Regeringskansliet

**Government Offices of Sweden**

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

## Foreword

This report is Sweden's fifth 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 2019 and subsequently supplemented with *inter alia* updated statistics for 2018. It is worth noting that the statistical basis has been revised since 2005 through the introduction of an improved statistical method for allocating biofuels between sectors in the official energy statistics. 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 and its update from October 2017 as a guide for Member States' progress reports pursuant to Article 22.

## Contents

# Overall amount and share 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 <u>in the preceding 2 years</u> (2017 and 2018) (*Article 22(1)(a) of Directive 2009/28/EC*). *Please fill in the actual shares and actual consumption of renewable energy* ***<u>for the preceding 2 years</u>*** *in the suggested tables below.*

The data in Tables 1–1d are based on the current version of the calculation tool (SHARES 2018) 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]***

| | 2017 | 2018 |
|---|---|---|
| RES-H&C[2] (%) | 65.8% | 65.4% |
| RES-E[3] (%) | 65.9% | 66.2% |
| RES-T[4] (%) | 26.8% | 29.7% |
| **Overall RES share[5] (%)** | **54.2%** | **54.6%** |
| *Of which from cooperation mechanism[6] (%)* | -1.3% | -1.2% |
| *Surplus for cooperation mechanism[7] (%)* | 8.4% | 8.8% |

There has been a general upward trend in the overall share of renewable energy. The share rose from 54.2% during 2017 to 54.6% in 2018. 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 2017, despite the fact that energy consumption as a whole was higher in 2017 compared with 2016. In 2018, energy consumption was lower and renewable energy consumption was higher, such that the share of renewable energy is higher compared with 2017.

The joint support scheme for electricity certificates with Norway started on 1 January 2012. Greater capacity for renewable electricity production was built in Sweden in 2017 and 2018, which must therefore be divided between the countries. The amount of renewable electricity

[1] *Facilitates comparisons 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.

transferred to Norway (and deducted from Sweden) is 5,362 GWh for 2017 and 5,020 GWh for 2018. The amounts for 2017 and 2018 correspond to the 1.3 and 1.2% that has been deducted from the overall percentage for renewable energy in Table 1. Please also see Point 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]***

| | 2017 | 2018 |
|---|---|---|
| A) Gross final consumption of RES for heating and cooling | 9,813 | 9,634 |
| B) Gross final consumption of electricity from RES | 8,086 | 8,175 |
| C) Gross final consumption of energy from RES in transport | 1,516 | 1,643 |
| D) Gross total RES consumption[9] | 19,415 | 19,453 |
| E) Transfer of RES to other Member States | 461 | 432 |
| F) Transfer of RES from other Member States and third countries | 0 | 0 |
| G) RES consumption adjusted for target D - E + F | 18,954 | 19,021 |

[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]***

| | 2017 | | 2018 | |
|---|---|---|---|---|
| | MW | GWh | MW | GWh |
| Hydro[11]: | 16,502 | 66,145 | 16,431 | 66,381 |
| non-pumped | 16,403 | 66,145 | 16,332 | 66,381 |
| *< 1 MW* | 174 | 558 | 174 | 492 |
| *1 MW – 10 MW* | 807 | 2,493 | 782 | 2,401 |
| *> 10 MW* | 15,422 | 62,015 | 15,376 | 59,254 |
| *pumped* | - | 102 | - | 100 |
| *mixed* | 99 | N/A | 99 | N/A |
| Geothermal | - | - | - | - |
| Solar: | 244 | 230 | 428 | 407 |
| *photovoltaic* | 244 | 230 | 428 | 407 |
| *concentrated solar power* | - | - | - | - |
| Tide, wave, ocean | - | - | - | - |
| Wind[11]: | 6,611 | 17,222 | 7,300 | 18,096 |
| *on-shore** | 6,408 | 16,939 | 7,097 | 16,073 |
| *off-shore** | 203 | 670 | 203 | 550 |
| Biomass[12]: | 4,255 | 10,261 | 4,455 | 10,205 |
| *solid biomass* | 3,706 | 10,250 | 3,918 | 10,195 |
| *biogas* | 2 | 11 | 2 | 10 |
| *bioliquids* | 547 | 0 | 535 | 0 |
| Waste*** | | 1,778 | | 1,656 |
| **TOTAL**** | **27,612** | **95,670** | **28,614** | **96,744** |
| *Of which CHP*** | | 12,076 | | 11,913 |

* 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 bio-oils, 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 in heating and cooling (ktoe)[14]***

| | 2017 | 2018 |
|---|---|---|
| Geothermal (excluding low temperature geothermal heat in heat pump applications) | - | - |
| Solar | 11 | 11 |
| Biomass[15]: | 7,838 | 7,621 |
| *solid biomass* | 7,792 | 7,584 |
| *biogas* | 46 | 37 |
| *bioliquids** | - | - |
| Waste** | 584 | 551 |
| Renewable energy from heat pumps: | 1,379 | 1,451 |
| *- of which aerothermal (air heat)* | 337 | 358 |
| *- of which geothermal (ground heat)* | 936 | 981 |
| *- of which hydrothermal (water-borne heat)* | - | - |
| **TOTAL** | 9,813 | 9,634 |
| *Of which DH[16]* | 3,154 | 3,108 |
| *Of which biomass in households[17]* | 911 | 776 |

* There are some sustainable bioliquids, in the form of bio-oils, 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]***

| | 2017 | 2018 |
|---|---|---|
| Bioethanol | 83 | 91 |
| Biodiesel (FAME) | 189 | 278 |
| **Hydrogenated Vegetable Oil - HVO** | 985 | 984 |
| Biomethane | 101 | 110 |
| Fischer-Tropsch diesel | - | - |
| Bio-ETBE (ethyl tert-butyl ether) | 4.6 | 5.06 |
| Bio-MTBE (methyl tert-butyl ether) | 0.32 | 0 |
| Bio-DME (dimethyl ether) | 0.003 | 0 |
| Bio-TAEE (tert-amyl ethyl ether) | | |
| Biobutanol | | |
| Biomethanol | | |
| Pure vegetable oil | | |
| **Total sustainable biofuels** | 1,376 | 1,500 |
| of which | | |
| *sustainable biofuels produced from raw materials specified in Annex IX Part A* | 222 | 223 |
| *other sustainable biofuels eligible for the target specified in Article 3.4(e)* | 790 | 863 |
| *sustainable biofuels produced from raw materials specified in Annex IX Part B* | 0 | 18.6 |
| *sustainable biofuels for which the contribution to the target for renewable energy is limited under Article 3.4(d)* | 364 | 395 |
| *Imported from third countries* | N/A* | N/A* |
| **Hydrogen from renewables** | | |
| **Renewable electricity** | 140 | 144 |
| *of which* | | |
| *used in road transport* | *N/A*** | *N/A*** |
| *used in rail transport* | *140* | *144* |
| *used in other transport* | | |
| **Other (specify)** | | |

* 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 2017 and 2018, the numbers of purely electric vehicles were 11,034 and 16,664 respectively, the numbers of plug-in hybrids were 32,253 and 49,394 respectively, and the numbers of electric hybrids 71,475 and 90,273 respectively.

Table 1d only includes sustainable amounts of biofuel that have been verified. Section 8 of Table 5 provides more information on the biofuels covered by Annex IX to 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 20.9 TWh of sustainable biofuels has been reported for 2018, compared to 19.5 TWh the previous year. Quantities of HVOs fell very slightly during 2018 from the previous year, while quantities of FAME have increased three-fold. In recent years, ethanol

[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.*

has steadily declined, but this trend was broken in 2018 and the amount of ethanol is now rising.

Ethanol is primarily produced from cereals originating from within the EU or third countries. As in previous years, most ethanol is produced from cereals. FAME is almost exclusively produced from rapeseed oil. In 2018, rapeseed originated predominantly from Germany, the Baltic, Denmark, the UK and France.

Quantities of HVOs declined from 2017 to 2018. HVO produced from crude palm oil was not used during 2016, but returned to the market in 2017, only to then halve in 2018. The share of PFAD[21], which dominates the raw material base, increased during 2018 compared with 2017, as did animal fats.

[21] *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 2016 and which have not been amended but are still in force have been included. Measures that were amended or added in 2017–2018 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<br>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<br>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 threshold for VAT registration<br>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 | 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 | | a further 18 TWh by 2030 | | | |
| **4** | Tax reduction for micro-scale electricity production<br>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<br>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<br>Electricity Act (1997:857) | Financial | Increased micro-scale production of renewable electricity | Micro-scale producers of electricity | Existing | From 1 April 2010 |
| **7** | Changed aid levels for investment aid for solar photovoltaic cells connected to the grid<br>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<br>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** | Repayment of energy tax for electricity following battery storage<br>Bill 2017/18:294 | Financial | Avoid double taxation for energy storage | Enterprises, organisations and private individuals | Existing | From 1 January 2019 |
| **10** | Smart Electricity Grid Forum<br>Bill 2015/16:1 | Soft | Promote dialogue on opportunities for a smart grid | Authorities, industry and consumers | Existing | 2016–2019 |
| **11** | Wind Power Network | Soft | Promote the well-planned and well-anchored | Local authorities and County Administrative Boards, | 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 |
|---|---|---|---|---|---|---|
| | | | development of wind power | universities and colleges, local business, etc. | | |
| **12** | The 'Klimatklivet' local climate investment programme<br>Ordinance (2015:517) on aid for local climate investments | Financial | Reduced greenhouse gas emissions | All, other than private individuals | Existing | 2015–2023 |
| **13** | The 'Energy Leap' programme<br>Ordinance (2018:57) on State aid for more energy efficient consumption in industry | Financial | Promote the implementation of energy efficiency measures | Industrial enterprises | Existing | 2018–2020 |
| **14** | Energy and climate advice<br>Ordinance (2016:385) on contributions to municipal energy and climate advice | Soft | Effective and environmentally-adapted energy consumption | Enterprises and private individuals | Existing | 1997–2020 |
| **15** | Aid for regional energy offices<br>Ordinance (2016:385) on contributions to municipal energy and climate advice | Soft | Greater use of renewable energy and more efficient energy consumption at regional level | Energy and climate advisers, County Administrative Boards, Regional Councils, local authorities, business | Existing | 2002–2020 |
| **16** | 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, regions | Existing | 2016–2020 |
| **17** | Investment aid for renewable energy (including biogas) under the Rural Development Programme | Financial | Greater production of renewable energy | Rural enterprises | Existing | 2014–2020 |

| | 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 (2015:406) on aid for rural development measures | | | | | |
| **18** | Aid for biogas<br>Ordinance (2018:1501) on State aid for the production of biogas for use as a biofuel | Financial | Increased production, distribution and use of renewable gases | Producers, distributors and users of biogas and other renewable gases | Existing | 2018 |
| **19** | Aid for manure gas<br>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 |
| **20** | Business development aid in the energy sector | Financial | Greater share of renewable energy and increased energy efficiency | Seed enterprises | Existing | 2006– |
| **21** | Exemption from road tax for green vehicles<br>Road Traffic Tax Act (2006:227) | Financial | More environmentally-adapted vehicles | Vehicle owners | Existing | 2013–1 July 2018 |
| **22** | $CO_2$-based road tax<br>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 |
| **23** | Reduced taxable benefit value for certain environmentally-adapted vehicles<br>Income Tax Act (1999:1229) | Financial | More environmentally-adapted vehicles | Vehicle beneficiaries | Existing | From 1 January 2012 to 31 December 2020 |
| **24** | Super green car premium<br>Ordinance (2011:1590) on the super green car premium | Financial | More environmentally-adapted vehicles | Vehicle owners | Existing | 1 January 2012–30 June 2018 |
| **25** | Urban environment agreements | Financial | Energy-efficient solutions | Local authorities and county councils | Existing | 2015–2029 |

| | 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 (2015:579) on aid for promoting sustainable urban environments | | with low greenhouse gas emissions. | | | |
| **26** | Coordination of energy adaptation in the transport sector<br>Bill 2015/16:1 | Soft | Promote adaptation in the transport sector | Transport sector | Existing | 2016–2019 |
| **27** | Implementation of the sustainability criteria laid down in the Renewables Directive.<br>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– |
| **28** | Fuel Act (2011:319) | Administrative | Reduced greenhouse gas emissions | Fuel suppliers | Existing | 1 May 2011– |
| **29** | Pump Act<br>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 |
| **30** | Electric bus premium<br>Ordinance (2016:836) | Financial | More electric buses | Enterprises and local authorities | Existing | 2016–2023 |
| **31** | Public procurement of transport services<br>Ordinance (2009:1) on environmental and traffic safety requirements for authorities' cars and car journeys | Administrative | More environmentally-adapted vehicles | Authorities | Existing | 1 February 2009 |
| **32** | Extension and aid for the energy research sector<br>Bill 2016/17:66 | Administrative | Contribute to achieving the set climate and energy targets | Universities and colleges, industry and the public sector | Existing | 2017–2021 |
| **33** | The 'Industriklivet' governmental support programme | Financial | Contribute to achieving the target for net zero | Industries with process-related emissions, but also universities | Existing | 2018–2022 |

| | 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 |
|---|---|---|---|---|---|---|
| | Spring Supplementary Budget for 2018 Bill 2017/18:99 Appropriation directions for the 2019 budget year regarding grants 1:20 Industriklivet programme | | emissions 2045 | and research institutions | | |
| **34** | Reduction obligation<br>Act (2017:1201) on reduction of greenhouse gas emissions through blending of biofuels in petrol and diesel | Financial, administrative | Reduced greenhouse gas emissions through the increased blending of biofuels in fossil fuels | Fuel sellers and professional users | Planned | 1 July 2018 |
| **35** | Bonus malus system | Financial | Promotion of vehicles with low $CO_2$ emissions per km | Vehicle owners | Planned | 1 July 2018 |
| **36** | Action plan for infrastructure for alternative fuels | Soft | Promotion of development of infrastructure for alternative fuels | Authorities | Existing | 2016- |
| **37** | Coordination for charging infrastructure and renewable fuels which require special infrastructure | Soft | Promotion of development of infrastructure for sustainable transport | Authorities | Existing | 2015–2020 |
| **38** | Environmental information concerning fuels | Administrative | Increased climatic performance and sustainability of fuels | Fuel sellers | Planned | 2020– |
| **39** | Urban innovations<br>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 |
| **40** | Energy efficiency aid under the National Regional Fund programme | Financial | Energy efficiency | SMEs | Existing | 2015–2020 |

| | 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 |
|---|---|---|---|---|---|---|
| **41** | Fossil free transport solutions | Financial | Promotion of fossil free transport solutions | All activities | Planned | 2018–2023 |
| **42** | Home charging | Financial | Improving the charging infrastructure for electric vehicles | Infrastructure | Planned | 2018–2020 |
| **43** | Revised property tax for hydro power | Financial | Reduced costs for hydro power | Electricity producers | Existing | 2017– |
| **44** | Electrification Commission[22] | Soft | Accelerate the work to electrify the transport sector | Business | Planned | 2020–2022 |
| **45** | Rapid charging along major roads | Financial | Accelerate the work to electrify the transport sector | Business | Planned | 2020–2022 |

** 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 a collective term 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 adjustment 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. In January 2019, the energy tax on diesel (environmental class 1) and petrol amounted to SEK 2.48 per litre and SEK 4.08 per litre respectively, while the carbon tax on diesel (environmental class 1) and petrol amounted to SEK 2.24 per litre and SEK 2.62 per litre respectively.

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 is expressed as an increase in energy tax alone. The conversion entailed an increase in tax from 1 January 2018 of SEK 0.240 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 on

[22] Government Bill 2019/20:1

1 July 2018 according to which greenhouse gas emissions from petrol and diesel were to be reduced through the blending of biofuels, specific adjustments were made to the energy and 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 was 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/$m^3$, was temporary for the period 2016– 2018. For the period 1 January to 30 June 2019, the reduction thus corresponded to SEK 1,430/$m^3$. During the period from 1 July 2019 to 31 December 2019 inclusive, the reduction is SEK 2,430/$m^3$, of which SEK 2,236 is a reduction in the carbon dioxide tax and SEK 194 is a reduction in the energy tax.

## 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 was increased 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 has also been 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 since 1 January 2018 has been subject to a tax corresponding to 11% of the general $CO_2$ tax level. From 1 August 2019, the $CO_2$ tax level was increased further to 91% for fuels which are consumed in CHP plants within the EU ETS. CHP has also been subject to full energy tax since 1 August 2019.

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

In order to prevent biofuels from being overcompensated under 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 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[23] limits the degree of blending to 10% of ethanol and 7% of FAME). The volume limit was

[23] 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.[24] 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. In connection with the introduction of a reduction obligation on 1 July 2018, biofuels used in diesel also became subject to full energy and $CO_2$ tax (see above). On 1 January 2018, the energy tax exemption for high FAME blends was also increased to 100% of the energy tax that is applicable to diesel fuel.

The abolished restriction on the tax exemption for HVO (hydrogenated vegetable and animal oils and fats) was implemented on 1 January 2015, but applied from 1 May 2014 onwards.[25] 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. HVO and other biofuels classed as low-blend diesel or petrol will not be entitled to an energy and $CO_2$ tax reduction from 1 July 2018.

Sweden has State aid approval for the current tax relief on bioliquids, and for biogas through to the end of 2020.[26] 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[27],[28] a 'plant approval certificate' was introduced on 1 January 2016 in the Act (2010:598) on Sustainability Criteria for Biofuels and Bioliquids and in the Energy Tax Act (1994:1776). The plant approval certificate is intended to demonstrate the existence of a control system that 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 and $CO_2$ tax for ethanol in low petrol blends was abolished in connection with the introduction of a reduction obligation on 1 July 2018. For high ethanol blends in E85, the energy tax exemption was increased on 1 July 2018 from 92% to 100%. There is no longer any energy or $CO_2$ tax reduction for the biofuel-based percentage of ethyl tertiary butyl ether (ETBE) and methyl tertiary butyl ether (MTBE). For ethanol included in ED95, the energy and $CO_2$ tax exemption is 100%. 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.

The energy and CO2 tax exemption is 100% for biogas consumed or sold as engine fuel and for the biofuel bio-DME, dimethyl ether.

[24] www.skatteverket.se, New for 2015.
[25] Ibid.
[26] http://www.regeringen.se/pressmeddelanden/2015/12/forlangda-statsstodsgodkannanden-for-skattebefrielse-av-biodrivmedel/.
[27] Memorandum, Plant approval certificates for biofuels, M2015/3227/R.
[28] 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 28.4 TWh of renewable electricity production by the end of 2020. Sweden has undertaken to finance 15.2 TWh and Norway 13.2 TWh, 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.

The collaboration with Norway concerning 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 they feed into the grid[29].

The tax reduction amounts to SEK 0.60/kWh for the surplus electricity that is fed to a connection point with a fuse not exceeding 100 amps during a calendar year. The ceiling for the reduction is SEK 18,000/year.

### 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 above, 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 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.

In the proposal for new legislation submitted to the Council on Legislation entitled 'Further expansion of the tax exemption for self-produced electricity'[30], the Swedish Government proposes that the energy tax be abolished in its entirety for electricity which is produced in small plants (less than 255 kW) at the location where the electricity is consumed. The Government has applied to the European Commission for state aid approval.

[29] Income Tax Act (1999:1229), Chapter 67, Articles 27–33
[30] https://www.regeringen.se/4a55ca/contentassets/36ddf435cc5f487d941ff4b3880a019d/ytterligare-utvidgning-av-skattebefrielsen-for-egenproducerad-el.pdf

6. Exemption from grid charges

Electricity consumers with their own small-scale[31] 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. However, the exemption only applies if the electricity consumer has used more electricity from the electricity grid than has been fed in during a calendar year. 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.

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 54,000 applications had been submitted to the County Administrative Boards as of September 2019, approximately 29,000 of which were granted aid.

As of 8 May 2019, the aid level has been a maximum of 20%. 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 per 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 receive aid for solar photovoltaic cells.

The budget for the aid for solar photovoltaic cells amounted to SEK 585.6 million in 2017 and SEK 1,085 million in 2018. The budget for the aid for 2019 is SEK 736 million[32]. The Government has proposed a further SEK 500 million in the draft Budget. The scheme will end on 31 December 2020, and the budget for 2020 has been announced as SEK 835 million.

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[33]. 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

[31] The exemption from grid fees applies to electricity users with a power rating contract not exceeding 63 amperes which produce electricity which can fed in with a power rating not exceeding 43.5 kilowatts.
[32] https://www.regeringen.se/pressmeddelanden/2019/04/fortsatt-stod-till-solceller/
[33] Ordinance (2016:899) on the installation of systems to store electricity produced by individual customers.

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.

From the introduction through to April 2019, the Swedish Energy Agency distributed approximately SEK 36 million to the County Administrative Boards which administer the aid.

### 9. Refunding of energy tax for electricity following battery storage

Since 1 January 2019, it has been possible to apply for a refund of energy tax paid on electricity fed from a licensed electricity grid, stored and then fed back to the same licensed electricity grid again. This arrangement was introduced to avoid double taxation. The change took effect on 1 January 2018.

### 10. Smart Electricity Grid Forum

In spring 2016, the Swedish Government 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 was invested over the 2016–2019 period in accordance with the draft Budget for 2016.

### 11. 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. The Government has proposed new initiatives with the aim of facilitating the development of renewable electricity generation in the draft Budget for 2020.

### 12. The ‘Klimatklivet’ programme for local climate investments

Since 2015, all types of organisations, except enterprises in the EU ETS, have been able to apply for grants for local climate investments.[34] The candidates compete based on the estimated greenhouse gas reduction per SEK for each investment. During the period 2015–2018, Klimatklivet programme awarded SEK 4.7 billion in aid to 3,200 measures. Examples of investments which are eligible for aid include charging infrastructure for electric vehicles, biogas plants, the replacement of fossil-based oil by biofuel and district heating, the development of small-scale district heating grids, nitrous oxide destruction in the healthcare

[34] Investments in sectors in EU ETS may still be eligible if they lead to an increase in the utilisation of waste heat. Aid from Klimatklivet cannot be granted for electricity generation for which an electricity certificate is issed.

sector, cycle paths, and infrastructure for cycles. In 2019, the Government budgeted SEK 1.5 billion for the Klimatklivet programme.

### 13. The Energisteget programme

The Energisteget programme aims to promote energy efficiency within industry and thereby contribute to attainment of the goal of 50% more efficient energy use by 2030. The Energisteget programme covers a total of SEK 125 million and is being carried out during the period 2018–2020. Industry accounts for a high proportion of Sweden's total energy consumption, and industrial activity in the mining and manufacturing industries are specially selected areas in the programme.

Within the Energisteget programme, industrial enterprises which have carried out an energy survey within the framework of the Act on energy surveys in large enterprises can apply for two types of financial aid: project planning air and investment aid. Project planning aid is awarded as a contribution towards more detailed project planning or the study of energy efficient measures. Investment aid enables enterprises to apply for reimbursement for the added cost of investing in energy efficiency measures identified during the statutory energy survey.

### 14. Energy and climate advice

The Swedish Energy Agency distributes state funding to municipalities for energy and climate advice to private individuals and small enterprises. The aid has been extended through to 2020 inclusive and covers a total of around SEK 485 million for the period 2018–2020. Local 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 increase the use of more environmentally friendly technology wherever possible.

### 15. Aid for regional energy offices

The Swedish Energy Agency distributes financial aid to 15 regional energy offices, which coordinate the energy and climate advisers. Geographically, the regional energy offices cover the whole of Sweden. There are 15 energy officers and the aid amounts to approximately SEK 10 million per year and is being distributed between all the energy offices through to 2020.

The energy offices initiate and participate in many 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 cooperate regionally with enterprises, the County Administrative Boards, local authorities, municipal federations, etc. This could involve plans and strategies, for example. The aid is included under appropriation 1:2 Initiatives for energy efficiency, under expenditure area 21 (energy), specifically under the appropriation for municipal energy and climate advice.

### 16. Local and regional capacity development for climate and energy adaptation

In the spending authorisation for 2018, the Swedish Energy Agency was given two assignments which promote the more effective use of transport: Local and regional capacity

development and Sustainable transport solutions. On the basis of these two assignments, the Swedish Energy Agency has put together an aid programme which distributes funding through open announcements. The aim of the programme is to help local and regional operators to contribute to energy adaptation and reduced climate impact. The impact that will be achieved through the programme is to develop the organisational capacity of the operators to work systematically and strategically to integrate energy and climate issues in various areas for which the public sector is responsible, including public sector procurement, land use planning and contributing to a more transport-efficient society. The some 75 projects which have been awarded aid can continue through to 2020 inclusive. During 2019 and 2020, the Swedish Energy Agency will also arrange meetings to exchange experiences and transfer knowledge between projects and to develop guidelines and other knowledge support for operators wishing to implement and carry out similar work within their operations.

### 17. 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 their expenditure (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.

### 18. Aid for biogas

In 2018, a temporary aid scheme was introduced for the production of biogas which was upgraded to vehicle gas (biofuel) and which was not produced from waste sludge or landfill gas. In December 2018, SEK 270 million was disbursed as an advance to 39 facilities and the aid amounted to SEK 0.26/kWh of produced biogas[35]. In order to boost the competitiveness of the sector, the Government proposed in the autumn amending budget for 2019 also disbursing aid amounting to a total of SEK 100 million for such biogas production in 2019.

### 19. Aid for manure gas

An aid system has been in place for the production of biogas through anaerobic digestion of manure since 2015[36]. The aim is to increase biogas production from manure and thereby double the environmental and climate benefits through reductions in methane emissions from manure and the substitution of fossil energy. The increased digestion of manure offers many environmental benefits. It reduces both emissions of greenhouse gases and the eutrophication of fresh and marine waters, and produces biogas which can be used as energy. The biogas that is generated can be used to generate electricity or heat or as a fuel in vehicles.

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. Between January 2015 and September 2018, a total of SEK 176 million was distributed to 66 biogas facilities. The aid amounts to SEK 0.40/kWh produced biogas. 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

[35] The Swedish Board of Agriculture's annual report 2018
[36] Ordinance (2014:1528) on state aid for production of biogas

that will be paid. Between January 2015 and September 2018, a total of SEK 176 million was distributed to 66 biogas facilities.

### 20. 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 is helping small and medium enterprises (SME) to bring new products and services to the market and supports these enterprises until they are able to take over, provide finance and drive further development. Aid for business development is granted to projects where the Swedish Energy Agency believes the project will have a significant impact on the adaptation of the energy system, along with the potential to contribute to more Swedish jobs and increased Swedish export revenues. Since July 2017, the work relating to business development has been based on contributions. During 2018, a total of 57 projects were awarded contributions amounting to around SEK 66 million.

### 21. 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.

### 22. $CO_2$-based road tax

In order to incentivise vehicle buyers to choose cars, light vans, light buses and motorhomes with low greenhouse gas emissions, Sweden applies a differentiated annual vehicle tax concerning the vehicle’s carbon dioxide emissions per kilometre. This means that vehicles with lower carbon dioxide emissions are taxed at a lower rate than vehicles with higher emissions. This tax applies to vehicles purchased before the introduction of the bonus–malus system for new light vehicles in July 2018, and still applies to vehicles which ‘exit’ the bonus–malus system three years after purchase.

$CO_2$-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.

Since 1 July 2018, when the bonus–malus system for new light vehicles was introduced, the vehicle tax has been higher for three years from the date on which a vehicle first becomes taxable. The higher vehicle tax applies to cars, motorhomes, light buses and trucks of model year 2018 or later which first become taxable on or after 1 July 2018. Read more about this under the description of the bonus–malus system for new light vehicles.

### 23. Extension of reduced taxable benefit value for certain environmentally adapted vehicles

Company-registered vehicles account for approximately 50% of new vehicle registrations in Sweden and a high proportion of these can be used privately by company employees. The benefit of being able to use an employer's vehicle for private travel is generally taxable and the value is calculated according to a specific template. To support the introduction of environmentally friendly vehicles on the market, a rule has been introduced according to which the value of the vehicle benefit is reduced for environmentally friendly vehicles to a level corresponding to the new vehicle price of the closest comparable vehicle without such technology. In the case of electric vehicles, plug-in hybrids and gas-fuelled vehicles (except LPG), the benefit value may be reduced further to a value corresponding to 60% of the benefit value of the closest comparable conventional vehicle. Such reductions may not exceed SEK 16,000 per year. In 2017, the reduction was extended through to 31 December 2020 inclusive, but the maximum amount for the reduction in taxable benefit value was reduced from SEK 16,000 to SEK 10,000 per year.

New provisions concerning the calculation of the taxable benefit value of vehicles entered 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 paid congestion charges and road, bridge and ferry charges 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 was introduced on 1 July 2018.

### 24. Super green vehicle premium

A premium is paid for green vehicles meeting the requirements to be considered as a 'super green vehicle'. The provisions relating to this premium are regulated by 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 fulfil the EU's most recent emissions requirements (Euro 5 or Euro 6). The premium is a maximum of SEK 40,000 per car, and is paid out by the Swedish Transport Agency. The premium was available up to and including 30 June 2018.

### 25. Urban environmental agreements

In 2015, the Government introduced an aid scheme specifically to promote sustainable urban environments, or 'urban environmental agreements'. The aid is aimed at municipalities and county councils, and amounts to SEK 1 billion during the period 2018-2029, i.e. a total of SEK 12 billion. Urban environmental agreements are funded through the economic framework for the national transport infrastructure plan for 2018-2029. The measures will lead to energy efficient solutions with low greenhouse gas emissions and contribute to attainment of the *Good built environment* environmental quality goal. The aid gives municipalities and county councils the opportunity to obtain up to 50% in state cofinancing for infrastructure for public transport and, since 2017, for cycling as well. In April 2019, the Government decided to amend Ordinance (2015:579) on aid to promote sustainable urban environments so that urban environmental agreements were broadened to also cover measures for freight transport solutions. This amendment entered into force on 22 May 2019. Municipalities and county councils which are awarded aid must implement counterperformances which help to increase the proportion of sustainable transport or more housing developments.

### 26. 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 government agencies (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.

### 27. Implementation of the sustainability criteria laid down in the Renewables Directive

The sustainability criteria of the Renewables Directive have been implemented through Act (2010:598) on sustainability criteria for biofuels and bioliquids (the Sustainability Act) and the underlying ordinance and regulations.[37] Fulfilment of the sustainability criteria is a requirement in Act (2011:1200) on electricity certificates and Act (1994:1776) on tax on energy, amongst other legislation. The Sustainability Act was amended in certain respects in

[37] Ordinance (2011:1088) on sustainability criteria for biofuels and liquid biofuels, and the Swedish Energy Agency's regulations concerning sustainability criteria for biofuels and liquid biofuels (STEMFS 2011:2)

connection with the implementation of the ILUC Directive (2015/1513/EU), partly as regards the definition of processing residue. A residue is defined as a substance that is not the end product(s) that a production process directly seeks to produce or the primary aim of the production process and the process has not been deliberately modified to produce it. Substances that are listed in Annex IX (e), (f) and (h)-(o) of the Renewable Energy Directive must always be considered to constitute residues. As regards other substances which a production process is not normally optimised to produce, the evaluation must be made on the basis of the mean sales price per kilogram compared with the mean sales price per kilo of the substance that the process is normally optimised for. The information that parties covered by the reporting obligation are required to provide has also been expanded as regards biofuels produced from certain raw materials in accordance with the classification in Annexes VIII and IX to the Directive. The Act, Ordinance and regulations have been published on the Swedish Energy Agency's website.[38]

### 28. The Fuel Act

The EU's Fuel Quality Directive[39] 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 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 supervisory authority for the parts of the Act that relate to greenhouse gas reductions and the reporting of certain information.

Calculation methods have been established through a supplementary directive, namely Council Directive (EU) 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements. The updated requirements have been implemented in Swedish legislation.

The Fuel Act stipulates that individual fuel suppliers must implement the measures that are necessary to ensure that by 2020 greenhouse gas emissions do not exceed 88.5 grams of $CO_2$ or $CO_2$ equivalents per megajoule of delivered fuel. All taxable fuel suppliers are obliged to report fuel deliveries. Sanctions have also been introduced in the event of late reporting, along with a penalty tax to be paid by the fuel supplier of SEK 7 per kg carbon dioxide equivalents if the goal is not achieved by 2020.

### 29. The Pump Act

To ensure that renewable fuels are available, legislation[40] is applied in Sweden which requires petrol stations with a sales volume exceeding 1,500 cubic metres of petrol or diesel to provide at least one type of renewable fuel.

### 30. 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

[38] www.energimyndigheten/hbk.
[39] 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.
[40] Act (2005:1248) on the obligation to provide renewable fuels

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, trolleybuses and fuel cell buses with a transport capacity of at least 15 passengers that are used for public transport.[41] The electric bus premium corresponds to 20% of the purchase price of the electric bus concerned, but is limited by the price difference between the electric bus and the closest comparable conventional bus.

From 2020, the electric bus premium will be converted to a climate premium. This means that, in addition to electric buses, it will also be possible to apply for aid for electric vans and other environmentally friendly goods vehicles, as well as electrically operated work machinery which, together with the continuing aid for electric buses, is aimed at promoting the introduction of such vehicles on the market. The budget for 2020 is therefore being increased to SEK 120 million.

### 31. Public sector procurement of transport

Since 2009, it has been a requirement for cars purchased or leased by government agencies to be environmentally friendly vehicles (SFS 2009:1). Many municipalities and enterprises apply the same requirements in connection with the procurement and leasing of vehicles on a voluntary basis.

Act (2011:846) on environmental requirements in connection with the procurement of vehicles and certain public transport services contains criteria regarding the requirements which must be met in connection with the public sector procurement of cars and public transport services. The criteria are intended to help reduce environmental impacts by imposing requirements regarding *inter alia* energy use and emissions.

According to the Swedish Public Transport Association's environmental and vehicle database (FRIDA[42]), approximately 85%[43] of public transport was operated by vehicles powered by renewable fuels during 2018. According to statistics from the Swedish Confederation of Transport Enterprises, 63% of buses ran on fuels other than conventional diesel during 2017.

The Swedish National Agency for Public Procurement provides criteria for the establishment of requirements for the public sector procurement of passenger transport services, goods transport, fuels, tyres, public transport and vehicles[44] in order to support organisations involved in procurement as regards the establishment of requirements.

### 32. Extension and reinforcement of research initiatives in the energy sector

In the draft Budget for 2017[45], 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[46]. Relative to the previously

[41] SFS 2016:836
[42] https://www.svenskkollektivtrafik.se/verktyg-och-system/frida-miljo-och-fordonsdatabas/
[43] Concerns the proportion of vehicle kilometres which renewable fuel
[44] https://www.upphandlingsmyndigheten.se/hallbarhet/stall-hallbarhetskrav/fordon-och-transport/
[45] Swedish Government, Draft Budget for 2017, Bill 2016/17:1.
[46] Swedish Government, Draft Budget for 2018, Bill 2017/18:1.

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[47].

The draft Budget for 2019[48] sets out changes to the appropriation proposals. For 2019, the appropriation proposal was reduced by SEK 70 million, and for 2020, by SEK 135 million. For 2021, an appropriation proposal of SEK 1,468 million was added. In accordance with Report 2018/19:FiU1, the Swedish Parliament decided in December 2018 that the reductions proposed in the draft Budget should not be implemented and that the appropriation proposal for 2021 should be increased by SEK 135 million.

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, Sweden will during the period 2017 – 2020 carry out initiatives under the national energy research and innovation programme within the field of energy. The programme is carrying on research and innovation initiatives within nine separate topic areas:

- The transport system;
- Bioenergy;
- Buildings in the energy system;
- Electricity production and the electricity system;
- Industry;
- Sustainable society;
- General energy system studies;
- Business development and commercialisation;
- International cooperation.

### 33. The ‘Industriklivet’ governmental support programme

Sweden is taking the lead as regards research to enable energy-intensive industries to become more energy- and resource-efficient and ultimately free from carbon dioxide emissions. The

[47] Swedish Government, Bill 2016/17:66 Research and innovation in the energy sector for ecological sustainability, competitiveness and security of supply. https://www.regeringen.se/4afb26/contentassets/4b2850a9f6344d63b82f2f856053b31c/forskning-och-innovation-pa-energiomradet-for-ekologisk-hallbarhet-konkurrenskraft-forsorjningstrygghet_2016_1766.pdf
[48] Swedish Government, Bill 2018/19:1.

Industriklivet programme[49,50] is a long-term initiative which aims to reduce industrial emissions of greenhouse gas emissions. SEK 300 million per year will be spent during the period 2018–2040 in order to support Swedish industry in the switch to zero emissions of greenhouse gases into the atmosphere by 2045 and for the funding of measures which contribute to negative emissions of greenhouse gases. For the period 2020–2022, the Government has budgeted an additional SEK 300 million per year for the initiative as an increase to the original assignment.[51] The initiative involves the granting of aid to enterprises all the way from research and innovation projects to demonstration and full-scale facilities. The target group for the aid is industry, but universities and research institutions are also eligible.

### 34. Bonus malus system

The aim of the reduction obligation is to reduce emissions from petrol and diesel through blending with biofuels with low lifecycle emissions. The reduction obligation for petrol and diesel was introduced on 1 July 2018[52]. The instrument means that suppliers of petrol and diesel must annually reduce their greenhouse gas emissions through blending with renewable fuels compared with the equivalent amount of energy from its fossil-based equivalent according to a certain percentage. For the years 2018, 2019 and 2020, the following reduction levels have been approved:

- 2018: Petrol 2.6% emission reduction, Diesel 19.3% emission reduction

- 2019: Petrol 2.6% emission reduction, Diesel 20.0% emission reduction

- 2020: Petrol 4.2% emission reduction, Diesel 21.0% emission reduction

The amount of biofuel energy which is required to fulfil the obligation is determined by the lifecycle emissions from the biofuels that are used. The higher the lifecycle emissions, the greater the proportion of biofuel that must be added and vice versa. The magnitude of the reduction in the use of fossil fuels that the obligation gives rise to is therefore determined not only by the reduction levels that are established for each year, but also which biofuels are used.

The amount of energy in biofuel which is required to fulfil the obligation is also determined by the amount of energy in the fossil-based fuel that is used. Measures to promote energy efficiency, transport efficiency and electrification of the transport sector are reducing the amount of energy in fuel that is covered by the obligation.

In this way, the reduction obligation interacts with other instruments, such as the bonus–malus system for new light vehicles, which contributes to increased electrification of the transport sector.

[49] Government press release, https://www.regeringen.se/pressmeddelanden/2017/08/langsiktig-satsning-for-att-minska-industrins-utslapp-av-vaxthusgaser/
[50] Swedish Energy Agency, https://www.regeringen.se/pressmeddelanden/2017/08/langsiktig-satsning-for-att-minska-industrins-utslapp-av-vaxthusgaser/
[51] Government Bill 2018/19:99 Spring Amendment Budget for 2019, https://www.regeringen.se/4964bf/contentassets/3265eb4906644b3fb3b8f63649a4dcaa/varandringsbudget-for-2019-prop.-20181999.pdf
[52] Act (2017:1201) on reduction of greenhouse gas emissions through blending of biofuel in petrol and diesel

On 28 June 2018, the Government tasked the Swedish Energy Agency with investigating and submitting proposals for reduction levels for the period 2021 to 2030, and determining whether a common reduction level for petrol and diesel should be introduced and whether liquid high-blend and pure biofuels should be covered by the reduction obligation or continue to be promoted through tax exemption. The Agency was also tasked with investigating whether the reduction obligation could be made more cost-effective. The Agency submitted its report on the assignment to the Government Offices of Sweden on 4 June 2019 and supplemented the assignment on 25 October 2019. The process for determining gradual increases in reduction levels for the period after 2020 is now under way within the Government Offices of Sweden and is not expected to be completed until 2020.

### 35. Bonus malus system

Since 1 July 2018, a bonus-malus system has been in place for new light vehicles in Sweden. Under the system, vehicles with low carbon dioxide emissions can qualify for a bonus at the time of purchase, while vehicles with high carbon dioxide emissions are subject to a higher road tax for the first three years. From the fourth year onwards, a carbon dioxide-based road tax is applied. The system covers purchases of new cars, light buses and light vans. From 1 January 2020, a new and fairer method for determining the fuel consumption of vehicles (WLTP) will be used to determine the tax and bonus applicable to new vehicles. In general, the new measurement method results in higher measured emission values and the transition will therefore result in the tightening of environmental controls. WLTP replaces the previous measurement method (NEDC) for new vehicles, but not for vehicles covered by the bonus–malus system which became taxable before 1 January 2020. The effect on the taxation of WLTP is much greater than was anticipated at the time the bonus–malus system was proposed.

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 for new light vehicles was introduced on 1 July 2018. For 2019, a total of SEK 1,240 million was allocated, and for 2020 SEK 1,630 million. In the draft Budget for 2020[53], the Government is proposing that the appropriation for climate bonus vehicles be increased by SEK 130 million for 2020. The appropriation is also being reinforced with SEK 100 million for 2019 in the autumn amending budget[54].

### 36. 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 (the Infrastructure Directive), 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

[53] Government Bill 2019/20:1
[54] Government Bill 2019/20:2

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.[55]

### 37. Coordination of charging infrastructure and renewable fuels which require separate infrastructure

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.[56]

Within the coordination assignment for charging infrastructure, the Swedish Energy Agency has focused on developing the capacity of society's operators. The focus has been placed on engaging relevant operators to develop an appropriate charging infrastructure. The focus for the coordination assignment for infrastructure for renewable fuels has been on collating knowledge and experiences concerning renewable fuels which require separate infrastructure. This will be achieved through improved access to relevant and reliable information concerning infrastructure for renewable fuels for different operators.

### 38. Environmental information concerning fuels

The Government has approved amendments to the Fuel Ordinance (2011:346) which will mean that consumers will be given information at fuel pumps concerning the climate impact and origin of the fuel. The Ordinance will oblige fuel suppliers to provide information to consumers, which will be based on the information they report annually to the Swedish Energy Agency under the Fuel Act.

Environmental information must be made available to consumers at the pump. More detailed information shall be available on the websites of the fuel suppliers. To ensure that the administrative cost is not excessive for small fuel suppliers, such suppliers are exempted from the requirement to provide information. It will therefore be voluntary to provide information for suppliers which supply less than 1,500 cubic metres of liquid or 1,000,000 cubic metres of gaseous fuel per year.

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

The Swedish Energy Agency is now working to develop regulations concerning the detailed formulation of the environmental information. The requirement to provide information will enter into force on 1 May 2020.

### 39. 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. Around 50 projects have received aid which must be concluded during 2019.

### 40. 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 measures through the European Regional Development Fund to SMEs within the framework of the National Regional Fund programme, with the Swedish Agency for Economic and Regional Growth as the managing authority. The goal is that energy consumption among SMEs must reduce by 10% per unit of value added by 2023. The Swedish Energy Agency has SEK 80 million per year available during the period 2015-2020, with SEK 40 million coming via the European Regional Development Fund.

### 41. 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. During 2018, the Swedish Energy Agency was tasked with distributing aid amounting to SEK 575 million for the construction of a test centre for electromobility. The aid, which the Swedish Energy Agency is responsible for distributing, amounts to SEK 140 million for 2018, SEK 150 million for 2019, SEK 200 million for 2020, and SEK 85 million for 2021.[57]

### 42. Home charging

The aid for home charging gives private individuals the opportunity to apply for contributions to install a charging station for electric vehicles at home. Private individuals who own or have the right to use the property on which the charging point is to be installed are eligible to apply for the aid. The contribution is given as a one-off amount not exceeding 50% of the eligible costs, subject to a maximum of SEK 10,000 per property. No more than SEK 50 million of aid may be disbursed pursuant to Ordinance (2017:1318) on contributions to private individuals for installation of charging points for electric vehicles.

[57] Assignment to support the construction of a test centre for electromobility. N2017/05176/IFK

43. 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 commencing in 2017.

44. Electrification Commission

The Government is investing SEK 5 million per year through to 2022 inclusive for the establishment of an electrification commission to accelerate the work relating to electrification of the transport sector. The electrification commission will strive to accelerate investments in electric roads, charging infrastructure for electric trucks and other effective applications. The commission will also consider funding issues, how electricity can rapidly be ducted to roads, and the effects on electricity supply of goods traffic switching to electric. Together with industry and relevant stakeholders, it will urgently draw up an action plan for electrification of the most heavily trafficked roads in Sweden and otherwise consider other opportunities for electrification.

45. Fast charging along major roads

In the draft Budget for 2020[58], the Government is proposing the establishment of a new appropriation for aid to promote the deployment of charging infrastructure for rapid charging along major roads in order to cover blind spots where such infrastructure would otherwise not be deployed. The Government is therefore proposing an initiative amounting to SEK 50 million over three years for this deployment.

# Point 2.a 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.)*

### Strategy for sustainable wind power development

The Swedish Energy Agency and the Swedish Environmental Protection Agency are working together to develop a joint strategy for sustainable wind power development which takes account of resource-effectiveness, human health, impacts on the environment, etc. The initiative is a measure within the framework of the Swedish Environmental Goals Council. The work is focussing on coordinating the views of state operators regarding wind power, developing guidelines for striking a balance between different interests and developing a basis for the planning of wind power which breaks down the national need for wind power at regional and municipal level. This work began in 2018 and will be reported in spring 2020.

### Mapping services for information with wind power projects

Vindbrukskollen is a digital map and database of all wind power installations in Sweden, which was launched in August 2012. The map shows both planned and erected wind farms.

[58] Bill 2019/2020:1 Expenditure area 21 Energy

Vindbrukskollen is open and free for everyone to use. Vindbrukskollen also has a map store with other information of relevance to the establishment of wind power developments, e.g. various types of protected areas and infrastructure. During 2019, a major update to Vindbrukskollen (Vindbrukskollen 2.0) was launched, which *inter alia* made the service more user-friendly. Vindbrukskollen is operated by the county administrative boards on behalf of the Swedish Energy Agency.

### 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. This was followed up by a consultation process during the period 14 March to 14 June 2019. Proposals are expected to be submitted to the Government at the end of 2019.

### 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 evaluation of wind power relative to other interests in land use planning.[59] Identifying the best locations in the country for wind power as a national interest for wind power is a key aspect of the work to bring about an increase in the proportion of renewable energy.

In 2019, the Swedish Energy Agency also designated areas with nationally important electricity generation at *inter alia* certain nuclear power stations and power plants. Important electricity distribution installations had already been designated in the counties of Örebro and Södermanland. The Swedish Energy Agency is also working to develop a national interest for hydro power and has just begun a preliminary study within this field.

### Improvements to administrative procedures with the aim of eliminating statutory and non-statutory obstacles to the development of renewable energy sources

On 1 January 2015, changes were made to the Planning and Building Act (2014:900). The main aim of these legislative changes was to make the process relating to the Planning and Building Act simpler and more efficient. The changes will enable more planning proposals to be dealt with through a standard procedure, which will entail a simpler process with fewer sub-stages before a plan can be adopted. The changes will also lead to the introduction of even simpler procedures for abolishing local zoning plans and extending the implementation period. This should have a positive impact on the time that is taken in many cases where the development of renewable energy requires changes to be made to local zoning plans.

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

### Protection of the regulation capacity of hydro power

Hydro power plays a pivotal role in the Swedish energy system, partly as a production source, but also as regulation power and an enabler for the increasing proportion of renewable electricity generation from non-regulatable energy sources.

On 1 January 2019, new legislation was implemented through the Government Bill entitled Aquatic environment and hydro power (Government Bill 2017/18:243). The new provisions mean *inter alia* that all operators of hydro power plants for the production of electricity must be covered by modern environmental conditions. This is to be done through a reassessment instigated by the operator. A national plan will be established for these assessments. The Swedish Agency for Marine and Water Management, the Swedish Energy Agency and Affärsverket svenska kraftnät have jointly been tasked with drawing up a proposal for the national plan. A proposal for the national plan was distributed for consultation between 6 May and 28 June 2019 and has since been amended and improved. The final proposal was submitted to the Government for a decision on 1 October 2019. The proposed plan is intended as guidance for *inter alia* government agencies and operators, and presents a national holistic view and a timetable for the assessments. The plan is not a trade-off for individual hydro power stations, but is based on a regional analysis of environmental benefits and access to electricity generated using hydro power.

### Solelportalen – guidance concerning photovoltaic cells

In September 2018, the Swedish Energy Agency launched the web initiative Solelportalen.se. This initiative was developed by the Swedish Energy Agency on behalf of the Government. The work on the portal was carried out in consultation with a number of government agencies with relevant information in the field.

The portal collates objective and independent information concerning photovoltaic cell installations, from the planning phase ahead of an installation through to the decommissioning of an installation. The target groups are owners of small houses and commercial properties. The portal will enable potential photovoltaic cell consumers to take well-founded investment decisions.

### Abolition of requirement for building permits for photovoltaic cell panels and solar collectors which conform to the shape of the building

With the aim of facilitating and accelerating the switch to renewable electricity, the requirement to have a building permit was abolished for the installation of photovoltaic cell panels and solar collectors which conform to the shape of a building within areas covered by a local zoning plan (Government Bill 2017/18:197). The measures must follow the applicable local zoning plan and municipalities will be able to re-introduce the obligation to obtain a permit in local zoning plans. The legislative change entered into force on 1 August 2018.

### Simplified administration of photovoltaic cell aid

On behalf of the Government, the Swedish Energy Agency has investigated the handling of investment aid for photovoltaic cells and has submitted proposals to simplify the aid. In the first instance, the Swedish Energy Agency proposed simplifications to the aid within the existing administrative system. A number of simplifications have been implemented concerning administration, application forms have been simplified, information concerning the aid has been made available, e-applications have been facilitated, the requirement for follow-up has been abolished, and the dialogue between the government agencies which administer the aid has been improved.

# 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[60].

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[61]. This guidance is described in more detail in the 2011 progress report under Article 22.

### Grid reinforcement loans

A new Ordinance[62] 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. In total, four loans amounting to a total of SEK 449.3 million (out of the framework of SEK 700 million) were awarded to three grid owners[63].

Of this amount, SEK 95 million has been paid out (through to 31 December 2018) for actually completed measures. The need for further loans is a recurring item on the agenda of Svenska kraftnät's planning board, on which the industry is represented. Svenska kraftnät decided to initiate a new round of announcements on 10 December 2019 (the final date for receipt of applications was 14 February 2020).

### Efficient use of the electricity grid

Since 1 January 2012, the revenues of electricity grid enterprises have been regulated in advance. This takes place through the Swedish Energy Markets Inspectorate (Ei) establishing

[60] Please see the third paragraph of the twelfth point in Ordinance 2007:1119 containing instructions for Svenska Kraftnät.
[61] http://www.svk.se/aktorsportalen/elmarknad/anslut-till-stamnatet/.
[62] Ordinance (2015:213) on loans to grid companies to facilitate the connection of renewable electricity production.
[63] Svenska kraftnät's 2018 annual report

an income framework for each electricity grid enterprise for a supervisory period of four years. Prior to the third supervisory period (2020–2023), Ei evaluated the current regulations, which led to numerous changes. Chapter 5 of the Electricity Act (1997:857) has been revised and the Government adopted Ordinance (2018:1520) on income frameworks for electricity grid enterprises in August 2018.

Ahead of the supervisory period 2020–2023, Ei has drawn up new regulations[64] concerning incentives to promote quality and efficient grid utilisation. These will replace the previous regulations: EIFS 2015:5 (quality) and EIFS 2015:6 (efficient grid utilisation). The new regulations collate and present revised methods for assessing quality in grid operations and the efficiency of utilisation of the electricity grid in connection with the calculation of the electricity grid enterprises' revenue cap. The updated models will result in the aim of the incentives being achieved more effectively and lead to greater transparency and predictability.

**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;

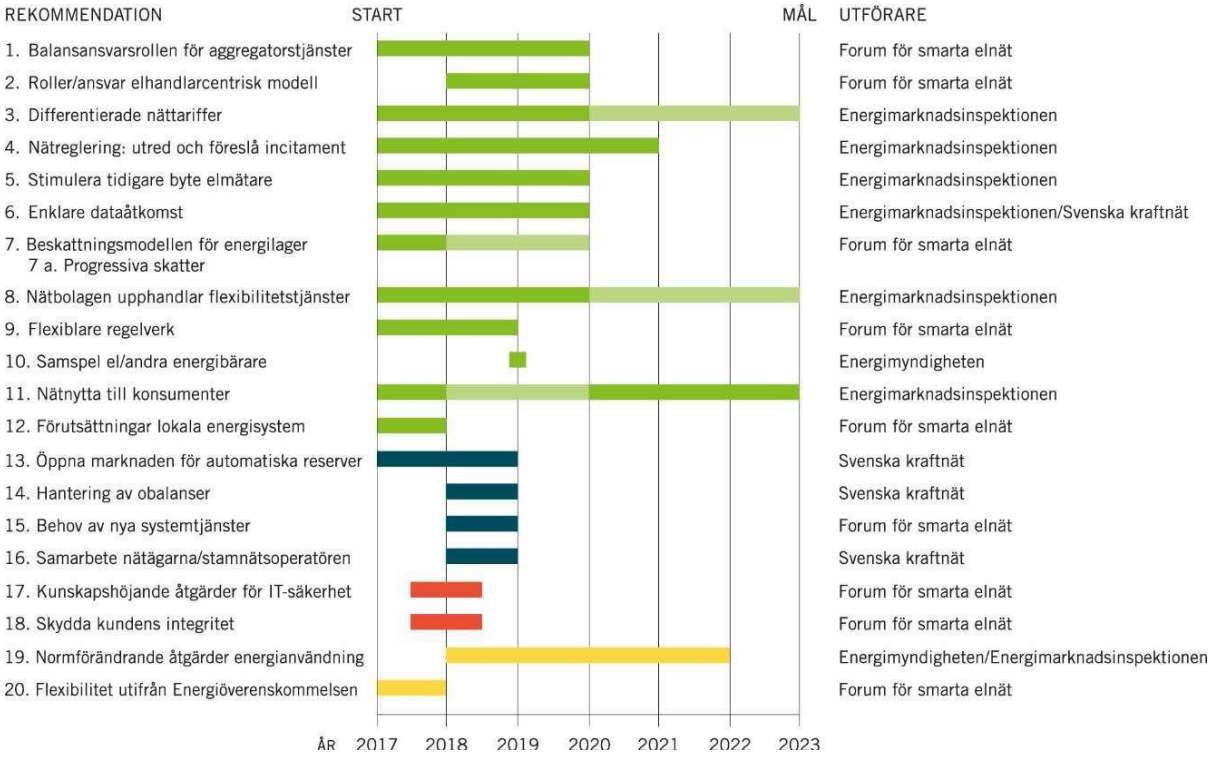
- Sweden to have both more numerous and greater variety in exporting companies, services and products within the smart electricity grid area.

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[65] 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;
- Information and knowledge-raising measures.

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

[64] EIFS 2019:4, The Swedish Energy Markets Inspectorate' regulations on what is meant by the quality of the network concessionaire's manner of conducting network operations when stipulating a revenue cap;
[65] http://swedishsmartgrid.se/wp-content/uploads/2017/09/170914_slutrapport_flex_final.pdf.




| RECOMMENDATION | START | GOAL | EXECUTOR |
|---|---|---|---|
| 1. The balance responsibility role for aggregator services | | | Forum for Smart Electricity Grid |
| 2. Roles/responsibilities, electricity trader-centric model | | | Forum for Smart Electricity Grid |
| 3. Differentiated grid tariffs | | | Swedish Energy Markets Inspectorate |
| 4. Grid regulation: investigate and propose incentives | | | Swedish Energy Markets Inspectorate |
| 5. Stimulate earlier replacement of electricity meters | | | Swedish Energy Markets Inspectorate |
| 6. Simpler data access | | | Swedish Energy Markets Inspectorate/Svenska kraftnät |
| 7. Taxation model for energy storage facilities<br>7 a. Progressive taxes | | | Forum for Smart Electricity Grid |
| 8. Grid companies procure flexibility services | | | Swedish Energy Markets Inspectorate |
| 9. More flexible regulations | | | Forum for Smart Electricity Grid |
| 10. Interaction electricity/other energy carriers | | | Swedish Energy Agency |
| 11. Grid benefit for customers | | | Swedish Energy Markets Inspectorate |
| 12. Prerequisites, local energy systems | | | Forum for Smart Electricity Grid |
| 13. Open markets for automatic reserves | | | Svenska kraftnät |
| 14. Handling of imbalances | | | Svenska kraftnät |
| 15. Need for new system services | | | Forum for Smart Electricity Grid |
| 16. Collaboration, grid owners/truck grid operator | | | Svenska kraftnät |
| 17. Knowledge-increasing measures for IT security | | | Forum for Smart Electricity Grid |
| 18. Protect customers' integrity | | | Forum for Smart Electricity Grid |
| 19. Norm-changing measures, energy use | | | Swedish Energy Agency/Swedish Energy Markets Inspectorate |
| 20. Flexibility based on the Energy Agreement | | | Forum for Smart Electricity Grid |
| YEAR | 2017 …….. 2023 | | |

**Local marketplaces for more efficient use of the electricity grid**

Many projects are under way to meet the challenge of local capacity shortages in certain parts of the electricity grid. One such project is aiming to create local markets where customers are compensated for being flexible and thereby reducing peaks in demand for power, which can help to reduce the capacity deficit. Svenska Kraftnät is participating in the project, which is funded by the EU and known as CoordiNet.

The aim of CoordiNet is to facilitate flexibility amongst industries and households without any need to compromise on customers' comfort or electricity grid costs. The project is seeking answers to a number of key questions. What incentives are needed to make households and industries want to be flexible? What peaks in demand for power can be reduced? Hoes does the coordination between the various operators in the electricity grid need to be improved, automated and digitalised?

Demonstration installations with local marketplaces for more efficient use of the electricity grid are being established in four areas in Sweden. The prerequisites and issues associated with these locations vary.


| | |
|---|---|
| Västernorrland/Jämtland | **Northern Sweden**<br>Temporary reduction in grid capacity, resulting in limitations for wind and hydro power production |
| Uppland<br>Gotland | **Uppland**<br>Capacity shortfall in overlying electricity grid and increased demand for power in urban environments, which hinders urban development |
| Malmö | **Gotland**<br>Limited transmission capacity between Gotland and the mainland, which is hindering the development of wind power – 100% renewable energy |
| | **Malmö**<br>Increased demand for power due to urban development, resulting in capacity shortfalls |

The project will be carried out through to the summer of 2022.

# 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*[66] |
|---|---|---|---|---|---|---|
| | | 2017 | | 2018 | | 2017 and 2018 |
| **Renewable electricity** | | | | | | |
| Electricity certificate scheme | Liability/quota in % | 24.7%[67] of quota-bound electricity consumption | | 29.9%[68] of quota-bound electricity consumption | | |
| | Penalty/buy-out option/buy-out price/unit[69] | SEK 148/MWh[70] NOK 139/MWh | SEK 1.8 million | SEK 215/MWh NOK 200/MWh | SEK 1.7 million | EUR 0.37 million |
| | Mean electricity certificate price[71] | SEK 121/MWh[72] | SEK 2,916 million[73] for renewables, excl. peat SEK 10 million[74] for peat. | SEK 119/MWh[75] | SEK 2,728 million[76] for renewables, excl. peat SEK 9 million[77] for peat. | Renewables EUR 588 million Peat EUR 2 million |
| Investment aid for solar photovoltaic cells connected to the grid | Aid for solar photovoltaic cell installations[78] | SEK 0.11/kWh | Amount granted SEK 331 million. Amount paid out SEK 236 million. | SEK 0.19/kWh | Amount granted SEK 1,149 million. Amount paid out SEK 602 million. | Granted EUR 154 million Paid out EUR 87 million |
| **Renewable fuels[79],[80]** | | | | | | |
| Energy tax exemption for biofuels | | - | SEK 7,670 million. | - | SEK 7,570 million. | EUR 1,588 million |
| Energy tax exemption for biofuels (heating) | | - | SEK 5,230 million. | - | SEK 5,430 million. | EUR 1,111 million. |
| **Vehicles** | | | | | | |
| Road tax exemption for green cars[81] | | - | SEK 49.9 million. | - | SEK 29.5 million. | EUR 13.3 million. |
| Reduced taxable benefit value for certain environmentally adapted vehicles[82] | | 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 10,000. | The revenue shortfall from the reduced taxable benefit value is estimated to be SEK 550 million. | 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 10,000. | The revenue shortfall from the reduced taxable benefit value is estimated to be SEK 650 million. | EUR 125 million |

[66] 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 2017 exchange rate has been used for certain amounts that are being paid out over several years. The relevant exchange rates were EUR 1 = SEK 9.5930 (2017); EUR 1 = SEK 9.6055 (2018). Source: Official Journal of the European Union.
[67] Source: Act (2011:1200) on Electricity Certificates.
[68] Ordinance (2011:1480) on Electricity Certificates.
[69] Source: Swedish Energy Agency, ET 2018:7, ET 2019:4.
[70] One electricity certificate = 1 MWh.
[71] 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.
[72] Source: Swedish Energy Agency, ET 2019:4.
[73] The calculation is based on information from Cesar concerning the types of energy that were granted electricity certificates in 2017 and the mean electricity certificate price for 2017.
[74] Ibid.
[75] Source: Swedish Energy Agency, ET 2019:4.
[76] The calculation is based on information from Cesar concerning the types of energy that were granted electricity certificates in 2018 and the mean electricity certificate price for 2018.
[77] Ibid.
[78] Source: 'Composition of solar photovoltaic cell aid 2009-2019'. Available at: http://www.energimyndigheten.se/globalassets/fornybart/solenergi/manadsrapporter/2019/manadsstatistik-solel_nov19.pdf
[79] 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.
[80]Source: Swedish Government Communication 2017/18:98, Tax Expenditure Report 2018 and Swedish Government Communication 2016/19:98, Tax Expenditure Report 2019.
[81] Estimate, Swedish Transport Agency.
[82] Source: Swedish Government Communication 2017/18:98, Tax Expenditure Report 2018 and Swedish Government Communication 2018/19:98, Tax Expenditure Report 2019.

| RES support schemes, year specified per scheme | | Info/aid per unit | Total, SEK* | Info/aid per unit | Total, SEK* | Total, EUR million*[66] |
|---|---|---|---|---|---|---|
| | | 2017 | | 2018 | | 2017 and 2018 |
| Super green vehicle premium[83] | | Private individuals: SEK 40,000. Legal persons: 35% of the difference in price as a new vehicle between the super green vehicle and the closest comparable vehicle, but no more than SEK 40,000. | SEK 451 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 closest comparable vehicle, but no more than SEK 40,000. | SEK 290 million | EUR 77 million |
| **Biogas and other renewable energy in rural areas** | | | | | | |
| Production aid for manure gas[84] | | Maximum SEK 0.40/kWh. | Budgeted amount of SEK 60 million. Amount paid out SEK 50.2 million. | Maximum SEK 0.40/kWh. | Budgeted amount of SEK 60 million. Amount paid out SEK 57 million | Budgeted EUR 12 million<br><br>Amount paid out EUR 10.7 million. |
| Investment aid for biogas under the Rural Development Programme[85] | | 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.[86] | Up to 40% of eligible costs. Maximum of EUR 200,000 for the same enterprise over a three-year period. | Amount paid out SEK 0.19 million | EUR 0.02 million. |
| Investment aid for renewable energy under the Rural Development Programme[87] | | Up to 40% of eligible costs. Maximum of EUR 200,000 for the same enterprise over a three-year period. | Amount paid out SEK 4.6[88]. | Up to 40% of eligible costs. Maximum of EUR 200,000 for the same enterprise over a three-year period | Amount paid out SEK 8 million | EUR 1.25 million. |
| One-off aid for the production of biogas[89] | | The aid is not relevant 2017 | | SEK 0.26/kWh | Amount paid out: SEK 270 million to 39 facilities | SEK 28.1 million |

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

# 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:

[83] Swedish Transport Agency: https://www.transportstyrelsen.se/sv/vagtrafik/Miljo/Klimat/Miljobilar1/supermiljobilspremie1/ (last accessed 12 October 2019).
[84] Source: Swedish Board of Agriculture Annual Report 2017 and 2018.
[85] Source: Swedish Board of Agriculture.
[86] Source: Swedish Board of Agriculture.
[87] Source: Swedish Board of Agriculture.
[88] Source: Swedish Board of Agriculture.
[89] Source: Swedish Board of Agriculture.

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

2. Electricity consumers who consume electricity that they themselves have produced[90] 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 high 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

[90] This encompasses electricity users who use electricity which they themselves have produced if the quality of electricity used exceeds 60 MWh per calculation year and was produced in a facility with an installed power output exceeding 50 kW.

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[91] (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

[91] Swedish Society for Nature Conservation http://www.naturskyddsforeningen.se/bra-miljoval

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[92]. 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

[92] For a more detailed background to the system, see Government Bill 2009/10:128 Implementation of the Renewable Energy Directive.

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 <u>in the preceding two years</u> 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) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2017 | 2018 | 2017 | 2018 | 2017 | 2018 | 2017 | 2018 | 2017 | 2018 | 2017 | 2018 |
| ***Biomass for heating and electricity:*** | | | | | | | | | | | | |
| Direct consumption of wood biomass from forests and other wooded land for energy purposes (fellings, etc.)** | 5,478 | 5,053 | 2,190 | 2,020 | 22 | 17 | 9 | 7 | 14 | 6 | 6 | 2 |
| Indirect consumption of wood biomass (residues and by-products from the wood industry, etc.) ** | 20,155 | 19,406 | 6,837 | 6,532 | 317 | 346 | 128 | 141 | 865 | 1,616 | 342 | 642 |
| Energy crops (grasses, etc.) and short-rotation trees (Salix) | 36 | 36 | 13 | 13 | - | - | - | - | - | - | - | - |
| Agricultural by-products/processed residues and fishery by-products ** | 141 | 118 | 66 | 60 | 33 | 37 | 24 | 30 | 18 | 37 | 15 | 30 |
| Biomass from waste (municipal, industrial, etc.) | 2,817 | 2,488 | 707 | 625 | 304 | 315 | 97 | 100 | 304 | 315 | 97 | 100 |
| Other – Biogas | 656 | 680 | 213 | 216 | - | - | - | - | - | - | - | - |
| ***Biomass for transport****:** | | | | | | | | | | | | |
| Traditional agricultural crops for biofuels (sugar cane, cereals and maize) | N/A | N/A | 30 | 40 | N/A | N/A | 277 | 286 | N/A | N/A | 73 | 109 |
| Energy crops (grasses, etc.) and short-rotation trees for biofuels (not used) | - | - | - | - | - | - | - | - | - | - | - | - |
| Other - Biomass-based waste | N/A | N/A | 94 | 95 | N/A | N/A | 384 | 446 | N/A | N/A | 663 | 687 |
| Residues/by-products from the pulp and paper industry (sulphite lye and tall oil) | N/A | N/A | 71 | 61 | N/A | N/A | 36 | 40 | N/A | N/A | 46 | 32 |

** Amount of raw material, if possible in **m³ 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.

## Biomass for heating and electricity

### 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[93],[94];
- Statistics Sweden (SCB)[95].

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)[96].

- 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)[97].

[93] Swedish Energy Agency. Annual Energy Balance 2017 and 2018. www.energimyndigheten.se.
[94] Swedish Energy Agency. Production of non-processed wood fuel 2017 and 2018, www.energimyndigheten.se.
[95] Statistics Sweden (SCB). External trade statistics, 2017 and 2018. www.scb.se.
[96] Swedish Forestry Association. 1992. Practical Forestry Manual 1992.
[97] Lehtikangas, P. 1998. The Storage Handbook. Swedish University of Agricultural Sciences.

- Conversion rates for waste liquors have been taken from Alakangas (2000)[98].

The following conversion rates are used for wood fuel[99]:

- 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 feedstock that are included are:

- Cereals;
- Straw;
- Short-rotation trees (Salix);
- Bio-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[100],[101],[102]

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)[103], partly from the Bioenergy Portal,[104] and partly from Fredriksson et al (2004)[105].

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;
- Bio-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.

[98] Alakangas, E. 2000. Properties of fuels used in Finland. Fact sheets. Issue number 2045. VTT Technical Research Centre of Finland Ltd. Finland.
[99] The calorific value has been harmonised with the FAO UNECE Joint Wood Energy Enquiry (JWEE).
[100] Swedish Energy Agency, Annual Energy Balance 2017 and 2018.
[101] Swedish Energy Agency. Fuels 2017 and 2018.
[102] Swedish Energy Agency. Production of non-processed wood fuel 2017 and 2018.
[103] Swedish University of Agricultural Sciences. 1992. Data Book for Operational Planning in Agriculture.
[104] www.bioenergiportalen.se.
[105] Fredriksson, C., Padban, N. and Zinti, F. 2004. Broadening the Fuel Base for Pellets and Powder Burners. Swedish District Heating Association.

## Biomass from waste

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

- Swedish Energy Agency[106];
- Swedish Waste Management Association[107];
- Swedish Environmental Protection Agency[108];

The renewable fraction of the waste has been assumed to be 52% for both 2017 and 2018. This assumption has been made based on an investigation of the composition of waste published in 2017[109]. 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;
- Industrial waste;
- Energy crops.

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

- Swedish Energy Agency[110].

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)[111];
- The Phyllis database (2013)[112];
- Swedish Board of Agriculture (2011)[113];
- The Bioenergy Portal (2017)[114];
- Hadders (2004)[115]

[106] Swedish Energy Agency, Annual Energy Balance 2017 and 2018.
[107] Swedish Waste Management Association. Swedish Waste Management 2017 and 2018. www.avfallsverige.se.
[108] Swedish Environmental Protection Agency. Statistics concerning notifiable cross-border waste transport 2019.
[109] Profu, 2017. Analysis of the renewable energy fraction in waste for combustion. Swedish Energy Agency ref. No 2016-010523.
[110] Swedish Energy Agency. Production and consumption of biogas and fermentation residues 2018, ER 2019:23.
[111] Alakangas, E. 2000. Properties of fuels used in Finland. VTT Technical Research Centre of Finland Ltd fact sheets, issue 2045. Finland.
[112] ECN, 'Phyllis database for biomass and waste'. 2013. Available at: www.ecn.nl/phyllis/single.html.
[113] Swedish Board of Agriculture 2011. Renewable fuels from agriculture – ethanol, biodiesel, and biogas. Report 2011:14.
[114] The Bioenergy Portal. 2017. Available at: www.bioenergiportalen.se.
[115] Hadders, G. 2004. Cereals as fuel.

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)[116], Basic Data About Biogas (2011)[117] and Alakangas (2000)[118].

### 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;
- 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[119].

[116] Carlsson, M., Uldal, M. 2009. Substrate Handbook for Biogas Production, Swedish Gas Technology Centre. Report SGC 200.
[117] Swedish Gas Technology Centre, 2011. Biogas – Basic Data About Biogas 2011.
[118] Alakangas, E. 2000. Properties of fuels used in Finland. VTT Technical Research Centre of Finland Ltd fact sheets, issue 2045. Finland.
[119] Swedish Energy Agency 2018. Fuels 2017 Report pursuant to the Fuel Act and the Sustainability Act. ER 2018:17.

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

| Land use | Surface (ha) | |
|---|---|---|
| | 2017 | 2018 |
| 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] | **10,246 ha**<br>Of which:<br>**7,814 salix**<br>**1,755 poplar**<br>**677 hybrid aspen** | **9,389 ha**<br>Of which:<br>**6,979 salix**<br>**1,711 poplar**<br>**699 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] | **643 ha**<br>Of which:<br>**559 reed canary grass**<br>**84 hemp** | **691 ha**<br>Of which:<br>**599 reed canary grass**<br>**92 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.[120] 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[121]. Hemp is not used for energy to any significant extent.

The substrates used for biogas production in 2017 and 2018 primarily consist of various types of waste such as sewage sludge, industry sludge, catering waste sorted at source, waste from the food industry and manure. Energy crops were only used to a limited extent. In 2017, the proportion of energy crops accounted for 2%[122] of the total raw material base for biogas, and in 2018 the total quantity of energy crops amounted to 1%[123].

[120] The databases for 2017 and 2018 may be found via the following web address: http://statistik.sjv.se/PXWeb/pxweb/sv/Jordbruksverkets%20statistikdatabas/?rxid=5adf4929-f548-4f27-9bc9-78e127837625
[121] Personal communication with Daniel Persson, statistician, Swedish Board of Agriculture, 3 July 2019.
[122] Swedish Energy Agency, 2018. Production and consumption of biogas and fermentation residues 2017, ES 2018:01
[123] Swedish Energy Agency, 2019. Production and consumption of biogas and fermentation residues 2018, ES 2019:23.

# 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*[124].

### 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.

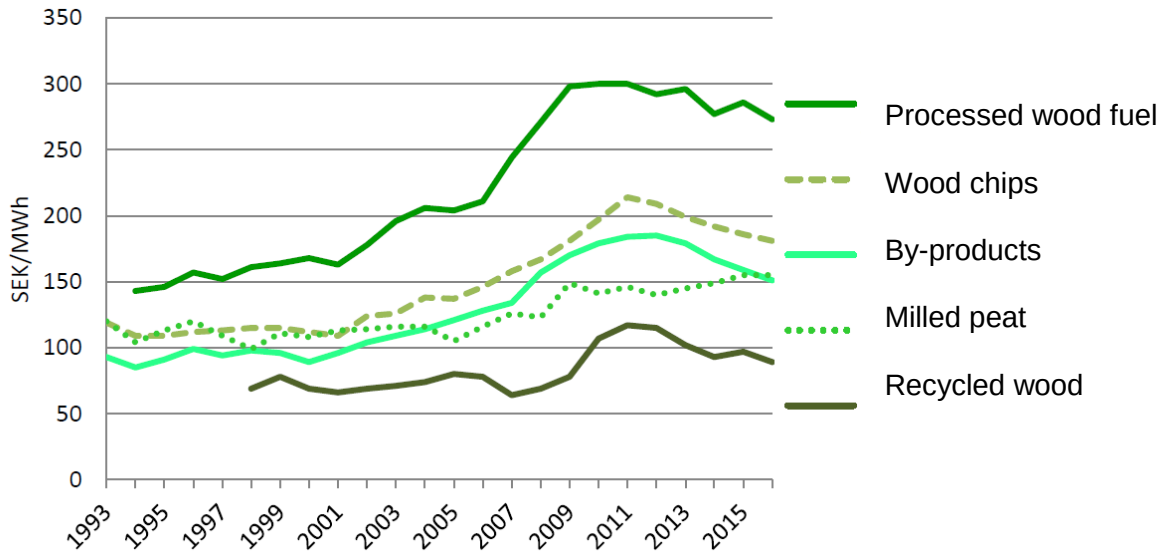
During recent years, the price of wood pellets, wood chips and by-products in particular has fallen, and the downward trend that started after the record-breaking cold winter of 2009-2010 has continued. The price of processed wood fuels (pellets, briquettes and powder) and recycled wood has also fallen. 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.

However, in 2018, the downward trend in prices for the types of wood fuel covered by the Swedish Energy Agency's statistics was broken, with the exception of recycled wood. The reversal in the price trend was caused by a prolonged and cold late winter, combined with delivery problems in the Baltic region, the latter a consequence of unusually high precipitation in the region during the autumn of 2017. However, whether or not this break in the trend continues remains to be seen. An ongoing and strong expansion of woodchip heating capacity in the Baltic region during the period concerned (e.g. Stockholm, Copenhagen and Åbo) and an associated increase in demand for fuel chips are also contributing to an increase in the price.

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.

[124] Traditional forest ranges should also be included here.

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




The prices for FAME and ethanol in Sweden are affected by prices in international markets. Swedish prices vary according to the price quotations[125] 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. In 2018, as in previous years, the highest proportion of ethanol was produced from cereals, of which maize and wheat collectively amounted to 84%[126]. During 2018, the proportion of ethanol from wheat fell considerably from 66% in 2017 to 33%. 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.[127],[128].

The use of HVOs has increased significantly in recent years. Around 88% of the raw materials used for HVO production in 2017 consisted of various types of residual products: slaughterhouse waste, PFAD, crude tall oil and vegetable and animal waste oils. The remaining 12% primarily consisted of maize and rapeseed[129], for which the price trend is determined on an international market and Sweden can be regarded as a price-taker. Almost half, 46%, of the HVO which was used in 2018 was produced from PFAD, which was dominant and led to an increase compared with previous years. 37% of the HVO was produced from animal fats.

Residues and waste have increased overall as raw material for biofuels. The proportion amounted to 70% during 2017 and to 73% in 2018. Biogas was also largely produced from various types of waste products and residues. In 2017, only 2%[130], and in 2018 1%[131]

[125] E.g. F.O. Licht and Platts.
[126] Fuels 2018. ER 2019:14. Swedish Energy Agency.
[127] Analysis of biofuels markets in the context of the transport gas market, Swedish Energy Agency 2013, ES 2013:08.
[128] Biofuels markets 2014 in the context of HVO, Swedish Energy Agency 2014, ER 2014:27.
[129] Swedish Energy Agency. 2018. Fuels 2017: Report pursuant to the Fuel Act and the Sustainability Act. ER2018:17.
[130] Swedish Energy Agency, 2018. Production and consumption of biogas and fermentation residues in 2017. ES 2018:01.
[131] Swedish Energy Agency, 2019. Production and consumption of biogas and fermentation residues in 2018. ES 2019:23.

of the supply of raw-materials came from energy crops; the remainder comprised various types of waste and residual products[132].

### 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 1,012,700 hectares in 2017[133] to 991,700 hectares in 2018[134], 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 2017 and 2018, from 114,300 hectares to 99,400 hectares[135].

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 2017, 176 MW of wind power was installed in Sweden, and a further 689 MW was installed in 2018. 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, 46 and 193 plants were taken into use in 2017 and 2018 respectively. All wind power expansion took place onshore during these years. The total number of wind-power plants was 3,600 at the end of 2018, with a total installed power of 7,300 MW.[136]

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.

[132] Swedish Energy Agency, 2017. Production of biogas and fermentation residues in Sweden in 2017. ES2017:7.
[133]Statistics Sweden (SCB). 2018. Agricultural land use 2015.
[134]Statistics Sweden (SCB). 2016. Agricultural land use 2016.
[135] Swedish Board of Agriculture's statistical database. Agricultural land use broken down according to county/national and crop. 1981-2018.
[136] Swedish Energy Agency, Wind Power Statistics 2018. ER 2019:10.

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 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. As regards reindeer husbandry, wind power can give rise to an avoidance effect for reindeer within a radius of approximately 5 kilometres[137].

A permit must be obtained before a wind farm can be erected. During the period 2014 to 2018, a total of 187 permit applications were received, approximately one third of which were rejected. The most common reasons for rejection were species protection issues, or because municipalities or the Swedish Armed Forces refused to grant permission. Alongside deficiencies in applications, these latter factors are ultimately linked to land use[138].

Collectively, 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 2017 and 2018 is deemed to be minimal, because 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 currently 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[139]. 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.

[137] Vindlov.se. Swedish Energy Agency and other government agencies. https://www.vindlov.se/sv/lagar--regler/rattsfall/vindkraft-och-rennaring/ Reviewed 20 August 2019.
[138] Wind Power Statistics 2018, ER2019:10
[139] Act (2010:598) on sustainability criteria for biofuels and liquid biofuels, Chapter 1 Article 1(e).

***Table 5: Total quantities of biofuel produced from the raw materials listed in Annex IX to Directive 2009/28/EC[140] (ktoe)***

| **Raw materials for fuels listed in Annex IX Part A** | **2017** | **2018** |
|---|---|---|
| (a) Algae if cultivated on land in dams or photo-bioreactors | N/A | N/A |
| (b) Biomass fraction of mixed municipal waste, but not separated household waste subject to recycling targets under point (a) of Article 11(2) of Directive 2008/98/EC | N/A | N/A |
| (c) Biowaste as defined in point (4) of Article 3 of Directive 2008/98/EC from private households subject to separate collection as defined in point (11) of Article 3 of that Directive | 26.7 | 23.1 |
| (d) Biomass fraction of industrial waste not fit for use in the food or feed chain, including material from retail and wholesale and the agro-food and fish and aquaculture industry, and excluding feedstocks listed in part B of this Annex | 41.6 | 55.8 |
| (e) Straw | N/A | N/A |
| (f) Animal manure and sewage sludge | 49.2 | 66.8 |
| (g) Palm oil mill effluent and empty palm fruit bunches | 0 | 0.3 |
| (h) Tall oil pitch | N/A | N/A |
| (i) Crude glycerine | 2.5 | 1.4 |
| (j) Bagasse | N/A | N/A |
| (k) Grape marcs and wine lees | N/A | N/A |
| (l) Nut shells | N/A | N/A |
| (m) Husks | N/A | N/A |
| (n) Cobs cleaned of kernels of corn | N/A | N/A |
| (o) Biomass fraction of wastes and residues from forestry and forest-based industries, namely, bark, branches, precommercial thinnings, leaves, needles, tree tops, saw dust, cutter shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil | 149.1 | 134.7 |
| (p) Other non-food cellulosic material; | N/A | N/A |
| (q) Other ligno-cellulosic material except saw logs and veneer logs | 0 | 1.3 |
| **Raw materials for fuels listed in Annex IX Part B** | **2017*** | **2018:** |
| (a) Used cooking oil | 0 | 14.4 |
| (b) Animal fats classified as categories 1 and 2 in accordance with Regulation (EC) No 1069/2009. | 0.0 | 8.1 |

The total reported quantity of raw materials according to Table 5 fell sharply from 555 ktoe for 2016 to 269 ktoe for 2017. This was followed by an upturn to 306 ktoe for 2018. Abrupt jumps in certain types may be the result of blended raw materials being reclassified. Maximum resources or different types of potential for the various types can in most cases be determined on the basis of annual statistics or other information from the government agencies, including the Swedish Board of Agriculture, the Swedish Forest Agency, the Swedish Energy Agency and the industry organisation Avfall Sverige – the Swedish Waste Management Association.

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

[140] Only sustainable raw materials originating in Sweden.

modified in order to produce the material. In its guidelines,[141] the Swedish Energy Agency has provided examples of what constitutes residues and waste.

The total proportion of raw materials for biofuel production which comprised residues or waste amounted to 70% during 2017, which increased slightly to 73% in 2018. This can be compared with just under 20% in 2011.

Biocomponents are used in various fuels, partly as a low-blend in petrol and diesel, but also in high-blend fuels such as E85, transport gas and ED95. Pure biofuels also occur, e.g. pure FAME or HVO. The quantities of biocomponents have continually increased and amounted to just over 21% in 2017 and to almost 23% in 2018. No double counting in accordance with the Fuel Act occurs.

**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. Approximately 93% (2017) and 96% (2018) of raw materials for HVO comprised waste or residues. Deliveries of HVO100 rose sharply during 2016 and 2017, but fell somewhat during 2018. Palm oil was again introduced as a raw material for HVO during 2017, after not having been used during the previous year. The proportion of PFAD rose considerably during 2017 and again to a more modest extent in 2018. The PFAD that was reported as a raw material for HVO has been classified as a residue. 46% of the HVO produced in 2018 was manufactured from PFAD. The proportion of vegetable and animal waste oil fell sharply during 2017, while waste from slaughterhouses increased considerably, the situation remained virtually unchanged in 2018. Raw materials for HVO which are classified as residues and waste during 2017 and 2018 were slaughterhouse waste, PFAD, tall oil and vegetable and animal waste oils.

**Biogas**

Most biogas is produced from waste and residues. Information concerning biogas is available concerning the country of origin of the raw materials. Increasing imports of biogas and raw materials from other countries do occur. The proportion which was imported during 2017 was 18%, while the corresponding proportion for 2018 was 29%. Denmark also accounted for the highest proportion of imports during 2018. The raw material base of biogas is varied. During 2017, half of all biogas was produced from sewage sludge and catering waste sorted at source. The most common raw materials in this category in 2018 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 0.1 ktoe. The raw material for this ethanol in 2017 and 2018 primarily comprised brown liquor, solid waste from the food industry and trade.

**DME and FAME**

The DM that was reported was produced from black lye from the paper pulp industry, whilst the FAME that was reported was produced from liquid waste from the food industry and trade, as well as FFA (Free Fatty Acids). During 2016 and 2017, sales of FAME fell to 31 ktoe, and then increased during 2018 to 86 ktoe. This is almost a three-

[141] Guidelines concerning the regulations on sustainability criteria for biofuels and bioliquids, ER 2012:27.

fold increase, which can be explained by the fact that it took market shares from HVO100 following the introduction of the reduction obligation.[142]

# 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 in the preceding two years.

*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[143], 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 2018 was just over 237,000 cubic metres, which corresponds to an area requirement of around 160,000 ha.[144] 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 260,000 ha, or around 10% 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 105,700 ha in 2016, while the area used for cereals fell from 1,153,200 ha to 1,012,700 ha over the same period, while the total area of arable land declined from 2,746,900 ha to 2,568,300 ha[145]. 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

[142] Ibid.
[143] Swedish Energy Agency (2016). Biofuels Markets 2016, ER 2016:29.
[144] With conversion efficiency and yield for rapeseed from Börjesson, P, Tufvesson, L, Lantz, M, 2010. Life-cycle analysis of Swedish biofuels. Lund University.
[145] Swedish Board of Agriculture (2018). Agricultural statistics summary 2018.

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 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. As regards biodiversity, it may 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.[146]

***Table A. Estimated life cycle emissions in accordance with the energy-allocation method for eutrophying substances (tonnes of $PO_4^{3-}$ equivalents) and acidifying 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) |
|---|---|---|
| Ethanol | 749 | 336 |
| FAME | 1,901 | 610 |
| Biogas | 27-30 | 158 - 174 |

[146] 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.

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.[147]

### 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[148] and their fossil counterparts. Emission factors for the fossil counterparts to renewable electricity and heating production are based on the Commission's recommendations[149]. 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[150] described in the Swedish Energy Agency Regulations (STEMFS 2011:2) on sustainability criteria for biofuels and bioliquids, as amended through STEMFS 2017:4. Certain statistics have not yet been received for 2018

[147] Sweden's first progress report on the development of renewable energy pursuant to Article 22 of Directive 2009/28/EC.
[148] Gode, J et al., Environmental Fact Book 2011 - Estimated emission factors for fuel, electricity, heat and transport, Thermal Engineering Research Association (Värmeforsk).
[149] 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.
[150] The use of a Nordic electricity mix is prescribed for the calculation of GHG performance for reporting by Sweden.

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 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 | 2017 | 2018 |
|---|---|---|
| **Total estimated theoretical net greenhouse gas emission savings due to the use of renewable energy[151]** | 100 | 97 |
| *Estimated net greenhouse gas emission saving due to the use of renewable electricity* | 65 | 61 |
| *Estimated net greenhouse gas emission saving due to the use of renewable energy in heating and cooling* | 31 | 30 |
| *Estimated net greenhouse gas emission saving due to the use of renewable energy for transport** | 4.7 | 5.2 |

* 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 2017 provides the theoretical possibility of emissions being approximately 100 million tonnes $CO_{2eq}$ (carbon dioxide equivalents) lower than they would have been if the renewable energy had come from their fossil counterparts instead. For 2018, the total consumption of renewable energy gives a theoretical possibility that emissions fell by approximately 97 Mtonnes $CO_{2eq}$

Table 6 also reports the data broken down by sector. The use of renewable electricity in Sweden in 2017 represents the largest contribution with 65 million tonnes $CO_{2eq}$ of the theoretical net savings, compared with 61 million tonnes $CO_{2eq}$ the year after. The difference is due to the fact that approximately 3 TWh more electricity was generated from hydro power in 2017 compared with 2018. This shows the impact of hydro power on this method of calculating net savings.

The use of biofuels continues to increase in Sweden. It was primarily the use of pure biodiesel that increased in 2015 and 2016, as this fuel has been competitive in terms of price. When the reduction obligation entered into force, the price of HVO rose, and sales fell in favour of biodiesel.

[151] 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.

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 energy for winter heating in Sweden. The winters have been warmer than usual in Sweden for several years, and it was 8.5% warmer than usual in 2018.

# 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*[152] and *Reference EU* form the basis for calculating the potential surplus/deficit in renewable energy in comparison with the indicative trajectory[153]. 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 2009–2018) and estimated (for other years) surplus production of renewable energy compared to the indicative trajectory.

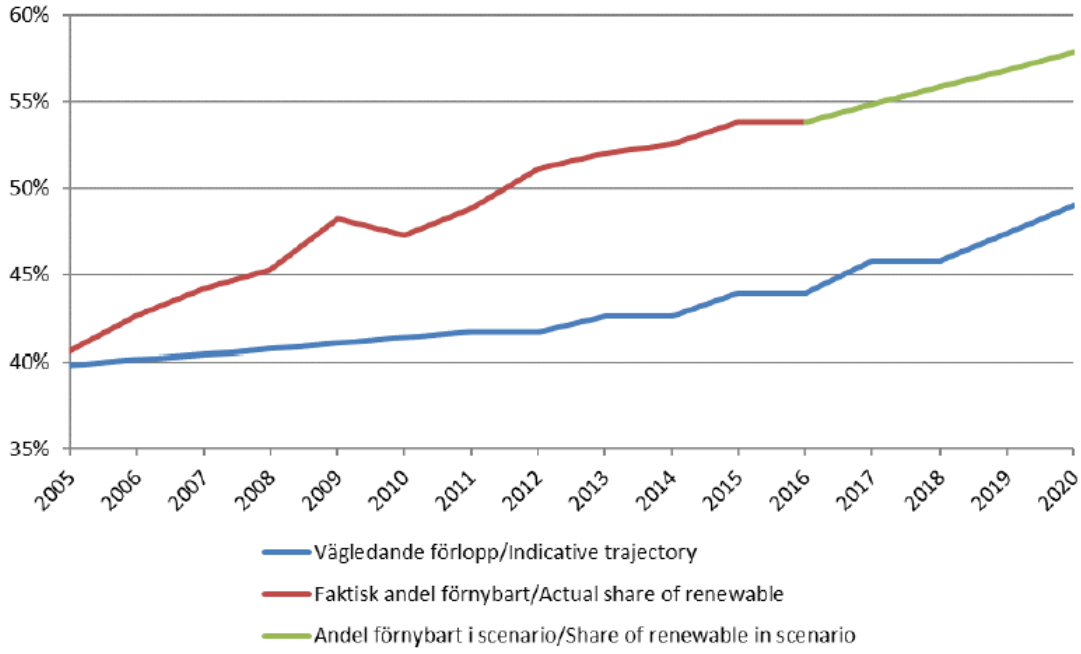
Table: Actual and estimated surplus production of energy carriers from renewable energy compared to the indicative trajectory in Sweden, and which could be transferred to other Member States (ktoe)[154] [155]

| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual/estimated surplus or deficit production[156] (ktoe) | | | | | | | | | | | | |
| | 2,322 | 2,055 | 2,314 | 3,033 | 2,838 | 3,117 | 3,087 | 3,285 | 2,945 | 3,086 | 3,249 | 3,415 |
| Actual/estimated surplus or deficit production (TWh) | | | | | | | | | | | | |
| | 27 | 24 | 27 | 35 | 33 | 36 | 36 | 38 | 34 | 36 | 38 | 40 |

[152] Scenarios for Sweden's Energy System 2018, ER 2019:7.
[153] The indicative trajectory is set out in the Directive.
[154] *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.*
[155] *For deficit production, please indicate the production shortfall using negative numbers (e.g. – x ktoe) in the table.*
[156] 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.

In 2020, the proportion of renewable energy is 58.2% in the scenario case *Reference EU*[157]. The values between the statistical years 2018 and 2020 have been interpolated. The surplus in the reference case is equivalent to 40 TWh of renewable energy in 2020 relative to the target of 49%.

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 40 TWh lower *or* total energy use could be 81 TWh higher (all other factors 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.

[157] The scenario contains several cases presented with various conditions and the percentage renewable for these is between 57 and 58%.

# 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.)*

The use of waste for energy recovery is gradually increasing year by year and has done so throughout the 2000s. In 2017, around 6.1 million tonnes were incinerated in 35 facilities. Imports of waste into Sweden for energy recovery are continuing to increase and have increased manifold over a ten-year period to approximately 1.5 million tonnes in 2018[158].

In this report, the Swedish Energy Agency has assumed that 52% of waste is renewable in both 2017 and 2018. The assumption is based on a study commissioned by the Swedish Energy Agency and carried out by energy consultant Profu in 2017[159]. 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[160]. 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.

A previous study dating from 2008[161] was therefore updated with new input data as regards waste composition taking into account available measurement data from seven major waste incineration plants. Within the framework of EU ETS, these plants have continually measured the biogenic and fossil components of $CO_2$ emissions in recent years using the carbon-14 method. With the exception of this later calibration, the method used in the new study was identical to the previous study. In 2008, it was shown that 60% of the waste was of renewable origin. The reduction since then is primarily explained by changes in the composition of the waste due to an increase in domestic sorting of waste at source and an increase in the proportion of imports.

The 2008 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

[158] Swedish Waste Management Association (2019) Swedish Waste Management 2018.
[159] 'Analysis of the renewable energy component in waste for incineration', Profu (2017).
[160] Swedish Waste Management Association (2014) Fuel quality – Composition and properties of waste fuel for energy recovery, Waste Refinery project 57.
[161] 'Analysis of the renewable component of waste for incineration in Sweden with regard to energy content', Profu (2008).

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[162]. The result showed a renewable fraction of just under 60%.

A second study was carried out in 2008 by Profu in collaboration with Statistics Sweden (SCB), with the aim of clarifying the differences between SCB's total waste estimates and the estimates 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) was probably in the order of 50–60%.

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:

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

2. 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;

3. 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[163]. The study did not suggest that there was a direct need to adjust the renewable energy percentage of 60%.

[162] For more information, please see the study 'Analysis of the renewable component of waste for incineration in Sweden with reference to energy content', Profu (2008).
[163] 'Determining the proportion of fossil carbon in waste incinerated in Sweden', Swedish Waste Management Association (2012).

## Point 13. Raw materials for fuel

**Point 13. Please provide the quantities of biofuels and liquid biofuels in energy units (ktoe) corresponding to each category of raw material group specified in Part A of Annex VIII which is taken into account by Member States with the aim of fulfilling the targets in Article 3(1) and (2) and the first subparagraph of Article 3(4).**

| Raw material group | 2017 | 2018 |
|---|---|---|
| Cereal and other starch-rich crops | 115.7 | 103.3 |
| Sugars | 5.3 | 17.3 |
| Oil crops | 799.5 | 917.3 |

# 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 2018*[164] and the case *Reference EU*.

*Scenarios for Sweden's Energy System 2018* 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 2018*.

## Basic assumptions

Some of the basic assumptions for the scenarios are:

- The oil price is USD 97/barrel in 2020;[165]
- The emission allowance price is EUR 16/tonne in 2020[166];
- Economic growth is 2.05% per annum between 2015 and 2035;
- A further two nuclear power reactors will be withdrawn from operation 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 1 June 2018 are included.
- Tax rates from 1 January 2018 will apply throughout the scenario period.

## Specific calculation assumptions for calculating the proportion of renewables

- For 2020, it is assumed that 52% of household waste will be of renewable origin, which was the percentage according to the most recent analysis; please see point 12;
- The percentages of biofuels and bioliquids used to calculate the goals in the scenario for 2020 are those which fulfil the sustainability criteria in 2017. An assessment has been made for 2030. During 2017, 22% of all HVO will fulfil the sustainability criteria, with the corresponding figure for biogas being 93%;

[164] Scenarios for Sweden's Energy System 2018, ER 2019:7. https://energimyndigheten.a-w2m.se/Home.mvc?ResourceId=5783
[165] Prerequisite provided by the European Commission.
[166] Prerequisite provided by the European Commission.

- 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.