



Green energy regional markets development – Green ReMark project (1.12.2018–30.11.2020)

HOW ELECTRIC PASSENGER CARS IN TRAFFIC USE ARE SUBSIDIZED IN FINLAND

2019

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1 INTRODUCTION

This article is part of the Green Energy Regional Markets Development (Green ReMark) project funded by the South-East Finland–Russia CBC 2014–2020 programme and project partners. The aim of the project is to promote cooperation across the borders between the EU Member State Finland and the Russian Federation. The Green ReMark project supports the growth potential of the new and attractive green economy, its commercialization, and awareness raising. The Green ReMark project partners are Peter the Great St. Petersburg Polytechnic University, the South-Eastern Finland University of Applied Sciences, Miksei Oy and Neva Energy Ltd.

As a result of the project, cooperation and networks between different energy producers, public authorities and energy consumers will grow and regional market opportunities can be anticipated and exploited strategically. The project will identify the weaknesses and strengths of future energy distribution networks and strengthen the region's potential for green energy use in the near future.

The challenges of climate change are globally recognized and scientifically proven. International efforts have been made to reach agreements to curb greenhouse gas emissions as well as global warming. One part of reducing greenhouse gas emissions is limiting traffic-related CO₂ emissions. Traffic CO₂ emissions can be reduced by low-emission vehicles. In order to respond to agreed CO₂ emissions targets in Finland, both EU and national legislation can be used to increase the number of low-emission vehicles and at the same time reduce greenhouse gas emissions. Increasing the number of electric cars is part of the Finnish Government's solution to cut CO₂ emissions from traffic. This article discusses Finland's national subsidies for electric cars and their infrastructure. It also deals with Finnish municipal subsidies for electric vehicles. Municipal support for electric vehicles varies in different parts of Finland. Often the larger cities in Finland are most comprehensive support for electric vehicle use.

The article points out that Finland is slightly above the EU average in the proportional number of electric cars, but Nordic countries, such as Norway and Sweden, where support for electric cars is higher, have higher numbers of electric vehicles. The impact of transport on greenhouse gas emissions reduction is also highlighted. SITRA's (The Finnish Innovation Fund) study shows that low-emission vehicles can be a cost-effective way to reduce CO₂ emissions in Finland.

In the near future Finland needs a change in traffic to low-emission vehicles in order to meet its international and national emission targets. Many valuable calculations and studies have been done to increase the low-emission vehicle fleet and curb greenhouse gas emissions. There has been a positive development in the number of electric cars, which has doubled every year since 2010 in Finland. However, further legislative support from Finland and the EU is needed both for electric cars and their infrastructure to achieve the desired targets, in terms of the number of electric cars and hence the reduction of CO₂ emissions.

Municipalities also have a big role to play in enabling the use of electric cars. For this reason, it would be important to take account of municipalities in electrifying the vehicle fleet and to extend good municipal electric vehicle practices to the whole country.

2 FINLAND NEEDS TO REDUCE CO₂ EMISSIONS FROM TRAFFIC

2.1 Environmental agreements globally

Climate change is a global challenge. As a solution, global climate agreements have been agreed. Until 2020, the EU's climate policy will be guided internationally by the Kyoto Protocol to the UN Climate Convention, and within the EU by the 2020 climate and energy package. By 2030, the target is to reduce greenhouse gas emissions by at least 40% of 1990 levels. In addition to the concrete orientations of the 2021–2030 Climate and Energy

Package, the European Commission's Roadmap for a Low Carbon Economy by 2050 envisages future climate policy in EU and in Finland. (Ministry of the Environment 2018).

With the Paris Agreement, Finland has pledged with the other agreement parties to limit the rise in the average global temperature to well below 2° Celsius above pre-industrial levels and to pursue efforts to limit the increase to 1.5° Celsius. According to a report from the Intergovernmental Panel on Climate Change (IPCC) all countries must undertake rapid and strong measures to reduce emissions. (SITRA 2018a).

2.2 Finnish national climate change policy

Finland's national climate change policy is based on international and EU policies on climate change. Each year, Finland reports to the European Commission and the UNFCCC Secretariat on the progress made in cutting greenhouse gas emissions. Statistics Finland is responsible for the national monitoring of greenhouse gas emissions, and it also compiles on a regular basis a country report on policy measures concerning climate change in Finland. (The Ministry of the Environment 2019a).

2.3 Finnish national CO₂ reduction targets

In publications of the Ministry of Economic Affairs and Employment 12/2017, the Finnish Government outlines the actions that will enable Finland to attain the targets specified in the Government programmed and adopted in the EU for 2030, and to systematically set the course for achieving an 80–95% reduction in greenhouse gas emissions by 2050.

Finland will phase out the majority of its use of coal for energy. The share of transport biofuels will be increased to 30%, and an obligation to blend light fuel oil used in machinery and heating with 10% of bio liquids will be introduced as the publication suggests. The report outlines that the minimum

aim is to have 250,000 electric and 50,000 gas-powered vehicles on the roads. The electricity market should be developed at the regional and the European level. The flexibility of electricity demand and supply, and, in general, system-level energy efficiency will be improved.

The share of renewable energy in the end consumption should increase to approximately 50% and self-sufficiency in energy to 55%. The greatest non-ETS (Emission Trading System) reductions in emissions will be achieved in the transport sector, and this will be the foundation of the medium term climate policy plan the report underlines. (Ministry of Economic Affairs and Employment 2017).

2.4 Reducing CO₂ emissions from transport in Finland

The medium-term climate policy plan (KAISU) was completed in September 2017 and approved by Parliament in March 2018. KAISU, together with the national energy and climate strategy completed at the end of 2016, implements the goals of the Finnish Government's climate and energy policy. The plan outlines the necessary measures to reduce greenhouse gas emissions in the non-ETS sector, i.e. transport, agriculture, heating and waste management. (Ministry of the Environment 2019b).

KAISU highlights that outside emissions trading, the best way to reduce emissions is through traffic, which now accounts for about a fifth of Finland's greenhouse gas emissions. It accounts for 40% of the burden-sharing sector's emissions. The objective is to reduce transport emissions by half by 2030 compared to 2005. The reduction potential is greatest in road traffic, where actions are specifically targeted. (Ministry of the Environment 2019b).

The plan outlines that emissions will be reduced by replacing fossil fuels with renewable and low-emission fuels and by improving the energy efficiency of vehicles and the transport system. Subsidies for electric cars are available, and the conversion of old cars to bio- and flex-fuel cars is being promoted. The construction of electric charging stations, biogas filling stations and the

addition of electric vehicle recharging points for housing cooperatives will be accelerated. (Ministry of the Environment 2019b).

2.5 Cost-effective traffic transformation in Finland towards low emission vehicles

In Finland the CO₂ emissions from the three largest sectors account for nearly three-quarters of GHG emissions: industry CO₂ emissions cover 27%, power and heat 26% and transport 20% of national GHG emissions in CO₂.

SITRA's study (Cost-efficient emission reduction pathway to 2030 for Finland) suggests that transport's share of Finland's CO₂ reduction should be 6.2 MtCO₂ abatement, a 25% share of the total targeted emissions reduction. The study recommends that diesel and gasoline vehicles are rapidly and extensively replaced by battery electric vehicles and plug-in hybrids both in consumer and commercial use, reaching 800,000 electric passenger cars, 200,000 trucks and almost 8,000 buses on Finnish roads by 2030. Electric trucks, buses and passenger cars could realize an abatement of about 4.6 MtCO₂ by 2030, while increasing the biofuel blending rate to 30% and internal combustion engine (ICE) efficiency improvements could realize another 1.6 MtCO₂.

The study analysis covers 65% of Finnish GHG emissions. Domestic aviation, marine and rail transport, heat-only plants and industries excluding steel, refining, cement, ethylene, and pulp and paper are left outside the SITRA study.

Substantial reductions in emissions through electric vehicles and wind power cost-neutral or cost-negative emission reduction levers, i.e. measures that result in net lifetime cost savings at the system level, have an abatement potential of up to roughly 50% of 1990 emissions. Road transport electrification will become the single most economical abatement lever as a result of the rapidly decreasing cost of battery packs that the SITRA report predicts. Wind power will be the most economical option for electricity

production, including new capacity needed to meet the increased power demand from transport electrification (SITRA 2018).

To be in line with international CO₂ reduction commitments, Finland will also need traffic transformation to low emission vehicles to cut emissions. The SITRA study (Cost-efficient emission reduction pathway to 2030 for Finland – opportunities in electrification and beyond) shows that electrical transportation could be one of the most cost-effective measures to cut CO₂ emissions in Finland.

The horizontal axis shows the abatement potential of the technology switches and the vertical axis displays the average abatement cost as EUR/tCO₂ for each switch. The CO₂ price of the EU ETS is included in the cost of measures for industry and power and heat. The measures have been ordered according to their cost. Transport and power and heat yield large cost-negative abatement, while industry measures have higher costs.

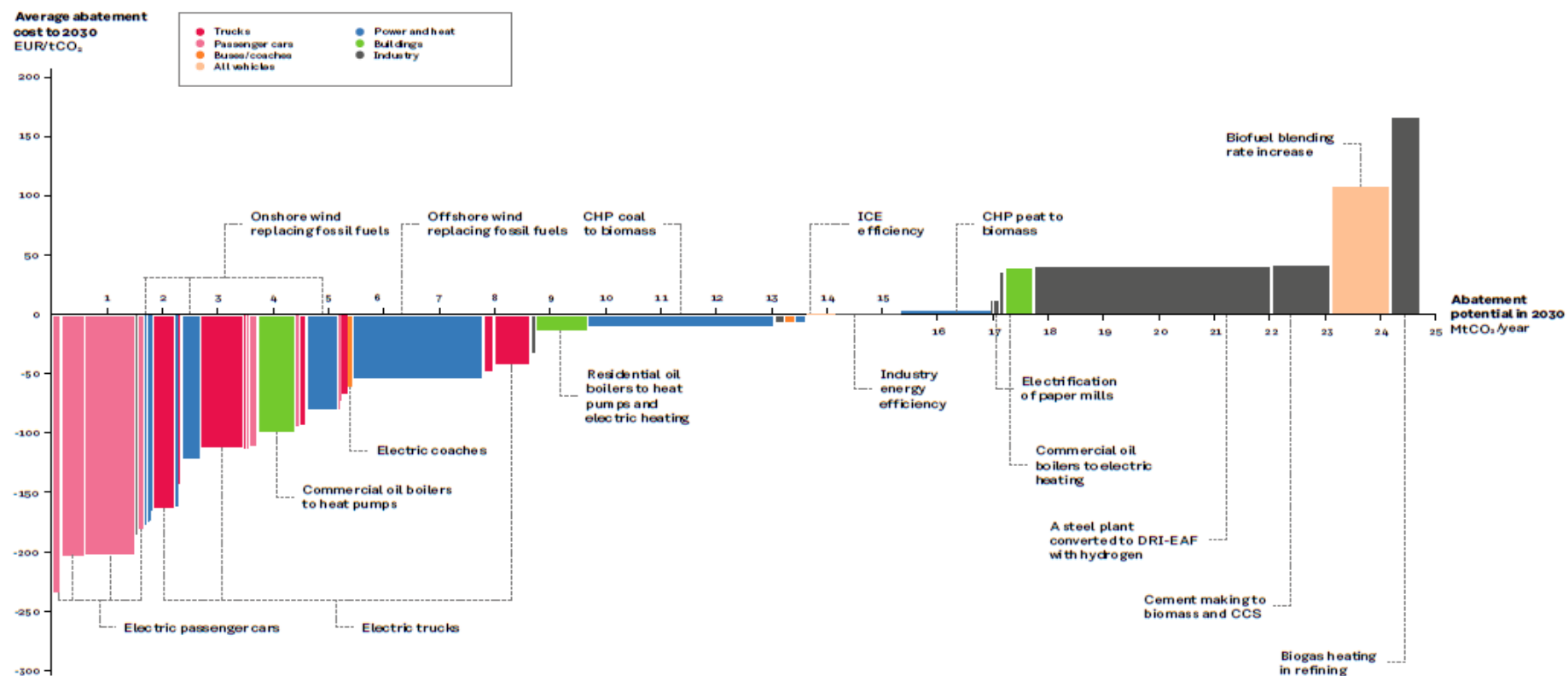


Figure 1. Electric passenger cars average abatement costs to 2030 EUR/tCO₂ (SITRA 2018)

3 ELECTRIC CARS AS A PART OF TRAFFIC CO₂ EMISSION REDUCTION IN FINLAND

As a solution to reduce GHG emissions and fulfil climate agreements, the Government has implemented an action plan based on ministry statements. The Government has introduced various measures to encourage companies and private people to have more low emission vehicles. One of these Government measures in Finland is to invest in subsidies to increase the low emission car fleet and the electric vehicle infrastructure in Finland.

3.1 Current situation and the number of electric passenger cars in traffic use in Finland

The total number of electric cars in Finland has grown slowly since 2010. The number of electric passenger cars in traffic use by the end of the year 2018 was 15,499 pcs. Battery electric vehicles were 2,404 pcs and plug in hybrid vehicles 13,095 pcs. However the number of electric passenger cars in traffic use has more or less doubled every year since 2010. (Finnish Transport and Communications Agency 2019a).

Table 1. *The number of electric passenger cars in traffic use at the end of the year. (Finnish Transport and Communications Agency 2019a)*

Year	battery electric vehicles	plug in hybrid vehicles
2010	23	0
2011	56	0
2012	109	128
2013	169	296
2014	360	569
2015	614	973
2016	844	2441
2017	1449	5719
2018	2404	13095

The majority of electric cars are bought as new in Finland but an increasing trend is to import used electric cars from Sweden, Germany or Holland.

Table 2. *Used electric cars in traffic use imported to Finland 1.1.2017–28.2.2019. (Finnish Transport and Communications Agency 2019b)*

Used electric cars imported to Finland			
Driving power	2017	2018	1.1.–28.2.2019
Electric	158	212	55
Hybrid electric/petrol	676	2,127	576
Hybrid electric/diesel	122	409	139

Considering the number of electric cars, Finland has been left behind by some Nordic and EU countries. For example, Sweden and Norway have invested more in purchase subsidies for electric cars to increase their electric car fleet than Finland. In Sweden and Norway, subsidies and advanced infrastructure for electric vehicles have encouraged consumers to make the transition from combustion to low emission electric vehicles. Even if the total number of electric cars is modest in Finland, electric cars' relative share of car sales is better when compared to EU countries. In EU countries, the relative share of PHEV (Plug-in Hybrid Electric Vehicle) and BEV (Battery Electric Vehicle) sales was highest in Sweden, Belgium and Finland, with shares of 5.5%, 2.7% and 2.6% of national car sales in 2017. (The European Environment Agency 2018).

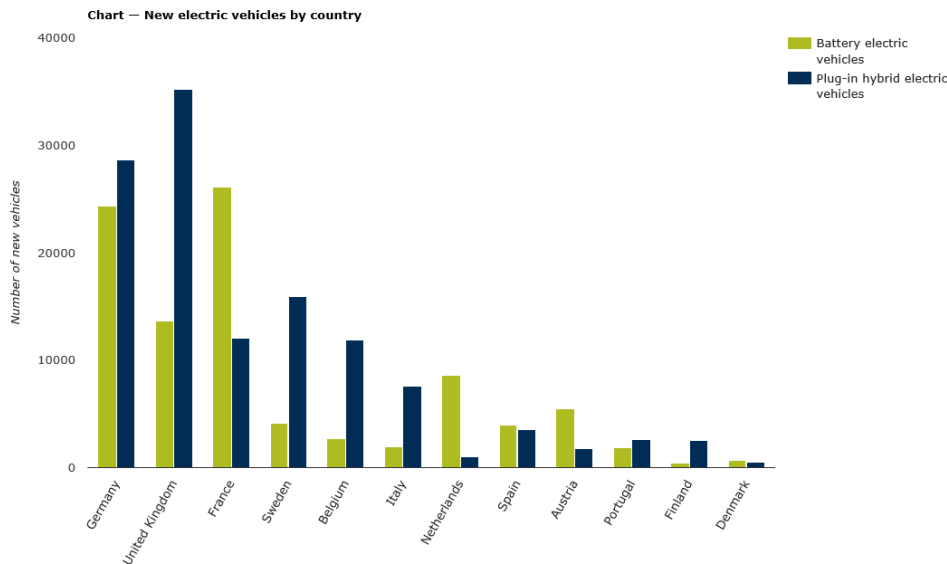


Figure 2. The number of new electric vehicles sold by country in 2017. (The European Environment Agency, 2018)

4 SUBSIDIES FOR ELECTRIC PASSENGER CARS IN TRAFFIC USE IN FINLAND

To achieve the desired level of low emission vehicles, including electric cars, the Finnish Government has set higher duties for high-emission vehicles. On the contrary, electric passenger cars in traffic use are subsidized by reducing electric car-related taxes and purchase subsidies. There are also various communal support mechanisms and ARAS (The Housing Finance and Development Centre of Finland) investment subsidies for electric vehicle infrastructure.

5 PURCHASE SUBSIDIES

5.1 Purchase subsidy for electric passenger cars in traffic use

The purchase subsidy for electric passenger cars was introduced at the beginning of 2018. For the period 2018–2021, people who are either buying a new electric passenger car or signing a long-term lease agreement for an electric passenger car may receive a €2,000 purchase subsidy from the Finnish Government. (Finnish Transport and Communications Agency 2019c).

5.2 Buying an electric passenger car

When buying an electric passenger car the purchase subsidy is received directly as a discount on the price of the electric car being bought.

The conditions for the purchase subsidy are that:

- the car is a fully electric passenger car
- the buyer or leaser is a private individual
- the leaser commits to leasing the car solely for their own use for a minimum of three years
- the total cost of the car is no more than €50,000 (including VAT and car tax)
- the car has not been registered before
- the car is registered for the first time between 1.1.2018 and 30.11.2021; it is permissible that the order or sale contract or long-term lease agreement was made before this date
- a scrapping premium has not been used for purchasing the car
- there is money still available from the funding allocated in the government budget for paying subsidies. A total of €6 million per year has been allocated for purchase subsidies and conversion subsidies.

(Finnish Transport and Communications Agency 2019c)

5.3 Leasing an electric car

If applying for the subsidy is not possible directly at the car dealership, the service provider may apply for a leased car purchase subsidy by separate application. The subsidy is paid to the service provider's bank account.

The service provider may apply for the purchase subsidy between 1.1.2018 and 30.11.2021. The service provider must apply for the reimbursement from Traficom no more than six months from the time when the car was delivered to the leaser.

The leaser must authorize the service provider to apply for the purchase subsidy on their behalf. The service provider must keep the letter of authorization for inspections for a period of two years. The decision on whether to grant the purchase subsidy is made based on the application, and the leaser is informed of the decision. (Finnish Transport and Communications Agency 2019c).

The leasing service provider must report to Traficom if the lease agreement ends before the three-year period is complete. (Finnish Transport and Communications Agency 2019c).

6 TAXATION FOR ELECTRIC PASSENGER CARS IN TRAFFIC USE

Purchase and operational taxes for electric cars are set mainly in relation to cars' emissions. Both car- and motor-vehicle tax is lower for low emission cars, favouring electric cars. This is expected to increase the size of the electric car fleet in Finland.

6.1 Motor vehicle tax for passenger electric cars in traffic use

Motor vehicle tax for a passenger car is composed of base tax and, in some cases, an additional tax on driving power if the car uses a fuel other than petrol. Cars which weigh under 2500 kg and were brought into use from 1.1.2001 or later have a base tax related to the car's CO₂ emissions. The lower the emissions are, the lower is the base tax. Taxation is method by which the government's persuades car buyers to have a low emission car. (Finnish Transport and Communications Agency 2019d).

Table 3. Examples of base tax in the year 2020, WLTP-measuring. (Finnish Transport and Communications Agency 2019d)

CO ₂ emissions (g/km)	Base tax euro/ year 2020
0	53,29
50	72,63
100	103,66
150	160,96
200	285,43
250	424,49

Another element of motor vehicle tax is an additional tax for driving power. For electricity, it is 1.5 cent/day/100kg. When using electricity + petrol, the tax is 0.5 cent/day/100kg. When using electricity + diesel, the tax is 4.5 cent/day/100kg. For diesel cars, the tax is 5.5 cent/day/100kg and for methane cars 3.1 cent/day/100kg.

This additional tax for driving power is not in line with low emission targets because zero tax on petrol, but on the other hand, battery electric cars have low additional tax for driving power compared to diesel, for example. (Finnish Transport and Communications Agency 2019d).

Table 4. *Additional tax for driving power. (Finnish Transport and Communications Agency 2019d)*

Tax on driving power for passenger cars	
Driving power	cent/day/100kg
diesel	5,5
electric	1,5
electric+petrol	0,5
electric+diesel	4,9
methane	3,1

6.2 Car tax for electric passenger cars in traffic use

In Finland, the car tax is determined on the basis of the general consumer price of the car. The tax rate is based on the information from the car manufacturer's CO₂ emissions (g/km), which correspond to the car's specific fuel consumption (l /100 km) of the combined urban and road cycles. (Veronmaksajain Keskusliitto 2018).

From the beginning of September 2018, CO₂ emissions of new passenger cars, and partly from vans, were measured using the new Worldwide Light Vehicles Test Procedure (WLTP). The transformation in the measurement method was based on European Union legislation. The new measurement method is more accurate than before and describes better vehicle specific emissions.

The amount of the tax rate changes according to the amount of emissions, so that it increases as CO₂ emissions increase. Maximum (48.9 %) and minimum (2.7 %) percentages are set for car tax. (Veronmaksajain Keskusliitto 2018).

Table 5. *Examples of car tax formation according to emissions. (Ministry of the Justice 2018)*

CO ₂ emissions (g/km)	3. - 31.12.2018 tax percentage	1.1.2019 tax percentage
0	3,3	2,7
50	4,9	3,9
100	8,1	6,8
150	17,6	16,8
200	29,7	29,7
250	38,6	38,6

6.3 The electric car as a company car, unlimited benefit

In the case of all-electric vehicles that run entirely on electricity, the taxable value of an unlimited company-car benefit is reduced, by subtracting either 8 cents per kilometre, or alternatively, €120 from the monthly value (The Finnish Tax Administration 2019).

7 SUPPORT FOR ELECTRIC VEHICLE INFRASTRUCTURE IN FINLAND

7.1 Municipal support for electric traffic

Municipalities in Finland support electrical transportation by various methods. One of the municipalities leading support for electric cars is Turku. Turku aims to become a carbon-neutral city by 2040, and electrical transportation is an important part of this target. Decision-makers in Turku think that electric vehicles can significantly reduce not only greenhouse gases, but also particulates and noise emissions from traffic. (City of Turku 2016).

Turku has been implementing its plans to increase electrical traffic in the Turku district. There are a total of six electric buses on the busy line, served by the charging stations at the end stops and at the depot.

Over 20 charging points have been constructed in Turku during the Intelligent Electronic Traffic project. A general plan for a charging station network has been made, which defines the general criteria and priority points for charging stations for electric cars. In Turku certain city district planning regulations require that there have to be charging stations for electric cars in parking areas and reserve for additional points later (City of Turku 2016).

The Turku city group has about ten chargeable shared electric cars in their use and the study shows there is the potential is to increase the number to 150 electric cars. The city takes into account vehicle emissions in public procurement. In the competition for rides in accordance with the Disability Services Act, the service provider must direct rides primarily to electric and hybrid cars at the pre-order phase. The number of electric- and hybrid-taxis in Turku has increased, and there are currently many electric- and hybrid-taxis in Turku. (City of Turku 2016).

Turku has developed its electrical traffic in many projects and with various project partners, for example, in the EU-funded Civitas Eccentric project, which develops the concept of e-traffic, car and bike services and mobility as a service. Its project partners include Munich, Madrid, Stockholm and Ruse, as well as companies and educational institutions. (City of Turku 2016).

Turku's municipal support for electric traffic does not represent the overall situation in Finland. Many cities are implementing plans for the provision of services to electric vehicles, but many rural small municipalities in particular have limited resources to invest in electrical traffic infrastructure.

7.2 ARAS investment subsidies for electric car infrastructure

The Housing Finance and Development Centre of Finland (ARA) has the major responsibility for the implementation of Finnish housing policy. ARA has introduced an

investment subsidy programme for housing cooperatives for the modifications to electrical systems required for recharging points for electric vehicles.

A total of €1.5 million has been reserved in the state budget for grants. The grants will contribute to the increase of households' recharging capacity for electric cars, and to the increase of the electric car fleet in Finland in line with the objectives of the National Climate and Energy Strategy. (ARA 2019).

Applicants for the subsidy may be communities owning a residential building (e.g. housing cooperatives, rental housing associations) and their own parking companies.

The grant will amount to 35% of the actual costs (VAT included) up to a maximum of €90,000. A prerequisite for the grant is that the community builds in readiness for at least five recharging points. A grant may also be obtained for the purchase of chargers. (ARA 2019).

8 THE FUTURE OF ELECTRIC CARS IN FINLAND

8.1 Renewal of the vehicle fleet

The Operational Program for Carbonless Transport by 2045, published in 2018 by the Finnish Ministry of Communications and Transport, has made a series of proposals for actions to be implemented by future governments.

The operational programme suggests that since the reduction of greenhouse gas emissions from transport by reducing traffic performance is estimated to be challenging, and because only a limited amount of biofuel raw materials for sustainable production are available, the main focus in reducing transport greenhouse gas emissions in the medium term will be on transport itself.

The aim is to significantly accelerate the renewal of the vehicle fleet, and that the share of zero and low emission vehicles in the vehicle fleet will increase from a few percent to 100% by 2045.

The numerical targets for zero and low emission vehicles have been estimated by Juhani Laurikkos's background calculations in the Operational Program for Carbonless Transport by 2045 report on the basis of the following assumptions: with the exception of passenger car driving volume, traffic volume is still increasing, biogas is being used as technically and economically feasible in Finland, and the absolute amount of liquid biofuels will not be increased after 2030.

The residual of the required emission reduction is covered by means of transport.

Therefore, the target is about 670,000 electric cars and about 130,000 gas cars in 2030, and about 2 million electric cars and about 250,000 gas cars in 2045. For heavy vehicles, the similar targets are about 7,000 electric and about 6,000 gas cars in 2030 and about 42,000 electric and 22,000 gas cars in 2045. About 50,000 electric vans would be needed for transport in 2030 and 164,000 in 2045, and 14,000 and 41,000 for gas-powered vans. (Laurikko 2018).

Table 6. Modified from Operational Program for Carbonless Transport by 2045 report on background calculations on the evolution of the car fleet. Propulsion distribution of passenger cars in new sales and stock development. (Laurikko 2018)

Registration Year	petrol	FFV	diesel	gas	PHVE(PE)	PHVE(DI)	electric	hydrogen	Checksum
2015	65,9 %	0,10 %	33,2 %	0,19 %	0,36 %	0,02 %	0,27 %	0 %	100 %
2016	67,6 %	0,01 %	31 %	0,1 %	0,94 %	0,10 %	0,22 %	0 %	100 %
2017	68,2 %	0,00 %	29 %	0,4 %	2,03 %	0,13 %	0,42 %	0 %	100 %
2018	66,0 %	0,0 %	27 %	2,0 %	3,0 %	0,1 %	2,1 %	0,000%	100 %
2019	65,4 %	0,0 %	25 %	3,0 %	3,0 %	0,1 %	3,96 %	0,00 %	100 %
2020	65,2 %	0,0 %	22 %	4,0 %	3,0 %	0,1 %	5,28 %	0,00 %	100 %
2021	65,0 %	0,0 %	20 %	5,0 %	3,0 %	0,1 %	6,60 %	0,00 %	100 %
2022	63,7 %	0,0 %	18 %	5,5 %	4,0 %	0,1 %	8,58 %	0,00 %	100 %
2023	63,0 %	0,0 %	16 %	6,0 %	5,0 %	0,1 %	9,90 %	0,00 %	100 %
2024	59,4 %	0,0 %	14 %	6,5 %	7,0 %	0,1 %	13,20 %	0,00 %	100 %
2025	51,5 %	0,0 %	12 %	7,0 %	10,0 %	0,1 %	19,80 %	0,00 %	100 %
2026	43,0 %	0,0 %	10 %	7,6 %	13,0 %	0,1 %	26,84 %	0,00 %	100 %
2027	34,5 %	0,0 %	7 %	8,2 %	16,0 %	0,1 %	33,88 %	0,00 %	100 %
2028	29,0 %	0,0 %	5 %	8,8 %	16,0 %	0,1 %	40,92 %	0,00 %	100 %
2029	23,5 %	0,0 %	3 %	9,4 %	16,0 %	0,0 %	47,96 %	0,00 %	100 %
2030	20,0 %	0,0 %	0 %	10,0 %	15,0 %	0,0 %	55,0%	0,00 %	100 %
2031	15,0 %	0 %	0 %	10,0 %	16 %	0 %	59 %	0,0%	100 %
2032	10,0 %	0 %	0 %	10,0 %	17 %	0 %	63 %	0,0%	100 %
2033	5,0 %	0 %	0 %	10,0 %	18 %	0 %	67 %	0,0%	100 %
2034	2,0 %	0 %	0 %	10,0 %	17 %	0 %	71 %	0,0%	100 %
2035	0,0 %	0 %	0 %	10,0 %	15 %	0 %	75 %	0,0%	100 %
2036	0,0 %	0 %	0 %	10,0 %	8 %	0 %	82 %	0,0%	100 %
2037	0,0 %	0 %	0 %	10,0 %	6 %	0 %	84 %	0,0%	100 %
2038	0,0 %	0 %	0 %	10,0 %	4 %	0 %	86 %	0,0%	100 %
2039	0,0 %	0 %	0 %	10,0 %	2 %	0 %	88 %	0,0%	100 %
2040	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2041	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2042	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2043	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2044	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2045	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2046	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2047	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2048	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2049	0,0 %	0 %	0 %	10,0 %	0 %	0 %	90 %	0,0%	100 %
2050	0,0 %	0,0%	0 %	10,0 %	0 %	0 %	90 %	0,0 %	100 %

8.2 Measures to increase the share of zero- and low-emission vehicles

The Operational Program for Carbonless Transport by 2045 report estimates that the most effective measures to increase the share of zero- and low-emission vehicles are fuel tax increases and procurement subsidies, as they guide, in particular, the decision to purchase a new vehicle.

It is also important to influence at EU level the binding CO₂ limit values for new passenger cars, vans and heavy vehicles, as they control the characteristics of vehicles to be sold at European level. The stricter the limit values, the more zero-emission and low-emission vehicles will be sold.

In addition to influencing the procurement decision for electric and gas vehicles, it is necessary to get the distribution infrastructure in line with customer needs. Therefore, the report also suggests subsidies for the construction of distribution infrastructure, at least in the initial stages.

9 CONCLUSION

To be in line with international climate change commitments, Finland will need traffic transformation to low emission vehicles to cut greenhouse gas emissions. Electric cars can be a substantial part of CO₂ emission reduction. Studies show that up to 25% of the total targeted emission reduction can be achieved with low emission traffic. Electrical transportation could also be one of the most cost effective measures to curb GHG emissions in Finland.

The total number of electric cars in Finland is modest, but has more or less doubled every year since 2010. If it is desired to make further progress towards achieving the required number of electric cars, efforts are needed to increase the number in the electric car fleet. The targets set by Ministries to increase the number of electric vehicles in Finland within the desired timeframe require further efforts to support a low-emission vehicle fleet.

Adequate purchase subsidies for low emission vehicles would speed up the purchase of low emission cars and fuel tax increases would benefit the use of electric vehicles. Lower binding CO₂ limit values for new passenger cars must be regulated at EU level to increase the number of electric cars, and subsidies are needed for the construction of the necessary distribution infrastructure for electric cars.

Municipalities should be involved in the decision-making process for Finnish national electric car strategy, and the best communal practices for the use of electric cars should be introduced nationwide. Municipalities make many practical decisions concerning electric

cars. They decide, for example, electronic public transport, municipal charging networks and parking spaces for electric vehicles and municipal taxi service transports orders made by electric cars.

Reducing greenhouse gas emissions from traffic in Finland by increasing the number of electric vehicles is possible but challenging. In international climate agreements Finland is committed to reducing emissions within a specific timeframe. Within this timeframe, upgrading the Finnish low-emission car fleet is an ambitious, though not impossible task.

For the fleet to be modernized to low-emission vehicles on the desired schedule, subsidies would be needed not only for the purchase of low-emission cars but also for the infrastructure they require.

Both EU and Finnish national strategy and legislation is needed to increase the number of low-emission vehicles, and municipal actors are also required to act, specifically in planning and implementing legislation for the use of electric vehicles.

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APPENDIX 1. FIGURE LIST

Figure 1. Electric passenger cars average abatement costs to 2030 EUR/tCO₂. SITRA. 2018. Available at: <https://media.sitra.fi/2018/11/30103309/cost-efficient-emission-reduction-pathway-to-2030-for-finland1.pdf> [referred to 21.8.2019].

Figure 2. The number of new electric vehicles sold by country in 2017. The European Environment Agency. 2018. Available at: <https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-4/assessment-2> [referred to 28.8.2019].

APPENDIX 2. TABLE LIST

Table 1. The number of electric passenger cars in traffic use at the end of the year. Finnish Transport and Communications Agency. 2019a. Updated 2.1.2019. Available at: <http://www.aut.fi/en/statistics/long-term-statistics/number-of-electric-vehicles> [referred to 21.8.2019].

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