



Sweden's policy framework for alternative fuels infrastructure under Directive 2014/94/EU

Memorandum

Appendix to Government Decision of
17 November 2016

Ministry of Enterprise, Energy and Communications

**Sweden's policy framework for alternative fuels infrastructure under
Directive 2014/94/EU**

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1.

1. Introduction

1.1 Directive 2014/94/EU

Under Article 3 of Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure¹, each Member State has to adopt a national policy framework for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure.

The Directive defines alternative fuels [*alternativa drivmedel*] as fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include, *inter alia*:

- electricity,
- hydrogen,
- biofuels as defined in point (i) of Article 2 of Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC,
- 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 policy framework has to contain, *inter alia*, an assessment of the current state and future development of the market as regards alternative fuels in the transport sector, The policy framework also has to contain national targets and objectives for the deployment of alternative fuels infrastructure. These national targets and objectives are to be established and may be revised on the basis of an assessment of national, regional or Union-wide demand, while ensuring compliance with the minimum infrastructure requirements set out in this Directive. The policy framework is also to make clear the measures necessary to ensure that the national targets and objectives are reached.

Under Article 3(7) of the Directive, the Member States have to notify their national policy frameworks to the Commission by 18 November 2016. Under Article 10(1) of the Directive, each Member State has to submit to the Commission a report on the implementation of its national policy framework by 18 November 2019, and every three years thereafter.

1.2 How have the interests of affected stakeholders been taken into account?

Affected stakeholders have been consulted on several occasions on the shift to a fossil-free vehicle fleet and the role that alternative fuels should have in this switch.

On 30 November 2015, the Minister for Energy and the Minister for Infrastructure hosted talks on how the industry and the Government can move forward and create a basis for fossil fuel dependence in

¹ The term *alternativa bränslen* [alternative fuels] is used in the Swedish-language version of the Directive. As the Directive is aimed at fuels used solely in the area of transport, it would have been better to use the term *alternativa drivmedel* [alternative transport fuels] in the Swedish-language version. *Alternativa drivmedel* is, for example, the term used for the products concerned in the Fuels Act (2011:319). The Government stated in Government Bill 2014/16:186 that the term *alternativa drivmedel* should be used in implementation of the Directive instead of *alternativa bränslen*, but that the meaning is the same as the definition given in the Directive. The term *alternativa drivmedel* is therefore also used in this policy framework.

the transport sector to be broken. Representatives of special interest groups, regional organisations, municipalities and authorities attended this event.

The Ministry of Enterprise, Energy and Communications has held two hearings to canvass opinions on a draft policy framework. The first hearing was held in April 2016 and the second in October of the same year. Representatives of special interest groups, regional organisations, municipalities and authorities also attended these hearings.

1.3 Common standards are dealt with according to a special procedure

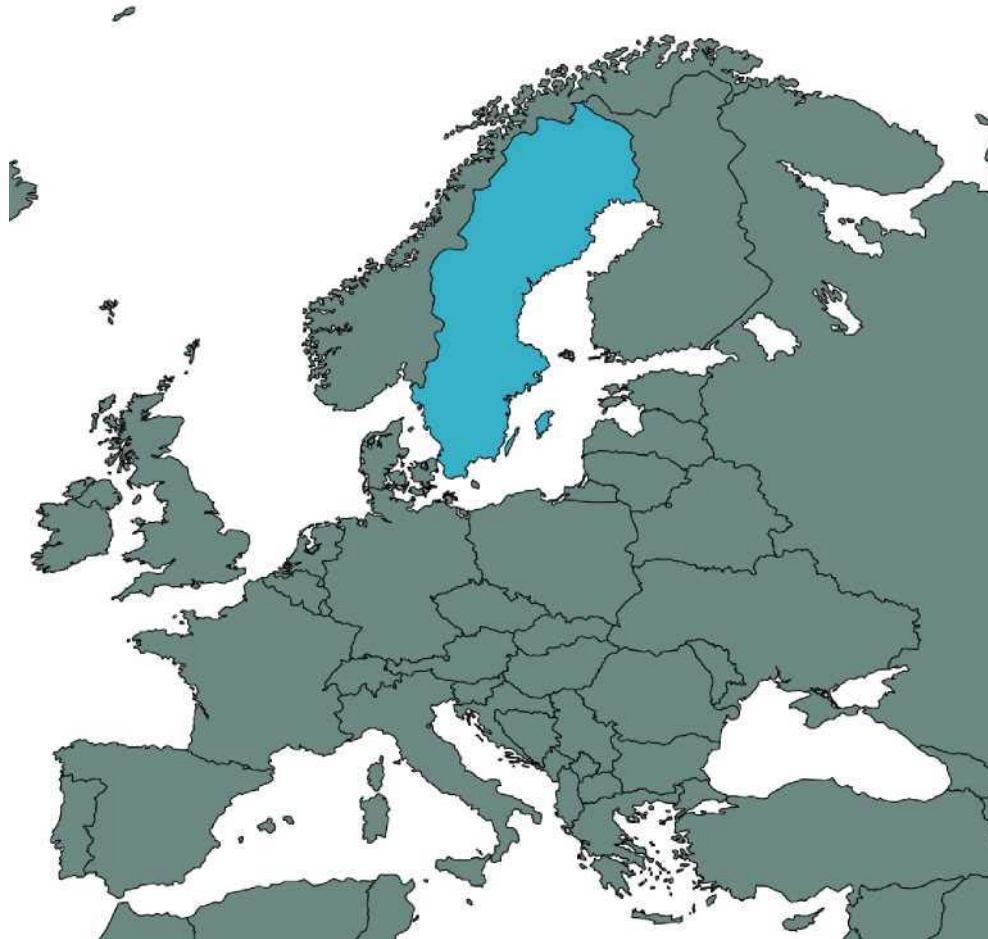
This policy framework does not address Sweden's implementation of the requirements contained in the Directive regarding which standards are to apply to installations for alternative fuels and information for users. These requirements are transposed in the Act (2016:915) on requirements for installations for alternative fuels and the Ordinance (2016:917) on requirements for installations for alternative fuels, see Government Bill 2015/16:189. The Act and the Ordinance enter into force on 18 November 2016.

2. Some national factors

Sweden is one of the larger countries on the continent, with a land area of 406 311 km². It has long coastlines in the east and south-west. Just over half of Sweden is covered in forest. Almost one-tenth of the country is occupied by around 100 000 lakes. Sweden extends in the north-south direction from 55 to 69 degrees of latitude. The distance from the most northerly point to the southern tip of the country is 1 600 kilometres, which is equivalent to the distance from Malmö to Rome.

Sweden has a population of around 9.9 million (in 2016). It is sparsely populated. This is particularly the case in the northern part of the country. Around 85 % of the population lives in the southern third of the country. The average population density is 24 inhabitants per square kilometre (in 2016).

Figure 1. The geographical location of Sweden



3. National targets

A shift to alternative vehicle fuels is a means of attaining several objectives. This section presents a brief description of relevant national objectives with regard to efforts to promote the use of alternative fuels with relevant infrastructure.

3.1 Climate-policy objectives

Climate change is a key issue of our time and one of the top priority issues for the Government. The Government's climate policy means that Sweden is to be a pioneering nation and become one of the first fossil-free welfare nations in the world. Long-term governance and ambitious targets are needed for a continued switch.

The All-Party Parliamentary Committee on Environmental Objectives was tasked in 2014 with proposing how a climate-policy framework and a strategy for a combined, long-term policy on climate change could be formulated. The All-Party Committee on Environmental Objectives presented its proposals in June 2016, proposing *inter alia* a long-term target for Sweden not to have any net emissions of greenhouse gases to the atmosphere by 2045, and to attain negative emissions thereafter. The All-Party Committee on Environmental Objectives also proposes a target for emissions from domestic transport (except for emissions from domestic aviation, which is included in EU ETS), which are to be at least 70 % lower than the 2010 level by 2030. The Government plans to present a Bill to the Riksdag at the beginning of 2017

concerning a climate-policy framework and new targets, based on the proposals presented by the All-Party Committee on Environmental Objectives.

3.2 Energy-policy objectives

The overarching objective of energy policy is security of energy supply in the short and long term on competitive terms.

Energy policy is to create the conditions for efficient and sustainable energy use and cost-effective Swedish energy supply with low impact on health, environment and climate. Energy policy is also to facilitate the switch to an ecologically sustainable society. Good economic and social development throughout Sweden is promoted in this way.

The Riksdag has decided on a number of energy-policy objectives²:

- The share of renewable energy is to be at least 50 % of total energy use in 2020.
- The share of renewable energy in the transport sector is to be at least 10 % in 2020.
- Energy use is to be 20 % more efficient by 2020. The objective is expressed as a sector-wide target of 20 % reduction in energy intensity between 2008 and 2020.

3.3 Transport-policy objectives

The overarching objective of transport policy is to ensure transport supply that is economically effective and sustainable in the long term for the public and for business throughout the country. In addition, there is a functionality objective regarding accessibility, and an objective of equal consideration of safety, environment and health.

The objective of functionality means that the design, function and use of the transport system should contribute to assuring everyone of fundamental accessibility of good quality and usability and contribute to development capability throughout the country. The transport system is to be gender-equal, in other words meet the transport needs of women and men equally. The objective of consideration means that the design, function and use of the transport system have to be adapted so that no one is killed or seriously injured, a contribution is made to meeting the overarching generational goal for the environment and the environmental quality objectives, and a contribution is made to improved health.

3.4 Regional-policy objectives

The objective of regional growth policy is development capacity in all areas of the country with greater local and regional competitiveness. The national strategy for sustainable regional growth and attractiveness for the period 2015-2020 guides work on sustainable regional growth and attractiveness throughout the country up to 2020. Priority areas in the strategy include accessibility through the transport system and environmentally driven business development and energy issues.

3.5 Industrial-policy objectives

The objective of industrial policy is to strengthen Swedish competitiveness and create the conditions for more jobs in more and growing businesses.

² See the Government Bill *En sammanhållen klimat- och energipolitik* (A coherent climate and energy policy) (Government Bill 2008/09:163).

The number of people working and the number of hours worked in the economy are to increase to such an extent that Sweden has the lowest rate of employment in the EU in 2020. A shift to alternative fuels can drive employment and innovation throughout the chain from raw material to processing and distribution to the automotive and other related sectors.

3.6 Consumer-policy objectives

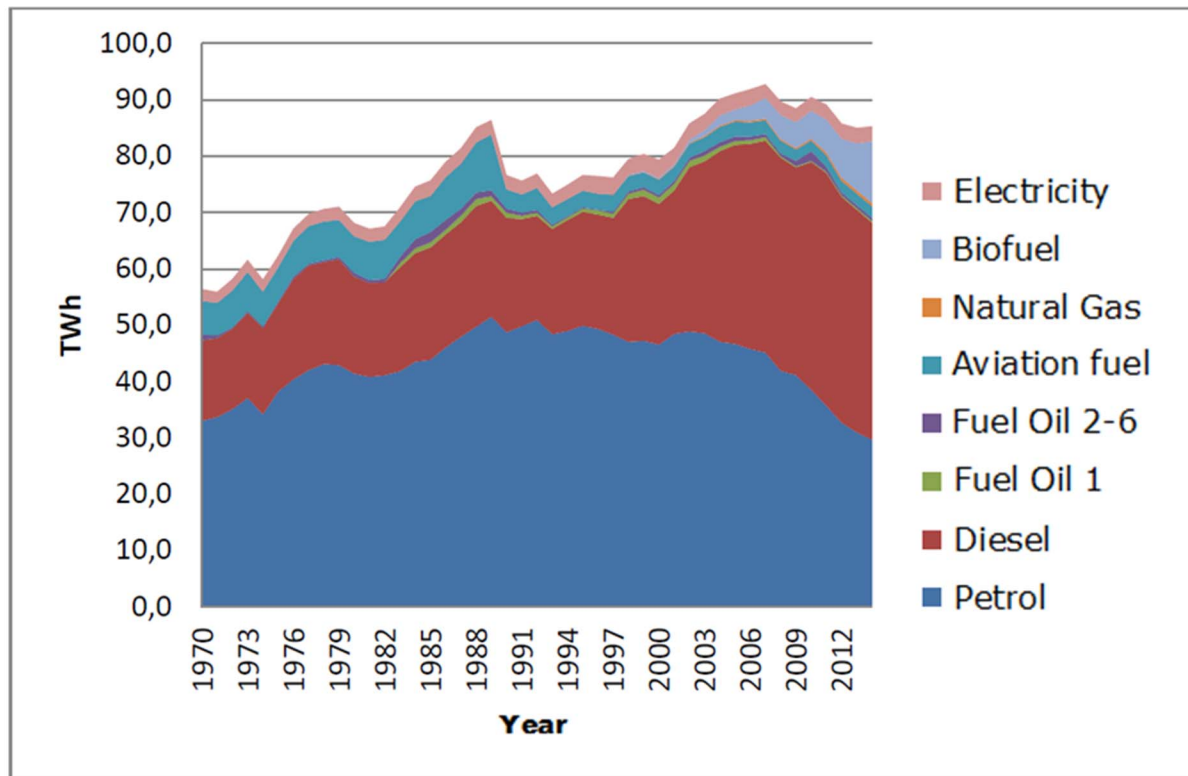
The objectives of consumer policy are consumer markets that work smoothly and environmentally, socially and economically sustainable consumption. Consumption of transport, vehicles and fuels accounts for a substantial share of both household expenditure and the environmental impact of households. It is therefore an important element in fulfilling the consumer-policy objective, with regard to functioning markets where the consumers make reasoned choices, and for more sustainable consumption. A functioning infrastructure for fuels takes account of consumers' circumstances.

4. The market for alternative fuels in Sweden

4.1 Energy use in the transport sector

The transport sector accounts for around one-third of Sweden's total energy use. The general trend since the 1970s has been towards increased energy use in the transport sector. This trend continued into the 2000s, but a break in trend occurred around 2007, with energy use starting to decrease instead. In 2013, energy use in domestic transport was on a par with 2004. In recent years there has, however, been some increase in energy use by the transport sector again.

Figure 2. Time series showing energy use in TWh for domestic transport, broken down by fuel 1970-2014.

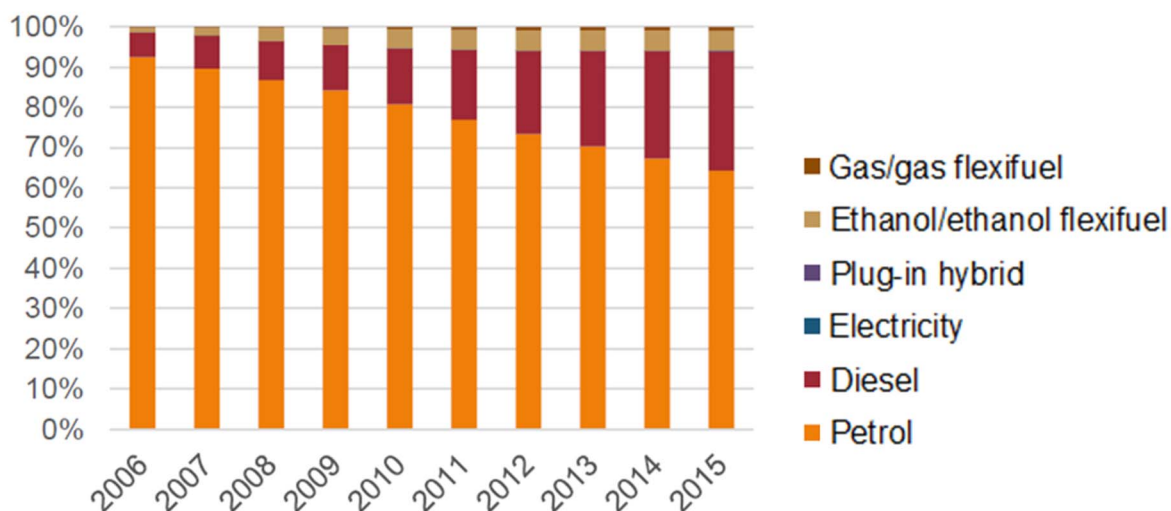


Source: Swedish Energy Agency. *Scenarier över Sveriges energisystem (Scenarios for the Swedish energy system)*, report ES 2014:19

Road traffic dominates energy use for domestic transport. In 2015, road traffic accounted for 93.8 % of energy use for domestic transport.

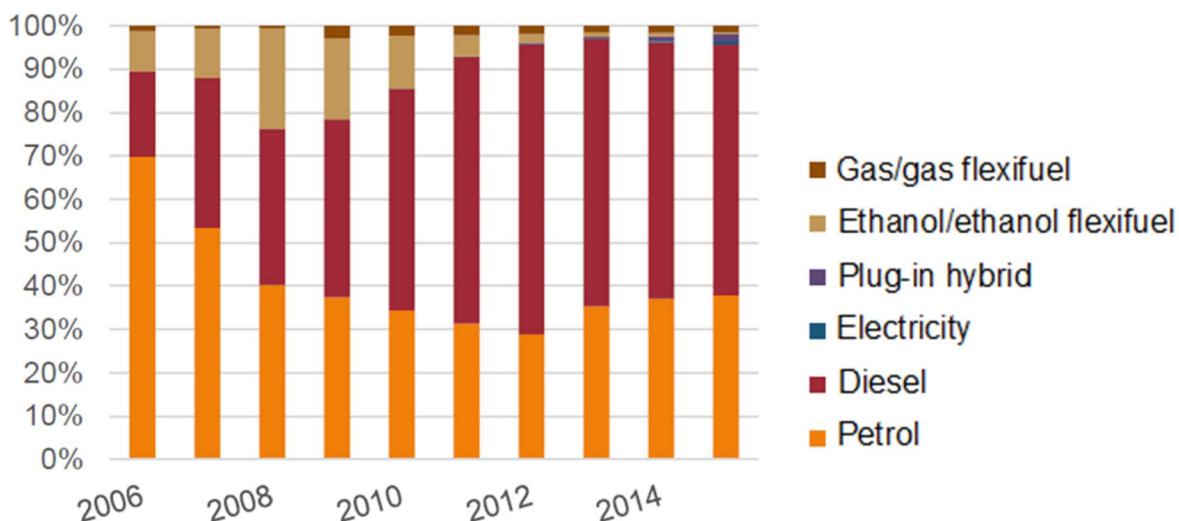
There has been a prolonged trend in road traffic towards a decrease in the use of petrol and an increase in the use of diesel. This is a result of changes in recent years in the car population, with an increase in the proportion of diesel cars in the Swedish car fleet. At the end of 2015 there were just under 4.7 million cars on the road in Sweden. Since 2006, when the number was 4.2 million, the size of the car fleet has increased at a relatively even pace, averaging 1.2 % per year. Car density was 475 cars per 1 000 population at the end of 2015 (in 2013 it was 467 cars per 1 000 population).

Figure 3. Cars on the road in 2006-2015 broken down by propulsion technology.



Source: Transport Analysis, *Statistik över fordonsflottans utveckling* (Statistics on development of the vehicle fleet), report 2016:3.

Figure 4. Cars on the road in 2006-2015 broken down by propulsion technology.



Source: Transport Analysis, *Statistik över fordonsflottans utveckling* (Statistics on development of the vehicle fleet), report 2016:3.

A sharp improvement in the energy efficiency of new cars has taken place over the past ten years. Average carbon dioxide emissions from new cars have decreased by just over 30 % since 2006. In 2015, average carbon dioxide emissions from new cars were 127 g CO₂/km. EU legislation on carbon dioxide emissions from new light vehicles has played a decisive role, but the trend in Sweden has been reinforced by a number of national policy instruments. Forthcoming revised EU legislation on carbon dioxide emissions from new light vehicles provides an opportunity to further improve the energy efficiency of cars.

4.2 Steadily increasing share of biofuels

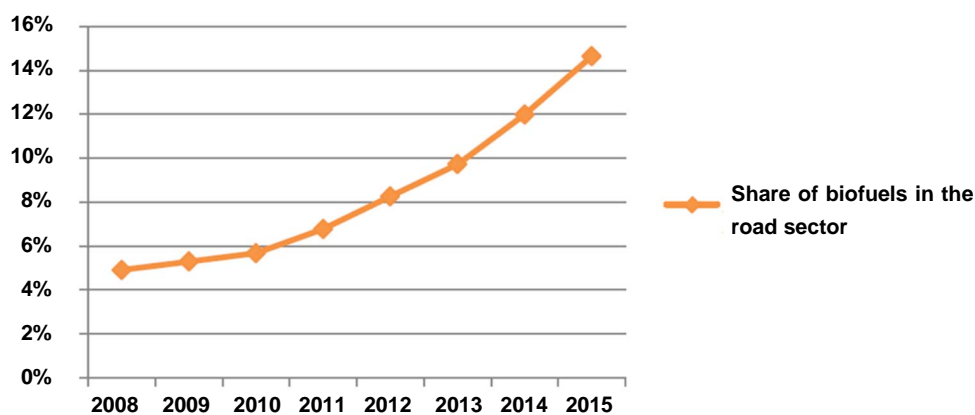
Another significant change is the increasing share of biofuels in the road-transport sector in recent years. The preliminary share of biofuels, based on energy content, was 14.7 % in 2015, see Figure 5. The share of renewable energy in the whole transport sector in 2015 according to the Swedish Energy Agency's

preliminary calculations was 23.1 %³, using the method of calculation in the Renewables Directive. This is an increase of 4.4 percentage points compared with 2014.

The objective of the Renewables Directive was for each Member State to reach at least 10 % renewable energy in the transport sector by 2020. Sweden fulfils and therefore already surpasses now the targets in the Renewables Directive for the transport sector by 2020 and the national energy-policy target for the transport sector.

Most of the quantity of biofuels used in Sweden today is sold as a blend in petrol and diesel and therefore does not need special infrastructure. This is a cost-effective solution that additionally often works in the existing vehicle population. Infrastructure for petrol and diesel is not presented in this policy framework. An account is given only of the existence of special infrastructure for ethanol (E85), road fuel gas (CNG), liquefied natural gas (LNG) for motor vehicles and for ship operation, hydrogen gas and electricity.

Figure 5. Trend in the share of biofuels in road transport, 2008-2015.



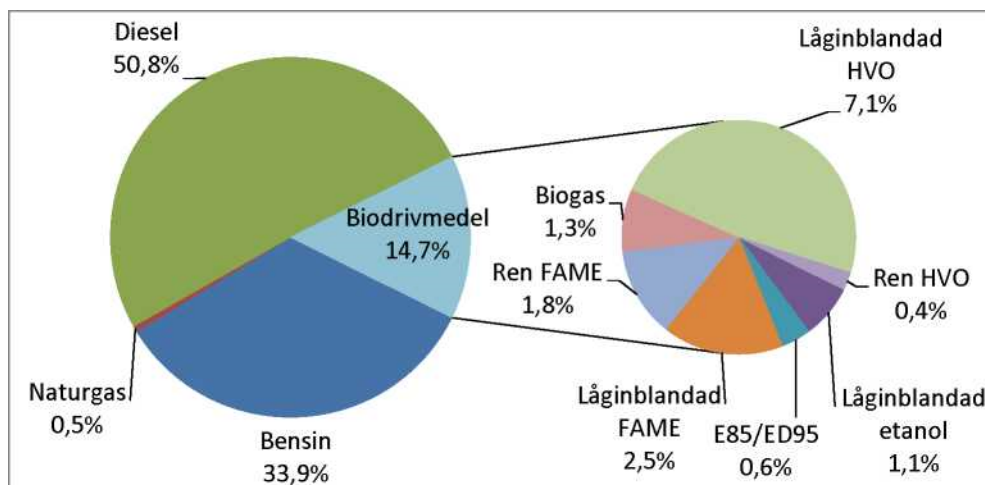
Source: Swedish Energy Agency, *Transportsektorns energianvändning 2015* (Energy use in the transport sector in 2015), report ES 2016:03.

The most common biofuels in the road sector are ethanol, biodiesel⁴ and road fuel gas, see Figure 6.

³ Swedish Energy Agency's short-term projection, report ER 2016:14.

⁴ Biodiesel is used as a collective name for FAME (fatty acid methyl esters, a form of RME, rapeseed oil ester) and HVOs (hydrotreated vegetable oils).

Figure 6. Share of biofuels in the road sector in 2015.



Source: Swedish Energy Agency, Transportsektorns energianvändning 2015 (Energy use in the transport sector 2015), report ES 2016:03.

Key

Diesel = Diesel
 Naturgas = Natural gas
 Bensin = Petrol
 Biodrivmedel = Biofuels
 Biogas = Biogas
 Ren FAME = Pure FAME
 Låginblandad FAME = Low-blend FAME
 E85/ED95 = E85/ED95
 Låginblandad etanol = Low-blend ethanol
 Ren HVO = Pure HVO
 Låginblandad HVO = Low-blend HVO

4.3 Ethanol

Ethanol occurs both as a low blend in petrol and as a high blend in the ethanol-based fuels E85 and ED95. All lead-free 95-octane petrol today contains up to 5 % ethanol by volume (E5). The use of ethanol increased at the turn of the century but has decreased in recent years. The decrease in use of ethanol is due in part to the use of petrol having decreased, but is also explained by the quantity of ethanol used for buses (ED95) and for fuel-flexible cars (E95) having diminished.

The quantity of E85 decreased by around 40 % in 2015 compared with 2014, despite the number of fuel-flexible cars on the road being largely unchanged. The share of fuel-flexible cars was one per cent in 2006, increasing to five per cent by 2010, and thereafter remained static at five per cent. Fuel-flexible cars have thus been refuelled with E85 to a minor extent, even when it is taken into account that older vehicles on average are driven shorter distances annually. One reason for this may be that the price of E85 has periodically been higher than for petrol, measured in terms of energy content.

New registrations of cars adapted for E85 have fallen sharply in recent years: only 1 370 fuel-flexible cars were sold in 2015, which is equivalent to around 0.4 % of all new registrations.

Refuelling points for E85 are spread across the whole country. Since 2006, refuelling points with a certain annual volume of sales have been obliged by law⁵ to supply at least one renewable fuel. In the vast majority of cases, the refuelling points have opted to supply E85. In 2015 there were 1 828 (publicly accessible) sales points for E85⁶.

⁵ Act (2005:1248) on the obligation to supply renewable fuels
⁶ Source Swedish Petroleum and Biofuels Institute.

4.4 Biodiesel

Biodiesel occurs partly as a low blend in fossil diesel and partly in pure form as what is known as B100 and HVO100. Use of biodiesel has increased sharply in recent years. The increase is largely due to increased blending of hydrotreated vegetable oils (HVOs⁷) in diesel. In 2015, around 83 % of the diesel on the Swedish market consisted of low-level blends. FAME⁸ accounted for approximately 5 % of this diesel and HVOs approximately 14 %. The diesel not containing a lower-level blend of biodiesel is principally used in non-road mobile machinery. Pure biodiesel has long consisted solely of FAME, but here too use of HVOs is increasing.

A significant portion of all Swedish heavy goods vehicles with Euro 5 and 6 can run on pure HVO, known as HVO100. The proportion of heavy goods vehicles that can run on gas or pure biodiesel (HVOs or FAME) has increased somewhat over the past three years.

4.5 Road fuel gas

Road fuel gas in Sweden consists of fossil natural gas, biogas or blends of the two. There has been a small increase in the use of road fuel gas in recent years. Its use appears to have stagnated somewhat in 2015, however. The share of biogas and natural gas varies geographically, principally due to regional factors, such as access to the natural gas network, production, local networks, upgrading facilities, etc. The fixed distribution network for natural gas in Sweden is concentrated on parts of the west coast. The share of biogas in road fuel gas in 2015 was around 70 % as an average across the country. Almost 25 % of all buses in public transport are adapted to run on methane gas/road fuel gas. The proportion of cars that can run on road fuel gas remained below one per cent throughout the period from 2006 to 2015. Just over one per cent of light commercial vehicles can run on road fuel gas.

A new aspect in recent years is that liquefied natural gas (LNG) has started to be used as a fuel for heavy goods vehicles and buses and as a bunker fuel in shipping. There are no official statistics yet on the proportion of compressed (CNG) and liquefied gas (LNG).

At the beginning of 2016 there were 160 public refuelling points for CNG in Sweden and more than 60 private or municipal ones⁹. There also refuelling points for CNG across the whole country. There are, however, no such refuelling points in large parts of the inland areas of the north, which are sparsely populated.

⁷ HVOs today do not necessarily come from vegetable oils but can also be produced from animal fats, etc.

⁸ Fatty acid methyl ester). Occurs both in pure biodiesel, B1000, and in low-level blends in ordinary diesel.

⁹ Source Swedish Gas Association.

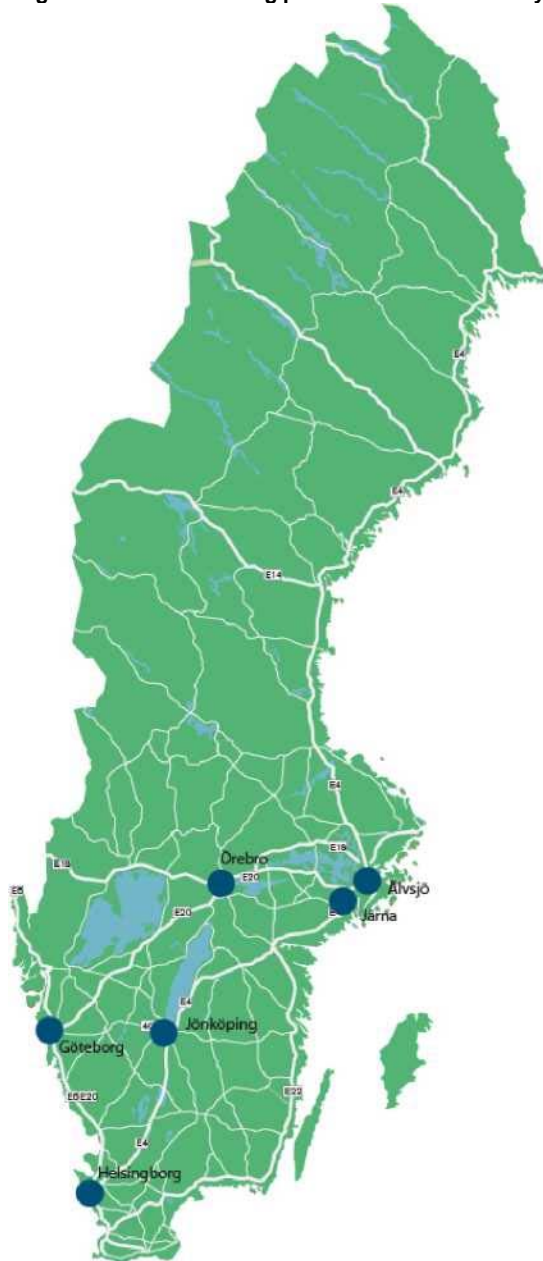
Figure 7. Public refuelling points for CNG in January 2016.



Source: Swedish Gas Association

There are currently six LNG refuelling points for road vehicles.

Figure 8. Public refuelling points for LNG in January 2016.



Source: Swedish Gas Association

4.6 Electricity

A sharp relative increase in the number of rechargeable electric cars is currently taking place. The number of rechargeable electric vehicles doubled between 2014 and 2015, and this rate of increase has, in principle, continued in 2016. There were around 24 800 rechargeable electric vehicles in Sweden in September 2016, approximately two-thirds of these being plug-in hybrid electric vehicles (PHEVs) and one-third pure electric vehicles (EVs). The number of trucks that can run on electricity is around 1 200.

The most common way of recharging an electric vehicle is when it is parked at the vehicle owner's home or place of work. Company-owned vehicles are normally charged at the company's own recharging points. Access to recharging points, at homes and places of work, is crucial to enabling an electric vehicle to be used in practice. If ordinary electric sockets in houses and engine block heaters at places of work and car parks are included, there is thus a very large number of recharging points, generally private, in Sweden. Naturally there are no official statistics for the total number.

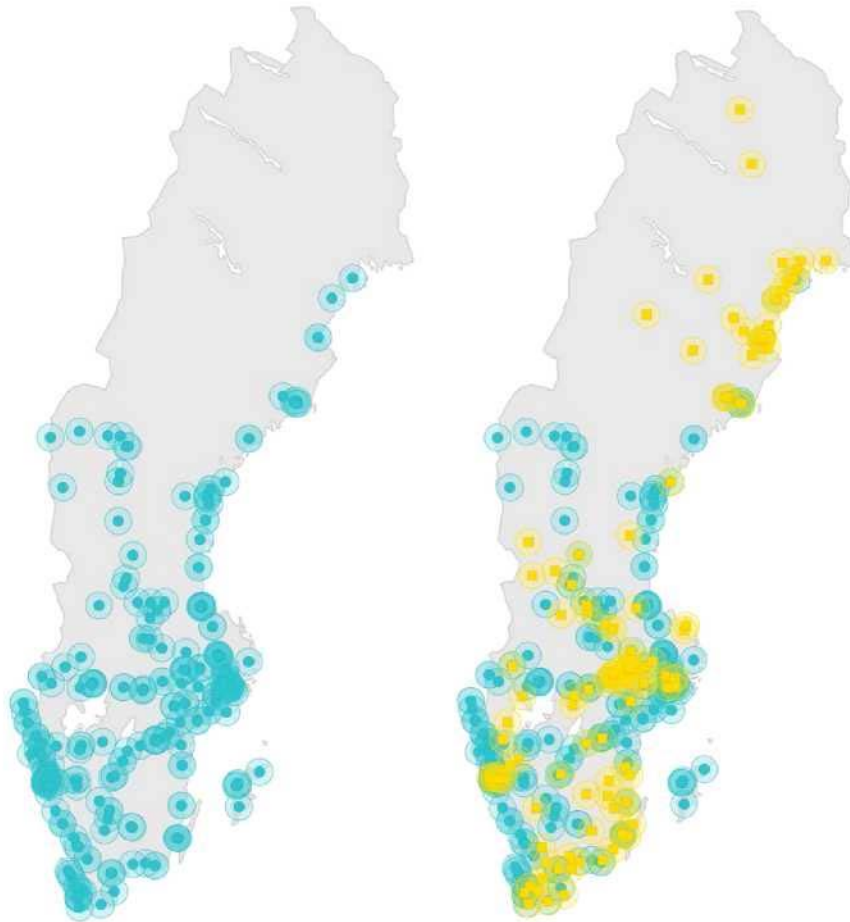
Public recharging stations are a complement to non-public recharging and are important in fostering confidence in rechargeable electric vehicles, increasing their usability within and between countries and consequently contributing to a high proportion of electric vehicles in the EU. Sweden does not have any public register of public recharging stations. Power Circle, which is an advocacy group for the Swedish electric vehicle sector, operates a database containing information on public recharging infrastructure. According to Power Circle there were 2 487 public recharging points in Sweden on 1 November 2016. Of these, 1 316 were equipped with Type 2 connectors and 178 with CCS /Combo.

Several private and public-sector operators are deploying recharging infrastructure in Sweden on commercial terms. In addition to this, operators can apply for state co-funding from what is known as the Climate Leap¹⁰. Recharging infrastructure is also being deployed with EU support. Figure 9 shows a schematic illustration of how large a part of Sweden is currently served by existing recharging stations equipped with high-power recharging of the CCS/Combo type and an estimate of the equivalent situation in July 2018.

The estimate for July 2018 is based on those recharging stations that have been granted support from the Climate Leap to date also being completed.

¹⁰ See Section 5 for a more detailed description of the Climate Leap.

Figure 9. Presence of recharging stations with high-power rechargers (DC high-power rechargers 50 kW). The circle indicates a radius of 50 km from the recharging station. The map on the left shows the situation in September 2016. The picture on the right is an estimation of the situation in July 2018 assuming that the recharging stations that have been granted support from the Climate Leap are also completed.



Source: Swedish Energy Agency

4.7 Hydrogen gas

In October 2016 there were two refuelling points for hydrogen gas, in Gothenburg and at Stockholm-Arlanda Airport. It is planned that two new hydrogen gas stations will be opened in the autumn of 2016, in Sandviken and Mariestad, while a former station in Malmö has been closed. There is a mobile hydrogen gas refuelling point in Arjeplog during the winter season. Ten hydrogen gas vehicles are registered in Sweden at present.

Figure 10. Hydrogen gas refuelling points in Sweden in autumn 2016:



Source: Hydrogen Sweden.

4.8 Alternative fuels for public transport

Vehicles adapted to run on alternative fuels are being used to an ever increasing extent in public transport by road. According to the Swedish Public Transport Association's environment and vehicle database FRIDA, around 65 %¹¹ of public transport was provided by buses powered by renewable fuels in 2015. The most common renewable fuel is biodiesel, followed by biogas. Almost 25 % of all buses in public transport are adapted to run on methane gas/road fuel gas. A breakthrough for electrified and rechargeable electric vehicles is now also taking place for city buses. Rail-mounted public transport is almost exclusively electric. In 2015 just over 97 % of transport activity by rail was electric.

¹¹ Expressed as share of total traffic activity in vehicle-kilometres.

4.9 Alternative fuels in shipping

Light fuel oil (Eo1) and heavy fuel oils are used in shipping. The Sulphur Directive¹² resulted in an increased share of diesel oil and Eo1 in shipping bunkers in 2015, as well as a reduced share of Eo 2-6. There are no official statistics as yet on use by shipping of LNG.

There are LNG terminals at present in Nynäshamn and Lysekil. LNG is transported from the Nynäshamn terminal to the port of Stockholm by truck, and bunkering then takes place with a bunkering vessel. A further LNG terminal is under construction at the port of Gothenburg. There are currently two vessels capable of running on LNG that call at Swedish ports. These are the cruise ship Viking Grace, which operates between Stockholm and Turku in Finland, and the cargo ship Ternsund, which operates in the Baltic Sea and the North Sea.

In March 2015 Stena Line introduced the first methanol-powered ferry, Stena Germanica, which operates on the Gothenburg-Kiel route.

4.10 Shore-side electricity supply

At present there are shore-side electricity supply installations at the ports of Gothenburg, Helsingborg, Karlskrona, Karlshamn, Luleå, Malmö, Piteå, Stockholm, Trelleborg and Ystad, among others.

4.11 Alternative fuels in aviation

Aviation mostly uses aviation kerosene (Jet A1) as its fuel. According to the international specifications for aviation fuel, it is possible today to blend up to 50 % biobased jet fuel into the fossil-based jet fuel. This blending does not require new infrastructure. Renewable bio Jet A1 can be blended with ordinary Jet A1 in existing tanks and pipe systems. Several initiatives concerning biofuel for aviation are currently in progress in Sweden. Biofuel is already blended to a limited extent today, and it is possible to refuel with biofuel at Karlstad Airport. Swedavia AB¹³ has launched an incentive programme to increase demand. The programme means that airlines opting to buy renewable aviation fuel at Swedavia AB's airports have 50 % of the additional cost met through a fund.

Swedavia AB has purchased 450 tonnes of fossil-free bio Jet A1 which will arrive at the company's airports in December 2016.

4.12 Electricity supply for stationary aircraft

Seven of Swedavia AB's airports have provision for supplying stationary aircraft through an electrically connected Ground Power Unit (GPU) at all aprons. At two of the airports all the aprons except one have an electrically connected GPU, and at one airport two-thirds of the aprons have electrical connections.

Municipal and private commercial service airports are significantly more numerous and, with a few exceptions, considerably smaller than State-owned airports. The presence of electrically connected GPU is not reported for these.

¹² Directive 2012/33/EU of the European Parliament and of the Council of 21 November 2012 amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels.

¹³ The State is responsible for a national base supply with ten airports owned and operated by the State-owned company Swedavia AB.

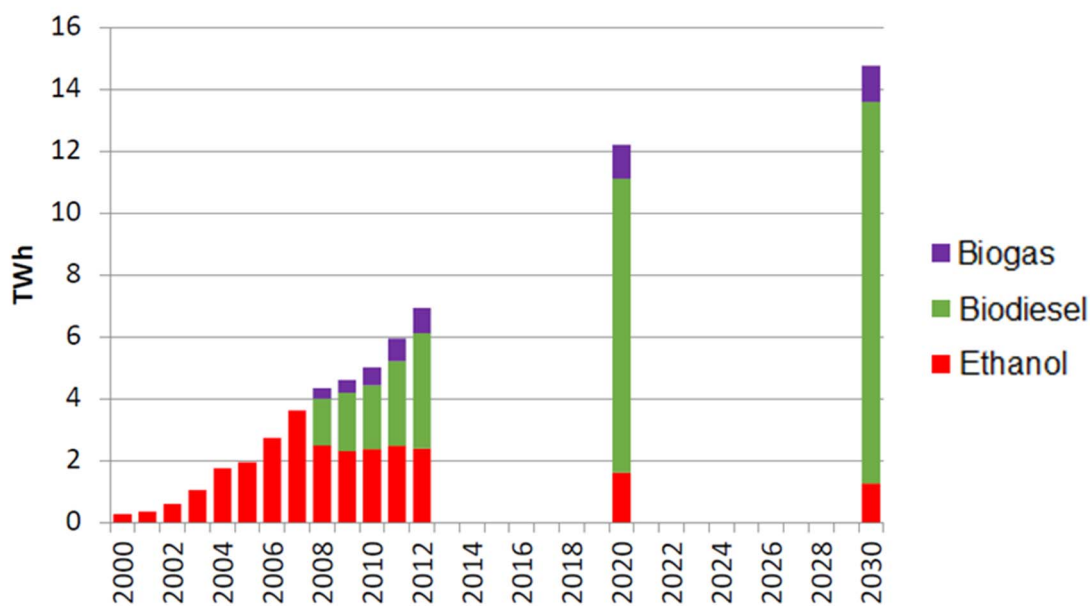
5. Estimation of future development

The estimates made in this section are taken from the Swedish Energy Agency report *Scenarier över Sveriges energisystem - 2014 års långsiktiga scenarier* (Scenarios for Sweden's energy system – 2014 long-term scenarios)¹⁴ which serves as a basis for Sweden's climate reporting to the European Commission¹⁵.

In the reference case, the Swedish Energy Agency estimates that total energy use in the transport sector will decrease successively over the whole period up to 2030, when it is estimated that energy use will have fallen by 12 % compared with the base year of 2011. The principal reason is improved efficiency, in particular in cars and light commercial vehicles. International transport increases, but at a relatively slow pace. Use of petrol decreases sharply, by 56 %, while use of diesel is unchanged.

With regard to the future share of renewable fuels, this depends mainly on fuel prices, production costs, policy instruments, deployment of distribution systems, access to vehicles and deployment of refuelling points and service points. The Swedish Energy Agency estimates that the use of biofuels will almost double by 2030, see Figure 9. It is the use of biodiesel in particular that is estimated to increase. Use of biogas is also expected to increase. It is estimated that the number of rechargeable electric vehicles will increase steadily.

Figure 11. Use of renewable energy for domestic transport 2000-2012 and 2020 and 2030, TWh.



Source: Swedish Energy Agency, report ER 2014:19.

¹⁴ Swedish Energy Agency report ER 2014:19. The agency plans to present updated scenarios in February 2017.

¹⁵ Reporting is done in accordance with Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision 280/2004/EC.

6. National targets for the deployment of alternative fuels infrastructure

Reduced emissions from the transport sector are crucial if Sweden is to attain its long-term climate targets and become one of the world's first fossil-free prosperous nations. To achieve this, Sweden has to have a fossil-free vehicle fleet. A fossil-free vehicle fleet requires a combination of several different measures: a transport-efficient society, improved energy efficiency and a shift to renewable fuels. Extensive efforts will be required on the part of both private and public-sector operators. The lead times are significant. If necessary changes are to be brought about, it is essential that there are long-term and stable ground rules that stimulate economically effective development. An objective of reduced emissions from the transport sector may also drive innovation for the automotive industry and the fuel sector and consequently create new jobs and export revenue.

Sweden has introduced a large number of national policy instruments with the aim of attaining a fossil-free vehicle fleet, see Section 7. The intention is for these policy instruments to lead, among other things, to increased demand for renewable fuels. Where there is demand and the necessary market conditions exist, this demand in turn will lead to investments in refuelling points and recharging stations.

As indicated by the descriptions in Section 4, a sharp increase has taken place in the share of biofuels in the road transport sector. Swedish policy to date has been a strong contributory reason for this trend. There has been a deployment of refuelling points for biofuels needing dedicated infrastructure. Over the course of time, public-sector initiatives have facilitated this deployment. Sales of electric vehicles have also picked up. The share of newly registered electric vehicles in Sweden has been among the highest in the world in certain months. The Swedish recharging infrastructure is also growing, among other things with financial support from the Government's climate investment programme, known as the Climate Leap, which also provides support for refuelling points for renewable fuels.

7. Policy instruments and other initiatives to meet set objectives

The Government considers that policy instruments with a general effect that put a price on greenhouse gas emissions should form the basis for the switch to a fossil-free vehicle fleet. By using policy instruments with a general effect, incentives are created for all the changes indicated above. The Swedish carbon dioxide tax is often mentioned in other countries as a highly effective instrument for reducing greenhouse gas emissions.

Policy instruments with a general effect may need to be supplemented by more targeted instruments. These may, for example, be aid for research, development and demonstration of new technology, emission requirements or financial incentives for the market launch of new technology. These instruments too should be as general and technology-neutral as possible with respect to their purpose.

This section contains a description of the most important national policy instruments for a fossil-free vehicle fleet.

The market for vehicles, ships and aircraft is extremely international, and in many respects global. A switch to a fossil-free vehicle fleet therefore also requires effective policy instruments in an international perspective. Effective EU-harmonised instruments are necessary. An aspect of this is that EU rules need to enable the Member States to promote effectively all types of sustainable biofuels.

Energy and carbon dioxide taxes

Carbon dioxide tax and energy tax are levied on fossil fuels with tax levels as shown in Table 1. These amounts of tax are levied on fuels consumed in motorised vehicles in both the household and business sectors. Certain tax relief is, however, applied to diesel fuel used in non-road mobile machinery in agriculture and forestry and in the mining industry. Energy tax was raised by SEK 0.48 per litre for petrol and by SEK 0.53 per litre for diesel fuel with effect from 1 January 2016. With effect from 2017, the rates of tax on petrol and diesel fuel are to be adjusted in line with GDP growth. This is done through a standardised addition of two percentage points to the consumer price index conversion for both energy tax and carbon dioxide tax, where the greater addition is made to energy tax.

Table 1.

Year	Unit	2013	2014	2015	2016
Energy tax					
Petrol, MK 1	SEK/litre	3.13	3.13	3.25	3.72
Diesel fuel MK1	SEK/m ³	1 762	1 759	1 833	2 355
Fuel oil	SEK/m ³	817	816	850	846
Natural gas, transport fuel	SEK/1000m ³	0	0	0	0
LPG, transport fuel	SEK/tonne	0	0	0	0
Carbon dioxide tax					
Petrol	SEK/litre	2.50	2.50	2.60	2.59
Diesel and fuel oil	SEK/m ³	3 093	3 088	3 218	3 204
Natural gas, transport fuel	SEK/1000m ³	1 853	1 850	2 409	2 399
LPG, transport fuel	SEK/tonne	2 603	2 599	3 385	3 370

With effect from 1 December 2015, all biofuels fulfilling EU sustainability criteria in accordance with Directive 2009/28/EC (hereafter referred to as sustainable biofuels) are fully exempt from carbon dioxide tax.

The exemption from carbon dioxide tax previously applied only up to 5 % by volume of sustainable fuels in petrol and diesel fuel. Sustainable biofuels are to some extent exempt from energy tax, and several changes have been implemented in recent years.

With effect from 1 August 2016, FAME (fatty acid methyl ester) as a low blend in diesel fuel is exempt from 36 % of the energy tax that applies to diesel fuel. The energy tax exemption for low-blend biofuels in petrol is 88 % of the energy tax applicable to petrol. In the case of non-sustainable biofuels contained in petrol or diesel fuel, carbon dioxide tax and energy tax are levied at the same amount per unit of volume as for equivalent fossil fuel. The energy tax exemption for ethanol in E85 is 92 % of the energy tax on petrol. The energy tax exemption for FAME as a high blend in diesel fuel was raised on 1 April 2016 from 50 to 63 % of the energy tax on fossil diesel fuel.

Full tax exemption has applied since 1 January 2015 and applies retroactively to HVOs (hydrotreated vegetable oils and fats) in diesel fuel.

Sustainable biogas is not subject to either carbon dioxide tax or energy tax. The European Commission approved the tax relief for liquefied and gaseous biofuels from the point of view of State aid through decisions in December 2015. These decisions apply until the end of 2018 for liquefied biofuels and until the end of 2020 for biogas.

An important element in efforts to attain a fossil-free vehicle fleet is creating long-term ground rules for sustainable biofuels. Renewable fuels are to be placed on a good footing to compete with fossil fuels, so that a steady increase in the proportion of renewable fuels can be brought about. The Government will therefore draw up proposals for new rules to be met by the economic policy instruments in the area.

Exemption from vehicle tax for certain environmentally sound light vehicles

Cars, light commercial vehicles and light buses with better environmental characteristics, known as green vehicles, are exempt from vehicle tax for the first five years. The tax exemption applies to all private individuals and legal entities owning green vehicles. The tax exemption applies from the time when the vehicle is registered and enters use for the first time and stays with the vehicle when it is sold.

The provision means that new light vehicles are exempt from vehicle tax if the car's carbon dioxide emissions do not exceed a calculated maximum level of emissions in relation to the kerb weight of the vehicle. Vehicles equipped with technology for operation with ethanol fuel or gas fuel, apart from LPG, are allowed to have higher carbon dioxide emissions in relation to the vehicle's kerb weight. To be exempt from vehicle tax, vehicles additionally have to fulfil the exhaust requirements in Euro 5 or Euro 6.

There are currently just over 440 variants of vehicle models fulfilling the requirements to be exempt from vehicle tax. These include, in particular, cars that run on diesel, gas, ethanol and electricity. The proportion of new car sales in 2015 was around 17 %.

Super green car premium

The super green car premium provides assistance towards the purchase of cars with minimum emissions and contributes to increased electrification of the vehicle fleet. The super green car premium is paid on newly registered vehicles and is SEK 40 000 for vehicles with CO₂ emissions of 0 g/km and SEK 20 000 for vehicles with CO₂ emissions not exceeding 50 g/km.

The number of newly registered super green cars in 2015 was 8 700, which is almost double the number in 2014. Around two-thirds of super green cars were plug-in hybrids, and the remainder were pure electric cars.

Bonus-malus system

The Government intends to introduce a bonus-malus system, which represents a substantial higher level of ambition with regard to the environmental effect of vehicle tax compared with the present system, by 1 July 2018. In the bonus-malus system, vehicles with relatively low emissions benefit at the time of purchase, while a higher level of vehicle tax is levied on vehicles with relatively high emissions.

Reduced taxable benefit rate for certain environmentally sound cars

When an employee uses, for private purposes, a car that is put at his or her disposal on the basis of employment or an assignment, a taxable benefit arises. Approximately 25 % of new car sales are accounted for by what are referred to as cars received as a fringe benefit.

Car benefit is calculated, as a rule, in some standardised manner. The intention is for the benefit value in principle to be equivalent to the market value. Exceptions to the rule are made for green cars. This means that the benefit value of green cars is lowered to a level equivalent to the benefit value for the most closely comparable conventional car. The rules, which are permanent, have been introduced to make it easier for green cars to be introduced onto the market. A reduction is additionally made for certain green cars – electric cars, plug-in hybrids and gas-powered cars (not LPG) to a value equivalent to 60 % of the benefit value of the most closely comparable conventional car, but to a

maximum of SEK 16 000 per year. The rules, which are time-limited, apply until the end of 2016. In the Government Budget Bill for 2017 (Government Bill 2016/17:1, budget statement and tax issues), the Government proposes that the time-limited reduction of the benefit value be extended to 2020. It is proposed, however, that the maximum reduction be limited to SEK 10 000 per year.

Lower vehicle tax for heavy vehicles that can run on alternative fuels

The vehicle tax for heavy vehicles is differentiated on the basis of vehicle weight. Hybrid buses, as well as buses and trucks that cannot run on diesel fuel, but can run, for example, on electricity, ethanol and gas, pay only the minimum tax level of SEK 984 per year. This provides an incentive to choose technology with lower carbon dioxide emissions, particularly for buses, where differences in vehicle tax between vehicles powered by diesel and alternative fuels can be great.

Electric bus premium

To promote the market launch of electrically powered buses, the Government introduced an electric bus premium in 2016. A sum of SEK 50 million was earmarked for the electric bus premium in 2016, and is proposed that SEK 100 million be added to the appropriation for the period 2017-2019. A total of SEK 350 million is earmarked.

The electric bus premium is given to a regional public transport authority or a municipality which the regional public transport authority has given powers for the purpose. The premium can be paid for electric buses, plug-in hybrids and trolley buses with a passenger capacity of more than 30. The electric bus premium is to meet part of the additional cost of the electric bus in comparison with a conventional bus. The electric bus premium is not allowed to be combined with other forms of State grant for the acquisition of electric buses. Rules and limits on level of premium can be found in the Ordinance (2016:836) on electric bus premium.

The Climate Leap – support for local climate investments

A State programme for local investments totalling SEK 1 925 million (over the period 2015-2018) was introduced in 2015. In order to be able to implement further projects, the Government has proposed in the 2017 Budget Bill that the Climate Leap be strengthened by SEK 100 million in 2017 and 2018 (Government Bill 2016/17:1 expenditure area 20). It is also proposed that the initiative be extended to 2020. This means that a total further sum of SEK 1.6 billion will be added to the Climate Leap programme.

The Climate Leap is intended to bolster local and regional efforts. The invested resources are to yield the greatest possible climate benefit and above all reduce greenhouse gas emissions. To date, support has been granted in the case of 330 out of a total of around 1 000 applications received. Most relate to building recharging points for electric vehicles, converting from fossil fuel to renewable or expanding the production of biogas. The aid on average meets around 40 % of the total cost of investment.

By August 2016, approval had been granted in response to 230 applications for investment support to establish recharging stations. Each recharging station can have more than one recharging point, and the Climate Leap has contributed to a total of 3 849 new recharging points. Most of the recharging points are for public recharging. To receive support, the recharging points have to be provided at least with the socket outlets and vehicle connectors referred to in Annex II to Directive 2014/94/EU. Over the same period, support was granted for 10 refuelling points for biogas and 11 refuelling points for HVOs.

State aid for sustainable urban environments – urban environment agreement

To encourage the efforts of municipalities on sustainable cities and public transport, the Government has earmarked SEK 500 million per year over the period 2015-2018 in State co-funding for local and regional investments in public transport in built-up areas through a framework for urban environment agreements. Support has been provided, among other things, for recharging stations and stops for electric buses.

In the Budget Bill for 2017, the Government has proposed that the initiative receive a further SEK 250 million of funding in 2017 and SEK 500 million in 2018 (Government Bill 2016:17:1, expenditure area 22). It is proposed that the initiative be broadened to apply also to investments in cycle infrastructure.

Tax relief for shore-side electricity supply

To be allowed to undertake port operations, the operator is required to have an environmental permit. It is common for requirements for the provision of a shore-side electricity supply to be set in the environmental permit. The purpose of the requirements is to create the necessary basis for the use of a shore-side electricity supply with the aim of reducing air pollution in ports.

In addition, Sweden has applied a reduced rate of energy tax since November 2011 for electricity supplied to ships in port (shore-side electricity supply). The aim is create a financial incentive to use a shore-side electricity supply. The lower rate of tax, of SEK 0.05 per kWh, is limited to ships used for professional shipping and with a gross tonnage of at least 400, and where the voltage of the shore-side electricity supply to the ship is at least 380 Volts. At present there are shore-side electricity supply installations at the ports of Gothenburg, Helsingborg, Karlskrona, Karlshamn, Luleå, Malmö, Piteå, Stockholm, Trelleborg and Ystad, among others.

Under the EU Energy Tax Directive¹⁶, the reduction in tax requires the Member State to inform the Commission of its wish, the Commission to examine the measures and submit a proposal to the Council of the European Union and the Council then to decide unanimously on such permission. Such permission may only be granted for a period of six years at a time. Sweden received permission for tax relief until June 2020 during the autumn of 2014.

Environmentally differentiated port and fairway dues

Environmentally differentiated fairway dues have been introduced through agreements between the National Maritime Administration, the Swedish Shipowners' Association and Ports of Sweden. The National Maritime Administration introduced environmentally differentiated fairway dues in 1998, at the same time as several ports in Sweden introduced environmentally differentiated port dues.

There are two parts to the National Maritime Administration's fairway dues. One part is levied on the cargo and another part on the gross tonnage of the ship. The part based on gross tonnage is environmentally differentiated with respect to emissions of nitrogen oxides (NOx) and is lower for ships whose emissions of nitrogen oxides have been reduced to below six grams per kilowatt-hour. A discount on port dues can be granted today to ships operated with cleaner fuel, with cleaning

¹⁶ Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity.

equipment for NOx installed, connecting to a shore-side electricity supply, separating waste and minimising the volume of waste.

To create stronger incentives to reduce the environmental impact of ships, it is important that as many ports as possible in the Baltic Sea Area use the same or similar steering parameters in their charging structures.

It is intended that a proposal for a new system of fairway dues, which steers in the direction of more of the national environmental and climate objectives than the current system, will be introduced in 2018.

Favourable opinion on applications under the Connecting Europe Facility

The Connecting Europe Facility funds initiatives under the Trans-European Networks, in IT, energy and transport.

In Sweden, funding has been provided, among other things, for initiatives such as LNG for ships and for heavy vehicles, refuelling points for biogas, refuelling points for hydrogen and recharging infrastructure for electric vehicles.

The Government is generally in favour of Swedish operators applying for part-funding through the Facility. To be considered for funding, a favourable opinion from the Government is required before an application is sent to the European Commission. A favourable opinion from the Government does not, however, signify any financial commitment unless a project to which the state is a party is concerned.

Support for research, development and demonstration.

There has been a special programme for research and development in the area of energy in Sweden since 1975. This activity includes initiatives from strategically oriented basic research to large-scale demonstration and product and business development. It is the Swedish Energy Agency that is responsible for strategic prioritisation and implementation. The total size of the programme in 2016 is SEK 1.3 billion. The activity is divided at present into six thematic areas, of which the transport sector is one. This thematic area includes, for example, research, development and demonstration of renewable fuels, energy-efficient vehicles and ships, electrification of road vehicles, energy-efficient and resource-efficient transport systems and behavioural aspects. Funding of this thematic area accounted for around one-third of the programme budget over the period 2013-2015.

Electrified roads

An electric road is a road where the supply of power to propel the vehicle takes place continuously during the vehicle's journey. In the short term, the concept of electric roads is of particular interest for heavy goods vehicles and buses that cannot be supplied with electricity solely from batteries. Sweden is the first country in the world to carry out tests with dynamic transmission of electricity to heavy goods vehicles on public roads. A two-kilometre-long electrified test strip was opened on the E16 road outside Sandviken in June 2016. Testing is taking place on this test strip of technology in which a pantograph power collector on the roof of the truck cab feeds the current down to an electric hybrid engine in the truck. Technology in which an electric rail in the road surface powers and recharges the vehicle during the journey is to be tested close to Stockholm-Arlanda Airport. The tests are expected to continue until 2018. They are intended to show how electric roads work in practice and whether the technology can be used in the future. The projects are co-funded by the State, regional bodies and industry.

Assignment to coordinate the switch to a fossil-free transport sector

The Swedish Energy Agency has been allocated special funding to coordinate the switch to a fossil-free transport sector. This task, with assistance from the Swedish Transport Agency, the Swedish Transport Administration, Transport Analysis, the Swedish Environmental Protection Agency, the National Board of Housing, Building and Planning and, where necessary, other affected parties, includes developing a strategic plan for the switch, coordinating the work of switching, conducting a dialogue with relevant stakeholders and stakeholder groups and endeavouring to ensure synergies with other national efforts. The strategic plan may cover, for instance, proposals for legislation, the tasks of authorities or lobbying abroad. The strategic plan is due to be presented to the Government Offices during the spring of 2017.

In June 2015, the Government tasked the Swedish Energy Agency with acting as the national coordinator for recharging infrastructure. Under this assignment, the Swedish Energy Agency has to coordinate support for recharging infrastructure and provide information on the location of recharging stations.

Fossil-free Sweden

The Government has created a platform through the Fossil-Free Sweden initiative for dialogue and cooperation, where stakeholders can demonstrate how they contribute to efforts to combat climate change and challenge others, both in Sweden and abroad. Just over 170 stakeholders are currently taking part. The Government has appointed an inquiry chair who, in the role of national coordinator, is to support the Government in reinforcing and deepening work on the Fossil-Free Sweden initiative. The coordinator's remit entails drawing up plans together with companies and other stakeholders that lead to fossil-free status. Particular emphasis is to be put on key sectors in society in which the switch to low emissions is particularly significant.

The Pumps Act

The Act (2005:1248) requiring refuelling points above a particular volume to be able to supply biofuels (the Pumps Act) was introduced in 2006. The aim was to increase the availability of biofuels. Refuelling points selling more than 3 000 cubic metres of petrol or diesel per year were affected in a first stage.

The requirements then became steadily more stringent, with all sales points with a volume of sales in excess of 1 000 cubic metres of petrol or diesel fuel being obliged to supply at least one renewable fuel by 2009. In June 2014, the Riksdag decided to raise the limit for the obligation to supply renewable fuels to 1 500 cubic metres of motor fuel. The Pumps Act provides for the possibility of obtaining an exemption from the obligation to supply renewable fuels.

Possibility of reserving car parks for electric cars

In 2011, the Government adopted new rules for parking spaces and a new road sign showing where electric vehicles can be recharged. These rules make it possible for a municipality or the Swedish Transport Administration to reserve parking spaces intended for the recharging of electric vehicles.

Inquiry on emission-free zones

The Government has tasked the Swedish Transport Agency with proposing ways in which the present-day environmental zone provisions can be developed. This assignment includes presenting proposals

on ways in which the environmental zone provisions can be used to reward quiet and emission-free vehicles, both light and heavy. The inquiry is due to report by 30 November 2016.

Consumer information

The Government wishes to make it easier for consumers to make informed and environmentally sound choices of fuels, and therefore intends to review the options for making information on the environmental impact of fuels mandatory.