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The Ukrainian Energy Sector at a Crossroads: Opportunities for Poland

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Ukraine's orientation towards the synchronisation of its energy system with the Continental Europe Synchronous Area (CESA) and the need to determine the future of nuclear energy has forced it to settle on an energy transformation strategy. One model may involve replacing nuclear and coal with renewable energy sources (RES), as advocated by Germany. However, a solution assuming the simultaneous development of nuclear, gas, and renewable energy would be more beneficial for Ukraine, and for Poland's energy security. Poland may promote this solution in Ukraine in cooperation with France, the U.S., and the UK.

The Condition of the Ukrainian Energy Sector

Ukraine inherited from the USSR an energy system dominated by state-owned entities. Currently, these companies control nuclear and hydroelectric power plants, as well as some fossil-fuelled units. In total, Ukrainian state-owned companies account for around 70% of the country's electricity production. Private entities operate mainly in the coal power and renewable energy sectors. Most of them are concentrated within oligarch Rinat Akhmetov's company DTEK, which accounts for about 23% of Ukrainian electricity production. This ownership structure encourages Akhmetov and the government alike to use the energy sector for political purposes, such as adopting populist policies aimed at keeping regulated energy prices low and thus depriving the economy of incentives to reduce energy intensity. As a result, the level of energy efficiency of the Ukrainian economy is one of the lowest in Europe.

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The stagnation of the Ukrainian energy sector can be seen in its energy mix, which has changed only slightly since the collapse of the USSR. At present, nuclear power plants produce more than 50% of the electricity generated, coal-fired plants generate around 30%, gas and hydropower about 6% each, and wind and solar together add just over 7%. The Ukrainian government and business elite were not interested in changing this structure until 2014, as the low prices of nuclear fuel and natural gas purchased from Russia and the country's coal deposits in Donbas guaranteed low generation costs. The stagnation of the Ukrainian energy sector was also influenced by illegal business activities related mainly to brokering cheap fuel from Russia. From 1992 to 2005, the price of Russian natural gas sold to Ukraine was set at $50 per 1,000 m^3. As a result of the Russia-Ukraine gas dispute, since 2006 it has gradually increased, reaching its highest level in 2014 at $485.

After the Russian aggression on Ukraine in 2014, the country's dependence on fuel supplies from Russia began to be seen as a threat to state security. A year later, Ukraine stopped importing natural gas from Russia, replacing it with gas imported mainly from the EU at market prices. The replacement of fuel in nuclear power plants from Russian to American sources was also accelerated. The resulting increase in prices of energy resources and dependence on external supplies led to an increase in the cost of electricity production while also providing incentives to reduce the energy intensity of the economy.

Need for Reform

Prioritising integration into the European energy system as part of the pro-European policy of the authorities elected after the overthrow of Viktor Yanukovych was a breakthrough in the development of the Ukrainian energy sector. This has manifested itself on three levels. The first is the implementation of the economic and trade part of the Association Agreement (DCFTA), which came into force in 2016. It obliges Ukraine to deregulate and liberalise the energy market, increase the energy efficiency of the economy and increase the safety standards of its nuclear reactors. The second level is the synchronisation of the Ukrainian energy system with the CESA, planned for 2023. Its implementation will make Ukraine independent from Russia (currently, it is synchronised with the systems of post-Soviet area countries—IPS/UPS—managed centrally from Moscow), which will enable free energy trade with EU countries. In this context, Poland is perceived by Ukraine as a key partner thanks to the existing Rzeszów-Chmielnicka ultra-high voltage line. This was reflected in the "Roadmap for the development of the Lublin Triangle" signed on 7 July by the foreign ministers of Lithuania, Poland, and Ukraine. It mentions the need to strengthen cooperation in the energy sector, especially with regard to the synchronisation with CESA of the Lithuanian and Ukrainian systems. The

third level of Europeanisation of the Ukrainian energy sector is its orientation towards zero emissions. This goal was expressed in a declaration by Deputy Prime Minister Dmytro Kuleba in February 2020 about Ukraine's willingness to join the European Green Deal, which envisages achieving climate neutrality by 2050. Reducing greenhouse gas (GHG) emissions is also driven by economic considerations. If the EU implements a border carbon tax, it will be imposed on Ukrainian products exported to the EU (about 40% of Ukrainian exports go to EU countries). This would result in a decrease in their competitiveness in the EU market.

At the same time, Ukraine has to face the expiry of the lifespan of its nuclear power plants. Twelve out of 15 nuclear reactors have already exceeded it and are operating under the extension of their operating licences by the State Nuclear Regulatory Inspectorate of Ukraine. Most of the current reactors will have to be shut down by 2037, so investment in the construction of new units is needed to maintain the role of nuclear in Ukraine's energy mix. The estimated cost of building one unit using the current infrastructure is about €1.6 billion (about half the cost of building a new facility from scratch).

At present, three main models, and thus scenarios for the transformation of the Ukrainian energy sector, can be distinguished: *Energiewende*, evolutionary, and inertial. The choice of the model will be decisively influenced by the activity of external players and their financial involvement in Ukraine.

Scenario 1: *Energiewende*

Energiewende is an energy transformation model implemented in Germany since 2010. It aims to reduce GHG emissions by 80-95% by 2050 with respect to 1990 emissions. To achieve this goal, a gradual phasing out of nuclear and coal and their replacement with RES is planned. This programme guarantees the achievement of climate targets but requires large investments in expanding and subsidising RES and developing related technologies. This has led to increased demand for windmills and photovoltaic panels in Germany and has allowed the country to gain a competitive advantage in the RES market, which has become one of the "flywheels" of the German economy.

To expand the market for German RES products and services, Germany is promoting its transformation model, including in Ukraine, through programmes and organisations focusing on cooperation with Ukrainian decision-makers and financing RES investments. The German Society for International Cooperation (GIZ) is the main institution for financing German-Ukrainian energy projects and has allocated €50 million for this purpose. At the same time, Germany is lobbying for the construction of RES-powered electrolysers for hydrogen production in southern Ukraine. The raw material produced by them would then be transported via an upgraded gas transmission network to the EU, mainly to German industrial plants via Slovakia and Czechia. This solution would also be promoted by Germany as what it would describe as compensation for Ukraine's loss of revenue from the transit of Russian gas to the EU after the commissioning of Nord Stream 2. Under the Germany-U.S. agreement of 21 July 2021, the two countries are to provide Ukraine with investments of about $1 billion for the energy transformation.

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Scenario 2: Evolutionary Model

A second solution could be an evolutionary model. It is being implemented in Poland based on the "Energy Policy of Poland until 2040" (EPP). A similar model is also being implemented in other EU countries, in particular Czechia and Greece. The EPP, adopted by the Polish government in February 2021, assumes achieving a zero-emissions system through the development of nuclear and renewable energy while ensuring energy security through the transitional use of gas. In terms of its objectives, this approach does not differ from *Energiewende* in assuming the complete elimination of GHGs in the power sector. However, the Polish model places greater emphasis on ensuring the security of the power system during its "greening" period. The evolutionary model assumes a gradual abandonment of the use of coal to slowly reduce the socio-economic costs of transforming mining regions. Coal-fired power plants are to be replaced by more environmentally friendly gas-fired ones (which emit half as many GHGs than coal-fired plants). At the same time, gas units can perform a stabilising function for the energy system during the adaptation to increasingly higher RES capacities. In the longer term (due to investment time and costs) the stable energy source function is to be performed by nuclear power plants, which combine features of RES (emission-free) and conventional power plants (stability).

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Scenario 3: Inertial Model

Since 2019 when the Servant of the People government took power in Ukraine, the Ministry of Energy has already been headed by six people. During this time, work was postponed on a new version of the energy strategy, among other things. In the absence of a coherent vision for the development of Ukraine's energy sector, there is a risk of the "implementation" of an inertial model consisting of the uncoordinated development of RES, the continued operation of coal-fired power plants, and a lack of action to keep nuclear power plants in the system after 2035. Such a scenario would be beneficial for Rinat Akhmetov's DTEK (which owns coal-fired power plants and RES) and foreign companies in the RES sector. In the long term, however, it risks keeping the Ukrainian energy sector synced with the Russian-controlled IPS/UPS system and the need for further state subsidies for the sector. This, in turn, would contradict the EU's and IMF's requirements for the elimination of subsidies in the energy sector, and risk a partial suspension of their financial support.

Conclusions and Recommendations

Most beneficial for Ukraine is to implement the evolutionary model of energy transformation. It would lead to a reduction of GHG emissions while limiting negative economic and social consequences and ensuring the stability of the energy system. Implementation of this model in Ukraine would also increase the chances for Polish investments in the Ukrainian energy sector, especially in gas-fired power plants. Their development in Ukraine would also ensure stable demand for gas imports, including American LNG, via Polish territory. To increase the security of investments in Ukraine, Poland may push for the EU to continue to condition its financial support on the completion of judicial reform in Ukraine and the guarantee of transparency in tenders.

The modernisation of Ukraine's nuclear power sector, which is assumed by the evolutionary model, would enable Poland to cooperate with Ukraine in attracting investors, creating a common financing model and unifying the nuclear fuel acquisition and disposal chains. Poland and Ukraine could also cooperate in acquiring cheaper small modular reactors in the future, e.g., from France, the U.S., or the UK. Together with these countries, Poland may promote in Ukraine an energy transition model

based on the simultaneous development of nuclear, gas, and renewable energy. This could be done through cooperation with NGOs involved in consultancy and lobbying among decision-makers and experts connected with the Ukrainian energy sector.

An obstacle to the implementation of the evolutionary model in Ukraine is the lack of political will and strategic planning on the part of the Ukrainian authorities. The German promotion of *Energiewende* in Ukraine also lessens the chances of implementing the evolutionary model in that country. The long-standing technological and financial support for the implementation of the German solution in Ukraine has resulted in a positive reception among most Ukrainian experts and politicians from pro-EU parties. However, full implementation of *Energiewende* in Ukraine is unlikely due to its high costs. Furthermore, it is an unfavourable model for Ukraine. The development of RES at the expense of state-owned nuclear and hydroelectric power plants (which is currently taking place in Ukraine and is an element of *Energiewende*) reduces funding for the modernisation or construction of new nuclear reactors and mainly benefits the oligarchs involved in the Ukrainian energy sector. This will lead to a gradual decrease in the share of nuclear energy in the energy mix, without the development of other stable sources such as gas-fired power plants. This may result in periodic interruptions in power supply (in the case of, for example, sudden weather changes), and consequently in economic losses, increased social discontent and delayed synchronisation of the Ukrainian system with CESA. Poland may draw attention to these issues by promoting the evolutionary model as a more favourable solution for Ukraine, which could protect the country from the adverse effects of the implementation of *Energiewende* or an inertial “transformation”.