

# Emobility in urban areas comparison of policies and lessons learned

## 1. Introduction

The goal of this article is better understanding of the problematic and development of e-mobility in EU, with the main focus of the role of e-cars in context of the urban areas. With the developing market with electric cars there is a question how to support their position in the market of car market, and how to involve them in the urban areas.

We will analyze the directive and goals of the European Union in the first chapter. Then we will have a look at the statistics and numbers of sales in EU and chosen countries. There we will get the hard numbers and will see the real situation and progress during last years.

After having the framework of the situation with the emobility in European context, we will move to the 4 countries we want to compare. Most importantly Austria, Czech Republic, Norway and Netherlands. There will be presented their policy and we will have more detailed look at the situation in the cities and their policy about integrating e-cars in their infrastructure.

In the last part we will summarize the situation in the 4 countries and we will conduct conclusions and recommended direction for the Czech and Austria approach in the field of sustainable mobility from the environmental and economic point of view.

## 2. EU policy

The EU is supporting the idea of clean mobility for long time and under any circumstances. As best exam the Communication from the Commission to the European Council - A European Economic Recovery Plan from November 2008. In this recovery plan are mentioned 10 areas which should help Europe to beat the economic depression. As the 9<sup>th</sup> area there is 'Developing clean technologies for cars and construction'. As the car industry was hit strongly by the depression, for its recover there were suggested 3 ways how to restore its importance. One of them was supporting research on new technologies, which would allow a breakthrough in the use of renewable and non-polluting energy in the transport segment. *"In addition, the Commission will support the development of a procurement network*

*of regional and local authorities to pool demand for clean buses and other vehicles and speed up the implementation of the CARS21 initiative”<sup>1</sup>*

More recently the issue was popularized by the Energy Union, which aims for the goal of reducing greenhouse gas in many sectors, including transport. <sup>2</sup> As stated in the speeches of the head politics, the focus in transport is mostly focused on electrical vehicles. <sup>3</sup> In the study by European Environment Agency is predicted and estimated the transmission toward electric vehicles in 2050. By that time E-car should pay for 80 % share of the automotive market. While in year 2014 the demand of electricity by electric car was 0.03 % within EU, by year 2030 its estimated to reach 4-5% and by 2050 9.5%.<sup>4</sup>

The EU stated many goals, but it`s mostly national responsibility to come with more specific steps and solutions how to achieve the goals in transport sector. What the EU biggest role is? It`s the foundation of the research programs in the area of electrical vehicles and all alternative sources that could be potentially used for replacing oil in transport sector. More information can be found in the EU research hub.<sup>5</sup>

Another way are international programs such as Electromobility+ run by 11 states (mostly EU), which goals are energy and environmental policy approach, testing, trials and normative standards, technology based innovation. <sup>6</sup>

By the EU fund Horizon 2020 there are regular awarded projects related with electro mobility. Last call was closed on 1<sup>st</sup> of February and 58 proposals were submitted. <sup>7</sup> In Horizon 2020 there is also included program ELENA which aims to support regional or local authorities in accelerating their investment activities in the field of renewable sources. Some city already used this possibility, for example Barcelona used it for financing project of use of electrical buses in the public transport.<sup>8</sup>

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1 EU, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN COUNCIL, A European economic recovery plan, available online 15/4/2017 [<http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008DC0800&from=EN>]

2 [http://europa.eu/rapid/press-release\\_IP-16-2545\\_en.htm](http://europa.eu/rapid/press-release_IP-16-2545_en.htm)

3 [http://europa.eu/rapid/press-release\\_SPEECH-15-5948\\_en.htm](http://europa.eu/rapid/press-release_SPEECH-15-5948_en.htm)

4 <http://www.eea.europa.eu/themes/transport/electric-vehicles/electric-vehicles-and-energy>

5 <https://ec.europa.eu/jrc/en/research-topic/interoperability-and-e-mobility>

6 [http://electromobility-plus.eu/?page\\_id=539](http://electromobility-plus.eu/?page_id=539)

7

<https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-gv-2016-2017.html#c,topics=callIdentifier/t/H2020-GV-2016-2017/1/1/1/default-group&callStatus/t/Forthcoming/0/1/0/default-group&callStatus/t/Open/0/1/0/default-group&callStatus/t/Closed/1/1/0/default-group&+identifier/desc>

8 [http://www.energy-cities.eu/IMG/pdf/reviewelena-eib\\_projects\\_june2015.pdf](http://www.energy-cities.eu/IMG/pdf/reviewelena-eib_projects_june2015.pdf)

In this chapter we want to present current and general policy of EU to the problematic of electric cars. <sup>9</sup> <sup>10</sup>The main goals and directive will be presented. More importantly the grants will be presented. The information about infrastructure will be mentioned as well.<sup>11</sup> Grants - Horizon 2020, ELENA- EIB, CEF, JASPERS, TEN-T, electromobility+ transnational call<sup>12</sup>

### 3. Statistics e-mobility

To get the overview about current situation with E-cars in European Union and some of country of our interest (Austria, Czech Republic, Norway and Denmark) there will be showed data and statistics about the current situation and trends in area of electric cars.

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9 <http://www.eea.europa.eu/themes/transport/electric-vehicles/electric-vehicles-and-energy>

10 <https://ec.europa.eu/jrc/en/research-topic/interoperability-and-e-mobility>

11 <http://oenergetice.cz/elektrina/elektromobilita/evropske-automobilky-vystavi-stovky-rychlonaabijecich-panic/>

12 [http://electromobility-plus.eu/?page\\_id=539](http://electromobility-plus.eu/?page_id=539)

## More than 500,000 electric vehicles on Europe's roads

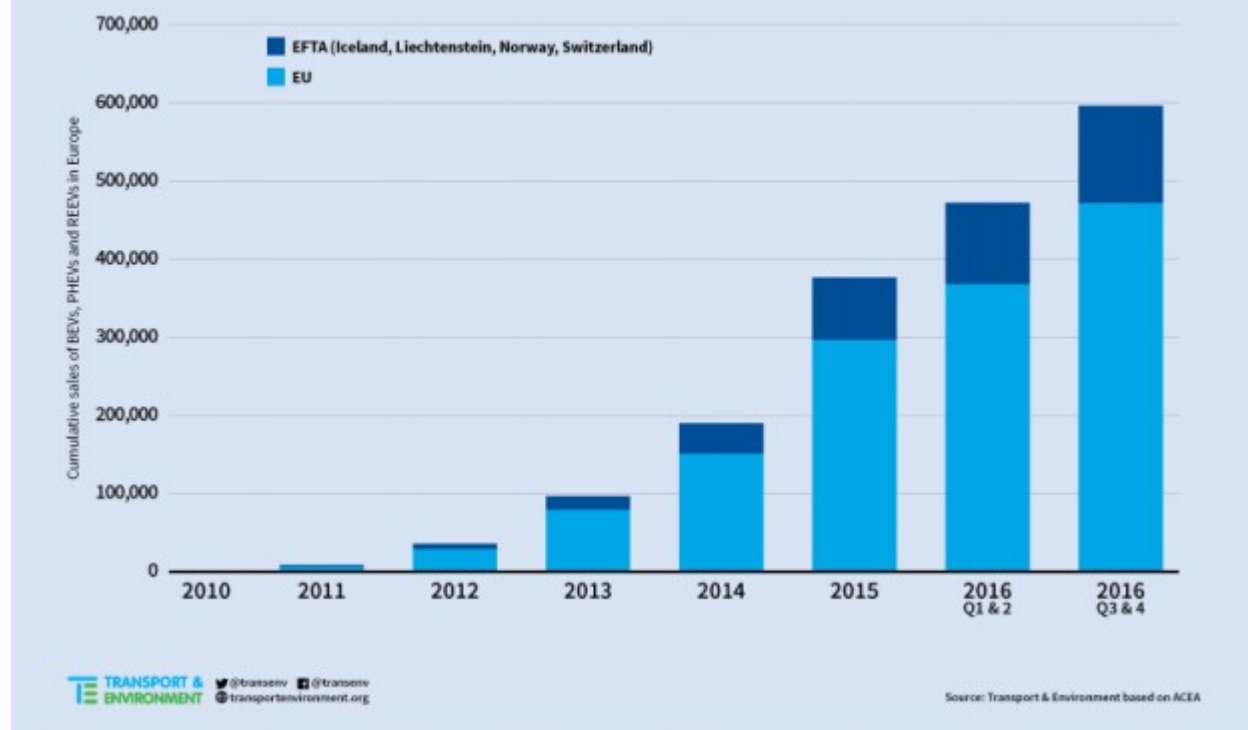
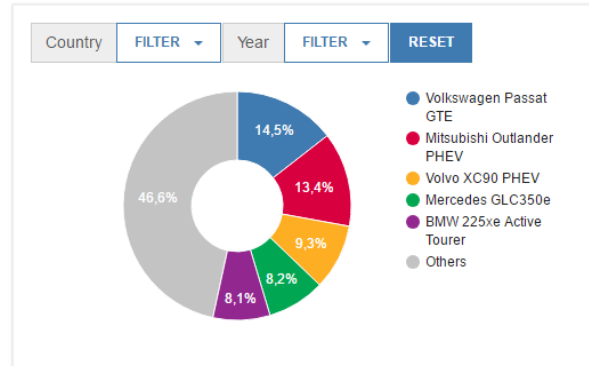
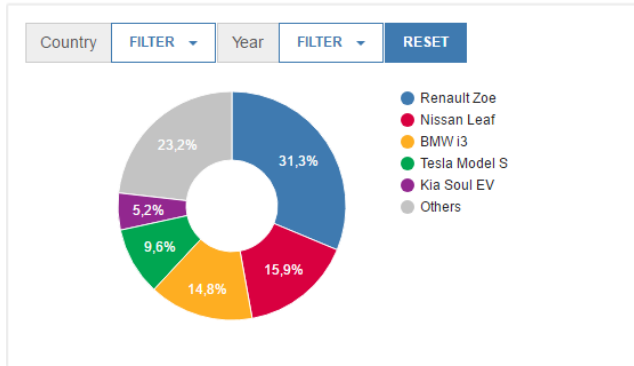


Figure 3: Cumulative sales of plug-in cars in Europe (BEV, PHEV and REEV), source: T&E based on ACEA

The graph shows the current situation of the market with electric vehicles in Europe. The data were collected by ACEA and for year 2016 there were completed with the data from European Environment Agency. There were estimated that the number of sold cars in Europe should be by the end of 2016 roughly 600 000.

For better understanding of the market with electric vehicles we need to distinguish between couple types of electric vehicles. More important for our purposes are these for categories: Battery electric vehicles (BEV), Plug-in hybrids (PHEV), Range-extender electric vehicle (REEV) and Hydrogen fuel cell electric vehicle (FCEV).



1 Top 5 selling BEV and PHEV in EU 2017, source: EAFO

As seen in the figure, the graphics show most sold cars in sector BEV and PHEV in European Union for the current year 2017. The most popular e-cars in category BEV are Renault Zoe with 31 % share, followed by Nisan Leaf 16 % and the third most popular car in battery electric vehicles is BMW i3. In the graph on the right side there are shown most sold Plug-ins. Volkswagen Passat GTE is most popular with almost 15% share, 2<sup>nd</sup> Mitsubishi Outlander with 13 % followed by Volvo XC90 with 9%.

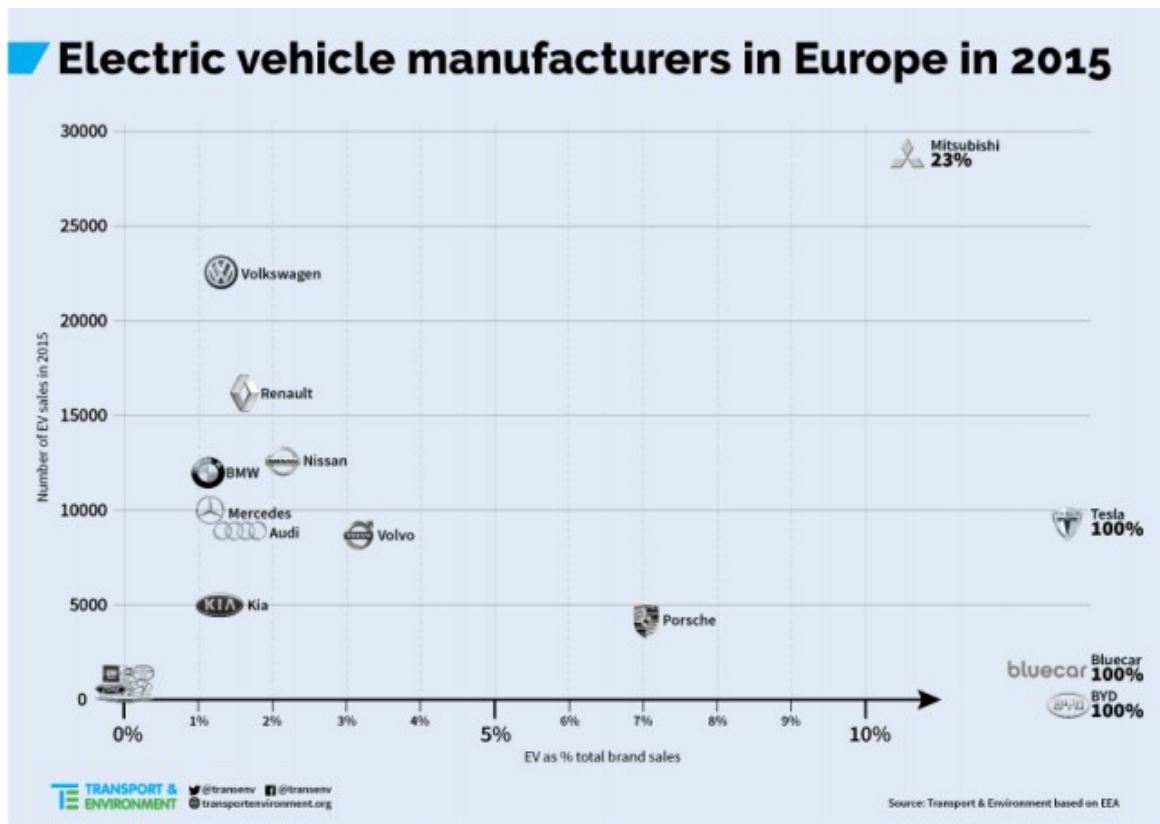


Figure 6: Market position of major manufacturers in the EU EV market in 2015

In figure there is to be observed the position of major manufactures of electric vehicles in EU for year 2015. The Y axe shows the number of sold cars and the X

axe shows the share of EV of the brand portfolio. More sold cars in absolute numbers are accounted for Mitsubishi with nearly 28 000 sold cars, Followed by VW (22 500) and Renault (16 000). When considered the importance of EV of the manufacturer total sells the winner is Tesla with 100 % of EV of its portfolio, which is not surprising. Second is Mitsubishi with 23 % and Porsche with 7% share of EV. While Mitsubishi sold nearly 28 000 cars, Tesla and Porsche combined sold around the half of that amount. (10 000 and 5 000 respectively).

, Czech and Austrian market will be presented data and statistics from the European Alternative Fuels Observatory. From the statistics will be extracted especially number of new registered electric cars, their market share, number of charging points in each region and finally the most sold e-cars.

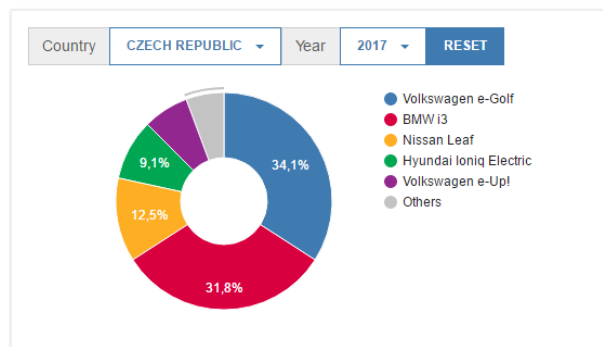
The data used in this paragraph are from the EAFO<sup>13 14</sup> and Eurostat.<sup>15</sup>

## 4. Statistics CZ

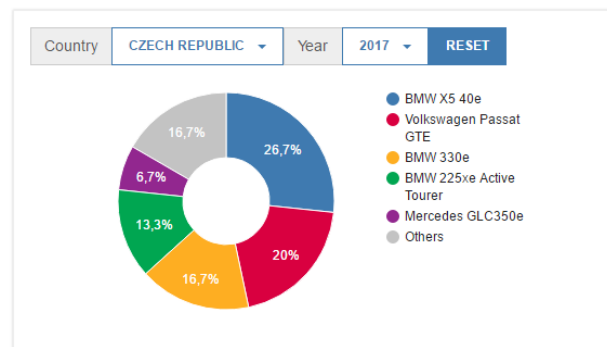
For better knowing the situation of e-mobility in urban areas, especially in Czech Republic and Austria not only data about electric vehicles will be presented but also the data about average duration of charging and energy charged will be shown in following charts.

Data will be used from the website of the electricity distributor in Prague, the company PREDi.<sup>16</sup> And from the biggest distribution company in Czech Republic – group CEZ.

 Top 5 selling BEV



 Top 5 selling PHEV



Obrázek 2 top selling BEV and PHEV cars in Czczh Republic in 2017

From the graphs we can observe that the mix of new electric car is slightly different to the mix of the rest of the world. In the category of BEV is leader Volkswagen e-

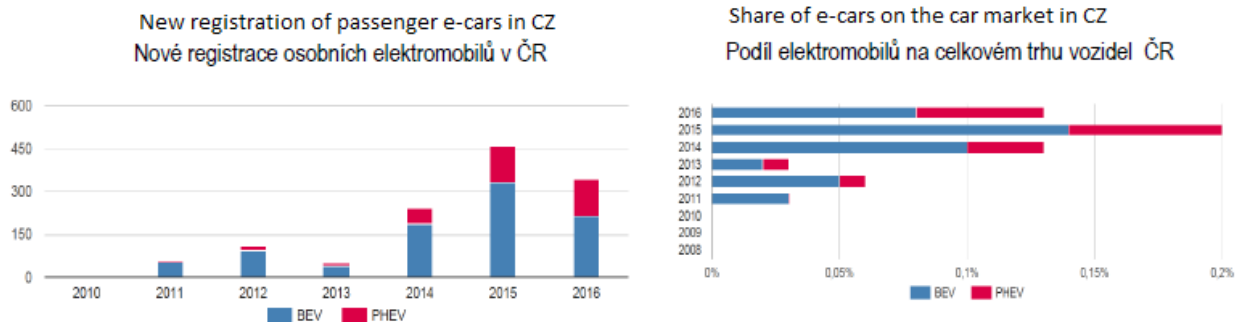
13 <http://www.eafo.eu/europe>

14 <http://www.eafo.eu/vehicle-statistics/m1>

15 [http://ec.europa.eu/eurostat/statistics-explained/index.php/Transport\\_equipment\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Transport_equipment_statistics)

16 [www.premobilita.cz](http://www.premobilita.cz)

Gof with 34% share followed by BMW i3 with similar share of 32 %. In category of PHEV vehicles there is the majority of the market covered by BMW X5, Volkswagen Passat and BMW 330e respectively.

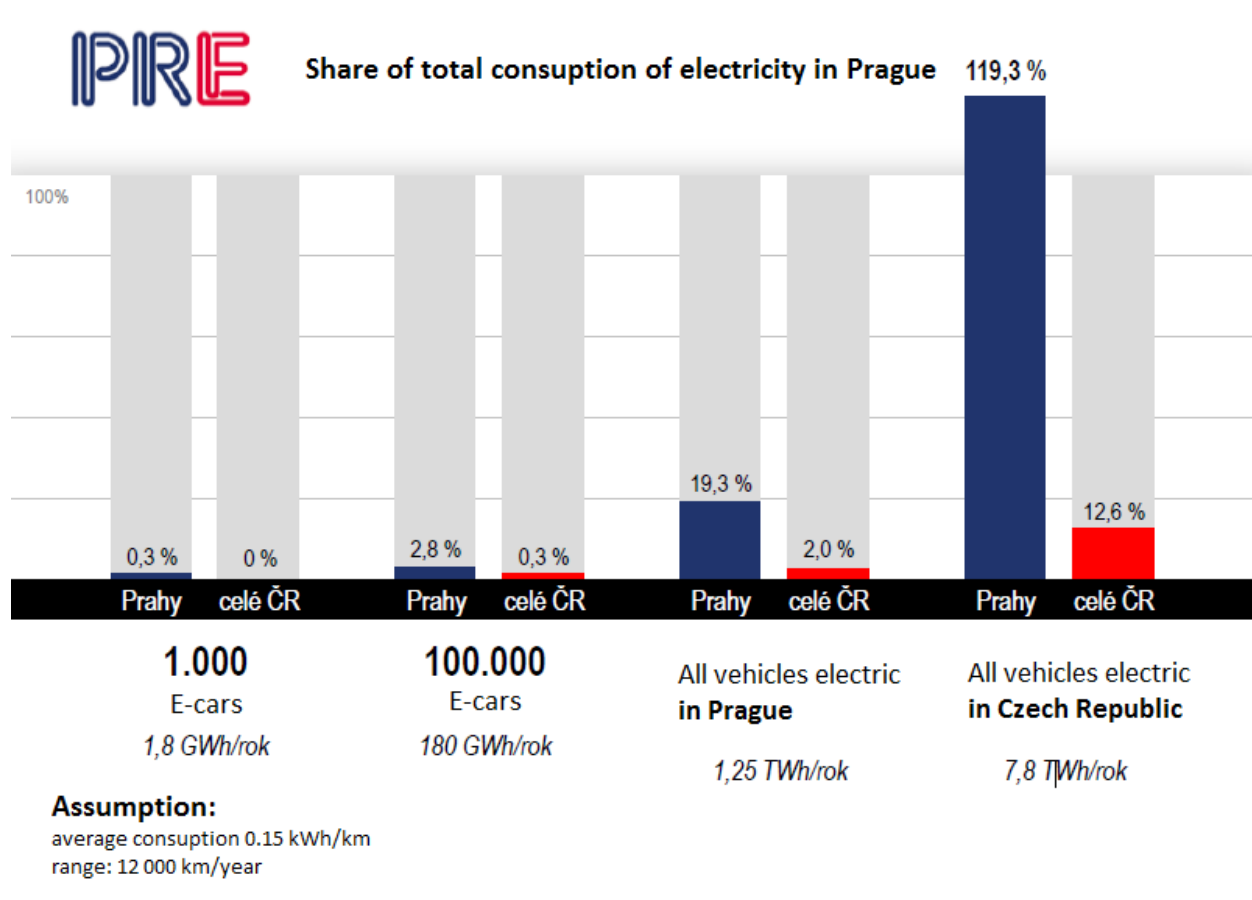


Obrázek 3 share of new e-cars in CZ by 2016, source EAF0

From graphs can be observed that the number of electric vehicle in czech republic is still quite low and in year 2016 was decreasing. Therefor in last year -2016- there was sold 320 e-cars only, this number is about 0.14 % of the share of new cars sold during the same period in Czech republic. Therefore we can't speak about any boom. The technology is obviously new, unexplored and most important - expensive for Czechs. Solutions to the mentioned problem will be covered in next chapter.

Next graphs will show the estimated requirements to distribution network during next years due to the increasing share of e-cars.

## E-cars



We can interpret the graph as follow: the current situation doesn't influent the distribution network in any way. Even if the number rises to 100 000 cars, the impact on load in PDO (power distribution operator) will be 3 % of the total load. The situation will change if we consider long-term goals to eliminate conventional cars and we would consider to use in cities e-car only. Then the e-cars would count with almost one fifth of total consumption of electricity in capital city Prague.

## 5. Policy and programs CZ

Czech Republic is aware about the situation with electric cars and is preparing legislative to be ready for the situation, when e-cars will be common transport vehicle. There are also various grant programs for supporting development of e-mobility market. These programs, mostly provided by ministry of industry and trade, by ministry of transportation or by ministry of environment will be described in this capitol.<sup>1718</sup>

17 <http://oenergetice.cz/cista-mobilita/mzp-rozdeli-100-milionu-nakup-vozidel-alternativnim-pohonom-zatim-jen-obce-kraje/>



Most important are following programs:

- NAP CM<sup>19</sup>
- OP PIK 2017 – Nízkouhlíkové technologie.
- OPD 2014-2020 – PO 2 Silniční infrastruktura na síti
- OPERAČNÍ PROGRAM - PRAHA PÓL RŮSTU ČR
- Projekty SMART CITY

The programs of the ministry of industry and trade NAP CM analyzes the problem of e-cars and predict its implementation into condition of Czech Republic.

There have been recognized several points that could motivate drivers to buy electric cars.

**a) Free parking**

- There would be free parking for electric cars in city center and there would be even reserved a certain number of parking spots for electric cars in public parking houses.

**b) Monetary incentives**

- = Incentives which purpose is to equilibrate the price of conventional car and the electric car. With the time the price of e-cars should fall and naturally fits with the price of combustible-engine cars. The initial amount for support was estimated for 200 000 czk (around 8 000 euro).

**c) Speed up the development of infrastructure**

- The biggest issue from point of view of potential users, is the lack of charging points in the country. In Prague itself there is more important impact of power distributors trying to build spread charging network. The maps of covering Prague find in attachment.
- Once eliminated this problem, the drivers won't be afraid of low range of their cars. Costs of supercharge installation were estimated to 750 000 – 1500 000 czk (28 000-54 000 e).

**d) Taxes and environmental consequences**

- With increasing number of e-car there will be decrease in tax paid for the combustible since there is no such a tax for electricity used for charging e-cars. Therefore the state is losing certain amount of money – in 2014 were losses estimated to 5 mil. Czk (190 000e). In 2020 there is expected decrease in raised tax of 250 mil. Czk (9.3 mil. e).
- From the environmental point of view in year 2014 there was saved 700 tons of CO2 thanks to e-cars. In 2020 there should be saved 2 900 t/CO2.

Apart from previous 4 topics there have been expertize survey and these are its conclusions: The tools for reaching better inclusion of e-cars into (city) structure can be divided into two groups. Monetary and non-monetary.

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18 <http://oenergetice.cz/cista-mobilita/mpo-rozdeli-40-milionu-na-rozvoj-elektromobility-dotace-pripravuje-mzp/>

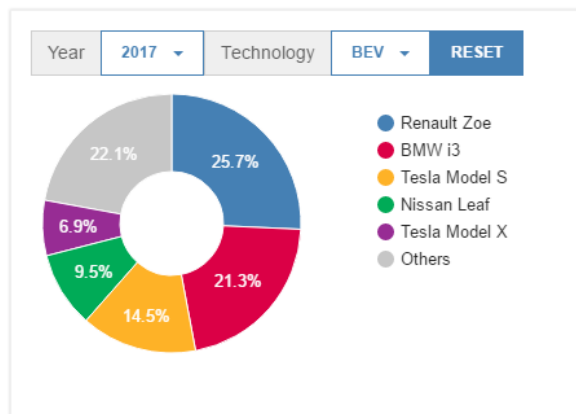
19 [https://www.mzp.cz/C1257458002F0DC7/cz/cista\\_mobilita\\_seminar/\\$FILE/SOPSZP-NAP\\_CM-20160105.pdf](https://www.mzp.cz/C1257458002F0DC7/cz/cista_mobilita_seminar/$FILE/SOPSZP-NAP_CM-20160105.pdf)

Typical example of the first group is lowering the investment cost of the electric car by excluding VAT (value added tax). At least in Czech Republic VAT is responsible for 19 % of the end price of the product. Another way is to lower/eliminate toll for electric vehicles. Or lower rate of electricity price for car charging. In case the car is bought by company there could be consider the possibility of accelerated depreciation.

In the second group - non monetary tools can be consider following: No entrance fee into city center for this kind of cars. Free parking. Especially in Prague this is a big advantage. Even if you are owner of the car, you are not allowed to get the residential parking card unless you/ your company has permanent address in the certain district. With e-cars You are allowed to get this parking cards in every district almost for free. Another way that doesn't cost anything anybody is the permission to use taxi and bus lines in the city. It means the owners of electric cars spend less times in traffic lines. This tool can be, of course, only used when the number of e-cars in not significant.

## 6. Policy and programs AU

Top 5 bestselling PEV models (M1) in Austria



Top 5 bestselling PEV models (M1) in Austria

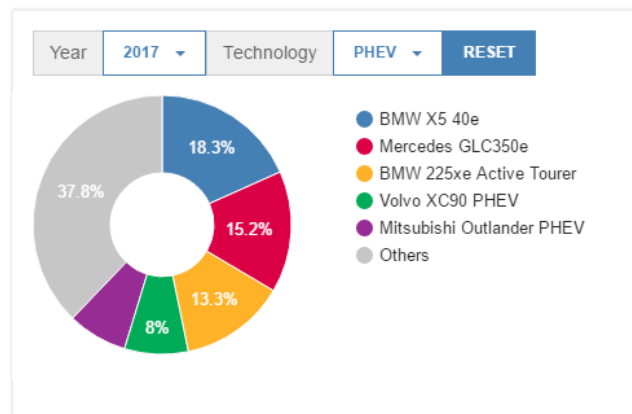
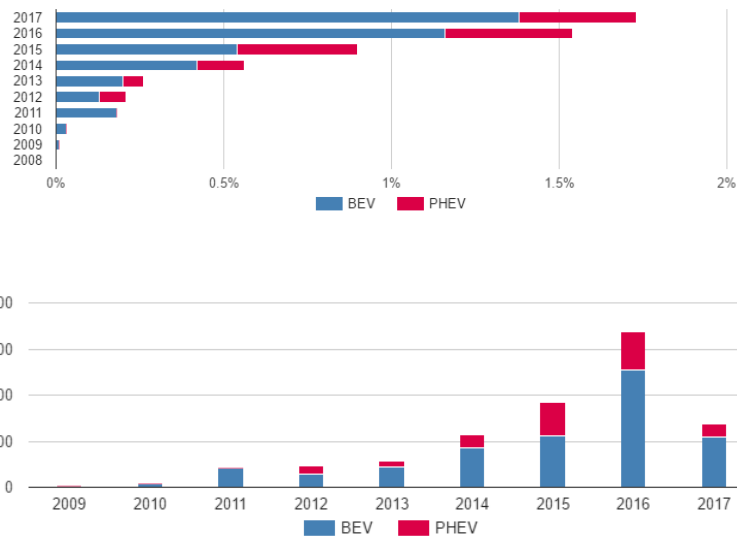


Figure 1 Top 5 selling cars in Austria, Source EAFO

From the figure 1 we can observe that the popularity for BEV and PHEV in Austria is slightly different. In the category of BEV is leader Renault Zoe with 25.7% share followed by BMW i3 with the share of 21.3 %. In category of PHEV vehicles there is the majority of the market covered by BMW X5. Mercedes GLC350e and BMW 225xe Active Tourer are the next popular ones respectively.



National subsidies are in place for electric vehicles. The purchase of electric vehicles is exempted from the NoVA tax which in Austria can increase a vehicle's price by up to a maximum of 16%. Exclusively electrically-powered vehicles are also exempted from the motor-based insurance.

In January 2011, an increase of the mineral oil tax became effective: for gasoline the increase is 0.04 €/L (increased by 9%) and for diesel 0.05 €/L (increased by 14%). A bonus-malus (tax credit and tax penalty) system was introduced in July 2008 for the acquisition of new vehicles (NoVA - Normverbrauchsabgabe). A tax reduction of €300 is applied for vehicles with CO<sub>2</sub> emissions lower than 120 g/km. A further tax increase of the NoVA-Malus applies as of January 1st, 2011:

- Emissions over 160 g CO<sub>2</sub>/km: 25€ tax increase for each additional gram of CO<sub>2</sub>
- Emissions over 180 g CO<sub>2</sub>/km: the incremental penalty increased from 25 to 50 €/g CO<sub>2</sub>
- Emissions over 220 g CO<sub>2</sub>/km: the incremental penalty increased from 25 €/g CO<sub>2</sub> to 75 €/g CO<sub>2</sub>

This tax will be followed by a further tax increase for each additional gram of CO<sub>2</sub> that will be implemented starting in January 2013, as follows:


- Emissions over 150 g CO<sub>2</sub>/km: Tax increase is 25€ /g CO<sub>2</sub>
- Emissions over 170 g CO<sub>2</sub>/km: Tax increase is 50 €/g CO<sub>2</sub>
- Emissions over 210 g CO<sub>2</sub>/km: Tax increase is 75 €/g CO<sub>2</sub>

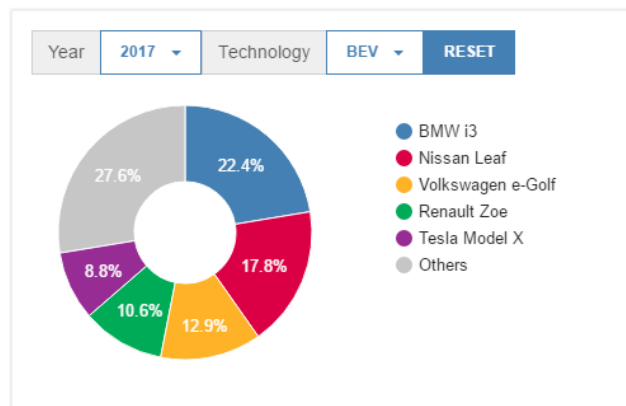
In 2010, the government appointed a group composed of the Ministries of Economy, Transport, and the Environment to coordinate and support electric mobility developments. The ministerial group for electric mobility was assigned with the following tasks:


- Structured exchange of information and communication
- Coordination of strategies, goals, and measures implemented by each Ministry
- Maximization of synergies between these activities
- Joint formulation of a timed plan for implementing the agreed-upon measures

The outcome of this joint-ministerial effort is the National Implementation Plan for Electric Mobility that is published in 2012. It will cover the following topics: EVs, charging infrastructure, users (demands and requirements), preferential areas to start implementation, industrialization and the national economic policy, instruments for research, innovation and technology, energy systems and resources, integration of electric mobility in the transport system, environmental impacts, and laws and regulations to support innovation.<sup>20</sup>

## 7. Policy and programs Norway

 Top 5 bestselling PEV models (M1) in Norway



 Top 5 bestselling PEV models (M1) in Norway

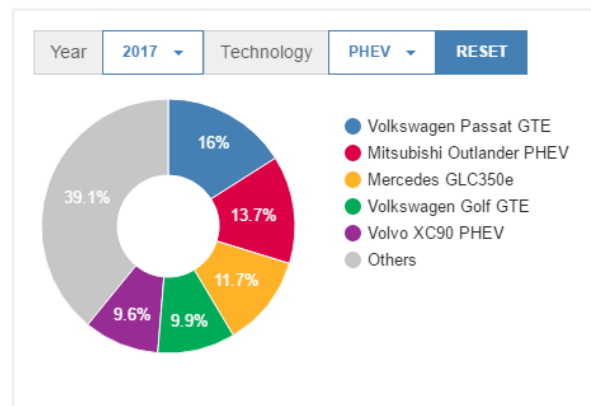
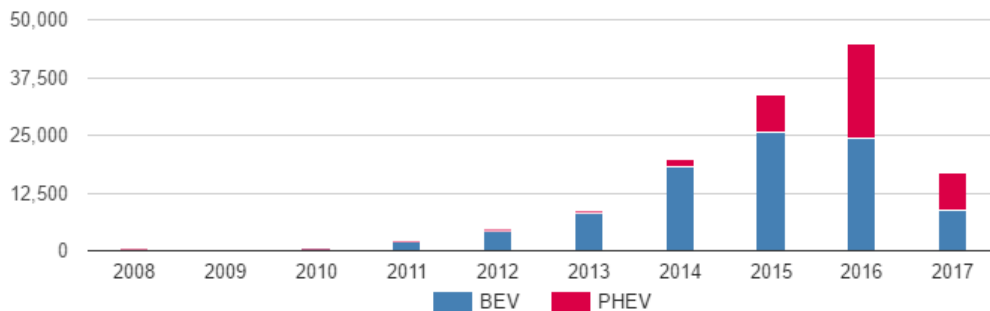
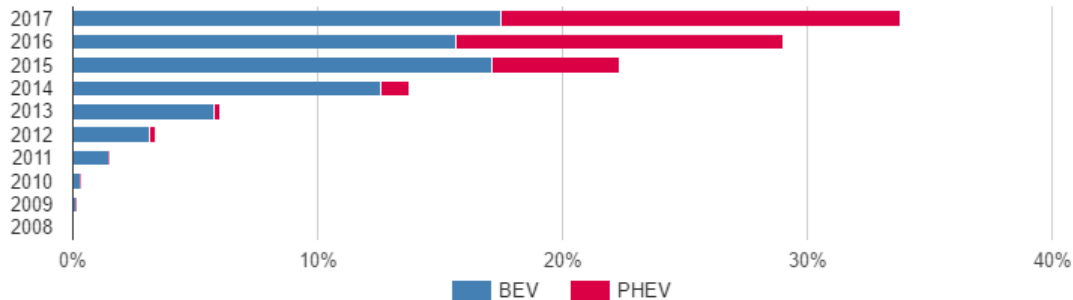


Figure 2 Top 5 selling cars in Norway, Source EAFO

As can be seen in the figure, the graphics show top 5 bestselling cars in sector BEV and PHEV in Norway. The most popular e-cars in category BEV are BMW i3 with 22.4 % share, followed by Nisan Leaf 17.8 % and the third most popular car in battery electric vehicles is Volkswagen e-Golf. The graph on the right side shows most sold

<sup>20</sup> <http://www.ieahev.org/by-country/austria-policy-and-legislation/>

Plug-ins. Volkswagen Passat GTE is most popular with almost 16% share, 2<sup>nd</sup> Mitsubishi Outlander with 13.7 % followed by Mercedes GLC350e with 11.7%.



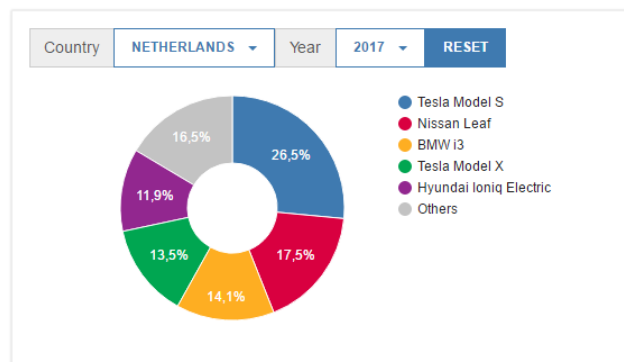
Norway will encounter challenges in the phasing out of Electric vehicle incentives in a controlled manner. The incentives are so extensive that to remove all of them would destroy the market completely. The most difficult incentive to remove is the exemption from the value-added tax (VAT), which will add 6,250 € to the price tag if a vehicle without VAT costs NOK 25,000 €. The most attractive usage incentive is access to bus lanes which will phase itself out. When the lanes are full, Electric vehicles will need to be taken out, otherwise the buses won't be able to move. The point at which Electric vehicles are selling well throughout the country, will gradually enable the removal of local user incentives in towns, without it involving too great a risk of destroying the market for Electric vehicles. This is a difficult balancing act. Electric vehicles are desirable in cities because of the greatest additional benefits of less air pollution and noise and each fast charging station can service a large population. On the other hand, Electric cars should replace petrol and diesel cars and not public transport, walking or cycling. Access to bus lanes, may to some extent make it more attractive to purchase an Electric vehicle than to use public transport. The combination of reduced time consumed for transport, ability to drive all the way from home to work, and the possibility of running everyday errands on the way, have most likely made the Electric vehicle more attractive for everyday use. It is also true that the bigger the Electric vehicles become, the more emphasis must be placed on the fact that Electric vehicles also

uses the same physical space as conventional vehicles. It is unlikely that Electric vehicles would be given as extensive subsidies, if the policy was developed today. On the other hand, the Norwegian example proves that Electric vehicle is attractive as long as the incentives are powerful enough. The feedback from the users, indicate that they can get their everyday travel done using them. The question is more about whether the policy contributes to EVs becoming fully competitive in the market of the future, or whether it will become a market that requires permanent incentives. An interesting question is also whether it is necessary for a small country to be so far ahead of other countries, in terms of the introduction of Electric vehicles. It involves greater costs over a longer time, given that it is the volumes in the large car markets in Europe, Britain, France, Italy and Germany which primarily will determine the future price and cost of EVs. So far it is only France and Norway in Europe, where large numbers of Electric vehicles have been sold.<sup>21</sup>

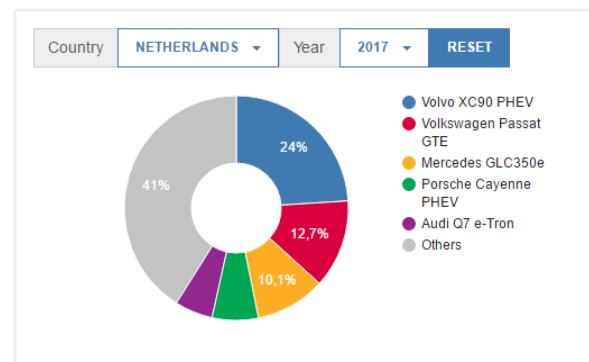
## 8. Policy and programs Netherland

Netherland tends to be leader in the area of electrical cars. With several documents such as: Electric mobility gets up<sup>22</sup>, The National energy agreement<sup>23</sup>, Brandstofvisie<sup>24</sup> they aim to support green infrastructure of their country. Partly because one of the global warming consequences is the melting of the icebergs and therefore the level of sea is raising. That could be significant problem in country which highest mountain is only 322 m above the sea level and only 50 % of its territory exceed 1 m above the sea level<sup>25</sup>.

Top 5 selling BEV



Top 5 selling PHEV



Obrázek 4 top 5 selling cars in Netherlands. Source EAFO

21 Electromobility in Norway - experiences and opportunities with Electric vehicles- TØI report 1281/2013- Erik Figenbaum, Marika Kolbenstvedt

22 <https://www.rvo.nl/sites/default/files/bijlagen/Action%20Plan%20English.pdf>

23 <http://energy.sia-partners.com/dutch-energy-agreement-2013-2023>

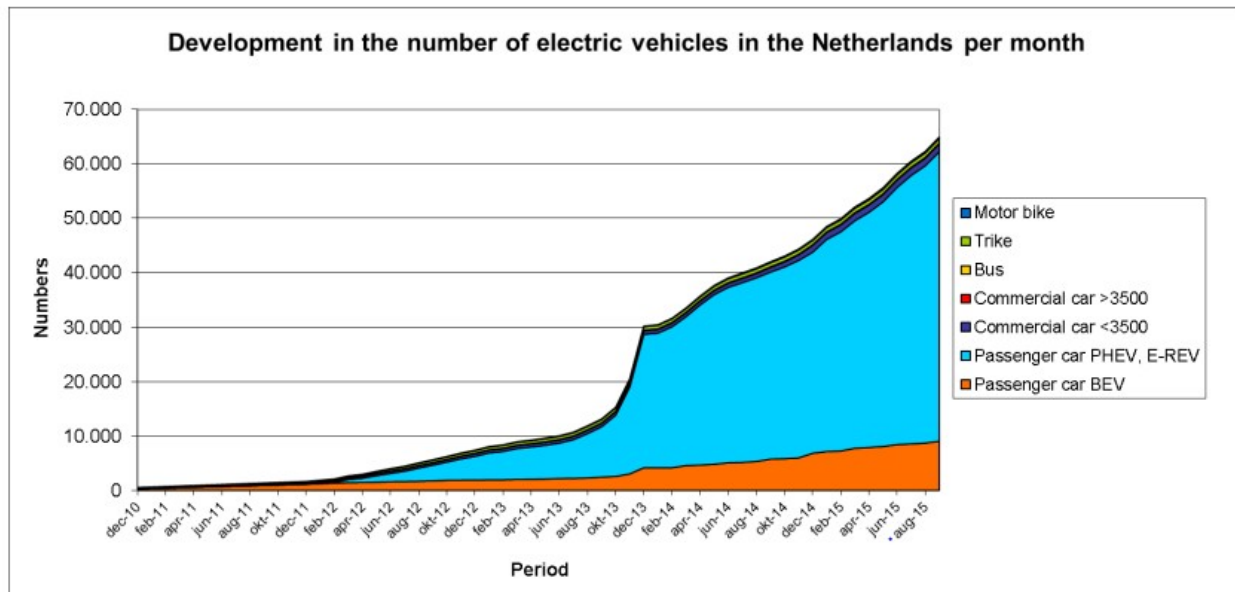
24 <http://www.energieakkoordser.nl/nieuws/brandstofvisie.aspx>

25 <https://en.wikipedia.org/wiki/Netherlands>

In real numbers there was sold in category BEV 446 Teslas model S, 294 Nissans Leaf and 238 BMW i3 so far this year (2/5/2017). In the category PHEV was situation following: 83 sold cars from Volvo XC90, 44 volkswagen Passat, 35 Mercedes GLC350e.

At the moment there was 117 168 e-cars and 28 668 charging points in the Netherlands<sup>26</sup>.

The last available graph about the development of the situation of electric market was from the end of 2015:



Obrázek 5 development of e-cars in the Netherlands source: Netherlands enterprise agency [http://e-mobile.ch/pdf/2016/The\\_Netherlands.pdf](http://e-mobile.ch/pdf/2016/The_Netherlands.pdf)

From the speech of minister Kamp about the smart emobility in practice at the conference in San Francisco on 9/1/2017 can be extrapolated:

- Netherlands and Germany work together to build common charging infrastructure. Right now their platform is 5<sup>th</sup> biggest in Europe.
- Not only electricity (BEV) is supported. There is intention by Mercedes to run hydrogen solutions.
- Innovating the approach of Dutch road transport authority about autonomy driving cars. (especially Tesla, which is famous and popular in the Netherlands)

By another document there are plans that public transport in Rotterdam will be 100 % run by electricity by year 2025. <sup>27</sup> Ie by year 2018 should all busses from the airport in Amsterdam be electric.

<sup>26</sup> <http://nederlandelektrisch.nl/gateway-to-europe>

<sup>27</sup> <http://emobility-nordbayern.de/files/2015/08/brochure-E-mobility-in-the-Netherlands.pdf>

Speaking about policy in cities, Amsterdam will ban combustible scooters older than 7 years from the city center starting from year 2018. Since the January of this year cars manufactured before year 2000 are not allowed to enter the city center.

By year 2021 all taxes at the Amsterdam Central station should be emission-free. The deal was already signed the years ago between the municipality and the taxi providers.<sup>28</sup> At the moment the cities are focusing on strengthening the charging network.

Similar to Czech Republic there are several financial stimulations to buy electric cars. Compared to Czech Republic, the system in Netherlands is not only studied and it is already working. The advantages are:

- Exemption from BPM (motor vehicle purchase tax) for full electric cars.
- Exemption from MRB (motor vehicle road-use tax) for full electric cars (*note*: semi-electric cars with a CO<sub>2</sub>-emissions between 1 and 50 g/km will only have to pay half of the MRB).
- 4 percent company-car addition to taxable income for people leasing BEVs.
- A maximum MIA (environmental investment allowance) of 36 percent, to a maximum of €50,000.

## 9. Plans for future

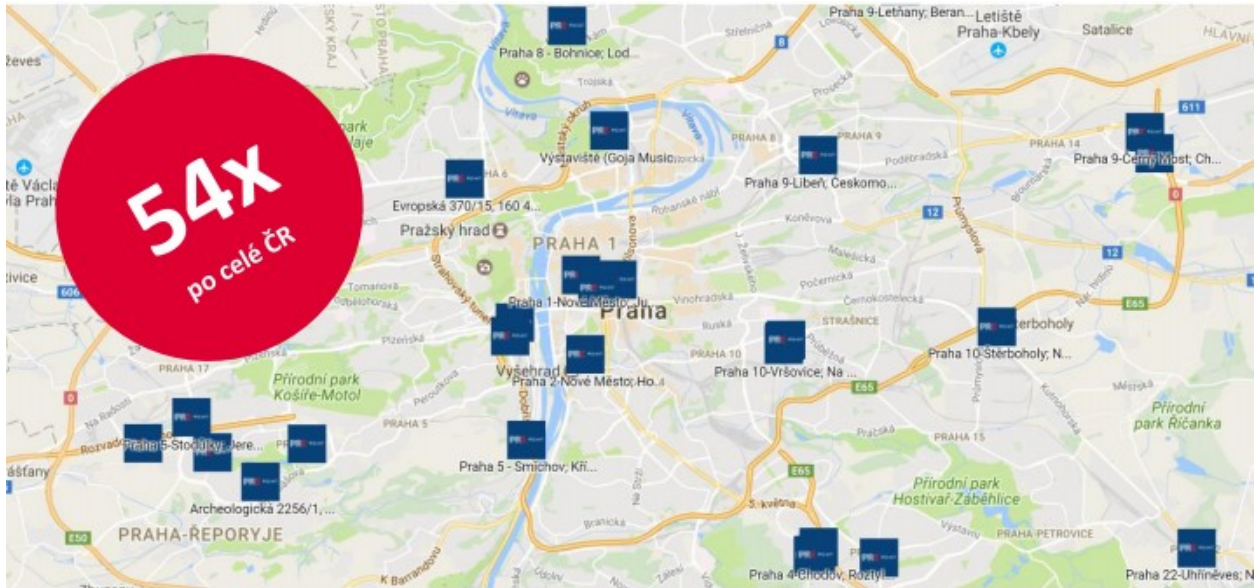
- are they realistic? , possible scenarios, discussion of the conclusions.

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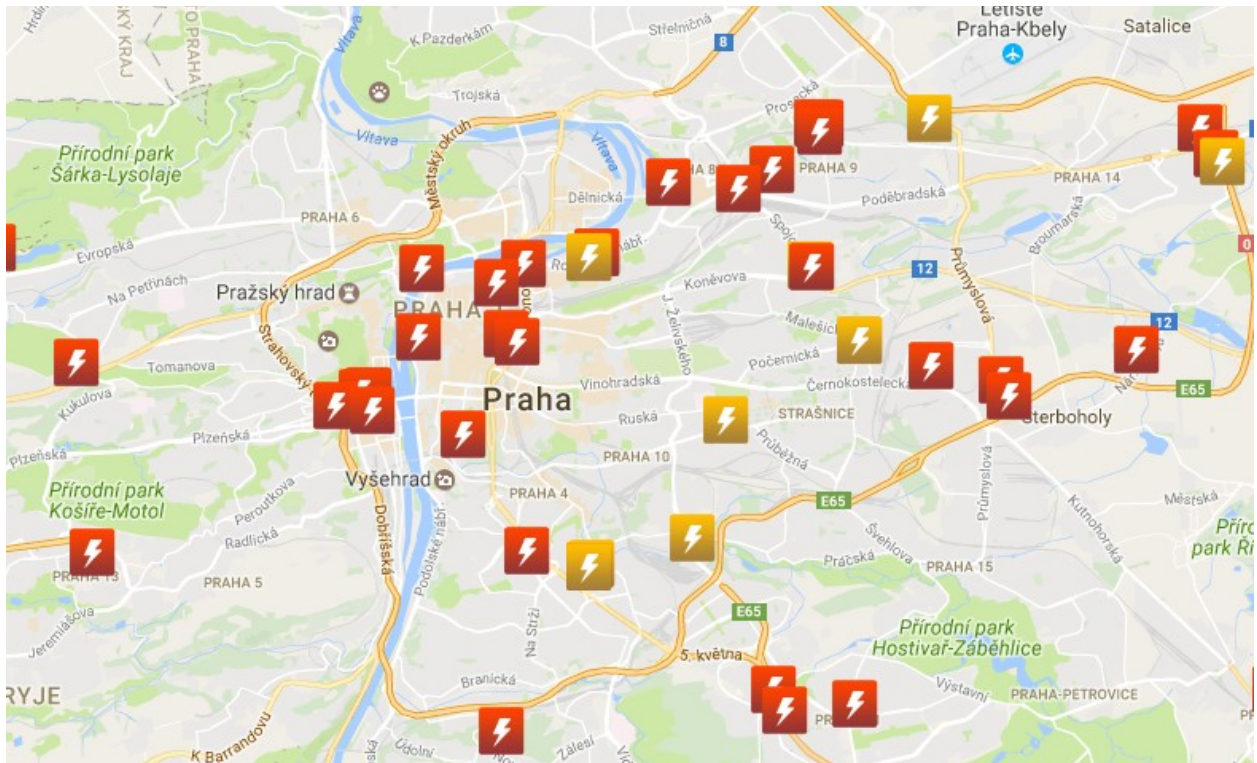
<sup>28</sup> <http://nederlandelektrisch.nl/regional-stimulation> <http://nederlandelektrisch.nl/regional-stimulation>



## 10. Attachments



Obrázek 6 charging points in prague - PREDi. source: [www.premobilita.cz](http://www.premobilita.cz)



Obrázek 7 charging points in prague PRE+CEZ source [www.hybrid.cz](http://www.hybrid.cz)