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Electric Vehicles – Competitiveness And Ascendancy In Croatia With Green Strategies Overview

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Introduction

- Last few years considerable global interest for electric vehicles, main reasons ...
- 1 – Increasing public sense for ecological and environmental protection
- 2 – different kinds of grants
- 3 – many improvements in battery production
- Restrictive battery capacity – still the main limitation
- Examination of advantages and competitiveness of EV in Croatia

Comparison between electric vehicle and diesel engine vehicle

		
Model:	e-Golf VII	Golf VII TDI Blue Motion
Price incl. tax:	295.000,00 kn	150.000,00 kn
Technology:	Full electric vehicle	Turbo Diesel , 4 cylinder, 1598 cm^3
Max range:	130-190 km	1100-1300 km
Power:	85 kW	81 kW
Average urban consumption:	12,7 kWh/100 km	3,8 l/100 km
Battery:	Li-ion 24,2 kWh	No
CO_2 emission:	0 g/km	85 g/km

Consumption comparison:

Electric Golf total consumption amounts about 68% of diesel Golf total consumption*.

Comparison of CO_2 emission:

Electric Golf CO_2 total emission is about 29% of diesel Golf CO_2 total emission*.

(* in urban driving conditions, accepting Croatian power system data)

Economical comparison:

In repayment period of price difference between electric and diesel Golf, with premise that the maintenance costs are similar for both vehicles, electric Golf has to pass over 725.000 km (too much for average, ordinary driver). Also, it is necessary to take into consideration 10 year (or shorter) period of battery operating cycle.

Green strategies and grants policies for electric vehicles in Croatia

- Croatian Environmental and Energy Efficiency Fund has prepared the „Transportation emissions reduction program" in the period 2013-2020, with direct citizens and companies grants for buying new electric, hybrid and plug-in hybrid vehicles.
- Last year grants amounted 70.000 kn for a new electric vehicle, 50.000 kn for new plug-in hybrid vehicle with CO_2 emission <50 g/km, and 30.000 kn for new hybrid vehicle with CO_2 emission <90 g/km.
- With actual Croatian electric vehicle grants with maximal amount of 70.000 kn, repayment period of price difference is shorter.

- In that case, electric Golf has to pass over 375.000 km, which on yearly basis of ten years battery operating cycle period means 37.500 km per year (3125 km/monthly). It is obvious that even with grants, range per year that justifies price difference is still over the usual range of ordinary drivers in Croatia and electric Golf with grants is still not competitive to diesel Golf.
- Instead of grants policy that favor electric vehicles it will be better to have grants policy that favor hybrid vehicles.
- For Croatian Power System the most significant is that hybrid vehicles don’t need electricity supply, because Croatian electricity import is about third of total consumption.
- Is the described Croatian policy of grants for buying electric vehicles reasonable from energetic, ecological and economical point of view?

Energetic point of view

- If we imagine radical substitution of liquid fuels for road transport with electricity, today's Worlds electricity power system networks with electricity power plants would have to increase about 50%!
- Croatian electricity power system is characterized by very low night loads compared to daily loads. Hence, electric vehicles battery charging during night hours could be beneficial for power system. But at the same time it will take effect on raising electricity import thus reducing oil import.
- It is necessary to develop smart grid solutions that would find optimum time for electric vehicle charging depending on electricity price level and power network load level.

Ecological point of view

- Concerning outright emission of CO_2, electric vehicle is surpassingly better from petroleum vehicle. On the other hand, total emission of CO_2 depends of power plants energy mix in each country power system. With greater participation of renewable energy sources and nuclear power plants, total CO_2 emission is less.
- In case of fast expansion of electric vehicles, it is possible to expect faster growth of electricity demand than the growth of renewable energy sources portion in the Croatian electricity production system. In this way, electric vehicles expansion could lead into total CO_2 emissions increase.

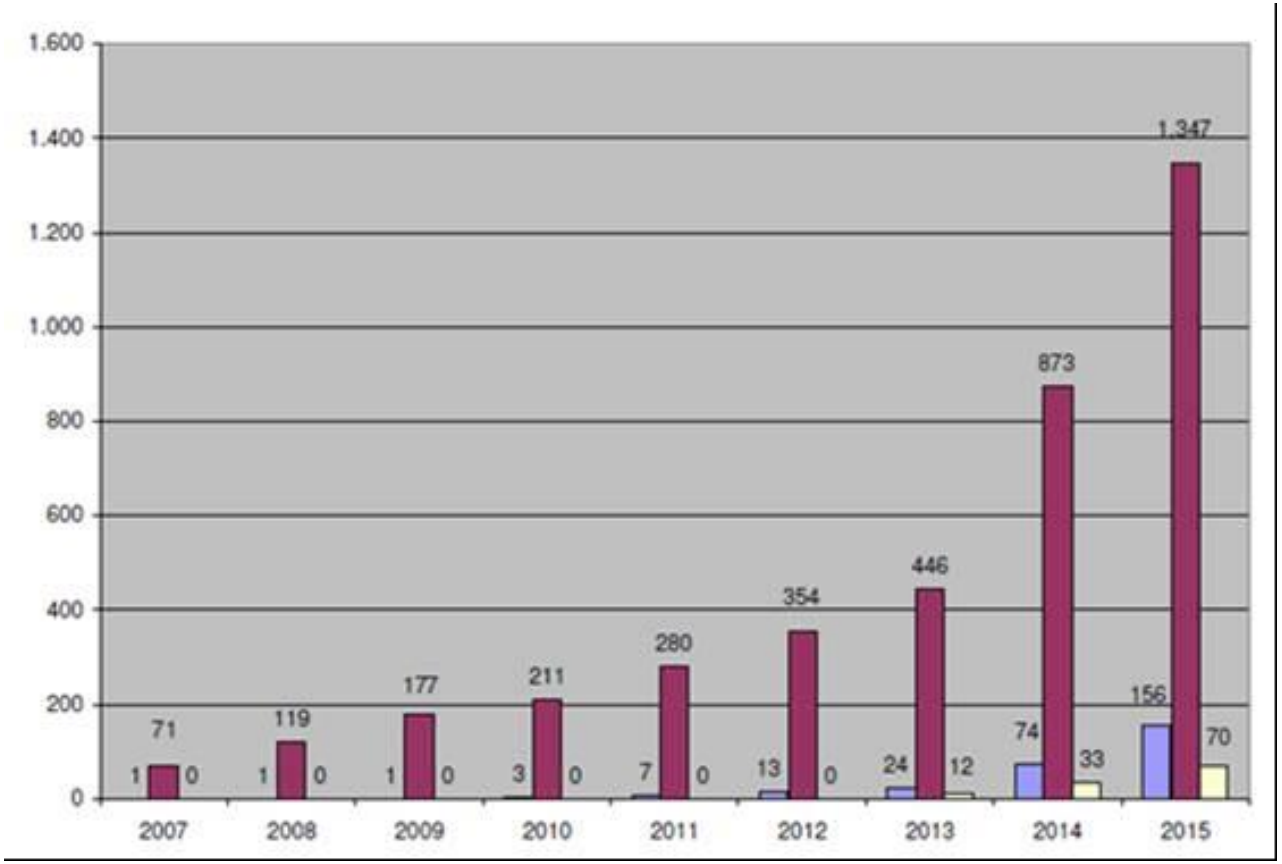
Economical point of view

- If the CO_2 emission is the main criteria for grants, why not grant also small petroleum city cars and petroleum cars with LPG (Liquid Petroleum Gas, widely available on petroleum stations across Croatia) that have less CO_2 emissions than many bigger hybrid cars?
- Another fact is that not one granted electric vehicle is produced in Croatia, so Croatian electric vehicles grants policy actually subsidizes foreign car industry and in this way drowns the possible development of custom vehicles industry!
- It would be reasonable to postpone or to reduce electric vehicles grants for more convenient Croatian budget, economy and electricity energy circumstances, when it will be sufficiently produced electricity by power plants in Croatia.

Perspectives on electric vehicles

- The unrealized goal in the USA is to have million electric vehicles on the roads by the end of 2015. USA spend billions of U$ on electric vehicles grants. High prices and short range of electric vehicles, and currently low fuel prices, are determined as the main barriers for better electric vehicles sales in USA.
- Germany plan is to have million electric vehicles on the roads by the end of 2020. However, at the end of 2015 on the German roads there were only 19.000 electric vehicles and about 108.000 hybrid vehicles over total of 44 million registered vehicles in Germany.
- HEP has a vision to become region leader in the electric vehicle supply area, through „eMobility” smart grid infrastructure development and electric vehicles „ELEN” charging services based on advanced power network concept.

- By statistic data of Croatian vehicles center, at the end of 2015 there were totally 1,5 million registered cars on Croatian roads, with 1347 hybrid, 70 plug-in hybrid and 156 electric cars, that amounts only 0,1% registered cars in Croatia.



(number of electric/hybrid/plug-in hybrid cars per year)

- For commercial success, EV should be within people's budgets (at the moment they are too expensive).
- EV must support people's mobility needs, currently range is maybe sufficient for urban areas, but is not sufficient in rural areas.
- Number of charging stations must increase sufficiently – bedazzled circle – to have more charging stations we need to have more electric vehicles demanding them.
- Increasing number of EV demands more electricity.
- Only advanced electricity tariff policy for electric vehicles, connected with real-time price market, could bring some benefit to balance power system load.

Conclusion

- We recommended postponed mass electric vehicle usage in Croatia, until we have sufficient electricity production in power plants on Croatian territory, in order not to increase Croatian necessary current import of about 30-40% electricity demand.
- Croatia needs smart instead saucy green strategies, including adequately restrained electric vehicles policy with favored policy for hybrid vehicles.
- For bigger roadway vehicles and for large (unlimited) distances, in environmental care manner, more reasonable is biofuels orientation (also based on EU Directive of renewable energy sources) and subsidize of domestic biofuels production.

Question of reviewer:

- „There are studies (steady state analysis and dynamic behaviour) about system impacts resulting from the presence of EV?”
- Answer:

During relatively short time period, like the authors, we focused ourselves on the overview paper and did not make further analyses. Also, we do not have infromation about that someone made steady state or dynamics behaviour analyses or studies about Electric Power System impacts in Croatia resulting from the presence of electric vehicles.

Reviewer's additional question to auditorium for open discussion:

- „According with the results of WG C6.20 (TB CIGRE 632) „Integration of EV in Electric Power System" there are other contribution on this topics?"
- Answer:

Results of WG C6.20 are very comprehensive and detailed, with contribution on many topics, because TB CIGRE 632 has more than 200 pages. As the authors we did not have informations about results of WG C6.20 while we were writing this paper. But, in comparison between our brief overview paper and comprehensive TB CIGRE 632 study, our conclusion is similar and comparable with results of WG C6.20.

Thank you for your attention !