Isover Multi-Comfort-House

Comfort and Energy Efficiency in Buildings

Robert Schild
2006

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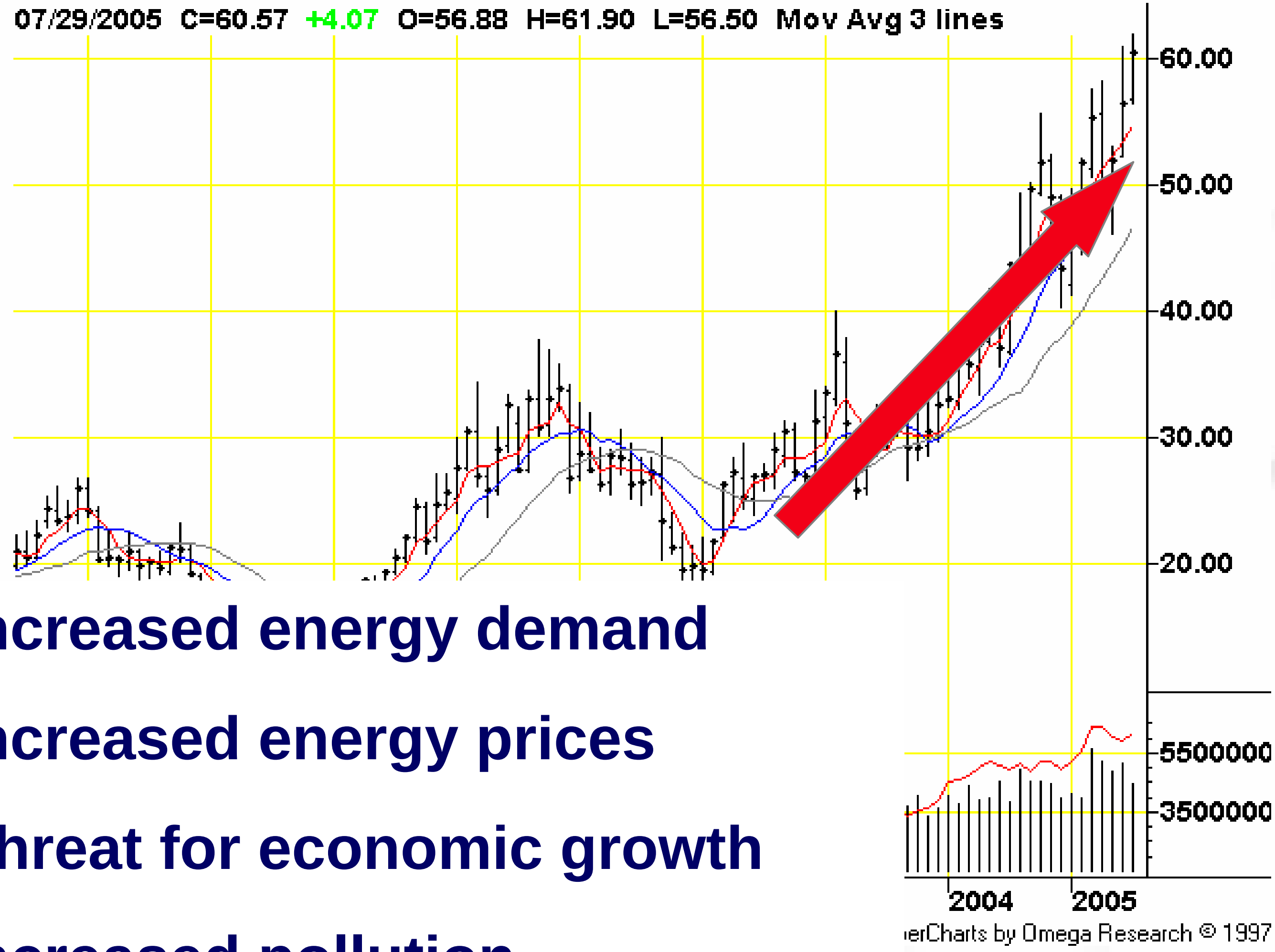
The problem we all have in common



- Increased energy demand
- Increased energy prices
- Threat for economic growth
- Increased pollution

In heating our houses we are far not so sensitive to energy prices.

Car Liter/100 km	House kWh/m²a	House Liter/m²a	
20	200	20	Old building
8-10	80-100	8-10	Building regulations
3-5	30-50	3-5	Low-energy house
1,5	15	1,5	Passive house/ Multi-Comfort-House

The building regulations differ from country to country.

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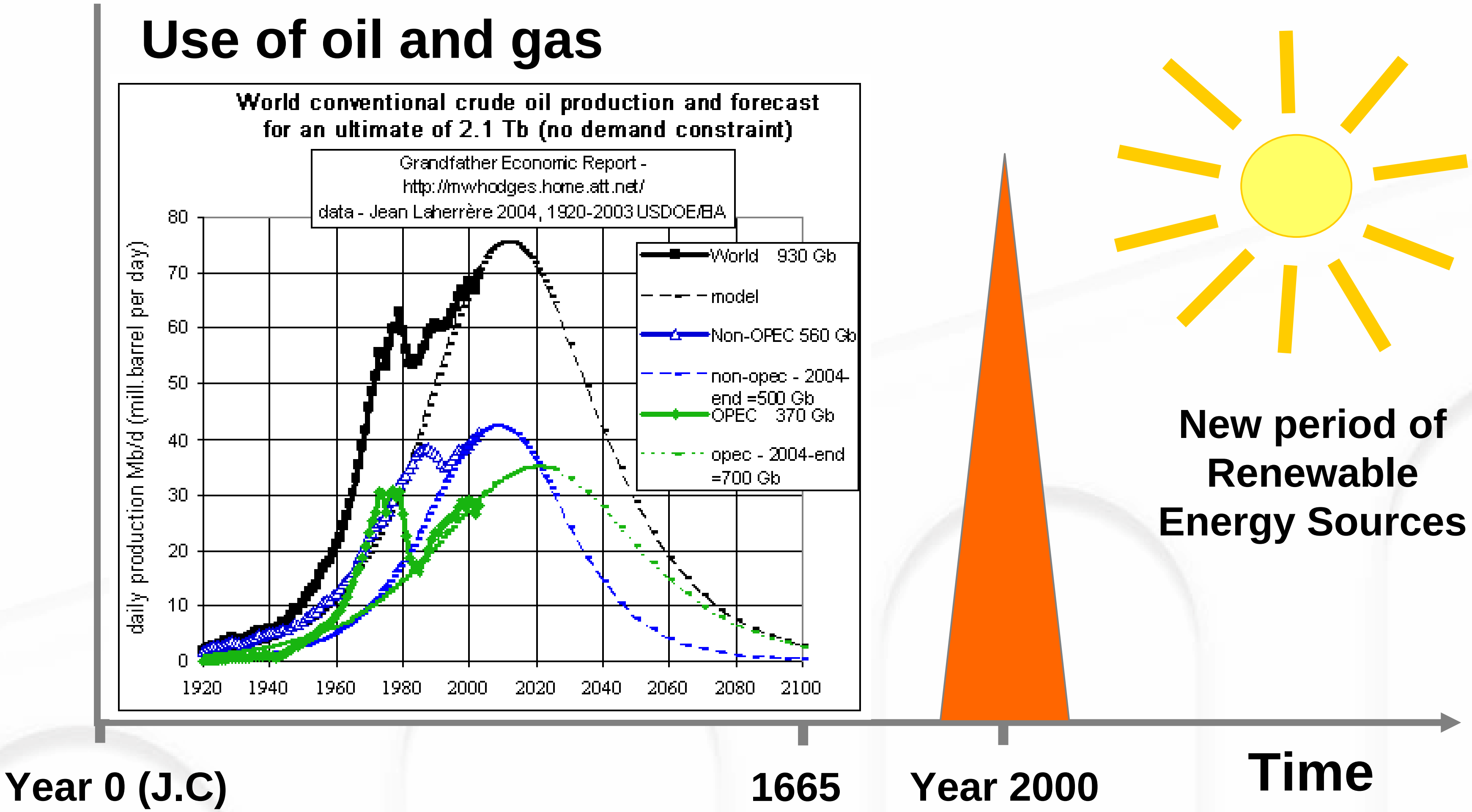
The period of using fossil energy is very short



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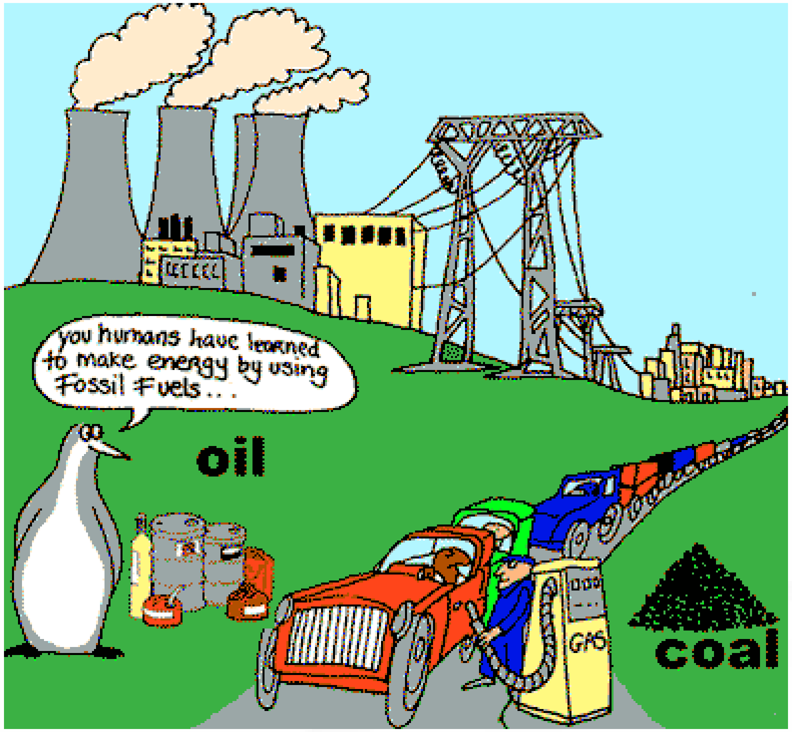
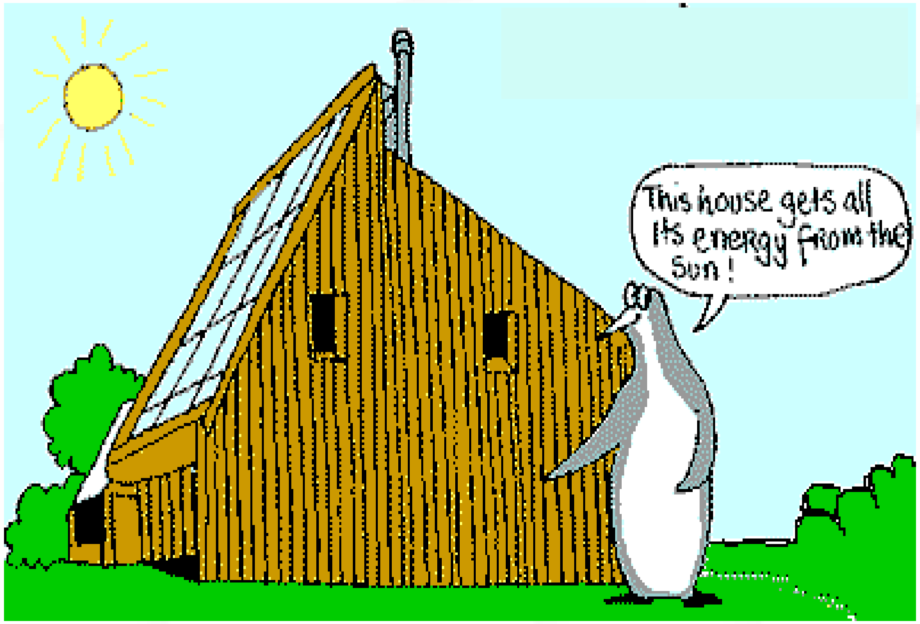
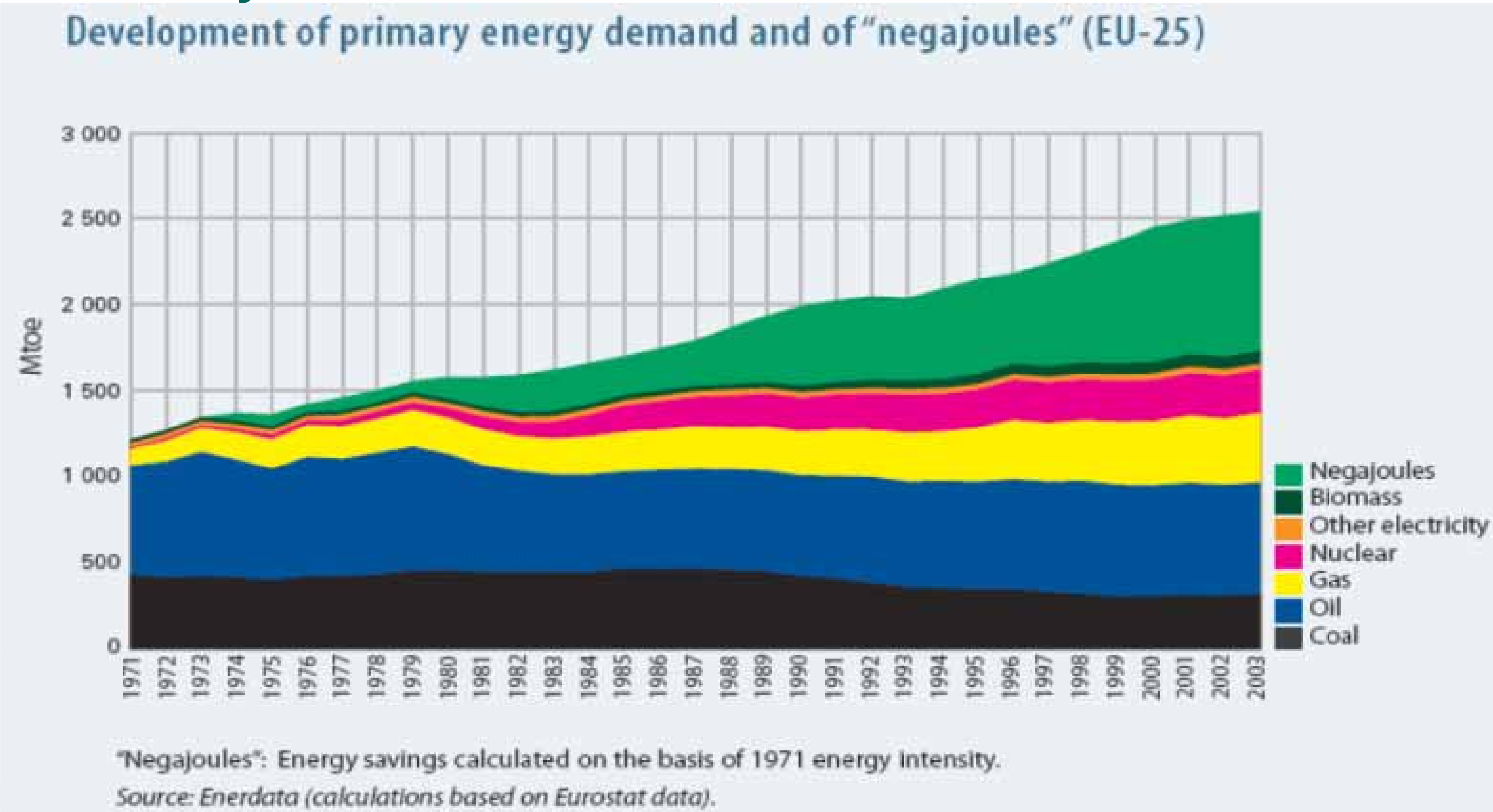


The step towards energy security



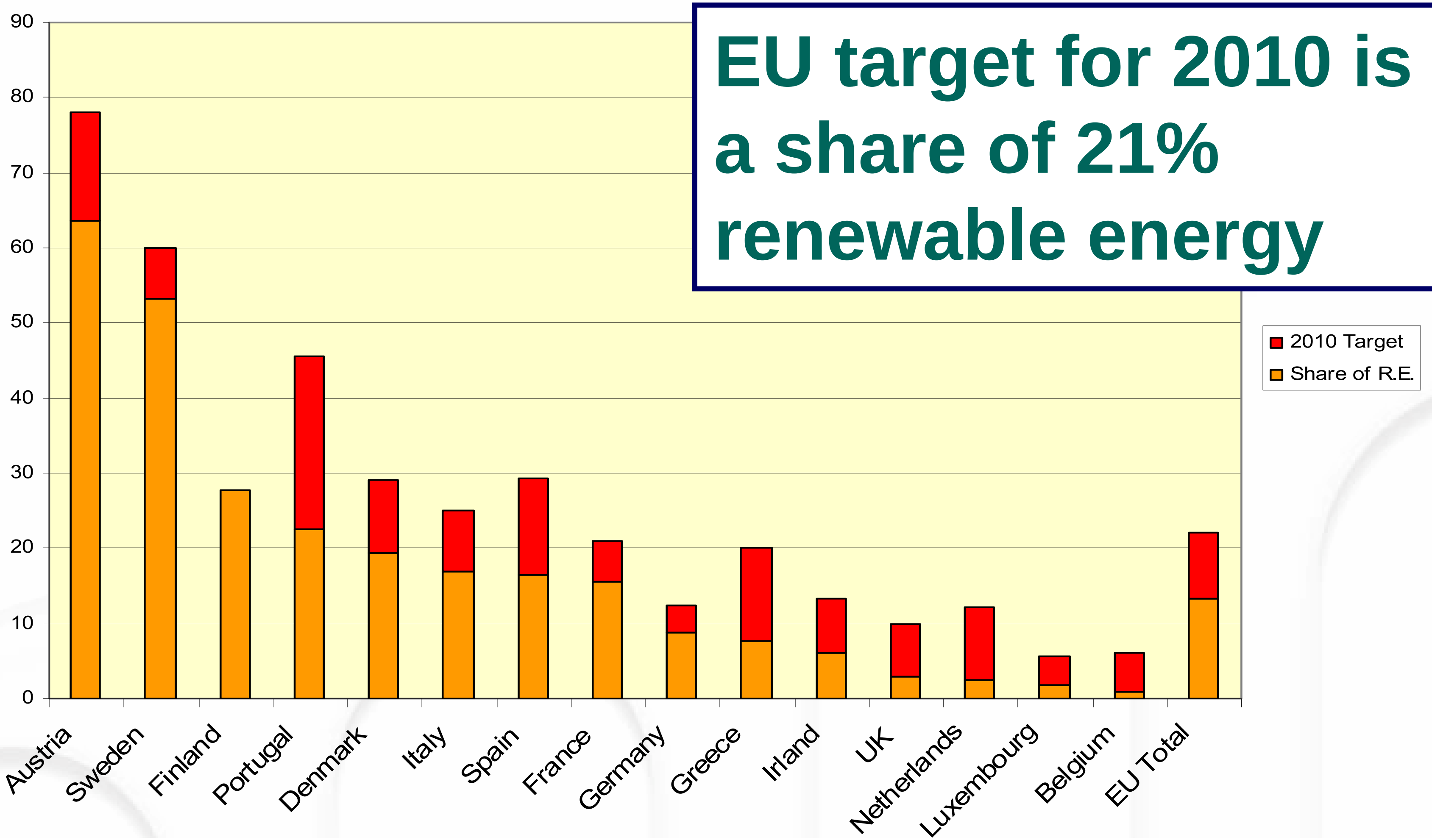
The cheapest energy
is the energy not used

“Making EU the most energy efficient economy in the world !”



Claude Turmes MPE, co-initiator of the intelligent Energy Europe Initiative; World sustainable Days Wels 3. Mach 2006

Share of Renewable Energy in EU countries 2003 and target for 2010



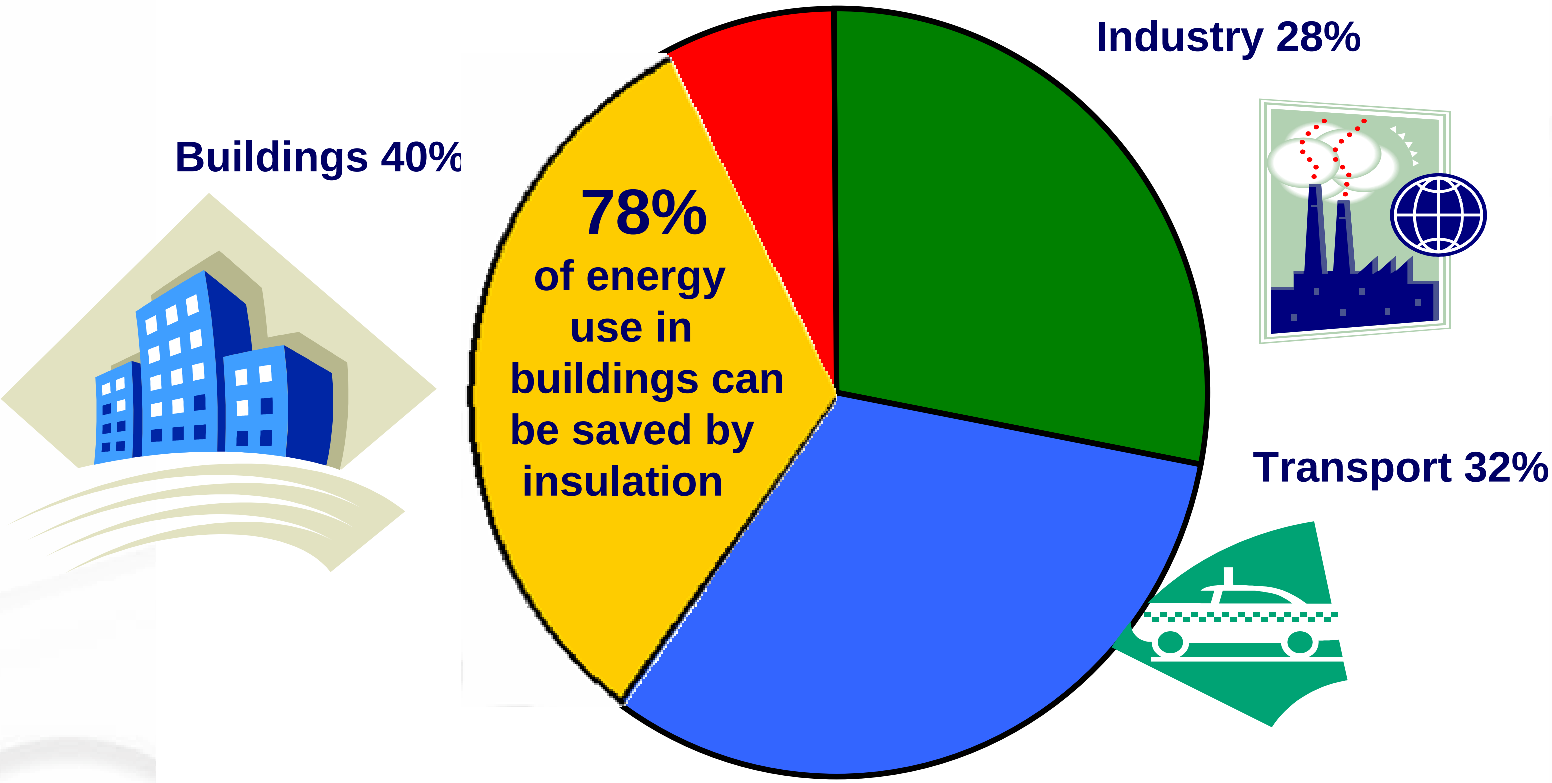
EU target for 2010 is a share of 21% renewable energy

Energy use in Europe

40% of Europe's energy is used in buildings

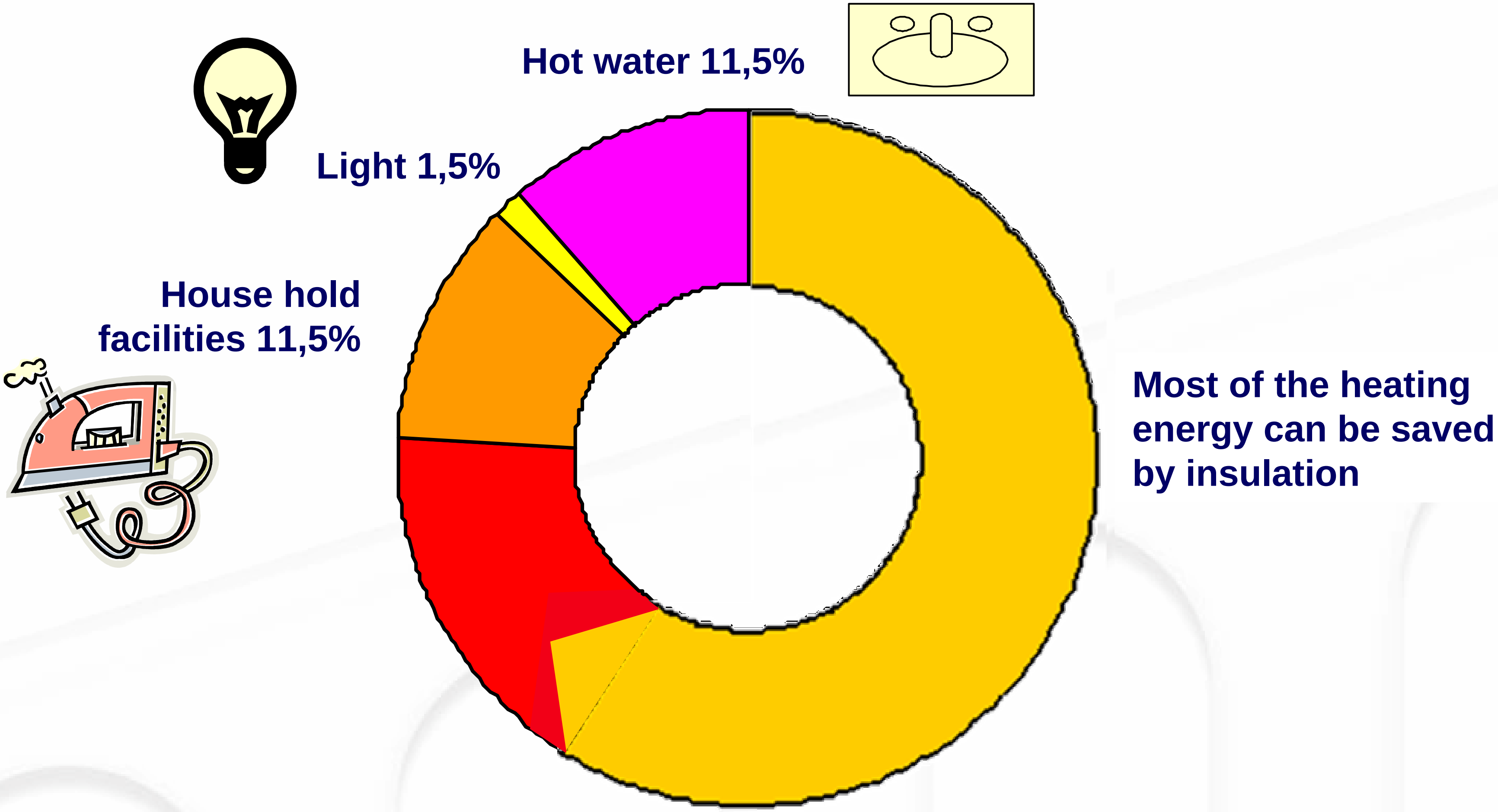
The buildings have an enormous energy-saving –potential

Insulation is by far the most important measure to reduce the energy use in buildings



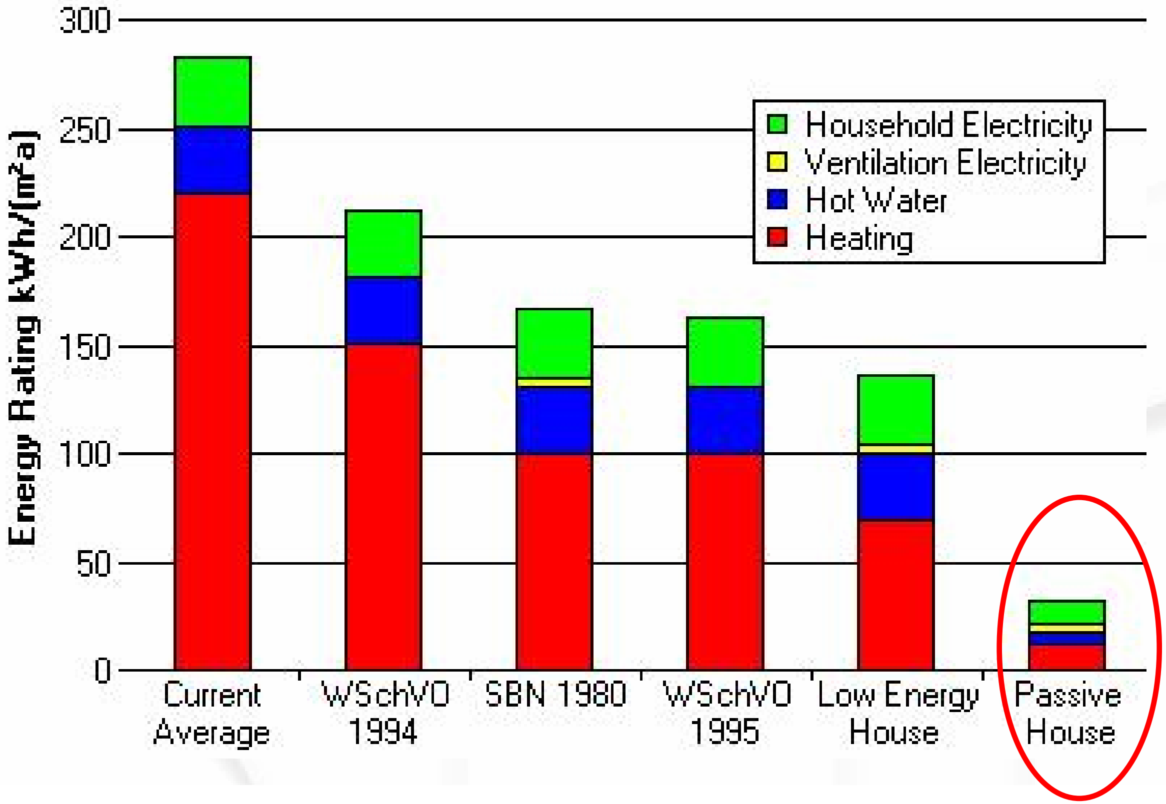
Source: EURIMA, ECOFIS-study "Mitigation of CO_2 Emissions from the Building Stock" Beyond the EU Directive on the Energy Performance of Buildings

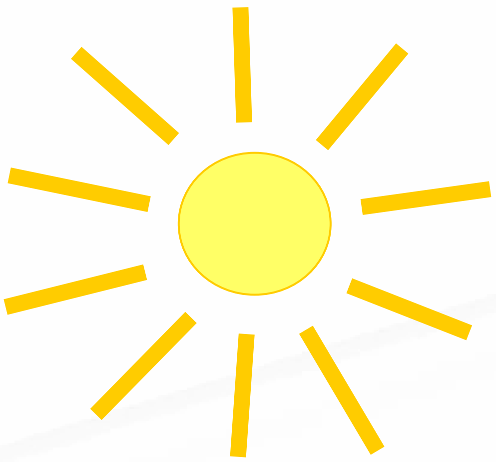
Energy consumption of a private household in Germany



Final energy consuption 2002; Electricity, oil, gas, coal, etc
Source: VDEW 2002

Passive House means independency in energy





Renewable Energy Sources

Passive Houses can easily work with 100% renewable energy.

The way to autonomy in energy.

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Comfort Energy Efficient Houses without active heating

Photo: CRIR

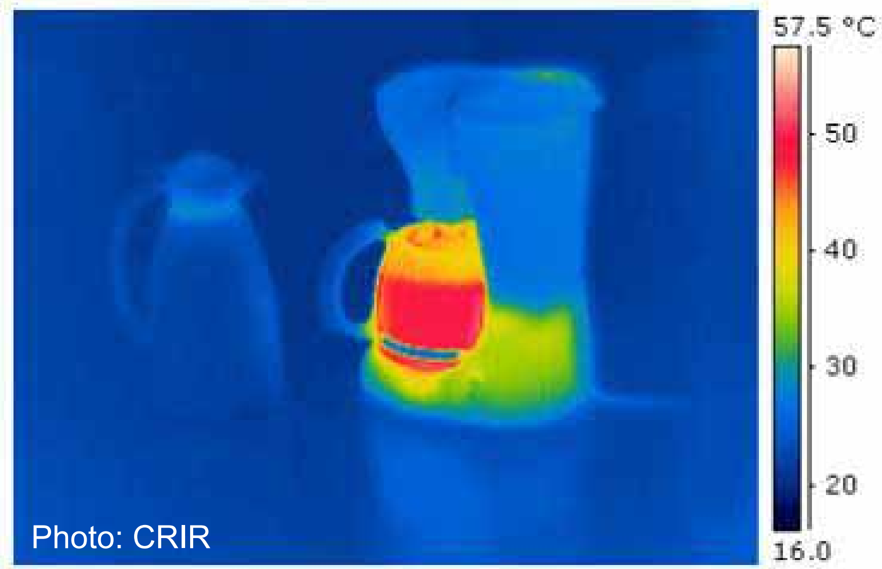


Photo: CRIR

Passive:
Keep it warm trough insulation

Active:
Keep it warm by heating with energy

Passive:
Keep it warm trough insulation

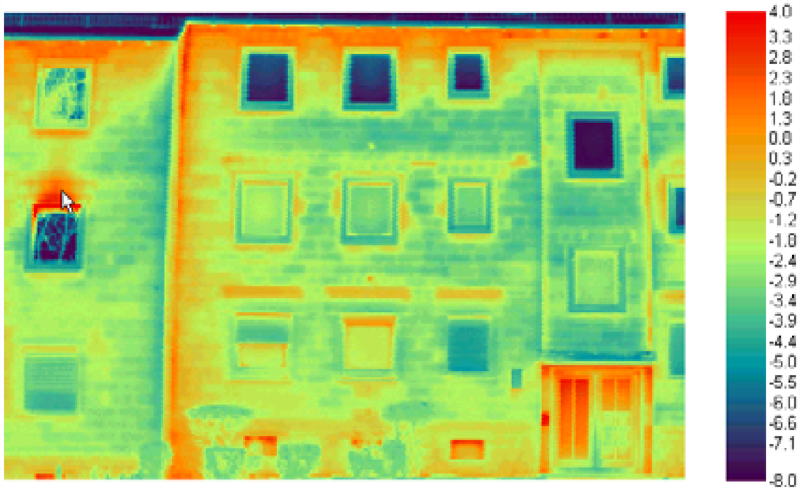
Active:
Keep it warm by heating with energy

Low tech –
low maintenance

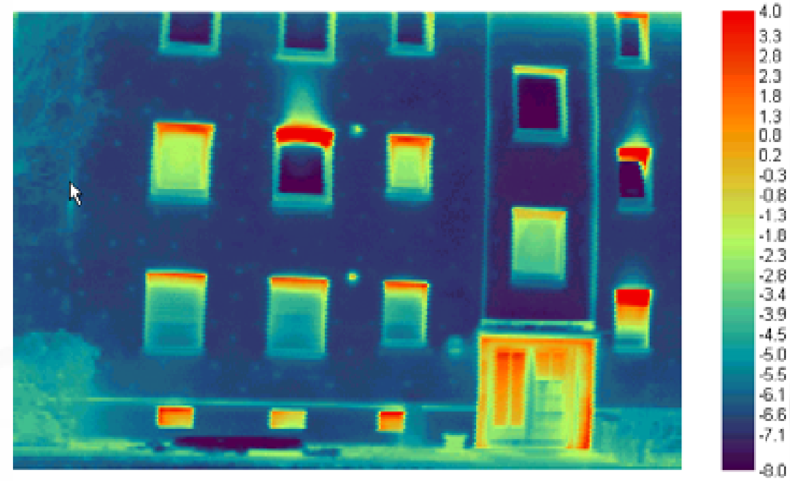
A well insulated
house is not visible

Renovation of a multi family house

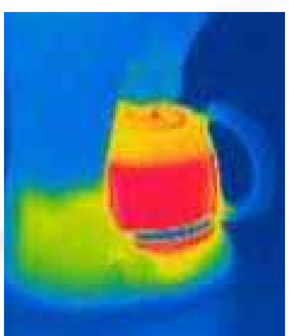
ISOVER



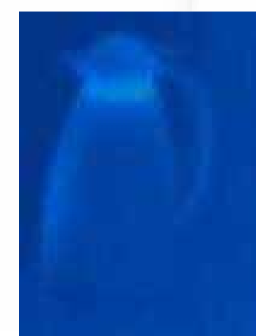
Before renovation heating the environment



After insulation, only the windows and door makes problems



From active heating to passive through insulation



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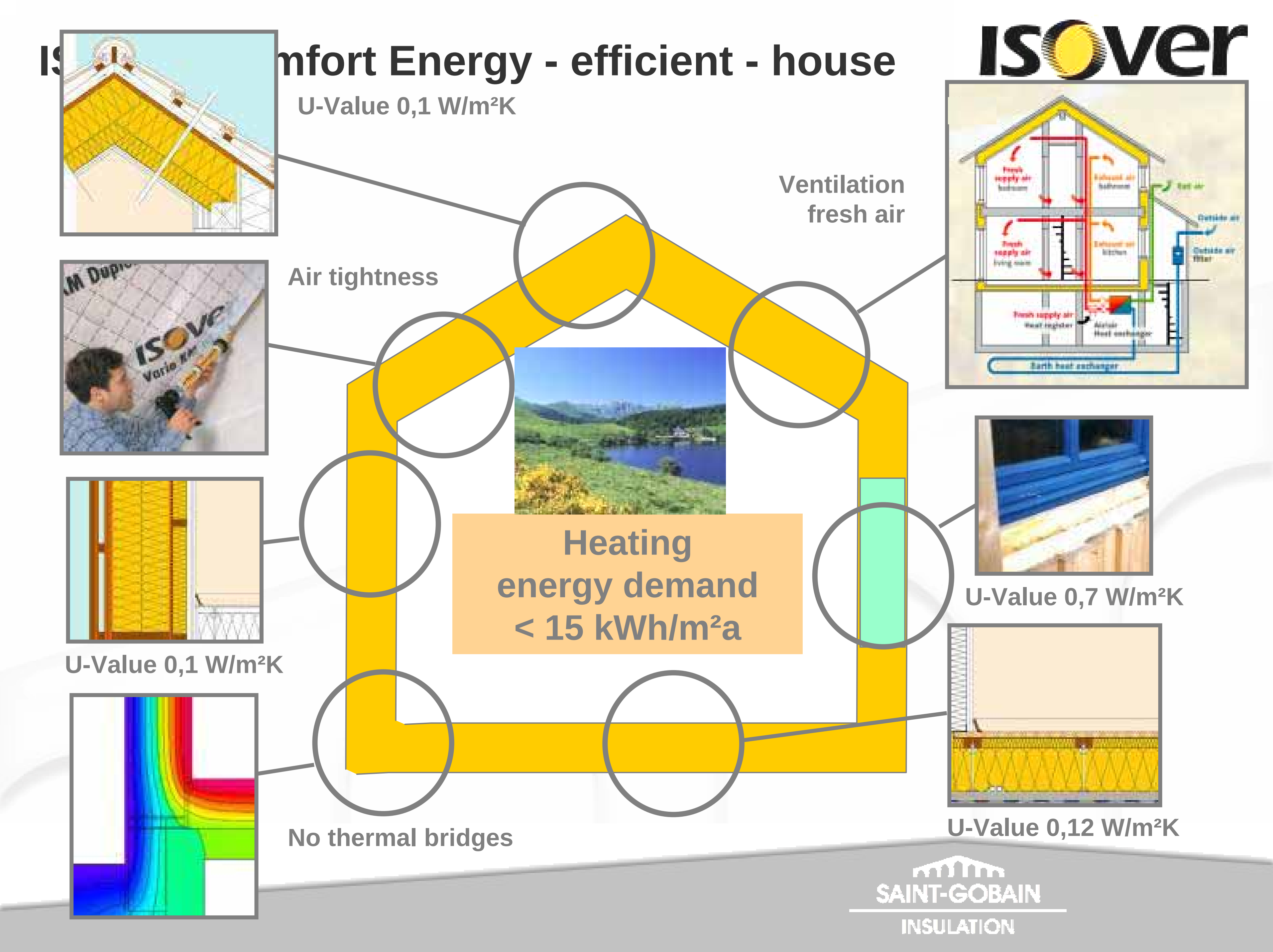
IS
mfort Energy - efficient - house
ISOVER
U-Value 0,1 W/m²K
Ventilation
fresh air
Air tightness
Heating
energy demand
< 15 kWh/m²a
U-Value 0,7 W/m²K
U-Value 0,1 W/m²K
U-Value 0,12 W/m²K
No thermal bridges
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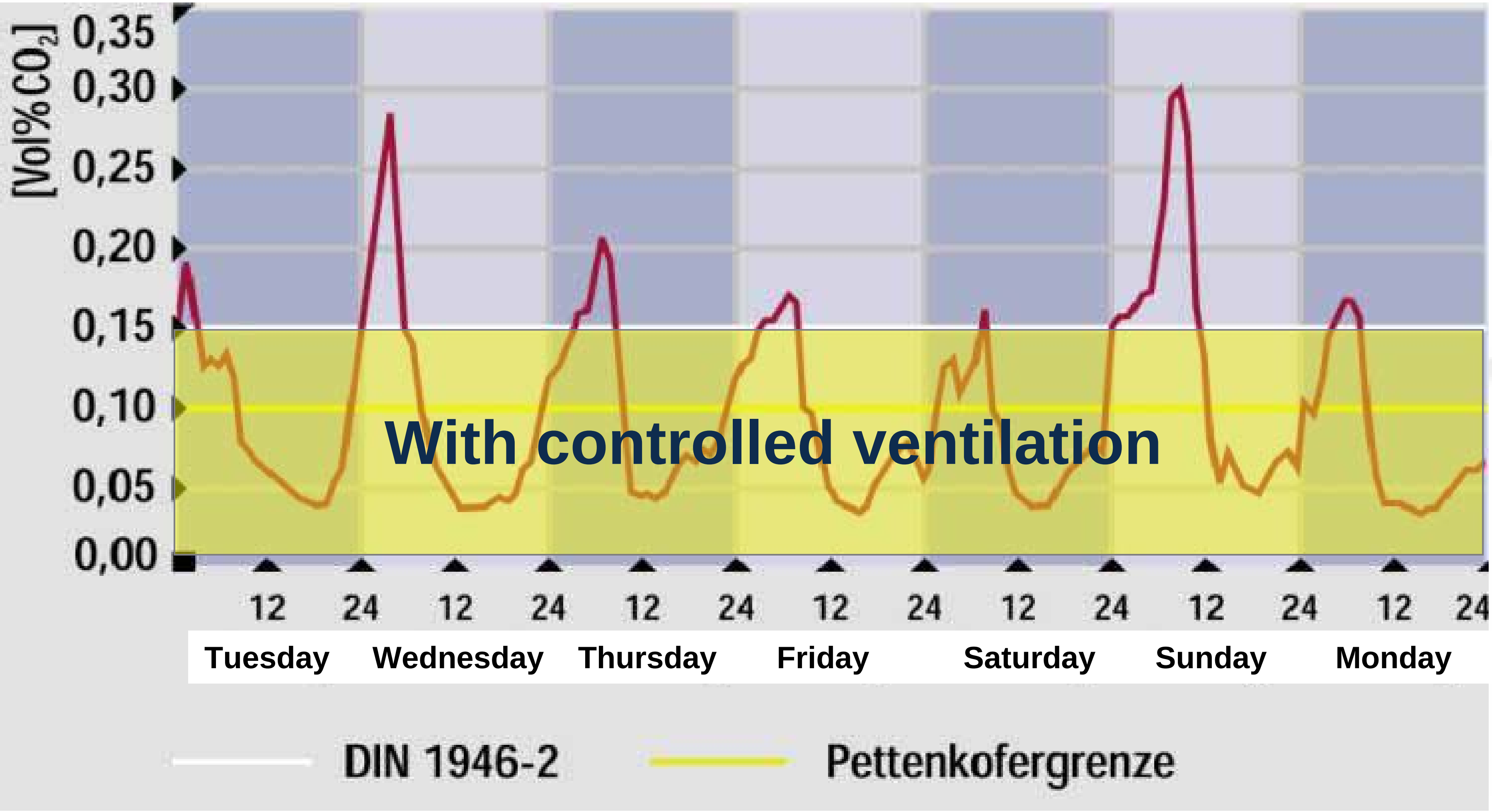
Always fresh air in an Isover Multi-Comfort-House

CO2-concentration in sleeping room



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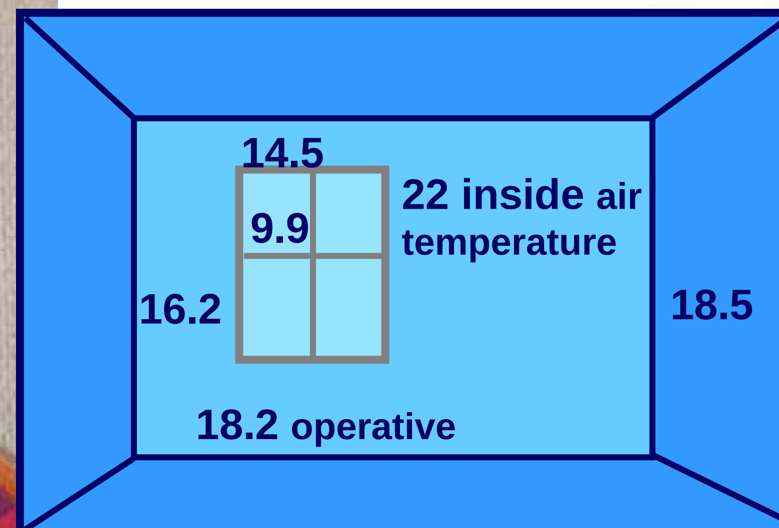
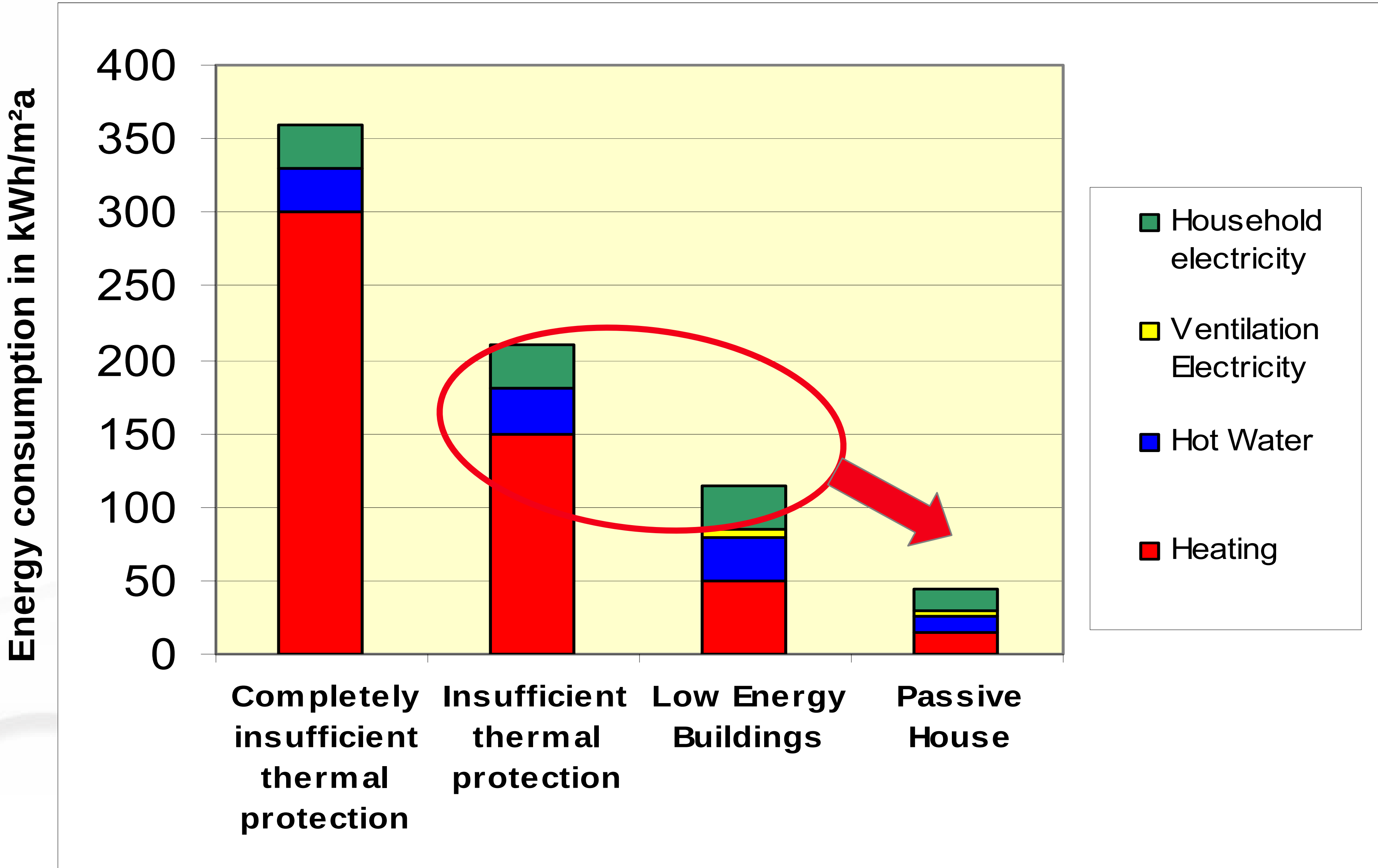
Thermal comfort

Old building



-10°C outside air temperature

Comparison of Buildings I



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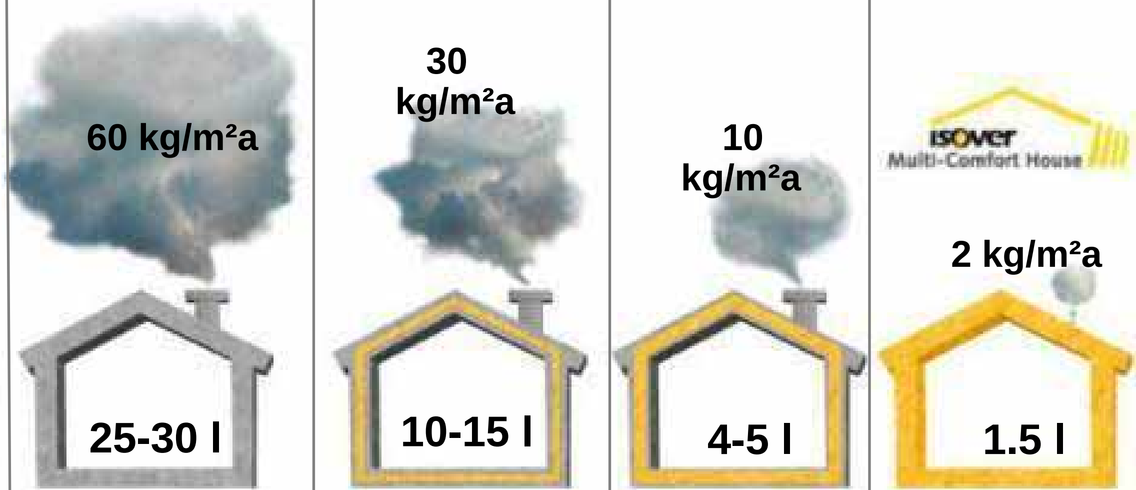
	Heat energy demand Gross floor area (HED_{GFA}) in kWh/m²a for a characteristic length of 1m	**kWh/m²a** **300-250**	**kWh/m²a** **150-100**	**kWh/m²a** **50-40**	**kWh/m²a** **≤ 15**
	Heating degree days (HDD) = 3400 K·d **CO_2 emission** **Energy consumption in liters heating oil per square meter and year**	 **60 kg/m²a** **25-30 l**	**30 kg/m²a** **10-15 l**	**10 kg/m²a** **4-5 l**	ISOVER Multi-Comfort House **2 kg/m²a** **1.5 l**
	Energy consumption in liters heating oil and yearh house 100m2	**3000-2500 liters**	**1500-1000 liters**	**400-500 liters**	**150 liters**
Annual heating cost **€**	 **30 $ /barrel** **60 $/barrel**	**950-1150** **1600- 2000**	**400-600** **650-1000**	**150-200** **250-320**	**60** **100**

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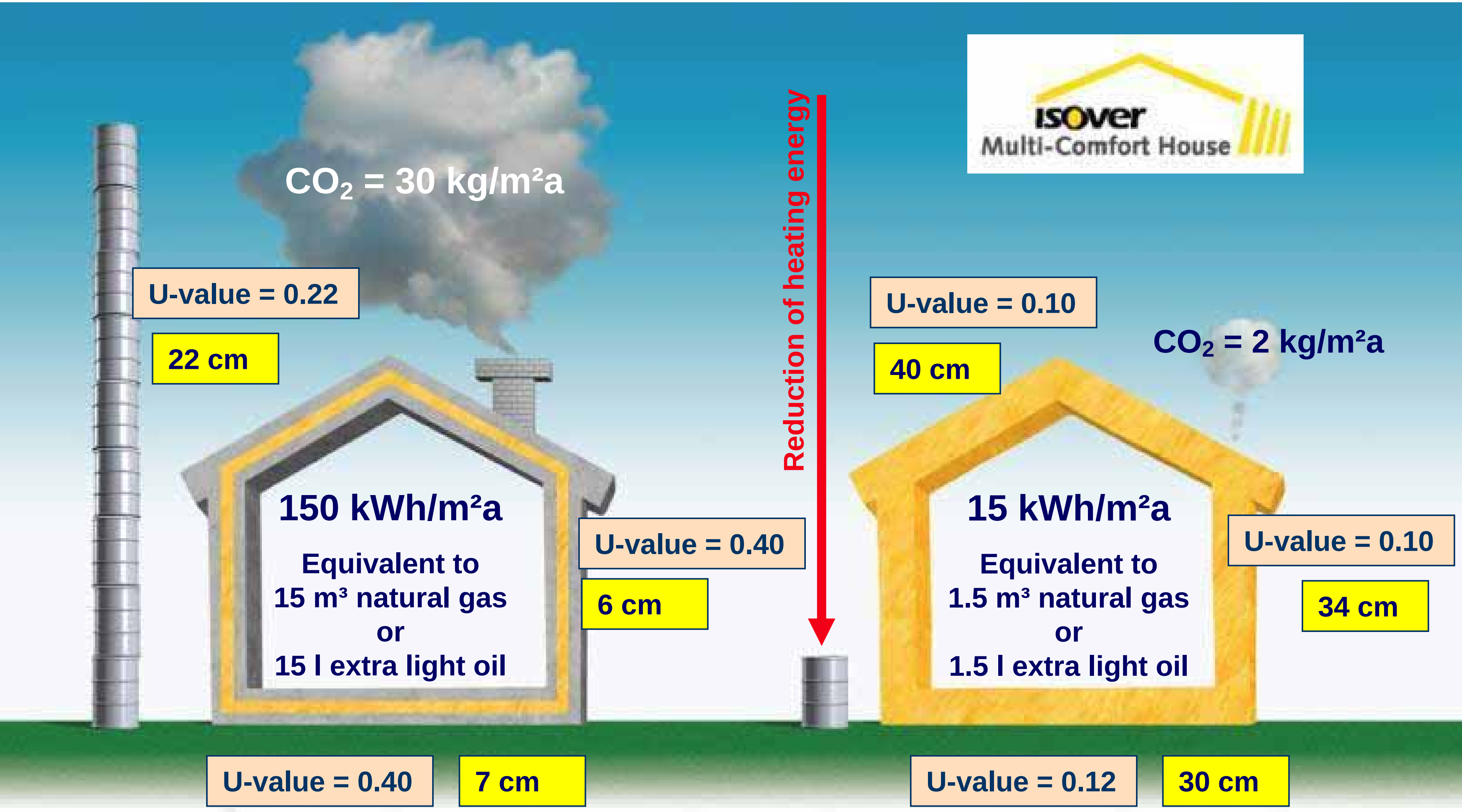
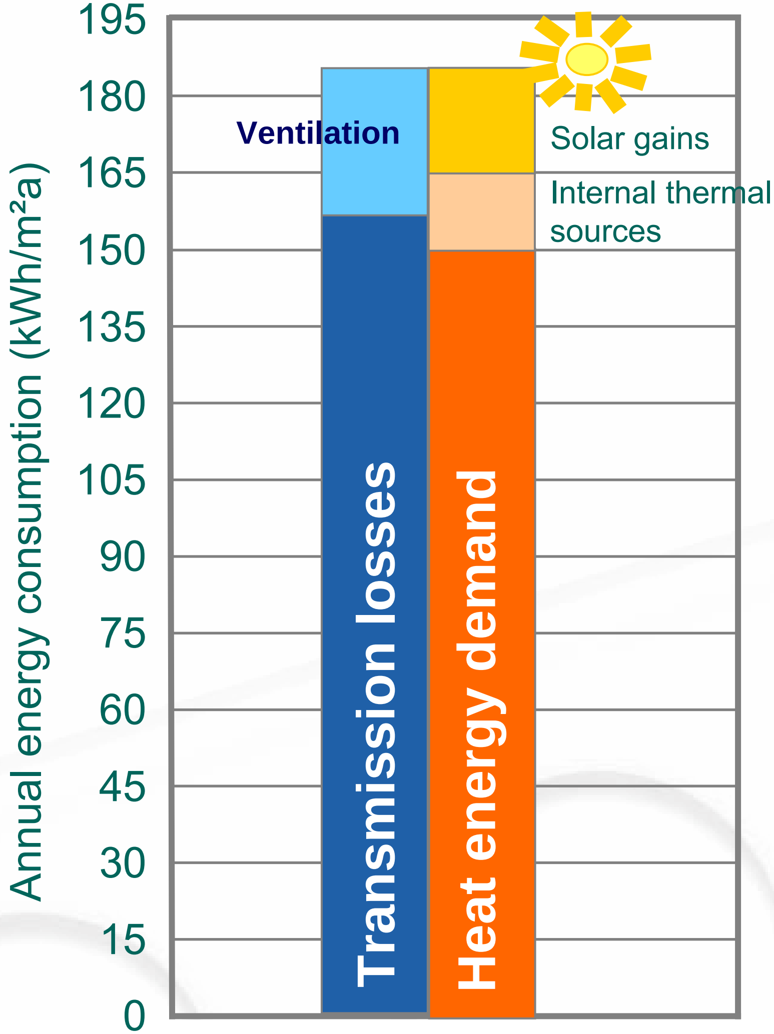
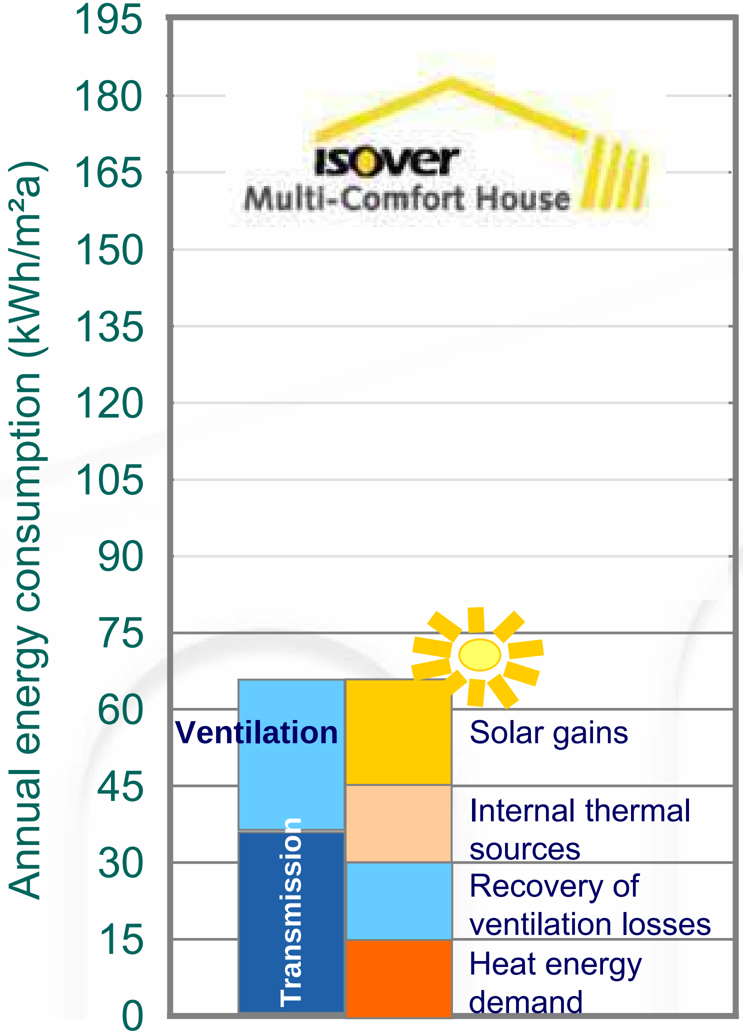
The objective of market motivation

ISOVER



Schematic description of the past and future net energy demand of a single-family house





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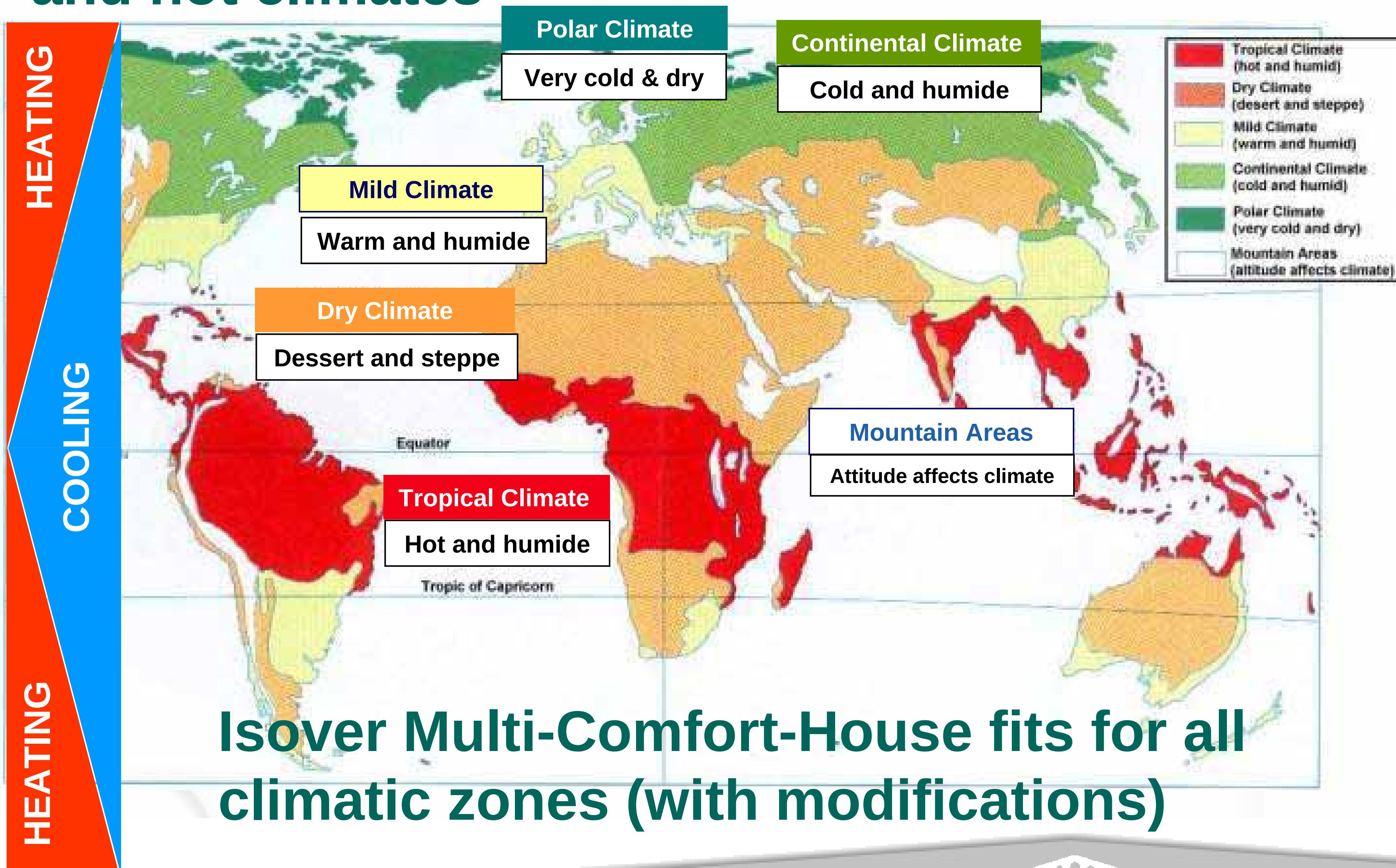
Isover Multi-Comfort-House for cold and hot climates



Isover Multi-Comfort-House fits for all climatic zones (with modifications)

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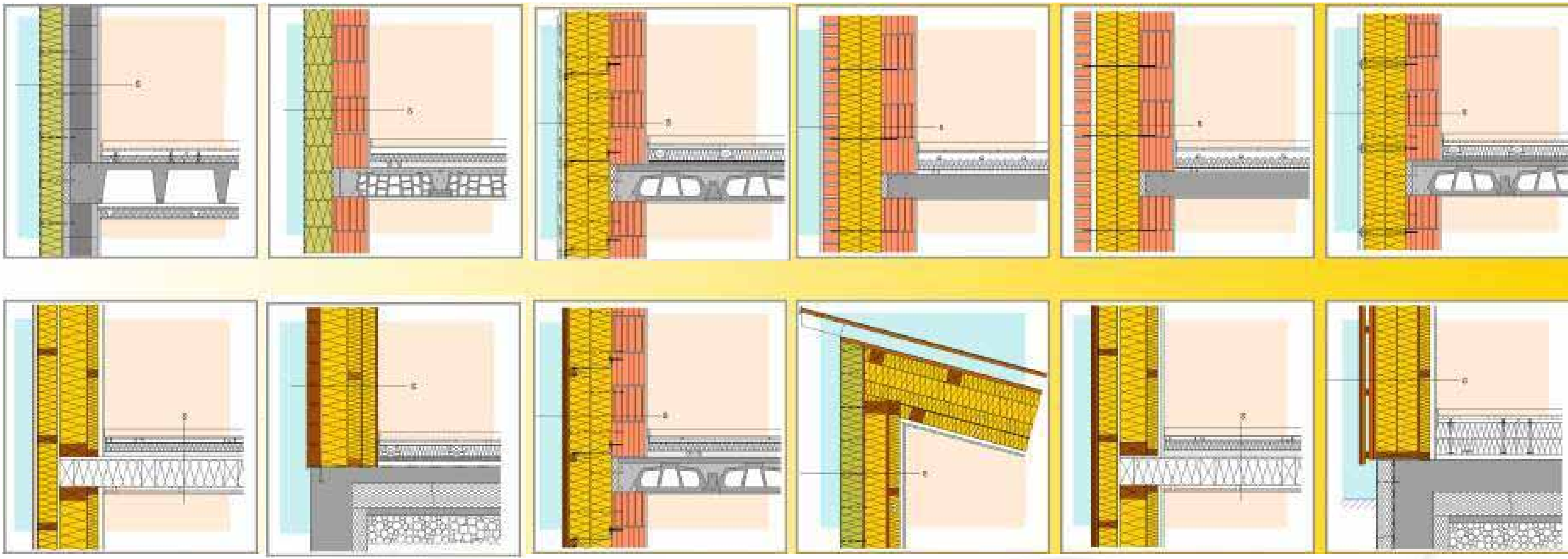
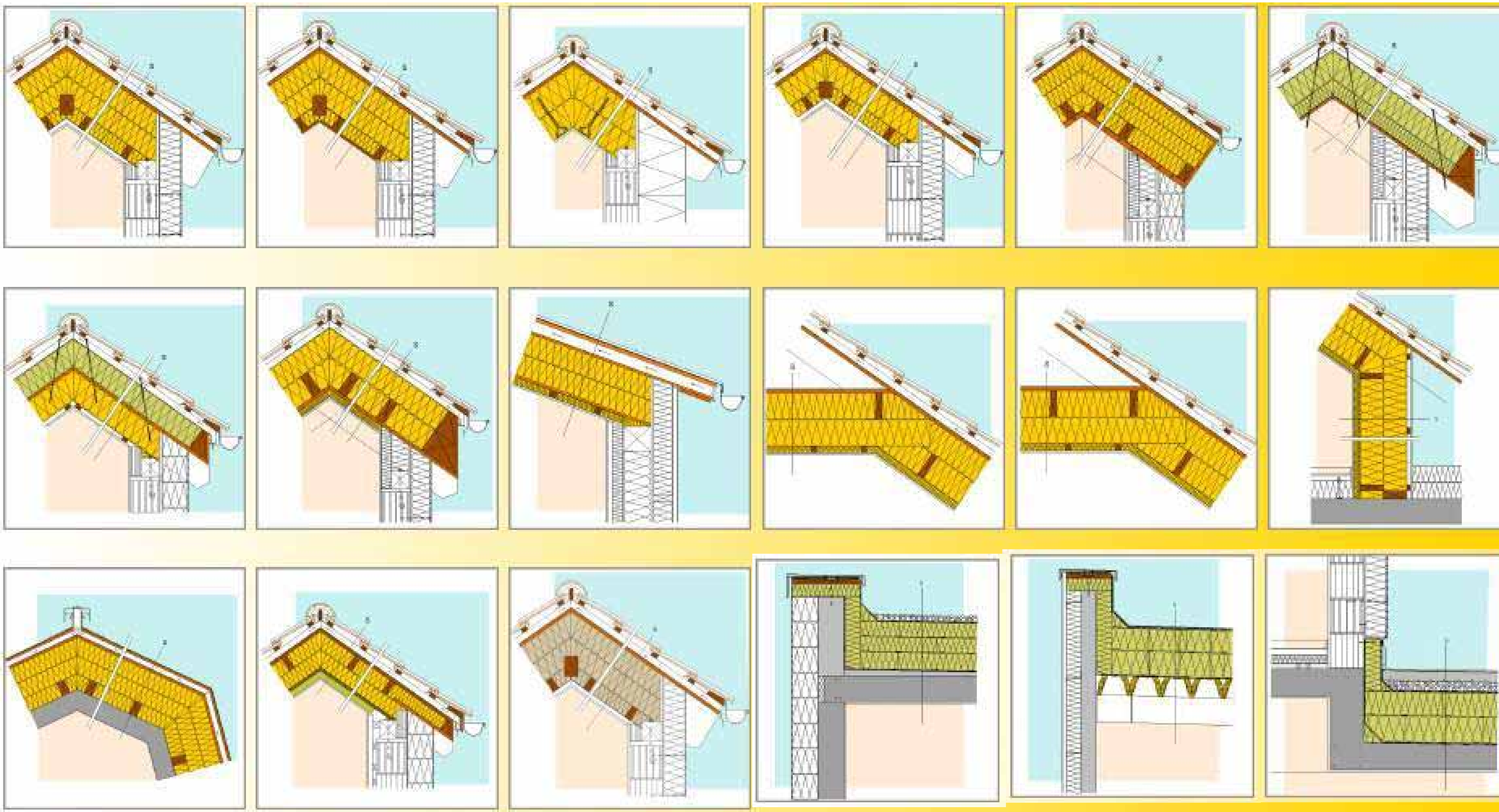
The high energy consumption is part of the planning and culture

To improve thermal comfort energy consumption turns excessive !

Outer Walls



Roofs



Energy autarchy for buildings

House in Austrian Alps at an altitude of 2150 m.
Heating energy demand 12.9 kWh/m²a

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Renovation of a Multi storey 50 apartment house in Linz/Upper-Austria

Thermal insulation of exterior wall for full comfort and less heating costs for 50 apartments on an total surface of 3.100m² on five floors.

Comfort ventilation system

Improved noise control

Linz, Makartstraße;
build 1957/58

	Before renovation	After renovation
Heating energy demand	179 kWh/m²year	14.4 kWh/m²year
Monthly heating cost per apartment 59m²	€ 40.8	€ 4.73
Annual CO_2 emission of total house	160.000 kg	18.000 kg

Renovation of a Multi storey 50 apartment house in Linz/Upper-Austria

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Renovation of a Multi storey 50 apartment house in Linz/Upper-Austria

Thermal insulation of exterior wall in prefabricated wooden construction entirely filled with Isover glass wool (Holzrahmenfilz HRF)

DI Ingrid Domenig-Meisinger, Arch+More ZT GmbH
Linz-Velden, Haseneck 7, 4048 Puchenau/Linz

Renovation of a school in Upper Austria

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Single family house in Pettenbach/Upper-Austria

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Single family house in Pettenbach/Upper-Austria

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Single family house in Pettenbach/Upper-Austria

Exterior Wall	0,10 W/m²K
Roof	0,09 W/m²K
Ceiling/Cellar	0,13 W/m²K
Window Glass	0,60 W/m²K
Windows total	0,77 W/m²K

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Single family house in Pettenbach/Upper-Austria

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Single family house in Pettenbach/Upper-Austria

Thermal insulation of exterior wall including photo voltaic panels for own electricity production

The renovation and the extension of first floor was made with prefabricated wooden frame elements

build 1960

	Before renovation	After renovation
Annual heating cost of the whole house	€ 2.700.-	€ 200,-

Example for market growth (Austria)

Pilot period is over – commercialization !
1000 Passive houses in Austria
10.000 Passive houses in Germany!

ISOVER Multi-Comfort House

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Thank you very much !

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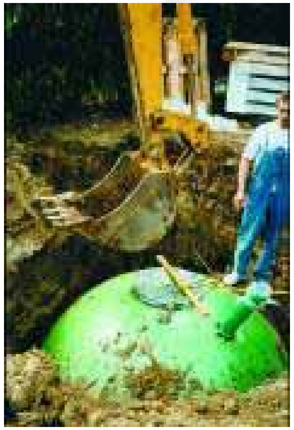
Back-up slides

Private house in Zagreb / Croatia

Renovation of Kuća Spansko in Zagreb

This data is permanent available to the public



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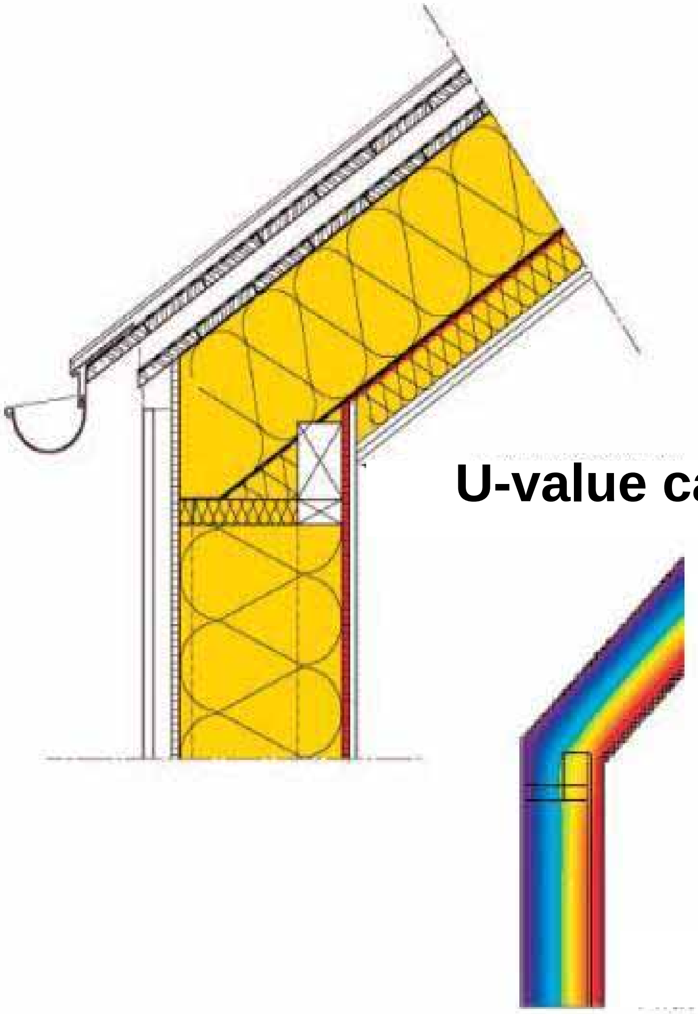
Building envelop with excellent insulation

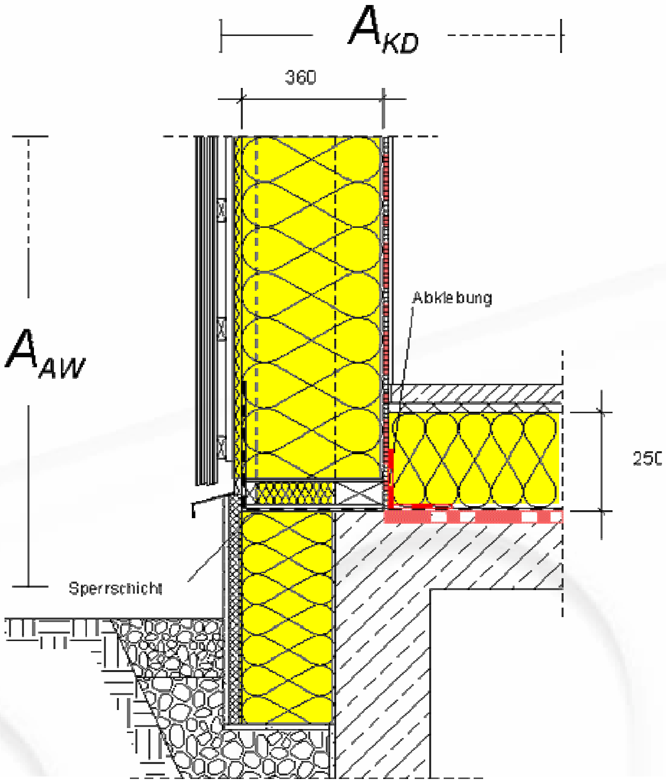


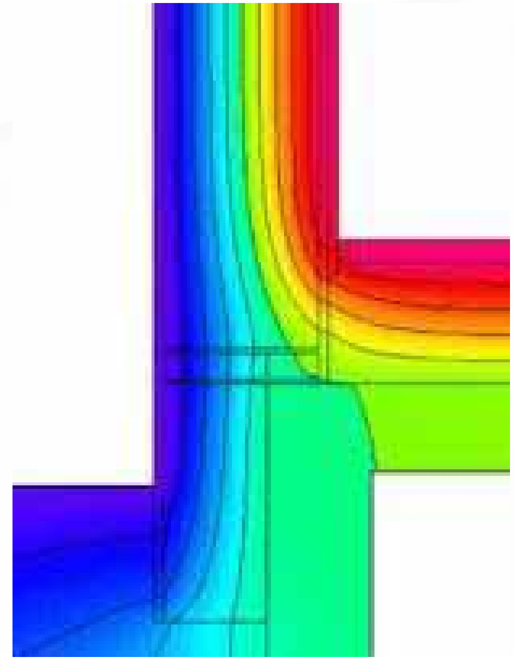
U-value ca. 0.1 W/(m²K)

Building element junctions

<u>Measure:</u> Thermal-bridge-free construction

<u>Specification:</u> Ψ (linear thermal transmittance, exterior dimensions) below 0.01 W/(mK)





Windows

Super glazing

Measure: Low-emissive triple glazing

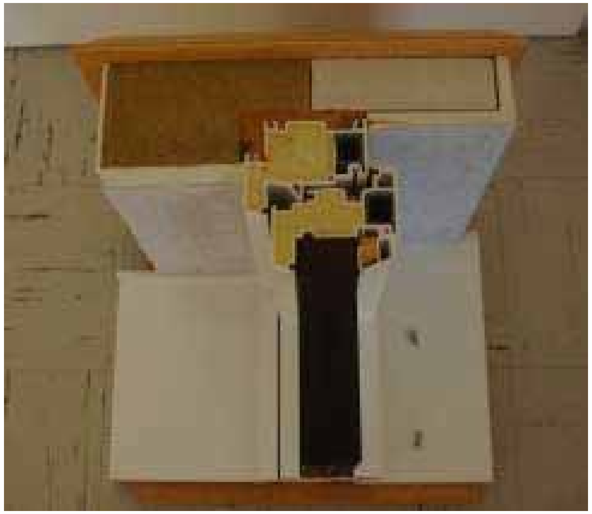
Specification: U-value $\leq$ 0.75 W/(m²K),
solar transmission factor $\geq$ 50%

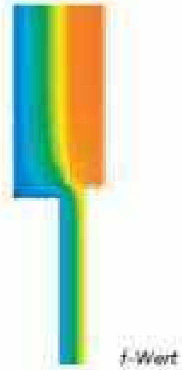
Super frames

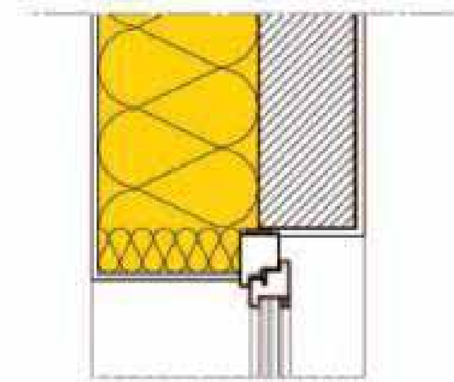
Measure: Super insulated window frames

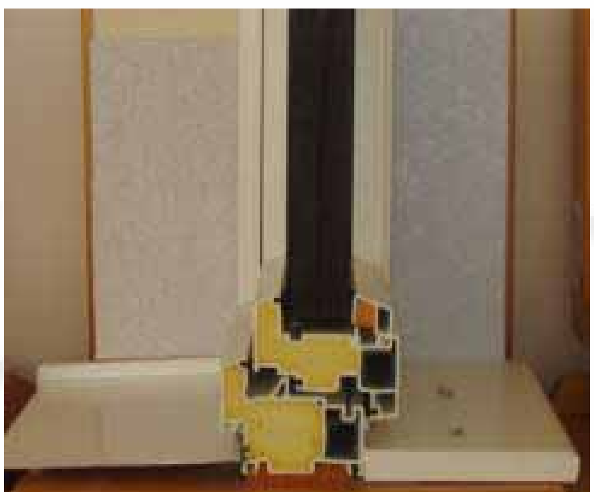
Specification: U-value $\leq$ 0.8 W/(m²K)

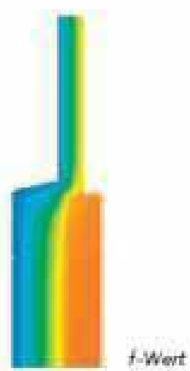
Correct installation of the window

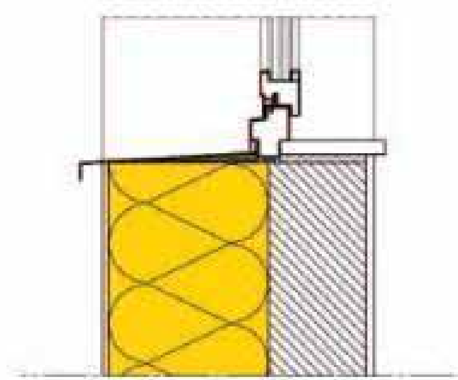












All building material producers tries to get a share of the market of Passive Houses

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50 cm brick

U-value 0.19

20 cm brick plus 20 cm EPS

U-value 0.14

40 cm Isover

U-value 0.10

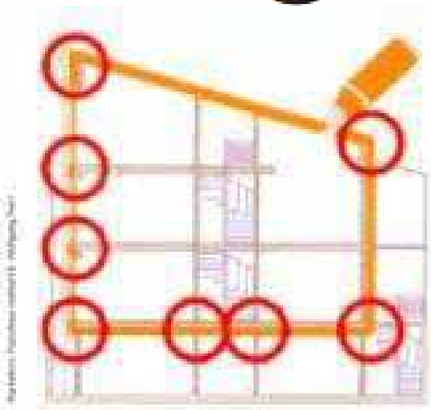
40 cm

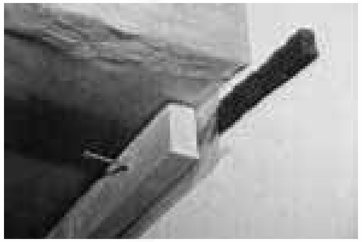
Constructions seen at Energy Saving Fair Wels 2006

Air tightness

Measure: Airtight building envelope

Specification: less than 0.6 air changes per hour at n50



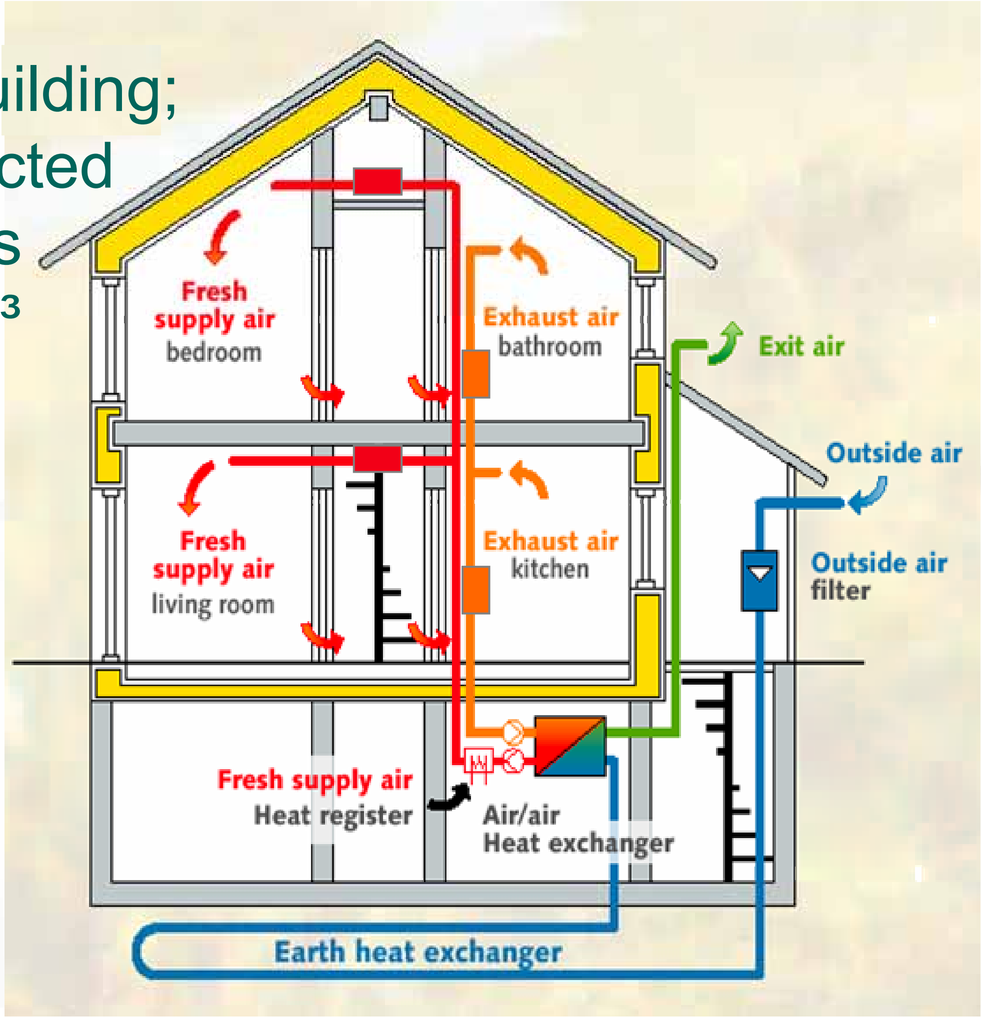


Anemometer

Hygienic ventilation

Measure: Directed air flow through whole building; exhaust air extracted from damp rooms

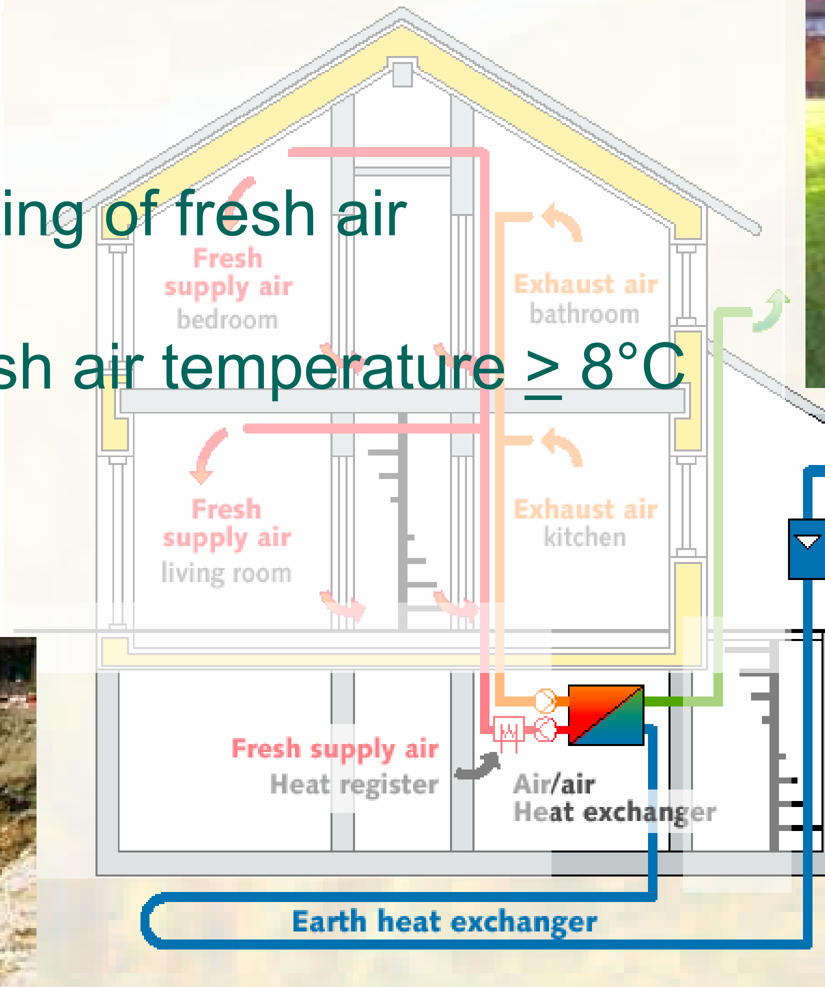
Specification: Around 30 m³ per hour and person



Subsoil heat exchanger

Measure: Preheating of fresh air

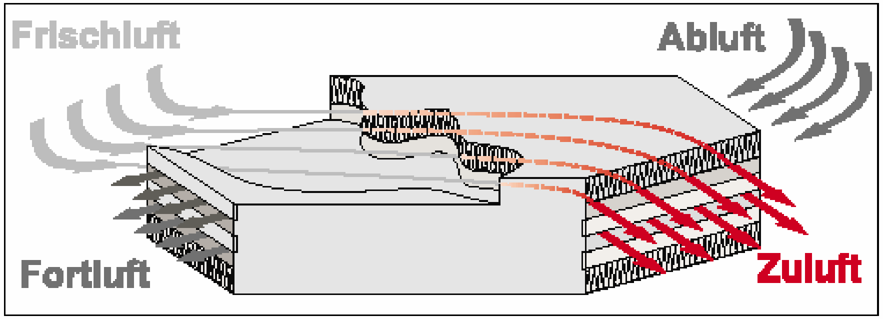
Specification: Fresh air temperature $\geq$ 8°C

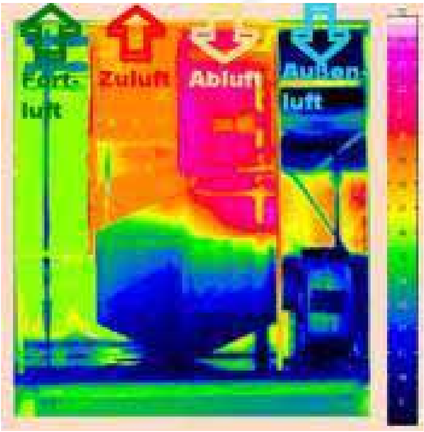


Latent heat recovery from exhaust air

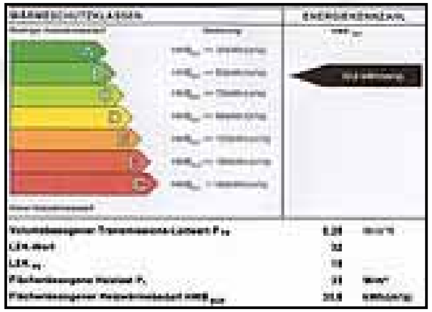
Measure: Counterflow air-to-air heat exchanger,
Compact heat pump unit

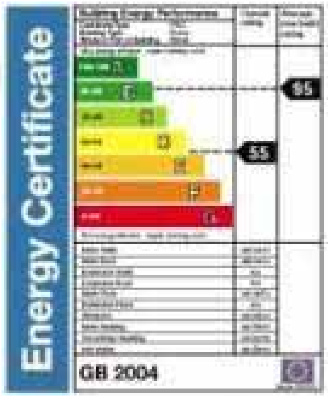
Specification: Heat transfer efficiency η ≥ 80%,
Max. heat load 10 W/m²





EBPD – European Building Performance Directive

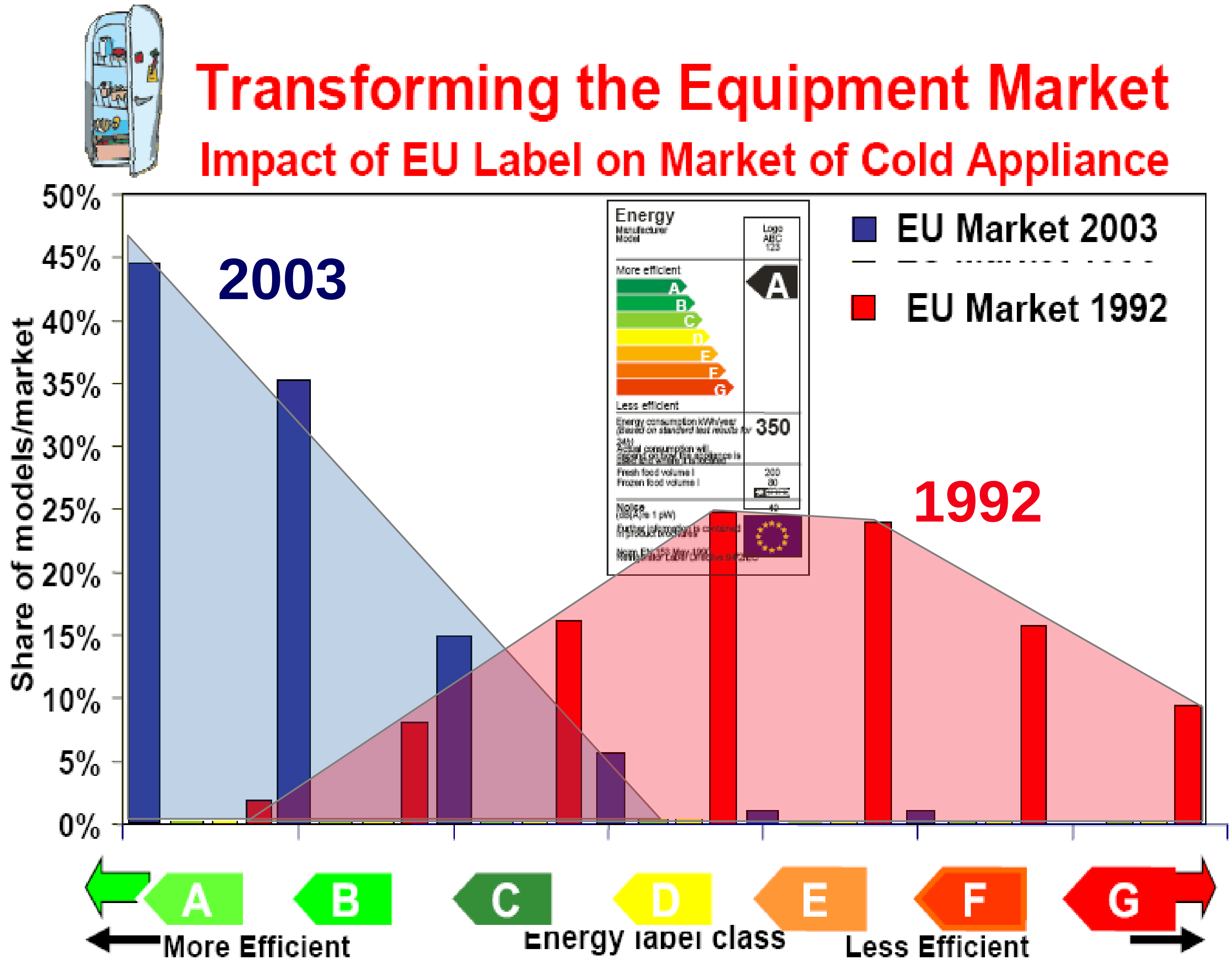




Transforming the Equipment Market

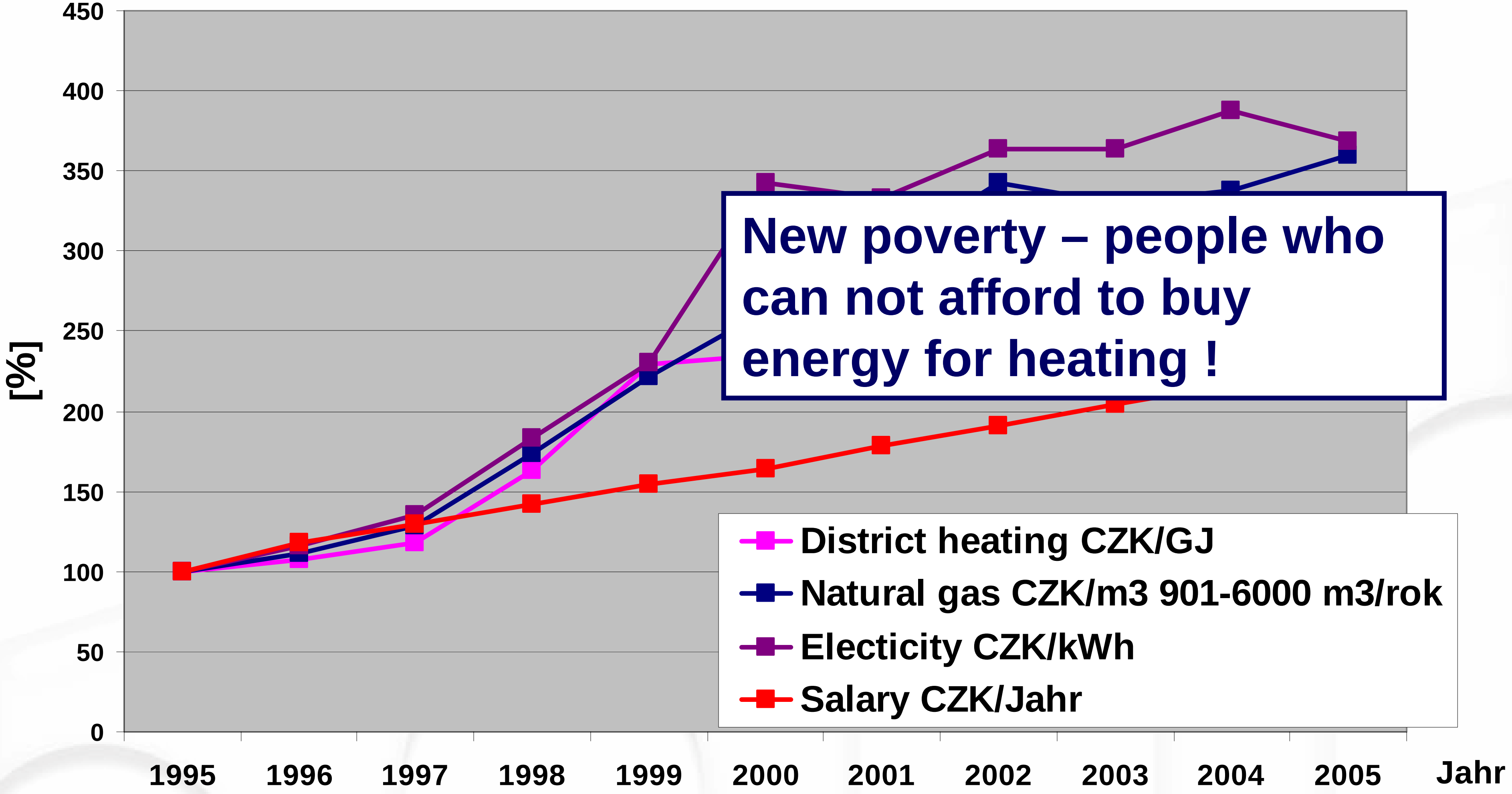
Impact of EU Label on Market of Cold Appliance

Energy Efficiency is winning (A&B class)



Benoit Lebot: UNDP-GEF, Business opportunities on global, European, national, regional & local levels. World sustainable Days Wels 3. Mach 2006

Development of average energy prices for private household in Czech Republic



Source: Ivana Klobusnikova; Energy Centre Ceske Budejovice 2006

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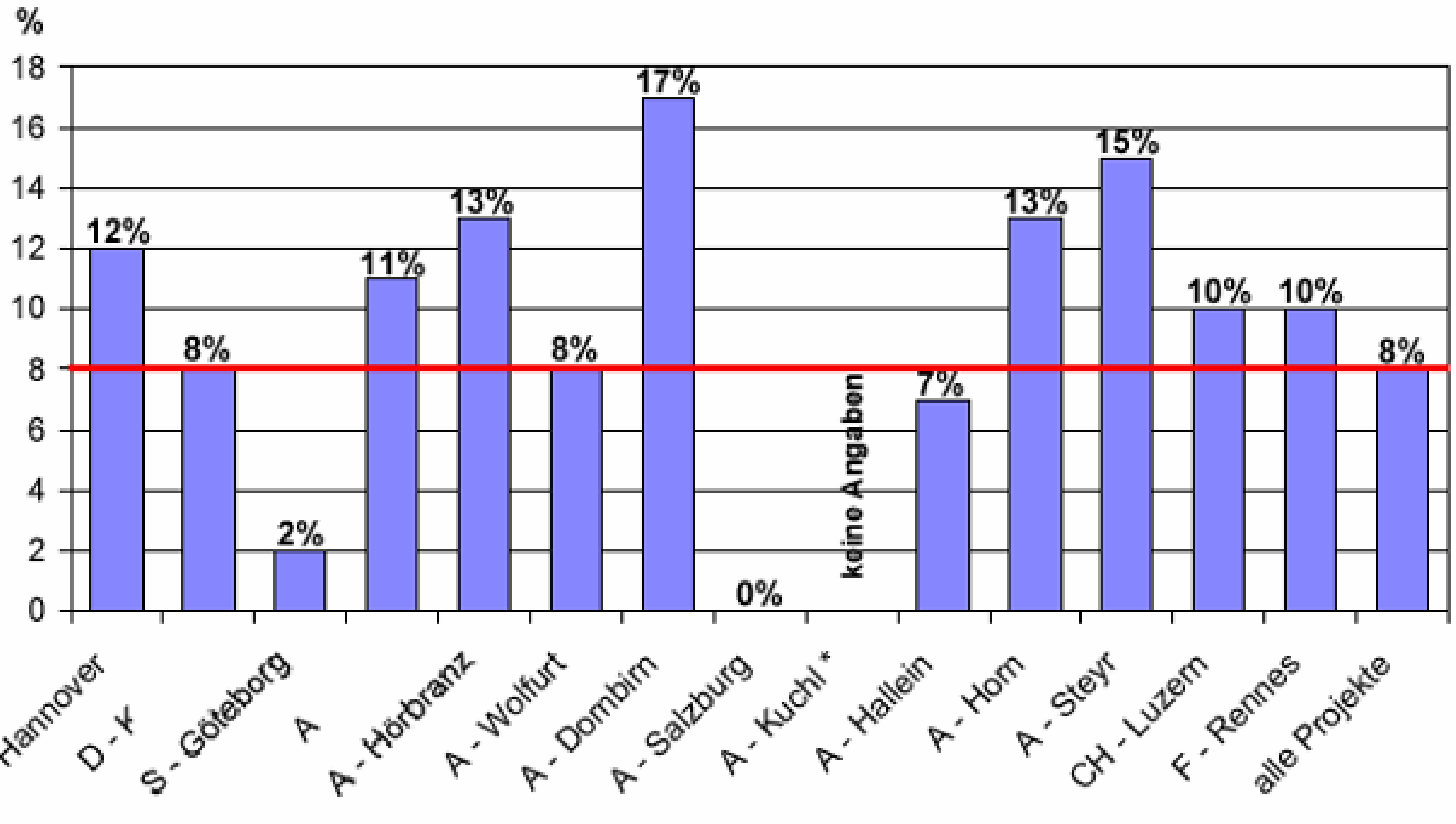
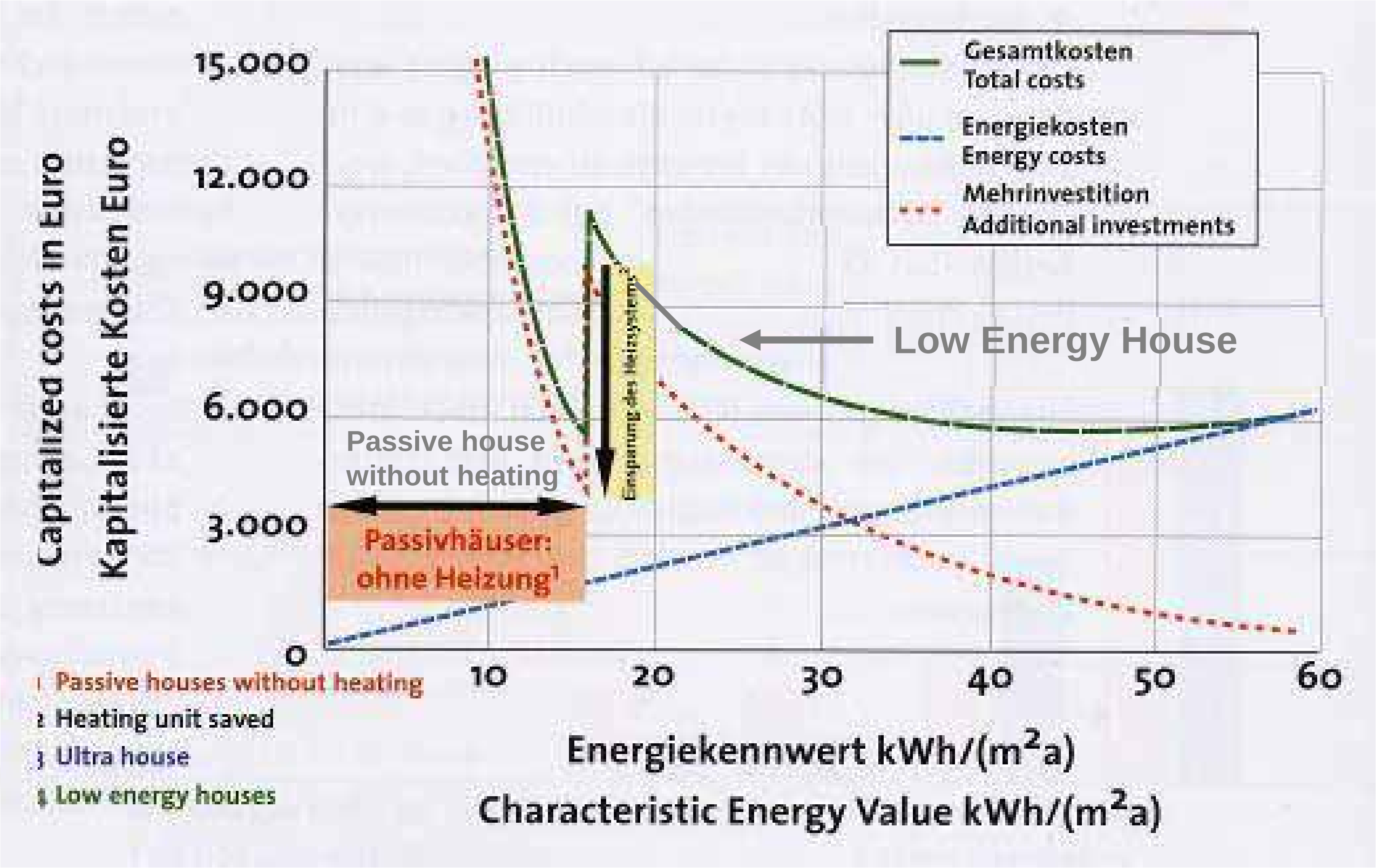
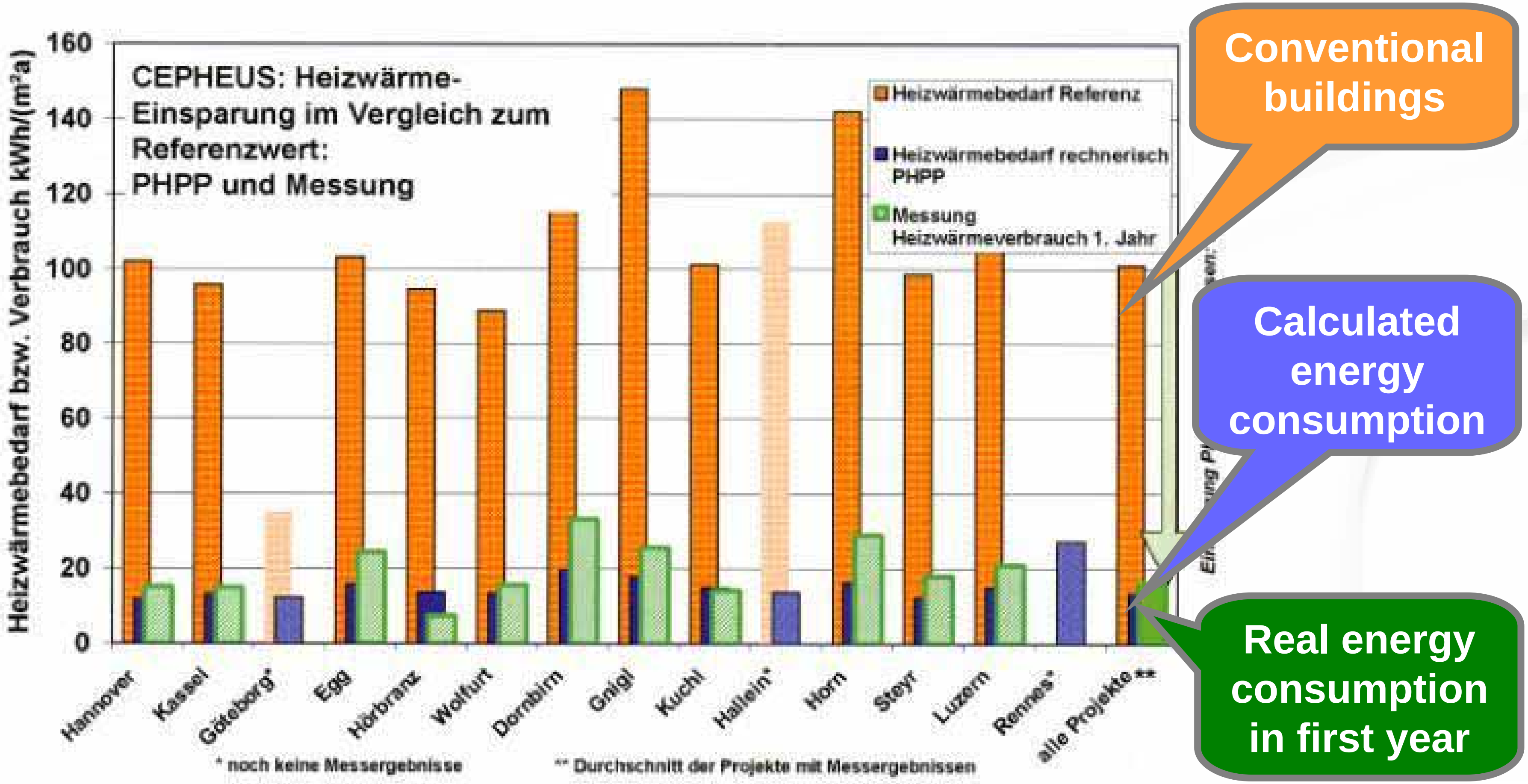
Additional construction costs for passive houses compared to conventional houses



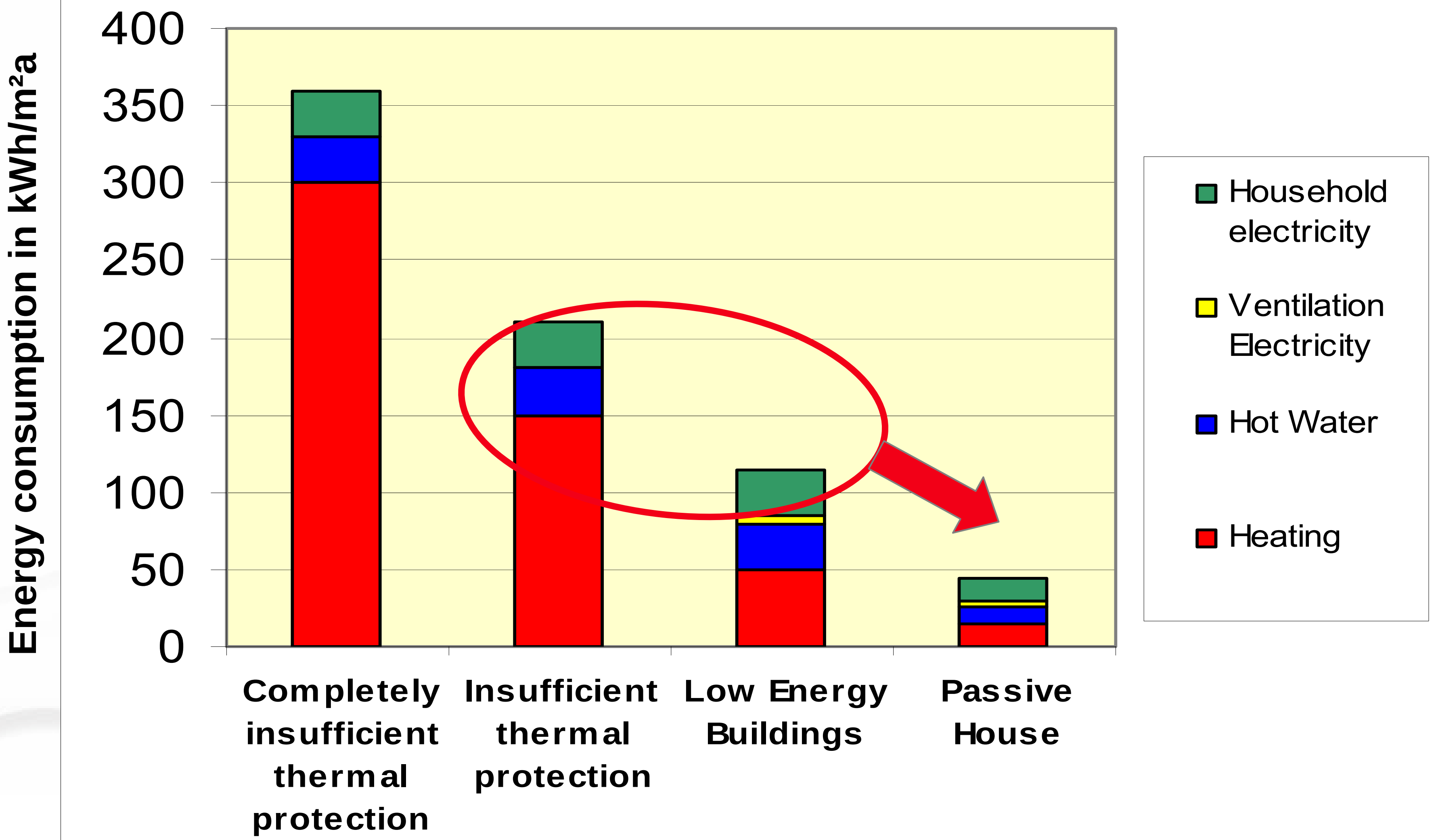
Passive house is cheaper than Low Energy House



Practical experiences with passive houses/energy consumption



Comparison of Buildings I



Comparison of Buildings II

Heat energy demand Gross floor area (HED_{GFA}) in kWh/m²a for a characteristic length of 1m Heating degree days (HDD) = 3400 K·d	**kWh/m²a** **300-250**	**kWh/m²a** **150-100**	**kWh/m²a** **50-40**	**kWh/m²a** **$\leq$ 15**
Building standard The HED_{GFA} value (heat energy demand related to the gross floor area) serves as a help to assess the thermic quality of a building - ÖNORM B 8110-5 (prestandard).	**Completely insufficient thermal protection** Structurally questionable, cost of heating no longer economical (typical of rural structures, buildings dating from the early years of the so-called Gründerzeit or from 1945 to 1970	**Insufficient thermal protection** Thermal renovation is clearly worth the trouble (typical of residential buildings constructed in the 50ies and 70ies of the last century)	**Low-energy buildings**	**Lowest-energy buildings** (essential parameter of the requirement profile to be met by Passive Houses)
Energy consumption in liters heating oil per square meter and year	**30-25 liters**	**15-10 liters**	**4-5 liters**	**1.5 liters**

Comparison of Buildings III

Heat energy demand	kWh/m²a 300-250	kWh/m²a 150-100	kWh/m²a 50-40	kWh/m²a $\leq$ 15
Construction	U-value and insulation thickness			
Exterior wall (massive wall of 25 cm)	1.30 W/m²K 0 cm	0.40 W/m²K 6 cm	0.20 W/m²K 16 cm	0.10 W/m²K 34 cm
Roof	0.90 W/m²K 4 cm	0.22 W/m²K 22 cm	0.15 W/m²K 30 cm	0.10 W/m²K 40 cm
Floors to ground	1.0 W/m²K 2 cm	0.40 W/m²K 7 cm	0.25 W/m²K 20 cm	0.12 W/m²K 30 cm
Windows	2.60 W/m²K Single glazing	1.70 W/m²K Double glazing	1.10 W/m²K Double glazing thermo	0.80 W/m²K Triple glazing special frame

Comparison of Buildings III

Heat energy demand Gross floor area (HED_{GFA}) in kWh/m^2a for a characteristic length of 1m Heating degree days (HDD) = 3400 K·d	**kWh/m^2a** **300-250**	**kWh/m^2a** **150-100**	**kWh/m^2a** **50-40**	**kWh/m^2a** **$\leq$ 15**
CO_2 emission	**60 kg/m^2a** 	**30 kg/m^2a** 	**10 kg/m^2a** 	ISOVER Multi-Comfort House **2 kg/m^2a** 
Energy consumption in liters heating oil per square meter and year	**30-25 liters**	**15-10 liters**	**4-5 liters**	**1.5 liters**

SAINT-GOBAIN INSULATION

Why not to have a simple information on energy consumption just like for cars and refrigerators?

Source: dena, Deutsche Energie Agentur