Implementation of the EPBD in Sweden

STATUS IN DECEMBER **2014**

1. Introduction

In order to implement the Energy Performance of Buildings Directive (EPBD), Sweden has altered existing, pre-EPBD regulations for energy performance in 2006, 2009, 2012 and 2015. In addition, a further revision is planned for 2016. Sweden has developed a Nearly Zero-Energy Buildings (NZEBs) action plan and is currently working towards establishing NZEB levels.

The original legislation regulating Energy Performance Certificates (EPCs), dating from 2006, has been amended with a view to comply with Directive 2010/31/EU. The system for the qualification of energy experts has changed its approach from accrediting companies, to accrediting experts and a new process of issuing certificates for buildings has been launched in 2014.

In response to Articles 14 and 15 of the Directive 2010/31/EU, Sweden has chosen the alternative approach, starting with mapping the target groups for inspections and directing all follow-up activities towards those groups. By the end of 2014, more than 1,200 companies and organisations have received advice on how to reduce energy use. Furthermore, systems have been developed and launched so as to follow up on the impact of the alternative measures. All the above information has also become part of the EPC advice.

2. Current status of Implementation of the EPBD

I. ENERGY PERFORMANCE REQUIREMENTS

I.i. Progress and current status

Swedish energy performance regulations are based on measured delivered energy, including energy performance requirements for heating, cooling, hot water and other general uses of the building (pumps, fans and lighting for all buildings), known in Sweden as "estate energy", divided by the area intended to be heated to more than 10 °C (A_{temp}).

According to the building regulations (BFS 2011:6), new buildings must be designed in such a way that energy use is limited by low heat losses, low cooling demands, efficient use of heating and cooling, and efficient use of electricity.

Buildings must be designed so as to ensure the following:

- building's specific energy use; for example, for climatic zone III (see Figure 1), where more than 80% of the Swedish population lives, the requirements are listed in Table 1 for residential buildings and in Table 2 for non-residential buildings;
- installed maximum electric power rating for heating (via electric resistance, electric boilers or heat pumps);
- average thermal transmittance (U_m) of the building envelope (A_{om}) displayed in Table 3.

AUTHORS

Hans-Olof Karlsson Hjorth,
Sofia Lindén,
Erik Olsson,
Roger Antonsson,
National Board of Housing, Building and Planning (Boverket)

Susan Linton,
Swedish Energy Agency (Energimyndigheten)

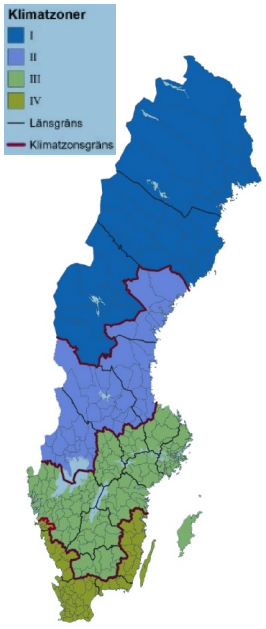


Figure 1: Climatic zones I-IV from north to south (länsgränser = county limits).

NATIONAL WEBSITES
www.boverket.se/sv/om-boverket/other-languages
www.energimyndigheten.se/en

Energy use requirements for new[6] residential buildings [kWh/m²] A_{temp}	2006	2009	2012	2015					2016 - 2017	2021[4]
				Single-family houses		Multi-family houses				
				1-2 apartments	PE-ratio[5]	>2 apartments	>50% of the dwellings < 35m²	PE- ratio[5]		
Electrically heated[1,2]	75[3]	55	55	55	90/55= 1.64	50	55	80/50= 1.60	Planned change due to re-evaluation in 2015	Due to cost-optimal at the time
Non-electrically heated	110	110	90	90		80	90	90/55= 1.64		

Table 1: Building code since 2006, residential buildings, electrically heated/ non-electrically heated buildings, climatic zone III.

1. Electrically heated defined as installed power of more than 10 W/m².
2. Electrically heated have a maximum power limit that must not be exceeded.
3. Only for electrical panels in single-family houses.
4. 1 January 2021.
5. Primary Energy (PE)-ratio is the ratio between the value for non-electrically heated and electrically heated buildings.
6. When altered, aim at the above with regard to the size of the alteration and the possibility of the building. Recommended but not required target. Target is defined by the possibilities of the building. For example, no change on the cultural values should be made. Owners cannot alter the look of the window and due to this fact it may not be possible to reach the exact demand.

Energy use requirements for new[8] non-residential (including public) buildings [kWh/m²] A_{temp}	2006	2009	2012	2015	PE-ratio	2016-2017	2019[6]	2021[7]
							Public buildings	Other non-residential buildings
Electrically heated[1,2]	100[3]	55[5]	55[5]	50[5]	70/50= 1.40	Planned change due to re-evaluation in 2015	Planned change due to cost-optimal at the time	
Non electrically heated		100[4]	80[4]	70[4]				

Table 2: Building code since 2006, non-residential buildings, electrically heated/non-electrically heated buildings, climatic zone III.

1. Electrically heated defined as installed power of more than 10 W/m²
2. Electrically heated also demand maximum installed power. Addendum if the $q_{hygiene}$ is between 0.35 and 1.0.
3. Addendum if $q_{hygiene}$ is between 0.35 and 1.0 l/s. m². +110*(q-0.35) [kWh/m²]
4. Addendum if $q_{hygiene}$ is between 0.35 and 1.0 l/s. m². +70*(q-0.35) [kWh/m²]
5. Addendum if $q_{hygiene}$ is between 0.35 and 1.0 l/s.m². +45*(q-0.35) [kWh/m²]
6. 1 January 2019.
7. 1 January 2021.
8. Existing buildings: When altered aim at the above with regard to the size of the alteration and the possibility of the building.

		2006	2008	2011	2015
Residential	Non-electrically heated	0.5	0.5	0.4	0.4
	Electrically heated		0.4		
Non-Residential	Non-electrically heated	0.7	0.7	0.6	0.6
	Electrically heated		0.6		
For buildings < 50 m²					0.33
Airtightness buildings < 50 m²					0.6 l/s.m²

Table 3: Evolution of maximum average building U-value [W/m².K].

Moreover, at least one more revision of the EPBD is expected before 2021 to take into account the 5 year revision cycle stipulated in its mandate.

The requirements for non-residential buildings include an air exchange rate set between 0.35 and 1.0 l/s.m², while requirements also vary depending on the heating source (electrical and non-electrical), as well as the climatic zone.

The overall U-values must not exceed 0.4 W/m².K for residential buildings and 0.6 W/m².K for non-residential buildings.

In general, there are no quantitative requirements for other building elements or systems. For example the building code states the following:

- Airtightness must be sufficient so that the requirements for specific energy use and installed electric power rating for heating are met. For buildings with a floor area less than 50 m² there is a requirement of 0.6 l/s.m² with regard to airtightness.
- Installations must be designed so as to provide adequate efficiency during normal operation.
- Building services requiring electrical energy, e.g., ventilation, fixed lighting fittings, electrical heaters, pumps and

motors, must be designed to ensure that the power requirement limit is met and energy is used efficiently.

> The need for cooling must be minimised through design and technical measures.

> The building must have a control and regulation system in order to maintain both optimal energy efficiency and thermal comfort.

> Heating Ventilation and Air-Conditioning (HVAC) systems must be fitted with automatic regulation equipment so as to ensure that the supply of heating and cooling is regulated based on power demand and in relation to both outdoor and indoor climate and the intended use of the building.

> According to regulations, a building's energy use shall be monitored by a method of measurement. This method shall ensure that the energy use of the building can be read in order to enable calculation of the building's energy use for the desired year.

The responsibility for compliance lies with the developer. The compliance check is based on measured values and takes place during the second year of operation. There is no requirement to measure single parameters as long as the measured value complies with the building code. For example, if the measured energy is within the specified limits, there is no reason for measuring airtightness or how it is regulated. Compliance controls are supervised by the Municipality Building Board.

Moreover, legislation provides for the compulsory ventilation check where a certified assessor checks the ventilation system before a building can be used, and thereafter every two years with regard to schools, and every three years regarding offices.

Furthermore, primary energy factors, PE-ratio, are addressed by different requirements, one for electrical heated and another for all non-electrical heated buildings.

Over the years, the regulations have evolved towards lower energy use requirements. Both the building code and the handbook entitled "*Energy management according to the building code*" (Figure 2) include general advice and guidelines. The methodology consists of adding up the measured values for energy used for heating, Domestic Hot Water (DHW), cooling and estate energy, divided by the heated[1] area.

I.ii. Format of national transposition and implementation of existing regulations

Swedish regulations regarding the required qualities of buildings are outlined in different legislation acts, the most significant ones being the "*Planning and building act*" and the "*Environmental code*". The regulations connected to the "*Environmental code*" indicate how a building should operate, e.g., thermal comfort, ventilation rates, etc. The regulations related to the "*Planning and building act*" set out the role of the building in achieving these qualities. EPCs are regulated by a separate legislative system.

When it comes to energy use, Sweden normally does not put restrictions on the selection of calculation programme/standards, with a recommendation, however, for CEN standards to be applied for the calculation of U-values.

The building compliance system comprises the developer and its representative, the certified person responsible for inspections and verification, and the local municipal building council. Boverket, the National Board of Housing, Building and Planning, has the responsibility to check if an EPC has been issued for a specific building. Boverket performs its role by cross-checking the national cadastre of the building stock with the EPC register. Boverket contacts owners who have not yet declared their buildings on a weekly basis. If non-compliance persists, Boverket may impose a fine against the owner. By the end of 2014, two demands/warnings have been sent to two building owners. In one case, the EPC was issued, in the other case, as no EPC was issued, the case was sent to the Court, which was about to impose a fine.

The EPC register also provides the opportunity to monitor the compliance level of new buildings. An analysis of the register has found that the compliance rate is not satisfactory. As a result, Boverket is working on ways to cooperate with the local building boards of municipalities to improve the compliance ratio, both for the energy use and for the EPCs. The main problem is the time it takes before the new buildings are registered into the system.

Figure 2: Handbook "Energy management according to the building code".

[1] A_{temp}, area intended to be heated to at least 10 ºC.

I.iii. Cost-optimal procedure for setting energy performance requirements

Boverket is continuously monitoring the results of the cost-optimal calculation requirements. It also examines the possible effect of a further tightening of requirements on the cost-optimal calculations for the three categories-according to the latest revision-, i.e., single-family houses, multi-family houses and non-residential buildings. Whenever there are favourable economic conditions, the regulations are tightened.

The latest revision of the building requirements (following cost-optimal calculations) was held in 2012, with follow up revisions planned for 2015 and 2016. The next revision of the NZEB levels is scheduled for 2018/2020.

I.iv. Action plan for progression towards Nearly Zero-Energy Buildings (NZEBs)

Up until now, the national plan has set 2015 as the landmark evaluation year regarding the progression towards NZEBs. This will also be followed by pilot projects demonstrating how to build low energy buildings while meeting all requirements of the building code. Until summer 2015, certain pilot projects will be evaluated as to the extent they managed to fulfil all the requirements of the building code, as well as to the point that they can still be considered low energy buildings. In parallel, ways for the best formulation of requirements stated in the building code will also be examined. The results of these last two exercises are to be reported to the government by mid June 2015. The government will then submit the results to the Commission.

As a result, no final definition of NZEB was available in Sweden at the end of 2014.

Nonetheless, the level of the NZEB requirements cannot be set lower than the requirements of 2014 until the end of 2015.

I.v. Implementation of the Energy Efficiency Directive (EED) regarding building renovation and the exemplary role of public buildings

Sweden's strategy for energy efficiency renovation is based on the building code and the EPC regulation, which so far have contributed to the efficiency improvement of building energy use by 11% during the period 1995 - 2011. If policy instruments are extended until 2050, the total energy purchased per m^2 is predicted to decrease by 22-30% by 2050. The new EPCs have an important role to play in this strategy, as they will support a functioning market for energy efficiency. A 50% reduction of energy use by 2050 (1995) requires that the extent of renovations must increase and that other measures relating to operational electricity, household and building electricity will also be taken. A particular aspect of the action plan is to provide sufficient information to the building owners of the now fifty year old "*million dwellings programme*", so that every time a building renovation takes place, energy efficiency is also taken into consideration. The "*million dwellings programme*" was a state initiated programme, developed between 1965 and 1975 and set to build 1 million dwellings in Sweden. As a consequence, the houses built during this period represent a significant part of the Swedish building stock and are particularly relevant, since due to age many of them are in need of refurbishment.

Sweden has chosen to follow the alternative approach under Article 5 of the EED. In Sweden, the two agencies that own 95% of the state-owned buildings are to implement the whole 3% target. The expected savings by 2020 will be 21 GWh and the reference floor area is 1,678,000 m^2. In addition, the EPC register has been used to form the alternative approach, while the database has been used to separate targets for energy savings.

II. REQUIREMENTS FOR TECHNICAL BUILDING SYSTEMS (TBS)

Sweden uses measured values for compliance control of regulation requirements. Thus, the developers themselves can choose the areas where they will focus their efforts. As a result, there are no qualitative figures on the specific parts of the system (e.g., boiler efficiency). As long as a total value is measured lower than the requirements, the building is regarded as compliant. When a building is renovated or refurbished, it is the altered part of the building that should comply with the regulations for new buildings. Requirements are set in relation to the "size of the alteration" and "the technical possibilities for changes in the building".

Sweden has also endorsed a general advice on the Specific Fan Power (SFP) factor of the ventilation system in new buildings, and in renovated and refurbished buildings, either for the ventilation system as a whole, or for a specific part of the system.

When a building component or function is altered, it is required that the altered part should fulfil the requirements so that the system as a whole, will be compliant with regulation requirements. The same control system applies also to installation, dimensioning and adjustment.

There is a market driven encouragement for using smart meters in buildings, mainly supported by Energy Service Companies' (ESCOs) competition on the best smart meter, prompting consumers to use the one which is energy wise the most efficient. However, there are no specific requirements on smart metering.

III. ENERGY PERFORMANCE CERTIFICATES (EPCs) REQUIREMENTs

III.i. Progress and current status on sale or rental of buildings

The Energy Performance Certificate system is run by Boverket which is responsible for supervision and control, as well as management of the national EPC database.

EPCs are issued by certified assessors. The organisations that carry out the certification of experts are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC). The certifying bodies are under SWEDAC´s supervision and have the right to revoke a license if the expert has shown incompetence, or has issued an incorrect or false EPC.

Sweden has used accredited companies up until January 2014. The company issuing EPCs had to be accredited by SWEDAC, and have at least one certified energy expert in a managerial position. This system changed on 1 January 2014. The accredited companies have been replaced by a system, which requires that all assessors have to be certified (individual responsibility). Sweden applies mutual recognition vis-à-vis assessors from other EU countries and so far Finnish, Danish and British assessors are also working in the system.

Since 2007, experts register the EPCs directly in the national database.

Through the website of Boverket, all EPCs are accessible and searchable by address. The information that can be obtained online is the ID-number of the EPC, the date of issuance, the energy performance rating (given as a single value of specific energy in kWh/m².year and energy class), and finally, whether radon measurements and compulsory ventilation controls have been executed. Building owners and real estate agents can order the full version of the EPCs from the website. There is also a GIS application under way that would enable people to look for certified buildings via this app.

EPCs are valid for 10 years. Moreover, certification following a major renovation is not mandatory, but is normally performed because of the owners' wish to update the value of the new reduced consumption relative to the reference benchmark.

EPCs are issued only at building level and thus there are no EPCs for individual apartments.

Format and content of the EPC

Boverket changed the EPC format in January 2014 by introducing classes A-G (Figure 3). The intervals for the classes are described as percentages of the minimum requirements for new buildings (Table 4). The higher limit of the Class C represents the minimum energy performance for a new building.

The average cost of an EPC is about 1,000 €. There may be variations depending on the type, size and complexity of the building (increasing costs for increasing complexity).

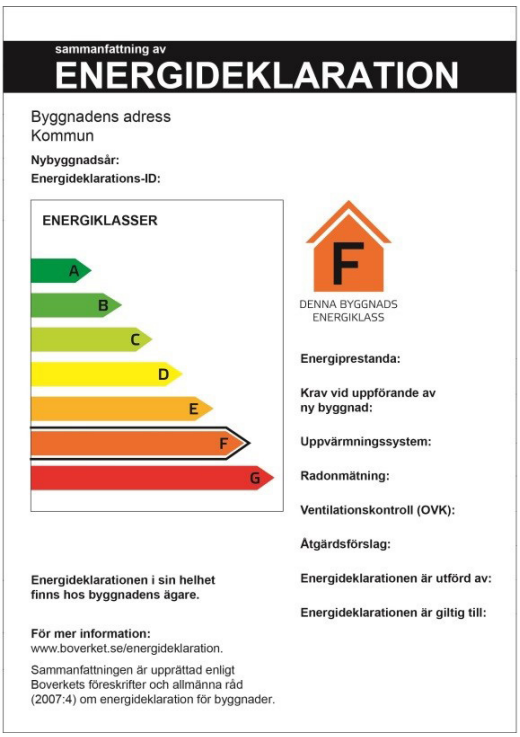


Figure 3: EPC format.

Class	Range [percentage of requirements for new buildings]
A	≤ 50%
B	> 50 - ≤ 75%
C	> 75 - ≤ 100%
D	> 100 - ≤ 135%
E	> 135 - ≤ 180%
F	> 180 - ≤ 235%
G	> 235%

Table 4: EPC classes.

Assessor corps

There are minimum requirements set out for qualified experts. Required qualifications include education and professional experience of at least five years, whereof at least two years in connection to energy use in buildings and indoor-environment. Education requirements entail university education, e.g., Master of Science or Degree in Architecture, which must be relevant to the energy systems or building, or other related technical education. Certifying bodies, accredited by SWEDAC, evaluate the qualifications of the applicants. Following evaluation of the education and experience requirements, there is also a mandatory exam for a qualified applicant to become a certified assessor (energy expert). Moreover, certified assessors have to take the exam every five years in order to renew their licence.

The CEX 2007:5 regulations, which define competence levels for qualified experts, are issued by Boverket.

There are two distinct levels of assessors. The lower level addresses simple buildings, e.g., single-family houses and smaller multi-family houses. The higher level is for more complex buildings (e.g., buildings with air-conditioning), public buildings, as well as all buildings with cultural value. Both levels have the same requirement for education and experience, but there are differences in the mandatory exam. For example, in the exam for the higher level, candidates must prove their knowledge on the interconnection of systems for heating, cooling and ventilation in a building, as well as on pertinent regulations.

Compliance levels by sector

There are certain buildings which are required to have a valid EPC in all cases. This category includes buildings for rental and also larger public buildings. There are indications that the compliance rate in this group is about 75%. This estimation is grounded on the comparison between property information managed by the public authority *"Swedish National Land Survey"* and information available in the EPC database. The system has been partly inactive, but this could generate a positive impact on the market, which will become more stable when all buildings have to renew their certificates after 10 years. Therefore, the demand for experts will be more stable throughout the years.

As far as other buildings are concerned, an EPC is required only in certain conditions. This second category includes buildings for sale and new buildings. Regarding the former, the most common trend is the sale of single-family buildings. In this case the compliance rate recorded is high, i.e., a certificate is available in 90-95% of the buildings sold.

Enforcement with building owners and real estate actors

The building owner is responsible for fulfilling the obligations set in the regulations. The fulfilment of these requirements is monitored by Boverket since July 2014. According to these requirements, if an EPC has been issued, the energy performance (energy class) has to be displayed in relevant advertisements and the EPC has to be showed to the buyer or tenant before purchase and to be handed over to the new owner or tenant after the deal is completed.

The Swedish Estate Agents Inspectorate (FMI) is the central authority assigned to supervise estate agents, while also providing information on code of practice. FMI includes a Disciplinary Board comprising members appointed by the Government.

Quality Assurance (QA) of EPCs

Swedish regulations separate buildings into two groups, i.e., buildings which are required to have a valid EPC in all cases and buildings that only need to have an EPC in certain conditions. Both categories include residential and non-residential buildings (and larger public buildings). For that reason, there is no distinction between sold and rented buildings, neither between public and large buildings. Instead there is a distinction between buildings required to have an EPC in all cases and those which only need an EPC when they are for sale.

Up until now, control mechanisms have focused on the first category. Since 2014 Boverket has the possibility to order an EPC to be issued combined also, if necessary, with a penalty. Until the end of August 2014, around 13,000 buildings

were subject to these controls. There has been no need so far for a fine to be imposed.

With regard to the second group, Boverket has been performing checks only when prompted by consumers' complaints. This is to be attributed to the regulations, which provide for the buyers the opportunity to have an EPC issued at the cost of the seller within 6 months from the transaction.

Moreover, certifying bodies have thus far not revoked the licence of any qualified expert.

The number of EPCs issued in 2014 was about 50,000. Validity checks are performed on every EPC automatically when the expert is actually issuing the EPC. In addition, input data are controlled by software in diverse (automated) ways, for example by climate-correction and validation of administrative information on the building through other national databases. There are also programmed warnings and error messages when input data are out of a certain range. Furthermore, the calculation of energy performance is controlled by software as well. Finally, the National Board is responsible for validity checks.

III.ii. Progress and current status on public and large buildings visited by the public

The original regulation included public buildings of more than 1,000 m^2, which has been changed, however, in accordance with Directive 2010/31/EU. As the regulation on certification covered all types of buildings, the development described above for sold and rented buildings also applies to public and large buildings, including assessors, quality control, etc.

The total number of EPCs for non-residential buildings is about 55,000, including also public buildings, while the number of new buildings is about 1,200.

III.iii. Implementation of mandatory advertising requirement

Energy performance indicators in advertisements are mandatory since July 2012 under the Law 2006:985 with changes to 2012:397 on energy certification of buildings. In January 2014, energy labels for classes A-G were introduced in the regulations. Building owners with EPCs with this symbol are required to show the EPC class in their advertisements. The EPC class makes the information easily accessible for the buyer or potential tenant, and is expected to raise the interest on energy consumption. Boverket supervises the fulfilment of mandatory requirements and may order corrections if these are not met. During autumn 2014, Boverket inspected the compliance of the use of the energy performance indicator with the mandatory advertising requirement. The findings were the following: in 43% of the advertisements, neither the new energy performance indicator[2] nor the old energy performance level indicators[3] were displayed, while 38% of advertisements included the energy performance level indicator. Additionally, in 19% of the advertisements both the energy performance indicator and the EP-level indicator were presented and in 1% only the energy performance indicator was publicised.

Certificates from the early days of the certification era did not require an energy performance indicator energy label but only a numerical energy performance level indicator. Boverket has introduced a service which makes it possible for building owners to acquire an energy class according to the new system for buildings with older EPCs. This option is on a voluntary basis and free of charge.

III.iv. Information campaigns

When Directive 2010/31/EU was incorporated in Swedish regulations, an information campaign was organised addressing estate agents. At the beginning of 2013 Boverket made the EPCs available for building owners and real estate agents through electronic channels to facilitate their work. A manual has also been produced with regard to advertisement displaying the energy class. In the future it will be possible to import energy labels from the national database into systems used for advertising.

In autumn 2014, the said information campaign targeted mostly the parties involved in transactions, namely buyers, sellers and real estate agents. The main focus was on buyers and information on how to use the EPCs. The campaign also focused on consumers' rights and sellers' obligations. Relevant information was made available through digital channels.

[2] *Energy performance indicator for the A-G scale.*

[3] *Energy performance level indicator with a numerical value.*

III.v. Coverage of the national building stock

The total amount of EPCs at the end of December 2014 was 535,260 (Figure 4) with the number of EPCs for new buildings reaching about 6,250 in total. The respective numbers by building type are presented in Table 5.

IV. INSPECTION REQUIREMENTS – HEATING AND AIR-CONDITIONING (AC) SYSTEMS

For heating and air-conditioning (AC) systems, Sweden has chosen alternative measures in response to Articles 14 and 15 of the EPBD.

IV.i. Report on equivalence

Sweden already has several control and information programmes where professionals carry out inspections of heating and AC systems. These energy advisors, inspectors, chimney sweepers and service engineers provide building owners with qualified advice on how to reduce energy use. In addition to fulfilling EPBD Articles 14 and 15, the following steps have been taken:

- Municipal energy advisors provide advice on how to reduce the total energy use and the effect on climate through other measures, such as transition to renewable energy sources.
- Advisors meet with numerous building owners who own systems that do not fall under the scope of Articles 14 and 15 of the EPBD, e.g., private home owners with a small oil boiler, or large and inefficient district heating systems. These groups represent a 10 times greater energy use compared to the focus groups of Articles 14 and 15, and meeting with them results in a combined increased reduction in energy use.
- Building owners receive free advice, which encourages them to spend money on energy-saving measures rather than inspections.

For estimations, see Tables 6 and 7.

IV.ii. Progress and current status on heating systems

So far, related activities have focused on four areas;

- identifying and giving advice to owners of relevant systems via the EPCs and also obtaining contacts through energy and climate advisers and professionals such as chimney sweepers and other persons who are in contact with property owners and managers;
- ensuring the quality of advice given, by educating municipal energy advisors and producing written information for the internet, brochures and small leaflets;
- building networks with other organisations that contribute through trained professionals in their respective fields—four such examples are the National Association of inspectors of ventilation systems, chimney sweepers, F-gas inspectors and the Swedish Association of Local Authorities and Regions;

Figure 4: Accumulated number of EPCs. Grand total in December 2014: 535,260 EPCs.

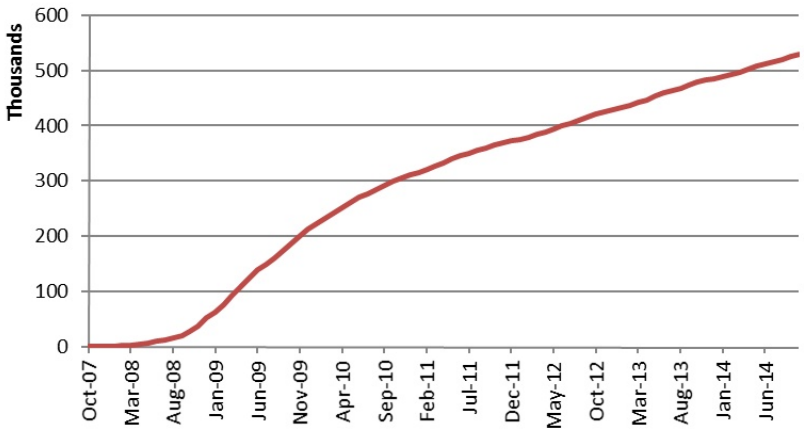


Table 5: Estimated amount of EPCs issued and percentage of building stock certified.

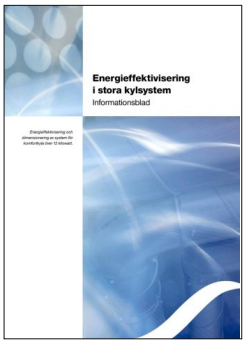
	§4[1] new buildings in 2014	§5.1 rented	§5.2 public	§6[2] when sold	Total number of EPCs	Total number of buildings	Percentage of Total [%]	Percentage in compliance with the law
Single-family houses	3,760	56,025[3]	-	281,560[4]	341,345	2,099,500	16.3	70.3
Multi-family houses	1,340	143,025	-	-	144,365	176,800	81.2	81.2
Non-residential buildings[5]	1,150	3,500	44,900	-	49,500	54,980	90.0	90.0
Total number of EPCs	6,250	202,550	44,900	281,560	535,260	2,331,280	23.0	71.3

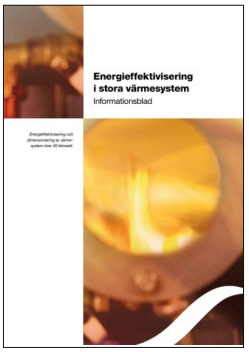
1. Paragraphs refer to the Swedish law (2006:985) on energy certification of buildings, etc.
2. Multi-family houses, other rented houses and public buildings are registered under §5 as they are required to have an EPC in all cases.
3. 56,025 EPCs issued represent 31% of 180,000 rented houses in 6 years (2009-2014).
4. 281,560 EPCs issued represent 94% of 300,000 transactions in 6 years (2009-2014).
5. EPC required only in case of rented or public building.

> introducing follow-up activities to ensure the impact of alternative measures, e.g., counsellors (energy and climate advisers) following up on interventions after 2-3 years, counting the web clicks on requests for information and follow-up on contacts via the energy certification system.

These activities have been designed in cooperation with representatives from existing programmes and have resulted in the outreach of building owners at three different levels: via energy advisors, via other trained professionals and through the dissemination of written information (Figure 5).

Figure 5: Information brochures for energy efficient heating and cooling systems.





Impact and equivalence assessment

According to the EU framework for comparing alternative measures with inspections, Sweden has chosen to use the top-down method to describe the impact, due to the lack of data at system level. There is information available on the national use of energy for heating, for different types of fuel, and in different types of buildings. However, there is no data available on the size (power) of the heating systems, their age, technical condition, replacement rate, etc. Therefore, approximations derived from the data in EPC protocols have been used to provide information on the average energy savings for a large heating system.

The impacts of alternative measures have thus been estimated based on reports submitted by energy advisors. As the follow-up system is newly launched the available database is rather small. However, assessments on future impact will become more precise over time.

The baseline of energy reduction in heating systems is approximately 1% per year. This number has considerable variations between individual years, mainly due to variations in winter temperatures. The effects below represent results on top of the 1% baseline.

Due to the inherent delay, until qualified advice results in a lower national energy use, it is not possible to detect any measurable impacts for the years 2013 and 2014. The full potential is to be reached over a period of 1-5 years thereafter with a reduction of 45 GWh in total.

As advice is offered through programmes already in place, there are no additional costs directly linked to addressing outreach efforts towards owners of large heating systems. However, the Energy Agency provides support to assure the quality of advice, as well as follow-up activities with a view to ensure the impact of the alternative measures by way of:

> project management;
> information material tailored for owners of large heating systems;
> education of municipal energy advisors;
> ready-to-use material for press and other trained professionals that come in contact with owners of large heating systems;
> follow-up two years after on-site inspection.

The total cost of the measures for heating systems in 2013 and 2014 is estimated at around 470,000 €.

The greatest benefit of the chosen measures is a better adaptation of implementation to the intentions of Article 14. The majority of Swedish buildings are heated by electricity (including heat pumps) or district heating, which in Sweden naturally have a low impact on climate. By educating and supporting existing professionals and concentrating on existing activities knowledge is spread to a wider range. The Swedish approach gives more building owners the opportunity to receive advice than if only inspections took place.

Table 6: Effects of alternative measures for heating systems in the years 2013 - 2016.

	Measured results		Estimations of final energy savings [MWh]		
Year / **Source of advice**	**2013**	**2014**	**2015**	**2016**	**After 2016**
On-site inspections by municipal energy advisors	0	0	3,500	3,500	7,000
On-site inspections by other skilled professionals	0	0	7,000	7,000	14,000
Written information (web sites, brochures, leaflets, etc.)	0	0	700	700	1,400
Total	0	0	11,200	11,200	22,400

Table 7: Effects of alternative measures for air-conditioning systems in the years 2013-2016.

	Measured results		Estimation of final energy savings [MWh]		
Year / **Source of advice**	**2013**	**2014**	**2015**	**2016**	**After 2016**
On-site inspections by municipal energy advisors	0	0	1,060	1,060	2,120
On-site inspections by other skilled professionals	0	0	6,625	6,625	13,250
Written information (web sites, brochures, leaflets, etc.)	0	0	212	212	424
Total	0	0	7,900	7,900	15,800

IV.iii. Progress and current status on AC systems

Detailing of activities to improve energy performance of air-conditioning systems

Activities to improve energy performance of AC systems overlap with those concerning the heating systems. For this, target group networks with other organisations have been established, e.g., service engineers working with cooling systems. Similarly, within the system of compulsory ventilation checks, assessors are obliged to give advice on how to reduce the energy use in the ventilation system. As a result, there are collateral benefits with regard to certain AC system owners, who are provided also with advice on energy reduction.

Impact and equivalence assessment

Sweden has chosen the top-down method also with regard to the AC systems. However, cooling systems are almost always powered by electricity and it is hard to separate this form of electricity from the electricity being used for other purposes. Due to this lack of data, an assessment on the number of AC systems has to be made. In the EPC protocols, one third of the buildings with a large heating system also have a large (> 12 kW) cooling system. Based on the assumption that the ratio is 1:3 for all buildings, a similar assessment to the one produced for heating systems can be made.

Due to the inherent delay, until qualified advice results in a lower national energy use, it is not possible to detect any measurable impacts for the years 2013 and 2014. The full potential is to be reached over a period of 1-5 years thereafter, with a reduction of 32 GWh in total.

Costs and benefits

Advice to owners of these systems is provided through the same programmes as for heating systems and consequently the benefits overlap as well. The costs are linked to the same support activities and are therefore divided between heating systems and AC systems in proportion to the size of the target group.

The total cost of the measures for AC systems is estimated at 155,000 €.

The Swedish climate is generally favourable for decreasing the need for cooling. The key in order to make AC systems more efficient is to control heating and cooling together, i.e., to ensure that the building is neither over-heated nor over-cooled. The main benefit of the chosen alternative measures is that the energy advisor shares advice on both aspects. One benefit is to point out what the building code suggests, namely avoiding simultaneous heating and cooling.

3. Conclusions, future plans

The work towards NZEBs has commenced and there will be an assessment completed at the end of 2015. As a result, the level of energy requirements in buildings will be further lowered.

The information campaign following the last amendment of the EPC has already produced and will give further results regarding the lower use of energy in the future. Sweden will continue to provide advice on the fulfilment of the requirements of Articles 14 and 15. It is estimated that the number of in-place inspections by municipal energy advisors will double in 2015 and continue growing thereafter. In 2015, a range of other professionals must also be engaged to reach an even greater number of building owners and companies. In 2016, the first follow-up of the outcome will take place two years after the inspections made in 2014. This will provide concrete data on the actual impact of the different advice systems.

Co-funded by the Intelligent Energy Europe
Programme of the European Union

The content of this report is included in the book “2016 – Implementing the Energy Performance of Buildings Directive (EPBD) Featuring Country Reports”,
ISBN 978-972-8646-32-5, © ADENE 2015

More details on the IEE Programme can be found at
ec.europa.eu/energy/intelligent

This individual report and the full 2016 book are available at
www.epbd-ca.eu and www.buildup.eu