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EU Directive on the overall energy performance of buildings (EPBD)

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

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Motivation for the 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

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Requirements of the directive

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- Definition of a calculation scheme (Useful energy demand for space heating (EN 13790), cooling (EN 13790 *new*), Lighting (*new*) and losses of heat/cold production and distribution (*new*)
- Definition of maximum values (minimum requirements) in the states, issuing and publishing of energy certificates)
- Applicate for all new and maior renovated buildings
  - privatebuildings: newly built, Selling, maior renovation (> 1000 m²)
  - öffentliche Gebäude > 1000 m² nach Inkrafttreten der Richtlinie
- Application of renewabel energy carriers, CHP and heat pumps if technolgoically feasable (buildings > 1000 m²)

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Requirements of the directive

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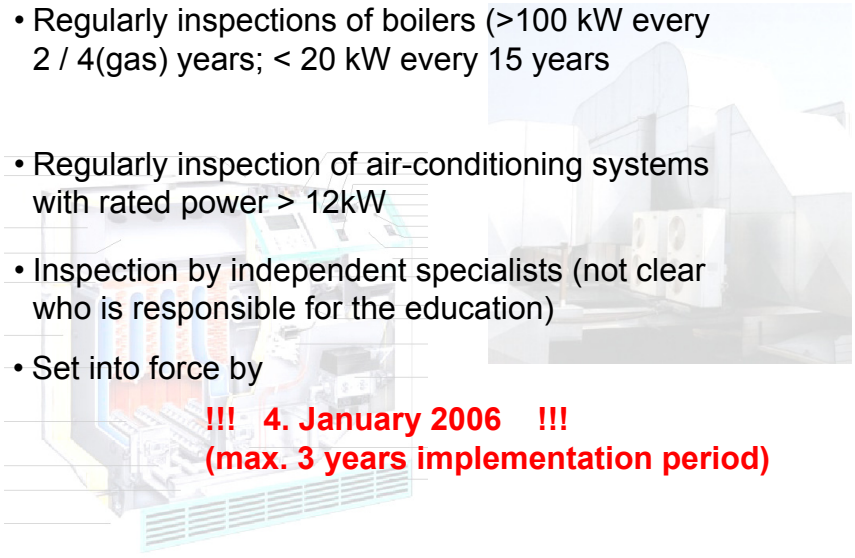
- Regularly inspections of boilers (>100 kW every 2 / 4(gas) years; < 20 kW every 15 years
- Regularly inspection of air-conditioning systems with rated power > 12kW
- Inspection by independent specialists (not clear who is responsible for the education)
- Set into force by

  !!! 4. January 2006 !!!
  (max. 3 years implementation period)



Str 4

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EPBD ⇔ CEN

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- Mandate to CEN (October 2003) for the development of calculation schemes
- Involved 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

The process is being overseen by CEN/BT WG 173, Energy performance of buildings project group, to coordinate the work and to ensure that standards prepared in different committees interface with each other in a suitable way.

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EPBD ⇔ CEN

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- Since then high activity in the standardization bodies
- Standards will be finalized earliest in 2007
- First country that implements was Denmark in spring 2007

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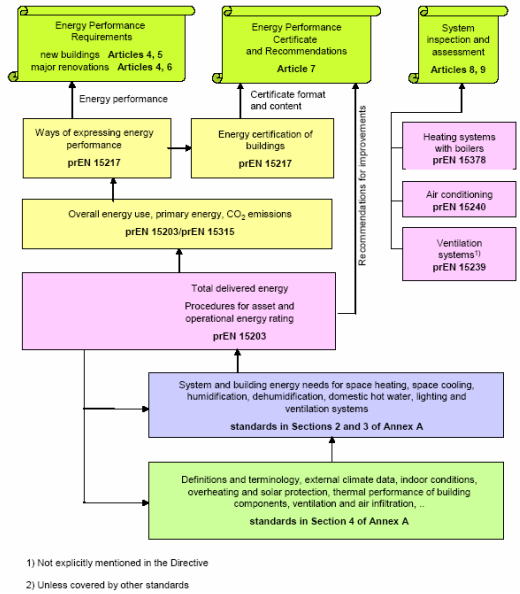

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EPBD ⇔ CEN Energy Flows

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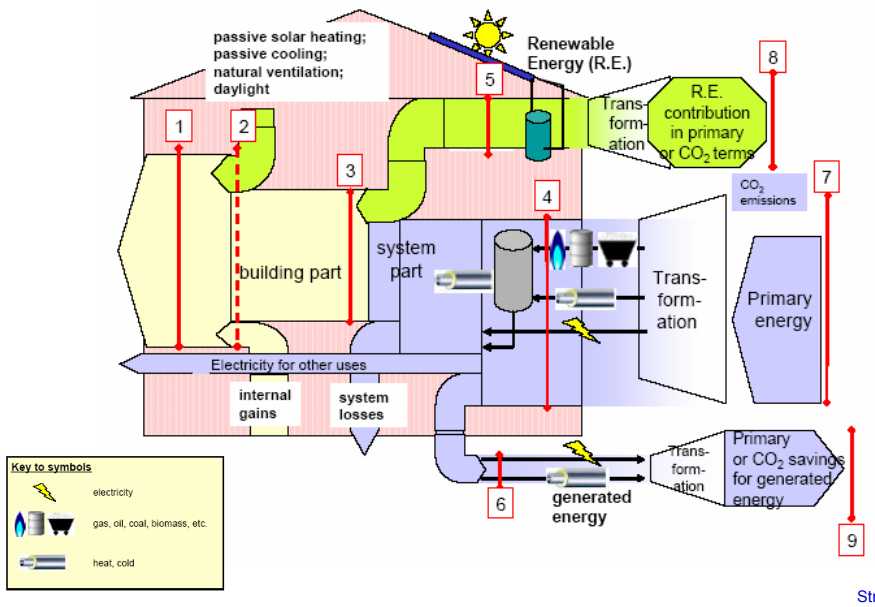

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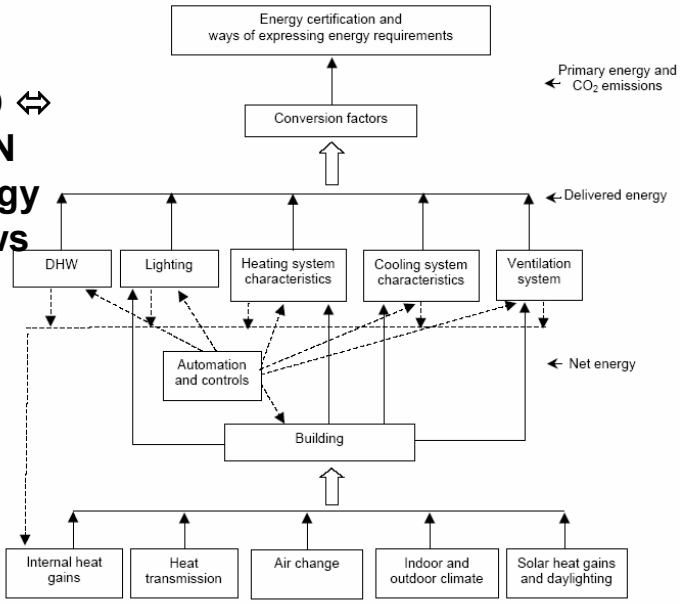
EPBD ⇔ CEN Energy Flows



NOTE The effect of controls that affect conditions within the building (e.g. thermostats, automatic solar protection devices) is included in the net energy. Other aspects of controls are handled in the calculations for the systems.

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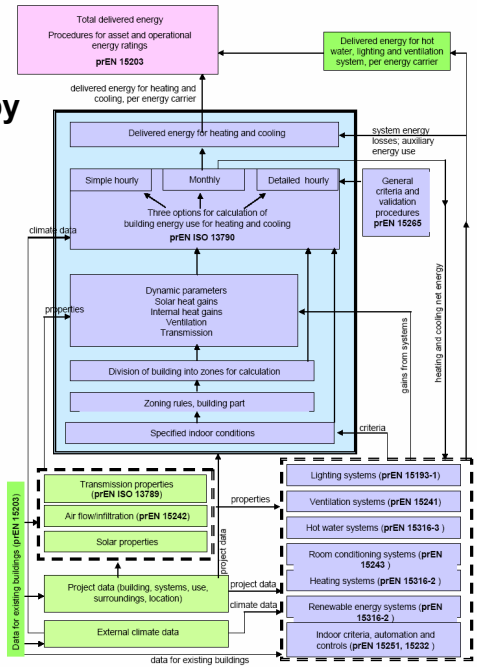
Standards affectd by the EPBD *(41 standards)*



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Supporting standards
Thermal performance of building components

Overall transmission heat loss coefficient: **EN ISO 13789**, which refers to other standards for the calculation of U-values. The standards for U-values fall into two groups:

- **simplified methods** (**prEN ISO 6946, prEN ISO 13370, prEN ISO 10077-1, prEN 13947**), which can be used for components within the scope of those standards; and
- **detailed methods** (**prEN ISO 10211, EN ISO 10077-2),** which can be used as an alternative, or for cases for which there is not an applicable simplified method.

The U-value of components, including windows and doors, can alternatively be established by measurement according to test methods cited in an applicable product standard.

Thermal bridges (at junctions between elements, etc) are covered in **prEN ISO 10211, prEN ISO 14683**.

The standards in this group also include those for obtaining thermal values (prEN ISO 10456).

Supporting standards

- **Ventilation and air infiltration**

•**prEN 15242** provides methods for calculation **air flow rates** to enable the calculation of heat losses due to air exchange. **EN 13779** covers **mechanically ventilated buildings** (including those with air conditioning).

- **Indoor conditions and external climate**

•Section 4D contains standards related to **indoor conditions** (**prEN 15251**) and specifications for the calculation and presentation of **climatic data** (**prEN ISO 15927**). [Note: The parts of prEN ISO 15927 do not contain climatic data, but rather a specification for it, so that data in conformance with this standard is on a known basis and a known format.]

- **Definitions and terminology**

•EN ISO 7345, EN ISO 9288, EN ISO 9251 and EN 12792 contain definitions of terms and quantities used by other standards.

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EU directives and mandates to CEN for sustainable buildings

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- EU directive 2002/91/EG on the overall energy performance of buildings (EPBD) (set into force 01/2006)
- Draft Standardisation Mandate to CEN, “Development of horizontal standardised methods for the assessment of the integrated environmental performance of buildings” (Inkrafttreten vorr. 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)

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Ansatz Deutschland, Berechnung

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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 Wohnungslüftungsanlagen 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

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Approach Germany and Austria

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Monatsbilanzierungverfahren
zur energetischen Bewertung klimatisierter Gebäude
aufbauend auf DIN EN 832 und EN ISO 13790

Prinzipielle Vorgehensweise:

1. Ermittlung des monatlichen Heiz- und Kühlbedarfs im Raum (in Anlehnung an DIN EN 832 bzw. EN ISO 13790)
2. Ermittlung des Nutzenergiebedarfs für die Luftaufbereitung
   - Zulufttemperierung (fühlbare Wärme)
   - Be- und Entfeuchtung der Zuluft
   - Luftförderung
3. Ermittlung des Endenergiebedarfs
4. Ermittlung der maximal erforderlichen Raumkühlleistung

Prof. Dr. L. Rouvel
Extraordinarius für Elektrische Gebäudeenergietechnik

Stand: 27.02.04

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Energy flow in Buildings EN ISO 13790

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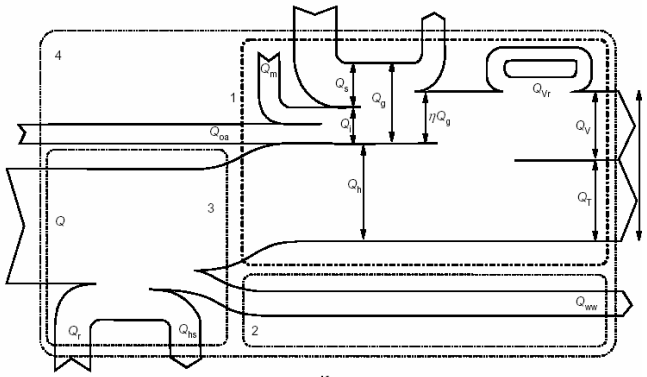

Key

Q	energy use for heating	Q_h	heat use
Q_{oa}	heat from other appliances	Q_V	ventilation heat loss
Q_r	recovered energy	Q_{Vr}	ventilation heat recovery
Q_{hs}	losses from the heating system	Q_T	transmission heat loss
Q_m	metabolic heat	Q_{ww}	heat for hot water preparation
Q_s	passive solar gains	Q_L	total heat loss
Q_i	internal gains		
Q_g	total gains	1	boundary of the heated zone
$\eta\, Q_g$	useful gains	2	boundary of the hot water system
		3	boundary of the heating plant
		4	boundary of the building

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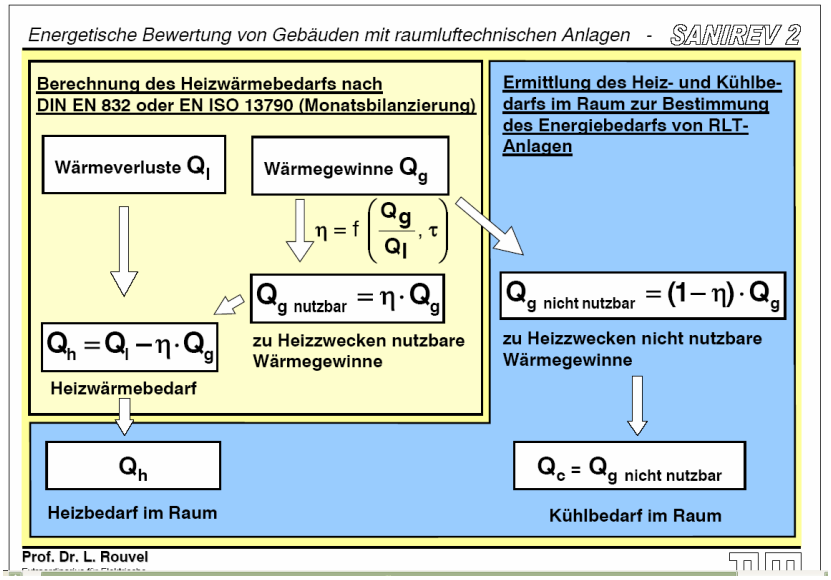
EN 13790 für space Heating and Cooling



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Approach Germany and Austria

Residential and non-residential Buildings, user profis Germany 33 zone profiles, Austria 8 building profiles (e.g. typ. Office building)

Einzel- und Gruppenbüro 1

		von	bis	
Nutzungszeiten				
Tägliche Nutzungszeit	[Uhr]	7:00	18:00	
Nutzungstage pro Jahr	[d/a]	250		
Tageslichtstunden	h/a	??		
Nachtlichtstunden	h/a	??		
Tägliche Betriebszeit RLT	[Uhr]	5:00	19:00	
Betriebstage RLT pro Jahr	d/a	250		
Tägliche Betriebszeit Heizung	[Uhr]	5:00	19:00	(nicht
Betriebstage Heizung pro Jahr	d/a	250		abgesenkt)

Raumkonditionen (sofern Luftbehandlungsfunktion vorhanden)

		Auslegungswert	Monats-mittelwert
Raumtemperatur	[°C] Heizung	20	21
	[°C] Kühlung	26	24

		Min	Max
Zuluftfeuchte	[g/kg]	6	11

Hygienischer Mindestaußenluftvolumenstrom (Normen)

Personenbezogen	[m³/(h Person)]	40
Flächenbezogen	[m³/(h m²)]	4

Mech. Außenluftvolumenstrom (Praxis)		von	bis
Luftwechsel	[h-1]	2	3
Luftwechsel nur Luft	[h-1]	4	8

Beleuchtung

Beleuchtungsstärke	Lux	500	(Wartungswert)
Höhe der Nutzebene	m	0,8	
Minderungsfaktor	-	0,92	
Abwesenheitsfaktor Beleuchtung	-	0,3	
Minderungsfaktor Geb.-betriebszeit	-	0,7	

Personenbelegung

Maximale Belegungsdichte	gering	mittel	hoch
m²/Person	18	14	10

Interne Wärmequellen

	Vollbenutzungs-stunden [h/d]	max. spezifische Leistung [W/m²] tief	mittel	hoch
Personen (70 W/Person)	6	3	5	7
Arbeitshilfen*	6	4	7	15
Wärmezufuhr pro Tag	[Wh/(m² d)]	42	72	132

Anmerkungen

* tief / mittel / hoch entspricht 50 / 100 / 150 W/Person für Arbeitshilfen

Einzelhandel (mit Kühlprodukten) 6

		von	bis	
Nutzungszeiten				
Tägliche Nutzungszeit	[Uhr]	6:00	20:00	
Nutzungstage pro Jahr	[d/a]	300		
Tageslichtstunden	h/a	??		
Nachtlichtstunden	h/a	??		
Tägliche Betriebszeit RLT	[Uhr]	6:00	21:00	
Betriebstage RLT pro Jahr	d/a	300		
Tägliche Betriebszeit Heizung	[Uhr]	6:00	21:00	(nicht
Betriebstage Heizung pro Jahr	d/a	300		abgesenkt)

Raumkonditionen (sofern Luftbehandlungsfunktion vorhanden)

		Auslegungswert	Monats-mittelwert
Raumtemperatur	[°C] Heizung	20	21
	[°C] Kühlung	26	24

		Min	Max
Zuluftfeuchte	[g/kg]	6	11

Hygienischer Mindestaußenluftvolumenstrom (Normen)

Personenbezogen	[m³/(h Person)]	20
Flächenbezogen	[m³/(h m²)]	-

Mech. Außenluftvolumenstrom (Praxis)		von	bis
Luftwechsel	[h-1]	-	-
Luftwechsel nur Luft	[h-1]	-	-

Beleuchtung

Beleuchtungsstärke	Lux	300	(Wartungswert)
Höhe der Nutzebene	m	0,8	
Minderungsfaktor	-	0,93	
Abwesenheitsfaktor Beleuchtung	-	0	
Minderungsfaktor Geb.-betriebszeit	-	1	

Personenbelegung

Maximale Belegungsdichte	gering	mittel	hoch
m²/Person	6	5	4

Interne Wärmequellen

	Vollbenutzungs-stunden [h/d]	max. spezifische Leistung [W/m²] tief	mittel	hoch
Personen (70 W/Person)	6	12	14	18
Arbeitshilfen *	17	-12	-10	-8
Wärmezufuhr pro Tag	[Wh/(m² d)]	-132	-86	-26

Anmerkungen

* Kühlvitrinen sind Wärmesenken, falls Wärmelast außerhalb des Raumes abgeführt wird; Ansonsten Standardwert von 5 W/m²
Kühlvitrinen haben am Wochenende geringerer Volbetriebszeit > angenähert durch 300 Nutzungstage mit jeweils 17 h/d Volbetriebszeit

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Approach Germany and Austria
Useful energy of air conditioning, non-residential buildings

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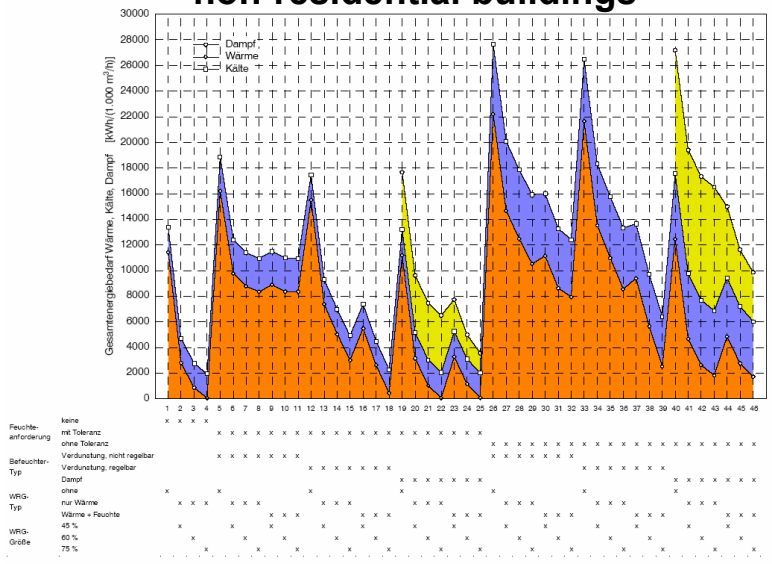

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Situation in Austria

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Competence of EPBD implementation (1)

- Building codes:
  - Competence of the nine federal states, therefore:
  - Nine different building codes
  - Nine different regulations concerning new or refurbishing old buildings
  - Nine different conditions in the subsidy schemes for new and existing buildings
- Concerning the buildings directive only few regulations are made on national level

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Situation in Austria

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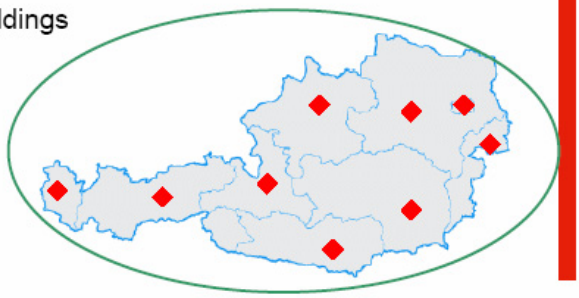
Competence of EPBD implementation (2)

- In General: Federal States („Länder“)
- Art. 7: Energy Certification - Sold and rented out buildings (Ministry of Justice)



Austrian Energy Agency | 18/03/05 | Page 4

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Situation in Austria

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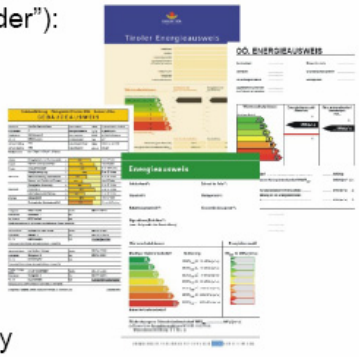
Art. 7: Energy certificates in the past

Between federal states (“Länder”):

- One national model (OIB) (calculation, layout)
- Different layout
- Differing calculation method
- Energy performance in subsidy schemes
- Outlook: harmonised energy performance certificate in Austria



Austrian Energy Agency | 18/03/05 | Page 8

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Situation in Austria

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- National implementation via the Austrian Institute for Building technology (OIB) and the Austrian Energy Agency (EVA) and national standards
- Generally following the processes, which were discussed by CEN and the German DIN 18599 (monthly approach for calculation)
- Methods of energy demand evaluation (state of diskussion April 2006)
  - Simple calculation with tables (Old buildings, renovation)
  - Calculation following OIB (Multi zone – detail or single zone - default)
  - Detailed simulation (dynamic simulation)
  - Measurement of energy demand and calibration to standard conditons (climate, user demand)

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Situation of calculation scheme in Austria

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- Space heating demand (final energy) following EN 13790 slightly adapted to Austrian situation
- End use energy demand for space heating is finished (OIB, EVA)
- Cooling energy demand (final energy) for cooling is finished according the (not finanlized) new EN 13790
- End use energy demand for Ventilation, cold production and distribution is finished (OIB, EVA, IWT)
- Austrian standards take over the calculation scheme developed for the EPBD

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Situation Austria, proposed limits

- For residential buildings cooling demand is NOT allowed (building must be build in a way that NO summer cooling load occurs, ÖNORM B 8110 Teil 3)
- Also for non-residential buildings cooling demand is allowed when the internal gains and the ventialtion is not taken into account (glass-palaces are not allowed with this in the future).
- First values for baseline and colors for heat demand (final energy) are presented.
- Values for end-use energy demand for residential buildings will be given.
- No maximum allowed values for the end-use of non-residential buildings are given (lack of experience)

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State of EPBD laws in Austria

- Energy certificate: After long discussion a common layout and common key figures are accepted by 8 provinces (1 province not (yet))
- Law about the certificate (EAV-G) law has passed the parliament. This is government competence: civil law)
  - Certificate maximum 10 years old
  - When only a dwelling in a mult family house is sold, the certificate of the whole building can be used.
  - If no certificate is available a stadard value accoring age and type of building is used (normally worse than reality)
- The discussion, who can issue the certificate is still ongoing (there will be an examination for all candidates)
- If everything runs well, the implementation can be finalized by the end of 2007

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Courses in Austria

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- There are several courses already ongoing to train future issuers of the certificate
- A general Austria-wide course-system is in preparation
- There will be no limitations in the profession of future issuers but they will have to pass an examination
- Courses will NOT be mandatory, each applicant can chose, which course he/she still need and which not.

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Calculation Scheme Austria (OIB)

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- Chapter I: General calculation information
- Chapter II: Useful energy demand
  - Part A: Calculation of useful space heating and cooling demand (HWB, KB) (very close to prEN 13790)
  - Teil B: Useful ebergy demand of energetical air treatment (heating, cooling, humidification/dehumidification (RLT-Anlagen) (close to DIN 18599 Part 3)
- Chapter III: End use energy demand
  - Part C: End use energy demand for space heating and domestic hot water (HEB)
  - Part D: End use energy demand for space cooling (KEB) and air transport (close to DIN 18599 part 6 and 7)
  - Part E: End use energy demand for ligthing (close to DIN 18599 part 4)
  - Part F: Calculation if total end use energy demand (EEB)
  - Part G: Reference HVAC system
- Chapter IV: Energy certificate
  - Part H: Template of the energy certificate (work in progress)
- Chapter V: Attachemsnts
  - Part I: Climate data (is being deliverd by Zentralanstalt für Meteorologie und Geodynamik)
  - Part J: Catalogue of heat bridges (has to be delivered)
  - Part K: User demand profiles (similar to EN, 10 sets for whole buildings)
  - Part L: Simplified data aquisition for old buildings (work in progress)

Quelle: OIB Berechnungsverfahren, Stand 01/2006

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Calculation Scheme Austria (OIB)

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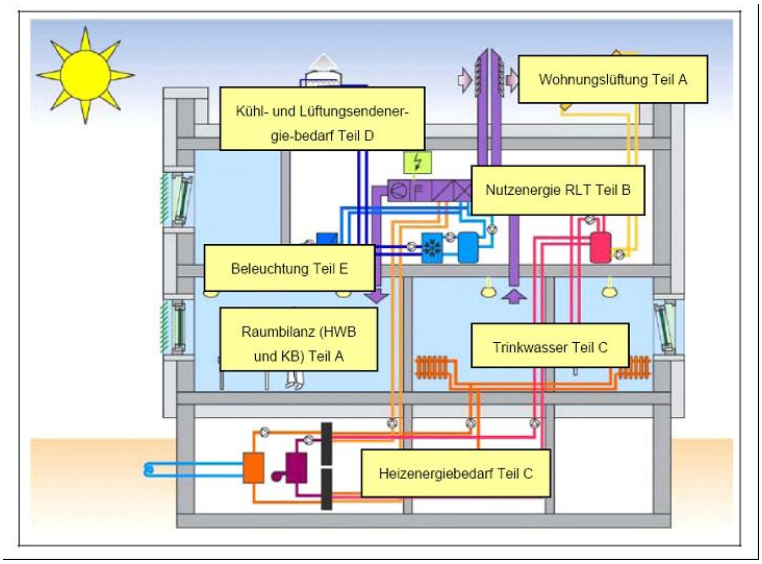

Quelle: OIB Berechnungsverfahren, Stand 01/2006

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Calculation Scheme Austria (OIB)

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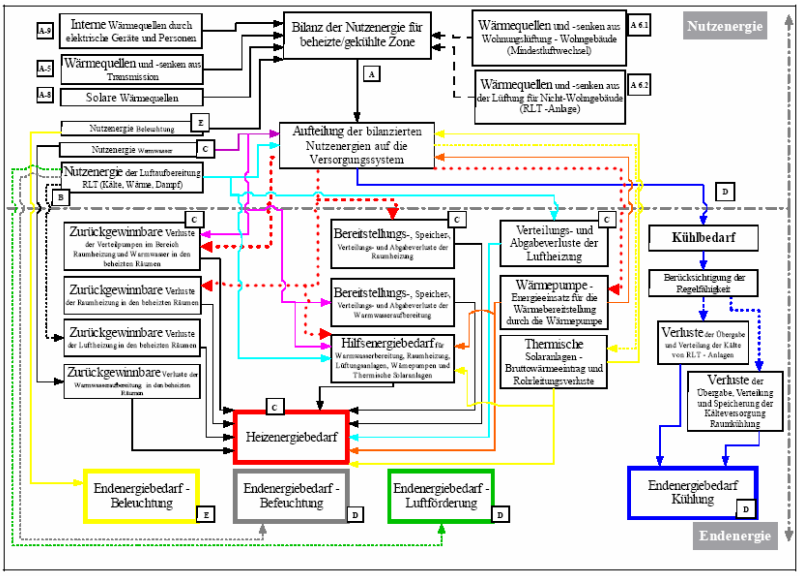

Quelle: OIB Berechnungsverfahren, Stand 01/2006

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Different cases to issue a certificate

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Case 1: New building/renovation – residential building (detailed calculation)

Case 2: New building/renovation – non-residential building (detailed calculation)

Case 3: Issuing of the energy certificate for existing residential buildings (simplified calculation)

Case 4: Issuing of the energy certificate for existing non-residential buildings (simplified calculation)

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Different cases to issue a certificate

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Teil des Leitfadens	Fall 1	Fall 2	Fall 3	Fall 4
A. Heizwärmebedarf (HWB)/Kühlbedarf (KB)	x	x	x	x
B. Nutzenergiebedarf der energetischen Luftaufbereitung (RLT-Anlagen)		x[2]		x[2]
C. Endenergiebedarf für Heizung und Warmwasser (HEB)	x	x	x	x
D. Endenergiebedarf für die Kühlung und Luftförderung		x[2]		x[2]
E. Endenergiebedarf für die Beleuchtung		x		x
F. Berechnung des gesamten Endenergiebedarfs (EEB)	x	x	x	x
G. Referenzausstattung	x	x		
I. Klimadaten	x	x	x	x
J. Wärmebrückenkatalog	(x1	(x)[1]		
K. Nutzungsprofile		x		x
L. Vereinfachtes Aufnahmeverfahren			x	X?

[1] Gilt nur in jenen Fällen, wenn die Wärmeverluste über Wärmebrücken nicht über den pauschalen Ansatz gemäß Teil A des Leitfadens ermittelt werden.

[2] Gelten nur in jenen Fällen, wenn haustechnische Anlagen vorhanden bzw. in Planung sind, die eine Berechnung der jeweiligen Teile des Leitfadens erfordern.

Anmerkung: Eine Reduzierung der erforderlichen Bestandteile des Leitfadens für Bestandsgebäude wird geprüft (sodass z.B. Teil C für Wohngebäude entfällt), sobald das vereinfachte Verfahren vorliegt.

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Components of useful energy demand

The useful energy demand is derived as sum of the following components:

- Useful space heat demand Heizwärmebedarf (HWB)
- Useful space cooling demand Kühlbedarf (KB)
- Useful energy demand of the energetic air treatment for heating, cooling, humidification, and dehumidification
- Useful energy demand of lighting
- Useful energy demand of domestic hot water production

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Calculation steps useful energy demand

1. Calculation of internal gains by persons and appliances according to part A (EN13790)
2. Heat sources and sinks by transmission, part nach Teil A (close to EN13790)
3. Solar heat gains according part A (close to EN13790)
4. Heat sources and sinks due to ventilation alternatively:
   - **Heat sources and sinks of ventilation of residential buildings (hygenically required air exchange rate) according to part A (close to EN13790)**
   - **Heat sources and sinks of non-residential buildings (HVAC-plants) according part B**
5. Useful energy demand of lighting (equals end use energy demand) according part E
6. Useful energy demand domestic hot water according part C
7. Useful energy demand of energetuc air treatment (heating, cooling, humidification, and dehumidification according part B
8. Net heat gain of solar thermal plant (useful energy) according part C
9. Net heat gain of heat pump according part C

Heating and cooling useful energy demand is calculated from items 1-5

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Components of end use energy demand

The end-use energy demand is claculated by the following balances:

- Heating energy demand (water or air heating, domestic hot water production (HEB)
- Space cooling demand (water and/or air based systems) (KEB)
- End use energy demand of humidification/dehumidification
- End use energy demand of lighting
- End use energy demand of domestic hot water production (in HEB included)

Calculation steps end-use energy demand

1. Useable losses of pumps for space heating and domestic hot water production according part C *(Domestic hot water and space heating demand)*
2. Useable losses of space heating in conditioned zones according part C *(HWB)*
3. Useable losses of air heating in conditioned rooms according part C *(Useful energy demand of energetic air treatment for space heating)*
4. Useable losses of domestic hot water production in conditioned rooms according part C *(energy demand of boiler for domestic hot water production)*
5. Proportional heat losses of boiler, storage, distribution, and heat delivery for space heating, part C
6. Proportional heat losses of boiler, storage, distribution, and heat delivery for domestic hot water production, part C

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7. Auxiliary energy demand for domestic hot water production, space heating , air handling, heat pumps and solar thermal plants according part C
8. Distribution and delivery losses of air heating systems according part C *(Useful energy, air heating*)
9. Heat pump . End use energy demand for heat production according part C
10. Solar thermal plant, gross heat production and collector loop heat losses according part C

Balances of items 1 to 6 and 8 to 10 are used fior the useful space heating demand using the utilization factor η. HEB includes space heating deamdn and domestic hot water production.

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11. Losses due to transport and distribution of cold for air handling according part D
12. Losses due to transport and distribution of cold for water based cooling systems according part D

Balances of items 11 and 12 result in the end use energy demand for cooling (KEB – end use energy demand for cooling).

13. End use energy demand for air transport according part B
14. End use energy demand for de/humidification according part D (useful energy demand according part Teil B)
15. End use energy demand for lighting according part E (equals useful energy demand according part E)
16. Calculation of total end use energy demand according part F (end use energya demand for space heating and sooling, domestic hot water, air handling amd lightning)

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Parts of useful energy demand

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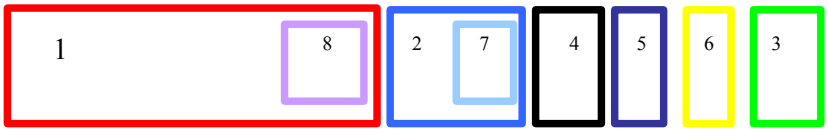

(1-UE) space heating demand OIB part A
(2-UE) space cooling demand OIB part A
(3-UE) useful energy demand for DHW OIB part C
(4-UE) useful energy demand air transportation OIB part B
(5-UE) useful energy demand de/humidification OIB part B
(6-UE) useful energy demand lighting OIB part E
(7-UE) useful energy demand air – handling cooling OIB part B
(8-uE) useful energy demand air – handling heating OIB part B

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Parts of end-use energy demand

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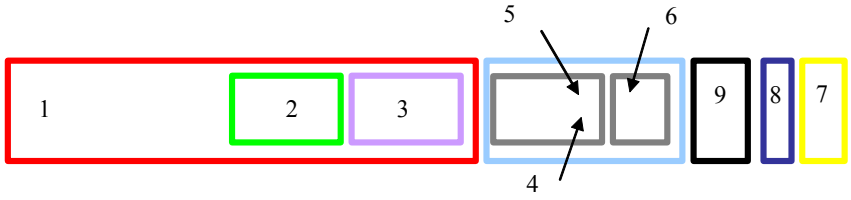

(1-EE) Space heating demand OIB part C
(4-EE) End use energy demand cooling OIB part D
(2-EE) End use energy demand DHW OIB part C
(5-EE) End use energy demand air-handling cooling part D
(3-EE) End use energy demand air-handling heating OIB part D
(6-EE) End use energy demand cooling water based OIB part D
(7-EE) End use energy demand ligthing OIB part E
(8-EE) End use energy demand de/humidifiaction OIB part D
(9-EE) End use energy demand air transportation OIB part D

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Energy Certificate Berlaymont Gebäude

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Year of errection: 1967 (renovated from 1995 to 2004)

Useful area: 241.515 m²

Persons: over 3000 Persons per day

Heating: 3 Gas burners with a total capacity of 7.800 [kW]

Cooling: 4 Compression cooling machines with a total cooling capacity of 8.900 [kW]

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Energy Certificate Berlaymont Gebäude

TU Graz Graz University of Technology

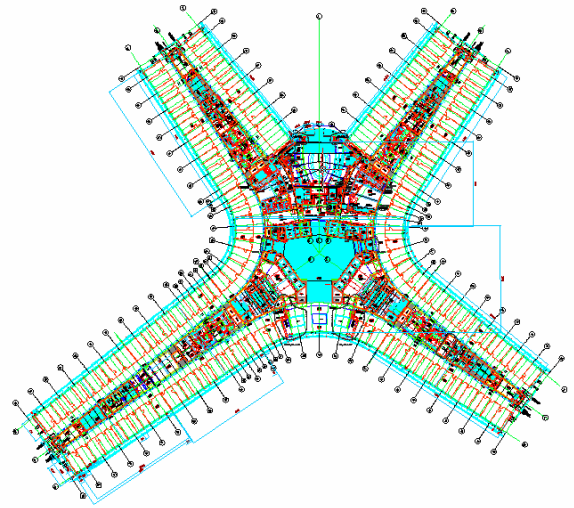

Abb.: 9 th floor of the Berlaymont buidling

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Zoning of buildings (OIB)

Zonierung rules

- At the level of **useful energy demand**
  - User profiles (e.g. more than 4°C difference in the indoor air set temperature)
  - Orientation of rooms (external solar load)
- At the level of **end-use energy demand**
  - HVAC system (heating, cooling, lightning, ventilation)
- *Zones that acoount for less than 5 % of the total useful area can be neglected*

Zoning of buildings, example Berlaymont, Brüssel

Criteria 1: User profiles according to DIN V 18599 Teil 10

Zone	Nutzen	Lüftung	Befeuchtung	Kühlung	Heizung	Beleuchtung	Warmwasser
1	office	+	+	+	+	+	-
2	corridor	+	-	(+/-)	+	+	-
3	foyer	+	-	(+/-)	+	+	-
4	stairs	+	-	-	+	+	-
5	lift	-	-	-	-	-	-
6	citchen	+	-	+	+	+	+
7	toilet	+	-	-	+	+	+
8	shower	+	-	-	+	+	+
9	archive	+	+	(+/-)	+	+	-
10	meeting room	+	(+/-)	+	+	+	-
11	service room	-	-	-	+	+	-
12	technik room	-	-	-	(+)	+	-
13	E+13 commission	+	+	+	+	+	-
14	restaurant	+	-	+	+	+	+
15	stockage / stores	+	-	-	+	+	-
16	sauna	+	-	-	+	+	+
17	V.I.P.	+	+	+	+	+	(+/-)
18	cinema / videoconferenze	+	+	+	+	+	-
19							
20	parking	+	-	-	-	+	-

Criteria 2: solar irradiation – oirientarion of the outer surfaces

⇨ ***In total 144 zones for the calculation***

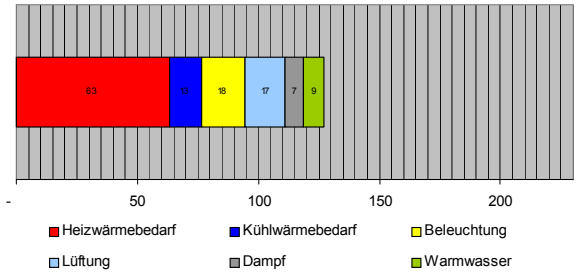
Results useful energy, example Berlaymont, Brüssel

Nutzenergie:

Heizwärmebedarf	63	[kWh/(m².a)]
Kühlwärmebedarf	13	[kWh/(m².a)]
Beleuchtung	18	[kWh/(m².a)]
Luftförderung	17	[kWh/(m².a)]
Dampf	7	[kWh/(m².a)]
Warmwasser	9	[kWh/(m².a)]

Summe	127[kWh/(m².a)]

spezifischer Nutzenergiebedarf [kWh/(m².a)]



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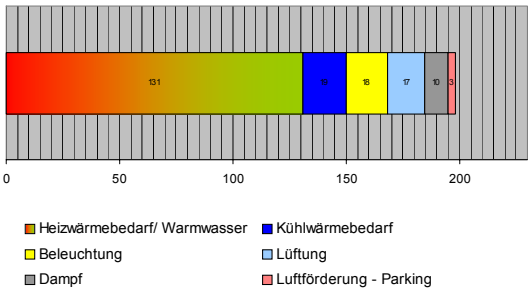
Results end use energy, example Berlaymont, Brüssel

Endenergie:

Heizwärmebedarf und Warmwasser	131	[kWh/(m².a)]
Kühlwärmebedarf	19	[kWh/(m².a)]
Beleuchtung	18	[kWh/(m².a)]
Luftförderung	17	[kWh/(m².a)]
Dampf	10	[kWh/(m².a)]
Luftförderung - Parking	3	[kWh/(m².a)]

Summe	198[kWh/(m².a)]

spezifischer Endenergiebedarf [kWh/(m².a)]



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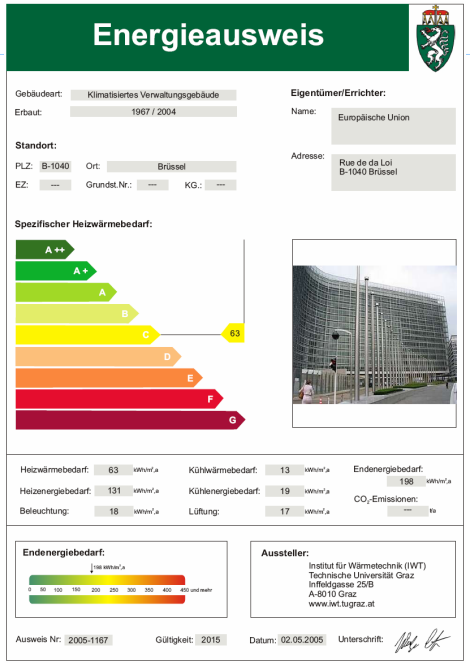
Energy certificate Berlaymont Building – Styria



Energieausweis

Gebäudeart: Klimatisiertes Verwaltungsgebäude
Erbaut: 1967 / 2004

Standort:
PLZ: B-1040 Ort: Brüssel
EZ: --- Grundst.Nr.: --- KG.: ---

Eigentümer/Errichter:
Name: Europäische Union
Adresse: Rue de da Loi B-1040 Brüssel

Spezifischer Heizwärmebedarf:

A++
A+
A
B
C 63
D
E
F
G

Heizwärmebedarf: 63 kWh/m²,a
Heizenergiebedarf: 131 kWh/m²,a
Beleuchtung: 18 kWh/m²,a
Kühlwärmebedarf: 13 kWh/m²,a
Kühlenergiebedarf: 19 kWh/m²,a
Lüftung: 17 kWh/m²,a
Endenergiebedarf: 198 kWh/m²,a
CO_2-Emissionen: --- t/a

Endenergiebedarf:
198 kWh/m²,a
0 50 100 150 200 250 300 350 400 450 und mehr

Aussteller:
Institut für Wärmetechnik (IWT)
Technische Universität Graz
Inffeldgasse 25/B
A-8010 Graz
www.iwt.tugraz.at

Ausweis Nr: 2005-1167 Gültigkeit: 2015 Datum: 02.05.2005 Unterschrift:

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Energy certificates Berlaymont Building

	Austria	France	Germany	Netherlands	Poland	Portugal
No. of Zones ►	19(144)	2	8	3	10	58
Net Energy (specify units)►	127,1 kWh/m²a		120,38 kWh/m²a		129,7 kWh/m²a	139,5 kWh/m²year
Final Energy (specify units)►	198,2 kWh/m²a		182,69 kWh/m²a		170,9 kWh/m²a	155,6 kWh/m²year
Primary Energy (sp. units)►		101 kWh/m²a	217,64 kWh/m²a	71.285.029 MJ/year	223,4 kWh/m²a	3.933.038 kgep/year
Net Energy (specify units)						
Heating►	63,12 kWh/m²a		65,31 kWh/m²a		35,8 kWh/m²a	1,1 kWh/m²year
Cooling►	13,24 kWh/m²a		12,72 kWh/m²a		30,1 kWh/m²a	50,6 kWh/m²year
AC moisture/humidifying►	7,39 kWh/m²a		2,68 kWh/m²a		7,4 kWh/m²a	(included in cooling)
Ventilation (mechanical) ►	16,55 kWh/m²a		12,12 kWh/m²a		5,9 kWh/m²a	(included in heating and cooling)
Lighting►	18,19 kWh/m²a		18,69 kWh/m²a		13,4 kWh/m²a	14,5 kWh/m²year
Domestic Hot Water►	8,57 kWh/m²a		8,86 kWh/m²a		8,7 kWh/m²a	-
Solar Energy►			n.a.			-
Cogeneration►			Included in primary energy conversion		74,7 kWh$_e$/m²a	Included in primary energy conversion
Equipment (if included) ►			n.a.		23,2 kWh/m²a	34,7 kWh/m²year
Pumps and Fans►			4,6 kWh/ m²a		3,3 kWh/m²a	27,2 kWh/m²year
Lifts and Parking►			5,57 kWh/ m²a (net parking energy)			11,4 kWh/m²year

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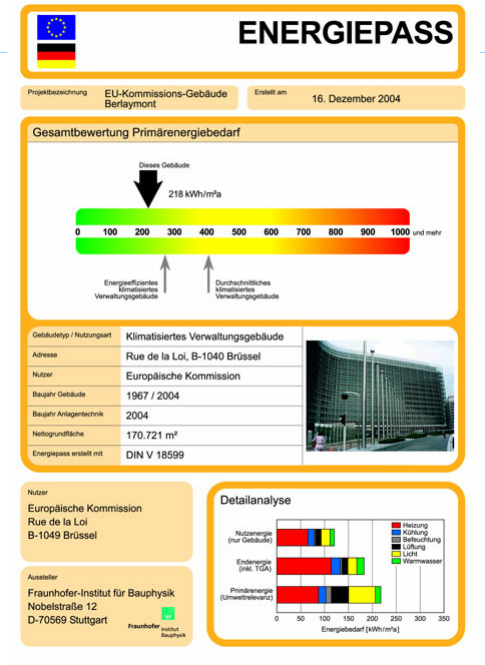
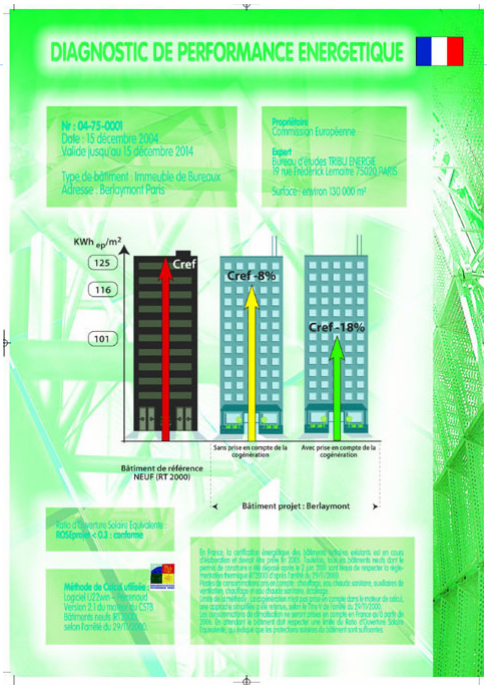
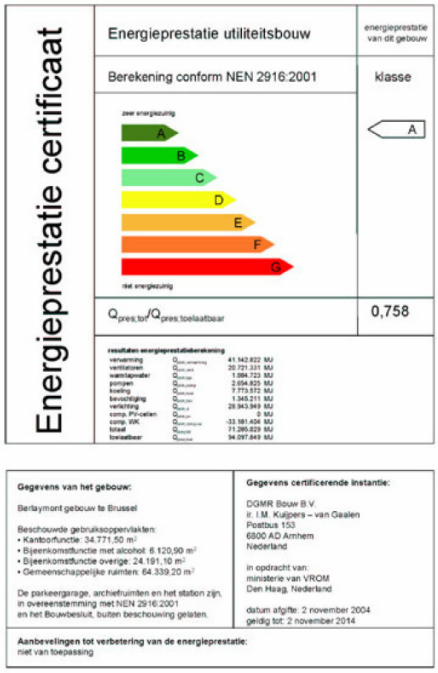

ENERGIEPASS
Projektbezeichnung
EU-Kommissions-Gebäude Berlaymont
Erstellt am
16. Dezember 2004
Gesamtbewertung Primärenergiebedarf
Dieses Gebäude
218 kWh/m²a
0 100 200 300 400 500 600 700 800 900 1000 und mehr
Energieeffizientes klimatisiertes Verwaltungsgebäude
Durchschnittliches klimatisiertes Verwaltungsgebäude
Gebäudetyp / Nutzungsart
Klimatisiertes Verwaltungsgebäude
Adresse
Rue de la Loi, B-1040 Brüssel
Nutzer
Europäische Kommission
Baujahr Gebäude
1967 / 2004
Baujahr Anlagentechnik
2004
Nettogrundfläche
170.721 m²
Energiepass erstellt mit
DIN V 18599
Nutzer
Europäische Kommission
Rue de la Loi
B-1049 Brüssel
Aussteller
Fraunhofer-Institut für Bauphysik
Nobelstraße 12
D-70569 Stuttgart
Detailanalyse
Nutzenergie (nur Gebäude)
Endenergie (inkl. TGA)
Primärenergie (Umweltrelevanz)
Heizung
Kühlung
Beleuchtung
Lüftung
Licht
Warmwasser
0 50 100 150 200 250 300 350
Energiebedarf [kWh/m²a]


DIAGNOSTIC DE PERFORMANCE ENERGETIQUE
Nr : 04-75-0001
Date : 15 décembre 2004
Valide jusqu'au 15 décembre 2014
Type de bâtiment : Immeuble de Bureaux
Adresse : Berlaymont Paris
Propriétaire
Commission Européenne
Expert
Surface : environ 130 000 m²
KWh ep/m²
125
116
101
Cref
Cref -8%
Cref -18%
Sans prise en compte de la cogénération
Avec prise en compte de la cogénération
Bâtiment de référence NEUF (RT 2000)
Bâtiment projet : Berlaymont



Energieprestatie certificaat

Energieprestatie utiliteitsbouw

energieprestatie van dit gebouw

Berekening conform NEN 2916:2001

klasse

zeer energiezuinig

A

B

C

D

E

F

G

niet energiezuinig

A

$Q_{pres,tot}/Q_{pres,toelaatbaar}$ 0,758

resultaten energieprestatieberekening

verwarming	41.142.822 MJ
ventilatoren	20.721.331 MJ
warmtapwater	1.894.723 MJ
pompen	2.054.825 MJ
koeling	7.773.572 MJ
bevochtiging	1.345.211 MJ
verlichting	28.943.949 MJ
comp. PV-cellen	0 MJ
comp. WK	-33.181.404 MJ
totaal	71.295.829 MJ
toelaatbaar	94.297.849 MJ

Gegevens van het gebouw:

Berlaymont gebouw te Brussel

Beschouwde gebruiksoppervlakten:
- Kantoorfunctie: 34.771,50 m²
- Bijeenkomstfunctie met alcohol: 6.120,90 m²
- Bijeenkomstfunctie overige: 24.191,10 m²
- Gemeenschappelijke ruimten: 64.339,20 m²

De parkeergarage, archiefruimten en het station zijn, in overeenstemming met NEN 2916:2001 en het Bouwbesluit, buiten beschouwing gelaten.

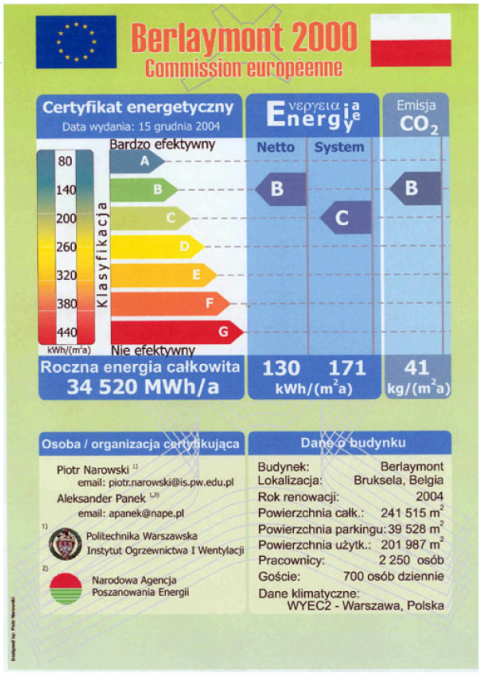
Gegevens certificerende instantie:

DGMR Bouw B.V.
ir. I.M. Kuijpers – van Gaalen
Postbus 153
6800 AD Arnhem
Nederland

in opdracht van:
ministerie van VROM
Den Haag, Nederland

datum afgifte: 2 november 2004
geldig tot: 2 november 2014

Aanbevelingen tot verbetering van de energieprestatie:
niet van toepassing



Berlaymont 2000

Commission européenne

Certyfikat energetyczny

Data wydania: 15 grudnia 2004

Energia

Emisja CO_2

Bardzo efektywny

Klasyfikacja

80
140
200
260
320
380
440
kWh/(m²a)

A
B
C
D
E
F
G

Nie efektywny

Netto
System

B
C
B

Roczna energia całkowita
34 520 MWh/a

130 171
kWh/(m²a)

41
kg/(m²a)

Osoba / organizacja certyfikująca

Piotr Narowski [1]
email: piotr.narowski@is.pw.edu.pl

Aleksander Panek [1,2]
email: apanek@nape.pl

1) Politechnika Warszawska
Instytut Ogrzewnictwa I Wentylacji

2) Narodowa Agencja
Poszanowania Energii

Dane o budynku

Budynek: Berlaymont
Lokalizacja: Bruksela, Belgia
Rok renowacji: 2004
Powierzchnia całk.: 241 515 m²
Powierzchnia parkingu: 39 528 m²
Powierzchnia użytk.: 201 987 m²
Pracownicy: 2 250 osób
Goście: 700 osób dziennie
Dane klimatyczne:
WYEC2 - Warszawa, Polska

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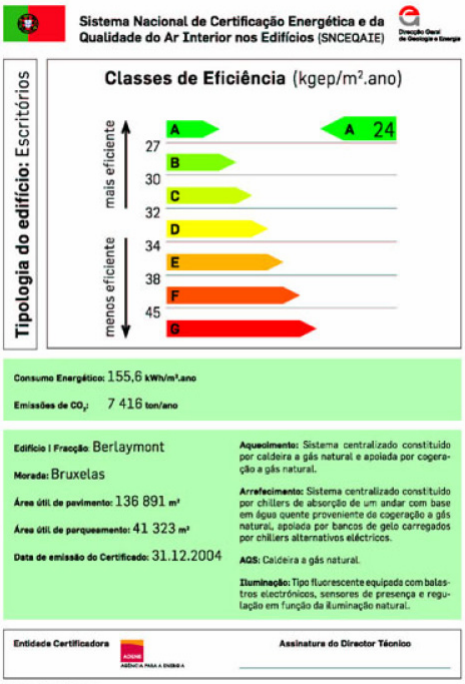

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Institut für Wärmetechnik

Hand over of the certificates to the EU commissioners

Hand over of energy certificates in the Berlaymont building to the die EU-commissioners Andris Piebalgs und Siim Kallas

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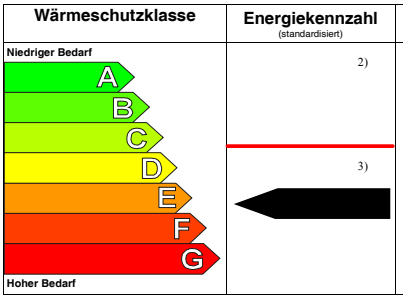
Open questions Austria (state 06/2006)

- Key figures and layout of the certificates (in finalization)
- Implementaion (costs) in specific for non public buildings



- Accordates free of charge Excel-Sheet for one zone is in finalization
- Examination for the official issuers of the certificates (inwork in progress)

Str 55

Study Thomas Eiper

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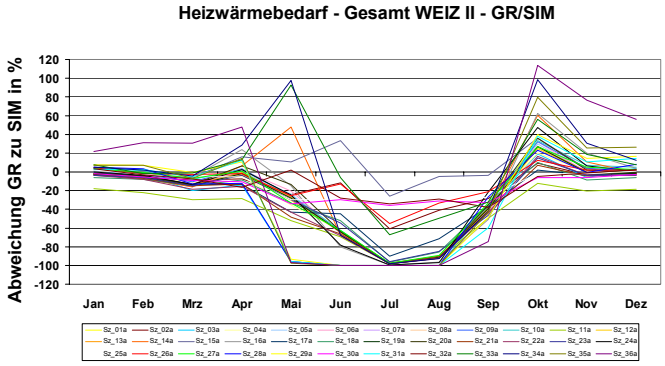
Evaluation of monthly calculation method



- The deviation between dynamic building simulation and monthly appoach ist low for the main heating season for most cases
- During off-season the relative deviations become bigger, the absolute deviation are still relatively small

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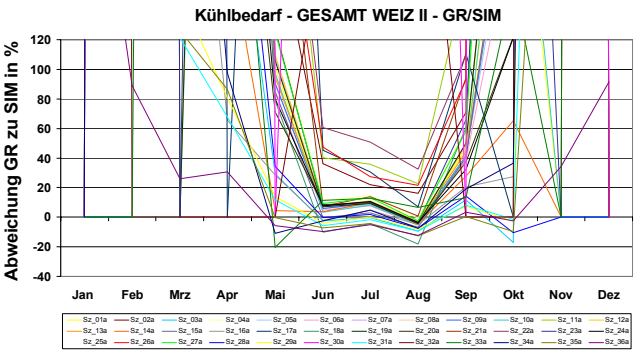
Evaluation of monthly calculation method



- The deviation between dynamic building simulation and monthly approach is higher for cooling than for heating (lower demand, monthly average temperatures in summer are below 20°C)
- High relative deviation in off cooling season

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What can‘t be done with the calculation via EPBD

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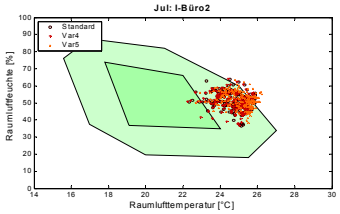
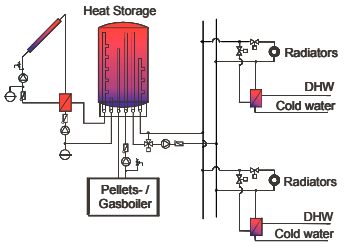
Graz University of Technology

- Heating / cooling load
- Statistic about over-temperature
- Detailed effects of complex hydraulics and controls





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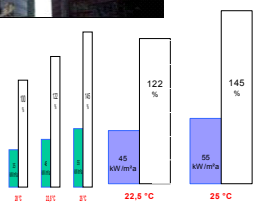
What can‘t be done with the calculation via EPBD

TU Graz
Graz University of Technology

- Effect of complex calculations (big sunspaces, double skin facades)

- Consideration of user-behaviour (window-ventilation, attendance, internal loads …)



Space heating energy for varying indoor air temperature in a Passive house

- Worst/best case scenarios regarding climate

Effects of the EPBD on the Design Process of Buildings

- Energy demand for heating and cooling 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 will use the EPBD certificates.
- Detailed questions to the building still need dynamic building simulation.