

IEA-Advanced Motor Fuels ANNUAL REPORT 2022

Sweden



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Drivers and Policies

The overall goal of Sweden's environmental policy is to be able to pass on to the next generation a society in which major environmental problems have been solved, without increasing environmental and health problems beyond the country's borders. Sweden aims to become one of the world's first fossil-free welfare countries. To achieve this, the transport industry must be freed of its dependency on fossil fuel. Several measures are needed, such as reducing the total energy demand of the transport sector and ensuring that the remaining energy is both renewable and sustainable.

In 2017, Sweden approved a new climate policy framework with a long-term climate goal of no net GHG emissions by 2045, at the latest. What this means is that emissions from activities on Swedish territory will be cut by at least 85% compared with those during the year 1990. To achieve net-zero emissions, flexibility measures are included. For the transport sector, a reduction in emissions of at least 70% by 2030 compared with 2010 (not including domestic air travel) has also been adopted.

In mid-2018, the Swedish government introduced what was known as a *bonus-malus system*, under which environmentally adapted vehicles with relatively low CO₂ emissions were awarded a bonus of up to SEK 70,000 (USD 6,699) at the time of purchase. Under the system, vehicles with relatively high CO₂ emissions (above 90 g/km as of April 1, 2021) were subject to a higher tax (malus) during the first three years. The system included cars, light buses, and light trucks. In November 2022 the newly appointed government canceled the bonus feature.

Another important measure introduced in mid-2018 is the reduction obligation, which entails an obligation for fuel suppliers to reduce GHG emissions from sold volumes of petrol and diesel fuels by incorporating biofuels. In 2022, the reduction obligation was 7.8% for petrol and 30.5% for diesel. For 2030, the levels are 28% for petrol and 66% for diesel. The biofuels included in the reduction obligation system are subject to the same energy and CO₂ taxation as fossil fuels. Biofuels outside the reduction obligation scheme have reduced taxes. As of July 1, 2021, aviation fuels were also subject to the reduction obligation which, in 2022, stood at 1.7%. The new Swedish government intends to lower the reduction obligation according to EU-minimum levels, with new reduction levels expected to be announced in 2023.

Advanced Motor Fuels Statistics

Since 1990, the number of passenger cars in Sweden has increased from approximately 3.5 million vehicles to 5.0 million vehicles. At the same time, GHG emissions from passenger cars were rather stable, remaining at around 13 million tons from 1990 to 2007. However, since 2007, emissions have decreased significantly and stood at about 9.4 million tons in 2021. The main reason for the reduction is the increased energy efficiency of new vehicles and renewable motor fuels.

The fleet of alternative-fueled passenger cars totaled around 520,000 at the end of 2021 (see Fig. 1). In addition, automakers have produced an increasing share of conventional diesel vehicles to be fueled with HVO100. However, no statistics are currently available on the size of this share.

3 THE GLOBAL SITUATION: SWEDEN

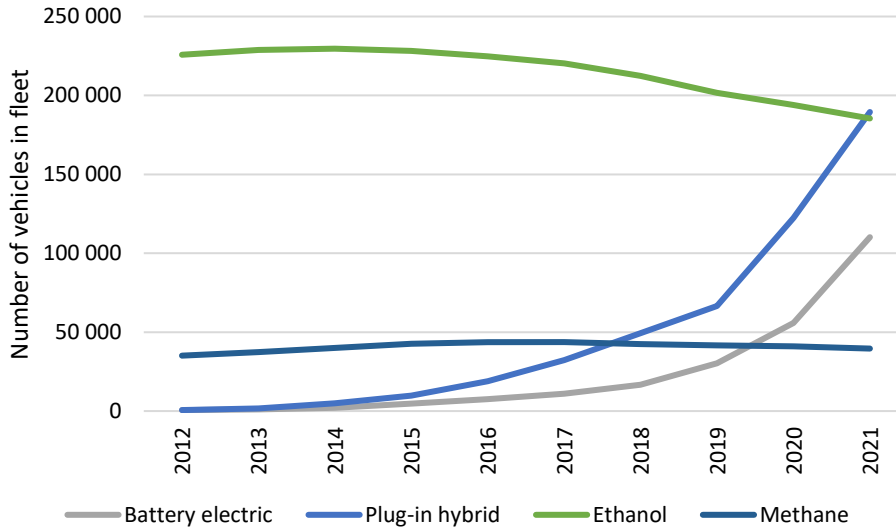


Fig. 1. Number of Advanced Motor Fuel Passenger Cars in the Fleet, 2012–2021

Alternative-fueled vehicles correspond to 11% of the total fleet of passenger cars (excluding diesel cars that can be fueled with HVO100). Light commercial and heavy-duty vehicles make up 3% and 2% of the total fleet, respectively. However, vehicles registered as other than petrol- or diesel-fueled is around 27% of the bus fleet. Diesel-registered buses make extensive use of HVO100.

The use of renewable biofuels and electricity for transport in Sweden amounted to 20.6 terawatt hours (TWh), or 29% of the transportation fuels sold during 2022 (see Fig. 2). Approximately 65% of the renewable fuel used in Sweden during 2022 was hydrotreated vegetable oil (HVO) and fatty acid methyl ester (FAME).

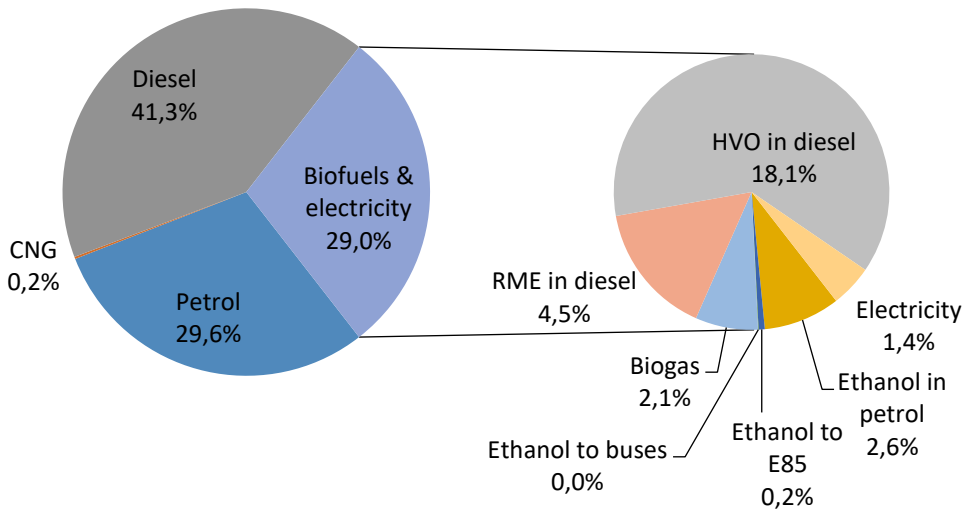


Fig. 2. Fuel Consumption in TWh within the Road Transport Sector, Preliminary Statistics, 2022

When HVO was introduced in the Swedish market, it was produced from crude tall oil from Sweden, Finland, and the United States. As the demand for HVO grew, the number of feedstocks and countries of origin increased. In 2021, the raw materials were, to a large extent, animal waste (63%), with the remaining shares consisting of crude tall oil, palm oil, rapeseed oil, and palm fatty acid distillate, in descending order. The majority of feedstock for HVO is imported, as shown in Figure 3. The average GHG emissions from HVO use in Sweden during 2020 corresponded to around 8g carbon dioxide equivalent (CO₂-eq) per megajoule (MJ).

FAME is primarily produced from rapeseed oil. A preferred feedstock, rapeseed oil's cold climate properties (i.e., cloud point) are more suitable than are many other vegetable oils for the Nordic climate.

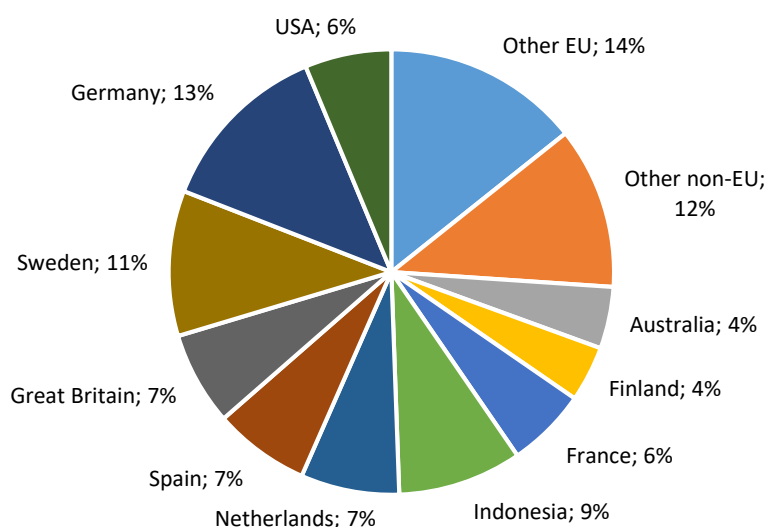


Fig. 3. Country of Feedstock Origin for HVO Consumed in Sweden, 2021

Research and Demonstration Focus

The Swedish Energy Agency has several energy-related research, development, and demonstration programs:

- *Biogas Solutions Research Center* (biogasresearchcenter.se)
- *TechForH2* ([TechForH2 bäddar för framtidens vätgasteknologi | Chalmers](#))
- [CESTAP – Competence centre in sustainable turbine fuels for aviation and power](#)
- Competence centre, Kompetenscentrum katalys (KCK)
- Hydrogen-related: [Pågående uppdrag och satsningar \(energimyndigheten.se\)](#)
- Research program for transport-efficient society, 2018-2023, on a system level. The call does not accept projects that focus on technology development of vehicle or engine technologies.

Outlook

The goal is set high in Sweden, with a reduction in GHG emissions of 70% in 2030 compared with 2010, and no net CO₂ emissions by 2045. Considering the rate of turnover of the vehicle fleet, advanced motor fuels play an important role for reaching these targets.

Additional Information Sources

- Swedish Energy Agency, <http://www.energimyndigheten.se/en/>
- The Swedish Knowledge Centre for Renewable Transportation Fuels, <http://www.f3centre.se/>

Major Changes

In 2017, the Swedish Parliament adopted a new climate law with the following targets:

- No later than 2045, Sweden shall have no net emissions of GHGs to the atmosphere.
- Emissions from domestic transport (excluding aviation) shall be reduced by at least 70% by 2030, compared with 2010.

Benefits of Participation in the AMF TCP

Sustainable and clean energy for transport is necessary to achieve national and international targets. The AMF TCP gives us an arena where we can cooperate with countries worldwide to develop unbiased reports on the effects of various advanced motor fuels.