



## Experience and Prospects of Financing Renewable Energy Projects in Ukraine

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### ABSTRACT

The study examined the experience of financing renewable energy projects in Ukraine. Renewable energy is one of the tools to enhance decarbonization and meet the obligations taken within the Association Agreement between Ukraine and the EU, and under the Paris Agreement. Ukraine has factors impeding the investments, resulting in a high cost of capital. Overall, there are five main options of financing theoretically available: lending, primarily with the aid of international financial institutions; funding of renewable energy projects by municipalities; voluntary associations of citizens; securities; irrevocable financial assistance. The future instruments include securities and a recently announced mechanism to finance renewable energy projects in the frame of the Green Deal. The most expansive spread option for funding renewable energy projects was lending with the help of international financial institutions. Due to the bilateral electricity market transition of Ukraine in 2019, Ukraine failed to found a model for sustainable financing of electricity from renewables, resulted in the accumulation of significant debt with the feed-in tariff payment. This fact hinders the planned and potential future investments until a sustainable model of financing is found.

**Keywords:** Renewable Energy, Financing, Ukraine

**JEL Classifications:** G23, Q280, Q480.

### 1. INTRODUCTION

Ukraine has signed the Association Agreement between Ukraine and the EU, which contains a clause recognizing the priority of environmental protection, development of green economy, and increasing production through modern technologies (Article 360). To do so, a financial system capable of resisting non-financial risks must be organized. The agreement came into force in September 2017, while Ukraine is reforming both the financial system and creating a regulatory environment attractive for investments, including in renewable energy projects, which are one of the financial elements of the green economy (UNEP, 2016). These tasks are challenging - according to the insurance company Euler Hermes Global, Ukraine has the lowest possible ranking (D4, high risk for enterprise). Economic, political, commercial, and

financial risks are maximal (Euler Hermes, 2021). World Bank ranks Ukraine as 64<sup>th</sup> out of 190 countries in terms of Ease of Doing Business 2020 report (World Bank, 2020), which is significantly worse compared to other Eastern Partnership countries.

Ukraine was one of the first countries that ratified the Paris agreement, and to date, the country is striving to become a country with a high level of ambitions in mitigation. In 2021, Ukraine revised its Nationally Determined Contribution (i.e., submitted its 2NDC), which anticipates reaching a 65% reduction of its 1990 level emissions and stating that climate neutrality is possible to attain in 2060 obeying the provisions of the Paris Agreement. Ukraine is also in the process of developing its first Climate Change Adaptation Strategy. These ambitions would enable Ukraine's economic growth and allow the country's export to

become more competitive, especially in the view of anticipated Carbon Border Adjustment Mechanism introduction in 2023.

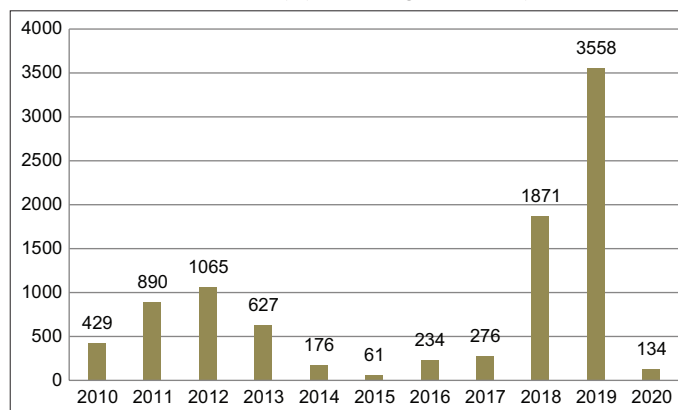
Climate-related ambitions and decarbonization require significant financing. Given the fact that Ukraine belongs to the group of lower-middle-income countries according to the World Bank's classification, Ukraine's possibilities for funding climate-related activities are pretty limited. European Union and countries of Northern America (USA, Canada) and Asia (Japan) provide generous help in attempts to decarbonize Ukraine's economy and follow the path of sustainable development. In 2018, overall international climate finance flow in Ukraine totaled USD 845 million (OECD, 2018). To this extent, investments in renewable energy sources mean partial or complete independence from imported energy carriers and thus increasing the country's national security and potential savings on (un)imported energy resources.

Formally Ukraine undertakes reform aimed to enhance its investment climate, establishing National Investment Council in 2014, a Business Ombudsman in 2015, and investment promotion agency UkraineInvest in 2016 (OECD, 2021). Energy is one of the priority areas for investment, according to UkraineInvest. However, these measures did not succeed, and Ukraine continues to have low foreign direct investments (4% of GDP) due to a very restrictive climate for FDI (OECD, 2021), additionally enforced with hostilities in the East of Ukraine, corruption, and poor quality of infrastructure.

It is essential to mention that Ukraine has a relatively high weighted average cost of capital (WACC), which significantly affects the Levelized cost of electricity. As of 2020, WACC in Ukraine was 15-16%. This is rather high, as in OECD countries, WACC usually does not exceed 10%. In early 2020, the Government of Ukraine set a task to reduce the cost of loans; as a result, loans for micro and small businesses began to be provided under the program "Affordable loans 5-7-9%." As of the end of March 2021, domestic banks provided loans with preferential rates mainly to farmers, primarily for sowing campaigns. Although the National Bank of Ukraine discount rate was reduced to 11% from late January 2020, that measure did not affect the interest rates for lending to renewable energy or other businesses. Renewable energy projects require special credit programs, which will be discussed below. A feature of renewable energy projects is that the projects are expensive to start and relatively inexpensive to maintain (as opposed to nuclear energy or the use of coal).

According to OECD assessments, during 2013-2017, Ukraine has received USD 38.7 billion of FDI. Out of this figure, renewable energy sources (hereinafter RES) attracted 12%, and conventional energy – 10% (OECD, 2019). Overall, 74% of FDI came from the EU. During 2009-2020, more than EUR 9 billion were invested in Ukraine's renewable energy, of which EUR 8.1 billion were invested in 2014-2020. EUR 4.9 billion was invested in electricity generation (Figure 1) (Bloomberg NEF, 2021), EUR 530 million in heat generation, and EUR 340 million in domestic solar PV (SAEE, 2020). Ukraine has declared transition to the auction system in 2020, which resulted in more capacity were commissioned in 2019 than in all previous years.

**Figure 1:** Investments in solar and wind electricity generation in 2010-2020 in Ukraine, USD million (excluding investments in home-owned SPPs) (Bloomberg NEF, 2021)



Out of the total amount of credit resources, foreign banks provided loans of EUR 2.5 billion, of which the EBRD provided EUR 1 billion in loans. Domestic banks UkrGasbank, Ukreximbank, Oschadbank, and Privatbank provided loans to finance renewable energy of EUR 1 billion. In Ukraine, from EUR 4 billion in credits for energy production from RES there is not less than EUR 2.5 billion. About EUR 2 billion invested by international companies was secured by export credit guarantees from other governments (Epravda, 2020).

Unfortunately, Ukraine has not yet found the source of funding for produced electricity from RES. In December 2019, the process of mediation between the state of Ukraine and investors in renewable energy on the restructuring of payments under the "feed-in tariff" with the assistance of the Energy Community began. As a result of negotiations in 2020, a "Memorandum of Understanding on the settlement of problematic issues in the field of renewable energy" was signed, based on which the Law of Ukraine "On Amendments to Certain Laws of Ukraine to Improve Support for Electricity Production from Alternative Energy Sources" was adopted. No. 810-IX of July 21, 2020. The law provides for a retrospective reduction of feed-in tariff coefficients for solar and wind power plants. The state guarantees timely payment for electricity from RES from August 2020. However, due to the lack of sources of financing, the debt continued to accumulate, and payments did not become timely. As a result, the EBRD refused to provide loans to NEC Ukrenergo to support the company's liquidity (UAZMI, 2020). The average level of payments for electricity from RES supplied in 2020 was 63.5%, and a total of UAH 40.579 billion (EUR 1.2 billion) was to be paid for electricity from RES in 2020. In 2021, according to the forecast of the National Commission for Electricity Market Regulation, expenditures on green electricity will increase to UAH 50.032 billion (EUR 1.5 billion) (ExPro 2021a). The government is considering several sources to cover debts for electricity sold, including the placement of securities of domestic governmental loans, budget funding, an increase in the interstate toll, and an increase in the tariff for the transfer for NEC Ukrenergo. As a result of this crisis, investments in renewable energy in Ukraine in 2020 tremendously decreased compared to 2019, which is predictable.

As was mentioned above, international financial institutions have already provided significant help in financing the Ukrainian renewable energy sector. Given the fact that Ukraine now is in the middle of the crisis caused by non-payment for electricity from RES, and by the fact that renewable energy technologies grow mature relatively fast, it is essential to consider what are the options of financing renewable energy projects in Ukraine now and in future, which defined the purpose of this paper.

## 2. RESULTS

Here we consider at least six options of renewable energy projects financing in Ukraine. They are the following:

- Lending (primarily with the aid of international financial institutions)
- Financing of RES projects by municipalities
- Voluntary associations of citizens
- Securities
- Irrevocable financial assistance
- Direct contracts between energy producer and buyer.

### 2.1. Lending (with the Help of International Financial Institutions)

Lending (with the aid of international financial institutions) is the most popular financing option for RES projects. Domestic banking institutions raised loan capital with the assistance of international financial institutions. Until recently, there were different options for lending - direct financing, financing through intermediaries, co-financing (Table 1).

International Finance Corporation (IFC) provides loans for the development of RES in Ukraine through cooperation with JSB Ukrgasbank (hereinafter Ukrgasbank), mostly (94.94%) owned by the state. The Bank has set a course for eco-banking. During the cooperation with IFC, Ukrgasbank financed 165 RES projects and lent EUR 572 million, ensuring the installation of 1,082 GW of RES capacity. In addition, the bank also lends to the installation of SPP for households. Thus, the bank lent 244 home-SPP of UAH 81 million. Ukrgasbank provides 5 years' loans with interest rates 18.1% in UAH, 8.6% in USD and 7.7% in EUR (Ukrasbank, 2020). Current loan programs are provided on the condition that the credit funds must be at least 40 EUR million.

The Nordic Finance Corporation (NEFCO) manages several funds that pursue renewable energy, energy efficiency, and climate-oriented solutions, including:

**Table 1: International financial institutions involved in financing RES projects in Ukraine (Slovak Aid and, UNDP, 2017)**

Direct financing	EBRD, IFU (jointly with Danida Business Finance), GFG Fund, FINTECC
Financing through intermediaries	IFC, NEFCO, World Bank, European Investment Bank, Entrepreneurship Development Fund
Co-financing	Finnish-Ukrainian Trust Fund
Financing of technical assistance	EBRD, Finnish-Ukrainian Trust Fund, GEF (as part of USELF), GFG Fund, FINTECC

Partnership of the Northern Financial Corporation (NEFCO) and Ukrasbank. The budget of the program is EUR 10 million. The goal is to lend to small and medium enterprises for seven years (starting in 2019). Out of EUR 10 million, NEFCO provides EUR 5 million, and the remainder is supplied by Ukrasbank (Ukrasbank, 2019).

Partnership of the Northern Financial Corporation (NEFCO) and JSB Ukreximbank, launched in 2020. The program budget is EUR 65 million, which will be provided within 5 years. The goal is to lend to enterprises in the field of energy efficiency and RES. Notably, the program was fully implemented in July 2020, which is somewhat unexpected given both the COVID-19 related quarantine restrictions and the problems of non-payment and retrospective revision of the feed-in tariff in Ukraine in 2020 (Ukreximbank, 2020).

During 2018-2019, the Danish Investment Fund (IFU) provided a loan of EUR 15 million in Ukraine to finance RES projects (Syvaska WPP with a capacity of 250 MW). IFU manages the several Danish financial institutions' funds, particularly the Danish SDG Investment Fund and Danida Sustainable Infrastructure Finance. The use of Danish equipment and technologies is mandatory to attract loans from IFU.

Lending by the Danish government organization Danida Business Finance (DBF) (Vinokurov, 2019). This program will provide interest-free loans for RES, energy supply, water treatment. The loans will cover 100% of the project cost and will be provided for 10 years. The projects will be provided under a state guarantee, and the size of the projects must exceed EUR 100 million.

Finland Ukraine Trust Fund (FUTF) provides loans, including for the renewable energy needs (FUTE, 2021). The fund is funded by the Ministry of Foreign Affairs of Finland and NEFCO, and the coordinator of its work in Ukraine is the State Agency for Energy Efficiency. The fund will operate until the end of 2021. The fund covers 100% of technical assistance related to the project (consulting services, project documentation, software). The share of Finnish "content" in each project must be at least 30%.

Facilities for Cleaner Production (NEFCO) is a loan program that provides loans for projects to reduce greenhouse gas emissions and pollutants. The program is designed specifically for Russia, Ukraine, and Belarus (NEFCO, 2021a). It allows getting loans up to EUR 5 million per project, and low-interest loans from EUR 100-500 thousand. With the participation (co-financing) of NEFCO, as of 2019, 15 wind and solar power plants were financed for EUR 566 million.

The Swedish-Ukrainian district heating program aims to upgrade heating systems through RES, heat dissipation potential, and heat demand management. The program is co-financed by the Swedish government, which has been allocated EUR 6 million and another EUR 4 million for technical assistance, and NEFCO, which can provide up to EUR 5 million in credit for each project, with NEFCO contributing to each project not more than 30%, and project beneficiaries must raise at least 10% of their funds (NEFCO, 2021b).

One of the largest borrowers for developing RES projects globally is the European Bank for Reconstruction and Development (EBRD). The institution has provided EUR 30 billion in clean technology loans, financing more than 1,600 projects (EBRD, 2020). Ukraine Sustainable Energy Lending Facility (USELF), operating in Ukraine, is an EBRD loan program to finance RES projects. There were several USELF programs. The size of the USELF-I program was EUR 50 million. In support of this phase, the Fund Clean Technology provided additional funding of EUR 20 million. The USELF-II program amounted to EUR 140 million. Loans of EUR 1-15 million are provided for small and medium enterprises. USELF-III amounted to EUR 250 million. What these programs have in common is that technical assistance (consulting services) is free. It is noteworthy that the EBRD strongly suggests the transition from the feed-in tariffs to the auction system, so the Bank's representatives have repeatedly stated that without this transition, the Bank will stop lending to projects (EBRD, 2018). Technical support for USELF projects is provided by the Global Environment Facility (GEF).

In 2018, the EBRD loan program was launched through JSC "Ukreximbank" Program for lending to small and medium enterprises, aimed at supporting the implementation of the Deep and Comprehensive Free Trade Agreement between Ukraine and the EU (DCFTA)" under the pan-European program EU4Business. The program budget is EUR 260 million. This program provides sub-loans of up to EUR 3 million for up to 18 months per project. A feature of this project is the ability to receive an additional 15% of funds for the program's implementation in the form of grant assistance (Ukreximbank, 2016a). In 2019, a separate EBRD loan program was launched through cooperation with JSC Ukreximbank for EUR 80 million, of which the EBRD provides EUR 40 million (EBRD, 2019).

In 2020, the EBRD launched a new credit program for the development of RES in Ukraine, Jordan, Lebanon, and Tunisia (EU External Investment Plan, EIP). The volume of lending is EUR 50 million. Borrowers' equity is essential, so the EBRD plans to raise EUR 500 million from these funds. This loan program is designed for RES projects that run through an auction system (and not through the feed-in tariff). However, from September 2020, the EBRD refuses to provide loans for projects that provide for the electricity sales against a feed-in tariff.

The Finance and Technology Transfer Center for Climate Change (FINTECC), established by the EBRD and GEF. This Program allows the implementation of climate-friendly technologies, including RES. The Program is currently being conducted in 17 countries. The Program provides both technical and investment assistance. In particular, concessional grants are provided, in addition to EBRD financing, covering up to 25% of the cost of specific technologies. The maximum contribution is USD 1 million, which is paid after the commissioning of the facility (EBRD FINTECC, 2021). Within this Program, the project "Innovations in biomass supply chains" was implemented in Ukraine.

The World Bank (WB), in 2017 through JSC Ukreximbank, launched a project to access long-term financing. Ukraine will be

granted USD 150 million for up to 35 years; the project will run until the end of March 2022. No more than USD 8 million will be provided for the needs of one project to private small and medium-sized enterprises, which can independently offer at least 15% of the capital. The project is aimed at enterprises whose products are export-oriented, so in the field of RES growing biomass or production of equipment for RES qualify, as well as projects of mini- or micro-hydro, small thermal power plants operating with clean fuel, renewable energy sources (except large hydropower plants) (Ukreximbank, 2016b).

The European Investment Bank (EIB) provides EUR 260 million to support businesses that contribute to implementing the Association Agreement and the Deep and Comprehensive Free Trade Area (DCFTA) with the EU. These types of companies include renewable energy. Projects for EUR 40 thousand and up to EUR 50 million are provided, with EUR 12.5-50 million allocated for one project.

In addition, in 2015, Ukraine took part in the EIB Ukraine Municipal Infrastructure Programme (UMIP), which allowed getting loans of EUR 10 million for the period from 22 years to municipalities and public companies on projects in the field of modernization of the heating system, renovation of lighting systems, wastewater treatment and energy efficiency of buildings. All these measures can be based on the use of technological solutions in the field of RES. The overall amount of credit funds under this program is EUR 400 million, which Ukreximbank distributes. The mechanism for obtaining a loan is quite tricky and requires the participation of the government. The funds are distributed with the involvement of the Ministry of Finance, the Ministry of Development of Communities and Territories of Ukraine, the National Commission for Regional Development and Regional Administrations (UMIP, 2020).

Green for Growth Fund (GGF) provides loans for energy efficiency projects and renewable energy for the countries in Southeast Europe. The Fund was initiated by the European Investment Bank and KfW Development Bank. The Fund also has the opportunity to provide technical assistance to financial and non-financial institutions, municipalities, and private companies and households. In Ukraine, Ukreximbank provided EUR 20 million for small RES projects, EUR 25 million for the construction of the Syvash Wind Power Plant, and EUR 9 million to finance the Boguslav WPP. Through ProCreditBank, EUR 8 million was provided for small RES projects, and another EUR 18.6 million through Megabank and OTPLending for energy efficiency projects (GGF, 2021). In total, the Fund allocated EUR 25 million for projects in Ukraine.

The Entrepreneurship Development Fund (through the German-Ukrainian Fund and the EU4Business program) offers loans of up to EUR 100 thousand for 3-5 years, among other things, in the field of energy efficiency and energy saving through several partner banks (ProCreditBank, Ukrgasbank, Oschadbank and Bank of Lviv) (GUF, 1999). Loans are provided to replenish working capital and investment activities (purchase of equipment, repair, reconstruction of fixed assets). Interest rate - UIRD3m + 5% (as of April 2021, the UIRD3m rate is 7.3%).

The Private Financing Advisory Network (PFAN) operates since 2006 and aims to close the business-to-investor gap. The program is organized by UNIDO and REEEP (Renewable Energy and Energy Efficiency Partnership). PFAN seeks funding for projects in RES, energy efficiency, agriculture, adaptation to climate change, and provides technical assistance for specific tasks (with the preparation of a business plan, feasibility study). The optimal size of the project is USD 1-50 million, as well as micro-projects - up to USD 1 million. In Ukraine, in 2019, the 2<sup>nd</sup> phase of the program began. In total, PFAN raised USD 20 million in RES projects.

Black Sea Trade and Development Bank (BSTDB) finances projects in energy, agriculture, housing, and provides technical assistance. In Ukraine, the Bank has invested EUR 646 million, of which EUR 18 million in the energy sector. The Bank became an investor in Syvasky WPP (250 MW), for which EUR 30 million will be allocated a total of 30 million (BSTDB, 2021).

U.S. International Development Finance Corporation (DFC) from 2020 and onwards (Overseas Private Investment Corporation, OPIC earlier) mobilizes American capital and invests it in less developed economies. Their global investments amounted to USD 29 billion, and from 2020 it should double, reaching USD 60 billion. Since 2014, DFC has invested USD 1 billion in Ukraine for 6 years (as of 2014, USD 115 million were funded). The loans may be provided for 10 years, and the loan amount is from USD 1 to 350 million. The Corporation has invested more than USD 150 million in Ukraine's wind energy (Myroniuk, 2019).

As we can see from the text above, the financing options are pretty diverse. They are summarized in Figure 2.

Here, we use the definitions of the Commercial Code of Ukraine on the size of companies (Table 2).

Below, we summarize the possibilities of obtaining loans for domestic enterprises by international financial institutions (Table 3). The renewable energy ranked in the TOP-3 industries of Ukraine in terms of attracting foreign direct investment.

As can be seen from the Table 3, several financial institutions in Ukraine can potentially provide both loans for RES projects and technical assistance, especially to medium and large enterprises. Representatives of MFIs note that in Ukraine, the level of submitted grant applications is often insufficient, so MFIs deny applicants lending.

The data in Figure 2 above largely reflect the investment trend in solar and wind technologies in Ukraine, but there are very few projects for biomass. The only exception is EBRD Sustainable Bioenergy Value Chain Innovation Programme, and there are absolutely no programs for small hydro or heat pumps. EBRD finances bioenergy projects above EUR 3 million (ExPro, 2021b). Given this, to recognize the priority of biomass and enable funding for biomass projects, including from international financial institutions, it is advisable to provide state financial assistance by expanding the state program to support farmers, including encouraging the purchase of specific machinery and equipment (UABio, 2019).

## 2.2. Financing of RES Projects by Municipalities

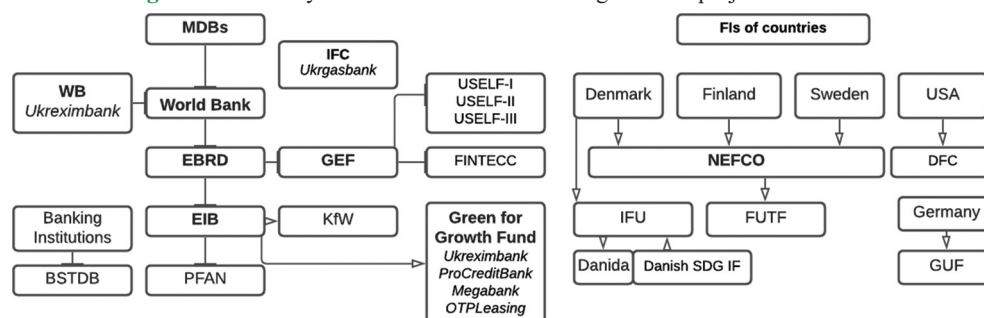
There are at least several mechanisms for raising funds by municipalities, such as State funding programs; Implementation of projects at the expense of donors, and Bank lending to municipalities.

According to UNDP in Ukraine, in France and Spain, bank loans account for 94% and 76% of municipal borrowing. With the assistance of UNDP in Ukraine, a pilot project "Development and commercialization of bioenergy technologies in the municipal sector in Ukraine" was launched. The logic of lending to municipalities in Ukraine is that due to decentralization, municipalities should have increased financial opportunities, which could be directed, including to RES projects or energy efficiency measures.

Until recently, there were only two regional programs in Ukraine aimed at the development of renewable energy: soft loans for the purchase of RES equipment in the Lviv and Zhytomyr regions. In 2018, in the Lviv region, the regional budget covered 10% of the loan amount for the installation of solar panels. In the Zhytomyr region, 20% of the costs for the installation of solar power plants, batteries, and rooftop panels were reimbursed from the regional budget. In 2017, about USD 37 thousand were allocated for these purposes in the Zhytomyr region, together with energy efficiency measures. In 2021, there are no such programs.

Eastern Europe Energy Efficiency and Environment Partnership (E5P, 2021) was initially established (in 2011) as a fund to assist municipalities in Ukraine. Gradually since 2014, its activities have been extended to other countries, such as Moldova, Azerbaijan, Belarus, and Georgia. The primary donor is the EU, and EU member states such as Sweden, Germany, Denmark and many others. The

**Figure 2:** Summary of sources to obtain financing for RES projects in Ukraine



Partnership funds projects in many areas, such as RES projects (with particular emphasis on biomass projects), district heating, urban transport, energy efficiency of social infrastructure facilities (hospitals, kindergartens, etc.), water and wastewater treatment. The project will end in 2022. During this period, Ukraine expects to receive EUR 115 million. In the field of RES, projects for the production of biogas from wastewater in Lviv were implemented.

### 2.3. Voluntary Associations of Citizens (Energy Cooperatives)

Energy cooperatives allow the construction of energy facilities at the expense of local communities, as communities spend from ten million to several billion hryvnias on energy per heating season (in case of using natural gas as fuel for heat) (Boell, 2019). The definition of “energy cooperative” in Ukraine is found in Law #555-IV “On alternative energy sources” (2003), allowing energy cooperatives selling electricity against the feed-in tariff. The creation of energy cooperatives is in line with several global trends, including distributed energy generation, use of renewable energy sources, and the approximation of energy production to places of direct consumption. The largest energy cooperatives are located in the United States, Germany, Denmark, Sweden, the Netherlands, and Austria. As of 2015, there were more than 1,000 cooperatives in Germany, which owned 47% of the generating capacity of renewable energy (Zinchenko et al., 2016).

There are several areas in which energy cooperatives can be effective, particularly using renewable energy sources, growing energy crops, heating and ESCO contracts (Boell, 2019).

As of 2021, there is only one official municipal energy cooperative in renewable energy - Consumer Society “Solar City.” The cooperative installed 200 kW rooftop SPP in the town of Slavutychny (Kyiv region).

The cooperative has been selling electricity against feed-in tariff since March 2020, having received a license to produce electricity in February 2020. A small part of the cooperative’s profit (5%) is used to finance the needs of the town of Slavutychny itself, which local authorities can select. In Ukraine, the creation of energy cooperatives may be particularly appropriate in rural areas, as about 30% of the population lives there, and the cost and quality of energy services are not always satisfactory.

There are examples of community associations based on the principles of an energy cooperative when the community uses waste from the production/cultivation of primary products as energy feedstock (for example, Yagidny Krai cooperative, Ternopil region). Still, such an association is not registered as an energy cooperative. There is also Berezdivsky Energy Cooperative LLC (Berezdovskaya OTG, Khmelnytsky region). The cooperative buys straw from local farmers, from which briquettes are made to heat the school.

The main obstacles to the formation of energy cooperatives in Ukraine are the high initial costs required to purchase energy equipment, lack of trust between neighbors (Boell, 2019), inability to self-organize, and a long payback period for projects. On the other hand, the opportunity to attract citizens’ funds, i.e. bypassing the stage of bank lending, makes such activities possible.

### 2.4. Securities

Securities can be issued both by state/government agencies and by individual companies. As of 2021, Ukraine is developing legislation for a fundamentally new instrument for financing RES projects - green bonds. In 2018, the State Agency for Energy Efficiency and Energy Saving of Ukraine, and the National Commission of Securities and Stock Market of Ukraine, GIZ, and UNIDO launched the development and implementation of green bonds, which will be put into circulation as a type of securities. For this purpose, the Law of Ukraine “On Amendments to Certain Legislative Acts of Ukraine on Simplification to Attract Investments and Introduce New Financial Instruments” #738- IX (2020) was adopted. The Law defines the concept of green bonds. Thus, “Green bonds are bonds, the prospectus (the decision on the issue, and for government bonds of Ukraine - the terms of placement) which provides (provides) the use of borrowed funds

**Table 2: Classification of companies by size in Ukraine (SCU, 2003)**

Indicator	Micro	Small	Medium	Large
Number of employees per year, persons	≤10	≤50	All others (not classified as micro, small and large)	>250
Annual income, EUR million	Not>2	Not>10		>50

**Table 3: Types of enterprises by size, which can be granted loans**

Financial institutions	Project end	Micro	Small	Medium	Large
UkrGasbank (via NEFCO and IFC)	2025	–	+	+	–
Danida		–	–	+	+
Finnish-Ukrainian trust fund (via NEFCO)	2021	–	+	+	–
Facilities for cleaner production (via NEFCO)		–	+	+	+
USELF (EBRD)		–	+	+	–
EIP (EBRD)		–	+	+	–
EU4Business (EBRD)		+	+	+	–
FINTECC (EBRD, GEF)					
World Bank	2022	–	+	+	–
European Investment Bank (EIB)		–	+	+	+
Green For Growth Fund (GGF) through the EIB and KfW Development Bank		+	+	+	+
Entrepreneurship development fund		+	+	–	–
BSTDB		–	+	+	+
DFC (ex OPIC)		–	–	+	+

exclusively to finance the environmental project or a separate stage.” Green bonds could be issued for specific environmentally friendly projects. They can be beneficial for municipalities, in particular, to attract funding for environmental or energy projects. During 2021-2022, Ukraine will continue to develop the secondary legislation, i.e., the order of the issuer to implement a project, will create a system of tax preferences (such as exemption of investors from several taxes, as well as compensation to issuers of interest rate differences when issuing bonds and exemptions from taxation not only of external but also of internal issuers). Relevant changes to the Tax Code are expected to be made in 2021. There will also be information campaigns that will acquaint potential issuers with the features of this debt instrument. In 2022-2023, a pool of projects is expected to be formed.

Green bonds are a relatively new instrument in the debt market. For the first time, that tool was used by International Finance Corporation, International Investment Bank, International Bank for Reconstruction and Development in 2007, released on USD 800 million. Green bonds have gained popularity since the signing of the Paris Agreement and aimed to attract investment, among other things, in renewable energy projects. As of 2017, the global green bond market amounted to USD 155 billion, and in 2019 – USD 257.7 billion (CBI, 2021). The largest issuer globally is the European Investment Bank, issuing bonds worth EUR 121 billion (Green Climate Fund, 2021). Green bonds might provide access to the Green Climate Fund (GCF), which, among other things, finances renewable energy.

At the end of 2019, DTEK Renewables issued its green bonds, although under the jurisdiction of another country, as at the time of the issue, there was no domestic legislation in this area. Thus, 5-year bonds in euros were placed at a rate of 8.5% per annum. The organizers were Raiffeisen Bank International AG and Renaissance Capital. The funds raised (EUR 325 million) were to allow the company to increase its installed capacity of WPPs and SPP by 1 GW, so by the end of 2022, they were to reach 1.9 GW (DTEK, 2019) (however, in May 2020, the company abandoned these plans due to the crisis of the industry and arrears of the feed-in tariff payments). From late 2019, DTEK Renewables bonds were listed on Euronext Dublin. This fact confirms the trend of 2017-2018, when globally, green bonds were mostly issued by energy companies (Tuerk, 2019).

The Low Emission Development Strategy of Ukraine until 2050 (LEDS, 2017) provides for the development of a system of green certificates as one of the measures of LEDS in the field of renewable energy to stimulate the purchase of electricity by consumers from RES. Each kilowatt\*hour corresponds to a certain number of certificates. For their distribution, the state sets quotas on the electricity content from RES in each megawatt\*hour sold by suppliers. The number of certificates for each type of energy can vary depending on the goals and changes in the cost characteristics of RES technologies in the world market. This instrument is well aligned with the principles of the Third Energy Package. The tool also applies to manufacturers who are not connected to the grid because they do not consume fossil fuels. Globally, this tool is widespread: green certificates are Australia, Britain, Norway,

Canada, the USA, Sweden. As of April 2021, green certificates have not yet been implemented in Ukraine.

### 2.5. Irrevocable Financial Assistance

This financing option includes the program “Climate Innovation Vouchers,” which operated in Ukraine during 2017-2019 and was extended in 2021 (CIV, 2021). During the first phase, funding in the amount of EUR 970 thousand was provided under the EBRD program “Center for Technology and Finance in Climate Change” (FINTECC) funded by the European Union. During the second phase, EUR 1 million will be allocated. The program aims to invest in technological solutions in clean technologies, which, among other things, include renewable energy. Although the funds are provided as irrevocable financial assistance, the recipient company is to finance part of the project, and the financial amount per company is EUR 20-50 thousand.

### 2.6. Direct Contracts between Electricity Producer and Buyer

Maturing renewable energy technologies and respective industry development gradually leave no place for the feed-in tariff. The rapid growth of renewables in Ukraine and high feed-in tariffs created a burden on the state budget. As the green tariff is higher than the market one, the difference must be compensated. Therefore, there is now a need to review the existing model of industry support. One of the next steps in this field should be the introduction of direct bilateral agreements. It is implied that companies enter into contracts to purchase and sell electricity where one party produces and sells electricity permanently, and the other buys it. This model is gaining popularity among large global corporations, which for their marketing purposes make their goods using electricity from RES and thus contribute to the development of global decarbonization, having an economic effect in the form of reduced taxes. On the seller's part, such electricity sales allow the formation of a transparent long-term trading strategy and guaranteed to sell electricity, minimize imbalances, and get a fixed price for a certain period. In addition, electricity can also be sold on the site of the State Enterprise “Market Operator,” which is responsible for the proper organization of purchase and sale of electricity in the “day ahead” market and the “intraday” market. Bilateral trade schedules for the purchase and sale of electricity, under certain circumstances, can be adjusted by understanding that the market will always be available. Even though this model does not work in Ukraine yet, it is expected to operate shortly.

## 3. DISCUSSION

The government of Ukraine understands the necessity of improving the energy infrastructure. In the OECD database, there is a pool of ongoing or planned projects in energy totaling USD 15.6 billion (40% of all infrastructure projects, surpassing only those in transport) (OECD, 2021). Given the solid global and European trend in decarbonization, the vast majority of these projects are expected to be related to decarbonization technologies and renewable energy in particular. Despite the availability of various credit programs and cooperation with international financial institutions, Ukraine lacks “long” money and loans. This makes companies extremely sensitive to state support schemes for renewable energy output

changes, such as retrospective revision of feed-in tariffs that took place in 2020. For companies, this means the impossibility of repaying loans and, consequently, the alienation of property (power plants) in favor of financial institutions. Potentially, this may result in the bankruptcy of domestic state-owned banks (primarily UkrGasbank), which will negatively affect the stability of the entire banking system. In Ukraine, the possibility of mobilizing domestic resources to finance RES projects remains extremely limited, so the need for financial and technical support from international financial institutions continues (Sokolova et al., 2019). Due to the long-term lack of practical solutions to cover debts for electricity generated as of spring 2021, corporate financial institutions represented in Ukraine have stopped issuing loans for electricity generation projects from RES.

In addition to the need for substantial financial resources, existing economic initiatives need to be streamlined. The so-called green taxonomy, a single European classification of investment projects that meet at least one of the sustainable development goals, e.g., may have the potential to reduce GHG emissions (including RES projects), needs to be introduced (Sokolova et al, 2019).

The problem of non-payment for electricity from RES indicates that despite RES per se in Ukraine since early 2000, Ukraine still could not find a proper scheme to finance it. This problem was aggravated with the transition to the system of bilateral agreements in mid-2019. A special fund to finance renewable energy, energy-saving and decarbonization needs to be created to overcome the problem. This Fund should be able to obtain finance not only from taxation but also from private entities. The idea of the creation of such a Fund is currently under consideration of the Ministry of Environmental Protection and Natural Resources of Ukraine and the Ministry of Energy of Ukraine. The source of filling the Fund should be the CO<sub>2</sub> tax, which currently stands at EUR 0.29/t, but is expected to increase to EUR 0.88/t until 2024 (DixiGroup, 2021).

In the meantime, the proximity of Ukraine to the EU and the attempts of Ukraine to become a part of the European Green Deal bring new options for financing RES in Ukraine. The EU has introduced a new mechanism to finance RES in frame of the Green Deal, when the EU member states can finance RES projects covering all technologies anticipated by Directive (EU) 2018/2001 in the other countries and share progress. This mechanism anticipates that hosting countries can be elsewhere. However, energy output has to be more cost-effective than on their territory (EC, 2021). This requirement can potentially be achieved even in Ukraine, should the contributing countries bring their own finance (as interest rates for loans in Ukraine are significantly higher than those in European countries). The potential advantage to Ukraine as a host country is that it would not require to allocate additional funds to finance new RES projects. The funding within such a scheme is distributed through a tender mechanism or a grant. The grant will cover either investment (installation of capacity) or actual energy output. This mechanism shows the concern of the EU about the state of the environment, being similar to the new EU climate change adaptation strategy adopted in February 2021, which now includes not only the EU itself but the entire Pan-European continent.

Other instruments, that show promising results in other countries but have not yet been introduced in Ukraine include feed-in premiums, net metering, and corporate power purchase agreements. However, they require further studies regarding their design of implementation in Ukraine.

## 4. CONCLUSION

A review of the existing credit programs for financing RES projects in Ukraine showed that more regional credit programs in the field of RES (e.g., soft loans) are needed, which could reimburse interest on the loan and be financed by increasing local tax revenues in a decentralized environment. Despite the availability of economic mechanisms, domestic and international financial institutions' financing of biomass projects has not yet become a priority, so it is necessary to expand state support in the framework of existing support for farmers. The EBRD has identified one of its priorities in Ukraine to finance projects in the field of biomass. The technical assistance of financial institutions is critical, which partially overcomes the problem of applications of insufficient quality. International financial institutions are quasi-political organizations, which are also the largest borrowers for the government, so the loan programs described above are expected to continue in the future but at higher interest rates.

International financial institutions are already refusing to finance projects based on the feed-in tariff. COVID-19 crisis, deteriorating investment climate, frequent changes in the regulatory environment in RES, and the unresolved problem of paying producers for electricity from RES make investing in RES even more risky business. It is noteworthy that according to the current legislation, the off-taker (SE "Guaranteed Buyer") is one of the market participants, which has special responsibilities to increase the share of energy from RES. Still, the deficit of the off taker contributes to a direct violation of this law. Sources of financing the debt of the off-taker are not yet identified. The problem of changing the legislation significantly increases the so-called country risk, which raises interest rates for other loans for the next 5-10 years. The four state-owned banks through which RES projects are financed are to some extent held hostage by the frequent policy changes. Therefore, a reasonable and predictable environment in terms of investment is needed as never before.

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