

E-mobility Outlook of Hungary

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Abstract

E-mobility and e-cars are very current topics in Hungary and in the EU. After the acceptance of the European Council's directive on the deployment of alternative fuels infrastructure and the several announcements of Hungary's leading government representatives about the vast amount of money to spend and challenging goals to reach in this industry the remaining main questions are: what is the realistic number of electric cars in Hungary, what will be the effect on the energy industry and how far does it worth the investment. Our publication will analyse the market drivers of e-mobility with international outlook and we try to estimate the numbers of electrically chargeable vehicles in Hungary.

Keywords

e-mobility, electric vehicles, plug-in hybrid (PHEV), pure electric vehicles (PEV), electrically chargeable vehicles, energy industry, vehicle-to-grid (V2G), costs and benefits

1 Introduction

Electric vehicles are now often featured in the Hungarian press and other professional publications when, for example, a new charging station is installed or a new type of electric or plug-in hybrid vehicle is spotted in the streets of Budapest. Several news portals are dedicated to the subject of alternative energy vehicles and

follow up on related developments in Europe and worldwide.

Although shorter or longer professional articles are regularly published, few analyses are available that provide a future outlook and overview of electric vehicles in Hungary – addressing questions such as how many electric vehicles will be used in Hungary in the upcoming years, the significance of electric mobility, and its effects on the Hungarian energy sector and economy.

2 Objective and scope

This study is a summary of our detailed report published previously and it is available on internet. We do our analysis and our statements based on 2014 data come from PwC Autofacts database and collected public information. Our new study will appear in the near future (this spring) and also it will be available. Now we deal with the following main subjects:

- Framework of e-mobility market model, introducing its main components;
- The international situation regarding electric mobility, and current directions for development;
- Forecast of the number of electrically chargeable vehicles in Hungary until 2023;
- An estimate of the growth in electricity demand resulting from the charging of grid-enabled vehicles and their effect on the electricity system;
- The macro-level effects of electric mobility, including the environmental (reduction of CO₂ emissions, noise and air pollution) and economic impact.

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3 Electric mobility: international and domestic perspectives

We have examined all-electric and hybrid vehicles that run on batteries that can be charged from the power grid, as well as motorcycles, light trucks, and buses. We refer to plug-in hybrids (PHEVs) and pure electric vehicles (PEVs) collectively as grid-enabled vehicles or electrically chargeable vehicles.

3.1 Framework of E- mobility market model

However, electric mobility is often associated only with the sight of grid-enabled vehicles on the streets and quite often the necessary charging infrastructure, for a comprehensive description we have developed our 3+1 pillar market model, incorporating the necessary elements of the market.

Electric vehicles, as the most visible part of e-mobility, represent the first, basic pillar. In our understanding all the vehicle types listed above are included in this component of the model, even though cars themselves do not make an exhaustive enumeration about the pillar. We also have to have respect for car manufacturers, OEMs, retailers and importers as important market players.

Charging infrastructure, being a crucial point in using vehicles covers the second basic pillar in our model. The physical part of this pillar incorporates the charging station itself and the necessary electric network and grid as well. At this point it is also important to take into account the relating market players such as energy companies, charging station manufacturers, maintainers and operators.

While we can find relevant examples in conventional mobility for the roles mentioned above, the third pillar represents a category that includes specific intermediary services only needed in electric mobility. As the procurement of electricity is completely different compared to gasoline and also cannot be stocked, we have to establish a different market model. A most likely and already spread solution is the emergence of e-mobility service providers. They sign on with consumers and provide a charging service, including: ensuring identification at charging stations, purchasing and selling electricity, billing and customer services. As electricity cannot be stocked and the presence of many service providers is likely in the future, for simplification purposes the emergence of data and financial clearing houses is expected, which we also consider to be part of this pillar.

The plus one or fourth pillar, the regulatory and business environment should more precisely be considered as a context which widely impacts the development of electric mobility in a certain region. Under this category we understand the state of legal regulations about electric mobility and also the performance of all concerned industries, such as telecommunications, energy, traffic and technology.

3.2 International outlook

The use of electric cars is on the rise globally. Last year more than half a million electric cars have been sold, increasing the global cumulated numbers to 1.25 million. Ongoing international pilot projects even amongst electric buses and light trucks also hint at further increases in the number of electric vehicles in the near future. Also the recently introduced Tesla Model 3's presales numbers – more than 400.000 in the first two weeks – have shown signs of growing interest in electric vehicles. The main hindrance to a much wider adoption of electric cars is that no breakthrough has been made yet in battery development to remove the technical barriers associated with grid-enabled vehicles (such as range and battery life). Besides the technical barriers, high costs associated with battery packs also put electric car sales at a disadvantage. In order to eliminate this drawback Tesla has partnered with Panasonic to build the Gigafactory, planning to produce more lithium-ion batteries in 2020 than the worldwide production accounted for in 2013. Some car manufacturers are in wait-and-see mode, others – like Toyota with fuel cell – are moving in the direction of other alternative energy technologies as well. The key driver for widespread adoption could be the introduction of incentive schemes used in countries where electric mobility is more prevalent. Based on the results of our forecast, we conclude that a significant rise in the number of grid-enabled vehicles can be expected by around 2020.

On the national level, governments soon realised that due to the expensiveness of cars and infrastructure, wide adoption of the technology is not achievable without incentives. They invested vast amounts in developing charging infrastructures and recently have introduced several incentives aiming at car owners. Based on the type, we can identify financial and non-financial incentives. On Figure 1., we collected a few examples from countries that have already introduced different variety of incentives.

	Norway	France	The Netherlands	United Kingdom	Germany	Ireland
Financial incentives						
Subsidy for the purchase of PHEV, or BEV	✓	✓	✓	✓	✓	✓
Exemption from, or subsidized tax for passenger / company car	✓	✓	✓	✓	✓	✓
Exemption from, or subsidized registration tax	✓	✓	✓	✓	✓	✓
Subsidy for the installation of public charging points	✓	✓	✓	✓	✓	✓
Part-financing of private charging points		✓	✓	✓	✓	✓
Exemption from, or subsidized parking fees, congestion fees	✓	✓	✓	✓	✓	✓
Non-financial incentives						
Simplified procurement processes for the acquisition of electric vehicles		✓	✓	✓	✓	✓
Priority parking					✓	✓
Usage of special priority lanes (eg. bus lanes)	✓			✓		

Fig. 1 National incentives in Europe

On a global scale, three countries and regions have played a key role in electric mobility: the United States, China, and the EU. Within the United States, California has the largest number of public charging stations, due to incentive schemes for both the supply and demand sides aimed at promoting emission-free traffic. Industry experts predict that, in the long run, China will surpass the United States as the most important player in both the manufacture and sale of alternative fuel vehicles. However, these expectations have yet to be realized, as electric mobility in China currently shows a rather mixed picture. The EU, which is the third key market player, has set the promotion of electro-mobility as a strategic objective (Europe 2020, Clean Energy for Transport), supported by various funding programmes (e.g., Horizon 2020).

3.3 Hungarian results

We have prepared two scenarios to forecast the number of electrically chargeable vehicles in Hungary: according to the realistic scenario, the number of electric vehicles could exceed 52,000 by 2023 (Figure 1), which would represent 1.35% of all motor vehicles (projected at 3.9 million). According to the optimistic scenario, there will be more than 2.5 times as many grid-enabled vehicles in use by 2023. But this would require government incentives for both plug-in electric vehicles owners and charging station operators.

Of all grid-enabled electric vehicles, nearly 88% will

be plug-in hybrid cars by 2023; the proportion of all-electric vehicles will be close to 12%. The majority of all-electric vehicles will also be passenger cars, but the proportion of light trucks among all electric vehicles is expected to be higher than among plug-in hybrids. The ratio of all-electric motorcycles and buses among all grid-enabled vehicles will not be significant (1.2% and 0.4%, respectively).

By 2023, the average mileage per year of grid-enabled vehicles will reach the current average mileage for conventional propulsion vehicles. This will be due to technological development in the next ten years and a gradually expanding network of charging stations. According to our calculations, an average efficiency increase of 5% can be expected every five years in the mileage count.

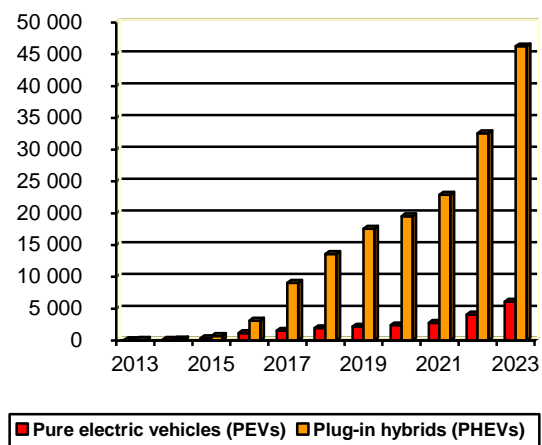


Fig. 2 Number of electrically chargeable vehicles – REALISTIC scenario

We have also examined the effect of battery charging on the electricity system, including returning power to the grid from the vehicles:

- Taking into account a 1.5% annual growth in electricity demand in Hungary, 48 TWh of energy use could be attained by 2023. The excess electricity demand resulting from the charging of electric vehicles will not be significant: even under the optimistic scenario, it will be less than 1% of total energy use. Based on the above, it can be concluded that electric vehicles will not require additional energy generating capacity.
- Vehicle-to-grid (V2G) – a system in which plug-in electric vehicles can not only be charged from the power grid but can also transfer electricity back to it – allows V2G vehicles to help balance electricity

loads and stabilise the market in two ways: by charging during off-peak hours and sending power back to the grid when demand is high, and by providing reserve capacity. In the power grid, electric vehicles can be used mainly for peak load levelling, as an energy cache for renewable power sources, and for network optimisation.

- V2G is expected to gain more widespread use in the next ten years – by the 2020s, the level of V2G regulation capacity could be substantial. However, according to our calculations, about 7% of grid-enabled vehicles should be V2G-capable by 2023 to balance grid load to some extent.

Plug-in hybrids and all-electric cars continue to cost significantly more than conventional vehicles, mainly because of the internal battery. With global manufacturers adopting a more cautious attitude, it is uncertain when a breakthrough in battery manufacture is likely to be achieved that would result in increased returns to scale, significantly lower retail costs and increased market penetration of electric cars. Government plays a crucial role in speeding up this process. The energy security, economic and environmental benefits are clear: by 2023, a wider use of electric cars in Hungary could help reduce CO₂ and other pollutant emissions.

4 Benefits of electric mobility in Hungary

The pollutant emission of electric vehicles at the place of use is much lower than that of internal combustion engine vehicles (zero in the case of all-electric vehicles), and their use reduces greenhouse gas emissions, concentrations of fine particles, other air pollution, and noise. Moreover, using electric vehicles can also reduce the external costs of road transport, i.e. costs arising from road transport that are not paid by road users.

One of the most important environmental benefits is that electric vehicles help reduce CO₂ emissions, which allows Hungary to sell more surplus CO₂ emission permits. According to the realistic scenario, electric vehicles will make it possible to reduce CO₂ emissions by at least 170 thousand tonnes over the next ten years. The sale of tradable CO₂ emission credits could generate nearly 7 million euros in revenues by 2023.

Reducing air pollution has the added benefit of lessening the likelihood of related diseases and death, and increasing average life expectancy at birth. This leads to an increase in the number of years lived in good health,

improved quality of life, and a reduction of differences in state of health among the population. The external costs of air pollution related to transport can be reduced by 36.44 million euros thanks to the use of electric vehicles.

Noise pollution is a contributing factor to heart attack, sleep disturbances and other psychological problems. Noise levels above 60 dB(A) may cause neurological disorders or permanent hearing loss. Electric vehicles can significantly reduce traffic noise. The external costs of noise pollution related to road transport can be reduced through the use of electric vehicles by up to 10.5 million euros according to the realistic scenario (calculated at 2013 prices).

When calculating the financial incentives for electric vehicles, we have considered the incentive schemes already in place in some EU member states: the average amount of support offered is 5,000 euros for passenger cars and light trucks, 300 euros for motorcycles, while in the case of electric buses we took at least 20-30% of the price of the vehicle to be purchased. Assuming that the amount of support will decrease over the next ten years, a financial assistance of at least 115 million euros would be required by 2023 to achieve widespread use of grid-enabled vehicles in Hungary.

We also assume that infrastructure development will be a catalyst for growth in the number of electric vehicles. It is expected that public charging stations will be installed first: rapid-charging stations along motorways, and commercial chargers at larger supermarkets and other transport hubs. The spread of domestic charging stations will largely depend on the introduction of government incentives. According to the realistic scenario, the deployment of charging stations will cost approximately 120 million euros over the next ten years (calculated at 2013 prices).

In addition, revenue lost due to decreasing fuel consumption and decreasing revenue from taxes on diesel and gasoline will also have to be taken into account.

In order to provide a comprehensive assessment of the impact on the national economy of grid-enabled vehicles, we also consider the following indirect factors that are more difficult to quantify: raising new sources of funding for R&D and infrastructure development, expanding the domestic vehicle manufacturing capacity and the scope of suppliers, growth in products manufactured using related and non-related technologies, creating new jobs, strengthening and building international relationships etc.