Electric cars: A market outlook

The future of plug-in hybrid electric and all-electric vehicles in Hungary

Our study is a continuation of where we left off two years ago, making use of updated calculations. We have also broadened the scope of our previous analysis: **in addition to all-electric vehicles, our study also deals with hybrid vehicles that run on batteries that can be charged from the power grid, as well as motorcycles, light trucks and buses.**

Summary

Objective and scope

Our previous study, **A look into the future of e-cars,** was published in spring 2012. That publication was a pioneering study on electric vehicles in Hungary. 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.

For the purposes of this study, we refer to plug-in hybrids and all-electric vehicles collectively as **grid-enabled vehicles or electrically chargeable vehicles.**

Our study deals with the following main subjects:

- 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 CO_2 emissions, noise and air pollution) and economic impact.

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Electric mobility: international and domestic perspectives

International outlook

The use of electric cars is on the rise globally. Ongoing international pilot projects also hint at further increases in the number of electric vehicles in the near future. 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). Some car manufacturers are in wait-and-see mode, others 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.**

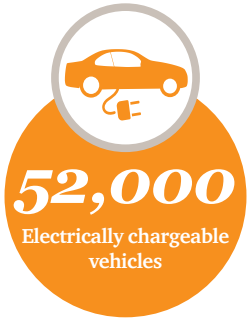
On a global scale, three countries and regions have played a key role in electric mobility: the United States, China, and the EU. Within the United States, California has the largest number of public charging stations, due to incentive schemes for both the supply and demand sides aimed at promoting emission-free 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).

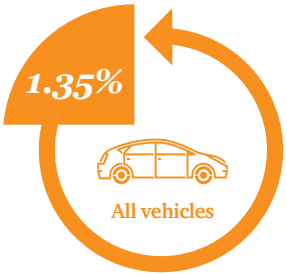
On 15 April, the European Parliament adopted a **directive on the deployment of alternative fuels infrastructure,** which clearly outlines the steps the European Union has to take by 31 December 2020 in order to promote the adoption of alternative fuel vehicles.

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, 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.



2023



2023

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.**

In the study, 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 CO_2 and other pollutant emissions.

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 r**educe CO_2 emissions, which allows Hungary to sell more surplus CO_2 emission permits.** According to the realistic scenario, electric vehicles will make it possible to reduce CO_2 emissions by at least 170 thousand tonnes over the next ten years. The sale of tradable CO_2 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.

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