Current state of Ukraine's Power Sector: Needs, Stakeholders and Partners

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#### LIST OF ABBREVIATIONS

- BESS Battery Energy Storage System
- CMU Cabinet of Ministers of Ukraine
- DSO Distribution System Operator
- EBRD European Bank for Reconstruction and Development
- ECS Energy Community Secretariat
- ECU Energy Company of Ukraine
- EIB European Investment Bank
- FS (feasibility study) Technical and Economic Justification
- HPP hydro power plant
- HPSPP hydro pumped storage power plant
- IFC International Finance Corporation
- IFI International Financial Institution
- NERP National Emission Reduction Plan
- NEURC National Energy & Utilities Regulatory Commission
- **RES** Renewable Energy Sources
- SPP Solar Power Plant
- **TPP** Thermal Power Plant
- TSO Transmission System Operator
- UDN Ukrainian Distribution Networks
- UES United Energy System of Ukraine
- UESF Ukraine Energy Support Fund
- UHE UkrHydroEnergo

#### INTRODUCTION

Russia's invasion of Ukraine had a devastating impact on the energy sector. 40% of electricity transmission infrastructure and a significant share of the electricity generating capacity has been destroyed or seriously damaged, causing severe disruptions in electricity supply as well as operation of water supply and district heating systems. War and targeted attacks on the energy sector infrastructure have significant impact and consequences on a country's energy sector.

As of October 2023, the United Energy System of Ukraine temporarily lost 44% of nuclear generation, 78% of thermal power plant capacity (including occupied plants), 66% of CHP capacity, 12% of hydro power plant capacity, and 32% of hydro pumped-storage power plant capacity. 45% of electricity distribution facilities were damaged.

The Government of Ukraine defines the following strategic goals in the energy sector for 2024-2027 in the *Draft Plan for the implementation of reforms within the framework of the implementation of the proposal of the European Commission regarding the Regulation of the European Parliament and the Council of the European Union on the establishment of the Ukrainian Fund* (this plan is a foundation for Ukraine to receive EUR 50 billion from EU under the recently established Ukraine Facility during next 4 years):

- Supporting the green transition in the energy sector and promoting the RES share increase, which should also be accompanied by increased decentralization of the energy system and a simultaneous increase in energy security and stability of the energy system;
- Gradual liberalization and integration of energy markets, support for the development and construction of interconnections between the UES and the energy systems of the EU countries in the Continental Europe Synchronous Grid in order to increase cross-border trade and increase the security of gas and electricity markets;
- Ensuring energy-efficient consumption, including in buildings and in the district heating sector.

The Government also notes the need to expand opportunities for natural gas extraction, storage and supply, while supporting measures to reduce greenhouse gas emissions in the coal and oil and gas sectors, adhering to the plan to phase out coal by 2035. In particular, priority will be given to the development of renewable gas, production, storage, and transportation of hydrogen and biomethane. Natural gas will play the role of a transitional fuel and a source of balancing flexibility for growing RES generation.

#### **EXECUTIVE SUMMARY**

Due to a massive damage caused to the energy sector facilities by the war, Ukraine needs to attract significant financial resources for recovery of the sector that is vital for stable functioning of the national economy. Currently the following **mechanisms** are available to finance recovery of energy assets as well as implementation of new investment projects in the sector:

1. **Financial support at macro level.** EU, separate countries, IMF, various international financial institutions provide loans and/or grants to Ukraine as a state. Such financing can be later distributed via the state budget of Ukraine for various national programs or projects, including those in the energy sector.

Such mechanism as of now can hardly be considered a tangible source as available international macro financing is significantly lower than Ukraine's state budget needs, which are focused on covering urgent current expenses rather than long-term recovery programs. Situation may change in the future if stable flow of external financial aid is achieved.

2. Financing from international financial institutions to state-owned energy companies. This has been the most popular track by now with EBRD, World Bank, EIB, KfW, and other IFIs providing loans and/or grants to state-owned companies such as hydro power generator UkrHydroEnergo, transmission system operator Ukrenergo, national gas company Naftogaz of Ukraine, nuclear generator Energoatom. In many cases financing coming from IFIs is a financing package that consists of different components and may include, for example, grants provided by specific countries.

This mechanism has been the main preference for many IFIs during 2022-2023 that allowed to prepare and launch on short notice many important projects that are described in this report. At the same time, such mechanism has its natural limitations as the number of the state-owned energy companies that has respective implementation capacity, transparency and accountability is limited.

3. Direct aid from special donor platforms and technical assistance projects. There are multiple cases when international donors use existing or create new platforms to procure equipment, spare parts, etc. and donate them to energy companies (both state-owned and private). Notable examples are the Ukraine Energy Support Fund managed by the Energy Community Secretariat, the aid provided via UN agencies, USAID Energy Support Project, etc.

Ukraine Energy Support Fund, described in detail below in the report, has been clear success story and we believe that such format can be replicated further as it allows to make decisions on ad-hoc basis, while maintaining proper transparency and efficiency levels.

4. Private investments. While recovery of Ukraine will not be possible without active private sector participation, such investments were limited in 2022-2023 due to the risks related to ongoing war. At the same time, there are a few Ukrainian and international investors that work on development of new projects, especially in the RES area. Some of them are ready to

proceed with construction even before the war is over as loans for such projects are available from certain IFIs (for example, EBRD, IFC, DFC). There are also war risk insurance programs from DFC and MIGA, while export credit agencies from several European countries (in particular, Germany and Poland) can provide export guarantees that will serve as a basis to obtain financing from European commercial banks.

The most challenging aspect of this mechanism is how to ensure stable payback to investors. All relevant business concepts are quite new for Ukraine and respective regulatory framework needs to be further developed. For example, the legislation needs to be improved to allow export of biomethane to Europe as well as to provide an opportunity for TSO to sign longterm contracts with operators of energy storage facilities to make respective projects bankable.

**5.** Financing from IFIs to municipalities and municipal companies. There are many programs, for example, programs financed and implemented by Nefco, that are focused on providing loans and grants to municipalities and/or municipal utilities. The focus of such programs is usually energy efficiency and upgrading of municipal infrastructure (water, heating, waste, etc.), while we expect that a portion of these funds will be directed towards construction of decentralized electricity generation (CHPs, on-site/rooftop solar installations, gas peakers, hybrid systems, etc).

**Key power sector players** working on investment projects who can be potential partners or customers for equipment/services include:

- State-owned companies with extensive track record of IFI financing such as transmission system operator **Ukrenergo** and hydro generator **UkrHydroEnergo**;
- Private renewable energy operators and investors (both international and Ukrainian);
- Distribution system operators (two main players in this segment are private **DTEK Grids** and state-owned **Ukrainian Distribution Networks**);
- **DTEK Energy** as a key private player in the segment of conventional power plants and potential player in SMR segment;
- State-owned commodities trader **Energy Company of Ukraine** moving towards owning/operating electricity generation and storage assets;
- State-owned gas holding company **Naftogaz of Ukraine** that will be responsible for operations of the state-owned CHP plants.

More detailed information about these companies and their ongoing projects is provided in Section 2.

Additional opportunities can come in the areas of decentralized generation and municipal utilities. Assets in municipal utility sector are usually old and inefficient. Considering decentralization trend, we believe that there will be more and more IFI financing directed to build new decentralized electricity and/or heat generation sources on a regional level. More details are provided in Sections 2 and 3.

Talking about **stakeholders**, most renewable energy projects are implemented by private companies without any facilitation or oversight from the municipal or state authorities. Therefore, the best source of information about them would be **industry associations**. There are several strong renewable associations in Ukraine that unite key players in this segment. Brief information about them is provided in Section 4.

There is currently no centralized platform where one can see ongoing energy projects, their scope, check related procurement opportunities, etc. Large projects are currently implemented by the stateowned companies; therefore, the **Ministry of Energy** and the **Ministry of Economy** would be able to provide relevant information and/or discuss potential cooperation programs on national level.

The Ministry for Communities, Territories, and Infrastructure Development of Ukraine (**Ministry of Infrastructure**) is the main ministry dealing with the recovery of Ukraine, while its focus is mainly on infrastructure, transport, housing, etc., thus, the ministry does not play major role in energy sector's recovery.

Considering that most of IFI and private sector funds during past 15 years went into renewable energy segment and grid development, Ukraine has a few **professional contractors** that have substantial experience in this area. Information on selected companies who can become partners in projects is presented in Section 4.

In terms of the **challenges** that are faced by Ukraine on the way of successful recovery of energy sector, we see the following:

Lack of stable long-term financing. As of now, Ukraine does not have any stable financing sources that can be relied on when planning recovery of the energy sector and its development in line with the "green" principles. Decisions to provide financing are approved by IFIs on a *project-by-project* basis that is a standard approach that has its benefits, but also limitations. Main limitation is that natural counterparts for the IFIs are state-owned companies and large private investors that shifts focus towards implementation of big investment projects, while recovery of the sector adhering to the principles of decentralized generation, increased flexibility of the energy system, higher energy security, etc. assumes simultaneous implementation of dozens of small and medium-size energy projects at regional level. This will be possible, in particular, if the *platform* approach is used when private investors, energy companies, municipalities will have an easy access to financing, insurance, grants, etc. that will be easier and faster to access than standard financing packages available for big projects (that require significant resources and time for structuring).

**High risks for private sector investments.** Ukraine has been a quite risky destination for private investors before the invasion. A full scale-war brought new range of risks to a surface. Even as certain

mitigation options are available (for example, insurance of war related risks from DFC or MIGA), they are not easily accessible to all investors and have associated costs and conditions. Also, the fundamental problem remains how to achieve predictable repayment of investments and how the project payback schemes may look like. This is especially relevant if we talk about construction of new electricity generation (gas peakers, renewable generation) and energy storage facilities in the absence of any long-term auctions or contracts that can become a basis for a bankable project. Potential of private corporate Power Purchase Agreements is currently limited in Ukraine as there are not so many electricity off-takers that can provide long-term financial guarantees acceptable for financiers.

**Implementation capacity.** The war had negative impact on the qualified workforce in engineering, construction, and energy sectors. Some people joined the army, while some others reallocated abroad as refugees. Also, certain production and service chains were disrupted by occupation of territories and damage caused to production facilities. Despite positive trend that many projects are being implemented during the war (for example, TSO and DSOs perform numerous asset repair and recovery projects, new power transmission lines are being built, several wind farms and two biomethane plants were commissioned during past 2 years as well as several hundred MW of on-site solar installations), it is hard to assess how many energy projects/programs can be implemented in parallel without causing the deficit of workers/contractors engaged in project design, engineering, construction, etc.

Lack of strong EPC contractors. While there are some positive cases of the Ukrainian contractors that implemented energy projects on a "turnkey" basis or took a lead on important components of large energy projects, the major bottleneck remains that Ukrainian companies simply do not have financial resources to provide standard guarantees to customers and financiers that would be normally expected from an EPC contractors based on the international practices. At the same time, there have been almost no large international EPC contractors with real presence and on-ground resources in Ukraine. As a result, to satisfy banks, EPC contracts were often signed with international companies that played a nominal role outsourcing major part of the work to Ukrainian subcontractors. This has had in many cases a negative impact on the project timelines, while also causing cost overruns. Therefore, entry of qualified international EPC contractors to Ukraine will have a paramount importance in ability to attract financing for projects as well as to implement them in fast and efficient manner.

In terms of potential, we see bright future for the **localization of equipment production** for energy projects. Ukraine has been historically strong in producing various types of energy equipment – transformers for transmission and distribution networks, cables, turbines and generators for hydro power plants, metal structures for solar PV power plants, etc. There have been also attempts to start local production of solar panels (KNESS) and wind turbines (Wind Parks of Ukraine). Massive recovery of the energy sector will create huge needs in different types of equipment, especially for renewable energy and decentralized generation projects. Therefore, we expect that this area will most likely will attract attention from international equipment producers, especially, considering Ukraine's path towards joining EU and ability also to cover a part of EU's needs in such equipment in the future.

#### 1. GENERAL OVERVIEW OF ELECTRICITY SECTOR IN UKRAINE

The major part of Ukraine's electricity demand is covered through:

- 4 nuclear power plants (covering the baseload electricity demand), which include 13 VVER 1000 power units and 2 VVER 420/415 units. All the units have reached or will soon reach the end of their initially designed operational life, with extension for companies; 10-20 years is usually granted after their safety reassessment.
- Outdated thermal power plants (12 TPPs with units ranging from 150 to 800 MW), which
  primarily address fluctuations in daily electricity consumption, handle morning and evening
  peaks, as well as rapid consumption changes. Such operational regimes are not typical for
  these old TPPs that leads to faster tear of equipment, adversely impacts technical and
  economic performance, and contributes to increased emissions. The TPPs are also the main
  reserve to cover seasonal (winter) demand peaks. These power plants, comprising 68 coal and
  7 gas/fuel oil units, are among major sources of air pollution in Ukraine.
- 10 (before the invasion) large hydro power plants on the Dnipro and Dniester rivers, with a total of 101 units and an installed capacity of approximately 4,640 MW, along with three hydro pump storage plants (1,963 MW) comprising 13 units (33 to 324 MW each) which serve as key flexible capacities in the UES. However, their regulating capacity falls short in meeting the growing demand for flexibility, particularly with the rapid expansion of renewable energy generation, primarily solar and wind.
- Morally and physically outdated combined heat and power plants, primarily used for heating large cities and powered mostly by natural gas.





#### Source: TSO

Renewable energy generation stood out as the sole dynamic segment in the mostly static energy sector prior to the onset of the full-scale war. Between 2016 and 2022, its growth surged nearly eightfold, as illustrated in Figure 2. This remarkable progress can be attributed to the state support policy backing for pertinent projects via Feed-in Tariff (FiT) scheme envisaging tariffs fixed in EUR,

priority dispatching, and the guaranteed electricity offtake by the state enterprise Guaranteed Buyer. Remarkably, the construction of RES power plants continued even amid the full-scale war, primarily driven by the projects that were initiated before the Russian invasion.

At the same time, due to an inadequately balanced state policy for support of various RES technologies, the UES faced the excessive development of power plants with variable electricity generation, predominantly solar photovoltaic power plants. The absence of mechanisms incentivizing flexibility exacerbated the irregularities in daily and seasonal electricity consumption and capacity schedules. This situation resulted in the challenging issue of compelled capacity curtailment of RES power plants.





#### Source: SAEE, UABIO

The seizure and idle status of Zaporizhzhya NPP with a 6 GW installed capacity resulted in a loss of nearly half of Ukraine's total nuclear power plants capacity. All Ukraine's power plants located on occupied territories account for approximately 35% of Ukrainian total installed capacity.

The onslaught of massive terrorist attacks by Russia on Ukraine's energy infrastructure, peaking from October 2022 to March 2023, inflicted significant damage. During this period, Russia executed 14 major missile and 17 drone attacks on Ukrainian electricity infrastructure causing damage to thermal, hydro and even nuclear generation (in part of electricity output grid capacities). Among the devastating incidents was the destruction by Russia on June 6, 2022 the dam and equipment of 335 MW Kakhovska HPP. This act of violence not only caused human casualties, but also had severe environmental repercussions in the lower reaches of the Dnipro, resulting from widespread flooding, negatively impacting irrigated agriculture in southern Ukraine, and depriving Zaporizhzhya NPP of a stable cooling source.

Mentioned rocket attacks in 2022-2023 decimated the entire 750 kV high-voltage network used to distribute electricity from nuclear power plants throughout Ukraine. This has created significant difficulties in meeting the country's energy consumption needs and complicated electricity transmission between regions.

By the conclusion of the autumn-winter season of 2022/23, the available capacity of power plants had more than halved, decreasing from 38 GW to 18 GW. Notably, the available flexible capacity saw a reduction of over threefold, plummeting from 14 GW to 4 GW, as depicted in Figure 3. In addition, Ukraine lost almost 80% of wind farms due to their location on occupied territories, 10% of solar photovoltaic plants, 40% of small hydro power plants and 30% of bioenergy power plants (according to their installed capacity).

As a result, Ukraine's power system ability to cover peak load especially in cold winter seasons substantially degraded (Figure 4) which was partially recovered in the repair campaign of summer 2023, but still stays much below the pre-invasion level.



Figure 3. Reduction of Power Plant Capacity in Ukraine During the Winter of 2022/23

Source: UNDP



Figure 4. Electricity Consumption Coverage on 24 December 2021 (peak load in 2021) and 27 February 2023, MW

#### Source: UNDP

23,600 km of overhead lines and 141 substations with a voltage of 110–750 kV connect power plants, electricity distribution networks and large electricity customers of Ukraine (connected directly to the main grid) as well as Ukraine's energy system with energy systems of neighbouring countries (Figure 5). The electricity distribution systems in Ukraine include more than 800,000 km of overhead and cable lines with 0.4—150 kV voltage and about 200,000 6-150 kV transformer substations.

During the peak of Russian attacks upon Ukraine's infrastructure in October 2022-March 2023, almost all critical high-voltage substations operated by the TSO were attacked by missiles or drones at least 3-4 times. Out of 94 high-voltage substations, 42 were damaged, as of spring 2023 (Figure 5).

These attacks are part of Russia's broader goal to destabilize the economy, disrupt the normal lives of people, and cause a humanitarian catastrophe by targeting critical infrastructure facilities, which provide essential services such as heating, water supply, drainage, and healthcare.

Despite these challenges, Ukraine's air defence forces and electricians have worked tirelessly to protect and restore the energy infrastructure facilities. Furthermore, Ukraine's international partners have provided significant support by supplying energy equipment for restoration, backup power sources, and air defence systems. Thanks to these combined efforts, the Russian attacks have not succeeded so far in destroying Ukraine's energy system. However, the threat of further massive attacks looms, which could severely impact Ukraine's energy structure in the future.

#### Figure 5. United Energy System and Status of High-Voltage Substations in Spring 2023



Status of High-Voltage Substations in Spring 2023



\* Khmelnitska NPP – Rzeszóv interconnector shown on the map as "perspective" has been operational from May 2023

#### Source: Energy Charter, UNDP

During the full-scale war, small, distributed power generation played a critical role in supporting the lives of people and the country. The security of energy infrastructure, provision of electricity to critical social facilities such as hospitals, utilities (heating, water supply and wastewater, etc.), provision of autonomous energy sources for business is currently the primary motivation for the development of distributed power generation in Ukraine.

In 2023, 182 MW of wind farms, 500 MW of solar PV plants, 100 MW of gas piston/gas turbine power plants were commissioned in Ukraine. Most of the solar PV and gas combustion power plants were commissioned by consumers to cover their own consumption and more than 90% of commissioned distributed power plants have installed capacity 1 MW or below.

Decentralization of the power system and support of development of distributed generation, first of all, generation from RES has been determined as one of the priorities of national energy policy for both war period and post-war economic recovery of Ukraine.

A notable decline in power plants' available capacity caused by war hostilities is partly offset by reduced electricity consumption (**Figure 6**). This drop is attributed to the mass migration of Ukrainians fleeing the war's impact, with around 6 million staying abroad (excluding labour migrants per the Institute of Demographics). Economic activity also contracted, evident in a 29% GDP decrease in 2022, expected to rebound by 5% in 2023 (official statistics). According to the TSO, total net electricity consumption in 2022 fell by 32% compared to 2021. Breakdown: industry (-46%), agriculture (-26%), transport (-34%), construction (-35%), utility/household (-28%), other non-industrial (-24%), and

population (-16%). Additionally, favourable weather conditions, including a warm 2022/23 winter (one of the warmest for 200 years of meteorological observations) and December 2023, positively affected the ability of the UES electricity to cover consumption.

The share of households and housing/utilities in electricity consumption significantly increased during full-scale war, comprising nearly 50% (up from 43% in 2021). This rise is mostly attributed to a decline in industry's share (from 42% in 2021 to 33% in 2022). The shift in electricity consumption across Ukrainian regions is notable due to mass internal population resettlement (around 5 million people, per the Ministry of Social Policy) and enterprise relocation (over 800 enterprises, according to the Ministry of Economy) from hostilities zones (eastern and southern regions) to more distant, relatively peaceful areas (central and western), as depicted in Figure 6.

#### Figure 6. Ukraine's Electricity Consumption

Electricity Consumption (2016-2022) \*



Reduced

Electricity

Consumption

in

\* Excluding electricity consumption on temporarily occupied territories

#### Source: TSO, UNDP

A critical factor in meeting internal electricity demand is the ability to import electricity from Europe on a commercial basis as well as TSO's ability to get emergency help from the ENTSO-E. This became possible after the connection of the UES to the ENTSO-E on March 16, 2022. Notably, this event occurred shortly after disconnecting the UES from the Russian energy system on February 24, 2022—just hours before Russia initiated a full-scale military invasion in Ukraine.

The first commercial electricity export from Ukraine to the ENTSO-E occurred on June 30, 2022. However, in 2023, Ukraine faced limited electricity export (366 GWh in 2023 compared to 3495 GWh in 2021) due to the restricted capacity of domestic power plants. During this period, interconnectors were primarily used for electricity imports, amounting to 806 GWh in 2023, compared to 1693 GWh in 2021. Ukraine achieved observer status in the ENTSO-E in April 2022 and gained full membership status on January 1, 2024.

The ENTSO-E applied certain quotas for commercial electricity exchanges between Ukraine and the ENTSO-E. These quotas are set to incrementally increase, with the eventual goal of lifting restrictions

once the technical parameters of the UES operation align fully with ENTSO-E requirements. As of January 2024, the allowed capacity for electricity export from Ukraine and Moldova (which form a single regulatory area within the ENTSO-E zoning) to the ENTSO-E is 400 MW, while the capacity for electricity import from the ENTSO-E to Ukraine is 1,700 MW. This is below the nominal capacity of Ukraine's cross-border interconnectors with the ENTSO-E (2.7-2.9 GW subject to seasonal fluctuations). This capacity has the potential to further increase to between 3 GW and 4 GW over next 10-15 years when respective investment projects are completed.

In addition to advancing projects aimed at expanding cross-border interconnector capacity with the EU, Ukraine has demonstrated its commitment to aligning with European standards and fostering deep integration within the European energy landscape. As a signatory to the *Treaty on the Establishment of the Energy Community* since 2011, an associated country with the European Union since 2014, and a candidate for EU accession since June 2023, Ukraine consistently harmonizes its national legislation with EU energy regulations. This harmonization extends beyond legal frameworks to encompass the integration of energy markets, enhancement of regulatory practices, and alignment of strategic plans with the EU's overarching energy and climate policy.

Ukraine actively implements the EU legislation package "Clean Energy for All Europeans" in the realms of energy and climate. According to the 2023 report from the Energy Community Secretariat, Ukraine earned a commendable 69% progress rating in energy market integration and a noteworthy 44% in decarbonization.

Moving forward, Ukraine's collaboration with the EU in the fields of energy and decarbonization will evolve within the framework of a strategic energy partnership, contextualized by forthcoming **negotiations for Ukraine's accession to the EU**. This collaboration also extends into the dialogue on the European Green Deal and Ukraine's green transition.

The strategic documents, including the Economic Strategy of Ukraine until 2030, the Energy Strategy until 2050, and the Updated Nationally Determined Contribution to the Paris Agreement, have been officially approved. Additionally, new strategic documents such as the National Energy and Climate Plan and the National Development Plan for Renewable Energy Sources until 2030 are being drafted now. These documents unequivocally outline Ukraine's priorities, with a strategic aim to achieve a 65% reduction in greenhouse gas emissions by 2030 and attain full carbon neutrality by 2060, thereby decisively driving the decarbonization of the national economy.

Energy sector decarbonization is a key for achieving overall decarbonization of Ukraine. Before the outturn of the Russian full-scale invasion, Ukraine had already achieved 50% share of clean electricity in terms of installed capacity of power plants and 70% in terms of electricity generation (counting nuclear, large hydro and all types of RES power plants).

Pre-war forecasts for development of the energy sector are not relevant anymore as many fundamental changes took place in the country. Also, there is a national confidentiality regime for any information related to operation of the energy sector. Publicly available estimates prepared by the TSO are presented below in Figure 7.





Anticipating future trajectory of the Ukrainian electricity sector, we see the following key trends:

1. Further Development of Renewable Energy Sources: A notable shift towards RES is explained by the planned decommissioning and replacement of outdated, technologically inefficient, and environmentally harmful coal-fired power plants. Despite pending international commitments for environmental upgrades or decommissioning of coal-fired power plants by 2035, Ukraine faces the challenging prospect of fulfilling these plans. Potential replacements of coal-fired TPPs include combination of new RES capacity (wind, solar, bioenergy) with highly manoeuvrable gas piston and gas turbine units, as well as energy storage technologies. Plans also include equipping existing TPPs with modern flue gas cleaning equipment and carbon dioxide capture technology.

**2. Continued Nuclear Energy Development:** There is a plan to extend the service life of existing nuclear power units for 10-20 years after respective upgrades to increase nuclear safety. Medium-term plans include the construction of 2-3 new power units based on Westinghouse (USA) AR1000 technology. Additionally, the possibility of building small modular reactors in Ukraine is under consideration.

**3.** Advancement of On-site Generation: There is a tendency that electricity consumers are installing small on-site generation (solar panels, gas units, BESS) to increase their own energy security as well as to save money on a long-term basis. This tendency is supported by the newly approved "net billing" mechanism.

Source: TSO

**4. Flexibility Enhancement:** The country aims to enhance flexibility of the UES by expanding or constructing new large hydro pump storage power plants (such as the 3rd stage of Dniester HPSP and new Kaniv HPSP), reconstruction of large HPPs at Dnipro and Dniester rivers, building around 1 GW of BESS and substantial capacity of flexible gas-fired units. Additionally, the strategy involves engaging consumers in demand regulation.

**5.** Reconstruction of Gas-Fired Combined Heat and Power Plants: A drive towards efficiency is evident through the planned reconstruction of outdated gas-fired CHP, particularly through the construction of modern biomass and biogas/biomethane cogeneration plants on their existing sites.

**6. Network Development:** There is a dedicated focus on developing electrical networks to accommodate the increasing number of decentralized RES power plants. Such development of distribution networks also includes penetration of the smart grids and digitalization.

If decarbonization plans are successful and respective financing is available, the electricity mix in 2033 can look like the TSO projections depicted on Figure 8.



Figure 8. Ukraine Electricity Mix in 2033 vs. 2021

Source: TSO

#### 2. KEY ELECTRICITY SECTOR PLAYERS

In this section, we describe main Ukrainian electricity companies that can be prospective buyers of equipment, works and services as they implement asset recovery/rehabilitation projects and/or new investment projects.

#### 2.1. UkrHydroEnergo

UkrHydroEnergo (UHE) is the largest hydropower generating company in Ukraine, 100% shares of which belong to the state. The company operates hydro power plants with a total installed capacity of 4.3 GW and hydro pumped storage power plants with a total installed capacity of 1.5 GW located on the Dnipro and Dniester rivers.

UHE provides coverage of peak loads, frequency and power regulation, and a mobile emergency reserve in the United Energy System of Ukraine. UHE's HPPs and HPSPPs are actively involved in the balancing market, in particular, in adjusting the daily load schedule to cover peaks and troughs and in frequency control. In addition, when unloading nuclear and thermal power units during missile attacks took place, UHE replaced the lack of generating capacity in the UES.

UHE currently works on asset restoration/rehabilitation projects, while also continuing to work on investment projects, which started before the invasion.

#### EBRD: Ukrhydroenergo Emergency HPP Restoration

EBRD plans to approve in January 2024 the provision of **EUR 200 million** sovereign-guaranteed loan to UHE. The loan consists of (1) up to EUR 150 million to finance supply of critical equipment for the Dnipro and Seredniodnipro HPPs, and (2) up to EUR 50 million for the emergency liquidity support for UHE. The loan facility will be divided into two tranches of up to EUR 100 million each with one tranche to be funded by EBRD and the other one using funds advanced by Italy to EBRD for that purpose.

Financing will be used for replacement of 4 hydropower generation units at the Dnipro HPP, which were worn out due to extensive exploitation since 2003 and damages caused by missile attacks. The total production capacity of the respective equipment is expected to increase by 16%. The project will also enable UHE to replace old gantry cranes at the Seredniodnipro HPP, which are crucial for maintaining the HPP efficiently.

#### **EIB: Hydro Power Plants Rehabilitation Project**

UHE in December 2023 received **EUR 133 million** from the European Investment Bank (EIB) to continue financing the Hydro Power Plants Rehabilitation Project. The new tranche follows the EUR 67 million that the EIB disbursed earlier for financing the existing project, which was fully used by mid-2022.

The funding will enable UHE to purchase critical equipment to be able to respond quickly to emergencies and ensure prompt restoration of the operation of both the company's plants and the UES. The company will also be able to continue reconstructing its HPP and HPSPP units on the Dnipro River, which should enhance their operational reliability.

UHE highlighted that the funding would be used not only to upgrade and reconstruct hydropower assets, but also to repair damaged ones referring to the partial destruction of the Dnipro HPP and the ruination of the Kakhovka HPP dam.

UHE started implementing the Hydro Power Plants Rehabilitation Project in 2012. Its main purpose was the reconstruction of 21 units at HPPs on the Dnipro, namely the Kyiv HPSPP, Kaniv HPP, Kremenchug HPP, Seredniodnipro HPP, Dnipro HPP-1, and Dnipro HPP-2.

#### **Restoration of Kakhovska HPP**

In June 2023, Kakhovska HPP (343.2 MW), which had been located on the territory occupied by Russia since the end of February 2022, was destroyed by Russian troops.

In July 2023, the Government approved a resolution on an experimental project to start rebuilding Kakhovska HPP. At the first stage, UHE will perform design works and construction of specific structures necessary to ensure stable operation of the neighbouring Dnipro HPP unit. The second stage assumes that works will be performed directly at the site of Kahovska HPP after de-occupation.

This will allow, after the de-occupation, to quickly start construction of a temporary hydraulic structure to block off the reservoir and, under flood conditions, will help to fill it with water to the required level. It is expected that the reservoir will be filled at least to the 12.5 m mark to provide water for three regions of Ukraine. After that, it is planned to build the same temporary hydraulic structure on the lower side of the plant to drain it, drain the construction site, invite experts, assess the consequences of the destruction. After that, the second stage should take place - the dismantling of the plant and the design/construction of a new one.

There is an agreement with the EIB on the possibility of directing **EUR 60 million**, which are currently being raised, to the temporary hydroelectric structure of Kakhovska HPP. The conclusion of the loan agreement is expected in February 2024.

According to UHE estimates, the capacity of the new station can be 520-580 MW. It should be a modern HPP built in compliance with environmental requirements, in particular, using modern transformers (without oil or with synthetic lubricant that dissolves very quickly in water), etc. The construction period is expected to be another 6 years. That is, taking into account the duration of the first stage, UHE plans to restore Kakhovska HPP in about 8 years.

#### Completion of the Construction of Dniester Hydro Pumped Storage Power Plant

UHE is planning to construct the remaining 3 units of Dniester HPSPP with a total installed capacity of 972 MW. Taking into account the experience of 2022-2023, these three hydro units should be maximally protected from possible destruction via shelling during military operations, therefore, the respective design of the project is being adjusted accordingly.

Financing sources for this project have not been defined yet. Previous units of Dniester HPSP were built using UHE funds, e.g. no IFI funds were used. The main reason was the decision to buy main equipment from the Ukrainian factories that went against standard procurement rules applied by IFIs.

It is worth mentioning that Igor Sirota, the Chairman of UHE, has mentioned that UHE plans buying only turbines and generators from the Ukrainian state-controlled company Ukraine Energy Machines (former Turboatom), while remaining equipment can be purchased from international suppliers.

#### **Construction of Kaniv Hydro Pumped Storage Power Plant**

The construction project of Kaniv HPSPP with total installed capacity of 1 GW was discussed for over decade, but UHE has previously failed to raise IFI financing for this project due to environmental concerns.

Considering the importance of HPSPP technology for energy security of Ukraine and ability to balance the energy system, UHE continues to search for financing of this project. In September 2023, UHE and Canadian Aecon Group Inc. signed a Memorandum of Cooperation, marking the beginning of a strategic partnership. The document provides for the study of the possible participation of Aecon in the construction of Kaniv HPSPP and Kakhovka HPP that increases chances to raise financing from Canadian sources.

Chairman of UHE, Igor Sirota, has mentioned that UHE remains open for collaboration with the companies from other countries who are interested in implementing this project.

#### World Bank: Installation of Battery Energy Storage Systems

In June 2021, the World Bank approved a **USD 212 million** financing package, including a USD 177 million World Bank's loan, a USD 34 million Clean Technology Fund (CTF) concessional loan, and a USD 1 million CTF grant for the project called Improving Power System Resilience for European Power Grid Integration (Installation of Hybrid Systems for Electricity Production in Ukrhydroenergo).

UHE is the borrower and implementing agency of the project. The project provides financing for the installation of 212 MW short-duration battery energy storage systems combined with solar power plants within 4 hydropower plant sites (Kyiv, Kaniv, Kremenchuk and Seredniodnipro) to further allow for ancillary services for frequency regulation and restoration to the national power grid. Also, a long-duration battery with a solar power plant will be installed within Dniester HPP.

According to our information, the project's concept most likely will be adjusted to focus fully on the energy storage part, cancelling the idea to build solar power plants at the HPP sites. Taking into account the repurposing of loan funds from the World Bank for the restoration of destroyed facilities and strengthening the physical protection of UHE facilities during the war, additional financing from the World Bank is expected in the amount of **EUR 70 million** to continue the storage system project.

According to UHE, an updated feasibility study for the project will be completed soon that will allow it to start procurement in 2024.

Procurement notices related to this project can be found here:

#### https://projects.worldbank.org/en/projects-operations/project-procurement/P176114

The procurement of block transformers will be concluded shortly. Complete procurement plan for this project can be found here:

https://documents.worldbank.org/en/publication/documentsreports/documentdetail/099110223070036697/p176114030e9f10220834c02ac1c85a93d4

#### Hydrogen

UHE has announced plans for the production of "green" hydrogen in collaboration with the German company Andritz Hydro GmbH. The project capacity is now aiming for 5 MW, with potential expansion to 10 MW.

The collaboration between UHE and Andritz took a step forward with the signing of a new Memorandum in October 2023. Notably, this move followed the conclusion of a previous trilateral memorandum involving MAN Energy Solutions, which did not result in the desired outcomes.

The Chairman of UHE, Igor Sitota outlined that next step would be preparation of the feasibility study, after which Andritz will seek funds from German government to finance the project.

#### 2.2. Transmission System Operator (Ukrenergo)

**National Power Company Ukrenergo** is a joint stock company with 100% state-owned shares, managed by the Ministry of Energy. Ukrenergo is certified in accordance with the ISO model and in compliance with the EU's Third Energy Package as Ukrainian TSO performing the functions of operational and technological control of the UES, transmission of electricity via trunk power grids from generation to distribution networks, as well as commercial metering administrator and settlement administrator in the electricity market of Ukraine.

Ukrenergo builds new substations and transmission lines, reconstructs the operating ones to enhance the efficiency and reliability of power grids, ensures integration of new generating capacities into the power system, and provides technical compliance with the standards and requirements of ENTSO-E.

In December 2023, the Continental European TSOs announced that Ukrenergo has achieved compliance with the key technical requirements necessary to enable a permanent interconnection between the power systems of Continental Europe and Ukraine. Ukrenergo became the 40th member of the association as of 1 January 2024, following the approval by the ENTSO-E Assembly.

On 16 March 2022, an emergency synchronization was achieved as a signal of solidarity between the Continental European TSOs and Ukrenergo. Since then, Ukrenergo has made extraordinary efforts, under difficult wartime conditions, to achieve full compliance with the operational rules. This announcement from ENTSO-E signalled the full implementation of the conditions included in this Agreement.

The Continental European TSOs have also decided to increase the capacity limit for electricity supplies from Continental Europe to Ukraine and Moldova to 1,700 MW, based on system security and stability simulations.

Ukrenergo has a long track record of raising financing from the World Bank, EBRD, EIB and the German KfW to implement various investment projects.

#### EBRD: Ukrenergo Transmission Network Emergency Restoration

The project is based on the provision of up to **EUR 300 million** sovereign-guaranteed loan from EBRD to Ukrenergo aimed at restoring the Ukrainian power transmission grid that was severely damaged by Russian bombings.

The loan consists of up to EUR 150 million for **procurement of equipment to implement emergency repairs** of the Ukrainian power transmission system and up to EUR 150 million of capital structure support. Furthermore, the loan is also complemented by an investment grant of **EUR 70.6 million** provided by the Netherlands via the Crisis Fund. In addition to the financing package of EUR 370.6 million mentioned above, the project will be complemented by an additional capital structure support loan of up to **EUR 150 million** together with donor-funded credit enhancement.

The proceeds of the Capex tranche and the investment grant will be used to finance the procurement of **new autotransformers and auxiliary equipment** to provide for the functioning of the high voltage transmission grid.

Respective tender for autotransformers was conducted in the summer of 2023. Respective procurement notice is available below: https://ecepp.ebrd.com/delta/viewNotice.html?displayNoticeId=26414233

#### World Bank: Restoration Project of Winterization and Energy Resources

The World Bank announced in April 2023 **USD 200 million** in grant financing for a project that will repair Ukraine's energy infrastructure. The funds for this project are provided by the Ukraine Relief, Recovery, Reconstruction and Reform Trust Fund, with additional funding of up to **USD 300 million** envisaged to come from partners through grants and other contributions as the project expands its scope.

The project will support emergency repairs to the electricity transmission and heating infrastructure by urgently procuring critical equipment. Emergency electricity equipment includes **autotransformers, transformers, instrument transformers, reactors, circuit breakers, disconnectors, surge arresters, relay protection devices and substation automation system equipment**, and specialized machinery and vehicles to assist in restoring the electricity supply for the national transmission network. Emergency equipment for the heating infrastructure includes mobile and stationary heat-only boilers, mobile mini co-generation units, pipes, fittings, valves, pumping sets and pumps, essential parts to repair district heating and gas networks, equipment for liquid fuel depot repairs, and equipment to provide alternative heating options such as electric heating and biomassbased heating.

In addition to Ukrenergo, implementing agencies of the projects are the Ministry of Construction, Territories, and Infrastructure Development, the Ministry of Energy, and the Restoration Agency of Ukraine.

General procurement notice for this project can be found here:

#### https://projects.worldbank.org/en/projects-operations/procurement-detail/OP00243439

The project's procurement plan can be found here: https://documents.worldbank.org/en/publication/documentsreports/documentdetail/099110623112022343/p18033205eb61f0a709b440262239c0b077

#### KfW: Improvement of the Efficiency of Electricity Transmission (Substations Modernization) III

The German government, through the German state development bank KfW, has just allocated a loan of **EUR 24 million** and a grant of **EUR 0.5 million** to Ukrenergo to strengthen the stability of the UES.

These funds will be directed to strengthening technical ties with the energy system of continental Europe, restoring high-voltage facilities in the Western Ukraine and building their defense. Signing of all necessary agreements is expected in the near time.

According to the Chairman of Ukrenergo, the company has already attracted **EUR 223 million** in grants and loans from KfW to restore substations, provide their physical protection, install new transformers, purchase other equipment, build overhead lines and maintain liquidity. The German operators of the transmission system Amprion, TenneT, TrasnetBW and 50 Herz provided more than a hundred items of equipment necessary for the repair of main power grids and substations of Ukrenergo.

In general, Ukrenergo's domestic procurement notices are published at ProZorro electronic system: <u>https://prozorro.gov.ua/search/tender?text=%D1%83%D0%BA%D1%80%D0%B5%D0%BD%D0%B5%</u>D1%80%D0%B3%D0%BE

#### 2.3. Distribution System Operators

Ukrainian DSOs suffered significant damage due to Russian missile attacks in the course of 2022-2023. According to UNDP, between October 2022 and March 2023, 37 distribution substations were damaged: two 150 kV, nine 110 kV, and twenty-six 35 kV substations. Damages to the distribution network were recorded throughout Ukraine, but the most critical ones were in the regions located in the combat zone and along the contact line. Trunk and regional power lines also sustained significant damage.

Therefore, restoration of the electricity distribution system will be the main priority of DSOs for the coming years.

#### **Ukrainian Distribution Networks**

State-owned joint-stock company Ukrainian Distribution Networks (UDN) was established in November 2022 by the Cabinet of Ministers of Ukraine to perform corporate management of the state shares of joint-stock companies that provide services in the area of electricity distribution (DSOs).

UDN manages the state-owned shares in the following DSOs: Khmelnytskoblenergo (70%), Mykolaivoblenergo (70%), Kharkivoblenergo (65%), Zaporizhyaoblenergo (60.25%), Ternopiloblenergo (51%), Cherkasyoblenergo (46%), Sumyoblenergo (25%).

It is possible that UDN will also receive under its control the shares in privately owned DSOs that were part of the so-called VS Energy group after Ukraine completes the nationalization of these shares (as they belonged to Russian oligarchs that got to Ukraine's sanction list).

UDN also plans working on the projects to build new smart grids, modernize distribution systems and strengthen the existing grid to allow for the connection of more renewable energy sources and decentralized generation.

Procurement is performed by individual DSO companies using electronic tender systems. For example, procurement notices of Kharkivoblenergo are published here: <u>https://zakupivli.pro/gov/company/00131954</u>

#### **DTEK Grids**

DTEK Grids is a private holding company that unites DSOs operating in Kyiv, Dnipro, Donetsk and Odessa regions, and in the city of Kyiv. The company serves 5.4 million households and 150,000 enterprises.

Current focus of the company is quick **restoration of the distribution systems** that were damaged by Russian missile strikes. As an example, DTEK Kyiv Regional Grids in 2023 invested about UAH 700 million in the restoration and development of networks for the autumn-winter period. Investments are connected not only with attacks on networks by the Russian aggressor and the consequences of the occupation of the region in 2022, but also with the company's desire to develop networks. The company had managed to restore all 10,000 km of networks damaged by shelling, as well as 3,000 transformer substations and 71 10-0.4 kV substations.

In 2023, DTEK Grids presented a concept for the **development of smart grid networks** on the example of the Kyiv region, on the basis of which a national technical standard can be developed for updating distribution networks throughout Ukraine. The 10-year plan of DTEK Grids provides for a complete renovation of the electrical infrastructure of the Kyiv region with an investment of EUR 2.4 billion and a 3-year pilot project in the Irpin-Bucha-Borodianka energy hub worth EUR 145 million.

After the implementation of the network development concept for customers in the Kyiv region, the average time of power outages will decrease from 1,500 to 100 minutes per year (System Average Interruption Duration Index), and 100% of customers will be equipped with smart meters.

At the first stage of the project, DTEK Grids will develop a digital model, which will become the first digital twin of a real distribution network in Ukraine. This model will allow testing the effectiveness of applied technical solutions and innovations at the planning stage.

Procurement of equipment, works and services is performed separately by each DSO (being a part of DTEK Grids) via electronic procurement platform SmartTender.biz: <u>https://smarttender.biz/en/etm/about-company</u>

#### 2.4. Thermal Power Plant Operators (DTEK Energy)

DTEK Energy is a vertically integrated coal mining, electricity generating and trading group. The Group's coal mines and power generation plants are located in the Donetsk, Dnipropetrovsk, Lviv, Ivano-Frankivsk, Vinnytsia and Zaporizhzhya regions in Ukraine.

DTEK Energy has 13 coal mines, 4 coal processing plants, 8 thermal power plants with 13.3 GW of total installed capacity. During 2023, DTEK's generating enterprises supplied over 15.2 billion kWh of electricity.

In March 2022, DTEK Energy lost control over operations of Luhanska TPP as a result of war with Russia. DTEK's Zaporizhzhya TPP is also located in non-controlled territory and coal supplies are not possible there from the group's mines, because of a destroyed bridge and railway track.

During October 2022-February 2023, Russia committed multiple attacks against civilian and critical infrastructure facilities throughout Ukraine, including DTEK's energy enterprises. 1.4 GW of DTEK's TPP generating capacity became unavailable as a result of air strikes and shelling by the spring of 2023. In the course of 2023, DTEK Energy performed a repair campaign to recover as much damaged equipment as possible to be able to meet the demand of winter period 2023/2024.

DTEK Energy's investments into asset recovery/restoration and new construction can be broken down into the following segments:

**Ad-hoc restoration/repair during the war.** In the course of 2023, DTEK invested UAH 3.9 billion in repairs at its thermal power plants. 20 power generating units were repaired and 8 power generating units were restored after shelling. DTEK also purchased 200+ electricity generators to serve as a backup for emergency situations and created extra stock of equipment and spare parts in order to be able to undertake restoration works quickly in case of further damage caused by Russian missile attacks during the autumn-winter season 2023/2024.

Detailed information about which TPP units were repaired/restored and respective scopes of work is considered confidential information in Ukraine during the war and was not disclosed by the company.

Large scale restoration/rehabilitation after the war. A number of TPP units were damaged to the extent that quick repair/restoration is not possible. There is a possibility that DTEK may decide to restore some of them after the war. Such a decision will depend on the overall post-war situation in the electricity sector of Ukraine (electricity demand-supply, carbon tax, environmental requirements to TPP units, TPP decommissioning plans, etc.), availability of financing as well as economic expediency to invest in the restoration of specific units.

**Investments to comply with the environmental requirements.** In accordance with the requirements of the Directives of the European Parliament 2010/75/EU and 2001/80/EU, as well as the National Emission Reduction Plan (NERP), which came into force on 1 January 2018 and will last until 31 December 2033, for operators, which use large combustion plants requirements were set for the gradual and steady reduction of emissions of sulphur dioxide, nitrogen oxides and substances in the form of suspended solids, not differentiated by composition (dust). At the end of the validity period of the NERP, each heating installation must comply with the requirements of Directive 2010/75/EU on emissions of the above pollutants.

DTEK Energy is expected to continue to make capital investments to ensure compliance with environmental regulations. To meet the requirements of the NERP, additional investments may be needed to upgrade combustion plants. In 2022, working hours limits for power units mentioned in the Opt-out list for the period of martial law and 3 months after its abolition were withdrawn and emission permits for some DTEK Energy TPP's units were obtained without specifying restrictions on the operating hours. Due to the martial law and Russian hostility against Ukraine, further implementation of the NERP requirements is in question and now Ukraine, together with the European Commission and the Energy Community, is looking for ways to further implement the NERP, including postponement of implementation dates in part of emissions rates reduction (dust, SO2, Nox) and modernization of large combustion plants.

Prior to the Russian invasion, DTEK Energy, along with the upgrading and reconstruction of TPP power units, planned to carry out reconstruction of electrostatic precipitators to achieve the residual dust content in exhaust gases not exceeding 50 mg/m3.

DTEK's coal mining enterprises also take measures to reduce greenhouse gas emissions. Stepova Mine of DTEK Pavlohradcoal together with REGEN implemented the project of coal mine methane disposal through high-temperature oxidation on the basis of the 1.6 MW Caterpillar cogeneration unit.

In the course of work of DTEK Energy enterprises, the major scope of their waste accrues to bulk waste, i.e. rocks and ash sludge. To increase the utilization of ash sludge waste and rock, programs for increasing the utilization of waste are being implemented.

**New construction projects.** Rolls-Royce is in talks with DTEK to build a string of **small modular reactors (SMRs)** at the TPP sites. Maxim Timchenko, DTEK's CEO, expects nuclear power to form an important part of DTEK's future portfolio as Ukraine is rebuilt and switches away from fossil fuels. DTEK and Rolls are examining whether up to 8 existing TPP sites, 2 of them currently in territory occupied by Russia, could eventually be converted to house SMRs in the 2030s. DTEK is seeking to establish a partnership with Rolls that could see some of the supply chain eventually set up in Ukraine, where there is significant nuclear engineering expertise.

It is also worth noting that DTEK has established a special company Denetek LLC in partnership with U.S. decarbonization investment vehicle Eney LLC. Denetek has publicly announced its intent to deploy SMRs across a number of sites in Ukraine currently housing DTEK's coal-fired TPPs.

Procurement notices from DTEK companies are usually published at the sites of electronic procurement systems such as:

https://zakupivli.pro/en/commercial/company/34225325

Centrenergo and Donbasenergo - two other companies operating TPPs in Ukraine have not been covered in this report as they are close to bankruptcy and are unlikely to be in position implementing any major projects.

#### 2.5. **Combined Heat Power Plant Operators**

#### **Kyivteploenergo**

Kyivteploenergo is the municipal company owned by the city of Kyiv that operates two largest Ukrainian CHPs (CHP-5 and CHP-6 with total installed capacity of 1.2 GW), waste incineration plant Energiya, numerous boiler only plants and a large heat distribution and supply network.

In July 2021, EBRD approved EUR 140 million loan to Kyivteploenergo, split into two equal tranches, to finance critical rehabilitation and modernisation of the district heating infrastructure in the city of Kyiv. The project aims to provide sustainable and efficient operation of the existing CHPs and boiler houses, improve the reliability of heat transportation, address other critical challenges in rehabilitating and modernizing the city's district heating system, enhance the quality of heat and hot water services to residential and non-residential customers and improve the Company's operational and financial performance and capacity.

In order to support the city's electrical system outside of the heating season, Kyivteploenergo has to operate a portion of the CHP capacity in an extremely inefficient manner, releasing considerable amounts of produced heat into the atmosphere. This approach leads to excessive natural gas consumption and reduced reliability of the facility. Installation of new cogeneration units with heat capacity of up to 136 Gcal/h in the framework of mentioned EBRD project will allow for more rational and efficient operation outside of the heating season. It should also ensure more efficient use of gas and improve the sustainability and reliability of the heat and electricity supply in Kyiv.

General procurement notice for this project can be found here: https://ecepp.ebrd.com/delta/viewNotice.html?displayNoticeId=14952171

Standard procurement notices of Kyivteploenergo are published at electronic tender system: https://zakupivli.pro/gov/company/40538421

#### Naftogaz of Ukraine

The state-owned gas holding company emerges as an important player in the CHP segment. The Cabinet of Ministers of Ukraine made a decision to transfer to Naftogaz the state shares in Dniprovska CHP, Mykolayiv CHP, Kherson CHP, Odessa CHP, Kryviy Rih CHP and Severodonetsk CHP (located at the occupied territory). Transfer of the control over operations of these power plants is underway.

The plan is that Naftogaz will attract funds to the reconstruction and modernization of these CHPs and will operate them in an efficient and transparent manner. Specific investment projects have not been prepared to date. Due to the difficult financial situation, above mentioned CHPs rely mostly on external aid when it comes to finding equipment and spare parts needed for restoration works to mitigate the negative impact from Russian missile attacks (please see below more information in the section covering the activities of Ukraine Energy Support Fund).

Also, the subsidiary of Naftogaz, **Naftogaz Teplo LLC**, currently manages Novoyavoriv and Novorozdil CHPs with total heat output in 2022 being 147.2 thousand GCal.

Naftogaz Teplo performs procurement via Prozorro electronic system. Link to one of recent tenders for procurement of transformers is provided below: <u>https://prozorro.gov.ua/tender/UA-2023-10-12-001789-</u> <u>a?fbclid=IwAR1j4fNiVA34ZoAK3jtI4E8AG6w6VV79MiwyU5I8Ej0xKu4AoHrmAoxUk6c</u>

Additional information is also available at the web site of Naftogaz Teplo: https://www.naftogazteplo.com.ua/%d1%96%d0%bd%d1%84%d0%be%d1%80%d0%bc%d0%b0%d1 %86%d1%96%d1%8f-%d0%bf%d1%80%d0%be-%d0%b7%d0%b0%d0%ba%d1%83%d0%bf%d1%96%d0%b2%d0%bb%d1%96/

It is worth noting that in 2022, Naftogaz made a public announcement about the plans to construct 9 biomass-fuelled CHPs and boiler houses in 8 regions of Ukraine with a total capacity of 250 MW of heat energy and 52 MW of electric energy. The company started working on preparing respective feasibility studies and holding negotiations with partner cities (Lviv and Zhytomyr were selected for pilot projects).

After two changes of management in the subsidiary of Naftogaz responsible for this stream, we have an impression that no real progress was achieved in the course of 2023. This was confirmed also by the statement of Lviv's Mayor that the project with Naftogaz on the construction of biomass fired CHP was on hold.

In general, Naftogaz has access to IFI financing that increases chances that the company will be able to finance any projects related to CHP upgrade/rehabilitation. As evidence, EBRD has recently provided EUR 200 million to Naftogaz to help it build up strategic gas reserves for the winter period.

#### Ukrteplo

Ukrteplo is a diversified group of private companies specializing in energy projects, production of electricity and heat from renewable sources. Primary focus is on the construction of solid fuel boiler plants and gas replacement with renewable energy sources.

In 2021, Ukrteplo completed the construction of 5.9 MW biomass-fired Poliska CHP in Ovruch in 2021. The company also operates biomass-fired boiler only plants with a total installed capacity of 40 MW in 6 regions of Ukraine (Kyiv, Kharkiv, Cherkassy, Chernivtsi, Poltava, Odessa and Ternopil).

As operator of heat supply company Rivneteploenergo, Ukrtreplo plans to construct 12 biomass-fired CHPs in the city of Rivne with a total installed capacity of 40 MW. 1 MW unit was launched in the beginning of 2021. In 2022, the company upgraded a 20 MW boiler only plant in Rivne to switch it from natural gas to biomass and plans to convert all other gas-fired boiler only plants in Riven to biomass in the course of 5-10 years.

There are more CHP operators in Ukraine, which we have not mentioned in this report.

### 2.6. Energoatom

National Nuclear Power Generating Company Energoatom is the largest electricity producer in Ukraine. The company operates four nuclear power plants — Zaporizhzhya NPP (temporarily occupied by Russian troops), Rivne NPP, South Ukrainian NPP, and Khmelnytskyy NPP having in total 15 units with a total installed capacity of 13,835 MW. The company also operates Tashlyk HPSPP (453 MW), Olexandrivska HPP (25 MW) and Centralized Spent Fuel Storage Facility located in the Chornobyl Zone.

Investment activity of Energoatom is focused on the following areas:

- extending the lifetime of existing facilities by implementing respective upgrades;
- construction of new nuclear units, in particular, using Westinghouse AP 1000 technology;
- construction of SMRs;
- creation of a nuclear fuel production cycle in Ukraine.

Naturally, after de-occupation of Zaporizhya NPP, the primary focus of Energoatom will be on restoring the power plant and its fast re-connection to the UES.

The company is undergoing corporate restructuring process transitioning from the state enterprise to a joint stock company. We hope that this process will deliver positive results with improved corporate governance, increased efficiency, transparency, and accountability.

#### 2.7. Renewable Operators

#### Renewable power plants working on feed-in tariff system

Vast majority of renewable capacity in Ukraine was built before 2022 on the basis of the feed-in tariff support scheme. Part of this capacity remains in the territories occupied by Russia (around 0.6 GW of solar and more than 1 GW of wind power plants). Other renewables operate in the usual regime, while their financial condition remains challenging due to continued problems with payments from the side of the state-owned electricity off-taker (Guaranteed Buyer).

Despite challenges, some existing renewable operators work on new projects such as:

**Scatec** from Norway, operator of 5 solar power plants with the total installed capacity of 336 MW, has announced plans to deploy in Ukraine its Release technology - a containerized distributed energy solution of solar panels and energy storage, which is set up on site and leased to consumers. This

project is supported by IFC. A respective Memorandum of Understanding was signed between Scatec and IFC in the summer of 2023.

**DTEK**, the largest Ukrainian private energy company, has recently signed the Memorandum of Understanding with Vestas to complete the construction of the largest wind farm in Eastern Europe. The installed capacity of Tyligul Wind Power Plant, after completion of the second stage with the capacity of 384 MW, will be 500 MW (83 turbines) with a total investment of more than EUR 650 million.

DTEK Renewables, DTEK's renewable arm, has also announced the start of the development of a new large wind farm project in Poltava region.

**MHP**, a large Ukrainian agricultural holding, works on expansion of its portfolio of biogas and biomethane production facilities. It has also announced the plan to build a 60 MW wind farm.

**Elementum Energy**, operator of 536 MW solar portfolio and 100 MW wind farm, considers to continue implementation of the project on construction of 100+ MW Limanska WPP in partnership with US-developer Ukraine Power Resources.

**Hero Asia Investment,** operator of 77 MW wind farm in Odessa region, together with Chinese partners plans to construct a 300 MW South-Ukrainian Wind Farm in the Mykolaiv region.

#### New investors in renewable projects

There is interest from new investors, both Ukrainian and international, to develop and implement projects in the following areas:

- construction of wind power plants;
- construction of solar power plants;
- construction of biomethane plants;
- construction of energy storage facilities.

**Wind projects** currently attract most of the investors' interest. Based on the survey conducted by the Kyiv School of Economics for the Government of Ukraine in 2023, investors submitted information that they were working on 30 wind farm construction projects with a total approx. capacity of 6 GW.

This is explained by the following reasons:

- with modern technologies it is possible to reach relatively high load factor (35-45%) in many regions of the country;
- electricity production pattern of wind farms is more friendly for the system needs as wind farms produce electricity also in cold periods of the year when there is the highest demand, while solar capacity is idle;
- levelized cost of electricity produced by wind farms in Ukraine is the lowest among different types of new electricity generators (current level of electricity market prices is sufficient to ensure payback of respective investment projects).

According to our discussions with international investors, wind farm construction seems to be the most interesting area in Ukraine for decades ahead (especially, considering the Government plans to develop green steel and hydrogen hubs in Ukraine in mid-term). Considering the **significant need in wind turbines and other equipment for such projects, localization of respective production** in Ukraine is considered as a promising area.

**Solar power plant** construction draws less attention from investors as there is already significant solar capacity in operation in Ukraine. Besides, solar generation is considered less friendly for the Ukrainian energy system by TSO due to its seasonality. At the same time, there is still room for a limited number of utility-scale solar power plants (they can be bankable if they are implemented based on corporate PPAs with electricity off-takers).

The area that has been booming since 2022 is the **installation of "behind the meter" solar and hybrid** (solar+storage) installations by electricity consumers on their sites or rooftops. This activity is supported by recently adopted changes to legislation introducing the *net billing* system for electricity consumers with own generation installations. Also, the investment payback of such projects is attractive considering that consumers with their own generation achieve tangible savings as there is no need to pay relatively high transmission and distribution tariffs for respective volumes of produced electricity. Last, but not least, own generation, especially hybrid systems, contributes towards increasing the energy security situation of specific consumers that is important in the case of blackouts.

Ukrainian agricultural companies also work on development of a significant number of **biomethane projects** with the aim to export biomethane to Europe under long-term contracts with the European traders. Such project structure looks bankable (after legislation is amended in the course of 2024 to allow for biomethane export to Europe via gas network), thus, such projects have good chances to attract financing and reach compilation stage. There are no established technology leaders in this segment in Ukraine that opens opportunities for international companies offering respective technologies, equipment and services.

There has been limited activity on construction of **energy storage facilities** in Ukraine. At the same time, the needs of the energy system in such capacities remains high (0.8 GW based on TSO estimates). There have been calls from the Chairman of Ukrenergo, to allow 5-year contracts for ancillary services provided by energy storage facilities (that should help to make such projects bankable). Once respective changes to regulatory framework are approved, we expect that a number of investors will start working on respective projects to take a benefit of the "first mover" status (that potentially would allow capturing the highest prices at initial auctions conducted by TSO).

Several notable new investors working on renewable projects in Ukraine are mentioned below:

**Notus Energy** from Germany is working on development of the portfolio of wind projects in different parts of Ukraine, including the exclusion zone of the former Chornobyl nuclear power plant.

**Goldbeck Solar** from Germany has announced its interest in construction of the portfolio of solar power plants in Ukraine.

**OKKO**, a large Ukrainian operator of gas filling stations, plans to construct a 150 MW wind farm in the Volyn region.

As all mentioned companies are private companies, they perform procurement of equipment and services based on internal rules and procedures.

#### 2.8. Energy Company of Ukraine

Joint-stock company Energy Company of Ukraine (ECU) is a state-owned energy trading company that carries out transactions on the purchase, sale and supply of energy resources to commercial customers. 100% of the company's shares belong to the state. The company operates on domestic and foreign energy resource markets and is the founder of the first state balancing group of electricity market participants, which was joined by the largest electricity producer in the country (Energoatom). A modern trading platform is being created on the basis of ECU, which will enable the state to become an effective and competitive player on the energy market.

It is important to note that ECU has an ambition to become **owner and/or operator of the energy storage facilities and flexible electricity generation (such as gas peakers, gas turbines, etc.)** that are critical elements essential for stable operations of the Ukrainian energy system. Control over such facilities would also strengthen the ability of ECU to provide better balancing services to its customers and improve their energy security, while also bringing positive impact for increasing flexibility of the UES. The company is currently working to attract relevant financing for such projects.

#### https://ecu.gov.ua/

#### 3. FINANCING SOURCES

Financing for restoration/repair of energy assets and implementation of new energy projects during 2022-2023 came via the following main streams:

**IFI financing provided to the state-owned energy companies.** During the mentioned period, EBRD, World Bank, EIB, KfW, etc. provided loans and/or grants to the state-owned companies that have a prior track record of working with IFIs, namely Ukrenergo, UkrHydroEnergo, Energoatom and Naftogaz. Information about respective projects was provided in Section 2. Often loans from IFIs are blended together with grants provided by separate countries or other international institutions. Also, often such loans from IFIs are partially guaranteed by other countries.

As an example, the Ukraine Relief, Recovery, Reconstruction and Reform Trust Fund (URTF) was set up by the World Bank to coordinate grant financing for sustaining Ukraine's government functions, delivering services, and implementing relief efforts. The URTF is a flexible platform that allows the World Bank to prioritize and channel funding to the most urgent development needs identified by the Ukrainian Government (including energy sector), with current contributions from Austria, Canada, Iceland, Japan, Lithuania, the Netherlands, Norway, Sweden, Switzerland. **Support to energy companies via Ukraine Energy Support Fund.** UESF managed by the Energy Community Secretariat has proven to be an efficient instrument to channel aid to a wide range of Ukrainian energy companies. Different countries and/or organizations can make a donation to the UESF that pays for the equipment, fuel, etc. necessary for the Ukrainian energy companies. Respective requests from the companies are verified by the Ministry of Energy of Ukraine. The ownership of energy companies does not make a difference; thus, this mechanism can be also used to help private companies that need urgent support. More details about UESF are provided below.

**IFI financing provided to private companies for energy projects.** Such financing has been quite limited to date. The usual suspects that are able to receive debt financing from IFIs are the largest Ukrainian agricultural holdings that have strong financial position despite the war and attract funds, in particular, for implementation of bioenergy projects. As an example, please see below information about the loan from IFC to MHP.

Assistance via technical assistance projects. In some cases, the decision was made by the countries to use the infrastructure of ongoing technical assistance projects to procure and deliver much needed equipment or materials and donate them to the Ukrainian recipients. Notable example is the decision of the USA to make a purchase of gas fired units via the USAID Energy Support Project and the plan to expand such an approach with the new USAID SPARC program that will be launched in 2025. More details about both programs are available below.

**Financing of municipal projects via various programs.** A number of IFIs are implementing various programs with different municipalities that are focused on energy efficiency and/or have components that can be used for installation of decentralized electricity/heat generation courses. Sample of such programs are presented below:

#### 3.1. Municipal projects

#### **EBRD: Zhytomyr District Heating Project**

Municipal company Zhytomyrteplokomunenergo intends to use part of the proceeds of a loan and grant provided by EBRD in the amount of EUR 15 million for supply and installation of biomass fuelled CHP. Links to respective procurement notices are provided below: https://ecepp.ebrd.com/delta/viewNotice.html?displayNoticeId=27778336

https://ecepp.ebrd.com/delta/viewNotice.html?displayNoticeId=27771826

#### EIB-Germany: Renewable Energy Solution Program

During the United Nations Climate Change Conference (COP28), the German Federal Ministry for Economic Affairs and Climate Action (BMWK), the EIB and the Ministry for Communities, Territories and Infrastructure Development of Ukraine agreed to sign a **EUR 20** million grant for the Renewable Energy Solution Programme. The grant is intended to support the development of renewable energy in Ukraine, in particular during the restoration of municipal infrastructure in communities.

The programme is designed to implement energy-efficient solutions in public buildings such as schools, hospitals and kindergartens. The grants will be allocated to communities and cities already receiving funding under **existing EIB framework loan agreements**. These include the Ukrainian Public Buildings Energy Efficiency Programme (UPBEE) and two recovery programmes: the Ukraine Early Recovery Programme (UERP) and the Ukraine Recovery Programme (URP).

Assistance will be provided for the provision of **solar energy systems, geothermal heat pumps, and biomass energy solutions**. **Battery storage** will also be installed in order to increase the resilience of the buildings in locations where the grid is vulnerable. The RES Programme will thereby improve the energy autonomy of critical public buildings and ensure operational continuity even during power cuts caused by Russian attacks on energy infrastructure.

The German Agency for International Cooperation (GIZ) is expected to provide technical assistance and advisory services necessary for the successful implementation of the programme.

#### **KfW: Business Development Fund**

The Government of Ukraine and KfW actively cooperate in supporting small and medium-sized enterprises through the Business Development Fund. Thanks to joint efforts, **EUR 17 million** were spent to support small and medium size enterprises (by providing local currency loans to such enterprises through the financial sector).

The funds received from KfW are used to develop small and medium-sized businesses, support the energy sector, construction and energy saving, restore social and critical infrastructure, events, water supply and sewage, and support protected areas. At the same time, a significant portion of the funds is allocated to support and restore municipal infrastructure at the regional level.

On 30 November, the Minister of Finance of Ukraine signed a grant agreement worth **EUR 50 million** with KfW to finance the Affordable Loans at 5-7-9% programme. The funds will compensate for the interest rate on the loans for Ukrainian small and medium enterprises. EUR 50 million of KfW grants will make a significant contribution to the activities of the Business Development Fund to improve the existing financial support programmes for businesses.

#### **Nefco Green Recovery Programme for Ukraine**

Nefco via this **EUR 290 mln** program provides financial and technical assistance to municipalities to conduct repairs and rebuild in an environmentally sound way and support them in accommodating internally displaced people and designing *Local Green Recovery Plans* with Nordic support and competence.

It is a multi-donor programme aiming to work long term towards a green recovery in Ukraine. While the programme's focus is more on municipal infrastructure (water, heating, waste) and energy efficiency in buildings, it may include some energy-related components (rooftop solar, decentralized generation) when it comes to developing and implementing so-called Green City Recovery Plans.

Relevant procurement notices can be found here:

#### https://www.nefco.int/procurements/

#### 3.2. Private projects

Several IFIs (EBRD, IFC, DFC, etc.) are currently able to provide debt financing for energy projects in Ukraine. In theory, some of them can also provide equity, but we are not aware of such cases in practice.

As an example, IFC is ready to finance private energy projects via the **Economic Resilience Action Program** aimed to cover the immediate needs of Ukraine's private sector, and help prepare for reconstruction. The USD 2 billion response package includes finance from IFC's own account working alongside guarantees from donor governments. IFC's financing will be provided directly to existing and new clients in the real sector, as well as through financial intermediaries to on-lend to micro, small and medium enterprises and agribusinesses, and through trade finance guarantees.

#### **IFC: MHP Biomethane Project**

IFC resumed cooperation with MHP agricultural holding, the largest chicken producer in Ukraine, and provided a loan to its daughter company, the Vinnytsia Poultry Factory. The company already operates two biogas plants for processing waste from its farms into green energy. As part of its decarbonization strategy, MHP plans to increase biomethane production in Ukraine by modernizing and expanding the capacity of its biogas plants in several stages.

The project's first planned stage is to modernize existing capacities to obtain 14,000 tons of liquefied biomethane per year, and the second stage - to expand capacities to 20.5 MW (as of today, the capacity is 12 MW). The total cost of the project is estimated at USD 52 million. In addition to the IFC loan, MHP expects to self-finance the project.

#### 3.3. Ukraine Energy Support Fund

In agreement with the European Commission and the Ministry of Energy of Ukraine, the Ukraine Energy Support Fund (UESF or the Fund) was established to counteract the impact of the Russian attacks targeting critical energy infrastructure. UESF enables governments, IFSs and international organizations as well as corporate donors to provide financial support to the Ukrainian energy sector's efforts to repair that damage and keep functioning.

Contributions to the Fund are used to finance the most urgent needs of Ukrainian energy companies such as **equipment, spare parts and other technical items, as well as fuels and services** needed to repair infrastructure and maintain energy and heat supply in Ukraine.

The Fund is managed by the **Energy Community Secretariat (ECS)**, the independent executive institution of the Energy Community based in Vienna, Austria. The Energy Community is an international organization to which Ukraine and the European Union are members. The ECS acts as

the fiduciary of the Fund as well as an intermediary between the donors and the Ukrainian authorities. Its services are free of charge.

The Fund's status as of 08 January 2024: total amount pledged - **EUR 404.2 million**; total amount transferred to the Fund - EUR 264.6 million.



Source: Energy Community

UESF has been so far mainly used to purchase equipment for energy companies to restore electricity and heat supplies to consumers across the country. The Ministry of Energy has a working group for the organization of humanitarian aid in the energy sector, which deals with requests from Ukrainian energy companies for the necessary equipment.

The **procurement of such equipment is carried out by the USAID Energy Security Project** in accordance with international standards of transparency. Procurement contracts worth nearly EUR 114 million have already been signed as part of the Fund's implementation.



Categories of items contracted under the Fund: on the basis of value (%)

Source: Energy Community

The 53 Purchase Agreements concluded in the first half of 2023 (latest available reporting period) concerned mostly special purpose vehicles (33%), transformers (25%) and gas distribution station (23%) based on respective value of the equipment.



Categories of items requested from the Fund by Ukrainian beneficiaries: on the basis of value (%)

Source: Energy Community

Above chart shows the structure of requests submitted by Ukrainian energy companies to the Fund. As one can see, the largest requests concern equipment for CHPs, gas transmission, electricity transmission and distribution.

#### **Procurement process**

Since time is of essence for the restoration of an operational energy system in Ukraine, the ECS invites potential suppliers of items/services for Ukrainian energy companies to present their portfolio and/or submit unsolicited offers via an online questionnaire that can be downloaded here: <a href="https://www.energy-community.org/Ukraine/Fund/form.html">https://www.energy-community.org/Ukraine/Fund/form.html</a>

The information submitted via online questionnaire will be shared with the procurement agency (US company Tetra Tech ES, Inc. acting as the contractor of USAID under Ukraine Energy Security Project). Tetra Tech will contact suppliers in case of matches with items/services under procurement.

Whilst Tetra Tech selects the supplier and negotiates the terms and conditions of the Supply Agreement, the ECS, acting as manager of the Fund, is responsible for the payment of the said goods and/or services (a contract is concluded directly between the supplier and the Ukrainian energy company).

**Tender platform** run by Tetra Tech can be accessed here: <u>https://bids.sciquest.com/apps/Router/PublicEvent?tab=PHX\_NAV\_SourcingOpenForBid&Customer</u> Org=MSI&SourcingPublicSite FilterWorkGroup PublicSite=40341

Illustrative cases of UESF support to Ukraine.

In July 2023, the UESF approved vital financial aid for three key energy facilities severely damaged by Russian missile attacks.

A part of the funding, **EUR 15.2 million**, was directed to expedite **Kremenchuk's CHP** restoration that should enable power, heat, and hot water supplies to the city's households, administrative buildings, businesses, and surrounding areas.

Another part of the funding, EUR 8.5 million, was directed for a prompt restoration of the capacity and performance of **Kharkiv CHP-5**, enabling it to strengthen Kharkiv's energy resilience during the upcoming winter months.

EUR 2.6 million was directed to enable **Kramatroskteploenergo** to refurbish the damaged infrastructure and enable steady heat and hot water supplies for critical infrastructure facilities, households, businesses, and public institutions during the colder months.

In the fall of 2023, UESF procured essential equipment for the **Mykolaiv CHP**, valued at over **EUR 1 million**. The newly-procured equipment, including excavators, mobile cranes, manipulator cranes, and other crucial machinery, plays a pivotal role in delivering essential services to Mykolaiv residents. With this equipment in place, the facility will be able to address unforeseen emergencies efficiently, ensuring that critical services remain uninterrupted.

Also, an important area which the UESF is considering right now is financing the **passive protection systems for key energy objects** in the Ukrainian energy system.

According to the statements from UESF representatives, **in 2024 the UESF plans expanding its activities** and (in addition to current activities) to focus on the following new areas:

- construction of decentralized electricity generation (such as gas peakers and rooftop solar installations);
- construction of utility-size **battery energy storage facilities**.

Talking about rooftop solar, the focus will be on public and social infrastructure (hospitals, etc. and potentially on households.

#### https://www.energy-community.org/Ukraine/Fund.html

#### 3.4. UN Programs

#### **United Nations in Ukraine Transitional Framework**

The United Nations in Ukraine Transitional Framework September 2022-204, among other areas, focuses on *Energy and Environment*: winterization, mitigating the energy crisis, preparedness for next heating season, energy management systems; connecting buildings to energy monitoring tools and energy efficient technologies; support to energy system repair and reconstruction; environmental

clean-up and remediation, clean transport and green reconstruction; promotion of bioenergy use in agriculture.

23 UN agencies have been implementing 283 programs in Ukraine since the beginning of the invasion with USD 997.6 mobilized as of November 2023. 13% of these funds went for the programs related to Energy and Environment direction.

#### UNDP

The United Nations Development Programme (UNDP) is the UN's global development network. UNDP is actively supporting energy security, with work ongoing to restore energy supply to critical public facilities (including hospitals, fire and police stations), through provision of energy equipment, water supply and heating. Going forward, UNDP will provide technical support for the implementation of an EIB loan for <u>comprehensive energy rehabilitation of public buildings</u> (such as hospitals, schools and kindergartens), for the benefit of approximately 300 municipalities.

The list of current projects in Ukraine can be found <u>here</u> and <u>here</u> with search by country. In 2023, UNDP procured, among other things, 4 Gas Engine Generation Units (<u>UNDP | Procurement Notices</u>), circuit breakers (<u>UNDP | Procurement Notices</u>), as well as supply of step-up transformers (<u>UNDP | Procurement Notices</u>).

On 8 January 2024, the CMU announced that UNDP with financial support from Japan and JCIA transferred gas turbines to Ukraine. According to the Minister of Energy of Ukraine, their total capacity exceeds 200 MW.

Specific UNDP tenders are managed via the new supplier portal system of UNDP Quantum. Interested suppliers must subscribe following the instructions in the <u>user guide</u>.

#### 3.5. USAID Programs

#### **USAID's Energy Security Project (ESP)**

ESP works with Ukrainian government, private sector, and civil society leaders to improve Ukraine's energy security, and transform Ukraine's energy sector into a modern, market-oriented, EU-integrated, engine of growth.

ESP seeks to create open and competitive energy markets and increase resilience of energy supply, which will promote broad-based, economic development for Ukraine.

#### Tender platform run by Tetra Tech can be accessed here:

https://bids.sciquest.com/apps/Router/PublicEvent?tab=PHX\_NAV\_SourcingOpenForBid&Customer Org=MSI&SourcingPublicSite\_FilterWorkGroup\_PublicSite=36602

Please check the procurement portal to find out about current opportunities to work with TetraTech. Access to any of the opportunities listed below require registration on the system. Simply click on the "Respond Now" button next to any opportunity to get started. If you have any questions about the system or are experiencing problems with registering or submitting a proposal or application, contact: admin.sciquest@tetratech.com.

As of the end of December 2023, there were 13 tenders open for bid, concerning procurement of equipment, pipes, container gas stations, electrical materials, power transformers etc.

#### USAID, OEG: SPARC (Energy)

There is also an activity of USAID, which will serve as USAID/Ukraine's energy resilience project from 2024 to 2029. The award will build on the work of the Energy Security Project, which is scheduled to end in June 2025. The new program with the budget up to **USD 750 million** will work to support Ukraine's electricity, natural gas and district heating sectors to provide affordable, reliable, resilient and secure energy services to all Ukrainians.

A large component of this new award is anticipated to include the *procurement, delivery, and potentially installation of energy sector goods and equipment.* 

A detailed description can be found here <u>https://www.usaid.gov/node/501141</u>.

#### 4. LOCAL STAKEHOLDERS

#### 4.1. INDUSTRY ASSOCIATIONS

#### **European Ukrainian Energy Agency**

European Ukrainian Energy Agency (EUEA) is an association of the companies working in renewable energy and energy efficiency segments in Ukraine. EUEA unites all major international investors working in the Ukrainian energy sector such as Acciona, Scatec, Elementum, EuroCape, Emergy, GS Group, Modus Group, Notus, TIU Canada, etc.

Established in November 2009, EUEA has grown into an effective advocate for improvement of the legal and regulatory framework in the RES area. The association is known for initiating in 2019 the mediation between renewable investors and the state authorities in Ukraine during the conflict situation related to the feed-in tariff system that was resolved in the middle of 2020 when two industry associations (EUEA and UWEA) signed the Memorandum of Understanding with the Ukrainian Government and the Energy Regulator that was approved by the Energy Community Secretariat acting as a mediator.

#### https://euea-energyagency.org/en/

#### **Bioenergy Association of Ukraine**

Bioenergy Association of Ukraine (UABIO) was established in 2013. The purpose of the Association's activity is to create a common platform for cooperation on the bioenergy market of Ukraine in order to create favourable business conditions; accelerate, and sustainably develop bioenergy in Ukraine. UABIO includes 41 members. UABIO's members have positive experience of participating in a number of European projects and practical implementation of bioenergy installations.

#### https://uabio.org/en/

#### **Ukrainian Wind Energy Association**

Ukrainian Wind Energy Association (UWEA) united key players in the Ukrainian wind energy sector. It serves as the principal communication and cooperation platform for large-scale adoption of wind technologies in Ukraine and further advancing the "green" transformation of the UES. The UWEA was founded in 2008 to protect the interests and support the activities of both the national and international electricity producers and investors, wind farm developers, equipment manufacturers and suppliers, construction, consulting and logistic companies, etc. involved in the wind industry. The UWEA is a full member of the World Wind Energy Association and WindEurope.

#### https://uwea.com.ua/en/

#### Solar Energy Association of Ukraine

Solar Energy Association of Ukraine (ASEU) is the specialized association of the solar industry in Ukraine, which unites investors of utility-scale PV plants, EPC contractors and developers, PV service companies, manufacturers of equipment for PV plants, distributors and installers of small PV stations, specialized in energy, insurance and transport companies, companies engaged in the disposal of solar panels, as well as owners of household solar installations. The association is an active member of the European solar association SolarPower Europe and the global solar association – Global Solar Council.

#### https://aseu.org.ua/en/

#### Association "Hydropower of Ukraine"

The largest Ukrainian hydro electricity generator UkrHydroEnergo is the main driving force behind the activity of this association that also includes suppliers of equipment, contractors and service providers involved in implementation of the projects on construction or reconstruction of large and small hydro power plants in Ukraine as well as developers and operators of small HPPs.

The Association unites 50+ members and is a member of a number of specialized international organizations, in particular: the International Hydropower association (IHA) and the International Commission on Large Dams (ICOLD).

#### https://logos-ukraine.com.ua/project/piued5/r2\_15.pdf

#### **Ukrainian Association of Renewable Energy**

Ukrainian Association of Renewable Energy (UARE) is an association of Ukrainian renewable energy market participants. UARE has been established as a consolidated platform for all participants of the renewable energy market aimed at provision of the most favourable business environment, as well RES development support. It usually represents the voice of the Ukrainian investors and market participants (while EUEA is seen more as the voice of international renewable investors).

#### https://uare.com.ua/en/

#### **Association Smart Grids of Ukraine**

The Association Smart Grids of Ukraine (SGU) was founded in 2020. Now it unites 14 distribution system operators. The main goal of SGU is to consolidate and present the positions of DSO's in various regulatory matters. Members of SGU are private DSOs: Prikarpatyaoblenergo, Lvivoblenergo, Odesaoblenergo, Khmelnitskoblenergo, DTEK Kyiv Electrical Networks, DTEK High Voltage Networks, Kyivoblenergo, Kirovogoboblenergo, Rivneoblenergo, Khersonoblenergo, DTEK Dneprovskiy Electrical Networks, DTEK Donetsk Electrical Networks, Zhitomyroblenergo, Chernivtsioblenergo.

#### https://smartgrids.com.ua/en/home-page/

#### Big Recovery Portal (brp.org.ua)

On 17 July, the Centre for Economic Strategy, the Institute for Economic Research and Policy Consulting and the Technologies of Progress launched the project 'The Recovery Spending Watchdog' in Ukraine, funded by the EU. The project aims to establish an impartial and government-independent monitoring system for tracking the allocation of budgetary and donor funds towards reconstruction efforts. This entails a comprehensive analysis of expenditures and the active engagement of the public in overseeing the recovery process.

The project developed an innovative online platform 'Big Recovery Portal', which will serve as a centralized hub for a publicly accessible database with an open source information of ongoing recovery projects, led by governmental bodies, communities, donors, or philanthropic organizations. The portal will also analyse the priority and expediency of the projects, their risks and possible defects.

The project helps state structures to promptly identify emerging problems. To facilitate this process, the Big Recovery Portal is interconnected with platforms such as the Prozzoro e-procurement system, a comprehensive database of damaged objects (damaged.in.ua) and many other open data sources.

The project is financed by the EU, while individual components are financed by USAID, Prague Civil Society Center, and KSE. All project participants are members of the RISE coalition.

Main objectives are: to collect a database of reconstruction projects; to analyse relevant public expenditures; to involve citizens in monitoring the quality and feasibility of specific projects.

#### https://brp.org.ua/

#### 4.2. UKRAINIAN ENGINEERING AND CONSTRUCTION COMPANIES

#### **KNESS**

KNESS is a group of companies operating in the energy sector since 2009. The company has headquarters in Ukraine and representative offices in Poland and Latvia. KNESS operates in the B2B market, providing a wide scope of services, including:

- "Turnkey" development, design and construction of solar power plants more than 1.2 GW of utility-size SPPs was constructed in Ukraine;
- Operation and maintenance of solar power plants KNESS provides such service to more than 1.4 GW of SPPs;
- Design and construction of grid objects substations, transmission lines, etc.;
- Design and construction of battery energy storage facilities (KNESS is the second company in Ukraine after DTEK that commissioned standalone BESS object);
- Manufacturing of equipment several years ago KNESS opened the factory in Ukraine producing solar panels. Also, KNESS produced equipment for almost 1 GW of solar projects (inverter stations, steel structures, electrical equipment);
- Electricity trading, supply, forecasting as well as administration of the balancing group.

All principal procurements are carried out through the electronic trading platform <u>SmartTender</u> in the format of an open tender. There is also the application contact form on the website to fill in and become a supplier - <u>https://kness.energy/en/procurements/</u>

#### https://kness.energy/en/

#### **STRUCTUM**

Structum is Ukrainian EPC contractor covering the following types of projects: overhead transmission lines up to 750 kV, substations, cable lines, wind power plants, solar power plants, industrial facilities.

The company has recently signed contract with Ukrenergo for UAH 2.79 billion to construct the second part of 330 kV Novoodesska-Artsyz power transmission line in Odessa region.

Detailed information on the company's project track record can be found at the link below.

#### https://structum.ua/en/projects/

#### UTEM

UTEM is a group of companies specializing in building energy and industrial facilities on a turnkey basis. UTEM Group offers a full range of engineering services which includes preparation of investment feasibility studies, Basic Design documentation, Detailed Design documentation, etc. UTEM-Engineering, the Group's leading company, performs the Main Contractor's functions and applies in-house techniques to manage projects in new construction, technical re-equipment, reconstruction and commissioning of thermal and nuclear power facilities, as well as industrial facilities in the metals, oil and gas, chemical, food and other industries.

UTEM Group can also produce pipeline pieces, parts and pipe spools of various applications, custom equipment, reservoirs, tanks and metal structures of different purposes.

Company has been operating for 97 years, has 1150 employees, and has completed 307 projects. UTEM Group has commissioned over 37 GW of generating capacities, including 32 GW in Ukraine.

UTEM Group consists, among others, of the following companies:

- UTEM-ENGINEERING is responsible for development of investment feasibility studies, basic engineering, elaboration of process engineering documentation (PED) and Work Execution Plans (WEPs), project management, installation of process equipment and pipelines, startup, and commissioning;
- **UTEM-ZMK** is responsible for fabrication and installation of metal structures and custom equipment (<u>www.utem-zmk.com</u>);
- **UTEM-PROCESS PIPELINES** is responsible for fabrication of process pipeline parts, pieces and pipe spools, stainless steel containers and structures (<u>www.utem-tech.com</u>).

#### https://utem-group.com/en/home/

#### **PRO ENERGY**

Pro Energy is engineering and construction company active in bioenergy segment. The company has successfully implemented several biogas and biomass projects covering design, engineering and construction. It also worked on a number of municipal projects related to district heating, water and wastewater.

Pro Energy has been "turnkey" contractor for construction of the first biomethane plant in Ukraine (Gals Agro facility that was commissioned in 2023) and currently works on construction of more biomethane facilities in Ukraine.

https://www.pro-energy.com.ua/en/

#### SOUTH POWER COMPANY

South Power Company is Ukrainian engineering company focusing on design and construction of power transmission lines and substations up to 750 kV.

The company implemented many projects for Ukrenergo, including construction of the power transmission line from Zaporizhya NPP to substation Kahovska.

More detailed information on the company can be found at the link below.

https://southpower.com.ua/okompanii258/

#### AVENSTON

Avenston is a Ukrainian group of companies specializing in project management and implementation of renewable energy projects (solar power plants, BESS and other RES). The company designs, installs, builds and operates utility-scale solar power plants, rooftop solar power systems, battery energy storage systems, and hybrid power systems.

Talking about solar power plants, Avenston designed 470+ MW, constructed 100+ MW and operates 30+ MW. The company currently focuses on installing solar panels on the sites of electricity consumers to reduce purchase of electricity from main grid.

The company is interested in purchasing solar panels, solar inverters, cables, metal structures, transformers and transformer substations, cable sleeves, power tools, batteries and other equipment that can be used in projects for the construction of solar power plants and other renewable energy facilities. Procurement department can be reached tenders@avenston.com

#### https://avenston.com/en/

#### **EDS ENGINEERING**

Current list of services of the company includes construction of electrical substations; cable lines; industrial solar power stations; construction of solar power plants for personal needs; servicing and maintenance of SPPs.

The company was founded in 2009. In 2011-2014, EDS Group was created and started cooperation with such major market players as DTEK, MHP, ATB network, Interpipe, Ukrainian Railways. Also, EDS was contracted by Chinese EPC contractor PowerChina to construct the electricity transmission lines for 250 MW Sivash wind farm.

In 2020, the largest project of the EDS Group was built from zero - a high-voltage substation 330/35 kV in Nadezhdyne needed to connect 500 MW Zaporizhzhya Wind Farm.

#### https://eds-engineering.com

#### **KTS ENGINEERING**

KTS Engineering is a Ukrainian engineering company with 21 years of experience in the energy sector, implementing projects in the field of distributed generation. The main focus of the company is the energy-efficient solutions based on the equipment of Innio Jenbacher engines. KTS Engineering is an official partner of INNIO, Nidec Leroy-Somer and Baker Hughes.

Representative offices of KTS Engineering are located in Slovakia, Austria, and Uzbekistan. The team of specialists provides a full range of services and works for all industries on a turnkey basis: design, equipment supply, installation and commissioning, comprehensive service of Jenbacher and Waukesha gas engines, Nuovo Pignone turbines and Thermodyn compressors, Nidec Leroy-Somer generators.

#### https://kts-eng.com

#### **DMCC ENGINEERING**

DMCC Engineering is an independent R&D, consulting and engineering company founded in 2003 by professional engineers and researchers that have already had extensive experience in the power industry. The company covers different areas of power systems' digitalization and analysis, including stability studies, complex power systems simulation and modelling, grid interconnection projects and master planning, renewables integration and grid code compliance study, conceptual pre-design, feasibility study for new technologies FACTS, HVDC, BESS, SmartGrid, WAMS, HIL/MIL, research on applications of AI techniques for systems' control and planning, design of special protection

automatics, protection coordination and arc flash hazard study for industrial plants, development and validation of models, software development and trainings.

DMCC collaborates with TSOs, ENTSO-E, DNOs, IFIs, USAID, universities and research centers. Company participates in large scale international consulting, scientific, and research projects related to power systems' interconnection and master planning. DMCC is active in Eastern Europe, Central Asia, Caucus, and Africa.

The market niche of the company is highly developed expertise in very specific areas of power systems analysis, including hybrid and smart grids computer simulation, dynamic software models' development, tuning and verification, know-how transfer programs, special types of power systems studies.

https://dmcc.com.ua/

#### ANNEX A. PROCUREMENT METHODS AND OPPORTUNITIES

Gradation of companies - participants of electricity market in terms of the main characteristics that impact the procedure for their procurement:

- 1. By belonging to the public sector of the economy:
  - Companies of the state sector of the economy (more than 50% of the share in the authorized capital belongs to the state). This category includes, in particular, UHE, Energoatom, Ukrenergo, and some DSOs.
  - Private companies (less than 50% of the share in the authorized capital belongs to the state or without a state-owned share).

#### 2. By the status of a subject of natural monopoly:

Subjects of natural monopolies include Ukrenergo and DSOs.

- 3. By the source of funds used for settlements during procurement:
  - Funds from the state budget (there is no information on the use of this source by market participants during wartime).
  - IFI funds (used in particular by UHE, Ukrenergo, Energoatom).
  - Funds received by the market participant from the tariff (for example, transmission tariff or distribution tariff).

**Regulatory requirements**, which, under normal circumstances, impact the procurement procedure:

The Law of Ukraine "On Public Procurement" prohibits the acquisition of goods, works and services before/without conducting procurement procedures/simplified procurement defined by this Law, and the conclusion of procurement contracts that provide for payment by the customer of goods, works and services before/without conducting procurement procedures/simplified procurement defined by this Law.

At the same time, there are requirements to carry out purchases in accordance with the provisions of this law, in particular, by legal entities:

- which carry out activities in the spheres of ensuring production, transmission, distribution, purchase and sale, supply of electricity to consumers, dispatch management and ensuring the release of electricity to/from the transmission/distribution system; and
- in which state authorities own a share in the authorized capital in the amount of more than 50%; and
- in which the value of the subject of procurement of item of goods (goods), service (services) equals or exceeds UAH 1 million, and works UAH 5 million.

Thus, under normal circumstances, UHE, Ukrenergo, Energoatom, and DSOs referred to the companies of the state sector of the economy **are obliged to purchase goods**, works and services through procurement procedures/simplified procurements defined by the Law of Ukraine "On Public Procurement".

Purchase of goods, works and services with the funds of credits, loans, grants provided to UHE, Ukrenergo, Energoatom in accordance with the international agreements of Ukraine by IBRD, IFC, MIGA, IDA, EBRD, EIB, NIB, as well as other international financial institutions, **is carried out in** 

accordance with the rules and procedures established by these institutions (Part 2 of Article 6 of the Law of Ukraine "On Public Procurement").

According to *the Licensing conditions for electricity distribution*, approved by the NEURC Resolution No. 1470 dated December 27, 2017, when conducting licensed activities, the licensee shall use the funds received from electricity distribution according to the intended purpose and in compliance with the principles of procurement, respectively meeting the requirements of the Law of Ukraine "On Public Procurement".

Thus, the DSOs - private companies (for their procurements) shall only adhere to the procurement principles, namely, fair competition among participants; maximum savings, efficiency and proportionality; openness and transparency at all stages of procurement; non-discrimination and equal treatment of participants; objective and impartial determination of the winner of the procurement procedure/simplified procurement; prevention of corrupt practices and abuses (Part 1 of Article 5 of the Law of Ukraine "On Public Procurement").

# Obligation to purchase goods, works and services under the procurement/simplified procurement procedures defined by the Law of Ukraine "On Public Procurement" for private companies:

Usually, procurement is carried out in accordance with the rules and procedures established by these private enterprises, which only have to comply with the <u>principles of procurement</u> in accordance with the requirements of the Law of Ukraine "On Public Procurement".

#### The procedure for public procurement during martial law:

According to Clause 37 of Chapter X of the Law of Ukraine "On Public Procurement", during the period of the legal regime of martial law in Ukraine and within 90 days from the date of its termination or cancellation, the specifics of procurement of goods, works and services for customers provided for by this Law shall be determined by the CMU with ensuring the protection of such customers from military threats. Such specifics are approved by the CMU Resolution No. 1178 dated October 12, 2022 (hereinafter - Resolution 1178).

According to Part 4 of Clause 13 of the Resolution 1178, acquisition by customers of goods and services (except current repair services), the cost of which is or exceeds UAH 100,000, current repair services, the cost of which is or exceeds UAH 200,000, works, the cost of which is or exceeds UAH 1.5 million can be carried out by concluding a procurement contract without the use of open bidding and/or an electronic catalog for the purchase of goods in the event that there is an urgent need to carry out the purchase due to the occurrence of reasonable circumstances that make it impossible for the customer to comply with the terms for the purchase of using open tenders and/or an electronic catalog, which shall be documented by the customer.

Purchase of goods (works, services) using credit (loans, grants) funds provided in accordance with the international treaties of Ukraine by the above-mentioned IFIs, as well as by other international financial organizations, which is carried out in accordance with the rules and procedures established by these organizations, which provide for the possibility of applying the laws of Ukraine in the field of public procurement can be carried out in accordance with these specifications, taking into account additional requirements and conditions approved by the relevant organization, in particular in the special procedural manual regarding the corresponding credit (loan, grant) provided in accordance with the international agreement (paragraph 9 of clause 3 of the Resolution 1178).

Thus, UHE, Ukrenergo, Energoatom, and DSOs, where the state owns more than 50%, during martial law can make procurements:

- by concluding a purchase contract without the use of open tenders and/or an electronic catalog for the purchase of goods in case of documentary confirmation by them of the urgent need to carry out the purchase due to the occurrence of objective circumstances that make it impossible to meet the deadlines for the purchase using open tenders and/or electronic catalog (when purchasing with company funds, except for loans (credits, grants) provided by international monetary and credit organizations). The rules and procedures for concluding such procurement contracts are determined by the company's internal rules;
- in accordance with the rules and procedures established by international monetary and credit organizations (when purchasing with the funds of credits (loans, grants) provided by international monetary and credit organizations);
- in accordance with the rules and procedures established by the Law of Ukraine "On Public Procurement".

DSOs - private enterprises that, during the period of martial law, carry out procurement in accordance with the rules and procedures established by these DSOs, which shall comply with the principles of procurement in accordance with the requirements of the Law of Ukraine "On Public Procurement" (when purchasing with the funds provided for by the target program and approved in part of its tariff).

Means	Public sector				Private	Publication of information	Note
	NPC	UHE	EA	DSO	DSO		
According to the Law of Ukraine "On Public Procurement"	+	+	+	+		https://prozorro.gov.ua/	Procurement at the Customer's funds
According to the procedures established by the IFI	+	+	+	+		According to the procedures established by the IFI	With the funds of credits (loans, grants) from the IFI
According to the procedures established by the Customer <sup>1</sup>	+	+	+	+	+	According to the Customer's procedures	Procurement at the Customer's funds

#### Methods of procurement by UHE, Ukrenergo, Energoatom, DSOs during martial law

 $<sup>^{\</sup>rm 1}$  Due to reasonable circumstances that make it impossible to meet the deadlines for procurement using open tenders and/or an electronic catalog

According to the results of the analysis of announcements on procurement by enterprises of the state sector of the economy (https://prozorro.gov.ua/) at the present time, these enterprises quite often use the right to be exempted from procurement using open tenders and/or an electronic catalog in case of making purchases for the emergency restoration of destroyed property, as well as making purchases in accordance with the procedures and rules of the IFI (in case of purchases with the funds from the IFI).