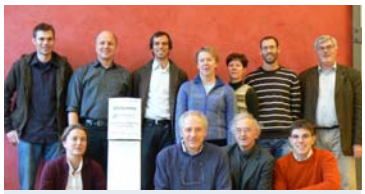
Building EQ
intelligize your energy management

Newsletter Issue 3 | June 2008

Energy Performance Certificates – first experiences

Within the project BuildingEQ, energy performance certificates are issued for all 12 demonstration buildings according to the regulations currently in force in the participating countries.

The regulations differ a lot in complexity and practical application and a linkage to an ongoing commissioning process is not always obvious. In order to cope with that situation, the BuildingEQ team prepared guidelines for evaluating the building performance. These guidelines can be downloaded from the project website. Furthermore, until the end of 2009, BuildingEQ will provide practical tools to support the analysis.



About BuildingEQ

BuildingEQ is an international project comprised of international partners who are involved in monitoring non-residential buildings. The project background is the EU-wide introduction of the Energy Performance Certificate for buildings.

The focus is on optimizing the energy efficiency of the building services technology in the 12 buildings selected for this study. With only a small amount of investment a 20% savings in the energy and heating costs is expected.

In BuildingEQ tools for building monitoring are developed. These can be applied throughout Europe. The project results are targeted to facility managers, building owners, energy consultants and agencies.

The program BuildingEQ is sponsored by "Intelligent Energy Europe", a program of the European Commission.

Italy: different regulations on regional level

Legal background

In Italy the energy performance certificate is still implemented on the regional level. Because the laws on the national level have not yet been passed, a series of different regulations on the regional level exist for the calculation methodology, the energy performance certificate and for obligatory postings of the certificate.

Energy certificate label in Italy,
The certification is based on primary energy for space heating.

Methods of calculation for existing non-residential buildings

In the Lombardy region, the energy consumption is calculated using asset rating AR which uses extremely simplified lumped values. For non-residential buildings, the energy demand is calculated with respect to the gross volume of the building. In addition to the energy needed for heating and domestic hot water, cooling energy is also to be calculated. For summer cooling, no calculating methods are available as yet. The calculation of the primary energy consumption is therefore limited to heating and domestic hot water. Electricity use considers only auxiliary energy (e.g. pumps and fans).

Classification

The energy efficiency class is allotted only for indoor space heating and uses primary energy demand as a basis. In total, there are 8 classes which range from A+ to G. The classification is dependent on the respective climate zone and on the S/V(*) value.

(*) envelope surface on exterior/gross volume

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Supported by European Commission
Intelligent Energy Europe

Reference values

The classification only distinguishes between residential and non-residential buildings. Therefore, an evaluation based on the different building uses for the non-residential buildings is not possible.

Evaluation/Discussion

The differing procedures all of which are currently valid cause a great deal of confusion among energy experts as well as building owners. This problem is then intensified by the economic incentives e.g. tax incentives that use the energy performance certificate as a basis. Nevertheless, it provides a good impetus for energy efficiency and renewable systems within the market. ■

Informatic systems, Milan university building
2,100 m²
1961
83 kWh/(m³a)[1)]
The building comprises mainly office rooms. Special uses are a computer and a multi media room.

Electronic departments, Milan university building
3,700 m²
2006
24 kWh/(m³a)[1)]
The facade is covered with black fiber reinforced concrete panels that provides insulation.

Lecture Halls, Milan university building
3,200 m²
1999
50 kWh/(m³a)[1)]
The energy performance is poor due to the seemingly ineffective domestic hot water, the distribution and control system.

[1)] primary energy for heating per volume (asset rating)

■ Finland: classification value still under discussion

Legal background

As of 2009, energy performance certificates for existing buildings are required. Industry buildings are excluded from this rule.

Methods of calculation for existing non-residential buildings

The certification of non-residential buildings in the building stock is carried out using the actual energy consumption (operational rating OR) as a basis. As well as the heating energy, the electricity consumption and the cooling energy are considered. The user-dependent electricity consumption for electrical devices like PC's, refrigerators, etc. is not included. The gross floor area is used as a reference value.
The procedure as to how to determine, for example, the fraction of total energy consumption used for cooling, is not specified.

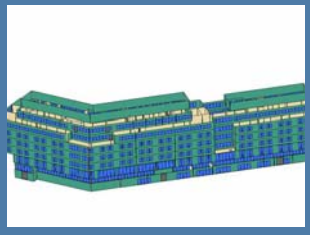
Classification

The energy efficiency is divided into 7 classes from A (highest efficiency) to G (lowest efficiency). The boundary values defining the classes are set depending on the building use. This distribution is based on statistical values from the energy consumption of existing buildings in Finland.

Evaluation /Discussion

Presently there are discussions as to whether the primary energy or CO_2 emissions rather than the end energy should be given in the classification. ■

Energy certificate label for Finland. The certification is based on end energy for heating, cooling and electricity.



State Treasury, Helsinki offices
16,200 m²
1984
128 kWh/(m²a)[1)]
The energy performance seems to be quite good because there is no cooling device.

Senate headquaters, Helsinki offices
11,350 m²
1934
224 kWh/(m²a)[1)]
The former grain mill with huge storage silos was renovated in 2002.

[1)] end energy (operational rating)

Engineering department, Espoo
university building
8,600 m²
1966
275 kWh/(m²a)[1)]
The building comprises offices for researchers, auditoriums, seminar rooms, classrooms and a canteen.

Aurora 2, Joensuu
university building
8,100 m²
2006
202 kWh/(m²a)[1)]
The building is U-shaped. There are glazed courtyards for the distribution of daylight to the surrounding office spaces in both wings.

[1)] end energy (operational rating)

Germany: either asset rating or operational rating can be chosen

Legal background

The legal basis for the certificates is the Energy Saving Ordinance 2002, which was last revised in 2007. This regulation comes into effect for non-residential buildings on 1 July 2009.

Methods of calculation for existing non-residential buildings

As a rule, a certificate based on either an asset rating AR or an operational rating OR can be selected.
In the asset rating, a detailed calculation of the energy demand is carried out which considers the demand for heating, cooling, ventilation, lighting and auxiliary electricity. The building is divided into zones according to use. The calculations must be carried out separately for each zone.
In the operational rating, the energy consumption for heating and electricity over the last 3 years is used as a basis for the calculations.

Classification

The classification is carried out by displaying the primary energy demand, or energy consumption, of the building on a slide bar. Depending on the type of building use and the calculating method (AR/OR), the maximum value and the reference value are fitted.

Reference values

For the asset rating, a so-called reference building is calculated at the same time. This reference building has the same geometry and use, however the energy calculations are carried out using standard building components and a standard heating system. This resulting calculated values are used as a comparative standard.
For the certificate based on the operational rating, standard values for the electricity and heating consumption throughout Germany were published and categorized according to the building purpose (85 different types of use).

Evaluation/Discussion

A certificate based on an asset rating AR costs several thousand Euro, therefore, it is assumed that for existing buildings a OR certificate would be issued in most cases.
According to our estimates, reliable software as well as a sufficient amount of experts who know how to correctly apply the rules for the asset rating are lacking at present. ■

District, Hagenow
Hospital
16,000 m²
1994
210[1)] kWh/m²
155[2)] kWh/m²
The heating energy consumption for the hospital is high because of the large amount of warm water consumption. Furthermore, electricity use is enormous because of medical devices.

Kreuzgebäude, Essen
offices
19,500 m²
1985
181[3)] kWh/m²
Owner of the building ist ThyssenKrupp, a company that is designated as the success-oriented management and marketing of office real estate.

Ministry, Düsseldorf
offices
30,000 m²
1953
211[3)] kWh/m²
The building is owned by a public owned company that is responsible for the facility management of all buildings belonging to the state of North Rhine-Westphalia.

Multi Purpose Building, Stuttgart
university building
9,150 m²
1995
256[3)] kWh/m²
The building is used to help research groups overcome shortages of both office or laboratory space. Energy performance in the multi-purpose building is quite poor due to the laboratories.

[1)] end energy heating (operational rating)
[2)] end energy electricity (operational rating)
[3)] primary energy for heating (asset rating)

Focus: certification of "Kreuzgebäude"

For the German demonstration building "Kreuzgebäude" in Essen, the certificate based on operational rating (OR) shows that the energy consumption performance of the building ranges obviously from a mediocre to high level. *(Fig 1)*. Particularly in the area of electricity consumption, there is potential for savings since the value is just marginally under the value of the reference building *(Fig 2)*.

Fig 3 shows, however, that the AR gives a completely different assessment of the building performance as the OR. The AR rating shows positive results that even exceed the requirements for a new building with the same features. Despite the fact that the calculated heat demand (district heating) is about 150 kWh/m²a, which is almost twice as much as the building actually consumes. One reason for this is that the district heat has a very low primary energy factor.

The differences between OR and AR will be investigated in detail in order to make the certification more realistic and valuable.

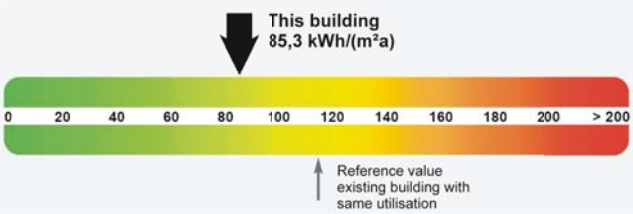


FIG 1: end energy consumption (OR) for heating and hot water

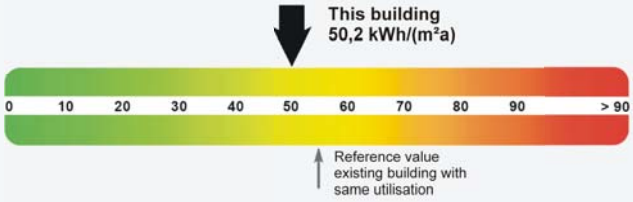


FIG 2: end energy consumption (OR) for electricity

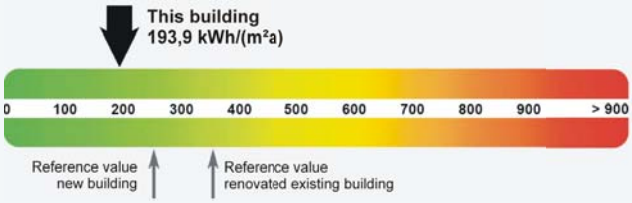


FIG 3: total primary energy demand (AR)

Sweden: any calculation method allowed

Legal background

In Sweden, energy performance certificates are mandatory by law as of 1 Jan. 2009.
The energy expert delivers all data to be recorded on the energy performance certificate via a web interface to Boverket (The National Board of Housing Building and Planning), which performs a central statistical analysis of the data.
The law states that the suggested cost-effective energy efficiency measures may not jeopardize the indoor environment in any way.

Methods of calculation for existing non-residential buildings

There are no calculation methods specified. However, only operational rating can be applied.
The electricity consumption of the user, that is indoor lighting, electrical devices, etc. shall not be considered. This makes operational rating complicated in buildings where the users do not have their own electricity contract, for example hospitals and schools.
The area of reference is the net floor area, whereby the surface area of the interior walls and shafts is also included here, in contrast to other floor area definitions in Sweden.

Energy certificate label for Sweden.
The certification is based on end energy for heating and cooling.

Classification

The evaluation of the energy efficiency is carried out by classifying the building into one of 7 classes. The class with the highest energy consumption, independent of the building use, corresponds to an energy consumption of over 400 kWh/m²a of delivered end energy.

Reference value

For non-residential buildings, a correction of the basis value is necessary (as based on a comprehensive building statistic) in the reference values for existing buildings whereby the climate zone, the location of the building (e.g. free-standing) and the type of the energy carrier are considered.
Cooling energy, is not included in the reference values. The measured, or more typical, calculated cooling consumption must be added to the reference value which effects that it nonsensically is being compared to itself.

Evaluation / Discussion

As of 2009, the obligatory posting of the certificate will not be met in many public buildings, since there is not a sufficient number of experts available. Currently discussions are taking place about handling the breach.

Duka house, Gothenburg
retail, school
1.770 m²
1810
146[1)] kWh/(m²a)

[1)] end energy heating and electricity

Energy certification processes in comparison

country	reference value	type of classification	type of energy	heating	hot water	cooling	air conditioning	lighting	electrical equipment	auxiliary electricity	asset rating (AR)	operational rating (OR)	aprox. time needed for certification in days	certificate obligatory for existing non-residential buildings
Germany	net floor area	slide ruler	primary energy	x	x	x	x	x	x	x	x	x	AR: 3 - 15 OR: 0,5 - 1	01.07.2009
Finland	gross floor area	classes	end energy	x	x	x	x	x		x		x	1 - 2	01.01.2009
Italy	gross volume[1)]	classes	primary energy	x	x	x[3)]				x	x		2 - 16	01.07.2007[4)] 01.07.2008[5)]
Sweden	net floor area[2)]	classes	end energy	x	x	x	x			x		x	2 - 5	01.01.2009

[1)] reference value is net floor area when residential building or hotel

[2)] area of inner walls included

[3)] only for energy requirements of the building, not included for classification

[4)] for buildings > 1,000 m², compulsory only in some cases e.g. renovation of envelope

[5)] for buildings < 1,000 m²

Overview of the demonstration buildings

Each project partner selected up to 4 buildings from his or her country. The selected building must be a non-residential building with over 3,000 m² floor area. At the same time, a minimum of technical equipment should be present (air-conditioner, ventilation, heating).

The year of construction was not a decisive criterion in choosing the buildings. The oldest building participating in the project was built in 1810 in Sweden. The newest building was built in 2006 in Finland and functions as a school and office building.

Primarily the buildings are owned by the state or housing associations. In all, 6 university buildings and 1 hospital were selected. Office space is located in 10 out of the 12 buildings.

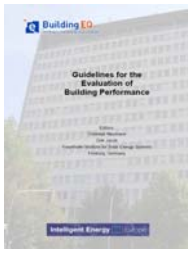
Only 3 of the buildings use gas, the rest are supplied by a district heating system. Further information about these buildings is found in internet on our project home page.

Summary of report WP3

The BuildingEQ team prepared detailed guidelines for evaluation of building performance. The guidelines can be downloaded from the project website
The guidelines contain information about:

- Detailed description of a general systematic approach for performance analysis of buildings
- Definition of a minimal data set
- Technical and financial information on measurement equipment and data transfer
- Description of different national approaches
- Possibilities for further analysis

www.BuildingEQ.net



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