Energy efficiency and sustainability

Trends, Technologies, Quality and certification of windows and curtain walls

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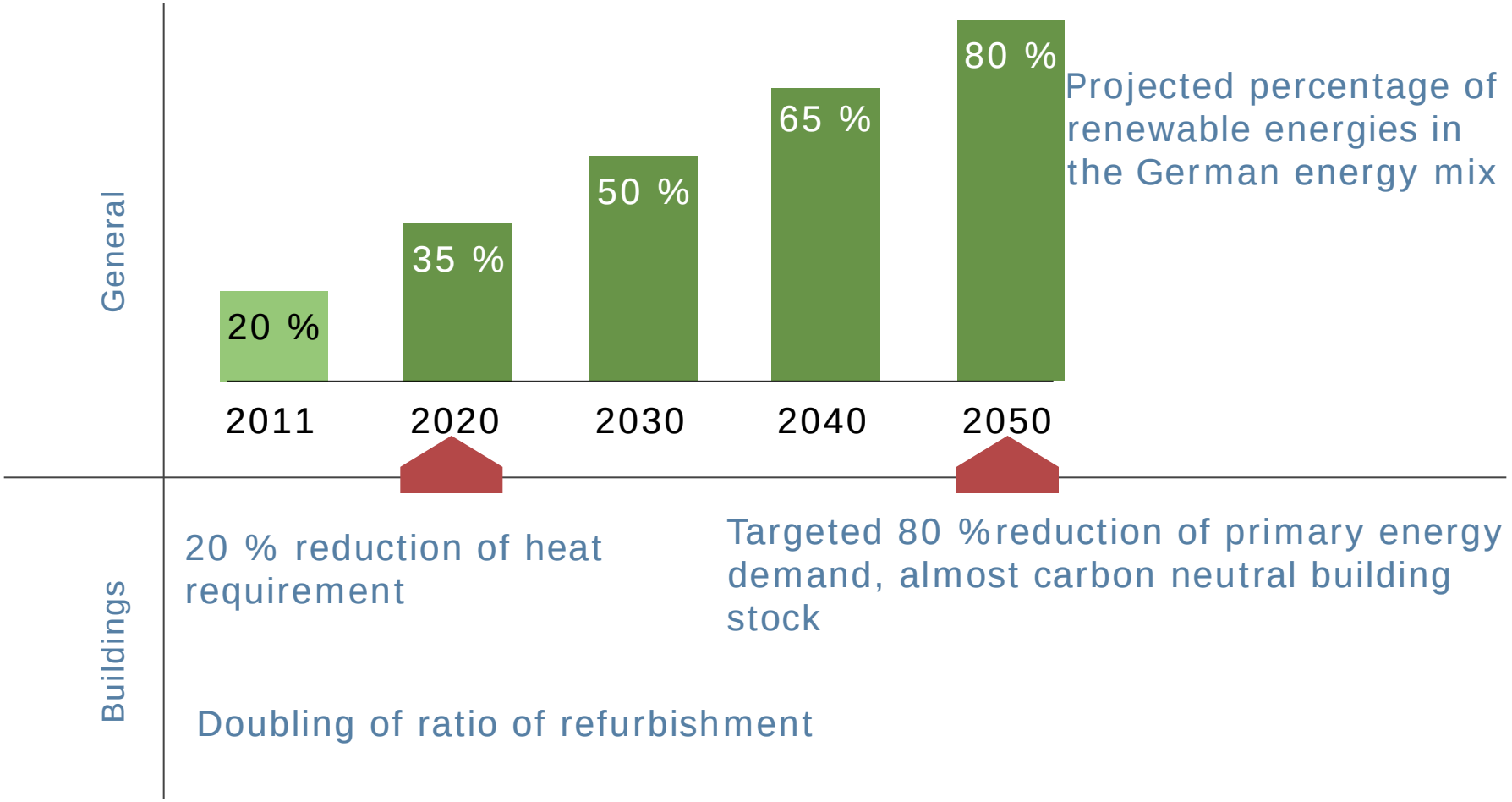
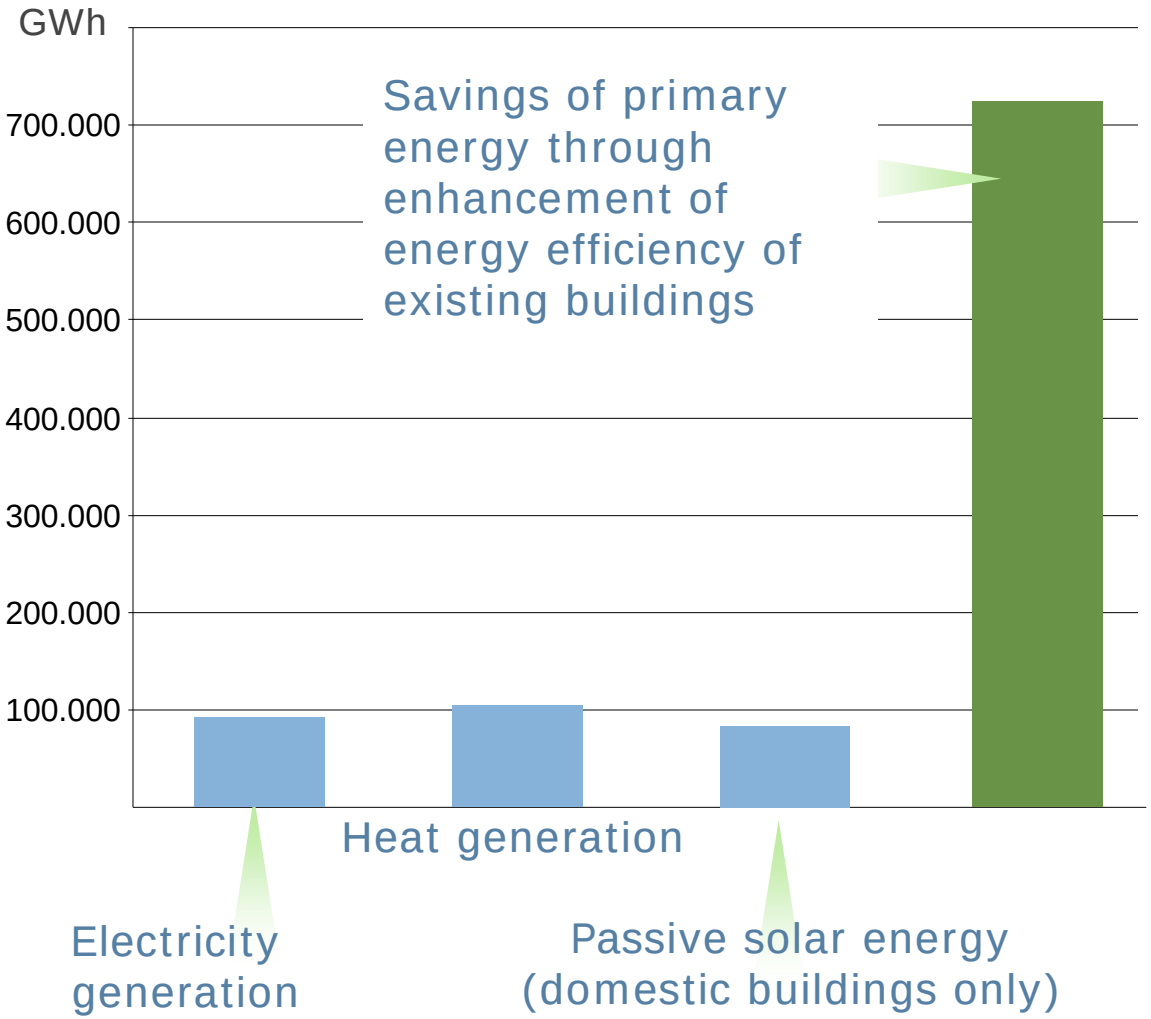
Climate Change
Determining issue of our times

Energy turnaround – Data and facts

Timeline of the German government



Usage of renewable energies in Germany



Quelle: BMWi
Basis: Fraunhofer IBP/TUM, ift

Future of building

Plus Effizienzhaus BMVBS

Solar decathlon


Bild: TU Darmstadt

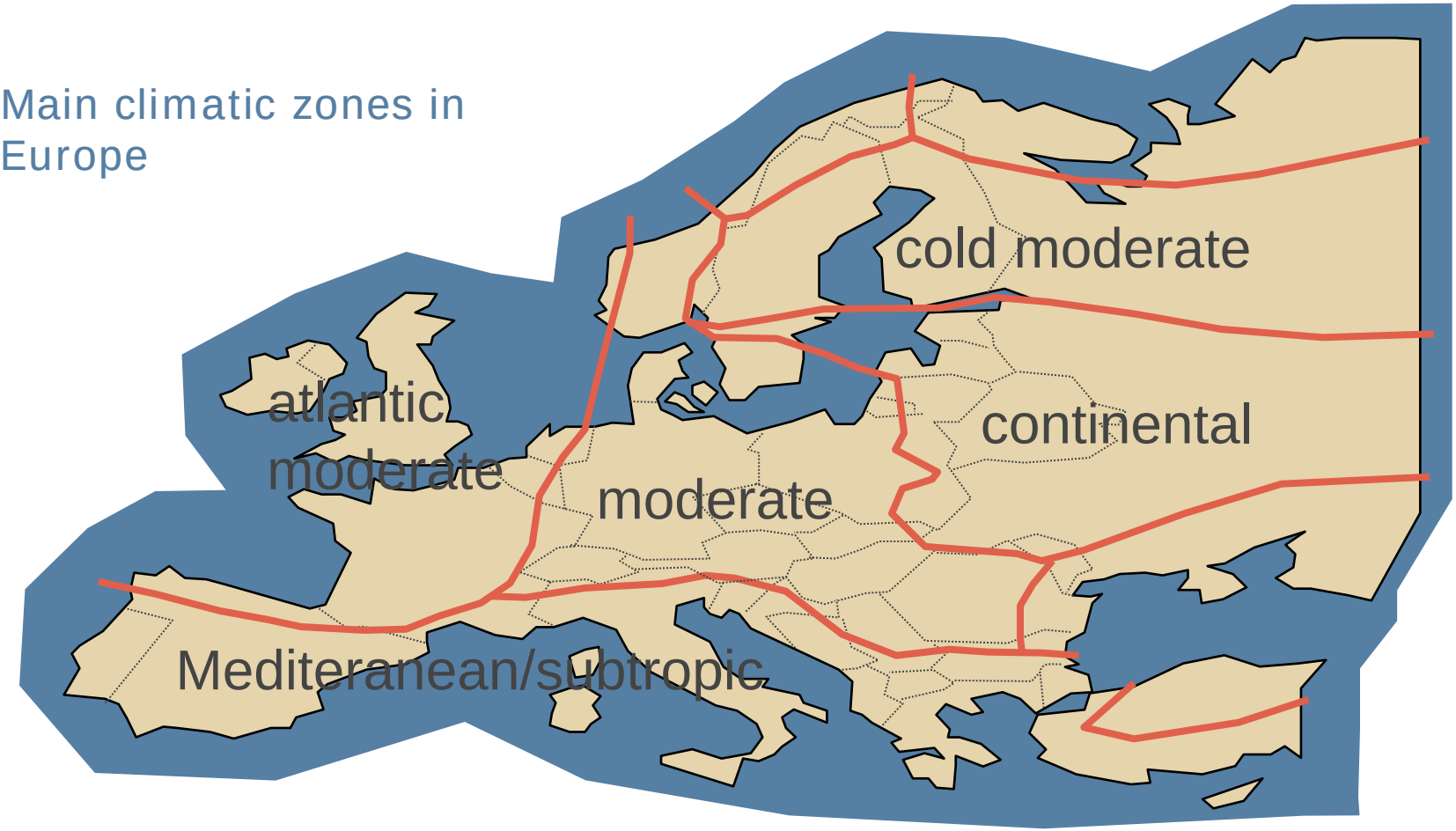

Bild: Hochschule Rosenheim

Characteristics

- Efficient
- Technically and multifunctional
- Cross-linked

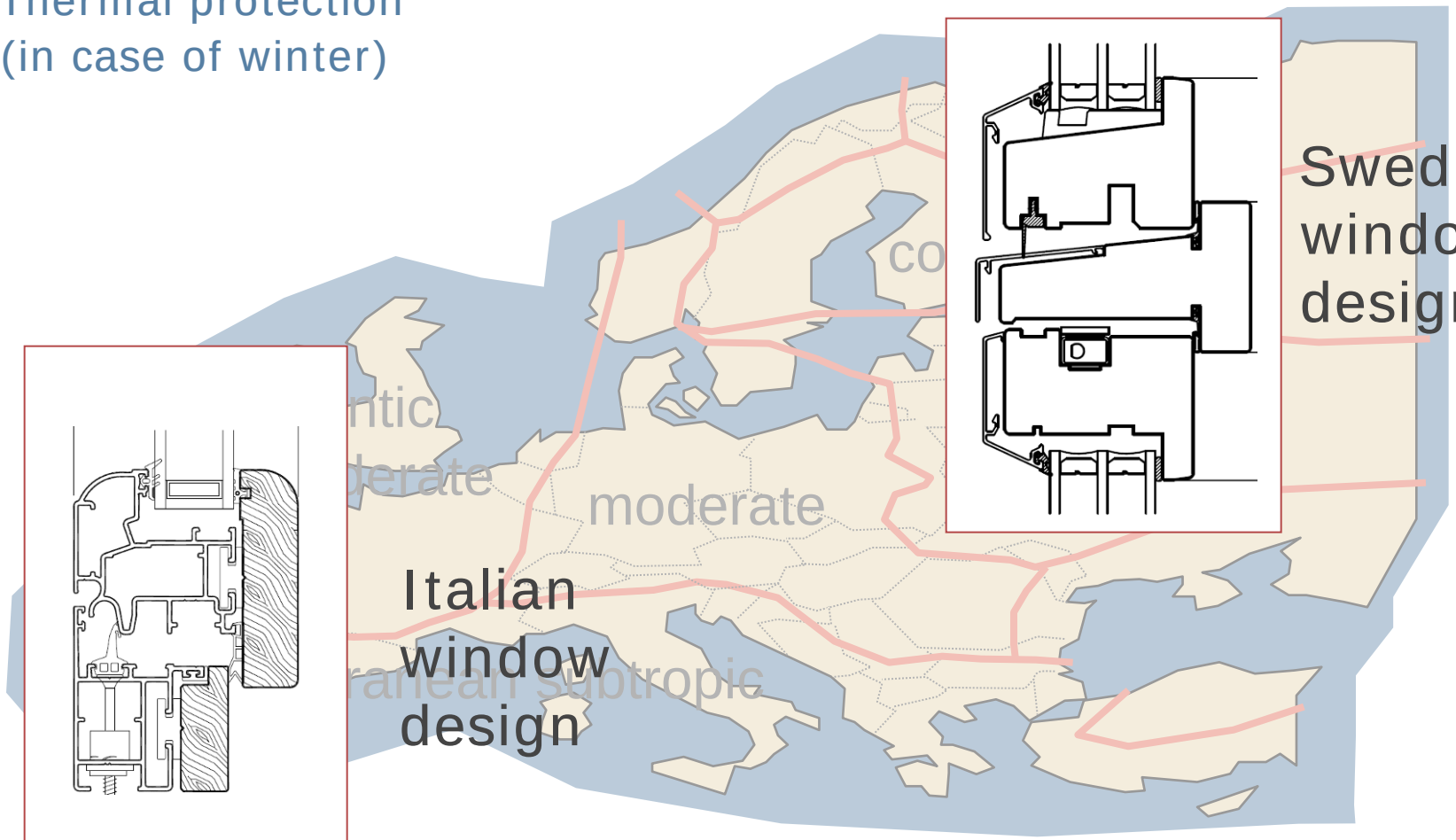
Climate as a determining influence for window design

Main climatic zones in Europe



Thermal protection as determining factor

Example:
Thermal protection
(in case of winter)

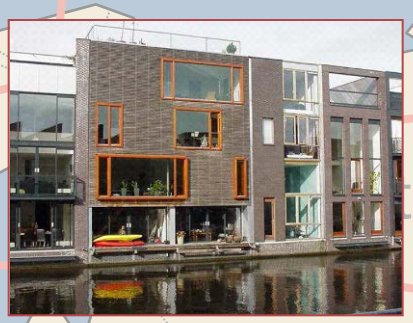


Italian window design

Swedish window design

Solar protection as determining factor

Building with large-area windows and no shutters



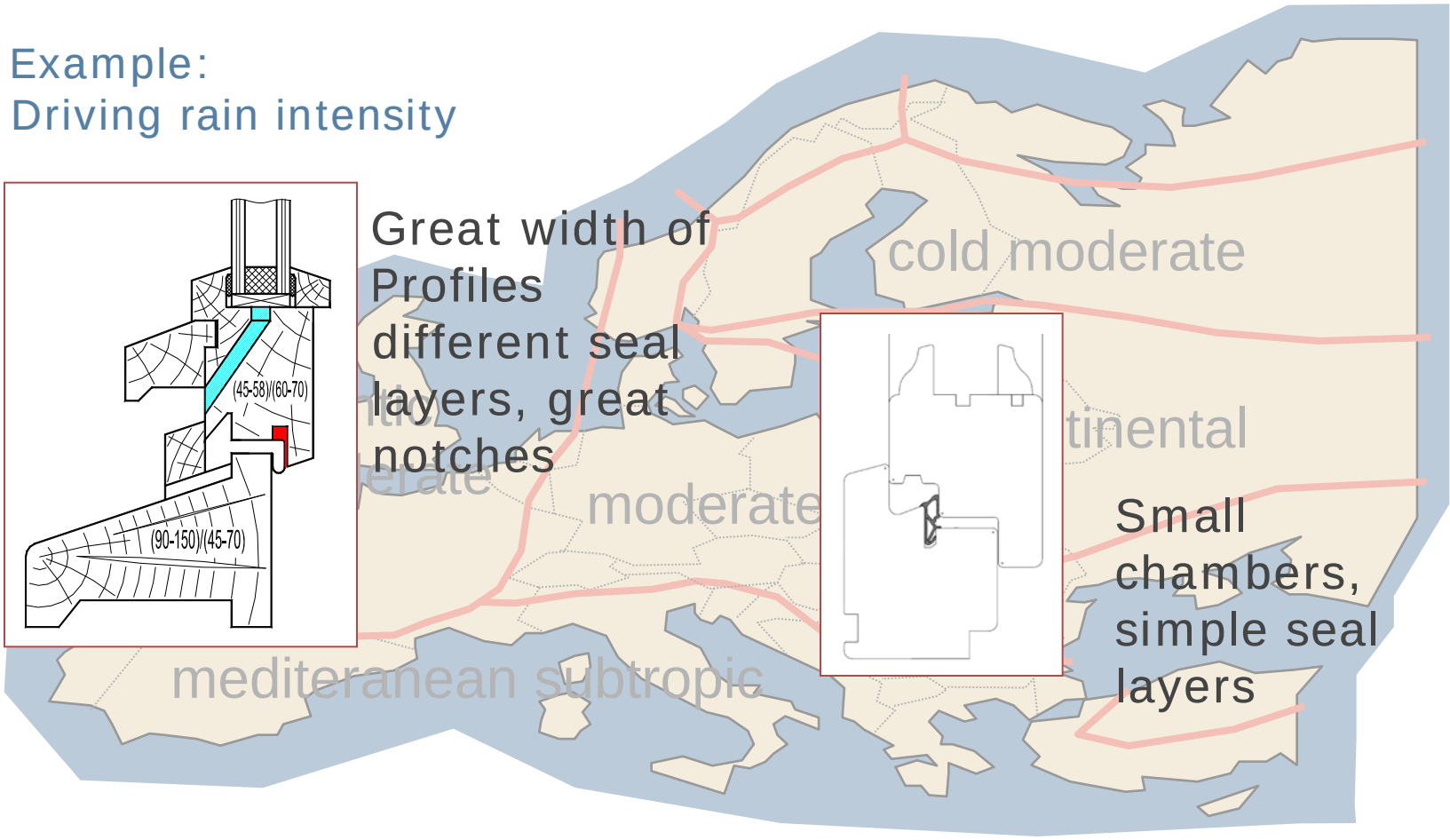
Adaptive shading devices

Small windows with blind out shutter

Driving rain as determining factor

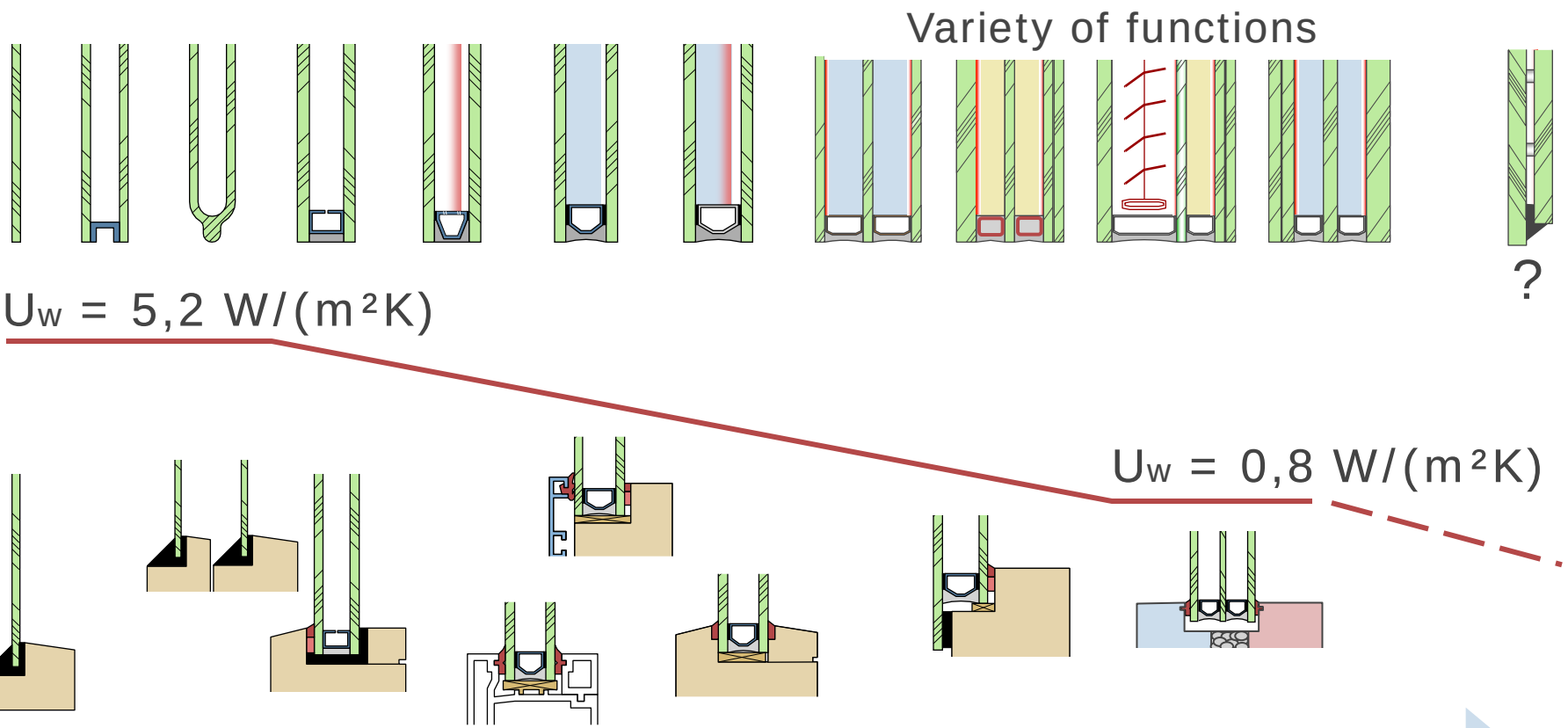
Example:
Driving rain intensity

Great width of Profiles different seal layers, great notches

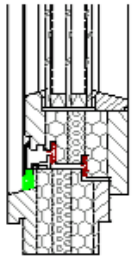
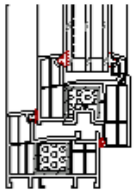
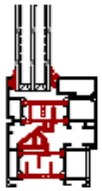


Small chambers, simple seal layers

Development of window design, glass and glazing



Thermal protection versus fitness for use

Minimization of cavities		Ventilation of cavities, drainage
Fillings with insulation materials		Ventilation of cavities, drainage, separability, compatibility
Reduced material usage		Durability, mechanical loads
More different materials		Separability, recycling
Multiple-Glazing		Higher weights, durability, light efficiency
...		...

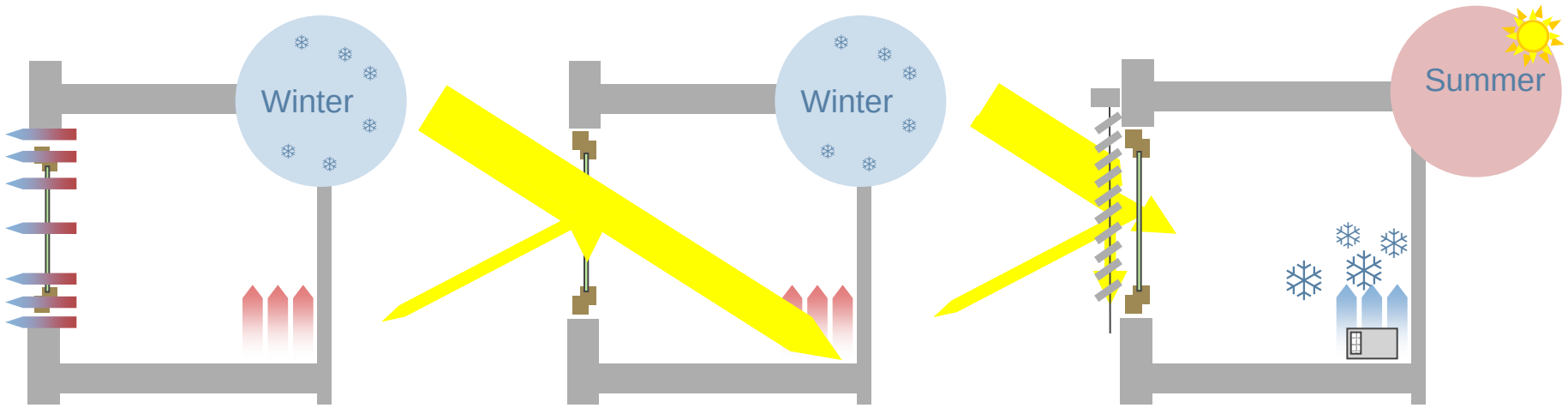
Thermals optimization

Fitness for use

Vision: Age of energy gains

Optimization of losses only is too shortsighted and has no further potentials

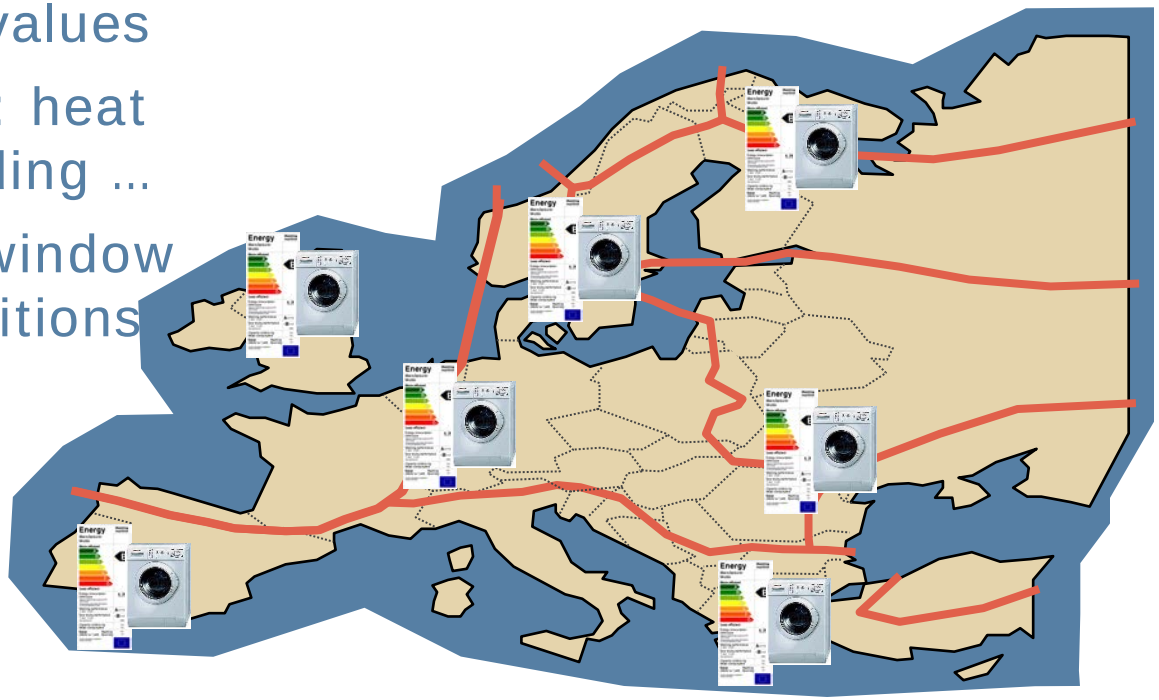
In future is the energy-gain-house the only suitable approach!



Energy label: A window is no washing machine!

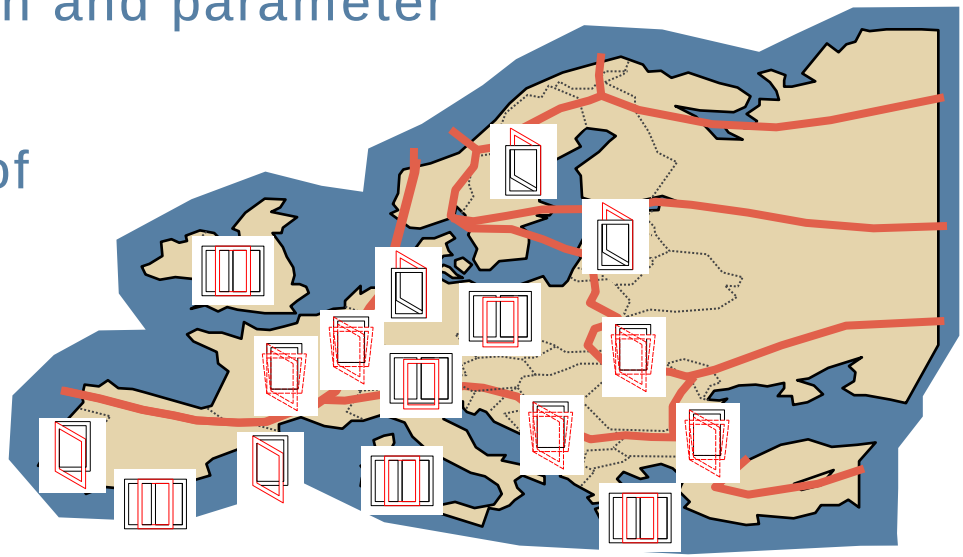
Efficiency depends on

1. Climatic conditions, heating/cooling period
2. Dimensions
3. Characteristics: U-values
4. Building conditions: heat capacity, solar shading …
5. Orientation of the window and boundary conditions



Energy label concept from Denmark

- Different bases of calculation and parameter
- (Over) simplification contra sophisticated presentation of results



Example : Rating by DTU (Danmarks Tekniske Universitet)

$$E = I_S \cdot F_S \cdot g_W - D_{Gt} \cdot U_W$$

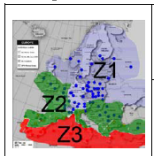
Solar gain factor

heat loss factor

Energy label – concept from Greece

Sophisticated presentation
And classification of results

Q: Proposal



Opening's location	Opening's Orientation S	W/E	N
Z1	**C**, 350 kWh/m²a (Heating) 350 / kWh/m²a (Cooling) 0	**B**, 300 kWh/m²a (Heating) 300 / kWh/m²a (Cooling) 0	**D**, 400 kWh/m²a (Heating) 400 / kWh/m²a (Cooling) 0
Z2	**C**, 375 kWh/m²a (Heating) 250 / kWh/m²a (Cooling) 125	**B**, 340 kWh/m²a (Heating) 230 / kWh/m²a (Cooling) 110	**C**, 385 kWh/m²a (Heating) 300 / kWh/m²a (Cooling) 85
Z3	**A**, 260 kWh/m²a (Heating) 100 / kWh/m²a (Cooling) 160	**B**, 290 kWh/m²a (Heating) 120 / kWh/m²a (Cooling) 170	**A**, 272 kWh/m²a (Heating) 150 / kWh/m²a (Cooling) 122

Energy	Door - Window
Manufacturer	Name of Manufacturer
System	System's Name
Typology	Single Leaf Opening Window
Transparent Size	1,00m (W) x 1,28m (H)
Outdoor Visible Size	1,00m (W) x 1,28m (H)
External Size	1,20m (W) x 1,48m (H)
Product Operation	☑ Manual ☐ Automatic
Shading	☑ Included ☐ Excluded

More Efficient A B C D E Less Efficient

U_w	2,00	$\frac{W}{m^2 * K^o}$
g_{gl}	0,3	
LT	60%	
L_{50Pa}	0,2	$\frac{m^3/h}{m^2}$
FC	25%	☐ Internal ☐ Middle ☑ External

Daylight Potential 32% (Max 50%)

Further Information is Contained in Product Brochures
Product has been considered that will be placed on **Residents**
▪ Actual Energy Losses/Gains are Related on Product's Use
▪ If A/C is NOT applied, only **Heating Demands** Should be Used

v. 08/02/2010

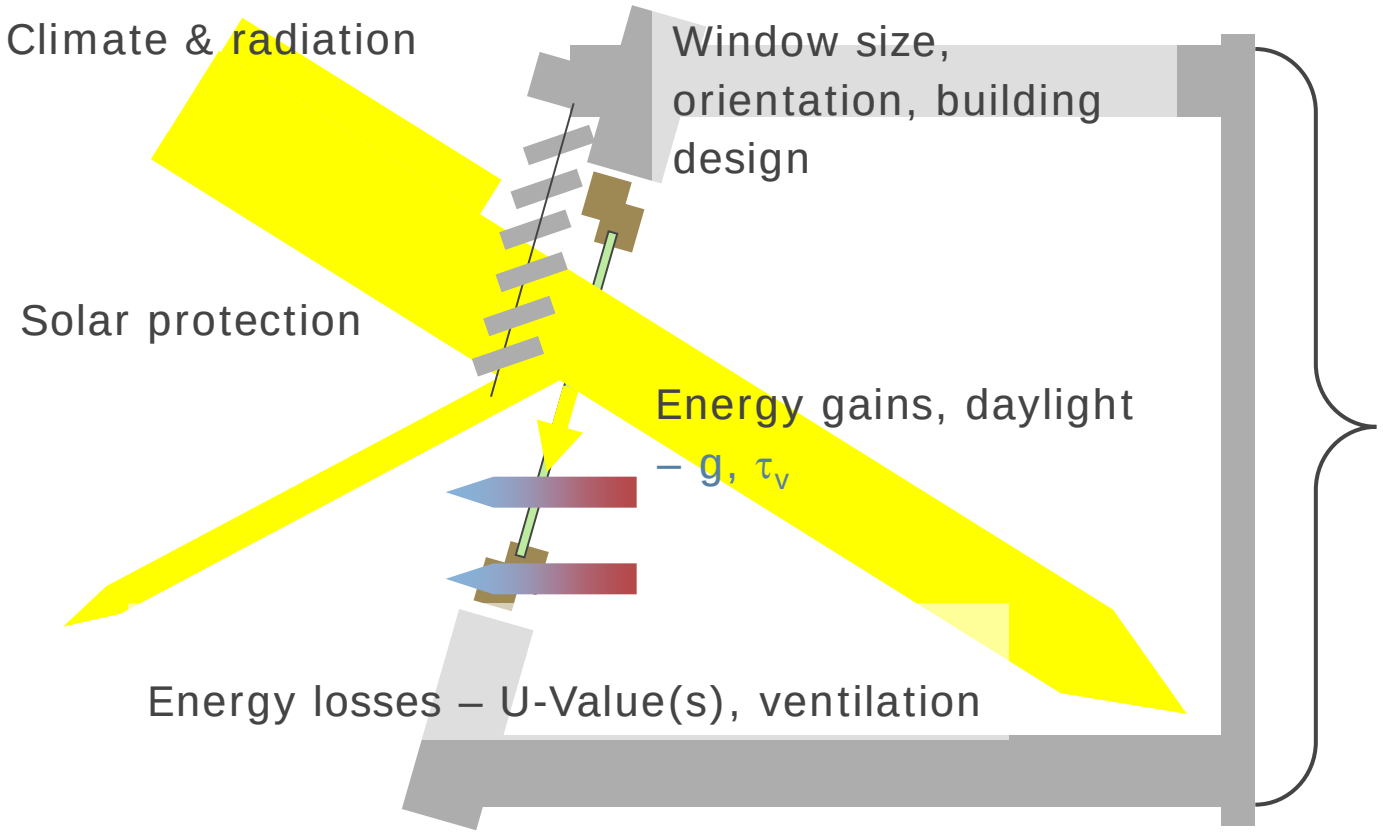
9 Classifications
depends on
orientation & location
(3 zones for Europe)

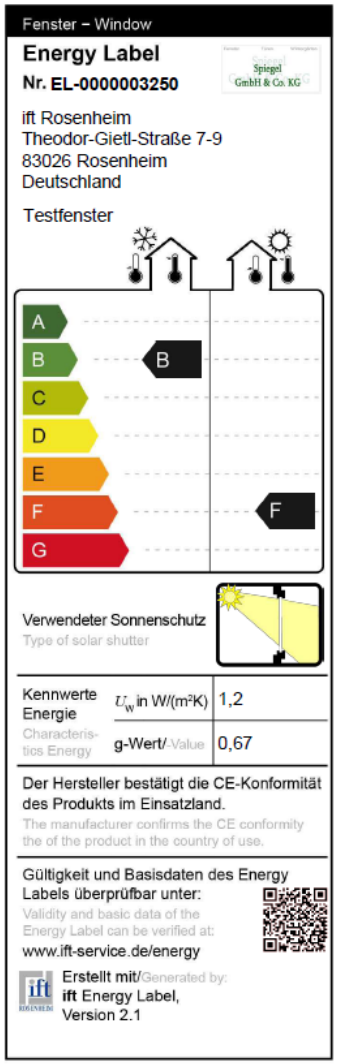
Example : Rating by

ARISTOTLE UNIVERSITY OF THESSALONIKI

Simple evaluation of efficiency by an energy label

Assessment of energy efficiency according ISO 18292
→ Energy Label



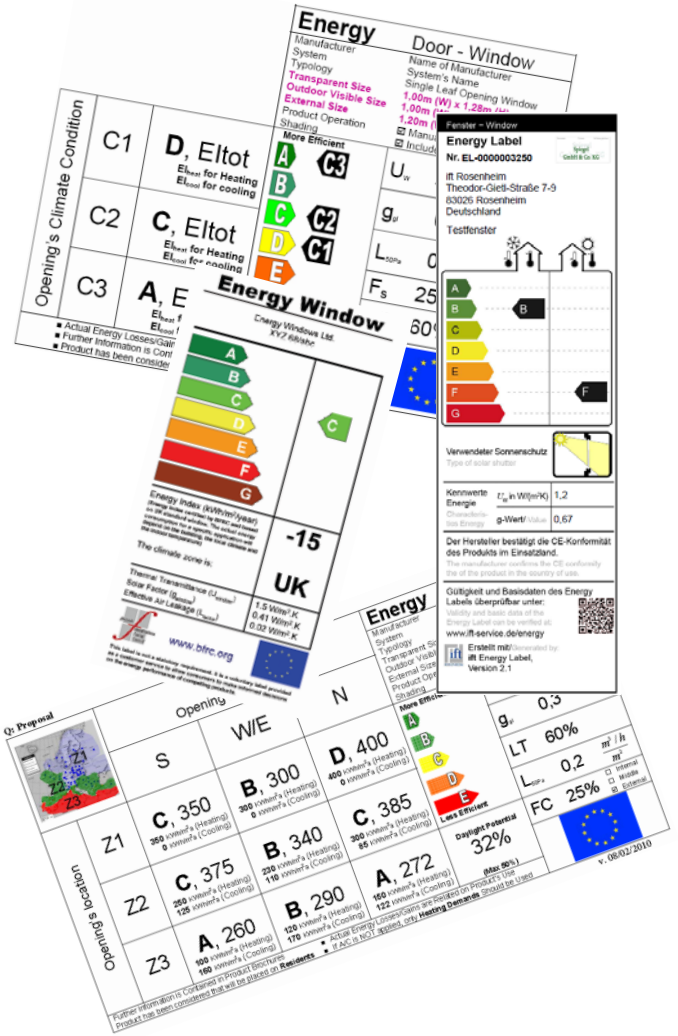


Perspective energy label

The right concept will decide

then …

- First time end customer will be reached
- Positive image of the window as a solar power plant
- „Additional value is saleable“



Vision: The window of the future

Easy operable

Energy gains

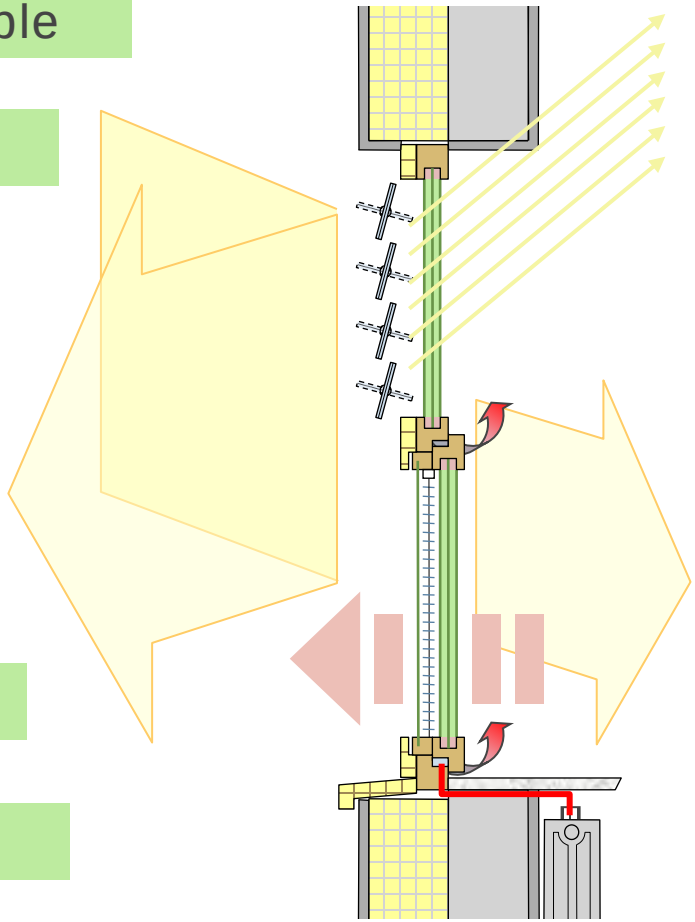
Multifunctional

Modular

Accessible

Secure

Sustainable

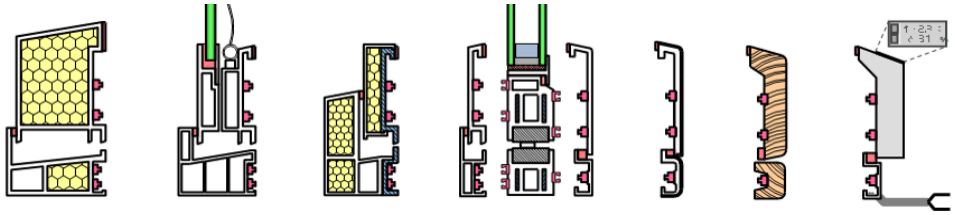


More complex

Accepted by the user?

Solution: Modularity

Permisses



Tolerances of parts and modules
Fabrication tolerances, variable dimensions, fixed measures …

Mechanic joints
Removable joints, statics, functional parts …

Electronic interfaces
Connectors, voltage, protocols …

Taxonomy of values and certificates
Exchange rules, access to valid values & calculation procedures …

Modularity in the automotive industry

Example: Shared modular construction principle of Volkswagen

Wide construction kit with over 200 technical variants

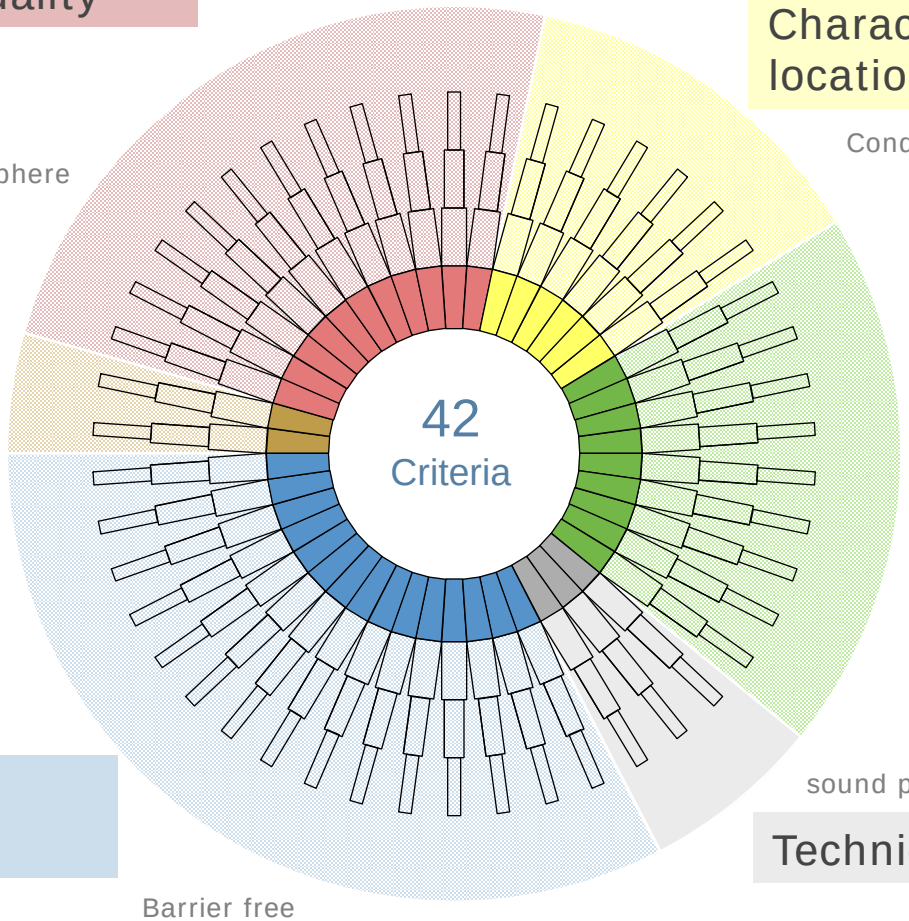
Standardized technical dimensions

Widely variable dimensions

Sustainable buildings and environmental life cycle assessment – Worldwide megatrend

Green windows for sustainable Buildings

Example: Criteria German BNB certificate



Global warming

Ecological quality

Risk for local environment

Ozone

Destroying of the ozonosphere

Life cycle cost of a building

Economic quality

Capability of alternative use

Hygienic of internal air

Thermal comfort in summer

Acoustic comfort

Socio-cultural & functional quality

Barrier free

Thermal comfort in winter

Thermal insulation

Technical quality

sound protection

Maintenance

Quality of processes

Pre-qualification of suppliers

initial operation

Project preparation

Integral design

Surveillance on sight

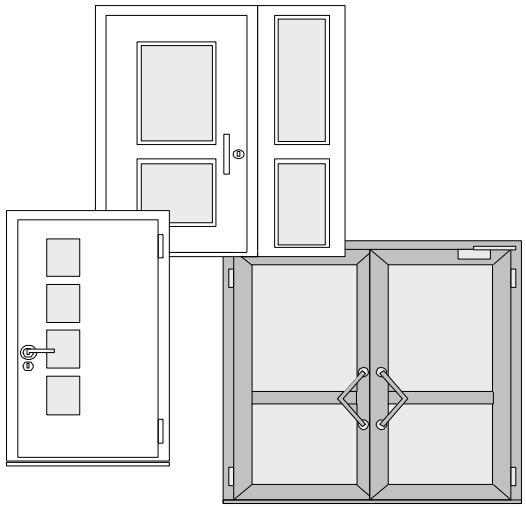
Characteristics of the location

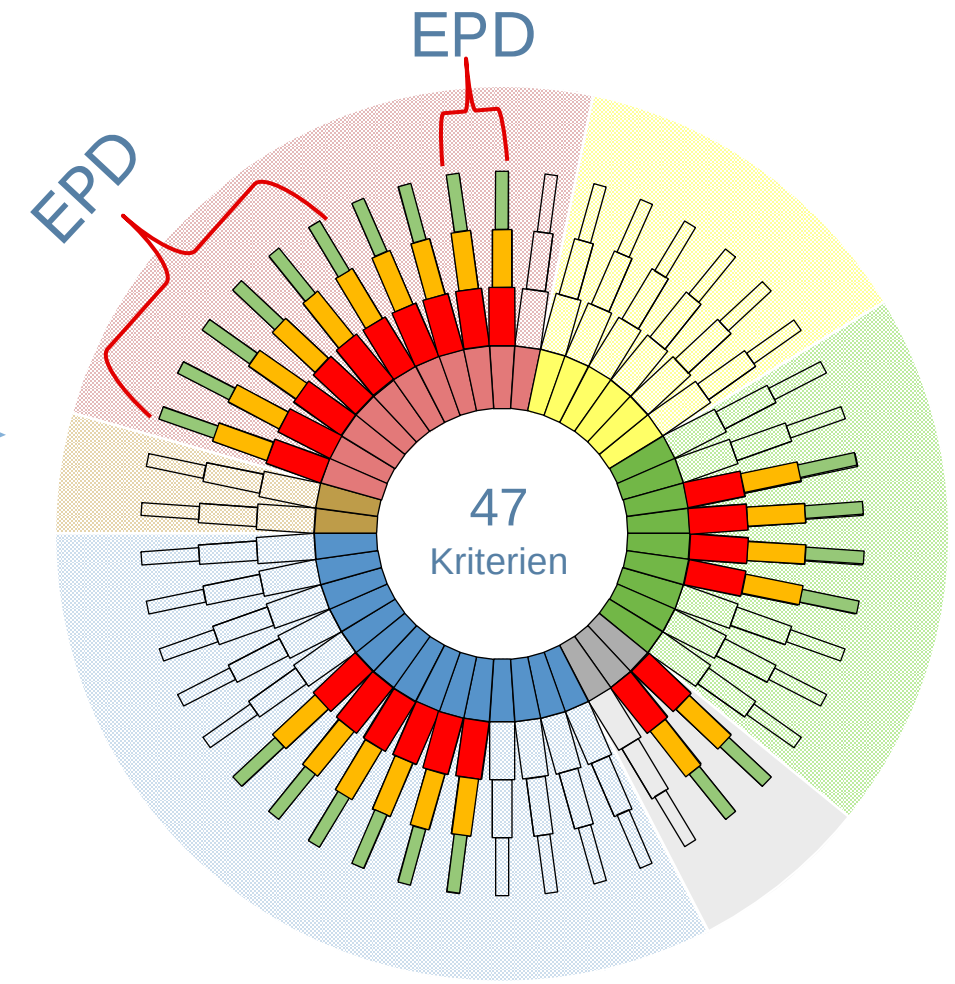
Risk for micro systems

Conditions at micro systems am

Performance of quarter

EPD and additional documents





Additional documents are necessary!

Environmental Product Declarations

Demand of the systems

System system		EPD	Evidence
BNB		✓	✓
DGNB		✓	✓
LEED		X	✓
BREEAM		X	✓

BNB certification for all new federal buildings since march 2011 madatory

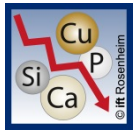
Environmental Product Declarations
Environmental impacts

Primary energy – non renewable

primary energy - renewable

Global warming potential

Ozone deplation potential



Abiotic ressources depletion elements

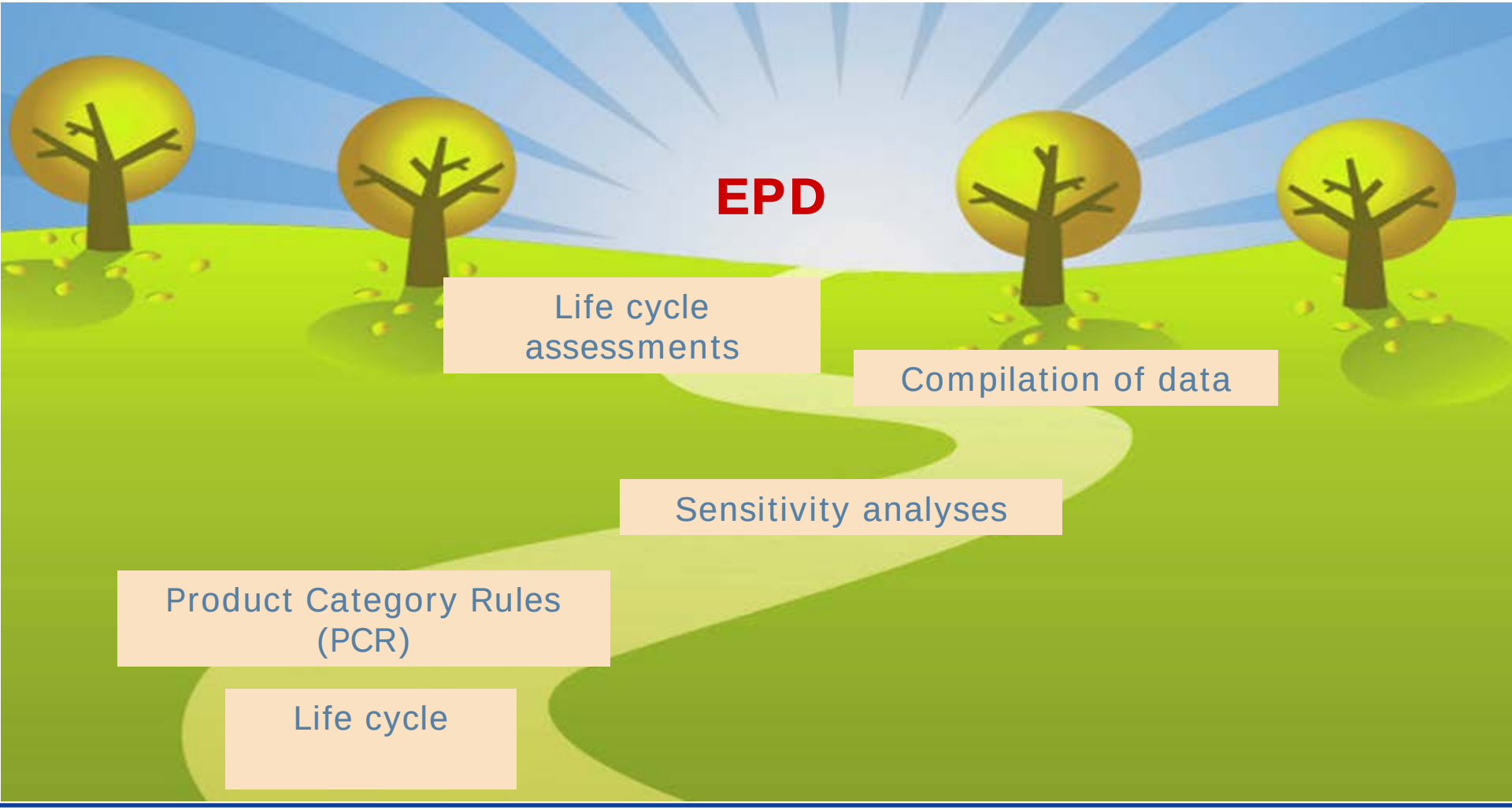
Ozone deplation potential

Acidification potential

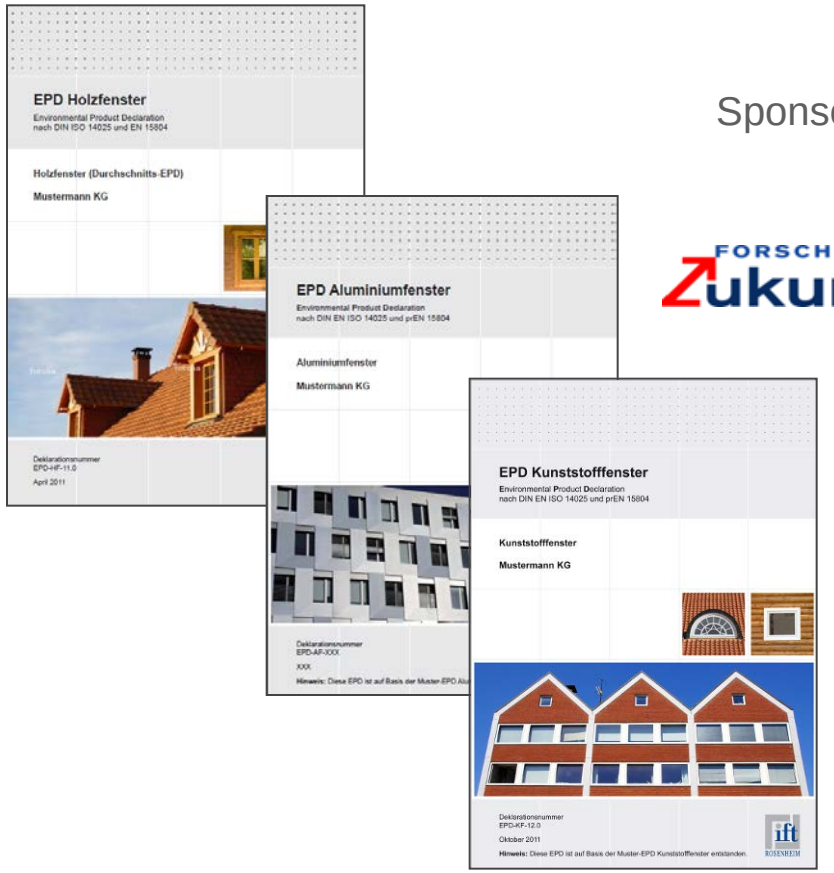
Eutrophication potential

Aiotic ressources depletion fossil

Environmental Product Declarations
The five steps to the EPD



Pattern EPDs



Sponsorship

FORSCHUNGSINITIATIVE Zukunft BAU

Bundesinstitut für Bau-, Stadt- und Raumforschung
BBSR

Bundesamt für Bauwesen und Raumordnung

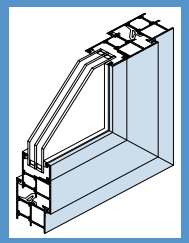
Bundesministerium für Verkehr, Bau und Stadtentwicklung

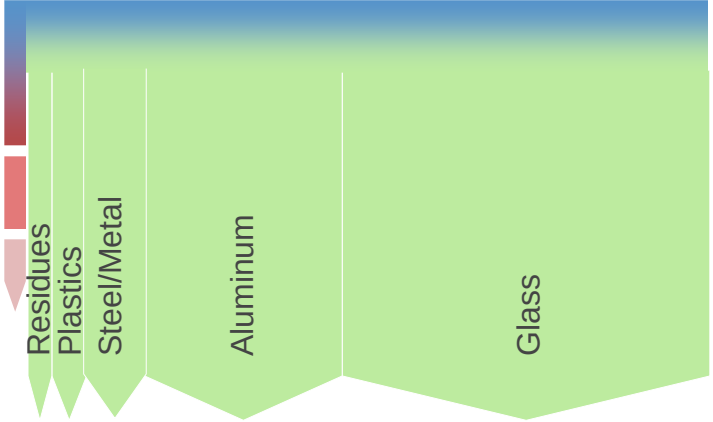
Also possible for doors and gates

Green building evaluation

Example: Optimizing recycling systems for windows

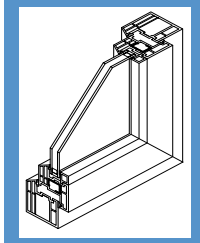
Aluminum windows

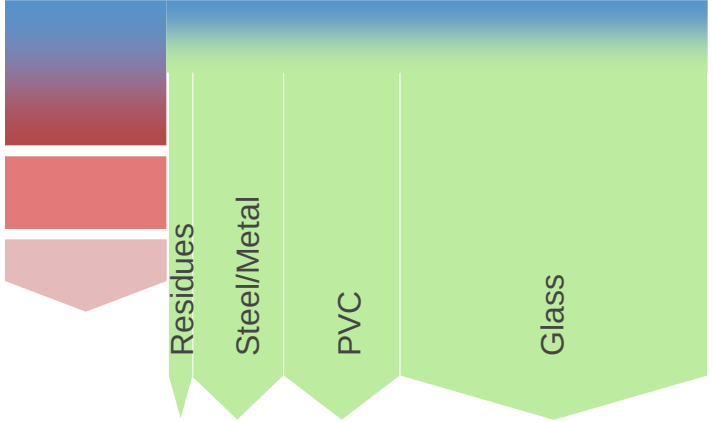




97 %

PVC windows





77 %

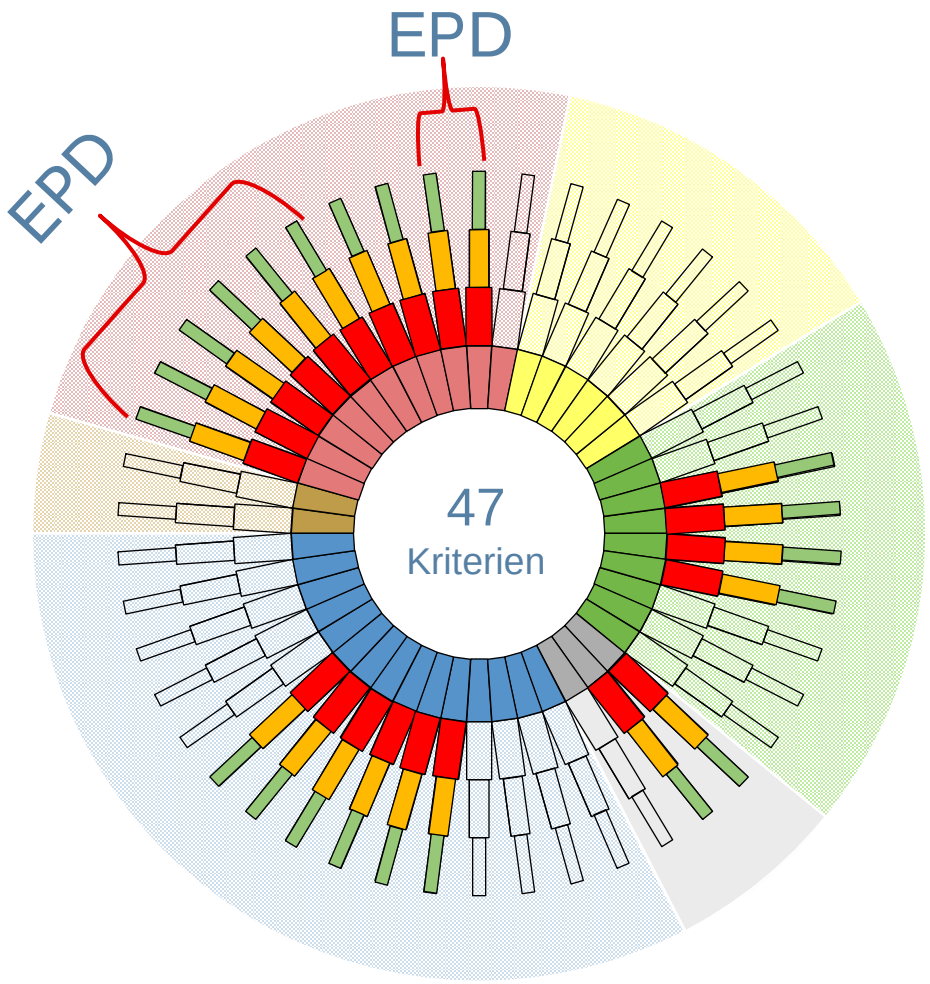
Recycling ratio

Environmental Product Declarations
1 m² Steeldoor

Ergebnisse der Ökobilanz pro m² Tür		Herstellung A1 – A5	Nutzung B1 – B7	Nachnutzung C1 – C4	Recycling-potenzial D
Primärenergie nicht regenerativ ($PE_{n\,reg}$) in MJ		1510,38	133,59	-88,28	-636,7
Primärenergie regenerativ (PE_{reg}) in MJ		98,24	5,72	-2,36	-8,864
Treibhauspotenzial (GWP 100) in kg CO_2-Äqv.		220,58	7,98	28,51	-47,09
Ozonabbaupotenzial (ODP) in kg R11-Äqv.		$2,43 \times 10^{-5}$	$3,96 \times 10^{-7}$	$-6,83 \times 10^{-7}$	$4,87 \times 10^{-7}$
Versauerungspotenzial (AP) in kg SO_2-Äqv.		0,32	0,022	$8,30 \times 10^{-3}$	-0,1347
Eutrophierungspotenzial (EP) in kg PO_4^{3-}-Äqv.		0,031	$3,00 \times 10^{-3}$	0,045	-0,0137
Photochem. Oxidantien-bildungspotenzial (POCP) in kg C_2H_4-Äqv.		0,057	$3,10 \times 10^{-3}$	$5,80 \times 10^{-3}$	-0,020
Abiotischer Ressourcen-verbrauch elements ($ADP_{el.}$) in kg Sb-Äqv.		$3,70 \times 10^{-4}$	$6,44 \times 10^{-6}$	$3,00 \times 10^{-7}$	$-2,28 \times 10^{-4}$
Abiotischer Ressourcen-verbrauch fossil ($ADP_{fos.}$) in MJ		1346,80	108,98	-54,57	-631,65

Additional evidence

Further evidence for building products required!



Ift compass as additional evidence

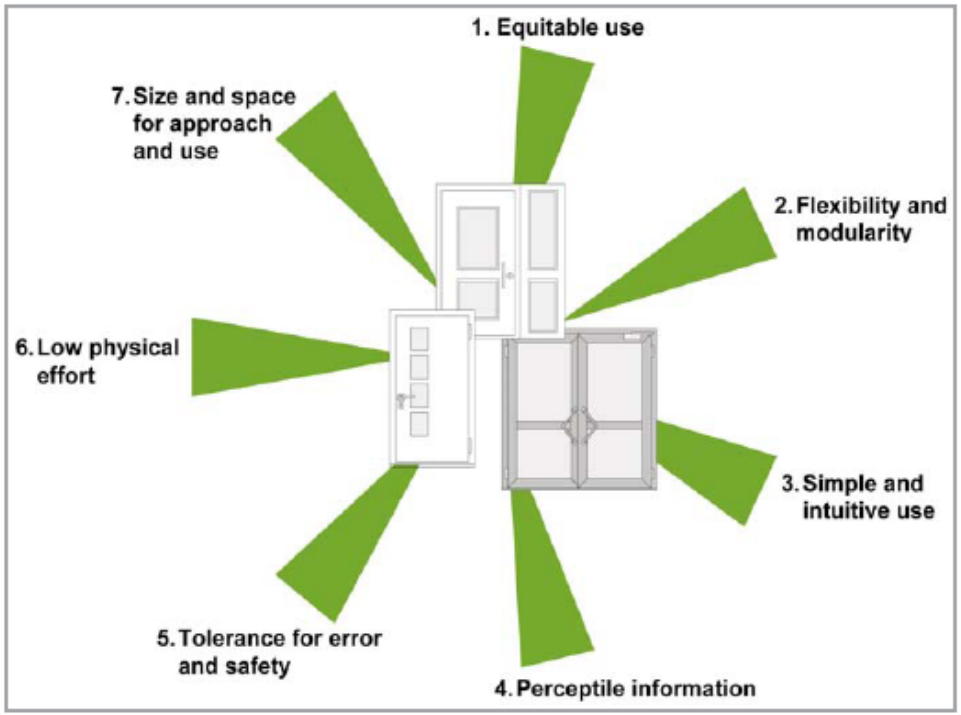
- freedom from barriers
- noise protection
- ventilation
- Light Pollution Emission
- Regional Materials
- Energy and Atmosphere

Advantages:

- one document for the building certification
- no need of continuous examination of the evidence required

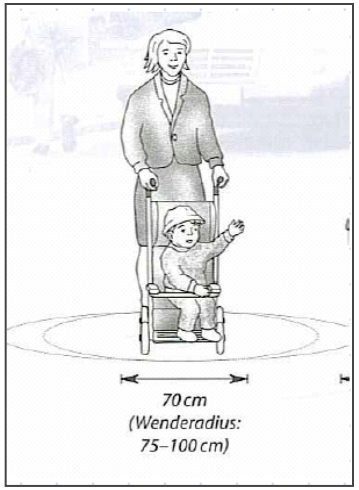
The 7. principles of Universal Design

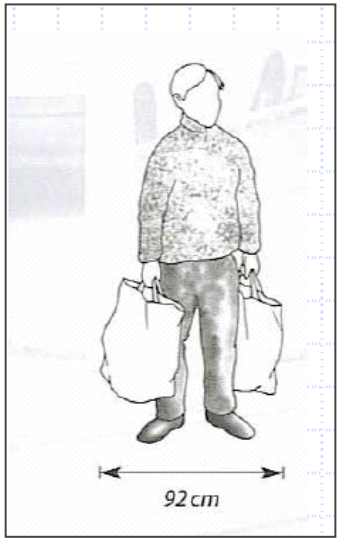
1. **Equitable** Use
2. **Flexibility** in Use
3. Simple and **Intuitive** Use
4. **Perceptible** Information
5. **Tolerance** for Error
6. **Low Physical** Effort
7. **Size and Space** for Approach and Use

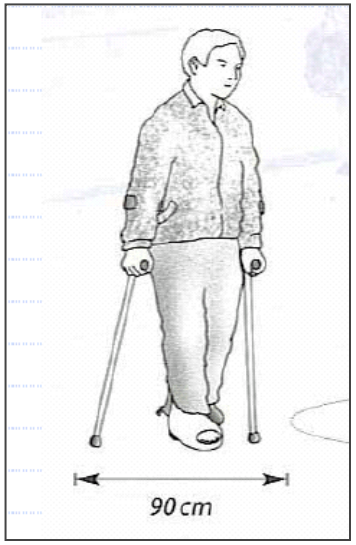


Which persons are affected?

1. **“Normal people”** like you and I
2. **Mobility impaired people**
   (walking impaired/arm or hand impaired/growth repressed people/wheelchair users)
3. **Sensory impaired people**
   visually impaired/blind/hearing impaired/ deaf/temporarily impaired people)
4. **Old people & Children**
5. **People of small & large stature**
6. **Parents with young children and baby buggies**







Universal Design product groups

Intensive use in industries such as

- **Electrical** devices
- **Utility** items
- **Consumer** electronics
- **Automotive**
- **Living area** (bath room, kitchen)

Example automotive: Minivan
Opel Meriva UD principals 1/2/3/4/5/6/7

- **Ergonomic seat** can be set to 18 different positions
  Principals
  1. Equitable Use and
  2. Flexibility in Use
- The **rear-hinged back doors** make getting in and out of the car comfortable and ergonomic even in narrow parking spaces
  Principal 7. Size and Space for Approach and Use.
- The **cycle rack** system in the rear bumper is convenient to adjust and loading height for bicycles is low
  Principal 6. Low Physical Effort
- **Park Pilot** with acoustic and visual warnings and **hill start assistance** prevents from rolling down the hill
  Principals
  4. Perceptible Information
  5. Tolerance for Error

Minivan Opel Meriva; Manufacturer: Adam Opel AG

Transfer to windows and doors

You have to be able to perceive, understand, reach and use building elements.
Therefore they have to be:

1. Clearly **perceptible**,
2. **Simple** to open and close,
3. **Safe** to operate,
4. **Adaptable**
   (e.g. retrofitting of automation)
5. Sustainable,
6. Aesthetical,

Picture: Special show BAU 2011/Geze

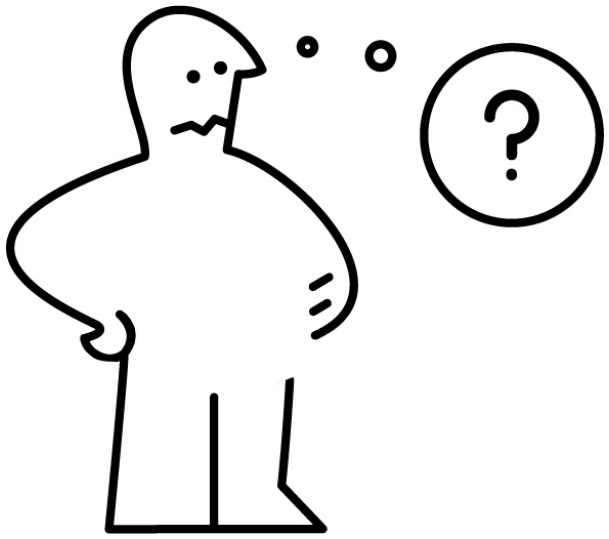
Construction requirements – operation

Requirements on **operating force** for manual operated internal doors

Durability against	Class 0	Class 1	Class 2	Class 3	Class 4
Closing force .	- [1)]	75	50	**25**	10
Manual operated hardware (door handle) - max. Moment (Nm) - max. Force (N)	 - -	 10 100	 5 50	 **2,5** **25**	 1 10
Finger operated hardware (cylinder lock) - max. Moment (Nm) - max. Force (N)	 - -	 5 20	 2,5 10	 **1,5** **6**	 1 4
[1)] No requirements					
Classification of operating forces according DIN EN 12217					

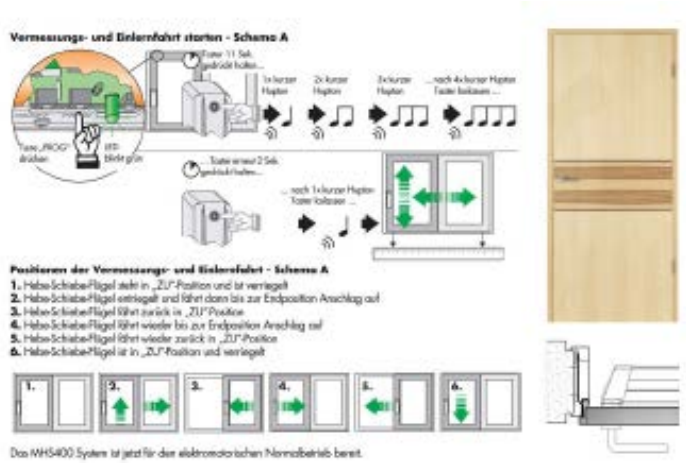
Requirements – packaging

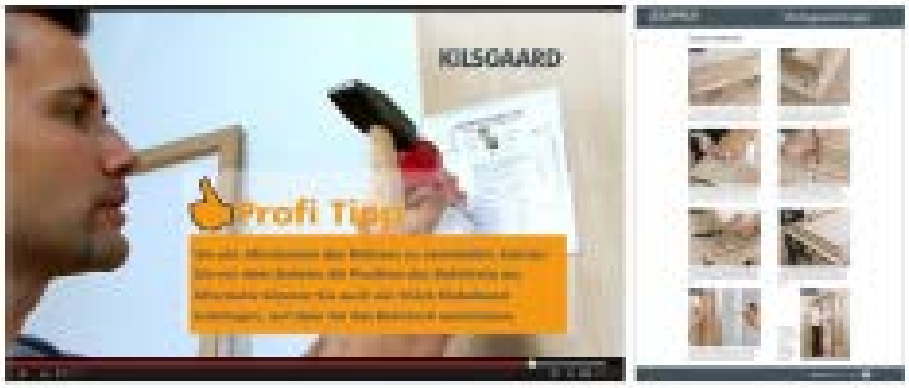
1. Material (sustainable, recycling)
2. Transport (weight, lifting pins)
3. Handling while unpacking (IKEA style)
4. Recycling

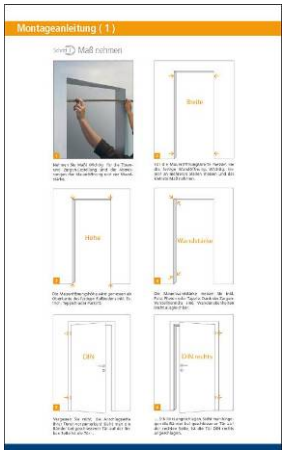


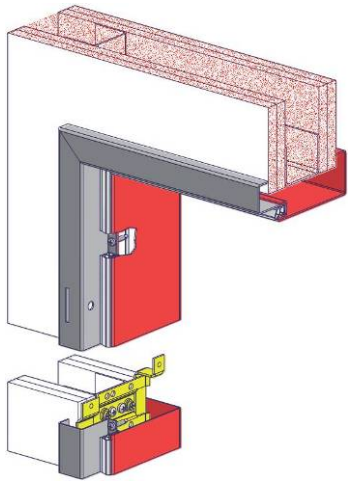
Assembly, mounting and maintenance instructions

1. **Comprehensive** & easy to understand
2. **Illustration** and coloring
3. **Instruction** in
   - different **languages**
   - different **media** (letters, pictures, acoustic, video)

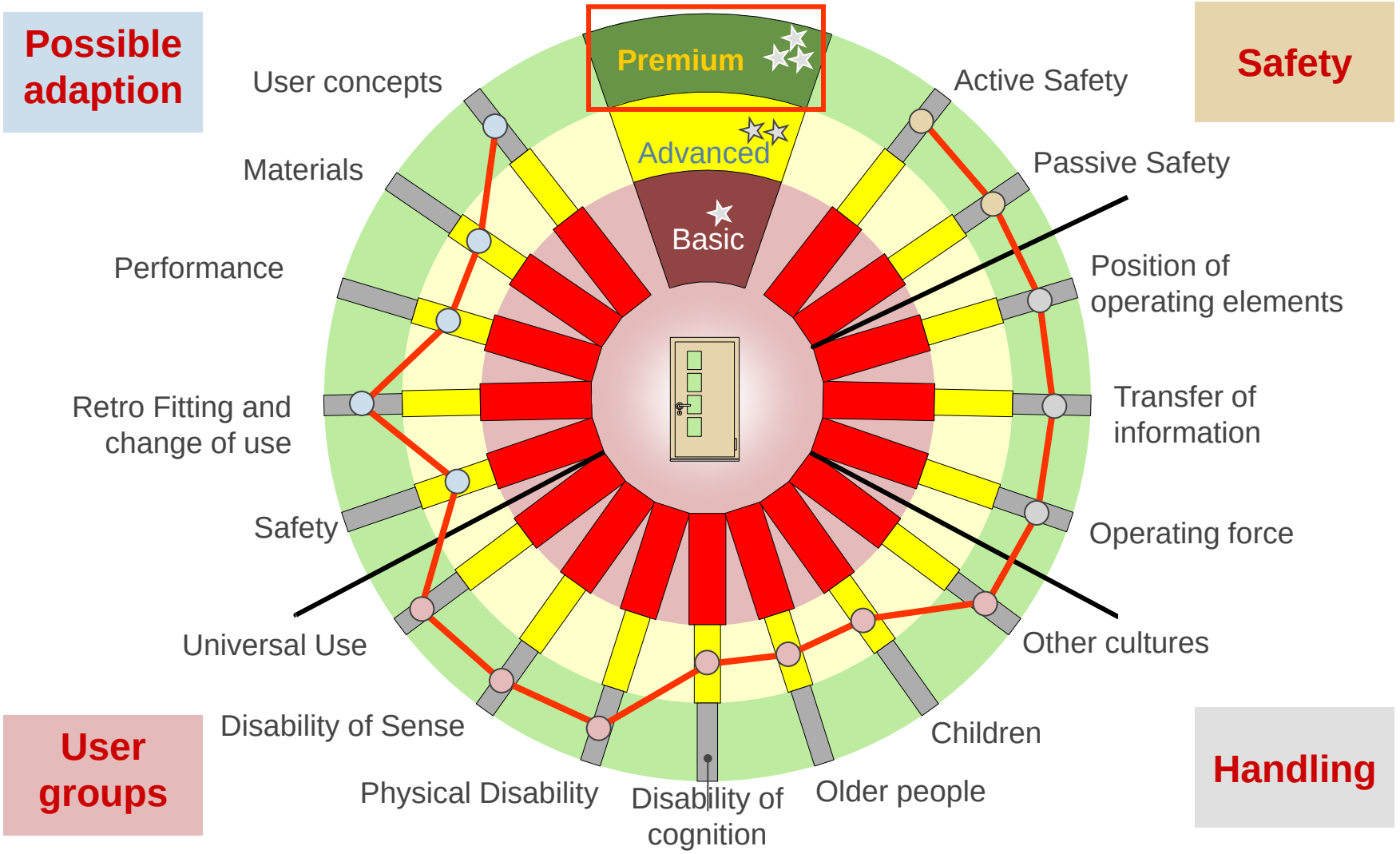








Universal Design: Benchmarking of products „UD profil“ Doors



Assessment and certification

Assessment by means of the ift catalogue of criteria „Universal Design“

and the quality criterias of the ift-certification “QM 328”

ift-KONFORMITÄTSZERTIFIKAT
ift-CERTIFICATE OF CONFORMITY

ZERTIFIZIERT
CERTIFIED

Universal Design

Produkt / *product*	Innentür / *Interior door*
Produktname / *product name*	Innentürblatt
Hersteller / *manufacturer*	Innentürhersteller Innentürstraße 1, 12345 Innentürstadt
Produktionsstandort / *production site*	Innentürhersteller Innentürstraße 1, 12345 Innentürstadt

LOGO Firma

Mit diesem Zertifikat wird bescheinigt, dass die benannten Produkte und das Unternehmen den Anforderungen des ift-Zertifizierungsprogramm für Universal Design (QM358 : 2012) sowie dem Kriterienkatalog der Universal Design GmbH entsprechen. Grundlagen hierfür sind:

- die Bewertung des Unternehmens und der Produkte gemäß dem Kriterienkatalog für Universal Design,
- ein Probandentest über die genannten Produkte,
- eine Prüfung durch das Prüflabor gemäß den Anforderungen des Zertifizierungsprogramms für Innentüren QM 326 : 2009 mit Mindestklassifizierungen,
- zusätzliche technische Anforderungen gemäß Anlage 1 des ift-Zertifizierungsprogramm für Universal Design,
- Aufbau eines Systems der werkseigenen Produktionskontrolle unter Berücksichtigung Universal Design,
- eine kontinuierliche Fremdüberwachung des Unternehmens durch die Überwachungsstelle am benannten Standort.

Das Zertifikat darf nur unverändert vervielfältigt werden. Alle Änderungen der Voraussetzungen für die Zertifizierung sind dem ift-Q-Zert mit den erforderlichen Nachweisen unverzüglich schriftlich anzuzeigen. Die Gültigkeitsdauer des Zertifikates beträgt 3 Jahre

Das Unternehmen ist berechtigt, die Beschläge gemäß der ift-Zeichensatzung mit dem „ift-zertifiziert“-Zeichen zu kennzeichnen.

The present certificate attests that the product and the company mentioned fulfills the requirements of the ift-certification scheme for Universal Design (QM358 : 2012) as well as the criterias of Universal Design GmbH. Basis therefore are:

- the evaluation of the company and the products based on the criteria catalogue for Universal Design,
- tests performed by probands of the mentioned products,
- tests performed by the test laboratory according to the requirements of the certification scheme for interior doors QM 326 : 2009 with a minimum classification,
- additional technical requirements according to annex 1 of the certification scheme Universal Design,
- setting up a system of a factory production control in consideration of Universal Design,
- a continuous third party control of the company by the surveillance body at the production site mentioned.

The reproduction of the certificate without any change whatsoever from the original, is permitted. Any changes to the prerequisites applicable to certification shall be immediately communicated in writing to ift-Q-Zert accompanied by the necessary evidence. The certificate is valid for a period of 3 years.

The company is authorised to affix the “ift-certified”-mark to the hardware according to the “ift Rules for use of the “ift-certified”-mark.

Universal Design
universal design

Systemprüfung
system testing

Nachhaltigkeit
sustainability

universal design

Rosenheim
12.34.5678

Christian Kehrer
Leiter ift Zertifizierungs- und Überwachungsstelle
Head of ift Certification and Surveillance Body

Ulrich Sieberath
Institutsleiter
Director of Institute

Vertrag-Nr. / *Contract No.*: 123 12345
Zertifikat-Nr. / *Certificate No.*: 123 12345-1-1
Gültig bis / *Valid*: 12.34.5678

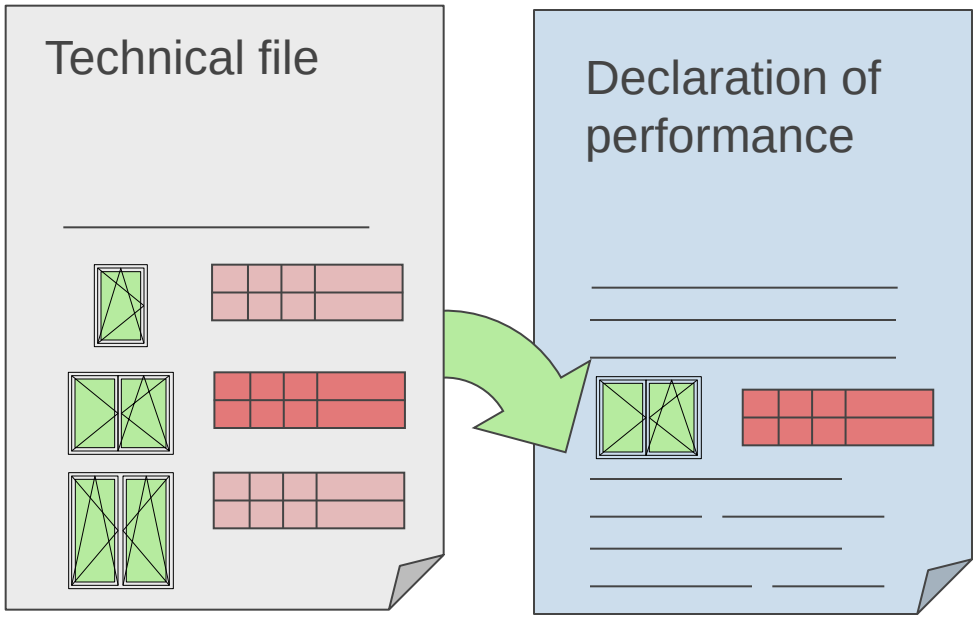
ift Rosenheim GmbH
Zertifizierungsstelle
Theodor-Gietl-Str. 7-9, 83026 Rosenheim
Germany
www.ift-rosenheim.de
info@ift-rosenheim.de

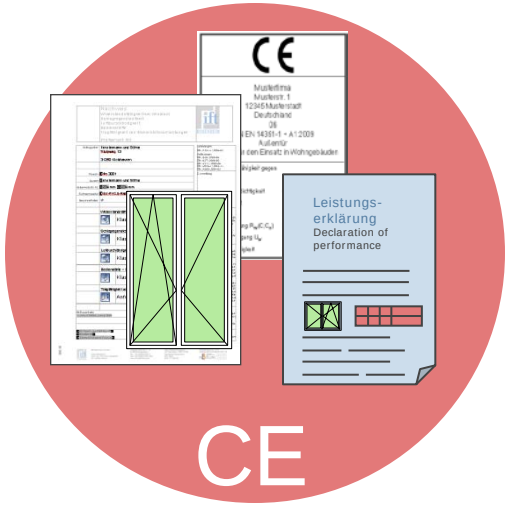
DAP-ZE-2288.00

Building products **guideline** → Building products **regulation** (CPR)

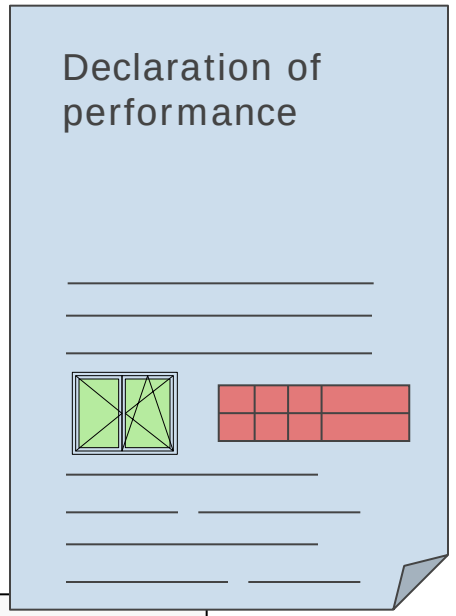
1. EU law from July 2013 binding
2. Declaration of conformity is turning into declaration of performance
3. New essential requirements on buildings: Sustainability - Accessibility – (Burglar) Safety
4. CE labeling and traceability

Individual declaration of performance is precondition of CE-labeling





Declaration of performance according to annex III



Declaration of performance

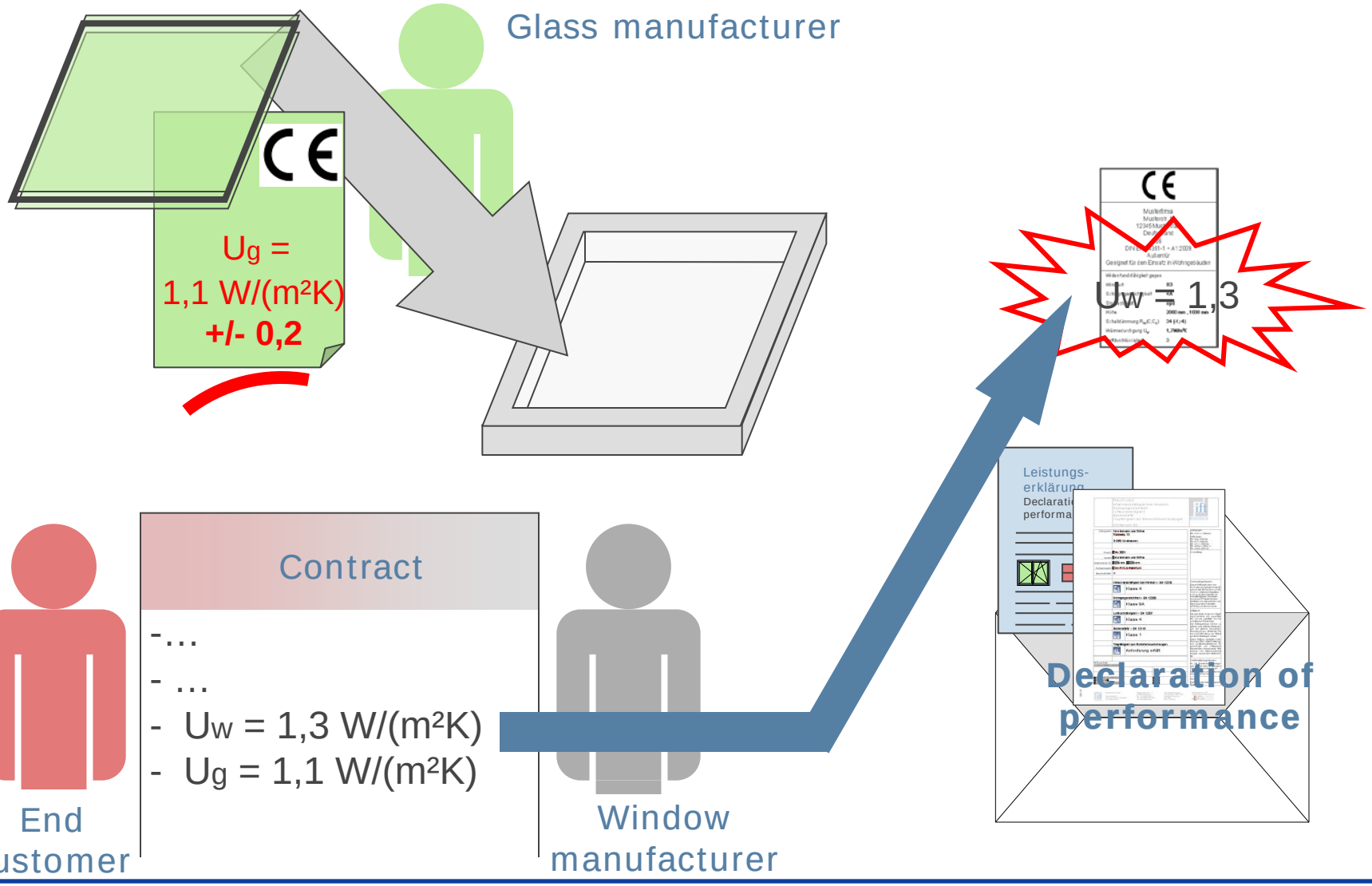
No. .....

1. Unique identification code of the product-type: .....

2. Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

   ...

Consequence – reliable characteristics



Valid certificates per mouse click

Processing

Input

Valid values
- standards
- standard-conforming calculation
- test results

Output

Valid certificates

Certified programs

ift Rosenheim

Research, Verification, Certification, Training
All services from a single source!

Testing Body

- Research & Development
- Testing of construction products
- Technical analysis and evaluation

Services

- Standardization & guidelines
- Technical hot line
- Publication and literature
- Test rigs, test centers, calibration

Certification

- Management systems
- product certification
- Surveillance

Training

- Seminars, Workshops, In-house trainings
- Congresses