

Electric mobility case study for Slovenia

Developing electric mobility plays an important role for Slovenia since the country wants to become a carbon emission environment in the future. Electric mobility is in consensus with state goals to decrease harmful effects of transportation to the environment. Slovenia has proven through diverse projects that it is an electric vehicles (and mobility) friendly country.

Electricity is an energy source produced in Slovenia and also used in transportation, especially in personal transportation, where it would mean that Slovenia would not need to import other energy sources. The country therefore has a chance to get rid of a global dependence on fossil fuels and become locally self-sufficient.

Slovenia could be energetically self-sufficient as far as personal transportation goes if vehicles would run on electricity. Electric vehicle spends $\frac{3}{4}$ less energy for the same distance as internal combustion vehicle.

Charging infrastructure

Green corridors of Slovenia is a project that helps expanding charging stations network for electric vehicles.

More active promotion of electric vehicles started in spring of 2015. Fast charging station network was established throughout entire Slovenian highway cross at the end of 2015. 26 DC charging stations were built. This is a part of the international project Central European Green Corridors, where 115 fast charging stations were built in participating countries like Austria, Germany, Slovak Republic, Slovenia and Croatia. Nearly all electric vehicles have the option for fast charging and can be charged up to 80% in 30 minutes, which means that people can travel from Ljubljana to Maribor or from Ljubljana to Koper without major delays caused by charging.

Establishing fast charging station network was a major step towards electrified mobility in Slovenia. This step would be impossible without many AC charging stations that are already placed around the country.

We must also know that around 250.000 residents drive less kilometers per day than the average range of more accessible electric vehicles. This means that using only over night home charging would suffice their needs. Or on the other hand, majority of daily migrants use their vehicles to go to work where cars stay on parking lot for more than 8 hours, which is enough to fully charge an electric vehicle on an inexpensive charging station.

Electric vehicles: numbers

With established charging station network, car sales helix has moved upwards. Slovenian car market is offering almost all of established global brands of electric vehicles with their support system of services and salons. This includes BMW i program, VW e-vehicles, Renault-Nissan alliance Zero Emission vehicles, Mitsubishi, Citroen, Peugeot and their take on electric car, as well as Daimler group electric drive cars. Besides those, Tesla models are also holding quite a share in Slovenian EV numbers.

Real sales of electric vehicles began in April 2015. Before that, electric car sales were sparse.

Information from infrastructure ministerial says that there are around 300 electric vehicles and around 70 plug in hybrid cars (end of the year 2015).

In previous years, Eco fund for electric vehicles was depleted quite fast and many were unable to purchase their own electric vehicle. This has changed in 2015 and is valid also in 2016. There will be enough nonrefundable fund for electric vehicle mass. It is expected that electric vehicle sales will increase for huge portions. Infrastructure ministerial and many communes are doing everything in their power to increase number of electric vehicles on Slovenian roads.

It is predicted that in 2050 or even sooner there will be only electric vehicles in Slovenia.

Development by communes

Involvement of communes in electric mobility development is the key for success. They contribute to charging station network, taking the lead with them and they are an example in adopting electric vehicles for their needs. They incorporate them in public transport and are a good example to other companies to encourage them to include electric vehicles in their fleet. Communes are also very important in educational process.

Energy agency of Podravje has started consortium of Slovenian communes that are contributing to the fields of electric mobility. 40 communes are already taking part in it.

Ljubljana

City commune of Ljubljana has developed much further than the rest of the country in regards of electric mobility. Until the end of 2020, 400 charging stations are planned to be

build in and around Ljubljana. 4% parking spots will be equipped with charging stations and designated only for electric vehicles. In 2020, 15% of parking spots will have proper infrastructure for possible future charging stations.

There is a debate going on, whether the yellow track designed only for buses and taxis should also be allowed for electric vehicles and another debate, whether or not electric vehicles should be allowed at Slovenska cesta which is currently open only for public transport.

City commune of Ljubljana is also planning to decrease the price for parking for electric vehicles in garage.

Ljubljana is a green capital of Europe in 2016 and further increases educational projects about sustainable mobility and is one of the few cities that are offering free rides around city center with a small electric vehicle – Kavalir.

Taxi drivers are encouraged to use electric vehicles. In 2015, City commune of Ljubljana organized few days of free taxi rides with Renault Zoe.

Maribor

City commune of Maribor is the second biggest city in Slovenia and is taking part in consortium of communes that develop electric mobility. They plan to restructure the whole mobility city concept in the next ten years. This plan includes many new charging stations for electric vehicles as well as for compressed gas and one for hydrogen cars. They will open mobility center, enable more eco friendly public transport and encourage companies to use electric vehicles or vehicles on compressed gas in their fleet.

City commune of Maribor is in the process of acquiring 30 electric buses for public transport.

Other smaller communes are following the state and few big leaders, and they are developing their own concepts of sustainable and electric mobility. For an example communes Izola and Novo Mesto started using electric vehicles for their needs. Both decided to acquire vehicles from Renault-Nissan alliance.

State incentives

Between 2011 and 2014 ,Eco fund has offered 500.000 € of nonrefundable money for purchase of electric vehicles to initiate energy efficient traffic program. 200.000 € were meant for private people and 300.000 for companies.

This amount has increased in 2015 and even more in 2016. There was 2 million € for companies and 500.000 € for private owners. Nonrefundable financial incentive can be approved for purchase of the new electric vehicles of M1, N1, L7e and L6e category without CO2 emissions from the exhaust. This incentive can also be approved for reworking an existing vehicle into an electric one. State money can also be approved for plug in hybrid vehicles or for electric vehicles with range extended technology, but those must not exceed 50 g CO2/km exhaust emissions. In 2015 the amount of state incentive depended on the vehicle category and ranged from 2.000 € to 5.000 €.

Those amounts increased in 2016. Eco fund has arranged more money to achieve state goal for energy efficient and less pollutant traffic. The nonrefundable incentive money for electric vehicles and plug in hybrid vehicles in 2016 varies between 3.500 € and 7.500€.

Citizen with approved state incentive is also allowed to ask for a loan for environmental investments.

The amount of predicted money for energy efficient vehicles was not completely used in years from 2011 to 2013, yet in 2014 the amount did not suffice the needs.

Renault-Nissan alliance sold the highest number of electric vehicles in Slovenia thanks to Renault Zoe. They say that people decide for an electric vehicle over the conventional one only if it is more friendly for their budget. They say that the biggest problem regarding electric vehicles is the battery price, which is currently still high.

Besides ecological aspects of electric mobility, state of Slovenia sees in it a huge impact on a Slovenian economy. There are many producers of various electric vehicles parts and there is also a well developed Slovenian car cluster. Bills that increase electric vehicle sales numbers and well developed charging infrastructure will definitely influence those companies affected by electric mobility and enable them to be competitive on a global marketplace.

Private incentives

Association of electric vehicle enthusiasts of Slovenia

This is an organization that unites electric vehicle enthusiasts and early adopters. They are trying to popularize electric cars, publishing a guidebook for new electric vehicle owners and attending as well as organizing events connected to electric mobility. They are also more than willing to help with electric vehicle import.

Avant car

Avant car is a technology mobility provider that is offering innovative and affordable solutions, co-creating new mobility trends. The company is the first in region to commit to comprehensive development of electric mobility with the mission of accelerating the shift towards e-mobility paradigm. They own the largest electric vehicle fleet in region and are offering them through innovative business models. Their R&D department explores 5 main pillars on the e-mobility field: education (raising awareness), charging infrastructure, electric fleet availability, business models and renewable resources for energy creation/storage. With its fleet the company already covered more than 1 million zero emission kilometres in 2015.

Andrej Pečjak and Metron institute

Andrej is an innovative privateer that redesigns conventional vehicles into electric ones. He is raising awareness of electric mobility in Slovenia and has also achieved some noticeable results on diverse e-mobility competitions.

Industry

Slovenia is playing an important part in electric vehicle component production. From basic development, to research, development and production of components, production of electric vehicles as well as in sales and maintenance of such technologically advanced vehicles. Slovenian industry has also infrastructure capabilities and good support for this new mobility. State excels at electricity production. More than sole electricity production

capabilities, important is the electricity from renewable energy sources in Slovenia.

Chemical institute made diverse important advances towards different and better battery technology. They are working on lithium-sulfide battery project as a part of two European industrial research projects. Apart from this, they were also approved by Honda for their visionary project for magnesium batteries.

For a further example, companies like Estrel and Avantcar are manufacturing charging stations. Petrol is developing an efficient system to control and supervise charging infrastructure.

Cimos has developed and is producing electric motor carrier for BMW i3. Hella Saturnus is producing front lights for Renault Zoe. Mahle Letrika is producing electric motor for Renault Twizy and so on.

In 2016, there will be first electric car produced in Slovenia company Revoz which is part of Renault.

As we can see, Slovenia plays an important part in electric vehicle development in the worldwide view.

Long and short term goals

Slovenian energy policy names charging station network expansion and electric mobility development as of a high importance.

Green book for national energy program of Slovenia is stating: »Electric energy that would be needed to power expected electric vehicles in 2030 is only 2% of currently spent electrical energy in Slovenia or 6% of energy spent only from low amperage grid.

In 2055 Slovenian energy concept envisions only electric vehicles on Slovenian roads.

National energy program of Slovenia until 2030 for strategic plans for sustainable mobility and energy usage is stating:

- Introduction of electric and hydrogen vehicles in car parks
- Building charging infrastructure for electric vehicles
- Developing charging station network for transit and internal traffic.
- Expanding measurements and requirements for charging stations in projects.
- Development of intelligent and smart traffic networks that enable technical grounds for building proper charging infrastructure for sustainable mobility.

National energy program is also covering supply and demand of energy for traffic. It points out improvement in energy efficiency of vehicles as well as in driving, introducing new energy sources in traffic with establishment of proper charging infrastructure. It envisions

incorporation of electric vehicles and vehicles on other alternative fuels into traffic. All this would decrease local and global environmental pollution.

Goals of the program that regards energy usage in traffic are:

- ensuring 50% of renewable energy sources for charging electric vehicles and hydrogen vehicles until 2015, which was not entirely met and it also plans to reach 100% until 2020 on public charging stations.
- developing energy and charging infrastructure for efficient use of environmental friendly vehicles and building more than 3.000 public charging station till 2020.

The majority of energy needed for electric vehicles for everyday driving can be supplied from domestic charging at home socket or home charging station which is easy and handy. Green book for national energy program is following foreign studies and bills and is forecasting that in 2030 there will be 400.000 hybrid vehicles, 200.000 plug-in hybrid vehicles and 100.000 electric battery vehicles, 100.000 electric vehicles on hydrogen with a battery pack and 100.000 hydrogen vehicles.

In general, traffic policy is executing incentives for energy efficient and environmental friendly transportation.

Economical effectiveness of electric mobility

Higher starting investment in electric vehicle bring along many economical effectiveness like low cost maintenance and low ownership expenses. Battery is the most expensive part of any electric vehicle, yet the technology is advancing. Battery capacity is increasing, price is decreasing, resulting in cheaper electric vehicles in the future.

The main economical benefits of electric vehicles are:

- Low maintenance cost (services)
- No tax for highways at registration
- Possibility of free charging at many locations
- Free parking in city centers and at other places
- Less to none environmental pollution taxes

With current electricity price rate and with all the taxes, driving an electric vehicle and charging it at home, costs from app. 1,5 EUR per 100 km driven. Yet, charging it at almost all charging locations around the state is still free of charge.

Electric vehicle insurance and registration are the same as at internal combustion engine and is based on engine kilowatts, but EVs are exempt from the road tax. In the case of plug in hybrid vehicles, electric engine and internal combustion engine kilowatts are

summed up together.

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