

## 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

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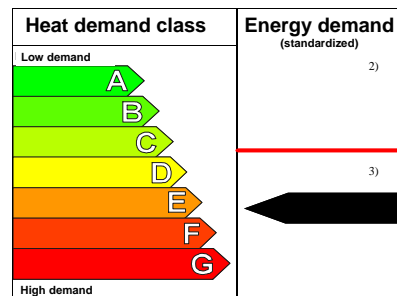


### Motivation for Directive (16.12.2002)

- Reduction of the energy demand and the CO<sub>2</sub> 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

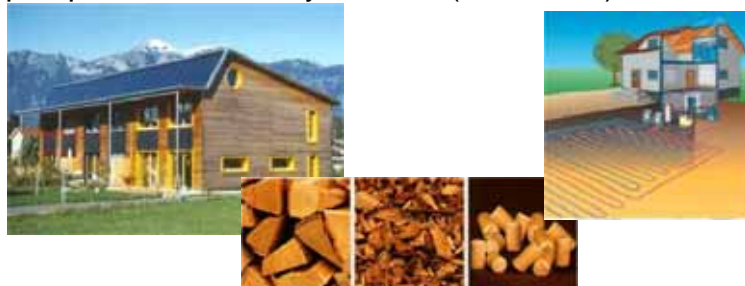
## Content of the Directive

- Development of the calculation method (energy demand of heating (EN 13790), cooling (new), lightning (new) and losses of the production- and distribution systems (new))
- Fixing of average, minimum and maximum energy demand of buildings by the national governments
- Development of energy certificates for buildings



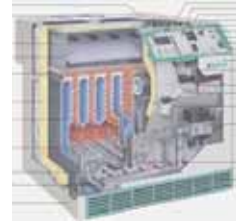
## Content of the Directive

- Application for all new and refurbished buildings > 1000 m<sup>2</sup>
  - Private houses: new buildings, (partly)selling, renovation
  - Public buildings: right after the directive comes into force (>1000 m<sup>2</sup>)
- Increasing the use of renewable energy sources, combined heat and power plants (CHP) and heat pumps if economically feasible (> 1000 m<sup>2</sup>)



## Content of the Directive

- Regularly inspections of boilers (>100 kW every 2 / 4(gas) years; <20 kW every 15 years)
- Regularly inspection of air-conditioning systems
- Inspection by independent specialists
- Set into force by



!!! January 4th 2006 !!!

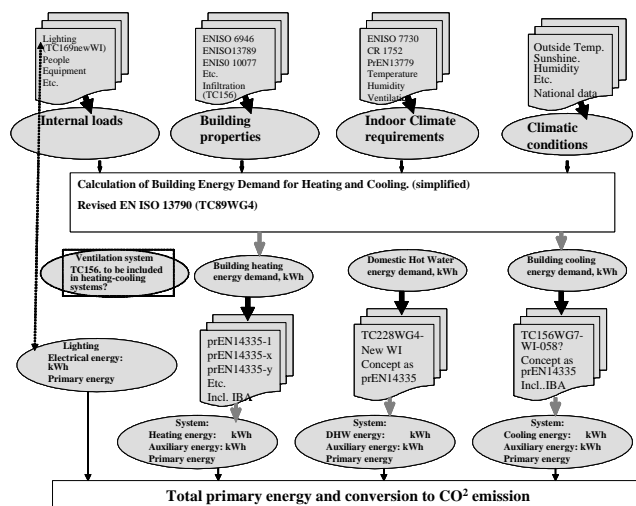
## Three Levels of Energy-Demand Evaluation

- **Level A**  
Detailed simulation (asset rating)
- **Level B**  
Calculation of End-Use Energy demand (predefined user behaviour, Asset Rating)
- **Level C**  
Measurement of End-Use Energy demand (actual user behaviour, Operational Rating)

## Status of the EPBD development (CEN)

- Mandate to CEN (October 2003) for developing calculation systems
- Affected Technical Committees (TCs)
  - CEN/TC 89 Thermal performance of buildings and building components
  - CEN/TC 156 Ventilation for buildings
  - CEN/TC 169 Light and lighting
  - CEN/TC 228 Heating systems in buildings
  - CEN/TC 247 Building Automation, Controls and Building Management
- Till this time big activities in the standardization bodies

## Affected CEN Standards



## Problems at CEN-Regulation

- Tremendous pressure of time  
(normal time to set up a new CEN standard is about 10 years)
- New methods can only be limited verified  
(single countries, such as Germany had money for this)
- In 2006 there probably won't be harmonized standards
- As the regulation is European law (independent from the CEN) → necessity of national transitional arrangements

## German National Activities

- DIN 18599-1 Allgemeine Bilanzierungsmethodik und Definitionen, Zonierung, Bewertung der Energieträger
- DIN 18599-2 Berechnung des Jahresheizwärme- und Jahreskühlbedarf von Gebäudezonen
- DIN 18599-3 Berechnung des Nutzenergiebedarfs für die energetische Luftaufbereitung
- DIN 18599-4 Beleuchtung
- DIN 18599-5 Berechnung von Heizsystemen
- DIN 18599-6 Wohnungs Lüftungsanlagen und Luftheizungsanlagen für den Wohnungsbau
- DIN 18599-7 Raumlufttechnik und Klimakälte
- DIN 18599-8 Berechnung der Warmwassersysteme
- DIN 18599-9 Berechnung multifunktionaler Erzeugungsprozesse
- DIN 18599-10 Randbedingungen
- Richtlinie 2004/8/EG über die Förderung einer am Nutzwärmebedarf orientierten Kraft-Wärme-Kopplung im Energiebinnenmarkt und zur Änderung der Richtlinie 92/42 EWG

## What about Austria???

- National implementation via the Austrian Institute for Building technology (OIB) and the Austrian Energy Agency (EVA)
- Generally following the processes, which are discussed by CEN (EN 13790) and the German DIN 18599 (monthly approach for calculation)

## Austrian National Activities

Austria is divided into nine provinces. Each province presently has its own building law. There is an harmonisation process for all building laws (acoustics, fire protection, energy = EPBD,etc) in progress led by the Austrian Institute of Building Physics, that is financed by the provinces.

- Several items are addressed by the harmonized introduction of the EPBD in Austria
- Calculation method for the energy performance (asset rating)
- Measurement of the Energy demand (operational rating)
- Set up of minimum, baseline and range of energy demand for different types of buildings for the specific energy demand

## Status of Austrian National Activities

- Calculation procedure for residential buildings is finished (cooling demand avoided by law (Standard B 8110, part 3))
- Calculation of non-residential buildings is in final stage using
  - Cooling demand according prEN 13790
  - DIN 18599 part 3: Useful energy for air conditioning
  - DIN 18599 part 4: Lighting
  - DIN 18599 part 7: Air conditioning and air cooling technology
  - DIN 18599 part 10: standard user behaviour

## Status of Austrian National Activities

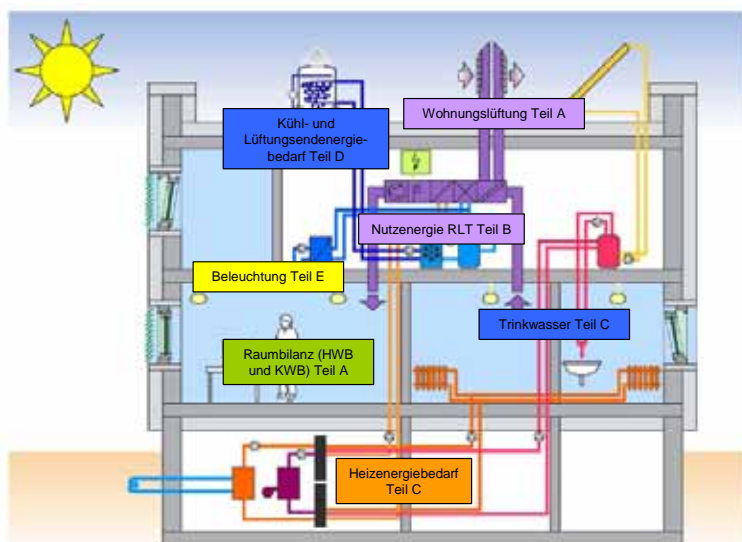
- The layout of the certificate is still point of discussion
- For the values of the different ratings first discussions have started
- Primary energy and CO<sub>2</sub> – standards are not yet under development, but should be part of the energy certificate.
- Creation of a method how to train independent experts for the calculation and issue of the energy certificate are under discussion
- Creation of a method how to train independent experts for regular inspection of boilers and ventilation/cooling systems are under discussion

## Austrian National Activities

I. General Information for the calculation including zoning and multiple systems	
II. Useful Energy	A. Space heating and space cooling useful energy demand (close to EN 13790)
	B. Useful energy demand for ventilation, exhaust air heat/enthalpy recovery humidification / dehumidification for non-residential buildings
III. Endenergiebedarf	C. End use energy for space heating and domestic hot water demand
	D. End use energy for space cooling
	E. Energy demand for lighting
	F. Sum of all end use energy demand
	G. Reference loads and user behaviour for residential and various non residential buildings
IV Energy certificate	H. template for the certificate
V Appendices	M. Monthly local climate data
	N. Catalogue of thermal bridges
	O. User behaviour profiles

Quelle: OIB Berechnungsverfahren, Stand 11/2005

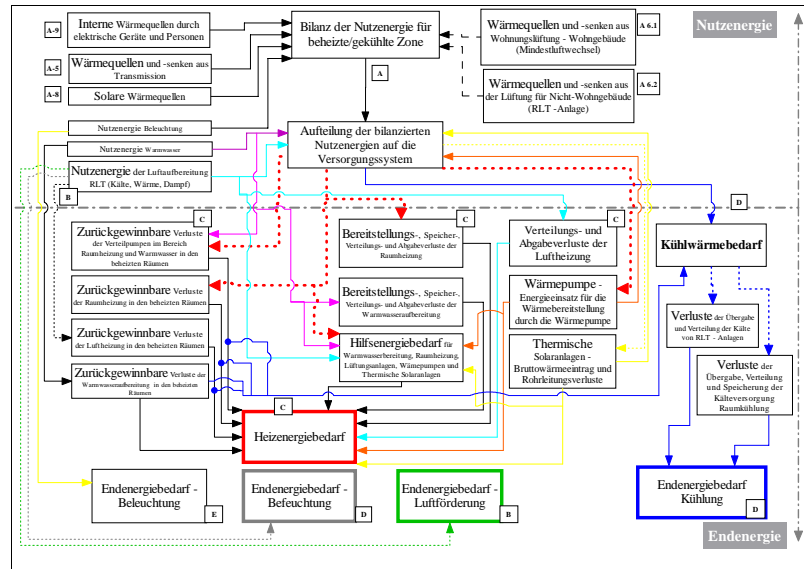
## Austrian National Activities



Quelle: OIB Berechnungsverfahren, Stand 11/2005



## Austrian National Activities



## Components of useful energy

- Useful energy of space heating demand (HWB)
- Useful energy of cooling demand (KWB)
- Useful energy of air conditioning (heating cooling, humidification, dehumidification )
- Useful energy of lighting
- Useful energy of domestic hot water production

Quelle: OIB Berechnungsverfahren, Stand 11/2005

## The Berlaymont Building

Built: 1967 (from 1995 to 2004 renovated)  
Useful area: 241.515 m<sup>2</sup>  
Persons: over 3000 Persons per day  
Heating system: 3 Gas-boilers with a total capacity of 7.800 [kW]  
Cooling plant: 4 Compression-chillers and 2 Absorption chillers with a total rated capacity of 8.900 [kW]



## The Berlaymont Building

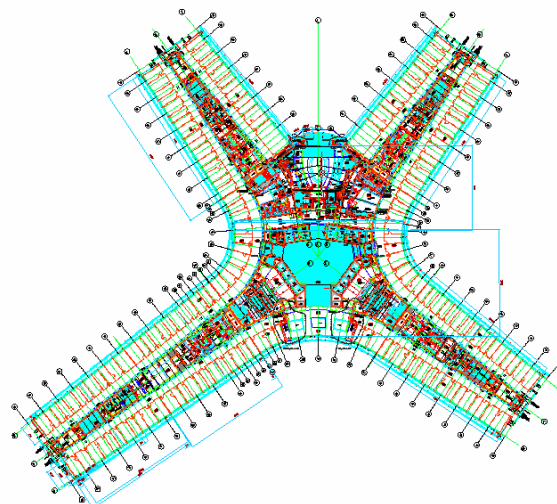


Abb.: Schnittzeichnung der Etage 9 des Berlaymont Gebäude

## Zoning of the Berlaymont Building, Brussels

Criteria 1: User profiles D according IN V 18599 Teil 10

Zone	Nutzen	Lüftung	Beleuchtung	Kühlung	Heizung	Beleuchtung	Warmwasser
1	office	+	+	+	+	+	-
2	corridor	+	-	(w)	+	+	-
3	lobby	+	-	(w)	+	+	-
4	stairs	-	-	-	+	+	-
5	staircase	-	-	-	-	-	-
6	staircase	+	-	+	+	+	+
7	toilet	+	-	-	+	+	+
8	shower	+	-	-	+	+	+
9	shower	+	-	-	+	+	+
10	meeting room	+	+	(w)	+	+	-
11	service room	+	-	-	+	+	-
12	tech room	-	-	-	(w)	+	-
13	EVG compression	+	+	+	+	+	-
14	restaurant	+	+	+	+	+	-
15	storage/ stores	-	-	-	+	+	-
16	storage/ stores	-	-	-	+	+	-
17	storage/ stores	+	+	+	+	+	+
18	storage/ stores	+	+	+	+	+	(w)
19	storage/ stores	+	+	+	+	+	-
20	parking	+	-	-	-	+	-

Criteria 2: solar irradiance – orientation of building shell

In total there were 144 zones defined for the calculation

## Zoning of the Berlaymont Building, Brussels

Zonierung/Endenergie:

**Kriterium 1:** Bereiche die von den gleichen Versorgungsleitungen für Warmwasser, Kaltwasser und Dampf versorgt werden. (Sektoren)

**Kriterium 2:** Bereiche die von den RLT-Anlage versorgt werden.



**9 Sektoren:** A1, A2, B1, C1, D1, D2, E1, F und Basement

Abb.: Sektoren zur Berechnung der Endenergie

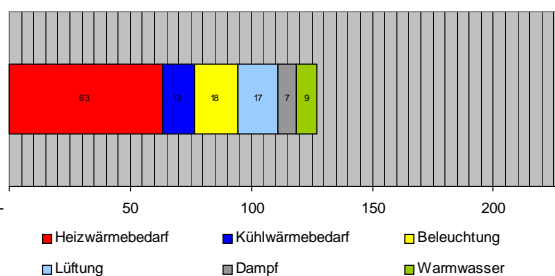
### Results of the Berlaymont Building, Brussels

**Nutzenergie:**

Heizwärmebedarf	63	[kWh/(m <sup>2</sup> .a)]
Kühlwärmebedarf	13	[kWh/(m <sup>2</sup> .a)]
Beleuchtung	18	[kWh/(m <sup>2</sup> .a)]
Luftförderung	17	[kWh/(m <sup>2</sup> .a)]
Dampf	7	[kWh/(m <sup>2</sup> .a)]
Warmwasser	9	[kWh/(m <sup>2</sup> .a)]

Summe 127 [kWh/(m<sup>2</sup>.a)]

spezifischer Nutzenergiebedarf [kWh/(m<sup>2</sup>.a)]



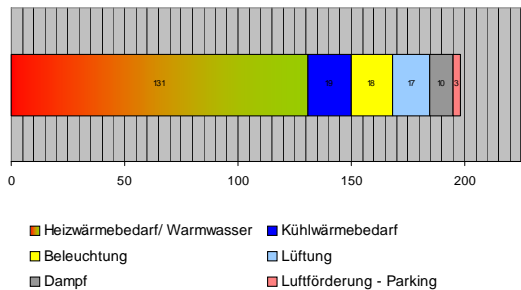
### Results of the Berlaymont Building, Brussels

**Endenergie:**

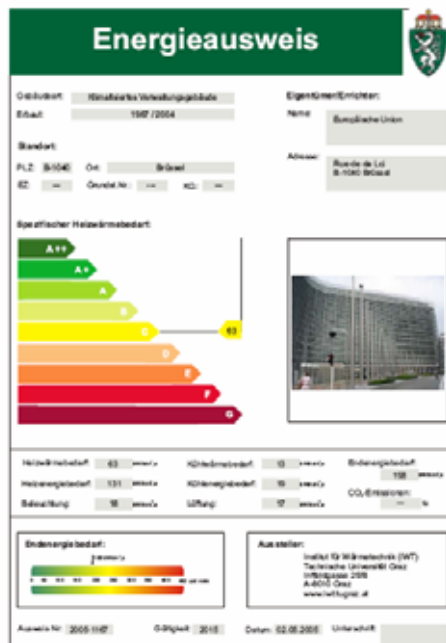
Heizwärmebedarf und Warmwasser	131	[kWh/(m <sup>2</sup> .a)]
Kühlwärmebedarf	19	[kWh/(m <sup>2</sup> .a)]
Beleuchtung	18	[kWh/(m <sup>2</sup> .a)]
Luftförderung	17	[kWh/(m <sup>2</sup> .a)]
Dampf	10	[kWh/(m <sup>2</sup> .a)]
Luftförderung - Parking	3	[kWh/(m <sup>2</sup> .a)]

Summe 198 [kWh/(m<sup>2</sup>.a)]

spezifischer Endenergiebedarf [kWh/(m<sup>2</sup>.a)]



## Energy certificate Berlaymont building – Styria



## Results of the countries

Table 2

	Austria	France	Germany	Netherlands	Poland	Portugal
No. of Zones	19(144)	2	8	3	10	58
Net Energy (specify units)	127,1 kWh/m <sup>2</sup> a		120,38 kWh/m <sup>2</sup> a		129,7 kWh/m <sup>2</sup> a	139,5 kWh/m <sup>2</sup> year
Final Energy (specify units)	198,2 kWh/m <sup>2</sup> a		182,69 kWh/m <sup>2</sup> a		170,9 kWh/m <sup>2</sup> a	155,6 kWh/m <sup>2</sup> year
Primary Energy (spec. units)		101 kWh/m <sup>2</sup> a	217,64 kWh/m <sup>2</sup> a	71.285.029 MJ/year	223,4 kWh/m <sup>2</sup> a	3.933.038 kgep/year
Net Energy (specify units)						
Heating	63,12 kWh/m <sup>2</sup> a		65,31 kWh/m <sup>2</sup> a		35,8 kWh/m <sup>2</sup> a	1,1 kWh/m <sup>2</sup> year
Cooling	13,24 kWh/m <sup>2</sup> a		12,72 kWh/m <sup>2</sup> a		30,1 kWh/m <sup>2</sup> a	50,6 kWh/m <sup>2</sup> year
AC moisture/humidifying	7,39 kWh/m <sup>2</sup> a		2,68 kWh/m <sup>2</sup> a		7,4 kWh/m <sup>2</sup> a	(included in cooling)
Ventilation (mechanical)	16,55 kWh/m <sup>2</sup> a		12,12 kWh/m <sup>2</sup> a		5,9 kWh/m <sup>2</sup> a	(included in heating and cooling)
Lighting	18,19 kWh/m <sup>2</sup> a		18,69 kWh/m <sup>2</sup> a		13,4 kWh/m <sup>2</sup> a	14,5 kWh/m <sup>2</sup> year
Domestic Hot Water	8,57 kWh/m <sup>2</sup> a		8,86 kWh/m <sup>2</sup> a		8,7 kWh/m <sup>2</sup> a	-
Solar Energy			n.a.			-
Cogeneration			Included in primary energy conversion		74,7 kWh/m <sup>2</sup> a	Included in primary energy conversion
Equipment (if included)			n.a.		23,2 kWh/m <sup>2</sup> a	34,7 kWh/m <sup>2</sup> year
Pumps and Fans			4,6 kWh/m <sup>2</sup> a		3,3 kWh/m <sup>2</sup> a	27,2 kWh/m <sup>2</sup> year
Lifts and Parking			5,57 kWh/m <sup>2</sup> a (net parking energy)			11,4 kWh/m <sup>2</sup> year

## Presentation of the certificates in Brussels



Hand over of the certificate in the Berlaymont Building to the EU-Commissioners Andris Piebalgs and Siim Kallas

France, Germany, Netherlands, Poland, Portugal, Austria



## Further upcoming 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)**