WECHANGE

# ENERGY COOPERATIVES: HOW TO

CIVIL SOCIETY ENERGY

# Energy Cooperatives: How To



**WECHANGE** is a cooperative of visionaries, developers and many volunteers with one clear goal: to actively further societal change for a more social, sustainable and ecological world. We accompany initiatives, networks and large organizations in digitalisation, remote group work, online communication and explain risks, best practices and benefits of digital networking.

The online platform wechange.de enables individuals, initiatives and organizations to work together effectively, without relying on online tools with questionable data protection policies, or on their expensive, licensed software. As an ethical alternative to widespread commercial tools, wechange.de consolidates the most important functions with maximum data protection.

In our role as an empowerment actor, WECHANGE is focusing on international networking, workshops and digitalisation support as well as on other efforts for NGOs in Eastern Europe that are funded by the German Federal Foreign Office.

Actors of civil society, local communities as well as municipalities are crucial drivers of transition towards carbon-neutral and decentralized energy supply systems and sustainable local development in Europe. Examples of more than 5600 German cooperatives and a well-established all-European tradition of local cooperation and horizontal networks development demonstrate one of the possible paths towards decentralized energy transition Ukrainian and Polish communities are able to pursue. At the same time, renewable energy enthusiasts and professionals from civil society, academia, business and municipal sectors in these countries face their own unique challenges and develop a great variety of possible ways to tackle them mowing towards a sustainable future for their communities.

In the framework of the Civil Society Energy 2021 project, launched by wechange eG[1] participants from Ukraine, Poland and Germany exchanged knowledge about cooperation for renewable energy and together developed ideas for establishment of energy cooperatives.This Handbook was produced as a part of the project and brings together studies and reflections on renewable energy (RE) and cooperation potential for sustainable development in Poland and Ukraine and presents possible scenarios for RE cooperatives development from organizational, legal, economic and social perspectives.

First chapter by Agnieszka Szostok outlines the importance, potential and challenges of renewable energy in Poland, Ukraine and Germany. Next chapter, by Tomasz Marzec examines the energy transition and legal challenges for the cooperative movement in Poland and demonstrates how the first energy cooperative in Poland was created.
Articles by researchers Olena Rubanenko and Viktoriia Vostriakova analyze the latest developments in the renewable energy sector in Ukraine, the potential for cooperation there for sustainable development of the country and related technological and economic challenges. Michael Shomin, Maryna Sadkina and Anna Pastukh study the financial and legal mechanisms and regulations which could be beneficial for all who are engaged in the creation of RE cooperatives in Ukraine. In the concluding article Andriy Zincheko, the founder of the first Ukrainian RE cooperative in Slavutych discusses how energy cooperatives and local partnerships could be the drivers of municipal energy transition in Ukrainian communities.

We hope these materials would be useful for all renewable energy enthusiasts who are eager to engage in cooperative movement!

*Igor Tyshchenko*

1 More about the project: https://community.civilsocietycooperation.net/project/civil-society-energy-2021/

# CONTENTS

## INTRODUCTION



## POLAND



## UKRAINE

# WHY RENEWABLE ENERGIES ARE IMPORTANT?

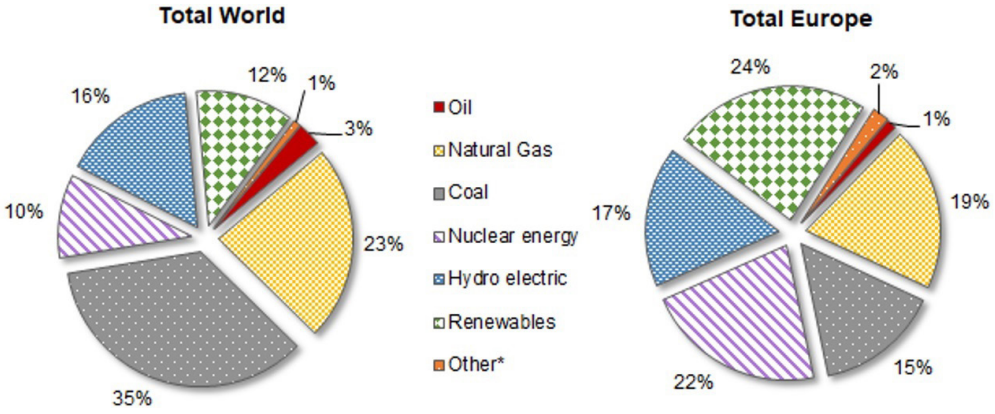
*Agnieszka Szostok*

Renewable energies, which include energy generation from sunlight, wind, waves, tides and geothermal heat, are increasingly common and accessible. A lot is said about the need for their development and their increasing role in the future energy generation market. The article presents the main issues that determine the importance of renewable energy sources.

## Mineral resources depletion

Currently, the primary resources for world energy supply are raw materials: coal, gas and crude oil. As shown in Figure 1, these three fuels account for 61% of the world's electricity generation and 35% of the electricity generation in Europe. Nuclear power also has a large percentage of electricity generation (world — 10%, Europe — 22%). The rest of the electricity production is mainly based on hydropower and renewable sources [1] [2].

Coal, gas and oil are finite and non-renewable. Figure 7 shows the amounts of global raw material resources as of December 31, 2020. It is estimated that proven oil reserves are 244.4 billion tonnes, of coal — 1074, 1 billion tonnes and gas — 188.1 trillion cubic meters. The values seem high and might give a sense of security, but it is enough to look at the growing global fossil fuel consumption (Figure 2) to realize that if the management of natural resources does not change, their exhaustion is imminent and inevitable [2] [3] [4].




*Includes sources not specified elsewhere e.g. pumped hydro, non-renewable waste and statistical discrepancies (which can be positive or negative)

**Figure 1. Electricity generation by fuel (based on gross output)**
Source: bp's Statistical Review of World Energy

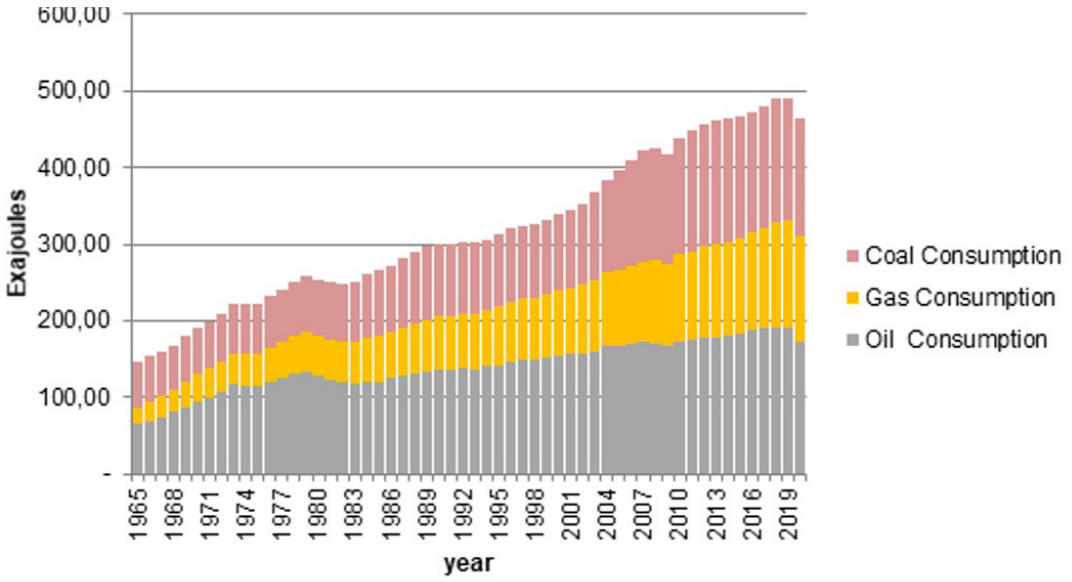



**Figure 2. Global fossil fuel consumption**
Source: bp's Statistical Review of World Energy

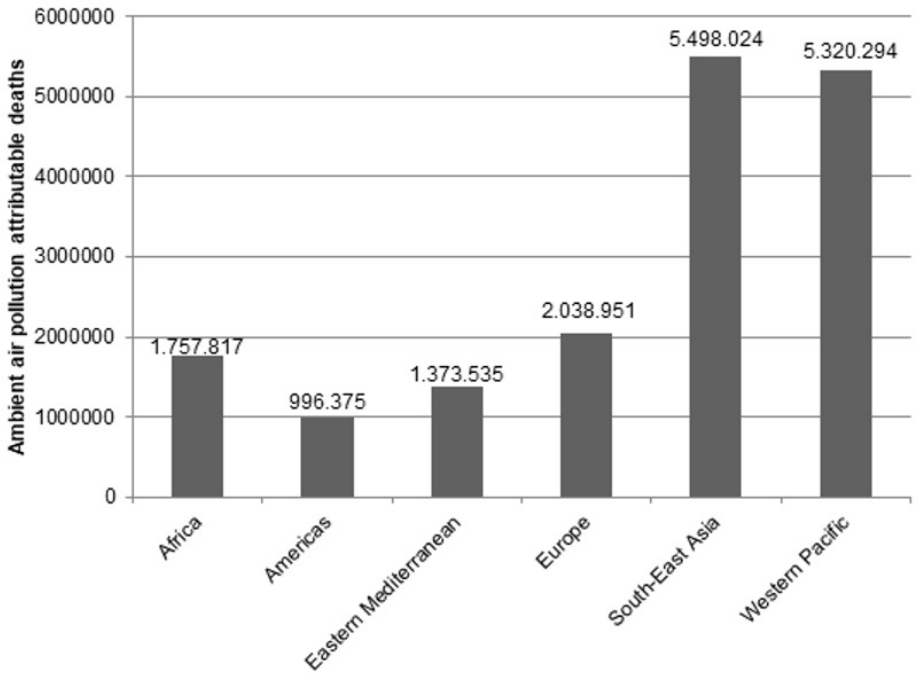



**Figure 3. Ambient air pollution attributable deaths in 2016 by WHO regions.**
Source: WHO, The global health observatory. Explore a world of health data

It is hard to estimate the complete depletion of fossil fuels since many factors must be considered, such as the discovery of reserves, technological potential to extract the resources and growing demand for fossil fuels. Judging from BP's Statistical Review of World Energy 2016, the Reserves-to-Production ratio for coal, oil and gas predicts that roughly 115 years of coal production and about 50 years of both oil and gas are remaining [2] [6].

## Human health

Many harmful substances are released when fossil fuels are burned. Pollutants emitted into the atmosphere through energy generation from fossil fuels include the following: carbon dioxide, sulphur oxides, nitrogen oxides, carbon monoxide, particulate matter, etc. Air pollution causes an increase in pollution-related diseases such as respiratory infections, lung cancer, heart disease and stroke. It is estimated that globally in 2018, fossil-fuel related emissions account for about 8.7m of deaths [5] [6] [7].

Mortality is highest in regions with the highest concentration of contaminants related to fossil fuels — inter alia in Southeast Asia, Europe, and the eastern part of North America. Figure 3 shows that the number of ambient air pollution deaths in 2016 was the highest in Southeast Asia and the Western Pacific (the Western Pacific Region is one of six regions of the World Health Organization that extends from Central Asia, east to the Pitcairn Islands in the Pacific Ocean and south to New Zealand). The mutual goals of clean air and a stable climate under the World Health Organization guidelines and the Paris Agreement (adopted at the 2015 United Nations Climate Change Conference) require a rapid phasing out of fossil fuels. The transition from fossil-fuel-based energy generation to clean, renewable energy sources could significantly decrease excess mortality [7] [5] [6] [8].

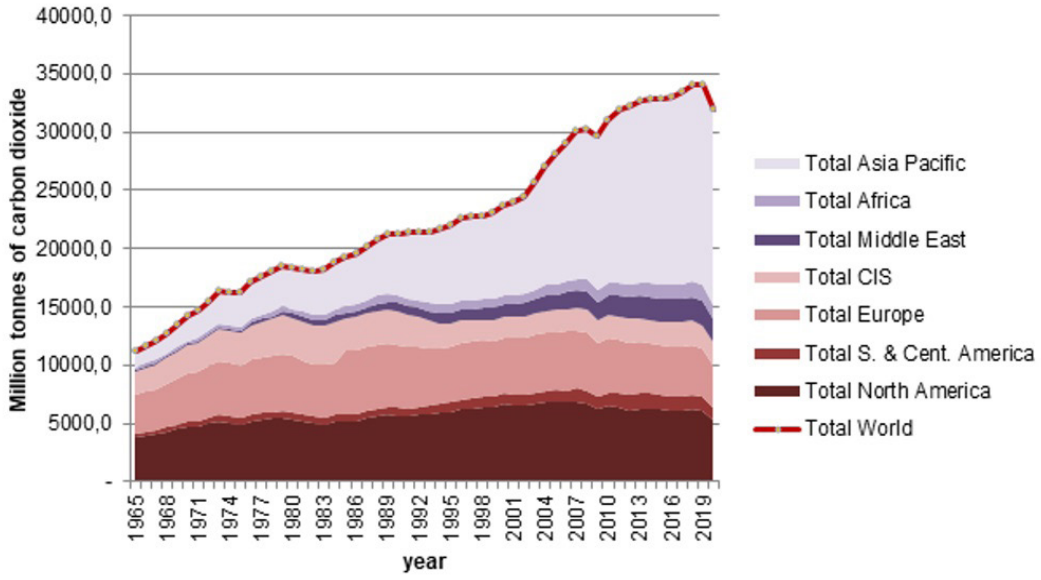



**Figure 4. Carbon Dioxide Emissions**
Source: bp's Statistical Review of World Energy

## Climate Change

Conventional energy generation based on natural coal, gas, oil or coal sources is accountable for greenhouse gas emissions, which are released into the atmosphere during combustion processes. The Intergovernmental Panel on Climate Change Report (AR6 Climate Change 2021: 'The Physical Science Basis human impact on climate change') refers to human activities that lead or contribute to climate responses, such as human-induced greenhouse gas emissions (the primary greenhouse gases are water vapour (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and ozone (O3). Greenhouse gases change the radiative properties of the atmosphere and warm the climate. Climate

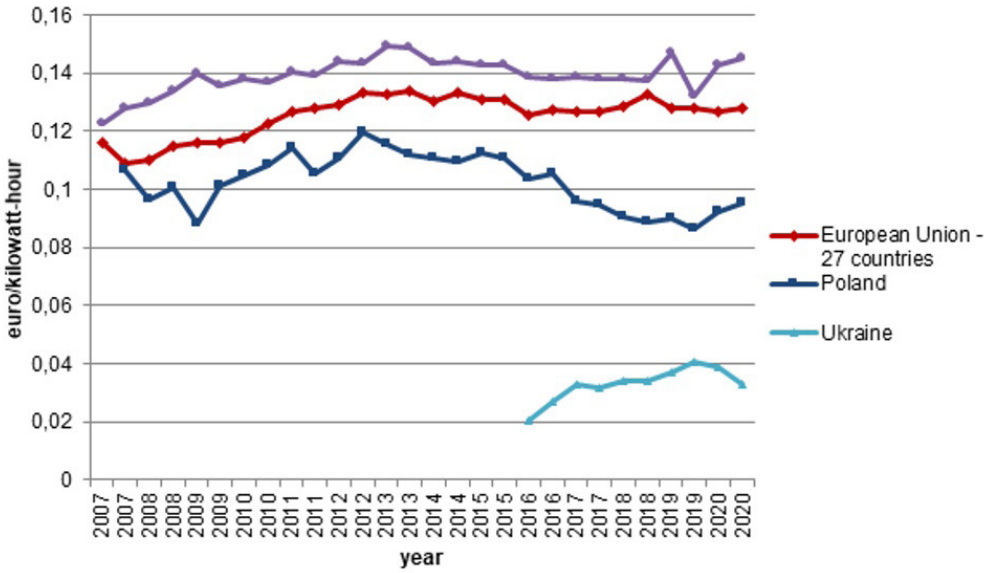



**Figure 5. Electricity prices for household consumers - bi-annual data**
Source: Eurostat, Electricity prices for household consumers - bi-annual data (from 2007 onwards)

warming is also furthered by emissions from aerosols, other short-term climate factors, and land-use changes, such as urbanization. Combustion of fossil fuels and land-use change in 1750—2019 resulted in the release of 700 ± 75 PgC (likely range, 1 PgC = 1015 46 g of carbon) into the atmosphere, out of which about 41% ± 11% remains there today. Of the total anthropogenic carbon dioxide emissions, the combustion of raw materials (coal, gas, oil, etc.) was responsible for about 64% ± 15%, growing to an 86% ± 14% contribution over the past ten years.

As shown in Figure 4, carbon dioxide emissions systematically grow. Between 2010–2019, average annual anthropogenic carbon dioxide emissions reached the highest levels in human history [9] [10] [4].

The most important effect of climate change is the rise in global temperature, which is already 1.1°C higher compared to pre-industrial temperatures. If the current rising trend continues to the end of this century, warming could increase to about 3 to 5 °C, which could be catastrophic for us. Rising temperatures will cause ice to melt at the poles, raising sea levels and putting coastal areas at risk. Climate change is visible in extreme weather events such as violent storms, heavy rainfalls, tornadoes, floods, and droughts. This, in

**Table 1. The medium levelized costs of generating electricity (LCOE) by technology, discount rate of 7%**

| Source | Medium LCOE USD/MWh | Source | Medium LCOE USD/MWh |
|---|---|---|---|
| Lignite | 95 | Solar PV (residential) | 126 |
| Coal | 88 | Solar thermal (CSP) | 121 |
| Gas (CCGT) | 71 | Hydro (reservoir, >= 5MW) | 72 |
| Nuclear | 69 | Hydro (run of river, >= 5 MW) | 68 |
| Nuclear (LTO) | 32 | Geothermal | 99 |
| Wind onshore (>=1MW) | 50 | Biomass | 118 |
| Wind onshore | 88 | Lignite (CCS) | 116 |
| Solar PV (utility scale) | 56 | Coal (CCS) | 116 |
| Solar PV (commercial) | 94 | Gas (CCGT, CCS) | 91 |

CCGT - combined-cycle gas turbines; LTO - long-term operation; CSP - concentrated solar power; CCS - carbon capture and storage
Source: IEA, Projected Costs of Generating Electricity 2020

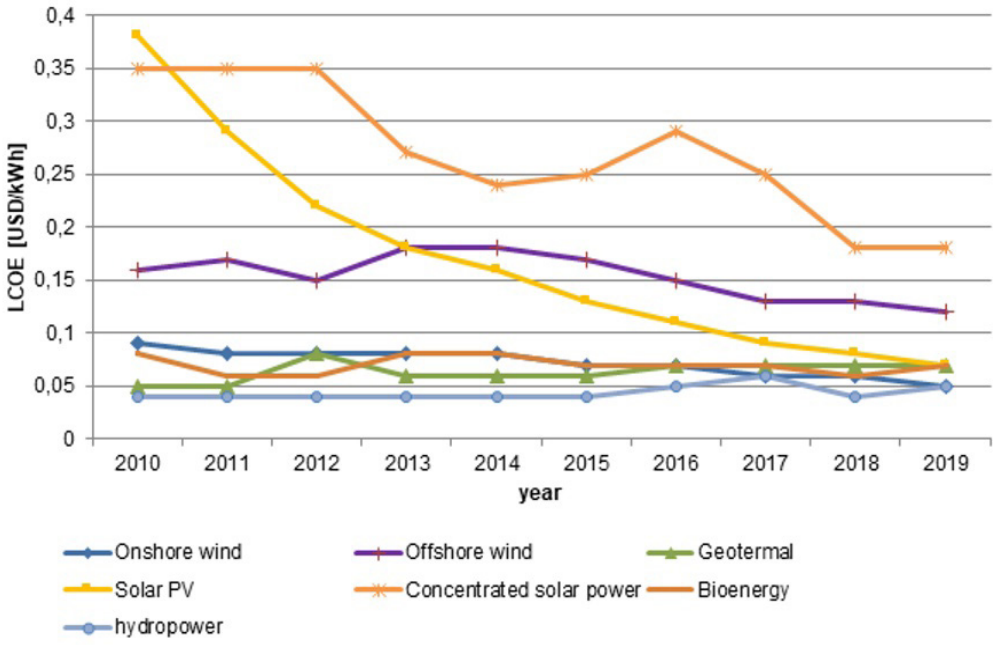



**Figure 6. Global levelized cost of energy by technology**

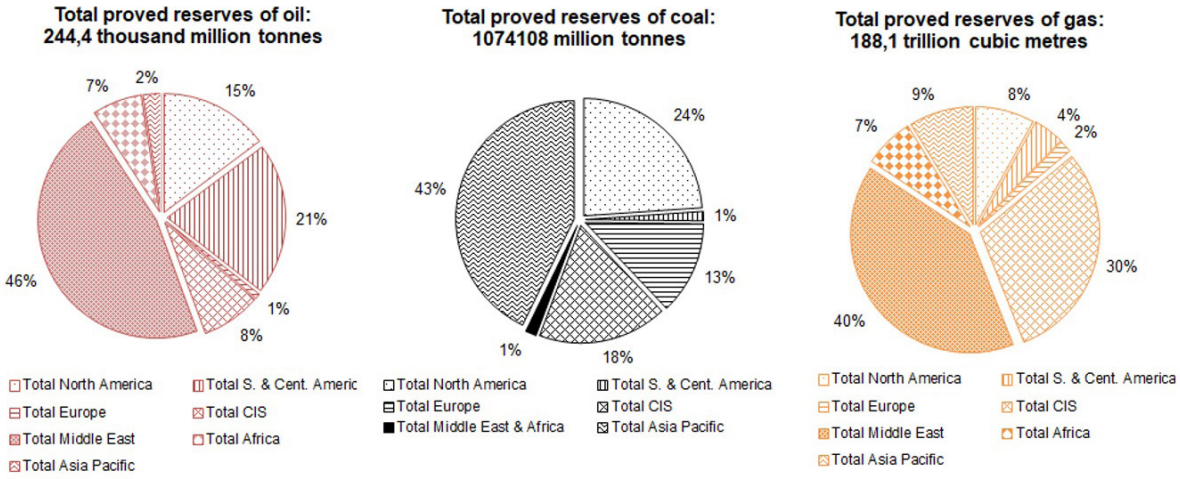



**Figure 7. Total proved reserves of oil, coal and gas by regions.**
Source: bp's Statistical Review of World Energy

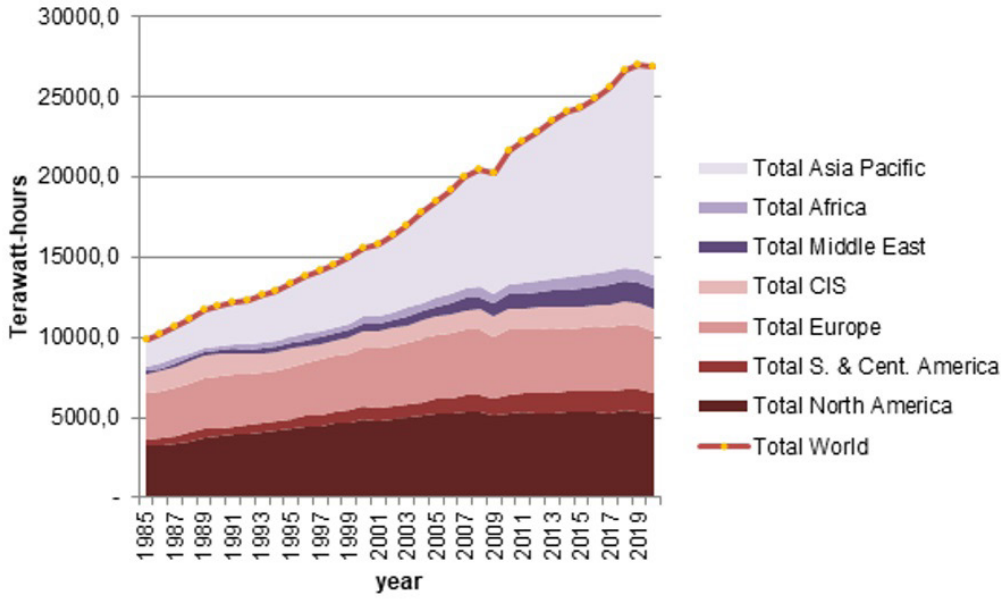



**Figure 8. Electricity Generation in the years 1985-2020**
Source: bp's Statistical Review of World Energy

turn, will reduce the quality of life in several regions. Malnutrition, diseases, and climate migrations will become a growing problem [9] [10] [3].

## Economy

The depletion of fossil fuel resources will increase the cost of their extraction: the deposits will be less accessible, and their extraction

will require a bigger expenditure. This will have an impact on the increase in electricity prices. Figure 5 depicts energy prices in Germany, Poland, Ukraine and an average for the European Union. It can be seen that the average price tends to increase [11].

The report 'Projected Costs of Generating Electricity – 2020 Edition' developed by International Energy (IEA) and the OECD Nuclear Energy Agency (NEA) under the oversight of the Expert Group on Electricity Generating Costs (EGC Expert Group), shows that the levelized costs of electricity production of low-carbon generation technologies are following a downward trend and are increasingly getting lower compared to the cost of traditional fossil fuel generation. Table 1 provides the medium levelized costs of generating electricity by technology. Traditional fossil fuel generation costs (lignite, coal, gas) range between 95 and 71 USD/MWh and for the technologies with carbon capture and storage (CCS) between 116 and 91 USD/MWh. For comparison, values for nuclear power plants are 69-32 USD/MWh. Renewable energy costs are varied; for example, the cost of generation from wind onshore (>=1MW) is 50 USD/MWh, from solar PV - 56-126 USD/MWh, geothermal power - 99 USD/MWh [12].

An important issue that encourages the turn to RES is that renewable energy is becoming cheaper. The results illustrated in Figure 6 provide the values of levelized cost of energy (LCOE) by technology. LCOE estimates the average cost per unit of energy generated across the lifetime of a new power plant. The levelized cost of energy for most of the presented renewable sources is falling or remaining relatively constant. For example, between 2010 and 2019, the LCOE of solar PV fell from 0.38 to 0.07 USD/kWh, onshore wind from 0,16 to 0,05 USD/kWh, geothermal 0,05 to 0,07 USD/kWh [15].

## Energy independence

Another benefit of the development of renewable energy sources is energy independence. Figure 7 represents the geographical distribution of deposits. Proven reserves of oil, coal and gas are unevenly distributed, affecting many regions' energy security. The resilience of energy system can be built through energy diversification and independence. The key is to diversify the energy mix and not base it on only one or two fuels. Therefore, it is crucial to introduce energy generation from renewable sources [13].

Expanding a decentralized energy supply system by introducing small and large installations of renewable energy sources can help preserve energy security in the event of a failure in large units. Increasing the share of renewable energy sources in the energy balance is a prerequisite for energy security and an essential element of energy policy [14] [13].

## Growing electricity demand

The shape of Figure 8 vividly demonstrates that electricity generation has grown over the past 35 years — it has increased from 9880 to 26823 terawatt-hours (between 1985-2020). This trend is a response to the ever-growing demand. According to the International Energy Agency report, the rise in electricity demand in 2021 is 5% [15] [3]. Considering the depletion of fossil fuels and the expected growth of electricity demand, it is necessary to turn to renewable sources. Renewables are expanding quickly (see Figure 9 and Table 2), but not enough to satisfy a strong rebound in the electricity demand [4].

## Conclusion

Renewable energy sources are essential for achieving Sustainable Development Goals. To meet future energy challenges and prevent further degradation of the natural environment, moving away from conventional energy to clean energy technology is necessary. Critical challenges for our future, such as climate change or increasing electricity demand, are closely related to energy gen-

eration from sunlight, wind, waves, tides and geothermal heat. If we want to live in a clean, healthy environment and maintain the current standard of living ensuring easy access to electricity, renewable energy transition is a crucial issue [16] [17].

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# CHALLENGES of RENEWABLE ENERGY SOURCES

*Agnieszka Szostok*

Renewable energy sources (RES) bring many benefits: free ecological energy, energy independence and a less polluted natural environment. However, among the many advantages of RES, there are also challenges, which are discussed below.

## Availability of Power

The main challenge in the field of renewable energy is the unpredictability of energy generation. In contrast to conventional energy, which is controllable by humans (non-renewable resources are available at all times and can be used as needed), RES are dependent on weather conditions. Solar installations generate power only when the sun shines and turn off at night. Figure 1 depicts the total intensity of solar radiation on the horizontal surface by months for localization Katowice in Poland. Solar radiation is different not only throughout the day, but also changes significantly throughout the year, reaching low values in winter months and high in summer for the presented location [1] [2].

Wind-powered electricity also depends on weather conditions: if the wind speed is too low, the turbine will not turn, which results in a non-power generation. The cut-in speed (typically between 3 and 4 m/s) means the blades start rotating and generating power. As shown in Figure 2, during the year, much of the wind speed value for location Katowice, Poland, is below the cut-in, so energy is not generated. The same holds true when the wind speed is too high — the turbine can be damaged, so the energy generation is also stopped if the wind is too fast. The cut-out speed is usually about 25 m/s) [3] [4].

## Resource Location

Renewable energy sources depend on climate and geographical location, meaning that every type of energy generation is not appropriate for all regions. Figure 3 represents the geographical distribution of photovoltaic electricity potential. Some regions are completely unprofitable for solar energy generation (due to low solar radiation values), while in other regions insolation allows to reap benefits from the photovoltaic. The photovoltaic electricity potential can vary significantly within one area as well. Figures 4, 5 and 6 (photovoltaic electricity potential for Germany, Poland and Ukraine) show considerable differences within one country [1] [5].

Photovoltaic electricity potential in different regions serves merely as an example; the situation also applies to other RES. Whether an area is promising for wind power generation or not can depend on many factors, such as geographic location, topography, seasonal variability, etc. The same is the case with tides, waves, and geothermal heat — the potential of a RE source is not the same in every region [6] [7].

## Energy storage

Renewable energy sources can be used in small, decentralized systems — stand-alone power systems (SAPS or SPS). They are not fitted with an electricity distribution system and are hence defined as off-the-grid electricity systems. In this case, as shown in Figure 7, the following is needed: an energy source (wind turbine, PV modules etc.), regulation and conversion module, energy storage and energy consumer. The system can also be equipped with an emergency power source.

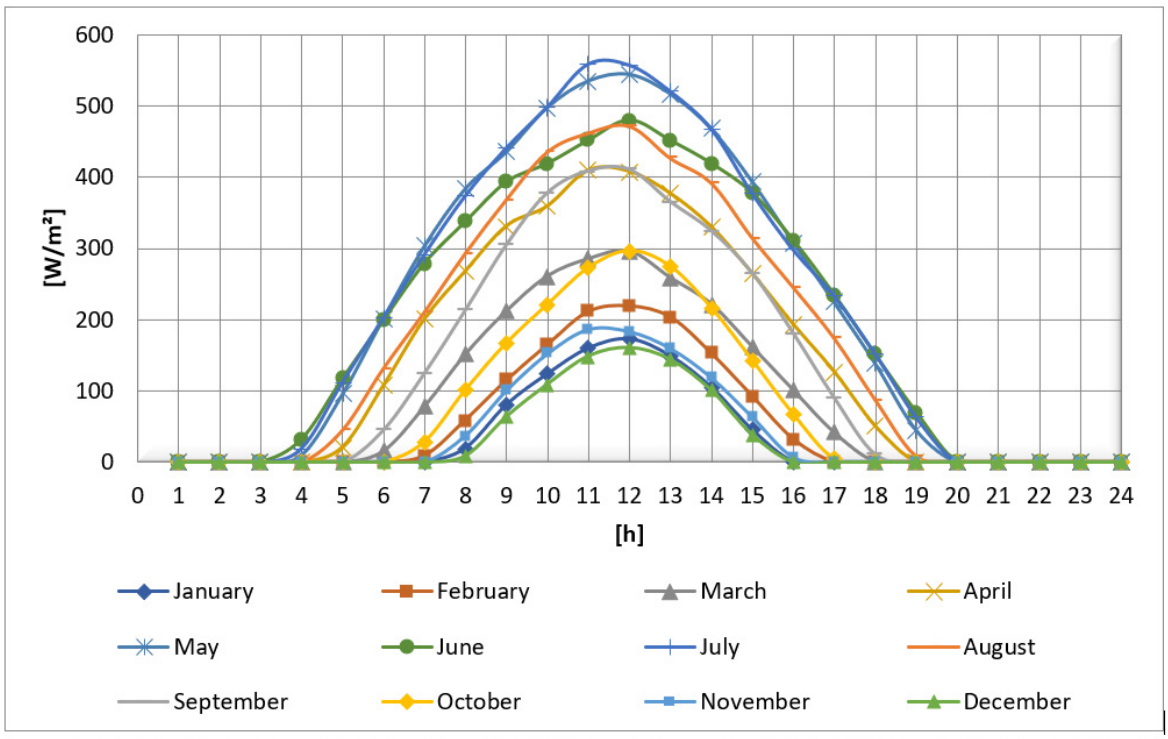


**Figure 1. The total intensity of solar radiation on the horizontal surface averaged for months, localization Katowice (Poland)**
data source: mib.gov.pl

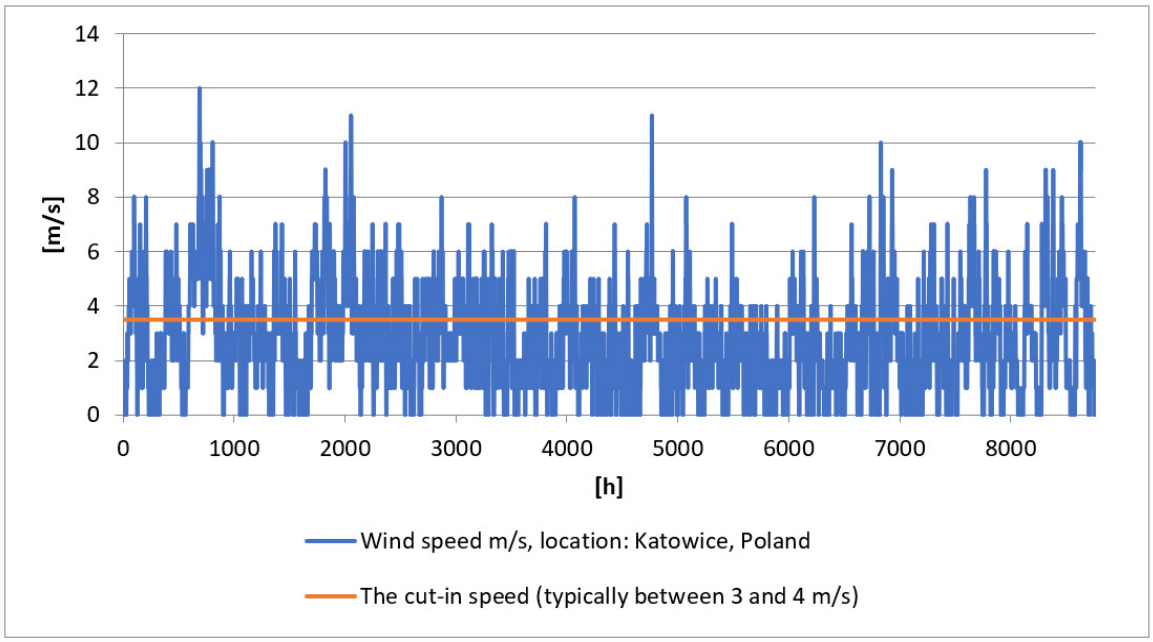


**Figure 2. Examples of wind speed parameters during the year, localization Katowice (Poland)**
data source: mib.gov.pl

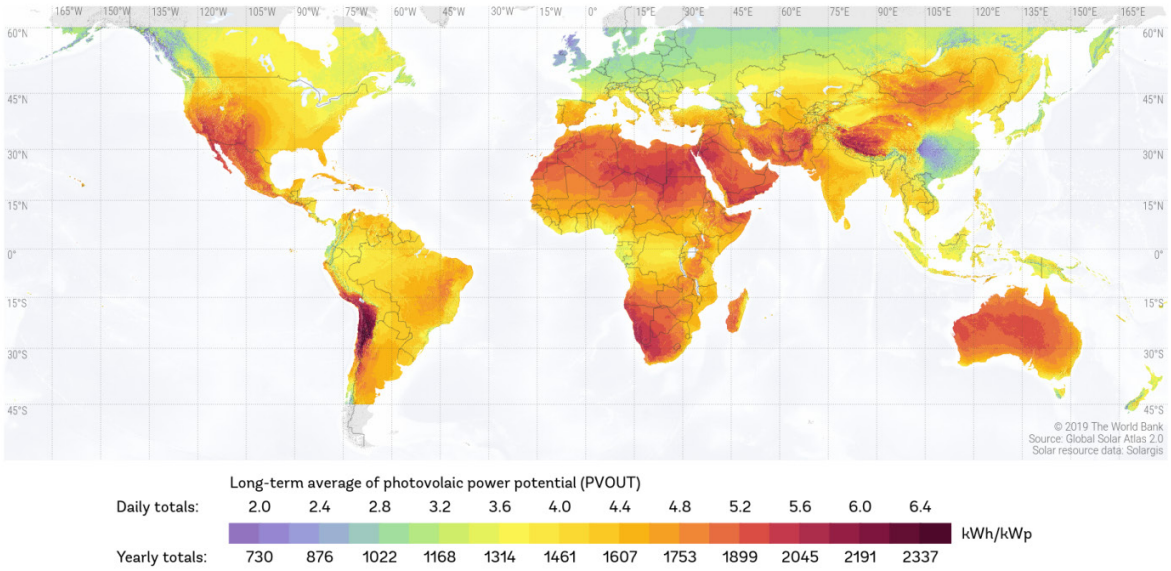


**Figure 3. Photovoltaic Electricity Potential - World**
Source: https://solargis.com/maps-and-gis-data, 2020 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis.

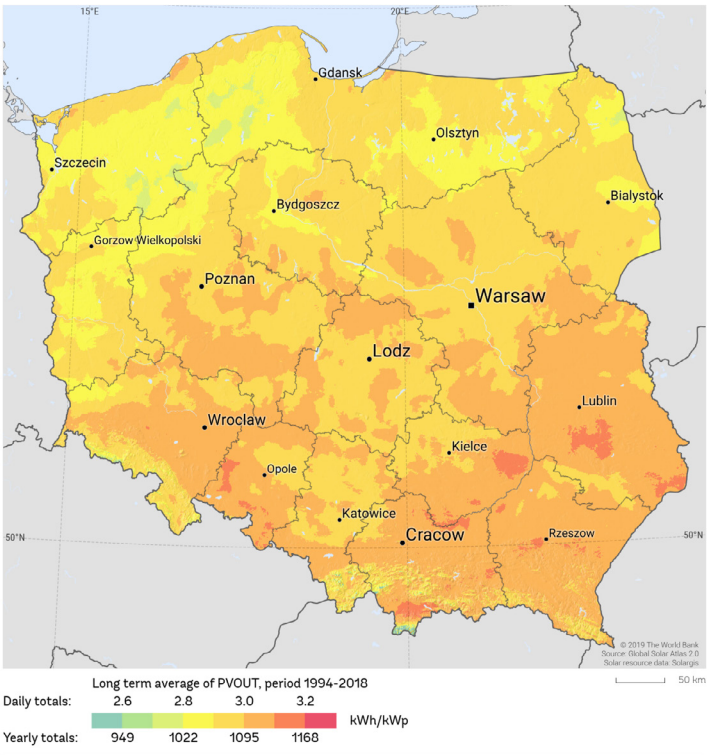


**Figure 5. Photovoltaic Electricity Potential - Poland**
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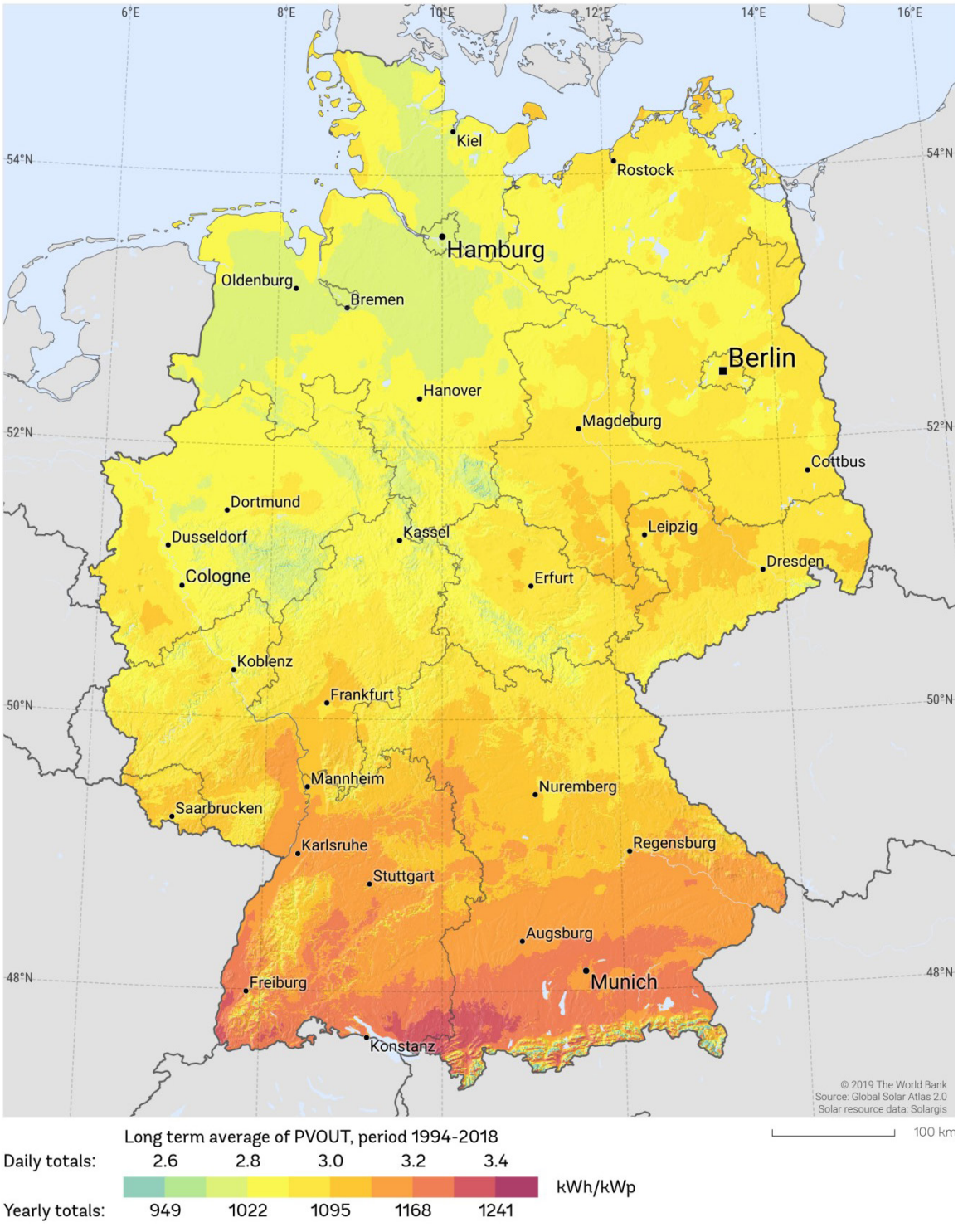


**Figure 4. Photovoltaic Electricity Potential - Germany**

Source: https://solargis.com/maps-and-gis-data, 2020 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis.

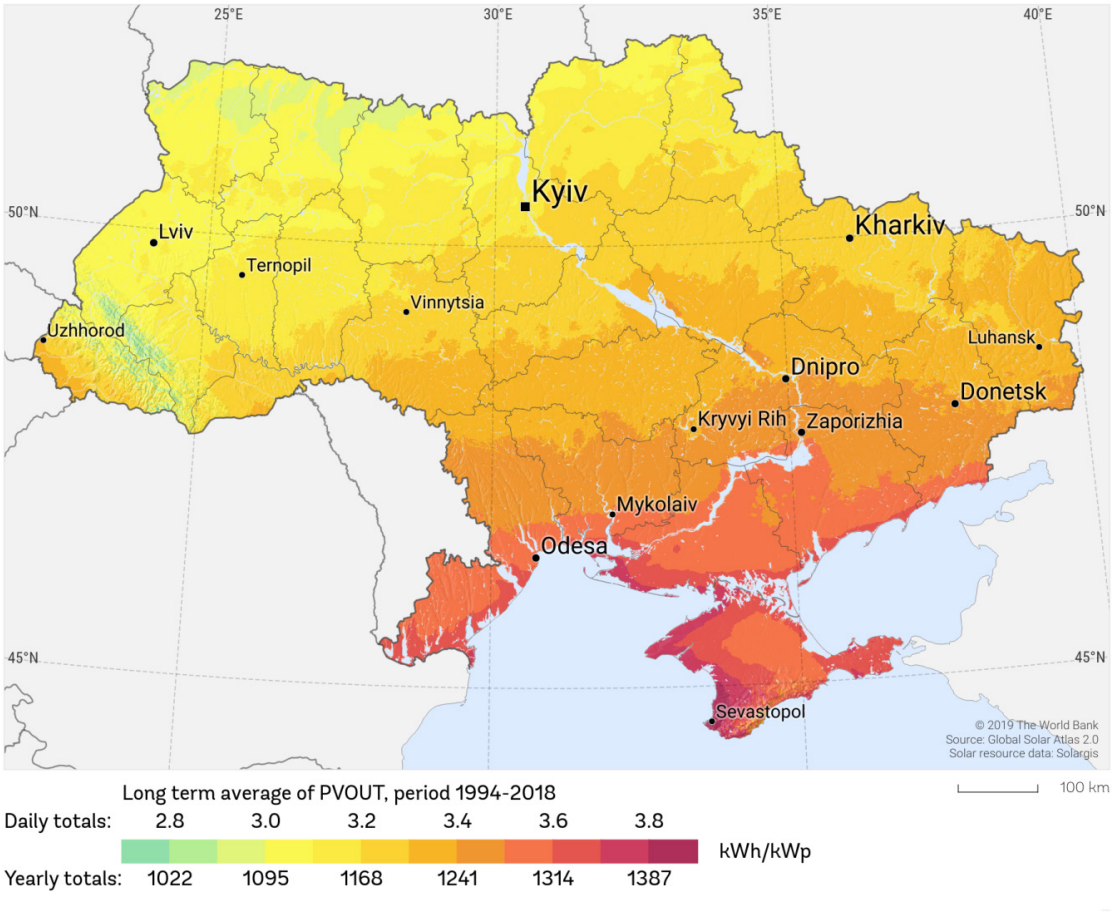


**Figure 6. Photovoltaic Electricity Potential - Ukraine**
Source: https://solargis.com/maps-and-gis-data, 2020 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis.

Energy storage or an emergency power source is necessary for off-the-grid electricity systems because of the randomness of RES operation. At the same time, they result in a significant increase in the investment outlays [8] [9].

## Power Quality Issues

One way to avoid expenses related to energy storage or a backup energy source is to connect the system to the grid. When the electricity produced is bigger than the amount consumed, the excess energy is transferred to the power grid. If RES fail (due to lack of sunshine or wind), energy is taken from the grid. This situation, in turn, causes significant challenges for the grid — as a result of connecting distributed sources, the grid structure and the way it functions change. What is more, the impact of wind turbines and photovoltaic systems on network operation and power quality (harmonics and voltage fluctuations) is highly important. Renewable source systems can pollute the electrical network with harmonic components that must not exceed the stipulated limits [10] [11] [12] [13].

The publication "Connecting the dots:

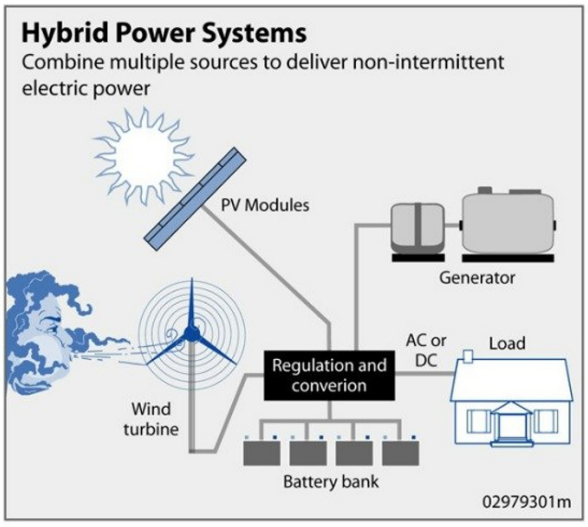


**Figure 7. Schematics of a hybrid system**

Source: U.S. Department of Energy https://www.energy.gov/energysaver/hybrid-wind-and-solar-electric-systems

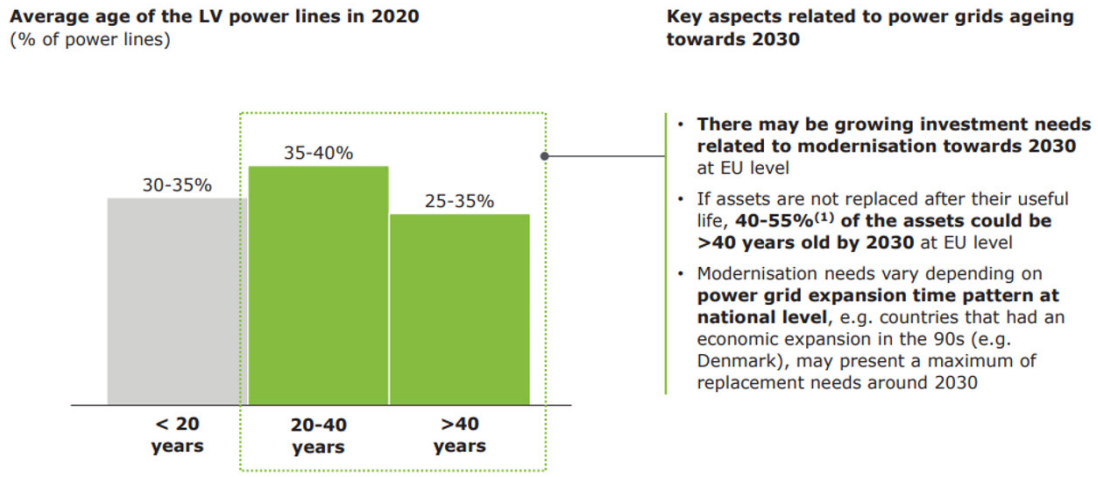


**Figure 8. Average age of the LV power lines in 2020**

Source: Connecting the dots: Distribution grid investment to power the energy transition Final Deliverable, by Monitor Deloitte, E.DSO and Eurelectric

Distribution grid investment to power the energy transition Final Deliverable" (by Monitor Deloitte, E.DSO and Eurelectric) showed that around one-third of the assets in the EU are over 40 years old; by 2030 the number of the 40 years old assets could be 40-55% (Figure 8). This creates additional challenges in the development of renewable energy sources [14] [15].

## Life Cycle Assessement

Life Cycle Assessment (LCA) is a methodology that estimates the total environmental impact of a product with all the stages of the life cycle: raw material extraction, manufacturing and processing, transportation, usage and retail, waste disposal. Life cycle assessment of renewable energy technologies reveals a

few crucial issues.

First of all, the LCA shows that RES are not completely zero-emission: production, transport and storage result in the use of natural resources and the emission of greenhouse gases [16][17]. Recycling of elements created after dismantling is difficult or impossible. For example, wind turbine blades can be recycled, but the result is a material of lower quality, and thermal recovery is associated with the emission of toxic compounds from the combustion of polyvinyl chloride (the life cycle of a wind turbine is shown in Figure 9). As for PV, the most significant environmental impact is observed in the production stage of photovoltaic modules: the extraction of silicon is a highly energy-intensive process, which is difficult to recover in the recycling process [18] [17].

LCA reveals many problems, especially in the end-life of RES — their dismantling, recycling and storage of waste generated after such installations. The severity of the problem is increased by the short service life of the facility: the standard lifetime of a wind turbine is about 20-25 years, the guarantee of full efficiency for PV panels is 25 years [19] [20].

## Conclusion

The development of renewable energy sources entails many challenges. One of them results from the characteristics of alternative methods of obtaining energy — availability of sources (sun, wind, etc.). The amount of energy produced is highly dependent on the season, day and geographic location. The second group of challenges results from technological problems and the need to improve the production and recycling processes.

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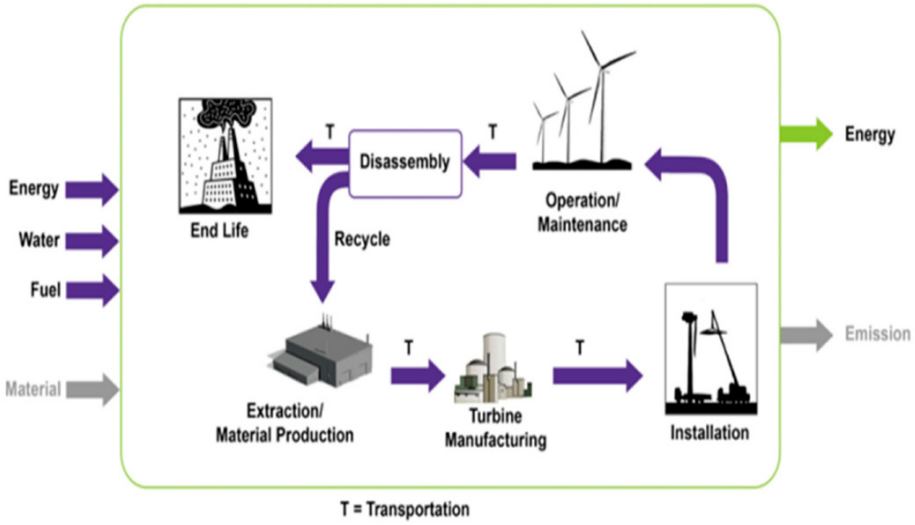


**Figure 9. Average age of the LV power lines in 2020**
Source: Jesuina Chipindula, Venkata Sai Vamsi Botlaguduru, Hongbo Du, Raghava Rao Kommalapati, Ziaul Huque, *Life Cycle Environmental Impact of Onshore and Offshore Wind Farms in Texas;* Sustainability, 2018

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# POLAND:
# ACTUAL STATE of RENEWABLE ENERGY SUPPLY

*Tomasz Marzec*

*Polish electricity generation is mainly based on coal burning (hard and brown coal), but the increase in the importance of the renewable energy sector is significant. Energy cooperatives were defined in Polish law in 2016. According to the Polish Act on Renewable Energy Sources, the scope of activity of an energy cooperative is to generate renewable energy solely for the needs of the energy cooperative and its members. There is currently only one registered energy cooperative in Poland. This article aims to present the general legal framework for renewables in Poland, focusing on energy cooperatives.*

The share of energy from renewable sources in the total primary energy production reached 15.96% in 2019. Energy from renewable sources in Poland is mainly derived from solid biofuels (firewood, briquette, pellet and waste from forestry) - 65,56%, wind energy - 13,72% and from liquid biofuels (bio-components added to engine fuels manufactured from petroleum) - 10,36% (data for 2019). Figure 1 illustrates the structure of primary energy from renewable sources.

Moving on to electricity generation – the share of renewable sources in 2019 has reached 15,4%. This is the highest result in history. The most electric power from renewable sources is produced by wind power plants – 60% and by power plants fueled by biomass – 18% (Figure 2, 3).

In the past, wind power has been the fastest-growing energy source in the renewable energy sector in Poland. In 2016, however, Wind Energy Investments Act introduced significant restrictions for the construction of new wind power plants. According to its regulations, wind power plants can only be built at a distance equal to or greater than ten times the height of the wind power plant, measured from the ground level to the higher point of a windmill from the residential buildings. For example, if the height of a windmill at the maximum elevated position of the rotor blade is approx. 150 - 180 m, the minimum distance from residential buildings should be approx. 1,5 - 1,8 km.

Currently, the fastest developing sector of renewable energy is photovoltaic. There are many developing solar farms projects, many of which have an installed power exceeding 1 MW. The number of prosumers (end-users who produce electricity exclusively from renewable energy sources for their own needs in installations of a total installed electrical power not exceeding 50 kW) is also increasing in Poland. According to data, from mid-2021, there are more than 650 thousand of them. The present increase in their number is caused by a dedicated public funding program for photovoltaic microinstallations. It is important to note that the prosumers usually explore the photovoltaic installations of installed power not higher than 10 kW.

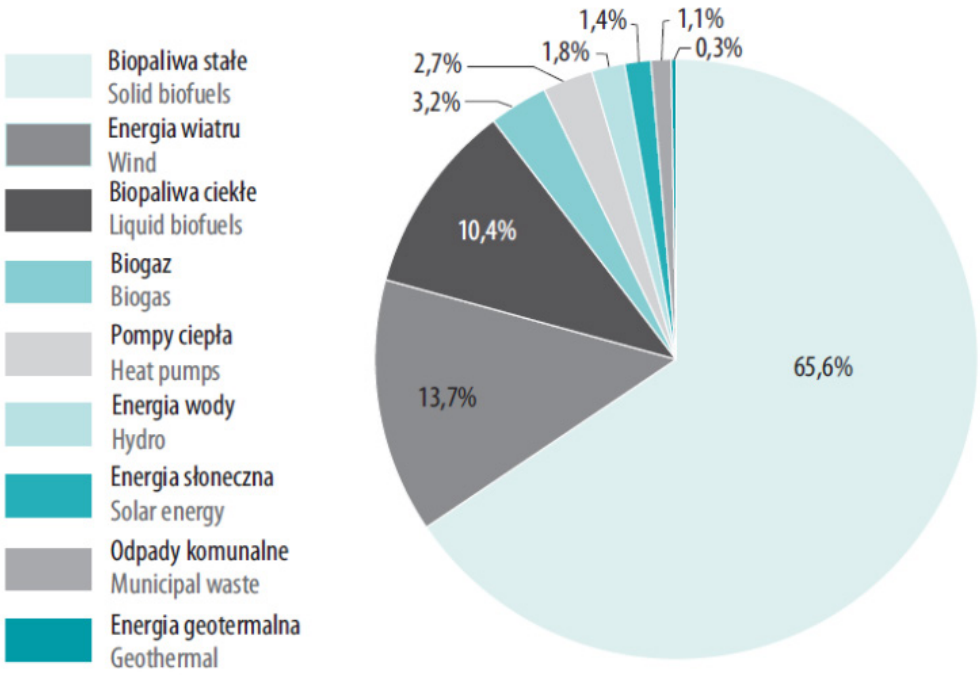



**Figure 1. Structure of primary energy production from renewable sources in 2019**

Source: Forum energii, Transformacja energetyczna w Polsce | Edycja 2020, Aleksandra Zieleniec (editor), access: https://www.forum-energii.eu/pl/analizy/transformacja-2020

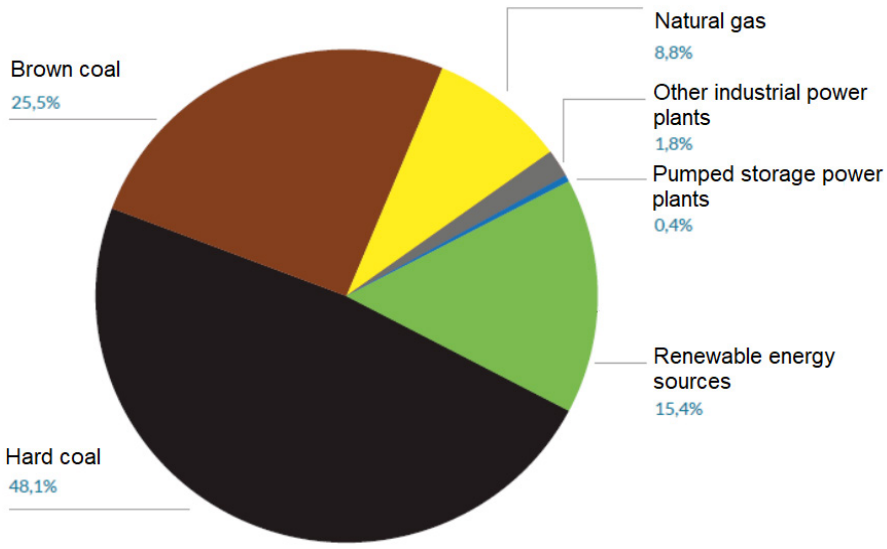



**Figure 2. Electricity generation in 2019**

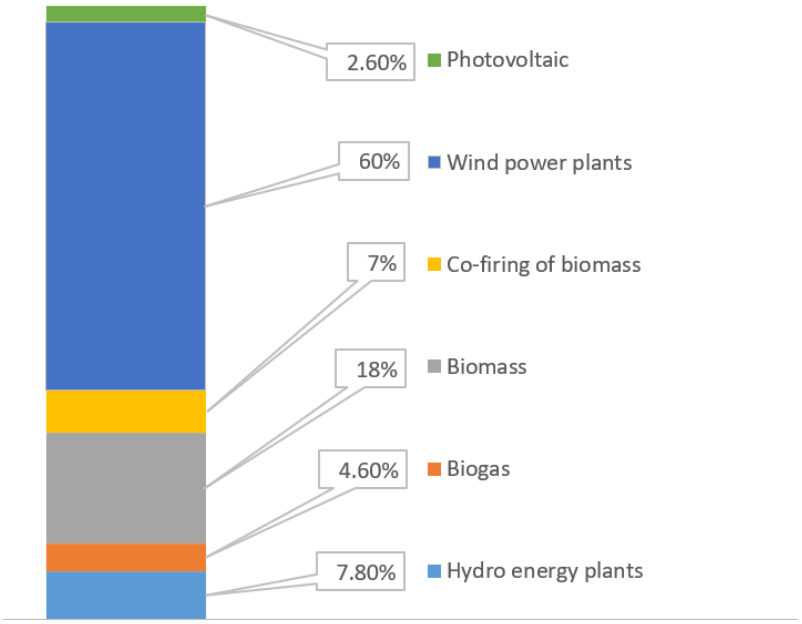



**Figure 3. The share of different types of renewable energy sources in electricity production generated from RES in 2019**

*Figures 2-3 are based on sources from: Główny Urząd Statystyczny (Statistics Poland), Energy 2021, Warsaw 2021.*

Investors from the renewable energy sector may apply for funding from public financial institutions (e.g., National Fund for Environmental Protection and Water Management), European Union funds or municipalities. There are also factors hindering the development of this sector. The most important obstacles are the frequent law changes (in addition to the mentioned above, i.a. changes to support systems of renewable energy sources) and outdated grid infrastructure – which causes difficulties with the connection to the electrical grid.

Despite the obstacles, renewable energy sources in Poland are constantly developing. The development objectives of the entire energy sector are established in a regularly updated strategic document – the State's energy policy. Adopted by the Council of Ministers in 2021 document "Energy Policy of Poland until 2040"[1] assumes a dynamic development of local and citizen's energy.

1 The document can be downloaded from the government's webpage — https://www.gov.pl/web/klimat/polityka-energetyczna-polski

# ENERGY COOPERATIVES DEVELOPMENT in Poland

*Tomasz Marzec*

The regulation on energy cooperatives is a section of regulation on renewable energy sources. Energy cooperatives are also perceived as a form of energy communities and important component of decentralized energy. In the Polish legal model, particularly emphasized are the prosumer aspects of energy cooperatives. In 2016, the Polish legal system received a legal definition of an energy cooperative. Therefore, to be perceived as an energy cooperative, a legal entity must comply with that definition.

The regulations on energy cooperatives are contained in the Polish Act on Renewable Energy Sources (RESA). According to its definition (art. 2 p. 33a RESA), an energy cooperative is a cooperative within the meaning of the Cooperatives Law Act or is a farmers' cooperative within the meaning of the Farmers' Cooperatives Act. Energy cooperative conducts economic activity consisting in the production of electricity or biogas or heat from renewable energy source installations owned by an energy cooperative or its members and balancing the demand for electricity or biogas or heat, solely for own needs of the energy cooperative and its members, connected to an area-defined power distribution network with a rated voltage of less than 110 kV or a gas distribution network or a heating network.

In the light of the above – the energy cooperative in Polish law is a subtype of a cooperative within the meaning of the above stated acts (the Cooperatives Law Act and the Farmers' Cooperatives Act). Regarding the scope of economic activity, it should be emphasized that energy cooperative cannot sell and/or distribute energy to other parties then cooperative members.

The energy cooperative can conduct its activity only after being registered. In fact, the registration procedure includes two main steps. First, registration of a cooperative or a farmers' cooperative in a registration court, having territorial jurisdiction. Second, registration of an energy cooperative by the Director of the National Agricultural Support Center. What is important: the energy cooperative can conduct its activity only after being registered in the list of energy cooperatives. The list is publicly available on the webpage of the National Agricultural Support Center.

To register the energy cooperative, all legal requirements stated in cooperative law and RESA have to be fulfilled. Below there is a catalogue of the legal requirements for the energy cooperatives (selected, most important conditions):

- The EC has to be registered as a cooperative or a farmers' cooperative (requirements in this respect include i. a. having a specific number of members, cooperative's statute, members of cooperative's bodies).

- The subject of EC activity should comply with the RESA provisions.

- The amount of EC members shouldn't exceed 999.

- The EC should generate energy solely from renewable energy source installations owned by an energy cooperative or its members.
- The EC should generate electricity (as well as biogas or heat) exclusively to cover its demand or the demand of its members.
- The EC may be established only in rural or urban-rural municipalities. It can cover maximally the territory of 3 municipalities directly adjacent.
- The EC may be established in the area of operation of one distribution-system operator.
- The EC members should be connected to the low- and medium-voltage electricity grid.
- The maximum capacity generated by the energy cooperative shouldn't exceed 10 MW (30 MW for heat).
- If the EC produces biogas, its annual capacity shouldn't exceed 40 mln $m^3$.

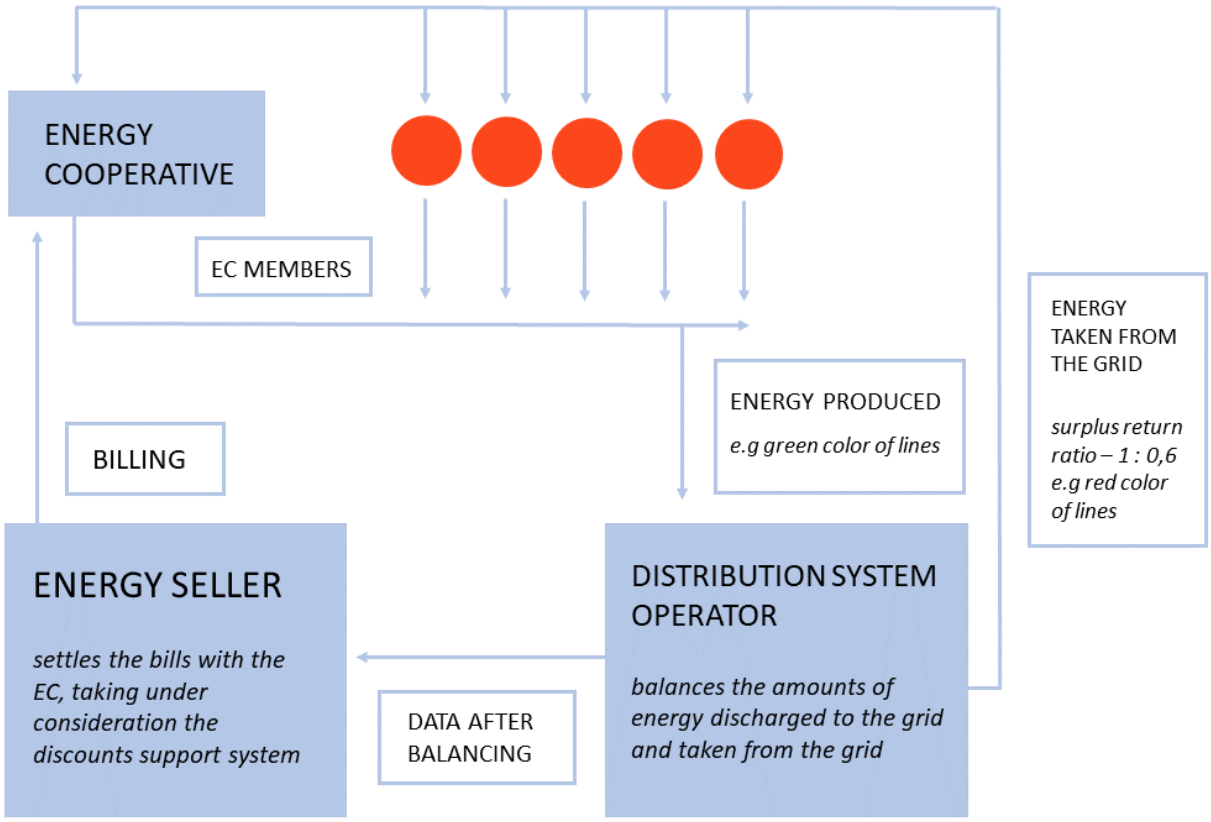



**Figure 1: Model of functioning of an energy cooperative**

- If the EC generates electricity, the total installed electric power of all renewable energy installations should enable the EC to cover not less than 70% of the annual needs of the EC itself and its members.

The provisions of RESA also establish the support system dedicated to energy cooperatives. This support system is based on a previously adopted scheme for prosumers to balance their energy consumption. It can be described generally as the system of discounts.

The energy cooperative is connected to the common electricity grid. If the energy cooperative and its members do not consume generated energy, the surplus is discharged to the electricity distribution network. But if the consumption rate is higher than generation, the shortage is covered from the common electricity grid (see Figure 1). If the EC discharges more electric energy to the grid, than consumes from it, amount of time – the surplus is returned to the cooperative at the ratio of one to six-tenths.

Currently, the legal framework for the support system is not entirely established. Detailed solutions are still being proceeded. The project of the implementing provisions includes that the surplus or the shortage will be counted and billed for each hour. The external balancing of cooperatives with the seller and the distribution system operator takes place during the annual billing period, according to the RESA.

In the Polish model, energy cooperative is not a profit-oriented entity and is not set for the sole purpose of generating profits. According to the legal framework, an energy cooperative should be established in order to generate energy with the purpose of autoconsumption. Although this scheme fits into the sustainable development model, it also limits the energy cooperative capability of raising capital, especially during the first stages of the investment.

Provisions of the Act on Renewable Energy Sources require very high level of self-consumption which requires relevant rate of sources spent on the installation. Also, the legal framework is not yet finished. Those factors can be perceived as obstacles by the possible founders of energy cooperatives in Poland.

# PILOT PROJECTS in Poland

*Tomasz Marzec*

Currently, there is only one registered energy cooperative in Poland. It operates under the name "Spółdzielnia Energetyczna EISALL" (Eisall)[2]. There are reports of energy cooperatives that are being established by local communities with the help of municipalities, but they have not been yet registered. In April 2021 Polish Ministry of Agriculture and Rural Development, in cooperation with the German Federal Ministry for the Environment, launched the program RENALDO – Rural Development through Renewable Energy Sources. Its target is to support six municipalities in Poland with the know-how in the project of establishing energy cooperatives on their territory[3].

Eisall consists now of four members[4]. The three founding members are limited liability companies. The energy cooperative has two photovoltaic installations with a total installed power of 20 kV. According to the interviews given by its chairman of the board, Eisall is currently negotiating agreements with the distribution system operator and with the seller of electricity[5]. Based on information from Eisall's webpage, its business model consists of the use of energy storage technologies and with the distinction of three types of members: producers, prosumers and consumers. Membership in the energy cooperative in this model is an opportunity for consumers to receive less expensive energy, for prosumers to use the public grid more efficiently and for producers to obtain a stable energy-reception guarantee and higher sales price than in auction system or at power exchange. Currently, Eisall can be perceived more as a business venture rather than a community project. But it is important to note that its development may influence the future shape of energy cooperatives in Poland.

There are also announcements of public funds, that will be ntended for the development of energy cooperatives – but no specific information has been released by Polish public authorities yet. Because of that, communities that are in the process of establishing energy cooperatives wait for more particular schemes in order to invest in projects that have sufficient public support.

**Conclusion.** Polish legislator has chosen a unique model for the functioning of energy cooperatives. Generation of renewable energy solely for the needs of the energy cooperative and its members complies with the idea of sustainable development, but makes this business model less attractive for profit-oriented part of society. In the Polish model, energy cooperative allows its members to reduce electricity costs, rather than generate profit. The above, with other factors described in this paper, result in a relatively moderate interest in establishing new energy cooperatives by communities in Poland. Therefore, if the present model must be continued, there is a need for funding programs and know-how exchange initiatives for rural communities to popularize energy cooperative movement in Poland.

2 Webpage of Spółdzielnia Energetyczna EISALL: https://eisall.eu/.

3 More information about RENALDO: https://www.euki.de/en/euki-projects/srsp/.

4 Data collected from the list of energy cooperatives available online on National Agricultural Support Center's webpage: https://www.kowr.gov.pl/odnawialne-zrodla-energii/spoldzielnie-energetyczne/zatwierdzenie-w-wykazie-spoldzielni-energetycznych/wykaz-spoldzielni-energetycznych.

5 Two parts of the interview are available on the webpage www.gramwzielone.pl.

# UKRAINE: POTENTIAL of ENERGY COOPERATIVES

## in sustainable development of Ukraine

*Olena Rubanenko*

The article analyzes the potential of energy cooperatives development in Ukraine, particularly the possibility of using photovoltaic and wind power plants, as well as biogas plants. The tendencies of annual electricity generation in the world and Ukraine by photovoltaic and wind stations are analyzed. The existing problems of electricity supply and power supply quality indices that could be solved and improved by developing of energy cooperatives in Ukraine are outlined and analyzed.

### Introduction

The load of low-voltage networks of rural settlements in Ukraine is from 3 to 8 kW / km and averages 5 kW / km, so the electricity supply of agro-industrial enterprises and settlements in rural areas differs from the electricity supply of large cities. The main task of electricity supply in the agro-industrial complex is the supply of electricity to a large number of relatively low-capacity facilities scattered over a large area; as a result, the length of networks (per unit of consumer capacity) many times exceeds this value in other sectors [1].

At the present stage of development of electrification of agriculture, especially during the creation of livestock complexes of industrial type, poultry farms, greenhouses, etc., the shutdown of the transmission line, both planned (for audit and repair) and unforeseen, emergency, causes significant damage to consumers and energy itself [1].

The problems of electricity supply to agro-industrial enterprises, which are mostly built closer to raw material bases, ie fed by rural power grids, are low rates of renewal of electrical equipment, significant losses of electricity during transportation, due to the long length of transmission lines. This is evidenced by statistics covered in [2][3]. By the beginning of 2000, approximately 30% of overhead power lines (630 thousand km) and transformer substations (140 thousand units), which provided electricity to 153,000 rural settlements, agro-industrial enterprises and social facilities, as well as industrial enterprises, small towns and urban-type settlements located in rural areas, fulfilled the normative term, in 2010 - this value was 40%. Annually, the share of damage to transformers with a voltage of 6 ... 10 / 0.4 kV is ~ 2.5% (1300 pieces), and transformers with a voltage of 35 ... 110 kV ~ 1.2% of the number installed.

The annual report on the results of the National Commission for State Regulation of Energy and Utilities for 2019 states that the main indicators of reliability of electricity supply for electricity distribution companies: index of average duration of long power outages in the system (SAIDI), index of unauthorized electricity (ENS), which characterize the quality of electricity supply are many times higher than those of European countries. The

value of the SAIDI index due to companies in 2019 - 683 minutes, for comparison in the Czech Republic - 84 minutes, Denmark - 12 minutes, Germany - 12 minutes. The values of the SAIDI and ENS indices for Ukraine are shown in Fig. 1 and 2 (NKREP Report, 2019). Therefore, the task of creating energy cooperatives with dispersed energy sources (DES), in particular renewable energy sources (biomass cogeneration plants, solar power plants, wind power plants) is urgent, which will not only provide the agricultural enterprise with reliable electricity supply and quality electricity, but will also be an additional source of income. In 2009, Ukraine introduced a preferential payment mechanism for electricity produced using alternative types of energy at a «green» tariff and its guaranteed purchase by a wholesale electricity supplier. The values of the «green» tariff are set

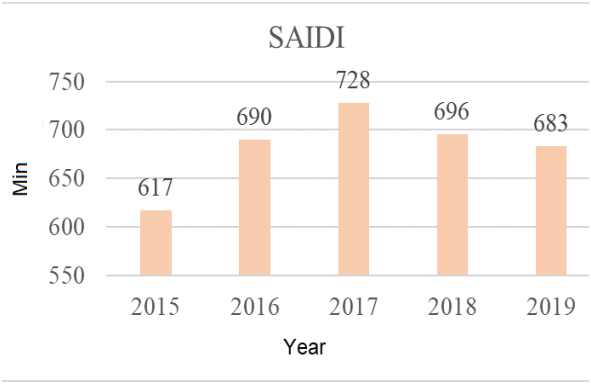



**Fig. 1. SAIDI index for Ukraine**

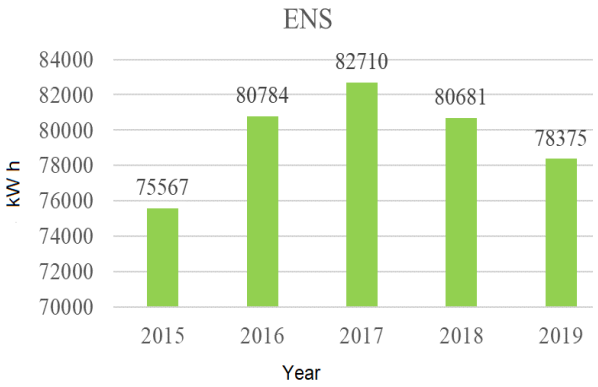



**Fig. 2. ENS index for Ukraine**

quarterly depending on the average official exchange rate of the UAH to the euro set by the National Bank of Ukraine.

In the last few years, energy cooperatives have become increasingly popular due to their advantages, such as energy saving, environmental protection, and decentralization of heat and electricity.

Environmental problems related to fossil fuel extraction, depletion of fossil fuels, overloading of low voltage electrical grids and deterioration of their performance are the reasons for integrating sources (small generating capacities) of distributed generation (DRG) and converting the existing power system into a restructuring system. So, that is a question of creation of local electric systems and microelectric grids which would promote the increase of energy efficiency of RES during their operation, namely — creation of power cooperatives. The main prerequisites for the creation of energy cooperatives that have emerged in Ukraine, which negatively affect the energy efficiency of RES could be seen at Fig. 3.

The rapid pace of construction of new RES facilities can also boost employment in the amalgamated territorial communities (OTGs) in Ukraine by creating jobs in new green technologies. Since energy cooperatives are mostly focused on the implementation of local projects to ensure energy independence from district heating and electricity, the installation of distributed generation facilities is appropriate, of course, taking into account the priority of environmental friendliness. Therefore, the projects of using RES in OTG and creation of energy cooperatives are promising. The latest statistics on the share of energy from renewable sources in

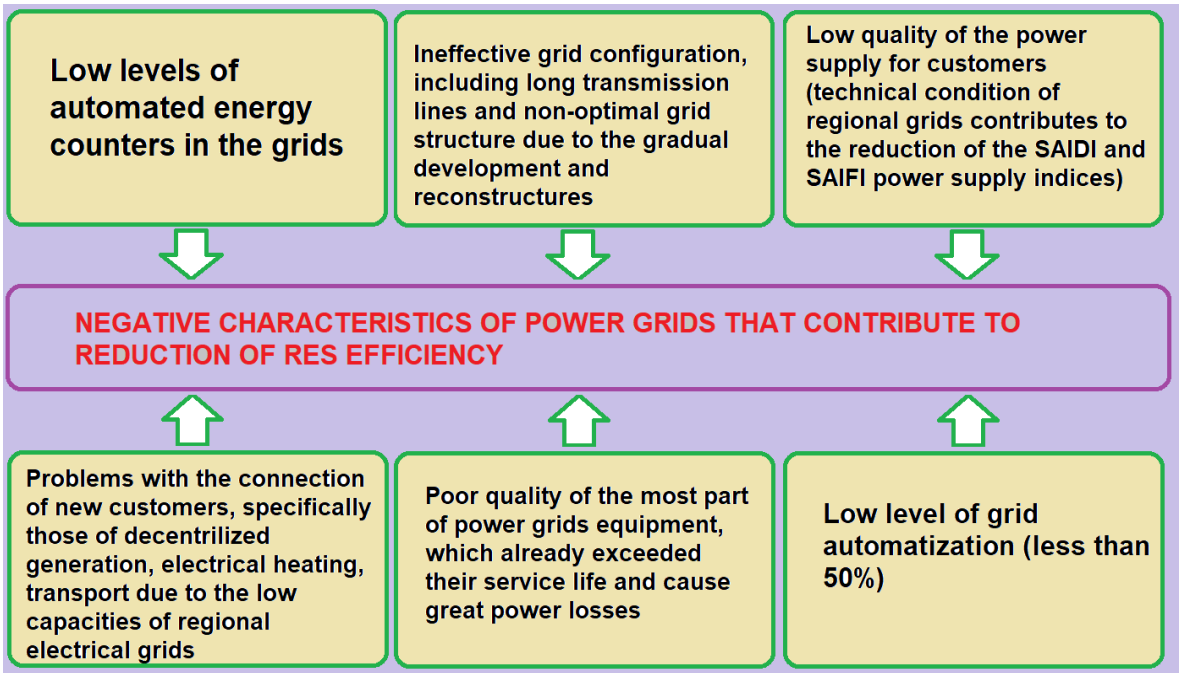



**Fig. 3. Prerequisites for the establishment of energy cooperatives**

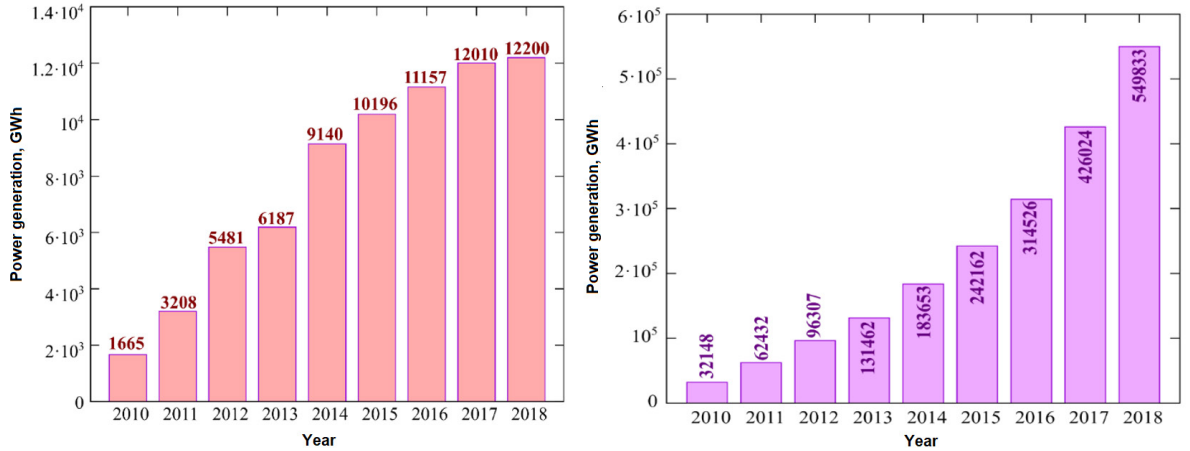



**Fig. 4. The trend of global increasing electricity power generation according to IRENA: a) solar thermal stations; b) FES**

general and in the three consumption sectors (electricity, heating and cooling, transport) in the EU are presented in [4].

According to the NREL (National Renewable Energy Laboratory), more solar energy enters the Earth in one hour than is used by the Earth's population in one year. Today, solar energy is used in different ways — for heating homes and businesses, for heating water or generating electricity [5]. According to the International Energy Agency, the demand for RES is growing, despite the negative impact of the situation caused by COVID-19 [6]. According to IRENA, the world's electricity generation is growing every year. One of the most popular types of RES is solar and wind energy, as evidenced by the global trend of increasing electricity generation by photovoltaic plants (FES) and wind power plants (WPPs) (Fig. 4), which are the most promising for energy cooperatives. In Ukraine, alike to the rest of the world, there is a ten-year trend of rapid growth of renewable energy capacity (Fig. 5).

The annual global increase of 7.9% of the installed capacity was provided by the

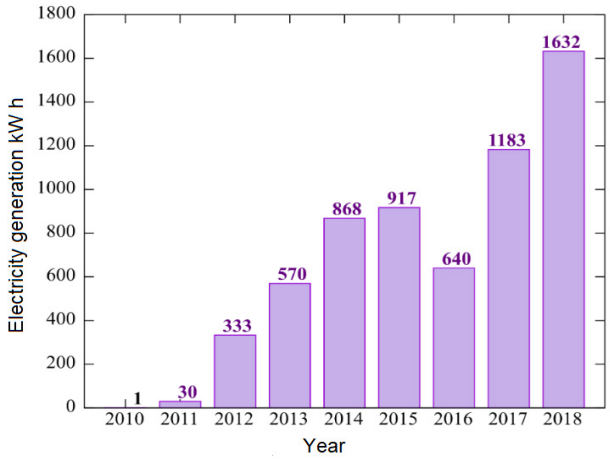



**Fig. 5. The tendency to increase the generation of electricity FES in Ukraine according to IRENA**

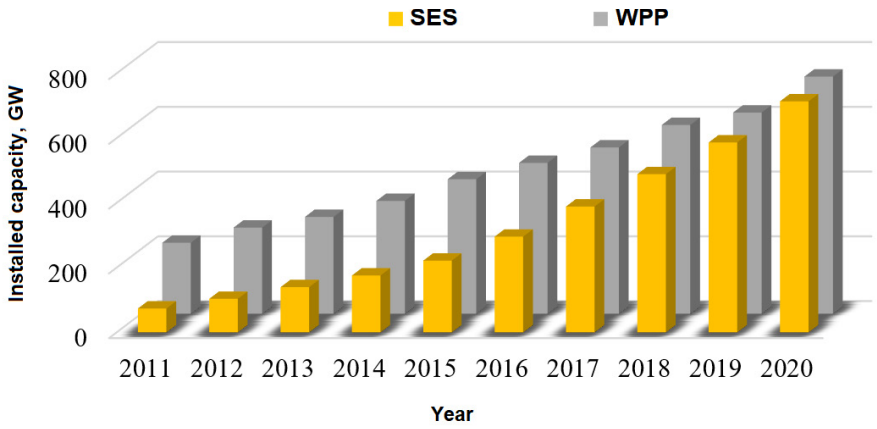



**Fig. 6. Dynamics of changes in the installed capacity of wind farms and power plants in the world according to IRENA**

commissioning of FES and WPPs, the share of which amounted to 84% of all types of RES (Fig. 6). The total renewable energy production capacity in the world reached 2551 GW at the end of 2018. There is a stable tendency to a rapid increase in the growth rate of connection to the electric networks of the UES of Ukraine of renewable energy facilities. The total installed capacity of electricity facilities that produce electricity from alternative energy sources and which have a «green» tariff, compared to 2017 increased by 742.5 MW (of which wind farms - 67.7 MW, SES - 646.4 MW, biomass / biogas - 24.4 MW, micro, mini and small hydropower plants - 4 MW) and is 2117.2 MW.

The total installed capacity of generating units of private households has increased 3 times: from 51 MW at the end of 2017 to 157 MW at the end of 2018. The installed capacity of RES in Ukraine according to NEC «Ukrenergo» is presented in Fig. 7.

Electricity production in 2018 by electricity facilities, which set a «green» tariff, compared to 2017 increased by 691 million kWh or 33% and amounts to 2,777.3 million kWh (which is 1, 9% of the volume of electricity production by power plants that are part of the UES of Ukraine) [7]. The tendency to increase the installed capacity of RES in Ukraine, which sells the generated capacity at a «green» tariff according to the National Commission for State Regulation of Energy and Utilities (NKREKP), is shown in Fig. 8.

The plan for implementing the strategy of increasing the use of RES requires consideration of new approaches to the system of control of RES parameters. According to NEC Ukrenergo, in 2020 the structure of installed capacity in the energy sector of Ukraine changed compared to 2019 as follows: the share of power plants with an uneven generation schedule increased, ie wind farms and power plants and amounted to 6473.8 MW (which is 1893.4 MW more than in 2019). The capacity of TPPs and CHPs was 21.8 GW and 6.1 GW, and the capacity of HPPs and PSPs was 4.8 GW and 1.5 GW, respectively. Installed powerful PSP, HPP, TPP, CHP remains unchanged from 2018. Also in 2020, the share of wind farms and power plants in the structure of electricity generation almost doubled - to 6.8% (3.3% in 2019) with a total electricity generation of 148.9 billion kWh. HPPs, PSPs and TPPs play a key role in covering the peak load and compensating for the uneven generation of WPPs and FES,

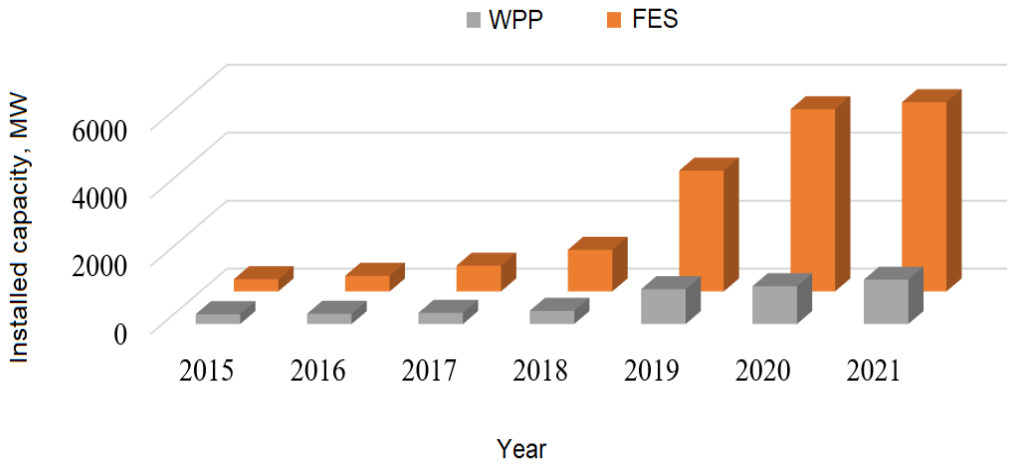
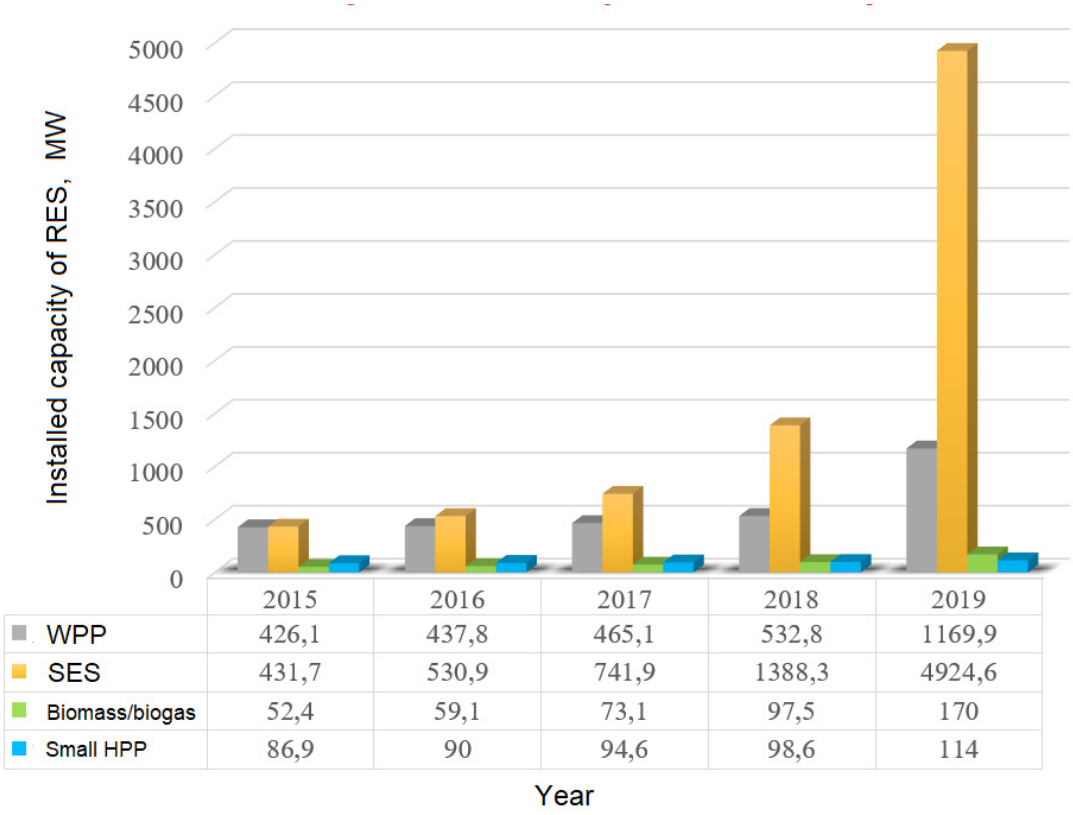



**Fig. 7. Installed RES capacity in Ukraine according to NEC Ukrenergo**




| | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| WPP | 426,1 | 437,8 | 465,1 | 532,8 | 1169,9 |
| SES | 431,7 | 530,9 | 741,9 | 1388,3 | 4924,6 |
| Biomass/biogas | 52,4 | 59,1 | 73,1 | 97,5 | 170 |
| Small HPP | 86,9 | 90 | 94,6 | 98,6 | 114 |

**Fig. 8. The tendency to increase the installed capacity of RES in Ukraine, which sells the generated capacity at the «green» tariff according to the NERC.**

which reduces their energy efficiency [8].

As small hydropower plants require significant investment and special natural conditions, wind farms and power plants are available to most. Volumes of electricity production by wind farms in the world and in Ukraine in recent years are shown in Fig. 9. If Ukraine makes new commitments in accordance with the requirements of the Paris Agreement, the planned 20% of RES in 2035 will be insufficient [9]. The use of HPPs will partially help to solve this problem.

In the coming years, the entire energy base of the planet will change. Environmental problems that urgently need to be addressed to reduce CO2 emissions have been a powerful impetus for the development of RES. Up to 60% of electricity by 2030 will be generated by RES in European power grids. The country's energy strategy until 2035 envisages that RES will account for 25% of the energy balance. Also, investments in RES in Europe are projected to be more than three times larger than investments in TPPs and NPPs by 2035.

## Conclusions

Ukraine has enough RES potential to create a large number of energy cooperatives. Unsatisfactory condition of electricity grids, changes in consumption schedule, the emergence of new generating capacities, the possibility of providing balancing services

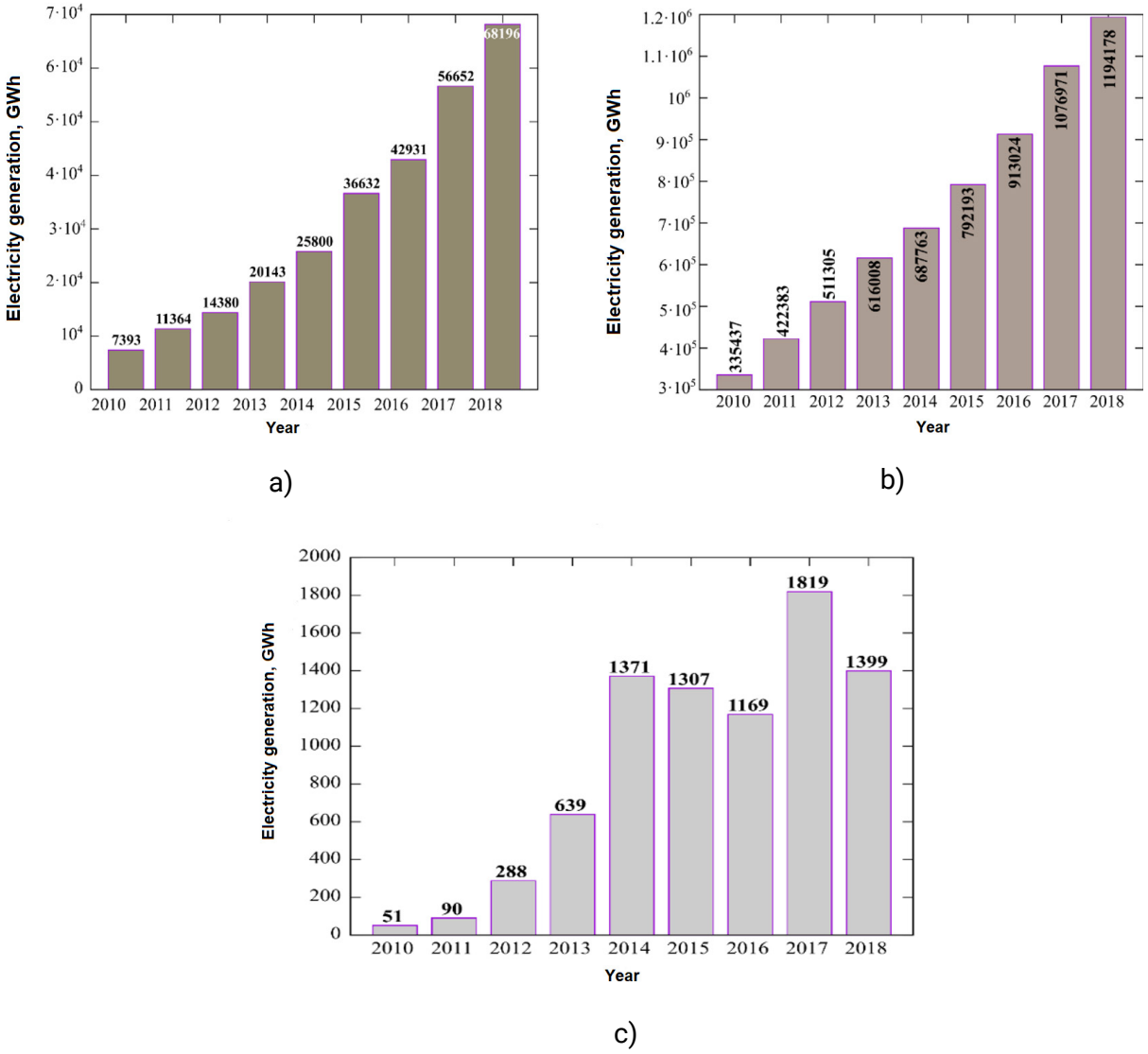



**Fig. 9. Volumes of electricity generation according to IRENA: a) in the world of Offshore wind farms; b) in the world of Onshore wind farms; c) the amount of electricity generated by RES in Ukraine**

creates the need to use sources of distributed generation, which will work more efficiently in energy cooperatives [10].

In contemporary conditions, the task of creating energy cooperatives focused on improving the energy efficiency of RES is relevant and its solution will ensure the sustainable development and implementation of commitments to the decarbonisation course. Also, it will provide the population with quality heating and electricity services with minimal damage to the environment. And in an optimistic scenario of RES development within OTG, it will not only save but also gain additional income from excess electricity generated by RES at the «green» tariff. The creation of energy cooperatives is only way to improve the quality of electrical networks.

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## List of Figures:

Fig.1. Source: Report on the implementation of the annual plan of state control of economic entities operating in the markets in the fields of energy and utilities. https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2019.pdf

Fig.2. Source: Report on the implementation of the annual plan of state control of economic entities operating in the markets in the fields of energy and utilities. https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2019.pdf

Fig. 3. Source: Own work

Fig.4. Source: The International Renewable Energy Agency (IRENA). https://www.irena.org/

Fig.5. Source: The International Renewable Energy Agency (IRENA). https://www.irena.org/

Fig.6. Source: The International Renewable Energy Agency (IRENA). https://www.irena.org/

Fig.7. Source: https://ua.energy/vstanovlena-potuzhnist-energosystemy-ukrayiny/

Fig.8. Source: Report on the implementation of the annual plan of state control of economic entities operating in the markets in the fields of energy and utilities. https://www.nerc.gov.ua/data/filearch/Catalog3/Richnyi_zvit_NKREKP_2019.pdf

Fig.9. Source: The International Renewable Energy Agency (IRENA). https://www.irena.org/

# PROBLEMS, PROSPECTS & MECHANISMS of ENERGY COOPERATIVE DEVELOPMENT in Ukraine

*Viktoriia Vostriakova*

*The article considers the problems that hinder the establishment of energy cooperatives as a promising form of organizational and legal form of development of the renewable energy sector in Ukraine. Perspective directions of development of energy cooperatives as one of the main mechanisms of ensuring energy independence of communities and their sustainable development are determined. The world experience of models of formation of energy cooperatives is generalized.*

Energy is the main component of meeting the socio-economic needs of any country and Ukraine in particular. The ever-increasing demand for energy and the associated risks to national energy security in the context of Ukraine's energy sector's dependence on gas supplies from the Russian Federation in the face of military aggression cause market instability, rising energy prices and associated negative economic consequences. In addition, carbon emissions, which are directly related to the energy sector, have a negative environmental impact and lead to climate change.

In 2015, Ukraine ratified the Paris Agreement at the XXI Conference of the Parties to the United Nations Framework Convention on Climate Change, which will enter into force after the expiration of the Kyoto Protocol in 2020. Thus, Ukraine has joined the international initiative for sustainable development, thus confirming its intentions to reorient the economy from traditional fossil to renewable energy sources.

These current environmental and economic challenges underscore the need to revise models of energy systems. For Ukraine, as a developing country, the development and implementation of renewable energy technologies is vital. However, from an economic point of view, the use of renewable energy sources is inaccessible to developing countries and the poor. Nevertheless, due to the reduction of costs for alternative energy technologies and the projected increase in fossil fuel prices, the use of RES in Ukraine is becoming increasingly popular. The OECD estimates that more than 70% of electricity supply needs can be met through the use of renewable energy. For 65% of non-electrified households, the cheapest way to supply electricity is mini-networks, and in 45% of households — off-grid technologies [1]. Accordingly, the current situation in the energy sector of Ukraine requires a rethinking of energy investment, reorientation from the monopoly use of central network infrastructure by large utilities towards decentralization and diversification of networks, studying the potential of local amalgamated territorial communities (OTGs) in renewable energy.

In Ukraine, the cost of fossil fuels is constantly rising, with the local population

paying extremely high bills for heating and electricity, which ultimately almost reach the level of capital investment available for renewable energy (which has high upfront costs but very low operating costs). In addition, the quality of energy services does not always correspond to their cost. Based on the above, household access to modern energy in Ukraine is limited not only due to its high cost, but also due to lack of finances and institutional mechanisms to attract them at the local level, lack of cooperative organizations in communities and shortage of qualified personnel, education and human resources in rural areas.

Energy cooperatives are forming a new socio-economic business model in the field of renewable energy, which will overcome the lack of institutions and state regulation through self-organization of the local population (households). After all, the creation of an energy cooperative allows several owners to invest in modern renewable energy, in fact, independently creating and financing a cooperative network. The next section considers the main problems and prospects of creating energy cooperatives in Ukraine, as well as possible models of their organization.

## Prospects

Establishment of energy cooperatives in Ukraine is a very promising area of activity. In the context of the recent decentralization reform, amalgamated territorial communities (OTGs) with a wide range of powers have been established to replace districts. The creation of an energy cooperative within a separate OTG provides opportunities for communities as a whole and for other self-organized groups to provide themselves with a variety of energy resources — from solid fuel for heating individual households to providing electricity for personal and business use.

The topic of energy cooperatives is especially relevant for rural areas, as according to the State Statistical Service of Ukraine [9], about 30% of the population (13.2 million people) live there. For the rural population, the payment for energy resources, given the constant rise in prices for traditional energy sources, is too high today. Given the significant amount of agricultural waste, which is the main activity in rural areas, combining local farmers and peasants into energy cooperatives will reduce utility costs by using energy resources available in rural areas, such as biomass. According to UAB (Bioenergy Association of Ukraine), our country has a significant potential for energy production from biomass — more than 30 million toe (tons of conventional fuel) per year. Of this potential, Ukraine currently uses about 10%, producing only 3 million tons of conventional fuel from various types of biomass [2].

According to the statistics of recent years (Fig. 1.), since 2014 in Ukraine there have been significant changes in the direction of increasing the share of production and consumption of energy from alternative sources.

Today in Ukraine there are already positive examples of the introduction of the energy cooperative model in communities that use biomass. For example, in Losiatyn village (Ternopil region, Ukraine) on the basis of the existing agricultural service cooperative «Yahidnyi Krai» introduced processing of agricultural waste from raspberries (raspberry stalks which are burned annually) into fuel briquettes, thus turning waste into a cheap energy resource. Fuel briquettes are suitable for heating the homes of farmers who use solid fuel boilers, are a cheaper alternative to gas heating and are an example of creating added value from waste that had to be disposed of.

In farming and business circles, energy cooperatives, as a form of organization, also have their advantages. The democratic nature of the cooperative, which is ensured by

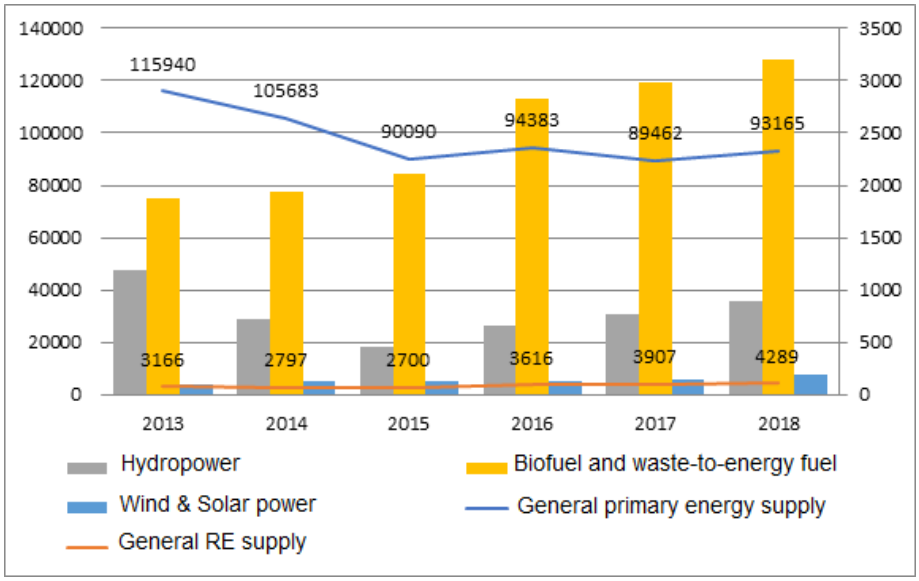


**Fig. 1. The level of consumption of energy produced from alternative energy sources (toe)**

an immutable rule: one member — one vote (regardless of the size of the share), allows you to effectively combine financial and property resources of members to meet their own needs. For example, several farmers can join a cooperative to accumulate resources and install certain equipment: a biogas plant, a bracket station or a cogeneration plant, and get a «green tariff» for electricity generation.

The current state of energy consumption from alternative sources can be monitored by the dynamics of the annual installed capacity of renewable energy facilities using the «green» tariff (Fig. 2).

World experience and Ukrainian realities demonstrate the diversification capacity of energy cooperatives. Energy cooperatives can be created on the basis of almost any technology currently available to use alternative energy sources (solar, wind, hydro). In addition, energy cooperatives can be:

— consumer-created (for the purchase at wholesale prices of energy raw materials, equipment, insulation materials, etc.);

— production - created (for energy production or cultivation of energy raw materials and its processing into energy);

— for service (providing information and consulting services, development of technical documentation, etc.). This type provides an opportunity to use energy cooperatives to work under the ESCO scheme (Performance contracting).

The main advantage of the cooperative form of organization is the flexibility of the legal and organizational form, because it allows you to combine a wide range of participants - citizens, farmers, entrepreneurs, community representatives to meet different energy needs at different levels. At the level of local communities, the creation of energy cooperatives creates a number of advantages (Fig. 3).

The world experience of creating energy cooperatives demonstrates a number of advantages: creation of new jobs at the local level; opportunity to save energy and get added value; local energy production reduces the burden on the ecosystem, and the use of

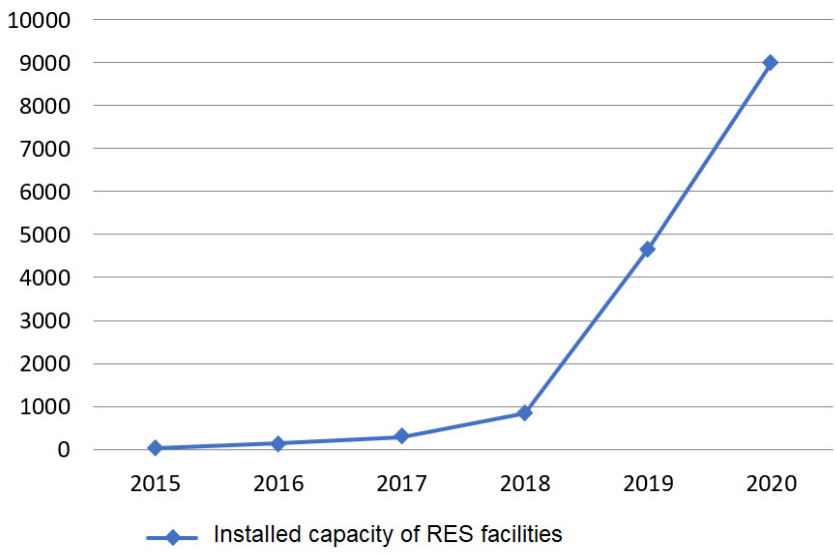


**Fig. 2. Dynamics of growth of the installed capacity of RES facilities using the «green» tariff, MW**

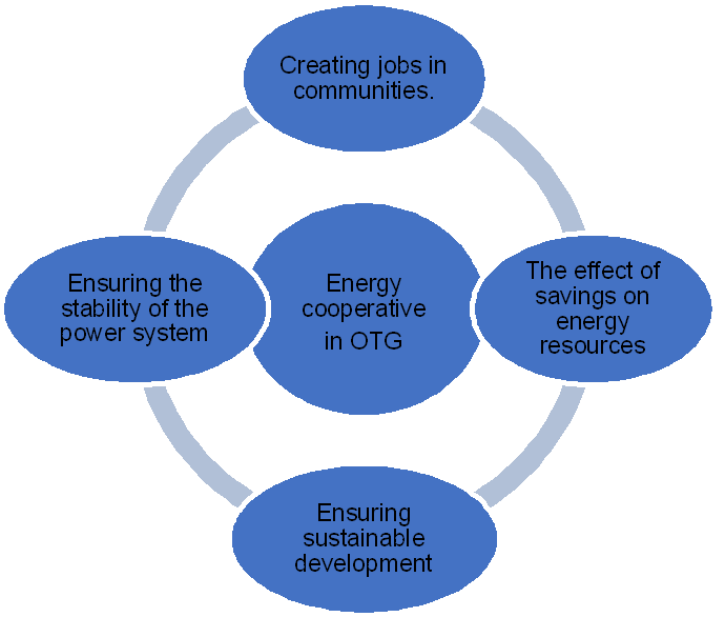


**Fig. 3. Advantages of creating energy cooperatives for local communities**

alternative energy sources often leads to a reduction in CO2 emissions; ownership and management of its own energy infrastructure and diversification of energy sources reduces the community's dependence on the negative impact of external factors of monopoly ownership of energy resources.

## Problems and challenges

Despite the considered range of prospects for the application of the cooperative model of organization in the energy sector, in Ukraine this movement is just beginning to emerge. The main obstacles to the active establishment of energy cooperatives in Ukraine are lack of knowledge about world experience and best practices in this area, lack of understanding of the benefits and understanding of how it works, lack of technical and economic support and poor previous experience of establishing cooperatives in Soviet times. However, one of the most important challenges on the way to full-fledged launch of energy cooperatives in Ukraine is Ukrainian legislation and over-regulation of the energy sector. In modern realities in Ukraine, the green light is on to create energy cooperatives that meet the needs of cooperative members with energy raw materials or services, but as soon as the purpose of creating a cooperative is to create a heating or electricity network for joint operation, there are a number of restrictions and excessive adjustments. For example, this refers to the fact that the tariff for the supply of heat by the cooperative to its own members, in accordance with current legislation, is set by representatives of local governments. In addition, in the field of creation of small and micro-electric networks, which, in fact, include members of the cooperative, today there is no clearly defined procedure for the creation of current legislation, which also creates uncertainty.

To overcome these challenges, certain decisions are being made at the legislative level today, for example, in 2019 the term "energy cooperative" was defined by law, but these decisions are fragmentary and often contradictory, creating legal conflicts and complicating the process of self-organization. In addition, there are a number of institutional barriers to the establishment of energy cooperatives in Ukraine, which require a complex process of licensing this activity, which requires three licenses and three tariffs: for the production, transportation and supply of electricity. Thus, a cooperative created to meet the energy needs of its own members must comply with the same conditions as those approved for natural monopolies. Which in some cases is simply impossible and significantly increases the cost of organizing a cooperative and makes it dependent on local governments [3]. To overcome these challenges, it is necessary to simplify the procedure for establishing energy cooperatives at the legislative level, to ensure an active dialogue between state and local authorities with public organizations, which in international practice are the driving force behind the necessary changes. Institutional components of the mechanism of development of energy cooperatives (Fig.4.)

To date, there is no single institution that would deal with development issues and encourage the establishment of energy cooperatives at the state level, which greatly complicates this process.

## Development mechanisms

The cooperative form of organization in the energy sector has a number of competitive advantages in the production, supply and distribution of energy. Cooperatives are often public non-profit organizations, which makes it possible to ensure democratic local control in the energy sector. At the international level, this model of organization has successfully proven itself in the field of electrification of rural areas and efficient use of biomass available in rural areas. On the basis of the

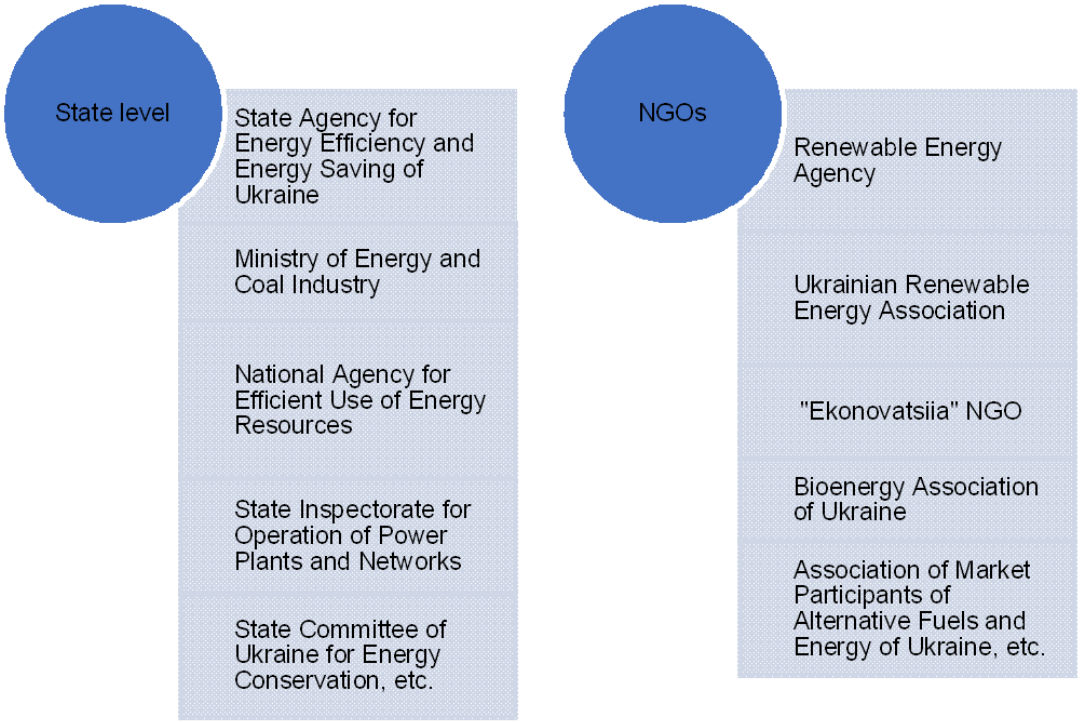


**Fig. 4. Institutional components of the mechanism of development of energy cooperatives**

considered world experience of creation of cooperatives it is possible to form acceptable for Ukraine models of the organization of energy cooperative.

## Cooperative model of rural electrification

In world practice, energy cooperatives established in the nineteenth and twentieth centuries were aimed at promoting electrification in rural areas and / or to provide electricity to the population at a more affordable price in remote areas. Municipalities or other public institutions and private enterprises, which often took the form of cooperatives, were involved in the process of electrification of rural areas. Due to the high cost of electrification in remote areas, commercial enterprises considered such investments too expensive and even unprofitable, and cooperatives were often the first and only providers of electrification services in rural areas.

As off-grid electricity supply is decentralized, a number of business models have been developed for its implementation. The variety of models varies depending on the subject of implementation: municipalities - to increase economic activity, communities - to access modern forms of energy and the effect of savings, entrepreneurs — to create a profitable energy business. Accordingly, these models have different efficiencies and scales. After all, community-based models often involve strong support from local municipalities, government models typically reach a wider range of consumers, while commercial enterprises often focus more on the financial and investment component.

We try to focus mainly on participatory electrification models to understand the importance of the role of communities and their impact on the implementation of energy cooperation practices. After all, the

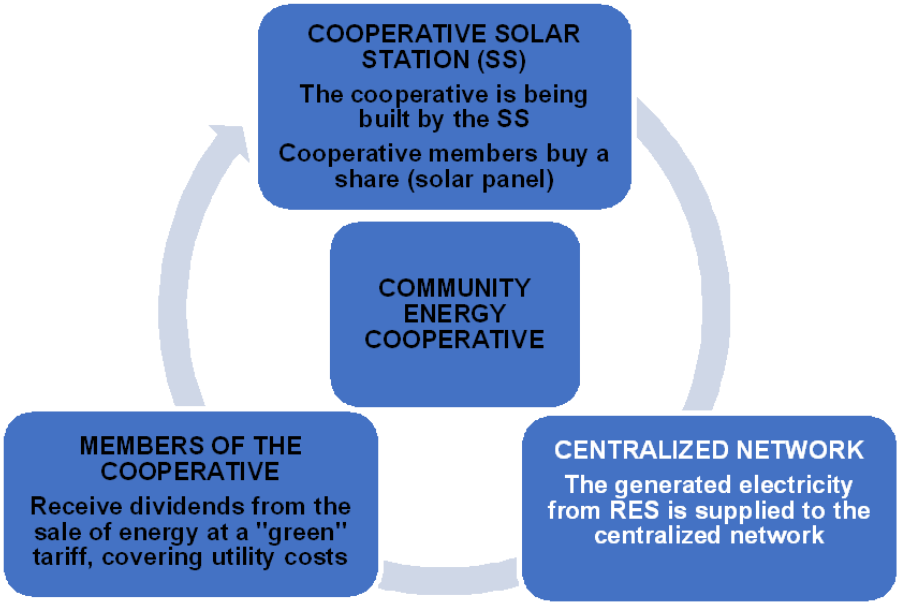


**Fig. 5. Model of a community energy cooperative on the basis of a solar power plant**

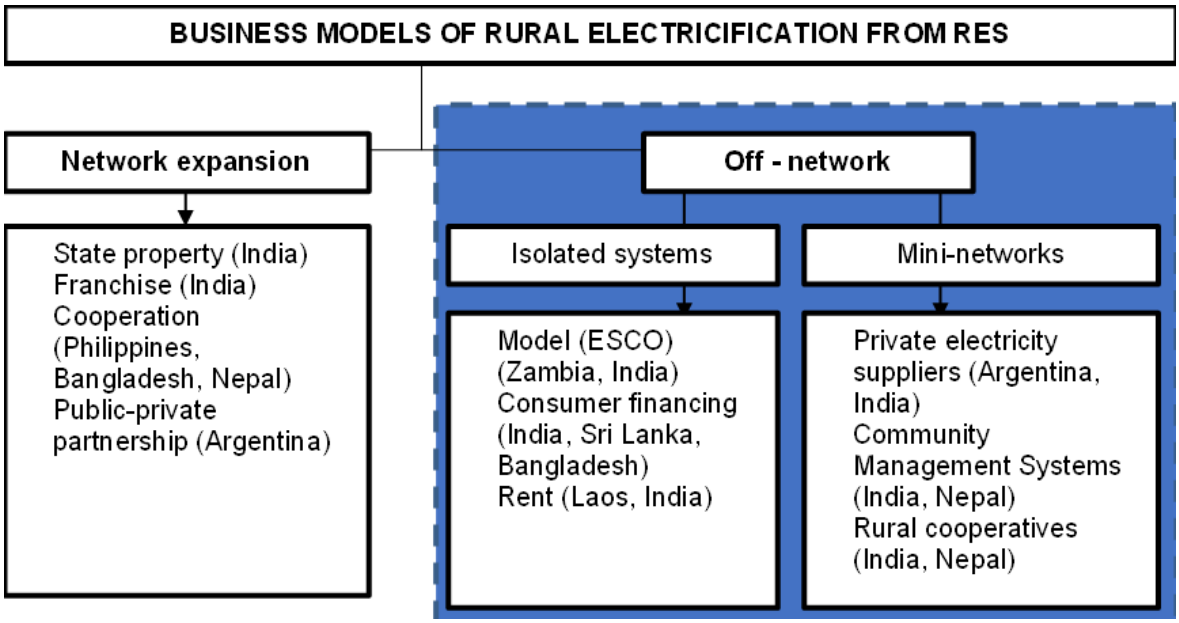


**Fig. 6. World experience in forming business models of electricity supply from renewable energy sources**

experience of India [4], Nepal, Ghana [5] and other countries clearly demonstrates the importance of involving communities in this process. The model of a community energy cooperative on the example of a solar power plant is presented in Fig. 5.

Given that the functioning of the energy cooperative in Ukraine is closely linked to the centralized power supply network, and the formation of mechanisms outside the grid is at an early stage of development, it is advisable to consider the world experience of forming business models of electricity from renewable energy sources (Fig. 6), which may be useful in developing mechanisms for the development of energy cooperatives in Ukraine at the state level.

Rural electricity cooperatives should operate on the same principle as enterprises — democratic governance and social orientation in accordance with the principles of sustainable development of the region. After all, the cooperative form of organization is the middle ground between the social orientation of public administration and the maximization of private sector profits. Given that cooperatives operate on a one-member-one-vote basis, local communities are given the opportunity to participate in the development of an OTG development strategy [6].

### Energy Center Model (HUB)

Energy centers or energy hubs generate and/or sell electricity, which is mainly produced from renewable energy sources. They meet the local electricity needs of local customers, including cooperatives and other businesses. If they are organized as cooperatives, the beneficiaries are usually also members of the energy center or energy hub (Fig. 7).

The energy produced by the center is used for various purposes, such as energy supply and stabilization of mini-networks of small agricultural processing or local municipality premises. The idea of creating energy centers is to promote the use of electricity in RES for both industrial and consumer use. Energy centers can also be used for educational purposes, offering training and coaching courses in the field of energy efficiency and electricity production from renewable sources. Another promising area of energy cooperation is agricultural waste — biomass. In world practice, there are such options for cooperation as biomass farms, biomass power plant / boiler house, biomass district heating systems.

### The cooperative model based on a biomass processing farm

It is a farm that serves as a center for the collection, processing and sale of firewood, wood products and other biomass. They can be owned and operated in a cooperative manner, for example by farmers and forest owners, and serve as suppliers of fuel for heating / biomass power plants (Fig. 8).

### Biomass boiler house / power plant

Local biomass processing can provide enough energy to meet the needs of entire communities. Such plants provide heat and / or electricity to buildings in the local community by burning biomass. In Austria, for example, biomass processing cooperatives are one of the most common types of energy cooperative, usually involving a large number of local farmers. Biomass-based heating systems not only provide the population with reliable and affordable heat and energy, but also stimulate the local economy by creating new jobs and added value.

### Biomass central heating / power supply systems

In countries where there is a central heating system on biomass (cogeneration unit), consumers can be joined in consumer cooperatives to purchase heat / electricity

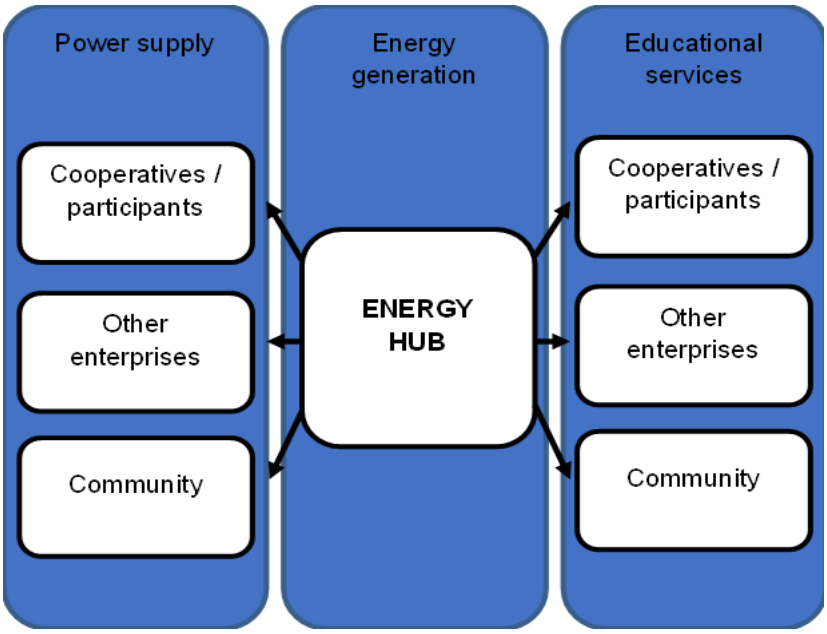


**Fig. 7. Energy Center Model (HUB)**

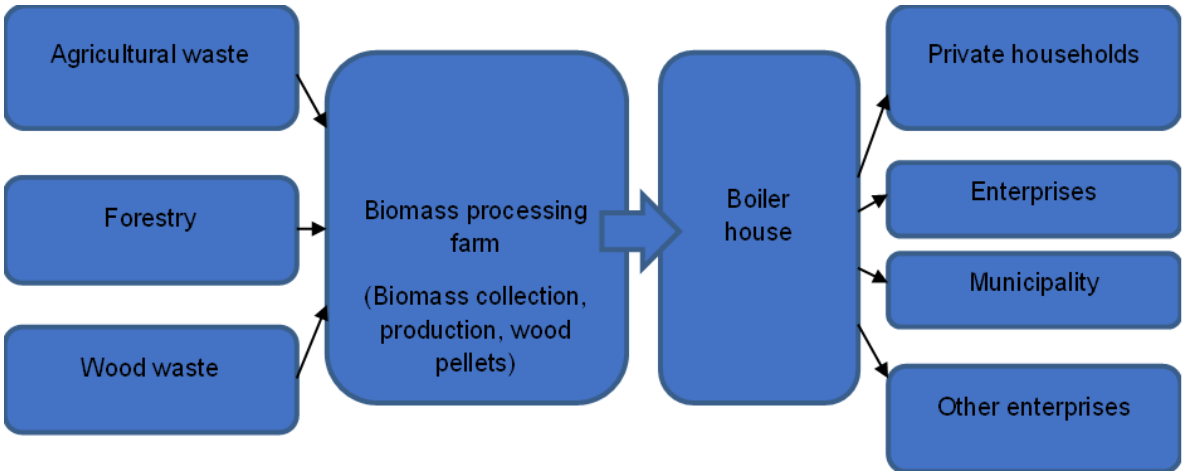


**Fig. 8. Biomass processing farm**

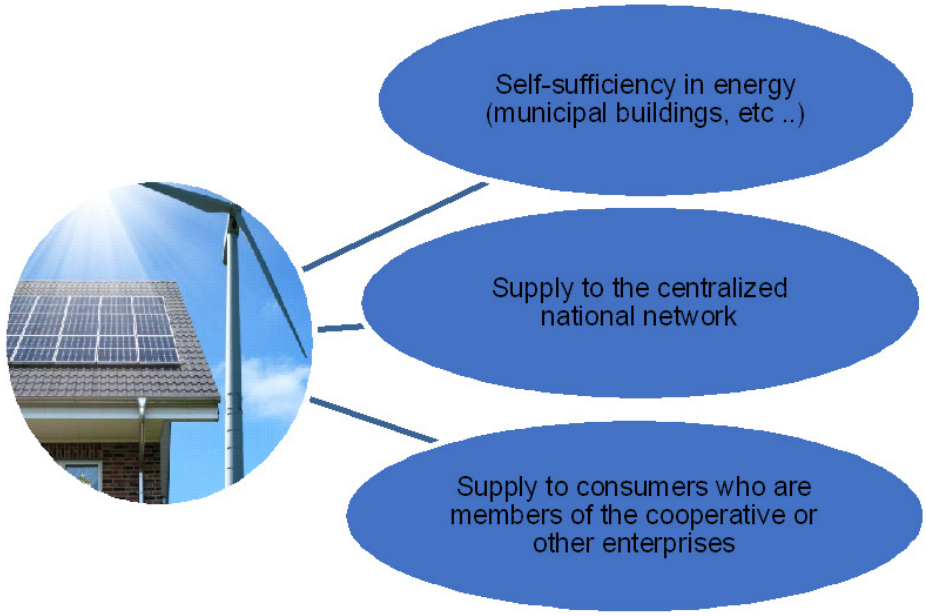


**Fig. 9. Cooperative model based on a combination of wind generating and photovoltaic (PV) capacities**

from a cogeneration plant. In this case, the distribution and not the production of heat / energy is organized using a cooperative model. For example, in Denmark, 300 of the 400 district heating networks are organized as consumer cooperatives [7].

### Bioenergy villages

Bioenergy villages can also be created on the basis of an energy cooperative, the electricity of which is produced within the community and used by the community. This is a comprehensive energy solution for OTG. One of the first examples of creating a cooperative bioenergy village was the village. Juhnde in Germany [8]

### Cooperative model based on a combination of wind and photovoltaic (PV) capacities

Installation of wind and power plants usually requires a high level of initial capital investment, so an important factor in their success is the availability of certain credit lines from financial institutions or partnership with the state (public-private partnership). However, in the case of wind energy, the availability of investment is only one of the problems, as the location of wind turbines in a certain community requires the approval and permission for their placement and operation by local residents. Therefore, the fact of torture and community participation in the planning process of this type of activity is important. Therefore, the cooperative model is particularly relevant.

### Photovoltaic cooperative model (solar panels)

Most photovoltaic energy cooperatives are organized in the form of consumer cooperatives, which not only provide their members with electricity, but also sell electricity to the grid at a «green» tariff.

## Conclusions

The creation of energy cooperatives in Ukraine is a very promising area and well reflects international practice. However, today there are only a few such cooperatives, and not all of them are legally energy cooperatives, but rather in form. Given the fact that Ukraine is an energy-dependent country, increasing the share of energy from RES in total consumption is one of the main ways to solve many economic problems. The imperfection and underdevelopment of the institutional environment is the biggest obstacle to the development of energy cooperatives and the diversification of energy sources in general. According to international practice, energy cooperatives can become a new effective mechanism for reorienting Ukraine's economy towards the sustainability. The further development of the cooperative movement in the energy sector needs support at the state level in the form of the establishment of appropriate institutions with clearly defined powers. This, in turn, requires an appropriate legal framework, political environment and favorable conditions, including state support measures. This section presents various versions of business models of energy cooperatives for the production and distribution of renewable energy. It is established that the creation of energy cooperatives makes it possible to create new jobs in the production and distribution of renewable energy, as well as in relevant services. Effective public-private (cooperative) partnership can be a particularly important engine of progress in achieving the country's sustainable development goals.

To date, there is no single universal model for creation and promotion of energy cooperatives. However, it can be concluded that in all countries and continents, regardless of the type of energy cooperative, preference is given to the cooperative form of production and distribution of renewable energy. With increasing attention to environmental issues around the world, the competitive advantage of decentralized renewable energy technologies, decentralization reform in Ukraine, and the growing interest in community control over infrastructure, this trend will increase. Therefore, the topic of developing the institutional environment for the establishment of energy cooperatives at the state level should be considered as one of the priorities, as it can make energy accessible to all and increase the energy security of the country as a whole.

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## List of Figures

# FINANCIAL CHALLENGES & POSSIBLE SOLUTIONS for cooperatives in Ukraine

*Michael Shomin*

*The article briefly describes various options and programs for energy cooperatives in Ukraine to get financial support for energy efficiency projects and analyzes advantages and disadvantages of various solutions.*

The Ukrainian Energy Strategy aims to increase the share of primary energy supply from renewables to 25% by 2035. There is therefore a need to increase the energy efficiency and implement renewable energy projects like development of energy cooperatives. However, most of the small business entities in Ukraine are limited in their own sources of financing, and therefore it is necessary for them to get financial support and additional loan funds.

Today, Ukraine renewable energy sector faces several risks in utilizing its potential. The first is related to the high costs of capital investments for renewable energy facilities. Capital costs are usually influenced by local economics when plants are built, such as conditions for financing, depreciation, and potentially also by the type of investor or financier. These can be local or foreign companies, private or state, either directly or through government-owned mechanisms. Today the cost of financing in Ukraine is relatively high. In 2021, interest rates for Hryvnia (UAH) denominated loans for SMEs exceeded 16%. High cost of financing acts as a barrier for investment. Furthermore, most industrial ventures in Ukraine have narrow profit margins and have limited ability to invest in modernization and the high interest rates lowers access to funds. Removing the key risk factors will help accelerate lending in Ukraine. Until that is achieved, measures such as injecting banks with more capital, providing liquidity and exploiting international sources of funds and expertise could be important. The second most important risk is the changing state renewable energy policy that creates lack of confidence among investors. Predictable and stable policies that can be maintained over long periods will be important for the continuity of investments in renewable energy technologies.

Demand and proposal of financial resources for the implementation of renewable energy projects Energy in Ukraine today is in imbalance, because investment in the field of energy efficiency is considered by most of the banks as risky and, according to most investors, does not guarantee payback in the short term. In addition, regulatory framework for energy saving remains imperfect, there is as well an absence of precise coordination between energy market participants, namely the state, local communities, investors, energy producers and consumers.

Disregarding the challenges mentioned above, there are three possible sources of funding for renewable energy projects:

- Cooperative own funds (statutory funds);

- Bank loans;

- State- or international donor-supported programs.

### Cooperative statutory funds

One of the most significant benefits of cooperatives is the ability to start commercial activity without the involvement of external sources of funding. And involvement of the many small contributions from members of a cooperative can generate the amount needed to get started and unite members around a common idea. In general, the cooperative's funding can consist of:

- a mutual fund that is formed at the expense of shares of members of the cooperative;
- an undividable fund, formed at the expense of entrance fees and deductions from the income of the cooperative;
- a contingency fund to cover possible losses;
- a special fund to provide statutory activities.

Main legal barriers for energy cooperatives in Ukraine are numerous non-specific legal norms regulating the creation and operation of cooperatives including the process of creation of statutory fund. The first point leads to difficulties in choosing what type of cooperative should be established.

The new amendments to the Law of Ukraine "On alternative energy sources" set up the new legal status of energy cooperatives. It is the legal entity based according to the Law of Ukraine "About cooperation" or the Law of Ukraine "About consumer cooperation" for implementation of economic activity on production, procurement or transportation of fuel and energy resources and for provision of other services for the purpose of requirements satisfaction of his members or territorial community, and for the purpose of profit earning, according to requirements of the legislation. But there is still a possibility to set up a cooperative in the field of renewable energy in the form of:

- Production cooperative (only individuals, compulsory labor participation, profit oriented).
- Service cooperative (physical and/or legal persons, provision of services mainly to members of the cooperative, non-profit).
- Limited liability company (physical and/or legal persons, free provision of services, profit oriented).
- Housing cooperatives / homeowners associations (HOA) as a specific form of cooperation in order to provide accommodation.

The legal form of cooperative plays an important role in further process of setting up the statutory fund, defining its business model and getting external financing if needed. There is no legal requirement for the minimum amount of statutory fund for all types of cooperatives and for the Limited liability company.

Major economic activities of energy cooperatives in Ukraine according to Law on Cooperation:

1) Growing and processing of energy crops. The land of the cooperative is formed by share contributions of members in the form of land plots, lease and acquisition of property.

2) Production and supply of heat energy. It requires the construction of heat-generating facilities, the need to create or connect to heat networks, obtaining a license for the production and supply of heat energy and an approval of tariffs by the National Commission, which carries out state regulation in the fields of energy and utilities.

3) Production and supply of electric energy. It requires use of energy lands, a connection to the grid, obtaining a license and the sale of electric energy to the Wholesale Electricity Market of Ukraine.

4) insulation of houses (housing cooperatives).

5) execution of works under the ESCO contract for the budget.

### Bank loans

Loans are promising instruments for the energy saving measures funding, although they are not widespread in Ukraine. Banks are very restrained with the development of special loan products for renewable energy projects. The existing interest rates in the market are quite high and no reimbursement for interest payments is provided, so bank loans cannot compete with special energy efficiency funding programs, such as "Warm" Loans, IQ Energy and others.

Commercial banks in Ukraine have limited number of programs of their own for funding renewable energy projects. Nevertheless, few Ukrainian banks (mainly state banks) have loan products that may be interesting for energy cooperatives. In addition, Bank Lviv is a partner of local programs encouraging energy efficiency measures. The local programs implemented in Lviv Region and in two cities in Ivano-Frankivsk Region (Drohobych and Novoiavorivsk) get an additional reimbursement of interest payments to the amount of 10–20% of annual interest rate.

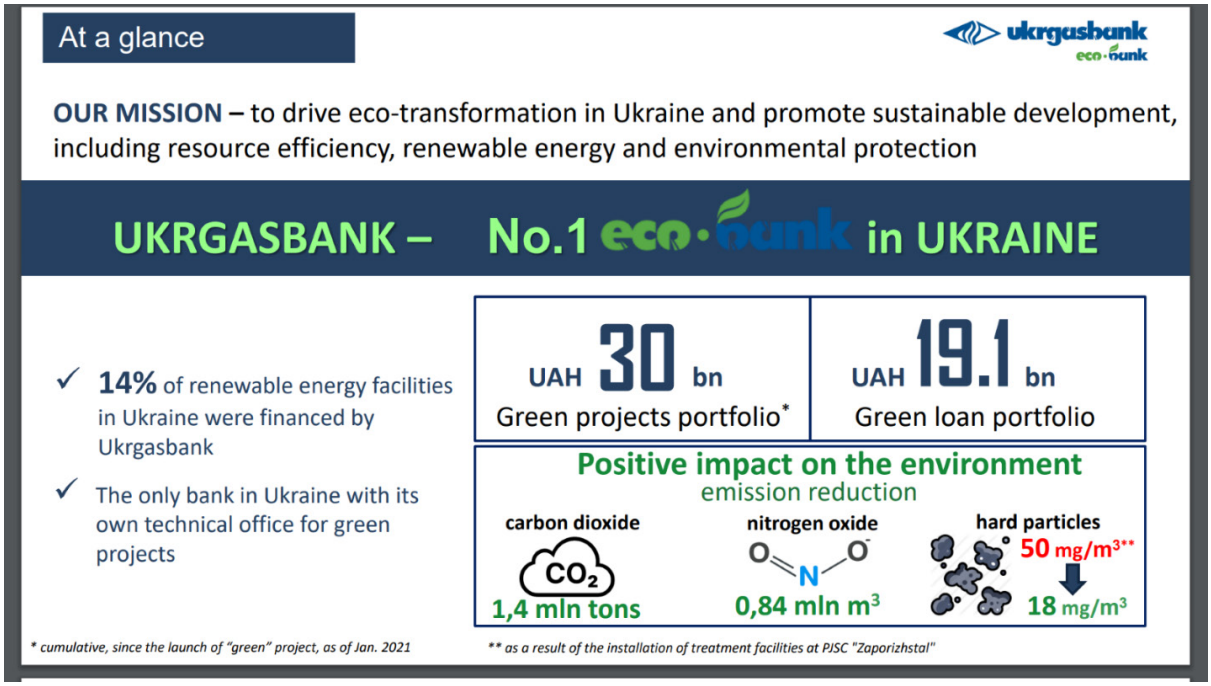
### State or donor support programs

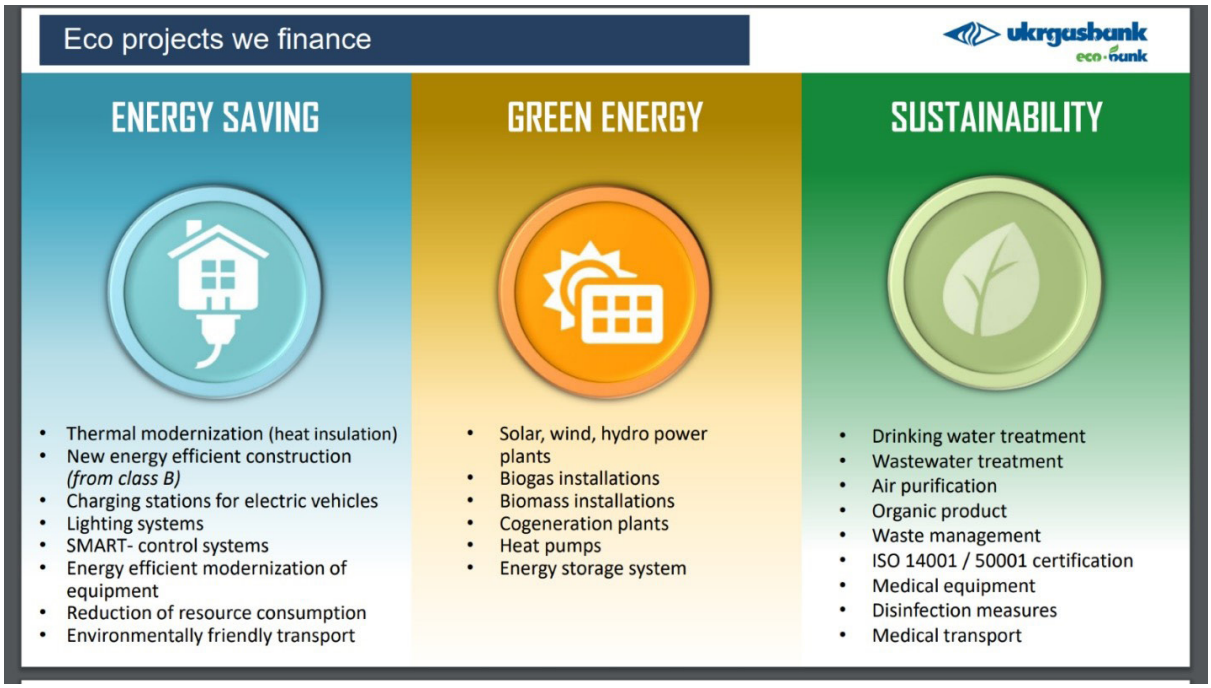
Ther are few programs for the financial support of households and municipalities in implementing energy efficiency projects that may be used for energy cooperative funding as well.

Existing programs mainly support separate energy efficiency projects; however, it is possible to achieve significant energy savings only with all-inclusive renovation projects ensuring the effective use of energy resources during their consumption.

**The "Warm" Loans**, Ukrainian Government incentive to improve energy efficiency using banks have a quite significant potential for carrying out energy saving measures. At present the State partially reimburses loans taken to pay for respective materials and equipment under the "Warm" Loans government program.

The program started in November 2014. After the completion of an energy efficiency






project funded by a loan the household gets a reimbursement from the state budget. The amount of the reimbursement covers a part of the loan principal. Only loans used for specified energy efficiency measures are reimbursed. Important feature of this program is that only physical persons or homeowner associations (HOA) may get the financing.

**The EBRD IQ Energy program** is a program implemented by international organizations in Ukraine. It was started in 2016 under the management of the EBRD. Funds are distributed through bank institutions. In September 2020 IQ energy team completed its mission and the IQ energy program has ended. Incentives to program participants in the amount of EUR15 million were provided by the E5P fund, where the European Union made the largest contribution. Funding for technical assistance was provided by Sweden and E5P in equal parts. The projects participating in the program achieved energy savings of 72,596 MWh per year and reduction of CO2 emissions by 27,732 tons per year.

**The NEFCO energy efficiency program** — Municipalities in Ukraine may initiate energy saving programs and obtain funds for their implementation at their own discretion. Respective loan agreements are concluded directly between IFOs and municipal authorities, with loan funds transferred to loan recipient's account in a local bank. This EE project funding scheme is used in the NEFCO energy efficiency program.

**Programs of local authorities** — to introduce energy efficiency projects local authorities may provide additional funds from their own budgets. Such funds may be provided through participation in various government programs (such as "Warm" Loans) or allocated for energy saving projects directly form the budget. Municipalities also may mobilise external investments from IFOs with guarantees of the state or other lenders.

**The Energy Efficiency Fund** is a Ukrainian government institution providing instruments for thermal innovations in multi-family buildings where homeowners associations were established. The Fund provides support in the form of grants to homeowner associations and comprehensive technical solutions for energy-efficiency renovations in

multi-family buildings in line with the best European practices. Currently The Energy Efficiency Fund lunched the program "Houses" according to which homeowner associations of multi-apartment buildings are entitled to receive partial compensation of project expenses (i.e. grants) under the terms of the Program. According to the Law "On the Energy Efficiency Fund" and the financial agreements concluded between Ukraine and the EU in 2018, the Fund is currently implementing the Program exclusively for buildings with HOAs.

Overall, grants and technical support for energy efficiency projects in Ukraine energy efficiency market is relatively new for Ukraine, so even its key players do not have sufficient knowledge of tools and mechanisms available for the implementation of projects. The aim of technical support programs is to help enterprises, households, authorities and private companies in implementing energy efficiency projects. Such technical support programs are provided in Ukraine by the governments of the US, Canada, Switzerland, Germany and other countries, as well as by the EU and various funds and donors. Besides the technical support programs there are also grant programs for energy efficiency projects.

**Useful links:**

1. The Law of Ukraine "On alternative energy sources" (https://zakon.rada.gov.ua/laws/show/555-15#Text)

2. The Law of Ukraine "About cooperation" (https://zakon.rada.gov.ua/laws/main/1087-15#Text)

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# LEGAL CHALLENGES

## of ESTABLISHMENT & OPERATION

of energy cooperatives in Ukraine

*Maryna Sadkina and Anna Pastukh*

This article aims to outline the main legal challenges for the establishment and operation of energy cooperatives in Ukraine, which will help the pioneers of the industry. Authors considered the basic laws that form the legal field for energy cooperatives and key aspects that should be considered when establishing them.

The creation of an energy cooperative requires in general two important components: enthusiasts who are passionate about the topic, ready to invest time and effort to inform and encourage potential members of the cooperative, and perfect regulation at the national level. Under favorable conditions, it is possible to find facilitators of change in communities, so this article will focus on the legal aspects of the establishment and operation of energy cooperatives as one of the reasons for the lack of their popularity in Ukraine.

For a long time, the concept of "energy cooperative" has not been singled out in the legislation of Ukraine. The definition of "energy cooperative" was first introduced by the Amendments to the Law of Ukraine "On Alternative Energy Sources" in accordance with Law №2712-VII of April 25, 2019 [1], where an energy cooperative is a legal entity established in accordance with the Law of Ukraine "On Cooperation" or the Law of Ukraine «On Consumer Cooperation» for economic activities for the production, procurement or transportation of fuel and energy resources, as well as for the provision of other services to meet the needs of its members or local community, as well as for profit, in accordance with the law. In Ukraine, the cooperative movement in the energy sector is actually in its infancy. The experience of Germany and Austria shows that energy cooperatives operate, usually in the following areas [2]:

- energy production (solar energy, wind energy, biogas, cogeneration, ie combined heat and power production);

- sale of alternative energy (electricity, heat, gas);

- purchase and operation of power grids;

- services aimed at efficient use of energy (consulting, energy-saving rehabilitation of buildings, implementation of various energy efficiency projects), etc.

How to create an energy cooperative in Ukraine? As we can see, the legislative definition refers to the Law of Ukraine "On Cooperation" and the Law of Ukraine "On Consumer Cooperation". According to the Law of Ukraine "On Cooperation", there are three types of cooperatives: production, service and consumer. Therefore, in the beginning it is necessary to choose the type of cooperative. These types of cooperatives differ in the nature of their activities.

1. Production cooperative is formed by uniting **individuals** for joint production or other economic activities on the basis of their **compulsory labor participation in order to make a profit.** Advantages: compulsory labor is able to help solve the problem of employment, and its profitability allows members to distribute income among them.

Disadvantages: restrictions on membership (only individuals may participate in it), because individuals, as a rule, set small share contributions to the share fund of the cooperative, which forms a weak financial basis for the cooperative [3].

2. Service cooperative is formed by uniting **individuals and / or legal entities to provide services** mainly to members of the cooperative, as well as other persons in amounts not exceeding 20 percent of the total turnover of the cooperative. Advantages: participation of legal entities in it that gives the chance to involve considerable financial resources for development of the cooperative. Disadvantages: created only to provide **services** mainly to members of the cooperative. According to some researchers, this shortcoming makes it impossible to create an energy cooperative of the type of service cooperative [4].

3. Consumer cooperative is formed by uniting **individuals and / or legal entities** to organize trade services, procurement of agricultural products, raw materials, production and provision of other services to meet the consumer needs of **its members.** Advantages: a wide range of activities that it can carry out. Disadvantages: it is created only to meet the consumer needs of its members.

In our opinion, in each case of creating an energy cooperative it is necessary to proceed from local conditions and choose the appropriate type of cooperative, taking into account their advantages and disadvantages. In addition, if you do not apply for a «green» tariff, the energy cooperative can be established in the form of a limited liability company, but with mandatory compliance with the principles of the cooperative (one member - one vote). After choosing the type of cooperative, it is necessary to carry out its actual establishment. To do this, a **constituent assembly** should be held to decide on the establishment of a cooperative. It is important to note that the legislation of Ukraine allows foreigners and stateless persons, as well as legal entities of foreign countries to be founders of cooperatives. The Constituent Assembly also approves the Charter of the future cooperative, and it must contain an exhaustive list of its activities. The Charter should also provide for the establishment of governing bodies of the cooperative.

After the constituent assembly, the energy cooperative is subject to state registration in the manner prescribed by the Law «On State Registration of Legal Entities, Individuals - Entrepreneurs and Public Associations» [5], as well as registration with regulatory authorities, as the energy cooperative is a taxpayer.

An equally important stage in the creation of a cooperative is the formation of its funds.

1) **The share fund** is formed by shares of members of the cooperative. A **share** is a property repayable contribution of a member of a cooperative, which is made by transferring property, including money, property rights, as well as land plots to the cooperative.

2) **The indivisible fund** is created on a mandatory basis and is formed at the expense of entrance fees and deductions from the income of the cooperative. **Entrance fee** - a monetary or other non-refundable property contribution that a person is obliged to pay in case of joining a cooperative.

3) **The reserve fund** is created by deductions from the income of the cooperative, redistribution of the indivisible fund, donations, non-refundable financial assistance and at the expense of other revenues not prohibited by law to cover possible losses (damages).

4) **The special fund** is created at the expense of target contributions of members of the cooperative and other receipts provided by the law for maintenance of its statutory activity and is used by the decision of governing bodies of the cooperative.

Thus, the main challenges of the stage of creating an energy cooperative are the difficulty of choosing its type, as well

as the presence of a large number of dissimilar legal norms governing the general procedure for establishing and operating cooperatives - Civil Code, Commercial Code, Law «On Cooperation», Law «On Agricultural Cooperation», Law «On Consumer Cooperation». After registration and creation of funds, the cooperative can carry out direct economic activity. One of the most common forms of energy cooperation in the world is the generation of energy using renewable sources (sun, wind, water, biomass, etc.).

In Ukraine, energy cooperatives have the right to receive **a «green» tariff.** «Green» tariff is a special tariff at which electricity at electricity facilities is purchased, and it is produced from alternative energy sources (except for blast furnace and coke oven gases, and with the use of hydropower - produced only by micro, mini and small hydropower plants).

The establishment of a «green» tariff is carried out by the National Commission for State Regulation of Energy and Utilities. According to the Law №2712-VIII of 25.04.2019 [6] for energy cooperatives incentives are possible in the case of using generating units with an installed capacity of up to 150 kW (provided the use of solar energy and / or wind energy, biomass, biogas, hydropower, geothermal energy ). Under the following conditions, in accordance with this law:

- The cooperative produces electricity from solar energy and / or wind energy **without a license;**

- For energy cooperatives that produce electricity from alternative energy sources (except blast furnace and coke oven gas, and with the use of hydropower only microhydroelectric power plants) generating units with an installed capacity not exceeding 150 kW, the «green» tariff is set and operates provided that the day of setting the «green» tariff and during its operation the members of such energy cooperative are **not less than 10 individuals** whose share contributions are not less than **75 percent** of the share fund, or a utility company whose share contribution is not less than **25 percent** of the share fund.

- The guaranteed buyer is obliged to purchase electricity produced by generating installations of consumers, including energy cooperatives with an installed capacity **not exceeding 150 kW**, at a «green» tariff **in excess of the monthly consumption** of electricity by such consumers.

- The «green» tariff for electricity produced by energy cooperatives generating units with an installed capacity not exceeding 150 kW is set at the level of the retail tariff for consumers of the second voltage class in January 2009, multiplied by the «green» tariff for electricity produced energy cooperatives, from the relevant type of energy.

Energy cooperatives can also carry out other activities, such as procurement of energy raw materials. In particular, harvesting of agricultural raw materials is carried out without any licenses - harvesting and processing of residues and waste from agricultural activities (straw, tree pruning, corn stalks, vines, sunflower husks, raspberry stalks, reeds), growing energy crops and more. As a rule, agricultural lands are needed for such procurement. An array of agricultural land can be formed at the expense of share contributions of members of the cooperative in the form of land, lease and acquisition of property. The collected raw materials can be used on the line for the production of biomass briquettes. Produced briquettes can be sold or members of the cooperative will buy them at cost. The results of the previous feasibility study indicate that the project for the production of straw briquettes within the energy cooperative has a payback period of less than 5 years with an internal rate of return of more than 20% [7].

For example, a plant for the production of straw briquettes was built and launched in 2016 in the village of Konski Rozdory, Zaporizhia region, under the EU / UNDP Community-Based Local Development Program.

The villagers developed a business plan,

organized the "Zlagoda-2015" cooperative and applied to the official representative office of the program in Zaporizhia region. As a result, 80% of the required investments were allocated for the project implementation; the rest was invested by the cooperative (10%), provided by the regional and town budgets (10%). The total cost of launching a briquette line with a percussion-mechanical press amounted to 772.5 thousand UAH. The main driving forces of the project were the high cost of coal in the region and the availability of local raw materials (straw) [8].

Residents of Losiatyn village, Kremenets district of Ternopil region, merged into two cooperatives growing raspberries and wild strawberries. Subsequently, «Yahidnyi krai» (Berry Land) cooperative was transformed into the energy one - raspberry growing waste (cut stems), which were previously simply burned in the fields, since the beginning of 2017 are used for the production of fuel briquettes [9]. The implementation of the briquetting line was financially supported by an EU / UNDP project. The members of the cooperative bring the raw materials (bundles of raspberries) to the hangar where the briquetting equipment is located, and take their briquettes from there at cost. Thus, residents of Losiatyn village are supplied with biofuel of own production, which is much cheaper than natural gas.

In addition to the procurement of raw materials, energy cooperatives can carry out other activities, but their implementation is already more difficult, mainly due to excessive regulation, designed for the activities of monopoly organizations. In particular, energy cooperatives can produce and supply thermal energy, but the construction of heat generating facilities should be carried out on energy lands (if necessary, the purpose of the land should be changed). In addition, to supply heat to consumers, it is necessary to build or connect to heat networks, as well as obtain a license for the production and supply of heat and approve tariffs. Among the restrictions for energy cooperatives are also the following [10]:

- licensing and regulation of tariff formation in the fields of production, transmission and supply of electricity and heat, even if this production is carried out exclusively for own consumption;

- lack of possibility to sell electricity by a group of households at a «green» tariff;

- taxation of heat and electricity sales, even in the case of production exclusively for the own consumption of members of the cooperative;

- the need to design the purpose of land under facilities that produce heat and electricity for its sale to third parties.

In 2017, the bill "On Consumer Energy Cooperatives" was presented. The concept of the bill provided for the removal of barriers to the activities of cooperatives, in particular, in the production, supply and sale of heat and electricity [11]. In our opinion, the removal of these barriers remains relevant to this day, as they are the main challenges hindering the development of energy cooperation in Ukraine.

Summarizing, we see that joining efforts to address common issues often becomes the best solution in terms of balancing the effort, time and money required. Cooperatives are a clear example of how joint activities can not only help communities meet their own energy needs through the local renewable resources, but also receive dividends on investment. The issue of establishment and operation of energy cooperatives in Ukraine is regulated by a number of laws. Though outlining the preconditions for their creation, they posess a number of obstacles failing to take into account the specifics of small rescoops, and generalizing the requirements for production, supply and sales of energy for both monopolies and small cooperatives which hinders their widespread use of cooperatives in Ukraine.

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# CAN ENERGY COOPERATIVES DRIVE MUNICIPAL ENERGY TRANSITION?

## Example of Slavutych Solar Town

*Andriy Zinchenko*

Cities and towns are the places where most of the energy consumption takes place. The higher is the city skyline — the more energy it needs to heat and cool its houses, public and commercial spaces and serve its intense transportation connections. In this short article, we contemplate whether energy cooperatives can become drivers of energy transition for local communities based on the example of Ukraine's first municipal energy cooperative "Solar Town".

### Solar Town Story

From the very outset "Solar Town" was planned as a municipal energy coop developed in partnership with local community leaders of a small town of Slavutych located in the north-most part of Ukraine – Chernihiv region. The initial group of cooperative founders started their effort to build a solar energy cooperative by discussing possibilities with the mayor of Slavutych – Yuriy Fomichev, back in 2018.

At this moment, it makes sense to provide some background to what kind of town Slavutych is, since it is the place where Solar Town was launched. The very existence of Slavutych is closely connected to the Ukrainian energy industry. The youngest town in Ukraine was constructed from ground-up in 1986-1989 to provide a place for living for engineers and support staff of the Chornobyl nuclear power plant. Contamination from the nuclear disaster at the NPP made the closely located Prypyat town unfit for living, and it was wholly evacuated – primarily to Slavutych. Planned to host and serve over 30 000 inhabitants, Slavutych now has a population of around 25 000. A noticeable decline in numbers happened mainly after the decommissioning of the Chornobyl Nuclear Powerplant in 2000.

Going back to the story behind the "Solar Town" coop – it started from a short talk with city mayor Yuri Fomichev. The future cooperative team had asked the mayor if he was interested in discussing launching a solar energy cooperative and got a welcome reply.

### Re-Inventing Slavutych

There was a good reason for Slavutych mayor to launch a solar cooperative that would use municipal buildings roofs. Slavutych, a town with many talented and skilled people, thousands of highest-grade engineers, now needs to re-invent itself.

After the Chornobyl NPP stopped producing power, many of the station's ex-employees left the town to search for better job opportunities. The smaller town located in the remote part of the Chernihiv region bordering with Belarus had to to develop new growth points, new jobs and new businesses. Ultimately, it had to become something more than the town of nuclear engineers.

The very idea of re-inventing the town was

coined in 2017 at the conference "New life of nuclear cities" held in Slavutych by the Ukrainian NGO "Greencubator". It gathered representatives of all Ukrainian cities that were located near nuclear power plants and designed to serve the former. Slavutych mayor and other town leaders actively participated in the event and vigorously supported the idea of reinventing Slavutych. And this is the very reason why they have supported the idea of launching Ukraine's first energy cooperative in the town of nuclear engineers just over a year later.

### What exactly is "municipal cooperative"?

"Solar Town" is often presented as a municipal energy coop. While it is not a new concept in EU countries (notably Austria and Germany), energy cooperative is a new concept in Ukraine, let alone its municipal part. But what makes a cooperative "municipal"?

In the case of "Solar Town", the "municipal" part means several things. First – close cooperation between the cooperative team and Slavutych leaders. And it is more than inspirational talk – the representatives of City Council and local Agency for Regional Development (a communal enterprise tasked with town's development and promotion) provided practical instrumental assistance and advice in the process of development.

There were numerous aspects of this help which started with the most basic – selecting the roofs suitable for installing the solar power plants. Agency for Regional Development provided the coop team with information regarding the roofs of municipal buildings, their technical condition, and their availability for the rent by coop. That allowed the cooperative team to perform analysis and select the most interesting roofs for solar power-plant installation.

The "Solar Town" team have also received a lot of support from Slavutych in the form of consultations regarding the necessary local procedures, regulations and local electricity grid connections. Besides that, Agency for Regional Development provided the premises of its Centre for Entrepreneurship Support for several presentations of the "Solar Town". This allowed to save on the development costs and present the cooperative to future local investors in a well-known location which helped build bridges of trust.

But besides the mentioned above, two other aspects allow calling Solar Town a municipal coop. First, the Agency of Regional Development is a co-owner of cooperative shares. Besides purely financial reasons, this provides more insight to the city's managers regarding the inner working of the energy cooperative. Such transparency adds to the mutual trust of the cooperative and the town. Another important aspect is the Solar Town's commitment to pay the town 5% of its annual pure income to support the projects selected by the Agency of Regional Development. This commitment is fixed into cooperative's statute, and its members think of it as "giving back to the community". In this case – a friendly community.

Based on laid out above, the definition of municipal energy cooperative in the case of Solar Town encompasses the following components:

- The energy coop cooperates with the local community;

- Communal enterprise owns a share in a cooperative (providing a part of the capital and getting more transparency);

- The cooperative enables the use of a municipal resource that was not used before (in case of Solar Town – municipal buildings' flat roofs);

- Members of cooperative commit to giving back to community efforts.

## The Proof-Of-Concept Impact

Solar Town is a small project, indeed. The total installed capacity of coop-owned three solar power plants located on three roofs in the very centre of Slavutych is just 200 kW (AC) and 240 (DC). Thus, in terms of capacity, the project could be categorized as a small energy market participant.

The first Ukrainian energy coop is not large in terms of finance as well. Its 100 investors provided around $175 000 worth of financing.

Though, it has its significant impact in demonstrating to Ukrainians the opportunity of energy cooperation. There are numerous requests from local communities and groups asking for consultations and help with launching similar cooperative models in various parts of Ukraine. For them, the installed capacity is of lesser importance.

But the fact that 100 Ukrainians became investors and could finance their own solar power plants is genuinely inspiring for many local communities. For them, it means that ordinary citizens can successfully crowd-fund and co-own energy assets. It also means that energy does not necessarily equal monopoly or large bureaucracy.

## Helping Communities Meet Their Investors

Modern communities have a huge load of problems to solve and challenges to respond to on their way towards sustainable development. In most cases, that means cities, towns and villages must invest into making themselves more sustainable. This includes switching to renewable energy – starting with deploying solar rooftops and using local sewage for bio-methane production or replacing fossil fuels with local biomass. These actions require significant investments to be mobilized and local budgets do not always have the funds to do that. Overall, the public budget alone is not capable of financing and organizing sustainable development and energy transition.

And it is exactly where there is an opportunity for energy cooperatives like Solar Town. They can unite groups of citizens-investors to finance local sustainable energy projects. At the same time, local communities can provide such cooperatives with administrative support during the project development. Even more important, communities can provide local energy coops with privileged access to now-unused resources – rooftops for solar power plants, sewage waste for biogas digestion, land plots suitable for local biomass production.

Given this, there is quite an opportunity for cooperatives to make a significant contribution to local communities' energy transition. And this contribution ulitimately depends on the ability of local communities and energy cooperatives to look and find mutually beneficial business models.

# CIVIL SOCIETY ENERGY 2021:

## about the project

The project was launched by wechange eG in partnership with EcoClub Rivne (Rivne, Ukraine), Polish Foundation for Energy Efficiency FEWE (Katowice, Poland) and was funded by the German Federal Foreign Office.

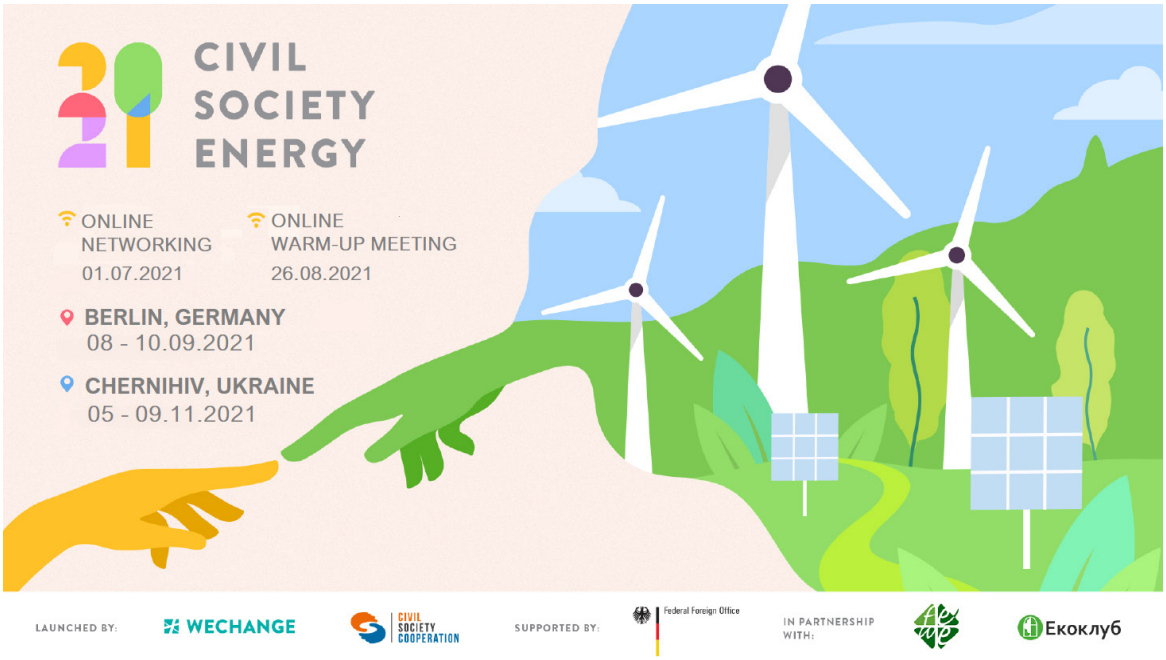
The aim of the project lies in the creation of a network of renewable energy enthusiasts from Ukraine, Poland and Germany and in fostering cross-border knowledge exchange about citizen-organized energy projects.

CSE 2021 constitued of online and offline events taking place in Germany and Ukraine that included networking sessions, discussions and workshops. Project was focused on actors in the field of renewable energy from all three countries: representatives of existing energy cooperatives, local communities willing to create a cooperative, NGOs working in the field of renewable energy and all interested in cooperation for renewable and decentralized energy supply from Ukraine, Poland and Germany.

The last phase of the project in Ukraine took the form of a hackathon, during which participants, with the help of experts, worked on the development of concepts for their own energy cooperatives.

Platform of the project: [https://community.civilsocietycooperation.net/project/civil-society-energy-2021/](https://community.civilsocietycooperation.net/project/civil-society-energy-2021/)

Photos presented in the next pages were taken during workshop sessions in Berlin, September 2021. Credits: Nadine Brenner

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# CIVIL SOCIETY ENERGY

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