

Finland

Drivers and Policies

In 2017, total energy consumption in Finland was 1,348 petajoules (PJ), and the share of renewable energy was 36%. Furthermore, road transportation consumed about 163 PJ of energy (i.e., 15% of final energy end use of 1,100 PJ). Transport produces about one-fifth of Finnish greenhouse gas (GHG) emissions, and 92% of transport emissions are from road transport.¹

In November 2016, the National Energy and Climate Strategy outlined the actions that will enable Finland to (1) attain the targets specified in the government programme and (2) set the course for achieving an 80% to 95% reduction in GHG emissions by 2050.³⁷ The government's medium-term climate policy plan targets carbon neutrality for Finland by 2045. The proposed action plan to achieve targets includes using zero- and low-emission cars, renewable fuels, mileage reduction of passenger cars, and sustainable forms of transportation.² Taxes and fees would be increased for those vehicles and modes that produce the most emissions ("polluter pays principle"). Simultaneously, transition into emission-free technologies and sustainable forms of mobility would be supported. Community planning is at the heart of sustainable mobility, namely, minimizing the need for transport, guiding people to move on foot or by bicycle, or using carpooling or public transportation. The action plan includes the following targets:

- In 2030–2045, Finland would have about 670,000–2 million electric cars, 130,000–250,000 gas-fueled cars, about 7,000–42,000 heavy-duty (HD) electric vehicles (EVs), and 6,000–22,000 HD natural gas vehicles (NGVs).
- The share of liquid biofuels would change to 30% of all liquid fuels in 2030 and to 100% in 2045. The use of domestically produced biogas will increase strongly. The sale of fossil transport fuels would be prohibited in 2045.

Advanced Motor Fuels Statistics

The total consumption of gasoline and diesel in Finland in 2017 was 3.8 megatonnes of oil equivalent (Mtoe) (Table 1). In 2017, the actual share of biofuels was about 10.5%,³ while the target for 2017 was 12% (with

¹ <http://www.stat.fi/> and <http://lipasto.vtt.fi>

² Action programme for carbon-free transport 2045. Final report by the Transport Climate Policy working group (in Finnish); www.lvm.fi

³ Not necessarily equal to the formal reporting of biofuel obligation due to different principles and restrictions in data availability due to the EU's rules on competition.

double-counting). The Finnish biofuel obligation allows “banking,” as long as the overall cumulative volumes are met. Finland uses ethanol both as such and as fuel ethers, that is, as ethyl tertiary-butyl ether (ETBE) and tertiary-amyl ethyl ether (TAAE). Finland also uses biogasoline as a blending component. The bioportion of diesel fuel mainly consists of paraffinic renewable diesel fuel.

Table 1 Use of Road Transportation Fuels in Finland, 2017

Gasoline/Diesel ^a (Mtoe)	Ethanol, Ethers and Biogasoline ^c (Mtoe)	Renewable Diesel and Biodiesel ^b Total/Bio ^c (Mtoe)	Methane Total/Bio (Mtoe)
1.3/2.5	0.086	0.310	0.0048/0.0026

^a Includes alternative/bio.

^b Mainly renewable diesel, only minor amount of FAME.

^c Bio = meets EU's sustainability criteria (2009/28/EC; without double-counting).

Source: Tilastokeskus, see also, <http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/>

Finland's total road vehicle fleet in September 2018 was about 3 million (excluding non-road) vehicles (Table 2). This included around 4,100 flex-fuel vehicles (FFVs) capable of using E85, around 6,300 gas vehicles using natural gas or biomethane (or bi-fuel gasoline/methane), and 13,100 plug-in hybrids and 2,700 battery electric vehicles (BEVs). The average age of cars was 12 years in 2017, and the age of cars scrapped was 21 years.

Table 2 Types and Numbers of Vehicles in Use in Finland by December 31, 2018^a

Passenger Cars	Vans	Trucks	Buses	Two-Wheelers	Non-road
2,696,300	325,660	96,170	12,480	279,030	538,420

^a 28% of cars were diesel cars.

Source: Traficom, trafi2.stat.fi/PXWeb/pxweb/fi/TraFi/TraFi_Liikennekaytossa_olevat_ajoneuvot

Renewable Diesel Fuels

Renewable diesel is currently the main renewable component in Finnish automotive fuels.

Neste produces a renewable paraffinic diesel fuel, Neste MY Renewable Diesel, with a worldwide capacity of 2.6 Mtoe/year. Around 80% of Neste's renewable diesel production is based on waste and residue raw materials. Neste MY Renewable Diesel is made 100% from waste and residues, and Pro Diesel contains at least 15% of renewable diesel.⁴

⁴ Neste, www.neste.com/.../neste-my-renewable-diesel, accessed in January 2019

UPM, a pulp and paper company, produces hydrotreated renewable diesel, UPM BioVerno, from crude tall oil in Lappeenranta. St1 Biofuels Oy (Diesel Plus) and ABC (Smart Diesel) refueling stations in Finland sell 10 vol% of UPM BioVerno blended into diesel fuel. Finland uses a small amount of conventional esterified biodiesel (i.e., fatty acid methyl esters [FAME]).

Bioalcohols and Ethers

Fuel ethanol and fuel ethers (fossil and bio-origin) are blended in gasoline in Finland (E10) and sold as E85 for FFVs. RED95 ethanol-diesel has been tested in a limited number of vehicles.

The energy company, St1 Renewable Energy Oy, has four decentralized Etanolix[®] plants using waste from the food industry and one in Gothenburg, Sweden, and one Bionolix[®] plant using biowaste from shops and households as their feedstock (0.5–3.5 ktoe/year/unit ethanol). The Bionolix[®] unit in Hämeenlinna is combined with a biogas production plant.

In 2017, St1 Renewable Energy Oy started its Cellunolix[®] bioethanol production in Kajaani, using sawdust and chips as feedstock. The production capacity of the plant is 10 million liters of advanced ethanol per year. The Kajaani Cellunolix[®] Plant is the first in the world utilizing sawmill residues of softwood in ethanol production in commercial scale. In addition, lignin, wood vinasse, wood turpentine, furfural, carbon dioxide, and biogas are produced in the Cellunolix[®] biorefinery.

Biogasoline

Biogasoline contains only biohydrocarbons (oxygen-free). Small amounts of biogasoline components are produced at Neste's and UPM's renewable diesel processing units and blended in gasoline. Neste produces traffic fuels also using tall oil pitch as a co-feeding feedstock at the Naantali refinery.⁵

Natural Gas and Biomethane

Finland has some 40 methane filling stations, 4 of which offer liquefied natural gas (LNG). In addition to natural gas, renewable methane (biogas) is used for transport.⁶ Renewable methane is mostly distributed though co-feeding into the natural gas grid. LNG terminals have been built for industry and ships in Pori (15,000 metric tons) and Tornio (Manga 50,000 m³).

⁵ <https://www.neste.com/en/neste-oil-uses-tall-oil-pitch-produce-traffic-fuel>

⁶ <http://www.kaasuyhdistys.fi/sisalto/kaasutilastot>

Renewable Jet Fuel

Neste's renewable aviation fuel is refined in Porvoo, and it meets the strict quality requirements for aviation fuels. Partnership in renewable aviation fuel has expanded to Lapland Airports, Air BP, Norway, SFO, Alaska Airlines, Dallas DFW, American Airlines, and Stuttgart Airport.

Electric and Hybrid Electric Vehicles

Helsinki Region Transport (HSL), the public transportation authority in metropolitan Helsinki, has ordered 12 electric buses from the Finnish start-up company Linkker. Operations with Linkker buses started in Espoo in 2015 and in Helsinki in 2017.⁷ The goal is to have 400 electric buses operating in the Helsinki region by 2025 (roughly one-third of the fleet). In the fall 2018 tendering round for bus services, HSL for the first time required a number of electric buses, if only 5, for a certain route. This was the real opening of commercial e-bus services.

Hydrogen

Finland's first commercial hydrogen fueling station opened in 2014 in Helsinki. It is now closed, however, and the only hydrogen fueling station is at Voikoski, and, so far, also the only hydrogen car in Finland.

Research and Demonstration Focus

The TransDigi program, started in 2017, created a collaboration and innovation platform for sustainable, seamless, and safe mobility. The BioOneHundred pilot project, led by HSL and covering 2016–2019, focuses on high-concentration biofuels for carbon-neutral urban traffic. In Helsinki, bus services procured by HSL and the vehicles of Helsinki City Construction Services, Stara, aim at using sustainable biofuels in minimum 50% in 2018 and 70%–90% in 2019. In 2018, the cities of Espoo and Vantaa and also the Finnish Post joined the project.

There are also projects on developing a catalytic pyrolysis technology for upgrading bio-oil. Biomass-to-liquid (BTL)-related projects aim to produce transport fuels from biomass by gasification-based concepts. Neo-Carbon Energy, 2014–2019, creates a new energy system, including the world's first pilot plant capable of producing hydrocarbons from the air by using solar power as the energy source.

⁷ HLS, 2017, "Helsinki's First Fully Electric Bus to Hit the Road in January," www.hsl.fi/en/news/2017/helsinkis-first-fully-electric-bus-hit-road-january-9590

MARANDA (2017–2021) is a hydrogen-related project aiming at hydrogen-fuelled fuel cell-based hybrid powertrain system for marine applications. The LOHCNESS (2017–2019) project studies liquid organic hydrogen carriers aiming at hydrogen storage media compatible with the present infrastructure for liquid fuels.

Outlook

Bioethanol and renewable diesels will be used increasingly as biofuels in Finland. In the long term, cellulosic BTL is expected to cover a significant share of the diesel pool in Finland.

Neste strengthens its global leading position in renewable products with a major investment increasing Neste's renewable product overall capacity in Singapore by up to 1.3 million tons per year, bringing the total renewable product capacity close to 4.5 million tons per year in 2022.

St1 is planning 50-million-liter (~25 ktoe) Cellunolix[®] biorefineries in Nordic countries in the near future and further on in all softwood producing countries in the world. Feasibility studies and environmental impact assessments for three sites — two in Finland and one in Norway — are already processed. North European Bio Tech Oy is also looking into expanding the Kajaani Cellunolix[®] plant. Suomen Bioetanoli Oy plans to build a straw bioethanol plant at Myllykoski, Kouvola (~45 ktoe/year). St1 is planning to invest 50 million liters Cellunolix[®] biorefineries in Nordic countries in the near future.

The LNG infrastructure being built offers opportunities to consider LNG for heavy-duty transportation. A new LNG terminal in Hamina will have a 30,000-m³ LNG storage tank by 2020, and a second 20,000-m³ storage tank may be added at a later date. Finland and Estonia will construct a gas pipeline, Balticconnector, which will enable the opening of Finnish gas markets starting in 2020 (currently, demand in Finland is met only by Russian natural gas). The energy company Gasum increased its shareholding in Skangas to 100%. Gasum is now the leading Nordic LNG provider.

Major Changes

The government's climate change policy plan targeting carbon neutrality in Finland by 2045 was supported by the action plan proposed by an expert group. The proposed actions include, for example, goals of having about 670,000 EVs (also hydrogen and rechargeable hybrids) and 130,000 gas-powered vehicles by 2030. The increase in the share of renewable fuels would be 30% of all liquid fuels in 2030, and a strong increase in domestically produced biogas.