



EC Requirements for Buildings 2050: Impacts on the Structure of the Building Sector and the Opportunity for New Markets



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Arbeitsbereich: Energieeffizientes Bauen

Content:

Boundaries:

- **Climate Change and impact on heating/cooling demand**
- **Limitation of fossil fuels „peak oil/gas“**

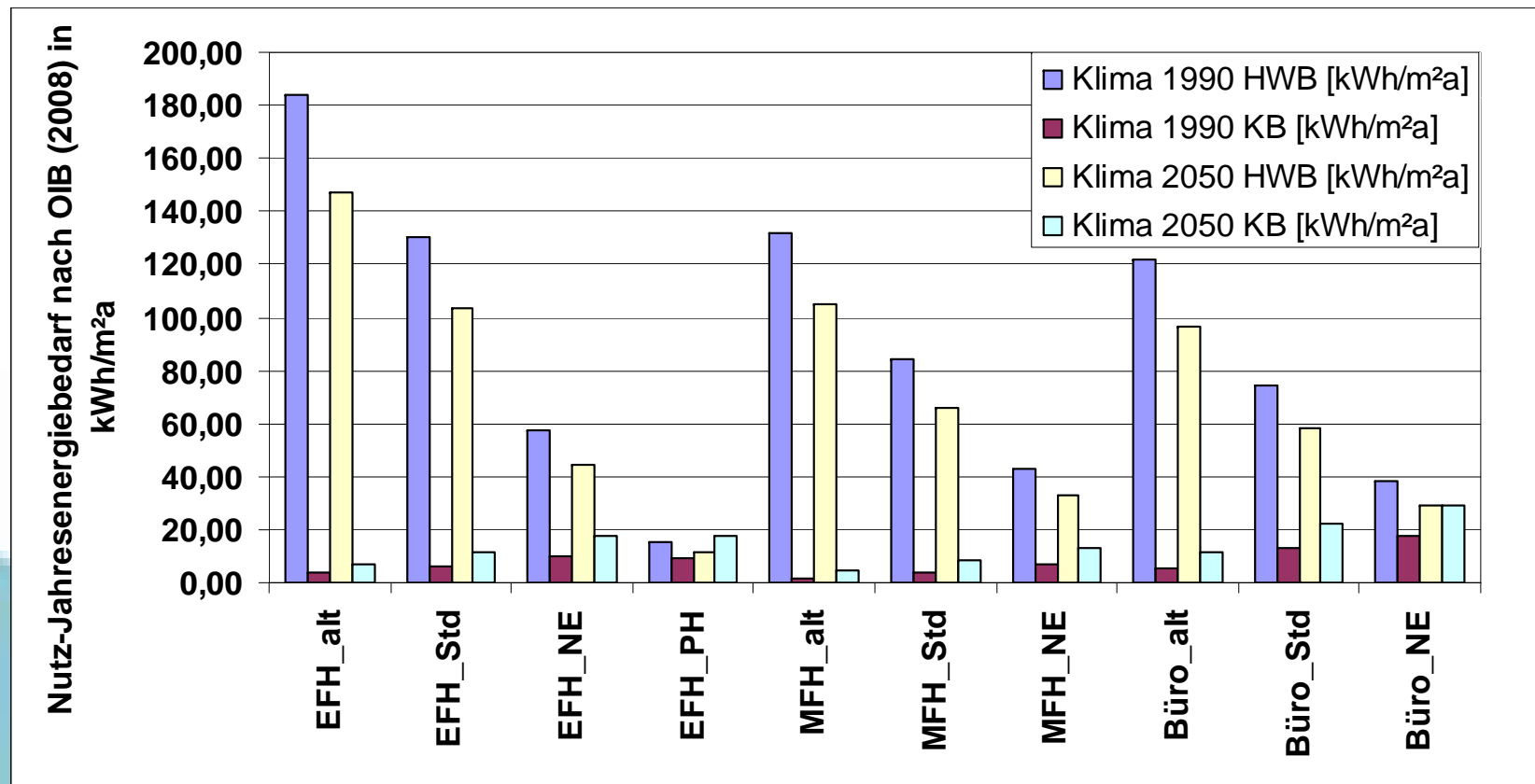
EC Rules :

- **European Building Directive 2002**
- **Changes in the European Building Directive 2010**
- **Energy Efficiency Directive**
- **20-20-20 goals**

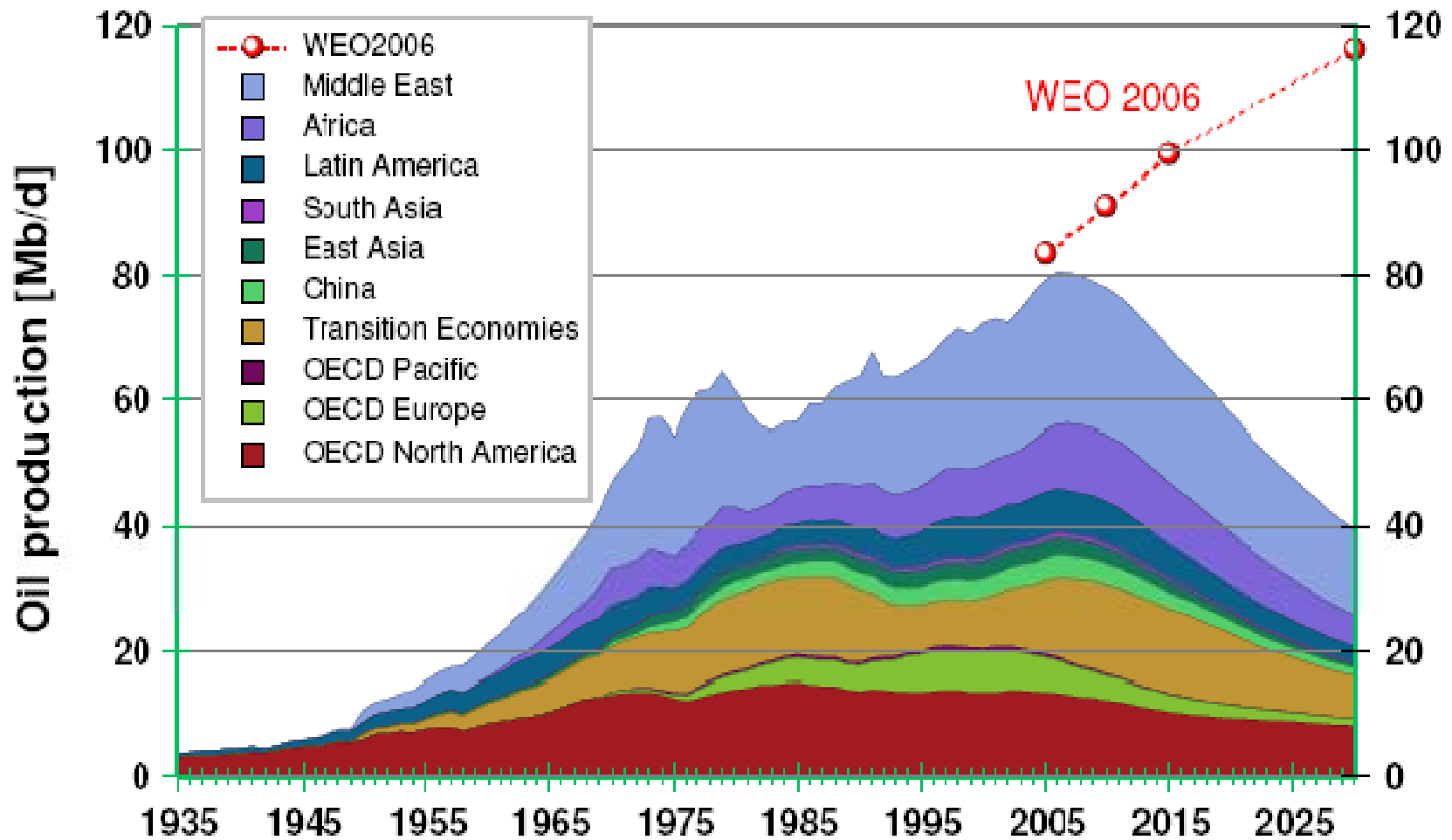
- **Sustainability of Buildings**
- **Directive on Urban**

Climate change and Heating and Cooling Energy Demand

various Building types Results for climate Graz 1990 und 2050



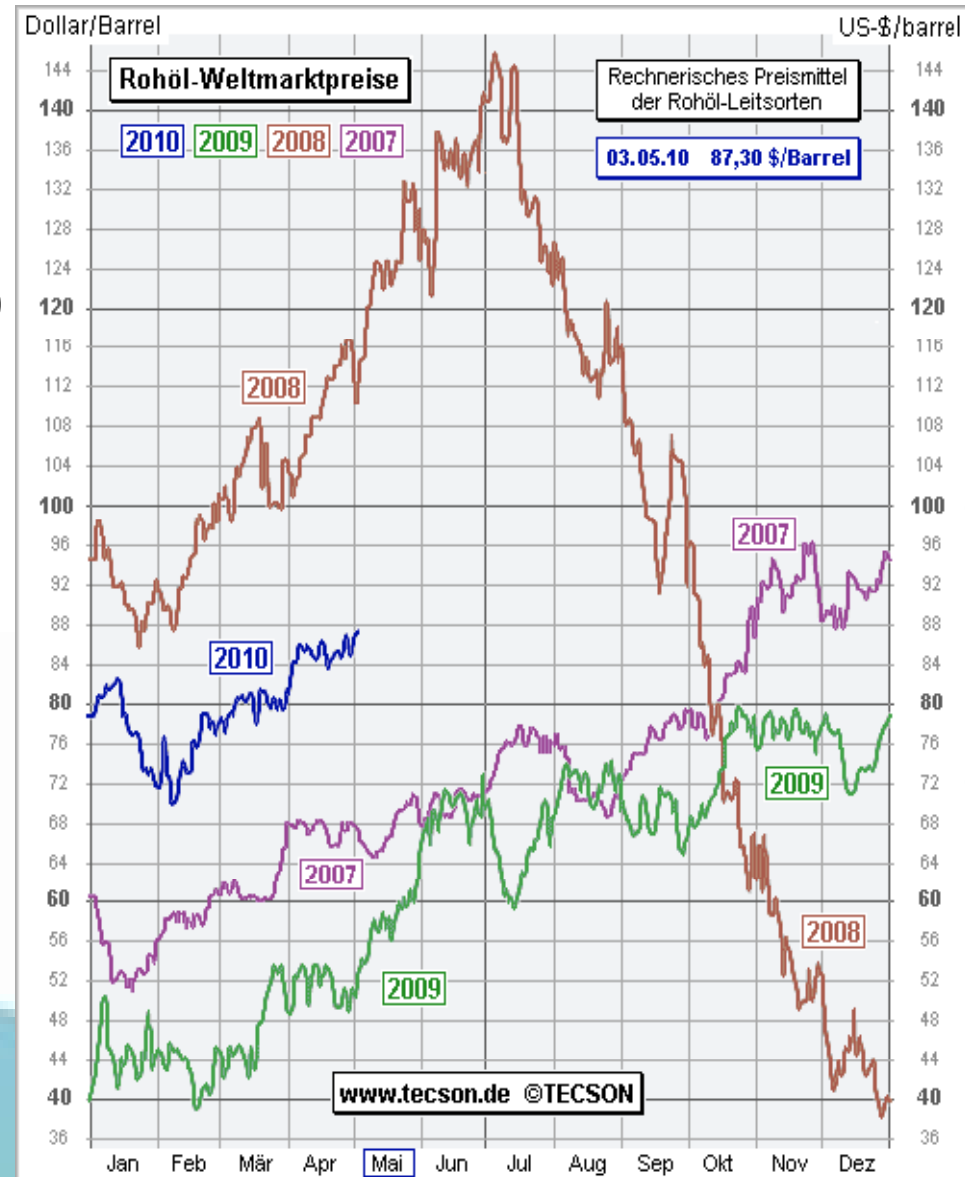
Peak oil ?



Energy Watch Group, 2007

World Nominal Oil Price Chronology: 2007-2010

(<http://www.tecson.de/prohoel.htm>)



EU Directive on the overall energy performance of buildings (EPBD) and its effect on the planning of buildings

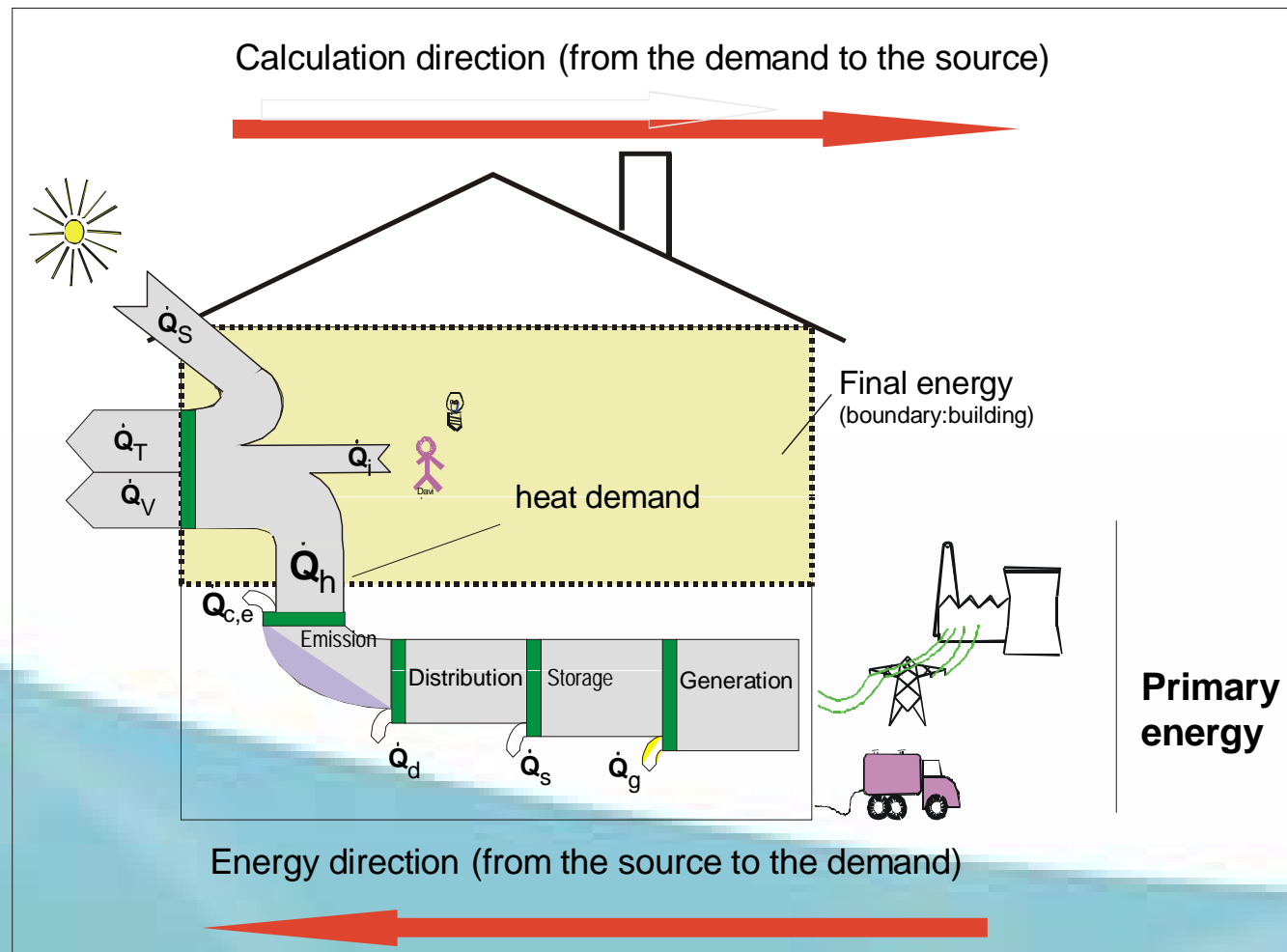
Directive 2002/91/EG of the European Parliament and the Commission



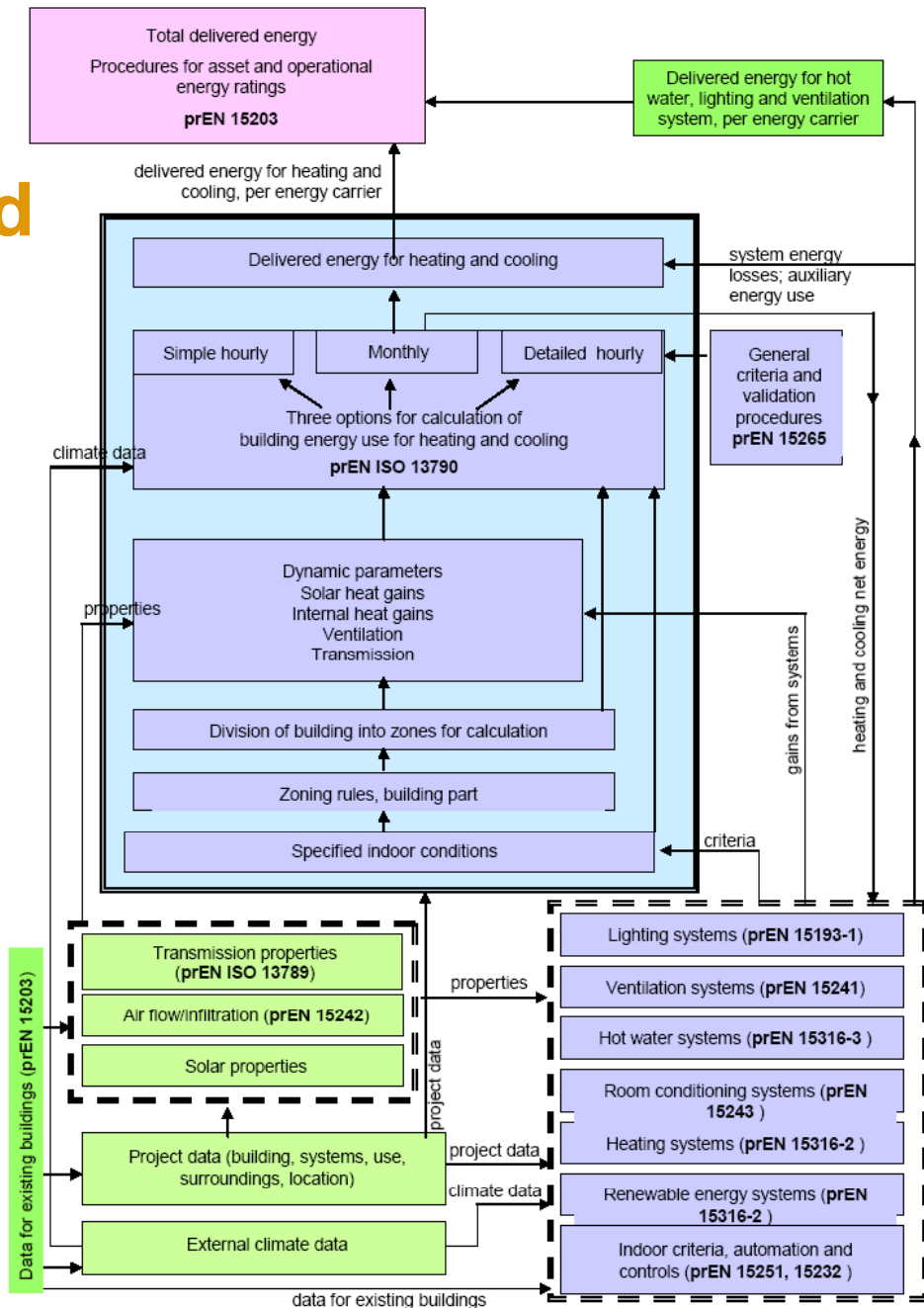
Motivation for Directive (16.12.2002)

- Reduction of the energy demand and the CO₂ emission of buildings (space heating and hot tap water amounts to 40% of the total end-use energy demand in Europe)
- Value of buildings not (only) because of the location but also because of the energy demand and the operating costs
- European harmonization of standards for calculation and evaluation (certificates) of energy demand of buildings
- Reduction of emissions by constant maintenance of boilers and air-conditioning systems

Calculation of Final, End-Use (and Primary Energy) Demand



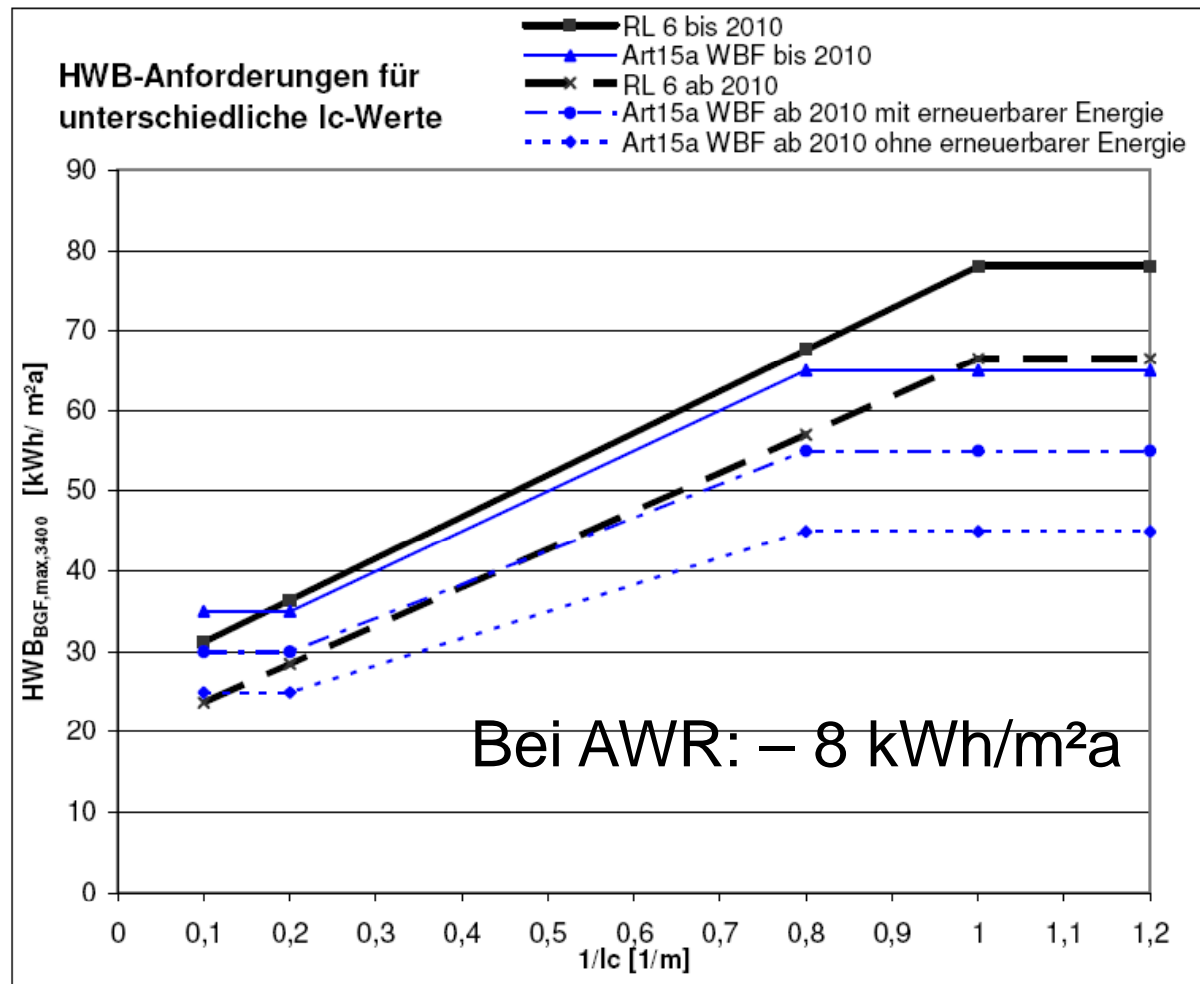
Standards affected by the EPBD (41 standards)



Maximum U-values (W/m²K) Austria (2007)

| Bauteil | U-Wert [W/m ² K] |
|--|--------------------------------|
| WÄNDE gegen Außenluft | 0,35 |
| Kleinflächige WÄNDE gegen Außenluft (z.B. bei Gaupen), die 2% der Wände des gesamten Gebäudes gegen Außenluft nicht überschreiten, sofern die ÖNORM B 8110-2 (Kondensatfreiheit) eingehalten wird. | 0,70 |
| TRENNWÄNDE zwischen Wohn- oder Betriebseinheiten | 0,90 |
| WÄNDE gegen unbeheizte, frostfrei zu haltende Gebäudeteile (ausgenommen Dachräume) | 0,60 |
| WÄNDE gegen unbeheizte oder nicht ausgebaute Dachräume | 0,35 |
| WÄNDE gegen andere Bauwerke an Grundstücks- bzw. Bauplatzgrenzen | 0,50 |
| ERDBERÜHRTE WÄNDE UND FUSSBÖDEN | 0,40 |
| FENSTER, FENSTERTÜREN, VERGLASTE oder UNVERGLASTE TÜREN (bezogen auf Prüfnormmaß) und sonstige vertikale TRANSPARENTE BAUTEILE gegen unbeheizte Gebäudeteile | 2,50 |
| FENSTER und FENSTERTÜREN in Wohngebäuden gegen Außenluft (bezogen auf Prüfnormmaß) | 1,40 |
| Sonstige FENSTER, FENSTERTÜREN und vertikale TRANSPARENTE BAUTEILE gegen Außenluft, VERGLASTE oder UNVERGLASTE AUSSENTÜREN (bezogen auf Prüfnormmaß) | 1,70 |
| DACHFLÄCHENFENSTER gegen Außenluft | 1,70 |
| Sonstige TRANSPARENTE BAUTEILE horizontal oder in Schrägen gegen Außenluft | 2,00 |
| DECKEN gegen Außenluft, gegen Dachräume (durchlüftet oder ungedämmt) und über Durchfahrten sowie DACHSCHRÄGEN gegen Außenluft | 0,20 |
| INNENDECKEN gegen unbeheizte Gebäudeteile | 0,40 |
| INNENDECKEN gegen getrennte Wohn- und Betriebseinheiten | 0,90 |

Heating demand HWB limits new residential buildings, (OIB - Richtlinie 6 (2007))



Austria: Limit for cooling energy demand in the building code.

- For residential buildings standard ÖNORM B 8110 Part 3 about the summer overheating protection has to be fulfilled e.g. **NO** cooling demand should occur
- The is also valid for non-residential buildings taking into account reduced internal heat gains like in residential buildings

Both limits for the cooling energy demand can be fulfilled easily in Middle European climate by using architectural measures like not to large window areas, shading (by building or active shading), thermal mass, and night ventilation.

Taking into accout heating and cooling limits fuilly glazed buildings are not possbile any more

New directive on the energy performance of buildings 2010/31/EU .

- For all new buildings the possible use of renewable energies has to be evaluated
- All new buildings have to be build as nearly zero energy buildings by 2020 (public authorities starting with 2018)
- ‘nearly zero-energy building’ means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;

Further EU-regulations

- **Draft Standardization Mandate to CEN, “Development of horizontal standardized methods for the assessment of the integrated environmental performance of buildings” (into force presumably 12/2007)**
- **Directive on energy end-use efficiency and energy services (into force presumably 6/2006).
(1 % increase of end-use energy efficiency per year)**
- **Thematic strategy for urban environment (sustainable building) (KOM(2004)60, 11.02.2004)**

The EU climate and energy package

In March 2007 the EU's leaders endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. They committed Europe to transforming itself into a highly energy-efficient, low carbon economy.

Climate and energy targets to be met by 2020. These are:

A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels

20% of EU energy consumption to come from renewable resources

A 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

Collectively they are known as the 20-20-20 targets.

In January 2008 the European Commission proposed binding legislation to implement the 20-20-20 targets. This 'climate and energy package' was agreed by the European Parliament and Council in December 2008 and became law in June 2009

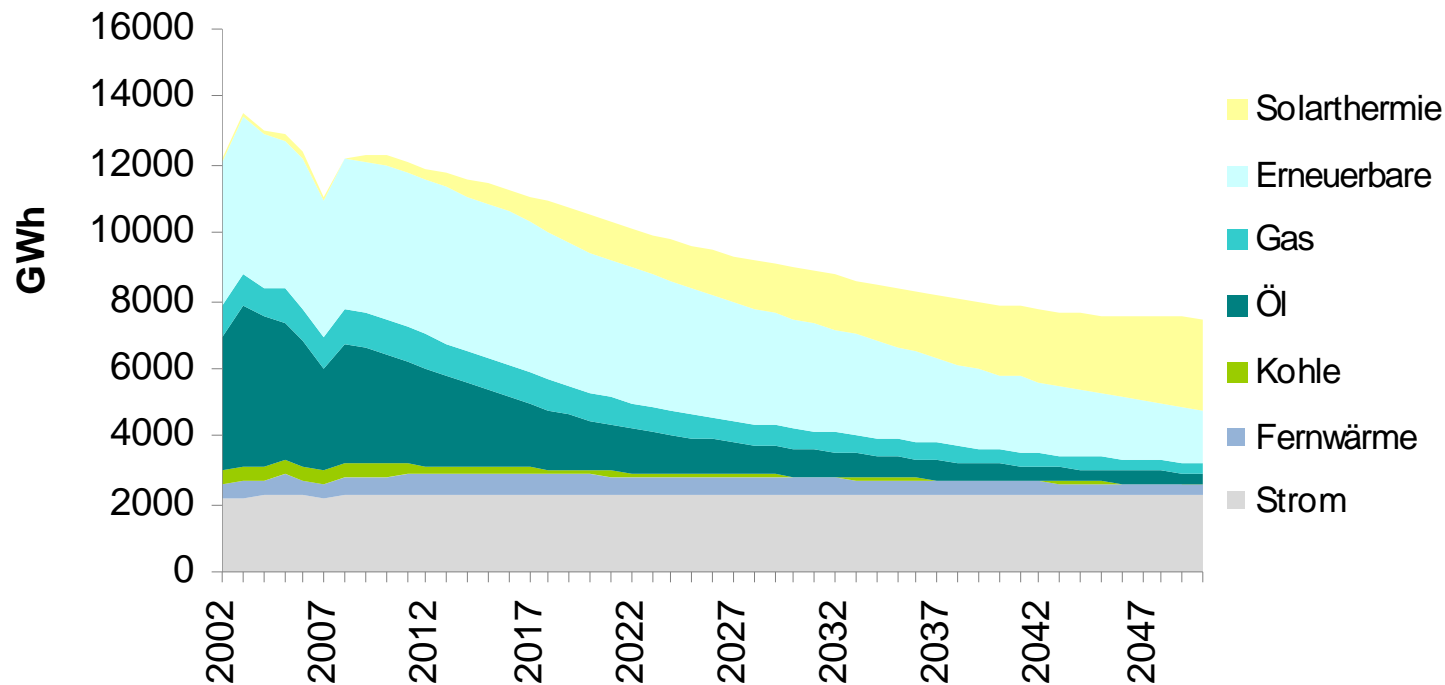
EU Directive 2009/28/EG for the Promotion of Renewable Energy, April 23. 2009

- National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2020* (ANNEX I of RES Directive)

| | 2005 | (1) 2020 (2) | | 2005 | 2020 |
|-----------------------|--------|--------------|------------------------|--------|------|
| Belgium | 2,2 % | 13% | Lithuania | 15,0 % | 23% |
| Bulgaria | 9,4 % | 16% | Luxembourg | 0,9 % | 11% |
| Czech Republic | 6,1 % | 13% | Hungary | 4,3 % | 13% |
| Denmark | 17,0 % | 30% | Malta | 0,0 % | 10% |
| Germany | 5,8 % | 18% | The Netherlands | 2,4 % | 14% |
| Estonia | 18,0 % | 25% | Austria | 23,3 % | 34% |
| Ireland | 3,1 % | 16% | Poland | 7,2 % | 15% |
| Greece | 6,9 % | 18% | Portugal | 20,5 % | 31% |
| Spain | 8,7 % | 20% | Romania | 17,8 % | 24% |
| France | 10,3 % | 23% | Slovenia | 16,0 % | 25% |
| Italy | 5,2 % | 17% | Slovak Republic | 6,7 % | 14% |
| Cyprus | 2,9 % | 13% | Finland | 28,5 % | 38% |
| Latvia | 32,6 % | 40% | Sweden | 39,8 % | 49% |
| United Kingdom | 1,3 % | 15% | | | |

- * In order to be able to achieve the national objectives set out in this Annex, it is underlined that the State aid guidelines for environmental protection recognise the continued need for national mechanisms of support for the promotion of energy from renewable sources.
- (1) Share of energy from renewable sources in **gross** final consumption of energy,
- (2) Target for share of energy from renewable sources in **gross** final consumption of energy

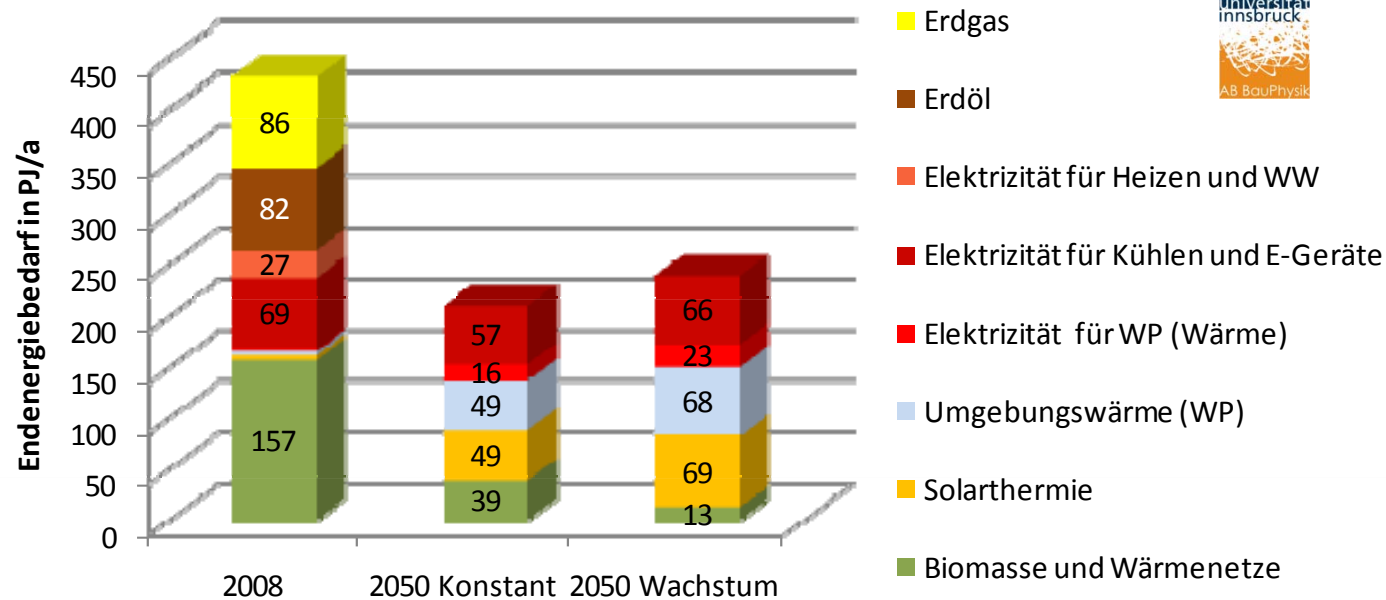
Trendscenario for the Austrian province of Styria for various measures in the building sector



- Renovation rate to today's standard, in the first years 4 % renovation rate, then reduced
- New buildings: no new CO2 Emissionen
- 4 – 1 % switch of heating fuel to renewables, district heat and gas, increase of efficiency

Energieautarky in Austria 2050 Results for Buildings

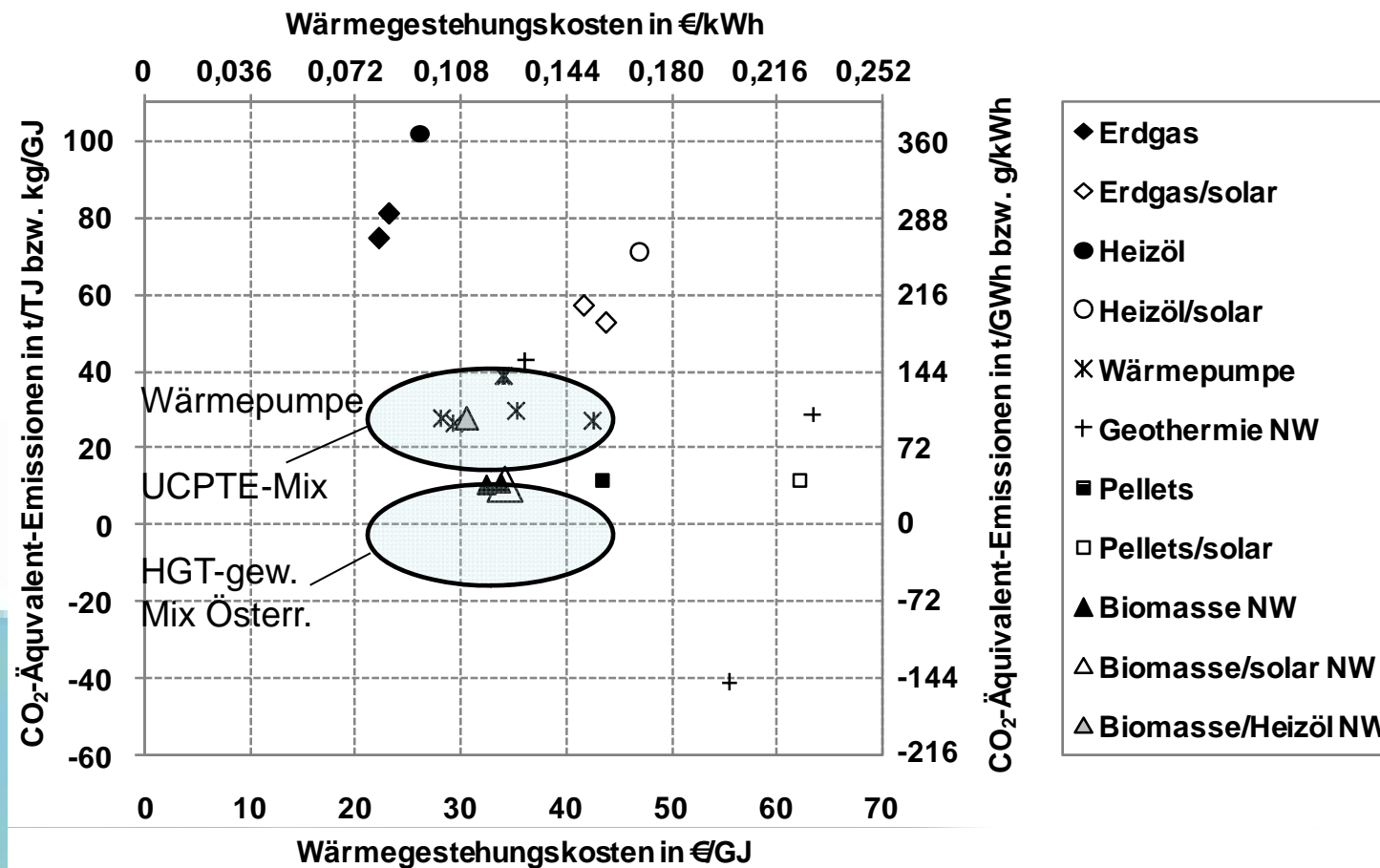
Endenergiebedarf Gebäude



- Ca. 50 % Energy savings -> high quality renovation of old buildings, new buildings in passive house quality
- Switch to solar thermal and heat pumps + reduction of electricity demand of households
- (biomass is needed for transportation and industry)

Heat generation

specific CO₂-equivalent-emissions – heat generation costs
Example of EFH-1 with 8 KW heating load





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Systemvergleich

GreenBuilding EU – LEED – BREEAM – ÖGNI / DGNB



| Kapitel | GB-EU | LEED | BREEAM | DGNB / ÖGNI |
|---|-------|-------|--------|-------------|
| Energieeffizienz | 100% | 32,6% | 19,0% | 9,6% |
| Raum- & Umgebungsqualität, Gesundheit Wohlbefinden | | 20,7% | 15,0% | 37,6% |
| Materialien und Ressourcen | | 15,2% | 12,5% | 5,6% |
| Nachhaltigkeit am Standort | | 13,0% | 10,0% | 2,4% |
| Wassereffizienz | | 10,9% | 6,0% | 2,3% |
| Innovation, Planung, Management | | 7,6% | 12,0% | 29,5% |
| Umweltverschmutzung | | | 10,0% | 11,3% |
| Transport | | | 8,0% | 0% |
| Müllmanagement | | | 7,5% | 1,7% |

indirekt in anderen Kategorien erfasst

Stand: 2010.11

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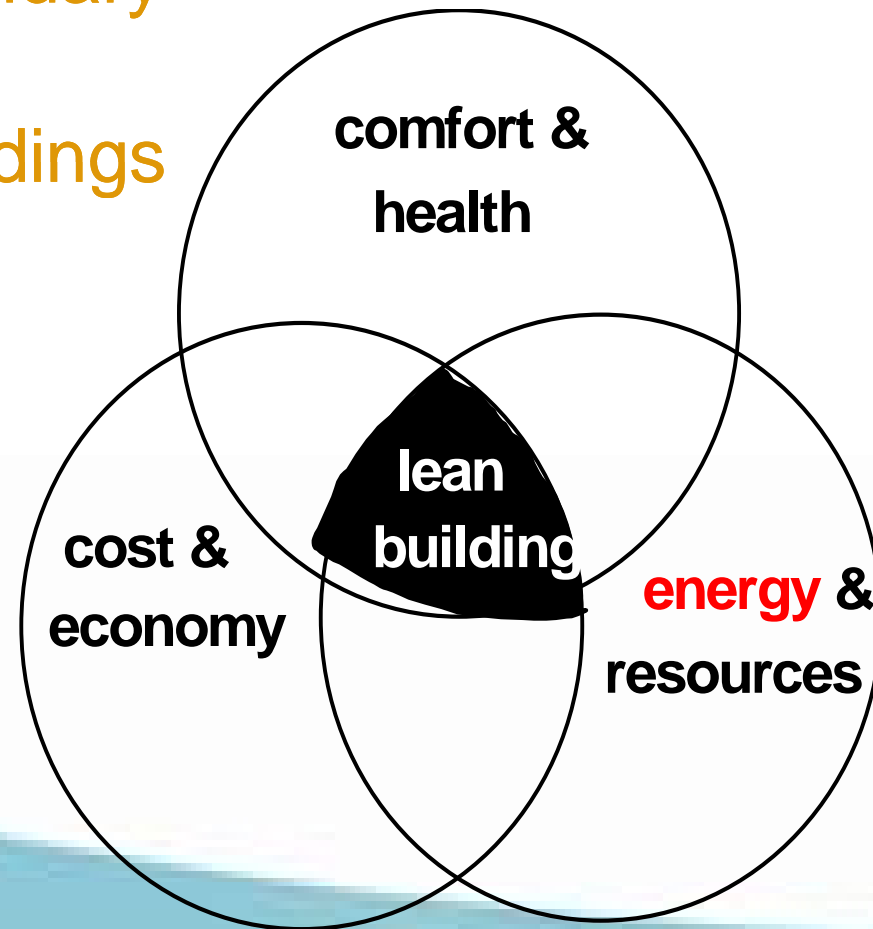
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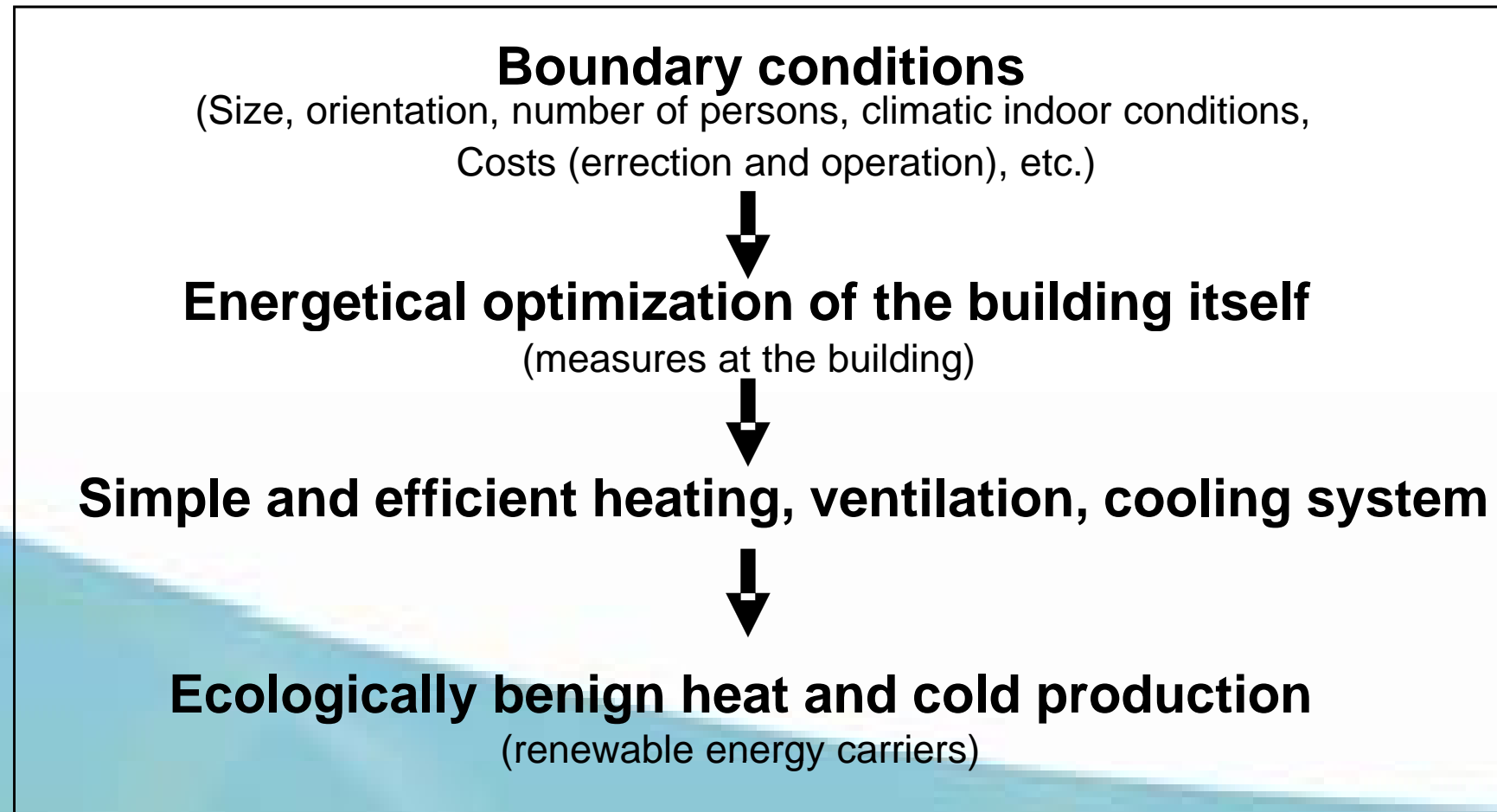
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Effects of the new boundary conditions on the Design Process of Buildings

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Steps of integrated building design for low energy demand



Effects of the EPBD on the Design Process of Buildings

- Energy demand for heating and cooling and other sustainability factors will be relevant already in architectural competitions.
- As the first sketch of the architect fixes about 40 % of the energy demand of the building, integrated design approaches (architect, civil engineer, mechanical engineer...) will become relevant
- Building codes and subsidy schemes are using the EPBD limits and certificates.
- Building design will become a more integrated process