IEA-Advanced Motor Fuels ANNUAL REPORT 2022

Finland



Finland

Drivers and Policies

Finland's 2016 energy and climate strategy calls for a 50% reduction of CO₂ emissions from transport by 2030, the reference year being 2005. The 2019 Government Programme sets a new upper level: Finland will achieve carbon neutrality by 2035 and aims to be the world's first fossil-free welfare society.

In May 2021, the Ministry of Transport and Communications of Finland published a roadmap for fossil-free transport with the goal of halving GHG emissions from transport by 2030, using 2005 as the base year, and to achieve zero emissions by 2045. Roadmap measures include actions to support the procurement of electric and gas-powered vehicles, the distribution infrastructure, pedestrian and bicycle traffic, and public transport. Additionally, assessments cover the impacts of a stricter obligation to distribute renewable fuels, as well as the impacts of remote work, new transport services, and combined transports in freight traffic.²

In spring 2019, the biofuels obligation was revised and the pathway toward 2030 was set. The biofuel target for 2029 and beyond was set at 30%, and this time the target reflects actual energy contributions without double counting. This explains the lower obligation for 2021 compared to 2020 (20%). A separate sub target for advanced biofuels also exists, following the RED II directive: 2% between 2021 and 2023. In 2021, Finland passed a law amending gaseous and liquefied biogas in the transport biofuels obligation beginning January 1, 2022, and passed a law amending electro-fuels in the biofuels obligation beginning January 1, 2023.^{3,4} In September 2022, the government proposed that Parliament increase the renewable fuels blending obligation to 34% in 2030 and onward.⁵ The original biofuels obligation (liquid biofuels) calls for 19.5% biofuels for on-road transportation in 2022. However, due to a sudden increase in fuel prices during the spring of 2022, the government decided to reduce the blending obligation by 7.5%, to 12% for 2022.

In addition, a separate renewable fuels obligation is set for non-road machinery diesel fuels. With the current level at 4%, the original law called for an annual increase of up to 10% in 2030. In November 2022, the government proposed that Parliament increase the renewable fuels blending obligation in non-road machinery use to 30% in 2030 and onward.⁶

As of 2011, the fuel tax system consists of an energy component, a CO₂ component, and a bonus for reduced local emissions. The system favors the best biofuels, but it is still transparent and technology-neutral and can be used in combination with the obligation for liquid biofuels. Passenger car taxation (purchase tax and annual tax) has been CO₂-based (tailpipe) since 2008, providing substantial incentives for battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).⁷

The current government programme promotes renewable fuels utilization via fuel conversion kits. The government has also proposed national legislation modifications for promoting flexi-fuel (E85) and biomethane passenger car conversion kits installations. However, the proposal leaves open the details regarding how motorists with converted cars can demonstrate compliance with safety and emissions.

Advanced Motor Fuels Statistics

In 2021, the energy consumption in domestic transport (all modes together) was 171 PJ, and energy consumption in road transport was 157 PJ, or 3.8 Mtoe (Table 1). Relative to the total final consumption of 1,358 PJ in 2021, the figures were 12.6% and 11.2%, respectively.⁹

¹ https://tem.fi/en/energy-and-climate-strategy-2016

² https://www.lvm.fi/en/-/transport-emissions-can-be-halved-by-2030-through-national-and-eu-measures-1641099

³ https://www.edilex.fi/verohallinnon_ohjeet/2020_1116.html

⁴ https://tem.fi/-/biopolttoaineet-jakeluvelvoitteeseen

⁵ https://www.eduskunta.fi/FI/vaski/HallituksenEsitys/Sivut/HE 174+2022.aspx

⁶ https://www.eduskunta.fi/FI/vaski/HallituksenEsitys/Sivut/HE 297+2022.aspx

Parkkonen, L. (2013). Taxation of petroleum products and vehicles in Finland. CEN/TC 19 Conference. Helsinki, May 27, 2013.

https://www.finlex.fi/fi/esitykset/he/2022/20220291

https://pxdata.stat.fi/PxWeb/pxweb/fi/StatFin/StatFin_ehk/statfin_ehk_pxt_12sz.px/

Table 1. Energy in Road Transport, 2021

	PJ	ktoe	Share of fuels (%)	Share of bio (%)	
Petrol (fossil)	47.5	1135	30.1		
Biocomp. petrol	4.6	110	2.9	8.9 of petrol	
Diesel (fossil)	81.3	1941	51.6		
Biocomp. diesel	23.2	554	14.7	22.2 of diesel	
Natural gas	0.40	9.6	0.25		
Biomethane	0.51	12.1	0.32	56.1 of gas	
Σ fuels	152.3	3761		18.0 of fuels	
	PJ	ktoe	Share of total (%)		
Electricity	0.85	20.3	0.5		
Σ fuels	157.47	3638	99.5		
Total	152.7	3,648			

Source: pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin_StatFin_ene__ehk/statfin_ehk_pxt_12sz.px/

In terms of energy, the contribution of biofuels relative to the total amount of actual fuels is 18.0%, varying from 8.9% in petrol (mostly ethanol and some ETBE but also bio-naphtha; the statistics do not give details on this) to 56% in methane. The actual amount was 676, or 18.0% of the fuels, meaning that the greater part of the biofuels used was eligible for double counting.

The four major Finnish players in biofuels are Neste (the world's biggest producer of HVO), UPM, St1, and Gasum. The total production capacity of biofuels in Finland is some 540 ktoe. ¹⁰ Compared to the Finnish consumption of biofuels in 2021, consumption exceeds production. In 2020, total biofuels use in road transport was 402. However, it should be noted that Neste relies mainly on imported feedstocks, whereas UPM, St1, and Gasum use indigenous feedstocks. All Finnish biofuel producers have announced major increases in capacity, either in Finland or abroad.

Table 2 presents the vehicle fleet in use at the end of 2022 (without two- and three-wheelers and light four-wheelers). Table 3 presents the sales figures for new passenger cars in 2015–2022 (revised).

2

https://valtioneuvosto.fi/artikkeli/-/asset_publisher/10616/selvitys-biopolttoaineiden-kustannustehokkaattoteutuspolut-vuoteen-2030

Table 2. Vehicle Fleet in Use at the End of 2022 (without two- and three-wheelers and light four-wheelers)¹¹

Fuel	Cars	Vans	Trucks	Buses	Special vehicles	
Petrol	1,851,355	9,141	2,248	20	267	
FFV/ethanol	4,474	14	120	0	0	
Diesel	719,927	331,612	89,691	10,472	1,309	
Methane	7,038	785	269	63	0	
Methane bi-fuel	8,566	324	101	0	0	
BEV	44,889	1,556	25	550	0	
PHEV petrol	98,353	185	0	0	0	
PHEV diesel	5,685	73	0	2	0	
Other	56	15	163	5	0	
Total	2,740,343	343,705	92,617	11,112	1,576	
Fuel	Cars (%)	Vans (%)	Trucks (%)	Buses (%)	Special vehicles (%)	
Petrol	67.6	2.7	2.4	0.2	16.9	
FFV/ethanol	0.2	0.0	0.1	0.0	0.0	
Diesel	26.3	96.5	96.8	94.2	83.1	
Methane	Methane 0.2		0.2	0.5	0.0	
Methane bi-fuel	ethane bi-fuel 0.3		0.1	0.0	0.0	
BEV	1.6	0.5	0.0	4.9	0.0	
PHEV petrol	3.6	0.1	0.0	0.0	0.0	
PHEV diesel	EV diesel 0.2		0.0	0.0	0.0	
Other	r 0.0		0.2	0.0	0.0	

Table 3. Sales of New Passenger Cars, 2015–202212

Year	Petrol	FFV	CNG	Diesel	HEV P	HEV D	PHEV P	PHEV D	BEV
				38,797			400		243
2015	66,248	105	158	30,797	2,817	29	400	15	243
2016	7,3251	14	165	39,451	4,668	11	1115	93	223
2017	70,520	1	433	36,060	8,512	2	2,401	152	502
2018	73,065	0	1,161	28,710	11,631	224	4,797	135	776
2019	67,751	0	2,142	20,871	14,582	990	5,807	159	1,897
2020	45,589	0	1,841	14,133	17,371	1,354	12,797	435	4,245
2021	30,757	12	909	8,397	25,871	2,235	19,519	620	10,152
2022	19,244	27	595	5,418	24,084	1,626	15,770	401	14,530

In 2022, 81,694 new cars were sold – approximately 17% fewer than in 2021. Diesel shares of new sales continue to decline and in 2022 represented only 6.6%, compared to 35.7% in 2015. Increasing new sales of PHEVs stopped and totalled around 30% of total new sales. BEVs are becoming more popular, and sales have increased year over year. In 2022, BEVs represented about 18% of total new sales.

Finland has some 490 alternative-fueled trucks, including FFVs and bi-fuel vehicles. Methane-fueled trucks represent the greatest share. In addition, the numbers for these two categories are explained by the fact that some heavy pickup trucks and vans are registered as trucks. With the development of LNG

 $^{^{11} \ \}underline{https://tieto.traficom.fi/fi/tilastot/ajoneuvokannan-tilastot?toggle=K\%C3\%A4ytt\%C3\%B6voimat}$

¹² https://www.aut.fi/tilastot/ensirekisteroinnit/ensirekisteroinnit kayttovoimittain/henkiloautojen kayttovoimatilastot

refueling infrastructure and increased offerings of heavy gas trucks, trucks fueled by LNG now operate on Finnish roads. The number of trucks fueled by CNG and LNG grew from 134 in 2020 to 269 in 2022. In the case of buses, the number of battery electric buses has surpassed the number of CNG buses. The increase of electric (city) buses has been rapid. The year 2020 saw a total of 87 electric buses and in 2022, already 550.

Research and Demonstration Focus

Below are presented some major national R&D projects where VTT is taking part. There are number of additional projects as well.

In 2020, Business Finland funded a new project on liquid electrofuels. The E-Fuel project (2021–2022) aims to develop integration of hydrogen production through high-temperature electrolysis with CO₂ sequestration and Fischer-Tropsch fuel synthesis; the project also includes research on end use.

The BIOFLEX project (2020–2022) explores how suitable fuel oils made from biomass and waste plastics are for power plants and ship diesel engines. The project studied the development of production processes as well as measurements of the emissions when using new biofuels in marine engines.

The Clean Propulsion Project (2021–2023), funded by Business Finland, focuses on developing maritime and non-road engine technologies for better efficiency and renewable fuels. The project has four focus areas:

- 1. Developing a roadmap for sustainable shipping.
- 2. Investigating and developing multiple power source propulsion systems, including hybrid technology demonstration.
- 3. Formulating novel combustion concepts and exhaust gas after-treatment technologies close to zero emissions. Different fuel options are investigated, including hydrogen in non-road applications.
- 4. Developing a virtual sensor and control algorithm for increased powertrain efficiency and full deployment of renewable fuels.

The NoDamageTruck project (2022–2024), funded by Business Finland, focuses on developing an electrically assisted trailer axle for heavy-duty vehicle purposes to improve energy efficiency of ICE-powered vehicles and improve work productivity. The focus is on typical Nordic countries' vehicle applications, i.e., vehicles with gross weight up to 76 tons. The project includes formulating a flexible and rapid design methodology for combining model-based development with experimental testing activities for speeding-up the overall development process. The project also includes a simulation-based evaluation of the potential of e-axles in different HDV applications, such as timber, long-haul, and rock transport. The e-axle concept will be demonstrated on an experimental basis.

The DeCARBO project (2022–2024), funded by Business Finland, investigates the most suitable technologies for decarbonization non-road mobile machinery in mining, harbour, and forestry use cases. The project consists of four focus areas.

- 1. Foresight and scenario investigation for offering guidance on possible future development paths.
- 2. Research on the most potential technological solutions for decarbonization of NRMM in different use cases and operational environments. In particular, the study looks at different options for off-grid environment NRMM applications.
- 3. Hydrogen fuel-cell and renewable fuel ICE power generation options for off-grid power generation needs.
- 4. Techno-economic analyses for evaluating not only the technical attributes but also the economic feasibility.

Outlook

Finland has to reduce its CO_2 in the non-ETS sector by 39% by 2030. This puts pressure on emission reductions in transport. Biofuels – or, in more general terms, renewable fuels – are seen as a very important element in emission reductions in transport. With its new liquid biofuels mandate written into law in spring 2019, Finland is one of the few countries with a fixed biofuels policy articulated through 2030. In parallel with increasing the amount of biofuels, energy efficiency and electrification in transport are promoted as well.

In the newest government program, much attention is given to the circular economy and biogas, so the country has the political will to promote the use of biomethane in transport. Opening up the gas market (gas transmission and sales separated) as of 2020, a new pipeline connector to Estonia, and terminals for LNG important open up new possibilities for methane in stationary as well as mobile applications on land and at sea. Currently, the Finnish LNG vessel fleet encompasses some 10 LNG-fueled ships, including passenger and cargo ships, one icebreaker, and one border patrol vessel. At the end of 2020, a biogas obligation for transport and heating gas was proposed. If passed, the new law would require that future biogas be mixed in the national gas grid.

Finnish energy companies have a record of being active in the field of biofuels. New capacity is to be expected within the borders of Finland and abroad.

During 2022, green hydrogen and e-fuels production took a new step ahead as many new investment plans were published. In total, currently planned capacity will be over 1 GW for green hydrogen and over 500 MW for green methane production. In addition, there are investment plans for green ammonia production. Green methane is targeted to support green fuels use in HDVs.

To support e-fuels production, over 2400 MW of new wind power capacity was installed during 2022. At the end of 2022, the total peak power capacity of wind power was around 5700 MW in comparison to around 12 000 MW capacity of traditional sources (CHP, condensing power, hydro, and nuclear). Wind power capacity is expected to be increased to around 9000 MW by 2025. 14

Major changes

Finland's energy and climate strategy calls for a 50% reduction of CO_2 emissions from transport by 2030, and a new upper-level target for the country to be CO_2 -neutral by 2035. A renewable fuels (incl. liquids and biomethane) law for road transport calls for an actual energy share of 34% renewable fuels by 2030. A separate sub-target of 10% is set for advanced biofuels. In addition, the law for non-road machinery fuels calls for a 30% share of renewable fuels beginning in 2030. This legislation signals that Finland is implementing one of the world's most progressive biofuels policies. Additionally, the government emphasizes a circular economy and the development of biogas.

¹³ https://figas.fi/en/gas-market

⁻

¹⁴ Investment decision made before 4.1.2023