Sweden's Second National Energy Efficiency Action Plan

Adopted at the Cabinet meeting of 30 June 2011

Summary

In accordance with Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC (the Energy Services Directive), the Swedish Parliament, the *Riksdag*, has adopted an overall national indicative energy savings target of 9% by 2016 compared with the average final energy consumption for the 2001-2005 period (prop. 2008/09:163 [government bill], bet. 2008/09:NU25 [report], rskr. 2008/09:301 [*Riksdag* notification]). In the same decision, the *Riksdag* also laid down an intermediate indicative energy savings target of 6.5% by 2010. These percentage-based energy savings targets have been converted into energy savings in physical terms and correspond to 24.0 TWh for 2010 and 33.2 TWh for 2016.

This action plan shows that Sweden will achieve the savings targets under the Energy Services Directive (2006/32/EC) by a comfortable margin. Primarily through the use of the calculation methods recommended by the European Commission, the savings have been calculated as 33.1 TWh of final energy consumption by 2010 and 53.8 TWh by 2016.

The results in this action plan differ from those of the first action plan on the basis that more actions have been included, different calculation methods have been used and the calculations cover different time periods and lifetimes. It is therefore not appropriate to compare the results.

In addition to what is laid down in Article 14(2) of the Energy Services Directive (2006/32/EC), this action plan also sets out a list of the instruments and measures to promote improved energy efficiency in buildings as required under Article 10(2) of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. The plan also clarifies that Swedish actions to provide advice about heating systems and air conditioning systems are equivalent to the inspection of such systems, in accordance with Article 14(4) and 15(4) of Directive 2010/31/EU.

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1 Conditions for national energy efficiency action plans

Under Article 4 of Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC (the Energy Services Directive), each Member State must adopt an overall national indicative energy savings target of 9% by 2016 compared with the average final energy consumption for the 2001-2005 period. The Directive also requires the Member States to establish an intermediate national indicative energy savings target for 2010, which is to be consistent with the target for 2016. The Member States are also required to take cost-effective, practicable and reasonable measures designed to contribute towards achieving these targets. The Member States are to draw up programmes and measures to improve energy efficiency.

Under Article 14 of the Energy Services Directive (2006/32/EC), the Member States have to submit national action plans to the Commission on a total of three occasions. These action plans are supposed to describe the energy efficiency improvement measures planned in order to reach the targets set, as well as to comply with the provisions on the exemplary role of the public sector and the provision of information and advice to final customers set out in Articles 5(1) and 7(2), respectively, of Directive 2006/32/EC.

Sweden submitted a preliminary first action plan to the Commission on 25 March 2008. This took the form of an annex to the Commission of inquiry into improving energy efficiency's interim report *Ett energieffektivare Sverige* (SOU 2008:25) [A more energy-efficient Sweden] and covered proposals for savings measures and calculating resultant energy savings. The final version of Sweden's first national action plan formed Chapter 11 of the government bill *En sammanhållen energi- och klimatpolitik – Energi* (prop. 2008/09:163) [A coherent energy and climate policy – Energy], which was submitted to the Commission in March 2009.

Under Article 14(2) of the Energy Services Directive (2006/32/EC), the Member States are obliged to submit their second and third action plans by no later than 30 June 2011 and 30 June 2014, respectively. In addition to the description of the energy efficiency improvement measures, the exemplary role of the public sector and the provision of information and advice to final customers, the second and third action plans must:

- include a thorough analysis and evaluation of the preceding plan;
- include the final results with regard to the fulfilment of the energy savings targets for 2010 and 2016, respectively;
- include plans for – and information on the anticipated effects of – additional measures which address any existing or expected shortfall vis-à-vis the target;

- use and gradually increase the use of harmonised efficiency indicators and benchmarks, both for the evaluation of past measures and estimated effects of planned future measures;
- be based on available data, supplemented with estimates.

In the autumn of 2010, the Commission brought forward a template that the Member States were to use, if possible, for their reports in the spring of 2011.[1] The template assumes that the effects of each individual measure can be calculated. In many areas, Swedish policy on improving energy efficiency is based on cross-sectoral instruments, which are not suited to reporting in accordance with the Commission's proposed template. This action plan therefore does not strictly follow the format of the template.

Section 2 of this action plan describes the national context for Swedish energy efficiency policy. The section gives an account of the overall premises behind the policy and behind the national energy efficiency targets. It also includes statistics on energy use and various indicators for improvements in energy efficiency. The account given includes targets that extend beyond 2016 and therefore go beyond what is required under the Energy Services Directive (2006/32/EC). The reason for recounting this information in the national action plan is that the perspective for improving energy efficiency has been broadened since the adoption of the Energy Services Directive in April 2006. One very significant factor was the European Council's adoption of a target of 20% energy savings by 2020. This target is one of the overall objectives in the EU's strategy for employment and growth in the run-up to 2020, known as the Europe 2020 strategy. The template produced by the Commission contains a recommendation that the Member States should incorporate the 2020 perspective in their second national energy efficiency action plans.

Instruments and measures for greater energy efficiency are described in Section 3. The section also describes the public sector's exemplary role. Section 4 sets out the energy savings calculations for 2010 and 2016, respectively. Between 2006 and 2010, the Commission drew up proposed calculation methods in order to harmonise monitoring of target attainment by the Member States pursuant to the Directive.[2] The Commission recommends that the Member States use these methods, but it is permitted for them to use national methods instead. The savings in final energy consumption reported in this action plan have primarily been calculated using the methods recommended by the Commission. Section 5 contains analysis and comparison with Sweden's first national energy efficiency action plan.

[1] Guide and template for the preparation of the second national energy efficiency action plans. Final version 26/10/2010. European Commission. Directorate-General JRC, Joint Research Centre. Institute for Energy.

[2] Recommendations on measurement and verification methods in the framework of Directive 2006/32/EC on energy end-use efficiency and energy services. European Commission. Directorate-General for Energy. Directorate C. New and renewable sources of energy, energy efficiency & innovation. Unit C.4 Energy efficiency. See also Annex 1.

On 18 June 2010 a recast version of the Directive of the European Parliament and of the Council on the energy performance of buildings entered into force (Directive 2010/31/EU). This Directive contains a number of reporting requirements. In some cases, a report must be submitted to the Commission by 30 June 2011 at the latest, and every three years thereafter. Given that these reporting periods coincide with reporting under the Energy Services Directive (2006/32/EC), the Energy Performance of Buildings Directive (2010/31/EU) allows for reporting to take place by means of the national energy efficiency action plans.

Article 10(2) of Directive 2010/31/EU requires the Member States to draw up a list of existing and, if appropriate, proposed measures and instruments including those of a financial nature, other than those required by the Directive, which promote the objectives of the Directive. The different instruments and actions made use of in Sweden to provide incentives to implement energy efficiency measures in buildings are described in Section 3.4 on cross-sectoral instruments, Section 3.5 on sector-specific energy efficiency instruments for households and services (domestic settings and business premises) and Section 3.8 on measures in the public sector.

Article 14(4) of the Energy Performance of Buildings Directive (2010/31/EU) allows the Member States, as an alternative to inspection pursuant to Article 14(1) to (3), to opt to take measures to ensure the provision of advice to users concerning the replacement of boilers, other modifications to the heating system and alternative solutions to assess the efficiency and appropriate size of the boiler. The overall impact of such an approach must be equivalent to that arising from the provisions set out in Articles 14(1) to (3).

Article 15(4) of the Directive 2010/31/EU allows the Member States, as an alternative to inspection pursuant to Article 15(1) to (3), to opt to take measures to ensure the provision of advice to users on the replacement of air-conditioning systems or on other modifications to the air-conditioning system which may include inspections to assess the efficiency and appropriate size of the air-conditioning system. The overall impact of such an approach must be equivalent to that arising from the provisions set out in Article 15(1) to (3).

The Energy Performance of Buildings Directive (2010/31/EU) is currently being transposed into Swedish law. The Swedish government intends to opt to ensure, in accordance with Articles 14(4) and 15(4), that advice is given to users of heating and air-conditioning systems, respectively. The report that is supposed to be submitted to the Commission can be found in Section 6 of this second national energy efficiency action plan. The government's definitive proposals for the transposal of Articles 14 and 15 of Directive 2010/31/EU will be presented to the *Riksdag* in a bill in the spring of 2012.

2 National context

2.1 Guidelines for the national energy efficiency policy

The effective utilisation of resources, including energy, is the foundation for economic growth and sustainable development. The government's objective is to break the link between economic growth and increased consumption of energy and raw materials. Improving energy efficiency usually results in reducing the pressures on the climate and the environment while increasing the security of energy supplies. In this context, different energy sources and energy carriers are significant to different extents. Saving one kilowatt hour of electricity from coal liquefaction must be valued more highly than saving one kilowatt hour of district heating from industrial waste heat or from a solar collector. Households and businesses can save money through lower energy costs and thus use their resources in other ways that provide for prosperity and growth. For businesses, energy-efficient products and services represent a growing market. A successful energy efficiency policy results in millions of decision-makers also taking energy efficiency into account on a daily basis, integrated into other decisions they make. For this reason, the measures in the field of energy efficiency are broadly-framed and aim to reach as many individuals as possible and to affect their actions in many different situations.

National energy efficiency policy is largely based on the guidelines that were outlined in the 2002 energy policy programme put forward in the government bill *Samverkan för en trygg, effektiv och miljövänlig energiförsörjning* (prop. 2001/02:143) [Working together for a secure, efficient and environmentally friendly energy supply]. These were developed in the Alliance government's energy and climate policy agreement, which was put forward in the government bill *En integrerad energi- och klimatpolitik – Energi* (prop. 2008/09:163) [An integrated energy and climate policy – Energy]. Government action is focussed both on the use and supply of energy and on supporting those improvements in energy efficiency that takes place spontaneously within society and as a result of instruments adapted to market mechanisms. The task of government policy is to identify and eliminate "market failures", principally externalities and a lack of information.

Externalities mean that market prices do not reflect the social cost or benefit of the production or consumption of a good. One example is harmful environmental effects. Traditionally, there are two potential solutions: extension of usufruct and correction of the existing market prices in order to include the costs of the harmful effects, which otherwise go unnoticed. Economic instruments (such as taxes and subsidies) and administrative instruments (such as licences to carry on certain environmentally hazardous activities) have an important role to play in this connection. Within Swedish energy and climate policy, economic, market-based instruments such as environmental taxes and emissions trading have become increasingly important, as these instruments are well suited to internalising the externalities in a cost-effective way. Such instruments have, to a large extent, replaced various kinds of grant. For the maximum possible socio-economic cost-effectiveness, all sectors of society should bear an equal cost for the externalities. However, attention must also be paid to the risk of carbon leakage, in other words the risk that the introduction of instruments to a sector does not lead to lower emissions but to emissions being relocated elsewhere.

In a market economy, the price is the most important bearer of information. If the price always provided relevant and complete information on the markets, there would scarcely be any need for socio-economic cost/benefit analyses or for other instruments to provide a push towards effective socio-economic energy efficiency. In practice, however, it is difficult for all actors to have complete information about all the available possibilities and consequences of their actions. Moreover, incomplete knowledge can also be intentional, as it costs time and money to acquire knowledge. The development of expertise and the dissemination of information often have the character of what can be termed a public good. This means that it sometimes tends to be produced in what, from society's point of view, are all too small quantities, which could therefore justify state intervention in this area. One consequence of this is that a balanced use of information instruments relating to business and domestic energy conversion and energy use could lead to gains in prosperity. A broad definition of state information instruments includes not only information campaigns and information activities from state authorities, but also state-funded research and education or training that takes place in schools, universities and institutes, amongst others. Increasing the accessibility of the information reduces the searching costs on the part of the actors. It becomes the state's job to collate the research that is taking place and disseminate its results and to make the information clear and comprehensible for the ordinary members of society.

Information instruments can bring about changes in behaviour or attitude. An important prerequisite if information actions are to be effective is that there must also be price signals. A combination of, for example, economic, market-based instruments and balanced information actions is well suited to achieving a socio-economically effective improvement in energy efficiency. Information actions can also be seen as a necessary complement to economic instruments in those circumstances where the price signal does not fully make its presence felt or is not sufficient, for example where individual metering and billing of energy use is introduced, or where the state promotes information about a market that is not mature, such as with certain types of energy services. Information actions are probably also justified from the socio-economic perspective in order to build on existing instruments, such as energy certification for buildings. The system is in place, and is expected to be so for a long time to come, and there is therefore reason to obtain the greatest possible impact from it through the provision of additional information.

2.2 National energy efficiency targets

The *Riksdag* has adopted a number of targets for greater energy efficiency. These targets have varying focuses and various timescales (see Table 1).

Table 1. National energy efficiency targets

Year	Energy supply	Final energy consumption	
	Cross-sectoral	Cross-sectoral	Buildings
2010		6.5% (24.0 TWh) energy saving vs. average for 2001-2005	
2016		9% (33.2 TWh) energy saving vs. average for 2001-2005	
2020	-20% energy intensity (kWh/SEK) vs. 2008 level		-20% (kWh per m2 of heated area) vs. 1995 level
2050			-50% (kWh per m2 of heated area) vs. 1995 level

In accordance with Article 4 of the Energy Services Directive (2006/32/EC), the *Riksdag* laid down an overall national indicative end-use energy savings target of 9% for 2016 by means of its energy policy decision of 2009 (prop. 2008/09:163, bet. 2008/09:NU25, rskr.

2008/09:301). In the same decision, the *Riksdag* also laid down an intermediate indicative energy savings target of 6.5% by 2010. Converted to energy savings in physical terms and compared to the average final energy consumption for the period 2001 to 2005, this corresponds to 24.0 TWh for 2010 and 33.2 TWh for 2016. The average final energy consumption does not include use for international transport or fossil fuels that are covered by the EU's emissions trading scheme (EU ETS).

In light of the adoption by the European Council in the spring of 2007 of an energy savings target for the EU for 2020, the *Riksdag* laid down a cross-sectoral national target whereby energy intensity (which is to say the energy supplied per unit of GDP at fixed prices) is to fall by 20% between 2008 and 2020 (prop. 2008/09:163, bet. 2008/09:NU25, rskr. 2008/09:301). This target covers all sectors of society and incorporates efficiency improvements at every stage of the energy system from energy conversion to transmission and distribution and on to final consumption. This target, as an overall target, forms part of the national reform programme on which Sweden has reported to the Commission in accordance with the European Council's decision on an EU strategy for growth and employment for 2020.

Within the sphere of environmental policy, Sweden has a system consisting of a total of 16 national environmental quality objectives that describe the state of the Swedish environment that environmental efforts should culminate in by 2020 and, in some cases, by 2050. Every environmental quality objective incorporates a number of interim targets (that are to be replaced on a gradual basis with intermediate targets). One of the 16 environmental quality objectives is to achieve "A good built environment". This objective incorporates six interim targets, one of which is to achieve more efficient energy use in buildings. An objective was adopted through the *Riksdag*'s decision on a national energy efficiency and energy-smart building programme (prop. 2005/06:145, bet. 2005/06:BoU9, rskr. 2005/06:365) whereby "the total energy use per unit of heated area in residences and business premises [was] to be reduced by 20% by 2020 and 50% by 2050 in comparison with the usage in 1995. By 2020, the dependence on fossil fuels for energy use in the building sector [was] to be broken, while the proportion of renewable energy [was] to increase on an on-going basis."

2.3 Energy balance and energy efficiency indicators

Total energy use in Sweden consists of the total final energy consumption in various use sectors, energy losses, use for international maritime and air travel and use for non-energy purposes. The total energy use for 2010 amounted to 611 TWh. Of this, the total final energy consumption within the industrial, transport and residential sectors amounted to 401 TWh.

The remaining 210 TWh was made up of losses, the use of oil for international transport[3] and use for non-energy purposes. The losses largely consist of the energy that is cooled off during the production of electricity

[3] Covers international travel by both sea and air.

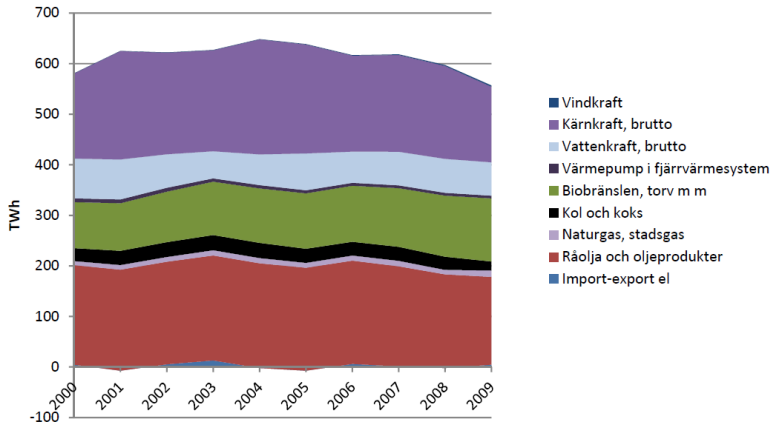
in nuclear power stations. There are also conversion losses in power plants[4] and distribution losses when supplying electricity, district heating, natural gas and town gas, coke oven gas and blast furnace gas. Use for non-energy purposes includes raw materials for the chemicals industry, lubricants and oils for construction and civil engineering activities.

Figures 1 and 2 show Sweden's total energy use for the supply side and the end-user side from 2000 to 2009. There has been a downward tendency in energy use over the last few years, but the trend varies between the different energy carriers and sectors. The use of fossil fuels has fallen, while the use of renewable energy has increased.

As a result of the work on increasing power outputs that were being carried out in the majority of nuclear reactors in 2009, the supply of electricity from that sector fell in comparison with previous years. In total, 149 TWh of input nuclear fuel was consumed in 2009, which produced a little over 50 TWh of electricity. Hydroelectric power generation is dependent on the quantity of precipitation over the course of the year. In 2009, 66 TWh of electricity were generated from hydroelectric sources, which is comparable to the average annual hydroelectric production in the period 1985 to 2005, which is estimated at 67.5 TWh. Fuel-based thermal power produced 15.5 TWh of electricity, while wind power produced 2.5 TWh of electricity. Fuel input for district heating production amount to a little under 60 TWh. The proportion of the total energy supply made up by renewable energy sources amounted to just over 34% in 2009. These renewable energy sources include, *inter alia*, biofuels, hydroelectric power and wind power.

[4] 'Power plant' in this context means electricity and district heating production facilities, refineries, gasworks, coking plants and furnaces.

Figure 1. Sweden's total energy supply (TWh) by energy carrier, 2000-2009

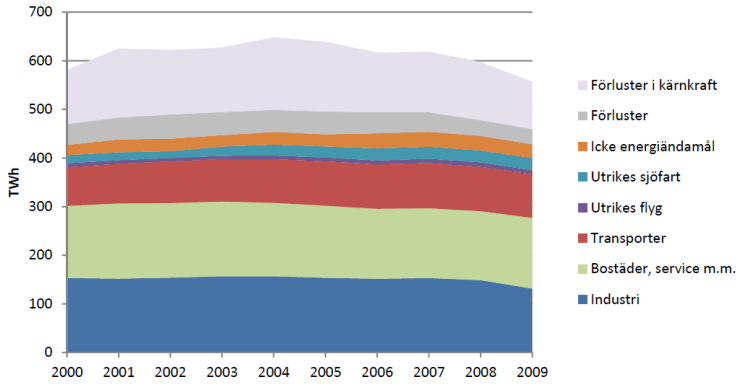


Source: Statistics Sweden and the Swedish Energy Agency

Key to Figure 1
Vindkraft = Wind power
Kärnkraft, brutto = Nuclear power, gross
Vattenkraft, brutto = Hydroelectric power, gross
Värmepump i fjärrvärmesystem = Heat pumps in district heating systems
Biobränslen, torv m m = Biofuels, peat, etc.
Kol och koks = Coal and coke
Naturgas, stadsgas = Natural gas, town gas
Råolja och oljeprodukter = Crude oil and oil products
Import-export el = Import/export electricity

During the first decade of the 21st century, final energy consumption varied. During 2008 and, above all, 2009, use fell dramatically, particularly in industry. This was a result of the economic downturn. Seen over a longer period, industry is using roughly as much energy now as it did in 1970, despite the fact that production within industry is considerably higher today. The housing and service sector has reduced its usage since 1970 as a result of numerous structural changes within the sector. Amongst other things, the transition away from oil has meant that some losses have been moved over to the supply side of the energy system. Individual heating using oil has largely been replaced by district heating.

Figure 2. Final energy consumption (TWh) by sector, plus international transport, losses, etc. 2000-2009



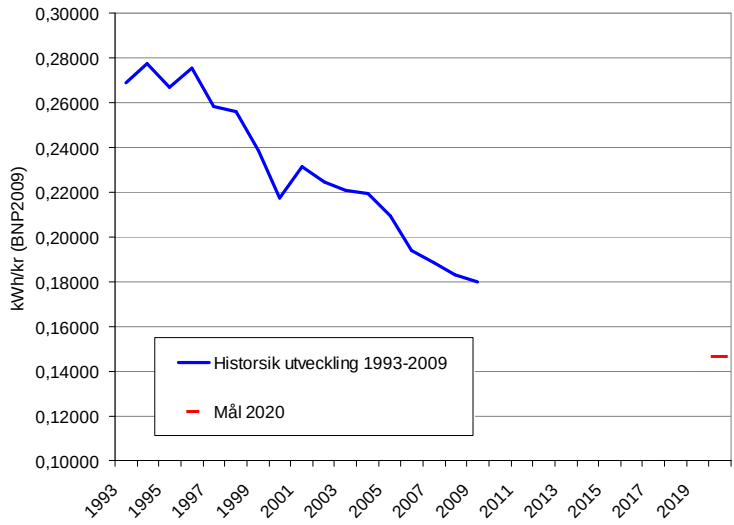
Source: Statistics Sweden and the Swedish Energy Agency.

Key to Figure 2
Förluster i kärnkraft = Losses in nuclear power
Förluster = Losses
Icke energiändamål = Non-energy purposes
Utrikes sjöfart = International transport by sea
Utrikes flyg = International transport by air
Transporter = Transport
Bostäder, service m.m. = Housing, services, etc.
Industri = Industry

Sweden has a target of reducing its energy intensity, measured as the energy input per unit of GDP (at fixed prices), by 20% by 2020 in comparison with 2008. Figure 3 shows that energy intensity in the Swedish economy fell gradually over the period 1993 to 2009.

Assuming an annual growth in GDP of 1 to 3% and that there is no further decoupling of energy input and GDP trends in the period between 2008 and 2020, we believe that Sweden meeting its targets would contribute to a reduced energy input corresponding to 135 to 171 TWh (11.6 to 14.7 Mtoe).

Figure 3. Energy intensity (kWh/SEK) 1993–2009 (GDP_{2009})

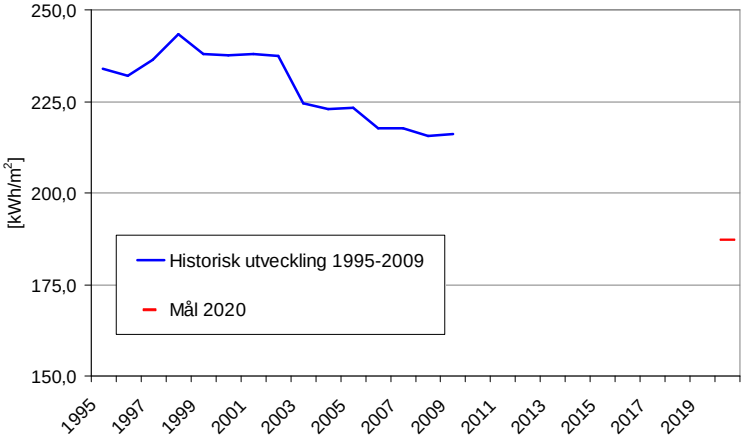


Source: Statistics Sweden and the Swedish Energy Agency.

Key to Figure 3
kWh/kr (BNP2009) = kWh/SEK (GDP_{2009})
Historisk utveckling = Historical development
Mål 2020 = Target for 2020

Sweden also has a target of reducing total energy use per unit of heated area in residences and business premises. Figure 4 tracks the figures in this regard between 1995 and 2009. After some increase at the end of the 1990s, the specific energy consumption in buildings fell throughout the first decade of the new millennium.

Figure 4. Energy consumption per unit of heated area (kWh/m^2) 1995-2009



Source: Statistics Sweden and the Swedish Energy Agency.
Key to Figure 4
Historisk utveckling = Historical development
Mål 2020 = Target for 2020

3 Instruments and measures to promote energy saving

3.1 Introduction

This section describes the most significant energy efficiency instruments and actions that have already been implemented and are still on-going. It also provides a description of the work on which the estimated energy saving presented in the next section is based.

As well as constituting the reporting pursuant to the reporting requirements of the Energy Services Directive (2006/32/EC), Sections 3.4, 3.5 and 3.8 also constitute reporting pursuant to Article 10(2) of the Energy Performance of Buildings Directive (2010/31/EU). The article requires the Member States to draw up, by 30 June 2011, a list of existing and, if appropriate, proposed measures and instruments, including those of a financial nature, which promote greater energy efficiency in buildings.

3.2 Government energy efficiency programmes

Government actions relating to energy management have been an important energy policy tool since the 1970s. Energy efficiency policy has often been conducted in the form of programmes. The programmes adopted by the *Riksdag* during the 1970s and 1980s included investment support and information actions. The energy policy decisions taken in 1991 included support for the procurement and introduction of energy-efficient technology, the demonstration of energy-efficient technology in residences and business premises, support for pilot installations within industry and general information relating to energy. Proposals put forward in what was known as the short-term programme within the 1997 energy policy included measures to promote more efficient energy use and reduced energy use. Furthermore, the energy efficiency measures were partially based on measures from the 1991 programme. Between 2002 and 2007, around SEK 200 million were set aside for actions for more efficient energy use within the framework of the 2002 energy policy programme. The actions included information and education, as well as support for municipal energy advice services, technology procurement and market launches for energy-efficient technology. In connection with what was known as the “climate billions investment programme” in the draft budget for 2008, there was a major boost in investment in this area of approximately SEK 60 million per annum, while the measures were also broadened and deepened at the same time. The draft budget for 2009 extended this investment up to 2011 inclusive.

On 11 March 2009, the government adopted the bills *En sammanhållen energi- och klimatpolitik – Klimat* (prop. 2008/09:162) [A coherent energy and climate policy – Climate] and *En sammanhållen energi- och klimatpolitik – Energi* (prop. 2008/09:163) [A coherent energy and climate policy – Energy]. The energy bill included an action plan for improving energy efficiency. A key part of the action plan consists of a new five-year energy efficiency programme for the period 2010 to 2014. SEK 300 million has been allocated to the programme for each of the five years. The aim of the programme is to bolster work on energy and the climate at the regional and local level and actions for information and advice-giving. The public sector is to play an exemplary role when it comes to energy efficiency improvements.

3.3 Scope of responsibility of the authorities

The responsibility for implementing various programmes, instruments and measures for greater energy efficiency is divided between state authorities, as well as other actors. The government mandates the Swedish Energy Agency with overall responsibility for monitoring and supervising the national energy efficiency programme, along with other actions aimed at achieving the national cross-sectoral energy efficiency targets.

The Swedish Energy Agency is also the surveillance authority pursuant to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products, Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products and in relation to what is laid down in Regulation (EC) No 1222/2009 of the European Parliament and of the Council of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters. Responsibility for the Energy Performance of Buildings Directive (2010/31/EU) is shared between the Swedish National Board of Housing, Building and Planning and the Swedish Energy Agency.

Other authorities that assume responsibility for particular parts of the work on implementing energy efficiency are named in connection with the description of the part in question.

In order to co-ordinate the work on improving energy efficiency, a special Energy Efficiency Board has been set up within the Swedish Energy Agency, incorporating members from the Swedish National Board of Housing, Building and Planning, the Swedish Energy Markets Inspectorate, the Swedish Energy Agency, the Halland county administrative board[5], the Swedish Board of Agriculture, the Swedish Environmental Protection Agency, the Swedish Association of Local Authorities and Regions, the Swedish Agency for Economic and Regional Growth and the Swedish Transport Administration. The Director-General of the Swedish Energy Agency chairs the Board.

[5] Representing all the county administrative boards.

3.4 Cross-sectoral instruments and measures

3.4.1 Taxation of energy

In the past, the primary purpose of energy taxation was to help fund public services. Since the early 1990s, when the CO_2 tax was introduced, the environmental profile of energy taxation has been heightened. It is now the aim with energy taxation to help achieve the targets in relation to greenhouse gas emissions, the proportion of energy from renewables and more efficient energy use.

Since Sweden joined the European Union, adaptation has taken place in order to fall into line with the *acquis communautaire*. The legislative framework is primarily laid down by the Energy Taxation Directive[6], which regulates the taxation of electricity and fuels, and the EU's rules on state aid. There are taxes on electricity and fuels, on emissions of carbon dioxide and sulphur and a charge for emissions of nitrogen oxide. The taxes vary depending on whether the fuel is used for heating or propulsion. There are also variations depending on whether it is used domestically, by industry, in the energy conversion sector or in a facility covered by the EU's emissions trading scheme (EU ETS). The taxes on electricity vary depending on what the electricity is used for and whether the electricity is consumed in the north of the country or elsewhere. There are also taxes that lie outside the scope of what is harmonised at EU level, and these include the sulphur tax and the tax on the thermal output of nuclear reactors. In addition to taxation instruments, there are also environmental charges on emissions of oxides of nitrogen when producing energy.

The energy tax is paid in respect of fossil fuels. The CO_2 tax is paid per kilogram of carbon dioxide emitted for all fuels except biofuels and peat. The general level of the CO_2 tax was increased by SEK 0.01 on 1 January 2010 and amounts to SEK 1.05/kg of carbon dioxide. The sulphur tax amounts to SEK 30/kg of sulphur emissions from coal and peat. In the case of oil, it amounts to SEK 27 for every tenth of a percent by weight of sulphur content per cubic meter of oil. Oil with a sulphur content below 0.05 percent by weight is exempt from the sulphur tax. The environmental charge on emissions of oxides of nitrogen is charged at SEK 50 per kilogram of nitrogen oxides for boilers, gas turbines and stationary combustion sources of at least 25 GWh/year. However, the nitrogen oxides charge is budget-neutral for the State and is paid back in proportion to the energy input of the installation in question, which means that only those installations with the highest emissions per useful energy produced are net payers.

In Sweden, fuel used to produce electricity is not subject to energy tax or CO_2 tax. In certain cases, the nitrogen oxides charge and the sulphur tax are paid, however. Since 1 July 2000, the nuclear power tax has been based on the maximum permissible thermal power rating of nuclear

[6] Council Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity.

reactors. Since 2008, the power rating tax has been set at SEK 12 648 per MW per calendar month.

The generation of heat is subject to energy tax, CO_2 tax and, in certain, cases, sulphur tax and the nitrogen oxides charge. Biofuels and peat used for the generation of electricity and heat are, in principle, free of tax.

On 1 July 2006 a tax was introduced on the combustion of the fossil part of domestic waste within the framework of energy taxation. The tax on the combustion of household waste was discontinued as of 1 October 2010. Electricity production facilities are also subject to a property tax which, for example, amounts to 2.8% of the taxable value of a hydroelectric facility.

For industries that are not covered by EU ETS, the level of CO_2 taxation amounts to 30% of the general CO_2 tax. For industries within the EU ETS, there is zero CO_2 tax. For fuels used by industry for heating purposes, both within the scope of EU ETS and outside it, within the greenhouse cultivation sector and in agriculture, silviculture and aquaculture, the energy tax amounts to SEK 0.024/kWh in 2011. A further reduction of CO_2 taxation may be granted within the scope of what is known as the 0.8% rule. This rule covers a relatively small number of energy-intensive businesses for which the CO_2 tax exceeds 1.2% of the business's turnover. For taxation amounts exceeding this level, 24% of the tax that otherwise would have been paid is paid.

In line with the government bill *Vissa punktskattefrågor med anledning av budgetpropositionen för 2010* (prop. 2009/10:41) [Some excise duty issues relating to the draft budget for 2010], some decisions on changes to the taxation system have been taken for 2011, but also for 2013 and 2015. The purpose of those changes is to achieve the targets in relation to greenhouse gas emissions, the proportion of energy from renewables and more efficient energy use. The changes in the taxation system relate to fossil fuels used for propulsion purposes and fuels used for heating purposes and covered by the EU Energy Taxation Directive.

The changes that relate to fossil fuels used for propulsion purposes include an increase in the energy tax on diesel by SEK 0.20/litre in 2011 as compared to 2010 and a further increase by SEK 0.20/litre in 2013. In addition, the CO_2 tax on natural gas and liquid petroleum gas (LPG) has been increased from 59% of the general CO_2 tax level to 70% in 2011 and will be increased to 80% in 2013 and 100% in 2015.

The CO_2 tax has been increased from 21% of the general CO_2 tax level to 30% for industry not subject to the EU ETS and for agriculture and silviculture. In 2015, there will be a further increase to 60% of the general CO_2 tax level. For industries falling within the scope of the EU emissions trading scheme, the CO_2 tax has been discontinued. For fuels used by industry for heating purposes, both within the scope of EU ETS and outside it, within the greenhouse cultivation sector and in agriculture, silviculture and aquaculture, an energy tax of SEK 0.024/kWh was introduced for 2011. Heat generation from cogeneration plants is taxed with the same energy tax as industries but a CO_2 tax is paid which, for 2011, amounts to 7% of the general CO_2 tax level. The 0.8% rule has been tightened up for 2011 and will be entirely abolished as of 2015. The new changes to the taxation system represent one part of the government's efforts to reduce the exceptions in the energy taxation system, thereby making energy and CO_2 tax more efficient.

The Swedish Tax Agency is the competent authority for taxation in the field of energy.

3.4.2 Emissions trading

The emission allowance trading scheme is an important climate policy instrument within the EU's European Climate Change Programme (ECCP). The aim of the programme is to achieve the Union's undertaking under the Kyoto Protocol to reduce emissions. The purpose of the emissions trading scheme is to reduce greenhouse gas emissions for the lowest possible cost outlay. This takes place by means of allowing businesses to trade in allowances to emit carbon dioxide, given a limited emissions ceiling. From 2008 to 2012, the emission allowance trading scheme will run in parallel with the first commitment period under the Kyoto Protocol. EU emission allowance trading is regulated by means of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC and covers all 27 Member States. Sweden will be allocating 19.8 million European Union allowances (EUAs) for emissions to existing facilities each year during the 2008-2012 trading period. The facilities in question include those that produce electricity and heat. In Sweden, such facilities are not receiving a free allocation for 2008-2012, which means that they have to pay for their emissions of carbon dioxide. This is a cost that, in most cases, is passed on to the end-consumer.

The Swedish Environmental Protection Agency, the Swedish Energy Agency and the county administrative boards are responsible for the emission allowance trading scheme.

3.4.3 The Environmental Code

The Environmental Code is a mandatory and all-encompassing instrument within the environmental field that covers all activities and actions that have an impact on the environment. The basic provisions of Chapter 1 of the Environmental Code aim to promote sustainable development and are to be applied so as to promote economy with energy and raw materials.

The general rules of consideration under the Environmental Code state that anyone who carries out an environmentally hazardous activity or implements a measure must be economic with raw materials and energy and, principally, make use of renewable fuels. The aim of this provision is to reduce the burden on the environment from the use of raw materials and energy in the course of the activities in question. The definition of environmental activities is broad and means that nearly all actors in society are covered by the rules of consideration under the Environmental Code. Certain types of activity require a special licence with specific conditions associated with them covering, for example, the maximum permitted levels of emissions.

The Environmental Code also lays down requirements whereby all operators must be aware of and regularly monitor and follow up on their own environmental impact, which includes energy use. Operators are

also required to produce action plans in order to reduce their environmental impact, including measures to economise on energy. Government or municipal authorities monitor compliance with the provisions of the Environmental Code through their supervision.

The Swedish Environmental Protection Agency has overall responsibility for the application of the Environmental Code. Since March 2011 the Swedish Energy Agency has been responsible for supervisory guidance on issues relating to operators' internal checks in relation to energy economy and use of renewable sources of energy.

3.4.4 Municipal energy and climate advice services

Different actors' awareness of their own energy use, of measures to reduce it and make it more efficient and of energy-efficient technology are a prerequisite if energy use in society is to be made more efficient. Situation-specific and locally-based information and advice is usually more effective than general information in countering market failures connected with a lack of awareness and information.

Since January 1998, Swedish municipalities have had the option of applying for state support to provide advice in connection with the local specifics. All 290 municipalities in Sweden have applied for and been granted subsidies, which means that the citizens of every municipality have access to a municipal energy and climate consultant. Pursuant to Section 2 of the Ordinance (1997:1322) on subsidies for municipal energy and climate advice services, energy and climate advice services must "disseminate locally and regionally-adapted knowledge on energy efficiency, energy use and climate impact and on the prerequisites for changing energy use in business premises and in residences. The energy and climate advice may also cover the transportation of people and goods." The advice services have been developed over the years to incorporate information relating to energy, the climate and transport, primarily for the target groups of the general public and small and medium-sized enterprises. Municipal advice services are independent and complement the advice given by suppliers of electricity, heat and fuel.

The basic subsidy currently amounts to SEK 280 000 per annum per municipality, with some additional amounts for larger municipalities. In 2008-2009, municipalities had the opportunity to apply for additional subsidies for advice in relation to their own properties and transport. However, this support was withdrawn in 2010 when municipalities and county councils were given the option of applying for specific support for improving energy efficiency in their own activities.

The Swedish Energy Agency works actively to support municipal energy and climate advice services. This takes place by means of a comprehensive training programme, project funding, the publication of information material, etc. In this connection, the regional energy offices, of which there are currently 12, have an important role to play in coordinating the energy and climate advice within the region via network meetings for municipal energy and climate consultants, skills development, joint focus areas, trade fairs, etc. The Swedish Energy Agency also supports the regional energy offices. The energy offices

have been formed through collaboration between county administrative boards, associations of municipalities, industry and municipalities.

3.4.5 Regional climate and energy strategies

In many ways it is the local and regional actors who have the task of realising the transition to an energy efficiency and sustainable society. The planning and development of a regional strategic energy and climate programme is therefore an important tool for the implementation of the national policy.

Since 2008, all Sweden's county administrative boards have been tasked by the government with producing regional strategies for energy and climate issues in the county in question, in collaboration with other regional and local actors. The county administrative boards have a key role to play, as the representatives of the State at the regional level, in the carrying out and realisation of national climate and energy policy out in the country at large.

The appropriation directions for 2010 gave the county administrative boards a clearer responsibility to co-ordinate and lead regional work on realising state policy on the energy switchover and reducing the impact on the climate and, in collaboration with other regional actors, to further develop and carry out the work of the regional climate and energy strategies. The county administrative boards are also responsible for working to bring about an increased proportion of energy coming from renewable sources, particularly in relation to efforts to achieve planned conditions within the planning framework for wind power, and to support climate and energy efforts by industry and the municipalities.

Since 2010, the county administrative boards have received targeted State funding to work on energy and climate issues and to continue developing implementing the regional energy and climate strategies. The county administrative boards receive these funds in order to give tangible form to and co-ordinate the work with the regional energy and climate strategies. The funds are to be used to plan and implement actions and measures in collaboration with other regional and local actors and to co-ordinate regional energy and climate work. The actions may support the energy and climate work of both industry and the municipalities to develop and implement the regional energy and climate strategies. A little over three quarters of the funds may be used for the county administrative boards' own work, whilst the rest must be used to assist other local and regional actors to play their part in the on-going development of regional energy and climate strategies. This investment forms part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163).

The Swedish Energy Agency is responsible for supporting the county administrative boards in their work on the regional climate and energy strategies.

In order to further support and develop regional work on climate and energy and to make use of that work in order to promote and environmentally driven economy, the Swedish government has nominated the counties of Dalecarlia, Scania and Norrbotten as pilot counties for green development for the period 1 September 2010 to 30 June 2013. The county administrative boards in these three counties, in close co-operation with co-operation organisations and local government and other relevant actors[7] in the three counties, are to promote and develop regional work to reduce the impact on the climate and bring about the energy switchover, thereby converting to green development. These pilot counties have an important role to play in terms of supporting and acting as inspiration for those counties that have not reached the same stage in their work. By developing working methods and tools and sharing their experiences, the pilot counties can provide guidance to other counties. The pilot counties are also supposed to help provide analyses of the impact of national instruments at the regional level with the aim of identifying obstacles and opportunities to reduce the impact on the climate and bring about an energy switchover. This work should exploit the opportunities to co-ordinate and make use of synergies between climate and energy policy and regional work on growth.

3.4.6 Ecodesign and energy labelling

The aim of ecodesign is to lay down requirements for environmental performance, usually energy efficiency, for the lifecycle of a product. Such requirements for manufacturers will lead to the disappearance of energy-hungry products from the market. The ecodesign requirement applies to all Member States of the EU and is regulated by Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products. The Directive is able to cover all energy-related products with the exception of products for the transport sector. The product groups are usually regulated in the form of EU regulations, although self-regulation can also occur. EU regulations for ecodesign have been adopted for the following product groups: domestic lighting, standby and off-mode losses of electrical and electronic equipment, televisions, electric motors, simple set-top boxes, external power supplies, circulators, tertiary sector lighting (office and street), domestic refrigeration, domestic washing machines, domestic dishwashers and fans. There are draft EU regulations for the following product groups: air conditioning, boilers, water heaters, image-processing equipment (copiers, faxes, printers, scanners, etc.), complex set-top boxes, machine tools and medical imaging equipment[8].

[7] Municipalities, county administrative boards, private and public companies, plus higher education institutions and non-profit organisations.
[8] See www.energimyndigheten.se/sv/Foretag/Ekodesign.

The recast Ecodesign Directive has been transposed into Swedish law by means of the *Riksdag*'s decision on amendments to the Act (2008:112) on ecodesign (prop. 2010/11:61, bet. 2010/11:NU17, rskr. 2010/11:198).

The purpose of energy labelling is to provide consumers with the ability to choose the most efficient models, thereby inspiring businesses to continue to push forward product development. How energy efficiency a product is shown on a scale from A (in certain cases A^{+++}) to G, where A (A^{+++}) is the most efficient. Other important characteristics, such as, for example, how well a washing machine dries, are also shown on the labelling. The energy market is regulated by Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products. The product groups are regulated by means of delegated acts, usually in the form of EU regulations.

In light of the Energy Labelling Directive (2010/30/EU), the *Riksdag* adopted a new Energy Labelling Act (prop. 2010/11:106, bet. 2010/11:NU22, rskr. 2010/11:271). The Act (2011:721) on the labelling of energy-related products was promulgated on 9 June 2011.

The Swedish Energy Agency is the competent authority.

3.4.7 Research

Research and research programmes form a significant part of Sweden's energy efficiency efforts. The Swedish Energy Agency is an important funder of research into improving energy efficiency, above all in buildings and industry, but also in relation to wide-ranging approaches to energy systems and energy use. The Swedish National Road and Transport Research Institute (VTI) and the Swedish Transport Administration are responsible for the majority of research into improving energy efficiency in the transport field. In addition to the above actors, there are also a number of other actors who carry out research and investigative activities in relation to improving energy efficiency. The most important non-sector-specific research programmes are detailed below (sector-specific programmes are listed under the relevant sector – buildings, industry and transport).

ELAN – the Programme for day-to-day electricity use

ELAN began in 1998 and was terminated in 2009. The aim of the programme was to increase knowledge of how behaviour and values affect electricity use and to ensure the long-term development of skills in this field. The vision was to make up a knowledge hub where both energy companies and authorities can source information and expertise and to create a forum for dialogue in issues relating to energy use and behaviour. For more information see www.elanprogram.nu.

The Energy Systems Programme

In practice, the Energy Systems Programme had already been initiated as early as 1997, when it was funded by the Swedish Foundation for Strategic Research (SSF). In 2001, the Swedish Energy Agency decided to assume the main responsibility. Within the scope of the programme, engineers work with social scientists to study energy issues from a broad perspective with various angles of approach. The programme consists of a research institute and a research programme. The research programme involves five institutions at four universities. The research programme is operated in three consortia: The building as an energy system; Industrial energy systems; and Local and regional energy systems.

The basic objective for the programme is to develop new knowledge that makes possible long-term strategic development towards sustainable and resource-efficient energy systems. A stage of the programme was approved for the 2010-2013 period with 14 pre-doctoral researchers and an investment of SEK 46 million from the Swedish Energy Agency and approximately SEK 71.8 million from higher education institutions/industry.

AES, the General Energy Systems Studies Programme

The aim of the AES programme is to develop systematic and holistic thinking in the switchover of the energy system. The programme also aims to manage and further develop the tradition of energy systems research that the programme has built up. The projects cover many aspects of energy systems research. The allocation of funds has a wide geographical spread, with many research environments that are new for the AES programme.

The Co-ordinated Urban Development Programme

The Co-ordinated Urban Development research programme aims to support and promote inter-disciplinary research and development projects concerning urban areas and urban development that are system-focused and based on real practice, thereby reinforcing the development of knowledge and the skills base in relation to sustainable urban areas. The programme is a collaboration between the Swedish Energy Agency, the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning (Formas), the Swedish Environmental Protection Agency, the Swedish National Heritage Board and the Swedish Transport Administration. Within the framework of the 2010-2012 programme period, the Swedish Energy Agency is allocating SEK 9 million, while the budgetary framework for the research programme amounts to a total of SEK 33 million.

The Sustainable Municipalities programme

Sweden's municipalities have a special position in the national efforts towards sustainable development. The municipalities have a series of complex roles, for example as a supplier and consumer of energy and electricity. The Swedish Energy Agency's Sustainable Municipalities programme aims to help along the road to sustainable energy use within an energy system that is secure, cost-effective and that has little detrimental impact on health, the environment and the climate and where different actors' decision-making basis and decision-making processes are of high quality.

The processes that are activated within the Sustainable Municipalities programme involve various groups of actors whose activities have a bearing on a series of issues that are of key importance if the investment is to be a success. The 2009-2012 programme stage has a budget of SEK 16 million.

The *Fjärrsyn* [District Vision] Programme

The *Fjärrsyn* programme aims to improve district heating companies' ability to realise the sustainable energy systems of the future through competitive commercial and technological development in line with the expectations and requirements of customers and society. *Fjärrsyn* incorporates three research areas and a demonstration section. The research areas are the surrounding world, the market and technology. The programme has room for both basic research and applied research and more applied projects. The focus is on research and development that can be directly commercialised or can in some other way benefit the sector directly. The programme is jointly funded by the Swedish Energy Agency and the district heating industry and is operated by the Swedish District Heating Association. The programme will run for four years (July 2009 to June 2013), with a planned budget of SEK 18 810 000 per annum.

Norra Djurgårdsstaden

During 2010 and 2011 a preliminary study is being carried out with the aim of creating a national arena for research and development in the field of smart networks and plans to implement new products, services and systems in the Norra Djurgårdsstaden area of Stockholm. The preliminary study aims to describe in detail the implementation and design of a major demonstration project that includes a plan with a market model, technical solutions, installation and studies and evaluation of a smart network in Norra Djurgårdsstaden. The preliminary study aimed to identified general solutions applicable to similar energy systems in an urban environment and to create commercial products and services within 3 to 5 years.

The Swedish Energy Agency, together with the Swedish Governmental Agency for Innovation Systems (VINNOVA), is providing 40% of the funding for the cost of preliminary study, which amounts to a total of SEK 33 800 400.

3.5 Sector-specific energy efficiency instruments and measures for households and services – buildings

3.5.1 Planning and construction legislation and energy requirements in building regulations

A new Planning and Construction Act (2010:900) is in force from 2 May 2011. The new Act replaces the 1987 Planning and Construction Act (1987:10) and the Act (1994:847) on technical functional requirements for structural works, etc. The technical functional requirements are given more specific form in the Planning and construction ordinance (2011:338) and the Swedish National Board of Housing, Building and Planning's administrative provisions (building regulations).

The building regulations (Swedish abbreviation: BBR) constitute technical functional requirements and represent society's minimum requirements for buildings with regard to areas including energy management. The objective of the rules governing energy economy is to direct towards lower energy use by means of a clear and verifiable upper limit for energy use in new buildings. In the Swedish National Board of Housing, Building and Planning's building regulations, the requirements for the energy performance of new buildings take the form of a clear upper limit to how large the demand for energy supplied may be in order to heat the new building. The energy requirements are reviewed regularly.

Since 2006[9], the energy requirements have been expressed as functional requirements where buildings have to attain a specific energy performance level. This makes verification easier by means of estimation in the planning stage and by means of metering the actual energy use once the building has entered into service. The requirements take the form of a maximum permitted quantity of energy per square metre of floor area per year. The required level for a building's specific energy consumption varies depending on whether it is a residential building or business premise and in what climate zone it is located.

Along with requirements pertaining to the specific energy consumption of a building, requirements are also laid down in the BBR pertaining to minimum acceptable thermal insulation in the form of U values for certain building elements. The Swedish National Board of Housing, Building and Planning's building regulations also lay down efficiency requirements for installations (heating and cooling installations, air-conditioning systems, control systems and efficient use of electricity) within the building and requirements pertaining to metering systems for the energy consumption.

As of February 2009, stricter requirements have been in force for all new buildings that use electricity for heating or air-conditioning. There is also an upper limit for how much installed electrical capacity for heating a new building may have. A tightening-up of the requirements pertaining

[9] The Swedish Board of Housing, Building and Planning's administrative provisions (BFS 2006:12) amending the Board's building regulations.

to buildings heated by means other than electricity is currently also being prepared.

The Swedish National Board of Housing, Building and Planning recently adopted a tightening-up of the general energy requirements by an average of 20%. The new administrative provisions (BBR2011) will enter into force in October 2011.

The Swedish Board of Housing, Building and Planning's general guidance on the alteration of buildings (Swedish abbreviation: BÄR) in conversion work have also been revised and will now take the form of binding administrative provisions instead of general guidance. These, too, will enter into force in October 2011. The starting premise is that the same functional requirements are to be applied both when erecting a building and when altering it. However, when making alterations, attention must always be paid to the scale of the alteration and the requirements of the building when applying the requirements. This means that it is often possible to get some guidance from the requirement for new buildings when evaluating the content of corresponding requirements when alterations are being made, even if the requirement for new buildings is never directly applicable to alterations.

It is the municipalities that have the responsibility for monitoring compliance with the requirements of the BBR. Verification by measuring a building's specific energy consumption can be co-ordinated with energy certification.

3.5.2 Energy certification

The Swedish system of energy certification is part of its implementation of Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings. On 18 June 2010 a recast version of this Directive entered into force (Directive 2010/31/EU). The Directive, in its original form (2002/91/EG), was transposed in Swedish legislation by, *inter alia*, the Act (2006:985) on energy certification for buildings[10]. The government is currently working on the issue of the transposal of the recast Directive and intends to submit a proposal to the *Riksdag* in a government bill in the spring of 2012.

An energy certificate is to be produced when a building is sold, rented or built or if the building in question is a large building occupied by public authorities or institutions that supply public services and is therefore often visited by the general public.

The owners of buildings that are subject to this Act are under an obligation to ensure that there is a valid energy certificate for such buildings. If such a building is rented out or if it is a large public building, the owner must also ensure that the summary submitted as part of energy

[10] The details of the system are laid down in the Ordinance (2006:1592) on energy certification for buildings, the Swedish National Board of Housing, Building and Planning's administrative provisions and general guidance (BFS 2007:4) on energy certification for buildings and the Swedish National Board of Housing, Building and Planning's administrative provisions and general guidance (BFS 2007:5) on the certification of energy experts.

certification is also displayed in a clearly visible location. Most multi-dwelling buildings and business premises are subject to this requirement.

Energy certification must include proposals for appropriate and cost-effective measures to improve energy efficiency within the building. Whether or not to implement those measures is up to the building owner.

Energy certification is thus an information instrument. The energy certificate is partly intended to act as consumer information for prospective buyers or tenants, especially for single-dwelling residences and buildings containing flats for rent. It is also intended to remedy the lack of information for property owners concerning their options in respect of the buildings in question.

A standardised version of the visual elements of energy certificates is currently being produced to ensure correspondence with the European standard (which is to say that it will correspond with "refrigerator labelling").

3.5.3 Repairs, maintenance or conversion and extension work (Swedish abbreviation: ROT)

The primary motivation behind the government's introduction of the "ROT" deduction (which stands for the Swedish for repairs, maintenance or conversion and extension work) was to stimulate the labour supply and reduce black market labour. Many energy-saving measures are covered by the term ROT, which makes them deductible amounts. The ROT deduction was introduced on 8 December 2008. It is permissible to make a tax deduction for 50% of the cost of the building work carried out in residences or holiday homes. However, there is a maximum deduction of SEK 50 000 per person per annum. The tax deduction does not apply to new-builds or to conversion and extension work on new-builds. The term "new-build" means a single-dwelling residence whose year of taxable valuation is within the last five years. The Swedish Tax Agency determines what measures are covered by the ROT deduction and these are set out on its website[11].

3.5.4 Windows and biofuels

Between 2004 and 2009, the owners of single-dwelling residence had the opportunity to apply for assistance from the state for the installation of energy-efficient windows and biofuel installations. From 2004 to 2006, this assistance was granted in the form of a tax deduction, administered by the Swedish Tax Agency. A deduction of 30% of the costs of materials and labour was granted, pursuant to the Act (2003:1204) on tax deductions for certain environmentally friendly measures in single-dwelling residences, to private individuals who had installed energy-efficient windows in an existing single-dwelling residence or who had installed a biofuel installation in a new-built single-dwelling residence. From 2007 to 2009, the assistance took the form of a state grant pursuant to the Ordinance (2006:1587) on assistance for the installation of energy-efficient windows and biofuel installations in single-dwelling residences,

[11] See www.skatteverket.se

and was administered by the county administrative boards and the Swedish National Board of Housing, Building and Planning. The Swedish National Board of Housing, Building and Planning has produced an evaluation of this assistance[12].

3.5.5 Conversion to sources of renewable energy

Between 2006 and 2010 the Swedish state gave a grant, pursuant to the Ordinance (2005:1255) on grants for conversion from direct electric heating in residential properties, to the owners of single-dwelling residences, multi-dwelling residences and business premises with associated residences in order to provide a stimulus to convert direct electric heating into district heating or individual heating using biofuels, heat pumps or solar heating. The Swedish National Board of Housing, Building and Planning has produced an evaluation of this assistance.[13]

From 2006 to 2007, state assistance was granted to the owners of single-dwelling residences who switched from an oil-fired heating system to district heating, a borehole, lake or sea-source or ground-source heat pump, a biofuel-fired heating system or one of these heating systems complemented with solar heating. The assistance was granted pursuant to the Ordinance (2005:1256) on support for conversion from oil-fired heating systems in residential properties and took the form of a one-off grant[14].

3.5.6 Solar cells

Between 2005 and 2008, assistance for the installation of solar cells in public buildings formed part of the investment support for energy efficiency measures and the conversion of premises used for public services, known by its Swedish-language acronym “OFFrot” (see Section 3.5.8). This included the cost of labour, materials and planning.

On 1 July 2009 a new grant for the installation of solar cells was introduced. These grants are regulated by the Ordinance (2009:689) on assistance from the state for solar cells and form part of the funds set aside for new energy technologies, half of which being set aside for biogas and half for solar cells. The purpose of the grants is to help bring about the switchover of the energy system and business development within the energy technology sector. The grants are aimed at all types of actors, namely both businesses and public organisations as well as private individuals.

[12] Utvärdering av stödet för installation av energieffektiva fönster eller biobränsleanordningar [Evaluation of the assistance for the installation of energy-efficient windows or biofuel installations], the Swedish National Board of Housing, Building and Planning, 2009, www.boverket.se.

[13] Stödet för konvertering från direktverkande elvärme i bostadshus – en utvidgad uppföljning [Grants for conversion from direct electric heating in residential properties – an extended follow-up], the Swedish National Board of Housing, Building and Planning, 2007, www.boverket.se.

[14] Mindre olja, bättre miljö – men till vilket pris [Less oil – better environment. But at what cost?], the Swedish National Board of Housing, Building and Planning, 2008, www.boverket.se.

The grants apply to solar cell systems, which is to say systems for the generation of electricity from insulation incorporating solar cells. These systems are delimited by their connection to property-internal or external electricity networks. The grants are also awarded to hybrid solar electric/solar heating systems, which is to say systems that provide both solar electricity and solar heat in an integrated framework. Grants may be awarded to all kinds of network-connected solar cell systems and for installations that were begun by no earlier than 1 July 2009 and completed by no later than 31 December 2011.

The level of the grants is a maximum of 60% of the investment costs, with the exception of for large companies, which can obtain up to 55% of their costs. There is an upper limit of SEK 2 million per solar cell system and a maximum of SEK 75 000 plus VAT per installed kilowatt of peak electrical power. A total of SEK 212 million has been allocated in the 2009-2011 period. Funds have been set aside in the national budget up to and including 2012. Applications for grants are made to the county administrative boards, which are also for deciding on grants. It is possible to apply both via paper forms and via the Internet. The documents can also be obtained from the county administrative boards.

3.5.7 Solar heating

A state grant for investments in solar heating was introduced in 2000, and finished in 2007, the aim of which was to promote the use of solar heating technology in the heating of residences and certain business premises[15]. The size of the grant was determined by the estimated annual heat produced by the solar collectors.

In 2006 a grant was introduced for the installation of solar heating in commercial premises. The grant could also be awarded to the owners of buildings where at least half of their area consisted of premises that were intended to be used for commercial purposes. Grants were awarded for installations that were installed between 1 July 2006 and 31 December 2010[16].

In 2009, the previous state assistance system for investments in solar heat was replaced with state grants that can be applied for by the party investing in solar heating, irrespective of where the solar collector is installed[17]. The purpose of the grants is to promote the use solar heating technologies. The assistance is awarded in the form of a one-off grant to individuals or companies that install solar heating equipment for heating purposes. The amount of the assistance is determined by the heat production of the solar collector (SEK 2.5/kWh), up to a maximum of SEK 7 500 per dwelling or SEK 3 million per project. Funds have been set aside in the national budget up to and including 2011.

[15] Ordinance (2000:287) on state subsidies for investments in solar heating. The evaluation report Ett fortsatt solvärmestöd [On-going support for solar heating], the Swedish National Board of Housing, Building and Planning 2006, can be accessed via www.boverket.se.
[16] Ordinance (2006:1028) on grants the installation of solar heating in commercial premises.
[17] Ordinance (2008:1247) on support for investments in solar heating.

3.5.8 Assistance for energy efficiency measures and energy switchover in premises used for public services (Swedish abbreviation: OFFrot)

Between 2005 and 2008 state assistance was given for energy efficiency actions and/or energy switchover in premises that were used for public services[18]. The assistance included assistance for solar cell systems.

3.5.9 Technology procurement

Technology procurement is a method of commencing a shift in the market and to spread new efficient technology (products and systems). Technology procurement is a process that has a number of different phases (activities) and actors.

Technology procurement processes are primarily implemented in the fields of heating and air conditioning, hot water and sanitation, ventilation, white goods, lighting and industry. The Swedish Energy Agency has compiled a list of all the technology procurement processes within the energy field that it and its predecessors have carried out.[19]

The Procurement Group for Business Premises (BELOK) and the Procurement Group for Residential Properties (BEBO) are the procurement groups for the owners and managers of business premises and residential properties, respectively. They are responsible for driving and supporting various energy efficiency projects in business premises and residential properties and for initiating and carrying out technology procurement processes. The Groups comprise property owners and property managers, as well as the Swedish Energy Agency. They represent 20% of the floor area of business premises in Sweden and roughly 70% of the country's dwelling stock in multi-dwelling residences.

The Process Group for Business Tenants (HyLok) comprises State authorities that are tenants in their premises and that work to improve energy efficiency in those premises. The participating authorities include the Swedish Public Employment Service, the Swedish Police, the Swedish Tax Agency, the Swedish Environmental Protection Agency, the Swedish Migration Board, the Swedish Energy Agency, the Swedish International Development Cooperation Agency (SIDA), the Swedish Meteorological and Hydrological Institute (SMHI) and the Swedish Social Insurance Agency. HyLok's areas of activity include benchmarking, green IT and energy-efficient server rooms, collection strategies for energy statistics, green offices, green rental contracts and public procurement.

[18] The Ordinance (2005:205) on support for investments in energy efficiency measures and switching over to renewable energy sources in premises used for public services. The evaluation report Utformningen reducerade effekterna – Boverkets utvärdering av OFFrotstödet [The design reduced the impact – the Swedish National Board of Housing, Building and Planning's evaluation of OFFrot assistance], the Swedish National Board of Housing, Building and Planning, 2009, can be accessed via www.boverket.se

[19] See www.energimyndigheten.se.

The Procurement Group for Residential Tenants (HyBo) works to develop the options for residential tenants to actively contribute to improving the energy efficiency of multi-dwelling residences, including in collaboration with the property owners. Issues such as the individual metering of electricity, heating and hot water, obligations incumbent upon landlords and economic incentives for tenants are discussed.

3.5.10 The Delegation for Sustainable Cities

The Delegation for Sustainable Cities has been tasked by the government with managing and deciding financial support for the development of sustainable cities. The support aims to create attractive and ecologically, socially and economically sustainable urban environments that help to minimise emissions of greenhouse gases and represent good examples of urban construction measures with integrated planning and applied environmental technologies. The projects must show the potential in the development of sustainable cities, act as showcases and facilitate the spread and export of sustainable urban planning, environmental technology and know-how. The financial support for the years 2009-2010 amounted to a total of SEK 340 million, distributed between both investment and planning projects. For 2011 and 2012, financial support can only be sought for planning projects. For 2011, the Delegation can disburse funds up to a total of SEK 19 million. It will also be possible to apply for financial support in 2012.

3.5.11 Low-Energy Buildings Programme

In the spring of 2010, the Swedish Energy Agency awarded the Swedish Construction Federation a 5-year programme for buildings with very low energy consumption (LÅGAN). The aim of the project is to stimulate energy efficiency new builds and conversion. The programme is a collaboration between the Swedish Energy Agency, the Swedish National Board of Housing, Building and Planning, the Swedish Construction Federation, Region Västra Götaland and the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning (Formas). Energy consumption for those projects that receive funding must be at least 50% below the requirements laid down in the Swedish National Board of Housing, Building and Planning's building regulations and the project must have major value as a showcase. Determining the energy performance of existing buildings, disseminating the results and providing inspiration for the exchange of experiences by means of support for collaboration actions are also important elements of the programme.

3.5.12 Information actions

Numerous authorities have produced information about energy use for both domestic households and businesses. The Swedish Energy Agency is responsible for and has developed *Energikalkylen* [The Energy Calculation], which is an online tool that can be used to calculate energy use in single-dwelling residences and flats[20].

Energy services

The government has tasked the Swedish Energy Agency with promoting the market for energy services in Sweden. The term energy services includes relatively simple products such as energy statistics and energy mapping, alongside more complicated services such as incentive contracts (Energy Performance Contracting (EPC), for example) and functional contracts where the power companies provide a specified indoor climate. The work consists, above all, of producing, compiling and disseminating information that increases the competence of potential customers in this field. Dissemination takes place via websites, training sessions, presentations and networks. The Swedish Energy Agency has analysed the Swedish market for energy services[21].

Become Energy-Smart – Renovate Energy-Smart

From 2007 to 2009, the Swedish Energy Agency, the Swedish National Board of Housing, Building and Planning and the Swedish Environmental Protection Agency ran an information tour featuring the "energy-smart" house. Alongside others including municipal energy and climate consultants[22], the authorities provided information about how it is possible to be energy-smart in the home. This collaboration resulted in a joint website (www.blienergismart.se) featuring tips and guidance.

On 1 June 2010, the Renovate Energy-Smart campaign was launched. The aim is for the environmental programme show home to generate interest, inform people, enable people to see the possibilities and contribute towards a dialogue that will drive forward energy efficiency improvements in multi-dwelling residences. The campaign was aimed at property owners and the managers of multi-dwelling residences, house builders, manufacturers, suppliers and installers of building products and various occupational groups in the building sphere, energy and building consultants, architects, municipal planning and construction case officers, trade and professional associations and banks. The campaign is run by the Swedish Energy Agency, the Swedish National Board of Housing, Building and Planning and the Swedish Environmental Protection Agency.

[20] See energikalkylen.energimyndigheten.se.
[21] Analys av den svenska energitjänstemarknaden [Analysis of the Swedish energy services market], ER 2011:06, www.energimyndigheten.se.
[22] See section 3.4.4.

The energiaktiv.se web portal

In the spring of 2011, the Swedish Energy Agency and the Swedish National Board of Housing, Building and Planning launched a web-based information and advice portal (www.energiaktiv.se) aimed at the owners of single-dwelling residences, multi-dwelling residences, special properties and business premises seeking advice about improving energy efficiency. The purpose of the portal is to support the implementation of measures proposed in connection with energy certification. However, the information applies just as much to energy efficiency measures that are not associated with the energy certificates. The structure is process-supporting and guides users step by step from mapping to following up on measures. The website will be continually updated and expanded with material relating to energy services and energy management. The action forms part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163).

UFOS Energi

UFOS, the Development of Public Sector Property Management, has been organising collaboration in relation to joint development issues since 1994. Collaboration on development issues can deliver major leverage of resources input. For that reason, the Swedish Association of Local Authorities and Regions, the National Fortifications Administration, Akademiska Hus AB, the National Property Board Sweden and Specialfastigheter Sverige AB are working together. The projects run within the framework of UFOS generate considerable interest from both the participating organisations and their tenants. Since 2004, UFOS has been working with the Swedish Energy Agency on energy and climate-related projects. This collaboration operates under the name UFOS Energi. By pooling and developing know-how, the focus is placed on measures that increase knowledge among actors with the ability to influence development towards a sustainable energy system.

Since the beginning of 2004, this collaboration has resulted in, amongst other things, 19 publications/reports aiming at presenting the methods of improving the energy efficiency of the property stock. This publications, collectively, are referred to as UFOS Energi's "Energy library".

The Construction/Living Dialogue

In 1998, the Swedish government tasked the Environmental Advisory Council with promoting voluntary environmental work in the business community and decided to start-up a dialogue with the construction and property sector (the Construction/Living Dialogue) and with those involving in trading/transporting everyday goods (Future Trade). The result was the "Vision for 2025", which set out targets and strategies for a sustainable construction and property sector. In 2003, a secretariat was set up within the Swedish National Board of Housing, Building and Planning in order to support the Construction/Living Dialogue, which was a unique collaboration between businesses, municipalities and the government with the aim of making progress towards a sustainable construction and property sector in Sweden. As of the end of 2009, the Construction/Living Dialogue came to an end, and the Swedish National Board of Housing, Building and Planning was tasked, for 2010, with running the Construction/Living Dialogue's skills development programme and environmental classification, which the Board worked on until the end of December 2010.

3.5.13 Water and wastewater treatment plants

The Swedish Water and Wastewater Association has been funded by the Swedish Energy Agency to develop and demonstrate new technology and to increase awareness of and skills in relation to energy efficiency in water and wastewater treatment plants. The project also involves improving the statistics about energy use.

3.5.14 Primary production

Compared with, for example, the work on energy efficiency improvements in residential buildings, the work on improving energy efficiency in primary production has not progressed all that far. New-build functional agricultural buildings, for example, are exempted from energy certification. At present energy and CO_2 tax rates are also reduced for agriculture, silviculture and aquaculture. These reductions, however, are to be raised in stages up to 2015 (see Section 3.4.1).

The current energy efficiency actions that take the form of subsidised advice services (for example energy mapping checks, see Section 3.6.2) can, to some extent, be made use of by the primary production sector. In order to increase knowledge about energy efficiency in smaller agricultural businesses, on 30 June 2011 the Swedish government tasked the Swedish Board of Agriculture with putting in place a special advice-giving system within the framework of the Rural Development Programme[23].

Within the framework of the Rural Development Programme, organisations and entrepreneurs can apply for funding both for skills development and to act as investment support for investments in more energy-efficient equipment. Additional funds can be applied for investments for switching to renewable energy.

[23] See www.sweden.gov.se/sb/d/8723/a/82724

3.5.15 Research

The Swedish Energy Agency, as the government agency for the sector, has a primary and co-ordinating responsibility for energy-related research into buildings. In addition to the Swedish Energy Agency, the Swedish Research Council for the Environment, Agricultural Sciences and Spatial Planning (Formas) also funds projects in this field. Furthermore, the Swedish Consumer Agency, the Swedish National Board of Housing, Building and Planning and Swedish Environmental Protection Agency also have energy-related measures relating to buildings.

The energy-related research, development and demonstration activities are characterised by a system-based approach. It is an objective to further reduce the use of oil and electricity for heating purposes – or to improve the energy efficiency of their use. Another objective is to optimise the use of common area and private domestic electricity within properties. The actions are focussed on reducing the energy demand of the buildings and on switching from fossil fuels to renewable energy.

It is an objective of the research into the building as a system to improve the specific energy consumption for heating, hot water and common area electricity by 50% by 2050.

CERBOF – the Centre for Energy and Resource Efficiency in the Built Environment

CERBOF[24] is a research and innovation programme initiated by the Swedish Energy Agency. CERBOF is run in collaboration with actors in the construction sector. Secretariat services are provided by the Association for Innovation and Quality in the Built Environment. CERBOF's vision is for all use of energy and resources within buildings to be efficient and sustainable over the long term and for buildings to have a sound indoor environment. CERBOF's mission is to be the leading meeting place where the state, trade and industry, academia and consumers stimulate the advent of relevant research and innovation projects. CERBOF's activities are supposed to help bring about the utilisation of the results in commercial products, services, systems or methods. Research, development and demonstration that receive support are to help achieve national energy and environmental targets and to bolster the competitiveness of Swedish trade and industry. The areas in which CERBOF is active are:

1. the building as a technical energy system; and
2. behaviour, processes and instruments.

CERBOF has a clear ambition to link up with multinational collaboration. CERBOF has a total budget (2007-2011) of SEK 130 million, SEK 52 million of which comes from the Swedish Energy Agency, with the rest provided by construction and property companies and others.

[24] See www.cerbof.se

EFFSYS+

EFFSYS+ is an applied research and development research programme for the field of heat and cooling pumps. The vision of the programme is to help, over a 10-year period, to develop Swedish trade and industry into a world leader in the field of cooling technology and heat pumps. The objectives of EFFSYS+ are to:

- provide system solutions based on heat pump technology that helps to make it possible to meet EU and Swedish targets for 2020 in relation to the environment and energy
- create solutions, through improving the efficiency of components and systems, that bring about an 8% reduction in specific energy consumption (a reduction in electricity consumption in Sweden of 0.6 TWh/year) compared with the best heat pump technology on the market at the beginning of the programme. In the field of shop cooling, for example, the corresponding improvement would be nearly 0.1 TWh/year.

The programme period runs from 1 September 2010 until 31 August 2014, with a budget totalling SEK 88 million, SEK 36 million of which comes from the Swedish Energy Agency.

Improving energy efficiency in buildings of cultural and historical importance

The programme to improve energy efficiency in culturally and historically important buildings began in 2007 and focuses on older buildings of major cultural and historical importance. The aim is to develop and disseminate know-how and technological solutions that contribute to improving energy efficiency in buildings of cultural and historical importance without destroying or defacing buildings or their fixtures and fittings. The buildings in question are those that, pursuant to the Act (1988:950) on cultural monuments, etc. and the Ordinance (1988:1229) on historic state buildings, etc., fall within the scope of municipal protection in detailed urban plans or area regulations – 3500 protected churches and 2500 historic buildings. Careful modifications are made in these buildings which will lead to lower energy costs and the long-term preservation of the buildings and their fixtures and fittings. In many cases, the buildings of cultural and historic importance contain fixtures and fittings with the character of museum pieces that require an adapted indoor climate to prevent them from being destroyed. The Swedish Energy Agency has set aside SEK 40 million for the research programme for each of the periods 2006-2010 and 2011-2014.

Energy IT and Design

The Energy IT and Design programme combines expertise in IT with design know-how and knowledge about human attitudes to, primarily, electricity, everyday goods and technology use. It is an applied programme and aims to result in a number of real prototypes and demonstration pieces: attractive design solutions that make individuals aware of their day-to-day energy use, informative IT solutions that provide detailed and useable information about energy and electricity consumption, simple but advanced IT solutions for the control and monitoring of electricity and energy use in the home and a relevant and motivational decision-making basis that will help change day-to-day habits to make them more efficient in terms of resource and energy use. The programme runs from April 2009 to December 2012 and is part-funded (50%) by SEK 60 million from the Swedish Energy Agency, out of a total of SEK 120 million.

SolEl Programme

The SolEl Programme is an applied, national development programme for solar cell systems that is co-funded by the Swedish Energy Agency and industry. The basis of the programme is that the Swedish market for solar cells will expand – on commercial terms but in the long-term perspective – from niche markets to grid-feeding electricity production.

The programme therefore offers interested parties an opportunity to follow and participate in development in this field, with a focus on technical and non-technical issues in the field of energy and buildings. Collaboration then represents an opportunity to resolve some outstanding development needs and recycle experience through the likes of assessments, training and the dissemination of objective information.

The budget for the programme is around SEK 4 million per annum. The project is funded by ABB Sverige AB, Bixia AB, E.ON Sverige AB, the Swedish Energy Agency, Exoheat AB, Falkenberg Energi AB, Fortum Sverige AB, Göteborg Energi AB, HSB, Jämtkraft AB, the City of Malmö, Mälarenergi AB, the Development Fund of the Swedish Construction Industry (SBUF), Sharp Sweden AB, Swedish Energy System Transition AB (Switchpower), Umeå Energi AB, Vattenfall AB and Växjö Energi AB.

3.6 Sector-specific energy efficiency instruments and measures in industry

3.6.1 PFE

The Programme for improving energy efficiency in energy-intensive industry, PFE, was introduced in 2004 and operates as a voluntary agreement between a company and the Swedish Energy Agency. Under the agreement, if a company meets the requirements of the PFE programme, it receives an exemption from the energy tax on electricity (SEK 0.005/kWh)[25] that was introduced on 1 July 2004[26]. The PFE provides businesses with greater knowledge of their energy use, which leads, in combination with the measures implemented, to reduced energy costs.

Companies that participate in the PFE must, amongst other things, carry out energy mapping and introduce an energy management system[27] and processes for taking account of energy when purchasing equipment that requires electricity and when carrying out future planning, altering or renovating the business. Energy mapping and analysis must be carried out from a system point of view, be both long and short-term and result in measures to increase electrical energy efficiency. Where measures have a return-on-investment time of less than 3 years, companies must implement them during the course of the programme.

Many of the measures have covered demand management (speed control for electrical motors and time management for lighting) and optimisation. The measures often have a short return-on-investment time and some of them do not require any investment at all. Switching to more energy efficiency products is commonplace.

As well as energy mapping, companies are also required – if they are to be exempted from the energy tax on electricity – to implement measures that will bring about greater energy efficiency that largely corresponds to what would have been achieved if the minimum rate of taxation that applies under Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity had been applied.

Many of the measures reported are to be found in the area of pumps, which can be partially explained by the fact that the majority of the participating companies are in the pulp and paper industry. The measures relating to compressors and air pressure systems are also a major efficiency improvement item.

[25] Participating companies that meet the requirements of the programme have their energy tax reduced from SEK 0.005/kWh to SEK 0/kWh.

[26] The requirements to be met under the PFE and thus the basis for the tax reduction are laid down in the Act and in the Ordinance on energy efficiency programmes. The legal basis for the condition that companies must participate in an energy efficiency programme to receive the tax reduction is to be found in the Act on a tax on energy.

[27] Energy management systems are a tool to work with energy issues within an organisation in a consistent and systematic way. An energy management system enables companies to plan, implement, follow up on and improve the energy usage.

On 1 January 2013, new state aid rules in the energy taxation field will enter into force, and these rules limit the opportunities to grant tax exemptions to companies. In order to complete the current programme period of the PFE (2009-2014), Sweden submitted a state aid notification to the European Commission in 2009. Sweden is currently holding discussions with the Commission on the conditions for the tax exemption to continue after 2012.

3.6.2 Energy mapping checks

From 2010 to 2014, businesses can apply for support for energy mapping if they have a final energy consumption above 0.5 GWh/year or if they are active in the primary production of agricultural products and have at least 100 livestock units. The support is governed by the Ordinance (2009:1577) on state support for energy mapping. Businesses can receive grants of up to 50% of the costs of energy mapping up to a maximum of SEK 30 000 per business. The Swedish Energy Agency is responsible for the administration of the support, which forms part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163).

3.6.3 Energy efficiency handbook for small and medium-sized enterprises

In order to further assist smaller companies to make progress in improving their energy efficiency, the Swedish Energy Agency has produced an Energy efficiency handbook for small and medium-sized enterprises. The handbook is distributed by the municipal energy and climate consultants, regional energy offices, via post to those applying for state aid for energy mapping and through networks that are co-financed by the Agency. The action forms part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163).

3.6.4 Networks

The Swedish Energy Agency actively works to promote the formation of networks of actors within the industry. The purpose of such networks is to increase know-how and provide tools to increase the energy efficiency at every level of industrial firms through the exchange of information and knowledge.

Networks have been formed, *inter alia*, in the mining and steel industry, the materials processing industry and in the sawmill industry.

The Network for Energy Efficiency, ENIG, consists of a network of experts, industries, energy offices and energy and climate consultants to improve energy efficiency. The focus is on casting, surface treatment, heat treatment, sheet metal forming and plastics processing. The primary purpose of the project is to reduce the energy use of participating enterprises by 5% per annum – a total of 30% by 2015 – which is to be monitored in a small number of reference companies, and to contribute to the implementation and commercialisation of at least 10 new and energy-efficient processes or products. The network was launched in June 2009.

The purpose of the Energy-efficient Sawmills Network, EESI, is to demonstrate that it is possible to reduce the specific energy consumption in the sawmill industry by at least 20% by 2020. This result is to be achieved through an energy efficiency programme including everything from mapping of energy consumption (with the aid of energy mapping checks, see Section 3.6.2) to modelling the options for energy efficiency options and a demonstration plan for selected sawmills. The network was launched in January 2010.

3.7 Sector-specific energy efficiency instruments and measures in the transport sector

3.7.1 Introduction

Greater energy efficiency in the transport sector is all about solving society's accessibility and transport needs whilst at the same time reducing the energy use for transport. This can be accomplished by making vehicles and infrastructure more energy-efficient, but also by reducing the need for travelling and transport. There is also a need for a holistic view of society and the transport system where the car has a smaller role to play as a means of transport and where accessibility is created through reliable public transport and increased opportunities to walk and cycle. In addition, society's goods transport must be made more efficient.

3.7.2 Requirements pertaining to vehicles and tyres within the EU

On 23 April 2009, Regulation (EC) No 443/2009 of the European Parliament and of the Council setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles was adopted. The Regulation aims to reduce the average emission of carbon dioxide for new passenger cars to 130 g/km in 2015. This required is expressed as a function that permits heavier cars to emit more than lighter ones whilst achieving the cut at the same time. The stated target for 2020 is 95 g/km. The requirements are being introduced gradually starting in 2012 and will apply as a cut for each manufacturer's sales within the EU. If new cars' fuel consumption falls as much as for the EU as a whole, the requirements could mean that emissions of carbon dioxide in Sweden fall by a little over 1 million tonnes by 2020. The emissions requirements form part of the EU's strategy to reduce carbon dioxide emissions from new cars to 120 g/km. The last 10 g/km is to be achieved through other measures, including energy requirements for tyres and air conditioning.

On 13 July 2009, Regulation (EC) No 661/2009 of the European Parliament and of the Council concerning type-approval requirements for the general safety of motor vehicles, their trailers and systems, components and separate technical units intended therefore was adopted. The Regulation introduced requirements for systems to monitor tyre pressure, road grip, maximum rolling resistance and rolling noise as of 1 November 2012. The requirements pertaining to rolling resistance and noise will be tightened up as of 1 November 2016.

Later in the same year, Regulation (EC) No 1222/2009 of the European Parliament and of the Council of 25 November 2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters was also adopted. This Regulation stipulates that, as of 1 November 2012, tyres are to be labelled with their rolling resistance, rolling noise and wet grip. The labelling of rolling resistance is based on a similar system to that for white goods, with different colours and letters from A to G.

The main point of reducing the use of studded tyres is to improve air quality and reduce noise. One positive side effect is that rolling resistance and thus fuel consumption fall, as does the need for road maintenance, which requires energy. In 2009, the Swedish government reduced the period during which it is permitted to use studded tyres by two weeks in the spring and gave the municipalities the ability to prohibit the use of such tyres on certain stretches of road.

3.7.3 Vehicle tax

In 2006, Sweden introduced carbon dioxide-differentiated vehicle tax for passenger cars through the Road Tax Act (2006:227). For fossil fuel-powered cars, the differentiation in Sweden is SEK 20/g of carbon dioxide, and for vehicles powered by alternative means it is SEK 10/g of carbon dioxide. Since 1 July 2009, environmentally friendly cars have been exempt from vehicle tax for the first 5 years. This measure replaced the previous environmentally friendly car premiums. Changing the instruments used in Sweden and internationally have had a powerful impact on the make-up of new car sales.

3.7.4 Purchasing and leasing of cars and car journeys by the authorities

Since 2005, environmental requirements have been in place in respect of the purchasing and leasing of cars by the authorities. Since 2005, these requirements have been complemented by road safety requirements, while the proportion of environmentally friendly cars was increased from 85 to 100% by means of the Ordinance (2009:1) on environmental and road safety requirements for the authorities' cars and car journeys. These provisions apply to purchasing, leasing and use of cars by the authorities and to the procurement of taxi trips and rental cars. The Ordinance lays down the criteria that authorities must take into consideration when purchasing. Environmentally friendly is defined as those that can be driven on ethanol, compressed natural gas or electricity and fossil fuel-powered vehicles with maximum carbon dioxide emissions of 120 g/km. Energy requirements are also laid down for vehicles powered by ethanol, gas and electricity.

On 23 April 2009, Directive 2009/33/EC of the European Parliament and of the Council on the promotion of clean and energy-efficient road transport vehicles was adopted. In light of this, the *Riksdag* adopted a new Act on environmental requirements when procuring vehicles and certain public transport services (prop. 2010/11:118, bet. 2010/11:FiU37, rskr. 2010/11:303). Under the new Act (2011:846) on environmental requirements when procuring vehicles and certain public transport services, when buying and leasing cars, procuring authorities and units must take into consideration the environmental performance linked to operation for the length of the period of use. The energy and environmental impact can be given a monetary value that is incorporated into the evaluation of the bids. If this method is used, the estimate of costs, which is linked to the life of the vehicle, must follow the rules laid down in the Directive.

The Ordinance on environmental and road safety requirements for the authorities' cars and car journeys will continue to apply. The Ordinance contains detailed rules for exhaust gas cleaning, low emissions and low fuel consumption. The rules are also stricter in some regards than in the Act currently proposed.

3.7.5 Taxation of company cars

Company cars are taxed on the basis of the value of the fringe benefit of the car. Under the current rules there is a reduction of the taxable fringe benefit value for environmentally friendly cars. However, the definition of environmentally friendly car is different from that used for vehicle tax and the purchasing of environmentally friendly cars by the authorities. The reduction amounts to 20% for ethanol-powered cars and 40% for gas, electricity or electricity hybrid cars. The current rules apply until the end of 2011.

3.7.6 The congestion charge and other local actions

The congestion charge was introduced in Stockholm on a permanent basis on 1 August 2007. In January 2010, the Municipality of Gothenburg, along with Region Västra Götaland, Halland and the Association of Municipalities in the Gothenburg Region decided to introduce congestion charges in the city centre and on all crossings over the river. The charge will be introduced in 2013 and will by and large follow the same principle applied in Stockholm.

A "super environmentally friendly car premium" is to be introduced for particularly energy-efficient cars.

Locally, municipalities can also have an impact on car use without resorting to congestion charges through parking charges, parking rules and parking policy. Increasing parking charges makes alternatives to the car more attractive.

3.7.7 Lower speeds and economical driving

At present, there are around 1000 road safety cameras along the Swedish road network. In 2008 and 2009, the Swedish Transport Administration and some municipalities introduced new speed limits based on a more flexible 10-step system. The result was that the existing speed limits were complemented with speed limits of 40, 60, 80, 100 and 120 km/h. The speeds are to be adapted to how safe each road is. The objective is to strike a balance between the requirements of road safety, the environment, accessibility, convenience, positive regional development and equality. In 2010 and 2011, numerous municipalities across Sweden introduced the new speed limits. There is a strong link between speed and fuel consumption, with greater fuel consumption from around 50 km/h. At lower speeds, too, consumption can increase with speed if there are lots of stops and starts, otherwise consumption usually falls up to 50 km/h. Many of the roads that have had speed cuts for road safety reasons are to be equipped with crash barriers and other measures, which could mean the speed limits being raised again. That would probably reduce the positive impact of the speed limit system on emissions of carbon dioxide.

In 2006, requirements relating to economical driving were incorporated into driver training and into the driving test for licence class B (passenger cars). These requirements were subsequently extended to all licence classes. The requirements cover both practical and theoretical factors.

In rail traffic, too, the concept of economical driving is judged to have potential. The installation of energy meters and the use of Drive Style Manager reduces energy use in both new and old vehicles.

3.7.8 Green corridors

Green corridors are a Swedish initiative launched by the European Commission in 2007. National and international freight traffic is to be concentrated on long stretches with bottlenecks removed and co-ordinated regulations. The aim is to make optimal use of the different means of transport by means of logistical solutions and strategically located trans-shipment terminals with suitable support infrastructure. The green corridors are also intended to provide a platform for innovative logistical solutions and the showcasing of good examples. The project includes logistical forums in collaboration with the organisations like the Swedish Transport Administration.

3.7.9 Improving the energy efficiency of infrastructure

In addition to the energy use that the traffic on the roads and railways gives rise to, energy is also used for the construction, operation and maintenance of infrastructure. As a rough estimate, this amounts to around 10% of the energy use of road traffic, which amounts to a total of just over 80 TWh. In the field of road traffic there is great scope for energy efficiency improvements in relation to bulk materials management, surfaces and winter operation. For many years, the Swedish Road Administration, and subsequently the Swedish Transport Administration, has been working according to a lighting strategy involving switching to more energy efficiency fittings, turning off unnecessary lighting and also moving lighting from the roadway to cycleways and footpaths.

In the field of railway traffic there are also options to improve the efficiency of energy use in infrastructure. In a project covering the whole country, the Swedish Transport Administration estimates it could make 59 major station areas and railway yards more energy-efficient when it comes to lighting on railway yards and platforms, station buildings, electrically-heated points and engineering buildings. There is a great opportunity to save energy. In a pilot project at Östersund central station, the Swedish Transport Administration is working together with Östersund municipality and Jernhusen in Scandinavia's largest full-scale test of LED lighting.

There is also work underway on more energy-efficient lighting in relation to maritime transport. In order to minimise energy use and increase the lifetimes of fairway markings, LED technology is being used in more and more applications, for example in light buoys, which has also led to a reduction in the purchasing of batteries despite an increase in the number of light buoys. Furthermore, fewer maintenance trips are required.

3.7.10 Information actions

There are many different types of information action that affect energy use in the transport sector.

The "Car index" covering the climate impact of new cars is the result of collaboration between the Swedish Transport Administration, the Swedish Environmental Protection Agency and the Swedish Consumer Agency that began in 2007. The aim of this report is to shine a light on new car purchases by Swedes and what impact they have on the environment. The report is produced twice a year and sets out statistics on new cars' CO_2 emissions according to the EU method and the estimated climate impact in every municipality and county and for the country as a whole.

The Swedish Transport Administration and the Swedish Consumer Agency collaborate on the “New car guide”, which is available both as a website and in print. The Swedish Consumer Agency also has a car calculation that also provides information on older cars. The Swedish Motor Vehicle Inspection Company has a website, bilsmart.se, where users can search for new and older cars and obtain information about fuel consumption, carbon dioxide emissions and vehicle inspection results. The “New car guide”, the “Car calculation” and bilsmart.se offer support to help private individuals to choose a car with less of an impact on the climate. The “New car guide” is being developed so as to also cover light goods vehicles.

The Swedish Transport Administration also works with resellers to promote the sale of environmentally friendly cars. For environmentally friendly cars there is the website www.miljofordon.se. This site contains information that complements the “New car guide”.

3.7.11 Technology procurement

As part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163), the Swedish Energy Agency funds the programme “Technology procurement and market launches for improving energy efficiency in the transport sector”. The programme will run between 2010 and 2013 and has a budget of SEK 35 million. The aim is to develop, verify and practically demonstrate new technology and technological solutions prior to market launch in the areas of logistics, transport integration, planning, organisation, IT and influencing behaviour.

Another example of technology procurement is a project run by the City of Stockholm and Vattenfall AB. The purpose of the project is to procure roughly 1 000 electric vehicles and battery hybrids between 2011 and 2014 and the intention is to speed up the introduced of electric vehicles in Sweden. The Swedish Energy Agency co-finances the technology procurement, paying 25% of aid-based costs to a maximum of SEK 62 million.

3.7.12 Collaboration with public actors and trade and industry

Since the end of the 1990s broad-based work has been ongoing on limiting the climate impact of transport. An important element of this is to carry out actions together with public actors and trade and industry. This relates to information, co-ordination and financial support for projects. Some of the actions that have formed part of this work include community planning for reduced car use, the choosing energy-efficient means of travel and transport, choosing energy-efficient vehicles, car pooling, improved logistics for passenger and freight transport, economical driving, increasing speed limit compliance and reducing the use of studded tyres.

The Swedish Transport Administration and the Swedish National Board of Housing, Building and Planning, together with the municipalities of Jönköping, Norrköping and Uppsala and the Swedish Association of Local Authorities and Regions, have been involved with "A sound town – an urban development project" since 2005. The aim of the project has been to develop know-how, processes and solutions for how integrated planning of built-up areas and transport systems can be performed through collaboration on real life planning cases in the municipalities.

Sweden co-operates with Finland in order to optimise icebreaking. Icebreaking is an energy-intensive service that is offered to shipping. Better co-ordination between the two countries' icebreaking activities could deliver reductions in energy use with the same degree of service.

Another example of the collaboration between actors is the three-party agreement between the Swedish Maritime Administration, Ports of Sweden and the Swedish Shipowners Association for greater use of shore supply, which was signed in April 2009. The purpose of the agreement is to encourage greater use of electricity supplied from the shore.

3.7.13 Research

The Swedish Energy Agency, and other authorities and organisations fund research in the transport field. The Swedish Transport Administration funds research covering all aspects of climate impact and energy use on the roads and the railways. The Swedish Maritime Administration's research relates to ships, their physical design, power sources, fuel and emissions, as well as to energy efficiency improvements throughout the transport chain. The research funded by the Swedish Energy Agency takes place in fields including alternative fuels and energy-efficient vehicles.

"LETS 2050" (Governing transitions toward Low-carbon Energy and Transport Systems) is a multidisciplinary programme that analyses how Sweden can be transitioned towards low-carbon and sustainable energy and transport systems. The programme is headed by Lund University and employs around 25 researchers from ten different institutions. The research takes as its starting point the position that it is both technically possible and economically feasible to transition to a low-carbon society but that now is the time to discover how to make that possible. The programme is co-funded by the Swedish Environmental Protection Agency, the Swedish Energy Agency, the Swedish Governmental Agency for Innovation Systems (VINNOVA) and the Swedish Transport Administration.

"Strategic Vehicle Research and Innovation (FFI)" is a collaboration between the state and the vehicle industry to jointly fund research, innovation and development activities with a focus on the areas of the climate and the environment, as well as safety. The investment currently covers five areas of collaboration, which include energy and the environment and transport efficiency.

"Energy systems in road vehicles" is another research programme that brings together research projects relating to more energy-efficient road vehicles. Research is carried out in various sub-projects into lithium-ion batteries, various kinds of hybrid systems and reorganisation to switch from diesel to hydrogen. The project also encompasses more long-term research relating to managing, controlling and developing internal combustion engines.

The Swedish Energy Agency funds the research programme “Energy efficiency in the transport sector”, which is intended to run from 2010 to 2013 with a budget of SEK 35 million. The vision behind the programme is to help realise the potential for improving energy efficiency that there is in the transport sector by means of new solutions relating to switching journeys to more energy-efficient kinds of transport, logistics, planning, behaviour and physical measures in different environments. One primary aim is to find more energy-efficient means of transporting goods and passengers by exploiting advanced IT solutions and through behaviour-centred measures.

3.8 The exemplary role of the public sector

The Energy Services Directive requires public authorities to fulfil an exemplary role in the context of work on improving energy efficiency. The government has tasked the Swedish Energy Agency with providing advice and following up on the other public bodies’ energy efficiency work.

The public sector’s responsibility can be clearly seen through a series of measures and programmes that aim to bolster the work towards improving energy efficiency. Certain types of measures aim for tangible results (examples being procurement rules or energy efficiency measures in buildings), whereas the objective for other types of measures may be, for example, to increase co-operation or disseminate information. Among the latter type of measures, in particular, numerical estimates of the energy saved are not practicable. The review of the public sector’s role that is carried out here is, at the same time, a listing of the various programmes, as this kind of presentation format is likely to provide a more comprehensive picture.

3.8.1 The state

In the autumn of 2009, a new Ordinance (2009:893) on energy efficiency measures for public authorities was introduced, with the aim of helping bring about efficient final energy consumption in the public sector. The Ordinance lists six energy efficiency actions that correspond to the actions described in Annex VI to Energy Services Directive (2006/32/EC) which every public authority must implement at least two of. The actions can relate to improving energy efficiency in premises or to the procurement of equipment and services. The Swedish Energy Agency is responsible for co-ordination and administration with regard to information and start-up for public authorities and for follow-up and further reporting of the outcome. The Swedish Energy Agency works with Miljöstyrningsrådet AB on issues relating to environmental and energy requirements and on public procurement. Energy follow-up by the authorities also forms part of the reporting to the government via the Swedish Environmental Protection Agency pursuant to the requirements of the Ordinance (2009:907) on environmental management in state agencies.

A total of 180 state agencies are covered by the requirements of the Ordinance on energy efficiency measures for public authorities. Many public authorities have chosen to implement more than two of the actions required under the Ordinance. A majority of the authorities are actively working on purchasing energy-efficient equipment and on renting energy-efficient buildings. Few authorities make use of energy certificates and carry out the associated recommendations. Hardly any authorities make use of the financial instrument for improving energy efficiency. The reason that few public authorities implement these last two schemes is that few state agencies own their own premises.

3.8.2 Municipalities and county councils

Support for improving energy efficiency in municipalities and county councils

In order to promote the improvement of energy efficiency in that part of the public sector that does not consist of state agencies, Swedish municipalities and county councils have been able, since 1 January 2010, to apply for state aid for strategic work on improving energy efficiency in their own activities from a system point of view. The purpose of this support is to help municipalities and county councils to act as good role models for the efficient use of energy. This investment forms part of the five-year energy efficiency programme that the government proposed in its first national energy efficiency action plan (prop. 2008/09:163). In 2010, 269 (out of a total of 290) municipalities and all 20 county councils applied for and were awarded support.

Those municipalities and county councils that are obtain support commit to establish and implement an energy efficiency strategy pursuant to the Ordinance (2009:1533) on support for improving energy efficiency in municipalities and county councils. The strategy must encompass an analysis of the current situation, energy efficiency targets for 2014 and 2020 and an action plan to achieve the said targets, plus a selection of at least two of the six actions described in Annex VI to the Energy Services Directive (2006/32/EC). This may involve, for example, purchasing energy-efficient products or renting/owning energy-efficient buildings. The impact of the work on energy efficiency is to be reported to the Swedish Energy Agency on an annual basis.

In addition to paying out financial support to municipalities and county councils, the Swedish Energy Agency is also responsible for providing advice and support for improving energy efficiency.

The county administrative boards have an explicit role in supporting municipalities and county councils at a regional level, both in applying for energy efficiency support and in producing a local strategy and implementing actions, including follow-up. This could be through providing support and guidance through networks, training sessions and individual support and through answering questions.

The Sustainable Municipalities programme

Since 2003, the Swedish Energy Agency has been running the Sustainable Municipalities programme in order to support the work of Swedish municipalities towards an energy switchover and a reduced impact on the climate. The work that has hitherto been carried out within the programme aims to influence the municipalities' own energy use (in premises, transport, street lighting, sports facilities, etc.), but also to help citizens, households and local business communities to get involved in the work and for energy use by these groups to move forwards in a positive direction. The programme is characterised as a soft instrument focussed on network management and aims to complement and facilitate other activities and processes underway in the field of energy and the climate. The Swedish Energy Agency provides know-how, information and networks that facilitate and optimise the work of the municipalities.

A well-known factor for the success of local work on energy and the climate is that it should have a firm basis among, and be prioritised by, leading politicians and officials within the municipality. The Sustainable Municipalities programme therefore incorporates actions aimed at and involving these groups in implementing the programme. The municipalities must provide a sound political basis for and establish their energy and climate strategies, which must include specified targets and action plans with a specific timeframe covering their own activities. The municipalities must document the activities and processes they are involved in and their outcomes, and report these on an annual basis to the Swedish Energy Agency. This description must include activities relating to knowledge-sharing, network-building and co-operation. The municipalities collate and disseminate information and know-how by means of reporting on good examples.

For the municipalities, participation in the Sustainable Municipalities programme means that the politicians and officials of the municipality in question are able to participate in joint conferences and training sessions within the programme, apply for project funding for collaboration projects and gain access to a network of expertise in other municipalities, government agencies and among researchers and consultants.

Five municipalities were part of the initial pilot stage from 2003 to 2007. The second stage of the Sustainable Municipalities programme was launched on 26 June 2008 and will run until 30 June 2011. A total of 66 municipalities are taking part, four of which were involved in the pilot stage. These four municipalities now act as the "grand old men" among the municipalities to support the others. The pilot county of Kalmar receives financial aid from the Swedish Energy Agency to develop a model for collaboration at the regional level.

The Swedish Energy Agency is carrying out a series of activities that are intended to bring about improved knowledge-sharing, network-building and co-operation. Numerous electronic tools for knowledge-sharing have been developed in the form of handbooks, newsletters and an extranet. Co-operation and knowledge-sharing also take place in national meetings. The Sustainable Municipalities research programme was launched in 2009 as part of the process of expanding know-how.

In the autumn of 2011 a third stage of the Sustainable Municipalities programme will be launched. Work in the third stage will be aimed at:

- developing local energy and climate efforts with a broad political basis;
- developing new and existing ways of working and collaborative models, locally and regionally, in the fields of energy-smart town and country planning and industrial policy with energy as a springboard;
- developing and disseminating methods, handbooks, indicators and cutting edge examples, in collaboration with the authorities in question, in energy-smart town and country planning and industrial policy with energy as a springboard.

3.8.3 Miscellaneous

An important part of the public sector's special responsibility consists of certain arrangements for the co-ordination of public procurement and other measures that require major backing, such as energy-efficient server halls and green IT. Such activities are co-ordinated by the Process Group for Business Tenants (HyLok) (cf. Section 3.5.9).

Another example is the Development of Public Sector Property Management (UFOS), a collaboration action between a series of key managers of properties in which public sector operations are carried out and, amongst others, the Swedish Energy Agency (see also Section 3.5.12). One of the objectives is improving energy efficiency, and UFOS has twice arranged a kind of nationwide tour of meeting forums known as the Energy Kick, which were aimed at everyone with an interest in more energy-efficient property management.

4 Estimated energy saving

4.1 Total energy saving

The total energy saving of different energy efficiency measures in the end-user stage is estimated to amount to 33.1 TWh for 2010 and 53.8 TWh for 2016. As Table 2 shows, this exceeds the energy savings levels laid down in the national targets. Sweden is thus meeting the savings targets under the Energy Services Directive by a good margin.

Table 2. Comparison of targets and estimated energy saving

	Energy savings target		Achieved/estimated energy saving	
Year	TWh	%	TWh	%
2010	24.0	6.5	33.1	9.0
2016	33.2	9	53.8	14.6

Table 3 shows the total savings from previous and future measures in residential properties and business premises, the industrial sector and the transport sector. It can be seen, for example, that Sweden was quick to put in place measures to improve the energy efficiency of buildings. When it comes to industry and the transport sector, it is above all new actions that it is thought will lead to the targets being met. It should be pointed out that the estimated energy savings are the result of both general and specific instruments and measures. Other factors, too, such as higher fuel prices, contribute to energy savings. The results of the calculations are *only* to be used to follow up the targets pursuant to the Energy Services Directive.

Table 3. Calculation results for following up on the Energy Services Directive

	2010 (TWh)	2016 (TWh)
Residential properties and business premises – early actions	20.7	16.3
Residential properties and business premises – new actions	2.5	8.2
Industry – early actions	0.4	0.4
Industry – new actions	4.6	17
Transport – early actions	1.9	1.9
Transport – new actions	3.0	10.0
Total	**33.1**	**53.8**

Note: the energy savings from early actions are calculated with 1995 as the base year, while the base year for new actions is 2007. The results of early actions for 2010 and 2016 differ as a result of the lifetime of the actions. For more information, see Annexes 1 and 2.

A large part of the programme for more efficient energy use is focused on knowledge acquisition, advice services, energy labelling, information and introducing market-level technologies. It is not possible to assess the impact of these programmes using the Commission's recommended methods. On the other hand, the programmes represent one element in overcoming market failure whilst, at the same time, complementing the financial instruments. The Swedish government thus wants to stress that these actions are significant in terms of supporting and complementing general measures such as energy taxation, emission allowance trading and energy use standards for products and buildings.

4.2 Calculation methods

According to Annex IV to the Energy Services Directive (2006/32/EC), calculations for a 20-30% share of final energy consumption should be carried out using harmonised, bottom-up methods. The Commission subsequently recommended that the saving in buildings should be calculated using bottom-up methods and proposals for methods were produced (see Annex 2).

The calculation methods that the Commission recommends have been used as far as possible for the calculation of energy savings in the various sectors covered by the Energy Services Directive (2006/32/EC). The energy savings in buildings (residential properties and service business premises) are calculated using bottom-up methods, while the energy savings in the transport sector are calculated using top-down methods. Energy savings in the industrial sector are calculated using a combination of bottom-up and top-down methods. The recommended methods are described in Annex 1 and the calculations are described in more detail in Annex 2.

Bottom-up means that energy efficiency measures have been calculated from the perspective of starting at the bottom and working upwards. That means that the savings resulting from measures are calculated separately and the sum total of all the calculations represents the total savings for residential properties and business premises. As an example, the savings thanks to the installation of solar cells and efficient lighting has been calculated using various bottom-up methods[28].

Top-down means that energy efficiency measures have been calculated from the perspective of starting at the top and working downwards and that the saving is calculated at the subsectoral or sectoral level. As an example, the savings in industry are calculated using a top-down method for various subsectors and the sum total represents the savings in industry.

[28] See method 2.9 in Annex 2.

The results for the various sectors cannot be compared since the savings in residential properties and business premises have been calculated using bottom-up methods, whilst the savings in the industrial and transport sectors have been calculated using top-down methods. This means that only the savings based on measures included in the calculations (for example replacing energy-inefficient windows or carrying out conversions) are reported for residential properties and business premises. In the calculations for the industrial and transport sectors, on the other hand, "everything" is included, including structural impacts[29].

The Energy Services Directive (2006/32/EC) makes a distinction between what it calls early and new energy efficiency measures. 'Early energy efficiency measures' means measures implemented from 1995 to 2007, while 'new' measures means those implemented as from 2008.[30]Annex III of the Energy Services Directive (2006/32/EC) provides examples of eligible energy efficiency measures. The Annex states, for example, that, if the quantity of energy purchased falls as a result of the installation of renewable energy (such as solar cells or solar heating) in a building, this is deemed to be an efficiency improvement.

The bottom-up methods that the Commission recommends for residential properties and business premises are designed in such a way that they are actually based on statistics at the building level. Given that there are no existing statistics at that level, existing statistics have been accompanied by estimates and assumptions. It is similarly not reasonable to use methods of this great detail to calculate efficiency savings at the national level. The methods have therefore, to some extent, been adapted to the statistical basis available in Sweden.

The top-down methods that the Commission recommends are designed in such a way that activity in the closing year of 2016 will have a major impact on the final saving. If usage becomes more efficient during the period, the savings will be larger the greater the level of activity in 2016. As an example, the energy savings for the period will be higher the more transport traffic there is in future if it is assumed that the vehicles of the future will have a lower fuel consumption than today's vehicles. It can thus be more interesting to follow the development of the indicators[31] than to simply study the final savings.

[29] Structural impacts include changes within industry that do not involve changes in the production process or similar, but that do bring about an efficiency saving under the calculation method. This could be, for example, a change to the product composition within a sector or the fact that a subsector with a low energy-intensity makes a switchover more quickly than a subsector with high energy-intensity.

[30] The impact of taxes may be calculated from 1991.

[31] The indicators for the relevant top-down methods are set out in Annex 1.

4.3 Energy savings for households and services

The domestic and services sector covers residences, holiday homes, private and public business premises (excluding industrial premises), primary production and other services. Primary production encompasses the use of biological resources on land and in the water, such as agriculture[32], forestry and fishing. Other services encompasses the construction sector, street and road lighting, wastewater and water treatment plants, etc.

The bottom-up methods that the Commission has recommended only relate to buildings. For other parts of the domestic and services sector, no methods have been recommended. In this action plan, efficiency improvement measures have only been calculated for residential properties and business premises, which is why the term "residential properties and business premises" has been used instead of "domestic and services". For other parts of the domestic and services sector, such as primary production, no calculations have been made. The lack of reliable and sufficiently detailed data makes it difficult to carry out calculations that meet the Commission's requirements. The other subsectors make up only roughly 10% of the total energy use in the sector.

4.3.1 Early and new actions

Table 4 shows the estimated savings for residential properties and business premises. The savings for each action are compiled for each year from the year when the action was put in place until the end of its lifetime or 2016, if the latter comes first.

Table 4. Estimated energy savings for residential properties and business premises

Efficiency improvement measure	2010 (TWh)	2016 (TWh)
Energy-efficient windows and insulation – early actions (2.2)	1.60	1.60
Energy-efficient windows and insulation – new actions (2.2)	0.56	1.70
Conversions – early actions (2.4)	14.40	12.50
Conversions – new actions (2.4)	1.10	3.40
Solar cells – early actions	0.01	0.01
Solar cells – new actions	0.02	0.09
Solar heating – early actions (2.7)	0.07	0.07
Solar heating – new actions (2.7)	0.04	0.07

[32] Agriculture traditionally encompasses agriculture but also horticulture and reindeer husbandry.

Energy-efficient white goods – early actions (2.8)	1.50	0.85
Energy-efficient white goods – new actions (2.8)	0.20	0.60
Energy-efficient lighting in residences – early actions (2.9)	0.31	0
Energy-efficient lighting in residences – new actions (2.9)	0.44	1.05
Energy-efficient lighting in business premises – early actions (2.10 C)	2.78	1.22
Energy-efficient lighting in business premises – new actions (2.10 C)	0.18	1.33
Total	23.2	24.5

Note: the results for 2010 and 2016 differ as a result of the lifetime of the actions. The number of the method used is given in brackets. For more information, see Annexes 1 and 2.

The results presented in this action plan are estimates of a proportion of the efficiency improvement measures[33] described in detail in the previous section. The results have *not* been calculated in order to be used as a basis for follow-up on individual actions, and *must not* be used as such. It is thus incorrect, for example, to draw the conclusion that support for converting heating systems have realised a saving of 15.9 TWh[34] by 2016, which is the figure in Table 4. One reason for this is that the calculations also include estimates for conversions that take place without subsidy. Subsidies for conversion are just one of numerous reasons for an individual to decide, for example, to switch his/her heating system from an oil-fired boiler to district heating (conversion). Other reasons include energy tax, expected prices for oil and district heating and the knowledge and preferences of the individual. To evaluate an individual action requires more information in order to make it possible to distinguish the impact of the subsidy.

The calculated energy savings listed in Table 4 are based on available statistics and assumptions for energy-efficient windows and insulation, conversions, solar cells, solar heating, energy-efficient white goods and energy-efficient lighting. The calculations are presented in more detail in Annex 2. The fact that the results for early actions differ between 2010 and 2016 is a consequence of the difference in their lifetimes[35].

Some of the actions that have been calculated here as efficiency measures can also contribute towards other energy policy targets. By way of example, heat pumps and solar cells contribute towards meeting the target under the Renewables Directive[36].

[33] The term actions is used in this action plan instead of both instruments and measures.
[34] See Annex 2.
[35] The lifetimes according to the Commission's recommended methods are presented in Annex 1.
[36] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

4.3.2 Uncertainties

Examples of assumptions that have been made are future sales of energy-efficient windows, white goods and lighting, and the future development of the solar cells market. In order not to overestimate the impact of the various actions, in most cases progress has been assumed to continue at the same speed as at present or else more slowly. It will be possible to ameliorate most of the calculations later, once the statistical basis has been improved. For more information, see Annex 2.

4.4 Energy savings in the industrial sector

The calculated energy savings for the industrial sector are 5.0 TWh for 2010 and 17.4 TWh for 2016 (see Table 5). Of the 17.4 TWh for 2016, 0.4 TWh corresponds to early actions, 15 TWh is from on-going actions and 2 TWh from further actions in the form of the second programme period of Programme for improving energy efficiency in energy-intensive industry (PFE) and energy mapping checks. The calculated savings, however, are based both on structural impacts and technical measures.

A saving of 17.4 TWh corresponds to approximately 10%[37] of industry's energy use in 2007. Calculated between 2007 and 2016, it corresponds to an energy efficiency improvement rate of approximately 1%[38] per year. The calculation includes both "technical" efficiency improvements and structural impacts.

Table 5. Calculated energy savings for the industrial sector

	2010 (TWh)	2016 (TWh)
Early actions		
Programme for improving energy efficiency in energy-intensive industry, PFE	0.4	0.4
New actions		
Top-down calculation 2007-2016 (M8)	4.6	15
PFE, programme period 2		1
Energy mapping checks		1
Total	**5.0**	**17.4**

Note: the number of the method used is given in brackets (M8), see Annex 1 for more information.

[37] 13% of the energy use that is covered by the Energy Services Directive.
[38] Nearly 1.5% if the calculation is made for energy use covered by the Energy Services Directive.

4.4.1 Early actions

Early actions have been calculated on the basis of the Programme for improving energy efficiency in energy-intensive industry, PFE[39]. Up to 2006, the programme delivered total savings of 0.4 TWh.

4.4.2 New actions

New actions are expected to bring about savings of 17 TWh by 2016. This calculation is largely based on the Swedish Energy Agency's updated Long-term forecast, 2008[40], which covers adopted actions up to the end of June 2008 and the impact of adopted taxation changes under the government bill *Vissa punktskattefrågor med anledning av budgetpropositionen för 2010* (prop. 2009/10:41) [Some excise duty issues relating to the draft budget for 2010]. This part of the new actions corresponds to 15 TWh.

New actions also include a second programme period of the PFE and the new contribution to energy mapping checks[41]. These are not included in the forecast and have thus been calculated separately. The impacts are calculated as 1 TWh each.

4.4.3 Uncertainties

The base year for the Long-term forecast, 2008, is 2005, and the forecast covers all actions adopted as of the end of June 2008. The forecast thus does not take into consideration developments after the end of June 2008 and does not incorporate, for example, the recent recession. The assumptions about economic development, price trends for energy carriers and emission allowances are major uncertainty factors. In the long term, energy use by industry depends, *inter alia*, on economic growth for various sectors, the future composition of products within Swedish industry and technical developments.

4.5 Energy savings in the transport sector

The calculated energy savings for the transport sector are 4.9 TWh for 2010 and 11.9 TWh for 2016 (see Table 6). Of the 11.9 TWh for 2016, 1.9 TWh corresponds to early actions. Some of the calculations in the transport sector show negative savings, which means a fall in efficiency. This means, for example, that light goods vehicles (method P9 A2) used more energy per tonne-kilometre in 2007 than they did in 1994. For more information, see Annex 2.

[39] For more information, see Section 4.6.1.
[40] The Long-term forecast, 2008, can be accessed via www.energimyndigheten.se.
[41] Preliminary study on the options for the introduction of energy mapping checks in the period 2010-2014, background report to the Swedish government (reference no N2009/6909/E).

Table 6. Calculated energy savings for the transport sector

	2010 (TWh)	2016 (TWh)
Early actions		
Passenger cars (P8)	3.32	3.32
Heavy goods vehicles (P9)	-1.03	- 1.03
Light goods vehicles (P9 A2)	-0.35	-0.35
Railways (M6)	0.23	0.23
Maritime transport (M7)	-0.31	-0.31
Total for early actions	**1.9**	**1.9**
New actions		
Passenger cars (P8)	2.56	9.02
Heavy goods vehicles (P9)	0.10	0.38
Light goods vehicles (P9 A2)	-0.01	0.39
Railways, passenger (P10)	0.10	0.29
Railways, freight (P11)	0.01	0.02
Transfer of passenger journeys from cars to public transport (P12)	0.21	-0.07
Total for new actions	**3.0**	**10.0**
Total, early and new actions	**4.9**	**11.9**

Note: the number of the method used is given in brackets, see Annex 2 for more information.

4.5.1 Early actions

Savings from early actions were calculated using the Commission's top-down methods. Given the lack of statistics for certain means of transport, the simpler methods variant was used for the railway and maritime transport subsectors. The calculation for the early actions was made using an average value of three years. The methodology for calculation is described more extensively in Annex 2.

4.5.2 New actions

New actions are expected to bring about savings of roughly 10 TWh by 2016. This calculation is primarily based on the Swedish Transport Administration's forecast for transport traffic, which formed the basis for the Swedish government's decision on a national plan to develop the transport system for all means of transport for the period 2010-2021[42].

[42] The Draft national plan for the transport system, 2010-2021, the Swedish Road Administration, the Swedish Rail Authority, the Swedish Transport Agency, and the Swedish Maritime Administration (2009) can be accessed via www.trafikverket.se.

The forecast has been updated somewhat with regard to the recent recession.

For the maritime transport subsector there are no forecasts that can be used to calculate the savings using the Commission's methods. Maritime transport will be followed up in the next action plan.

4.5.3 Uncertainties

It has not been possible to fully include the long-term effects of the recent recession in the calculations. On the other hand, account has been taken of the developments of 2008 and 2009, meaning that the short-term impacts on transport traffic and energy use are included in the forecast.

The forecast outcome is based on the assumptions made in respect of the prevailing economic trends, taxes, prices, etc. That means that the actual outcome will differ from what is forecast. In order to illustrate how the calculated savings for 2016 are affected by changes in the assumptions made, a couple of sensitivity analyses have been carried out. These are discussed in Annex 2.

5 Comparison with the previous action plan

5.1 Introduction

On 14 June 2006, the Swedish government appointed a special rapporteur, with the remit of proposing how to implement Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services in Sweden (dir. 2006:89 [Terms of reference 2006:89]). The special rapporteur's remit also included drawing up weighting factors[43] and a draft of Sweden's first national energy efficiency action plan. The Commission of Inquiry presented a draft first action plan as an annex to its interim report *Ett energieffektivare Sverige* (SOU 2008:25) [A more energy-efficient Sweden]. The Swedish government submitted this to the Commission on 25 March 2008 as a preliminary action plan. This preliminary action plan covered the Commission of Inquiry's proposed savings measures and calculations of the resultant energy savings. The final version of Sweden's first national action plan formed Chapter 11 of the government bill *En sammanhållen energi- och klimatpolitik – Energi* (prop. 2008/09:163) [A coherent energy and climate policy - Energy], which was submitted to the Commission in March 2009. The final action plan contains no calculations of energy savings, for which reason the below comparison of energy savings in the first and second national action plans refers to the preliminary version of the first action plan.

5.2 Energy savings targets

The savings targets of 6.5 and 9%, respectively, were calculated in the first action plan to work out as 23.3 TWh of final consumption energy by 2010 and 32.3 TWh by 2016. The targets were calculated in the same way in both action plans. The differences in the target calculations of 0.7 TWh for 2010 and 0.9 TWh for 2016 for the two action plans are because of a correction of the statistics for the base years, 2001-2005[44].

[43] Weighting factors for electricity, district heating, district cooling and oil products should reflect the conversion and distribution losses of the different energy carriers.
[44] I.e. the difference between 23.3 and 24.0 TWh and between 32.3 and 33.2 TWh.

5.3 Estimated energy saving

The total saving from various actions is calculated in the first action plan to amount to 21.5 TWh for 2010 and 26.5 TWh for 2016. According to these calculations, then, the targets have not been achieved according to the above when expressed in terms of final energy consumption. Table 7 shows the calculated savings in the first and second action plans. The differences are the result, first and foremost, of the fact that more actions are included in the later calculations and that the industrial and transport sectors have been calculated using top-down methods. In the first action plan, savings were calculated from specific actions (such as economical driving and video surveillance) instead of calculating a total saving for the sector as a whole.

Table 7. Calculated results for 2010 and 2016 in the first and second action plans

	Savings 2010 (TWh)		**Savings 2016 (TWh)**	
	Action plan 1	Action plan 2	*Action plan 1*	Action plan 2
Domestic and services	*15.1*	23.2	*20.4*	24.5
Industry	*0.7*	5.0	*0.7*	17.4
Transport	*5.7*	4.9	*5.9*	11.9
Total	***21.5***	**33.1**	***27.0***	**53.8**

In the first action plan, the savings were also presented in terms of primary energy. The final energy consumption of 27 TWh for 2016 corresponds to 46.3 TWh in terms of primary energy. This means that a saving of 7.5% of final energy consumption and 10.1% of primary energy was calculated to be achieved by 2016. The Commission of Inquiry was of the opinion that the target for 2016 would be achieved without further efficiency improvement measures.

Despite this, the Commission of Inquiry proposed further actions on the basis that it had identified a socio-economically beneficial potential energy efficiency saving of 35 TWh of final energy consumption[45]. The potential energy efficiency saving is calculated on the basis that only worthwhile energy efficiency improvements are to be made.

[45] The Commission of Inquiry also calculated the potential saving in terms of primary energy. In the calculation, 35 TWh of final energy consumption corresponded to 56 TWh of primary energy.

In the course of 2009 and 2010, the European Commission brought forward methods that it recommended the Member States should use when following up on the Directive. This means that the calculations in the first action plan were carried out using methods that differ from those used in this action plan. The first action plan also does not include the same actions as this action plan. Moreover, in the first action plan, early actions[46] were defined as actions implemented in the years 1991/1995-2005, while in this action plan they are defined as actions implemented in the years 1995-2007. As a consequence of all this, it is difficult to compare the results.

5.3.1 Energy savings in residential properties and business premises

In the first action plan a saving of 15.1 TWh was calculated for 2010 and 20.4 TWh for 2016. Table 8 shows the results from the first action plan for residential properties and business premises. See Table 4 for corresponding results in this action plan.

Table 8. Calculated results in residential properties and business premises in the first action plan

Efficiency improvement measure	2010 (TWh)	2016 (TWh)
Conversions[1]	12.3	13.6
White goods[1]	0.3	0.3
Switching to district heating	0.4	1.00
Switching to solar heating, etc. 2000–2005	0.11	0.22
KLIMP project[2]	0.13	0.05
Technology procurement	1.1	2.3
OFFrot[3]	0.60	0.60
Support for energy-efficient windows	0.06	0.06
Expanding combined heat and power[4]	0	0
New building regulations, BBR06	0.04	2.3
District cooling[4]	0	0
Total	**15.1**	**20.4**

[1] Conversions and white goods are the only two actions that were accounted for under early actions. The conversion calculations include LIP/KLIMP, the short programme, solar heating 2000-2005.

[2] KLIMP, the state-funded Climate Investment Programme. Municipalities and other actors were able to apply to the Swedish Environmental Protection Agency for funding between 2003 and 2008. Implementation of the programme will be on-going until 2012.

[3] OFFrot, support for investments in energy efficiency measures and switching over to renewable energy sources in premises used for public services. Applications for this support could be made between 2005 and 2008.

[4] Calculations showed that the energy efficiency actions would not have an impact on final energy consumption, but they would have one on primary energy use.

[46] Early actions based on taxation may be calculated as of 1991, otherwise calculation starts from 1995. In this action plan, savings based on taxation have not been calculated.

In the first action plan, the savings were calculated for individual measures, so, for example, savings were reported for the Climate Investment Programme (KLIMP), technology procurement and energy efficiency measures and energy switchover in premises used for public services (OFFrot). In the second action plan, savings have instead been calculated for each category of action, for example for switching to energy-efficient windows and conversions. The calculation for conversions includes conversions within the scope of OFFrot.

Conversions

Conversion calculations are carried out in the same way as in the first action plan, but have been updated in the second action plan with new statistics, whilst consideration has also been given to the lifetimes to be found in the Commission's recommended methods. Calculation of conversions in this action plan also includes switchover to district heating (this was calculated separately in the first action plan).

White goods

In the first action plan, the Commission of Inquiry made the assessment, based on research by the Swedish Energy Agency and the Swedish Consumer Agency, that labelling of white goods brought about a saving of approximately 0.3 TWh in the period 1995-2005. In this action plan, the Commission's proposed methods have been used.

Solar heating

The calculation was carried out in the same way as in the first action plan, but in this action plan an update has been made with new statistics.

Energy-efficient windows

In the first action plan, energy savings were only calculated in respect of support for energy-efficient windows. The calculations were based on information from grant applications, assuming the U values of the windows. In this action plan, the savings from all replacement of windows have been estimated using statistics from survey information and sales statistics.

Building regulations

In the first action plan, energy savings were calculated in accordance with new building regulations, assuming that there would be a gradual adaptation in the market over a five-year period. In this action plan, no saving under building regulations has been calculated in order to minimise the risk of duplicate calculation.

As a consequence of these facts, it is not possible to compare the calculation methods.

5.3.2 Industry

The biggest difference between the calculations for the industrial sector in the first and second action plans is that the first action plan only included a bottom-up calculation while, in this action plan, both bottom-up and top-down calculation methods are used.

The savings in the first action plan were calculated as 0.7 TWh for both 2010 and 2016. The calculation was based on background data from the Programme for improving energy efficiency in energy-intensive industry (PFE), but only on data from those companies that reported through to 2006[47]. In this action plan, the calculation has been updated and includes results from the entire first programme period of the PFE, with account also being taken of the lifetimes of the actions in question[48]. Savings from the PFE represent an early action and have been calculated as 0.4 TWh.

In this action plan, the savings were calculated for 2008-2016 using a top-down method and an estimate of the anticipated savings from the energy mapping checks and the second programme period for the PFE. It is the top-down calculation that results in the largest change, with a saving of 5.0 TWh for 2010 and 17.4 TWh for 2016. As a consequence, it is not possible to compare the calculation methods.

5.3.3 Transport

In the first action plan a saving of 5.8 TWh was calculated for 2010 and 5.9 TWh for 2016. Table 9 shows the calculated results from the first action plan for the transport sector.

Table 9. Calculated results in the transport sector in the first action plan

Efficiency improvement measure	2010 (TWh)	2016 (TWh)
Fuel tax and vehicle taxation – early actions	5.0	5.0
Local Investment Programme (LIP)	0.03	0.03
Fuel tax and vehicle taxation – new actions	0.20	0.30
Taxation of fringe benefits (company cars)	0.12	0.15
Smooth driving, railways	0.01	0.01
Automatic traffic safety monitoring with cameras, speed monitoring	0.10	0.17
Climate Investment Programme (KLIMP) projects	0.26	0.26
Local Investment Programme (LIP) projects	0.03	0.03
Total	**5.8**	**5.9**

[47] The data basis for calculation was information from 80% of companies that participated in the first programme period for the PFE. The result of the calculations has been corrected so as to exclude lower electricity use in the trading sector.

[48] The Commission's recommended methods specify what lifetimes are to be used in calculations.

In the first action plan, the savings were calculated for individual measures, so, for example, savings were reported from taxing fringe benefits and from surveillance cameras. In this action plan, the Commission's recommended top-down methods have been used to calculate the savings for, for example, passenger cars or heavy goods vehicles. As a consequence, it is not possible to compare the calculation methods.

5.4 Proposals for further energy efficiency measures

In the preliminary version of Sweden's first national action plan, an overall potential for efficiency improvements for those sectors covered by the Energy Services Directive was presented. The potential was based on a large number of studies and reports. Table 10 shows the calculated worthwhile potential that the Commission of Inquiry thought would be achieved with further actions. The Commission of Inquiry took the view that further knowledge was required in respect of efficiency measures and the economic gains it could involve, as well as in respect of new technology.

Table 10. Potential energy efficiency saving according to the first action plan

Sector	Potential that could require further actions (TWh)
Residential properties and business premises, etc.	16
Industry	11–12
Transport	8
Total	**35–36**

5.4.1 Proposals for further actions for the domestic and services, industrial and transport sectors

The Commission of Inquiry put forward a large number of proposals for new and bolstered efficiency actions for the domestic and services, industrial and transport sectors (see Table 11), based on the estimated potential for worthwhile actions.

Table 11. The Commission of Inquiry's proposals for further efficiency improvement actions for the domestic and services, industrial and transport sectors

Domestic and services	Industry	Transport
Continuing to promote energy services	Energy advice services for small and medium-sized enterprises	Stronger carbon dioxide component in vehicle tax and other tax issues
Technology procurement and market launches	Extended and deepened energy efficiency programme in industries	Economical driving
Programmes for more efficient energy use in primary production	Technology procurement in the industrial sector	Binding emissions requirements for vehicles
Tightened-up building regulations		Community planning for more efficient transport
Energy performance certification for buildings		
Individual energy metering in multi-dwelling residences		
More efficient district heating		
Increased state support for improving energy efficiency		

In addition to these measures and actions, the Commission of Inquiry's proposals included the following:

- The establishment of an Energy Efficiency Board within the Swedish Energy Agency in order to improve co-ordination of different public bodies' work in this area
- Actions to improve statistics
- Improved training and information actions
- Greater focus on co-operation and networks

The majority of the Commission of Inquiry's proposals were incorporated into the Swedish government's bills for an integrated energy and climate policy (prop. 2008/09:162 and prop. 2008/09:163), and thus into the final version of Sweden's first national energy efficiency action plan. The government proposed, *inter alia*, the establishment of a five-year energy efficiency programme in order to strengthen actions relating to information, advice services, technology procurement and market launches, network activities, the introduction of a support system involving energy mapping checks, and others. The shape of the five-year programme was set out in detail in the draft budget for 2010 (prop. 2009/10:1) and in the appropriation directions for the Swedish Energy Agency for 2006 and 2011.

As the description in Section 4 clarified, a number of the proposed measures have been implemented, either fully or partially. In some cases further investigation was proposed before specific proposals for measures were brought forward. This applies, above all, to energy efficiency measures in buildings, which are also affected by the recast Energy Performance of Buildings Directive (Directive 2010/31/EU). At the government's request, the Swedish National Board of Housing, Building and Planning and the Swedish Energy Agency investigated and reported on what measures needed to be taken in Swedish legislation and otherwise as a result of the recast Directive. These agencies' proposals are currently being worked on in the Offices of the Swedish Government and will be circulated for consultation purposes during the autumn of 2011. The government intends to return to the *Riksdag* in 2012 with a government bill on improving energy efficiency in buildings.

5.4.2 Proposals for further actions in the public sector

The Commission of Inquiry proposed, in line with the Directive, that the public sector must lead the way for other actors, including by means of state and municipal energy efficiency programmes. The Commission of Inquiry therefore proposed that:

- The Swedish Environmental Protection Agency should be tasked with integrating the state energy efficiency programme into environmental management systems
- The Swedish Energy Agency should be tasked with supporting other authorities with tools for more effective energy use, for example energy management and lifecycle cost calculation

- The Swedish Energy Agency should sign and follow up on special energy efficiency agreements with municipalities and county councils
- The Swedish Energy Agency should investigate and report on how the Sustainable Municipalities programme can be developed and improved

All the proposals for the public sector were included in the government's 2009 energy bill and thus in the final version of Sweden's first national energy efficiency action plan. The proposals put forward there have been implemented, albeit not exactly as proposed by the Commission of Inquiry. More information about energy-efficient authorities, voluntary energy efficiency agreements and the Sustainable Municipalities programme can be found in Section 3.8.

5.5 The Commission's views on the first action plan

The European Commission has reviewed all the national energy efficiency action plans from the first round of reporting[49]. When it comes to Sweden's first action plan, the Commission pointed out, in connection with its review, that the action plan was unrealistic as the new actions had not been adopted by the *Riksdag* or the government but were merely proposals from the Commission of Inquiry. In this context, it should be pointed out that the Commission only reviewed the preliminary version of Sweden's first national action plan, which is to say the annex to the Commission of inquiry into improving energy efficiency's interim report (SOU 2008:25). The final action plan has not been reviewed by the Commission.

The Commission also observed that energy use in international transport had not been excluded from the calculation of the target. However, it was made clear in the basis for calculation for the first action plan that this use of energy was excluded, but that the calculations were not being reported. The distinction between early and new actions was calculated using the wrong reference year (2005 instead of 2008). In addition, the Commission also found that the description of the actions was insufficiently detailed and it was unclear what actions were expected to be carried out.

[49] Synthesis of the complete assessment of all 27 National Energy Efficiency Action Plans, European Commission (2010).

6 Information and advice action for fossil fuel-fired boilers, heating systems and air-conditioning systems

6.1 Introduction

Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings is currently being transposed into Swedish law. The government intends to submit a government bill on measures to improve energy efficiency in buildings to the *Riksdag* in the spring of 2012. The government intends to propose in the said bill, in accordance with Articles 14(4) and 15(4) of Directive 2010/31/EU, to ensure, as an alternative to inspection pursuant to Articles 14(1) to (3) and 15(1) to (3), the provision of advice to users of heating systems and of air-conditioning systems.

Given its intention, Sweden must submit a report to the Commission by no later than 30 June 2011 evaluating the equivalence of these information and advice actions with inspection. That evaluation is presented in this section of the second national energy efficiency action plan.

In transposing Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, Sweden chose, in accordance with Article 8b, to implement information and advice actions for fossil fuel-fired boilers as an alternative to inspection. The activities and the results of the information and advice actions that were carried out in Sweden between 2007 and 2011 are recounted in Section 6.2. Section 6.3 contains proposals for measures to implement the information and advice services alternative pursuant to Article 14(4) of the Directive 2010/31/EU.

Under Directive 2002/91/EC it was not possible to choose providing advice as an alternative to inspection for air-conditioning systems. Section 6.4 gives an account of experiences of how the inspection of air-conditioning systems has taken pl in Sweden up to now. Section 6.5 contains proposals for measures to implement the information and advice services alternative pursuant to Article 15(4) of the Directive 2010/31/EU.

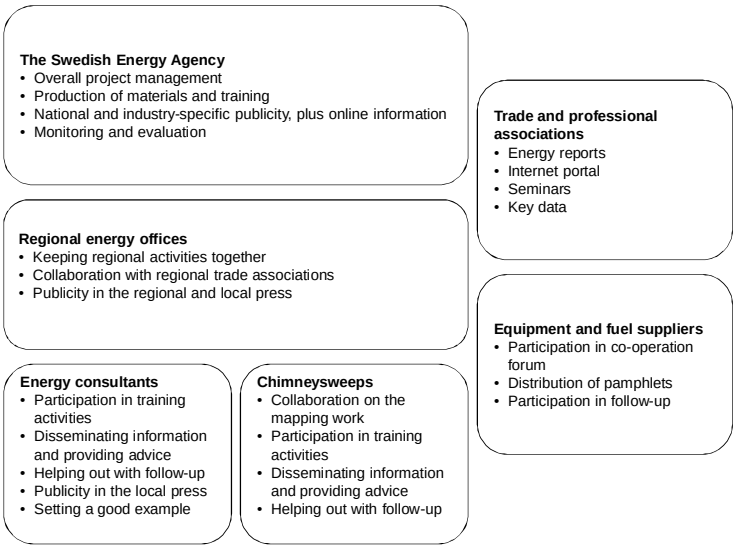
It is a prerequisite if these proposals are to be implemented that funds continue to be set aside in future for municipal energy and climate advice services and some of the operations, information and training activities, etc., of the regional energy offices. At present, funds are set aside in the national budget for 2011 and 2012. The government intends to return to the issue of funding energy and climate advice services after 2012.

6.2 Information and advice action for fossil fuel-fired boilers during the 2007–2011 period

6.2.1 Organisation and target group

The government has given the primary responsibility for the implementation of the information and advice actions relating to fossil fuel-fired boilers to the Swedish Energy Agency. The Agency carries out these activities in collaboration with the regional energy offices and other actors. The Swedish Energy Agency is responsible for co-ordinating and heading up the project at the national level. The Agency is also responsible for producing information and training material and for disseminating information about the action in the national media. The Swedish Energy Agency has delegated responsibility for local and regional co-ordination with trade and professional associations, regional actors such as chimneysweeps and municipal energy and climate consultants, and co-ordination of the mapping of fossil fuel-fired boilers to the regional energy offices. The energy offices have also been a source of advice for chimneysweeps, energy consultants and others. The division of responsibility is illustrated in Figure 5.

Figure 5. Division of responsibility for information and advice actions for fossil fuel-fired boilers during the 2007–2011 period



The target group for the information and advice activities is made up of the owners of properties where individual fossil fuel-fired boilers have a burner calorific output of 20 to 500 kW. However, properties with boilers with a lower calorific output and boilers of up to 1 MW are to be able to benefit from the information action. In practice, the action was targeted at the owners of properties where fossil fuel-fired boilers have a burner calorific output of 60 to 500 kW. The reason for this is that the chimneysweep registers have been divided into boilers under and over 60 kW. The information and advice actions only related to fossil fuel-fired boilers because the purpose is to minimise emissions of carbon dioxide and reduce the import-dependence on fossil fuels through energy efficiency and switchover measures. The target groups have been divided into seven different categories:

- Public property owners
- Manufacturing industry occupying its own properties
- Service and commercial companies
- Service companies where heat consumption is important for the service, for example hotels, fitness facilities, etc.
- Non-profit associations occupying their own properties
- Housing co-operatives and smaller property rental firms
- Larger property rental firms.

Property owners in the category of single-dwelling residences, fossil fuel-fired district heating systems or other larger boiler arrangements were not covered by the information and advice action. The reason for this is that there were many other activities to influence these target groups during the period in question.

In addition to these target groups, regional energy offices, chimneysweeps, energy consultants, trade and professional associations and equipment suppliers have been involved in the work. The Swedish National Board of Housing, Building and Planning, the Swedish Environmental Protection Agency and the Rescue Services Agency (subsequently the Swedish Civil Contingencies Agency) have been affected to some extent by the action and have been informed of the progress and outcome of the work.

6.2.2 Objectives

The Swedish government has set as an objective that the dependence on fossil fuels for energy use in the building sector is to be broken by 2020, while the proportion of renewable energy is to increase on an on-going basis (see Section 2.2).

An overarching objective for the information and advice actions is to get private and public organisations with oil-heated properties to undertake to optimise and/or convert their heating systems, thereby reducing emissions of carbon dioxide and the reliance on imported fossil fuels. The following more specific end-result goals apply to properties with oil-fired boilers with burners in the 20 to 500 kW calorific output range in the regions participating in the action five years after the commencement of the action:

- 50% of the properties with oil-fired boilers are to have undertaken efficiency or conversion measures;
- measures implemented for the same period and calorific output range are to have led to a 20% reduction in oil use compared with when the information and advice action began.

When it comes to the realisation and spread of the information and advice actions, the objective is for:

- 90% of the target group to have been reached or had good opportunities to have been reached, from a purely physical point of view, by information and advice two years after the commencement of the action in their region;
- 50% of those property owners who have been reached by the information to have managed to express interest in implementing measures by no later than two years after the commencement of the action in their region.

6.2.3 Activities carried out at national level

Information material for pamphlets and the Internet

Effektivare uppvärmning i fastigheter [More effective property heating]

The Swedish Energy Agency produced the pamphlet *Effektivare uppvärmning i fastigheter* [More effective property heating] in order to increase knowledge about and interest in converting oil-fired heating systems and to motivate the intended recipients to implement energy efficiency measures in their buildings and heating systems. The aim was to provide the inspiration to reduce the burden on the environment by means of using less energy and consuming less oil.

A presentation and a factsheet have also been produced, based on the above-mentioned pamphlet. The primary purpose of the material is to get across a common message. The presentation can be used in its entirety or on a partial basis and contains the script of a speech to aid energy and climate consultants.

Det är ut med olja inne [Calling time on oil for indoor use]

The factsheet *Det är ut med olja inne* [Calling time on oil for indoor use] is designed to be used by both energy and climate consultants and by master chimneysweeps and is a shorter version of the pamphlet *Effektivare uppvärmning i fastigheter* [More effective property heating].

Good examples

The Swedish Energy Agency's website lists good examples. The examples cover different types of activities and represent the majority of the operative target groups, with the common factor being that all of them have made the conversion from oil. These good examples are designed to be useable when carrying out regional and local activities.

Training key disseminators of information

Training for those advising businesses

The Swedish Energy Agency holds training for those advising businesses that is mandatory for all municipal energy and climate consultants, while staff from the regional energy offices can also register for the course. The training course focuses on improving energy efficiency and on advice for small and medium-sized industrial enterprises. The course consists of 1.5 days of theory and includes a study visit to a local industry on the afternoon of the first day. The theory part includes a section on improving efficiency in heating systems.

Basic training for energy and climate consultants

Municipal energy and climate consultants also have to undergo the basic training produced by the Swedish Energy Agency, which covers practical advice-giving plus energy use in buildings and the indoor climate. In 2009, this training was extended with a section on the connection between energy use and the climate issue.

6.2.4 Activities carried out at the local and regional level

The boiler stock is distributed unevenly across the country and the options for conversion and efficiency improvement differ in different locations. Efforts have therefore been adapted to prevailing regional and local conditions.

First of all, in 2007, a pilot action providing information and advice activities in the four counties of Jämtland, Stockholm, Västra Götaland and Scania was set up in 2007. In December, regional energy offices and the Swedish Energy Agency met to launch the wider action, and share information about the project and working methods. In 2008, information and advice actions began in the remaining participating counties, which can be seen in Table 12 below. The counties of Västra Götaland and Scania, which participated in the earlier pilot action, also participated in the on-going information and advice action.

Mapping the oil-fired boiler stock

All the participating regions launched the action by carrying out mapping of the existing stock. The mapping covered boilers fired using fossil fuels (oil, gas or coal) in the 60 to 500 kW range.

Part of the purpose of the mapping was to obtain contact information for property owners, but it was also carried out in order to make it possible to follow up on the information and advice actions by providing an information basis for the current boiler stock.

The mapping was carried out in collaboration between regional energy offices, municipal energy and climate consultants, master chimneysweeps and other actors with an interest in this area. The starting point for the mapping was the municipal chimneysweep registers. In the county of Jämtland there was also a previous mapping of the stock to use as a basis[50].

Many of the energy offices report that it was difficult to get information from the municipal chimneysweep registers. Out of the total of 290 municipalities in Sweden, 207 are participating in the action (see Table 12). This is partly the result of the fact that not every region took part in the action, but also of the fact that it proved difficult to get information from the municipalities.

Table 12. Results of the mapping of oil-fired boilers

Region	Total number of municipalities	Number of municipalities participating	Number of oil-fired boilers according to the registers	Number of oil-fired boilers in the mapping	Number of property owners in the mapping
Dalecarlia, Gävleborg	25	25	1 691	523	418
Gotland	1	1		172	172
Jämtland	8	8	900	464	210
Norrbotten	14	7	54	17	17
Scania	33	27	2 421	1324	1 324
Småland, Blekinge	35	28	3 563	3057	1 860
Stockholm	26	14	1 131	279	1 131
Uppsala	8	7	463	308	308
Värmland	16	15	600	600	370

[50] The report Inventering av el-och oljeuppvärmda fastigheter i Jämtlands län 1996 [Inventory of electrically and oil-heated properties in the county of Jämtland in 1996] was compiled by the Jämtland county administrative board in 1997.

Västernorrland	7	7	550	550	340
Västra Götaland	49	43	3 951	2140	1 150
Örebro, Östergötland	25	25	1 845	574	425
Total	**247**	**207**	**17 169**	**10 008**	**7 725**

The mapping shows that a large proportion of the oil-fired boilers that are included in the municipal chimneysweep registers were already converted before the information and advice actions began. In total, 42% of the oil-fired boilers included in the chimneysweep registers had already been converted before the action began.

Information and advice actions

Training

Training for municipal energy and climate consultants was arranged at the beginning of the action so that they could pass on their knowledge to businesses in the region. In Scania, in particular, the focus in the pilot action was on preparing chimneysweeps, energy and climate consultants and relevant industry organisations before the action began.

Contact via telephone for information and/or advice services

In connection with mapping the boiler stock, many energy offices made contact via telephone with property owners who the chimneysweep registers indicated had fossil fuel-fired boilers. The purpose of these calls was to obtain information about whether the property owner had undertaken any energy efficiency and/or conversion measures, to offer advice and information about energy efficiency and conversion measures and, in certain cases to, provide information about and invitations to seminars and/or information meetings.

Some energy offices have made use of call centres in order to initiate contact with property owners. In the majority of the counties, the regional energy offices called property owners either themselves or in collaboration with local energy and climate consultants. Those energy offices that chose to contact property owners themselves perceived that there was added value in coming into contact with a target group that can otherwise be difficult to reach.

A number of regional energy offices sent out an information mailshot to property owners prior to making telephone contact. The mailshot contained pamphlets and information on conversion and energy efficiency measures.

Mailshot of information materials

The information materials in the mailshot from the regional energy offices usually took the form of a letter from the municipality with a brief description of the action, information pamphlets that had been produced (such as *Effektivare uppvärmning i fastigheter* [More effective property heating] and/or *Minska företagets energianvändning* [Reduce your company's energy use]), and invitations to upcoming seminars and/or information meetings.

The majority of energy offices sent a letter with information materials to every property owner with a fossil fuel-fired boiler in the region (Jämtland, South-East[51], Västernorrland, Västra Götaland). In a few regions, the mailshot of information materials was only sent to property owners that had not been contacted by telephone (Gävleborg/Dalecarlia). Other regions chose to send out their mailshots of information materials only to properties who had expressed an interest in more information during telephone conversations (Stockholm and Uppsala).

As a follow-up to conversations involving advice services, many energy offices emailed the property owners in question with tips, links, information materials and invitations to seminars and/or information meetings.

Seminars, conferences, campaigns

Seminars with various speakers and on various subjects have taken place in the various regions in order to inspire property owners to take energy efficiency and/or conversion measures. Such seminars have focussed on alternative fuels to oil and on improving energy efficiency.

Participation take-up in the seminars has varied between the different regions. In regions where participation has been low, the reason for that may be that the majority of property owners have already converted or have plans to convert that are already at a late stage and so do not need further information. Factors such as who was speaking, organisation, timing and the invitations themselves also had an influence on what interest there was in the seminars.

In connection with regional/national campaigns, some of the energy offices provided information about the information and advice action for fossil fuel-fired boilers. On the island of Gotland, the "Become Energy-Smart" campaign was carried out in conjunction with the work on promoting biofuels and solar heating. In Jämtland, the "Energy days, autumn 2007" campaign was held. A few energy offices also participated in and provided information about the information and advice action for fossil fuel-fired boilers in connection with other conferences arranged in the region in question.

[51] The South-East Energy Office covers the counties of Blekinge, Kalmar and Kronoberg.

Establishment of networks

Local and regional networks were formed in some regions in order to exchange information and inspiration. Network partners included local property owners with oil-fired boilers, energy and climate consultants, master chimneysweeps, municipal environmental and building offices, the county administrative boards, trade associations, professional associations, district heating and block heating companies, the energy office and others.

Visits to companies, group meetings

Direct visits to companies in order to inspire them to take energy efficiency and conversion measures have represented a good but time-consuming method valued by the companies concerned. In Östergötland and the county of Örebro, nearly 70 firms were visited. Group meetings or "round table discussions" to talk about conversion and efficiency improvement measures have been held in numerous regions. They have been a valued method for property owners to exchange experiences and specific tips.

6.2.5 Results

The information and advice actions carried out were followed up on approximately a year after activities commenced. The follow-up method was different in the different regions. In those regions where the follow-up took the form of sample checks, the results are more uncertain than in those regions where all the property owners were contacted again.

At the beginning of the action, records of the number of oil-fired boilers in the regions were incomplete. All the energy offices reported that it took time to map the number of oil-fired boilers in their regions. The results of the mapping in each region are given in Table 13. The first column shows the number of oil-fired boilers that were reported in the local chimneysweep registers. These registers were compiled over a number of rounds and dated, for most municipalities, from the turn of the 21st century, while for other municipalities they were updated in the same year as the action was launched. This is one explanation for why there is such large variation in the table: in some regions the same total is given for oil-fired boilers in the chimneysweep register and the mapping, while in other counties there are major differences between these numbers.

As Table 13 shows, the number of oil-fired boilers in relevant regions has fallen by 60% since the beginning of the 2000s, from nearly 17 200 to a little over 6 800. The use of fossil fuels in single-dwelling residences, multi-dwelling residences and business premises in Sweden has fallen continually for many decades. The fact that the boiler stock has fallen drastically can also be seen by the falling use of oil in residential properties and business premises (see Figure 6). Overall, the use of oil fell by 94% between 1983 and 2009, from 46.9 TWh to 2.7 TWh.

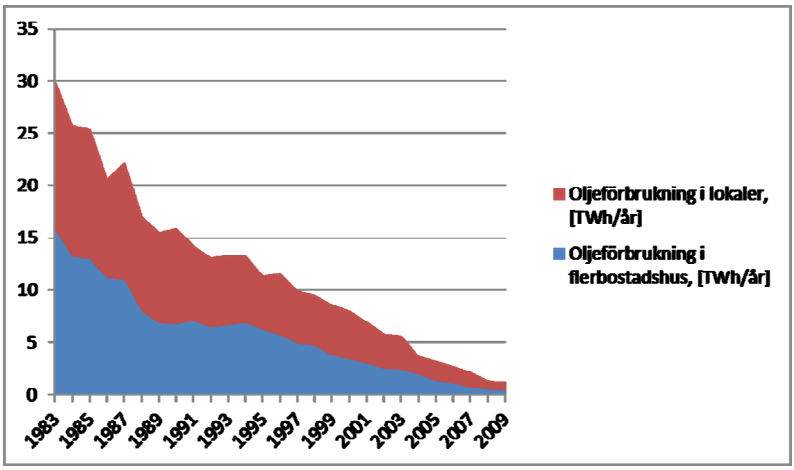
Table 13. Results of mapping and follow-up

Region	Oil-fired boilers according to the registers[1]	Oil-fired boilers according to the mapping[2]		Oil-fired boilers according to the follow-up	
	Number	Number	Percentage	Number	Percentage
Dalecarlia, Gävleborg	1 691	523	31	445	85
Gotland		172		69	40
Jämtland	900	464	52	295	64
Norrbotten	54	17	31	17	100
Scania	2 421	1 324	55	875	66
Småland, Blekinge	3 563	3 057	86	1 860	61
Stockholm	1 131	279	25		
Uppsala	463	308	67	297	96
Värmland	600	600	100	324	54
Västernorrland	550	550	100	398	72
Västra Götaland	3 951	2 140	54	1 972	92
Örebro, Östergötland	1 845	574	31	288	50
Total	**17 169**	**10 008**	**58**	**6 840**	**68**

[1] Data from the chimneysweep registers for oil-fired boilers for each region, dated 2003 or 2007

[2] Updated boiler stock based on the mapping carried out

Figure 6. Oil use in multi-dwelling residences and business premises (1983-2009)



Source: Statistics Sweden and the Swedish Energy Agency

Key to figure

Öljaförbrukning i lokaler, [TWh/år] = Oil consumption in business premises, [TWh/year]

Öljaförbrukning i flerbostadshus, [TWh/år] = Oil consumption in multi-dwelling residences, [TWh/year]

When it comes to communication actions, Table 14 shows that the information and advice actions did reach the majority of relevant property owners in most regions. The target of reaching 90% of property owners has been achieved in all but three of the regions. The target of half of those property owners in the region in question who have been reached by the information and advice managing to express interest in implementing measures by no later than two years after the commencement of the action has been achieved in half of the regions.

Table 14. Results of information and advice actions carried out

Region	Property owners in the mapping	Property owners reached by information and advice		Property owners reached who are interested in implementing measures	
	Number	Number	Percentage	Number	Percentage
Dalecarlia, Gävleborg	418	412	99	330	80
Gotland	172	172	100	0	0
Jämtland	210	210	100	110	52
Norrbotten	17	17	100	12	71
Scania	1 324	1 296	98	770	59
Småland, Blekinge	1 860	810	44	40	5
Stockholm	1 131	671	59	203	30
Uppsala	308	308	100	204	66
Värmland	370	364	98	115	32
Västernorrland	340	340	100	115	34
Västra Götaland	1 150	1 150	100	105	9
Örebro, Östergötland	425	337	79	201	60
Total	**8 784**	**6 087**	**69**	**2 205**	**36**

6.2.6 Conclusions and recommendations for future advice actions

Property owners are interested in reducing their consumption of oil. Economic reasons mean that both improving efficiency and conversion are of interest. This view is backed up by the introductory mapping, which exhibits a major reduction (60%) in the number of oil-fired boilers since the start of the 2000s. This makes clear that measures are actually being taken and that fossil fuel-fired boilers are being phased out at a rapid pace.

Many of the regional energy offices say that they found that knowledge about alternatives to fossil fuels were already high before the start of the action. One energy office said that, in many cases, “it was like kicking in open doors”. At the same time, other energy offices say that they have found that many companies have poor knowledge about their installations and what measures were needed. This shows that there is a large degree of variation between and within the regions in respect of knowledge about and interest in improving energy efficiency and conversion.

In many cases, participation in seminars was considerably lower than anticipated, and in some cases seminars were cancelled. One reason may be that the oil-fired boiler stock proved considerably smaller than the registers indicated.

In many of the regions, it has been difficult to obtain basic information for mapping, which means that the statistics for the number of boilers are not fully complete. This is partly because it was difficult to get registers from all the municipalities and that the registers used were not complete. There are uncertainties in the chimneysweep registers – the fact that a boiler is included in a register does not necessarily mean that it is used as a primary source of heat. In many cases the oil-fired boilers are out of operation, have already been converted or are used only for peak load. The fact that registers and contact information was incomplete was an obstacle to work on information and advice actions. In some regions, the difficulties in reaching property owners as a result of erroneous address information meant that considerably fewer property owners were reached than was planned.

One good method is on-site advice services for businesses on their premises. The reviews are very much valued and lead to greater understanding both of energy efficiency improvements and conversion. Carrying out on-site visits made it possible to discuss the existing system and, in many cases, it showed that the existing oil-fired boilers were far too large and could be replaced for a considerably lower investment cost than anticipated. Added value is provided by the fact that the action has provided a natural way to discuss improving energy efficiency with a target group that is relatively difficult for the energy offices to reach. One specific consequence of the project is that the extension of district heating into an industrial area in Värmland has been accelerated.

Information and advice actions for oil-fired boilers have taken place at a time when there is a move away dependence on oil. It is impossible to say what impact the information and advice action had on the switch away from oil. The action did not change the target group's knowledge that oil is expensive – everyone is aware of that. On the other hand, the information and advice actions did have an impact by means of bringing the issue to the top of the agenda and accelerating conversions made.

In light of the results of the advice actions thus far, we can give the following recommendations for future actions:

- The most successful method has proven to be making direct contact with the property owners through either networks, giving advice over the telephone or on-site visits
  - Take an active approach with personal communication with the target group, for example call instead of sending letters
  - Design the working procedures around the needs and objectives of the target group Communicate with those who are interested, but do not "kick in open doors"
  - Design the project with multi-stage communication to the target group. The more times contact is made, the better the impact

- Create a structure that provides feedback in respect of the results of the work Facilitate follow-up and evaluation
  - Make clear what is to be followed up on before the start of the action
  - Plan the action so that energy offices and energy and climate consultants are able to involve local actors.

6.3 Proposed information and advice actions for heating systems as of 2012

6.3.1 Prerequisites

The changed rules under the recast Energy Performance of Buildings Directive (2010/31/EU) mean that advice has to cover a larger section of the heating system compared with previous actions. The Member States now have to ensure that advice is provided to users of heating systems, instead of users of oil-fired boilers, as was previously the case. The advice has to concern the replacement of boilers, other modifications to the heating system and alternative solutions to assess the efficiency and appropriate size of the boiler.

6.3.2 Organisation and target group

The Swedish government takes the view that future advice actions relating to heating systems should build on the system so far, where the Swedish Energy Agency has overall responsibility (see organisational chart, Figure 5). The government believes, however, that municipal energy and climate consultants (see Section 3.4.4) could play a more active role. Since 1998, energy and climate advice has been run by the municipalities with funding from the state. These consultancy services are to be found in every municipality in Sweden and have been developed over the years to incorporate information relating to energy, the climate and transport, primarily for the target groups of the general public and small and medium-sized enterprises. From the outset, municipal consultancy has been the most important channel for those information actions aimed at the general public and small and medium-sized enterprises for which the Swedish Energy Agency is responsible. At the moment, the municipal energy and climate consultants already provide information about different aspects of buildings' heating systems. The impact of the heating system on comfort, quantity of energy used, economy and the climate has always been a primary issue for the energy and climate consultants. There is, however, a need for better information materials in order to be able to provide advice that covers the whole heating system.

The government believes that the target groups for advice actions relating to heating systems should essentially be the same as before, but the difference is that it covers more heating systems where the boilers can be fired using any fuel source. Actions should therefore cover owners of properties with heating systems with boilers in the 20 to 500 kW range, but information must also be available for owners of heating systems with smaller or larger boilers up to 1 MW. The target groups are divided into seven different categories:

- Public property owners
- Manufacturing industry occupying its own properties
- Service and commercial companies
- Service companies where heat consumption is important for the service, for example hotels, fitness facilities, etc.
- Non-profit associations occupying their own properties
- Housing co-operatives and smaller property rental firms
- Larger property rental firms.

The information action will not address the owners of heating systems in the single-dwelling residences category or boilers in district heating systems or other larger boiler arrangements. Owners of borehole-source or other types of heat pump are similarly not addressed, as these systems are not fired by any fuel. Parts of the material and the planned activities could be used for improving energy efficiency in and replacing boilers of almost 1 MW.

Given that regional energy offices, chimneysweeps, municipal energy and climate consultants, trade and professional associations and equipment suppliers could need to be involved in working on the action, these groups are also important target groups. The Swedish National Board of Housing, Building and Planning, the Swedish Environmental Protection Agency and the Swedish Civil Contingencies Agency are affected to some extent by such an action and should therefore be kept informed of the progress and outcome of the action.

6.3.3 Measures to improve advice services

In planning future advice services, experiences from previous actions must be utilised – for example in terms of making use of direct contact with businesses via networks, telephone advice services or on-site visits. It is desirable to create a uniform action across Sweden, although consideration should be given, at the same time, to local conditions.

In order to achieve the desired results, the government believes that information actions need to be improved in the following areas:

- Better written material about the heating system, its parts and size
- A factsheet about heating systems should be issued to property owners in connection with energy certification
- The training for energy and climate consultants needs to be augmented with information about heating systems
- A review of existing online material on heating systems. Supplement and make reference to such material and to the website energiaktiv.se for property owners.

There is also a need for an enhanced follow-up action in order to meet the requirements both of this Directive and of the Renewables Directive. The new external network for municipal energy and climate consultants enables the consultants to input information about the questions asked, which can then be processed statistically. This provides a new opportunity to follow up on the actions implemented and on what need there is of information. That makes it possible to enter the system – which does not store any kind of personal data – and see how common the provision of advice is in different areas.

If the actions are to be evaluated, it is necessary to clarify the follow-up requirement before the actions even begin.

6.4 Inspection of air-conditioning systems prior to 2012

6.4.1 Requirements under current legislation

Under the original Energy Performance of Buildings Directive (Directive 2002/91/EC), air-conditioning systems of an effective rated output of more than 12 kW must be inspected. In Sweden, this requirement was transposed as follows.

Section 10 of the Act (2006:985) on energy certification for buildings lays down a requirement that, where an air-conditioning system is electrically powered, there must be information in the energy certificate about the energy efficiency of the system, the size of the system relative to the cooling requirements of the building and whether more efficient energy use can be achieved in the existing system or by replacing the system with another system or another method of cooling the building. Under Section 11 of the same Act, air-conditioning systems in buildings that are not required to undergo energy certification must nonetheless be inspected at regular intervals.

The Swedish National Board of Housing, Building and Planning's administrative provisions and general guidance (BFS 2007:4) on energy certification for buildings require an air-conditioning system to be inspected to the extent necessary in order to be able to assess the efficiency of the system and to make it possible to carry out a comparison between the cooling power of the system and the scale of cooling required by the building. It is also stipulated that the interval between inspections is to be the same as for energy certification, which is to say 10 years.

In light of this, the Swedish National Board of Housing, Building and Planning asks for information on air-conditioning systems in the form that constitutes the energy certificate. The reporting requirement is only at a general level, however, and the information requested is information about the cooling power of the cooling system, the building's requirement for cooling and its temperate area. If there are energy efficiency measures for the air-conditioning system or another way to reduce the need for cooling, these must also be reported.

6.4.2 Results of current legislation

In total, roughly 333 000 buildings have been energy-certified in Sweden. Around 157 200 of these are buildings that include business premises. It is primarily in this category that air-conditioning systems with a cooling power of more than 12 kW are to be found. Around 52% of the total number of buildings containing business premises for which certification is required have been certified. Of these, approximately 4.5% have air-conditioning systems over 12 kW. Of these, roughly 38% contain efficiency measures relating to air conditioning.

For buildings that are not subject to the requirement for energy certification but where requirements are laid down for inspection of the air-conditioning systems, the inspection report must be recorded by the Swedish National Board of Housing, Building and Planning. The Swedish National Board of Housing, Building and Planning has only received four inspection reports for air-conditioning systems (for buildings that are exempt from the requirement for energy certification). The reason for this very low figure is probably that the legislation does not lay down any final date by which such an inspection must have been carried out.

When it comes to air conditioning in connection with energy certification, there has been criticism from the European Commission, the Swedish National Board of Housing, Building and Planning and the Swedish Energy Agency, amongst others, some of which is as follows:

- An interval of 10 years between inspections is too long. Such systems often have an economic lifetime that is shorter than this. Having closer inspection of air-conditioning systems means that this information cannot be integrated into the energy certification as has been done.
- There is no end time limit by which inspection must have been carried out for those buildings that are not subject to the requirement for energy certification.
- It is often difficult to find out an air-conditioning system's effective rated output as there is often no documentation or rating plates. Similarly, it is resource-intensive to calculate the cooling requirements of a building. There are usually no plans available or else the activities in the building, and therefore its cooling requirements, have altered. There has been criticism that the costs of producing this information are disproportionate to the benefit.
- There can be no active supervision as it is not known which buildings have air-conditioning systems.
- Inspection of air-conditioning systems may be carried out by non-certified individuals (although they must be employed by an accredited inspection body).

In this context, however, it is also important to note that, for those systems that form part of a ventilation system, inspection of air-conditioning systems over and above what is performed in connection with energy certification is also carried out in connection with mandatory checks on ventilation systems. In light of this, the Swedish government has concluded that, taken together, Swedish legislation has satisfied the requirements under the Directive for the inspection of air-conditioning systems. On the other hand, the government has decided that advice actions would constitute a valuable complement to the inspections of air-conditioning systems that are carried out in connection with mandatory checks on ventilation systems and that the rules could be simplified somewhat by eliminating the overlap in the legislation. The requirements pertaining to mandatory checks on ventilation systems are described below.

6.4.3 Requirements pertaining to mandatory checks on ventilation systems

Pursuant to planning and construction legislation, the Swedish National Board of Housing, Building and Planning is issuing Administrative provisions and general guidance (BFS 2011:16) on functional checks on ventilation systems and the certification of specialist functional testers, referred to as mandatory checks on ventilation systems (Swedish abbreviation: OVK). The purpose of requirements for functional checks on ventilation systems is to ensure that there is a satisfactory indoor climate in buildings. Table 15 shows which buildings are covered and at what intervals the recurrent functional checks are to take place.

Table 15. Requirements for mandatory checks on ventilation systems for different buildings

Building type	Interval between inspections
Preschools, schools, care facilities and similar buildings, irrespective of the type of ventilation system; multi-dwelling residences, office buildings and similar with ‘FT’ or ‘FTX’ ventilation	3 years
Multi-dwelling residences, office buildings and similar with ‘F’, ‘FX’ or ‘S’ ventilation	6 years

The requirement for functional checks does not apply to residential properties consisting of one or two dwellings with natural ventilation or mechanical exhaust air ventilation without heat recovery. The requirement likewise does not apply to farm buildings for agriculture, forestry or similar activities, industrial buildings, nor to buildings intended for defence activities that are of a secret nature.

As part of the recurrent functional checks on ventilation systems it is required to investigate energy-saving measures within the ventilation system that will not lead to a deterioration of the indoor climate. It is required, as part of the functional checks, to investigate and report on the conceivable options applying to the ventilation system in question. The measures that the functional tester proposes must be weighed against any negative impact on the indoor climate. The property owner can then use the functional tester's proposals as the basis for collecting further basic data, where needed, in advance of a decision on energy efficiency measures. It is thus the property owner who decides whether energy efficiency measures are to be taken. Functional testers must always be certified.

6.5 Proposed information and advice actions for air-conditioning systems as of 2012

6.5.1 Prerequisites

Considering the deficiencies in the current system for energy certification for buildings, and in particular that it is not possible to tie in effective supervision with this system, but also that the legislation can be subject to revision so that the instrument will better lead to the intended effect, the Swedish government is of the opinion that provision of advice is a better alternative than inspection for certain types of air-conditioning system.

Article 15(4) of Directive 2010/31/EU stipulates that advice is to be provided to users of air-conditioning systems of an effective rated output of more than 12 kW. The said advice is to concern the replacement of air-conditioning systems or other modifications to the air-conditioning system which may include inspections to assess the efficiency and appropriate size of the system.

6.5.2 Target group and organisation

The information actions for air-conditioning systems should, the government believes, primarily focus on the owners of properties with air-conditioning systems larger than 12 kW, but it must also be possible to provide information to owners of smaller air-conditioning systems. Air-conditioning systems are primarily found in buildings containing business premises, and the target group has been subdivided into three different categories:

- Public property owners
- Manufacturing industry occupying its own properties
- Service and commercial companies.

The information action will not target the owners of air-conditioning systems in the single-dwelling residences category. Similarly, owners of air/air heat pumps (which, in the summer, can be used for cooling) are generally not affected, as these heat pumps have an effective output of less than 12 kW.

Air-conditioning systems can be divided into two groups. One group consists of air-conditioning systems that form part of a ventilation system. Such systems are covered by the mandatory checks on ventilation systems (referred to in Swedish by the abbreviation OVK). Those property owners with buildings that are not subject to the requirement for energy certification but that have air conditioning with an effective rated cooling output of more than 12 kW and ventilation that is subject to requirement for recurrent checks on ventilation systems can be reached via the certified ventilation inspectors. However, those without ventilation for which inspection is required will not, going forwards, be reached by the information unless steps are taken to ensure this.

The Swedish government therefore takes the view that advice actions relating to air-conditioning systems should build on the existing system of mandatory checks on ventilation systems (see Section 6.4.3) in combination with the existing systems of municipal energy and climate consultancy services (see Section 3.4.4). Those air-conditioning systems that are not reached through inspection and information in connection with mandatory checks on ventilation systems must therefore be reached through other advice actions.

Regional energy offices, trade and professional associations and equipment suppliers may need to be involved in working on the action, and so these groups are also important target groups. The Swedish National Board of Housing, Building and Planning, the Swedish Environmental Protection Agency and the Swedish Civil Contingencies Agency are affected to some extent by such an action and should therefore be kept informed of the progress and outcome of the work.

6.5.3 Measures to improve advice services

In planning actions, experiences from previous information and advice actions must be utilised – for example in terms of making use of direct contact with businesses via networks, telephone advice services or on-site visits. It is desirable to create a uniform action across Sweden, although consideration should be given, at the same time, to local conditions.

In order to achieve the desired results, the government believes that information actions need to be improved in the following areas.

Written materials

The production of written materials concerning air-conditioning systems, their parts and sizing in collaboration with trade associations, such as Kyl och Värmepumpföretagen, a trade association for companies active in installation, servicing and contract work on cooling pump and heat pump installations and responsible, *inter alia*, for the Swedish Cooling Standards[52].

Mandatory checks on ventilation systems

Business premises with air conditioning over 12 kW usually have either 'FT' or 'FTX' ventilation. They are thus subject to the requirement for mandatory checks on ventilation systems. In connection with such inspections, the functional inspector must also make suggestions for improving the energy efficiency of the ventilation system. However, the area of responsibility of a separate ventilation system is limited. When ventilation checks are carried out, the certified inspectors may also pass on the information materials on air-conditioning systems that have been produced to property owners with comfort air conditioning.

Energy certification

For buildings that are subject to a requirement for energy certification and that contain air-conditioning systems, these systems will continue to be reviewed for their energy efficiency exactly like other systems in the building (heating, ventilation, hot water, etc.). However, it is not an obligatory requirement to carry out an inspection of the building when carrying out energy certification. If the building exhibits good energy performance and it thus cannot be expected that there will be cost-effective suggestions for measures to propose, energy certification may take place without an inspection. It can then also be presupposed that there are no cost-effective suggestions for measures for air-conditioning systems. In order to augment the information on efficiency improvement options for air-conditioning system, information sheets on improving energy efficiency can be added to the energy certificate for those buildings with air conditioning.

[52] See www.kvforetagen.se.

Energy and climate consultants

In the past, municipal energy and climate consultants have only given advice about air-conditioning systems on an exceptional basis. Advising businesses is one service that is becoming increasingly common for the consultants. In order to meet the requirements under the Directive, the consultants must provide businesses with advice on air-conditioning systems. This may require more resources in the form of consultancy time, planning actions and reporting. In order to increase the consultants' expertise in relation to air-conditioning systems, the Swedish Energy Agency's compulsory basic training for Sweden's energy and climate consultants should be supplemented with training on air-conditioning systems.

Campaigns coordinated by the regional energy offices have proven to be a good way to reach the target groups with information materials. The most successful method is direct contact with businesses via networks, telephone advice services or on-site visits.

There is also a need for an enhanced follow-up action in order to meet the requirements of the Directive. The new external network for energy and climate consultants enables the consultants to input information about the questions asked, which can then be processed statistically. This provides a new opportunity to follow up on the actions implemented and the subjects on which information is needed. That makes it possible to enter the system – which does not store any kind of personal data – and see how common the provision of advice is in air-conditioning systems or other areas.

If the actions are to be evaluated, it is necessary to clarify the follow-up requirement before the actions even begin.

The energiaktiv.se web portal

General information can also be provided via the existing information and advice portal energiaktiv.se. In addition, there is a need for a review of existing online materials on air-conditioning systems on the websites of the Swedish National Board of Housing, Building and Planning and the Swedish Energy Agency.

Annex 1. Calculation methods

This Annex sets out the methods and lifetimes recommended by the European Commission. Comments are only added where calculations in this action plan deviate from the Commission's recommended methods.

Households and services (residential properties and business premises)

Method 2.2 Insulation, conversion (walls, roofs, windows) in residential properties and business premises

$$UFES_x = \frac{\left(Uvalue_{init} - Uvalue_{new}\right) \cdot HDD \cdot 24h \cdot a \cdot \frac{1}{b} \cdot c}{1000}$$

$UFES_x$ = annual unitary final energy savings relative to x (kWh/m^2); X = windows, insulation; U_{init}= initial U value (W/m^2·K), U_{new}= new U value (W/m^2·K); HDD = number of heating degree days (K·days/year);

a = correction factor for the climatic zone; b = correction factor for efficiency; c = correction factor for the time.

Detailed data is required in order to be able to use method 2.2 – information is required for each individual building. Given that there are no statistics for individual buildings, the savings from windows and insulation have been calculated by means of calculating the change in reduced heat losses in the building stock based on data on area and U values. This produces a conductance in watts per kelvin (W/K) which can then be multiplied by the number of degree days in a year to obtain the reduced heat losses in Wh/year.

Conductance is calculated using the formula:

$$\Delta UA = ELIB \sum_{i=-1960}^{1976-1988} \overline{U}_i \cdot A_i^{tot} - BETSI \sum_{i=-1960}^{1976-1988} \overline{U}_i \cdot A_i^{tot}$$

U_i = average U value for a structural element in buildings of a certain age class (up to 1960, 1961–1975, 1976–1988); A_i = total area for the structural element for the age class in question;

ELIB = statistics from the national study Electricity economy in buildings; BETSI = statistics from the national study Energy use, technical status and indoor environment of buildings.

Degree hours are calculated using the formula:

The calculation of degree hours has been weighted by hours in each municipality having been weighted against the number of residents in that municipality.

$$\overline{GT} = 24\sum_{i=1}^{290} GT_i \cdot AI_i \,/\, \sum_{i=1}^{290} AI_i = 24 \cdot 3734 = 89616$$

GT_i = number of degree days in municipality i; AI_i = number of residents in municipality i.

Method 2.4 Conversion of heating systems in residential properties and business premises

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}} \right) \cdot SHD \cdot A$$

UFES = unitary final energy savings (kWh/unit/year); η_{init}= efficiency of old system, η_{new}= efficiency of new system; SHD = specific heating demand (KWh/m^2/year); a = average area (m^2).

In order to employ method 2.4, the savings for each individual building must be calculated and then added up for the national level. Since there are no statistics for individual buildings, statistics for the entire stock (all single-dwelling residences, multi-dwelling residences and business premises) have been used. The number of cases of replacement and conversion are listed in the basic data. Together with basic data concerning how the efficiency has changed (corresponding to the parentheses in Method 2.4) for various kinds of boiler and heat pump, the total savings have been calculated according to Method 2.4 but with the following alteration.

$$UFES = \left(\frac{1}{\eta_{init}} - \frac{1}{\eta_{new}} \right) \cdot HD_n$$

HD_n = total net heating demand for segment n of the building stock, which has improved its efficiency by means of switching to new boilers, etc.

Method 2.7 Solar heating in residential properties and business premises

$$UFES = \frac{USAVE}{\eta_{stock\_average\_heating\_system}}$$

UFES = unitary final energy savings (kWh/m^2/year); $\eta_{stock\_average\_heating\_system}$= average efficiency of existing heating systems; USAVE = average annual savings per m^2 of solar panel (kWh/m^2).

Method 2.7 has been employed, but the average efficiency in existing heating systems has been omitted.

Method 2.8 Switchover and new domestic appliances in residential properties

$$UFES = AEC_{reference\_year\_stock\_average} - AEC_{reference\_market\_promoted\_energy\_class}$$

UFES = unitary final energy savings (kWh/unit/year); $AEC_{reference\_year\_stock\_avergae}$ = annual energy consumption of the stock in 1995 or 2007 (kWh/unit/year); $AEC_{reference\_market\_promoted\_energyclass}$ = annual energy consumption of the promoted stock (kWh/unit/year).

Method 2.8 was employed for calculating for energy-efficient white goods in both domestic settings and business premises. As Sweden does not promote particular energy classes, an average value for the appliances on the market was compared with the stock of appliances.

Method 2.9 Switchover or new bulbs in residential properties

$$UFES = \frac{(P_{stock\_average} - P_{best\_market\_promoted}) \cdot n_h \cdot F_{rep}}{1000}$$

UFES = unitary final energy savings (kWh/unit/year); $P_{stock\_average}$ = power average of the existing lighting bulbs in 1995 or 2007 (W); $P_{best\_market\_promoted}$ = power average of the market-promoted bulbs (W); η_h = average number of operating hours; F_{rep} = correction factor for the number of bulbs purchased but not used straight away.

As Sweden does not promote particular energy classes, an average value for the bulbs on the market was compared with the stock of bulbs. Instead of using the Commission's recommended operating hours, data from electricity meters was used[53].

Method 2.10 C Switchover or new bulbs in business premises

$$UFES = \frac{(p_{ini} \cdot n_{h\_ini} - p_{new} \cdot n_{h\_new})}{1000}$$

UFES = unitary final energy savings (kWh/unit/year); P_{ini}= power average per light source per square metre in the stock in 1995 or 2007 (W/m^2); P_{new} = power average per light source per square metre for promoted bulbs (W/m^2); η_{h_ini} = average operating hours before replacement, η_{h_new} = average operating hours after replacement.

[53] The Swedish Energy Agency metered electricity use at the appliance level in 400 households. For more information, see www.energimyndigheten.se.

As Sweden does not promote particular energy classes, an average value for the bulbs on the market was compared with the stock of bulbs. Instead of using the Commission's recommended operating hours, data from STIL2 was used[54]. As data from STIL2 is given in kWh instead of W/m^2 and average operating hours, kWh was used in the subtraction above.

Industry

Method M8

$$Indikator \frac{E^{I^X}}{VA^{I^X}};$$

$$M8 = \left(\frac{E_{2007}{}^{I^X}}{VA_{2007}{}^{I^X}} - \frac{E_t{}^{I^X}}{VA_t{}^{I^X}} \right) \cdot VA_t^{I^X} \cdot K_{2007}^{I^X}$$

E^{Ix}_{2007}, E^{Ix}_t = energy consumption of sub-sector x in 2007 and in year t; K^{Ix}_{2007} = share of energy consumption of sub-sector x falling under the scope of the Directive; V^{Ix}_{2007}, V^{Ix}_t = value added in real terms of sub-sector x in 2007 and in year t.

Transport

All calculations in the transport sector were made in kWh instead of oil equivalents. In order to reduce the effect of individual years, the savings for early actions were realised by means of using average values over three years instead of simply using the statistics for the start and end years.

Method P8 Passenger cars

$$Indicator \frac{E^{CA}}{T^{CA}}; \qquad P8 = \left(\frac{E_{2007}{}^{CA}}{T_{2007}^{TLV}} - \frac{E_t{}^{CA}}{T_t{}^{CA}} \right) \cdot T_t^{CA}$$

E^{CA} = energy consumption for cars (kWh); T^{CA} = total passenger transport traffic (person-kilometres)

[54] The Swedish Energy Agency takes stock of the energy use in various types of business premises by means of the STIL2 project. For more information, see www.energimyndigheten.se.

Method P9 Heavy goods vehicles

$$Indicator \frac{E^{TLV}}{T^{TLV}}; \qquad P9 = \left(\frac{E_{2007}^{TLV}}{T_{2007}^{TLV}} - \frac{E_t^{TLV}}{T_t^{TLV}} \right) \cdot T_t^{TLV}$$

E^{TLV} = energy consumption for heavy goods vehicles (kWh); T^{TLV} = total freight transport traffic (tonne-kilometres)

Method P9 A2 Light goods vehicles

$$Indicator \frac{E^{TLV}}{S^{TLV}}; \qquad P9A2 = \left(\frac{E_{2007}^{TLV}}{S_{2007}^{TLV}} - \frac{E_t^{TLV}}{S_t^{TLV}} \right) \cdot S_t^{TLV}$$

E^{TLV} = energy consumption for light goods vehicles (kWh); S^{TLV} = stock of light goods vehicles.

The reason that different indicators are used for heavy and light goods vehicles is that there are only statistics for total freight transport traffic for heavy goods vehicles. In order to still incorporate the trends for light goods vehicles, a different indicator is used for light goods vehicles, a modified version of the Commission's P9 A2. The method in question actually shows the energy consumption per goods vehicle, as in the formula above. On the other hand, Sweden does have statistics for the distances driven by this vehicle group. To thus use the existing statistics for distances driven and the calculated indicator for energy consumption per km should represent a accurate way to calculate savings for light goods vehicles than simply to consider the number of vehicles.

Method P10 Railways, passenger

$$Indicator \frac{E^{RPa}}{T^{RPA}}; P10 = \left(\frac{E_{2007}^{RPa}}{T_{2007}^{RPa}} - \frac{E_t^{RPa}}{T_t^{RPa}} \right) \cdot T_t^{RPa}$$

E^{RPa} = energy consumption (kWh); T^{RPa} = total passenger transport traffic (person-kilometres)

Method P11 Railways, freight

$$Indicator \frac{E^{RFa}}{T^{RFr}}; \qquad P11 = \left(\frac{E_{2007}^{RFr}}{T_{2007}^{RFr}} - \frac{E_t^{RFr}}{T_t^{RFr}} \right) \cdot T_t^{RFr}$$

E^{RFr} = energy consumption (kWh); T^{RFr} = total freight transport traffic (tonne-kilometres).

Method P12 Transfer of passenger journeys from cars to public transport

$$Indicator\ \frac{T_{Public}^{Pa}}{T^{Pa}};$$

$$P12 = (PT_t - PT_{2007}) \cdot T_t^{Pa} \cdot (UE_t^{CA} - UE_t^{PT})$$

PT = share of public transport (calculated in person-kilometres); T = total passenger traffic (person-kilometres);

UE^{CA} = unit energy consumption of cars (kWh/person-kilometre);

UE^{PT} = unit energy consumption of public transport (kWh/person-kilometre).

Method M6 Railways

$$Indicator\ \frac{E^R}{T^R}; \qquad M6 = \left(\frac{E_{2007}^R}{T_{2007}^R} - \frac{E_t^R}{T_t^R} \right) \cdot T_t^R$$

E^R = energy consumption of rail transport (kWh); T^{RFr} = total transport traffic (tonne-kilometres).

Method M7 Maritime transport

$$Indicator\ \frac{E^W}{T^W}; \qquad M7 = \left(\frac{E_{2007}^W}{T_{2007}^W} - \frac{E_t^W}{T_t^W} \right) \cdot T_t^W$$

E^W = energy consumption of maritime transport (kWh); T^R = total transport traffic (tonne-kilometres).

Lifetimes

Table B1-A shows some of the lifetimes to be found in the Commission's recommended methods.

Table B1-A Some of the lifetimes to be found in the Commission's recommended methods

	Recommended lifetime in years
1b Insulation: building envelope – loft/roof and floor insulation	25
3 Windows/glazing with low U value	30
12a Heat pumps: air to air	10
12b Heat pumps: exhaust air to water	15
12c Heat pumps: ground source	25
14 New or upgraded district heating	30
15 Solar thermal collectors for hot water supply	20
16 Energy-efficient (class A or above) cold appliances (e.g. refrigerators, freezers)	15
17 Energy-efficient (class A or above) wet appliances (e.g. dishwashers, washing machines and tumble driers)	12
20 Luminaries with ballast systems (lighting units with dedicated efficient lamp fittings)	15
23 Photovoltaic solar panels	23
39 Energy-efficient lighting systems in new or renovated offices	12

Annex 2. Calculation basis

This Annex provides a description of statistics and assumptions used in the calculations. The methods that the Commission recommends were used as much as possible, and deviations from those methods are set out in Annex 1.

Households and services (residential properties and business premises)

Bottom-up calculation of energy efficiency improvements in buildings

Using bottom-up methods means that savings from actions, for example switching to more efficient windows, are measured or estimated in kilowatt-hours, joules or kilograms of oil equivalents and then combined with the result of other actions, such as insulation and changing heating systems. The calculations were carried out as follows.

- The annual saving from each individual action (such as changing a filament lamp to a low-energy bulb) was calculated.
- The annual saving from all the actions (for example all the filament lamps replaced in Sweden in one year) was totted up.
- The savings were calculated up to 2010 and up to 2016. This means that the saving for each year since the start of the action were totted up up to 2010 and up to 2016. However, account is taken of the lifetimes of the actions (for example of low-energy bulbs), which have been published by the Commission (see Annex 1). This means that certain actions can only be calculated up to 2010. That is why the savings for early actions is larger for 2010 than for 2016.

Actions relating to the building envelope (energy-efficient windows and insulation)

In order to calculate savings resulting from actions relating to the building envelope, the change in heat losses for the building stock has been calculated (for more information, see Method 2.2 in Annex 1). Because of a lack of statistics, the savings have been partially calculated using a top-down method, and therefore do not follow the calculation principle above. The calculated savings resulting from energy-efficient windows and insulation can be seen in Table B2-A.

Table B2-A. Calculated savings from early and new improvements to the building envelope, energy-efficient windows and insulation

Energy-efficient windows and insulation	2010 (TWh)	2016 (TWh)
Early actions	1.60	1.60
New actions	0.56	1.70

Energy-efficient windows

The data on U values[55] and areas was obtained from the sample surveys ELIB[56] and BETSI[57].

Calculations for new measures to replace windows, in the period 2008-2016, are based on sales statistics from the Swedish Energy Agency and data on new-builds from Statistics Sweden (residential properties) and from the Swedish Energy Agency (business premises).

The following values have been assumed for both early and new window replacements:

$A_{windows}$ = 1.4 m^2; $U_{new\_windows}$ =1.1 W/m^2, K; $U_{old\ windows}$ = 2.48 W/m^2,K.

Insulation

In order to calculate the impact of retrofitted insulation of facades and loft beam layouts that was carried out in residential properties (single-dwelling residences and multi-dwelling residences) from 1995-2007, data from (the sample surveys) ELIB and BETSI was used. In these surveys, information about the thermal insulation and areas of exterior walls and loft beam layouts was estimated for the national level. In order to calculate the reductions in transmission losses that insulation brings about, the change in the U value for exterior walls and loft beam layouts was multiplied by the area of the structural area in question. This produces a conductance in watts per kelvin (W/K) which can then be multiplied by the number of degree days in a year to obtain the reduced heat losses in kWh/year.

Since the period between the sample surveys (1991-2007) goes back before the time that can be included in the calculations according to the Directive, the insulation that was retrofitted was assumed to have had a linear distribution over the years between 1991 and 2007.

[55] Heat transfer coefficient.
[56] Electricity economy in buildings, ELIB, is a national study that was carried out in 1991/92.
[57] Energy use, technical status and indoor environment of buildings, BETSI, is a national study that was carried out in 2007/2008.

Conversions

Method 2.4 from Annex 1 was used. Table B2-B shows the calculated savings from conversions up to 2010 and 2016.

Table B2-B. Calculated saving from early and new conversion actions

Conversions	2010 (TWh)	2016 (TWh)
Early actions	14.4	12.5
New actions	1.1	3.4

Converting a heating system is not necessarily an improvement of energy use efficiency. However, Annex III to Directive 2006/32/EC stipulates that the efficiency saving in the final energy consumption is to be calculated, which means, in practice, that the energy bought is to be reduced. A large proportion of the conversion results is made up of the installation of heat pumps as they reduce the quantity of energy bought.

Savings resulting from conversions were also calculated in the first action plan. These calculations have been updated and supplemented. Account was also taken of the lifetimes of the actions, which, for example, means that air-to-air heat pumps that were installed up to the year 2000 are included in the calculation for 2010 but not that for 2016.

The calculation includes all types of efficiency improvements, such as conversion (full or partial switch to another means of heating), or change to a new boiler, heat pumps, etc. The calculations also cover the saving of heating up hot water despite the fact that there is a particular recommended method for that. This is due to the fact that, in Sweden, hot water is nearly always provided by the same installation that provides a building with energy for heating. Conversion to solar heating was not included but calculated separately, see Solar heating below.

The calculations for the period 1995-2007 were primarily based on the annual official energy statistics for single-dwelling residences, multi-dwelling residences and business premises. More details about the co-efficient of performance and sales statistics for heat pumps were obtained from reports from and contact with the Swedish Heat Pump Association (SVEP)[58]. The calculations relate only to those buildings that were already built by 1995 and that are still standing at the end of the relevant checking period. Buildings that were erected in or after 1995 are thus not included.

The forecast for single-dwelling residences for 2008-2016 was produced in the same way as in the first action plan. This means that the conversions depend on the physical prerequisites for different types of conversions and on the trends for conversion that have been prevalent over recent years.

[58] See www.svepinfo.se

No calculation of new actions has been made for multi-dwelling residences and business premises. The same was the case for the first action plan, as the judgement was made that that would have little impact on the results. The calculations may be supplemented with efficiency improvements for buildings erected after 1995 on condition that the calculations for new buildings are not done separately (as that could lead to duplicate calculations).

Table B2-C shows the calculated savings for 2010 and 2016 by early and new actions.

Table B2-C. Calculated savings resulting from replacements and conversions

Efficiency improvements resulting from replacements and conversions Expressed in GWh of energy purchased			
Contribution to saving	**2007 (end of year)**	**2010 (end of year)**	**2016 (end of year)**
SINGLE-DWELLING RESIDENCES			
Savings resulting from early actions	9 661	9 661	9 661
Reduction: actions that are no longer eligible for inclusion	0	-10	-1 450
Savings resulting from early actions that are eligible for inclusion	9 661	9 651	8 211
Savings resulting from actions, 2008-2016	- -	1 149	3 448
Total	**9 661**	**10 801**	**11 659**
MULTI-DWELLING RESIDENCES			
Savings resulting from early actions	2 392	2 392	2 392
Reduction: actions that are no longer eligible for inclusion	0	0	-130
Savings resulting from early actions that are eligible for inclusion	2 392	2 392	2 262
Estimated savings resulting from actions, 2008-2016	- -	Not calculated	Not calculated
Total	**2 392**	**2 392**	**2 262**

BUILDINGS INCORPORATING BUSINESS PREMISES			
Savings resulting from early actions	2 318	2 318	2 318
Reduction: savings that are no longer eligible for inclusion	0	0	-330
Savings resulting from early actions that are eligible for inclusion	2 318	2 318	1 988
Savings resulting from actions, 2008-2016	- -	Not calculated	Not calculated
Total	**2 318**	**2 318**	**1 988**

Solar cells

There is no recommended method, but since all the electricity produced from solar cells can be counted as savings, no particular method is needed. The calculated result for the installation of solar cells is shown in Table B2-D.

Table B2-D. Calculated savings from early and new installations of solar cells

Solar cells	2010 (TWh)	2016 (TWh)
Early actions	0.01	0.01
New actions	0.02	0.09

Information about the quantity of solar cells installed is given in terms of power. In order to calculate the savings, an average annual production for all the solar cell systems of 750 kWh per kilowatt of installed peak electrical power and year has been assumed. No account has been taken of improved performance over the years.

Data on the quantity of solar cell systems in Sweden installed prior to 2005 has been obtained from the national annual reports published by the International Energy Agency (IEA)'s Photovoltaic Power System Programme (PVPS)[59]. In the statistics, a distinction has been made between those systems connected to the grid and those that are not. The market for systems that are not connected to the grid is independent of state support, and the trends show stable development. A continued market growth has therefore been assumed after 2008 in line with the average growth since these statistics began in 1992.

Data on installed grid-connected installations in the years 2005-2008 was taken from the Swedish National Board of Housing, Building and Planning's grant statistics for the OFFrot support [support for investments in energy efficiency measures and switching over to renewable energy sources in premises used for public services] for solar

[59] See www.iea-pvps.org.

cell installation in public buildings. Separate solar cell systems could have been installed without a grant, but in principle the market for grid-connected systems is completely dependent on grants. Data on installed grid-connected installations in the years 2009-2010 was taken from the grant statistics for the state grant for solar cells (2009-2011).

In order to calculate the savings for the years 2012-2016 a continued trend corresponding to the market trend for non-grid-connected systems has been assumed. This means that neither new installations for grid-connected systems nor new grants have been included after 2011. The results resulting from future installations therefore amount to a minimum level. A small number of installations have also been installed without grants. The results from these are not included in these calculations.

Solar heating

Conversion to solar heating was not included in the calculations for conversions, but calculated separately. Method 2.4 from Annex 1 was used. The calculated results for solar heating are shown in Table B2-E.

Table B2-E. Calculated savings resulting from early and new actions involving solar heating

Solar heating	2010 (TWh)	2016 (TWh)
Early actions	0.07	0.07
New actions	0.04	0.07

The following three scenarios have been calculated based on information on average energy output.

1. The assumption that support is removed, which results in only 40% of the solar collectors installed at present being installed.
2. The assumption of a continued constant trend of solar collector installation up to 2016.
3. The assumption of the proposed target being achieved, which corresponds to the installation of 75 000 m^2 of solar collectors per annum.

In the synthesis, the results of the most cautious scenario were used, which is to say alternative 1.

The data that forms the basis of the calculations is the grant statistics. For 2010, a forecast has been made based on the rate of applications in the first quarter. According to SP Technical Research Institute of Sweden, there is a 10% margin of error corresponding to data that is not reported on. If account were taken of these installations, the calculated saving would be bigger.

Energy-efficient white goods (replacements and new products)

Method 2.8 from Annex 1 was used. The calculated savings for energy-efficient white goods are shown in Table B2-F.

Table B2-F. Calculated savings resulting from early and new actions involving energy-efficient white goods

Energy-efficient white goods	2010 (TWh)	2016 (TWh)
Early actions	1.50	0.85
New actions	0.20	0.60

In order to calculate the savings, statistics on sales and scrapping of white goods from GfK[60] and Branschkansliet[61] were used. Assumptions about how white goods are used are largely based on the Swedish Energy Agency's metering of domestic electricity[62].

Data and assumptions about energy classes for responsible products are uncertain. The calculations for washing machines and dishwashers are more uncertain than those for refrigerators and freezers as they are based on a larger share of forecast values.

Energy-efficient lighting in residences and business premises

Methods 2.9 and 2.10 c in Annex 1 were used to calculate the savings in residential properties and business premises. The calculated savings for energy-efficient lighting can be seen in Tables B2-G and B2-H.

Table B2-G. Calculated savings resulting from early and new actions involving energy-efficient lighting in residential properties

Energy-efficient lighting	2010 (TWh)	2016 (TWh)
Early actions	0.31	0.00
New actions	0.44	1.05

Table B2-H. Calculated savings resulting from early and new actions involving energy-efficient lighting in business premises

Energy-efficient lighting	2010 (TWh)	2016 (TWh)
Early actions	2.78	1.22
New actions	0.18	1.33

[60] GfK is a research company whose activities include compiling sales statistics for various products, www.gfk.com.
[61] Branschkansliet administers a large number of industry associations, www.branschkansliet.se.
[62] The Swedish Energy Agency metered electricity use at the appliance level in 400 households. For more information, see www.energimyndigheten.se.

The calculations are based on data from the Swedish Energy Agency's metering of domestic electricity (for lighting in private residences)[63] and audits of electricity use in business premises, STIL2 (for lighting in business premises)[64].

Industry

The Energy Services Directive (2006/32/EC) covers only energy consumption in industry that does not fall within the scope of the EU's system of trading emission allowances. As a result, the energy consumption of fossil fuels within the trading sector was excluded. This was done by calculating the trading sector's share of that consumption for every energy carrier within the sector in question. These shares were used to exclude energy consumption of different energy carriers covered by the trade in emission allowances. The same share was used for both 2008 and 2016.

Early actions

Only the result of the Programme for improving energy efficiency in energy-intensive industry, PFE, has been calculated as an early action. The improvement in energy efficiency has been calculated up to 2006 with the aid of the programme's two-year and final reports. The final reports state, amongst other things, what actions have been carried out, when and what improvement in energy efficiency resulted. The savings resulting from the PFE were calculated at 0.4 TWh. The calculations only cover quantifiable actions to increase electrical energy efficiency, which means that the result of the actions is underestimated as a number of measures to increase electrical energy efficiency are not quantifiable.

New actions

In order to calculate the savings for the years 2007 to 2016 method M8 (see Annex 1) was used. It is an update of the Long-term forecast, 2008[65] that was used, which means that the forecast also takes account of the new taxation levels that the *Riksdag* adopted under government bill (prop.) 2009/10:41.

The calculation is carried out by energy carrier and industry, with the same distribution as the Swedish Energy Agency's forecasts, which is to say on 16 energy carriers[66] and 13 industries[67]. The selected division by industry and fuel has an impact on the results of the calculation.

[63] The Swedish Energy Agency metered electricity use at the appliance level in 400 households. For more information, see www.energimyndigheten.se.
[64] The Swedish Energy Agency takes stock of the energy use in various types of business premises by means of the STIL2 project. For more information, see www.energimyndigheten.se.
[65] Long-term forecast, 2008, the Swedish Energy Agency (2009). The updated forecast was produced in the autumn of 2009, but has not been published.
[66] The energy carriers are coal, coke, petroleum coke, biofuels, liquefied petroleum gas, motor spirit, light petroleum oils, diesel, fuel oil 1, fuel oil 2-5, natural gas, town gas, coke oven gas, blast furnace gas, district heating and electricity.

In order to reduce the impact of structural impacts, the calculations were carried out at the most finely distributed industry level possible. Yet, as a result of the composition of the method (M8) and the forecast, it was not possible to entirely exclude effects from, for example, fuel substitution or all structural impacts.

The further five-year period of the PFE is expected to result in an improvement of electrical efficiency of 1 TWh[68]. The Swedish Energy Agency, as the agency with administrative competence, estimates that around 1 000 companies will apply for and receive support for energy mapping checks in the upcoming five-year period. That is expected to bring about savings of approximately 0.7 TWh by the end of 2014. Once all the actions have been carried out (by the end of 2016), it is estimated that the savings will amount to around 1.0 TWh[69].

Transport

The Commission's recommended methods are split between what are known as "P", "A" and "M" methods. The "P" (preferred) methods are those that the Commission views as better to use than the "A" (alternative) and "M" (minimum) methods. The selection of which method to use is based on access to statistics.

Early actions

Savings resulting from early actions have been calculated using the Commission's top-down methods. Given that there is a lack of statistics from the middle of the 1990s, the minimum methods have been used for the calculations for railways and maritime transport. The following methods are used to calculate the energy efficiency improvements resulting from early actions[70]:

- Passenger cars (P8)
- Heavy goods vehicles (P9)
- Light goods vehicles (P9 A2)
- Railways (M6)
- Maritime transport (M7)

Calculated savings for the transport sector are shown in Table B2-I.

[67] The industries are the mining industry (10-14 in SNI 2002), the food industry (15–16), the textiles industry (17–19), the wood products industry (20), the pulp and paper industry (21), the publishing industry (22), refineries (23), the chemical industry (24), the plastics and rubber (25), soil and rock industry (26), the iron and steel industry (271–273), the metallurgical industry (274–275) and the engineering industry (28–35).

[68] A further five-year period of the PFE is being examined by the EU under state aid rules.

[69] Preliminary study on the options for the introduction of energy mapping checks in the period 2010-2014, background report to the Swedish government (reference no N2009/6909/E).

[70] Some adjustments were made to the Commission's indicators, see Annex 1.

Table B2-I. Calculated savings resulting from early actions in the transport sector

Early actions	2010 (TWh)	2016 (TWh)
Passenger cars (P8)	3.32	3.32
Heavy goods vehicles (P9)	-1.03	-1.03
Light goods vehicles (P9 A2)	-0.35	-0.35
Railways (M6)	0.23	0.23
Maritime transport (M7)	-0.31	-0.31
Total efficiency improvement, early actions	**1.9**	**1.9**

The Commission's calculation methods are presented in Annex 1. Put simply, the savings are calculated using the following method:

$$Saving = \left(\frac{E_0}{A_0} - \frac{E_t}{A_t} \right) * A_t$$

E = energy use; A = activity; 0 = start year; t = end year.

The saving is the difference in energy use per activity between the start and end years multiplied by the activity for the end year.

The saving thus depends on the situation in the start year and in the end year. In order to reduce the effect of individual years, the savings for early actions were realised by means of using average values over three years instead of simply using the statistics for the start and end years.

New actions

Forecast for transport traffic

"Forecasts for freight transport traffic in 2020"[71] and "Passenger transport forecasts for 2020 and 2040"[72] were used as the statistical basis for transport traffic. These forecasts were produced as the basis for the Swedish Transport Administration's action planning[73] in the winter of 2009. There have been changes since the forecasts were produced, for example it has been decided to raise diesel taxes[74] and economic developments have had an impact on activity in the transport sector. In order to take account of the actual developments between 2006 and 2009, statistics for these years have been fed in to the model. For 2010 and onwards, the development rate according to the Swedish Transport Administration's forecast is used. Given that the Swedish Transport

[71] The Swedish Rail Authority and the Swedish Road Administration, Memorandum 9 February 2009.
[72] The Swedish Rail Authority and the Swedish Road Administration, Memorandum 6 February 2009.
[73] The reference scenario was used in this work (in the transport agencies' memorandum, this scenario is referred to as Reference scenario JA).
[74] A total increase of SEK 0.40 in two stages, 2011 and 2013.

Administration's forecast only applies to 2020, it is assumed that development during the forecast period is linear. The forecast progress of freight and passenger transport traffic are shown in Tables B2-J and B2-K.

Table B2-J. Statistics for total freight transport traffic in 2007 and forecast development for 2010 and 2016 (millions of tonne-kilometres)

	2007	2010	2016
Roads	40525	39799	45365
Railways	23250	23372	24141
Maritime transport	7246	7410	7737

Table B2-K. Statistics for total passenger transport traffic in 2007 and forecast development for 2010 and 2016 (millions of person-kilometres)

	2007	2010	2016
Passenger cars	99315	101297	112678
Railways	10261	11313	12199
Other rail traffic	2200	2307	2630
Buses	8655	8762	8786

Energy use for passenger cars and goods vehicles

For this energy use, the results from the Swedish Transport Administration's statistical basis for climate reporting are used, although they are adjusted somewhat in order to be in line with the transport traffic reported in Tables B2-J and B2-K. The model results are set out in Table B2-L. The energy forecast includes an efficiency improvement of 1% per annum for heavy goods vehicles. In addition, it is assumed that passenger cars will achieve 130 g/km by 2015 at EU level, with gradual introduction between 2021 and 2015 and Sweden is assumed to attain the same relative reduction as the EU average. After 2015, an efficiency improvement of 1% per annum is assumed. Light goods vehicles are expected to undergo the same relative improvement as passenger cars.

Table B2-L. Energy use for passenger and freight transport journeys by road. Statistics for 2007 and forecast for 2010 and 2016

	2007	2010	2016
Passenger cars	49.3	47.8	46.9
Light goods vehicles	7.5	7.9	8.0
Heavy goods vehicles	17.9	17.5	19.7

Source: Artemis/the Swedish Transport Administration.

Energy use for passenger and freight transport journeys by rail.

The energy use between 2007 and 2016 is a forecast based on historical development of the quotient "kWh/transport traffic" between 2000 and 2007. The reason for using this period as the basis is that the energy use for passenger and freight traffic was not subdivided prior to this. The calculation is based on statistics from traffic analysis for transport traffic and energy use, and when these are brought together the result is a development of energy use per transport traffic kilometre as shown in Table B2-M.

Table B2-M. Energy use per transport traffic kilometre (kWh/passenger-kilometre and kWh/tonne-kilometre)

	2000	2007	Trend *
Passenger (railways)	0.12	0.11	0.98
Passenger (other rail traffic)	0.14	0.12	0.98
Freight	0.04	0.04	1.00

* This column shows the average annual change of energy use per transport traffic kilometre

Energy use per transport traffic kilometre for freight traffic has been relatively constant in recent years, while for passenger traffic there appear to have been efficiency improvements of approximately 2% per annum. The same rate of progress is assumed for the period 2007-2016, see Table B2-N.

Table B2-N. Energy use per transport traffic kilometre

	2007	2010	2016
kWh/passenger-km (railway)	0.11	0.10	0.09
kWh/passenger-km (other rail traffic)	0.12	0.11	0.09
kWh/tonne-km	0.04	0.04	0.04

Transfer of passenger journeys

Saving resulting from method P12 are calculated according to the formula:

$$\text{Saving} = (PT_t - PT_{2007}) * T_t * (UECA_t - UEPT_t)$$, where:

PT = share of public transport (calculated in passenger-kilometres); T = total transport traffic (passenger-kilometres); UECA = unit energy consumption of cars (kWh/passenger-kilometre); UEPT = unit energy consumption of public transport (kWh/person-kilometre).

The conditions for calculating method P12 are shown in Table B2-O. Public transport includes buses, underground railways, trams and trains. The energy use for buses was provided by Artemis. The energy use for rail-bound traffic was taken from the calculations carried out for method P10, see Annex 1. The transport traffic was taken from the passenger transport traffic forecast described above.

Table B2-O. Conditions for calculating the saving for indicator P12

	2007	2010	2016
Share of public transport	17.5 %	18.1 %	17.3 %
Total transport traffic (passenger-km)	120431	123679	136293
Energy use, passenger cars (kWh/passenger-km)	0.50	0.47	0.42
Energy use, public transport (kWh/passenger-km)	0.19	0.17	0.16

The savings by 2016 are negative (-0.1 TWh), which means a fall in the share of public transport.

Saving, new actions

Methods P8, P9, A2, P10, P11 and P12 from Annex 1 have been used. Calculated savings in the transport sector for new actions are shown in Table B2-P.

Table B2-P. Calculated savings resulting from new actions in the transport sector

New actions	2010 (TWh)	2016 (TWh)
Passenger cars (P8)	2.56	9.02
Heavy goods vehicles (P9)	0.10	0.38
Light goods vehicles (P9 A2)	-0.01	0.39
Railways, passenger (P10)	0.10	0.29
Railways, freight (P11)	0.01	0.02
Transfer of passenger journeys from cars to public transport (P12)	0.21	-0.07
Total for new actions	**3.0**	**10.0**

Sensitivity analyses

The parameters used in the forecast are energy use per transport traffic kilometre in the start and end years and the transport traffic for the end year. Using the Commission's recommended methods for savings, this means that the quantity of transport traffic in the end year obtains

relatively major significance. It is thus uncertain whether the transport traffic will increase in the way forecast. Lower transport traffic in 2016 would mean a lesser saving, even if energy use per transport traffic kilometre undertaken progressed as forecast. In order to illuminate this uncertainty, a sensitivity analysis has been carried out where transport traffic is assumed to be constant throughout the forecast period. With constant transport traffic, the calculated saving for new actions amounts to 8.8 TWh for 2016 which is to say reduced savings of 1.2 TWh compared with the base case (Table B2-P).

Maritime transport is not included in the assessment of the transport sector's savings, but should be included in later analyses of the transport sector's savings as more statistics, and also potentially forecasts, are available. Including maritime transport at a later stage could have an impact on total savings, but the significance of maritime transport for the national target is expected to be marginal. This is based around the expectation that the saving in maritime transport will be high but the transport traffic will be low. In order to illuminate the marginal impact of maritime transport, a sensitivity analysis was carried out, where energy use per tonne-kilometre was assumed to half between 2007 and 2016 while the transport traffic is assumed, at the same time, to be constant during this period. The savings from maritime transport for 2016 would then amount to 0.1 TWh. This development would mean the total savings for the transport sector would amount to 10.1 TWh.