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SS 24 300: A Swedish Standard for Energy Classification of Buildings

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Abstract

Energy use in buildings is one of the construction and property sector's most important environmental awareness areas: in most buildings, there is substantial potential for reducing their quantity of energy use. Public authorities, property-owners, contractors, equipment manufacturers, consultants and scientists are working together to develop a standard for the energy performance and classification of buildings. The intention is that buildings should be rated on a scale from A to G, in the same way as is already done for refrigerators and freezers. The final target is that clear marking of the energy performance of a building should act as a driving force towards the development of more energy-efficient buildings.

The EU's Energy Performance of Buildings Directive [EPBD 2002] already specifies requirements for energy declarations of buildings. Two European standards have been developed so that the directive can in due course be implemented as an overall European system for energy classification of buildings. For these standards to be applied at national levels, they need to be complemented by national guidelines that accommodate the requirements of national building regulations and rules concerning the energy performance of buildings. These guidelines have been produced in the form of a Swedish standard series (SS 24300 series – Energy Performance of Buildings).

This Swedish standard classifies four aspects: power classification of heating requirements, classification of energy use, classification of environmental impact, and classification of energy for domestic or business activity purposes. Energy marking aims to confirm and concentrate the attention of developers and property-owners on energy aspects, and to provide buyers and occupants with information on what the developers and property-owners aim to achieve. This means that classification will therefore provide an incentive for more energy efficiency improvement measures to be implemented. A passive house should achieve a Category A classification.

Introduction

With the coming of the Energy Performance in Buildings Directive [EPDB 2002], Sweden has the means of applying an obligatory system of declaration of the energy performance of buildings, together with a proposal for cost-effective energy conservation measures [BFS 2007]. However, there are no public authority requirements specifying that these proposed measures must be applied. A classification system of energy use in buildings is an important incentive to develop the technology of, and needed for, more energy-efficient buildings and cost-effective energy conservation measures.

Energy use in buildings is one of the construction and property sector's most important environmental considerations, and in most buildings there is substantial potential for reducing their quantity of energy use. Several projects have been carried out in recent years, resulting in the development of various systems for classifying buildings with respect to their indoor environments, external environmental impact, choice of materials, use of resources, sorting at source, energy use and so on. Some of them have resulted in initiatives with groups working to establish various classification principles for buildings. They show that attention is now being paid to the environmental impact of buildings, and that there is a need for various forms of classification (energy classification, environmental classification, indoor environment classification etc.) However, at the same time there is a risk that there will be too many different systems on the market, which can be confusing for the ordinary person. It would therefore be of value that there should be a coordinating system that defines a common ground for energy classification.

To complement the EPBD, CEN (European Committee for Standardization) has developed two European standards to provide the structure for an overall European system for determining the energy performance and energy classification of buildings. To apply them at individual national levels, these standards need to be complemented with specific national guidelines that link to national building regulations and other rules concerning the declaration of the energy performance of buildings.

In addition, the 2010 revision of the EPB Directive specifies a requirement that the energy performance of buildings must be stated in advertisements in commercial media when renting out or selling buildings [EPBD 2010]. This requires clear guidelines as to how energy classification should be effected if it is to ensure that all buildings will be classified in the same way.

A technical committee, consisting of representatives of public authorities, property-owners, contractors, component manufacturers, consultants and scientists, has therefore developed a voluntary Swedish standard for energy classification, based on the CEN standards. The Swedish standard series has been given the name of SS 24300 –Energy Performance of Buildings.

CEN standards

European standard SS-EN 15217 specifies that energy performance shall be based either on calculated or on measured energy use for a specified heated floor area. This is in good agreement with the most recent building regulations [BBR 2011] and rules governing the declaration of buildings' energy performance [BFS 2007]. In addition, the standard specifies that metrics of total energy performance can be:

- Primary energy,
- CO_2 emissions, *or*
- Weighted net energy supplied, where the weighting factor is nationally set.

The standard also contains an informative annex on how an energy classification system can be set up at a national level.

Primary energy and CO_2 emissions must be calculated using primary energy factors and emission coefficients, described in SS-EN 15603. The standard includes an informative index with examples of primary energy factors and emission coefficients, but recommends that national rules should be established. The Swedish standard therefore aims to complement SS-EN 15217 and SS-EN 15603 with a description of how this should be done in order to classify the energy use of buildings on a scale from A to G, based on the above indicators.

The purpose of energy classification in accordance with SS 24300

The purpose of SS 24300 is to provide an incentive for more energy efficiency improvement measures by confirming and drawing attention to the energy-related aspects of the work of developers and property-owners, and to provide buyers and the occupants of buildings with information on the aims of the former group. A standard for energy classification provides a means for one party clearly to show a second party that energy use in the building when it is occupied could have been improved. Classification aims to provide information to (for example) a prospective purchaser on the running costs to be expected, and whether the building is of good standard.

The aim of energy classification of buildings is to encourage developers, property-owners, caretakers and users to improve the energy performance of all parts of a building. The standard:

- Applies for all buildings (existing and new, regardless of their purpose);
- Provides an incentive for constant improvement, and thus drives technologies forward;
- Is based on functional requirements, and is therefore technology-neutral;
- Is restricted to energy aspects, i.e. it is not a total environmental classification;
- States that the results must be illustrated in the same way as used for European energy marking of products.

Energy classification of buildings is voluntary, and uses the definitions and concepts that the National Board of Housing, Building and Planning has used in the Building Regulations and in its rules for energy declaration of buildings.

Energy classification is intended to provide correct and clear information on a building to prospective purchasers (whether professional or non-professional), residents, tenants and persons in the building and to their customers. In this way, SS 24300 can contribute to the EU's and the Government's target of reducing energy use in the construction and property sector.

The SS 24 300 standard series

A draft standard was produced several years ago, in 2008, and circulated for consultation. In it, all four parts of the standard were contained within the one part. This could not be agreed by all parties, and so the technical committee decided to develop each part on its own, thus producing a series of standards consisting of four parts:

Part 1: Power classification of heating requirement. [SS 24300-1:2011]
Part 2: Energy classification of energy use. [SS 24300-2:2011]
Part 3: Classification of environmental impact. (SS 24300-3)
Part 4: Classification of domestic or business activity energy. [SS 24300-4:2012]

Power classification of heating requirement

SS 24300-1 was published in 2011 and provides a description of the performance of a building's thermal insulation, the airtightness and raintightness of the climate screen, and heat recovery. Classification is based on the power requirement, which is defined as the aggregated power demand of equipment for heating and internal heating as needed in order to create the desired indoor climate and ventilation at the design winter ambient temperature, per unit of heated or cooled floor area.

The power demand may be either measured or calculated. Measurement establishes a power signature (energy signature) based on measured data of indoor and outdoor temperatures and the heating power input. To the measured power requirement is added the internal heating power contribution from heat from occupants, lighting and electrical equipment, weighted to reflect their time duration, over an average week at the design outdoor winter temperature. Calculated power requirements are based on calculation of power requirements for transmission losses through the climate screen, ventilation losses and infiltration losses at the design outdoor winter temperature.

Power classification is expressed on a scale from A to G, with A being a building having a low power demand for heating, and G being one having a high power demand for heating, and with the boundaries between the classes depending on in which climate zone (of the country) the building is situated. Class A in Climate Zone 3 requires a power requirement less than 16 W/m^2, while the power requirement for Class G in Climate Zone 1 must not exceed 72 W/m^2.

Classification of energy use

SS 24300-2 was published in 2011 and describes determination of the amount of energy used for operation of a building's technical systems, and thus also provides an indication of the costs of running the building.

The energy use of a building is defined as the energy that, in normal use, is supplied to the building (often known as purchased energy) over a statistically average climate year, for heating, comfort cooling, domestic hot water and the building's services systems. It can be reduced by energy contributions from solar cells and solar collectors installed on the building. Domestic energy and energy used for (business) activities in the building are not included. The classification is based on the building's energy performance, which is given by the amount of energy use divided by the heated or cooled floor area.

A building's energy use is its measured energy use of purchased energy for each form of energy carrier over twelve consecutive months, and with the building's various occupant activities in use. Classification can be preliminary for buildings being designed, under construction or having been in use for not more than 24 months. In such cases, classification is based on design values.

A building's energy use is then classified in accordance with a scale based on required energy performance values, as set out in the applicable building regulations for new buildings [BBR 2008]. Class C is equivalent to the requirements in the building regulations, while Class B is 75 % and Class A is 50 % of the Class C values.

Class D is 25 %, Class E is 50 %, and Class F is 75 % higher than the Class C values. Class G is any value higher than Class F.

Since SS 24300-2 was published, the National Board of Housing, Building and Planning has published new building regulations [BBR 2011], with stricter requirements for the energy performance of buildings that are not electrically heated, which will come into force on 1st January 2013. The standard has therefore been under revision, with external circulation for consultation during the spring of 2012, and a new version reflecting the new rules in the Building Regulations expected to be published in October 2012. The reason for the standard giving actual values, and not references to the Building Regulations, is to avoid cross-references.

The new building regulations refer to SS 24300-2 if the developer wishes to specify higher requirements in respect of energy conservation than are required by the regulations. At the same time, new requirements for energy declarations of buildings have been added. Under the new regulations, the purchaser's copy of the energy declaration marking has been brought into line with the standard's A-G scale with effect from 1st July 2012. In addition, the new regulations incorporate the requirements of the revised directive [EPBD 2010] that advertisements for the sale of one-family houses must include an energy declaration and information on energy performance.

Classification of environmental impact

Work on SS 24300-3 has only recently started, but the standard is expected to specify how to quantify the environmental impact of the building's supply systems for energy carriers for powering its technical systems and building services systems. The purpose of Part 3 is to:

- Describe possible environmental impact resulting from the building's use of energy.
- Encourage the purchase of energy having a declaration of origin (which in turn becomes an incentive measure for improved electricity and district heating mix).
- Encourage improved operation to reduce load peaks during cold winter days.

The working party has agreed the following criteria for continued work on drafting Part 3:

- Classification will be restricted to the environmental impact of energy used in operation, and will therefore not be a total environmental classification (i.e. it will not consider the energy use for production or delivery of materials, distance from local traffic, emissions from materials etc.).
- The work will investigate classification based on energy efficiency (of primary energy) and environmental impact (climate effect, i.e. CO2 equivalents). Primary energy is included because it is explicitly included in the updated EPBD. The greenhouse effect is included as it has a direct environmental effect, which is important to consider.
- Classification will be based on an accounting approach, i.e. mean values of actual energy use. Decision perspectives based on marginal values, and which may be relevant (e.g. in connection with new building or renovation/conversion of existing buildings) will not be considered. However, the differences in the approaches will be described in the explanation of terms used.
- It is the objective that the outcome should be <u>one</u> single classification value. If both classifications (i.e. based on primary energy and possible greenhouse effect) turn out to be relevant for classification metrics, it shall be further investigated if it is possible to weight them into one single scale.
- The work will not investigate environmental effects such as acidification, eutrophication or similar. However, it will be considered if it is feasible to include aspects such as particle emissions or creation of low-level ozone arising from energy use if they could have a substantial effect on local environmental conditions. This can be done, for example, by considering 'black carbon' as an indicator of greenhouse effect, or by accepting only environmentally certified boilers in properties if the properties are to be considered for Class A or Class B classification. (This is similar to the condition as required in SS 24300-4 for white goods.)
- The objective is that classification of environmental impact in accordance with SS 24300-3 should be based on the entire energy use for heating, domestic hot water production, building services systems, comfort cooling and electricity for domestic purposes and business activities (i.e. energy use in accordance with SS 24300-2 and SS 24300-4). The second-preference alternative is that classification of electricity for domestic purposes and business activities should be listed separately, while the final-preference classification is that of basing it only on energy use for heating, domestic hot water production, building services systems and comfort cooling.

- It is the objective that energy use should be weighted by specific factors depending on the origin of the energy. Average values may be used if it is not possible to specify exact values.
- The factors and the method on which the finished standard will be based apply only for the application of energy use in buildings, and cannot be used for environmental evaluation in other contexts, such as transport.
- It is the objective that the new standard should be based on earlier work, rather than developing something completely new.

Classification of domestic electricity and electricity for business use/activities

SS 24300-4 provides a description of how a building is used. It has been circulated for consultation, and is expected to be published in October 2012. It defines the boundaries between energy used for domestic purposes, that used for business activities, and that used for building services systems.

A building's energy use for domestic or business activity purposes is verified by metering or measuring all forms of 'purchased energy' energy carriers over a period of twelve consecutive months with the particular energy demands.

Energy classification covers the buildings category, with the following sub-divisions:

- one-familyhouses and apartment buildings
- infant schools, schools, old people's homes and social-care premises
- offices, universities, hospitals, hotels and restaurants, sports halls for ball sports and gymnastics
- wholesale and retail trade
- galleries, leisure centres with swimming pools or ice rinks
- retail grocery shops, swimming pools or ice rinks.

Use of domestic energy in a Class A residence must not exceed 10 kWh/m^2, year. In addition, for Class A and Class B buildings, the energy-using appliances etc. installed in the buildings must be energy-marked under a relevant scheme and have the lowest energy classification or best function performance, with such requirements often being Class A or better. Typical examples are Class A^+ for a refrigerator and Class A for a dishwasher. Domestic energy use in a Class C residence must not exceed 30 kWh/m^2 per year, and not exceed 60 kWh/m^2 per year in a Class F residence.

For an office to receive a Class A rating, its energy use for its activities and equipment must not exceed 10 kWh/m^2 per year. In addition, for the office to receive this rating, it must be possible easily to turn off energy-using equipment at room or tenant level when work is not being performed during parts of the day, or has finished for the day. This could be arranged, for example, by powering the energy-using items at room or tenant level from a supply that can be disconnected by some suitable means from the electricity system in the building. Fixed lighting must be of Class A rating, and lighting systems must be occupancy-controlled and, where appropriate, also be daylight-responsive. Activity energy use in a Class C office must not exceed 50 kWh/m^2 per year, and not exceed 170 kWh/m^2 per year in a Class F offices.

Energy classification certificates

Although the various parts of the standard can be used on their own, all four classifications should be presented in order to provide an overall picture of the energy use of a building. On completion of classification, the results are presented in the form of an energy classification certificate (Figure 1). The presentational form of the declaration aims to be the same as that used on (for example) refrigerators and freezers, so that it is easy for the public to recognise and understand it.

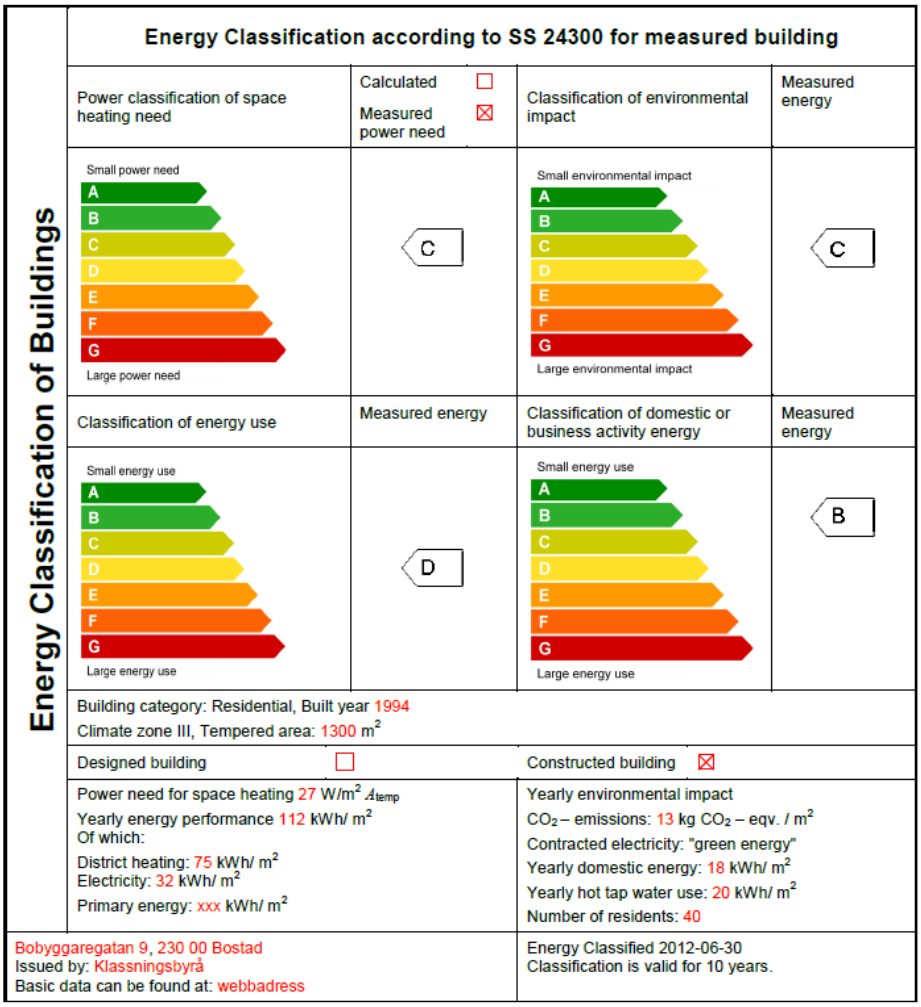

Figure 1. An energy classification certificate with several energy classes.

Discussion

Why consensus now?

When drafting SS 24300 in 2008, it was not possible to achieve consensus, with this applying particularly to Part 3. However, conditions for achieving consensus in 2012 are much more favourable. For several years now the construction and property sector has sought a simple and reliable means of assessing the relative environmental performances of different energy carriers. Different results are obtained depending on where system boundaries are drawn when evaluating energy use, which has meant that different parties have different views, so making it difficult to achieve consensus. This means that it is difficult for a property-owner or tenant to persuade builders or developers to choose 'green' energy in order to reduce the environmental impact of energy use. Several investigations have come to the conclusion that it is very difficult to find general factors that can be applied to all individual cases, but rather that evaluation often depends on the specific circumstances. However, with the passing of time, a greater unity has started to appear as our neighbouring countries have adopted clear guidelines. Today, much work has been done on which a standard can be based, and these are areas where agreement on different systems has in recent time been reached.

Much of the sector has today realised that it will not be possible in the long term to avoid the application of some form of assessment. It is therefore better to become involved to influence developments, rather than passively watching the world go by. It is better to compromise on a system that is relatively close to the ideal, and which can be used in practical apsplications, based on a Swedish standard, rather than to have several systems all unrestrictedly competing on a disorganised market.

Is A class challenging enough?

The part 2 in the standard has been criticised for not being challenging enough. Several of the consideration instances recommend to also include a A^{+} or a A^{++} scores. However, not to do that will open the market for other environmental labelling schemes. This can for example be certification of passive houses that will show the best class of energy performance and is not suitable for ranging the complete existing building stock and get incentivises to make energy efficiency measures even though the energy performance is far from the best class.

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