REGERINGSKANSLIET

Government Offices of Sweden

Sweden’s fourth progress report on the development of renewable energy pursuant to Article 22 of Directive 2009/28/EC

Foreword

This report is Sweden's fourth progress report pursuant to Article 22 of Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (the Renewables Directive).

Article 22 of the Renewables Directive requires Member States to submit a report to the Commission on progress in the promotion and use of energy from renewable sources by 31 December 2011, and every two years thereafter.

As the basis for this report the Swedish Energy Agency [*Energimyndigheten*] was entrusted with the task of producing a draft national report on how the promotion and use of energy from renewable energy sources is being developed pursuant to Article 22 of the Renewables Directive. An account of the task was given on 30 October 2017 and subsequently supplemented with *inter alia* updated statistics for 2016. The forecasts and statistics included in this report comprise information belonging to the Swedish Energy Agency.

This report follows the voluntary template published by the European Commission in May 2011 as a guide for Member States' progress reports pursuant to Article 22.

Contents

Overall shares and actual consumption of energy from renewable sources in Sweden (point 1 in the template from the Commission)

Point 1. Energy from renewable sources

1. Sectoral and overall shares and actual consumption of energy from renewable sources in the preceding 2 years (2015 and 2016) (*Article 22(1)(a) of Directive 2009/28/EC*). *Please fill in the actual shares and actual consumption of renewable energy **for the preceding 2 years** in the suggested tables below.*

The data in Tables 1–1d are based on the current version of the calculation tool (SHARES 2016) supplied by Eurostat for Member States to report renewable energy.

Table 1: The sectoral (electricity, heating and cooling, and transport) and overall shares of energy from renewable sources[1]

	2015	2016
RES-H&C[2] (%)	68.6 %	68.6 %
RES-E[3] (%)	65.8 %	64.9 %
RES-T[4] (%)	24.0 %	30.3 %
Overall RES share[5] (%)	**53.8 %**	**53.8 %**
Of which from cooperation mechanism[6] (%)	*-1.0 %*	*-1.2 %*
Surplus for cooperation mechanism[7] (%)	*9.9 %*	*9.9 %*

There has been a general upward trend in the overall share of renewable energy. However, the percentage remained at the same level of 53.8 % for both 2015 and 2016. The continuing strong growth in wind power and the increasing share of renewables in the transport sector are trends that have lasted for several years. The proportion of renewable energy increased in 2015, despite the fact that energy consumption as a whole was higher in 2015 compared with 2014. Both energy consumption and renewable energy consumption increased in 2016 such that the percentage remained unchanged from 2015.

[1] *Facilitates comparison with Table 3 and Table 4a of the NREAPs.*
[2] *Share of renewable energy in heating and cooling: gross final consumption of energy from renewable sources for heating and cooling (as defined in Articles 5(1)b) and 5(4) of Directive 2009/28/EC divided by gross final consumption of energy for heating and cooling. The same methodology as in Table 3 of NREAPs applies.*
[3] *Share of renewable energy in electricity: gross final consumption of electricity from renewable sources for electricity (as defined in Articles 5(1)(a) and 5(3) of Directive 2009/28/EC divided by total gross final consumption of electricity). The same methodology as in Table 3 of NREAPs applies.*
[4] *Share of renewable energy in transport: final energy from renewable sources consumed in transport (see Articles 5(1)(c) and 5(5) of Directive 2009/28/EC) divided by the consumption in transport of: 1) petrol; 2) diesel; 3) biofuels used in road and rail transport; and 4) electricity in land transport (as reflected in row 3 of Table 1). The same methodology as in Table 3 of NREAPs applies.*
[5] *Share of renewable energy in gross final energy consumption. The same methodology as in Table 3 of NREAPs applies.*
[6] 'Cooperation mechanism' means the common electricity certificate system between Sweden and Norway. *In percentage points of overall RES share.*
[7] The difference in percentages between the indicative trajectory and the outcome for the relevant year.

The common support scheme for electricity certificates with Norway started on 1 January 2012. Greater capacity for renewable electricity production has been built in Sweden in 2015 and 2016, which must therefore be divided between the countries. The amount of renewable electricity transferred to Norway (and deducted from Sweden) is 4 042 GWh for 2015 and 5 008 GWh for 2016. The amount for 2015 and 2016 corresponds to the 1 and 1.2 % that has been deducted from the overall percentage for renewable energy in Table 1. Please also see Article 11.1 on the common support scheme for renewable electricity production.

When calculating the share of renewable energy for transport (RES-T), some biofuel has been double-counted in accordance with the Directive.

Table 1a: Calculation table for the renewable energy contribution of each sector to final energy consumption (ktoe)[8]

	2015	2016
A) Gross final consumption of RES for heating and cooling	9 581	9 842
B) Gross final consumption of electricity from RES	7 740	7 895
C) Gross final consumption of energy from RES in transport	1 315	1 622
D) Gross total RES consumption[9]	18 636	19 359
E) Transfer of RES to other Member States	348	431
F) Transfer of RES from other Member States and third countries	0	0
G) RES consumption adjusted for target D - E + F	18 288	18 928

[8] *Facilitates comparison with Table 4a of the NREAPs.*
[9] *According to Article 5(1) of Directive 2009/28/EC gas, electricity and hydrogen from renewable energy sources shall only be considered once. No double counting is allowed.*

Table 1.b: Total actual contribution (installed capacity, gross electricity generation) from each renewable energy technology in Sweden to meet the binding 2020 targets and the indicative trajectory for the shares of energy from renewable resources in electricity[10]

	2015		2016	
	MW	GWh	MW	GWh
Hydro[11]:	16 329	66 668	16 466	66 145
non-pumped	16 230	66 685	16 367	66 158
< 1 MW	*182*	*711*	*177*	*682*
1 MW – 10 MW	*779*	*3 006*	*784*	*2 981*
> 10 MW	*15 269*	*62 968*	*15 406*	*62 495*
pumped	-	-	-	-
mixed	*99*	*N/A*	*99*	*N/A*
Geothermal	-	-	-	-
Solar:	104	97	153	143
photovoltaic	*104*	*97*	*153*	*143*
concentrated solar power	-	-	-	-
Tide, wave, ocean	-	-	-	-
Wind[11]:	5 840	14 117	6 434	15 774
*on-shore**	*5 605*	*15 608*	*6 231*	*14 871*
*off-shore**	*213*	*714*	*203*	*608*
Biomass[12]:	4 278	8 988	4 286	9 761
solid biomass	*3 700*	*8 977*	*3 769*	*9 750*
biogas	*2*	*11*	*2*	*11*
bioliquids	*576*	*N/A*	*515*	*N/A*
Waste***		1 749		1 681
TOTAL**	**26 551**	**91 619**	**27 339**	**93 503**
*Of which CHP***		*10 765*		*11 488*

* Unlike the total fields for wind power, the division of on-shore/off-shore wind power has not been normalised.

** There are some sustainable bioliquids, in the form of pyrolysis oil, that are used in Sweden. There are no statistics available, however, with regard to where they are used and whether they are used in industry or for electricity and heat production.

*** The original template does not include the waste item. Only the renewable share of waste is included in the table.

[10] *Facilitates comparison with Table 10a of the NREAPs.*
[11] *Normalised in accordance with Annex II to Directive 2009/28/EC and Eurostat methodology.*
[12] *Take into account only those complying with applicable sustainability criteria, see Article 5(1) last subparagraph of Directive 2009/28/EC.*

Table 1c: Total actual contribution (final energy consumption[13]) from each renewable energy technology in Sweden to meet the binding 2020 targets and the indicative trajectory for the shares of energy from renewable resources <u>in heating and cooling</u> (ktoe)[14]

	2015	2016
Geothermal (excluding low temperature geothermal heat in heat pump applications)	-	-
Solar	11	11
Biomass[15]:	7 740	7 909
solid biomass	*7 689*	*7 852*
biogas	*51*	*57*
*bioliquids**	-	-
Waste**	633	566
Renewable energy from heat pumps:	1 196	1 356
- of which aerothermal (air heat)	*289*	*337*
- of which geothermal (ground heat)	*803*	*936*
- of which hydrothermal (water-borne heat)	-	-
TOTAL	**9 581**	**9 842**
Of which DH[16]	*3 000*	*3 109*
Of which biomass in households[17]	*913*	*912*

* There are some sustainable bioliquids, in the form of pyrolysis oil, that are used in Sweden. There are no statistics available, however, with regard to where they are used and whether they are used in industry or for electricity and heat production.

** Only the renewable share of waste is included in the table.

In Table 1c only the contribution from large heat pumps in the district heating network is included in the total fields for heat pumps. The sub-categories for heat pumps in the table only include contributions from small heat pumps used in homes and on premises. The estimated amount of energy from the small heat pumps has been calculated in accordance with the Commission's guidelines.[18]

[13] *Direct use and district heating as defined in Article 5(4) of Directive 2009/28/EC.*
[14] *Facilitates comparison with Table 11 of the NREAPs.*
[15] *Take into account only those complying with applicable sustainability criteria, see Article 5(1) last subparagraph of Directive 2009/28/EC.*
[16] *District heating and/or cooling from total renewable heating and cooling consumption (RES - DH).*
[17] *From the total renewable heating and cooling consumption.*
[18] 2013/114/EU.

Table 1d: Total actual contribution from each renewable energy technology in Sweden to meet the binding 2020 targets and the indicative trajectory for the shares of energy from renewable resources <u>in the transport sector</u> (ktoe)[19],[20]

	2015	2016
Bioethanol/bio-ETBE (ethyl tertiary butyl ether)	136	110
Of which biofuels[21] Article 21(2)	*< 1*	*< 1*
Of which imported[22]	*N/A**	*N/A**
Biodiesel	954	1 249
Of which biofuels[23] Article 21(2)	*467*	*869*
Of which imported[24]	*N/A**	*N/A**
Hydrogen from renewables	-	-
Renewable electricity	138	145
Of which road transport	*N/A***	*N/A***
Of which non-road transport	*138*	*145*
Others (as biogas, vegetable oils, etc.) – please specify	100 (biogas, biogasoline, DME)	120 (biogas, biogasoline)
Of which biofuels[25] Article 21(2)	*90*	*113*
TOTAL	**1 328**	**1 624**

* The information concerning verified sustainable fuels only includes the country of origin of the raw material, and no conclusions may be drawn as regards whether the biofuel in question has been imported or was produced in Sweden.

** The number of electric road vehicles in Sweden is growing, but there are no official statistics on their energy consumption. In 2015 and 2016, the number of vehicles was 4 765 and 7 532 respectively (excluding electric hybrids and plug-in hybrids).

Table 1d only includes sustainable amounts of biofuel that have been verified. Section 8 of Table 5 provides more information about the biofuels described in Article 21(2) of the Directive (the biofuels produced from wastes, residues, non-food cellulosic material, and ligno-cellulosic material) and which may therefore be double-counted when calculating the share of renewable energy in transport (RES-T).

A total of 17.2 TWh of sustainable biofuels has been reported for 2016, compared to 13.8 TWh the previous year. Quantities of HVOs have continued to rise, while quantities of FAME have fallen. The trend of declining quantities of ethanol has been maintained. Ethanol is primarily produced from cereals originating from within the EU. The amount of ethanol from European sugar beet rose during 2015, but essentially disappeared during 2016. FAME is produced from rapeseed oil. In 2016, rapeseed originated predominantly from Germany, the Baltic, Denmark, the UK and France. Quantities of HVOs rose sharply during the period 2015-2016. PFAD[26] is a new raw material and accounted for a significant part of this increase, although waste oils have also increased. Quantities of HVO originating from crude tall oil fell during 2016, and sales of HVO from palm oil ceased during the same year.

[19] *For biofuels, take into account only those compliant with the sustainability criteria, see Article 5(1) last subparagraph.*
[20] *Facilitates comparison with Table 12 of the NREAPs.*
[21] *Biofuels that are included in Article 21(2) of Directive 2009/28/EC.*
[22] *From the whole amount of bioethanol/bio-ETBE.*
[23] *Biofuels that are included in Article 21(2) of Directive 2009/28/EC.*
[24] *From the whole quantity of biodiesel.*
[25] *Biofuels that are included in Article 21(2) of Directive 2009/28/EC.*
[26] *Palm fatty acid distillate. A fraction that is separated from crude palm oil in connection with refining because this is inedible.*

Instruments and measures for energy from renewable sources (points 2–5 in the template)

Point 2. Instruments and measures

2. Measures taken <u>in the preceding two years</u> and/or planned at national level to promote the growth of energy from renewable sources taking into account the indicative trajectory for achieving the national RES targets as outlined in the National Renewable Energy Action Plan *(Article 22(1) of Directive 2009/28/EC)*.

Table 2 shows existing and planned measures that directly or indirectly promote renewable energy. This means that measures introduced prior to 2014 and which have not been amended but are still in force have been included. Measures that were amended or added in 2014–2016 are also included. Planned measures are also included so that the table gives a comprehensive picture of current instruments in the area of renewable energy. The instruments and measures that are listed are described in more detail after the table.

Table 2: Overview of existing and planned instruments and measures.

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
1	Changed levels of energy taxes Act (*1994:1776)* on energy tax	Financial	Fiscal and steering tax designed primarily to reduce energy consumption but also to guide the choice of energy carrier	All activities	Existing	Latest amendment in force as of 1 July 2017
1	Changed levels of carbon taxes Act (*1994:1776)* on energy tax	Financial	Environmental steering tax in order to reduce CO_2 emissions	All activities	Existing	Latest amendment in force as of 1 January 2017
2	Amendment to turnover for VAT registration VAT Act (1994:200)	Financial	Increased micro-scale production of renewable electricity	Micro-scale electricity producers	Existing	From 1 January 2017
3	Common electricity certificate scheme with Norway	Financial, administrative	28.4 TWh of new renewable electricity production by 2020 and a further 18 TWh	Quota-bound electricity suppliers/consumers and producers of renewable electricity	Existing	2012–2045 (scheme introduced to Sweden in 2003)

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
	Act (2011:1200) on electricity certificates and bilateral agreement with Norway		by 2030			
4	Tax reduction for micro-scale electricity production Income Tax Act (1999:1229)	Financial, administrative	Increased micro-scale production of renewable electricity	Micro-scale producers of electricity	Existing	From 1 January 2015
5	Reduced energy tax for micro-scale production of electricity Act (1994:1776) on energy tax	Administrative	Increased micro-scale production of renewable electricity	Micro-scale producers of electricity	Existing	From 1 July 2017
6	Exemption from electricity grid fees Electricity Act (1997:857)	Financial	Increased micro-scale production of renewable electricity	Micro-scale producers of electricity	Existing	From 1 April 2010
7	Investment aid for solar photovoltaic cells connected to the grid Ordinance (2009:689) on State aid for solar photovoltaic cells	Financial	Greater electricity production from solar photovoltaic cells	Households, enterprises, organisations.	Existing	2009–2020
8	Aid for energy storage Ordinance (2016:899) on contributions for the storage of self-produced electricity	Financial	Increased installation of energy storage facilities.	Households and enterprises	Existing	2016–2019
9	Smart Electricity Grid Forum Bill 2015/16:1	Soft	Promote dialogue on opportunities for a smart grid	Authorities, industry and consumers	Existing	2016–2019
10	Wind Power Network	Soft	Promote the well planned and well	Local authorities and County Administrative	Existing	2008–2019

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
			anchored development of wind power	Boards, universities and colleges, local business, etc.		
11	The 'Klimatklivet' local climate investment programme Ordinance (2015:517) on aid for local climate investments	Financial	Reduced greenhouse gas emissions	All, other than private individuals	Existing	2015–2023
12	Extended aid for energy and climate advice Ordinance (1997:1322) on municipal energy and climate advice	Soft	Effective and environmentally-adapted energy consumption	Enterprises and private individuals	Existing	1997–2020
13	Extended aid for regional energy offices	Soft	Greater use of renewable energy and more efficient energy consumption at the regional level	Energy and climate advisers, County Administrative Boards, Regional Councils, local authorities, business	Existing	2002–2020
14	Local and regional capacity development for climate and energy adaptation	Soft	Greater use of renewable energy and more efficient energy consumption at local and regional level	County Administrative Boards, regional energy offices, local authorities, business	Existing	2016–2020
15	Investment aid for renewable energy (including biogas) under the Rural Development Programme Ordinance (2015:406) on aid for rural development measures	Financial	Greater production of renewable energy	Rural enterprises	Existing	2014–2020
16	Investment aid for biogas and other renewable gases	Financial	Greater production, distribution and consumption of renewable	Producers, distributors and consumers of biogas and other renewable gases	Existing	2009–2016

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
	Ordinance (2009:938) on State aid for measures relating to the production, distribution and consumption of biogas and other renewable gases		gases.			
17	Aid for manure gas Ordinance (2014:1528) on State aid for the production of biogas	Financial	Reduced methane emissions from manure and reduced need for fossil fuels	Biogas producers and farmers	Existing	2014–2023
18	Business development aid in the energy sector	Financial	Greater share of renewable energy and increased energy efficiency	Seed enterprises	Existing	2006–
19	Exemption from road tax for green vehicles Road Traffic Tax Act (2006:227)	Financial	More environmentally-adapted vehicles	Vehicle owners	Existing	2013–
20	CO_2-based road tax Road Traffic Tax Act (2006:227) and Act (2006:228) with special provisions on road tax	Financial	More environmentally-adapted vehicles	Vehicle owners	Existing	Latest amendment in force as of 1 January 2015
21	Extension of reduced taxable benefit value for certain environmentally-adapted vehicles Income Tax Act (1999:1229)	Financial	More environmentally-adapted vehicles	Vehicle beneficiaries	Existing	As of 1 January 2012 to 31 December 2020
22	Super green car premium	Financial	More environmentally-adapted	Vehicle owners	Existing	1 January 2012–30 June 2018

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
	Ordinance (2011:1590) on the super green car premium		vehicles			
23	Urban environment agreements Ordinance (2015:579) on aid for promoting sustainable urban environments	Financial	Energy-efficient solutions with low greenhouse gas emissions.	Local authorities and county councils	Existing	2015–2018
24	Coordination of energy adaptation in the transport sector Bill 2015/16:1	Soft	Promote adaptation in the transport sector	Transport sector	Existing	2016–2019
25	Implementation of the sustainability criteria laid down in the Renewables Directive. Act (2010:598) on sustainability criteria for biofuels and bioliquids	Administrative (May also be regarded as a condition for financial instruments)	Greater use of sustainable biofuels and bioliquids	Suppliers and consumers of biofuels and bioliquids.	Existing	2011–
26	Fuel Act (2011:319)	Administrative	Reduced greenhouse gas emissions	Fuel suppliers	Existing	1 May 2011–
27	Pump Act Act (2005:1248) on the requirement to provide renewable fuels	Administrative	Greater availability of renewable fuels	Fuel sellers	Existing	Latest amendment in force as of 1 August 2014
28	Electric bus premium Ordinance (2016:836)	Financial	More electric buses	Enterprises and local authorities	Existing	2016–2023
29	Ordinance on environmental and traffic-safety requirements for authorities' cars and car journeys	Administrative	More environmentally-adapted vehicles	Authorities	Existing	1 February 2009

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
	Ordinance (2009:1)					
30	Extension and aid for the energy research sector Bill 2016/17:66	Administrative	Contribute to achieving the set climate and energy targets	Universities and colleges, industry and the public sector	Existing	2017–2020
31	Reduction obligation	Financial, administrative	Reduced greenhouse gas emissions through the increased incorporation of biofuels in fossil fuels	Fuel sellers and professional users	Planned	1 July 2018
32	Bonus malus system	Financial	Promotion of vehicles with low CO_2 emissions per km	Vehicle owners	Planned	1 July 2018
33	Action plan for infrastructure for alternative fuels	Soft	Promotion of the development of infrastructure for alternative fuels	Authorities	Existing	2016
34	Coordination for sustainable transport	Soft	Promotion of the development of infrastructure for sustainable transport	Authorities	Existing	2015–2020
35	Information concerning fuels	Administrative	Increased climatic performance and sustainability of fuels	Fuel sellers	Planned	2018–
36	Urban innovations Ordinance (2016:448) on aid for the strategic use of high tech solutions for sustainable urban development	Financial	Promotion of new high performance environmental technology	All with the exception of private individuals	Existing	2016–2019
37	Energy efficiency aid under the National Regional Fund programme	Financial	Energy efficiency	SMEs	Existing	2015–2020
38	Fossil free	Financial	Promotion of	All activities	Planned	2018–2023

	Name and reference of the measure	Type of measure*	Expected result**	Targeted group and/or activity***	Existing or planned****	Start and end dates of the measure
	transport solutions		fossil free transport solutions			
39	Home charging	Financial	Improving the charging infrastructure for electric vehicles	Infrastructure	Planned	2018–2020
40	Electric vehicle premium	Financial	Reduction of car journeys and the promotion of journeys using electric vehicles	Private individuals	Planned	2018–2020
41	Amendment of property tax for hydro power	Financial	Reduced costs for hydro power	Electricity producers	Existing	2017–

** Indicate if the measure is (predominantly) regulatory, financial or soft (i.e. information campaign).*

*** Is the expected result behavioural change, installed capacity (MW; t/year), energy generated (ktoe)?*

**** At whom is the measure aimed: investors, end users, public administration, planners, architects, installers, etc.? At what activity/sector is the measure aimed: biofuel production, use of animal manure as energy, etc.?*

1. Changed levels of energy and CO_2 taxes

Energy tax is an overall concept for excise duties on fuels and electricity, and is regulated by Act (1994:1776) on Energy Tax. Energy tax is payable on most fuels and is based *inter alia* on energy content. CO_2 tax is calculated on the fossil carbon content for the taxable fuels.

Amended tax rates for petrol and diesel fuel

On 1 January 2016, the energy tax on fossil-based petrol and fossil-based diesel was increased, over and above the annual conversion relative to the trend in the consumer price index, by SEK 0.48 per litre for petrol and SEK 0.53 per litre for diesel fuel. During 2017, the energy and CO_2 tax will amount to a total of SEK 6.50 per litre for petrol fuel (environmental class 1) and SEK 5.73 per litre for diesel fuel (environmental class 1).

Just as hitherto, the amount of tax on fossil fuels will be converted on the basis of the consumer price index. For petrol and diesel fuel, the tax rates will also be converted to account for trends in gross domestic product from 1 January 2017. This is done using a template addition of two percentage points to the consumer price index (CPI) conversion. This additional conversion is done on both energy tax and CO_2 tax, but it is expressed as an increase in energy tax alone. The conversion will entail an increase in tax from 1 January 2018 of SEK 0.24 per litre for petrol fuel and SEK 0.213 per litre for diesel fuel relative to the 2017 level. In connection with the introduction of a reduction obligation system as a new instrument for biofuels for petrol and diesel fuel from 1 July 2018, specific adjustments will be made to the energy and carbon dioxide tax rates for petrol and diesel fuel in view of the fact that full tax will be levied on biofuels that are low-blend fuels and the

biofuel blend levels for these fuels set out in the reduction obligation (see below for further details).

The exemption from CO_2 tax for diesel fuel in work machinery used in agriculture, forestry and aquaculture activities will be increased on 1 January 2016 from SEK 900/m^3 to SEK 1 700/m^3. A proportion of the increase, amounting to SEK 270/m^3, is temporary for the period 2016– 2018. Thus, the reduction will correspond to SEK 1 430/m^3 from 2019.

Amended levels for the reduction for tax on heating fuel in certain sectors

Heat produced using some form of heat production outside EU ETS other than through industrial operations or combined heat and power (CHP) plants must pay 80 % of the CO_2 tax for the fossil fuel used in connection with production. Fuel used for the production of heat in CHP plants under EU ETS and the production of taxable electricity, irrespective of whether this takes place in a condensing power plant or a CHP plant, shall be exempt from CO_2 tax. From 1 January 2018, CO_2 tax will rise from 80 to 91 % of the general CO_2 tax level for fuel consumed in connection with heat production under EU ETS other than that taking place in the manufacturing process in industrial operations or at CHP plants.

From 1 January 2018, CO_2 tax will also be levied on fuel consumed in CHP plants covered by the European Union emissions trading scheme (EU ETS). Fuel consumed at these plants has been completely exempt from CO_2 tax since 1 January 2013, but from 1 January 2018 will be subject to a tax corresponding to 11 % of the general CO_2 tax level.

From 1 January 2016, the special opportunity for a rebate on CO_2 tax, which applies to those who have restricted their CO_2 emissions in conjunction with the consumption of certain fuels, was abolished. From 1 January 2016, the special opportunity for a rebate on CO_2 tax, which applies to those who have restricted their CO_2 emissions in conjunction with consumption of certain fuels, was also abolished, and the energy tax allowance for diesel fuel consumed by work vehicles used in industrial mining activities was increased from 86 % to 89 % of the energy tax payable on diesel fuel.

Amended rules for exemption from energy and CO_2 tax for renewable fuels

In order to prevent biofuels from being overcompensated in accordance with the EU's State aid rules, energy tax was imposed on biofuels for the first time on 1 January 2013. Article 16(1) of the Energy Tax Directive allows Member States fully or partly to apply tax exemption for *inter alia* products which are produced from biomass. The requirements for the granting of State aid to protect the environment include the requirements for the aid in question to have a stimulus effect, for the aid to be necessary in order to achieve the relevant measure, and for the aid to be proportionate. Any such tax exemption may not, however, involve any overcompensation for the additional costs of producing the relevant biofuels in relation to the fossil fuels that they replace.

In December 2015, amendments were implemented meaning that the tax exemption level of ethanol in petrol and biodiesel in diesel no longer had a volume limit (but the Fuel Act[27] limits the degree of blending to 10 % of ethanol and 7 % of FAME). The volume limit was

[27] Fuel Act (2011:319).

also abolished for ETBE in low petrol blends. When the new provisions came into force on 1 February 2013, the reduction in energy tax for biofuel became dependent on the type of fuel.

On 1 August 2016, new provisions concerning a reduced tax exemption for renewable fuels entered into force.[28] The energy tax exemption was increased for fatty acid methyl esters (FAME) sold or consumed as motor fuel. For FAME in low diesel blends, the tax exemption was increased from 8 % to 36 % of the energy tax. The tax exemption for high blends or pure FAME also increased from 50 % to 63 % of the energy tax. On the other hand, the tax exemption for CO_2 tax was not amended but will remain at 100 %. Biofuels used in diesel fuel will be subject to full CO_2 and energy tax (see above) in connection with the introduction of a reduction obligation on 1 July 2018. On 1 January 2018, the energy tax exemption for high FAME blends will also be increased to 100 % of the energy tax applicable to diesel fuel.

The abolished restriction on tax exemption for HVO (hydro-treated vegetable and animal oils and fats) was implemented on 1 January 2015, but applied from 1 May 2014 onwards.[29] The tax exemption applies to all HVO contained in the diesel fuel and which was produced from biomass. The tax exemption for HVO was previously up to 15 % HVO by volume of the diesel fuel declared for tax purposes during a given accounting period.

Sweden has State aid approval for the current tax relief on bioliquids through to the end of 2018, and for biogas through to the end of 2020.[30] Extension of the approvals necessitated the revision of the Communication from the Commission on Guidelines on State aid for environmental protection and energy 2014-2020. To ensure that Sweden satisfies the requirements laid down in the guidelines[31],[32] a 'plant approval certificate' was introduced on 1 January 2016 in the Act (2010:598) on Sustainability Criteria for Biofuels and Bioliquids and to the Energy Tax Act (1994:1776). The plant approval certificate must demonstrate the existence of a control system which ensures that the biofuels for which the taxpayer is applying for a reduction originate from plants which became operational before 31 December 2013 and which are fully depreciated

The exemption from energy tax for ethanol in low petrol blends was amended on 1 August 2016 from 74 % to 88 %. For high ethanol blends in E85, the energy tax exemption was increased on 1 August 2016 from 73 % to 92 %. The energy tax exemption is 100 % for the biofuel-based percentage of ethyl tertiary butyl ether (ETBE) and methyl tertiary butyl ether (MTBE) and for ethanol included in ED95. The exemption from CO_2 tax remains at 100 % for both low and high ethanol blends. In connection with the introduction of a reduction obligation on 1 July 2018, biofuels included in petrol will be subject to full CO_2 and energy tax. On 1 January 2018, the energy tax exemption for ethanol in E85 will increase to 100 % of the energy tax applicable to petrol.

Energy and CO2 tax exemption will be 100 % for biogas consumed or sold as engine fuel and for the biofuel bio-DME, dimethyl ether.

[28] www.skatteverket.se, Nyheter under år 2015 (News for 2015).
[29] Ibid.
[30] http://www.regeringen.se/pressmeddelanden/2015/12/forlangda-statsstodsgodkannanden-for-skattebefrielse-av-biodrivmedel/.
[31] Memorandum, Plant approval certificates for biofuels, M2015/3227/R.
[32] http://www.regeringen.se/artiklar/2015/10/lagandring-om-skattebefrielse-for-biodrivmedel/.

2. Amendment to turnover limit for VAT

In accordance with the Swedish Government's proposals in the draft Budget for 2017 (Bill 2016/17:1, report 2016/17:FiU1, parliamentary notice 2016/17:49), rules were introduced from 1 January 2017 meaning that enterprises with a low turnover may apply to be exempted from the reporting obligation for VAT. The exception means that a person liable to pay tax whose turnover for the present tax year does not exceed SEK 30 000 will not be subject to a reporting obligation for VAT under certain conditions. Moreover, the turnover must also not have exceeded SEK 30 000 during either of the two previous tax years. Actors likely to be affected by this include micro-scale producers of renewable electricity, such as homeowners who sell overproduction from their own solar photovoltaic cells.

3. Common electricity certificate scheme with Norway

The electricity certificate scheme is a market-based support scheme for the expansion of electricity production from renewable energy sources and peat. Producers of electricity whose electricity production meets the requirements in the Electricity Certificates Act receive one electricity certificate for each megawatt hour (MWh) of electricity that they produce. Demand for electricity certificates is created because all electricity suppliers and some electricity consumers are obliged to purchase electricity certificates equivalent to a certain percentage (quota) of their electricity sales/consumption. The quantity of electricity certificates that electricity suppliers have to purchase increases from year to year in line with the quota, which successively increases and results in rising demand for electricity certificates. Through their sales of electricity certificates, producers of renewable electricity thus gain an extra source of income in addition to their income from electricity sales. The scheme thus stimulates the expansion of renewable electricity production.

Since 2012, Sweden and Norway have had a common market for electricity certificates and a common target whereby the electricity certificate scheme must contribute to expansion in the order of 26.4 TWh of renewable electricity production by the end of 2020. Each country has to provide half of the financing, but it is up to the market to determine where and when new production will take place. The common electricity certificate market is the first example in the EU of a common support scheme as described in Article 11 of the Renewables Directive.

In accordance with Swedish Government Bill 2014/15:123 on Enhancing Renewable Electricity and Control Points for the Electricity Certificate Scheme in 2015, the Swedish Parliament has decided that 30 TWh of new, renewable electricity production is to be financed by 2020 in comparison with 2002 levels. The new national financing target replaces the target previously set by the Swedish Parliament for the production of renewable electricity, which involved an increase of 25 TWh by 2020 in comparison with 2002 levels. The target for the common market with Norway is being increased from 26.4 TWh to 28.4 TWh of new, renewable electricity production by 2020.

Collaboration with Norway on a common electricity certificate market is regulated by a bilateral agreement between Sweden and Norway. The agreement regulates the target for the common market by 2020, as well as a commitment to abolish electricity certificates by 2020 and phase them out completely by 2035. According to the agreement, the countries need to agree on any amendment of the target for the common electricity market that is to be achieved by 2020. Through the agreement between the Governments of Sweden and Norway,

the two Governments agreed *inter alia* to increase the common target for new renewable electricity production in the common electricity certificate market up to 28.4 TWh by 2020 with the aim of enabling the enhanced ambition announced by the Government. The increase will, however, be financed by Sweden.

In April 2017, the Government presented Bill 2016/17:179 'New Goals for Renewable Electricity and Control Points for the Electricity Certificate Scheme in 2017' containing proposed changes to the Act (2011:1200) on Electricity Certificates, which means that the electricity certificates scheme will be extended to 2045 and that the system will be expanded by 18 TWh by 2030. The enhanced ambition will be financed by Sweden. The proposal was approved by the Swedish Parliament on 20 June 2017 and involves the linear escalation of the 18 TWh, which will commence in 2022 and amount to 2 TWh per year through to 2030. The legislative changes will enter into force on 1 January 2018.

4. Tax reduction for micro-scale renewable electricity production

In order to facilitate investments by private individuals and enterprises in the production of electricity from renewable sources for their own consumption, micro-producers receive financial compensation for the surplus electricity that they feed into the grid. As of 1 January 2015, natural and legal persons, the estates of deceased persons, and Swedish limited companies may, pursuant to Articles 27-33 of Chapter 67 of the Income Tax Act (1999:1229) receive a tax reduction for the micro-scale production of renewable electricity. The reduction provides financial compensation for the part of the electricity that these producers feed into the electricity grid without compensation.

The tax reduction applies to the person who produces renewable electricity, feeds in renewable electricity at one and the same connection point as that from which he takes electricity, has a fuse of at least 100 amperes at the connection point, and has reported his micro-scale production to the grid concession holder. Private individuals and enterprises are eligible for the tax reduction. The right to a tax reduction is granted in respect of the kilowatt hours of renewable electricity that have been fed in at the connection point over the course of the calendar year, but amounting to no more than the number of kilowatt hours of electricity taken from that connection point during the year. The basis for the tax reduction may not exceed 30 000 kilowatt hours per person or per connection point. The tax reduction amounts to the basis multiplied by SEK 0.60.[33]

5. Reduced energy tax for micro-scale producers of renewable electricity

The exemption from tax liability applies to electrical power produced in a facility with an installed power output of less than 50 kW, by a producer possessing a total installed power output of less than 50 KW, and that has not been transferred to an electricity grid covered by a grid concession issued with the support of Chapter 2 of the Electricity Act.

As regards what is meant by an installed power output of 50 kW, this corresponds to a 125 kW installed generator output for electrical power generated from wind or wave power, 255 kW installed peak power for solar power, and 50 kW installed output for other sources

[33] http://www.skatteverket.se/privat/fastigheterbostad/mikroproduktionavfornybarel/skattereduktionformikroproduktionavfornybarel.4.12815e4f14a62bc048f4220.html.

without a generator. The installed output must be pooled when electrical power is produced from various different sources.

If the producer's total generator output exceeds 50 kW or corresponding, but the individual facility does not correspond to this value, the energy tax will instead be set to a rate of SEK 0.50 per kWh. The tax exemption will be provided in the form of a reduction in energy tax on electricity. This reduction is one of the steps announced in connection with the Government's work to abolish the energy tax on solar electricity produced by small facilities at the location where the electricity is consumed.

6. Exemption from grid charges

Electricity consumers with their own small-scale electricity production facility who use their own electricity production to supplement that purchased from the electricity system are exempt from fees for the feeding of electricity. An exemption from grid charges applies to electricity consumers with a power rating contract for a maximum of 63 amperes who produce electricity for which the feed in takes place with a maximum output of 43.5 kilowatts. However, the exemption will only apply if the electricity consumer has used more electricity from the electricity grid than has been fed in. One example of an electricity consumer covered by the aid is a farmer with small wind turbines and buildings with solar panels fitted to the roof. The self-produced electricity is sometimes entirely used for the farmer's own consumption, but during other periods, more electricity is produced than is required for the farmer's consumption. The surplus is normally fed into the local grid and subsequently into the national electricity system. Releasing these electricity consumers from the obligation to pay grid charges for their feed in increases the profitability of selling surpluses.

7. Amended aid levels for investment aid for solar photovoltaic cells connected to the electricity grid

State aid has been available for the installation of solar photovoltaic cells since 2009. The aid is aimed at all kinds of stakeholders, such as enterprises, public-sector organisations, and private individuals. There is great interest in this aid, and approximately 8 000 applications were submitted to the County Administrative Boards as of December 2014, approximately 3 000 of which were granted aid.

As of 1 January 2015, the aid level has been a maximum of 30 % for enterprises and 20 % for other stakeholders. The aid level is calculated on the basis of the eligible installation costs. The maximum aid possible for each solar photovoltaic cell system is SEK 1.2 million, and the eligible costs may amount to no more than SEK 37 000, excluding VAT, for each kilowatt of electrical peak power installed. The aid covers the installation of all kinds of solar photovoltaic cell system and solar electricity/solar heating hybrid systems that are connected to the grid. Applications are processed by the County Administrative Boards in order of receipt. The aid has a framework limit, which means that it may only be granted while the money set aside for it is available. Installations that are eligible for electricity certificates may also obtain aid for solar photovoltaic cells.

Investment aid has remained high during 2017 with SEK 200 million to reduce queues. Aid in 2018 will be reinforced with SEK 525 million. The total amount of aid is SEK 915 million

per year for the period 2018–2020. The aid level will be raised to 30 % for all beneficiaries compared with the present rate of 20 % for households.[34]

8. Aid for energy storage for electricity produced by individual customers

Energy storage can contribute to increased efficiency of the energy system. In order to help enhance the opportunities open to individual customers to store electricity they have produced themselves, the Swedish Government has offered a subsidy since November 2016 for the storage of electrical energy produced by individual customers. The subsidy allows private individuals to receive financial support for the installation of a storage system[35]. The subsidy will be available until 2020 and amounts to a total of SEK 60 million per year. The requirement imposed on the system for which the subsidy is to be used is that it must be connected to an electricity production facility by the individual customer that is connected to the electricity grid. This will promote the storage of electrical energy for use at times other than at the time of production, and increase the annual percentage of electrical energy produced by individual customers themselves used in the property to meet their own electricity needs. The subsidy may be granted for a maximum of 60 % of the cost of the storage system, up to a maximum amount of SEK 50 000. The Ordinance entered into force on 15 November 2016.

9. Smart Electricity Grid Forum

The Swedish Government has set up a Smart Electricity Grid Forum, with a focus on promoting and developing dialogue on the opportunities for smart electricity networks. To this end, SEK 10 million per annum will be invested over the 2016–2019 period in accordance with the draft Budget for 2016.

10. Wind Power Network

The aim of the Wind Power Network is to promote the expansion of wind power by means of information initiatives, training events, exchanging experiences, and financial aid for projects relating to wind-power issues. The Swedish Energy Agency acts as a hub for the Network and has formal responsibility for it, which means *inter alia* that it makes decisions on the resources allocated to projects in the Network through annual calls for expression of interest. The number of projects granted resources has fluctuated between 15 and 32, and the total amount of funding granted has varied between SEK 8 million and SEK 18 million. The Network has funding up to and including 2019.

11. The ‘Klimatklivet’ project for local climate investments

The ‘Klimatklivet’ initiative is part of the Swedish Government’s budget, which has been adopted for 2018 by the Swedish Parliament, and is regulated through Ordinance (2015:517) on aid for local climate investments. Since 2015, SEK 2.6 billion has been awarded in aid for

[34] Ministry of the Environment and Energy, Memorandum, The largest ever investment for green spatial planning, 4 September 2017.
[35] Ordinance (2016:899) on the installation of systems to store electricity produced by individual customers.

around 1 300 projects, and further funds will be allocated up to and including 2023. During 2018, the aid amounted to a total of SEK 1.7 billion.

The aid from Klimatklivet must go to climate investments at a local level, for example in a town or municipality, in an enterprise or in a school. The main aim of the investments must be to reduce greenhouse gas emissions. A number of the projects granted aid contribute to the increased use of renewable energy, e.g. through the increased production of biogas or charging points for electric vehicles. In addition, desired effects include the distribution and marketing of new technology and an impact on other environmental quality goals, health and employment. Organisations covered by emissions trading may only receive aid from Klimatklivet if they contribute to the increased use of waste heat. Moreover, aid may not be granted from Klimatklivet for electricity production receiving electricity certificates. Anyone except private individuals and sole traders may apply for funding from Klimatklivet.

12. Extended aid for energy and climate advice

The Swedish Energy Agency offers financial aid for municipal energy and climate advice under Ordinance (2016:385) on municipal energy and climate advice. The Ordinance entered into force on 1 July 2016 and supersedes Ordinance 1997:1322 on municipal energy and climate advice.

The aid has been extended for the period up to and including 2020 and covers a total of around SEK 485 million for the period 2018–2020. This enables in-depth advice to be provided at local level and special project initiatives through energy and climate advice. The energy and climate advice is aimed at the general public and small and medium-sized enterprises and organisations. Municipal energy and climate advisors respond free of charge to questions, including those relating to heating, energy costs, energy efficiency, transport, climatic impacts and State subsidies relating to energy. The information is intended to help reduce energy consumption and to use more environmentally-friendly technology, wherever possible.

13. Extended aid for regional energy offices

Since 2002, the Swedish Energy Agency has been in charge of the financial aid granted to the regional energy offices and is responsible for some of the funding for the energy offices, so it requires reports on these offices' activities, primarily in relation to the efforts that have been made in coordinating municipal energy and climate advisers. The energy offices also have the role of leading regional development in the coordination of energy and climate advisers, which entails greater responsibility for the development of advice and means that there is a clearer link between the Swedish Energy Agency and the advisers. Since 2016, the energy offices have also taken on the role of national initiative leader for the project initiatives implemented by all advisors in the country at regional level. There were three project initiatives during 2016 focusing on the sun, transport and lighting.

The energy offices initiate and participate in major projects relating to energy efficiency and renewable energy sources, with funding from the EU, the County Administrative Boards, regional councils and other organisations. The energy offices also operate regionally, whereby they work in collaboration with business, the County Administrative Boards, local

authorities, municipal federations, etc. This could involve plans and strategies, for example. The regional energy offices cover all of Sweden. There are 15 energy offices and aid amounts to approximately SEK 10 million per annum, being divided among all of the energy offices up until 2020. The aid is included in appropriation 1:2 Initiatives for energy efficiency, under expense area 21 (energy), more specifically under the appropriation for municipal energy and climate advice.

14. Local and regional capacity development for climate and energy adaptation

The appropriation for local and regional capacity development for climate and energy adaption, which will be divided between the Swedish Energy Agency and the County Administrative Boards during the period 2016-2020, may be used to finance the County Administrative Boards' work in coordinating local authorities, enterprises and other stakeholders in their respective counties, and running the development, implementation, follow-up and the evaluation of regional energy and climate strategies, aid for regional networks and collaboration projects. The work is based on the regional climate and energy strategies. The appropriation may also be used for coordination and cooperation between the County Administrative Boards. The appropriation has been strengthened and extended and comprises SEK 90 million for 2018, SEK 115 million for 2019 and SEK 135 million for 2020.

The payment of funds will be linked to the reporting obligation concerning the use of the subsidy. The regional networks and collaboration projects that have been established aim to increase the capacity of participating stakeholders to work with climate and energy adaptation. The development of appropriate methods, work processes and learning within organisations are anticipated outcomes of the aid.

15. Investment aid for biogas and other renewable gases

Aid was introduced in 2010 for the production, distribution and use of biogas and other renewable gases to promote energy technology that is climate-friendly but not yet commercially competitive. The previously approved projects continued in 2015 and 2016, but no further calls for expression of interest have been issued, and the aid will cease to be available following the end of these projects.

16. Investment aid under the Rural Development Programme 2014–2020

Farmers and other entrepreneurs in rural areas wishing to invest in facilities for the production of renewable energy (relating to biogas and including the use, upgrading and handling of digestate) may receive aid through the Rural Development Programme for 40 % of the expenses (subject to a maximum of SEK 200 000 over a three-year period). Enterprises not active in agriculture, gardening and reindeer farming must have a turnover not exceeding EUR 10 million and have fewer than 50 employees in order to receive aid.

17. Aid for manure gas

Aid for the production of biogas from manure has been available since 2015. The aim is to provide compensation for biogas production from manure for its climate and environmental benefits through special production aid or 'methane reduction compensation'. In 2015, the compensation level was SEK 0.20 per kWh, which has been increased to SEK 0.40 per kWh from 2016.

The aid has been put together in the form of a project running from 2014 to 2023 with a total of SEK 385 million allocated for the period. The aid is based on the quantity of manure that is digested by a facility and how much biogas is produced. If the manure is digested with another substrate, aid will only be available for the gas that can theoretically be derived from the manure. The funds allocated for the aid period also represent a limit as to the amount of aid that will be paid.

18. Business development aid

Since the start of 2006, the Swedish Energy Agency has been engaging with start-up enterprises operating in the energy sector. The Swedish Energy Agency helps fledgling enterprises bring new products and services to the market and supports these enterprises until they reach a level of maturity at which private stakeholders are prepared to take over, provide finance and drive further development. Aid for business development is granted for projects where the Swedish Energy Agency considers the commercial potential to be high and believes that the project will have a significant impact on the adaptation of the energy system.

The work relating to business development is based on contributions with limited royalties. This aid is repaid in the event of commercial success. During 2016, a total of 10 enterprises have been granted contributions with royalties and one enterprise has been granted a growth loan.[36]

19. Road tax exemption for green vehicles

As of 1 January 2013, cars, light vans and light buses that fulfil the new definition of green vehicles and which are taken into use for the first time in Sweden are exempt from road tax for five years from the date on which the vehicle in question is taken into use. The calculation that determines whether a vehicle is classed as a green vehicle is the kerb weight of the vehicle minus 1 372 and multiplied by 0.0457. A factor of 95 is then added for a vehicle that can run on petrol or diesel, or 150 for a vehicle that can run on biofuel. If the information in the road traffic register is the same or lower than the calculated sum, the vehicle will be covered by the tax exemption. If it is an electric or plug-in hybrid, electrical energy consumption may be a maximum of 37 kilowatt hours per 100 kilometres, according to information from the manufacturer or concessionaire. The tax exemption will be obtained automatically if a vehicle is covered by it. The aim is to stimulate purchases of fuel-efficient vehicles and vehicles that can run on biofuels or electricity.

The vehicle tax exemption for green vehicles will be abolished in connection with the implementation of the bonus malus system (see 32. Bonus malus system). The bonus malus system will enter into force on 1 July 2018.

[36] Swedish Energy Agency Annual Report 2016.

20. CO_2-based road tax

CO_2-differentiated road tax was introduced in 2006. As of 2015, this tax consists of a basic amount of SEK 360 per annum. The amount of CO_2 is SEK 22/gram of CO_2 emissions in excess of 111 grams/kilometre for combined-cycle use.

For vehicles equipped with the technology to run on a fuel mixture consisting predominantly of alcohol, or consisting in whole or in part of a gas other than LPG (e.g. ethanol or methane gas), the amount of CO_2 is SEK 11/gram of CO_2 that the vehicle emits per kilometre during combined-cycle use in excess of 111 grams.

For vehicles that are able to run on diesel fuel, the total of the basic amount and the CO_2 amount must be multiplied by a fuel factor of 2.37. An environmental supplement of SEK 500 is applied to vehicles that first became taxable before the end of 2007, and a supplement of SEK 250 is applied to vehicles that first became taxable following the end of 2007. The system covers the following vehicles:

- Private motor cars, class I registered during or after 2006 in accordance with the road traffic register;

- Private motor cars, class I registered before 2006, but fulfil the requirements for environmental class 2005 for electric or hybrid vehicles;

- Private motor cars, class II (motorhomes), light buses and light vans that first became taxable following the end of 2010.

Light vehicles registered before 2006 are taxed on various factors, including weight.

21. Extension of reduced taxable benefit value for certain environmentally-adapted vehicles

Plug-in and other environmentally friendly vehicles that run on alternative fuel may give entitlement to a reduction in the taxable benefit value, which aims to stimulate sales of such vehicles.

The present rules concerning the reduction in the taxable benefit value for environmentally adapted vehicles comprises two parts. The first part is a permanent reduction, which means that the taxable benefit value for a vehicle that is wholly or partly equipped with technology for running on electricity or a more environmentally friendly fuel other than petrol or diesel oil is reduced to a level corresponding to the taxable benefit value of a comparable vehicle running on petrol or diesel. This applies to both electric and plug-in hybrid vehicles that run on biofuels.

For electric and plug-in hybrid vehicles that can be recharged from the electricity grid, and gas-fuelled vehicles (not LPG), the taxable benefit value will be reduced further to a value that corresponds to 60 % of the tax benefit value of the closest comparable conventional vehicle. Such reductions may not exceed SEK 16 000 per year.

The temporary reduction will be extended from 2017 up to and including 31 December 2020, but the maximum amount for the reduction in taxable benefit value will fall from SEK 16 000 to a maximum of SEK 10 000 per year.

New provisions concerning the calculation of the taxable benefit value of vehicles will enter into force on 1 January 2018. The vehicle tax imposed on a vehicle will be taken into account as an additional item in the calculation of the taxable benefit, in addition to the price base amount component, the interest-related amount and the price-related amount. Furthermore, benefits in the form of congestion charges and road, bridge and ferry charges paid will no longer be included in the vehicle's taxable benefit. The purpose of the new provisions is to adapt the taxable benefit value to the new bonus malus-based vehicle tax, which will be introduced on 1 July 2018.

22. Extension of the super green vehicle premium until 30 June 2018

A premium is paid to green vehicles meeting the requirements to be considered as super green vehicles. The provisions relating to this premium are regulated by the Ordinance (2011:1590) on the super green car premium. The premium covers cars with very low greenhouse gas emissions, i.e. a maximum of 50 grams CO_2 per km, which also fulfils the EU's most recent emissions requirements (Euro 5 or Euro 6). The contribution is a maximum of SEK 40 000 per car, and is paid out by the Swedish Transport Agency. The premium will be extended through to 30 June 2018 and will then be replaced by the bonus malus system. The appropriation will be increased by SEK 250 million in 2018.

23. Urban environmental agreements

Local authorities and county councils may apply for aid to promote sustainable urban environments, or 'urban environmental agreements', which are administered by the Swedish Transport Administration through the Ordinance (2015:579) on aid for promoting sustainable urban environments. The aim of the urban environmental agreements is to use State cofinancing to create the conditions for ensuring that public transport and cycling accounts for a greater proportion of journeys. The measures are intended to result in energy-efficient solutions with low greenhouse gas emissions, and the aid will in particular promote innovative, high capacity and resource efficient solutions for public transport or bicycle traffic. Aid is also given to demonstration facilities for new solutions relating to local and regional public transport. The aid is given for no more than 50 % of the costs of the measures that are implemented.

SEK 2.75 billion is being set aside in aid for the 2015-2018 period. During 2015 and 2016, the Swedish Transport Administration has granted aid amounting to around SEK 1.26 billion in cooperation with the Swedish Energy Agency. A condition for receiving aid is that counterperformances are also implemented that contribute towards sustainable transport or increased housing developments.

24. Coordination of energy adaptation in the transport sector

In its spending authorisation for 2016, the Swedish Energy Agency was tasked with coordinating and preparing a strategic plan for the transition to a fossil-free transport sector together with five other authorities (the National Board of Housing, Building and Planning, Swedish Environmental Protection Agency, Transport Analysis, Swedish Transport Administration and the Swedish Transport Agency). The Swedish Energy Agency has set aside SEK 3 million per year between 2016 and 2019 in accordance with the draft Budget for 2016. The strategic plan was submitted in April 2017 and work is now being done to implement the plan.

25. Implementation of the sustainability criteria laid down in the Renewables Directive

The Act on Sustainability Criteria for Biofuels and Bioliquids entered into force on 1 August 2010 in order to implement the provisions of the Renewables Directive concerning sustainability criteria. The provisions of the Directive concerning sustainability criteria also entail certain amendments to the Electricity Certificates Act. The Act, Ordinance and regulations have been published on the Swedish Energy Agency's website.[37]

26. The Fuel Act

The EU's Fuel Quality Directive[38] was updated in 2009 to include requirements concerning reductions in greenhouse gases and a reporting obligation for fuel suppliers. The Directive was implemented in Sweden by the Fuel Act (2011:319). The Act stipulates that individual

[37] www.energimyndigheten/hbk.
[38] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC, most recently amended by Commission Directive 2011/63/EU.

fuel suppliers must reduce the greenhouse gas emissions caused by the fuels that they have supplied by at least 6 % by 2020 in comparison with 2010 levels. The Swedish Energy Agency has been designated the monitoring authority for those parts of the Act that relate to greenhouse gas reductions and the reporting of certain information.

Calculation methods have been decided upon by means of a supplementary Directive, namely Council Directive (EU) 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements. The Directive has brought about changes to the Fuel Act[39], and the Swedish Energy Agency has distributed a proposal for consultation concerning regulations relating to the legislation.

27. The Pump Act

The Act (2005:1248) on the Requirement to Provide Renewable Fuels means that large petrol stations have been obliged to provide renewable fuels since 1 April 2006. The aim of what is known as the Pump Act is to reduce CO_2 emissions by improving accessibility to renewable fuels. Sales points that had a sales volume in excess of 1 500 cubic metres of petrol or diesel fuel during the calendar year two years previously have been covered by the Pump Act since 1 August 2014.[40]

28. Electric bus premium

The Swedish Government has set aside SEK 750 million for the period 2016-2023 for an ‘electric bus premium' through Ordinance (2016:836) on an Electric Bus Premium. The aim of the premium is to promote the introduction of electric buses to the market and thereby contribute to the overall environmental goal of a better climate, reduced air pollution and reduced noise levels. The electric bus premium is aimed at regional public transport authorities and transport companies. The premium is paid on electric buses, plug-in hybrid buses and trolleybuses with a transport capacity of at least 15 passengers that are used for public transport. The size of the electric bus premium corresponds to 20 % of the purchase price of the electric bus but is limited by the price difference between the electric bus and the closest comparable conventional bus.

29. Ordinance on environmental and traffic-safety requirements for authorities' cars and car journeys

Ordinance (2009:1) stipulates that private cars purchased by an authority or for which an authority enters into a leasing agreement must be green vehicles. In the case of light vans, the vans must have emissions not exceeding 230 grams of CO_2 per kilometre during combined-cycle use. Authority vehicles equipped with technology enabling them to be run either entirely or partly using renewable fuels must be driven using such fuels wherever possible. Follow-up takes place in the form of a report, which must be submitted to the Swedish Transport Agency by no later than 1 March annually. The Ordinance entered into force on 1 February 2009 and supersedes Ordinance (2004:1364) on State authorities' purchasing and leasing of green cars.

[39] http://www.regeringen.se/remisser/2017/01/remiss-av-promemoria--minskad-klimatpaverkan-av-drivmedel/.
[40] SFS 2014:537.

30. Expansion and reinforcement of research initiatives in the energy sector

In the draft Budget for 2017[41], the Swedish Government proposed the expansion and gradual strengthening of initiatives for research and development under the Energy spending area worth a total of SEK 620 million for 2017-2020. The appropriation proposals presented in the draft Budget for 2017 were retained in the draft Budget for 2018[42]. In relation to the previously determined levels, the appropriation will rise by SEK 70 million in 2017, SEK 115 million in 2018, SEK 185 million in 2019 and SEK 250 million in 2020. This means a level of around SEK 1.6 billion from 2020 compared with the previous basic level of around SEK 1.3 billion. This strengthening has made it possible to raise the level of ambition as regards a number of adjacent areas, such as cross-sectoral and interdisciplinary research and innovation, international cooperation, strategic innovation areas and gender equality in the future energy system[43].

The majority of the funding will be at the disposal of the Swedish Energy Agency and the work will be driven on the basis of five overarching challenges relating to the financing of research in the energy sector:

- An entirely renewable energy system;
- A flexible and robust energy system;
- A resource-efficient society;
- Innovation for jobs and climate;
- Interaction in the system.

Based on these challenges, research and innovation initiatives will be implemented in nine separate topic areas:

- The transport system;
- Bioenergy;
- Buildings in the energy system;
- Electricity production and the electricity system;
- Industry;
- A sustainable society;
- General energy system studies;
- Business development and commercialisation;

[41] Swedish Government, Draft Budget for 2017, Bill 2016/17:1.
[42] Swedish Government, Draft Budget for 2018, Bill 2017/18:1.
[43] Swedish Government, Bill 2016/17:66 Research and innovation in the energy sector for ecological sustainability, competitiveness and security of supply.

- International cooperation.

31. Reduction obligation

The reduction obligation requires petrol and diesel that is sold to reduce greenhouse gas emissions compared with a corresponding energy quantity of fossil fuel petrol or fossil fuel diesel fuel through the blending of biofuels. The reduction levels must initially be 2.6 % for petrol and 19.3 % for diesel, and will increase gradually until 2030 to contribute to attainment of the target of a 70 % reduction in greenhouse gas emissions. The reduction obligation will apply from 1 July 2018[44].

32. Bonus malus system

The current super green vehicle premium and the five-year tax exemption for green vehicles will be replaced by a bonus malus system for light vehicles. The system only applies to new vehicles and means that light vehicles, light buses and light vans with low CO_2 emissions will be favoured upon purchase in the form of a bonus, while vehicles with high CO_2 emissions will be subject to higher vehicle tax (malus) during the first three years from when the vehicle becomes taxable for the first time[45].

The maximum bonus will be awarded to vehicles with zero emissions and these will receive SEK 60 000; the bonus will then be reduced linearly until an emissions level of 60 grams is reached, for which the bonus will be SEK 10 000. The malus aspect will apply from 95 grams of CO_2 per kilometre and will increase in line with increasing emissions. No malus will apply to vehicles that can run on ethanol or a gas other than LPG, and gas-powered vehicles will receive a bonus of SEK 10 000.

The bonus malus system will enter into force on 1 July 2018. SEK 1 240 million has been set aside for 2019 and SEK 1 630 million has been set aside for 2020.

33. Action plan for infrastructure for alternative fuels

In accordance with Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure, each Member State must adopt a national action plan to develop the market for alternative fuels in the transport sector and the development of associated infrastructure. The Directive defines alternative fuels as fuels or power sources which at least partly serve as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. These include, inter alia: electricity, hydrogen, biofuels as defined in point (i) of Article 2 of Directive 2009/28/EC, synthetic and paraffinic fuels, natural gas, including biomethane, in gaseous form (compressed natural gas (CNG)) and liquefied form (liquefied natural gas (LNG)), and liquefied petroleum gas (LPG). The action plan was adopted by the Government on 17 November 2016.[46]

[44] Swedish Government, Memorandum 17 March 2017.
[45] Swedish Government, Draft Budget for 2018, Bill 2017/18:1.
[46] Swedish Government, Sweden's Action Plan for the Infrastructure for Alternative Fuels in Accordance with Directive 2014/94/EU.

34. Coordination for sustainable transport

The Swedish Energy Agency's Government assignment during the period 2015-2018 of coordinating aid for the development of the charging infrastructure and information concerning the location of charging stations has been expanded and extended from 2018 to also include gas and other fuels requiring separate infrastructure. The work includes supporting the Environmental Protection Agency in relation to aid for charging infrastructure under the Klimatklivet initiative, including in the form of expert knowledge and advice concerning prioritisation and information concerning geographical distribution and the evaluation of aid granted. The appropriation will therefore be increased by SEK 5 million annually between 2018 and 2020. The work will be coordinated with the strategy work under the direction of the Swedish Energy Agency relating to the transition to a fossil-free transport sector.[47]

An initial report for the work relating to climate investment aid and charging infrastructure for electric vehicles was prepared and submitted to the Government Offices of Sweden in March 2016.

35. Environmental information concerning fuels

A proposal concerning the requirements for environmental information concerning fuels to be provided by fuel suppliers has been prepared by the Government Offices of Sweden and has been announced in the draft Budget for 2018. The proposed requirements mean that fuel suppliers must provide information concerning the fuel's greenhouse gas emissions per energy content, origin and raw ingredients to consumers via the supplier's website. Information concerning greenhouse gas emissions may possibly also be provided via labelling at the pump.

36. Urban innovations

The programme involves SEK 68 million during the period 2016–2019 and aims to boost demand for and the increased use of high tech and advanced system solutions in urban environments. The aid will contribute to innovations for sustainable solutions in areas such as water, wind, waste, energy and transport.

Funds may be obtained for planning, preliminary studies and planning for the use of high tech and advanced system solutions in urban environments. It is intended that the project will lead to more investment decisions involving high tech and advanced system solutions and aid may be applied for by e.g. county councils, local authorities, companies, organisations, housing associations, non-profit associations, financial associations, universities, university colleges and foundations. However, sole proprietorships or private individuals may not apply for this aid.

37. Energy efficiency aid under the National Regional Fund programme

The Government has given the Swedish Energy Agency the task of providing aid for energy efficiency through the European Regional Development Fund to SMEs within the framework of the National Regional Fund programme and where the Swedish Agency for Economic and Regional Growth is the managing authority. The goal is that energy consumption among

[47] Swedish Government, Draft Budget for 2018, Bill 2017/18:1.

SMEs must reduce by 10 % per unit of value added up until 2023. The Swedish Energy Agency has SEK 80 million per year available during the period 2015-2020, with SEK 40 million coming from the Swedish Government and SEK 40 million coming via the European Regional Development Fund.

38. Fossil-free transport solutions

SEK 1 billion has been set aside for the period 2018-2023 to focus on the development of fossil-free transport solutions. The initiative must support the conversion to an electrified transport sector and the development of sustainable solutions for electric cars and other electric vehicles, including batteries. The initiative also relates to developments such as biogas.

39. Home charging

SEK 90 million has been set aside annually for the period 2018-2020 to make it easier for households to invest in the installation of charging points for electric vehicles in the home.

40. Electric vehicle premium

SEK 350 million has been set aside annually for the period 2018-2020 for electric vehicle premiums for the purchase of electric bicycles and electric mopeds. The intention is to replace car journeys in major cities with journeys using these types of electric vehicles.

41. Amendment of property tax for hydro power

The property tax for hydro power facilities is to be gradually reduced to 0.5 % of the valuation figure over a four-year period starting in 2017.

Point 2a Evaluating and improving administrative procedures

2.a Please describe the progress made in evaluating and improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy. *(Article 22(1)(e) of Directive 2009/28/EC.)*

Follow-up and evaluation of licensing processes for renewable energy production

The Swedish Government has tasked the Swedish Energy Agency and the Swedish Environmental Protection Agency with following up and analysing the way in which the planning and licensing process for the establishment of wind power has been developed following the authority's Guidelines on municipal ratification produced in 2015. The task also includes the proposal of measures to facilitate the licensing process if the authorities consider there to be a need for such measures. The report was submitted to the Government Offices of Sweden in June 2017 and has subsequently been distributed to obtain the views of parties affected by 4 December.

Improving administrative procedures to remove regulatory and non-regulatory barriers to the development of renewable energy

The Planning and Building Act (2014:900) was amended on 1 January 2015. The main aim of the legislative amendments was to make the processes subject to the Planning and Building Act more simple and efficient. The amendments mean that more planning proposals should be handled by means of what is known as a standard procedure, which involves a simpler process with fewer steps before the plan can be adopted. The amendments also mean that even simpler procedures will be introduced for cancelling detailed plans and extending the implementation period. This should have a positive impact on the time taken in several cases where the development of renewable energy requires amendments to detailed plans.

Regulatory capacity of hydro power safeguarded

Hydro power plays a key role in the Swedish energy system, both as a production source and as a regulatory power and enables an increased percentage of renewable electricity production from non-regulable energy sources.

In order to fulfil the EU's Water Framework Directive and the Swedish environmental goal of flourishing lakes and streams, hydro power in Sweden must implement environmental measures. Therefore, the Swedish Energy Agency has worked with the Swedish Agency for Marine and Water Management to draw up a proposal for a national strategy where catchment areas are assessed based on their importance to the electricity system and environmental impacts. Together with Svenska Kraftnät, the two agencies have developed the strategy further, with the aim of assessing what constitutes reasonable measures at installation level. The starting point for the assessment at installation level is that the contribution of hydro power in terms of its regulatory capability in the electricity system must be

safeguarded, while at the same time essential measures to achieve a good ecological status in watercourses must be achieved. The proposals have been distributed for consultation.

The considerable importance of hydro power in the energy system is also indicated in the Energy Agreement, which inter alia stipulates that hydro power must have modern environmental conditions and that hydro power must primarily be developed by increasing the output of existing plants with modern environmental licensing. In order to implement the Energy Agreement, the Ministry of the Environment and Energy has distributed a memorandum entitled *Vattenkraft och Vattenmiljö (Hydro power and aquatic environments)*, which is now being prepared for the Government Offices of Sweden.

Solar strategy developed

The Swedish Government tasked the Swedish Energy Agency with proposing a strategy for increasing the use of solar electricity in Sweden and analysing how solar energy could contribute towards Sweden having 100 % renewable electricity in the long-term. The strategy was presented to the Government in October 2016. The strategy includes a goal which states that around 5-10 % of electricity usage is considered to realisable for Sweden by 2040, which corresponds to 7-14 TWh. The strategy also includes two packages of measures to increase the use of solar electricity in Sweden, one focusing on the immediate period leading up to 2022 and the other on the longer term through to the reduction year of 2040. The first phase of the strategy addresses barriers which prevent the introduction of small and medium-sized players to the electricity market. The strategy also includes short-term measures to increase the availability of information regarding photovoltaic installations and to increase the number of certified photovoltaic cell suppliers.

National interest areas to optimise land use

The Swedish Energy Agency is responsible for specifying national interests as regards energy production and distribution. The specification of national interests regarding wind power, which began in 2004 and was most recently updated in 2013, is a vital aspect of the assessment of wind power relative to other interests in land use planning.[48] Identifying the best locations in the country for wind power as a national interest in wind power is a key part of the work to bring about an increase in the percentage of renewable energy. The Swedish Energy Agency is currently reviewing and updating the national interests for energy purposes to ensure that areas of importance for the energy system are safeguarded without impinging on other interests unnecessarily. The overview covers both the updating of older requirements for energy production and the designation of national interests regarding hydro power and energy distribution. It is anticipated that the agency's decision concerning these national interest expectations will be made during 2018.

Mapping services for information with wind power projects

The Swedish Energy Agency is also working on the further development of the web-based 'Vindbrukskollen' mapping service concerning the establishment of wind-power plants in Sweden, and which was launched in August 2012. The Vindbrukskollen website is made available through a collaboration between the Swedish Energy Agency, the County

[48] https://www.energimyndigheten.se/Om-oss/Var-verksamhet/Framjande-av-vindkraft/Riksintresse-vindbruk-/.

Administrative Boards and the Wind Power Network[49]. The mapping service is available to everyone and can be used to search for information about wind-power plants and the surrounding environments. Vindbrukskollen may also be used as an aid for project design. The work is currently focussing on supplementing and quality-assuring information concerning existing and planned wind power projects in the mapping service.

Development of marine plans

On 17 June 2015, the Swedish Government adopted a Marine Planning Ordinance, which regulates the manner in which marine planning by the State is to be carried out in Sweden. According to that Ordinance, the Swedish Agency for Marine and Water Management must produce draft marine plans for the Gulf of Bothnia, the Baltic Sea and the North Sea. The marine plans must help to ensure that marine resources are used sustainably and that industry can be developed whilst at the same time achieving a good marine environment. As part of this work, the Swedish Agency for Marine and Water Management must work in collaboration with the Swedish Energy Agency in relation to the opportunities for looking after marine energy in the form of marine wind power and wave energy. The Swedish Agency for Marine and Water Management produced the first draft of marine plans during autumn 2016, which were then distributed for consultation in the spring of 2017. A dialogue is currently under way between the agencies concerned in preparation for the cooperation concerning the marine plans, which is planned to commence at the start of 2018.

Guidance in connection with the decommissioning of wind power plants

The Swedish Energy Agency worked in collaboration with the Swedish Environmental Protection Agency to develop guidelines for the decommissioning of wind-power plants and site reclamation, which were published in 2016. The guidelines summarise the knowledge currently available and issue recommendations on the decommissioning of wind-power plants and site reclamation, with the aim of contributing to a more uniform enforcement throughout the country.

[49] The Network is organised by the Swedish Energy Agency and includes County Administrative Boards, the Gotland Campus of Uppsala University, and local authorities.

Point 2.b Measures in ensuring transmission and the sharing of costs, etc.

2.b Please describe the measures in ensuring the transmission and distribution of electricity produced from renewable energy sources and in improving the framework or rules for bearing and sharing of costs related to grid connections and grid reinforcements. *(Article 22(1)(f) of Directive 2009/28/EC.)*

In Sweden, the state-owned Svenska Kraftnät (the Swedish national grid) has the task of managing, operating and developing in a commercial way a cost-effective, reliable and environmentally-adapted power transmission system, allocating excess capacity, and otherwise running activities that are linked to the power transmission system. According to the instructions for its sphere of activities, Svenska Kraftnät must ensure that the possibilities for expanding renewable electricity production are facilitated[50].

In order to facilitate the connection of renewable electricity production to the backbone grid, Svenska Kraftnät has produced a document providing guidance for project planners of large wind-power plants on matters relating to grid connection[51]. This guidance is described in more detail in the 2011 progress report under Article 22.

Grid reinforcement loans

A new Ordinance[52] has been in force since 1 May 2015, which means that grid companies can apply for a so-called grid reinforcement loan. The aim is to facilitate the connection of renewable electricity production to the electricity grid.

Grid reinforcement loans are a temporary solution which mean grid companies may, subject to certain conditions, apply for a loan from Svenska Kraftnät. The loan covers the part of the grid reinforcement costs that can facilitate the future connection of further electricity production in the same area. In contrast to the previous situation, the first connecting party need only pay 'its' part of the grid reinforcement.

The first round of applications was concluded on 31 December 2015. A second round of applications will be introduced as soon as the need for new grid reinforcement loans arises.

Efficient use of the electricity grid

In 2012, the EU decided upon a new Energy Efficiency Directive, which in turn involved amendments to the Swedish Electricity Act, meaning that grid companies' revenue frameworks are affected by how efficiently the network is used. The Swedish Energy Markets Inspectorate has produced a report entitled 'Incentives for Efficient Use of the

[50] Please see the third paragraph of the twelfth point in Ordinance 2007:1119 containing instructions for Svenska Kraftnät.
[51] http://www.svk.se/aktorsportalen/elmarknad/anslut-till-stamnatet/.
[52] Ordinance (2015:213) on loans to grid companies to facilitate the connection of renewable electricity production.

Electricity Grid', with associated regulations[53], with the aim of creating an incentive for electricity grid companies to use the grid efficiently. The Regulation entered into force on 1 June 2015. The aim of the new Regulation is to reduce grid losses and achieve a more even load on the electricity grid at all times of day and night. These incentives apply to the regulatory period 2016-2019.

The aim of using grid losses as an indicator of efficient use of the electricity grid is that they have a direct impact on grid costs and energy consumption. An incentive for grid companies to reduce losses thus generates clear benefits for grid users and for society as a whole.

The other indicator of balancing the grid load provides an incentive for the efficient use of the grid by evening out the grid load and capping power surges. Grid capacity may thus increase, resulting in greater opportunities for new connections for renewable energy or end-users, for example, without investing in additional capacity. A more even load also reduces grid losses.

National action plan for a smart electricity grid

In December 2015, the Swedish Government decided to set up a Smart Electricity Grid Forum. The forum is a special project within the Government Offices of Sweden, and the work is led by a steering group. The Smart Electricity Grid Forum is tasked with promoting a smart electricity grid as a growth sector, both in Sweden and internationally.

The Smart Electricity Grid Forum has decided on the following outcome targets:

- An electricity market comprising active customers and the robust and effective integration of 100 % renewable electricity production;
- Sweden to be a smart electricity grid hub with internationally recognised skills and to be a natural testbed for the smart electricity grid;
- Sweden to have both more numerous and greater variety in exporting companies, services and products within the smart electricity grid area.

In September 2016, the Smart Electricity Grid Forum set up a working group with the aim of developing a strategy for greater flexibility in the electricity system through a smart electricity grid. The report[54] entitled *Strategi för en ökad flexibilitet i elsystemet genom smarta elnät* (Strategy for greater flexibility in the electricity system through a smart electricity grid) was published on 22 September 2017. The strategy can be summarised under four key areas:

- Provide the conditions for new business models for flexible services;
- Develop the market for system services;
- Measures relating to IT security and integrity;

[53] Swedish Energy Markets Inspectorate, 2015, Incentives for Efficient Use of the Electricity Grid, Swedish Energy Markets Inspectorate report 2015:07.
[54] http://swedishsmartgrid.se/wp-content/uploads/2017/09/170914_slutrapport_flex_final.pdf.

- Information and knowledge-raising measures.

The strategy contains a total of 20 recommendations in the form of activities under these four areas.

Point 3. Support schemes for renewable energy

3. Please describe the support schemes and other measures currently in place that are applied to promote energy from renewable sources and report on any developments in the measures used with respect to those set out in your National Renewable Energy Action Plan. *(Article 22(1)(b) of Directive 2009/28/EC.)*

The Commission reminds Member States that all national support schemes must be compatible with the provisions on State aid as laid down in Articles 107 and 108 of the Treaty on the Functioning of the European Union. The notification of the report in accordance with Article 22 of Directive 2009/28/EC does not replace a State aid notification in accordance with Articles 107 and 108 of the Treaty on the Functioning of the European Union.

*It is suggested that **Table 3** be used to provide more detailed information on the support schemes in place and the support levels applied to various renewable energy technologies. Member States are encouraged to provide information on the methodology used to determine the level and design of support schemes for renewable energy.*

Please note that an account of the changes with regard to support schemes and other measures being applied is given first and foremost under point 2. Under this point, only more detailed information about the support schemes for renewable energy requested in Table 3 is provided.

Please also note that in many cases the support schemes listed in Table 3 overlap each other, and for this reason it may be difficult to obtain a true picture of the total subsidies involved. This factor, together with the fact that it has not been possible to quantify all aid for renewable energy, is why the total calculated aid, per sector and in total, has not been specified.

A general feature of Table 3 is that the specified aid levels are the estimated values. It should therefore not be interpreted as meaning that the aid level amounts to exactly the level specified in the table irrespective of whether it is a capital grant or a loan. The table should not be taken out context and makes no claim to be complete.

Table 3: Support schemes for renewable energy. Please note the comments above the table, and the footnotes.

RES support schemes, year specified per scheme		Info/aid per unit	Total, SEK*	Info/aid per unit	Total, SEK*	Total, EUR million*[55]
		2015		2016		2015 and 2016
Renewable electricity						
Electricity certificate scheme	Liability/quota in %	14.3 %[56] of quota-bound electricity consumption		23.1 %[57] of quota-bound electricity consumption		
	Penalty/buy-out option/buy-out price/unit[58]	SEK 243/MWh[59] NOK 248/MWh	SEK 1.1 million	SEK 208/MWh NOK 200/MWh	SEK 0.4 million	EUR 0.16 million
	Mean electricity certificate price[60]	SEK 174/MWh[61]	SEK 3 779 million[62] for renewables, excl. peat SEK 13 million[63] for peat.	SEK 156/MWh[64]	SEK 3 271 million[65] for renewables, excl. peat SEK 13 million[66] for peat.	Renewables EUR 764 million Peat EUR 2.8 million
Investment aid for solar photovoltaic cells connected to the grid	Aid for solar photovoltaic cell installations[67]	SEK 0.26/kWh	Amount granted SEK 97 million. Amount paid out SEK 78 million.	SEK 0.17/kWh	Amount granted SEK 260 million. Amount paid out SEK 139 million.	Granted EUR 38 million Paid out EUR 23 million
Renewable fuels[68],[69]						
Energy tax exemption for biofuels		-	SEK 3 960 million.	-	SEK 6 210 million.	EUR 1 098 million
Energy tax exemption for biofuels (heating)		-	SEK 5 060 million.	-	SEK 5 210 million.	EUR 1 112 million.

[55] Official exchange rates (as of 1 October of the year prior to the relevant year) have been used for conversions from SEK into EUR. The 2016 exchange rate has been used for certain amounts that are being paid out over several years. The relevant exchange rates were EUR 1 = SEK 9.0932 (2015); EUR 1 = SEK 9.3754 (2016). Source: Official Journal of the European Union.
[56] Source: Act (2011:1200) on Electricity Certificates.
[57] Ibid.
[58] Source: Swedish Energy Agency, *Detailed information on the electricity certificate scheme 2003-2016 with regard to quota liabilities and allocation of electricity certificates in Sweden.* Available at: http://www.energimyndigheten.se/contentassets/045c073e424c405d8bc195990373d20a/detaljerade-uppgifter-elcertifikatsystemet-2003-2016.docx. Last accessed 11 September 2017.
[59] One electricity certificate = 1 MWh.
[60] The mean electricity certificate price specifies the mean price based on all transfers effected in the Cesar accounting system during the relevant year, and it differs from the market price.
[61] Source: Swedish Energy Agency Cesar reporting system.
[62] The calculation is based on information from Cesar concerning the types of energy that were granted electricity certificates in 2015 and the mean electricity certificate price for 2015.
[63] Ibid.
[64] Source: Swedish Energy Agency Cesar reporting system.
[65] The calculation is based on information from Cesar concerning the types of energy that were granted electricity certificates in 2016 and the mean electricity certificate price for 2016.
[66] Ibid.
[67] Source: 'Composition of solar photovoltaic cell aid 2009-2017'. Available at: http://www.energimyndigheten.se/fornybart/solenergi/solceller/stod-till-solceller/investeringsstod/manadsrapport-for-solcellsstod/.
[68] Please note that the CO_2 tax exemption for biofuels in the tax expenditure should not be regarded as a form of aid for biofuels. The tax exemption does, however, constitute approved State aid.
[69] Source: Swedish Government Communication 2015/16:98, Tax Expenditure Report 2016 and Swedish Government Communication 2016/17:98, Tax Expenditure Report 2017.

RES support schemes, year specified per scheme		Info/aid per unit	Total, SEK*	Info/aid per unit	Total, SEK*	Total, EUR million*[55]
		2015		2016		2015 and 2016
Vehicles						
Road tax exemption for green cars[70]		-	SEK 200-250 million.	-	SEK 200-250 million.	EUR 43-54 million.
Reduced taxable benefit value for certain environmentally adapted vehicles[71]		Reduced taxable benefit value to nearest comparable vehicle for plug-in vehicles and gas vehicles with 40 % additional discount – however with a maximum reduction of SEK 16 000.	The revenue shortfall from the reduced taxable benefit value is estimated to be SEK 310 million.		The revenue shortfall from the reduced taxable benefit value is estimated to be SEK 370 million.	EUR 74 million
Super green vehicle premium[72]		Private individuals: SEK 40 000. Legal persons: 35 % of the difference in price as a new vehicle between the super green vehicle and the nearest comparable vehicle, but no more than SEK 40 000.	SEK 347 million	Private individuals: SEK 40 000. Legal persons: 35 % of the difference in price as a new vehicle between the super green vehicle and the nearest comparable vehicle, but no more than SEK 40 000.	SEK 348 million	EUR 75 million
Biogas and other renewable energy in rural areas						
Production aid for manure gas[73]		Maximum SEK 0.20/kWh.	Budgeted amount of SEK 15 million. Amount paid out SEK 15 million.	Maximum SEK 0.40/kWh.	Budgeted amount of SEK 55 million. Amount paid out SEK 47 million	Budgeted EUR 7.5 million Amount paid out EUR 6.7 million.
Investment aid for biogas under the Rural Development		Up to 40 % of eligible costs. Maximum of EUR 200 000 for the same enterprise over a three-	Amount paid out SEK 0.[75]	Up to 40 % of eligible costs. Maximum of EUR 200 000 for the same enterprise over a three-	Amount paid out SEK 187 200.	EUR 0.02 million.

[70] Estimate based on Ministry of Finance Memorandum 'A bonus malus scheme for light vehicles' Fi2017/01469/S2.
[71] Source: Swedish Government Communication 2015/16:98, Tax Expenditure Report 2016 and Swedish Government Communication 2016/17:98, Tax Expenditure Report 2017.
[72] Swedish Transport Agency: https://www.transportstyrelsen.se/sv/vagtrafik/Miljo/Klimat/Miljobilar1/supermiljobilspremie1/ (last accessed 30 May 2017).
[73] Source: Swedish Board of Agriculture Annual Report 2015 and 2016.

RES support schemes, year specified per scheme		Info/aid per unit	Total, SEK*	Info/aid per unit	Total, SEK*	Total, EUR million*[55]
		2015		2016		2015 and 2016
Programme [74]		year period.		year period.		
Investment aid for renewable energy under the Rural Development Programme [76]		Up to 40 % of eligible costs. Maximum of EUR 200 000 for the same enterprise over a three-year period.	Amount paid out SEK 0[77].	Up to 40 % of eligible costs. Maximum of EUR 200 000 for the same enterprise over a three-year period	Amount paid out SEK 566 228.	EUR 0.06 million.

** The quantity of energy receiving aid per unit gives an indication of the effectiveness of the aid for each type of technology.*

[75] No payments were made in 2015 because of long processing times.
[74] Source: Swedish Board of Agriculture.
[76] Source: Swedish Board of Agriculture.
[77] No payments were made in 2015 because of long processing times.

Point 3.1 Allocation of renewable electricity in respect of which aid has been granted

3.1. Please provide information on how electricity in respect of which aid has been granted is allocated to final customers in accordance with Article 3(6) of Directive 2003/54/EC. *(Article 22(1)(b) of Directive 2009/28/EC.)*

Electricity certificate scheme

Aid for producers of renewable electricity is paid out via the electricity certificate scheme by the stakeholders who are bound by quotas. These stakeholders are:

1. Electricity suppliers who supply electricity to end-users;

2. Electricity consumers who consume electricity that they themselves have produced or imported, or which they have purchased on the Nordic electricity exchange; and

3. Electricity-intensive industry registered with the Swedish Energy Agency.

Electricity-intensive industry does, however, have the right to a deduction in respect of electricity consumed during the manufacturing process when calculating the quota obligation. If a quota-bound stakeholder is an electricity supplier, its costs associated with electricity certificates will be included as part of the invoice that it issues to the electricity customer. It is therefore the final customer who pays for the expansion of renewable electricity production.

Origin labelling

All electricity must have origin labelling by law. Electricity brokers are responsible for showing the customer where the electricity comes from and what the environmental impact of the electricity's production has been. According to Article 12 of Chapter 8 of the Electricity Act (1997:857), electricity brokers must provide information concerning:

1. The proportion accounted for by every single energy source in the mean composition of energy sources used to produce the electricity sold by the electricity broker during the most recent calendar year; and

2. The impact on the environment in terms of CO_2 emissions and the quantity of nuclear waste generated by production of the electricity sold.

This information must be provided on or together with invoices for the sale of electricity and in advertisements aimed at electricity customers. Electricity brokers may also choose to make reference to the place where customers may find this information, for example on the enterprise's website. Since 1 July 2013, electricity brokers have also had to show on their invoices how the electricity purchased by the customer was produced. This means that all electricity brokers are now required to report their total production (in other words, if electricity brokers have chosen to purchase any particular electricity or if they sell the Nordic

mix and supply it onwards). The requirement is that electricity brokers must at least show whether the electricity comes from nuclear power, renewable energy or fossil sources. In the interests of better communication with customers, electricity brokers may also show their customers a more detailed breakdown (such as the proportion of solar energy and wind power). Electricity brokers must also show the environmental impact of the electricity sold in the form of CO_2 emissions and nuclear waste. Electricity from renewable sources and in respect of which an electricity certificate has been obtained under the electricity certificate scheme is not reported separately in the system. The energy sources that are eligible for electricity certificates are described within the system framework.

A large proportion of electricity in the Nordic countries is sold via the electricity exchange (NordPool). Customers purchase their electricity from electricity brokers who in turn primarily purchase electricity via the exchange. A customer who has signed a contract with an electricity broker in accordance with the rules laid down in the Electricity Act receives information about the electricity broker's electricity mix in the previous year. Some electricity brokers also offer their customers the option of signing an electricity agreement for the purchase of electricity of a particular origin, for example exclusively from wind power or hydro power. Irrespective of the choice made, the electricity broker must ensure that any guarantees of origin corresponding to the quantity of electricity from each of the selected energy sources are cancelled. Electricity brokers who purchase electricity via NordPool may purchase guarantees of origin in order to guarantee that the electricity is of a particular origin (the Swedish system of guarantees of origin for electricity is described under point 5). There are also some types of environmental labelling, such as Good Environmental Choice (Bra Miljöval), for which requirements are imposed on how the origin of the electricity is traced. This is followed up by means of audits. Many electricity brokers specify the origin of their electricity for various agreements on their websites.

The Swedish Energy Markets Inspectorate has supervisory authority in relation to the Electricity Act, and in the autumn of 2013, it published its latest regulations and general guidance on origin labelling for electricity (EIFS 2013:6). The Swedish Consumer Agency is responsible for ensuring that electricity brokers comply with the rules that govern marketing, etc.

Point 4. Support schemes for renewable energy with additional benefits

4. Please provide information on how, where applicable, the support schemes have been structured to take into account RES applications that give additional benefits in comparison with other, comparable applications, but may also have higher costs, including biofuels produced from waste, residues, non-food cellulosic material, and ligno-cellulosic material. (Article 22 (1)(c) of Directive 2009/28/EC.)

By way of introduction, it should be mentioned that all biofuels produced from waste, residues, non-food cellulosic material and ligno-cellulosic material are eligible for the relevant general instruments described under point 2. Since 2015, there has also been a special production aid available for biogas produced from manure, which like other forms of bioenergy can replace fossil energy, and can additionally reduce the methane emissions from manure that would otherwise occur.

This production aid, also referred to as ‘methane-reduction compensation’ had a compensation value of SEK 0.20/kWh in 2015, which has been raised to SEK 0.40/kWh from 2016 onwards.

The project’s first aid period commenced in 2015 and the project will run until 2023. The aid is based on the quantity of manure fermented at a plant and the quantity of biogas that is produced. If the manure is fermented together with another substrate, the aid is only granted in respect of the gas that can theoretically be attributed to the manure. The Swedish Board of Agriculture has calculated the scope to provide aid under the EU’s State aid rules by determining the difference between the average production costs for manure gas incurred by the representative eligible plants and the market price for the energy form concerned (both the natural gas price and electricity price), and multiplying the difference in SEK by the plant output. The funds allocated to the aid period also impose a limit on the amount of aid that is paid out.

Point 5. System of guarantees of origin

5. Please describe how the system of guarantees of origin for electricity, heating and cooling from RES works, and what measures have been taken to make the system reliable and protect it from fraud. (Article 22(1)(d) of Directive 2009/28/EC.)

The Swedish system of guarantees of origin for electricity is described below. Sweden does not currently have any system of guarantees of origin for heating and cooling from renewable energy sources.

The purpose of guarantees of origin is to make the origin labelling of electricity reliable. The electricity end-user must be made aware of the origin of the electricity, in a clear manner. According to the Act (2010:601) on Guarantees of Origin for Electricity, electricity producers in Sweden have the right to have guarantees of origin issued that show the origin of the electricity generated. It is, however, voluntary for electricity producers to apply for the issuing of guarantees of origin. A guarantee of origin is issued for each megawatt hour of electricity generated. Guarantees of origin may be issued for all types of electricity production, which is more comprehensive than the minimum requirements of the Directive.

The Swedish Energy Agency is the supervisory authority and the authority that assesses the applications. There are also special regulations concerning guarantees of origin for electricity (STEMFS 2017:2). The issuing of guarantees of origin is managed in purely practical terms by the Swedish Energy Agency, which is also the accounting authority. Guarantees of origin exist only in an electronic format, in the form of a note against an account in the Swedish Energy Agency's CESAR accounting system. Consequently, there is an electronic register of all guarantees of origin. The Swedish Energy Agency decides on the right for guarantees of origin to be issued, and it transfers to CESAR the information necessary for the guarantees of origin to be issued. A guarantee of origin from another Member State of the EU is also recognised unless there is reason to doubt its authenticity. If a guarantee of origin is not recognised, the Swedish Energy Agency will ensure that it cannot be cancelled for the purposes of origin labelling. In order to facilitate the exchange of guarantees of origin between Member States, the Swedish Energy Agency became a member of the Association of Issuing Bodies (AIB) on 9 June 2017. Membership of the AIB means that guarantees of origin may be transferred directly to other Member States without going via any intermediary.

In order to ensure that the guarantees are reliable, there are requirements relating *inter alia* to measuring and reporting the transmitted electricity, unique identification numbers for each guarantee of origin and ensuring that the guarantees are cancelled after they have been used. The person designated the holder in the guarantees of origin register must ensure that the accounting authority cancels a guarantee of origin after it has been used. A guarantee of origin lapses automatically if it has not been used within twelve months of the date on which the unit of energy to which it relates was produced. A guarantee of origin that lapses under the twelve-month rule may not be used to label production-specific electricity, but is instead included in the residual mix. The cancellation procedure thus becomes a guarantee in itself that the producer and supplier will not sell more electricity of a particular origin than is actually produced. The Swedish Energy Markets Inspectorate's regulations (EIFS 2013:6) regulate how origin labelling works in practice.

The Swedish Energy Agency monitors the system of guarantees of origin and has the right to obtain information on request and to view the documentation required for such monitoring. The authority is also entitled, on request, to access production plants as well as premises and areas pertaining to such plants, to the extent required for monitoring. The Swedish Energy Agency may also revoke a decision concerning the allocation of guarantees of origin.

The development of biomass for energy purposes (points 6–9 in the template)

Point 6. Biomass resources for energy purposes

6. Please describe any changes in the preceding two years in relation to the availability and use of biomass resources for energy purposes.

(Article 22(1)(g) of Directive 2009/28/EC.) *It is suggested that* ***Tables 4 and 4a*** *be used to provide more detailed information on the use of biomass.*

Please note that domestic and imported biofuel and raw materials for biofuel are specified uniformly in thousands of tonnes of dry weight (1 000 tonnes DW) in Table 4. The reason for this choice of reporting unit is that tonnes DW are an appropriate unit of measurement for comparisons of different raw materials. The absence of complete statistics also means that some of the data are based on estimates and there is therefore great uncertainty associated with them. This is particularly true of the import data.

Table 4: Biomass consumption for energy purposes

	Amount of domestic raw material (1 000 tonnes DW)*		Primary energy in domestic raw material (ktoe)		Amount of imported raw material from the EU (1 000 tonnes DW)*		Primary energy in amount of imported raw material from EU (ktoe)		Amount of imported raw material from outside the EU (1 000 tonnes DW)*		Primary energy in amount of imported raw material from outside the EU (ktoe)	
	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016	2015	2016
Biomass for heating and electricity:												
Direct consumption of wood biomass from forests and other wooded land for energy purposes (fellings, etc.)**	5 369	5 629	2 147	2 250	4	6	2	2	4	5	1	2
Indirect consumption of wood biomass (residues and by-products from the wood industry, etc.) **	19 984	19 766	6 777	6 694	316	226	129	92	462	1 072	186	427
Energy crops (grasses, etc.) and short-rotation trees (Salix)	27	38	10	14	-	-	-	-	-	-	-	-
Agricultural by-products/processed residues and fishery by-products **	132	152	65	80	29	38	19	28	18	18	15	14
Biomass from waste (municipal, industrial, etc.)	2 826	2 700	710	678	321	278	102	88	308	267	98	85
Other – Biogas	534	446	145	129	-	-	-	-	-	-	-	-
Biomass for transport*:**												
Traditional agricultural crops for biofuels (sugar cane, cereals and maize)	N/A	N/A	42	12	N/A	N/A	334	239	N/A	N/A	114	69
Energy crops (grasses, etc.) and short-rotation trees for biofuels (not used)	-	-	-	-	-	-	-	-	-	-	-	-
Other - Biomass-based waste	N/A	N/A	88	63	N/A	N/A	11	1	N/A	N/A	2	1
Residues/by-products from the pulp and paper industry (sulphite lye and tall oil)	N/A	N/A	81	35	N/A	N/A	390	468	N/A	N/A	127	466

** Amount of raw material, if possible in **m^3 for biomass from forestry** and in **tonnes for biomass from agriculture and fisheries and biomass from waste.*** Please note that domestic and imported biofuel and raw materials for biofuel are specified uniformly in thousands of tonnes of dry weight (1 000 tonnes DW). In Tables 7 and 7a of Sweden's Action Plan, tonnes DW and ktoe are also used as units of measurement.

*** The definition of this biomass category should be interpreted in line with Table 7 of part 4.6.1 of Commission Decision C (2009) 5174 final establishing a template for National Renewable Energy Action Plans under Directive 2009/28/EC.*

*** It has not been deemed possible to report raw materials by weight or the energy content of biofuels in a fair and useful way because the various raw materials are not comparable in terms of their weight relative to their energy content.

Direct consumption of wood biomass from forests and other wooded land for energy purposes, and indirect consumption of wood biomass

The following wood fuels are included in the report:

- Round timber and fuel wood;
- Residues from tree felling, such as branches, tops and stumps;
- Solid by-products from the forestry industry, such as shavings, bark, etc.;
- Liquid by-products from the forestry industry, such as black liquors, crude tall oil, and tall oil pitch;
- Recovered (recycled) wood, such as packing material, old furniture and demolition timber;
- Processed fuel wood, such as wood pellets, wood briquettes and wood powder.

The following sources of information have been used concerning fuel from forestry:

- Swedish Energy Agency[78];[79];
- Statistics Sweden (SCB)[80].

A variety of forest biofuels and raw materials for biofuels are imported (including in the form of pellets, round timber, wood waste and shavings/sawdust). The quantities of these raw materials that are imported are reported by the Swedish Forest Agency, the Swedish Energy Agency, Statistics Sweden and the Swedish Pellet Association. There are also indirect imports, in other words imports that occur when the forest industry imports round timber for industrial forestry purposes. When processing round timber, whether this is done mechanically at a sawmill or processed into pulp, by-products are generated that can be used for energy purposes. There are no reliable statistics for this.

The following sources of information have been used for the conversion rates and ratios:

- The conversion between the units of measurement m^3 and tonnes DW is done on the basis of established conversion rates/ratios in the forestry industry, in accordance with the Practical Forestry Manual (1992)[81].
- The conversion between the physical units of measurement (m^3 and tonnes) and units of energy is done on the basis of established conversion rates according to Lehtikangas (1998)[82].

[78] Swedish Energy Agency. Annual Energy Balance 2015 and 2016. www.energimyndigheten.se.
[79] Swedish Energy Agency. Production of non-processed wood fuel 2015 and 2016, ES 2016:05 and ES 2017:09.
[80] Statistics Sweden (SCB). External trade statistics, 2015 and 2016. www.scb.se.
[81] Swedish Forestry Association. 1992. Practical Forestry Manual 1992.
[82] Lehtikangas, P. 1998. The Storage Handbook. Swedish University of Agricultural Sciences.

- Conversion rates for waste liquors have been taken from Alakangas (2000)[83].

The following conversion rates are used for wood fuel[84]:

- Residues from tree felling, round timber, etc.: 5.28 MWh/tonne DW;
- Sawdust, bark, etc.: 5.28 MWh/tonne DW;
- Black liquors, etc.: 3.48 MWh/tonne DW;
- Pellets, etc.: 5.28 MWh/tonne DW;
- Recovered wood: 5.28 MWh/tonne DW.

Energy crops and short-rotation trees, and agricultural by-products/processed residues and fishery by-products

The biofuels and biofuel raw materials that are included are:

- Cereals;
- Straw;
- Short-rotation trees (Salix);
- Pyrolysis oils (animal and vegetable oils and fats);
- Olive pits, oat husks, bean pods/husks, etc.

The information about fuels from agriculture comes from the following sources:

- Swedish Energy Agency[85],[86],[87]

The conversion between physical units of measurement (m^3, tonne, and tonne DW) and units of energy (MWh or similar) is done on the basis of established conversion rates/ratios in agriculture, derived partly from the Data Book for Operational Planning in Agriculture (1992)[88], partly from the Bioenergy Portal,[89] and partly from Fredriksson et al (2004)[90].

[83] Alakangas, E. 2000. Properties of fuels used in Finland. Fact sheets. Issue number 2045. VTT Technical Research Centre of Finland Ltd. Finland.
[84] The calorific value has been harmonised with the FAO UNECE Joint Wood Energy Enquiry (JWEE).
[85] Swedish Energy Agency, Annual Energy Balance 2015 and 2016.
[86] Swedish Energy Agency. Sustainable liquid biofuels 2015 and 2016.
[87] Swedish Energy Agency. Production of non-processed wood fuel 2015 and 2016, ES2016:04 and ES 2017:09.
[88] Swedish University of Agricultural Sciences. 1992. Data Book for Operational Planning in Agriculture.
[89] www.bioenergiportalen.se.
[90] Fredriksson, C., Padban, N. and Zinti, F. 2004. Broadening the Fuel Base for Pellets and Powder Burners. Swedish District Heating Association.

The following conversion rates are used for biomass from agriculture:

- Cereals: 4.0 MWh/tonne DW;
- Straw: 4.0 MWh/tonne DW;
- Short-rotation trees (Salix): 4.6 MWh/tonne DW;
- Pyrolysis oils (animal and vegetable oils and fats): 9.3 MWh/tonne DW;
- Olive pits, sunflower pellets, bean pods/husks, etc.: 5.0 MWh/tonne DW.

Biomass from waste

The information about refuse-derived fuel for the production of heating and electricity comes from the following sources:

- Swedish Energy Agency[91];
- Swedish Waste Management Association[92];
- Swedish Environmental Protection Agency[93];

The renewable fraction of the waste has been assumed to be 60 % for 2015. The renewable fraction has been assumed to be 52 % for 2016. This change has been made based on a new investigation of the composition of waste[94]. Please see point 12 for a more detailed description of this. The renewable fraction of solid municipal waste, including biowaste, and the biodegradable fraction of industrial waste are specified in tonnes of dry weight.

Biogas

The quantities specified in Table 4 are an estimate of the amounts of raw material used for the production of biogas for electricity and heating production. The following raw materials are included in the report:

- Catering waste sorted at source;
- Food waste;
- Slaughterhouse waste;
- Sewage sludge;

[91] Swedish Energy Agency, Annual Energy Balance 2015 and 2016.
[92] Swedish Waste Management Association. Swedish Waste Management 2016 and 2017. www.avfallsverige.se.
[93] Swedish Environmental Protection Agency. Imports of notifiable waste 2015.
[94] Profu, 2017. Analysis of the renewable energy fraction in waste for combustion. Swedish Energy Agency ref. No 2016-010523.

- Industrial waste;
- Energy crops.

The information about biogas for heating and electricity production comes from:

- Swedish Energy Agency[95].

The conversion from physical measurements for raw materials to energy terms has been done with the help of various conversion factors taken from:

- Alakangas (2000)[96];
- The Phyllis database[97];
- Swedish Board of Agriculture[98];
- The Bioenergy Portal[99];
- Hadders (2004)[100]

The proportion of biogas used for electricity and heating production is reported under the substrates used for the production of biogas. The conversion from physical measurements for the substrate to energy content has been done with the help of various conversion factors taken from the Substrate Handbook for Biogas Production (2009)[101], Basic Data About Biogas (2011)[102] and Alakangas (2000)[103].

Biomass for transport

The quantities specified in Table 4 are estimates of the quantities of raw materials used for the production of various biofuels. The following raw materials are included in the report:

- Cereals;
- Maize;
- Sugar cane;

[95] Swedish Energy Agency. Production and consumption of biogas and fermentation residues 2015 and 2016, ES2016:04 and ES2017:09.
[96] Alakangas, E. 2000. Properties of fuels used in Finland. VTT Technical Research Centre of Finland Ltd fact sheets, issue 2045. Finland.
[97] ECN, 'Phyllis database for biomass and waste'. 2013. Available at: www.ecn.nl/phyllis/single.html.
[98] Swedish Board of Agriculture 2011. Renewable fuels from agriculture – ethanol, biodiesel, and biogas. Report 2011:14.
[99] The Bioenergy Portal. 2017. Available at: www.bioenergiportalen.se.
[100] Hadders, G. 2004. Cereals as fuel.
[101] Carlsson, M., Uldal, M. 2009. Substrate Handbook for Biogas Production, Swedish Gas Technology Centre. Report SGC 200.
[102] Swedish Gas Technology Centre, 2011. Biogas – Basic Data About Biogas 2011.
[103] Alakangas, E. 2000. Properties of fuels used in Finland. VTT Technical Research Centre of Finland Ltd fact sheets, issue 2045. Finland.

- Sugar beet;
- Sugar molasses;
- Oilseed plants;
- Catering waste sorted at source;
- Food waste;
- Slaughterhouse waste;
- Sewage sludge;
- Industrial waste;
- Tall oil;
- Sulphite lye (brown liquor).

Neither energy crops nor short-rotation trees were used for the production of biofuel in Sweden. The information for biomass for transport comes from Swedish sustainability reports[104],[105].

[104] Swedish Energy Agency 2016. Fuels and biofuels 2015. ER2016:12.
[105] Swedish Energy Agency 2017. Fuels 2016. ER2017:12.

***Table 4a.* Current domestic agricultural land use for production of energy crops (ha)**

Land use	Surface (ha)	
	2015	2016
1. Land used for traditional arable crops (wheat, sugar beet, etc.) and oilseed plants (rapeseed, sunflowers, etc.) (Please specify main types)[1]	**N/A**	**N/A**
2. Land used for short-rotation trees (willows and poplars) (Please specify main types)[2]	**11 102 ha** Of which: **9 027 salix** **1 619 poplar** **456 hybrid aspen**	**10 932 ha** Of which: **8 587 salix** **1 672 poplar** **673 hybrid aspen**
3. Land used for other energy crops such as grasses (reed canary grass, switch grass, and miscanthus) and sorghum (Please specify main types)[2]	**661 ha** Of which: **624 reed canary grass** **37 hemp**	**691 ha** Of which: **620 reed canary grass** **71 hemp**

[1] The Swedish Board of Agriculture's statistics on traditional arable crops do not state the purpose for which the crops are used.

[2] The information for short-rotation trees and other energy crops is from the Swedish Board of Agriculture and is clarified in the text below.

The Swedish Board of Agriculture's statistics on agricultural land use contain information about which crops are grown and in which areas. However, there is no information about what the crops are used for.

Information on land where cereals and other crops are grown for food production may be found in the Swedish Board of Agriculture's statistics database.[106] It is possible that a small proportion of these crops is used as a raw material for energy production.

Information concerning the cultivation of energy crops and energy forests has been obtained from the Swedish Board of Agriculture[107]. Hemp is not used for energy to any significant extent.

The substrates used for biogas production in 2015 and 2016 primarily consist of various types of waste such as sewage sludge, catering waste sorted at source, waste from the food industry and manure. Energy crops were only used to a limited extent. In 2015, the proportion of energy crops accounted for 2.1 % of the total raw material base for biogas, and in 2016 the total quantity of energy crops amounted to 2 %[108].

[106] The databases for 2015 and 2016 may be found via the following web address: http://statistik.sjv.se/PXWeb/pxweb/sv/Jordbruksverkets%20statistikdatabas/?rxid=5adf4929-f548-4f27-9bc9-78e127837625.
[107] Personal communication with Ylva Olsson, statistician, Swedish Board of Agriculture, 18 April 2017.
[108] Swedish Energy Agency, 2017. Production of biogas and fermentation residues in Sweden in 2016. ES2017:7.

Point 7. Prices of raw materials and land use

7. Please describe any changes in the prices of raw materials and in land use <u>in the relevant Member State in the preceding two years</u> that may be associated with increased use of biomass and other forms of energy from renewable sources. If possible, please refer to relevant documentation on these effects in the relevant country. *(Article 22(1)(h) of Directive 2009/28/EC.)*

When assessing the effects of the prices of raw materials, at least the following raw materials should be considered: traditional food and feed crops, energy wood, and pellets[109].

Changes in the prices of raw materials

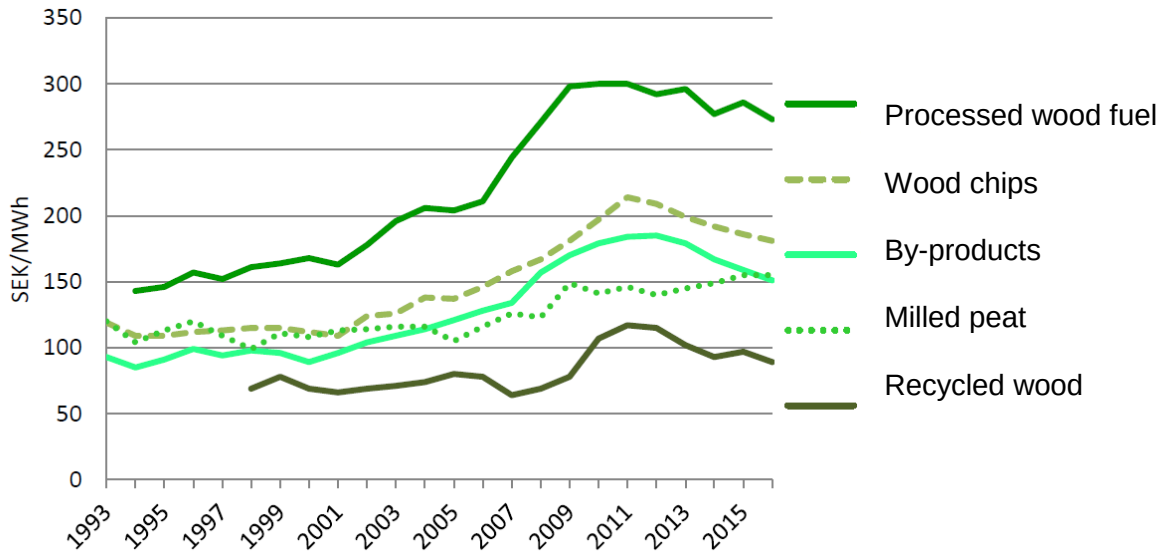
No empirical studies have been carried out to show the impact that increased domestic biomass consumption has had on the prices of domestic raw materials during the period in question, or on land use or the prices of raw materials during the period that can directly be explained by increased biomass consumption.

During recent years, the price of wood pellets, wood chips and by-products in particular has fallen, and the downward trend that started after the record-breaking cold winter of 2009-2010 has continued. The price of processed wood fuels (pellets, briquettes and powder) and recycled wood has also fallen. One reason for the fall in prices for wood fuel is that the use of waste in the heat sector has increased successively. Sweden has expanded its waste-incineration capacity in recent years and also imports a large amount of household waste. This is contributing towards prices being kept low. It is also likely that lower demand resulting from warmer winters over recent years may also have affected this trend.

In the longer term, the price of wood fuels for heating plants remained largely unchanged in real terms in the 1980s and 1990s. During that period, there was a surplus of residues from the forestry industry, without any outlet for them. Demand increased in the 2000s, which was also reflected in the price trend. More expensive product ranges, for example from an increase in branch and top removal for chipping, has affected prices. Political instruments such as the electricity certificates scheme have also increased demand in the market. The trend in prices for solid biofuels is shown in the Figure below.

[109] Traditional forests should also be included here.

Figure 1 Price trend for wood fuels and peat for heating plants, in SEK/MWh, current prices. Processed biofuels include pellets, briquettes and powder.



Source: Wood fuel and peat prices, Swedish Energy Agency 2016[110].

The prices for FAME and ethanol in Sweden are affected by prices in international markets. Swedish prices vary according to the price quotations[111] for biofuels in the European market. In this context, Swedish producers may be regarded as price takers who do not have any significant opportunity to influence prices. This is true for both low-blend and high-blend [bio]fuels. Cereals and other agricultural products from Sweden, like ethanol and FAME, also form part of the international market. The price trend for wheat and rapeseed, which are Swedish raw materials used in the production of ethanol and FAME, is in line with international price quotations.[112],[113].

The use of HVOs has increased significantly in recent years. Around 87 % of the raw materials used for HVO production in 2016 consisted of various types of residual products: slaughterhouse waste, PFAD, crude tall oil and vegetable and animal waste oils. The remaining 13 % primarily consisted of maize and rapeseed[114], for which the price trend is determined on an international market and Sweden can be regarded as a price-taker. The composition of raw materials in 2015 was the same as for 2016, with the main difference being that a certain amount of palm oil was used in 2015, which was phased out in 2016 in favour of PFAD.

Biogas is also largely produced from various types of waste and residual products. In 2016, only 2 % of the supply of raw-materials came from energy crops; the remainder comprised various types of waste and residual products[115].

[110] Swedish Energy Agency. 2016. Wood fuel and peat prices. EN 0307 SM 1701.
[111] E.g. F.O. Licht and Platts.
[112] Analysis of biofuels markets in the context of the transport gas market, Swedish Energy Agency 2013, ES 2013:08.
[113] Biofuels markets 2014 in the context of HVO, Swedish Energy Agency 2014, ER 2014:27.
[114] Swedish Energy Agency. 2017. Fuels 2016. ER2017:12.
[115] Swedish Energy Agency, 2017. Production of biogas and fermentation residues in Sweden in 2016. ES2017:7.

Changes in land use due to increased use of bioenergy

As the predominant use of biofuels in Sweden today consists of by-products and residues generated by the forestry industry, the wood and timber industry, and the pulp and paper industry (please see Table 4), their use is not currently causing any changes to land use.

The current use of domestic crops for the production of biofuels and bioliquids is limited, and it is not considered to be causing any changes to land use in Sweden. As the total cultivated area for cereals has reduced from 1 040 800 hectares in 2015[116],[117] to 1 021 040 hectares in 2016, it is reasonable to assume that the majority of cereal cultivation for biofuel production is taking place on what were previously open areas of agricultural land. The area used for rape/turnip rape fell between 2015 and 2016, from 94 600 hectares to 93 000 hectares.

As biogas is largely produced from various types of waste and residual products, this has not led to any change in land use.

Changes in land use due to the expansion of wind power, etc.

In 2015, 730 MW of wind power was installed in Sweden, and a further 616 MW was installed in 2016. Over the last 10 years, there has been a large increase in comparison with the years before 2007, when the increase in installed output was approximately 60 MW per year. In total, 208 and 171 plants were taken into use in 2015 and 2016 respectively. All wind power expansion was onshore during these years. The total number of wind-power plants was 3 334 at the end of 2016, with a total installed power of 6 434 MW.[118]

The area of land that is actually required varies depending on conditions at the site in question, as well as the requisite distance from other land uses. No safe distance between wind power plants and local residents has been specified. However, the guideline value for noise levels (40 dBA) from wind power plants acts as a safe distance in practice. This generally entails a distance of at least 500 metres, but often more. A general figure that is used to estimate the land required for a wind power plant is around 0.5 km^2 for a normal 3–4 MW power plant that is currently being installed. Technological developments in wind power are continuing in the direction of larger plants with more power and larger rotors. Larger rotors mean that plants must have greater distances between each other. At the same time, each individual plant has a greater output, which means that fewer plants are required to achieve the same level of production. In the early 2000s, the plants being installed had an average installed output of 500 kW and rotors that were 70 metres in diameter and a total height of around 100 metres. Plants are now being installed with an installed output of 3-4 MW and rotors with a diameter of 130-140 metres and a total height of 200-220 metres.

Wind-power plants only change land use to a certain extent, since the land around them can still be used for certain purposes, e.g. forestry and agriculture. Roads, etc., to wind-power plants do take up a certain amount of land and can alter the current land use. However, there is no estimate available for the surface area involved. Access to the land surrounding wind-power plants is limited for security reasons during the construction phase, but not once they

[116]Statistics Sweden (SCB). 2015. Agricultural land use 2015.
[117]Statistics Sweden (SCB). 2016. Agricultural land use 2016.
[118] Swedish Energy Agency, Wind-Power Statistics 2014, ES 2015:02, 2015, pp. 12-13.

are operational. The same rules apply during the construction phase as is the case for other construction sites. With regard to the safety distances for ice throw, access roads and entire wind farms may be closed if there is a risk of ice throw, but only in special cases.

This means that it is not deemed possible to provide a quantitative estimate of the change in land use resulting from wind power.

The change in land use due to the expansion of hydro power in 2015 and 2016 is deemed to be minimal, since there has not been any major expansion of hydro power.

The ongoing increase in installed capacity for solar electricity in Sweden almost exclusively takes place on buildings. There are only a few land-based solar power plants in Sweden. Thus, the change in land use due to solar electricity is deemed to be minimal.

Point 8. Biofuels produced from waste and residues, etc.

8. Please describe any changes relating to the trend in and proportion of biofuels produced from waste, residues, non-food cellulosic material, and ligno-cellulosic material. *(Article 22(1) of Directive 2009/28/EC.)*

The Swedish Energy Agency receives reports in accordance with the Sustainability Act (2010:598)[119]. The information given in Table 5 concerning consumption of sustainable biofuels in accordance with Article 21(2) shows the quantities that have actually been reported, and it relates to specific biofuels for transport.

Table 5: Production and consumption of biofuels in accordance with Article 21(2) (ktoe)[120]

Biofuel under Article 21(2)[121]	2015	2016
Production		
Biogasoline	1	4
Biogas	80	96
DME	< 1	< 1
Ethanol	< 1	< 1
FAME	< 1	< 1
HVO (hydrogenated vegetable oils)	91	68
Consumption		
Biogasoline	1	4
Biogas	89	108
DME	< 1	< 1
Ethanol	< 1	< 1
FAME	< 1	< 1
HVO	463	869
Total production of biofuels in accordance with Article 21(2)	172	168
Total consumption of biofuels in accordance with Article 21(2)	553	982
Fuels under Article 21(2) (in %) as proportion of total RES-T[122]	64 %	80 %
Fuels under Article 21(2) as proportion of total biofuels[123]	47 %	66 %

It has been necessary to make certain assumptions in order to produce production data. For biogas, there is information available concerning the country of origin of the raw materials. All biogas for which the raw materials originate in Sweden have been assumed to be produced in Sweden. The biogas production as stated below may have been underestimated somewhat, since imported raw materials may also have been used to a small extent at Swedish biogas plants. For HVO, it has been assumed that all HVO from crude tall oil has been produced in Sweden. The production of such HVO has also taken place in Finland since 2015, but the quantities produced are considered to have largely been used in Finland.

[119] Further details of sustainability criteria are provided in Annex 2.
[120] Only sustainable quantities are reported.
[121] Biofuels produced from waste, residues, non-food cellulosic material, and ligno-cellulosic material.
[122] Proportion of target achievement from biofuels that are double-counted, i.e. Fuels under Article 21(2) (in %) as proportion of total RES-T = (2*biofuels under Article 21(2)) [ktoe]/(2*biofuels under Article 21(2)+crop-based biofuels) [ktoe].
[123] Proportion of actual total biofuels consisting of fuels under Article 21(2).

Waste is defined as a substance or object that the holder disposes of, intends to dispose of, or is obliged to dispose of; residues are material remaining at the end of a process, the primary aim of which is not to produce this material and where the process has not been deliberately modified in order to produce the material. In its guidelines,[124] the Swedish Energy Agency has provided examples of what constitutes residues and waste.

HVO

All of the major fuel suppliers in Sweden now blend HVO into their diesel and many of them also use HVO that is produced from waste and residues. Vegetable or animal waste oil were the most common raw materials during 2015 and 2016. PFAD[125] was also used as a raw material in 2016 and was 23 % for the year.

Biogas

Around 63 % of all the biogas produced in Sweden in 2015 was upgraded to transport-gas quality[126] in order to increase the percentage to 64 % in 2016[127]. Most of the biogas was produced from waste and residues. Some biogas and raw materials are imported from other countries.

The biogas production above is a conservative estimate and only includes biogas from Swedish raw materials. The raw-material base for biogas is varied, and the most common raw materials in this category are slurry from municipal sewage-treatment plants and separate waste water, catering waste that has been sorted at source, and waste from the food industry and trade.

Ethanol

The production and consumption of ethanol from residues and waste that are sustainable and can be double-counted towards the transport target currently amounts to less than 1 ktoe. The raw material for this ethanol in 2015 and 2016 was brown liquor, solid waste from the food industry and trade and wine residues.

DME and FAME

Table 5 also includes some small quantities of DME and FAME that fall under this point. The DME that is reported is produced from black liquor, which is a residue from the wood-pulp industry.

The FAME that is also included in the table only occurs in very small quantities. It is produced from waste oils of Swedish and Norwegian origin.

[124] Guidelines concerning the regulations on sustainability criteria for biofuels and bioliquids, ER 2012:27.
[125] Palm fatty acid distillate. A residual product from the production of palm oil.
[126] Production and consumption of biogas and fermentation residues 2015, ES 2016:04.
[127] Production and consumption of biogas and fermentation residues 2016, ES 2017:07.

Point 9. Impact of the production of biofuels on biodiversity, etc.

9. Please describe the estimated effects of the production of biofuels and bioliquids on biodiversity, water resources, water quality and soil quality in the relevant Member State <u>in the preceding two years</u>.

Please describe how these effects have been assessed, with references to relevant documentation on these effects in the relevant country. ***(Article 22(1)(j) of Directive 2009/28/EC.)***

Use of agricultural land for production of energy crops for Swedish biofuel production

As indicated in Table 4 under point 6, the raw materials for Swedish biofuel production consist of traditional agricultural crops, biomass-based waste and residues/by-products from the pulp and paper industry. Of these, only the first category affects land use, which in the first instance means that it is FAME and ethanol that are of interest, as HVO, biogas and biogasoline are primarily produced from various types of waste and residual/by-products.

Swedish Board of Agriculture statistics relating to the use of agricultural land include information regarding the crops that are cultivated and the land area that is used for this purpose, but do not indicate whether the crop is used for energy, food or other purposes. In order to estimate the proportion dedicated to biofuels and bioliquids, it is possible to make an assumption relating to the production of ethanol and FAME in Sweden. All ethanol produced from arable crops in Sweden is currently produced by Lantmännen Agroetanol[128], which has stated that it requires around 100 000 ha in order to supply its factory. However, a small proportion of the cereals used are imported, and therefore do not affect land use in Sweden. As regards FAME, production in 2016 was just over 200 000 cubic metres, which corresponds to an area requirement of around 140 000 ha.[129] Some of the raw materials for FAME are also imported. Excluding imported raw materials, the production of ethanol and FAME in Sweden corresponds to an area of around 240 000 ha, or around 9 % of arable land in Sweden.

Arable land in Sweden has not expanded since the production of biofuels began to increase at the start of the 2000s. The area used for oilseed plants rose from 75 900 ha in 1999 to 93 000 ha in 2016, while the area used for cereals fell from 1 153 200 ha to 1 019 600 ha over the same period, while the total area of arable land declined from 2 746 900 ha to 2 579 600 ha[130]. Thus, the production of ethanol has not led to the creation of any new arable land, but instead the surplus of cereals that would otherwise have been exported has been reduced. Although the area used for oilseed plants has increased somewhat, the total arable area has declined; hence it has been possible to utilise former arable land. Thus, at an aggregated level there is no reason to believe that the cultivation of raw materials for biofuels is leading to the use of land of high natural value. However, the reduction in cereal exports

[128] Swedish Energy Agency (2016). Biofuels Markets 2016, ER 2016:29.
[129] With conversion efficiency and yield for rapeseed from Börjesson, P, Tufvesson, L, Lantz, M, 2010. Life-cycle analysis of Swedish biofuels. Lund University.
[130] Swedish Board of Agriculture (2017). Agricultural statistics summary 2017.

could lead to indirect changes in land use outside Sweden, but disregarding areas outside Sweden, the Swedish production of biofuels has had a limited impact on land use and the environmental effects associated therewith.

Biodiversity

The cultivation of a specific crop will have the same impact regardless of whether the crop is used for biofuels or food. However, the impact on biodiversity is heavily dependent on the assumptions that are made as to how the land would have been used were it not used for biofuels. As has been established previously, there is reason to believe that the raw materials for biofuels are cultivated on land in Sweden that was previously used as agricultural land. With the exception of landscapes dominated by agriculture, it may even be beneficial for biodiversity if the cultivation of biofuels reduces the decline in agricultural land and thereby contributes to the maintenance of an open landscape.

Water resources

The term 'water resources' is interpreted as meaning 'water supply'. Access to water is not a problem in Sweden, other than in the occasional year when some parts of the country may be hit by drought. However, cereals and other crops that are used to produce biofuels are not irrigated, not even in years when there is a drought.

Soil and water quality

Since no new agricultural land is deemed to have been given over to the current production of crops for biofuels, the assumption is that these crops do not contribute to any direct changes in stored carbon in the soil that need to be taken into account in this context. However, as is the case for food production, the production of biofuels results in emissions of acidifying and eutrophying substances, which in turn affect land and water quality. Shown below are the emissions that the production of Swedish biofuels under present conditions are considered as giving rise to during their life cycle when emissions are allocated between fuels and by-products based on their respective energy contents.[131]

Table A. Estimated life cycle emissions in accordance with the energy-allocation method for eutrophying substances (tonnes of PO_4^{3-} equivalents) and acidifying

[131] The values for ethanol and FAME relate to production in Sweden. For biogas, there are currently no production values for 2016; hence the values relate to the proportion of Swedish raw materials for the consumption of biogas as a fuel instead. No life cycle emission data is available for HVO, which is why HVO is not reported.

The life cycle emissions are taken from Börjesson, P, Tufvesson, L, Lantz, M, 2010. *Livscykelanalys av svenska biodrivmedel* (Life-cycle analysis of Swedish biofuels). Lund University. The values are based on the most common raw materials for the respective fuels, i.e. wheat for ethanol, rapeseed for FAME and household waste for biogas. In reality, varying quantities of a number of different raw materials are involved in the production of the respective fuels, but as life cycle data is only available for the most common raw materials, it has not been possible to determine a weighted average.

substances (tonnes of SO_2 equivalents) from the production of the ethanol, FAME and biogas sold in Sweden.

	Estimated life cycle emissions of eutrophying substances (tonnes of PO_4^{3-} equivalent)		**Estimated life cycle emissions of acidifying substances (tonnes of SO_2 equivalent)**	
	2015	**2016**	**2015**	**2016**
Ethanol	582	609	261	274
FAME	1 380	1 644	443	528
Biogas	29	35	172	204

Because these are life cycle emissions and both raw materials and input materials for cultivation and production may originate from different parts of the world, the values presented below must be viewed as the footprint of the biofuels produced in Sweden, rather than the environmental impact in Sweden alone. It should be noted that the energy-allocation method takes no account of the fact that by-products such as feed that are produced in conjunction with biofuel production may decrease (or increase in certain cases) the environmental impact relative to the products that they replace, which in turn will affect the biofuel's life cycle emissions if the system expansion method is applied instead.

Estimated net greenhouse gas emission savings due to the use of energy from renewable sources (point 10 in the template)

Point 10. Estimated greenhouse gas emission savings

10. Please estimate the net greenhouse gas emission savings due to the use of energy from renewable sources *(Article 22 (1)(k) of Directive 2009/28/EC.)*

Net greenhouse gas emission savings have been estimated using a calculation method that is described below. Please see the first progress report for a more detailed description of the calculation methods and assumptions.[132]

Calculation method

The Commission requires an estimate of the net greenhouse gas emission savings due to the **total** use of energy from renewable sources in the Member State.

Net greenhouse gas emission savings have therefore been estimated by calculating the difference between emissions from the renewable energy sources[133] and their fossil counterparts. Emission factors for the fossil counterparts to renewable electricity and heating production are based on the Commission's recommendations[134]. This entails the separate production of electricity and heat using fossil fuels.

For biofuels, the typical values for greenhouse gas emission savings that are set out in the Renewables Directive have been used. When calculating the savings, information on the amounts, raw materials, production processes and origins was taken from the reports that stakeholders subject to a reporting obligation pursuant to the Act on Sustainability Criteria for Biofuels and Bioliquids (2010:598) have submitted to the Swedish Energy Agency. The savings have been calculated using the method[135] described in the Swedish Energy Agency Regulations (STEMFS 2011:2) on sustainability criteria for biofuels and bioliquids. Certain statistics have not yet been received for 2016 regarding a number of areas covered by the reporting process. Estimates based on previous consumption levels and temperatures have been used in such cases.

Results

The estimated net greenhouse gas emissions savings in Table 6 are not a description of the actual emissions savings that have resulted from the use of renewable energy. The calculation method gives a very simplified description of the fossil emissions that are assumed to have

[132] Sweden's first progress report on the development of renewable energy pursuant to Article 22 of Directive 2009/28/EC.
[133] Gode, J et al., Environmental Fact Book 2011 - Estimated emission factors for fuel, electricity, heat and transport, Thermal Engineering Research Association (Värmeforsk).
[134] COM(2010)11 final. Report from the Commission to the Council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling.
[135] The use of a Nordic electricity mix is prescribed for the calculation of GHG performance for reporting by Sweden.

been replaced, but it does show how important the choice of method has been in terms of the results. This information should therefore not be taken out of context or used for any other purpose. It may, however, be interesting to compare the calculation with equivalent estimates for Sweden in previous and future progress reports on the development of renewable energy.

Table 6: Estimated greenhouse gas emission savings due to the use of energy from renewable sources in million tonnes of carbon-dioxide equivalents.

Environmental aspects	2015	2016
Total estimated theoretical net greenhouse gas emission savings due to the use of renewable energy[136]	103	93
Estimated net greenhouse gas emission saving due to the use of renewable electricity	70	60
Estimated net greenhouse gas emission saving due to the use of renewable energy in heating and cooling	30	30
*Estimated net greenhouse gas emission saving due to the use of renewable energy for transport**	2.8	3.9

* Please note that renewable electricity for transport is not included in this item but is instead included in the estimated net greenhouse gas emission savings from the use of renewable electricity.

The total use of renewable energy in 2015 provides the theoretical possibility of emissions being approximately 103 million tonnes CO_{2eq} (carbon-dioxide equivalents) lower than they would have been if the renewable energy had come from their fossil counterparts instead.

Table 6 also reports the data broken down by sector. The use of renewable electricity in Sweden in 2015 represents the largest contribution with 70 million tonnes CO_{2eq} of the theoretical net savings, compared with 60 million tonnes CO_{2eq} the year after. The substantial difference is due to the fact that 2015 was a record year for hydro power, with 75 TWh of electricity being produced compared with 60 TWh in 2016. This shows the impact of hydro power on this method of calculating net savings.

For 2016, the total use of renewable energy provides the theoretical possibility of emissions having fallen by approximately 93 million tonnes CO_{2eq}.

The use of biofuels continues to increase in Sweden. It was primarily the use of low-blend biodiesel and pure biodiesel that increased in 2015 and 2016, which explains the estimated greenhouse gas savings in the transport sector.

It is not only hydro power production that affects the results from this method of calculating the theoretical net greenhouse gas emissions. Wind power is growing in Sweden and accounts for a greater share of production every year. Temperature is a factor that affects the use of

[136] Gas, electricity and hydrogen from renewable energy sources should be reported depending on the final use (electricity, heating and cooling, or transport) and should only be counted once towards the total estimated net greenhouse gas emission savings.

energy for winter heating in Sweden. The winters have been warmer than usual in Sweden for several years, and it was 7.2 % warmer than usual in 2016.

Prerequisites for and information about cooperation mechanisms (point 11 in the template)

Point 11. Surplus of renewable energy

11. Please report on (for the preceding two years) and estimate (for the following years up to 2020) the surplus/deficit production of energy carriers from renewable sources compared to the indicative trajectory, and which could be transferred to/from other Member States and/or third countries, as well as the estimated potential for joint projects until 2020. (*Article 22(1)(l)–(m) of Directive 2009/28/EC.)*

The Swedish Energy Agency's most recent long-term scenarios, entitled *Scenarios for Sweden's Energy System 2016*[137] and *Reference EU* form the basis for calculating the potential surplus/deficit in renewable energy in comparison with the indicative trajectory[138]. Sweden lies above the indicative trajectory throughout the entire period; please see the Table and Figure below. Annex 1 describes the underlying scenario and the prerequisites for it.

The Table shows the actual (for 2009–2016) and estimated (for other years) surplus production of renewable energy compared to the indicative trajectory.

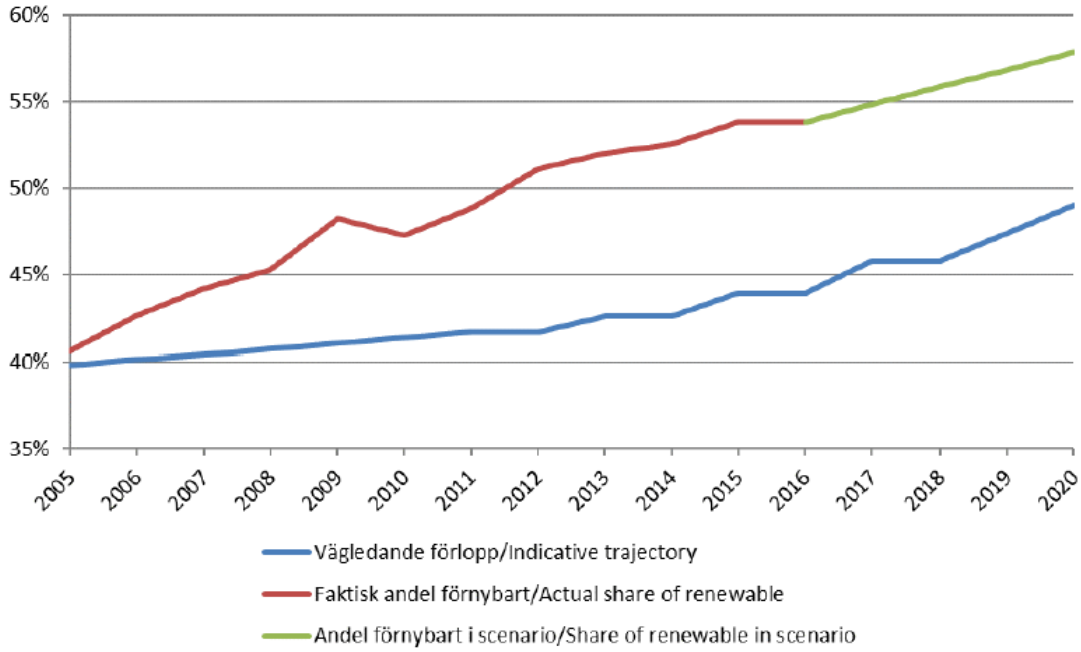
Table: Actual and estimated surplus production of energy carriers from renewable energy compared to the indicative trajectory in Sweden, and which could be transferred to other Member States (ktoe)[139],[140]

	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	2017	2018	2019	2020
Actual/estimated surplus or deficit production[141] (ktoe)												
	2 407	2 141	2 482	3 318	3 214	3 335	3 347	3 475	3 215	3 610	3 428	3 241
Actual/estimated surplus or deficit production (TWh)												
	28	25	29	39	37	39	39	40	37	42	40	38

In 2020, the proportion of renewable energy will amount to 57.8 % in the scenario case *Reference EU*[142]. The values between the statistical years and 2020 have been interpolated. The surplus in the reference case is equivalent to 38 TWh of renewable energy in 2020 relative to the target of 49 %.

[137] Scenarios for Sweden's Energy System 2016, ER 2017:06.
[138] The indicative trajectory is set out in the Directive.
[139] *Please use actual figures to report on surplus production in the two years preceding submission of the report, and a forecast for the following years up to 2020. The Member State must have the opportunity to correct the data from previous reports in each of its reports.*
[140] *For deficit production, please indicate the production shortfall using negative numbers (e.g. – x ktoe) in the table.*
[141] The Commission has asked for this information to be 'distinguished per type of renewable energy and per origin/destination of import/export', which we have disregarded in this report because the data on which this report is based do not present a surplus for each type of renewable energy.
[142] The scenario contains several cases presented with various conditions and the percentage renewable for these is between 57 and 59 %.

Figure: The indicative trajectory, the actual proportion, and the forecast proportion of renewable energy in Sweden up to and including 2020 in the case *Reference EU*.



It should be pointed out that these scenarios are uncertain. The quantity of renewable energy could be 38 TWh lower *or* total energy use could be 77 TWh higher (all other things being equal in the reference case) in order for the proportion of renewable energy to reach the target level of 49 %.

The electricity certificate scheme has been a common scheme with Norway since 2012. It is estimated that more renewable-electricity capacity will be constructed in Sweden than in Norway by 2020, and some of this capacity will therefore be transferred to Norway (and deducted from Sweden's capacity). It is estimated that approximately 3.2 TWh of renewable electricity will need to be transferred from Sweden by 2020, which has been incorporated into the table and figure above.

Point 11.1 Statistical transfers

11.1. Please provide details of the rules governing decision-making and statistical transfers, joint projects and joint support schemes.

Sweden and Norway have agreed upon a joint support scheme for renewable electricity production by means of a common market for electricity certificates, which was introduced on 1 January 2012. A common market for electricity certificates means that renewable electricity production may be located in both Norway and Sweden. The market determines where it is most cost-effective to build up a certain type of electricity production. Producers of renewable electricity can then sell their electricity certificates in this common market. This results in more players in the market and strong competition.

Since Sweden and Norway have a joint support scheme in accordance with Article 11 of the Renewables Directive, reporting on the division of the renewable electricity production promoted through the common system must take place accordingly on an annual basis in accordance with Article 11.

Under the agreement (Article 14(2)) between Sweden and Norway, reporting must be based on a division of electricity production of 50 % for each country up until each party has been credited with 13.2 TWh, with Sweden being credited with 100 % thereafter. Electricity production is being developed on the basis of the actual allocation of electricity certificates for new plants that have been commissioned and approved by the Swedish Energy Agency since 1 January 2012. The normalisation rules in the Renewables Directive are used for wind and hydro power.

As the common electricity certificate market has been extended to 2045 and the Renewables Directive is currently being revised, a new regulation has been introduced under Article 14(4) of the agreement between Sweden and Norway concerning any reporting requirements after 2020. Under the new Article, reports concerning the attainment of goals in accordance with future EU and EEA legal requirements corresponding to the requirements of the Renewables Directive covering the period after 2020 and through to 2030 must follow the basic principle that each party will be credited with the part that the party concerned has financed.

Other information (point 12 in the template)

Point 12. Share for biodegradable waste

12. Please provide information on how the share for biodegradable waste in waste used for producing energy has been estimated, and what steps have been taken to improve and verify such estimates. *(Article 22 (1)(n) of Directive 2009/28/EC.)*

In this report, the Swedish Energy Agency has assumed that 60 % of waste is renewable in 2015 and 52 % is renewable in 2016. The assumption for 2015 is based primarily on two studies carried out in 2008 by energy consultant Profu and commissioned by the Swedish Energy Agency. Since this time, changes have taken place relating to the combustion of waste in Sweden, while the composition of the waste has simultaneously changed because of increased sorting at source. This, together with improved data concerning emissions from waste combustion facilities, resulted in the Swedish Energy Agency commissioning a new study in 2017 in order to update the renewable percentage.

Assumption for 2015

The assumption for 2015 is based on two studies from 2008.

The first study was based on data for the amount of waste sent for incineration at the plants included in the Swedish Waste Management Association's (Avfall Sverige AB) annual statistics. These statistics included all plants that incinerated household waste, as well as two plants that incinerated sorted refuse-derived fuel, wood waste and plastic. In order to calculate the respective proportions of renewable and fossil energy content in the waste that was incinerated, information was initially gathered about the amount and composition of each category of waste. The majority of the fractions thus identified consisted of 100 % fossil, renewable or inert material. The contributions from the different fractions were weighted together to give the chemical composition of the waste category, and the calorific value of the category was then calculated using the Miles and Chan equations. The contributions from fossil materials and renewable materials to the calorific value were then calculated. The results from the calculations for each category could then be added together by finding the total contributions made by each category in proportion to the amount of waste incinerated in each category incinerated. The proportions of renewable and fossil-derived energy in the waste for incineration could thus be calculated[143]. The result showed a renewable fraction of just under 60 %.

The second study was carried out by Profu in collaboration with Statistics Sweden (SCB), with the aim of clarifying the differences between SCB's total waste estimate and the estimate from the study carried out by the Swedish Waste Management Association. Profu's studies showed that the renewable share in the Swedish Energy Agency's statistics (which were based on SCB's estimate) were most probably in the order of 50–60 %.

[143] For more information, please see the study 'Analysis of the renewable proportion of waste for incineration in Sweden with reference to energy content', Profu (2008).

In addition to the two studies referred to above, the Swedish Waste Management Association (Avfall Sverige AB) carried out a project with SP as the project manager in 2010–2011. The Swedish Energy Agency participated in the project as a cofinancier. The purpose of the project was to generate a knowledge base that would provide the industry with an opportunity to be involved in and influence the instruments and legislation in the area of waste incineration.

The project had three subsidiary objectives:

To determine the proportion of fossil carbon from household and commercial waste, respectively, from Swedish waste incineration plants;

1. To compare two different methods for determining the content of fossil and biogenic carbon in the waste, namely: 1) analyses of solid waste; and 2) analyses of the flue gases formed during incineration;

2. To evaluate the results of the analysis in relation to established standards based on selective analyses of the analysed waste.

Seven plants were included in the study: Sysav Malmö, Renova Göteborg, Borås Energi och Miljö, Händelöverket Norrköping, Tekniska verken Linköping, Högdalen Stockholm and Umeå Energi.

The study revealed that the difference between the composition of the household waste and commercial waste at the plants was very small. The relative standard deviation was less than 10 %. In the solid samples, 64 % of the carbon and 62 % of the exhaust gases were of renewable origin[144]. The study did not suggest that there was a direct need to adjust the renewable energy percentage of 60 %.

Assumption for 2016

In 2017, the Swedish Energy Agency tasked the energy consultancy firm Profu with updating the previous study from 2008 with new input data regarding the composition of waste and taking into account available measurement data from seven major waste incineration plants, which during the past year have commenced continuous measurements within the framework of EU ETS for both biogenic and fossil proportions of CO_2 emissions based on the carbon-14 method. Except for this later calibration, the method in the study was identical to the study dating from 2008. The study indicated that 52 % of the waste was of renewable origin.[145] The reduction observed in comparison with 2008 can primarily be explained by the change in composition of waste due to increased sorting of domestic waste at source and an increase in the import percentage compared with 2008.

[144] 'Determining the proportion of fossil carbon in waste incinerated in Sweden', Swedish Waste Management Association (2012).
[145] Analysis of the renewable energy fraction in waste for combustion, Profu (2017).

Annex: Description of the underlying scenarios

Background

The scenarios that form the basis for goal attainment and the estimated surplus production of renewable energy compared to the indicative trajectory as presented in Table 7 are the Swedish Energy Agency's *Scenarios for Sweden's Energy System 2016*[146].

Scenarios for Sweden's Energy System 2016 was written as a basis for Sweden's climate reporting pursuant to the Ordinance (2005:626) on Climate Reporting and under Regulation (EU) No 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change. For further details of the methodology and estimates, please see the report *Scenarios for Sweden's Energy System 2016.*

Basic prerequisites

Some of the basic prerequisites for the scenarios are:

- The oil price is USD 87/barrel in 2020;[147]
- The emission allowance price is EUR 15/tonne in 2020[148];
- Economic growth is 2.28 % per annum between 2013 and 2035;
- The four oldest nuclear power reactors are withdrawn from operations by no later than 2020 and the remaining six reactors have an operational life of 60 years;
- The instruments for climate and energy policy that have been decided upon in Sweden and which apply from 30 June 2016 are included.

  The tax rates from 1 January 2016 apply throughout the entire scenario period. The scenarios assume that low-blend fuels of up to 5 % ethanol in petrol will be subject to tax relief[149]. Above this level, low-blend fuels will be subject to the same tax as the fossil alternative. Low blend FAME in diesel does not have this type of tax limitation, but is in practice limited to 7 %, as this limit is set in the Fuel Quality Directive[150]. Other biofuels (ED95, ETBE, biogas and HVO) are completely exempt from energy and CO_2 tax.

Specific calculation assumptions for calculating the proportion of renewables

- For 2020, it is assumed that 60 % of household waste will be of renewable origin, which was the percentage which applied during 2015; please see point 12;

[146] Scenarios for Sweden's Energy System 2016, ER 2017:69.
[147] Prerequisite provided by the European Commission.
[148] Prerequisite provided by the European Commission.
[149] Ethanol is subject to energy tax equivalent to 12 % of the energy tax on petrol.
[150] Low-blend FAME is subject to an energy tax corresponding to 64 % of the energy tax on diesel.

- The percentages of biofuels and bioliquids used to calculate the goals in the scenario for 2020 are those which fulfil the sustainability criteria in 2015. Around 76 % of all HVO will fulfil the sustainability criteria, with the corresponding figure for biogas being 89 %;

- All use of ‘other biomass’ in Sweden will be sustainable, even under any future requirements;

- The following will be considered to constitute renewable energy in the case of energy extracted from heat pumps:

    - 100 % from ground source heat pumps;

    - 93 % from air source heat pumps;

    - 40 % from heat pumps at district heating plants.