IJEEP
INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY
EJ EconJournals
ISSN: 2146-4553

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2021, 11(6), 98-105.

Impact of New Renewable Electricity Generating Capacities on Employment in Ukraine in 2021-2030

Galyna Trypolska[1]*, Olena Kryvda[2], Tetiana Kurbatova[3], Olesya Andrushchenko[4], Chingiz Suleymanov[4], Yevgeniy Brydun[5]

[1]SO "Institute for Economics and Forecasting, UNAS," Ukranie, [2]National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute," Ukranie, [3]Sumy State University, Ukranie, [4]Odessa State Environmental University, Ukranie. [5]National University of Kyiv-Mohyla Academy, Skovorody Str., 2, Kyiv, Ukraine. *Email: g.trypolska@gmail.com

Received: 23 May 2021 **Accepted:** 22 August 2021 **DOI:** https://doi.org/10.32479/ijeep.11635

ABSTRACT

The paper estimates the impact of pursuing two scenarios of new renewable electricity generating capacities installation in Ukraine. Under the first scenario, 21% of electricity from renewable energy sources is expected to be generated until 2030, which relatively reflects the current trend of installation of generating capacities, while under the second scenario this figure is expected to reach 30%. To assess the employment effect, the method of employment factors was used. Jobs considered in this methodology include those in equipment manufacturing, construction and installation, operation and maintenance, and fuel supply, which is the case for biomass technologies. Calculations indicate that under the first scenario, 27.5 thousand job-years could be created by 2030, and under the second scenario this figure could reach 50 thousand job-years. The development of renewables in Ukraine nowadays faces regulatory challenges, thus measures to overcome the existing barriers were suggested.

Keywords: Renewable Energy, Jobs, Employment, Ukraine
JEL Classifications: O13, Q28, Q52

1. INTRODUCTION

The development of renewable energy sources has become rapid over the last several decades. Favorable policy measures and support mechanisms have led to investment and technological progress, drastic cost reductions, and exponential growth in renewable energy worldwide. Since 2010, the cost of solar energy has decreased by 82%, the cost of energy from onshore wind farms - by 39%, and from offshore - by 29%. In many parts of the world, renewable energy production, even without additional financial support, is now economically viable and cheaper than fossil fuel and nuclear energy. New solar power plants (SPPs) and wind power plants (WPPs) have become increasingly more profitable than coal-fired power plants (IRENA, 2020).

In 2019, renewables accounted for almost 80% of new electricity generation capacity worldwide. Most of the investment has been made in developing countries and economies in transition, most notably in China, India, Brazil, and Chile, which have allocated USD 152 billion to renewable energy. For comparison: in developed countries, this figure reached USD 130 billion (FS/UNEP 2020).

Growing energy demand and economies of scale coupled with deteriorating air quality and public health, provide increasing incentives for the energy sector to switch to renewables. In addition, awareness-raising and action to combat climate change and environmental protection, including in connection with the Paris Agreement commitments, as well as the global trend of declining funding for fossil fuels (divestments), have already accelerated the transition to renewables and energy efficiency in many parts of the world.

The COVID-19 pandemic has revealed the shortcomings of the modern global energy system: its dependence on fossil fuels and huge problems with access to energy, which negatively affect health care, water supply, information, and other vital services. While the fossil fuel industry has been hit hard by the crisis, the renewable energy sector has proved more resilient. In this regard, numerous international organizations, including the International Renewable Energy Agency (IRENA), the Organization for Economic Cooperation and Development (OECD), the International Energy Agency (IEA),in fact, the and the International Monetary Fund (IMF) have recommended government and business make decarbonization and the transition to green energy a key element in economic recovery and financial support programs, with a phasing out of fossil fuel subsidies and increased investment in renewable energy (IRENA, 2020a; OECD/IEA, 2020; IMF, 2020).

Investments in the energy transition will help the economy recover, create a wide range of new jobs, strengthen the health sector and prevent the climate crisis. Public funds and support are key to attracting private investment and should be used strategically for recovery and improvement through sound regulation of investment decisions and financing (IRENA, 2020a). Currently, some countries with strong economies are already discussing and reaching an agreement on "green" projects as part of their recovery programs (Carbon Brief, 2020).

At the same time, despite the very high potential of renewables, the development of renewable energy technologies in South-Eastern and Eastern Europe, the South Caucasus, and Central Asia remains quite slow. However, decarbonization of energy systems in the countries of the region is technically feasible and will be useful from a social, economic, and environmental point of view.

The COVID-19 pandemic has exposed the region's vulnerability to global challenges, including the climate crisis. The countries of the region are already suffering from its negative consequences: abnormal heat, drought, forest fires, catastrophic precipitation, floods, and melting permafrost. Further forecasts are even more alarming: these are serious consequences for society, and threats to human health and well-being, access to water, food, and energy security, as well as growing migration, gender inequality, and environmental problems (Safonov, 2019). However, no country of the former USSR has adopted the principles of sustainable development and green economy as a basis for recovery from the COVID-19 pandemic.

In Ukraine, the National Economic Strategy until 2030 (CMU, 2021) defines the target for output of energy from renewable sources should reach 25% by 2030. This will require an investment of EUR 10 billion. The Strategy identifies the need to reduce (greenhouse gas) emissions from energy, as well as to limit the negative impact of energy on the environment. The priority of distributed generation is also determined According to the Strategy, as of 2018, 400,000 people were employed in Ukraine's energy sector. The Strategy notes that the development of the energy sector can be a catalyst for job creation. Before the Strategy adoption, another strategic document setting up the targets in renewable energy output and consumption is National Renewable Energy Action Plan until 2020 (hereinafter NREAP) (CMU, 2014). It anticipated that the overall share of renewable energy in the total primary energy supply had to reach 11% in 2020. The share of electricity from renewable energy sources (hereinafter RES) had to reach also 11%, in heating and cooling 12.4% and 10% in the transport sector in 2020.

Despite attempts to reform the energy sector of Ukraine during the time of independence (since 1991), the remainder is still largely based on technological and industrial achievements of the former Soviet Union. The development and progress of renewable energy globally have induced reform of Ukraine's energy sector, in particular through the introduction of new, environmentally friendly sources of energy generation. Despite the ambitious goals for the production and consumption of energy from renewable sources, which arose due to membership in the Energy Community, and due to the acquisition of associate membership in the EU, in Ukraine, there is a certain lag behind the commitments to produce heat from renewable energy sources, as well as to meet obligations for RES consumption in the transport sector. At the same time, electricity generation from RES is expected to meet the targets of NREAP.

According to Transmission System Operator NEC Ukrenergo, as of May 2021, the installed capacity of electricity generating RES facilities connected to the Unified Power System is over 7.07 GW, and taking into account the SPPs of households, the capacity exceeds 8 GW (Figure 1).

One can see from the figure that there is a significant excess of solar generation capacity, due to the attractive feed-in tariff until 2020, as well as the imperfection of the regulatory field, making such a skew possible. During 2020, the share of energy from renewable sources in the electricity balance was 12.4% (UAEnergy, 2021).

In Ukraine, the law provides for the transition to the auction system for the allocation of support quotas for various types of electricity from renewables. The transition to the auction system as of the beginning of summer 2021 has not yet taken place, as well as there are no approved support quotas. However, at the end of 2020, the Ministry of Energy of Ukraine announced an approximate structure of support quotas until 2025. The Ministry expected that in 2021, 365 MW of new RES facilities will be put into operation, and later quotas should increase from 420 MW in 2022 to 570 MW in 2025.

To determine the potential sizes of quotas, the research agency Low Carbon Ukraine conducted an assessment of potential quotas. Two scenarios were considered: when extrapolating the existing trends, the share of electricity generation from RES may be <21% (Scenario 21%, hereinafter - S21%), and the scenario in which it is necessary to reach 30% by 2030 (hereinafter S30%) (Figure 2a and b). 30% of renewable energy is needed, given Ukraine's intentions to produce green hydrogen not only for internal consumption but also for export to the EU countries (European Commission, 2020). It is noteworthy that the first scenario corresponds to the established path of development of renewable energy, i.e., it is a kind of Business-as-usual Scenario.

The figures below show the annual quotas until 2030, i.e. capacities that need to be added annually.

Figure 2a and b indicate that to achieve a higher share of energy from RES in the energy balance, a significantly higher installed capacity of power generating facilities is required. Although the latter should almost double, the installed capacity of wind farms and other sources, especially biomass, should increase. Although wind energy is also an intermittent source, increasing the capacity of wind in energy balance makes sense, because energy can be produced at night when there is no sun and is reducing the demand for hydro pumped storage at noon, when the solar power plants produce less electricity (Hirth and Ziegenhagen, 2013). This will allow some diversification of the energy balance, which is one of the goals of the Ministry of Energy of Ukraine in the field of renewable energy. However, this task is not simple - under the development of renewable energy as envisaged under the S30% scenario, the capacity of

Figure 1: Installed capacity of RES electricity generating facilities in Ukraine, MW (NEC Ukrenergo)

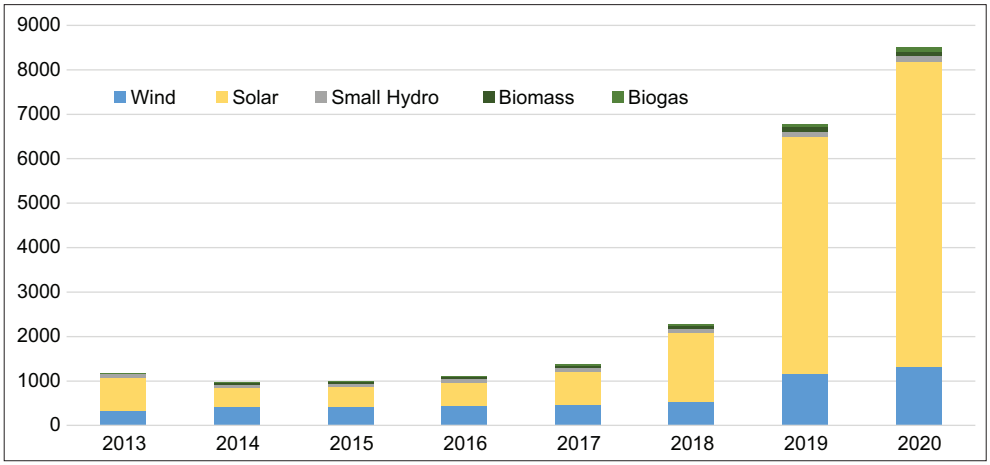


Figure 2: (a) Quotas for RES capacity to achieve 21% of RES energy production, MW (Low Carbon Ukraine (2021)). (b) RES capacity quotas to achieve 30 % of RES energy production, MW (Low Carbon Ukraine (2021))

solar power facilities will still exceed the capacity of wind farms 1.8 times, and under S21% 2.4 times.

Numerous studies show that investing in measures to combat climate change and the introduction of renewable energy sources and energy-efficient technologies stimulate economic growth, create new jobs, and improve society. This promotes technical innovation, improves the investment climate, and stimulates local business development (OECD, 2017; IRENA, 2016). At the end of 2018, the renewable energy sector employed 11 million people (IRENA, 2019). According to IRENA, with the accelerated development of renewable energy sources, the number of jobs in this sector by 2050 may reach 42 million (IRENA, 2020b). Meanwhile, according to the Energy Watch Group, achieving 100% renewable electricity globally will be able to offset the gradual reduction of approximately 9 million jobs in the coal sector in 2015, creating more than 15 million jobs in the renewable energy sector by 2050 (Ram et al., 2018).

The resulting economic activity and new jobs can help prevent the outflow of population and the decline of rural areas that are the cause of labor migration. In 2013, the number of emigrants from the countries of the region amounted to about 37 million emigrants, which is 16% of the total number of international migrants in the world and almost 10% of the total population in the countries of origin. The main reason for their departure was a job search (IOM, 2015).

Employment growth can also counteract the "brain drain" - the emigration of educated youth from the region. Depending on the level of development of renewable energy, jobs can be created throughout the value chain, including project planning, production, installation, grid connection, operation, maintenance, and decommissioning. First of all, installation, operation and maintenance are usually carried out by local engineering, purchasing, and construction companies, and can increase employment and added value on the ground. Additional opportunities for value creation within the region include administrative processes such as rulemaking, financial services, training, research and development, and consulting (IRENA, 2017).

2. MATERIALS AND METHODS

Below, we calculate the employment required to achieve the targets in RES under the two scenarios - S21% and S30%. One should bear in mind that these are hypothetical scenarios. The method of employment factors was used for the calculation, which is described in more detail in Rutovitz et al., (2015), Ram et al. (2020) and Trypolska (2021). Understanding the impact of renewable energy on employment is important for the country's development and the impact on its citizens, as increasing the share of renewable energy in the energy balance means reducing the share of fossil fuel generation and, consequently, losing some jobs in the conventional energy generation. This is the subject of attention and part of the discourse of Just Energy Transition, i.e. the transition to a sustainable low-carbon economy, friendly to people and the planet (90 by 2030, 2021).

To assess the impact of renewable energy on employment in Ukraine, the method of employment factors was used as stated above. Employment in renewable energy generates employment in equipment manufacturing, installation, operation and maintenance, and fuel (in our case biomass) supply (Rutovitz et al., 2015). The following formula is used to assess the employment:

Total Employment = Equipment manufacturing + Construction and installation+ Operation and Maintenance + Fuel Supply

Equipment manufacturing = MW set for the year * Employment rate in production * Regional job ratio for a given year.

Construction and installation = MW set for the year * Employment rate for construction and installation * Regional job ratio for a given year.

Operation and maintenance (O & M) = Aggregate capacity * O & M employment rate * Regional job ratio for a given year.

Fuel supply (biomass) = Demand for primary energy * Employment rate for fuel supply * Regional job ratio for a given year * Share of domestic production.

Equipment production, construction and installation, and fuel supply indicate indirect employment (i.e. employment in supply industries), while operation, maintenance, and decommissioning indicate direct employment (EUEI PDF, 2017). There are also induced jobs, for example, in energy trade, policy development, consulting, and so on. People who work in these fields do not consider themselves employed in the energy sector. Such jobs are not considered in this calculation, which is a certain disadvantage of the chosen method of analysis based on employment factors. For Ukraine, we use employment factors shown in Table 1.

Other assumptions are the following:

- In this paper, we consider only those effects on employment that are related to installation of new renewable electricity generating facilities. Heat or liquid biofuels production was not taken into account
- Solar PV of households are included in the calculation
- Decommissioning was not taken into account in this particular study, as in 2030 no RES facilities would need to be decommissioned
- Geothermal energy is not included, as it is not developed in Ukraine

Table 1: Employment factors in renewable energy in Ukraine (Rutovitz et al., 2015; Ram et al., 2020)

Technology	Equipment manufacturing, job-years/MW	Construction and installation, job-years/MW	O&M, jobs/MW	Fuel, jobs/PJ
Bioenergy	2.9	14.0	1.5	29.9
Small Hydro	8.75	18.5	0.5	
Wind	4.7	3.2	0.3	
Solar	6.7	13.0	0.7	

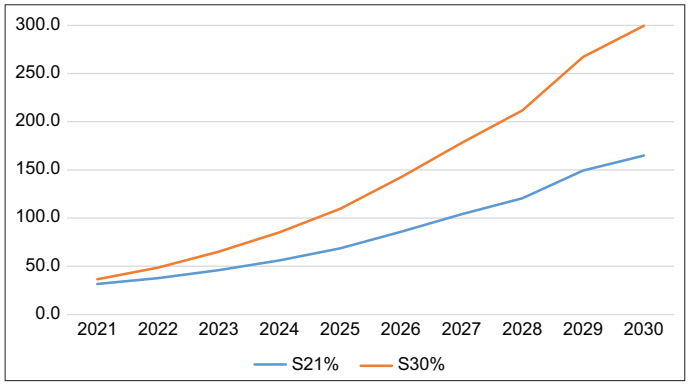
- The quota of "other" capacities will be distributed at the rate of 33% of small hydro and 66% - biomass (biomass and biogas) for several reasons: (a) in Ukraine the number of sites for installation of new capacities for small hydro is already limited or even exhausted; (b) leading international financial organizations (EBRD, NEFCO) already refuse to finance projects based on the feed-in tariff in Ukraine; (c) at the same time, biomass projects that could potentially produce electricity and heat remain promising for funding
- Primary demand for biomass is calculated based on data on the potential for biomass use of the Roadmap for the development of bioenergy until 2050, developed by the Bioenergy Association of Ukraine (Geletukha et al., 2020). The demand for biomass under the two scenarios is shown in Figure 3.

3. RESULTS

The results of the calculations show that under the S21% scenario, by 2030 as of 2030 in Ukraine can be provided from 11.5 thousand in 2021 to 27.5 thousand job-years (Figure 4).

Figure 4 indicates that the highest employment can be expected in solar energy because already in 2021 there is a significant installed capacity of solar, which is expected to increase in the future (but not as fast as before 2021). Also, many jobs are expected in bioenergy, primarily due to the cultivation of feedstock (which, according to the current legislation of Ukraine, belongs to agriculture). Bioenergy can provide even more jobs if the new installed capacity in category "other" biomass would prevail even more.

Figure 3: Primary demand for fuel (biomass), PJ



As can be seen from Figure 5, given the development of renewable energy under this scenario, the number of employees may be from 16 thousand people in 2021 to more than 50 thousand people in 2030. Thus, employment in 2030 under the S30% scenario may become almost twice as high as under the S21% scenario.

In terms of types of jobs (equipment production, installation, maintenance), we can state that the largest number of jobs will again be provided by solar energy, as it has the high installed capacity (the higher the capacity, the more equipment needs to be produced) and wind energy. It is noteworthy that despite the higher capacity of solar energy, in energy engineering for wind energy almost as many jobs as for solar energy is expected to be. It is important to note that a significant amount of equipment is manufactured outside Ukraine. Despite attempts to increase the localization of production, by 2030 we can expect that the production of equipment outside Ukraine for the needs of the domestic market will continue. To reflect this effect (i.e. the fact that the equipment is produced mainly abroad), localization coefficients of 0.3 for 2020 and 0.5 for 2030 were applied for Ukraine (i.e. that 30% and 50% of equipment elements are used in 2020 and 2030 respectively). In Ukraine, these jobs are classified as (energy) engineering.

Figure 6 indicates that the fewest jobs are possible in the production of equipment for bioenergy.

In terms of construction and installation (Figure 7) most jobs can be created by solar energy, as well as by bioenergy. According to the S21% scenario, from 3.6 thousand jobs in 2021 to 9 thousand in 2030 are expected. Under the S30% scenario, these figures may range from 7.3 thousand in 2021 to 18 thousand in 2030.

Regarding operation and maintenance, the most labor-intensive is again solar energy (Figure 8). It is interesting to note that under

Figure 4: Employment in renewable energy of Ukraine under the S21% scenario, job-years

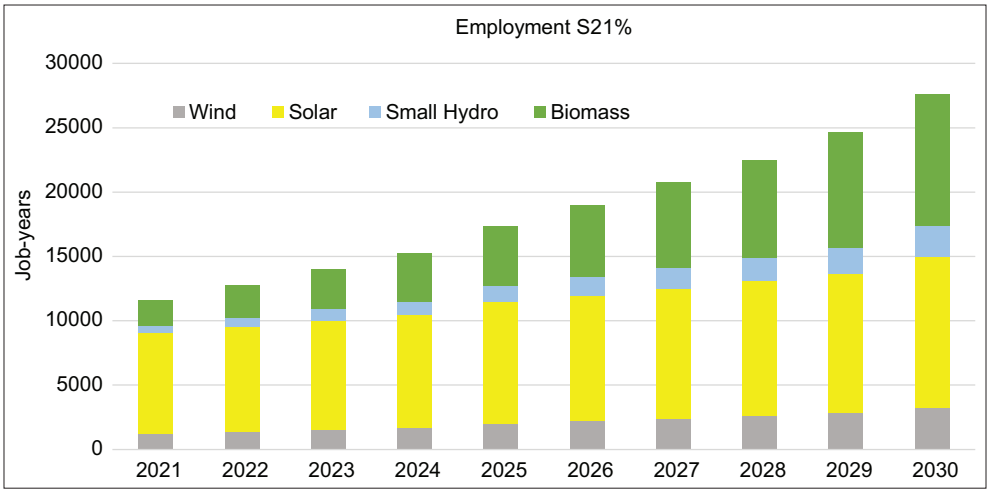


Figure 5: Employment in renewable energy of Ukraine under the S30% scenario, job-years

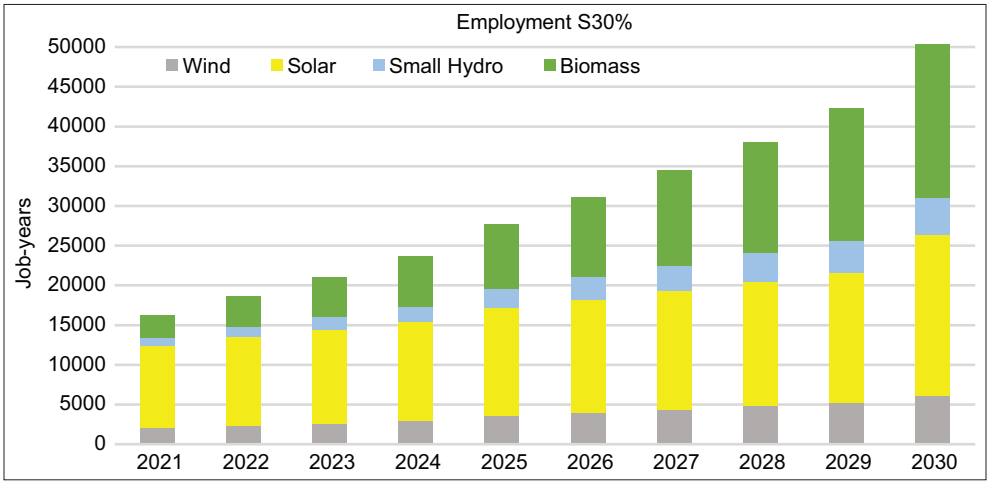


Figure 6: Jobs for equipment production for different technologies in S21% and S30% scenarios, job-years

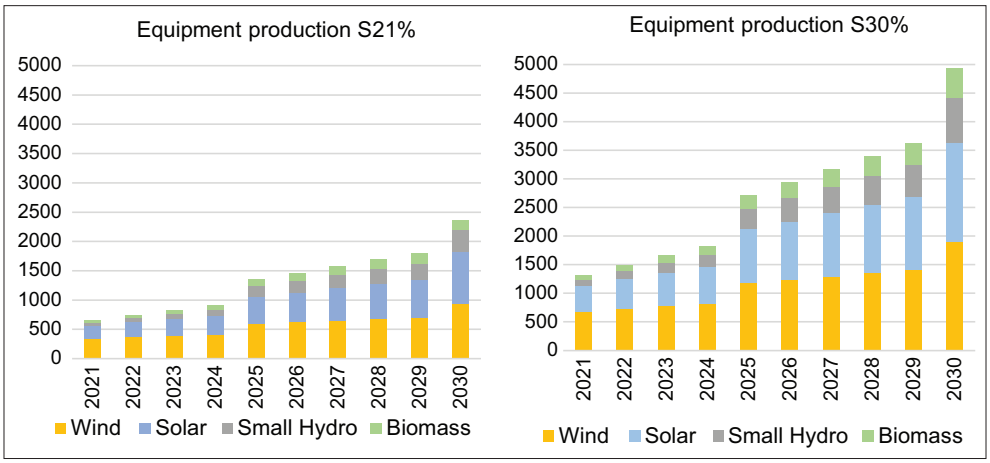
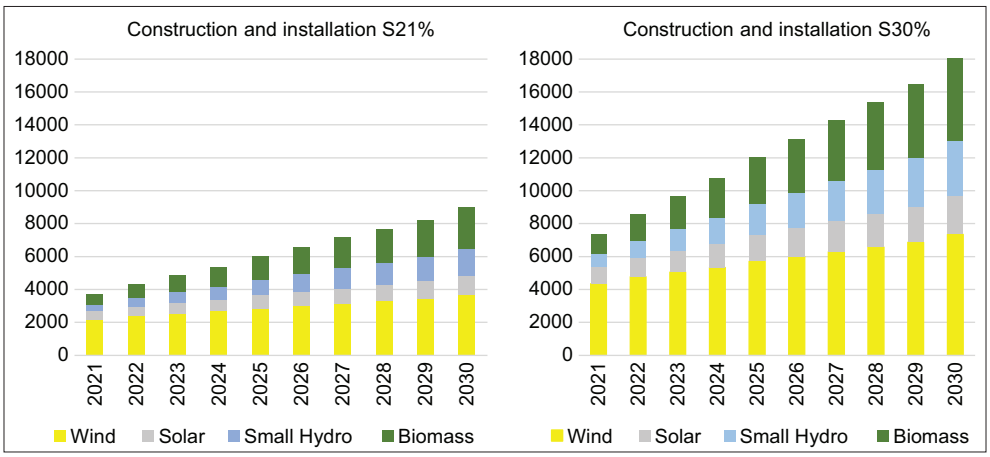


Figure 7: Jobs for construction and installation for different technologies under S21% and S30% scenarios, job-years



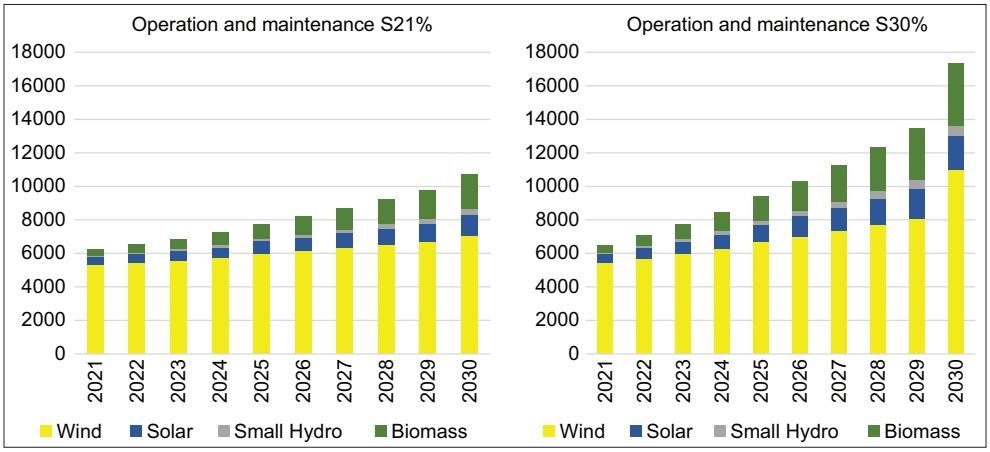
the S30% scenario for 2030, only 3,000 more jobs are expected to be serviced than under the S21% scenario, even despite the significantly higher installed capacity under the second scenario.

Biomass-based power generation technologies provide jobs in the cultivation/preparation of feedstock (Figure 9). In Ukraine, these jobs are classified as agricultural.

4. DISCUSSION AND CONCLUSION

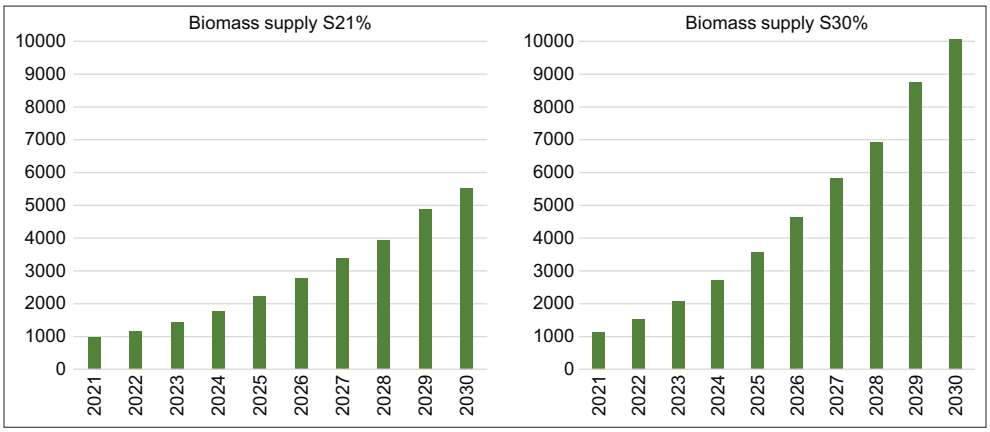
As noted above, the S21% and S30% scenarios are merely hypothetical. The growth of installed capacity is possible only with a stable regulatory environment, which is not the case in Ukraine, at least in 2019-2021. The development of the market is accompanied by significant uncertainty due to the transition

Figure 8: Jobs for operation and maintenance for different technologies under the S21% and S30% scenarios, job-years



Source: Own calculations

Figure 9: Jobs for biomass cultivation under S21% and S30% scenarios, job-years



to the auction system, which has not yet occurred, uncertainty of funding sources for payments at the feed-in tariff, as well as significant arrears of payments formed in 2020 (debt of TSO NEC "Ukrenergo" to the offtaker SO "Guaranteed Buyer" is UAH 11.6 billion (EUR 0.35 billion) (SO Guaranteed Buyer, 2021)). The mentioned debt and instability of the regulatory field further make borrowed capital in Ukraine even more expensive, which in turn increases the levelised cost of electricity production (Low Carbon Ukraine, 2021). To overcome the negative phenomena that have developed in the market, it is necessary to take several measures, including the following:

- Payment of debt of the feed-in tariff, which is necessary to restore investor confidence, including international, in the industry
- Identification of sustainable ways of financing electricity from RES
- Launch of auctions for the distribution of support quotas and legislative approval of quotas
- Legislatively approved the transition to state support for RES in the form of feed-in premium, in particular in the form of contracts for difference (CfDs), which will partially reduce the burden of payments for electricity sold from RES. The Ministry of Energy has developed a corresponding bill in 2021, but it has not been adopted yet.

Increasing the share of energy from RES in the energy balance by 2030 can contribute to the employment of 27.5 thousand to 50 thousand people in 2030, depending on the chosen development scenario. To ensure the installation of the required capacity, it is necessary to overcome the existing regulatory and financial barriers available in the market of electricity from RES in Ukraine. Overcoming these barriers will help restore the confidence of international and domestic investors, and promote Just energy transition in Ukraine.

5. ACKNOWLEDGMENT

The publication was prepared in the framework of the research project "Formation of economic mechanisms for sustainable development of renewable energy in the conditions of global and local threats to energy security of Ukraine" (No 0120U104806), funded by the National Research Foundation of Ukraine.

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