



# IEA-Advanced Motor Fuels ANNUAL REPORT 2021

Finland

## Finland

### **Drivers and Policies**

The 2016 energy and climate strategy calls for a 50% reduction of CO<sub>2</sub> emissions from transport by 2030, the reference year being 2005.<sup>1</sup> The [2019 Government Programme](#) sets a new upper level: Finland will achieve carbon neutrality by 2035, and aim 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. Measures of the roadmap 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.<sup>2</sup>

The current biofuels obligation (liquid biofuels) calls for 18% biofuels in 2021. In spring 2019, the biofuels obligation was revised, and the pathway toward 2030 was set. The biofuel target for 2029 and beyond is 30%, and this time the target reflects actual energy contribution without double counting. This explains the lower obligation for 2021 compared to 2020 (20%). There is also a separate sub target for advanced biofuels 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 electrofuels in the biofuels obligation beginning January 1, 2023.<sup>3,4</sup> In addition, a separate biofuels obligation is set for non-road machinery diesel fuels. The current level is 3%, and it will increase on a yearly basis up to 10% in 2030.

As of 2011, the fuel tax system consists of an energy component, a CO<sub>2</sub> component and a bonus for reduced local emissions. The system favors the best of biofuels, but it is still transparent and technology neutral, and it can be used in combination with the obligation for liquid biofuels. Passenger car taxation (purchase tax and annual tax) has been CO<sub>2</sub>-based (tailpipe) since 2008, providing substantial incentives for BEVs and PHEVs.<sup>5</sup>

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### **Advanced Motor Fuels Statistics**

In 2020, the energy consumption in domestic transport (all modes together) was 166 PJ, and energy consumption in road transport was 152 PJ or 3.6 Mtoe (Table 1). Relative to the total final consumption of 1,018 PJ in 2020,<sup>7</sup> the figures were 16.3% and 14.9%, respectively.<sup>8</sup> In 2020, total CO<sub>2</sub>-eq emissions were 47.1 Mt. The emissions from transport were 10.3 Mt (all modes together) and 9.8 Mt (road), which are 22.0% and 21.0%, respectively.<sup>9,10</sup>

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

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

<sup>3</sup> [https://www.edilex.fi/verohallinnon\\_ohjeet/2020\\_1116.html](https://www.edilex.fi/verohallinnon_ohjeet/2020_1116.html)

<sup>4</sup> <https://tem.fi/-/biopolttoaineet-jakeluvelvoitteeseen>

<sup>5</sup> Parkkonen, L. (2013). Taxation of petroleum products and vehicles in Finland. CEN/TC 19 Conference. Helsinki, May 27, 2013.

<sup>6</sup> <https://www.lvm.fi/en/-/transport-emissions-can-be-halved-by-2030-through-national-and-eu-measures-1641099>

<sup>7</sup> [http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin\\_ene\\_ehk/statfin\\_ene\\_pxt\\_12sz.px/](http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin_ene_ehk/statfin_ene_pxt_12sz.px/)

<sup>8</sup> [http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin\\_ympp\\_khki/statfin\\_khki\\_pxt\\_111k.px/](http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin_ympp_khki/statfin_khki_pxt_111k.px/)

<sup>9</sup> [http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin\\_ympp\\_khki/statfin\\_khki\\_pxt\\_111k.px/](http://pxnet2.stat.fi/PXWeb/pxweb/fi/StatFin/StatFin_ympp_khki/statfin_khki_pxt_111k.px/)

<sup>10</sup> <http://lipasto.vtt.fi/en/liisa/index.htm>

Table 1. Energy in road transport in 2020

	PJ	ktoe	Share of fuels (%)	Share of bio (%)
Petrol (fossil)	47.2	1127	31.0	
Biocomp. petrol	3.8	90	2.5	7.4 of petrol
Diesel (fossil)	87.9	2100	57.7	
Biocomp. diesel	12.6	301	8.3	12.5 of diesel
Natural gas	0.35	8.4	0.23	
Biomethane	0.40	9.6	0.26	53.3 of gas
Σ fuels	152.3	3638		11.0 of fuels
	PJ	ktoe	Share of total (%)	
Electricity	0.41	9.8	0.3	
Σ fuels	152.3	3638	99.7	
<b>Total</b>	<b>152.7</b>	<b>3,648</b>		

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 11.0%, varying from 7.4% in petrol (mostly ethanol and some ETBE but also bio-naphtha; the statistics do not give details on this) to 53% in methane. The actual amount was 402 ktoe or 11.0% of the liquid fuels, meaning that the greater part of the biofuels used was eligible for double counting.

The four major Finnish players in biofuels are Neste (being the world's biggest producer of HVO), UPM, St1 and Gasum. The total production capacity of biofuels in Finland is some 540 ktoe.<sup>11</sup> Compared to the Finnish consumption of biofuels in 2020, Finland is more than self-sufficient in the production of biofuels. 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 2021 (without two- and three-wheelers and light four-wheelers). Table 3 presents the sales figures for new passenger cars in 2015-2020 (revised).

<sup>11</sup> [https://valtioneuvosto.fi/artikkeli/-/asset\\_publisher/10616/selvitys-biopolttoaineiden-kustannustehokkaat-toteutuspolut-vuoteen-2030](https://valtioneuvosto.fi/artikkeli/-/asset_publisher/10616/selvitys-biopolttoaineiden-kustannustehokkaat-toteutuspolut-vuoteen-2030)

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Table 2. Vehicle fleet in use at the end of 2021 (without two- and three-wheelers and light four-wheelers)<sup>12</sup>

Fuel	Cars	Vans	Trucks	Buses	Special vehicles
Petrol	18,84698	9,440	2,145	20	20
FFV / ethanol	4,486	4,486	4,486	4,486	4,486
Diesel	751,779	751,779	751,779	751,779	751,779
Methane	6,351	6,351	6,351	6,351	6,351
Methane bi-fuel	8,025	8,025	8,025	8,025	8,025
BEV	22,921	22,921	22,921	22,921	22,921
PHEV petrol	72,363	72,363	72,363	72,363	72,363
PHEV diesel	4,626	4,626	4,626	4,626	0
Other	42	42	42	42	42
Total	2,755,349	2,755,349	2,755,349	2,755,349	2,755,349
Fuel	Cars (%)	Vans (%)	Trucks (%)	Buses (%)	Special vehicles (%)
Petrol	68.4	2.7	2.3	2.3	2.3
FFV / ethanol	0.2	0.2	0.2	0.2	0.2
Diesel	27.3	96.7	97.1	96.6	84.1
Methane	0.2	0.2	0.2	0.5	0.0
Methane bi-fuel	0.3	0.1	0.1	0.0	0.0
BEV	0.8	0.2	0.0	2.6	0.0
PHEV petrol	2.6	0.0	0.0	0.0	0.0
PHEV diesel	0.2	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.1	0.0	0.0

Table 3. Sales of new passenger cars in 2015 - 2021<sup>13</sup>

Year	Petrol	FFV	CNG	Diesel	HEV P	HEV D	PHEV P	PHEV D	BEV
2015	66,248	105	158	38,797	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

The share of alternative fuel vehicles (PHEVs, HEVs, NGVs, FFVs) ranges from 18.0% (cars) to 0% (special vehicles). Among passenger cars, HEVs form the largest alternative vehicle group.

From 2019 to 2020, petrol increased and diesel dropped, whereas registrations of BEVs and hybrid vehicles, including HEVs and PHEVs, increased. There are some 400 alternative-fueled trucks, including FFVs and bi-fuel vehicles. The numbers for these two categories are explained by the fact that some heavy pick-up trucks and vans are registered as trucks. With the development of LNG refueling infrastructure and increased offerings of heavy gas trucks, trucks fueled by LNG have entered Finnish roads. The number of trucks fuelled by LNG grew from 134 in 2020 to 214 in 2021. In the case of buses, the number of battery electric buses has surpassed the number of CNG buses.

<sup>12</sup> <https://www.trafficom.fi/fi/tilastot/ajoneuvokannan-tilastot>

<sup>13</sup> [https://www.aut.fi/tilastot/ensirekisteroinnit/ensirekisteroinnit\\_kayttovoimittain/henkiloautojen\\_kayttovoimatilastot](https://www.aut.fi/tilastot/ensirekisteroinnit/ensirekisteroinnit_kayttovoimittain/henkiloautojen_kayttovoimatilastot)

#### **Research and Demonstration Focus**

In 2020, a new project on liquid electrofuels was granted funding by Business Finland. The E-Fuel project (2021-2022) aims to develop integration of hydrogen production through high-temperature electrolysis with CO<sub>2</sub> sequestration and Fischer-Tropsch fuel synthesis, and 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. Development of production processes as well as measurements of the emissions when using new biofuels in marine engines are studied.

Between 2018 and 2021, VTT coordinated IEA AMF Task 57 “Heavy Duty Vehicle Evaluation,” which concentrated on energy efficiency, CO<sub>2</sub> and pollutant emissions of state-of-the-art HDVs among the AMF member countries<sup>14</sup>. The project covered a broad range of fuel options, including diesel, HVO, B20, ED95, LNG, CNG and different combustion modes. Independent of fuel type, the concepts based on compression ignition (diesel process), including HPDI dual-fuel, deliver rather high efficiency. In regards to tailpipe (TTW) CO<sub>2</sub> emissions, HPDI dual-fuel delivers on average close to 20% lower emissions than diesel. In addition, latest Euro VI trucks are capable of regulated emissions clearly below the legislative target values. Combined with state-of-the-art HDV powertrains, renewable fuels provide an effective measure for reducing GHG emissions in well-to-wheel (WTW) bases. Hence, HDV CO<sub>2</sub> regulations that focus only on tailpipe emissions constitute a barrier for further development of alternative-fueled trucks. This could halt development of clean and efficient engines for dedicated alternative fuels, resulting in a preference to use drop-in fuel in the legacy fleet and electrification for new trucks entering the market. The project also studied the impacts of vehicle size and relative loading, which are often dismissed. Increasing high capacity transportation (HCT) with a gross vehicle weight rating (GVWR) higher than the typical European 42-ton truck would be a cost-effective way for reducing CO<sub>2</sub> emissions per ton-km transported goods.

The MARANDA project (2017-2021), a hydrogen-related project examining hydrogen-fueled fuel cell-based hybrid powertrain system for marine applications, is still active. The H2020 (2019-2022) Flagship project will install a total of 1 MW hydrogen-powered fuel cells on two vessels located in France and Norway; the ships will operate commercially for 18 months during the project.

From 2017-2021, Business Finland ran a program called “[Smart Energy Finland](#).” The program brought together the services for technical development and exports and aimed to grant €100 million to smart energy solution innovations. The program also granted support for the international expansion of growth-oriented companies that possess growth potential and feature renewable energy and smart energy solutions in their product portfolio. The scope of the program was quite wide, and transport-related issues were only a minor part of the program. However, one subtheme of the program was “sustainable bioenergy solutions,” covering both biogas and advanced liquid biofuels. Another subtheme was dealing with batteries, thus having couplings to the transport sector.

The Clean Propulsion Project (2021-2023), funded by Business Finland, is focusing on development of maritime and non-road engine technologies for better efficiency and renewable fuels. The project has four focus areas. The first focus area includes developing a roadmap for sustainable shipping. The second focus area includes investigation and development of multiple power source propulsion systems, including hybrid technology demonstration. The third focus area covers novel combustion concepts and exhaust gas after-treatment technologies close to zero emissions. Different fuel options are investigated including hydrogen in non-road applications. The fourth focus area covers the development of virtual sensor and control algorithm for increased powertrain efficiency and full deployment of renewable fuels.

#### **Outlook**

Finland has to reduce its CO<sub>2</sub> 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 all the way to

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<sup>14</sup> [https://www.iea-amf.org/content/projects/map\\_projects/57](https://www.iea-amf.org/content/projects/map_projects/57)

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 circular economy and biogas, so there is a political will to promote the use of biomethane in transport. Opening up of the gas market (gas transmission and sales separated<sup>15</sup>) as of 2020, a new pipeline connector to Estonia, and terminals for LNG import open up new possibilities for methane in stationary applications as well as in mobile applications on land and at sea. Currently, the Finnish LNG vessel fleet encompasses some 10 LNG-fueled ships, including passenger and cargo ships, as well as one icebreaker and one border patrol vessel. At the end of 2020, biogas obligation for transport and heating gas was proposed. If passed as law, it would require that future biogas be mixed in the national gas grid.

The 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.

#### **Major changes**

Energy and climate strategy in Finland calls for a 50% reduction of CO<sub>2</sub> emissions from transport by 2030, and a new upper level target for Finland is set to be CO<sub>2</sub> neutral by 2035. A liquid biofuels obligation law calls for 30% biofuels (actual energy share) in 2030. There is also a separate sub target of 10% for advanced biofuels. This means that Finland is implementing one of the most progressive biofuels policies in the world. Additionally, the government emphasizes a circular economy and the development of biogas.

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<sup>15</sup> <https://figas.fi/en/gas-market>