

CONCEPT OF ELECTRIC VEHICLE CHARGING STATION BASED ON RENEWABLE SOURCES AND ENERGY BUFFER BATTERIES

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The market of electric vehicles is an important element of the modern development of vehicles [1, 2]. The development of renewable energy sources and electricity transport in Ukraine has a character similar to the global trend, but the beginning of its development took place somewhat later, which is explained by the economic and socio-political situation [3, 4]. In addition, not only the technical and economic conditions for the introduction of charging stations are important for the development of the electric transport market, but also the conditions for creating a network of charging stations, which is explained by the limited range of electric vehicles. The market of electric vehicles should be considered new for Ukraine, it is in the stage of intensive development, and it is necessary to develop a network of charging stations for various types of electric vehicles.

Given the rapid growth of renewable energy installations on the one hand, and the rapid growth of electric vehicles on the other, there is an urgent problem of developing the infrastructure of charging stations capable of charging batteries from renewable energy installations using both classic and new fast charging methods [5].

The most stable way to power the charging station is to use the central electrical network [6]. But in this case, there are questions about the availability of the necessary capacity of the power grid and the impact of heavy loads during fast charging on the quality of the network. At all types of stations, can use a buffer energy battery that accumulates charge during the day and at night when the maximum demand is needed. However, this approach will not solve the problem of network bandwidth and will not give the desired result in the case of a small bandwidth of the central power transmission line.

When implementing charging stations that use solar radiation and wind energy, it is necessary to solve a number of tasks related to the creation of technical conditions for charging stations of this type, a mathematical description of the process of energy conversion and storage, taking into account the details of the electric charging process, and an analysis of the economic feasibility of implementing such stations.

An alternative approach is to develop a network of charging stations with energy buffer batteries using power plants that combine wind, solar or wind-solar energy. This approach is not limited by available bandwidth and can be applied in any region. The implementation of charging stations for electric vehicles using a wind power plant and photovoltaic panels should be carried out according to the seasonal characteristics of the

region in terms of wind energy and solar radiation. If two renewable energy sources are used after receiving the assessment, their optimal ratio is determined, which allows for the most efficient charging of electric vehicles throughout the year. At the same time, it is necessary to be guided by the appropriate optimality criteria.

The structural diagram of charging station for electric vehicles using a wind power plant and photovoltaic panels is shown in Figure 1.

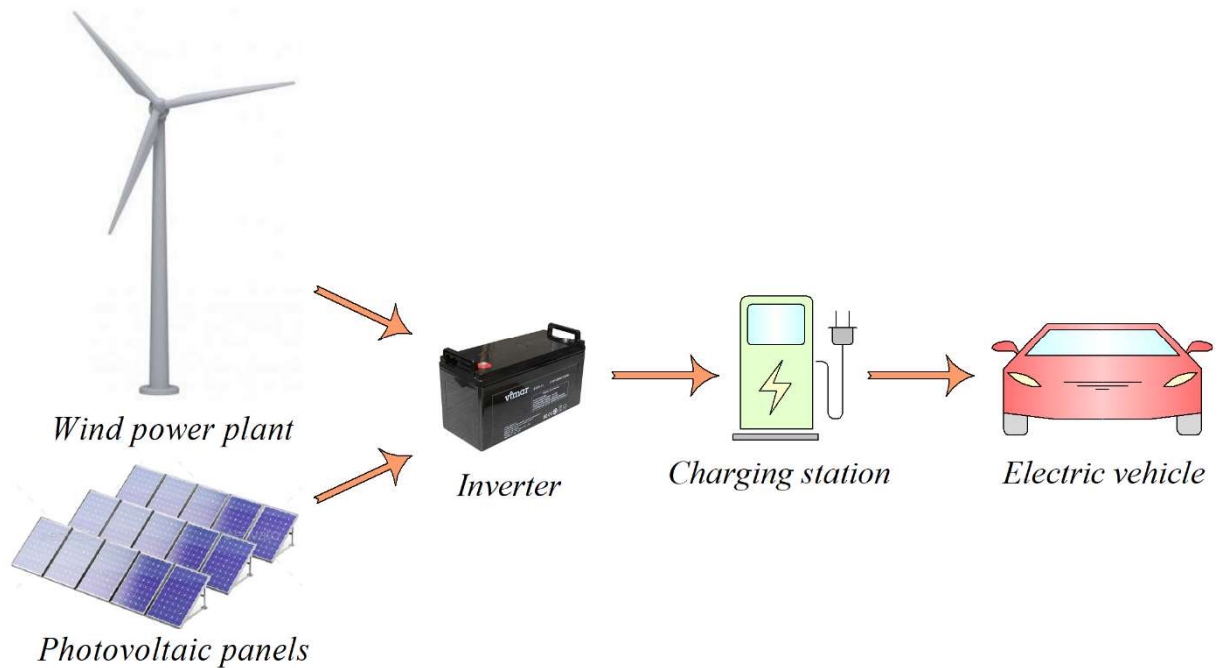


Figure 1 – Structural diagram of electric vehicle charging station

Considering the fact that there are failures in the production of energy by wind turbines during the calm period, it is most expedient to use the combination of "wind power plant – buffer energy accumulators" for charging stations, which will solve the problem of equalizing the production of electrical energy with its consumption. However, the issue of determining the appropriate capacity of the buffer battery is related to the complex use of several renewable energy sources, which will allow to reduce capital costs while simultaneously servicing a larger number of electric vehicles. The calculation of the capacity of the buffer battery based on the wind turbine should be carried out taking into account the specified parameters of the consumer's needs, that is, the amount of energy needed to charge the electric vehicle.

Taking into account the above conditions, it is possible to implement and develop an effective network of solar energy systems using wind energy installations as primary generators of electrical energy, which, in turn, expands the possibilities of using the energy potential of wind and solar radiation on the territory of Ukraine.

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