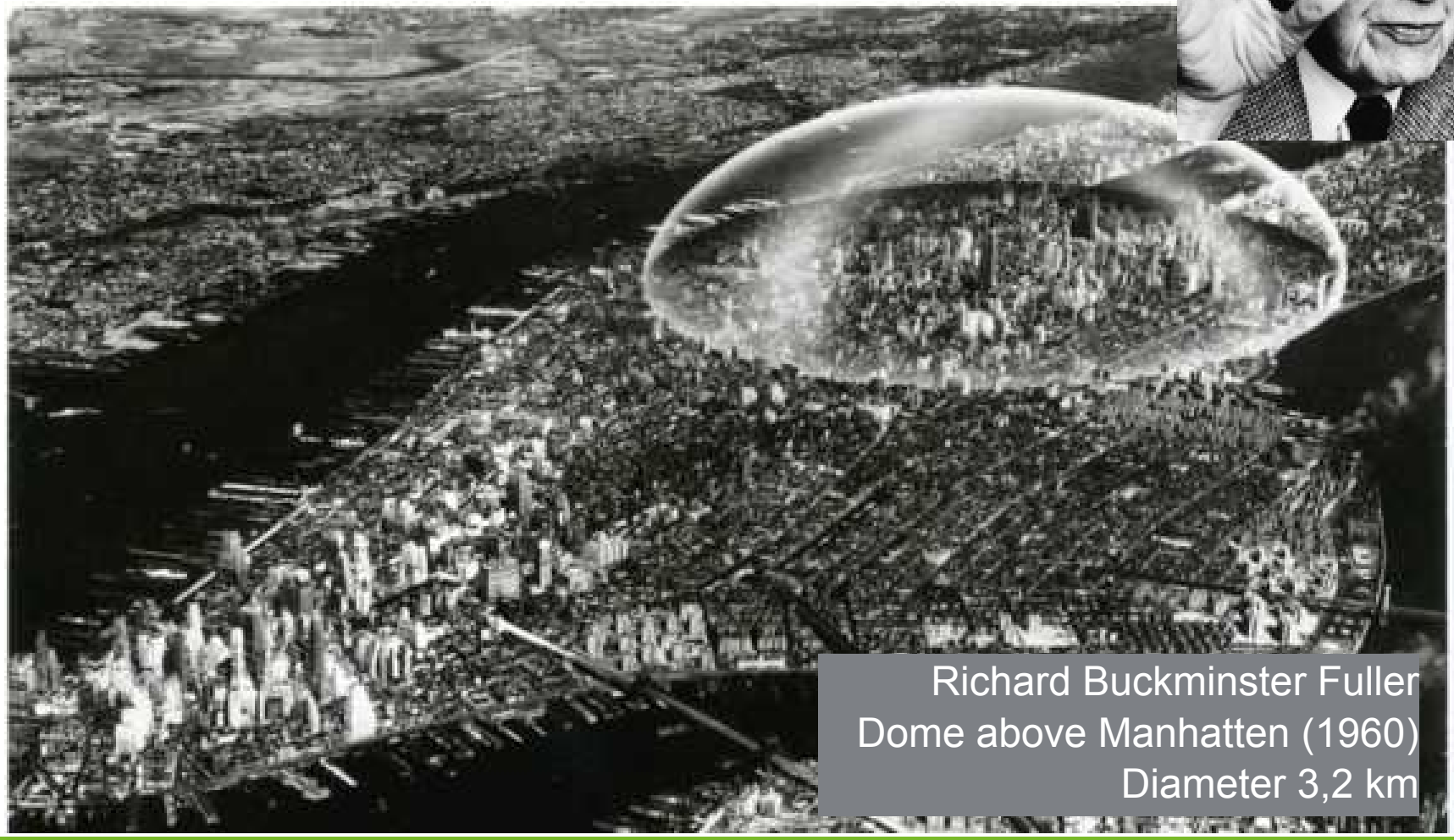

Richard Buckminster Fuller
Dome above Manhatten (1960)
Diameter 3,2 km

Z^3-islands: Zero energy, zero emission and zero waste

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