ANALYTICAL BRIEF

UKRAINE'S RESILIENCE TO CRISES: ENERGY

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CENTRE FOR ECONOMIC STRATEGY

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The Centre for Economic Strategy is an independent research agency on public policy issues. The mission of the CES is to support reforms in Ukraine in order to achieve sustainable economic growth. The Centre contributes to the development of Ukraine's economic growth strategy, performs an independent analysis of the most important aspects of national policy, and works on strengthening public support for reforms. It was established in May 2015

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1. ENERGY SUPPLY RISKS IN UKRAINE

This document includes a description of the main events and factors that determine Ukraine's energy vulnerability in the short run (up to 1 year) - the heating season 2021/22 and preparations for the heating season 2022/23. It does not focus on long-term and systemic threats but may refer to them in the context of short-term risks and threats. The brief outlines the main possible risk scenarios and possible measures to reduce them and mitigate consequences.

In our view, the most significant short-term risks are concentrated in the natural gas and electricity sectors. This does not negate or diminish the long-term risks in other areas, such as the security of supply of motor fuels (gasoline, diesel, LPG), predominantly imported from Belarus and Russia.

The Energy Security Strategy, approved by Cabinet of Ministers Decree No. 907-p of 4 August 2021, highlights the main threats to energy resilience.

An analysis prepared by an expert from the Centre for Economic Strategy and the opinions of panellists who participated in the forum "Ukraine's Resilience to Crises: A Look into the Near Future"[1] organised by the Centre for Economic Strategy on 8 December 2021 are presented in this brief.

1.1. GAS

1.1.1. Current state

Ukraine is heavily dependent on natural gas imports. About a third of domestic consumption, or more than 10 bcm/year, is imported from the EU. The high integration of the Ukrainian gas market with the EU market determines the synchronicity and magnitude of price fluctuations in the Ukrainian domestic market. At the same time, the EU is highly dependent on natural gas supplies from Russia (43.9% in 2020 and 46.8% in the first half of 2021),[2]

Natural gas has long been the main fuel for heating residential and commercial properties in both private and centralised heating systems in Ukraine. More than two-thirds of all gas is consumed for this purpose, with about half consumed either directly by households or for centralised heating of their households. A very low efficiency of natural gas use for heating in Ukraine caused by low energy conversion efficiency and high transmission losses in district heating systems, and high heat losses in residential and administrative buildings. Therefore, the prices and conditions of gas supply for households have been and still are under considerable political pressure, while prices for commercial consumers have been market-based for more than a decade.

At the same time, the retail gas supply segment is highly concentrated. About 70% of gas is supplied by regional gas retailers, which, according to public sources, are controlled by Dmytro Firtash. At the same time, according to the same sources, the natural gas distribution monopolies (GDNO) are under his control. This creates significant risks of market abuse and manipulation, as reported many times by the media.

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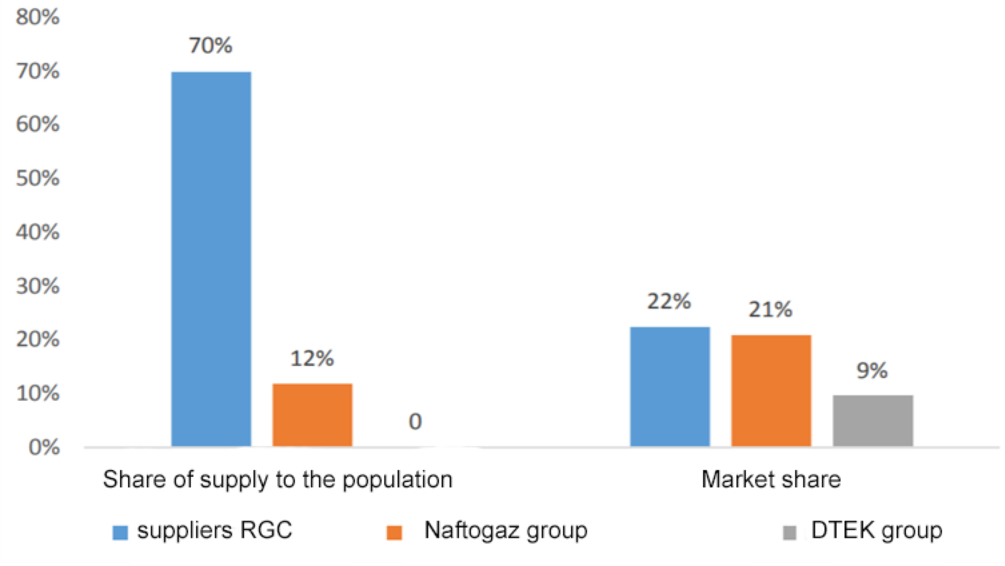
[1] https://ces.org.ua/ukraines-resilience-to-crises/

[2] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_imports_of_energy_products_-_recent_developments#Main_suppliers_of_natural_gas_and_petroleum_oils_to_the_EU

Figure 1. Distribution of natural gas supply to households and the market by main groups of companies in the second quarter of 2021



Source: Results of monitoring the functioning of the natural gas market for the second quarter of 2021. Committee on Energy and Housing and Communal Service, https://www.nerc.gov.ua/news/rezultati-monitoringu-funktsionuvannya-rinku-prirodnogo-gazu-za-ii-kvartal-2021-roku?news=12016

The second half of 2021 saw a rapid and substantial increase in the price of natural gas on the European market. This is particularly noticeable against the low comparison base of 2020, when prices reached their historic low over more than 20 years. In the recent months the price has been kept at an average level above 800-900 USD per tcm. Market players expect the price to be at the same level at least until April 2022, with off-season declines to 500-550 USD per tcm. These trends have determined prices in Ukraine's domestic market.

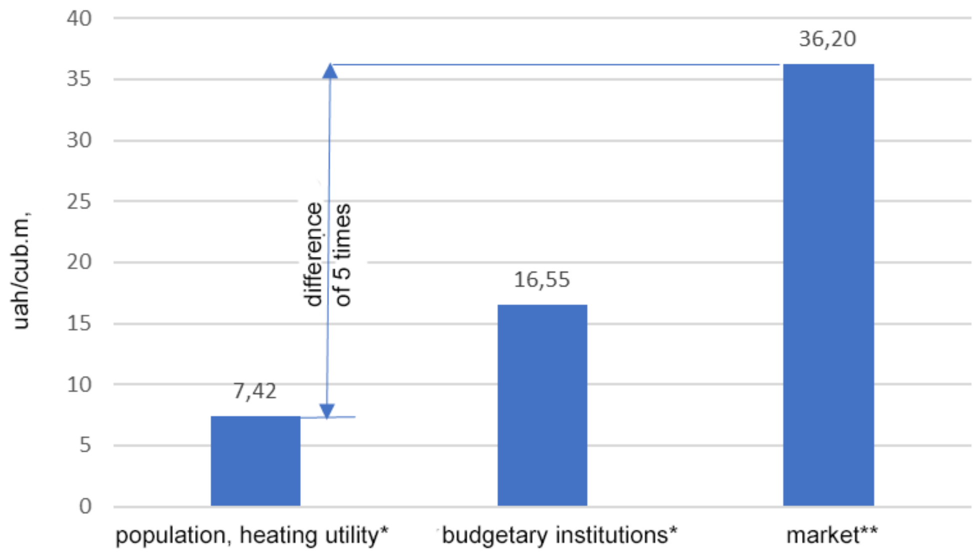
Figure 2. Natural gas price, EUR/MWh*year

Forward January 2022, virtual trading point TTF

Source: ICE Endex Energy exchange

The Special Duties Regime (SDR)[3], which regulated prices and conditions of gas supply to the population, was abolished in August 2020. As of January 2021, price regulation returned, first de jure through direct state price cap[4] and later de facto through a quasi-SCO, the implementation of which was taken over by the state-owned Naftogaz, which is still in place today. In addition to households, it covered heat producers and public institutions, and gas distribution network operators (GDNO) are also expected to be included. Under the quasi-GSO, gas is supplied to households and heat producers at prices that are 4-5 times lower than market prices.

Figure 3. The price at which natural gas is sold by Naftogaz Ukraine to household suppliers, fuel and energy companies and budget-funded institutions compared to the market price



Source: *Naftogaz Ukraine; ** Ukrainian Energy Exchange, as of December 2021

This has led to a rapid and substantial increase in indirect energy subsidies, the ultimate beneficiaries of which are household consumers, public institutions and other consumers. The size of these subsidies by the end of the 2021/22 heating season alone can be estimated at more than UAH 300 billion. Naftogaz informed the government back in early autumn that by the end of the heating season it needed more than 120 billion UAH to cover such non-market expenditures. As a side note, most of the gas owned and stored by Naftogaz was purchased in 2020 at low market prices. This is in addition to the 47 billion UAH direct energy subsidies provided to consumers directly through housing subsidy mechanisms from the state budget for 2021.

High prices for natural gas imported from the EU not only put direct pressure on the financial position of Naftogaz, but also have a significant impact on the natural gas production rents. This is due to the fact that the rent is calculated on the basis of the average customs value of imported natural gas. Meanwhile, while private producers sell gas at commercial prices, Ukrgazvydobuvannya, which is part of Naftogas Group, sells it at prices 5-6 times lower than market prices (around 6.5 UAH/cm). This has led to a situation where the effective rent rate for November may exceed 80%, with its formal level not exceeding 29%.[5]

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[3] The resolution of the Cabinet of Ministers dd 01.07.2020 № 542, Regulations on PSO, https://zakon.rada.gov.ua/laws/show/542-2020-%D0%BF#n9

[4] Resolution of the Cabinet of Ministers of 18.01.2021 № 25 "On Amendments to Certain Resolutions of the Cabinet of Ministers of Ukraine", https://zakon.rada.gov.ua/laws/show/25-2021-%D0%BF#Text

[5] Tax Code of Ukraine, https://zakon.rada.gov.ua/laws/show/2755-17#Text

Such cases happened amidst direct demotivating signals from the government to the natural gas market players that it was inexpedient to fulfil contractual obligations in terms of completeness and timeliness of payments for natural gas under supply contracts.[6] The volume of debt forgiveness and restructuring under this law is estimated to be more than 100 billion UAH. At the same time, OGRM's debt to the GTS operator for natural gas taken for production and technological costs (PTC) continues to grow and reached 12.5 billion UAH at the end of November. Moreover, around 47 billion UAH has been seized from the GTS operator in favour of Naftogaz Group, posing threats to its financial sustainability.[7]

The expert noted that all critical decisions are taken in the Office of the President of Ukraine, which de facto acts as an "energy headquarters". At the same time, its performance appears unsatisfactory due to the disastrous results, in particular, the financial deficit of Naftogaz, which has been generated. At the same time, he pointed out that Ukraine had returned to the situation when gas from the state-owned Naftogaz group, sold at low prices allegedly for the needs of the population, is actually used by private players, in particular by Dmytro Firtash's group. And this is unacceptable in the circumstances of the financial and resource crisis.

Mr. Kobolyev believes it is necessary to return to negotiations with Western partners, which should be based on mutual support and mutually beneficial cooperation, and to abandon the position that nothing is supposed to depend on Ukraine. The uncontrolled use of gas sold by the state-owned Naftogaz group in favour of private companies should be investigated in detail, followed by strict measures to halt such practices, return to the protection of vulnerable consumers and abandon the practice of low tariffs/prices for the whole population, as stipulated in the IMF memorandum.

Andriy Kobolyev, board chairman of Naftohaz Ukraine, 2014-2021.

There were 18.7 bcm of natural gas stored at the beginning of the 2021/22 heating season, most of which came from the leftovers of the previous heating season (15.1 bcm). Ukraine has no de facto practice of using an insurance reserve mechanism to build natural gas reserves in storage, although de jure it is required by law. Most market players and/or European traders have no commercial incentives to build new reserves under the pressure of high prices and expected price reductions.

This shifts the burden of stockpiling to Naftogaz, which has historically been and remains the main user of storage facilities.

Although gas reserves are on average at the level of previous years (except for 2020, when reserves were significantly higher at 28.3 bcm), there are factors that make the situation significantly different from the previous years. Due to high prices, the physical supply of gas from abroad has practically stopped. About 130 million cm was received in October and almost nothing in November. Consumption is being met solely by gas inflows from storage and from producers.

At the same time, since the second half of November, there has been an artificial incentive to use natural gas for electricity generation to balance the Ukrainian energy system in the circumstances of a shortage of thermal

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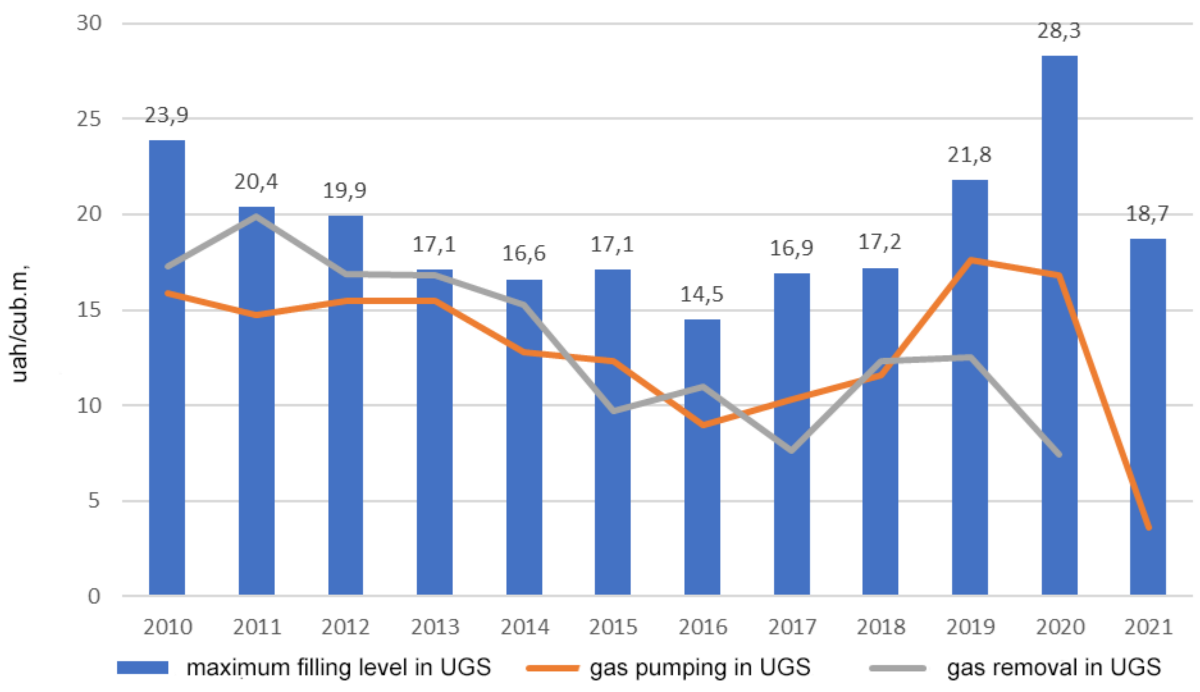
[6] Law of Ukraine "On Measures Aimed to Overcome Crisis Situation and Ensure Financial Stability in the Natural Gas Market" (№ 1639-IX of July 14, 2021), https://zakon.rada.gov.ua/laws/show/1639-20#Text

[7] Order of the Cabinet of Ministers of 29.09.2021 № 1187-r "Some issues of the joint-stock company" National Joint-Stock Company "Naftogaz of Ukraine", https://zakon.rada.gov.ua/laws/show/1187-2021-%D1%80#Text

coal. There are no price signals for the population, which during the heating period should encourage a reduction in consumption.

This leads to an accelerated extraction of gas from storage, which under conditions of technological limitations of gas extraction capacity may create a physical gas shortage at the end of January and until early March 2022.

Figure 4. Reserves, pumping and withdrawals of natural gas from storage facilities 2010-2021



Source: Ukrtransgaz

This takes place at the same time as Russia is intensifying its undisguised use of gas supplies to the EU as a means of influence to push its own economic and geopolitical interests in the EU and at the global level. In particular, it aims to force the launch of the Nord Stream 2 pipeline, which has recently been completed to bypass the EU rules.

The expert highlighted the risk of complete cessation of natural gas transit through Ukraine in case the Nord Stream 2 pipeline is launched, which would create technical problems with gas supply. In her opinion, it is necessary to coordinate the actions of all participants through the "crisis energy headquarters", the meetings of which should be held on a regular basis, to inform the population about the real situation in the energy sector and prepare people for possible scenarios, in particular for crisis scenarios.

Victoria Voytsitska, MP of the 8th convocation of the Verkhovna Rada of Ukraine.

Bearing the above-mentioned factors in mind, there are the following possible scenarios and risks:

- The formation of a quasi-fiscal **deficit** in the natural gas sector of more than **UAH 120 billion** by the end of the 2021/22 heating season (as estimated by Naftogaz);
- **a price arbitrage** of at least 25 UAH/m3, creating a wide room for abuse in the gas resale market worth 50-100 billion UAH per year. A significant portion of these funds will obviously fuel corruption at all levels;
- a possible **shortage of current assets in Naftogaz to import natural gas** during the 2021/22 heating season given high prices on the European market, low gas sales prices by Naftogaz, incomplete and untimely payments by contractors for natural gas, and high effective rents;
- a possible **shortage of current assets in Naftogaz to import natural gas** in the off-season of 2022 to stockpile natural gas before the 2022/23 heating season. It is assumed that by the end of the 2021/22 withdrawal period there will be about 5.6-6.5 bcm of gas in storage and it is necessary to fill storage facilities with 17-18 bcm before the start of the 2022/23 heating season, of which 11.5-12.5 bcm will be required during the off-season.
- About 10-11 bcm of which will need to be imported. Given the expected high prices during the off-season and the absence of effective mechanisms to encourage other market participants or non-residents to build reserves, it may be necessary for Naftogaz to build a very large volume of these reserves through imports. Thus, if Naftogaz imports even two-thirds of the required total imports in the 2022 off-season, it would require funds of around USD 3.5-4 billion;
- a high risk of **insufficient gas withdrawal from storage facilities** from late January to mid-March if there are no gas imports before this period - to maintain pressure in storage facilities and during this period - to reduce the need for withdrawal capacity from storage facilities;
- a high probability that natural gas transit from Russia through Ukraine to the EU will be significantly reduced or cut completely in December and March (the most probable and risky period to cut gas transit is from January to March). This could create natural gas shortages in Ukraine due to limited natural gas withdrawal capacity from storage facilities, limited or no feasible virtual imports, and reduced available volumes of gas for physical import from the EU. This will occur alongside a price spike for natural gas on the spot market due to the physical gas shortage in the EU market.

1.1.2. POSSIBLE MITIGATION EFFORT

- **To reduce the size of the quasi-fiscal deficit in the natural gas sector** by increasing natural gas prices and tariffs for heating, hot water and natural gas distribution, while increasing the expenditure to provide targeted subsidies to vulnerable customers. This will simultaneously reduce the consumption of natural gas;
- **To reduce/avoid price arbitrage** by aligning natural gas prices among different categories of consumers;
- **To restore natural gas imports** as soon as possible to maintain gas stocks in UGS (underground gas storage). The volume of imports can be estimated at 2-3 bcm, which depends on the gas use scenarios for power generation and the effectiveness of measures aimed at reducing consumption;
- **To find funding for Naftogaz to resume gas imports** during the heating period (around USD1.5-2.5 billion) and the 2022 off-season (USD 3.5-4 billion);
- To conduct **an information campaign for consumers** to encourage them to reduce gas consumption and prepare for possible restrictions on gas supply;

- To establish sufficient **stocks of emergency and back-up fuel (fuel oil) at gas-fired cogeneration plants and boiler plants**, and simultaneously inspecting and, if necessary, restoring fuel oil facilities;
- **To reduce gas consumption by CHP plants** (and in the future possibly by TPP), which are used for electricity generation and daily power regulation by introducing a set of measures to reduce electricity consumption during morning and evening peak hours or shifting them to other hours.

1.2. ELECTRICITY

1.2.1. CURRENT STATE

The electricity sector has very high depreciation of fixed assets, which results in a general technological and technical backwardness of the sector, expressed in low efficiency of TPPs/CHPs, high electricity losses and frequent accidents in the distribution networks. This problem is most acute in the manufacturing sector. This is a result of very low investments in generation capacity over the last few decades (except investments in generation from RES).

Frequent and unpredictable changes in legislation, failure to respect the rule of law and property protection do not create the conditions for investment in capital-intensive and long-term new generation capacity projects. Investments in RES generation in recent years have been the exception rather than the rule, and were based on state guarantees provided by law and legislation that allowed for a clear, transparent and relatively sustainable financial model for such projects, which were mainly financed through bank loans.

Consequently, there is an unbalanced structure of generation capacity, in particular the lack of highly manoeuvrable capacity, which leads to the involvement of inefficient coal-fired TPPs and gas-fired CHPs in regulation, as well as the excessive utilisation of hydropower resources and limited electricity production from RES.

> *The MP noted that there is now a significant seasonal and daily disequilibrium in the electricity market caused by the rapid development of renewable energy sources, reflected in a surplus of electricity from April to September and during night hours, which leads to a significant seasonal and daily decrease in market prices.*
>
> *Mr Gerus noted problems with the accumulation of coal reserves for thermal power plants, both for state-owned and private companies, in preparation for the 2021/22 heating season, which have been stored to this day. He pinned significant hopes on nuclear generation, which will operate with as much equipment as possible during this heating season.*
>
> *The transition to market-based electricity pricing (for RES - auth.), the introduction of energy storage systems to even out daily imbalances and, in the longer term, diversification of the source of energy supply will solve the industry's problems, Gerus said.*
>
> *Andriy Gerus, MP of the Verkhovna Rada of Ukraine, Chairman of the Committee on Energy and Housing and Communal Services.*

There is a high degree of concentration of power generation assets by ownership, especially in the conventional energy sector (state-owned Energoatom and Centrenergo; privately owned DTEK Energo). Large international companies are virtually absent.

The electricity sector has a very long history of indirect subsidies to household consumers through state-regulated retail electricity prices. This places a large financial burden on industry and state-owned generation companies. The volume of this subsidy reaches approximately 100 billion UAH per year.

In recent years Ukrenergo has had the problem of significant financial imbalance resulting from the electricity transmission tariff, which does not cover the company's expenditures as defined by legislation. This has forced Ukrenergo to borrow externally with government guarantees that do not have sustainable funding sources.

The facts mentioned above was the overall basis for the rapid and significant increase of thermal coal prices in the world market this year. Prices have been particularly high in May and October, when thermal power plants stockpile coal before the start of the heating season.

Meanwhile, the coal sector saw a 12% decline in thermal coal production in 2020 from 2019 levels and a 6% underperformance in the 10 months of 2021. High prices, lower production and unbalanced regulatory policies on the electricity market, in particular artificial price caps, led to a very low level of coal stockpiling by TPPs at the start of the heating season.

Currently, TPPs hold less than 400 thousand tons of coal in storage at the end of November 2021, which is two times less than the guaranteed reserves and five to six times less than the volumes envisioned by the stockpiling plan approved by the Ministry of Energy. In fact, fuel supply to coal-fired TPPs is done on wheels, and the very low coal reserves create a critical dependence on the logistics of coal supply.

Figure 5. Thermal coal price, USD/tonne

COAL API2 CIF ARA Futures Jan '22
Source: CME Group

The problem with the supply of steam coal became critical with Russia blocking both the supply of coal originating from Russia and the transit through its own territory from Kazakhstan from November 2021.

Electricity production was shifted to hydropower plants, gas-fired CHP plants and resumed electricity imports from Belarus because of coal shortages and the need to restore coal reserves in TPP stockpiles. This led to a significant depletion of water resources in the Dnipro River reservoirs by the Dnipro HPP cascade in a situation of general low water availability.

The use of natural gas CHP plants in electricity generation and participation in daily regulation under high gas prices and regulatory price constraints in the electricity market forced Ukrenergo to introduce a special type of ancillary service which de facto consists of a price bonus to the electricity producer using gas to the market price. On the one hand, this created incentives for producers, but led to increased ancillary service costs for Ukrenergo, which will be passed on to consumers as a result. In addition, Naftogaz signs contracts CHP plants for gas supply on special terms that differ from market terms, hence, creates significant risks, as described in the previous section.

The MP noted that currently Ukraine is facing the most critical energy crisis of all time since its independence. At the same time, Ukrainian politicians do not understand the scale of the problem, and now it is not worth looking for someone to blame, but it is necessary to unite in solving the problem.

In her opinion, the main problem is the lack of a single decision-making body in the energy sector. She also pointed to the critical situation at the Luhansk thermal power plant, where unified access routes for coal supplies from Russia are blocked and coal reserves remain for 20 days. This could lead to forced burning of natural gas, which is not only expensive, but there could also be physical restrictions on its withdrawal from storage facilities. Also, according to Buymister, Ukraine would be forced to turn to Russia for emergency assistance at the Ukraine-Russia crossing to balance the energy system.

According to Ms Buymister, it is necessary to have a single decision-making body in the energy sector and to ensure the full functioning of the electricity market, in particular due to the phase-out of the public service obligation (PSO), and to create an assistance package for generation companies and electricity consumers in the situation of high prices and imbalances in the market.

Lyudmyla Buymister, MP of the ninth convocation of the Verkhovna Rada of Ukraine.

In January-February 2022, it is planned to operate the Ukrainian IPS in isolated mode from the power systems of Belarus and Russia for several (3-5) days. This testing is carried out in preparation for the synchronisation of the Ukrainian IPS with ENTSO-E and involves measuring several power system parameters and checking the controllers' actions. This imposes additional requirements on the availability of resources, in particular coal and hydro resources and, and in the case of their shortage, natural gas. The high availability of generating equipment, including and above all coal-fired power units, to carry the burden is also important.

Thus, there are the following main possible development scenarios and risks:

- **The risk of a generation shortage in the Ukrainian IPS in case of targeted actions to limit crossflows from Belarus and Russia**. The risk can be realised both through a reduction/abandonment of electricity imports currently from Belarus (cross-sectional capacity of 900 MW) and through technological crossflows from Belarus and Russia. The most likely periods of realisation of this risk seem to be before (a few weeks before) the Ukrainian IPS starts to operate in isolated mode.

- The purpose of such actions on the part of Russia/Belarus would be to force the abandonment of testing in isolated mode through the forced accelerated premature depletion of accumulated resources (coal, gas and hydro resources). In the second case, which could lead to more severe consequences, actions could be taken by Belarus and Russia to prevent back-synchronisation of the Ukrainian IPS after the isolation test. In the event of such actions, the Ukrainian IPS would be forced to continue to operate in isolation, which would require the physical availability of significant primary resources (gas, coal, hydro).
- The situation is further complicated and, consequently, the risks increase due to the operation of the Ukrainian IPS in isolation together with the Moldovan energy system, about 80% of the needs of which are covered by the Moldovan (Kuchurgan) TPP located in the territory of the self-proclaimed Transdniestria, which is fully controlled by the Russian Inter RAO. This may require additional energy resources to support the Moldovan energy system;
- **The risks of a primary energy resources** (coal, gas) shortage for TPP/CHP operation due to the disruption of supply chains in the operation of coal-fired TPPs, as well as insufficient gas withdrawal capacity in late January - early March;
- **The deep financial imbalance in the PSO model and the electricity market in general,** and consequently lack of sufficient financial resources to purchase primary energy resources;
- The high accident rate of coal-fired TPP units creates capacity shortages.

1.2.2. POSSIBLE MITIGATION EFFORT

- **To increase electricity prices for households** (partially) in order to financially balance the PSO and provide price signals to households to save energy;
- **To increase the level of price cap in the electricity market (DGN/IDM)** in order to encourage producers to produce electricity and, consequently, to provide sufficient primary energy resources;
- **To postpone the testing of the Ukrainian IPS** in isolated mode to the time when appropriate resources will be available. It is advisable to make a prompt decision based on the actual state of resource availability and other factors just before the planned start date of testing;
- To establish sufficient **stocks of emergency and back-up fuel (fuel oil) at gas-fired cogeneration plants and boiler plants**, and simultaneously inspecting and, if necessary, restoring fuel oil facilities;
- **To resume natural gas imports** as soon as possible in order to maintain gas reserves in UGS in order to be able to support the operation of CHP/TPP if coal-fired operation is not possible;
- To conduct **an information campaign for consumers** to encourage them to reduce electricity consumption;
- **To introduce scheduled power outages during morning and evening peak hours** to reduce the consumption of electricity generated by hydro, thermal power plants and CHP plants to restore hydro resources, accumulate coal and reduce gas consumption.

2. CONCLUSIONS AND RECOMMENDATIONS

The overall situation of Ukraine's energy supply during the heating period 2021/22 is characterised by the coincidence of a significant number of the above mentioned threats/risks, which are of a long-term systemic nature and caused and exacerbated by a sharp increase in energy prices in the European and world markets, as well as by decisions of authorities and the actions of market players.

The likelihood of risks has increased significantly as a result of undertaken and possible future actions by Russia and Belarus as its satellite. Resilience and counter-threats have weakened due to chaotic and inconsistent actions both in state energy governance and regulation and in the management of state-owned energy enterprises.

The systemic disregard for financial imbalances in the largest energy markets (natural gas and related heat and electricity markets) poses very significant threats to the financial sustainability of the state-owned systemic energy enterprises - Naftogaz, Ukrenergo, Energoatom, GTS Operator and Centreenergo - as well as possible losses due to energy supply restrictions or interruptions.

While the time needed for corrective action is largely forgone, the measures listed will have a mitigating effect and some will offset the risks.