

ANALYSE OF ELECTROMOBILE CHARGING STATIONS FOR THE NEEDS OF URBAN PROJECTION

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Keywords: analyse, electromobile, charging station, urban elements, system

Abstract: Electrification of road vehicles is one of the basic characteristics for energy transformation in the future. An important prerequisite to this is to transform the results of research and development to many areas of practice. This includes development of efficient, affordable and practically usable accumulators or safe charging equipment and communication tools. Electromobility is a process that presents a considerable challenge for energy companies. The concept of electromobility offers a complex solution for expansion of electric vehicles and its infrastructure to be needed. There are battery manufacturers, electric vehicles manufacturers, end users, cities and countries (should provide some benefits for users of electric vehicles), as well as electricity distributors that play an important role.

1 Introduction

Renewable energy sources are not only a perspective alternative of the energy gaining but they are also bringing the opportunities for the development of the alternative drives in the field of the transport. They are environmentally friendly and they are helping to permanently sustainable growth [12]. One of the alternatives of the mobility is electric energy, which powers the electric vehicles. Although, they are commonly existing and working in the world, in our country are electric vehicles starting very slow. Besides the high purchasing cost, the relatively short driving range may discourage from their purchasing. Other states support the urbanism and electromobility related to it with the construction of the public charging stations by different forms of subsidies or concessions [2]. When buying they offer the advantages of the electric vehicles at the entry to the historic centres of the cities or when parking. Electric vehicles are becoming more and more popular in the world. They appear to be one of the alternatives to the vehicles with the combustion engine. Such a vehicles need appropriately deployed charging infrastructure regarding to the driving range, that is lower than that of vehicles with combustion engine. The development of the agglomerations, the urbanism has to take account of the future development in this area [5]. The number of the public charging stations (Charging Stations, ChS) did not change in Košice in two years [10]. Looking to the future, Košice do not have enough charging points for the electric vehicle's needs. The same problem is also in the other countries of the European Union.

Regarding to the future, there are big changes waiting for the vehicular traffic. One of the alternatives of the

replacing of the classical gasoline and diesel engines is electromotor powered by electric energy from the accumulators stored in the vehicle [5]. Electromobility deals with the electrification of the transport. It is dedicated to the new trends of the given branch, development of the affordable and practically applicable accumulators, materials and technologies, supporting the development of the electric transport, design and development of the required infrastructure, interconnection of the distributors of the electric energy, cities, states and users themselves, providing of the advantages by the state, standardization and legislation [14], so that the conception of the development of the electric vehicles would be able to assert in the competition of the classic automobiles. System of the urbanism has to develop such as the field of the electromobility is developing and it has to take into account the modern ways of the transport [4].

The advantage of the electric drive, if we are using any electric vehicle, is that we do not need gasoline/diesel, oil changes, catalyst, fuel pump, fuel filter, injectors, exhaust, spark plug key, fuel canister, air filter, emissions measurement, gearbox, starter, water pump, alternator, cylinders, oil pump, motor block, flywheel, brake pads replacement, Exxon, Shell, Chevron and other oil companies, gas stations, oil wells, wars for oil, etc.. Electric vehicles additionally offer absence of the emissions, high efficiency, quiet and smooth running. Electromobility brings benefits to all, and is one of the modern elements of the urbanism. It is improving the environment. The benefits of the electromobility are obvious and they are constantly examined from the different perspectives. Within the fluent development and the usage of the electromobility in the practice, it is

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necessary their logic allocation within the agglomeration taking into account the amount of the criteria [9]. Currently is the EU vehemently pushing for the using of the green energy, i.e. renewable sources. This will bring the jobs, improvement of the environment and, of course, the mobility at a somewhat higher level than today, which gives the perspective of the development and the prosperity of the whole society [11].

2 Analysis of the current state of the electromobility

Is the electromobile the vehicle of the future? In Slovakia, it does not seem so far, which is caused by the policy of selling of the oil products, producers of the classic cars and also by the legislation of the appertaining states, including Slovakia [6]. Other states, which support the electromobility, already have the charging stations, different types of the subsidies or concessions when buying, advantages at the entrance to the historic centres of the cities or when parking. In Slovakia, there is around 30 electromobiles and hybrid vehicles on the roads. Electromobile is mainly made for the short distances. It is relatively a good investment but electromobile have to be used effectively, in order to be worth. Before the buying, it is necessary to consider what type of the route is driver riding and what style of the riding driver prefers. The future owner have to carefully count the pros and cons, to decide whether to buy an electromobile, which is the process of the multi-criterial decision making according to the subjective requirements and criteria of the customers [1]. Ordinary motorist, who is not using car daily, may return back to the idea of the combustion engine. The companies, which make several trips a day, are better on it.

The high price, few charging stations and the short driving range can be ranked to the minuses. It is necessary to divide the price of the electromobile into the price of the accumulator and the price of the vehicle itself. When it is compared in this regard, it is brought to the totally different numbers, as it is known today. The price depends on the development of the accumulators. Someone has to pay for it. However, the price should gradually increase. Although it is nice to produce no gas from the exhaust, but why would you buy a small electric car, when you could buy two cars of the lower middle class with the combustion engine for the same price. If we need to replace accumulator after some times, another additional cost will occur. Offered services in the subjected area are questionable [13], since the amount of the electromobiles does not match to the proven classic, yet.

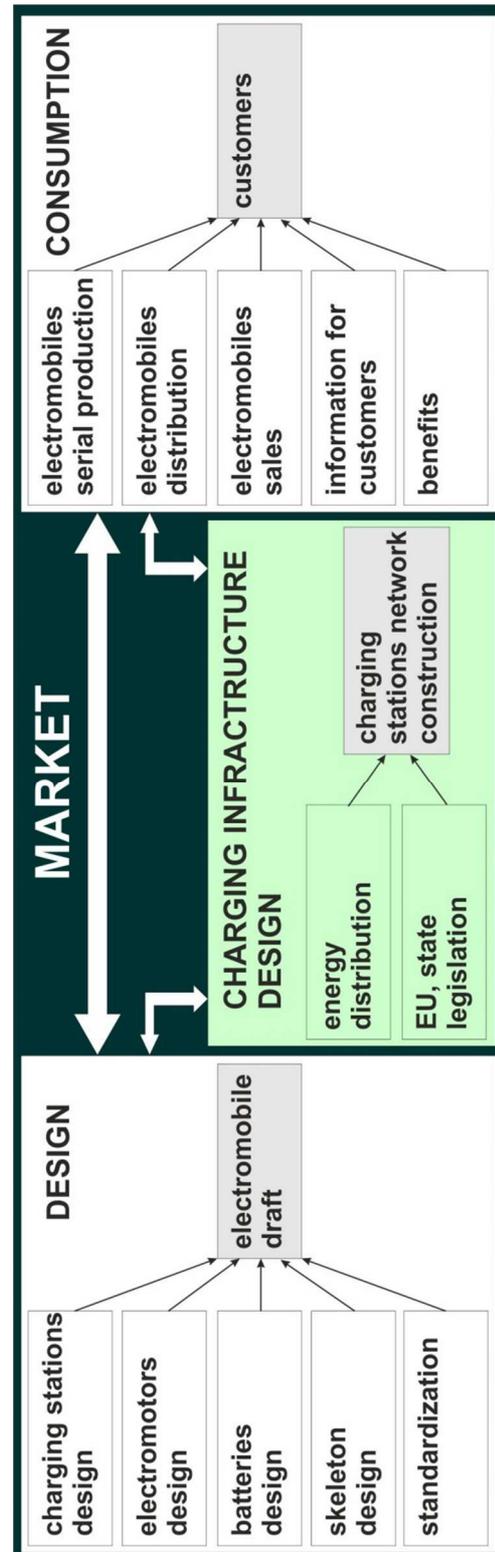


Figure 1 Relations between electromobility elements

The recharging of the electric vehicles at the public ChS will be free for some times. Will the initial investment be returned back? Despite the fact that the development in this field is rapidly progressing, the

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reality of the market is in many aspects different, which gives an opportunity for the usage of the different simulation models [7]. Constant monitoring of the driving range check light will additionally belong to the drive. Such arguments may also work to the disadvantage of the electromobility, which are not even the alternative source of the mobility in Slovakia. Current owners of the electric vehicles are complaining about the lack of information about the location of the nearest charging station and their system allocation within a specific region [8]. Therefore it is necessary to focus on the development of the information and communication technologies for the electromobility, which would allow navigating the driver to the closest charging station. Fuel tank capacity of the middle class vehicles is about 50 litres, which provides the driving range 500-1000 km, depending on the driving conditions, automobile and the system of the work with the vehicle. For comparison, accumulator in the electric vehicle has the weight of 100-700 kg according to the type and the total capacity. Driving range of the electric vehicles is currently in the range of 100-450 km. The energy contained in one litre of the fossil fuels is therefore greater than the energy produced by 1 kg of the accumulators. According to the driving range, the combustion engine is a better solution. But do not forget that 1 km by electric vehicle costs about 5-time less than 1 km by the vehicle with the combustion engine and the average annual costs of operation are lower by half.

Economic operation and many others already mentioned advantages belong to pluses. Regarding to the driving range, test with forty electromobility during the six months took place in the Germany. They drove 400 thousand km. Causes, of what affects the driving range of the electric vehicles, were examined. There occurs the transition from the objective physical situation (what is objectively measured during the driving cycle) to the subjective psychological situation. Everything is conditioned by the user behaviour. Additional technology, which consumes the energy, is used in the vehicle during the winter. This falls under the technical side of the vehicle. One driver drives for a time, second for consumption and the third for the length. This belongs to the psychological aspect. The maximal driving range is defined according to some driving cycle. Each user has his own criterion, abilities to estimate the driving range and adapt it to his needs. Therefore, there occurs, that the maximal driving range is decreasing by a certain amount. We talk about so called sufficient driving range. The driver scans the dynamics of the driving range and confronts it with the current situation, which is on the road. The operating driving range is lower than the sufficient driving range. Everyone has a suggested comfort level of the driving range. It is a balance between the mobility option, which means to move with the mobility means, i.e. to choose such a vehicle, which will ensure it to him. It is a distance from the one charging point to another charging point. Each person interested in

the buying of the electromobility should think about these things. Before the buying of such a vehicle it is good to do statistics of the travelled km on average per day, week and month. Often occurs, that the interested person has the exaggerated claims and requires from the vehicle the driving range of 150 km and more. In fact, he will not drive 150 km, he will drive only the 50-60 km. It is possible to extend the driving range by 20 to 25 %, which are formed by the psychological barriers of the every single user.

3 Current state of the electromobility in the world

About one billion cars currently drive in the world, while quarter million vehicles is registered in the North America. 60 million new cars are produced each year in the world. Slovakia contributes 640 thousand produced vehicles, which represents circa 1 %. In Europe, selling of the new vehicles stagnated due to the economic crisis, but in the Asia it rapidly increased. It is expected, that 10 million electric and plug-in hybrid vehicles will be driving in the whole world in the next decade. These vehicles will be concentrated in the urban areas and will have the positive impact on the local environment. Full transition to the electric mobility will last several decades. Panasonic company invited several supplier companies to join the investment in a US factory for the production of the car batteries. It plans to build this plant with the Tesla Motors company. Plant will be in charge of everything from the material processing to the installation of the batteries. It will produce small, lightweight accumulators. Except Tesla, it should supply also the Toyota car factory and other companies.

4 Current state of the electromobility in Slovakia

The electromobility in Slovakia is currently in its first phase, which means, that the electromobility is currently being solved as a project. This situation has not changed until today. The number of public charging stations has increased minimally. However, the number of private charging stations has increased. Currently, there are 6 charging stations in Slovakia (5-AC a 1-DC), which are available for public charging of electromobility. The first public charging station, which was used for slow AC charging, was made available in 2010. The first public fast-charging station was made available in 2012 in Bratislava. There are currently several pilot projects in the area of electromobility being solved in Slovakia. These concern the construction of the charging stations and the entry of electromobility into service. The Slovak government has to treat legislatively with the extensive entry of electromobility into service. The electromobility in Slovakia is in the stadium of commenting process at the moment, it waits for the approval from the General Director of the section.

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Volkswagen has run the construction of their first electromobile (VW eUP) in 2013 in Slovakia. In the second half of 2014, car factory Kia has run the construction of their first global electromobile Kia Soul EV. It will be based on the second generation of their conventional model Soul. In Europe, it should occur with the warranty of 7 years or 150 thousands km of mileage. The top speed should reach 145 km/h and the driving range should be 200 km.

Conclusions

It is important to have the option to charge your vehicle at any publicly accessible charging station while driving abroad. It can be done by agreements and full cooperation of all parties including all providers of electricity. By this charging can be carried out anywhere and sales account thereafter is realized through national electricity provider where the vehicle is registered. It is only possible if all the charging process will be standardized.

Parking places for the electric vehicles were variant designed on the free spaces and in the parking houses based on the analysis and there was designed graphical design of the charging stations. The work brought another view to the mobility, which is shown in the form of the electric energy, analyses the electromobility, new technologies in the field of the electric vehicles and the charging stations, thereby it meets the goal to inform, to get the electromobility into the awareness of the wide public.

The automotive industry is subjected to new trends in the last few years. Automobile manufacturers started to use the old-new drive - the electricity. They have started with selling cars called hybrid and plug-in hybrids that combine the advantages of the internal combustion engine and the batteries. It is only temporary period until full electrified vehicles will be supplemented on the market.

Acknowledgement

Publication has been created with the support of VEGA grant agency, in the framework of grant task VEGA 1/0036/12 "Methods development and new approaches to design of input, interoperable and output warehouses and their location in mining, metallurgy and building industries" and grant task VEGA 1/0216/2013 "Methods and new approaches study to measurement, evaluation and diagnostic performance of business processes in the context of logistics management company".

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Review process

Single-blind peer reviewed process by two reviewers.