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PROSPECTS OF FEED-IN TARIFF AND PROSUMERISM DEVELOPMENT IN UKRAINE'S HOUSEHOLDS

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Since 2009, renewable energy (RE) has been a priority direction for the electricity sector development in Ukraine in the context of achieving Sustainable Development Goals [6-25]. Since 2015, along with the business sector, domestic households have been approved to install facilities on renewable energy sources (RES) and generate green electricity, consuming it for their own needs or selling it to the state at the feed-in tariff, which at the time of introduction could exceed the current electricity price more than 5 times depending on the type of RES (sun or wind) [5]. A significant relief and incentive for households, compared to legal entities, was the opportunity to produce electricity from RES without obtaining a state license, provided that the installed capacity of household power plants did not exceed those determined by current legislation.

Having been the highest in Europe until recently, feed-in tariffs have ensured tremendous growth in RE installed capacity and electricity generation by the household sector in 2016-2021 [1; 2; 3]. Even the coronavirus pandemic in 2020-2021 did not significantly impede the increment in home RE capacities, which demonstrated the prevailing pace of development compared to the business sector during that period. However, due to the highest levels of the feed-in tariff for small solar power plants (SPPs) and the lack of state regulation of the types of RE technologies, solar power generation has become almost the only technology for use in the residential sector.

In addition to the financial benefits in the context of the feed-in tariff, the installation of solar modules is characterized by great flexibility, as they can be

differentiated by power and maximally adapted to the needs of a particular household. SPP is easy to maintain; it requires minimal operating costs compared to, for example, wind turbines. Solar modules can be compactly placed on the roofs and facades of buildings, without involving large land plots. In addition, solar modules can be added, increasing the capacity of the SPP over time. This is especially relevant due to the limited incomes of Ukrainians, most of whom cannot accumulate savings sufficient to invest in even small-capacity SPPs. Therefore, the possibility of expanding the capacity of such power plants over time is a good argument in favor of choosing this RE technology.

Due to both industrial and residential SPPs, the increase in the share of solar electricity generation in the electricity mix of Ukraine became noticeable in 2018-2021. However, it caused many technical, organizational, and economic problems in the electricity industry operating. In particular, the discreteness and unpredictability of solar power generation rose the need for balancing the national energy system, which was already experiencing a shortage of balancing energy capacities. The negative consequence was the emerging “green-coal” paradox during the COVID-19 pandemic. Green electricity generation growth multiplicatively increased the amounts of payments connected to the feed-in tariff. As the latter was compensated from the state budget, it caused the accumulation of debts of the state enterprise "Guaranteed Buyer" to the SPPs owners in 2020-2022 and discouraged investors from further development of the industry. In addition, since the southern and eastern regions of Ukraine have the most favorable conditions for solar power generation, most of the new SPPs were built there. Thus, the western and central regions could experience a deficit in electricity, while the eastern and southern regions had a surplus at certain hours of the day against the background of worsening energy imbalances.

Russia's full-scale invasion of Ukraine on February 24, 2022, wreaked havoc on the household solar energy sector. Since primarily the eastern and southern regions of the country were under long-term occupation or in the zone of active hostilities, a large part of small SPPs was destroyed or seriously damaged. Today, due to the unavailability of statistical data on the industry's real losses, it is impossible to estimate the amount of the lost capacities of residential and industrial SPPs in Ukraine. However, experts say about the destruction of 40% of SPPs in these regions [1]. So, once again, Ukraine steps on the same rake as in 2014, when due to the lack of state regulation of the spatial placement of industrial SPPs, 35% of them were lost due to the occupation of Crimea. Then, in 2015-2017, this loss was fully compensated by the construction of new RE facilities, including the household SPPs. Considering the rapid growth of the industry in 2018-2021 and the concentration of SPPs in the areas of current hostilities, the reconstruction of destroyed RE plants after the end of the war will require much more time and money.

In general, along with the tremendous impact of the war on losses in the solar energy industry, the defects of state regulation also significantly worsened the situation in the sector and must be corrected in the process of post-war reconstruction. Today, taking into account the large-scale destruction of the energy infrastructure in the country, it is clear that Ukrainians will experience several waves of increasing prices for electricity and other energy carriers, which may lead to higher energy poverty among the population. This questions the expediency of further feed-in tariff use as the main lever of RE development. First, due to rising prices, the hryvnia devaluation, and the general destabilization of the economy caused by the war, the state will not be able to continue compensating the high rates of feed-in tariffs to all green power producers. Second, when feed-in tariff levels are being reduced and electricity prices are going to rise, it will be more profitable for households to consume the generated electricity for their own needs, rather than sell it at the feed-in tariff and lend this electricity to the state with unclear payment terms [4]. Therefore, the prospect of transformation of small green energy producers into prosumers becomes more real. This, in turn, will contribute to the decentralization of electricity supply processes, the increase of energy independence of individual consumers and regions of Ukraine as a whole, the formation of a competitive environment in the power industry and, ultimately, the reduction of electricity prices.

At the same time, the prosumerism transition requires developing storage technologies to correct the main shortcoming of SPPs, namely, the discreteness of electricity generation. Since the cost of these technologies is high in today's world market, from the point of view of government regulation, the feed-in tariff can be replaced by benefits for investments in storage technologies, tax holidays for companies that provide system storage services and other tools that can directly or indirectly encourage even small players in the energy market - households - to produce and consume green electricity on the prosumerism basis. In addition, the population of Ukraine, impoverished due to the war, cannot invest in green energy technologies on a pre-war scale, so state investment support for small prosumer projects is critically important. Given the problems with balancing the national energy system and the presence of an aggressive northern neighbor, the state must regulate the spatial distribution of RE facilities and their technology types, which will allow for achieving the goals of decarbonization and increasing the energy independence of the national economy.

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