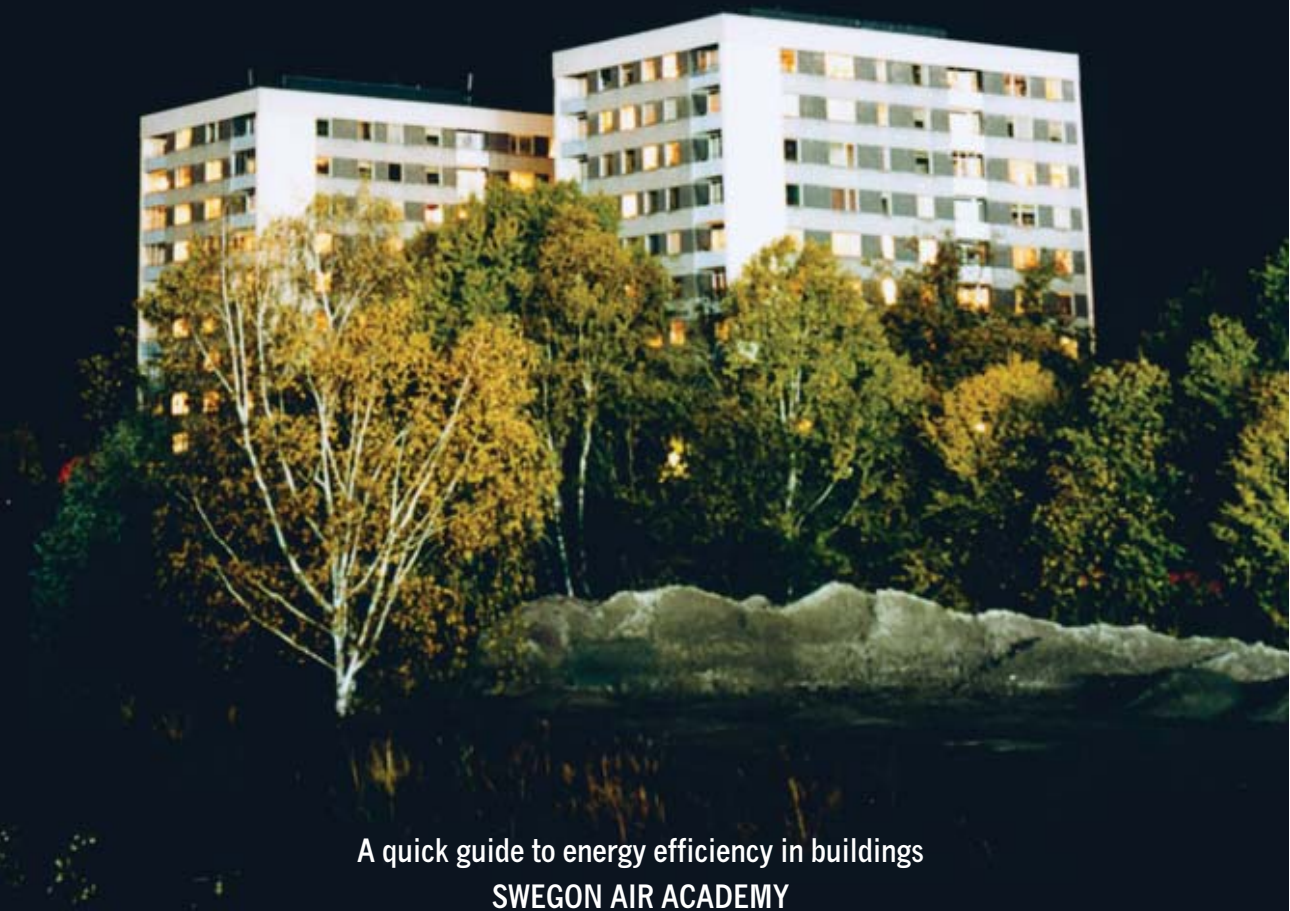
Simply EPBD



A quick guide to energy efficiency in buildings

SWEGON AIR ACADEMY

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FOREWORD

Our joint responsibility

The main reason why the EPBD (Energy Performance of Buildings Directive) came about was because there was a pressing need for formal guidelines to convince us that we needed to manage energy in a more responsible way. No matter whether it's a question of preventing environmental impacts that are impossible to repair or of managing oil, gas and coal supplies – so that these finite resources can last longer or, quite simply, our dependency on imported fuels can be reduced – it is quite clear that nothing will happen without appropriate legislation. This is an unfortunate, but sadly true, fact.

Of course, it is understandable, to a certain degree, that every one of us sees our own individual contributions towards global energy use as extremely marginal. On the other hand, if everyone thought this way, nothing would ever slow down the rate of climate change, of which we are so often reminded. Nor could we prevent the use of oil, gas and coal increasing at a rate that by far exceeds the resources found in new deposits. We have reached and passed 'peak oil'. In other words, we are no longer discovering enough new fossil energy sources to meet the increase in world demands. And, even if the production levels of oil, gas and coal in 2030 are predicted to be the same as they were in 1980, the basic premises are radically different. The population of the world will have doubled and our societies become industrialized to a completely different level than in 1980 and, therefore, critically dependent on sources of fuel.

Work on the EPBD identified a number of areas that were deemed necessary to regulate, if really significant results are to be achieved. These areas include heating, ventilation and air-conditioning systems.

Extensive framework of regulations

Very few private individuals or business people have the drive to penetrate the massive flow of information and legislation surrounding differ-

ent EU directives. Nonetheless, we are all expected to follow these well-meant and imperative orders. A lot has already been written, but we at the *Swegon Air Academy* are convinced that by publishing *Simply EPBD* we will help fill in a number of missing gaps. Quite simply, the book offers easily accessible information that each and everyone who owns a building – large or small – ought to read. It must also be mentioned that the Directive is now in the process of being updated and becoming more stringent, as it is quite clear that the 2002 version has not resulted in the intended positive effects.

Directives are not all that easy to understand

Previously published works have often been written by members of the legal profession and are, for many of us, exceptionally hard to penetrate. By publishing this book, we would like to make a contribution towards helping everyone who is obliged to follow the legislation and regulations to understand the importance and implications of their wordings. The contents of *Simply EPBD* have been written in a popular and easily accessible style, in order to explain the consequences that the EPBD and other directives will have on all of us. Of course, it is easy to object and say that they have to be written in a way that leaves no room for misunderstandings. It is, therefore, important to emphasize that this book can, in no way, replace the wordings of legislation or different directives. Instead, this is a serious attempt to explain complex texts, so that everyday people can understand the main points. We also touch on the implications of the revised Energy Performance of Buildings Directive that is expected to come into force in 2010.

Tight schedule

It was already realized when the Energy Directive came into force that the implementation schedule would be difficult to keep. It has also been seen that a great number of countries have been forced to use all available methods and excuses to postpone introduction. Despite this, a number of countries have not been able to meet their obligations within the stipulated extended time limits. In Sweden, this has mainly been due to

the limited availability of qualified and accredited inspectors and that the time required to train and accredit them has exceeded that allowed by the time schedule. When it comes to property owners who require energy certificates for their buildings, it is natural to ask what will happen, if they do not complete the stipulated inspections and assessments within the time limits. This and other issues are discussed in the book.

Target groups

This book is aimed at all property owners who manage buildings requiring energy certificates. The EPBD concern us all in some way or another – a message that we want to convey in this book, along with recommendations regarding how the requirements can be met. We have chosen to take a closer look at some of the EU member states, but why these in particular? The answer is simple; the choice was dictated by the fact that it was relatively easy to obtain the necessary information about them. Readers who are interested in finding out more about their own countries can refer to the Internet addresses given at the end of the book, via which further information is available.

Conny Nilsson *Director of the* SWEGON AIR ACADEMY

1 WHY DO WE NEED THE ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE?

1.1 Background

There are a number of reasons behind the joint efforts to reduce energy use within the EU. Among the more important are the environmental aspects and a desire to reduce dependency on imported energy. In both instances, minimizing long-term climate change plays a leading role.

In 2007, the EU share of global emissions of greenhouse gases was 14 percent. In 2002, the EU15, the fifteen countries comprising the EU at that time, ratified the Kyoto Protocol, in which a commitment to reduce emissions of CO_2 constitutes a central part. The EU Commission also emphasizes in its Green Paper *Towards a European Strategy for Energy Supply*[1] that the Kyoto Protocol must be seen as a first step in the fight against climate change, indicating their intentions to take further steps in the same direction.

Table 1.1 National emission targets as defined in the Kyoto Protocol.

Country (EU15)	Change (%)	Additional members* (EU27)	Change (%)
Austria **AT**	– 13	Bulgaria **BG**	– 8
Belgium **BE**	– 7.5	Czech Republic **CZ**	– 8
Denmark **DK**	– 21	Estonia **EE**	– 8
Finland **FI**	0	Hungary **HU**	– 6
France **FR**	0	Latvia **LT**	– 8
Germany **DE**	– 21	Lithuania **LV**	– 8
Greece **EL**	+ 25	Poland **PL**	– 6
Ireland **IE**	+ 13	Romania **RO**	– 8
Italy **IT**	– 6.5	Slovak republic **SK**	– 8
Luxemburg **LU**	– 28	Slovenia **SI**	– 8
Netherlands **NL**	– 6		
Portugal **PT**	+ 27		
Spain **ES**	+ 15		
Sweden **SE**	+ 4		
United Kingdom **UK**	– 12.5		

* All EU27 member states, except Cyprus and Malta, have set individual emission targets.

According to the Kyoto Protocol, the EU as a whole is committed to reducing its emissions of greenhouse gases so that by 2012 they will be 8 percent lower than the overall 1evel in 1990. The total reduction has then been apportioned to national levels, as shown in Table 1.1.

In order to facilitate comparison of these targets, the national reductions are also shown in Figure 1.1.

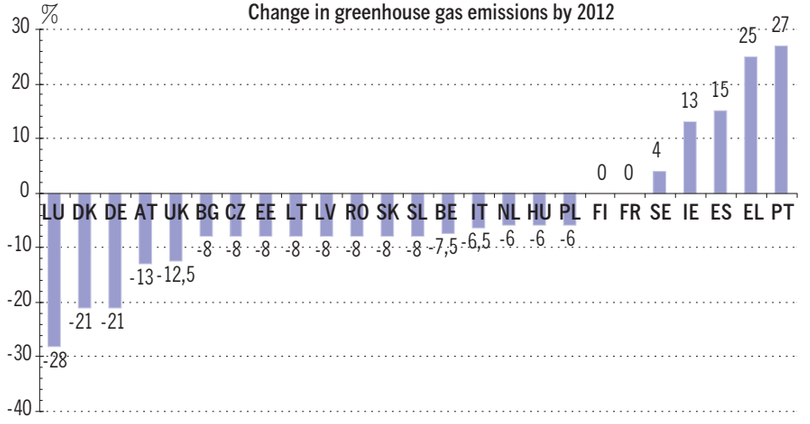


Figure 1.1 Reduction targets, compared to 1990 levels, for greenhouse gas emissions in the EU27 countries (excluding Cyprus and Malta) as defined in the Kyoto Protocol.

We can see that the total joint reduction provides a relatively large span in commitments for the individual member states. While Luxemburg, Denmark and Germany account for the greatest reductions, 28 and 21 percent respectively, Greece and Portugal can, in fact, increase their emissions of CO_2 by 25 and 27 percent respectively. All countries that have become member states after the ratification of the Kyoto Protocol are aiming to reduce their emissions by 8 percent, except Hungary and Poland, both of which will aim for 6-percent reductions.

1 COM(2000)769, 29 November 2000.

At the end of 2005, emissions from the original EU15 countries were 1.5 percent lower than 1990 levels, while the corresponding figure for the EU27 countries was a 7.9-percent reduction.

At their 2007 summit meeting, the European Council decided to further intensify their efforts regarding greenhouse gas emissions by adopting the goals presented by the Commission[2].

Fulfilling the goals will mean that by 2020:

- Greenhouse gas emissions will have been reduced by 20 percent compared to 1990 levels.
- The proportion of energy from renewable energy sources will have increased to 20 percent of all energy use in the EU.
- Energy efficiency will have increased by 20 percent.
- The proportion of bio-fuels used for engines will have increased to 10 percent.

The new, stricter targets mean that, in all probability, new directives will be forthcoming to make it easier for the targets, in reality, to be met. Already today, there are a number of directives pointing towards similar goals, i.e. a reduced use of energy, although they apply to different target groups and use different means.

Today, a system for trading emission rights is in operation, which means, basically, that emission rights are granted for industrial plants according to national allocation plans and the companies running them then have the right to buy and sell these rights. The total number of emission rights will be reduced successively and in this way future emissions will decrease. In 2020, air traffic will also be included in the emissions rights system. However, not all sectors of trade and commerce require emission rights and the sectors thus excluded are, in fact, responsible for approximately half of all greenhouse gas emissions in the EU. These sectors include the building industry, the heating of buildings, agriculture, transport and so-called F-gases[3].

2 The EU Climate and Energy Package was presented on 23 January 2008.
3 General term for emissions of HFC compounds (hydrofluorocarbons), PFC compounds (perfluorocarbons) and sulphur hexafluoride.

It is the Commission's aim to reduce emissions, compared to 2005 levels, from sectors at present not engaged in trading emission rights by 20 percent before 2020. Member states can themselves decide on the methods to be applied to reduce emissions in the different sectors. On the other hand, they are obliged to report to the Commission, so that it will be possible to follow up how their work is progressing.

The agreed measures to be taken by member states are shown in Figure 1.2.

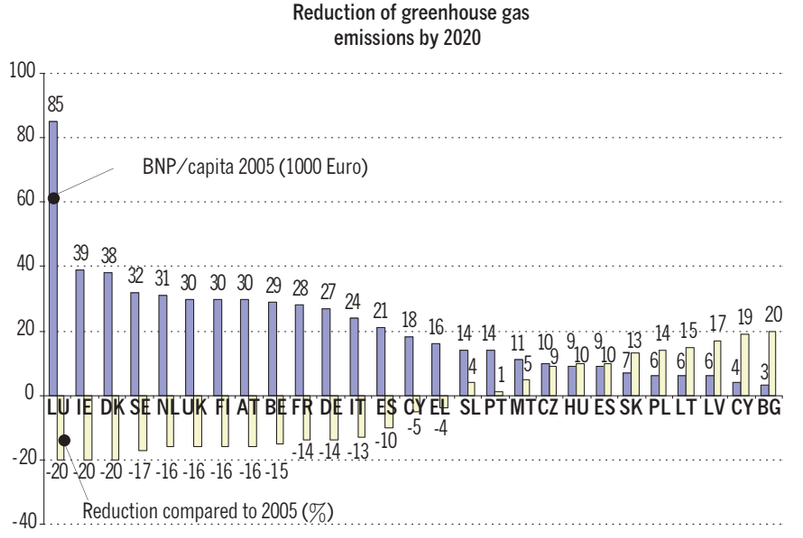


Figure 1.2 Reduction targets for greenhouse gas emissions by 2020.

As seen in Figure 1.2, the BNP of the member states has been taken into consideration when deciding on the measures to be taken. Countries with the highest BNPs are to reduce emissions to a greater extent than those with low BNPs. Some of the countries are even allowed to increase emissions, as these can be accommodated in the total joint commitment.

Simultaneously with their pledges to reduce emissions of greenhouse gases, member states have also committed themselves to increasing their proportions of renewable energy use. In order to compare to what

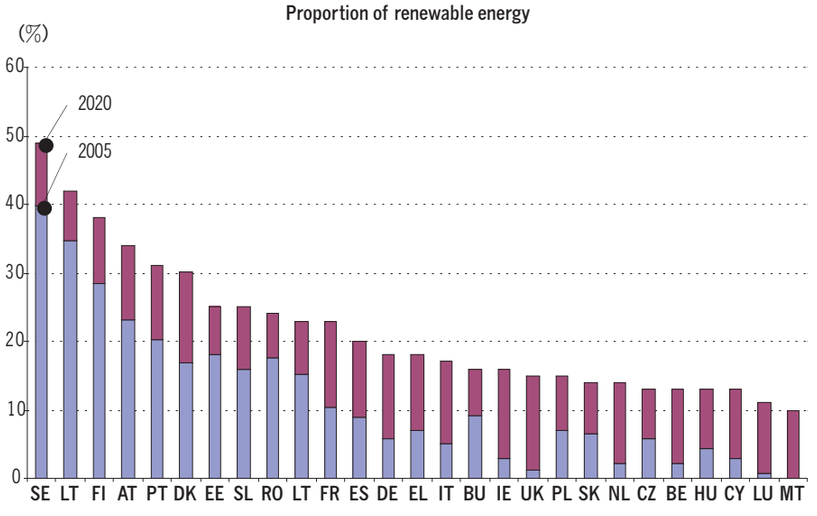


Figure 1.3 Proportion of renewable energy pledged by member states to be achieved by 2020.

extent renewable energy is being used by member states, Figure 1.3 shows the levels in 2005 and the proportions pledged by the countries to be achieved by 2020.

There is a very firm commitment in the EU to reduce emissions of greenhouse gases and reduce dependency on imported fuels. To these ends, the use of renewable fuels and more efficient energy use are pointed out as important tools.

The EU has had a continual and increasing dependency on external energy sources and this has been further enlarged by the increase in number of member states. Based on current estimates, the proportion of imported energy will reach 70 percent by 2030, compared to 50 percent today, if no action is taken.

The building industry is the largest single end-user of energy within the EU. A large number of studies indicate that there is great potential for energy savings in this sector, probably larger than in any other sector. In order to benefit from this potential, increased efforts and investments will be required.

The real outcome of former investments in new technologies in the energy field, in the form of reduced energy use, has been shown to be insufficient. At the same time, large investments have been made in the building sector and the potential gains have been shown to be extensive, although very little has actually happened when it comes to the reduction of energy use. In the opinion of the Commission, a more target-oriented effort was needed to produce a framework with the aim of reducing the rate of increase of the use of energy.

One such framework is the *Energy Performance of Buildings Directive (EPBD)*[4].

1.2 What does the EPBD actually say?

The Directive is a legislatively binding document. This means that member states must adopt the EPBD by introducing national legislation to enforce its regulations. In Sweden, for example, new legislation has been introduced and the national building regulations have been adapted accordingly.

The Directive itself covers five main areas:

- A general framework that stipulates how the energy performance of a building is to be calculated.
- Minimum requirements that must be set for the energy performance of new buildings.
- Minimum requirements that must be set for the energy performance of large existing buildings when subject to extensive renovation work.
- The provision of energy performance certificates (EPCs) for buildings.
- Regular inspections of boilers and air-conditioning systems must be carried out, as well as inspections of the whole heating installations, if the boilers are more than 15 years old.

These different areas affect, to very different extents, what has to be done and how the measures taken will affect property owners. The area

4 European Parliament and Council Directive 2002/91/EC.

described in the fewest words above has, by far, the greatest effect on the property owner.

These areas will be investigated in turn, looking at the demands made and how they could affect the average property owner.

1.2.1 CALCULATING ENERGY PERFORMANCE

The first requirement, which says that the energy performance of a building must be calculated, is normally part of the requirement that says that a building must be energy certified. This means that when an EPC is issued for a building its energy performance figures must be given.

The energy performance of a building can be shown in different ways in the different member states. However, there are two fundamental ways in which it can be expressed: one that is based on theoretical calculations and one that is based on measured use of energy. It might be necessary to use both of these in one and the same country, depending on the circumstances.

In general, buildings can be grouped as follows:

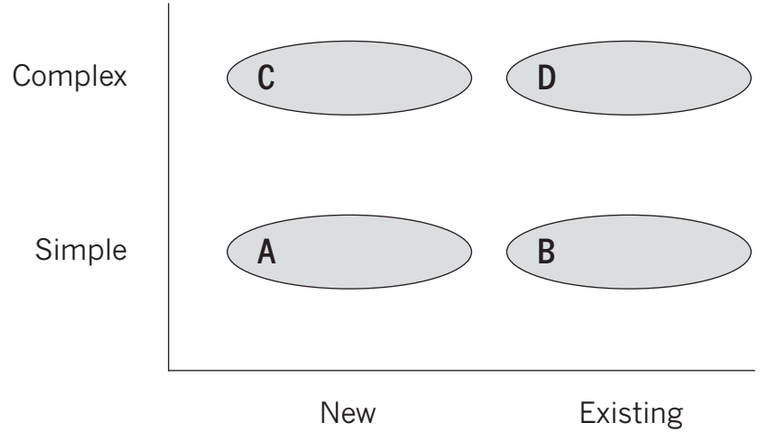


Figure 1.4 General grouping of building stock. Complex and Simple refer primarily to the complexity of the technical installations in the buildings.

It is a good idea to bear in mind the groups shown in Figure 1.4 when discussing energy certification, as the scope varies depending on whether the building is characterized as belonging to Group A, B, C or D.

Buildings belonging to groups A and B are of the same type. The difference is that one group represents new buildings while the other represents existing ones. In both groups, there are buildings with simple technical systems and installations. In this category we find, for example, detached houses and blocks of flats, etc.

Similarly, buildings belonging to groups C and D are also of the same type. The difference here is that the buildings are equipped with complex systems and installations. In this category we find, for example, hospitals, modern office blocks, etc.

The reason for dividing up buildings into new and old groups and not only simple and complex, is because the methodology for determining the energy performance differs between new and existing buildings.

In Sweden, it has been decided that measured values are to be used when determining the energy performance of a building. The numerical indicator is described in detail in regulations issued by *Boverket* (the National Board of Housing, Building and Planning)[5]. Energy performance is determined as the ratio of energy use – for heating, cooling and electric power for building services – to the heated area. The heated area, A_{heat}, is a new term in Sweden, but it closely resembles the previously used term gross floor area, A_{BTA}[6]. The gross floor area was defined as the area of a building within the outer limits of the building envelope, while the heated area is the area within the building envelope that maintains a temperature of at least 10°C.

Thus, in Sweden, the energy performance of a building is

$$EP = \frac{Used\ energy}{A_{heat}} \left(\frac{kWh}{m^2} \right)$$

This means that electricity used by tenants for their business operations, or rather the electrical energy used for these, is not included in

5 Energy Certification Regulations.
6 BTA, bruttoarea, in Swedish.

the amount of used energy. In dwellings, the corresponding exclusion is domestic electricity, i.e. domestic energy.

When energy performance is stated with the help of calculated values, as, for example, in Denmark, it is easy to separate the electrical energy used by a tenant for commercial/operational purposes from other types of energy. However, it can be more difficult when energy performance is to be stated with the help of measured energy use. This is because the electricity used by a tenant in many non-residential buildings is not distinguished from other uses, for example, by using separate meters. If, on the other hand, separate meters are used, a major reason why electrical energy used for commercial/operational purposes is not included in the performance measurements is that property owners do not automatically have access to these figures. This energy is often paid for separately by the tenant, with supply contracts being drawn up directly between the tenant and the electricity provider.

1.2.2 NEW BUILDINGS

When completely new buildings are to be certified there is, for obvious reasons, no measured use of energy to provide figures. This can be overcome in two ways: by calculating the energy performance of the building based on the properties of the building and the building service installations, and on its expected use, or by waiting and using the energy figures obtained from the first years of use of the building. The latter method is used in Sweden. Two years after a building has been put into use, its energy performance is determined from measured values.

The minimum requirements for energy performance in new buildings are given in building standards and similar regulations. They are often given as absolute values that must not be exceeded. The actual level of the value, however, can be based on different considerations. For example, it might be set so that, in practice, all buildings constructed using current building techniques will meet the requirements, although this would mean that buildings constructed with special focus on low energy use might then have performance levels that are considerably below the minimum levels. Here, one can speak of minimum requirement levels as worst cases, i.e. levels that not even the most poorly constructed buildings would exceed. Another way of stipulating a minimum energy performance level would be to define it at such a low level that extra effort is necessary in order to comply with it.

The building stocks in all member states comprise existing buildings and new buildings. The numbers of new buildings are extremely small in relation to the numbers of the existing ones. Even if new buildings were built with extremely low energy demands, they will not affect the total use of energy in buildings in the foreseeable future. In order to reduce energy use dramatically in the whole of the building stock, steps must be taken for reductions in existing buildings.

1.2.3 LARGE BUILDINGS

For the reasons given immediately above, the Directive states that buildings with a total useful floor area over 1000 m^2 that are subject to extensive renovation work must also comply to minimum requirements regarding energy performance. Buildings are normally extensively renovated at 15 to 40 year intervals, or at even longer intervals in the case of facades. When carrying out this type of work it is also often economically advantageous to consider measures to improve energy efficiency or reduce energy use.

The main aim of energy certification is to provide property owners with current assessments of their buildings and to recommend measures that could be taken to reduce the use of energy in a cost-effective way. As the fundamental purpose of the whole Directive is to improve efficiency, and thereby reduce the use of energy in buildings within the Union, hope has been placed, above all, on the recommendations for improvements. The word ‘hope’ is used on purpose, as, at present, no demands are made in the Directive on the property owners to carry out any of the recommendations.

Depending on the type of property owner, it is most probable that the degree of execution of recommended measures will vary. Today, there is a pronounced will among many of the large professional property owners to use energy certification as a tool in their efforts to reduce their use of energy. And among those who have come the furthest in using energy certification as a strategic tool in their ongoing manage-

ment work, there are those who go a step further. The 'normal' energy certification process of a building is, in these cases, supplemented with a detailed audit, producing a complete range of potential energy saving measures. The measures are then costed and judged as a 'package'. In this way, it is possible to produce better results, as some of the measures that are deemed to be economically weak in themselves now become viable, as they can be carried out in conjunction with highly cost-effective measures. It is quite common for economically weak measures to be the ones that actually reduce energy use the most.

Is it then sufficient to only use energy certification in one's energy saving efforts? No, at least not if you are a professional property owner. In buildings where improvements are carried out, it is essential that they are followed up and that the management staff maintain them so that they are effective over a long period of time. There are far too many examples of buildings in which energy saving measures have been carried out and have resulted in an immediate reduction in energy use, only to have reverted, after a year or two, to the old usage levels because the measures have not been maintained and followed up. In order to work with energy issues as part of an ongoing management assignment, some form of energy management system is required. If there is no existing system, then the introduction of one is one of the most important steps to be taken, if the work regarding energy issues is to be carried out in a rational and successful way. Energy certification can then be a powerful tool to tackle energy issues on a daily basis, instead of being regarded as a burden.

1.2.4 INSPECTIONS

Inspections of boilers and air-conditioning systems are carried out in order to realize their energy saving potential. Size limits have been set so that house owners will not be subject to inspections. For boilers, the effective rated output must be greater than 20 kW, if inspections are to be required. In addition, they need not be inspected if they burn renewable fuels. As an alternative to inspections, member states can rely on information drives, if it can be shown that the effects of these would be the same as those resulting from inspections. When this

solution is adopted, reports must be submitted to the Commission every two years.

Air-conditioning systems with an effective rated output greater than 12 kW must be inspected regularly. It might then be a good idea to carry out this inspection in connection with the energy certification of a building. Even if a building does not require an energy certificate, the property owner might still be obliged to carry out an inspection of the air-conditioning system.

In Sweden, it is often practicable to coordinate an inspection with the mandatory inspection of the building's ventilation system, the so-called OVK *(obligatorisk ventilationskontroll)* inspection. The inspection of the air-conditioning system must include an assessment of its efficiency and how it has been dimensioned in relation to the cooling needs in the building. Appropriate advice must be given to the users about possible improvements to the air-conditioning system, its replacement or about other alternative solutions.

An air-conditioning system, according to the Directive, is a combination of all the components required to achieve a form of air treatment that entails the regulation or reduction of the indoor temperature, in certain cases in combination with the control of the ventilation, or of the humidity or cleanliness of the air.

Also included here are the systems used to cool buildings. This type of cooling is called comfort cooling, as its primary aim is to make sure that comfort requirements are fulfilled. Another type of cooling, not to be confused with comfort cooling, is process cooling. Process cooling is used for other purposes than comfort, for example, in cold stores, and creates far lower temperatures than those required for comfort cooling.

2 HOW MANY OTHER DIRECTIVES ARE THERE?

There are a number of EU directives concerned with energy and improving energy efficiency. And there will be more in the future. As a matter of interest, one of the earliest agreements in the forerunner to the present Union – the European Coal and Steel Community Treaty in 1952 – regulated the coal industry from the very birth of the Union. As a result of the oil crisis in 1973, more far-reaching legislation concerning energy was introduced.

In this chapter, we will take a closer look at existing directives and how they affect property owners now and how they will affect them in the future. Some of the directives have a direct effect, while others have an indirect effect. However, all the directives have the same original purpose: to achieve a quicker and greater reduction of the use of energy within the Union than if the issue had been left solely to market forces.

As this book is primarily aimed at property owners, it is natural to focus on the directives that affect them. Besides giving a short general overview of the different directives, the aim of this chapter is to show whether, and how, they affect property owners in their day-to-day work.

The current directives concerned with energy, with a clear focus on improving efficiency, are:

- The Directive on the energy performance of buildings (2002/91/EC)
- The Directive on energy labelling of household electric refrigerators, freezers and their combinations (2003/66/EC)
- The Directive on promotion and development of cogeneration of heat and power (2004/8/EC)
- The Directive for establishing a framework for the setting of ecodesign requirements for energy-using products (2005/32/EC)
- The Directive on energy end-use efficiency and energy services (2006/32/EC)
- The Council decision concerning conclusion of the Agreement between the Government of the United States of America and the European Community on the co-ordination of energy-efficiency labelling programmes for office equipment (2006/1005/EC), including supplementary Regulation (EC) No. 106/2008.

The directives are shown in chronological order of adoption, not in their order of importance for property owners. The first mentioned is the EPBD. This directive directly affects most property owners in the Union and is also the directive that is studied in detail in this book. The contents of all the above-mentioned directives are summarized below, with the EPBD being discussed last.

2.1 The Directive on energy labelling of electric refrigerators and freezers

This directive states, as its name implies, that refrigerators and freezers, and combinations of these, when sold must include information about their use of energy. Since 1994, it has been possible to label products like these using a letter to indicate their energy-efficiency class, and this is still done today.

Originally, there were seven classes, A to G. Energy labelling contributed to improving the efficiency of the products, and more and more of them began to fulfil the requirements of Class A, the best class. In order to distinguish the most efficient products, two more classes were added in 2003, A+ and A++.

This directive can be seen as a help for property owners when choosing refrigerators and freezers. It only affects them to the extent that it provides a guide to the energy use of the products. On the other hand, it has resulted in greater demands being made on refrigerator and freezer manufacturers, especially in regions where the consumers are energy-conscious.

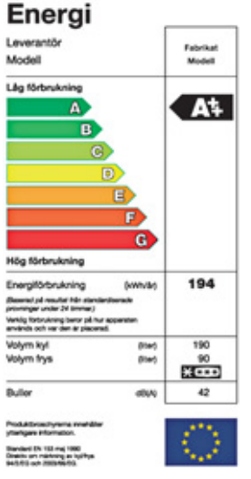


Figure 2.1 Energy labels used in Sweden for refrigerators and freezers. Seepage 103.

2.2 The Directive on cogeneration of heat and power

The purpose of this directive is partly to facilitate investments and partly to facilitate the use of combined heat and power stations. The fundamental goal of the Directive is not to maximize the number of combined heat and power stations but to emphasize that they can be efficient tools for achieving energy savings and reducing carbon dioxide emissions.

According to the Swedish Energy Agency, the combined heat and power stations in Sweden more than well fulfil all criteria stipulated in the Directive. For the individual property owner, the Directive will not require any measures to be taken, as these are all carried out at national level. For this reason, the Directive is not discussed any further.

2.3 The Directive on ecodesign requirements

The term 'ecodesign' refers to the integration of environmental aspects into product design, with the aim of improving the environmental performance of an energy-using product during the whole of its life cycle, while also maintaining the usefulness of the product. Specifically, steps should be taken as early as possible in the design phase of a product to ensure energy efficiency, as it is during this phase that the contamination or pollution that the product will later cause is decided. It is also during this phase that the opportunities for influencing the design of the product are greatest.

The Directive is a so-called framework directive, in which the framework for requirements for ecodesign has been determined with the aim of guaranteeing free mobility for the products concerned within the inner market. However, the Directive excludes means of transportation of passengers and/or goods.

Member states are obliged to set up authorities with responsibility for overseeing the market and to ensure that these authorities have and use the necessary powers in order to take the required steps in accordance with the obligations set forth in the Directive.

The Directive also emphasizes that energy-using products fulfilling the requirements for ecodesign should be CE marked and accompanied by relevant information, so that they can be released on the inner market

and enjoy full mobility. At the same time, it is stressed that self-regulatory measures adopted by trade and industry should be given priority, if it is likely that these measures will contribute to the political goals being achieved quicker, or at a lower cost, than they would be by mandatory requirements.

An energy-using product that fulfils the criteria below must be subject to an implementation measure[7] or self-regulation, for example, by voluntary agreements.

Criteria:

- The energy-using product must constitute a significant sales and trading volume within the Union, suggesting more than 200 000 units per year.
- The energy-using product must have, in relation to the quantities released onto the market and/or put to use, a significant environmental effect within the Union (according to the strategic priorities of the Union as stated in Decision 1600/2002/EC).
- The energy-using product must display significant potential for improvement with regard to environmental impact, without incurring unreasonable costs. Special consideration must be taken to the following conditions:
  - The lack of other relevant Union legislation or inability of market forces to address the problem in a suitable way.
  - The great difference in environmental performance between energy-using products, with similar functions, on the market.

2.4 The Directive on energy end-use efficiency and energy services

The purpose of this directive is to reduce the use of energy within the Union, partly by promoting the availability of energy services and partly by stimulating demand for energy services.

It is especially emphasized that the public sector should be seen as a

7 Measures approved in accordance with the Directive and which stipulate requirements for ecodesign for the specified energy-using products or for their environmental effects.

good example when it comes to investments, maintenance costs and other costs for energy-using products, energy services and measures to achieve improved energy efficiency. The public sector should therefore be encouraged to integrate considerations regarding energy efficiency improvement into its investments, depreciations and operational budgets. The public sector should also strive to make use of energy efficiency criteria when calling for tenders.

The Directive came into effect on 25 April 2006. Member states were required to introduce laws and regulations, to ensure that the Directive could be followed, before 17 May 2008.

The first article in the Directive has a clear goal: Member states are to set and to strive to fulfil a national energy saving goal of at least 9 percent by 2016, to be achieved by offering energy services and by introducing other measures aimed at improving energy efficiency. Member states must adopt cost-effective, feasible and reasonable measures to contribute to the fulfilment of this goal.

The Commission demands that every member state submit plans of action stating how the goals are to be fulfilled. The first plan was to be submitted by 30 June 2007, the second is to be submitted by 30 June 2011 and the third by 30 June 2014.

As previously mentioned, the aim is to position the public sector as a leading example in the execution of energy efficiency measures. This should be possible to achieve by stipulating requirements via legislation or via voluntary agreements. The Directive states that at least two of the following types of requirements must be imposed:

a) Requirements for the use of financial instruments for energy savings, including agreements regarding energy performance, in which measurable and pre-determined energy savings are stipulated.
b) Requirements to purchase equipment and vehicles based on lists provided by authorities (or similar institutions/bodies) that include energy-efficient product specifications using, where applicable, minimized life cycle cost analysis or corresponding methods to ensure cost-effectiveness.
c) Requirements to purchase equipment that is energy-efficient in all modes, even stand-by, using, where applicable, minimized life cycle costs or corresponding methods to ensure cost-efficiency.
d) Requirements to replace or retrofit existing equipment and vehicles with equipment specified in b) and c).
e) Requirements to use energy audits and to carry out the resulting cost-effective recommendations.
f) Requirements to purchase or rent energy-efficient buildings or parts thereof, or requirements to replace or retrofit purchased or rented buildings or parts thereof to make them more energy-efficient.

The Directive also points out that, in the case of public buildings, member states must publish guidelines for energy efficiency and energy savings as possible criteria when calling for tenders.

Other important target groups named in the Directive are energy distributors, distribution system operators and companies selling energy on the retail market. These must, if required, but not more than once a year, submit suitably compiled statistical information about their end-users to the relevant authorities (or similar institutions/bodies). The information must be comprehensive enough to be able to:

– Draw up and carry out programmes to improve energy efficiency in a satisfactory manner.
– Promote and check energy services and other measures to improve energy efficiency.

In addition, they must refrain from activities that can inhibit demand for and the provision of energy services and other measures to achieve energy efficiency or hinder development of the market for energy services and other energy-efficiency improvements.

Member states must also choose one or more of the following requirements that must be fulfilled by the said target groups, i.e. the energy distributors, the distribution system operators and companies selling energy on the retail market. They must either:

– Guarantee the offering and promotion to end-users of competitively priced energy services.

– Ensure availability and promote to end-users competitively priced energy audits that are carried out in an independent manner and/or measures to achieve improved energy efficiency.
– Contribute to funds and financing mechanisms.

As an alternative to the above, voluntary agreements and/or other arrangements aimed at the market can be made, for example, so-called white certificates[8] can be drawn up, if their effect corresponds to one of the points above. If voluntary agreements are made, then they must be evaluated, checked and followed up by the member states, so that sufficiently high effects can be obtained.

For other players, for example, energy service companies, energy equipment installers, energy advisers and energy consultants, member states must ensure that there are sufficient incentives, fair competition and equal conditions, so that they can independently offer and carry out energy services, energy audits and measures aimed at improving energy efficiency.

When it comes to end-users of electricity, natural gas, district heating and/or district cooling, and hot water for domestic purposes, the Directive clearly stipulates that member states must ensure that these end-users have individual meters to show how much energy has been used and when, as far as it is technically feasible and economically viable with respect to potential energy savings. Invoice specifications must be presented in such a way that they can be easily understood.

Among the reasons given for adopting the Directive, it is also stated that motor fuel and transport sectors have an important role to play, where energy efficiency and energy savings are concerned.

2.5 The Agreement on energy-efficiency labelling programmes for office equipment

USA and the EU have agreed to coordinate energy-efficiency labelling of office equipment. According to the agreement, it will be possible to use

8 It should be possible to award so-called white certificates, showing the value of improved efficiency, to companies that have improved their energy efficiency. A next step would be the possibility of trading them on an energy market.

the so-called Energy Star label in the EU to signify energy-efficient office equipment. In USA, products other than office equipment can also be labelled with the Energy Star label; in fact, whole buildings can be labelled in this way.

In the EU, the Energy Star is regarded as an 'energy quality label' for office equipment. In order to be able to use the Energy Star symbol, the product must fulfil stipulated performance requirements. The symbol is shown in Figure 2.2.

Figure 2.2 The Energy Star symbol.

When property owners purchase new office equipment they avoid having to investigate the energy performance of each product and in detail compare different makes with each other to find the most energy-saving products. By stipulating that the products must carry the Energy Star label, they can be assured that the products are energy-efficient. Energy Star labelling can be seen as a guide for property owners and is therefore not something that requires their active participation.

3 TO WHICH TYPES OF BUILDINGS DOES THE EPBD APPLY?

3.1 General aspects

In the EPBD, there are a number of goals that the member states of the EU must fulfil. The goals concern:

1. Methods for calculating the energy performance of buildings.
2. Minimum requirements regarding energy performance in new buildings.
3. Minimum requirements for energy performance in large existing buildings subject to major renovation.
4. Energy certification of buildings.
5. Inspections of boilers and air-conditioning systems in buildings.

But to what types of buildings do these goals refer? For the purpose of the Directive, the following definition, given in Article 2, narrows down the field:

> *"building": a roofed construction having walls, for which energy is used to condition the indoor climate*

Although this definition is, to say the least, very general, it does put its finger on the most important aspect – if the Directive is to apply to a building, then energy must be used to condition its indoor climate.

3.1.1 EXCEPTIONS

Although the general requirements apply, in principle, to all buildings, the Directive names the following building categories as potential exceptions, the decision to adopt them or not lying with the individual member states:

– Buildings or monuments that enjoy public protection when forming part of a particular environment or because of their special architectural or historic value, if fulfilment of the requirements would entail unacceptable changes in their distinctive features or appearance.
– Buildings that are used for worship or religious services.
– Temporary buildings to be used for two years or less, industrial plants, workshops and agricultural buildings requiring little energy and which are not meant for habitation.
– Houses that are meant to be used less than four months per year.
– Freestanding buildings with a useable floor space of less than 50 m^2.

These general exceptions are allowed when assessing energy performance with regard to Goals 1 to 4 set out above. However, they cannot be invoked in the case of Goal 5.

3.1.2 METHODS FOR CALCULATING ENERGY PERFORMANCE

The Directive states, in Article 3, that each member state, at national or regional level, must provide a methodology for calculating the energy performance of buildings. No special specifications about which buildings are included are mentioned and it must be assumed that the general guidelines apply.

3.1.3 MINIMUM REQUIREMENTS IN NEW AND EXISTING BUILDINGS

Article 4 of the Directive stipulates that member states must take the necessary steps to ensure that minimum requirements regarding a building's energy performance are set and that they may, when formulating these requirements, differentiate between new and existing buildings and between different categories of buildings. New buildings must meet the requirements, see Article 5, while existing buildings are not necessarily subject to the requirements, see Article 6. However, special consideration must be taken to buildings with floor areas over 1000 m^2:

– The energy performance of existing buildings over 1000 m^2, and on which significant renovation work is to be carried out, must be improved so that the minimum requirements are met, in so far as this is technically, functionally and economically feasible. The 1000-m^2 limit may be lowered in a few years' time.

– New buildings over 1000 m² must be assessed, before construction work starts, as to whether alternative systems are technically, environmentally and economically feasible. Here, alternative systems means systems based on renewable energy, combined heat and power production, district heating, district cooling and, in certain circumstances, heat pumps.

3.1.4 ENERGY CERTIFICATION OF BUILDINGS

The aspect of the Directive to which it is most often connected is the introduction of energy certification of buildings. The following lines from Article 7 in the Directive specify to which buildings it applies:

> *Member States shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant, as the case might be. The validity of the certificate shall not exceed 10 years…*
> *…Member States shall take measures to ensure that for buildings with a total useful floor area over 1000 m² occupied by public authorities and by institutions providing public services to a large number of persons and therefore frequently visited by these persons an energy certificate, not older than 10 years, is placed in a prominent place clearly visible to the public.*

All in all, the following four categories of buildings must be energy-certified:
– New buildings
– Buildings that are sold
– Buildings that are rented out
– Buildings over 1000 m² providing public services

The general exceptions in the Directive also apply, of course, to these categories of buildings. In addition, a number of member states, for

example, Sweden (more about this later on), have introduced special exceptions, which are only applicable where energy certification is concerned.

3.1.5 BUILDINGS WITH BOILERS AND AIR-CONDITIONING SYSTEMS

In order to reduce energy use and limit carbon dioxide emissions, Articles 8 and 9 in the Directive require member states to ensure that there are regular inspections of air-conditioning systems with an effective cooling power output greater than 12 kW and of boilers rated above 20 kW (fired using non-renewable liquid or solid fuels). Note that the general exceptions for buildings do not apply to these inspections: the Directive applies to all buildings with air-conditioning systems or boilers exceeding the above ratings.

Member states must provide routines for:
– Regular inspections of boilers that are heated using non-renewable fuels and have an effective power output of 20 to 100 kW.
– Regular inspections of boilers with an effective power output over 100 kW, to be carried out at least every other year. For gas-fired boilers, however, four-yearly intervals will suffice.
– One-off inspections of whole heating installations in which boilers are more than 15 years old and which have an effective power output of more than 20 kW, the purpose of which is to provide recommendations regarding replacement of the boilers, modifications to the heating system and alternative solutions.

Where boilers are concerned, the member states can choose to provide advice, instead of carrying out regular inspections, to the boiler users and in this way initiate replacements of and improvements to the heating system. This method has been adopted in Sweden. However, it must be possible to demonstrate that the effects of the advice will provide the same results as inspections.

In the following sections, the consequences of the Directive are summarized for five different countries.

3.2 Sweden

The application of the Directive in Sweden includes the general exceptions and, with regard to energy certification, a further number of exceptions (see below).

Boverket (The National Board of Housing, Building and Planning) has set minimum requirements for new buildings, most recently updated in the Swedish Building Regulations 2008. On the other hand, the Directive requirements have not yet been met for existing buildings with respect to the minimum requirements and regulations when carrying out major renovation work. Boverket plans to fulfil these obligations by 2010.

3.2.1 ENERGY CERTIFICATION OF BUILDINGS

The Swedish regulations regarding energy certification, SFS 2006:985 (in force from 1 October 2006), are based on the instructions in the Directive and apply to the following categories of buildings:

- Special buildings over 1000 m²
- Buildings that are rented out
- Buildings that are sold
- New buildings

These are, of course, the same categories as described in the Directive, though slightly adjusted. Special buildings in this context means buildings for public use and buildings that are used according to Chapter 2, §2 in the Swedish Property Tax Law, that is, principally, *"communications buildings for public communications, health care buildings, swimming pools, sports and athletics arenas, school buildings, cultural buildings and certain public buildings that are used for, among other things, public government, administration, administration of justice and law and order"*.

The term 'rented out' is applicable to all types of multi-unit dwellings, no matter whether the occupier has tenant rights or tenant-owner rights, as well as to other buildings that are rented to users, even if only part of the building is rented out.

In the Swedish Ordinance SFS 2006:1592, governing energy certification, the general exceptions in the Directive are expressed as buildings that are:

- Mainly used for worship or other religious activities
- Industrial plants and workshops
- Second/holiday homes comprising no more than two buildings
- Temporary buildings for less than two years use
- Agricultural buildings for farming, forestry and similar livelihoods
- Freestanding buildings under 50 m²
- Restricted/secret buildings

For buildings that are classed as historic or listed buildings, or otherwise especially valuable according to the Swedish Planning and Building Act, PBL 3:12, only measures that do not damage the cultural value of the building may be proposed. If, for these reasons, suitable recommendations cannot be made, then the building will be exempted.

In addition to the general exceptions, further exceptions, regarding energy certification, have been introduced in Sweden. For example, exceptions are made for buildings that are rented out, if the tenancy granted is:

- Temporary or is for a small part of the building
- Transferred between companies within the same group
- Transferred by lease (mainly farms on which the tenant farmer does not use the building as a dwelling)
- Subsequent to the owner's work or studies being pursued elsewhere, or because of illness or similar (only applicable to detached or semi-detached houses)
- Transferred by bequeath (only applicable to detached or semi-detached houses)

When selling a building exceptions are also made, if the sale is:

- Between two companies in the same group
- Due to expropriation or compulsory purchase
- Due to bankruptcy or forced sale
- To closely related parties

3.2.2 BOILERS AND AIR-CONDITIONING SYSTEMS

Boilers and heating systems do not have to be inspected in Sweden. Instead, the second alternative in the Directive is invoked, i.e. advice is given. On the other hand, air-conditioning systems with effective cooling power outputs greater than 12kW must be inspected regularly, no matter what type of building, with a maximum of 10 years between inspections.

3.2.3 THE BUILDING STOCK IN SWEDEN

According to Swedish legislation regarding energy certification of buildings, special buildings over 1000 m², as well as multi-unit dwellings, must be certified by 31 December 2008. From 1 January 2009, buildings that are built, sold (if building permission was sought after 1 January 2009) or rented out must have an energy certificate that is not more than 10 years old. The following lists show the approximate building stocks within these time limits.

Before year-end 2008/2009

Multi-unit dwellings:	135 000 (total: approx. 2 440 000 units)
Special buildings (over 1000 m²):	5–80 000 (total: approx. 90 000)
Commercial buildings (rented):	60 000
Total:	250 000–275 000

After year-end 2008/2009

Single-unit dwellings sold every year:	65 000 (total: approx 2 030 000)
Commercial buildings sold every year:	20–30 000
New buildings built every year:	10–15 000 (of which single-unit dwellings: 5–10 000)
Total:	95 000–110 000

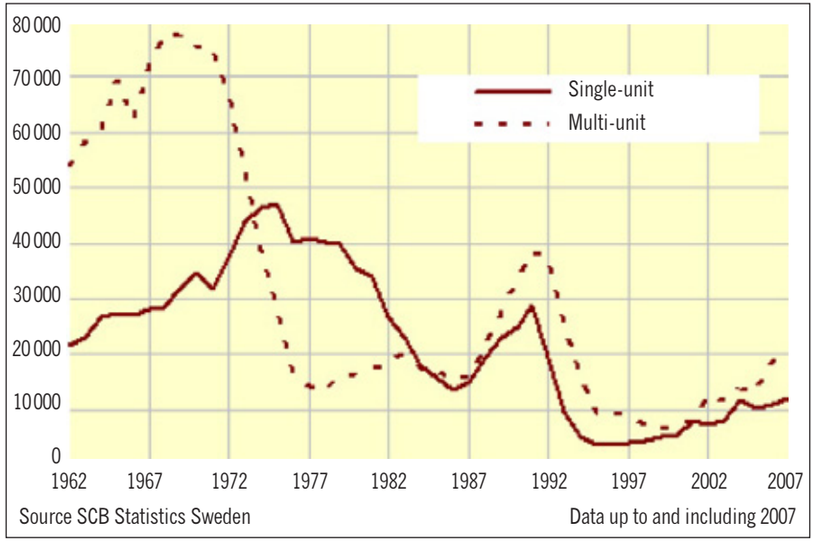


Figure 3.1 Number of dwellings built every year.

3.3 Denmark

Denmark is quite advanced when it comes to energy requirements and building inspections. Energy certification of buildings for sale has been compulsory by law since 1997 and buildings larger than 1000 m² were previously subject to energy inspections every year! Consequently, the Directive itself has not resulted in any dramatic changes. Changes will be seen, however, as Denmark has decided to introduce even more far-reaching legislation than required. For example, there are now minimum requirements for most types of buildings.

The general exceptions, as stated in the Directive, are not strictly applicable and instead there are special exceptions with regard to energy certification. The following types of buildings do not require energy certification in Denmark:

- Buildings smaller than 60 m²
- Buildings that are officially protected
- Churches

- Buildings for commercial production used in:
  - farming
  - forestry
  - horticulture
  - raw material extraction
- Industrial and handicraft buildings
- Electricity, gas, heating and incineration plants
- Buildings to be demolished
- Buildings in which the heated floor space is less than 25 percent of the building's total area
- Buildings in which energy use is impossible to calculate
- Allotment-garden cottages
- Garages for no more than 2 vehicles
- Outhouses

A question does arise when it comes to buildings used for religious purposes, as only churches are expressly exempted in the list of exceptions!

A stricter application of the requirements in the Directive means that buildings over 60 m² (i.e. not just over 1000 m² as in the Directive) must be energy-certified. Note that holiday cottages are not included in the exceptions and must, therefore, be certified just like all other non-excepted buildings.

In addition to energy certification being required when constructing, selling and renting out buildings, it is also required when extensive renovation work is carried out in existing buildings. The energy certificate must not be more than 5 years old, compared to 10 years in the Directive. This is, however, a relaxation of the previous Danish requirement of 3 years. One exception is that holiday cottages smaller than 120 m² must have an energy certificate not older than 10 years, if the property is sold or rented out.

Public buildings over 60 m² and other buildings over 1000 m², not included in the exceptions, must post energy certificates (summarized, with energy classifications) that are not older than 5 years.

In buildings with more than one dwelling unit, in which a separate

tenant owns each unit, so-called owner-occupied units, the building must be certified and each unit must also have an energy certificate if sold or rented out.

Danish energy certification, unlike, for example, Swedish energy certification, is based on calculated performance, although the measured energy use is also given. On the Danish energy certificate, the building is classified using a letter, in the same way as for white goods, from A (best) to G (worst). This type of graphical representation of the classification is the one that is most often used in the member states.

3.4 UK (England and Wales)

The United Kingdom comprises England, Wales, Scotland and Northern Ireland. The application of the Directive in the UK is identical in England and Wales. The differences when compared to Northern Ireland are at an administrative level, while in Scotland the differences are practical, especially where the energy certification process is concerned, as here this is solely dependent on calculated values.

The requirements for energy use in buildings in England and Wales are at present set 20 to 30 percent lower than prescribed in the former building regulations from 2002. In this respect, there is no distinction between new and renovated buildings.

In England and Wales, two types of energy certificates are used for a building's energy performance – the EPC (Energy Performance Certificate) and the DEC (Display Energy Certificate). No matter which is used, the energy-use rating and carbon dioxide emissions are always given for the building in question. The introduction of energy certificates has been gradual, but from 1 October 2008 all buildings will be have to be certified, of course, with a few exceptions.

The DEC comprises a certificate showing the measured data (and classification A to G) and is only displayed in public buildings over 1000 m² that are also visited by large numbers of people. The certificate must be renewed every year. The DEC also includes a report of the state of the building and the potential for carrying out energy saving measures. The report is valid for 7 years.

For all residential and non-residential buildings, an EPC must be available when a building is constructed, sold and rented out. The energy performance and pertinent details about carbon dioxide are based on calculations. Also included in the certification is a report covering potential measures to reduce energy use and carbon dioxide emissions. The following categories are exempted from certification:

- Buildings used for religious purposes
- Temporary buildings to be used for less than 2 years
- Special buildings with low energy use
- Buildings under 50 m^2
- Buildings to be demolished

All EPCs, regardless of type of building, are valid for 10 years.

In the same way that energy certification has been gradually introduced in England and Wales, inspections of air-conditioning systems, according to the Directive, will also be gradually introduced. In the first stage, buildings with large systems in which the effective cooling power output is greater than 250 kW will be included. These are to be inspected by 4 January 2009. For buildings with effective cooling power outputs greater than 12 kW, there will be a respite until 4 January 2011, but after this date inspections must be carried out every 5 years or less. For a more detailed schedule see Chapter 6.

3.5 Czech Republic

In the Czech Republic, eight different building categories have been defined, though without regard to the age of the buildings. Although these categories are defined in a Decree (148/2007), it will still be possible to apply new reference values to other types of buildings if required. How this is to be done is not quite clear. The eight categories of buildings with specific energy classes are:

- Single-family houses
- Apartment blocks
- Hotels and restaurants
- Offices

- Hospitals
- Education buildings
- Sports facilities
- Wholesale and retail trade services buildings

There are seven energy classes, A–G, and the respective limit values depend on the building category. For energy certification, the energy use (for heating, cooling, hot water, ventilation, lighting and other building services) in the building is calculated and the energy class of the building is determined according to its category. New buildings and buildings over 1000 m^2 in which extensive renovation work (according to the definitions in the Directive and taking into account the general exceptions) is to be carried out must have an energy class C rating or higher. There are no general minimum requirements for existing buildings.

Most public and many commercial buildings have already been subject to an energy inspection according to the guidelines set out in an older Decree (213/2001). This inspection is then often used as a basis for energy certification, which is normally only carried out with the aid of building documents. On-site visits are, in practice, optional.

What is regarded as a public building, in connection with energy certification, is regulated in Decree 148/2007 and applies to the following types of buildings larger than 1000 m^2:

- Schools
- Health and care institutions
- Buildings for cultural activities
- Shops
- Sports facilities
- Hotels, youth hostels, etc.
- Restaurants
- Publicly accessible parts of:
  - Water supply and sewage plants
  - Power and heating stations
  - Travel centres (airports, railway stations etc.)
  - Telecommunications establishments
  - Public buildings

3.6 Austria

In Austria, minimum requirements for energy use have been set for new buildings and buildings subject to extensive renovation work. Requirements are based on building type and location. This means that there are no formal minimum requirements for existing buildings.

Energy classification of buildings is based on calculated values. There are three types of energy certificates for the following building categories:
- Dwellings
- Non-residential and public buildings:
  - Offices
  - Nurseries, schools and high schools/universities
  - Hospitals and health care institutions
  - Hotels and restaurants
  - Sports facilities
  - Shops
- Other buildings

The following types of buildings are exempted (corresponding, in principle, to the general exceptions):
- Buildings and monuments protected for architectural or cultural reasons
- Buildings for religious purposes
- Buildings that are not air-conditioned
- Buildings using little energy

4 ENERGY CERTIFICATION OF BUILDINGS

The purpose of the EPBD is to reduce the use of energy in buildings. One of the ingredients in this enormous task is to determine numeric indicators for buildings so that goals can be defined both when constructing new buildings and renovating existing ones. However, the greatest savings potential can be found in existing buildings and this requires the status of these buildings to be investigated to find the available improvement potential. The provision of energy certificates is one way in which this can be achieved.

Put briefly, energy certification of a building means that the energy performance of the building can be determined and compared to numeric indicator values. The building can then be rated in relation to other buildings, in an individual member state, and suitable recommendations can then be made to reduce energy use.

Where most dwellings and commercial buildings are concerned, a valid energy certificate will be required to be displayed when they are built, sold or rented out. In this way it is hoped that the market itself will contribute to the initiation of energy saving measures, as there will be a significant value in having an energy-efficient building. In the case of public buildings, this value will be even more obvious, as their owners will be expected to set a good example and because they will be obliged to have the energy performance certificate available and clearly visible either in or on the building.

4.1 What does the Directive say?

In principle, the Directive, in Articles 7, 10 and 15, comprises the following overall framework for energy certification:
- An energy certificate, not more than 10 years old, must be made available when a building is constructed, sold or rented out.
- The general exceptions regarding buildings (see Chapter 3) are applicable.
- The energy certificate must include reference values so that it will be

possible for consumers to compare and assess the energy performance of a building.
- The energy certificate must be accompanied by recommendations for energy performance improvements that can be carried out in a cost-effective way.
- In public buildings with useful floor areas over 1000 m² and which provide public services for a large number of people, an energy certificate, not less than 10 years old, must be placed clearly visible in a prominent place.
- The certification of buildings and drafting of recommendations must be carried out in an independent manner by qualified and/or accredited experts.
- The Directive must be implemented via legislation and regulations by 4 January 2006. However, the introduction of energy certification may take an additional three years, if there are too few independent experts.

Thus the Directive describes, in brief, the minimum requirements regarding energy certification of buildings. It is then up to each and every member state to draft more detailed guidelines.

The following sections provide an overview of the implementation and application of energy certification in Sweden and four other member states.

4.2 Sweden

The introduction of energy certification in Sweden, based on the articles of the Directive, has resulted in the following documents:
- SFS 2006:985, *The Energy Declaration of Buildings Act* (passed by the Swedish Parliament)
- SFS 2006:1592, *The Energy Declaration of Buildings Ordinance* (passed by the Swedish Government)
- BFS 2007-4 BED1, *Regulations for Energy Certification of Buildings* (issued by *Boverket*, the National Board of Housing, Building and Planning)

- BFS 2007-5 CEX1, *Regulations for Accrediting Energy Experts* (issued by *Boverket*)
- BFS 2007-14 BED2, *Regulations Regarding Changes to the Regulations for Energy Certification of Buildings* (issued by *Boverket*)

These mandatory documents, described in brief below, thus regulate the energy certification process in Sweden.

4.2.1 BUILDINGS

The Energy Declaration of Buildings Act defines the buildings that have to be certified, according to the instructions given in the Directive. From 1 January 2009, an energy certificate, not more than 10 years old, must be available when:
- A building is sold.
- When a building is constructed, if planning permission is applied for after 1 January 2009. However, certification is not required until two years after the building has been taken into use.

In addition, for certain buildings, a valid energy certificate, not more than 10 years old, must be available and posted clearly visible in a prominent place. This certificate is required for:
- Buildings that are rented out.
- Special buildings with a usable floor space over 1000 m².

As pointed out previously, the term ‘rented out’ applies to all types of blocks of flats (rented or owner-occupied) as well as other buildings that are rented out to users, even if only part of a building is rented out. The term ‘special buildings’ means public buildings used for public services. See Chapter 3 for a more detailed description. All special buildings over 1000 m² and blocks of flats must, by law, have been certified by 31 December 2008. For more information regarding the time schedule for certification, see Chapter 6.

According to Ordinance SFS 2006:1592, exceptions can be made with regard to Act SFS 2006:985 for a number of building categories. These comprise the general exceptions, given in the Directive, as well as

a number of other buildings, but only where energy certification is concerned. These exceptions have already been specified in Chapter 3.

4.2.2 ENERGY CERTIFICATION

In most cases, an accredited energy expert carries out the energy certification on site, although the work is simplified, and costs reduced, if the client, i.e. the property owner, can produce relevant documentation, such as measured energy use, drawings and reports from mandatory ventilation inspections (OVK) and radon measurements. In the energy certificate that is then compiled, and electronically registered at *Boverket*, the following must be stated:

– The measured energy performance of the building

The use of energy comprises the corrected average yearly amount of bought energy for heating, comfort cooling, domestic hot water, service installations and other electrical energy for building services (the electricity used for the activities/operations carried out in the building and for domestic purposes are thereby excluded). The energy performance is to be stated in kWh/m², where the floor space in the building is defined using the term A_{temp} (A_{temp} is the floor area in a temperature-regulated space, within the interior of the building envelope, that is intended to be heated up to more than 10 °C).

– Reference values

Three reference values are given in the energy certificate:

1. *The energy use of the building is graded according to where it is placed on a scale comprising the contours of seven buildings placed within one another, see figure 4.2, representing the energy performance of the whole of the building stock and in which the best rating is 50 kWh/m² and the worst is 400 kWh/m². This scale may be revised when more buildings have been energy-certified.*
2. *The requirements stipulated in the Swedish building regulations for new buildings are to be stated.*
3. *A typical range of values for buildings, similar to the building in question, is to be stated. The range is drawn up with the help of statistical data for a building located in the town of Eskilstuna, with the values corrected for the building depending on its type, age, locality, heat source and use of cooling, if applicable. The range is determined by increasing or decreasing the corrected statistical values by 10 percent or 20 percent, depending on the type of building.*

– Recommendations (if possible)

An independent energy expert shall first assess whether it will be possible to propose recommendations for cost-effective measures to such a degree that a survey of the building is justified. If not, the expert may give general advice about improving energy efficiency. If a survey is carried out, the proposed measures must be cost-effective and not lead to negative consequences with regard to the indoor environment or the cultural value of the building.

– Information regarding the mandatory ventilation inspection (OVK) certificate and radon measurements

If a mandatory ventilation inspection has been carried out, this must be stated on the energy certificate. However, the results of the inspection need not be disclosed. The same applies to radon measurements.

– Information about the air-conditioning system

If a building is equipped with an air-conditioning system with an effective cooling power output greater than 12 kW and which is mainly electrically powered, this system must be inspected and the following data determined and stated in the certificate:

- *The energy efficiency of the air-conditioning system.*
- *The size of the air-conditioning system in relation to the building's cooling needs.*
- *Whether it would be possible to achieve greater energy efficiency when running the system, either the existing one or a new one.*

– Information about the geographical location of the building
– The date of certification
– The name of the independent expert who carried out the certification assignment

– A summary

The results of the energy certification process are to be summarized in an energy certificate in which the energy classification of the building, its energy performance and the appropriate reference values are clearly stated.

4.2.3 CLASSIFICATION

In addition to the certification process resulting in a report, a summary is also produced, in the form of a certificate. Iin the case of special buildings and buildings that are rented out, the certificate must be displayed in a visible place. The certificate states the energy classification of the building. How the classification is determined and illustrated graphically is up to each member state. In the EU, the classical model, also used for white goods, dominates and shows the energy efficiency rating of a building on a scale from A to G (sometimes with the addition of extra classes, such as A+ and A++). A so-called speedometer is also sometimes used to illustrate the rating on a horizontal scale.

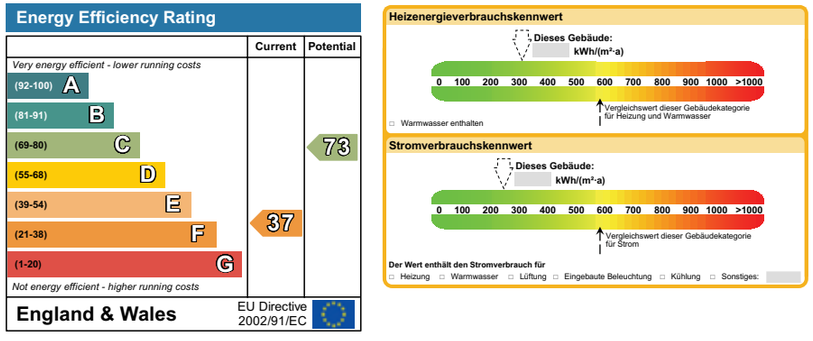


Figure 4.1 Energy certificate design used in the EU. See pages 104, 105.

In Sweden, however, an own version of the certificate is used comprising 7 stylized building contours placed within each other, see below, in which the innermost and smallest building corresponds to the best rating (less than 50 kWh/m²), while the outermost and largest building corresponds to one with the lowest energy use rating (greater than

400 kWh/m²). The position of a small building silhouette indicates the rating of the building in question. In addition to this certification, the building's use of energy is stated and shown in relation to the minimum requirements stipulated for new construction and also in relation to the reference range for similar buildings.

Figure 4.2 Energy certificate (summarized) used in Sweden. See page 106.

A Swedish standard, which will supplement the European standard (SS-EN 15217), for energy certification of buildings is, however, now being produced. This will recommend a graphical design of the classification in accordance with the white goods model with rating classes from A to G. The standard will also recommend the use of four different indicators for the building in question:

– The calculated heating power requirement at the design outdoor temperature.
– The measured energy performance (excluding electrical energy used for domestic purposes and/or for activities/operations in the building).

– The assessed environmental impact (based on weighted energy use).
– The measured use of electrical energy for domestic purposes and/or for running the activities/operations in the building.

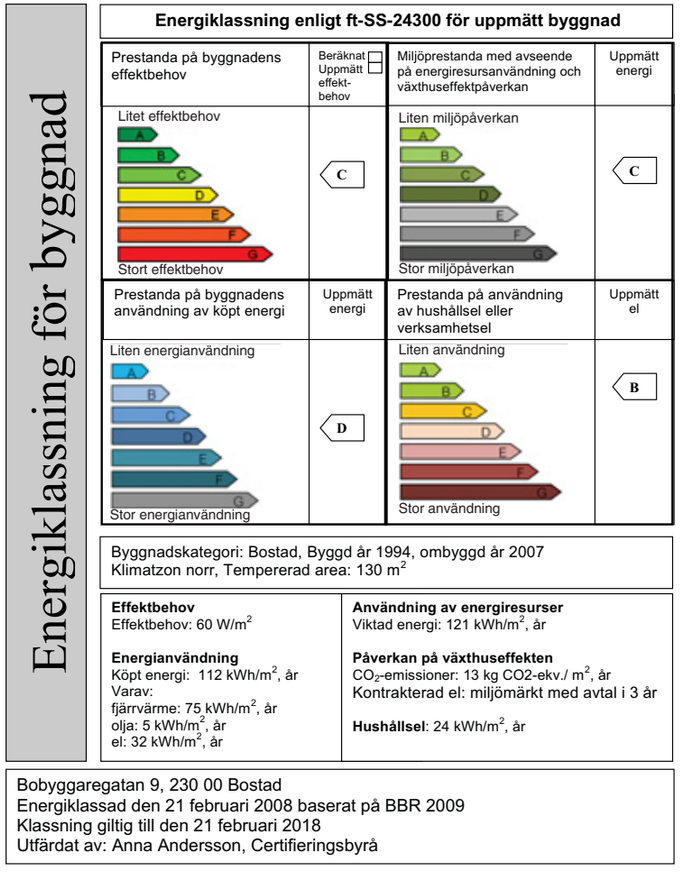


Figure 4.3 Preliminary design for the new Swedish energy certificate according to SS-EN 15217. See page 107.

Environmental impact is assessed based on a weighted use of energy in which different factors are used for different energy sources. Consequently, the weighting factor for oil and electricity might be significantly

greater than the factor for bio-fuels, although this will be decided based on political standpoints.

4.2.4 INDEPENDENT EXPERT

According to the Directive, a qualified and/or accredited expert must be engaged to carry out the energy certification work. This expert must also operate independently. In Sweden, this is achieved by ensuring that certain basic requirements are fulfilled with regard to the expert's knowledge and experience.

There are three different approval levels for energy experts:
– Standard *(for simple buildings)*
– Qualified *(for complex buildings)*
– Air-conditioning *(not for buildings, only for air-conditioning systems)*

In addition to general requirements for all the qualification levels, every level has its own list of requirements that must be fulfilled and these are specified in the *Boverket* regulations for certification of energy experts (BFS 2007-5 CEX1). The expert must also pass a test to become a certified energy expert. The certification is valid for 5 years, after which a new test must be taken. This test can, however, be somewhat simpler than the first test, depending on whether, and by how much, the regulations have been changed. In Sweden, there are four certification institutions that have been approved to set these tests and that are allowed to certify energy experts:
– SWEDCERT AB
– DNV *(Det Norske Veritas Certification AB)*
– INCERT *(Installations Certifiering i Stockholm AB)*
– SITAC AB

These four are, in turn, accredited by SWEDAC, the Swedish Board for Accreditation and Conformity Assessment. Companies offering energy certification services must also be accredited by SWEDAC and have at least one employee who is a certified energy expert. These companies are called accredited inspection agencies.

4.2.5 REGISTERING ENERGY CERTIFICATES

When an energy expert has carried out an assessment of a building the data is compiled on an electronic form and is registered in a database, known as GRIPEN, at *Boverket*, where all energy certification data is stored. The input data results in an automatic calculation of the reference values and a complete energy certificate, which the energy expert can then hand over to the client. The last page of the certificate is a summary, including the energy classification, which, in the case of special buildings and buildings that are rented out, must be publicly displayed.

As more and more energy certificates are issued, the reference values, which, today, are calculated using data based on a building located in Eskilstuna, will be revised and instead be based on the measured values derived from existing buildings.

4.2.6 REGULATORY BOARD

The regulatory board is the local municipal authority and it has the power to impose fines on a property owner who has not displayed an energy certificate (in summary) in a building where one is required. For buildings in which energy certificates need not be displayed, there is no regulatory board. However, when a building is sold the buyer can order an energy certificate to be produced at the seller's cost, if the seller cannot produce a valid certificate. More detailed information about the regulatory procedures for energy certificates is given in Chapters 7 and 8.

4.3 Denmark

Energy certificates for buildings in Denmark are, as previously mentioned, not new. They have, in fact, been prescribed by law for a number of years before the adoption of the EU Directive. Originally, there were two different types of energy certificates:

– The ELO (EnergiLedelsesOrdningen, the Danish Energy Management Scheme) certificate – applicable to buildings over 1500 m².
The energy certificate was based on measured values and contained a plan for remedial measures. The certificates were renewed every year (or every three years in the case of buildings which were highly rated with respect to energy use).

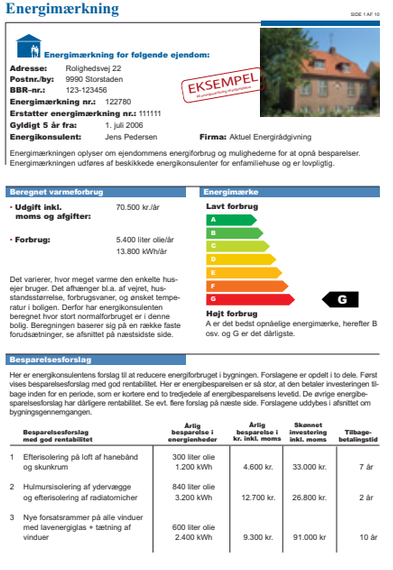
– The EM (EnergiMærkningsOrdningen, the Danish Energy Labelling Scheme) certificate – applicable to buildings under 1500 m².
The energy certificate was based on calculated values and was not to be more than 3 years old when a building was sold.

Since 2005, the *Danish Energy Board* has been responsible for the implementation of energy certification of buildings according to the EU Directive. There are now three types of energy certificates, one for each of the following building categories:

– Single-family dwellings
– Multiple-unit dwellings
– Non-residential buildings (including public buildings)

All certification is based on calculated values, although measured values are also given (for heating in dwellings, and for heating and electrical energy in non-residential buildings).

Large buildings, over 1500 m², must have been able to produce an energy certificate (not more than 5 years old) since 1 January 2006.



Energimærkning

SIDE 1 AF 10

Energimærkning for følgende ejendom:

Adresse: Rolighedsvej 22
Postnr./by: 9990 Storstaden
BBR-nr.: 123-123456
Energimærkning nr.: 122780
Erstatter energimærkning nr.: 111111
Gyldigt 5 år fra: 1. juli 2006
Energikonsulent: Jens Pedersen **Firma:** Aktuel Energirådgivning

EKSEMPEL

Energimærkningen oplyser om ejendommens energiforbrug og mulighederne for at opnå besparelser. Energimærkningen udføres af beskikkede energikonsulenter for enfamiliehuse og er lovpligtig.

Beregnet varmeforbrug

- **Udgift inkl. moms og afgifter:** 70.500 kr./år
- **Forbrug:** 5.400 liter olie/år, 13.800 kWh/år

Det varierer, hvor meget varme den enkelte husejer bruger. Det afhænger bl.a. af vejret, husstandsstørrelse, forbrugsvaner, og ønsket temperatur i boligen. Derfor har energikonsulenten beregnet hvor stort normalforbruget er i denne bolig. Beregningen baserer sig på en række faste forudsætninger, se afsnittet på næstsidste side.

Energimærke

Lavt forbrug
A
B
C
D
E
F
G

G

Højt forbrug

A er det bedst opnåelige energimærke, herefter B osv. og G er det dårligste.

Besparelsesforslag

Her er energikonsulentens forslag til at reducere energiforbruget i bygningen. Forslagene er opdelt i to dele. Først vises besparelsesforslag med god rentabilitet. Her er energibesparelsen er så stor, at den betaler investeringen tilbage inden for en periode, som er kortere end to tredjedele af energibesparelsens levetid. De øvrige energibesparelsesforslag har dårligere rentabilitet. Se evt. flere forslag på næste side. Forslagene uddybes i afsnittet om bygningsgennemgangen.

	Besparelsesforslag med god rentabilitet	Årlig besparelse i energienheder	Årlig besparelse i kr. inkl. moms	Skønnet investering inkl. moms	Tilbagebetalingstid
1	Efterisolering på loft af hanebånd og skunkrum	300 liter olie 1.200 kWh	4.600 kr.	33.000 kr.	7 år
2	Hulmursisolering af ydervægge og efterisolering af radiatornicher	840 liter olie 3.200 kWh	12.700 kr.	26.800 kr.	2 år
3	Nye forsatsrammer på alle vinduer med lavenergiglas + tætning af vinduer	600 liter olie 2.400 kWh	9.300 kr.	91.000 kr	10 år

Figure 4.4 A typical Danish energy certificate. See page 108.

In the case of public buildings over 60 m² and other buildings over 1000 m², an energy certificate, not older than 5 years, must be available by 1 July 2009.

In addition, from 1 July 2009, an energy certificate must also be made available, or one must be issued, when a building is constructed, has undergone extensive renovation, is sold or is rented out. The certificate must not be more than 5 years old. This is, of course, also the case with respect to multi-unit dwellings/blocks of flats, for which the energy certificate applies to the whole building. However, a sub-certificate must also be provided for every dwelling unit, in which its specific energy use is stated.

The energy certificate, drawn up by an independent and accredited energy expert, will show the building's energy classification on a scale from A to G, where class B corresponds to the current building standards. Class A is subdivided into classes A1 and A2, applicable to low-energy buildings. A list of recommendations for improvements must also be drawn up and assessed.

4.4 UK (England and Wales)

In England and Wales, the *Department for Communities and Local Government* is responsible for energy certification of buildings and this is regulated in the Energy Performance of Buildings (Certificates and Inspections) Regulations 2007 that came into force on 19 April 2007. The regulations cover the implementation and issuing of two different types of certificates in England and Wales:

– The EPC (Energy Performance Certificate)
  The certificate is issued for dwellings and non-residential buildings and is based on calculated energy use.
– The DEC (Display Energy Certificate)
  The certificate is posted in public buildings over 1000 m² and is based on measured energy use.

From 1 October 2008, an EPC must be available, or issued, when constructing a new building, or renting out or selling a building. The EPC must not be more than 10 years old. This rule applies to all

dwellings and non-residential buildings, with few exceptions. A report with recommendations for improvements must be attached.

In the case of public buildings, a DEC must be issued and posted, if the building is over 1000 m² and is visited by a large number of people, i.e. people who are not just employed in the building. A report with recommendations for improvements must accompany the certificate. Although the DEC must be renewed every year, the recommendations need only be renewed every 7 years.

There are two types of EPCs, one for dwellings and one for non-residential buildings. Where dwellings are concerned, there are two types of ratings – one for calculated energy use and one for calculated environmental impact with regard to carbon dioxide emissions. It is also stated which rating the building could be given, if the recommendations for improvement were to be followed. Only one rating is given for non-residential buildings and this is for carbon dioxide emissions (normalized to the value for a similar typical building) where this typical building has been given the rating 100. This corresponds to the rating D on a scale from A+ to G. The certificates for both dwellings and non-resi-

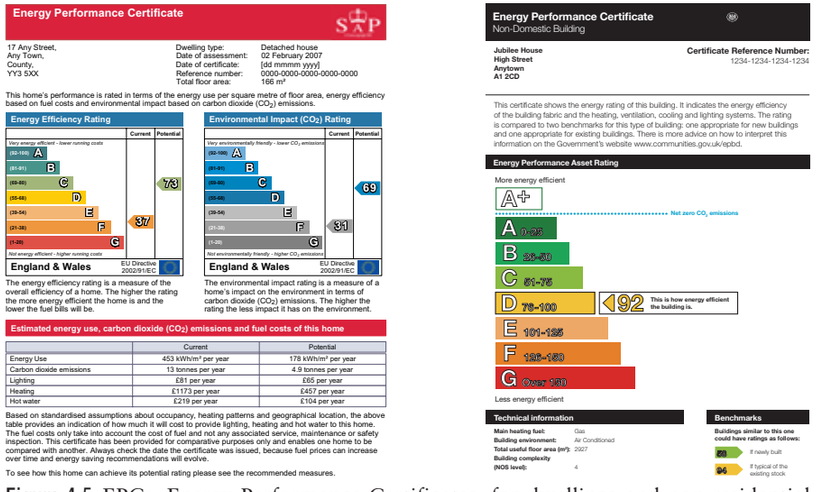


Figure 4.5 EPCs, Energy Performance Certificates, for dwellings and non-residential buildings in England and Wales. See pages 109, 110.

dential buildings also state two reference values – one for new buildings and one for similar buildings.

The contents of a DEC correspond, in principle, to those of an EPC for non-residential buildings but are based on measured values, which makes them considerably easier to update, compared to an EPC, when changes are made in a building or an air-conditioning system.

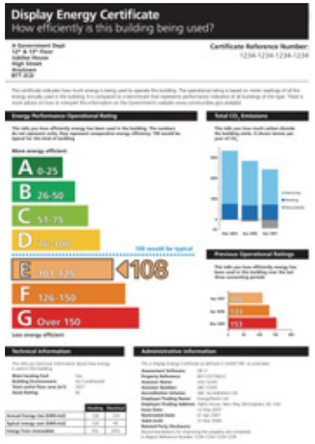


Figure 4.6 A DEC, Display Energy Certificate, for a public building in England or Wales.
See page 111.

The independent energy experts who carry out the energy certification work have different qualification levels depending not only on whether they carry out EPC certification or DEC certification but also depending on the type of building, i.e. if it is a dwelling, a non-residential building, or whether it is categorized as being simple, complex, new or old.

4.5 Czech Republic

The implementation of the EU Directive in the Czech Republic has resulted in legislation (Act 406/2006) regarding energy management in buildings. The implementation of energy certification is regulated in a Decree (148/2007) issued by the *Ministry of Industry and Trade*.

Energy certificates must be available from 1 January 2010 for new buildings, and when selling or renting out a building. For non-residential buildings, when sold or rented out, and for public buildings, an energy certificate must be available from 1 January 2009.

Until the end of 2005, energy inspections of buildings were, in certain instances, mandatory (as set out in Act 406/2000), which meant that many buildings in the Republic had already been subject to extensive inspections and provided with recommendations for improvements. The former inspection reports were based on measured energy use, whereas the new energy certificates are based on calculations. In the future, energy inspections will be carried out in parallel to energy certification. Energy inspections will therefore often form a basis for future energy certification, which only in exceptional cases will be carried out on site.

To be able to carry out energy certification work, the person involved must be accredited according to Decree 148/2007. Authorization is gained by meeting requirements concerning education/training and experience, and by passing tests. It is most probable that a great proportion of the present 300 energy inspectors will apply for authorization to carry out energy certification.

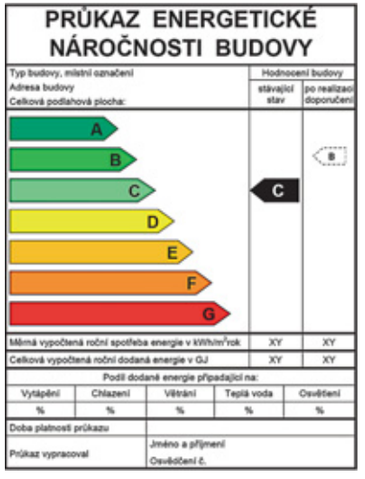
Only one type of energy certification is used in the Czech Republic, no matter what sort of building is involved. Certification is based on calculated energy use for heating, cooling, ventilation, domestic hot water and lighting. Reference values have been defined for 8 different building categories, with 7 energy classes, on a scale from A to G, for each one.

Building Category	A	B	C	D	E	F	G
Single-family Houses	<51	51–97	98–142	143–191	192–240	241–286	>286
Apartment Blocks	<43	43–82	83–120	121–162	163–205	206–245	>245
Hotels & Restaurants	<102	102–200	201–294	295–389	390–488	489–590	>590
Offices	<62	62–123	124–179	180–236	237–293	294–345	>345
Hospitals	<109	109–210	211–310	311–415	416–520	521–625	>625
Education Buildings	<47	47–89	90–130	131–174	175–220	221–265	>265
Sports Facilities	<53	53–102	103–145	146–194	195–245	246–297	>297
Wholesale & Retail Trade Services Buildings	<67	67–121	122–183	184–241	242–300	301–362	>362

Figure 4.7 Energy classes for different building categories in the Czech republic.

New and renovated buildings must reach at least Class C standard according to their energy certificates. There are no requirements regarding energy class where existing buildings are concerned.

The energy certificate comprises 11 pages. On the first page, the energy classification is given by using a letter from A to G and, on the following 10 pages, the building, the calculated energy use and recommendations for improvements are described. At present there is no system in the Czech Republic for storing energy certificate data in a database.


PRŮKAZ ENERGETICKÉ NÁROČNOSTI BUDOVY

Typ budovy, místní označení
Adresa budovy
Celková podlahová plocha:

Hodnocení budovy: stávající stav | po realizaci doporučení

A
B
C
D
E
F
G

C

Měrná vypočtená roční spotřeba energie v kWh/m²rok: XY | XY
Celková vypočtená roční dodaná energie v GJ: XY | XY

Podíl dodané energie připadající na:

Vytápění	Chlazení	Větrání	Teplá voda	Osvětlení
%	%	%	%	%

Doba platnosti průkazu
Průkaz vypracoval: Jméno a příjmení; Osvědčení č.

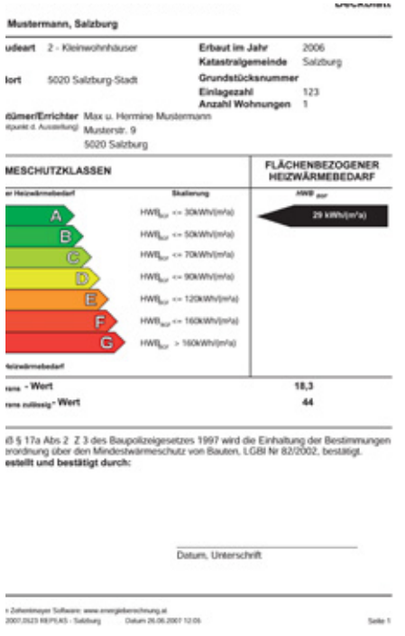
Figure 4.8 A typical Czech energy certificate. See page 112.

4.6 Austria

The authority responsible for implementing the Directive in Austria is the *Federal Ministry of Economics and Labour.* Energy certificates are issued in compliance with a federal law, the EAVG (Energieabgabenvergütungsgesetz, the *Law on the Rebate of Energy Taxes*). However, the Law is comparatively general, as every federal state in Austria is individually responsible for drafting its own laws and ordinances that apply to buildings. Consequently, the implementation of energy certification can vary from place to place in the country, although common to all is the fundamental platform for calculating the energy performance of buildings. The calculation models have been developed by the OIB (Österreichisches Institut für Bautechnik, *Austrian Institute of Construction Engineering*) and are consequently known as the OIB guidelines.

There are three types of energy certificates, one for each of the following building categories:

- Dwellings
- Non-residential buildings
- Other buildings (for example, industrial buildings with air-conditioning systems)


Mustermann, Salzburg

udeart 2 - Kleinwohnhäuser
Erbaut im Jahr 2006
Katastralgemeinde Salzburg
lort 5020 Salzburg-Stadt
Grundstücksnummer
Einlagezahl 123
Anzahl Wohnungen 1
ümer/Errichter Max u. Hermine Mustermann
Musterstr. 9
5020 Salzburg

MESCHUTZKLASSEN
FLÄCHENBEZOGENER HEIZWÄRMEBEDARF

A
B
C
D
E
F
G

29 kWh/(m²a)

- Wert 18,3
- Wert 44

ß § 17a Abs 2 Z 3 des Baupolizeigesetzes 1997 wird die Einhaltung der Bestimmungen rordnung über den Mindestwärmeschutz von Bauten, LGBl Nr 82/2002, bestätigt.
estellt und bestätigt durch:

Datum, Unterschrift

Figure 4.9 A typical Austrian energy certificate. See page 113.

The energy certificates for dwellings and non-residential buildings are quite similar in appearance, and use the same type of energy classification as for white goods. The difference is that, in the case of dwellings, focus is completely on the use of heat, while for non-residential buildings, energy used for cooling, ventilation and lighting is also specified. Recommendations for improvements must be drawn up for existing buildings – but only with regard to the technical aspects of a building's construction, such as additional insulation and replacing windows, etc. Recommendations regarding improvements to air-conditioning systems are not required!

Energy certification in the category 'Other buildings' is only based on a calculation of the U-value of the building. No energy classification is required for these buildings.

The classification scale on the energy certificate covers a range from A++ (0 to 10 kWh/m²/year) to G (greater than 250 kWh/m²/year) and the current rating for the building is calculated using the OIB guidelines.

Only organizations, institutions and similar bodies with building technology competence are allowed to issue energy certificates. Consequently, there is no individual certification by energy experts. The federal states are responsible for ensuring the quality of the certificates.

5 WHAT ARE YOU ALLOWED TO DO YOURSELF?

If you are a property owner, then there is a great deal that you can do yourself. Just how much you can and want to do is, of course, completely up to you. If you are an experienced property owner with your own management team, you could do practically all the work within your own organization, while a private property owner would normally require help for most of the work.

A property owner with an in-house management team normally owns a number of buildings, quite often with advanced features such as technically complex control systems and building services installations. Buildings of this type require much more work when it comes to energy certification. From an energy use point of view, single-family dwellings are normally quite simple structures and only require a minimum of assessment to be able to issue an energy certificate. Here, we can see a balance between the work required to complete the certification process and the extent to which the property owner is required to become involved in the process.

The energy certification process comprises a number of stages. How many and what they entail can, to a certain extent, be determined by the property owner. Nevertheless, what can be regulated by the property owner to the greatest extent is how the results of the certification process are used. And a property owner can also take advantage of the actual occasion on which the certification work is carried out, to a smaller or greater degree.

On the one hand, the owner can choose to carry out only what is required by law and try to reduce certification costs as much as possible. This type of action is prevalent when property owners regard an energy certificate as a necessary evil, the only result being proof that a building has been certified. On the other hand, the owner could use the opportunity to assess the condition of a building and, based on the certificate values, draw up plans for improvements to reduce its energy use. In this latter case, more extensive inspections than the very simplest can be carried out. These two very different ways in which property owners can

carry out certification work can be described as passive and active exploitation of the situation.

Passive property owners act solely by asking for tenders from companies or individuals who are qualified to offer energy certification services. The quotes must include everything connected to the certification process, and all work is to be carried out as cheaply as possible.

Active property owners can carry out a great deal themselves. Primarily, however, it must be decided in which way the energy certificates are going to be used. Are they going to be used as a tool in a larger scheme to improve energy use or is the energy improvement scheme going to be coupled to the energy certification process?

5.1 Procurement and execution of energy certification services

A property owner is responsible for ensuring that the necessary energy certification work is carried out. Information regarding when certification work must be carried out is available from the appointed authority or institution in every member state. In order to find detailed information, it is recommended to visit the websites run by these authorities or institutions. A joint website has been set up on the Commission's initiative and can be found at *www.buildingsplatform.org*

If a building is to be inspected, there are a number of details that the property owner can produce to simplify the process when inviting tenders for the certification work. The number and type of details vary, depending on whether the inspections are required for simple or more complex buildings. A reasonably complete list for a complex building would include the following:

- Heating and electrical energy statistics.
- The heated floor area of the building.
- The proportions of the floor area put to different uses (percentage office space, percentage shop space etc).
- Descriptions of the building services (number of air-conditioning systems, heating systems, cooling systems, etc).

- Mandatory ventilation inspection certificates (OVK certificates in Sweden), previous energy and/or environmental inspections.
- Operating instructions, flow charts (primarily for ventilation, piping, heating), up-to-date architectural drawings showing plans, sections and facade elevations as well as general details, for example, descriptions of different types of energy and indoor environment problems in the building.

When it comes to simple buildings the same list can be used as a starting point, and shortened as required. In Sweden, for example, single-family dwellings are not subject to mandatory ventilation inspections (OVK) or required to have operating instructions for the different building services.

Additionally, other data might be required for the tendering process, if the property owner wants to include other assessments than those connected purely with energy certification, for example, cost-efficiency calculations customized to meet specific needs.

5.2 Checklists and improvement recommendations

Different checklists and recommendations for improvements will be important instruments for energy experts when certifying buildings. This section discusses points that could be important to look at during the certification work. When property owners evaluate different tenders for energy certification work it is important for them to have a general understanding of what will be included.

The lists presented here are relatively general, making it easy to see how they have been drawn up and what they should include. Lists and improvement recommendations can become very extensive and detailed. Both the checklists and the recommended improvements must keep step with technological advances and the on-going build-up of knowledge in these fields.

In order to provide a building with a desired indoor climate and a sufficiently high level of air quality, different systems are required. Depending on the type of building and what it is used for, the technical

and building services systems can be more or less extensive and complex. The list compiled below is for buildings with relatively complex systems, though it can also be used for buildings with less complex systems, simply by excluding the parts that do not apply.

The building services systems can be divided into solutions for:
– Heating
– Comfort cooling
– Ventilation and air conditioning

Each of these systems can then be divided into the following subsystems:
– Production
– Distribution
– Room appliances
– Control and monitoring systems

Control and monitoring systems are those via which all the other service systems in a building are linked together and made to function in the prescribed manner.

In addition to the systems used for providing the correct indoor climate, there are often other installations and systems that are used for the activities/operations carried out in the building. Normally, there are also systems for lighting and hot water and there might even be other special systems for specific activities/operations. Examples of special systems include:
– Emergency power systems, stand-by systems etc
– Compressed air plant
– Vacuum extraction plant
– Electric motors and appliances for special purposes
– Lighting systems
– Process ventilation, fume cupboards and ventilated workstations
– Transportation systems, for example, lifts and escalators
– Large kitchen facilities and staff canteens

– Refrigerated and frozen food displays in shops and supermarkets
– Steam generating plant
– Wastewater treatment plant
– Water systems, including domestic hot water systems

The building envelope must protect the activities/operations taking place in a building from varying outdoor climates. The envelope is normally passive, i.e. it does not change its properties with outdoor seasonal changes in climate or when the use of the building changes. In addition to the passive building envelope, there are, in most non-residential buildings, systems for manual or automatic active solar shading. In buildings like these, the windows used differ from those used in homes and often have a protective layer that minimizes heating due to incident solar radiation.

Certification inspections are normally carried out as functional inspections, in which every system and sub-system is checked with regard to:
– The suitability of the system structure and whether the correct technical plant has been installed.
– The correct technical functions being maintained.
– Being operational when needed.
– Providing the required quantities.
– Providing the required quality.

The checklists are given as tables, in which the functions or components of the different systems and sub-systems are described and which would be advisable to check when carrying out an inspection. The column ‘Recommended checks and measures’ includes recommendations that might be appropriate to carry out, depending on the use of the building and the type of installations. The descriptions of the measures are expressed in general terms, without ranking them or detailing how they should be assessed. More details can be found in handbooks, manuals etc.

5.2.1 HEATING SYSTEMS

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Heat production	General	Status of production unit	Assess whether change to more efficient unit required.
		Heating need	(Improve the efficiency of the ventilation system. Improve the efficiency of the hot water system. Improve the efficiency of the building envelope. Reduce the room temperature during the heating season.)*
		Maximum output when measuring power output	Remove night temperature reduction function.
	District heating	Tariff, return temperature, cooling in the heat exchanger unit	Maintenance of heat exchanger. Clean, replace parts or whole.
	Fired boiler	Combustion efficiency, flue gas temperature	Adjust and adapt the burner and operational temperature. Sweep. Install flue gas cooler.
	Heat pump	Type, heating factor, peak heat, operating temperature	Ensure correct function. Maximize operating time of heat pump.
	Solar heating	Type, size, energy coverage, operating temperature	Ensure correct function.
	Electric boiler	Peak power limits	Adapt according to needs.
	Accumulator, hot water heater	Size, insulation, temperature level	Ensure correct function. Improve thermal insulation.

* These checks and measures apply to other systems or functions in the building that can also affect the heating need.

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Heat distribution	Flow/pumps	Water flows	Adjust, change size of pumps/change to pressure activated pumps. Installation of demand-controlled pumps
	Flow distribution	Settings, stability, return temperature	Adjust settings Change to smaller valves. Venting.
	Temperature regulation	Temperature levels, desired value curves	Consider need for shunts. Adjust desired value curves.
	Piping system	Thermal insulation	Improve insulation.
		Sectionalization	Sectionalize the piping system as required.
Room appliances	Flows	Type of apparatus, sizing, adjustments, room temperature	Adjust room appliances. Replace valves. Replace or adapt undersized units. Venting.
	Adjustments to actual needs, thermostats	Type of regulation, standard of thermostats, maximum limitations	Ensure correct function. Replace thermostats or change to other regulation system.
Control and monitoring, etc		Night and weekend reduction	Adjust to needs. Adjust timing and temperature levels.
		Forecast control (equivalent temperature)	Adapt/improve calculation models supplied by meteorological institutes or consultants.
		Mass of building, thermal inertia, heat retention properties	Take into consideration when reducing night temperatures and setting times for increasing temperature.

5.2.2 COMFORT COOLING SYSTEMS

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Cooling production	General	Status of production unit	Consider changing unit to more efficient alternative.
		Cooling need	Use night cooling. Use free cooling. (Reduce internal heat generation. Increase room temperature during cooling period.)*
	District cooling	Heating of return water, temperature in the heat exchanger unit	Maintenance of heat exchanger. Clean, replace parts or whole.
	Cooler	Power rating, cooling efficiency factor, temperature levels	Adjust the operating temperatures and operating times according to need. Improve efficiency of coolant cooler.
		Heat recovery	Consider recovery of condenser heat
Cooling distribution	Flows/pumps (coolant systems)	Water flows	Adjust, change size of pumps/change to pressure regulated pumps. Installation of demand-controlled pumps.
	Flow distribution	Settings, return temperatures	Adjust distribution of cooling.
	Temperature regulation	Temperature levels. Desired value curves	Consider need for shunts. Adjust desired value curves.
	Piping systems	Thermal insulation	Improve the insulation.
		Sectionalization	Sectionalize the piping system as required.

* These checks and measures apply to other systems or functions in the building that can also affect the cooling need.

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Room appliances	Flows	Type of appliances, sizes, settings, return temperatures, room temperatures	Adjust settings of room coolers.
	Adjustment to needs, thermostats	Standard of thermostats	Replace thermostats.
	Joint operation with room heaters	Simultaneous heating and cooling of rooms	Change to common thermostats for heating and cooling.
Control and monitoring		Time schedules, in general	Adjust to needs. Set timing and temperature levels.
		Forecast control (cooling production and storage)	Optimization of the system. Review conditions for cooling operations.

5.2.3 VENTILATION AND AIR-CONDITIONING SYSTEMS

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Production	Air filtration	Filter class, pressure drop	Change filter class. Check replacement intervals.
	Heat recovery	Type, temperature efficiency, temperatures	Clean, replace. Install heat recovery unit. Assess cooling recovery.
	Heating and cooling functions	Function and interaction between functions.	Check regulation functions, separately and sequentially. Adjust liquid flows. Clean heating/cooling batteries. Adjust supply air temperature.
	Humidification of the air	Is it required and is humidification carried out in a suitable way	Retrofit the system.
	Return air	Heat, cooling or moisture recovery	Adjust/install return air function.
Distribution	Flows and pressure levels/fans	Air flows, pressures	Adjust operating times, air flows and pressure levels. Install demand-controlled regulation.
		Power ratings, SFP	Increase efficiency of fans, transmissions and motors. Clean. Change to better fans, apparatuses, ducting systems, terminal devices
	Flow distribution	Settings	Reset the air flows.
	Ducting system, sectionalization constant-pressure terminal devices, flow devices and pressure boxes.	Is the system a suitable one, is this equipment required and is it used correctly?	Check the settings/assess need for retrofitting. Check the sealing of the system. Check the thermal insulation. Clean.

System or sub-system	Function	To be investigated/ measured	Recommended checks and measures
Distribution	Additional terminal device for heating and cooling	Is this equipment required and is it used correctly?	Check the settings/assess need for retrofitting. Adjust desired values.
Room appliance	General	Correct type of terminal device, ventilation principle	Adjust supply air temperatures. Clean air terminal devices.
		Integration with liquid-borne heating and cooling	Ensure correct functioning (do not allow heating and cooling at same time).
	Flows	Settings	Adjust air flows.
	Adjustment to needs (VAV/DCV)	Function	Adjust/replace VAV boxes. Install demand-controlled regulation.
Control and monitoring		Night and weekend reductions, time schedules	Adjust to needs. Adjust times, flows and temperature levels.
		Forecast control (equivalent temperature)	Adapt/improve calculation models supplied by meteorological institutes or consultants.
		Seasonally adjusted ventilation	Adjust temperature-pressure/ flow curves.

5.2.4 CONTROL AND MONITORING SYSTEMS

Where control and monitoring equipment is concerned, it is best to start with a checklist to determine the status of the system and how system data can help the inspector.

System or sub-system	Function
Regulation and monitoring	Capacity (measuring points, storage, speeds).
	Time intervals (5 min, hour, day, week, month, year).
	Statistics going back a number of years/energy signatures (day/night).
	Saved sequences for different operating conditions.
	Separate measurements of heat, electricity and cooling.
	Separate measurements from different buildings.
	Alarm functions (what, how, visualization, logs).
	Support for automatic fault detection and diagnosis.
	Measurement accuracy (type of sensor, location, calibration).
	Report generation (weekly, monthly, yearly).
	Raw data and normal year corrected data.
	Accessibility/manageability/user-friendliness.
	Visualization (schematic drawings and other diagrams).
	Automatic logging of changed settings.
	Data compatibility/export of data to Excel and similar programs.
	Integration of and coordination between different sub-systems.

5.2.5 SYSTEMS USED BY TENANTS

System or sub-system	Aspect	Recommended checks and measures
Emergency power system	General	Reliability requirements regarding load levels. Change battery capacity needs. Emergency power system, load levels. Emergency power system, activation time.
	Saving electricity	Efficiency improvements.
	Saving heat	Installation of heat recovery unit.
Compressed air plant	General	Maintenance of the plant.
	Saving electricity	Reduction of operating times. Speed control. Reduction of pressure conditions. Change of extraction conditions. Minimization of power requirement in connection with leakages. Sectionalization and part closure of the piping system. Replacement of compressed air.
	Saving heat	Installation of heat recovery unit.
Vacuum extraction plant	General	Maintenance of the plant.
	Saving electricity	Reduction of operating times. Minimization of power requirement in connection with leakages. Sectionalization and part closure of the piping system. Replacement of vacuum system.
	Saving heat	Installation of heat recovery unit.
Electric motors and apparatuses	Saving electricity	Reduction of operating times. Optimization of motor efficiency. Speed adjustment. Improved insulation standards. Minimization of stand-by losses.

5.2.5 SYSTEMS USED BY TENANTS

System or sub-system	Aspect	Recommended checks and measures
Lighting systems	General	Maintenance of the system.
	Saving electricity	Reduction of operating times. Sectionalization of the lighting system. Reduction of lighting strength. Use of reflectors in fittings with strip lighting. Use of colours in the building. Inspection of light sources. Use of energy-efficient HF lighting. Use of daylight.
Process ventilation (fume cupboards, ventilated workstations, etc)	General	Maintenance of the system.
	Saving electricity and heat	Reduction of operating times. Reduction of air flows. Changes in relative humidity, pressure and temperature conditions. Change of usage. Investigation of user behaviour.
	Saving heat	Installation of heat recovery unit.
Transportation systems (lifts and escalators)	General	Age and condition of the plant.
	Saving electricity	Installation of frequency converter. Inspection of light sources. Installation of operation-on-demand function.
	Saving heat	Installation of heat recovery unit.
Large kitchen facilities, staff canteens	General	Maintenance of the equipment
	Saving electricity and heat	Reduction of operating times. User behaviour. Minimization of passive operating times and stand-by losses. Local extraction.
	Saving electricity	Insulation of ovens, warming cupboards and dishwashing machines.
	Saving heat	Installation of heat recovery unit.

System or sub-system	Aspect	Recommended checks and measures
Refrigerated and frozen food displays	General	Maintenance of the equipment.
	Saving electricity	Storage temperature of goods. Cover refrigerated and frozen food displays/boxes. Installation of glass fronts/protection of open refrigeration and frozen zones. Location of goods in cold and frozen stores and in cabinets and boxes. Stop/start intervals for compressors. Evaporation and condensation temperatures. Heat transferring surfaces in evaporators and condensers. Insulation of ducts, pipes, containers and rooms. Assess cooling needs.
	Saving heat	Installation of heat recovery unit.
Steam generation plants	General	Plant maintenance
	Saving heat	Re-use of condensate. Replacement of central units with local steam generators. Changed pressure and temperature conditions. Air-tightness of the system. Insulation of distribution system and boilers. Installation of heat recovery unit.
Wastewater treatment plant	General	Plant maintenance.
	Saving heat	Insulation of sewage water sterilizers. Heat recovery from wastewater system.
Water systems	General	Plant maintenance. Temperature of hot water. Temperature of the circulating hot water.
	Saving water	Toilets – minimize leakages. Urinals – minimize leakages, flushing needs. Use of rainwater. Reduce water wastage due to long waits for hot water at tap.
	Saving water and heat	Taps – reduced flows.
	Saving heat	Improve thermal insulation. Heat recovery (from wastewater etc).

5.2.6 THE BUILDING ENVELOPE

System or sub-system	Aspect	Recommended measures
General	Air tightness	Seal leakages.
Lofts, roofs	Heat insulation	Consider extra external insulation. Consider extra internal insulation.
	Solar protection	Ventilation of ceilings and roofs.
Facades, cellar walls	Heat insulation	Consider extra external insulation. Consider extra internal insulation.
Floors	Heat insulation	Consider extra external insulation. Consider extra internal insulation.
Windows	Heat insulation	Install additional panes. Replace panes. Replace windows.
	Solar shading	Consider fixed external shading or manual/ automatic awnings. Installation of protective film on windows. Use windows with solar protection when replacing old windows.

6 HOW LONG HAVE YOU GOT?

The EPBD came into force in December 2002. The Directive stated, among other things, that member states were to have introduced laws and other necessary legislation by January 2006. Insofar as the energy certification of buildings and inspection of boilers and air-conditioning systems were concerned, the member states were allowed another three years in which to completely implement regulations. However, this delay could only be accepted, if a particular member state had too few qualified and/or accredited experts.

6.1 Sweden

6.1.1 BUILDING REGULATIONS STIPULATING ENERGY PERFORMANCE REQUIREMENTS

In Sweden, the first building regulations to include energy performance requirements came into effect in 1975 (SBN75). These requirements for energy performance were written as requirements with regard to the insulating properties of the building envelope. In fact, even before this, indirect requirements regarding the insulating properties of the building envelope had been in force, but these were from a health point of view, to prevent draughts and condensation on walls, etc. It was not until 2006 that the first building regulations concerning energy use in new buildings came into force, stipulating requirements for energy performance per unit floor area.

The latest building regulations for new buildings (BBR 2008) came into force in July 2008 and these included transitional regulations, to be applicable for one year. This means that the former regulations, from 2006, can still be used, if a building notification, i.e. notice that building work is about to commence, is submitted before 1 July 2009.

6.1.2 NEW REGULATIONS FOR RATIONAL USE OF ENERGY

In February 2008, the Swedish government decided to amend the Ordinance on Technical Requirements for Construction Works. Among other

things, the amendment requires buildings with electrical heating, for example, heat pumps, direct electric heating, etc, to be constructed so that energy efficiency is promoted to an even greater extent than in buildings with no electrical heating. The amendment to the ordinance came into effect on 1 April 2008, with transitional regulations applicable until 1 January 2010. The amended ordinance was then followed by special implementation regulations from *Boverket*. These came into force on 1 February 2009, with transitional regulations applicable until 1 January 2010.

6.1.3 ENERGY CERTIFICATES

The Swedish law governing energy certificates came into force in October 2006. Among other things, it states that:

- Special buildings[9] over 1000 m², rented buildings, buildings with tenant ownership and non-residential buildings (when rented out) must be energy-certified by 31 December 2008.
- Buildings that are constructed for own use or buildings in which all or part of the building is sold or rented out must be energy-certified from 1 January 2009. As Swedish energy certificates are based on measured energy use, it is not possible to issue certificates for completely new buildings. The energy certificates will be issued after two years of operation. This means that buildings constructed at the beginning of 2009 will not have to be certified until the beginning of 2011.
- Energy certificates must be issued for new buildings, even if they are not to be sold or rented out.

However, buildings built for own use after 1 January 2009 will not have to be energy-certified, if the building application was submitted before 1 January 2009.

9 Special buildings are buildings for public use, for example, military buildings, railway stations, airports, schools, swimming baths, etc. See Chapter 3, section 2.1.

Timetable for EPCs in Sweden

Special buildings – before 1 January 2009
Non-residential buildings, when rented – before 1 January 2009
Non-residential buildings, when sold – before 1 January 2009
Blocks of flats, when a flat is rented or sold – before 1 January 2009
New buildings – from 2009 (issued from 2011)

All buildings were not energy-certified before the end of 2008. The whole business of energy certification in Sweden started too late to be able to meet the deadline. The delay was caused by, among other things, the long time it took before legislation, ordinances and regulations were in place and it subsequently took a long time before accredited energy experts were available to take on the work. *Boverket* has therefore recommended to the supervisory authorities that a respite be granted to those who will not be able to issue certificates for their buildings before the end of 2008. This extension will only be granted on the condition that applications were submitted to an accredited inspection body before 31 December 2008, after which date the energy certification work must be carried out as soon as possible.

By law, it is the owner of a building, for which an energy certificate is required, who is responsible for ensuring that a certificate is issued and is made available when renting out or selling the building. An energy certificate must not be more than 10 years old, although, of course, a property owner can arrange for a new certificate to be issued within the 10-year limit. This is an especially advisable measure, if the energy performance of the building has been dramatically improved.

6.1.4 AIR-CONDITIONING SYSTEMS AND BOILERS

Irrespective of whether a building has to have an energy certificate or not, if there is an air-conditioning system for comfort cooling then this must be inspected, provided that the system has an effective cooling power output greater than 12 kW and it is mainly electrically driven. Systems like these must be inspected for the first time after 31 December 2008.

Timetable for inspections in Sweden

Air-conditioning systems > 12 kW – from 1 January 2008
Boilers > 20 kW – not required

Inspections of air-conditioning systems must be carried out at least once every 10 years. *Boverket* recommends that inspections of air-conditioning systems are coordinated with other inspections, for example, the mandatory ventilation inspection (OVK).

Air-conditioning systems, in which the primary purpose is not comfort cooling but rather to achieve a specific indoor climate for a certain activity or products (for example, sensitive electronic components), are exempt from inspection. This exemption does not apply to other inspections, for example, mandatory ventilation inspections or inspections required by the regulations issued by the Swedish Environmental Protection Agency.

The Directive also mentions inspections of large boilers. The Directive allows member states to choose between mandatory inspections and issuing advice. Boilers in this context are boilers with an effective power output greater than 20 kW and which are fired using fossil fuels. As the number of fossil fuel fired boilers is diminishing rapidly in Sweden, it has been decided that it will be sufficient to give advice and this is done via information campaigns directed at the general public.

6.2 Denmark

6.2.1 BUILDING REGULATIONS STIPULATING ENERGY PERFORMANCE REQUIREMENTS

Before 2008, there were two sets of building regulations in Denmark – one for single-family dwellings, including terrace houses, and one for multi-unit dwellings and non-residential buildings. The first set of regulations was known as BR-S and the second, quite simply, as BR. From 2008, the building regulations, also now known as BR, apply to all types of buildings.

The authority responsible for the building regulations is the *Danish Enterprise and Construction Authority* (Ervervs- og Byggestyrelsen).

The first time energy-related building regulations for new buildings were introduced in Denmark was in 1972 and, at that time, they did not include single-family dwellings or terrace houses. Since then, the building regulations have been revised and updated in 1977, 1982 and 1995. Further requirements regarding new buildings and extensive renovations were added to the 1995 version of the regulations on 1 January 2006.

Present regulations require energy performance levels to be calculated for every new building and extensive renovation project. The calculations are to result in separate, weighted assessments of energy use for heating, comfort cooling and ventilation. In the case of non-residential buildings, assessments for lighting are also required.

In addition to the overall requirements regarding energy performance, there are also requirements regarding:
– U-values of the building envelope
– Air-tightness of the building envelope
– Lowest allowable efficiency ratings for boilers

As the building regulations cover a great deal more than just energy-related issues, energy calculations and associated questions are discussed in detail in separate regulations and standards.

Before 2005, there were no energy performance requirements for existing buildings. However, when the law regarding energy certification of buildings was passed on 24 June 2005, requirements regarding energy performance were introduced to apply to extensive renovation work. These requirements were introduced as part of the additional requirements for new buildings, see above. Churches, museums and other buildings meriting public protection are not subject to the energy performance requirements when extensive renovation work is carried out.

6.2.2 ENERGY CERTIFICATES

The schedule for certification of buildings in Denmark came into force on 13 December 2005, in connection with the adoption of the ordinance regarding energy certification of buildings.

Previously, buildings were divided into three categories: single-family dwellings, multi-family dwellings and non-residential buildings (including public buildings), see Chapter 4.3. There are also a number of special exceptions from the energy certification requirements, see Chapter 3.3.

The schedule for Denmark is as follows:
- Since 1 January 2006, buildings over 1500 m² have required an energy certificate. The certificate must not be more than 5 years old. The extension for buildings with a valid energy certificate issued under the previous energy management scheme, ELO, see Chapter 4.3, was increased to five years from the date of issue of the old energy certificate.
- An energy certificate for buildings over 1000 m² and up to 1500 m² must be available by 1 July 2009. The certificate must not be more than 5 years old.

In the case of public buildings, the schedule for certification is governed by the total floor area built on the property on which the building is located:
- Public buildings over 60 m², on properties with a total floor area over 1500 m², have required an energy certificate since 1 January 2006. The certificate must not be more than 5 years old.
- Public buildings over 60 m², on properties with a total floor area under 1500 m², will require an energy certificate from 1 July 2009. The certificate must not be more than 5 years old.

Furthermore:
- Other buildings over 60 m² have required energy certificates on construction, when extensively renovated or sold since 1 January 2006. The certificate must not be more than 5 years old, although for holiday cottages under 120 m² certificates are allowed to be up to 10 years old.
- Other buildings over 60 m² must be issued with energy certificates when rented from 1 July 2009. The certificate must not be more than 5 years old.

Timetable for EPCs in Denmark

Buildings > 1500 m² – from 1 January 2006
Buildings 1000 to 1499 m² – before 1 July 2009
Public buildings > 60 m² (on properties with total floor area > 1500 m²) – from 1 January 2006
Public buildings > 60 m² (on properties with total floor area < 1500 m²) – before 1 July 2009
New buildings > 60 m² – from 1 January 2006
Buildings > 60 m², when sold or extensively renovated – from 1 January 2006
Buildings > 60 m², when rented – from 1 July 2009

This means that a building under 1000 m² that is not a public building and that is not undergoing extensive renovations, is not under construction, is not for sale or rent, need not be energy-certified.

6.2.3 BOILERS, HEATING SYSTEMS AND AIR-CONDITIONING SYSTEMS

Oil-fired boilers have been subject to inspections in Denmark for many years. The present regulations are based on the same ordinance that regulates energy certification of buildings.

Inspection requirements for boilers and heating systems became mandatory on 1 September 2006. Inspection requirements for air-conditioning systems and ventilation systems became mandatory six months later, on 1 January 2007.

Boilers and heating systems for heating buildings

Oil-, coal- and coke-fired boilers must be inspected every five years. These categories of boilers must be inspected for the first time by 1 September 2009. In addition, there is a requirement that states that these boilers must be swept every year.

Gas-fired boilers with nominal heating outputs greater than 100 kW must be inspected every four years and for the first time before 1 September 2010.

In Denmark, there are also requirements for extensive inspections of complete heating systems. These inspections are carried out once when the system is 15 years old. This inspection requirement need not be fulfilled, if the boiler is fired using bio-fuels.

Heating systems installed before 1 September 1991 must be inspected

before 31 December 2010. This one-off inspection is to be carried out in connection with the first energy certification inspection that is undertaken after the system has become 15 years old, but before it is 20 years old.

Timetable for boiler and heating system inspections in Denmark
Oil-, coal- and coke-fired boilers – before 1 September 2011, thereafter every 5 years
Gas-fired boilers > 100 kW – before 1 September 2010, thereafter every 5 years
Heating systems installed before 1991 – before 1 January 2011 (once)
Heating systems installed after 1991 – after 15 years (once)

Air-conditioning systems and ventilation systems

Systems for comfort cooling with compressor power outputs greater than 5 kW are to be inspected every five years. This inspection can be performed at the same time as the energy certificate is issued.

Ventilation systems in which the combined power output of the fans is greater than 5 kW are to be inspected every five years. The larger the building, the earlier the point in time at which the buildings must be inspected for the first time, see below.

Air-conditioning systems and ventilation systems in buildings used for handicrafts, industrial buildings, agricultural buildings, etc, are exempt from inspections, as are systems that are in operation less than 500 hours per year.

Timetable for comfort cooling and ventilation system inspections in Denmark
In buildings ≥ 8000 m² – before 1 January 2010, thereafter every 5 years
In buildings 4000 to 7999 m² – before 1 January 2011, thereafter every 5 years
In buildings 2000 to 3999 m² – before 1 January 2012, thereafter every 5 years
In buildings 1000 to 1999 m² – before 1 January 2013, thereafter every 5 years

6.3 UK (England and Wales)

6.3.1 BUILDING REGULATIONS STIPULATING ENERGY PERFORMANCE REQUIREMENTS

British building regulations can be traced back for centuries, at least in some parts of Britain, where they were first introduced in 1667, after the

Fire of London in 1666. Building regulations at this time were aimed at ensuring that buildings could withstand fire. In 1965, the first building regulations were introduced to tackle the subject of energy management. Since 1995, building regulations have been in force to regulate energy performance in new buildings.

6.3.2 ENERGY CERTIFICATES

The British law dealing with energy certification came into force in 2007. In brief, this covers nearly all types of buildings that are built, sold or rented out and these were to have obtained energy certificates by the end of 2008. In Britain, the energy certificates for buildings for private use or use as dwellings differ greatly from those issued for buildings used for public services. Energy certificates for buildings for private use or dwellings are relatively extensive documents and are based on calculated values, and only need renewing every 10 years. Energy certificates for buildings used for public services are, on the other hand, relatively easy to issue and are based on measured values and do not require the inclusion of recommendations for improvements (only the general requirements to be fulfilled, depending on building category and year built). In addition, these energy certificates can be issued by someone employed by the property owner. As they are so easy to issue, they have to be renewed every year.

The dates by which energy certificates for different types of buildings have to be issued are numerous. The easiest way to get a good picture is to study the fact box below.

Timetable for EPCs in Britain
New dwellings – from 6 April 2008
Commercial buildings > 10 000 m², when built, sold or rented – from 6 April 2008
Commercial buildings > 2500 m², when built, sold or rented – from 1 July 2008
Dwellings, when sold or rented – from 1 October 2008
All remaining commercial buildings, when built, sold or rented – from 4 January 2009
Public buildings > 1000 m² – before 1 October 2008
(DEC, Display Energy Certificate, renewable every year)

By law, all newly built dwellings must have energy certificates from 6 April 2008. New non-residential buildings over 10 000 m², except buildings for public use, must have energy certificates on construction and an energy certificate must be available when the building is sold or rented out after 6 April 2008.

New non-residential buildings over 2500 m² must, from 1 July 2008, be issued with energy certificates when built, sold or rented out. New non-residential buildings, except buildings used for public services, under 2500 m² ought to have been energy-certified by 1 October 2008, if they are to be sold or rented out. This time limit has been extended to 4 January 2009. Dwellings, when sold or rented out, must have been energy-certified by 1 October 2008. Buildings used for public services over 1000 m² must have been certified by October 2008.

Energy certificates for dwellings and non-residential buildings are valid for 10 years. Simplified versions of energy certificates for buildings used for public services are valid for 1 year.

6.3.3 AIR-CONDITIONING SYSTEMS AND BOILERS

Air-conditioning systems with a cooling power rating greater than 250 kW must have been inspected for the first time by 4 January 2009. The remaining air-conditioning systems with a cooling power rating greater than 12 kW must be inspected for the first time by 4 January 2011.

Timetable for inspections in the UK

Air-conditioning systems > 250 kW – before 4 January 2009
Air-conditioning systems > 12 kW – before 4 January 2011
Boilers > 20 kW – not required

An air-conditioning system with an effective cooling power output greater than 12 kW and that was commissioned after 1 January 2008 must be re-inspected within 5 years.

Where boilers are concerned, Britain has taken the same stance as Sweden and chosen not to carry out mandatory inspections. National information drives will be carried out instead.

6.4 Czech Republic

6.4.1 BUILDING REGULATIONS STIPULATING ENERGY PERFORMANCE REQUIREMENTS

Czech building regulations took the energy performance of buildings into account for the first time in 1960, when requirements regarding the insulation properties of the building envelope were stipulated. The building regulations have since then been updated relatively often, most recently in 2007. Regulations regarding, among other things, energy performance requirements came into force in July 2007.

6.4.2 ENERGY CERTIFICATES

Czech legislation concerning energy certification came into force in January 2008. In short, this states that dwellings must have energy certificates by 1 January 2010 when constructed, sold or rented out.

Other buildings, when constructed, sold or rented out, must have energy certificates by 1 January 2009. Even buildings used for public services must be certified by 1 January 2009.

Timetable for EPCs in the Czech Republic

New dwellings, when sold or rented – from 1 January 2010.
New non-residential buildings, when sold or rented – from 1 January 2009.
Public buildings – before 1 January 2009.

Note that an energy certificate must be issued for every unit in a block of flats.

6.4.3 AIR-CONDITIONING SYSTEMS AND BOILERS

Inspections of boilers with a nominal heating output greater than 20 kW have been mandatory since 1 January 2007.

Timetable for inspections in the Czech Republic

Air-conditioning systems > 12 kW – from 1 January 2009
Boilers > 20 kW – from 1 January 2007

Inspections of air-conditioning systems with an effective cooling power output greater than 12 kW have been mandatory since 1 January 2009.

6.5 Austria

6.5.1 BUILDING REGULATIONS STIPULATING ENERGY PERFORMANCE REQUIREMENTS

Laws have been in force in Austria since 1950 in which requirements are stipulated regarding energy performance in new buildings. Whereas requirements have previously concerned the insulating capacity of the building envelope, the present regulations also cover energy performance, air-tightness, insulation properties etc.

As Austria is divided into nine federal states, each with a relatively high degree of autonomy, the national building regulations are formulated in general terms and the federal states can themselves decide how and when they are to be implemented. This means that there is no common date when the law from 1950 came into force in each state. Some of them introduced legislation directly in 1950, but the majority decided to do so in the 1970s. The last state to introduce the law did so in 1978.

From 2009, the requirements regarding energy performance in new buildings will also be applicable to existing buildings undergoing extensive renovations.

6.5.2 ENERGY CERTIFICATES

The Austrian law governing energy certification came into force in 2008. Even this law is in general terms, allowing each state a wide degree of interpretation.

According to the law, new dwellings must be energy-certified from 1 January 2008. New non-residential buildings must be energy-certified from January 2009. Existing dwellings and non-residential buildings must be energy-certified when sold or rented out from 1 January 2009. Buildings providing public services must be energy-certified before 1 January 2009.

Timetable for EPCs in Austria

New dwellings – from 1 January 2008
Dwellings, when sold or rented – from 1 January 2009
New non-residential buildings – from 1 January 2009
Non-residential buildings, when sold or rented – from 1 January 2009
Public buildings – before 1 January 2009

6.5.3 AIR-CONDITIONING SYSTEMS AND BOILERS

Boiler inspections have been mandatory in Austria for many years. The requirements for inspections of large air-conditioning systems are new.

Timetable for inspections in Austria

Air-conditioning systems > 12 kW – from 1 January 2008
Boilers > 20 kW – older laws already in force

Inspections of air-conditioning systems with greater effective cooling outputs were begun on 1 January 2008.

7 WHO'S IN CHARGE?

The EPBD does not provide any guidelines regarding which national authority is best suited to manage the practical implementation of the Directive. It is up to each member state to appoint an authority.

7.1 Sweden

The Energy Declaration of Buildings Act (SFS 2006:985), which came into force on 21 June 2006, does not empower any particular authority with responsibility for energy certification. However, the applicable Ordinance (SFS 2006:1592), i.e. the government's interpretation of the Act, which came into force on 21 December 2006, designates *Boverket*, the National Board of Housing, Building and Planning, as the responsible authority.

7.1.1 BOVERKET IS RESPONSIBLE FOR DRAFTING THE REGULATIONS AND COLLECTING DATA

As the responsible authority, *Boverket* has compiled regulations for the implementation of the Directive. These regulations describe, among other things, *what* energy certificates are to include and *who* is allowed to issue them.

All energy certificates are registered and stored in the GRIPEN databank run by *Boverket*. The energy expert engaged for a particular building is responsible for registering the certificate when it is issued. *Boverket* is responsible for the running of the databank.

7.1.2 LOCAL AUTHORITIES ARE THE SUPERVISORY BODIES

According to the Act, local planning and building committees are responsible for ensuring that energy certificates have been issued. It is within the powers of the local authorities to fine property owners who have not had certificates issued for their buildings within the stipulated time. The supervisory powers of the local authorities pertain to the building categories that are to be certified before 1 January 2009, i.e.

special buildings, non-residential buildings and buildings that have been rented out. However, local authorities do not have supervisory powers when it comes to buildings that are sold or newly constructed. This is because the legislators have counted on the buyer always demanding an energy certificate when completing a purchase. Local planning permission is only given to buildings that are deemed to have an approved energy performance level.

7.2 Denmark

The *Danish Energy Authority* is responsible for implementing the Directive and for overseeing energy certification work in Denmark.

The practical and day-to-day work is managed by the *Common Secretariat for Inspection and Energy Labelling* (FEM-sekretariat, Fællessekretariat for Eftersyns- og Mærkningsordningerne) established on 1 January 2006.

The Secretariat co-ordinates:
- Energy certification of buildings
- Inspections of buildings when sold
- Inspections of boilers and heating systems
- Inspections of ventilation systems
- Inspections of state-owned buildings

The work managed by the Secretariat is governed by a number of different laws and ordinances.

7.3 UK

In England and Wales the implementation of the Directive is handled by the *Department for Communities and Local Government* with the help of the *Department for the Environment, Food and Rural Affairs*.

As in other countries where buildings are energy-certified according to the EPBD, responsibility to provide an EPC lies with the seller, landlord or builder, although it can be delegated, for example, to an estate agent or managing agent. However, legal responsibility for compliance

with the law cannot be transferred.

In Scotland, the *Scottish Building Standards Agency* is responsible for implementation of the Directive.

In Northern Ireland, the *Department of Finance and Personnel* is responsible for the implementation of the Directive, with the help of the *Department for Social Development*.

7.4 Czech Republic

The *Ministry for Industry and Trade* is responsible for the implementation of the Directive in the Czech Republic.

7.5 Austria

The implementation of the Directive in Austria is supervised by its federal states. At national level, responsibility for implementation lies with the *Federal Ministry of Economics and Labour*, as this is the authority that handles matters concerning the sale and renting of buildings.

8 WHAT HAPPENS IF YOU DON'T COMPLY?

The EU Directive does not provide any guidelines regarding the question of responsibility for supervising the issuing of energy certificates or how this supervision is to be carried out. At present, only a few member states have drafted guidelines for sanctions to be imposed on property owners who have not energy-certified their buildings.[10]

The questions of supervision and possible sanctions are to be solved by each individual member state. The European Commission can refer cases, in which the implementation of the Directive in the different member states has been managed wrongly, or not at all, to the European Court of Justice. However, the Commission cannot initiate proceedings against individual property owners.

8.1 Sweden

According to Swedish law (SFS 2006:985), a property owner is responsible for making sure that an energy certificate is issued for a particular building. According to the same law, the local authorities are the supervisory bodies for energy certification of multi-dwelling and non-residential buildings. The actual management of the supervisory matters is left to each local authority. However, local authorities are not obliged to scrutinize the energy certificates, as this is the responsibility of *Boverket* and the Swedish Energy Agency. Neither are local authorities responsible for informing property owners that energy certificates are mandatory.

10 Author's note: At the time of publication of this book, very little information was available regarding possible sanctions when energy certification had not been carried out. As requirements for energy certification had only recently come into force, there were no test cases to refer to. Member states had primarily focused on the implementation of the Directive, not on routines for sanctions. Any questions concerning sanctions in a particular country should be directed to a relevant authority in that country, see Chapter 7.

Local authorities have the right to impose fines, if the required energy certification is not carried out. They also have the right to determine the size of the fines.

Property owners who refuse to certify their buildings could find themselves in conflict with the local authority. If a property owner continues to refuse, fines can be issued. This is also the case if, for some reason, a property owner refuses to display the energy certificate and keeps its contents secret.

The local authority is also empowered to check that inspections of air-conditioning systems have been carried out in buildings where these are required.

8.1.1 WILL PROPERTY OWNERS BE FINED?

No, not if the property owner applied for an energy certificate in time.

As there was not sufficient time to issue energy certificates for a large number of buildings, a decision was made to urge property owners, who were required to have energy certificates by 31 December 2008, to apply for them in writing to an accredited inspection body and to have the application verified by an energy expert. Behind the decision were the Swedish Association of Local Authorities and Regions (SALAR); *Boverket*; the Swedish Energy Authority; the Ministry of Finance; the Ministry of Industry, Employment and Communications; and the Ministry of the Environment. This meant that if an energy certificate could not be issued by 31 December 2008, the supervisory department of a local authority would be able to confirm that an application had been made in time and, subsequently, would not have to take action, for example, by issuing a fine.

This was on condition that the energy certification work would be actually carried out and submitted to *Boverket* within a reasonable time limit. What is meant by 'reasonable' is to be determined by the local authorities from case to case.

8.1.2 WHO IS GOING TO CHECK THAT THE CERTIFICATE IS PROPERLY DISPLAYED?

Local authorities will not be actively engaged in any investigative procedures to see whether an energy certificate is on display and well visible. However, if a tenant reports that the certificate is not properly available, the local authority must take action.

If it is brought to the attention of the local planning and building committee that a certificate is not available, then the committee must take action. The first thing that the committee should do is to ask the property owner why the certificate is not readily available. In the best of worlds it might just be a case of forgetfulness. If the property owner has not applied for an energy certificate then, according to SALAR, a fine should be issued and the property owner urged to immediately apply for one.

8.1.3 HOW LARGE SHOULD THE FINE BE?

Before matters go any further and fines are issued, property owners will be informed a number of times of their obligations. However, if a property owner, despite repeated reminders, has not had an energy certificate issued, SALAR recommends that the local authorities should issue a fine. In SALAR's opinion, the fine should be higher than the original certification cost. As costs for energy certificates vary widely, depending on type of building, what it is used for and how it has been built, there are, at present, no fixed amounts for these fines.

8.1.4 SELLING A BUILDING WITHOUT AN ENERGY CERTIFICATE

The estate agent involved in a sale of a building is obliged to inform the seller and the buyer about the requirement regarding energy certification. The estate agent must inform the seller that an energy certificate, not more than 10 years old, must be available when the sale is made. Likewise, the estate agent must inform the buyer about this requirement. However, the estate agent is not responsible for making sure that an energy certificate has actually been issued.

In fact, a building can be sold without an energy certificate. If this happens, the buyer has the right to energy-certify the building after completing the sale and the seller will be obliged to pay. However, certification must be carried out within 6 months of the buyer taking possession of the building. This will be stipulated in the purchase agreement.

8.2 Denmark

A law passed in June 2005 and an ordinance issued in April 2008 together regulate the sanctions to be applied when energy certificates have not been issued or when they have been issued incorrectly. The Danish Energy Authority is the supervisory authority and was also responsible for drafting the ordinance.

The law states that property owners who rent out a building or part of a building are obliged to provide the tenant with a valid energy certificate when the lease is signed. Furthermore, the ordinance states that property owners, even if they do not rent out their buildings, must have an energy certificate issued, if otherwise required, see Chapter 3.3. Failure to follow these regulations can result in a fine.

The ordinance also regulates what will happen if the energy certificate is issued incorrectly. Among other things, an inspection agency (the issuer of the certificate) without liability insurance will be fined. Also, anyone issuing a certificate who is not personally authorized to do so will be fined. Fines will also be issued, if the reports sent to the Common Secretariat are incorrect, see Chapter 7.2.

The level of the fine and any extension of time for payment are not regulated in the law or the ordinance.

The law and the ordinance do not apply on Greenland or the Faroe Islands, which belong to the Kingdom of Denmark but are autonomous parts.

8.3 UK (England and Wales)

In England and Wales, the authorities responsible for overseeing the certification of buildings and inspections of air-conditioning systems are the local weights and measures authorities. These authorities have the power to require a person to produce, within seven days, an EPC and recommendation report, an advisory report or an air-conditioning inspection report for inspection.

Checklists have been drawn up to help enforcement officers carry out their duties. Furthermore, there are fixed penalties for failing to provide an EPC or make one available when required. However, enforcement officers have no powers to check the accuracy of the energy efficiency information in the EPC, only that it has been issued by an accredited assessor and entered into the EPC register in relation to the building featured in the transaction and is valid in respect of time.[11]

8.3.1 DWELLINGS

When selling or renting a home, the penalty is £200 for failing to make available an EPC or recommendation report to any prospective buyer or tenant or to give an EPC or recommendation report to the person who ultimately becomes the buyer or tenant.[12]

There is a six-month time limit for any enforcement action to be taken. There is a right for the landlord to request that penalty notices are reviewed and ultimately there is a right of appeal to the County Court against a penalty notice. Local authorities have statutory powers to require production of an EPC from landlords, if they suspect an offence has been committed. Investigation might follow if a tenant complains that he has not been given an EPC. An EPC will still have to be provided even though a penalty is imposed.[13]

8.3.2 COMMERCIAL BUILDINGS

The penalty for failing to make an EPC available to any prospective buyer or tenant when selling or letting non-dwellings is fixed, in most cases, at 12.5 percent of the rateable[14] value. The range of penalties under this formula is set with a minimum of £500 and capped at a maximum of £5000, with a default penalty of £750 where the formula cannot be applied.[15]

11 12 15 Improving the energy efficiency of our buildings – Local weights and measures guidance for Energy certificates and air-conditioning inspections in buildings. Crown copyright material, reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.
13 Residential Landlords Association Ltd, UK, www.rla.org.uk
14 Rateable values may be found at www.voa.gov.uk by entering the postcode into the search facility. Alternatively these may be available from the department in the Local Authority that deals with business rates.

8.3.3 DISPLAY ENERGY CERTIFICATES (DECs) FOR PUBLIC BUILDINGS

There are well-defined measures to be taken if buildings used for public services, for any reason, do not have the required DEC (Display Energy Certificate, see Chapter 3.4) available.

The local enforcement officers deal with complaints about DECs not being available and also carry out random spot checks. If the enforcing authority finds that a building requiring a DEC has not been issued with one, it can demand that the responsible party has one issued and that the necessary documents concerning the building are submitted. The party then has seven days in which to comply. If the information has not reached the inspectorate in time, it can issue a fine notice.

The fine for not having a valid DEC visibly displayed in a prominent place is £500. The fine for not having obtained a valid DEC, complete with recommendations for energy savings, is £1000. The requirement that the DEC is to be clearly visible and that the required documentation must be sent to the local inspectorate is still applicable, even when a fine has been paid.

If the person responsible for making sure that all possible measures to comply with the regulations have been taken, but for some reason has not managed to provide the correct documentation in time, the fine may be cancelled.

8.3.4 INSPECTION OF COMFORT COOLING SYSTEMS RATED OVER 12 KW

Local weights and measures authorities are responsible for ensuring that owners of air-conditioning systems (over 12kW) are in possession of an inspection report. Systems will have to be inspected at least once every five years.[16]

The person who is in charge of the daily operation of an air-conditioning system, with a nominal cooling power rating greater than 12 kW, is responsible for it being inspected every five years. After the inspection has been carried out, no certificate is issued, but a report is

16 Improving the energy efficiency of our buildings – Local weights and measures guidance for Energy certificates and air-conditioning inspections in buildings. Crown copyright material, reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

compiled giving information about the status of the system and recommendations for energy-saving measures. The person in charge is defined as the person responsible for the technical functioning of the system, not the person who, now and again, only adjusts the temperature levels.

The person in charge must make sure that:
- Inspections are carried out in accordance with the current law and regulations and that they are carried out in time, see Chapter 6.
- The report from the latest inspection is filed.
- A newly appointed successor is provided with all previous inspection reports for the air- conditioning system.

If regulations, schedules, etc are not adhered to a fine of £300 will be issued.

9 THE EPBD – MORE ON THE WAY

The EPBD has been in force for a number of years and property owners in the Union have begun to feel its effect. The Directive as such is not static and the Commission intends to develop the Directive as well as to draw up new directives of a similar nature.

The present EPBD does not completely cover all the issues that the Commission originally intended to address. In its opinion, there is still untapped potential to save energy in a cost-effective way. The reason for this, it is said, is partly due to the inherent complexity of the industry and its failures on the market, and partly due to limitations and ambiguity in the present EPBD. It is also suggested that some member states have displayed low levels of ambition when implementing the Directive at national level.

This is why a revision of the Directive has been initiated in cooperation with the member states. In the proposed revised Directive, it is explicitly stated that the present EPBD will be the point of departure and backbone of the revised version. That work has now been commenced to revise the EPBD must not be used in any way as an excuse for not adopting the existing Directive.

In the proposal for a revised EPBD, the scope of the present requirements and regulations will be made plainer, reinforced and expanded by:

- Clarifying the wording of certain requirements and regulations.
- Expanding the scope of requirements and regulations regarding the lowest allowable energy performance levels when renovations/alterations are carried out.
- Increasing the stringency of the requirements and regulations regarding energy certification reporting, inspection of heating and air-conditioning systems, energy performance, information and independent experts.
- Providing member states and other interested parties with calculation tools so that, by using benchmarking, it will be possible to compare lowest allowable energy performance levels, adopted nationally/regionally, with optimal-cost energy performance levels.
- Stimulating member states to develop means to facilitate market introduction of buildings with little or no use of energy and low or no emissions of carbon dioxide.
- Encouraging the public sector to take on a more active role, so that it can be seen as a good example.

The present EPBD is only applicable to renovations of buildings with floor areas over 1000 m^2. It is proposed to remove this limitation, which will mean that, independent of size, energy aspects must be taken into account when significant renovation/alteration work is carried out. It is also mentioned that member states must specify lowest allowable energy performance levels when installing new technical systems or when old systems are replaced by modern ones, or if extensive retrofitting of a system is carried out. In addition, there will be a requirement regarding the establishment of independent inspectorates in the member states, to be responsible for monitoring that energy certificates have been correctly awarded.

EPILOGUE

We hope that this book has been able to contribute towards creating an understanding of the importance of pulling together in matters concerning energy management – and that we all have a responsibility. It is also important that our ambitions go further than the issuing of energy certificates and that we actually carry out recommended improvements. Benchmarking of the present situation is well enough, but action must not stop there. A reduction of energy use requires concrete measures – and these need not be costly. On the contrary, they can offer significant benefits to all involved.

Incentives to save energy are a must. Let us hope, therefore, that property owners in the future do not just continue to pass on energy costs to their tenants. Energy costs must be included in their basic calculations; it is only when owners see for themselves the potential for improved profitability that anything will actually happen. Actively involved tenants must also make their voices heard and demand greater energy efficiency. This should lead to more competitiveness on the housing market, with a subsequent reduction of energy use. Today, it is quite feasible to save energy in most buildings, just by applying known and well-proven technology. By using these opportunities alone, we could already be well on our way to reaching our goals.

Up to now, focus has been on new and alternative sources of energy, while relatively little attention has been paid to measures to improve energy efficiency. Why, then, not reverse our efforts? Couldn't we first implement the opportunities offered to use energy more efficiently and, thereby, gain some time to develop new and more efficient energy sources and types of energy?

LINKS FOR FURTHER INFORMATION

For those who would like further information, the Internet offers a wealth of reading. The following list of addresses includes websites dealing with both energy management and alternative energy sources:

www.buildingsplatform.org
www.eceee.org
www.energimyndigheten.se
www.sustenergy.org
www.energy.eu
www.ec.europa.eu/energy

SWEGON AIR ACADEMY – A FORUM FOR OBJECTIVE AND COMPANY-NEUTRAL SHARING OF KNOWLEDGE

Via seminars, newspaper articles and literature, the Swegon Air Academy aims to convey knowledge and share experiences that could be of interest to a wider audience than that in its own company group. We believe that we can change attitudes and create a foundation for smarter decisions by spreading objective information. This is also the purpose of this first book in the forthcoming *Simply...* series.

CONTENTS, DESIGN AND PRODUCTION

Three experts from CIT Energy Management in Gothenburg were engaged as contributing authors to this book: Associate Professor Per-Erik Nilsson (chapters 1, 2, 5 and 9), Tech. Dr. Anders Trüschel (chapters 4 and 5) and Cicil Engineer Daniel Olsson (chapters 6, 7, and 8). They were chosen because they are exceptionally well-informed about the directives that address energy issues in buildings and building services installations. They are also experts at explaining complex issues so that we, as average readers, can understand what is actually meant. This is an art and just as important as being conversant with legislation and regulations.

The design and layout of the book has, once again, been in the hands of Torbjörn Lenskog, and Lennart Nilsson at No Stress Advertising has acted as administrative project manager. Last, but by no means least, John Bitton was responsible for the translation work, as he was for our first book, *AIR*. Why change a winning team?

Conny Nilsson *Director of the* SWEGON AIR ACADEMY

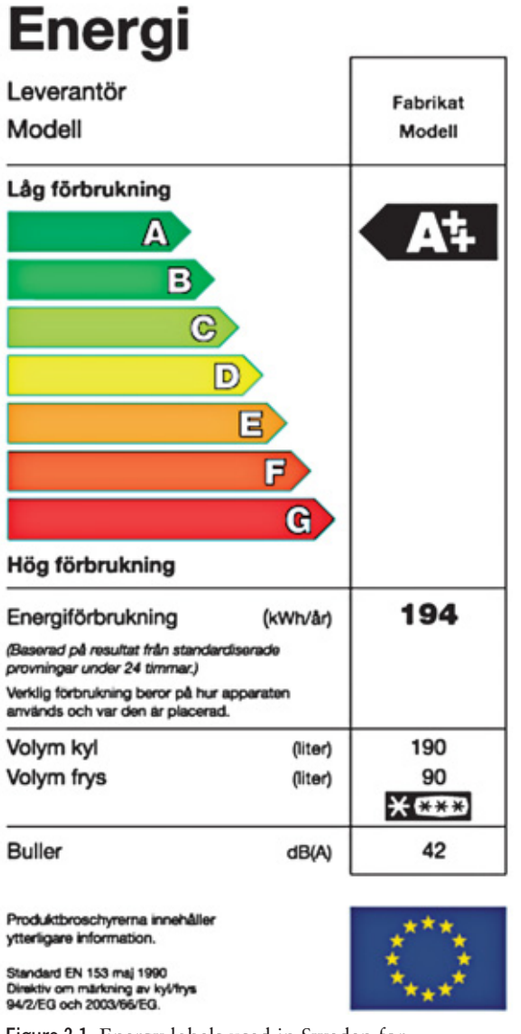


Figure 2.1 Energy labels used in Sweden for refrigerators and freezers.

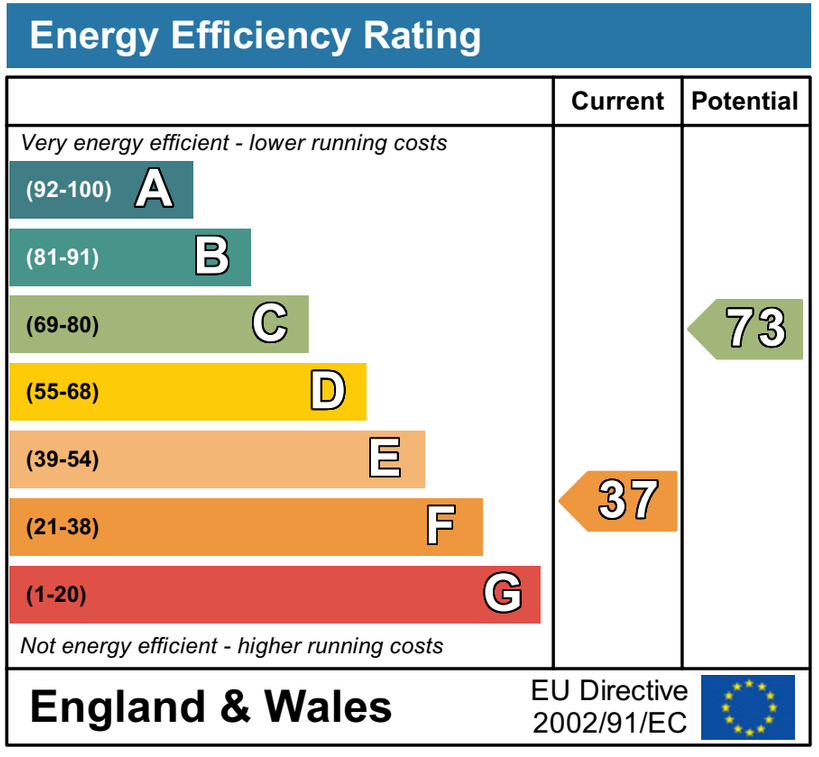


Figure 4.1 Energy certificate design used in the EU.

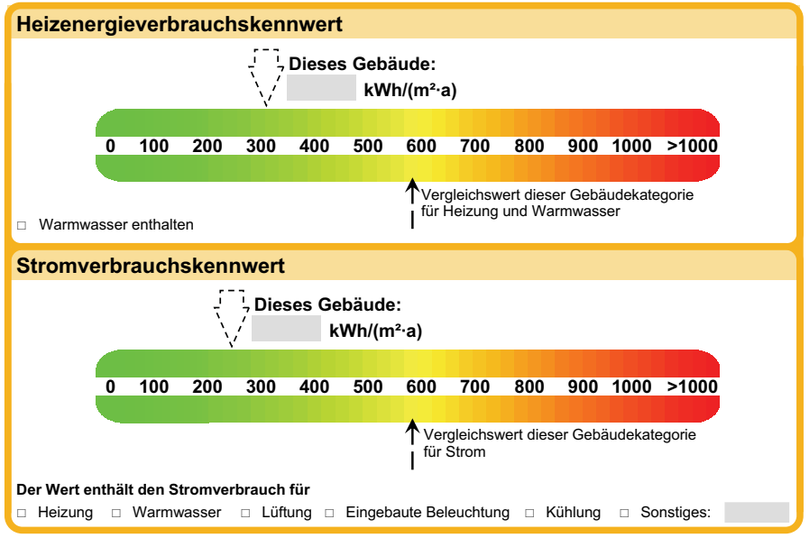


Figure 4.1 Energy certificate design used in the EU.

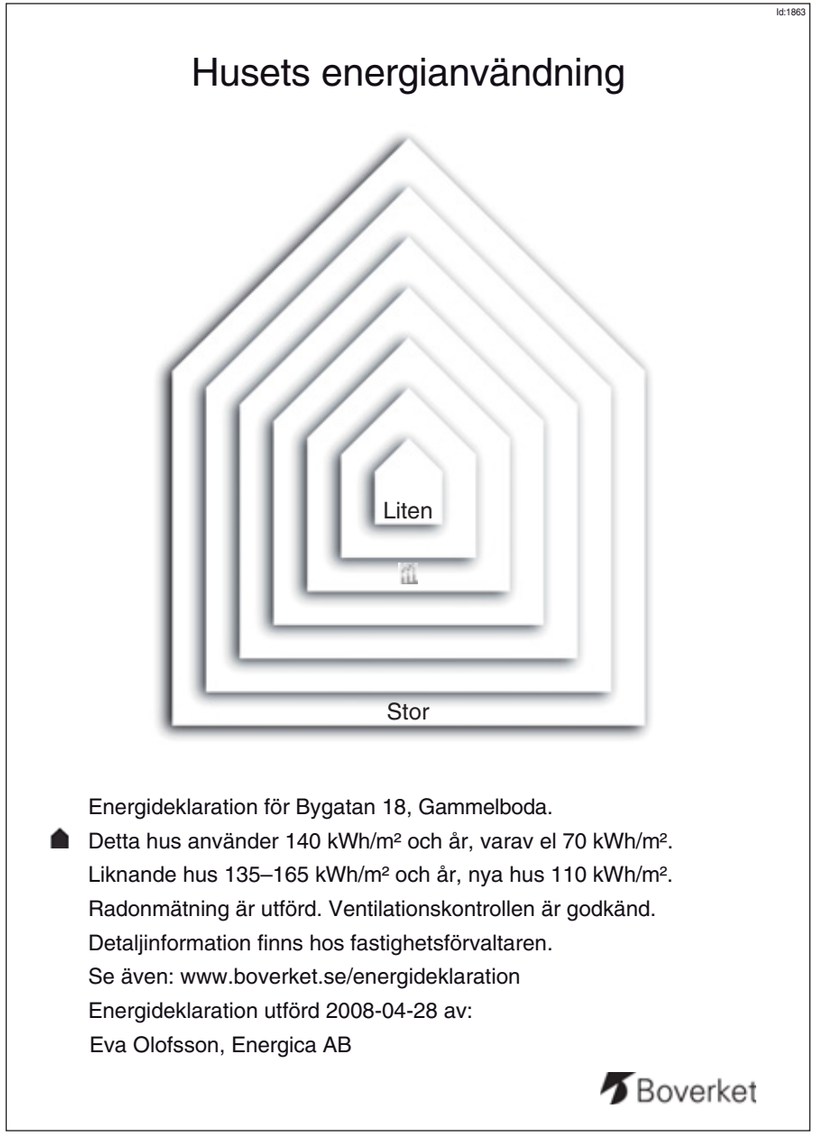


Figure 4.2 Energy certificate (summarized) used in Sweden.

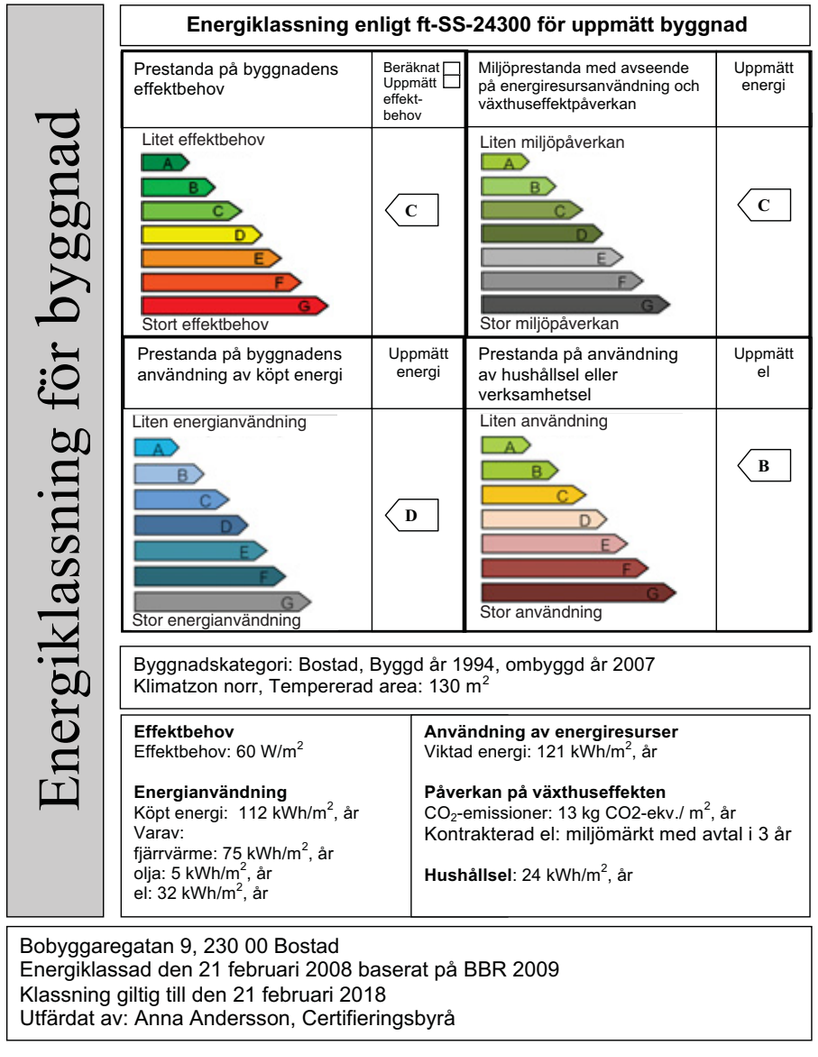


Figure 4.3 Preliminary design for the new Swedish energy certificate according to SS-EN 15217.

Energimærkning

Energimærkning for følgende ejendom:

EKSEMPEL
på energimærkning af enfamiliehus

Adresse: Rolighedsvej 22
Postnr./by: 9990 Storstaden
BBR–nr.: 123-123456
Energimærkning nr.: 122780
Erstatter energimærkning nr.: 111111
Gyldigt 5 år fra: 1. juli 2006
Energikonsulent: Jens Pedersen **Firma:** Aktuel Energirådgivning

Energimærkningen oplyser om ejendommens energiforbrug og mulighederne for at opnå besparelser. Energimærkningen udføres af beskikkede energikonsulenter for enfamiliehuse og er lovpligtig.

Beregnet varmeforbrug

- **Udgift inkl. moms og afgifter:** 70.500 kr./år
- **Forbrug:** 5.400 liter olie/år
  13.800 kWh/år

Det varierer, hvor meget varme den enkelte husejer bruger. Det afhænger bl.a. af vejret, husstandsstørrelse, forbrugsvaner, og ønsket temperatur i boligen. Derfor har energikonsulenten beregnet hvor stort normalforbruget er i denne bolig. Beregningen baserer sig på en række faste forudsætninger, se afsnittet på næstsidste side.

Energimærke

Lavt forbrug

Højt forbrug

A er det bedst opnåelige energimærke, herefter B osv. og G er det dårligste.

Besparelsesforslag

Her er energikonsulentens forslag til at reducere energiforbruget i bygningen. Forslagene er opdelt i to dele. Først vises besparelsesforslag med god rentabilitet. Her er energibesparelsen er så stor, at den betaler investeringen tilbage inden for en periode, som er kortere end to tredjedele af energibesparelsens levetid. De øvrige energibesparelsesforslag har dårligere rentabilitet. Se evt. flere forslag på næste side. Forslagene uddybes i afsnittet om bygningsgennemgangen.

	Besparelsesforslag med god rentabilitet	Årlig besparelse i energienheder	Årlig besparelse i kr. inkl. moms	Skønnet investering inkl. moms	Tilbage-betalingstid
1	Efterisolering på loft af hanebånd og skunkrum	300 liter olie 1.200 kWh	4.600 kr.	33.000 kr.	7 år
2	Hulmursisolering af ydervægge og efterisolering af radiatornicher	840 liter olie 3.200 kWh	12.700 kr.	26.800 kr.	2 år

Figure 4.4 A typical Danish energy certificate.

Energy Performance Certificate

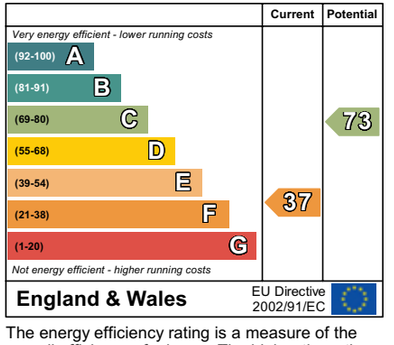
SAP

17 Any Street,
Any Town,
County,
YY3 5XX

Dwelling type: Detached house
Date of assessment: 02 February 2007
Date of certificate: [dd mmmm yyyy]
Reference number: 0000-0000-0000-0000-0000
Total floor area: 166 m²

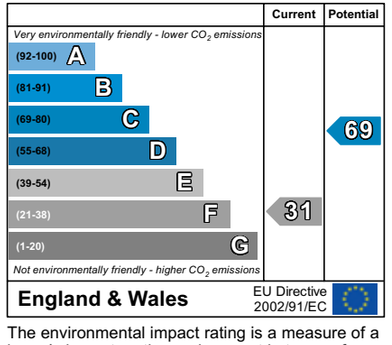
This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills will be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emissions and fuel costs of this home

	Current	Potential
Energy Use	453 kWh/m² per year	178 kWh/m² per year
Carbon dioxide emissions	13 tonnes per year	4.9 tonnes per year
Lighting	£81 per year	£65 per year
Heating	£1173 per year	£457 per year
Hot water	£219 per year	£104 per year

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Figure 4.5 An EPC, Energy Performance Certificate, for a dwelling in England and Wales.

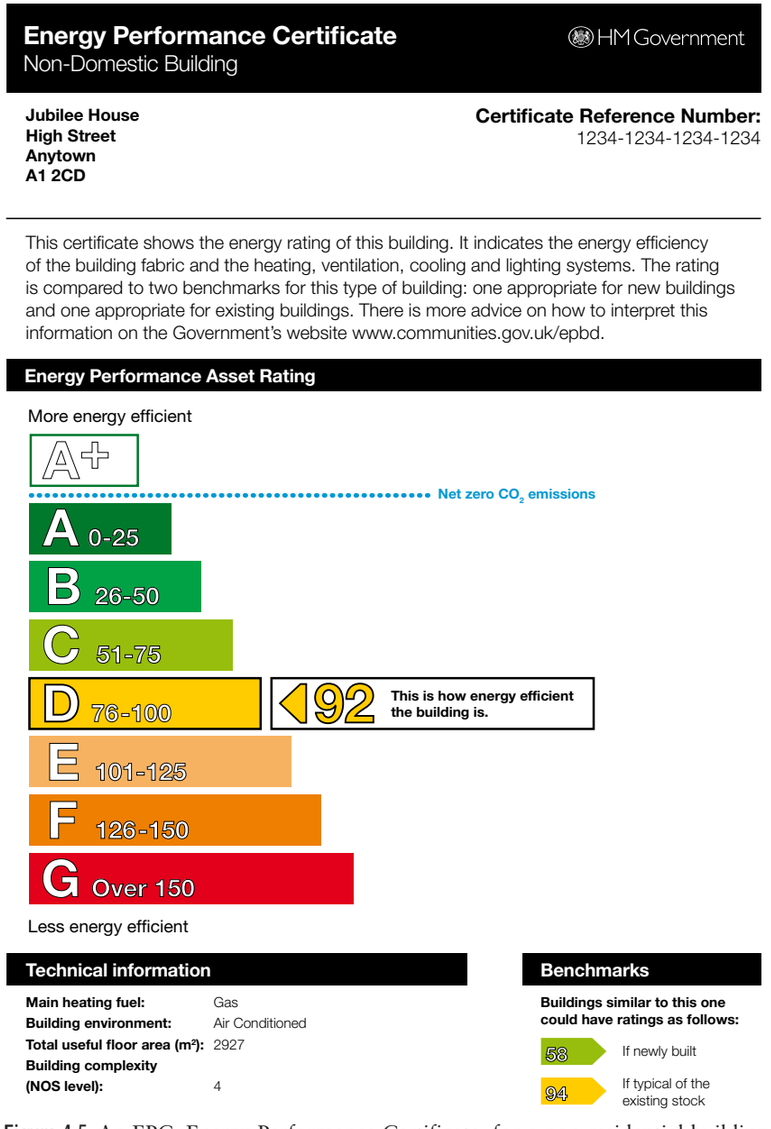


Figure 4.5 An EPC, Energy Performance Certificate, for a non-residential building in England and Wales.

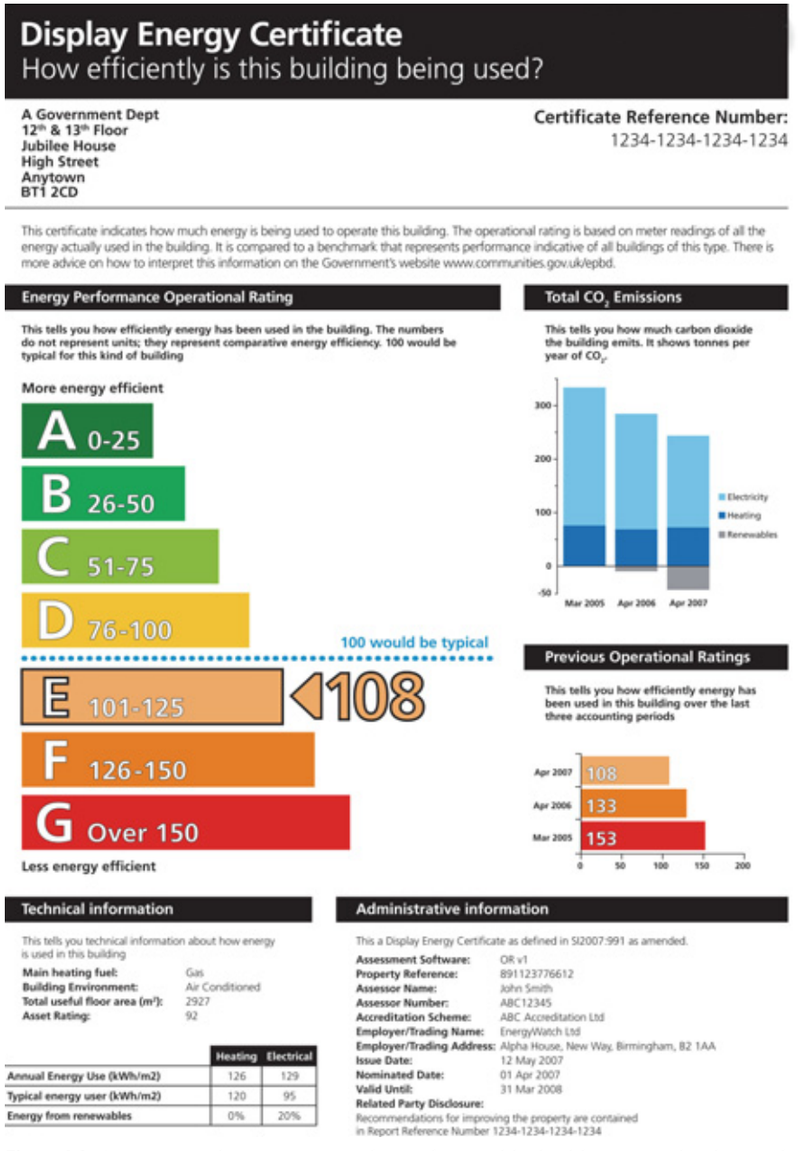


Figure 4.6 A DEC, Display Energy Certificate, for a public building in England or Wales.

PRŮKAZ ENERGETICKÉ NÁROČNOSTI BUDOVY

Typ budovy, místní označení Adresa budovy Celková podlahová plocha:	Hodnocení budovy stávající stav	 po realizaci doporučení
A B C D E F G	C	B
Měrná vypočtená roční spotřeba energie v kWh/m^{2}rok	XY	XY
Celková vypočtená roční dodaná energie v GJ	XY	XY

Podíl dodané energie připadající na:				
Vytápění	Chlazení	Větrání	Teplá voda	Osvětlení
%	%	%	%	%

Doba platnosti průkazu	
Průkaz vypracoval	Jméno a příjmení Osvědčení č.

Figure 4.8 A typical Czech energy certificate.

Projekt: 100

ENERGIEAUSWEIS-Neubau

Anlage 1

Deckblatt

Fam. Mustermann, Salzburg

Gebäudeart	2 - Kleinwohnhäuser	**Erbaut im Jahr**	2006
		Katastralgemeinde	Salzburg
Standort	5020 Salzburg-Stadt	**Grundstücksnummer**	
		Einlagezahl	123
		Anzahl Wohnungen	1

Eigentümer/Errichter (zum Zeitpunkt d. Ausstellung) Max u. Hermine Mustermann, Musterstr. 9, 5020 Salzburg

WÄRMESCHUTZKLASSEN		**FLÄCHENBEZOGENER HEIZWÄRMEBEDARF**
Niedriger Heizwärmebedarf	Skalierung	HWB_{BGF}
A	HWB_{BGF} <= 30kWh/(m²a)	29 kWh/(m²a)
B	HWB_{BGF} <= 50kWh/(m²a)	
C	HWB_{BGF} <= 70kWh/(m²a)	
D	HWB_{BGF} <= 90kWh/(m²a)	
E	HWB_{BGF} <= 120kWh/(m²a)	
F	HWB_{BGF} <= 160kWh/(m²a)	
G	HWB_{BGF} > 160kWh/(m²a)	
Hoher Heizwärmebedarf		

LEK_{Trans} - Wert	**18,3**
$LEK_{Trans\ zulässig}$ - Wert	**44**

Gemäß § 17a Abs 2 Z 3 des Baupolizeigesetzes 1997 wird die Einhaltung der Bestimmungen der Verordnung über den Mindestwärmeschutz von Bauten, LGBl Nr 82/2002, bestätigt.
Ausgestellt und bestätigt durch:

Datum, Unterschrift

GEQ von Zehentmayer Software: www.energieberechnung.at
Version 2007.0523 REPEAS - Salzburg Datum 26.06.2007 12:05 Seite 1

Figure 4.9 A typical Austrian energy certificate.

COLOPHON

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Sweden, 2009
Image credit, cover: Johan Warden/Linkimage

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air academy Swegon

The SWEGON AIR ACADEMY is a forum for objective and company-neutral sharing of knowledge and experiences related to air handling and indoor climate issues.

One of our primary goals is to explain complex relationships in an intelligible way, so that those who are interested in a special subject can understand it at a deeper level.

Via seminars, newspaper articles and literature, the SWEGON AIR ACADEMY contributes to a greater awareness of the importance of indoor air quality for health and well-being, to an increased understanding of the energy issue and to a higher level of involvement in matters concerning the outdoor environment.

The SWEGON AIR ACADEMY provides information and educational activities all over Europe and co-operates with well-known experts in relevant fields.

SWEGON AIR ACADEMY