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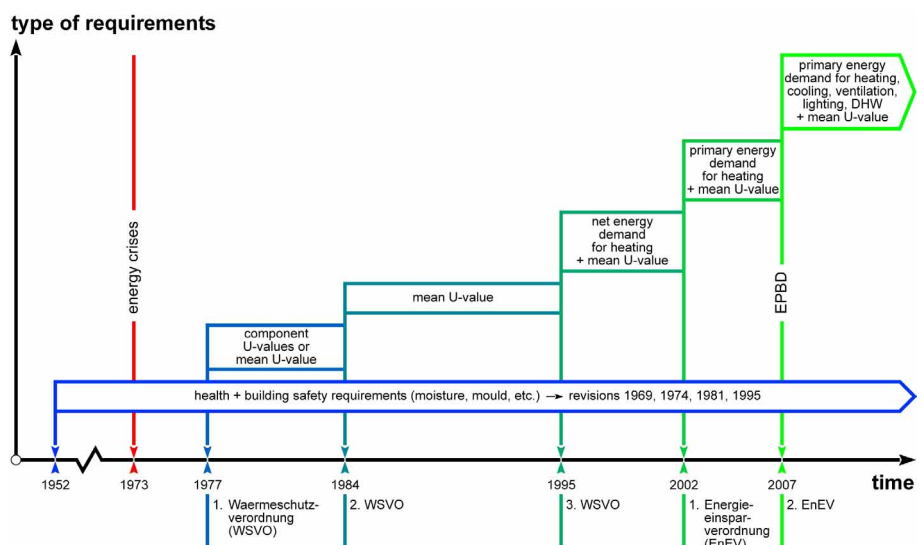
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## Germany: Impact, compliance and control of legislation

The implementation of the Energy Performance of Buildings Directive (EPBD) did not change the national energy performance requirements in Germany, but it has had a ground-breaking effect on energy certification. In consequence, the German building stock has not become more energy efficient, but energy efficiency has reached a higher level of visibility with certificates for new and existing buildings and especially for public buildings. The main change besides the certificates though was the development of a new holistic calculation method that includes heating, cooling, ventilation, domestic hot water and lighting. This paper describes the way in which Germany is handling EPBD compliance and control. The overall implementation status of Germany is described in greater detail in IP 73 [1].

### 1 > Impact of the EPBD on the national requirements

Germany had tightened the national energy performance requirements for buildings the last time before the Energy Performance of Buildings Directive in 2002. With the 2002 energy decree, maximum primary energy demands for heating, domestic hot water and ventilation have been fixed. The calculation method (consisting of two standards, namely DIN V 4108-6 [2] and DIN V 4701-10 [3]) had to be applied to all types of buildings.



Evolution of the energy performance requirements in Germany.

The requirements referred to the primary energy demand per square meter and year depending on the surface-to-volume-ratio, which has been used as an indicator for the compactness of a building in Germany since 1978. A compact building has less relatively seen less building surface area and less transmission losses and therefore less heating needs.

In 2007 a new energy decree was put into force, leaving the requirements and the calculation procedure for residential buildings unaltered. For non-residential buildings a new calculation standard was developed, the DIN V 18599, taking into account for the first time a detailed approach for the ventilation and cooling systems and the energy demand of lighting systems. The energy performance requirements were set by using a so-called reference building with a fixed set of reference technologies to be compared to the actual building (see also IP 71 [4]). By choosing the reference technologies from among state-of-the-art technologies, also here the general approach was not to tighten the energy performance requirements any further.

The focus in the 2006/2007 EPBD implementation period was on kick-starting the building certification process and developing an advanced calculation standard for non-residential buildings that takes into account all required energy components. At that time, the energy performance requirements were regarded to equal at least average level in Western Europe; a further tightening was planned for later. This further tightening of energy performance requirements by about 30 % has been fixed in the upcoming energy decree, which will be put into practice in autumn 2009.

Therefore the EPBD implementation did not have an influence on the energy performance of the German building stock if we regard strictly the energy performance requirements. It has to be mentioned that for the first time also the use of lighting and cooling energy was limited by integrating these energy shares into the total energy performance requirements. Also, requirements to the energy performance of air-conditioning systems have been fixed.

However,

- > the certificates,
- > the new calculation method,
- > the consideration of renewable energy systems,
- > the information and communication activities,
- > the requirement for inspection of air-conditioning systems and
- > the general discussion on these items

have placed the energy efficiency of buildings into the focus of the public, the building owners and professionals and might thus have led to new and existing buildings with a better energy efficiency.

#### **Additional requirements compared to the EPBD**

There are additional requirements concerning the energy performance of buildings if compared with the text of the Energy Performance of Buildings Directive, such as:

- > There is no 1000 m<sup>2</sup> threshold for buildings that undergo a major renovation.
- > The energy ordinance includes definitions for regulatory offences concerning inspections, insulation of heating pipes, qualifications for issuing an energy performance certificate and the completeness and punctual availability of the certificate.
- > With the "Erneuerbare WärmeGesetz"(EEWärmeG, Renewable Energies Heat Act) [5], Germany has stipulated a 15 % minimum use of renewable energy for all new buildings. The ratio of renewables is dependent on the type of energy source and runs from 15 % (solar

Energy source		Primary energy factor	
		Total	Proportion of non-renewables
Fuels	Fuel oil EL	1.1	1.1
	Natural gas H	1.1	1.1
	Liquid petroleum gas	1.1	1.1
	Anthracite coal	1.1	1.1
	Lignite coal	1.2	1.2
	Wood	1.2	0.2
District heating by CHP	Fossil fuels	0.7	0.7
	Renewable fuels	0.7	0.0
District heating by heating power plants	Fossil fuels	1.3	1.3
	Renewable fuels	1.3	0.1
Electricity	Electrical energy mix	3.0	2.7 (2.6)
Eco-energy	Solar energy, ambient heat	1.0	0.0

*Primary energy factors according to German DIN V 18599-1 based on the calculation model of the computer program GEMIS. According to the energy decree the values for the proportion of non-renewables have to be chosen for the calculation of the energy performance of buildings.*

energy) to 50 % (biomass, geothermal). In some federal states the use of renewable energy is also required for major renovations of existing buildings.

- > The 2009 energy performance decree sets a timeline for the removal of electrical night storage heating systems from service. From 2020 onwards all existing electrical night storage heating systems have to be removed depending on the year of their installation.

### Economic calculations as a basis for tightening the energy performance requirements

Several versions of the energy decree have been accompanied by economic calculations before fixing the minimum requirements (first maximum U-values, then maximum energy needs for heating and ventilation, and now maximum primary energy values). It has been assessed what kind of measures are necessary to make a building meet the new requirements and how high the additional investment costs are compared to the previous requirements. Those additional investment costs have been contrasted with the lower operational costs due to energy savings, and the resulting payback periods have been calculated. These studies were not only assigned by the responsible ministry but also by the federal states and the involved building industry.

### Country policy on renewable energy and conversion factors used

As the "Erneuerbare Wärmegegesetz" (Renewable Energies Heat Act) shows, renewable energies have gained great importance in Germany. Many small and medium sized companies that manufacture renewable energy products (such as solar thermal collectors, photovoltaic cells, wind turbines a.s.o.) have been started in the last decade. Especially the PV-production was accelerated by the law, which ensures that renewable energy can be fed into the grid at rather high tariffs. Though the tariffs are slowly decreasing by now, it is still quite cost-efficient to invest in solar cells on the roof.

The table on the left shows the primary energy factors that have to be used when calculating the primary energy performance of buildings in Germany. Renewable energies like solar and ambient heat are calculated with a primary energy factor of 0.0. Wood used as fuel also receives a favourable primary energy factor with 0.2. This has to be compared to fossil fuels such as oil and gas with 1.1 and even the electricity mix with a primary energy factor of 2.7. The primary energy factor for electricity will be changed to 2.6 with the updated energy decree of 2009.

### Minimum requirements for ventilation and summer comfort

There are fixed minimum ventilation requirements for certain building usages like for convention halls etc in the health and safety at work act (Arbeitsstättenverordnung) [6] and the health and safety at work guideline no. 5 (Arbeitsstättenrichtlinie ASR5) [7]. A minimum ventilation rate per person or per square meter is required. With the new calculation standard for non-residential buildings, which is based on usage zones, minimum default ventilation rates are included in the energy performance calculation. Especially for zones and buildings in need of a high air change rate (auditoriums, restaurants, kitchens, etc.) it has been proven that the standard ventilation rate for residential buildings, that has been used so far for all buildings, results in energy needs and uses that do not mirror the reality.

Summer comfort for buildings with and without air-conditioning systems has to be proven according to DIN 4108-2 [8]. A so-called solar gain factor limits the maximum heat gain due to solar but also incorporates different measures to reduce the heat (like solar shading, night ventilation, building mass, etc).

The health and safety at work guideline no. 6 [9] also includes requirements for the indoor air temperature, recommending a maximum indoor air temperature of 26 °C.

### **Impact of the EPBD implementation on the qualification requirements and independency of the energy experts for the certification process**

As mentioned before, the building certification process for existing buildings started with the EPBD implementation. For new buildings, energy performance calculations and certificates had to be made much earlier. Until 2007 the energy performance certificates could be issued only by persons authorized by the state to present building documents. Those persons are defined in the ordinances of the different federal states and include mostly:

- > Architects and civil engineers
  - > Experts for acoustics and thermal protection recognized by the state
- The same rules are still in force for all types of new buildings.

For existing non-residential buildings the following persons are entitled to issue energy performance certificates:

- > Graduates of architecture, civil engineering, building system engineering, building physics, mechanical engineering and electrical engineering studies

For existing residential buildings the group of issuers as defined for existing non-residential buildings is enlarged by the following experts:

- > Graduates of interior design studies,
- > Craftpersons for construction, interior fittings, building system mechanics and chimney sweepers,
- > Technicians authorized by the state,

all with specific further education. The required educational programmes are offered by different institutions.

### **Impact on the building market and building prices**

There is no measurable influence of the EPBD implementation on the building market and building prices in Germany. Building prices are affected much more by the regional, seasonal and general economic situation.

The previously unreleased CO<sub>2</sub> building report 2009 [10] by the German ministry for Transport, Building and Urban Affairs mentions that energy performance certificates are becoming more important for the marketing of residential buildings. Since July 2008 the Internet portal [www.immobilienscout24.de](http://www.immobilienscout24.de) analyses the ratio of buildings being advertised including an EP certificate:

- > August 2008: 2 %
- > December 2008: 4 %

For 15 % of the buildings with attached EP certificates, the characteristic energy performance value for the building is indicated within the advertisement text.

## **2 > Compliance and control**

Compliance with both EP certification and EP requirements for new buildings and buildings undergoing major renovations is in the hands of the federal states. There is no authority that checks the EP certificates for existing public buildings or buildings that are sold or let. Here the responsibility is with the building owner as defined in the German energy decree.

## Sanctions and penalties

The German energy decree defines in § 27 the following regulatory offenses:

- > missing inspections or inspections carried out by unauthorised personnel
- > installation of boilers without CE label
- > lacking insulation of heating pipes
- > inappropriate control system for heating system
- > incomplete, incorrect or delayed energy performance certificate
- > issuing of EP certificates by unauthorized personnel
- > incorrect or lacking confirmation by construction companies regarding the compliance with EP requirements for major renovations and renewed building components or systems

The corresponding penalties are defined in the Energy Saving Act of 2009 (Energieeinsparungsgesetz - EnEG) [11]. Here, penalties between € 5,000 and € 50,000 are defined for:

- > regulatory offences against the thermal protection and energy efficiency of building systems requirements (EP requirements) and regulatory offences against the inspection of building systems and the installation of heating control systems: 50,000 €
- > regulatory offences against the issuing of EP certificates (missing, delayed, incorrect or issued by unauthorised personnel): 15,000 €
- > regulatory offences against the compliance check procedure or incorrect or missing confirmation of private construction companies concerning the compliance of EP requirements for major renovations or renewed building components or systems: 5,000 €

There are also regulatory offences against the Renewable Energies Heat Act as defined in § 17 of the act. Here the offences are divided into:

- > not covering or not correctly covering the generated energy by renewable energy (as required);
- > not providing (not correctly or in time providing) the proof for covering the generated energy by renewable energy;
- > presenting an incorrect ratio of the covered generated energy by renewable energy;
- > not keeping the proof for at least 5 years.

The first 3 offences can be penalised by up to 50,000 € and the last one by up to 20,000 €.

## Compliance check by the public authorities

The compliance check by the public authority is organised differently in each state. It varies from the simple check of completeness of all documents and plausibility to random expert checks at the construction site.

The previously unreleased CO<sub>2</sub> building report 2009 [10] by the German Ministry for Transport, Building and Urban Affairs states that 70 % of the German citizens support the compliance check of the requirements for energy efficient renovations.

A special type of compliance check was developed for the updated energy decree of 2009: the contractor's declaration. All contractors having made changes at existing buildings that fall into "major renovations", or having added insulations to attic ceilings or having replaced heating boilers have to sign a document declaring that these changes fulfill the requirements defined in the energy decree. The building owner has to keep the declaration for at least 5 years and to show it to the authorities if requested.

Additionally the chimney sweeper is checking during his heat producing appliance check whether electrical night storage heating systems that had to be removed are still in use and whether heating and domestic hot water pipes that had to be insulated are still uninsulated. He also checks whether new central heating systems in existing buildings include an automatic night set-back or a night shut-down and an automatic shut-down for the pumps, circulation pumps are controlled and installation pipes are insulated according to a defined level. If there is any offense to the rules the chimney sweeper explains in written form the offense to the building owner, fixes a deadline for compliance and if not met, informs the authorities.

### **Certification market**

The persons qualified for issuing EP certificates have been defined in chapter 2. There are no specialised consultancy firms for EP certificates though some companies might issue more certificates than others. In general the price for issuing certificates is mostly not high enough for companies wanting to specialise in that field. The efforts for certificates based on calculations are rather high. The prices for certificates based on measurements are rather low.

### **Government incentives**

In general there are no incentives in Germany for the mere compliance with the EPBD or EnEV (Energieeinsparverordnung = energy saving ordinance) requirements. Incentives are only offered for buildings that go beyond the minimum requirements of the energy decree, given by the KfW bank (bank of the state) for:

- > energy efficient retrofit of public buildings
- > energy efficient retrofit of dwellings
- > ecological new buildings
- > energy efficient retrofit of social housing

Exemptions are market launch incentives for certain building technologies like wood pellet boilers, solar collectors, micro combined heat and power units, etc.

The German government's incentive policy is mostly realised as soft loans or subsidies. There are no more tax reductions for energy efficient buildings.

Third party financing is used in Germany for some projects but has not such a big impact as for example in the US. On the other hand new financing systems like intracting have been developed. Intracting is a form of "third party" financing where a city or community reserves a special fund for the energy improvement of buildings. This fund is spent as investment and paid back by the energy savings in order to be then again used for the next energy efficient renovation.

Another type of incentives are the rather high tariffs for the renewable energy production to be fed into the local grid defined in the law for renewable energy for electricity (Erneuerbare-Energien-Gesetz, Renewable Energies Act) [12].

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