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Problems and concept of electric vehicles energy networks

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Abstract— The article examines the potential and opportunities for the development of innovative power supply systems in the conditions of Ukraine. The peculiarities and prospects of the use of electric vehicles in electric networks as consumers-regulators are analyzed, the feasibility of implementing the Vehicle-to-Grid technology is substantiated. Templates for the introduction of decentralized sources of electric energy based on electric vehicles, provided that bidirectional charging stations are used, are proposed. It is shown that rational integration of electric vehicles in power grids allows decreasing existing level of active load that affords to increase the efficiency of power equipment use. The main obstacle to Vehicle-to-Grid technology use is the lack of regulatory documentation and approved legislative acts. In conclusion, noted the main problems and requirements for the creation of effective decentralized energy supply systems in Ukraine based on electric vehicles.

Keywords—*electric vehicle's battery, bidirectional energy transfer, Vehicle-to-Grid technology, smart grid.*

I. INTRODUCTION

In recent years, there has been rapid development of innovative renewable energy technologies and decentralization of its production systems. Ecological aspects of the transport sector transformation in the developed countries lead to an increasing of electric vehicles, including those with the possibility of charging them from renewable energy sources. The dependence of the renewable energy sources generation from the environmental conditions (insolation, wind speed, etc.), as well as the irregularity of charging modes of electric vehicles, leads both to the stochasticity of the electricity generation schedule in hybrid systems and to the increasing in the unevenness of the load created by consumers. The load on the power grid and the shortage of electricity during peak hours are important factors in matters of reliable power supply and the stability of the power system to dynamic changes in both generation and network load. Therefore, the issue of effective integration of non-guaranteed power sources into the network without reducing the reliability of electricity supply and stability of the system and load nodes is relevant for any country, taking into account the factors of limiting the supply of natural gas and increasing energy consumption. Ukraine also follows and implements advanced technologies and the risks associated with them, in particular, in the power industry. Scientists are engaged in the development of promising

projects related to the effective integration of electric vehicles into the infrastructure of populated areas in order to balance the load of power grids when charging/discharging electric vehicles [1-3]. Thus, the efficiency and reliability of electricity supply to consumers, the avoidance of overloading of electrical networks in case of unregulated introduction of electric vehicles is an important task of the innovative technologies integration in the conditions of Ukraine.

II. PURPOSE OF THE ARTICLE

The article is aimed at analyzing the technical capabilities of the Vehicle-to-Grid technology introduction into the infrastructure of electrical networks of Ukraine.

III. THE MAIN MATERIAL OF THE STUDY

The new strategy of energy independence of European states is based on reliable energy supply, sustainable energy consumption, and reducing dependence on fossil fuels while increasing the energy efficiency of modern innovative technologies used. The strategy for today's global economy emphasizes advanced technology, sustainable and inclusive growth, to increase productivity competitiveness in Europe and around the world. In the field of energy, the main goal by 2025 is to achieve more than 25% (Europe) and more than 15% (Ukraine) of the energy share from renewable sources and increase energy efficiency by 23% (compared to the projected primary energy consumption by 2020) [4]. Environmental issues, independence, and reducing the electricity costs of private households constantly stimulate people to use innovative technologies, modern solutions and independent energy sources. Today, Building energy management systems (BEMS) can adjust to external conditions, and optimize overall energy demand (see fig. 1). One of the most effective options and alternatives to transitions to environmental friendliness and fossil independence is to promote mobility with electric vehicles. The main problem of the total transition to electric transport for daily use is the limited access to power grids of the appropriate capacity without their modernization and reconstruction.