

# NATIONAL REPORT BY SWEDEN

MARCH 2020

Enhanced Black Carbon and Methane  
Emissions Reductions

Arctic Council Framework for Action





# SWEDEN'S NATIONAL BLACK CARBON AND METHANE REPORT

Submission 2020 to the Arctic Council

# National report Sweden 2019

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## Contents

National report Sweden 2019.....	0
1. Introduction .....	3
2. Black carbon emissions and future projections .....	3
2.1 Black carbon emissions .....	3
2.2 Black carbon emission projections .....	4
3. Methane emissions and future projections .....	4
3.1 Methane emissions .....	4
3.2 Methane emission projections.....	5
4. National strategies and action plans .....	6
4.1. Governance structure regarding BC and methane .....	6
4.2. National strategies .....	6
4.3. National action plans.....	8
5. International work .....	8
6. Sector based plans and projects .....	8
6.1. Mobile and stationary sources .....	8
6.1.1. Specific national strategies .....	8
6.1.2. Existing regulatory instruments .....	9
6.1.3. Follow up of EGBMC recommendations for mobile and stationary sources .....	11
6.2. Oil and gas .....	12
6.3. Residential combustion.....	12
6.3.1. Specific national strategies .....	12
6.3.2. Existing regulatory instruments .....	12
6.3.3. Follow up of EGBMC recommendations for residential combustion.....	13
6.3.4. Best practices and projects (Toolbox).....	13
6.4. Solid Waste Disposal .....	13
6.4.1. Specific national strategies .....	13
6.4.2. Existing regulatory instruments .....	13
6.4.3. Follow up of EGBMC recommendations for solid waste disposal .....	14
6.5. Agriculture and animal husbandry.....	14
6.5.1. Specific national strategies .....	14
6.5.2. Existing regulatory instruments .....	14

6.5.3. Follow up of EGBMC recommendations for agriculture and animal husbandry	14
6.6. Management of wildfires.....	14
6.6.1. Specific national strategies .....	14
6.6.2. Existing regulatory instruments .....	15
6.6.3. Follow up of EGBMC recommendations for management of wildfires.....	15
7. Annexes .....	15
Annex 1: Black carbon emissions .....	16
Annex 2: Methane emission table.....	17
Annex 3: Actions in regard to recommendations in the 2019 summary report .....	18
Mobile and stationary diesel-powered sources.....	18
Oil and gas .....	19
Residential combustion.....	19
Solid waste disposal .....	20
Agriculture and animal husbandry .....	20
Management of wildfires.....	21
Annex 4: Information from the 2017 Swedish national report .....	22
Cross-sector measures .....	22
Energy .....	23
Industry .....	24
Transport .....	24
Waste.....	25
Agriculture.....	25

# 1. Introduction

Swedish emissions of Black Carbon (BC) have decreased as measures to reduce emissions of PM<sub>2,5</sub> have been implemented in several sectors. As emissions of BC decrease in other sectors residential combustion is becoming increasingly important.

Emissions of methane from agriculture have not change since 2013 though a slight decrease is expected until 2030 as the number of cattle is expected to decrease. The trend of decreasing emissions of methane from landfills is expected to continue until 2030.

## 2. Black carbon emissions and future projections

### 2.1 Black carbon emissions

The largest source of BC emissions is residential and other small-scale stationary combustion. Emissions from this source have decreased by 23 % since 2013. The emission reduction is due to a reduced use of residential wood burning as the primary heat source as well as a slow phasing-out of old appliances that give rise to large emissions.

Other large sources are off-road transport and road transport, which have also decreased by 20 % and 42 % respectively. These emission reductions are a result of stricter exhaust requirements.

Other sources of BC are industry and power generation, shipping and aviation and other sources.

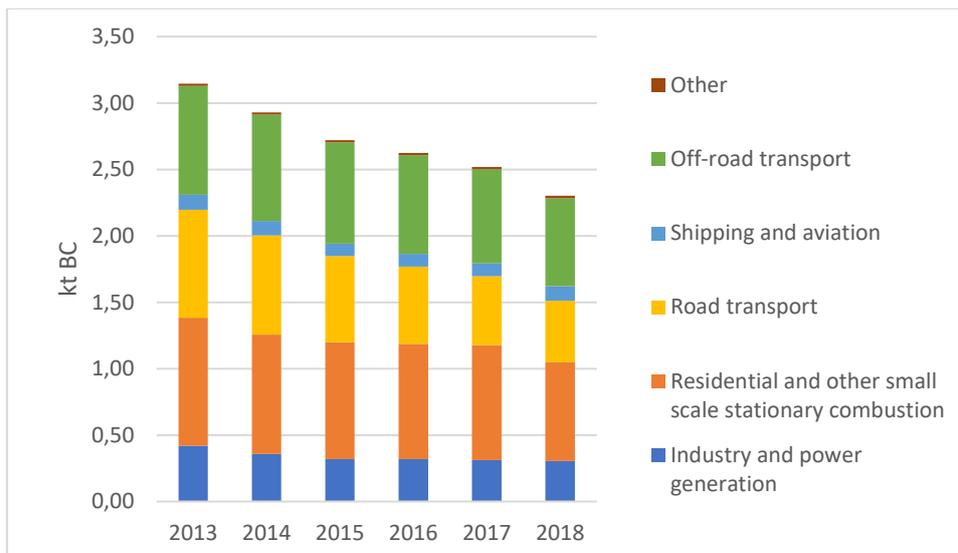


Figure 1. Black carbon emissions in Sweden 2013-2018 (kt).

## 2.2 Black carbon emission projections

Black carbon emissions from residential and other small-scale stationary combustion are expected to increase slightly in 2025 compared to 2018 and thereafter decrease. In 2030, this sector is expected to constitute about 45 % of total BC emissions, compared to 32 % in 2018.

BC emissions from road transport is expected to continue to decrease, however at a slower rate than during the past years. Off-road transport is also expected to decrease, mainly as a result of the new EU requirements on exhaust emissions.

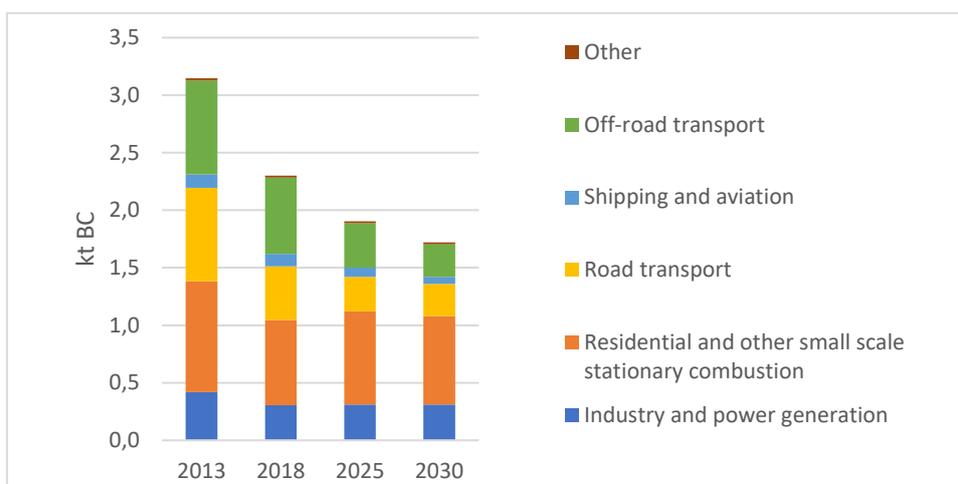


Figure 2. Swedish black carbon emission 2013 and 2018 and projections for 2025 and 2030 (kt).

## 3. Methane emissions and future projections

### 3.1 Methane emissions

The agriculture sector dominates the emissions of methane (around 75 percent of emissions), and emissions from the sector have been close to constant since 1990. Methane emissions from the agricultural sector arise from enteric fermentation from livestock and agriculture soil and manure management.

The second largest source of methane emissions in Sweden is the waste sector. Emissions from the waste sector have decreased by more than 70 % since 1990 and several policy instruments – both legislative and economic – have contributed significantly to this trend. The most important mitigation measures are an expansion of methane recovery from landfills, reduced landfill disposal of organic material, increased levels of recovery of materials and waste incineration with energy recovery.

Land use, land use change and forestry and the energy sector also contribute to methane emissions, and to a small extent also the combustion of fossil fuels in the energy sector and industrial processes.

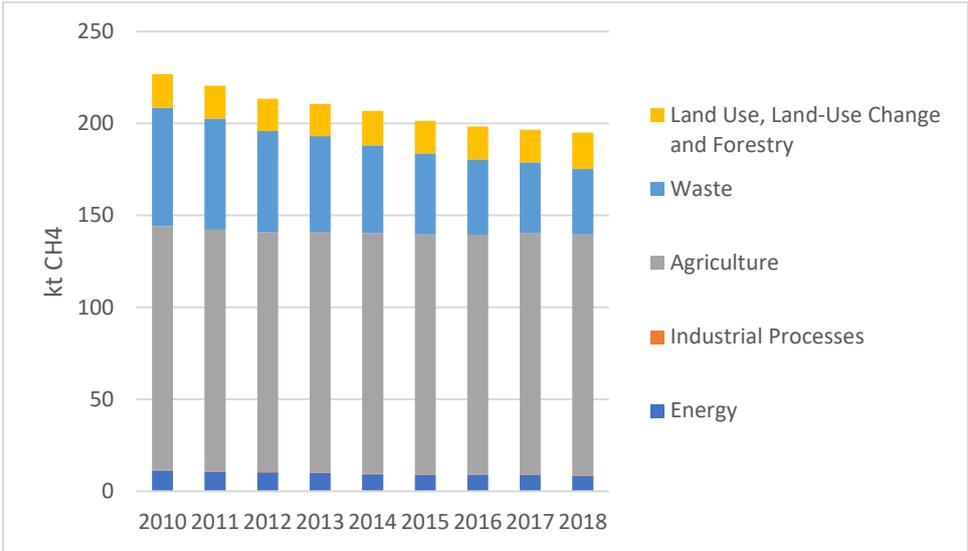


Figure 3 Methane emissions in Sweden 2010-2018.

### 3.2 Methane emission projections

Methane emissions from agriculture are expected to decrease in 2025 and 2030 due to a reduced number of animals. This is due to increased productivity, future production prices and adjustment of the agriculture policy in the EU.

Emissions from the waste sector are also expected to decrease in 2025 and 2030 due to the prohibition to landfill combustible material that was introduced in 2002 and the prohibition to landfill organic material that was introduced in 2005.

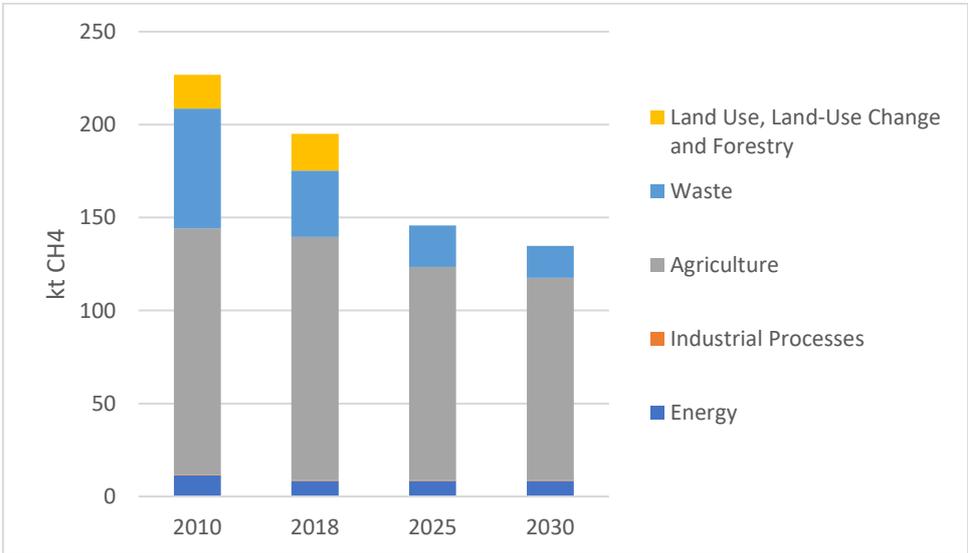


Figure 4 Swedish methane emissions 2010 and 2018, and projections for 2025 and 2030 (kt). There are no projections for the sector Land Use, Land Use Change and Forestry, and these are thus missing for the years 2025 and 2030. However, methane emissions from this sector are relatively stable and can be expected to stay at today's level for coming years.

## 4. National strategies and action plans

### 4.1. Governance structure regarding BC and methane

The responsible ministries and agencies for developing strategies and action plans regarding BC and methane are listed in Table 1.

Table 1. Overview of governance structure for developing strategies and action plans regarding BC and methane in Sweden.

Organisation	Role and responsibility
Swedish parliament/government	The parliament has legislative power and the government implements the parliament's decisions and draws up proposals for new laws or law amendments.
Swedish Environmental Protection Agency	Cross-sectoral responsibilities including follow-up of the Environmental Quality Objectives and administration of the Climate Leap
Swedish Energy Agency	Issues related to energy efficiency and change to renewable energy sources
Swedish National Board of Housing, Building and Planning	Issues regarding residential combustion appliances
Swedish Tax Agency	Cross-sectoral tax-related issues
Swedish Transport Administration	Mobile sources including road traffic and shipping
Swedish Board of Agriculture	Agricultural sector
Swedish Forest Agency	Guidance for management of wild fires
Swedish Contingency Agency	Issues related to chimney sweeping and guidance for management of wild fires
Local authorities	Temporary or local regulations on e.g. fire bans and residential wood burning

### 4.2. National strategies

National strategies that govern the overall environmental efforts and regulations in Sweden include the Environmental Quality Objectives, The Environmental Code and the Swedish Climate Policy Framework, as well as the Air Quality Ordinance and the Planning and Building Act.

#### Environmental Quality Objectives

The environmental policy of the Swedish government is based on the national environmental quality objectives and the generational objective for environmental work decided by the Swedish Parliament. The goals provide direction for all of Sweden's environmental policies at the national, EU and international level. The system of environmental objectives also provides a structure for systematic follow-up of environmental policy as a basis for strategic action. The sixteen environmental quality objectives express the environmental state sought in Swedish society.

There are also milestone targets that define steps on the way to achieving the environmental quality objectives and the generational goal.

The Environmental Quality Objectives *reduced climate impact* and *clean air* relate to emissions of methane and black carbon. The Environmental Quality Objectives were described in more detail in the 2017 report, see Annex 4.

### **The Environmental Code**

General legislation in the area of the environment has been collated in the Environmental Code since January 1999. Among other aspects, the Environmental Code contains general rules for consideration that are to be observed in all activities and measures. Major environmentally hazardous activities are covered by permit requirements. Greenhouse gas emissions form a part of the permit appraisal procedure and the code also includes requirements to use the “best possible technology,” a more stringent requirement than “best available technology”. Moreover, the code allows for requirements to be made in individual cases. This instrument helps to reduce emissions of both black carbon and methane.

### **The Swedish Climate Policy Framework and the Swedish climate action plan**

In June 2017, the Swedish Parliament adopted a climate policy framework which includes new climate goals (listed in Annex 4 under Environmental Quality Objectives), a climate act and a climate policy council. This framework is based on an agreement within the Cross-Party Committee on Environmental Objectives and therefore enjoys multi-stakeholder support. The climate policy framework is considered to be the most important climate reform in Sweden’s history and will guide Sweden’s efforts towards compliance with the Paris Agreement. This climate policy framework will help Sweden to reduce its methane emissions.

In accordance with the climate act, the Swedish Government presented a climate action plan in December 2019. The action plan sets the direction for the work during the election period in reaching Sweden’s climate goals by reducing greenhouse gas emissions in all sectors.

### **Air Quality Ordinance (2010:477)**

EU standards are implemented in the Air Quality Ordinance as Environmental Quality Objectives. For instance, there are threshold standards for PM2.5, PM10 and NO2. To ensure that an environmental quality standard is withheld, an action programme may be established. This ordinance reduces emissions of black carbon.

### **The Planning and Building Act**

Measures in the area of public planning have an impact on emission trends in the longer term and may be of great significance from this point of view. Measures in public planning are principally governed by the Planning and Building Act (PBL) but many measures, for example major infrastructure projects, are also covered by the provisions of the Environmental Code. Since May 2011, the PBL introduced a requirement to take account of environmental and climate aspects in planning. The significance of the development of the built environment for energy and transport needs in the longer term has been increasingly highlighted in the new PBL, thereby helping to reduce emissions of both black carbon and methane. PBL also makes it mandatory to consider inter-municipal and regional circumstances in the planning process.

## 4.3. National action plans

### **Climate Leap**

The climate initiative “Klimatklivet” (“The Climate Leap”) is a program run by the Swedish Environmental Protection Agency which invests in local projects that help to reduce carbon dioxide and other greenhouse gas emissions. In 2015-2019 4.5 billion SEK was distributed under the program, supporting 3 200 measures. In 2020, another 1.9 billion SEK are designated for climate investments under the program. There are several initiatives currently being funded throughout Sweden that help to reduce methane emissions as part of this program. These initiatives include, among other things, the destruction of residual gasses at biogas plants, the collection and utilization of landfill gas, and the mapping of air streams that are in need of purification.

## 5. International work

Sweden has since 2008 been involved in bilateral work with the Russian Federation and with Belarus. In 2015, a project “Development and improvement of emission inventories of fine particulate matter (PM<sub>2.5</sub> and BC) in the Russian Federation and Sweden” was carried out. The project resulted in a list of issues regarding PM<sub>2.5</sub> and BC work that could be improved. As a continuation of this, a pre-study defining further work was done in late 2019, in preparation of a project planned to be launched in 2020.

## 6. Sector based plans and projects

### 6.1. Mobile and stationary sources

#### 6.1.1. Specific national strategies

##### **National plan for transport infrastructure**

The Government has adopted a national plan for transport infrastructure for the period 2018–2029. It is a total investment of 700 billion SEK and includes among other things investments in rail infrastructure, fine-tuning and environmental measures, urban environment agreements, and new main lines for high-speed trains. Under the urban environment agreements, 12 billion SEK are set aside to co-finance municipal and regional investments in infrastructure for public transport and cycling as well as solutions for sustainable freight transport.

##### **Procurement requirements – new applications**

The Swedish Transport Administration and the metropolitan municipalities of Gothenburg, Stockholm and Malmö jointly apply procurement requirements on fuel, age, exhaust emissions and emission control on equipment such as lorries and other non-road mobile machinery. The Swedish Environmental Protection Agency has been commissioned by the government to investigate appropriate measures and instruments to reduce emissions of air pollutants and greenhouse gases from work machinery. One of the proposals under review in 2017 is to investigate the possibilities for facilitating more authorities and municipalities to make the procurement requirements that are already made by the Swedish Transport Administration, Gothenburg, Stockholm and Malmö. One aim of this measure is to reduce black carbon emissions caused by fossil fuel usage. The public transit system in western

Sweden has applied procurement requirements in order to procure electric buses to the Gothenburg area.

#### **Reduced speed in some streets – national roads**

A local action to reduce PM formation has been to reduce speed on certain streets, resulting in more efficient combustion. Cities such as Gothenburg, Uppsala and Stockholm have used this measure to decrease black carbon emissions. Speed limits for national roads have also been adjusted, mainly for traffic safety reasons.

#### **Counsel municipalities and property owners on parking**

Municipalities and property owners are counselled on how to reduce parking availability and regulate parking costs in order to reduce car travel and decrease car ownership. Also connect car sharing and other mobility services to properties in combination with a reduced number of parking places could be a way to reduce the need of owning a car.

#### **Energy step**

The “Energy step” is a program under which industry businesses can receive financial support for energy efficiency measures. 125 million SEK are designated for this purpose during the period 2018-2020. The mining and manufacturing industry are especially targeted, and they can get support for planning or investment of energy efficiency measures.

In addition, the following initiatives and programs exist:

- Initiatives for wind power
- Training programs in building for low energy consumption
- Grants for energy audit to small and medium-sized enterprises
- Energy and climate coaches for small and medium-sized enterprises
- Energy efficiency networks for small and medium-sized enterprises

Other national strategies already mentioned in the 2017 report are voluntary eco labels, a climate bonus for electric trucks, buses and mobile machines and an eco-bonus to stimulate a shift in freight transport from land to sea transport (see Annex 4).

#### **6.1.2. Existing regulatory instruments**

Existing regulatory instruments that were reported in the 2017 and are unchanged can be found in Annex 4. These include Energy tax, Energy tax on fossil fuels for heating in industry, Emission standards and Tolls for certain heavy vehicles.

New regulatory instruments and updates on existing ones are described below.

#### **New regulatory instruments since the 2017 report**

##### **Bonus-malus**

A bonus–malus-system was introduced in July 2018, encompassing new passenger cars, light buses and light lorries. The current system design implies that vehicles emitting 70 grams CO<sub>2</sub> or less per kilometer are eligible for a maximum bonus of 60 000 SEK. For zero-emission cars, the bonus is 60 000 SEK and is then reduced by 714 SEK for every gram of CO<sub>2</sub> emitted per kilometer. Vehicles emitting more than 95 grams CO<sub>2</sub> and cannot be powered by alternative fuel are charged with a higher vehicle tax for the first three years

(malus). The tax consists of a basic rate of 360 SEK plus 82 SEK for each gram of CO<sub>2</sub> emitted above 95 grams per kilometer. For cars emitting more than 140 grams CO<sub>2</sub> per kilometer, the added charge is 107 SEK per gram CO<sub>2</sub> per kilometer. Diesel cars pay an additional 250 SEK per year as well as an additional fuel charge, which is the vehicle's total CO<sub>2</sub> emission per kilometer multiplied by 13.52. Starting January 2020, the WLTP test cycle will be used to determine the CO<sub>2</sub> emissions, which means that the environmental steering is further strengthened. The bonus–malus-system is aimed at promoting the use of low-emitting cars and electric vehicles, thereby reducing black carbon emissions.

#### **Tax on air travel**

In April 2018, a tax on air travel was introduced. The tax is paid for passengers travelling from a Swedish airport. The airline that carries out the flight is liable to the tax. Different amounts are paid depending on the final destination of the passenger, for 2020: 62, 260 or 416 SEK per passenger.

#### **Eco-bonus system for freight transport**

To motivate the transfer of freight transport by road to water transport, and thus reduce emissions, SEK 150 million are allocated for an Eco-bonus system 2020-2022.

#### **Differentiated fairway dues**

The vessel-based fairway fee is differentiated according to the vessel's verified Clean Shipping Index (CSI) scores.

#### **Updated regulatory instruments since the 2017 report**

##### **Low emission zones – new legislation for light vehicles**

Under the ordinance (1998:1276) of road traffic, individual municipalities have the right to restrict heavy traffic in areas with poor air quality. Only heavy traffic that meets certain standards is allowed in the area. Such environmental zones have been introduced in Stockholm, Gothenburg, Malmö, Mölndal, Uppsala, Helsingborg, Lund and Umeå. As of January 2020, municipalities will be able to introduce low-emissions zones also for light vehicles. This will be applied to one street in Stockholm starting January 2020.

##### **Congestion tax – increased fees**

The Congestion Tax Act (2004:629) introduced congestion tax in order to reduce traffic during peak hours and thus improve air quality. The law is designed so that it can be applied in urban areas throughout Sweden, but is currently applied only in Stockholm and Gothenburg. As from 1<sup>st</sup> January 2020 the tax rates were increased in Stockholm, including the maximum amount that could be levied per day.

##### **Exhaust emission control – adjusted regulations**

Emission Control Act (2011:318) is designed to prevent the emission of exhaust gases including black carbon and other pollutants from fuels in motor vehicles from harming or causing damage to human health or the environment. The law includes, among other things, emission classes. In 2018, the regulations for exhaust emission control were adjusted to EU regulations resulting in higher emission limits.

#### **Existing regulatory instruments not mentioned in the 2017 report**

In addition to the above-mentioned regulations, there are some existing regulations and initiatives not mentioned in the 2017 report. These include:

#### **Support for solar power**

Installation of solar power systems connected to the electrical grid are eligible for financial support, covering up to 20 % of the investment cost. All actors, businesses, public organisations and the public may apply for financial support.

#### **Tax reduction for micro production of renewable electricity**

Individuals or businesses delivering electricity to the electrical grid from small scale renewable sources (mainly solar power) may be eligible for a tax reduction based on the amount of electricity that is fed into the grid.

#### **A reduced energy tax on shore side electricity.**

Ships that use shore side electricity when lying in port may be eligible for a reduced energy tax on electricity. Shore side electricity is a less polluting alternative to fossil driven generators.

In addition, EU directives that apply to Sweden include:

- Mandatory energy labelling
- Law on energy performance certificates for buildings
- Energy audit for large enterprises

#### **Regulatory instruments that have expired since the 2017 report**

**The electric vehicle premium** expired in 2018. The premium was granted for purchases of electric vehicles such as electric bicycles, motorcycles and mopeds in order to replace cars with other, less polluting means of transportation. The premium has been replaced by the bonus in the bonus malus system (see above).

##### **6.1.3. Follow up of EGBMC recommendations for mobile and stationary sources**

Recommendation 1a "Reduce emissions from new diesel vehicles and engines by adopting and implementing world-class particulate matter exhaust emission standards and ensuring widespread availability of ultra-low sulphur fuels" and recommendation 1d "Develop, as appropriate, and report on measures and best practices to reduce particulate matter and black carbon emissions from shipping" relate mainly to international regulations that apply to Sweden. Recommendation 1b "Reduce emissions from legacy diesel vehicles and engines by adopting targeted policies and programs" and 1c "Reduce black carbon by stimulating the shift to alternative vehicle technologies and modes of transportation, and through efficiency measures" relate to several of the actions mentioned above, e.g. the Bonus-malus-system. Recommendation 1e "Reduce emissions from stationary diesel engines by adopting targeted policies and programs, including shift to new technologies and improved efficiency" is not applicable to Sweden.

## 6.2. Oil and gas

There are no substantial emissions of BC or methane from the Oil and gas sector since there is no oil or gas extraction in Sweden. This sector is therefore not relevant for Sweden.

## 6.3. Residential combustion

### 6.3.1. Specific national strategies

#### **Information regarding efficient household wood burning**

Information on good practices regarding household wood burning has been compiled and are available at the Swedish EPA website. Campaigns are run occasionally.

#### **Government commission on mapping and analysis of emissions from small-scale wood burning**

The Swedish EPA was commissioned by the government to map the emissions from small-scale wood burning, to determine what emission reductions are needed to meet the precisions of the environmental quality objective Clean air, and to propose measures to reduce the effect on air quality from small-scale wood burning. The analysis resulted in a proposal to introduce a goal that in 2027, all wood-fired boilers used as a primary heating source in urban environments shall meet the 1998 BBR requirements and be equipped with an accumulator tank. The 1998 BBR include requirements on emission levels. The EPA proposed to the government that following measures be taken:

- that support is put in place for exchange of wood-fired boilers used for primary heating in urban environments that do not meet the 1998 BBR requirements,
- that the government commissions the EPA and the Swedish Energy Agency to propose the development of a harmonized information management and guidance for solid fuel appliances,
- that the government commissions the EPA, the National Board of Housing, Building and Planning and the Swedish Energy Agency to investigate a new regulation of approved wood-fired boilers that is based on technology.

A referral of the proposal has been issued but no formal decision has yet been taken.

### 6.3.2. Existing regulatory instruments

Existing regulatory instruments that were reported in the 2017 and are unchanged can be found in Annex 4. These include the Building regulations (BBR) and Temporary prohibition against small-scale wood burning.

Regulatory instruments updated since the 2017 report and existing instruments that were not included in the 2017 report are described below.

#### **Updated regulatory instruments since the 2017 report**

##### **The Building Regulations**

1 July 2017, the Building Regulations (BBR) for buildings were made more stringent in order to, as far as possible, equal the requirement levels for emissions and efficiency under the EU Ecodesign Directive in 2020 for solid fuel boilers and in 2022 for room heaters. The emission limits for particles, organic gaseous compounds (OGC) and carbon monoxide (CO) for solid fuel boilers are as of 1 July 2017 in line with the limits stipulated by the Ecodesign Directive.

## **Existing regulatory instruments not mentioned in the 2017 report**

### **Chimney sweeping**

Chimney sweeping and fire protection is regulated in the law on protection against accidents and include regulations on the measures that are to be taken by the government and municipality. The municipality determines the frequency and procedure of the chimney sweeping as well as which objects are to be included.

#### **6.3.3. Follow up of EGBMC recommendations for residential combustion**

Recommendation 3a "Reduce emissions from new solid fuel combustion appliances by accelerating deployment of cleaner and more efficient heating sources and by promoting proper operation and maintenance of appliances, including storage and treatment of fuels" relates to the eco design requirements that are implemented in the Building Regulations for Sweden. The content of recommendation 3b "Reduce emissions from legacy solid fuel combustion appliances by accelerating replacement with cleaner and more efficient new heating sources and promoting proper operation and maintenance of appliances, including storage and treatment of fuels" is discussed in the government commissioned investigation executed by the Swedish EPA. In addition, support for solar power and tax reduction for micro production of renewable electricity may to some extent support the transition to cleaner heating sources. Regulations on chimney sweeping reduce the risk of poorly maintained combustion appliances and poor combustion practices. Energy performance certificated for buildings pertains to recommendation 3c "Reduce emissions by promoting enhanced energy efficiency in residential dwellings reducing the need for heating, especially in buildings heated with oil or solid fuels".

#### **6.3.4. Best practices and projects (Toolbox)**

During 2013-2018, the project "Emissions of Short-Lived Climate Pollutants (SLCP)" commissioned by the Nordic Council of Ministers was carried out, aiming at improving the Nordic emission inventories of short-lived climate pollutants (SLCP) with a focus on Black Carbon (BC). A measurement program was carried out, resulting in emission factors for various combustion technologies used in residential biomass combustion in the Nordic countries. Ratios were developed for increased emissions at poor combustion conditions compared with normal combustion conditions. Scenarios using the new emission factors were developed, showing that reduced emissions from residential wood combustion can be achieved by modern technologies and through improved user skills in operating the combustion equipment. Modelling the technical SLCP reduction potential, including all relevant emission sources, show that full realization of the modelled SLCP emission reduction strategy in 2030 in the Nordic countries would save more than 60 000 life years in Europe and reduce the climate impact by about 14 million tons CO<sub>2</sub> equivalents.

## **6.4. Solid Waste Disposal**

### **6.4.1. Specific national strategies**

In order to reduce methane emissions from solid waste disposal, landfilling of organic waste has been banned in Sweden since 2005.

### **6.4.2. Existing regulatory instruments**

Existing regulatory instruments that were reported in the 2017 and are unchanged can be found in Annex 4. These include the Ordinance on landfilling of waste and landfilling tax.

There are no new regulatory instruments since 2017. Existing regulatory instruments not mentioned in the 2017 report include:

- Extended producer responsibility
- Municipal waste planning requirement

In addition, the following EU directives apply to Sweden:

- Industrial emissions Directive (2010/75/EU)
- Waste Framework Directive and the Directive on Landfill of Waste

#### **6.4.3. Follow up of EGBMC recommendations for solid waste disposal**

Regarding recommendation 4a “Avoid methane emissions by preventing food waste and the landfilling of organic waste. Improve resource efficiencies as appropriate for Arctic conditions, including new ways of reusing organic material based on more efficient sorting of waste, composting and biogas production”, the Ordinance on Landfilling of Waste bans landfilling of organic waste since 2005, and the Climate Leap has, for example, supported new facilities to convert biodegradable waste or manure to biogas, and also projects to prevent food waste. The ordinance on Landfilling of Waste also regulates the collection and disposal of methane gas from landfills, relating to recommendation 4b, “Adopt regulations or incentives for landfill gas capture and control”.

## **6.5. Agriculture and animal husbandry**

### **6.5.1. Specific national strategies**

National strategies include the rural development programme 2014-2020, support for biogas production and voluntary commitment regarding reduction of methane emissions. These are further described in Annex 4.

### **6.5.2. Existing regulatory instruments**

#### **Ban on straw burning**

Municipalities may also specify regulations for burning of straw on crop land that affects human health.

### **6.5.3. Follow up of EGBMC recommendations for agriculture and animal husbandry**

Recommendation 5a “Promote food consumption patterns that utilize Arctic food chains sustainably and efficiently, support the preservation of carbon sinks, and minimize life-cycle emissions of methane” and 5b “Promote work on possibilities to reduce emissions of enteric methane under Arctic conditions, in co-operation with relevant organizations” are not relevant for Sweden. Regarding recommendation 5c “Develop agricultural policies and practices to reduce open burning of agricultural waste. Encourage studies and piloting of innovative solutions that reduce the need for open burning”, local authorities may regulate open burning of agricultural waste if necessary.

## **6.6. Management of wildfires**

### **6.6.1. Specific national strategies**

#### **Guidelines for risk management of forest fires**

Skogforsk, the central research body for the Swedish forestry sector, has developed guidelines for risk management of forest fires in forestry. These are common guidelines for the Swedish Forestry Agency, the Swedish Civil Contingencies Agency, the Fire and Rescue Services and the largest forest owners in Sweden. The guidelines include measures to prevent forest fires and to limit the spreading of fires.

#### **6.6.2. Existing regulatory instruments**

##### **Temporary fire bans**

Municipalities and County Governments can issue fire bans due to for example dry and hot weather conditions.

#### **6.6.3. Follow up of EGBMC recommendations for management of wildfires**

Recommendation 6c “Develop and implement regionally appropriate forest management practices that reduce the risk of severe wildfires” and 6d “Use the best available science to develop prediction models that can be used to examine fire risks at daily to decadal scales, to support drafting of prevention and emergency response plans” relates to the Guidelines for risk management of forest fires.

## **7. Annexes**

## Annex 1: Black carbon emissions

Emissions of BC (kt)

<b>Alternative 1</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Latest inventory year (2018)</b>	<b>2025</b>	<b>2030</b>
A_PublicPower	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.04
B_Industry	0.38	0.32	0.29	0.28	0.28	0.27	0.27	0.27
C_OtherStationaryComb	0.96	0.90	0.88	0.87	0.87	0.74	0.81	0.77
D_Fugitive	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E_Solvents	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F_RoadTransport	0.81	0.75	0.65	0.58	0.52	0.47	0.30	0.28
G_Shipping	0.10	0.09	0.08	0.08	0.08	0.09	0.06	0.04
H_Aviation	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
I_Offroad	0.82	0.80	0.76	0.74	0.71	0.66	0.39	0.28
J_Waste	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
L_AgriOther	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O_AviCruise								
<b>Grand Total</b>	<b>3.15</b>	<b>2.93</b>	<b>2.72</b>	<b>2.62</b>	<b>2.52</b>	<b>2.30</b>	<b>1.90</b>	<b>1.72</b>

<b>Alternative 2</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>Latest inventory year (2018)</b>	<b>2025</b>	<b>2030</b>
Industry and power generation	0.42	0.36	0.32	0.32	0.31	0.31	0.31	0.31
Residential and other small scale stationary combustion	0.96	0.90	0.88	0.87	0.87	0.74	0.81	0.77
Fugitive (incl. Flaring)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Road transport	0.81	0.75	0.65	0.58	0.52	0.47	0.30	0.28
Shipping and aviation	0.11	0.11	0.09	0.10	0.10	0.11	0.08	0.06
Off-road transport	0.82	0.80	0.76	0.74	0.71	0.66	0.39	0.28
Field burning and agricultural wastes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
<b>Grand Total</b>	<b>3.15</b>	<b>2.93</b>	<b>2.72</b>	<b>2.62</b>	<b>2.52</b>	<b>2.30</b>	<b>1.90</b>	<b>1.72</b>

## Annex 2: Methane emission table

Emissions of methane (kt)

	2010	2011	2012	2013	2014	2015	2016	2017	Latest inventory year (2018)	2025	2030
Energy	11.36	10.58	10.40	9.91	9.21	8.99	9.07	8.90	8.41	8.41	8.41
Industrial Processes	0.35	0.34	0.36	0.35	0.36	0.36	0.36	0.36	0.37	0.37	0.38
Agriculture	132.46	131.37	130.03	130.84	130.83	130.23	130.02	131.24	130.79	114.68	108.78
Land Use, Land-Use Change and Forestry	18.09	17.85	17.43	17.53	18.72	17.70	17.85	17.72	19.79	NE	NE
Waste	64.50	60.35	55.19	52.02	47.67	44.24	40.99	38.32	35.65	22.33	17.17
Other											
<b>Total</b>	<b>226.75</b>	<b>220.49</b>	<b>213.41</b>	<b>210.66</b>	<b>206.79</b>	<b>201.52</b>	<b>198.29</b>	<b>196.54</b>	<b>195.01</b>		
Total (without LULUCF)	208.66	202.64	195.98	193.13	188.07	183.82	180.44	178.82	175.22	145.79	134.75

# Annex 3: Actions in regard to recommendations in the 2019 summary report

## Mobile and stationary diesel-powered sources

**Table A1:** Status of recommended actions 2019 related to the reduction of emissions from diesel engines.

<b>Recommendation 1a</b>	<ul style="list-style-type: none"> <li>• Sweden has implemented the Euro 6 standards for passenger cars, light duty vehicles and heavy-duty vehicles.</li> <li>• For working machinery step 5 was implemented from January 1st 2019 for almost all categories.</li> <li>• Exhaust emission control – adjusted regulations</li> </ul>
<b>Recommendation 1b</b>	<ul style="list-style-type: none"> <li>• National plan for transport infrastructure</li> <li>• Congestion tax – increased fees</li> <li>• Low emission zones – new legislation for light vehicles</li> <li>• Bonus malus</li> <li>• Counsel municipalities and property owners on parking</li> <li>• Reduced speed in some streets – national roads</li> <li>• Tolls for certain heavy vehicles</li> </ul>
<b>Recommendation 1c</b>	<ul style="list-style-type: none"> <li>• Procurement requirements</li> <li>• Bonus malus</li> <li>• Tax on air travel</li> <li>• Eco-bonus system for freight transport Climate bonus for electric trucks, buses and mobile machines</li> <li>• Energy step</li> <li>• Support for solar power</li> <li>• Tax reduction for micro production of renewable electricity</li> <li>• Energy tax</li> <li>• Tax reduction for shore side electricity</li> </ul> <p>EU directives that apply to Sweden include:</p> <ul style="list-style-type: none"> <li>• Mandatory energy labelling</li> <li>• Law on energy performance certificates for buildings</li> <li>• Energy audit for large enterprises.</li> </ul>
<b>Recommendation 1d</b>	<ul style="list-style-type: none"> <li>• Sweden works internationally within the IMO for a global regulatory framework to promote innovative solutions and technology development to reduce the emissions of BC, and to promote the use of low-sulphur fuels.</li> </ul>
<b>Recommendation 1e</b>	NA

**Recommendation 1a:** Reduce emissions from new diesel vehicles and engines by adopting and implementing world-class particulate matter exhaust emission standards and ensuring widespread availability of ultra-low sulphur fuels.

**Recommendation 1b:** Reduce emissions from legacy diesel vehicles and engines by adopting targeted policies and programs.

**Recommendation 1c:** Reduce black carbon by stimulating the shift to alternative vehicle technologies and modes of transportation, and through efficiency measures.

**Recommendation 1d:** Develop, as appropriate, and report on measures and best practices to reduce particulate matter and black carbon emissions from shipping.

**Recommendation 1e:** Reduce emissions from stationary diesel engines by adopting targeted policies and programs, including shift to new technologies and improved efficiency.

## Oil and gas

**Table A2:** Status of the recommended actions 2017 to reduce emissions from on oil and gas production

<b>Recommendation 2a</b>	NA
<b>Recommendation 2b</b>	NA
<b>Recommendation 2c</b>	NA
<b>Recommendation 2d</b>	NA

**Recommendation 2a:** Adopt and implement oil and gas methane emission reduction strategies.

**Recommendation 2b:** Encourage the adoption of best practices in reducing routine flaring and in improving gas capture.

**Recommendation 2c:** Urge firms to engage in international and domestic voluntary methane and black carbon emission reduction activities, including the implementation of methane management strategies.

**Recommendation 2d:** Promote targeted and cost-effective measures at large methane emission sources, where relevant.

## Residential combustion

**Table A3:** Status of recommended actions 2019 related to the reduction of emissions from residential combustion.

<b>Recommendation 3a</b>	<ul style="list-style-type: none"> <li>• Information regarding efficient household wood burning</li> <li>• The Building Regulations</li> <li>• The Eco-Design directive</li> </ul>
<b>Recommendation 3b</b>	<ul style="list-style-type: none"> <li>• Government commission on mapping and analysis of emissions from small-scale wood burning</li> <li>• Eco Labels</li> <li>• Chimney sweeping</li> </ul>
<b>Recommendation 3c</b>	<ul style="list-style-type: none"> <li>• The building regulations</li> </ul>

**Recommendation 3a:** Reduce emissions from new solid fuel combustion appliances by accelerating deployment of cleaner and more efficient heating sources and by promoting proper operation and maintenance of appliances, including storage and treatment of fuels.

**Recommendation 3b:** Reduce emissions from legacy solid fuel combustion appliances by accelerating replacement with cleaner and more efficient new heating sources and promoting proper operation and maintenance of appliances, including storage and treatment of fuels.

**Recommendation 3c:** Reduce emissions by promoting enhanced energy efficiency in residential dwellings reducing the need for heating, especially in buildings heated with oil or solid fuels.

## Solid waste disposal

**Table A4:** Status of recommended actions 2019 related to the reduction of emissions from solid waste disposal

<b>Recommendation 4a</b>	<ul style="list-style-type: none"> <li>• Under the Ordinance on Landfilling of Waste there is a ban on landfilling of organic waste since 2005.</li> <li>• Landfill tax</li> <li>• Extended producer responsibility</li> <li>• Municipal waste planning requirement</li> <li>• The Climate Leap has, for example, supported new facilities to convert biodegradable waste or manure to biogas, and also projects to prevent food waste.</li> </ul>
<b>Recommendation 4b</b>	<ul style="list-style-type: none"> <li>• The ordinance on Landfilling of Waste also regulates the collection and disposal of methane gas from landfills.</li> </ul>
<b>Recommendation 4c</b>	NA

**Recommendation 4a:** Avoid methane emissions by preventing food waste and the landfilling of organic waste. Improve resource efficiencies as appropriate for Arctic conditions, including new ways of reusing organic material based on more efficient sorting of waste, composting and biogas production.

**Recommendation 4b:** Adopt regulations or incentives for landfill gas capture and control.

**Recommendation 4c:** Promote best practices for waste management in northern and remote communities.

## Agriculture and animal husbandry

**Table A5:** Status of recommended actions 2019 related to the reduction of emissions from agriculture and animal husbandry

<b>Recommendation 5a</b>	NA
<b>Recommendation 5b</b>	NA
<b>Recommendation 5c</b>	<ul style="list-style-type: none"> <li>• Ban on straw burning. Municipalities may specify regulations for burning of straw on crop land.</li> </ul>

**Recommendation 5a:** Promote food consumption patterns that utilize Arctic food chains sustainably and efficiently, support the preservation of carbon sinks, and minimize life-cycle emissions of methane.

**Recommendation 5b:** Promote work on possibilities to reduce emissions of enteric methane under Arctic conditions, in co-operation with relevant organizations.

**Recommendation 5c:** Develop agricultural policies and practices to reduce open burning of agricultural waste. Encourage studies and piloting of innovative solutions that reduce the need for open burning.

## Management of wildfires

**Table A6:** Status of recommended actions 2019 related to the reduction of emissions from wildfires

<b>Recommendation 6a</b>	NA
<b>Recommendation 6b</b>	NA
<b>Recommendation 6c</b>	<ul style="list-style-type: none"><li>• Guidelines for risk management of forest fires</li><li>• Temporary fire bans</li></ul>
<b>Recommendation 6d</b>	<ul style="list-style-type: none"><li>• Guidelines for risk management of forest fires</li></ul>

**Recommendation 6a:** Build and maintain international mutual aid and resource exchange arrangements amongst Arctic nations that have specialized experience in wildfire management, suppression, and monitoring.

**Recommendation 6b:** Develop region-specific public education campaigns on wildfire prevention and safety.

**Recommendation 6c:** Develop and implement regionally appropriate forest management practices that reduce the risk of severe wildfires.

**Recommendation 6d:** Use the best available science to develop prediction models that can be used to examine fire risks at daily to decadal scales, to support drafting of prevention and emergency response plans.

# Annex 4: Information from the 2017 Swedish national report

## Cross-sector measures

### ENVIRONMENTAL QUALITY OBJECTIVES

The environmental policy of the Swedish government is based on the national environmental quality objectives and the generational objective for environmental work decided by the Swedish Parliament. The goals provide direction for all of Sweden's environmental policies at the national, EU and international level. The system of environmental objectives also provides a structure for systematic follow-up of environmental policy as a basis for strategic action. The sixteen environmental quality objectives express the environmental state sought in Swedish society. There are also milestone targets that define steps on the way to achieving the environmental quality objectives and the generational goal.

The Environmental Quality Objective *reduced climate impact* provides that concentrations of greenhouse gases in the atmosphere must be stabilized at a level that will prevent dangerous anthropogenic interference with the climate system. In line with the Paris Agreement, the Swedish Parliament has further specified the goal as holding the increase in the global average temperature to well below two °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. The *reduced climate impact* objective is aimed at reducing emissions of greenhouse gases including methane.

The *clean air* objective stipulates that the air must be clean enough not to represent a risk to human health or to animals, plants or cultural assets. The objective has 10 'specifications', two of which regard PM<sub>2.5</sub> and PM<sub>10</sub>, of which black carbon is a component.

The *reduced climate impact* objective contains five milestone targets related to methane and black carbon that were established by the Swedish Parliament. These include:

- By **2045**, Sweden is to have zero net emissions of greenhouse gases into the atmosphere and should thereafter achieve negative emissions. To achieve this goal, no more than 15 percentage point may be realized through supplementary measures. Supplementary measures are such as increased uptake of carbon dioxide in forests and land, climate investments in other countries and other negative emissions (for example bio-CCS).
- By **2020**, emissions of greenhouse gases in Sweden from activities not included in the EU Emissions Trading Scheme should be reduced by 40% compared with 1990 emissions levels. This means that by 2020, greenhouse gas emissions from the non-trading sector are to be around 20 million tonnes of carbon dioxide equivalent lower than they were in 1990. One third of this reduction may be achieved through investments in other countries. The Government's ambition is to achieve the goal fully with national measures.
- By **2030**, emissions from domestic transport, excluding domestic aviation, will be reduced by at least 70% compared with 2010 emissions levels.

- By 2030, emissions in Sweden in the sectors that will be covered by the EU Effort Sharing Regulation should be at least 63% lower than they were in 1990. Eight percentage points of the emission reductions may be achieved through supplementary measures.
- By 2040, emissions in Sweden in the sectors that will be covered by the EU Effort Sharing Regulation should be at least 75% lower than they were in 1990. Two percentage points of the emission reductions may be achieved through supplementary measures.

### **GOTHENBURG PROTOCOL**

Sweden was the first country to ratify the UN Convention on Long-Range Transboundary Air Pollution (CLRTAP)'s 2012 Gothenburg Protocol. The goal of the protocol is to reduce emissions, specifically PM and black carbon emissions, in an effort to improve human health and the environment, and to help mitigate climate change. The majority of Sweden's black carbon emissions currently come from stationary biomass combustion, which were over 25% higher in 2016 than in 2000. While stationary biomass emissions remain a challenge for Sweden, it has made significant improvements in the road transport sector. Black carbon emissions from road transport were reduced with more than 60% between 2000 and 2016. By 2016, total black carbon emissions in Sweden had been reduced by 39% compared with 2000 levels.

### **NATIONAL EMISSION CEILINGS (NEC) DIRECTIVE**

The Directive (2016/2284/EU) on the reduction of national emissions of certain atmospheric pollutants (the so called National Emission Ceilings Directive, NEC), which came into force in December 2016, was revised from its previous iteration to include more stringent, binding national emission ceilings for pollutants such as PM<sub>2.5</sub>.

## **Energy**

### **ENERGY TAX**

Sweden's long-standing energy tax covers fossil fuels used as motor fuels or heating fuels, as well as on the use of electricity. Sweden has steadily raised the energy tax on diesel. The energy tax on petrol and diesel was further raised in 2016.

The energy tax rates are inflation-adjusted by indexation to the Swedish consumer price index (CPI). Since 2017, the energy tax rates on petrol and diesel are also adjusted to take into account the development of the gross domestic product (GDP). Furthermore, Sweden applies a tax exemption for the use of sustainable biofuels, thereby incentivizing cleaner energy use and a move away from black carbon-emitting diesel.

### **BUILDING REGULATIONS (BBR)**

Building Regulations (BBR) regulates small-scale wood burning. The rule contains mandatory provisions and general recommendations for building new buildings and altering existing buildings within urban areas. Regarding emissions, the regulation focuses primarily on ventilation and the restriction of emissions of particles, organically bound carbon (OBC), and carbon monoxide (CO) from room heaters (stoves) and boilers. On behalf of the government, the National Board of Housing, Building and Planning are now (2017) reviewing building regulations to prevent new installations of old equipment with high emissions. This will help to reduce black carbon emissions that result from stationary biomass combustion, one of the most significant contributors to black carbon emissions in Sweden.

### **TEMPORARY PROHIBITION AGAINST SMALL-SCALE WOOD BURNING**

Municipalities are able to, on the basis of the ordinance (1998:899) on environmentally hazardous activities and health protection, issue regulations for a "temporary ban on small-scale wood burning with some solid fuels in the specified areas." Temporary prohibitions can reduce emissions of black carbon.

## **INFORMATION CAMPAIGN REGARDING HOUSEHOLD WOOD BURNING**

In November 2017, the Swedish Environmental Protection Agency and the Swedish Energy Agency launched an information campaign regarding energy-efficient wood burning techniques. A goal of the campaign is to reduce black carbon emissions since household wood burning is one of the primary sources of black carbon emissions.

## **ECO LABELS**

The eco labels “the Swan” (the official Nordic Ecolabel) and “P-Mark” are voluntary eco-labeling programs that evaluate the life-cycle environmental impact of products. The labels have different requirements for products including restrictions for black carbon emissions (though they do not label the restrictions as such). One example is a restriction on dust emissions from boilers.

## **MEDIUM COMBUSTION PLANT (MCP) DIRECTIVE**

A proposal for a new directive to reduce pollution from medium-sized combustion installations, such as energy plants for street blocks or large buildings and small industry installations, was negotiated in 2014. The directive entered into force in December 2015 and had to be transposed by EU member states by December 2017. By December 2018, all emissions values set by the directive had to be applied for new medium combustion plants. For existing medium combustion plants, the emission values set by the directive must be applied by 2025 or 2030. This directive will help reduce emissions of black carbon from combustion installations, especially for bio-fuel plants.

## **ECO-DESIGN DIRECTIVE**

The Eco-Design Directive includes product regulations with legal requirements on eco-design for solid fuel boilers, and other equipment for direct room heating that use solid fuels such as stoves, fireplaces and masonry heaters, which are emitters of black carbon. The stricter requirements will regulate the emissions of particulate matter, unburned hydrocarbons, carbon monoxide and nitrogen oxides. This directive was formally adopted and incorporated into law in 2015. New requirements will take effect in 2020 for solid fuel boilers, and in 2022 for space heaters, however, member states may introduce the requirements earlier. The legal requirements only apply to newly-installed equipment.

## **Industry**

### **ENERGY TAX ON FOSSIL FUELS FOR HEATING IN INDUSTRY**

An energy tax on fossil fuels for heating has been levied since a long time. In 2011 the energy tax rates were adjusted according to their energy content, significantly increasing the tax on LPG, natural gas, coal and coke. On fuels used in industrial manufacturing processes, 30% of the standard energy tax is paid. This instrument contributes to the reduction of emissions of both black carbon and methane.

## **Transport**

### **CLIMATE BONUS FOR ELECTRIC TRUCKS, BUSES AND MOBILE MACHINES (FORMER ELECTRIC BUS PREMIUM)**

The Swedish Energy Agency will provide support to regional public transport authorities and public service operators to invest in electric busses for their fleets. The amount of support that they receive will be 20% of the purchasing price on the bus with a cap to ensure that no part is over-compensated. In 2016, 50 million SEK was allocated for electric bus premiums, and the Swedish Energy Agency has been allocating a further 100 million SEK per year from 2017-2020 under this program. From 2020 the premium also covers electric trucks and mobile machines, and the allocation is increased to 120 million SEK per year.

## **EMISSION STANDARDS**

Ordinance (1998:1709) on emission standards for certain combustion-powered mobile machinery regulates emissions of inter alia particulate matter and black carbon from working machines.

## **TOLLS FOR CERTAIN HEAVY VEHICLES**

Heavy traffic is charged with a toll under the Tolls for Certain Heavy Vehicles act (1997:1137). The size of the toll is partly based on the vehicle's emissions class.

## **TEST CYCLE**

The United Nations Economic Commission for Europe plans to introduce requirements for a new test cycle for exhaust emissions testing for the approval of vehicles. The new test cycle known as the World Light Duty Test Procedure (WLTP) is intended to replace the previous test cycle, New European Driving Cycle (NEDC), since it did not sufficiently reflect real driving conditions. An EU-decision to introduce the WLTP-cycle entered into force in 2017. WLTP will help reduce emissions of black carbon.

## **NON-ROAD MOBILE MACHINERY (NRMM) DIRECTIVE**

The Non-Road Mobile Machinery Directive governs non-road vehicles such as lawnmowers, chainsaws, excavators, bulldozers, harvesters, trains and some inland boats. Combustible engines in these types of machinery and vehicles contribute to carbon oxide, hydrocarbons, nitrogen oxide and particulate matter emissions (including black carbon). The directive aims to both reduce emissions and phase out the most polluting types of engines. The NRMM Directive (2016/1628) was applied as of January 1, 2017.

## **Waste**

### **ORDINANCE ON LANDFILLING OF WASTE (2001:512)**

Under the Ordinance on Landfilling of Waste, a ban on landfilling of combustible materials was introduced in 2002, and a similar ban was imposed on organic material in 2005. The ordinance also regulates the collection and disposal of methane gas from landfills. The aim of the ordinance is to prevent and reduce adverse effects on human health and the environment.

### **LANDFILL TAX (SFS 1999:673)**

In 2000 a tax was imposed on waste disposed in landfills. The tax started at 250 SEK per tons of landfilled waste, and by 2019 it had increased to 520 SEK per ton of landfilled waste.

### **LANDFILL DIRECTIVE (1999/31/EC)**

The EC Landfill Directive requires that the landfilling of biodegradable waste be reduced and for methane to be collected from landfills. Sweden has introduced more far reaching national instruments than those required under the directive, resulting in earlier attained emissions reductions.

## **Agriculture**

### **THE RURAL DEVELOPMENT PROGRAMME 2014-2020**

The Swedish Government decided on a new Rural Development Program in June 2014. The new programme, which is ongoing (2014-2020), includes support for investments, young entrepreneurs, capacity building, cooperation and innovation. Furthermore, it offers support to areas with natural constraints, animal welfare payments, ecological farming, and environmental and climate actions. One area of focus is to reduce agricultural emissions of greenhouse gases such as methane.

## **SUPPORT FOR BIOGAS PRODUCTION**

On 1 January 2015, a support for biogas production from manure was established. The support aims to compensate for the double climate benefit that is achieved when manure is digested – spontaneous methane emissions from manure are reduced, and biogas production is increased – thereby replacing fossil fuels.

#### **VOLUNTARY COMMITMENT**

In 2007 the Swedish Waste Management and Recycling association introduced a voluntary commitment whereby participating facilities have pledged to actively work with mapping and other measures to reduce emissions of methane.