Synchronising the energy systems of Ukraine and the EU

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Note: due to constant attacks on critical energy infrastructure, electricity exports from Ukraine may be restricted.

Starting from 16 March 2022, the Ukrainian energy system has been operating synchronously with the European continental network ENTSO-E and has now become part of the European energy space. At that time, Ukraine's energy system was operating in a trial emergency synchronisation mode, which meant there were no export-import transactions conducted with European counterparties. The situation changed on 30 June, when Ukraine and ENTSO-E started the export-import operations. Ukraine's energy system is still working in the trial mode – Ukraine has to prepare and sign a lot of technical documentation to complete synchronisation.

1. What is the ENTSO-E?

ENTSO-E is a Brussels-based association of the European Electricity Transmission System Operators (TSOs) which, on a non-profit-making basis, pursues the co-operation of the European TSOs both on pan-European and regional levels. It coordinates TSOs' activity in the fields of transmission system operation, system development, market development, and research.

ENTSO-E is governed by an Assembly representing the 39 Transmission System Operators. Its work is focused on promoting completion and functioning of the internal energy market in electricity and cross border trade. Besides, it plays an active and important role in the European

rule setting process, in compliance with EU legislation.

2. What is meant by synchronisation?

Synchronisation means connecting energy systems to work together in an interconnected grid, allowing the energy systems to co-operate by combining generation and consumption. That is, synchronisation allows power generation to supply electricity to the common energy system.

Previously, from Soviet times until February 2022, the Ukrainian energy system was synchronised with the systems of Russia and Belarus. Some Baltic countries are currently still synchronised with these systems but are actively seeking ways to change this.

Ukraine started preparing for synchronisation with the EU energy system back in 2017. Synchronisation was scheduled for 2023-2024. The first trial cut-off from the Russian and Belarusian energy systems for technical analysis of the system's operation in an isolated state was scheduled for 24 February 2022. Following the outbreak of a full-scale war by Russia, Ukraine requested ENTSO-E for an urgent connection to ensure the stability of the Ukrainian energy system.

3. New opportunities for Ukraine

On 7 June 2022, Continental Europe TSOs decided to approve Ukrenergo's request to re-launch electricity export from Ukraine. To start a gradual increase in the Net Transfer Capacity of the export direction, six technical prerequisites had to be fulfilled before the approval of the Regional Group Continental Europe could be granted. Such measures were necessary to ensure stability of the interconnected grid and increase capacity of damping low-frequency oscillations.

The possibility of eventual increase in the export volumes is being discussed, since this would be mutually beneficial.

Firstly, Ukraine electricity exports to European countries would add to the liquidity in the electricity market and generate additional income. Under the conditions of martial law and active hostilities, the Ukrainian energy sector is struggling to maintain its pre-war financial indicators. Taking this into account, electricity export becomes an economically substantiated alternative to new borrowings and loans.

Secondly, low-carbon electricity supplies from Ukraine will significantly strengthen energy security in the region of Central and Eastern Europe. At the same time, electricity supplies from Ukraine could cover some share of electricity consumption in these countries and reduce their dependence on russia.

Thus, the synchronisation of energy systems and the resumption of electricity exports from Ukraine to the EU could serve as a catalyst for restarting Ukrainian generation and for attracting additional investment into the Ukrainian economy.

4. Why is exporting Ukrainian electricity profitable?

The situation in the markets of European countries changes based on structure of electricity production and consumption seasonality.

Countries with a large share in the energy balance of traditional energy are donors and suppliers of electricity (Germany, France, Poland, and even Ukraine).

Seasonal countries, in the balance of which hydroelectric power plants are of great importance, have a surplus and export electricity during a season of maximum use of hydro resources, whereby importing electricity in the autumn-winter period (Slovakia, Austria, Switzerland, Romania, Balkan countries). Seasonal fluctuations in the overall electricity balance are also affected by development of generation from other renewable energy sources. There are also countries with a permanent deficit (Hungary, Italy, Serbia). Consequently, prices fluctuate on regional markets, yet Ukrainian electricity is always cheaper.

Since early October, Ukraine's commercial exports have been to Romania and Slovakia. Electricity is also supplied to Moldova and Poland, but in this case exports are not commercial and are carried out under separate inter-state contracts.

Looking back at the three month export history (July-September 2022), all sides benefit greatly. This is primarily due to ultra-high prices on European electricity markets, as well as Ukraine's electricity surplus as a result of falling consumption in the industrial sector.

The EU's interest in Ukrainian electricity can also be seen in the accelerated increase in capacity at inter-state junctions. For example, whereas at the start of electricity exports on 30 June 2022 the permitted capacity was 100 MWh, a month later, on 30 July, the throughput was increased by a factor of two and a half to 250 MWh. With the start of exports, however, ENTSO-E stated that the capacity increase would take place in October 2022 at the earliest. As of 1 October 2022, the permitted throughput was already 300 MWh and further increases are planned.

It should also be kept in mind that synchronisation with the EU grid and increased capacity is also necessary for Ukraine's energy security. For example, if the energy infrastructure (in particular, power plants) is damaged, suppliers will be able to provide electricity to consumers from other countries until the infrastructure is restored. This is vital given the approaching winter and open statements by Russian representatives about further strikes on Ukrainian energy facilities.

Also, the hryvnia's exchange rate against other currencies has certainly contributed to the attractiveness of exports. Thus, we can expect further growth in electricity exports and increased cooperation with the EU in the energy sector.

5. Opportunities for renewable energy generation

European countries choose production of green energy over that from traditional sources. Green energy is also planned to be used for hydrogen production.

Ukraine has a great potential for green energy production, with many power plants (mainly solar and wind) already built and commissioned. Presently, European organizations, engaged in planning the restoration of Ukraine's energy system after the war, speak of the need to give preference to green or energy-efficient projects. That is, when restoring a destroyed power plant, that used to produce energy from gas or coal, it makes sense to build a new facility that will instead produce energy from renewable sources. If this is impossible or not feasible, such a power plant should be reconstructed using more latest energy-efficient technologies.

Related article: Renewable energy in Ukraine: current state of affairs

According to pre-war estimates from the International Renewable Energy Agency, Ukraine has the capacity to install more than 320 GW of wind and 70 GW of solar power. This does not include an assessment of the potential for installing wind and floating stations in Crimean waters, which, according to the World Bank, could add more than 250 GW. Thus, the total installed capacity of renewable sources in Ukraine can reach 415 GW within 10 years, and 700 GW with the Crimean projects.

In any case, construction of new facilities should be approved with the aim of preserving the energy balance of the system in Ukraine. Combined with the possibility of electricity export, the preferences granted to green energy provide for new opportunities in terms of green energy supply to Europe.

Also, hydrogen production in Ukraine can become a key tool for Ukraine and the EU on their path to independence from the russian energy resources, and speed up the transition to "green" energy. For Ukraine, it is also a chance to become the main supplier of "fuel of the future" for Europe.

The world already uses 70 million tons of hydrogen each year as a chemical in some manufacturing processes like fertilizer production. Today, nearly all this hydrogen is produced from fossil fuels. Innovators are working on several different technologies, some of which are more mature than others.

One option is to use solar, wind or nuclear power to turn water into hydrogen and oxygen. Another option is to produce hydrogen using the current methods that burn fossil fuels and then capture the CO2 produced in the process before it's released in the atmosphere. Other clean hydrogen technologies are further away.

The benefits of green hydrogen are becoming clearer every day. The EU has already announced its intention to produce and import 20 million tons of green hydrogen by 2030. This is enough to cut down its dependence on russian natural gas imports by at least one third.

Studies show that demand for electricity will grow with time as economic sectors decrease fossil fuel consumption. And renewables are expected to capture a major share in the world's energy balance. The interest towards hydrogen as a clean fuel is steadily growing.