

CENTER OF ANALYSIS OF INTERNATIONAL RELATIONS



Critical energy infrastructure of Ukraine and Azerbaijan

Shahmar Hajiyev

Viacheslav Potapenko

- 💡 Mirza İbrahimov 8, Baku, AZ1005, Azerbaijan,
- 🗍 (+994 12) 596-82-39, (+994 12) 596-82-41
- E-mail: info@aircenter.az, www.aircenter.az

MAY 2023

CRITICAL ENERGY INFRASTRUCTURE OF UKRAINE AND AZERBAIJAN

Introduction

Energy security is a key part of foreign policy, and it has been defined as an adequate and reliable supply of energy resources at a reasonable price. Energy security is multi-dimensional, and one of the most important dimensions of energy security is the political economy of energy security, which examines interrelations between crude and natural gas exporting and importing countries. Another dimension is the geopolitics of international relations, which explores how the geopolitics influences and shapes coalition, cooperation or unilateral action for energy security.¹

Today, many countries face challenges in terms of its energy security connected with high dependence on crude oil as well as natural gas, rising energy prices, security of supply and last but not least, security of critical energy infrastructure. The exploration of energy resources and their supply to the global energy markets need necessary energy infrastructure, and such critical energy infrastructure can be especially vulnerable against physical and cyber-attacks. The energy infrastructure is divided into three interrelated segments: electricity, oil, and natural gas, and these segments are tremendously important to ensure long-term energy security.

This paper provides analysis of critical energy infrastructure of Ukraine and Azerbaijan, and how both countries faced serious threats and challenges during the war. It is worth noting that the ongoing Russia-Ukraine war seriously affected Ukraine's energy infrastructure, causing damages and destructions. As a result of strikes on Ukraine's energy infrastructure about 50% of the country's energy infrastructure has destroyed. Many cities including Kyiv, Kharkiv, Lviv and Odesa have been hit by Russian missiles and lost energy supply during the winter.

Azerbaijan as a resource rich country also faced serious threats during the former conflict with Armenia. As a net crude oil and natural gas exporter Azerbaijan needed necessary transit infrastructure to export its natural resources to global energy markets. Therefore, availability of critical energy infrastructure is one of the main factors determining effective management of energy resources for the country. It is worth noting that the critical energy

¹ <u>https://www.sciencedirect.com/science/article/abs/pii/S0301421520302949</u>

infrastructure has been always targeting for Armenian attacks. During July 2020 Azerbaijan's main export pipelines – the Baku-Tbilisi-Ceyhan oil pipeline (BTC), the South Caucasus gas pipeline (SCP) –and the Baku-Supsa oil pipeline near Tovuz region of Azerbaijan were attacked with Armenia's cluster bomb.

In addition, Armenia threatened Azerbaijan to hit Mingachevir Dam, which is the center to the largest water reservoir in the South Caucasus with the area of 605 sq. km that supplies electricity to Azerbaijan. So, Armenia's attacks against critical energy infrastructure of Azerbaijan created significant danger not only for Azerbaijan, but also for its partners who invested billions to develop energy infrastructure in the country.

Ukraine's energy infrastructure

A considerable portion of Ukraine's energy infrastructure was established during the period of the Soviet Union. In the last ten years alone, leading international and Ukrainian RES investors have attracted more than USD 12 billion of direct foreign investment into the economy of Ukraine, and the share of foreign investors in the installed RES capacity as of the end of 2021 has reached more than $35\%^2$.

Shortly after midnight on February 24 last year, Ukraine severed its last links to the Russian electricity grid as it switched to integration with the European transmission infrastructure. A few hours after it unplugged from a system to which it had been connected since Soviet times, Russia launched its all-out invasion of Ukraine, a conflict now characterized by devastating airstrikes against its energy infrastructure³. Since March 2022, UES-U has been part of the European energy system ENTSO-E⁴. European Network of Transmission System Operators for Electricity (ENTSO-E) is a European network of electricity transmission system operators that unites 43 operators in 39 European countries (Pic. 1).

² https://razumkov.org.ua/statti/sektor-vidnovlyuvanoyi-energetyky-ukrayiny-do-pid-chas-ta-pislya-viyny

³ https://cepa.org/article/ukraine-energy-grid-resilience-continues-despite-invasion/

⁴ https://www.entsoe.eu/search/?q=Ukraine#/



Pic.1. European Network of Transmission System Operators for Electricity⁵

The organization was established in July 2009 through the initial merger of operators ATSOI, BALTSO, ETSO, NORDEL, UCTE, and UKTSOA. As of 2021, it has five managing sectorial groups in its structure that coordinate the provision of safe and optimal operation of Europe's network in real-time, support and develop communication infrastructure, provide coordination of critical infrastructure protection, develop coordination rules, conducts risk classification and assessment, and engages in planning and development strategies.

United Energy System of Ukraine (UES), is a collection of power plants, electric and thermal networks, and electric substations that work together under a centralized management system to produce, transmit, and distribute electricity and thermal energy. Ukraine's UES is among the biggest energy associations in Europe, comprising seven regional electric power systems, namely the Dnipro, Western, Crimean, Southern, South-Western, Northern, and Central. The main

⁵ https://uk.wikipedia.org/wiki/ENTSO-E

power transmission lines connect these systems, forming a single entity. As of 2020, Ukraine's total installed capacity was 54.5 GW, and its distribution transmission power lines spanned more than 1 million kilometers. Power production comes from various sources, including nuclear, coal, fuel oil, natural gas, biofuel, and renewable energy sources such as wind, water, and solar power⁶.

Ukraine has 15 nuclear reactors in four operational nuclear power plants, along with two research nuclear reactors, radioactive waste disposal facilities, and radioactive sources used in medicine and industry. While the Chernobyl NPP was decommissioned in 2000, it still contains two storage units for spent nuclear fuel. The country also operates 16 thermal power plants, 49 combined heat and power plants, three hydro-accumulating power plants, and eight hydropower plants, with the primary cascade of hydropower plants situated along the Dnipro River.

Ukraine's power production and distribution network is vast, with several vulnerable nodes that make it easy for Russian drones and missiles to strike. Ukraine has been actively promoting renewable energy since 2016, with renewable energy sources accounting for about 10% of the country's electricity in 2021. According to the Ministry of Energy, 11 TWh of energy was generated from renewable sources in the first 11 months of 2021, with the largest wind and solar power plants located in southern Ukraine's Mykolaiv, Kherson, and Odesa regions of Ukraine, is a collection of power plants, electric and thermal networks, and electric substations that work together under a centralized management system to produce, transmit, and distribute electricity and thermal energy.

Capture by the troops of the Russian Federation of Chornobyl and Zaporizhzhya nuclear power plants

Russian troops occupied the territory of the Chornobyl nuclear power plant, located near the border with Belarus, on the first day of the invasion, February 24th. They took Ukrainian soldiers' prisoner and effectively held the station's civilian staff hostage. The occupiers left the Chernobyl plant at the end of March.

On April 26, 1986, an uncontrolled nuclear chain reaction destroyed the Chornobyl Nuclear Power Plant's fourth reactor in an accident initially covered

⁶ https://paxforpeace.nl/media/download/PAX_Ukraine_energy_infrastructure_FIN.pdf

up by the Soviet authorities. The exact figure of death as a result of the accident at the Chornobyl nuclear power plant is still disputed. Ultimately, 350,000 people were evacuated from a 30-kilometer radius around the station, an exclusion zone that remains deserted except for some elderly residents who have returned despite an official ban. Three other reactors of the Chornobyl power plant were successively closed, and the last one was stopped in 2000.

According to representatives of Ukraine, the radiation level in the area surrounding the station increased, particularly due to the fact that equipment had turned over the top layer of soil. Additionally, Russian soldiers dug trenches and sat in areas of radiation contamination, including the infamous "Red Forest" near the plant, and may have received dangerous doses of radiation⁷. Serhii Kireev, general director of the state-specialized enterprise "Ecocenter", says that in some points of ASKRO, the control levels immediately increased by 2-8 times⁸.

On the evening of March 31st, the Russian occupiers left the Chornobyl nuclear power plant. The occupiers destroyed the laboratory in the "Ecocenter," which researched radiation exposure and substance characteristics. They also broke into the storage of ionizing radiation sources, stealing and damaging 133 sources of ionizing radiation. This caused the release of approximately 7 million Becquerels of beta and gamma radiation, which is equivalent to 700 kg of radioactive waste.

After the retreat of the Russian occupiers from the Chornobyl nuclear power plant, they left behind fortification facilities in places with the maximum radiation background, took out a unique radiological laboratory, captured the defenders of the Chernobyl nuclear power plant and forced personnel to work in conditions of excessive radiation. On the territory of the Chernobyl nuclear power plant, whole areas with a lot of mine traps and mined approaches were discovered

The offices and laboratory of the Institute of Nuclear Power Plant Safety Problems were also destroyed and ransacked, with computers, office equipment, laboratory equipment, and measuring devices taken away. Archives and documents that had been collected for decades were thrown away. The occupiers looted garages with cars used to transport scientists and took spare

⁷ https://lb.ua/society/2022/04/26/514788_rosiyska_okupatsiya_chornobilskoi.html

⁸ https://graty.me/uk/hlopczi-vi-serjozno-vi-rozumiete-kudi-ïdete-istoriya-rosijskoï-okupacziï-chornobilskoïatomnoï-stancziï-ta-zoni-vidchuzhennya/

parts to an unknown destination. They also took six of the 15 sea containers that were on the construction base.⁹ The losses from theft and vandalism by Russians amount to at least 135 million dollars¹⁰.

The Zaporizhzhya nuclear power plant (ZNPP) is a major concern in Ukraine's energy sector during the ongoing conflict due to potential radiation risks. The largest nuclear power plant in Europe, the ZNPP has six reactors that are currently in cold shutdown as of October, meaning they are not generating electricity but still require power for cooling and other essential safety functions. However, the power supply situation at the ZNPP is vulnerable, with only one external 750 kV power line in operation instead of the four that were operating before the invasion, putting the plant's safety at high risk. In November, the ZNPP was shelled again, resulting in multiple explosions and posing significant risks to nuclear security as warned by the IAEA¹¹.

The current situation began on March 4 when Russian troops captured the ZNPP, establishing a base there and placing heavy artillery in violation of international laws on nuclear power plant safety. Despite this, the ZNPP's regular management and staff have continued to operate the plant over the past nine months. However, months of shelling near and around the plant have periodically disabled its one remaining external power line. During these periods, emergency diesel generators are used to provide cooling systems for the plant's six reactors to prevent a meltdown.

Anthony Blinken, the US Secretary of State, has accused Russia of using the Zaporizhzhia nuclear power plant (ZNPP) as a "nuclear shield" to attack Ukrainian forces without fear of retaliation. He claimed that Russia had previously used civilians as a "human shield," but now uses the ZNPP instead. Raphael Grossi, the head of the International Atomic Energy Agency (IAEA), also expressed concern that the situation at the ZNPP, which is currently occupied by Russian forces, has worsened and is completely out of control. Grossi said that nuclear safety principles are being violated, and Ukrainian personnel are being kept at the plant by the occupiers, leading to conflicts and alleged violence. The IAEA has tried to conduct inspections to ensure nuclear safety, but the supply chain of equipment and spare parts has been interrupted, leaving them unsure if the plant is receiving everything it needs. The Russian occupiers are allegedly using the ZNPP to intimidate Western Europe with a potential nuclear disaster,

⁹ https://www.dw.com/uk/pislia-rosiiskoi-okupatsii-nebezpek-na-chaes-stalo-bilshe/a-61450852

¹⁰ https://www.slovoidilo.ua/2022/06/02/novyna/suspilstvo/rosijski-okupanty-chaes-vkraly-ta-znyshhyly-majna-135-miljoniv-dolariv

¹¹ https://paxforpeace.nl/media/download/PAX_Ukraine_energy_infrastructure_FIN.pdf

in order to decrease their support for Ukraine with weapons. Blinken also accused Russia of using the Zaporizhia NPP as a "nuclear shield" ¹².



Pic.2. Airstrike of Zaporizhzhya nuclear power plant¹³

The situation at the Zaporizhzhya nuclear power plant, which is occupied by Russian troops, continues to remain tense and threatens the entire region with a nuclear catastrophe. Artillery fire near the Zaporozhye nuclear power plant and the temporary loss of the only remaining backup power line at the ZANP have again highlighted the risk of a serious nuclear accident during the military conflict in Ukraine. This was announced by the Director General of the International Atomic Energy Agency (IAEA) on February 28, 2023, Rafael Mariano Grossi¹⁴.

Energy infrastructure damage

About 50% of Ukraine's critical electric power infrastructure was significantly damaged by Russian missile attacks, some of it was completely destroyed. This was stated by the Deputy Prime Minister for the Reconstruction of Ukraine Oleksandr Kubrakov, CNN reports¹⁵.

The waves of attacks by Russian armed forces on Ukraine's energy-related infrastructure from 10 October 2022 (Pic.3.), may amount to crimes against humanity, according to the Commission, which said that this should be investigated further. The disruption of energy-related infrastructure led to

¹² <u>http://1news.zp.ua/zahoplena-rashistami-zaporizka-aes-povnistyu-vijshla-z-pid-kontrolyu-golova-magate/</u>

¹³ https://paxforpeace.nl/media/download/PAX_Ukraine_energy_infrastructure_FIN.pdf

¹⁴ https://news.un.org/ru/story/2023/02/1438097

¹⁵ https://edition.cnn.com/europe/live-news/russia-ukraine-war-news-12-09-22/index.html

entire regions and millions of people being left for periods without electricity or heating, particularly during freezing temperatures - UN Commission of Inquiry on Ukraine¹⁶,¹⁷.



Pic.3. On October 10, Russia launched a massive missile attack on Ukraine. Russian troops fired 83 rockets at infrastructure facilities in various cities of Ukraine, 43 of them were shot down¹⁸.

Human Rights Watch has accused Russian forces of intentionally targeting Ukraine's energy infrastructure in order to spread terror among the population, which is a violation of the laws of war. These attacks, including missile and drone strikes, have left millions of civilians without access to electricity, water, heat, and other vital services, especially as the cold winter months approach.

The United Nations Office for the Coordination of Humanitarian Affairs reported that a single attack on November 23, 2022, killed or injured over 30 civilians and disrupted power supply for millions of people throughout Ukraine. The entire population of Kyiv, estimated at 3 million, had no access to water for the day, while other regions were completely cut off from electricity.

Human Rights Watch Senior Ukraine Researcher, Yulia Gorbunova, stated that Russia's repeated targeting of critical energy infrastructure reveals their intent

¹⁶ https://www.ohchr.org/en/press-releases/2023/03/war-crimes-indiscriminate-attacks-infrastructure-systematic-and-widespread

¹⁷ https://zabor.zp.ua/new/amerikanskie-eksperty-obyasnili-zachem-rossiya-vedet-obstrely-so-storonyzaporozhskoy-aes

¹⁸ https://texty.org.ua/fragments/107955/masovanyj-raketnyj-obstril-10-zhovtnya-miscya-vluchan-grafika/

to create terror and make life unsustainable for civilians. She warns that with the winter months approaching, the situation will become more life-threatening, and Russia seems determined to make life unbearable for as many Ukrainian civilians as possible. Under the laws of war, it is illegal to attack objects essential to the survival of the civilian population or use violence or threats to spread terror among civilians¹⁹.



Pic.4. Strikes on electrical infrastructure facilities in Ukraine

"Since October 10, 2022, the enemy has been purposefully destroying civilian critical infrastructure, in particular energy infrastructure. 255 hits were made on 112 objects (Pic. 4). These are the blows that reached the goal," said the Prosecutor General of Ukraine Kostin. He noted that the period from October 2022 to February 2023 accounts for 77% of such strikes, namely 197 recorded cases."²⁰

By the end of October 2022, 90% of its wind and 50% of its solar capacity was destroyed or no longer in operation following Russia's occupation of territories housing these installations²¹.

¹⁹ https://www.hrw.org/news/2022/12/06/ukraine-russian-attacks-energy-grid-threaten-civilians

²⁰ https://www.slovoidilo.ua/2023/02/22/novyna/suspilstvo/rf-pyat-misyacziv-zavdala-200-udariv-pokrytychnij-infrastrukturi-ukrayiny

²¹ https://cepa.org/article/ukraine-energy-grid-resilience-continues-despite-invasion/

Traumatic are the human losses among power network personnel. In the past year, DTEK, the largest private electricity generating company, lost 136 employees, 328 had been injured, 25 went missing, and four are held prisoner²².

Western officials have observed that Russian attacks on infrastructure are becoming more sporadic. This is believed to be due to a shortage of precision weapons, particularly missiles, necessary to carry out such attacks effectively. One official stated that assembling the required number of precision weapons for a comprehensive strike takes a significant amount of time. Additionally, the Ukrainian military has improved its ability to intercept missiles and drones.

Despite the loss of multiple transformers and other key components of Ukraine's infrastructure, Ukrainian engineers have managed to maintain the electricity supply throughout the country. This demonstrates their proficiency in maintaining critical infrastructure in the face of hostile attacks²³.

Azerbaijan's Energy Infrastructure

Azerbaijan as the Caspian basin country, exporting crude oil and natural gas to the global energy markets, provides secular energy supplies for energy consumers. Azerbaijan's oil reserves are around 7 billion barrels and proven natural gas reserves are 2.6 trillion cubic meters, and estimated reserves are about 3 trillion cubic meters²⁴.

Touching upon oil production in the country, it is worth noting that oil is being produced both onshore and offshore in the Caspian Sea. Export of crude oil to international energy markets played crucial role for economic development and especially, further development of energy sector. The largest oil field is the Azeri-Chirag-Deepwater Gunashli (ACG) field, which gave the highest oil production in the country's history. The most of the extracted crude oil from ACG is being exported via Baku Tbilisi Ceyhan Oil pipeline (BTC).

According to BP the field located about 100 km east of Baku and operated by BP on behalf of the Azerbaijan International Operating Company (AIOC). Operations at the ACG field started in November 1997 with the start-up of

²² https://cepa.org/article/ukraine-energy-grid-resilience-continues-despite-invasion/

²³ https://www.bbc.com/ukrainian/news-64904805

²⁴ <u>https://president.az/en/pages/view/azerbaijan/contract</u>

production from the Chirag-1 platform (Early Oil Project). ACG is composed of the following offshore fields²⁵;

- "Chirag field (has been in operation since 1997, average oil production 125, 000 barrels per day);
- Central Azeri (has been in operation since February 2005, is designed to process 420,000 barrels of oil per day);
- West Azeri (has been in operation since late December 2005 and has been constructed to produce oil from the western portion of the Azeri field);
- East Azeri (has been in operation since November 2006 and has been constructed to produce oil from the eastern part of the Azeri field);
- Finally, Deepwater Gunashli (has been in operation since April 2008, the DWG complex will produce approximately 320,000 barrels per day, thus bringing the total ACG production rate to a level of over 1 million barrels per day)".

Today, Azerbaijan is also net gas exporter and plays very important role in Europe's energy security. The Shah Deniz gas field is the most valuable natural gas field in the country. The filed located on the deep-water shelf of the Caspian Sea, 70 km south-east of Baku is one of the largest gas-condensate fields in the world and the largest gas discovery ever made by bp.

Shah Deniz project made foreign energy companies to invest to Azerbaijan's gas sector. Bp operates Shah Deniz on behalf of its partners in the Shah Deniz Production Sharing Agreement (PSA).

Shah Deniz Stage 1 began operations in 2006. It has the capacity to produce around 10 billion cubic meters of gas per annum (bcma) and approximately 50,000 barrels a day of condensate. Since Shah Deniz has proved a secure and reliable supplier of gas to Azerbaijan, Georgia and Turkey. In 2018, Shah Deniz celebrated 100 billion cubic metres of total gas production from the field since the start of operations. In 2021, Shah Deniz celebrated the 25th anniversary since the signing of the Shah Deniz Production Sharing Agreement (PSA).

During the year, the Shah Deniz field continued to provide deliveries of gas to markets in Azerbaijan (to Azerkontrakt), Georgia (to GOGC), Türkiye (to BOTAS), to the BTC Company in multiple locations and to buyers in Europe. In 2022, the field produced about 25 billion standard cubic metres (bscm) of gas and more

²⁵ https://www.bp.com/en_az/azerbaijan/home/who-we-are/operationsprojects/acg2.html

than 4 million tonnes (about 36 million barrels) of condensate in total from the Shah Deniz Alpha and Shah Deniz Bravo platforms. The existing Shah Deniz facilities' production capacity is currently about 74 million standard cubic metres of gas per day or more than 27 bcma. Shah Deniz Stage 2, or Full Field Development (FFD) is a giant project that will add a further 16 billion cubic meters per year (bcma) of gas production to the approximately 10 bcma produced by Shah Deniz Stage 1.

Shah Deniz Stage 2, one of the largest gas developments in the world, is also a gateway to the Southern Gas Corridor (SGC) that delivers natural gas from the Caspian Sea directly to European markets for the first time. On 31 December 2020, Shah Deniz celebrated a significant achievement by commencing first ever commercial gas deliveries to European markets via the newly-completed Southern Gas Corridor (SGC) pipeline system. The Shah Deniz field is the starting point of SGC and the commencement of gas deliveries to Europe from Shah Deniz marks the full integration of the entire SGC gas value chain, stretching 3,500 kilometres from Azerbaijan to Europe. With this important achievement Shah Deniz represents a new source of energy supply for Europe diversifying its energy market and strengthening its energy security.²⁶

At the present time the first phase of the project has been already finished, and now the second phase of this important energy project is underway. The second stage of the Shah Deniz project increases the capacity of natural gas and Azerbaijan turns out to be one of the important natural gas exporters of the region. The second stage of the project might play an important role in relations between EU and Azerbaijan in terms of energy.

Sangachal terminal²⁷

Located 55km south of Baku, the Sangachal terminal is a vital link in Azerbaijan's oil and gas industry. It is an oil and gas terminal that receives, processes, stores and exports crude oil and gas produced from all currently operated bp assets in the Caspian basin and has room for expansion. The terminal includes oil and gas processing facilities, the first pump station for the Baku Tbilisi Ceyhan (BTC) oil pipeline and South Caucasus gas pipeline (SCP) compressor and other facilities.

²⁶ <u>https://www.bp.com/en_az/azerbaijan/home/who-we-are/operationsprojects/shahdeniz.html</u>

²⁷ <u>https://www.bp.com/en_az/azerbaijan/home/who-we-</u>

are/operationsprojects/terminals/sangachal_terminal.html

The oil and gas from the offshore fields flow through the subsea pipelines into the terminal and they stretch across the entire length of the terminal. There are eight different pipelines entering the terminal from offshore locations and eight leaving it. They head off in different directions carrying premium quality Azerbaijani crude oil and gas to the world markets. In addition, the terminal receives third party oil from Kazakhstan and Turkmenistan.



Picture 1: Sangachal terminal

Source: Bp

Sangachal terminal also hosts two critical facilities for the Baku-Tbilisi-Ceyhan oil pipeline: the head pump station and the control room. The latter monitors the entire pipeline and can detect problems and isolate the necessary pipeline sections across all three countries or shut down the plant in case of emergency.

The daily capacity of the terminal's processing systems is currently 1.2 million barrels of crude oil and condensate, and about 81 million standard cubic metres of Shah Deniz gas, while overall processing and export capacity for gas, including ACG associated gas is around 100 million standard cubic metres per day.

Gas is exported via the South Caucasus Pipeline (SCP), the SCP expansion system and via Azerbaijan's pipelines connecting the terminal's gas processing facilities with Azerigas's national grid system. In 2022, oil and gas from ACG and Shah Deniz continued to flow via subsea pipelines to the Sangachal terminal. In 2022, the Sangachal terminal exported more than 232 million barrels of oil and condensate. This included about 225 million barrels through Baku-Tbilisi-Ceyhan (BTC) and around 7 million barrels through the Western Route Export Pipeline (WREP). On average, around 68 million standard cubic metres (about 2,416 million standard cubic feet) of Shah Deniz gas was sent from the terminal daily during the year of 2022.

The Heydar Aliyev Oil Refinery²⁸

The Heydar Aliyev Oil Refinery was established on the 29th of July 1953 by the USSR Ministry of Oil Industry. Formerly, the refinery had different names and was known as the New Baku Oil Refinery, AzerOilFuel Production Association, and AzerOilFuel Oil Refinery, respectively. On the 50th anniversary of the refinery on the 22nd of April 2004, it was named after the National Leader of the Azerbaijani people, Heydar Aliyev.



Picture 2: Heydar Aliyev Oil Refinery

Source: SOCAR

The Heydar Aliyev Oil Refinery processes 21 out of 24 types of Azerbaijani oil and produces 15 types of oil products. The list of the refinery's products includes

²⁸ <u>https://www.socar.az/en/page/the-heydar-aliyev-oil-refinery2</u>

gasoline, aviation kerosene, diesel fuel, petroleum coke, and fuel oil. It should be noted that the refinery meets the bulk of the domestic demand.

The oil refinery has 4 primary processing units: ED-AV-6, catalytic reforming, gradual coking, and catalytic cracking units, which were operated in 1976, 1980, 1986, and 1993, respectively. Preliminary oil refining is carried out in the combined package atmospheric-vacuum unit ED-AVQ-6 for pre-desalination of oil and re-expulsion of petrol. The products are sent as primary products to Azerikimya's Ethylene-Polyethylene Factory and other facilities. TC-1 jet engine fuel is produced in this unit and sent to consumers as a finished product.

The catalytic cracking unit, with an annual capacity of 2 million tons, allows the production of high-octane petrol components. In addition, the refinery produces technical propane, technical butane, and dry gas for Azerikimya and light condensate, which is essential for producing diesel fuel. The catalytic reforming unit, with an annual capacity of one million tons, produces a stable platformate that is one of the key components in producing A-92 petrol.

In addition, the refinery includes a hydrotreated diesel and gasoline production unit, a new bitumen unit with 400 000-ton production capacity, two primary refining units with a production capacity of 2 million tons each, and a unit for the production of Euro-4 diesel fuel and different oils with an annual capacity of 790,000 tons.

By 2017, the refinery had processed more than 300 million tons of oil. In 2019 and 2020, 6 and 5.9 million tons of oil were refined, respectively. However, due to the aging of the refinery's facilities and the growing demand of the domestic and foreign markets, it was decided to reconstruct and modernize it. In addition, the installation of new facilities to protect the environment and human health has become urgent. Therefore, the project is currently being implemented to increase the refinery's production capacity, optimize current costs, and bring the quality of oil products to the EURO-5 standard, as well as its reconstruction and modernization to meet the needs of Azerkimya PA in primary products.

It is noteworthy that Azerbaijan has already started reforms in its energy system to improve the security of supply and quality of petroleum products in the country. Now, one of the major investments is being made in the modernization of the SOCARS's Heydar Aliyev Oil Refinery, which is the main oil refinery in Baku. The refinery is processing 21 out of 24 grades of Azerbaijan crude and 15 different petroleum products, including automotive gasoline, aviation kerosene, diesel fuel, black oil, petroleum coke, and others. The plant is meeting the republic's entire demand for petroleum products completely, and 45% of its petroleum products are exported. According to Baku Oil Refinery officials from April 2022, the refinery was suspended for a major reconstruction and modernization process to increase the production capacity, produce high-quality fuel under EURO-5 standards, minimize environmental impact as well as increase the export potential of petroleum products. It should be noted after the completion of the major reconstruction process under the implementation schedule of the Modernization Project, from the 3rd quarter of the current year, the country will first produce Euro 5 Diesel. Also, the key target is to archive Euro 5 gasoline quality from the 3rd quarter of 2023. Improvement of the quality of petroleum products is highly important from production-side and demand-side because it ensures the security of supply in the country.

Energy exporting pipelines

Taking into account rich hydrocarbon reserves of Azerbaijan, the country needed pipelines to export its crude oil and natural gas to the global energy markets. Touching upon energy exporting pipelines, it is worth noting that today, pipeline politics plays crucial role for countries as exporting energy resources from energy producer to energy consumer involves different actors and each of those actors is interested in defending own interests. To this end, energy pipelines are the most usable method to export or import of energy resources. Azerbaijan is also using energy pipelines system to supply its own domestic distribution as well as export.

So, Azerbaijan exports most of its energy resources via pipelines which are very valuable critical energy infrastructure for the country. Energy infrastructure played an important role in socio-political life of the country. Exporting crude oil and natural gas, Azerbaijan developed energy sector and diversified energy supply routes. There are critical energy infrastructure exporting the Azerbaijani crude oil and natural gas to the international energy markets.

There are three main crude oil pipelines to export the Azerbaijani crude oil to the international energy markets. Exactly, crude oil pipelines played. Now, let us talk about these pipelines in detail.

Facility	Status	Capacity (thousand barrels per day	Total length (miles)	Origin	Destination	Details
Baku–Tbilisi– Ceyhan (BTC)	Operating	1,200	1,100	Sangachal terminal, near Baku, Azerbaijan	Ceyhan terminal, on Turkey's Mediterranean coast	First tanker loaded Ceyhar June 2006
Baku– Novorossiysk (Northern Route Export Pipeline)	Operating	105	825	Sangachal terminal, near Baku, Azerbaijan	Novorossiysk, on Russia's Black Sea coast	Started operati in 1996
Baku–Supsa (Western Route Export Pipeline)	Operating	100	515	Sangachal terminal, near Baku, Azerbaijan	Supsa, on Georgia's Black Sea coast	First tanker loaded Supsa i April 1999

Table 1. Azerbaijan's oil export pipelines

Sources: U.S. Energy Information Administration based on BP and SOCAR

The Baku-Novorossiysk Pipeline²⁹

During the first years of independence, Azerbaijan began to export its crude oil via the Baku-Novorossiysk pipeline through the Russian Federation. The first real option to start the export was through the Russian territory since that was much rational choice from the strategic and political approaches. Thus, Azerbaijan was interested in using the ready oil pipeline that was passing via the Northern Caucasus, which carries the Russian and Kazakhstan oil to Novorossiysk, a city on the shore of the Black Sea to provide it for consumers.

²⁹ https://www.socar.az/en/page/baku-novorossiysk-pipeline



Picture 3: The Baku-Novorossiysk Pipeline

Source: SOCAR

The contract about exportation of Azerbaijani crude oil via Baku-Novorossiysk pipeline was signed between SOCAR and Trasneft in 1996. The 231 km section of the pipeline passing through the territory of the Republic of Azerbaijan was built in 1996 while the 1,116 km Russian section was built in 1983. However, the direction of this part was later changed in 1995-1996 by SOCAR and AIOC (Azerbaijan International Operating Company). \$60 million was spent on the rerouting. Finally, on the 25th of October 1997, the Baku-Novorossiysk oil pipeline with a total length of 1,347 km was put into operation.

The oil transit from Azerbaijan to the port of Novorossiysk amounted to 249,710 tons in January-May 2019. The Baku-Novorossiysk oil pipeline transports oil extracted by SOCAR independently, as well as from onshore fields developed within joint ventures. SOCAR increased oil transportation via the Baku-Novorossiysk pipeline by 64.3 percent in 2021. During that period, SOCAR exported 1.7 million tons of oil through the Baku-Novorossiysk pipeline.³⁰

³⁰ https://www.azernews.az/oil and gas/187685.html

Baku Supsa Pipeline³¹

Developing oil sector of the country contributed also to growth of crude oil export, and this is, in turn, demanded alternative pipelines. At that time, as it was mentioned above Azerbaijan was exporting its crude oil mainly via Baku-Novorossiysk oil pipeline, but the former President, national leader Heydar Aliyev took right decision to establish new transport route for Azerbaijan's crude oil supply via Georgia. From geographical and economic point of view exportation of energy resources from Azerbaijan to the Black Sea or the Mediterranean via Georgia is the only way for the country. In addition, control of the whole Azerbaijan's oil by Russian monopoly was not favorable for the

Western companies, therefore in spite of pressure and difficulties the government of Azerbaijan managed to open new project that diversified Azerbaijan's energy routes.



Picture 4: Baku Supsa Pipeline

Source: Bp

Dependence of the country only on one transportation rout as well as other country was favorable neither economically nor politically. The contracts signed between International Operating Company of Azerbaijan, SOCAR and Georgia put basis of exportation of the "Azeri light" brand oil to the international energy

³¹ https://www.bp.com/en_az/azerbaijan/home/who-we-are/operationsprojects/pipelines/wrep.html

markets via Baku-Supsa through Georgia. So, 920 km length oil pipeline from Baku to Supsa, Black Sea started operation in April 1999, and the first oil from ACG filed was sent via this pipeline. Realization of the project was political and economic victory both for Georgia and Azerbaijan. Azerbaijan could export its "Azeri light" brand oil directly to the global energy markets without mixing Ural lower brand oil.

Georgia, in turn, became transit country as well as bridge connecting the Caspian energy with the global energy markets. The country got profits from the project as transit country which stimulated country's economic development. Baku-Supsa oil pipeline opened very important door for Georgia to participate in the future energy projects, and now it is very obvious that the country is participating in all important and huge projects, which are very favorable from political and economic standpoint.

According to Bp, today, Baku-Supsa is not in use, and the export of Azeri Light Azerbaijani oil is done only via the BTC oil pipeline. However, the pipeline is not frozen and is in a state of full readiness to start oil transportation at any moment. For example,

during the stoppage of tanker loading operations for Azerbaijani oil at the Ceyhan terminal after two devastating earthquakes in southeast Turkey on February 6, 2023, oil exports through the Baku-Supsa oil pipeline were temporarily resumed, and two tankers were loaded³².

It should be specifically underlined that the oil production from ACG filed demanded new and more powerful pipeline to carry increasing crude oil from energy rich Azerbaijan to the international energy markets, which was very important and profitable both for producer and consumer. Azerbaijan would be able to export the country's most valuable product and to get huge earnings for her economic development, and on the other hand consumers would be able to use oil to meet their energy demand as well as to ensure their energy security. Therefore, decision to open new oil pipeline, namely Baku-Tibilisi-Ceyhan (BTC) was one of the most important decisions in the country's history.

³² <u>https://interfax.com/newsroom/top-stories/88162/</u>

Baku-Tbilisi-Ceyhan (BTC)³³

BTC pipeline spanning three countries from the Caspian Sea to the Mediterranean coast. The pipeline carries oil from the Azeri-Chirag-Deepwater Gunashli (ACG) field and condensate from Shah Deniz across Azerbaijan, Georgia and Türkiye. It links Sangachal terminal on the shores of the Caspian Sea to Ceyhan marine terminal on the Turkish Mediterranean coast. In addition, crude oil from Turkmenistan and Kazakhstan was transported via the pipeline.



Picture 5: Baku-Tibilisi-Ceyhan

Source: Wix.com

The pipeline that became operational in June 2006 was built by the Baku-Tbilisi-Ceyhan pipeline company (BTC Co) operated by BP. The pipeline buried along its entire length is 1768km in total length: 443km in Azerbaijan, 249km in Georgia, and 1,076km in Türkiye. The Azerbaijan and Georgia sections of the pipeline are operated by BP on behalf of its shareholders in BTC Co. while the Turkish section is operated by BOTAS International Limited (BIL).

On 12 December 2021, BTC reached a significant milestone by achieving 500 million tonnes of oil export in total from the Sangachal terminal near Baku across Azerbaijan, Georgia and Türkiye to Ceyhan. It is worth noting that since the 1,768 km BTC pipeline became operational in June 2006 till the end of 2022, it carried a total of 3.99 billion barrels (more than 531 million tonnes) of crude oil loaded on 5,244 tankers and sent to world markets. On 18 January 2023, BTC achieved the 4 billion barrels of oil export milestone.

³³ https://www.bp.com/en_az/azerbaijan/home/who-we-are/operationsprojects/pipelines/btc.html

The pipeline provided insurance for the Western consumers and guarantee that the Western energy markets will no longer depend only on Middle East and Russian energy resources. From strategic point of view, BTC pipeline is a very important project not only for Azerbaijan, but also for all involved parties. It actually provides energy security for the consumers, and as they got access to new energy rich hub, they diversified respective supply routes that contribute positively to meet growing demand for energy to develop their economy. For other parties, the project opened new opportunity for economic development, huge money sources from export and transit as well as opening new work places. In addition, the BTC project can also be as guarantee of regional security because having close economic relations and interests the states used to choose mutual cooperation and flourishment. The pipeline not only contributed economically to involved parties, but also politically strengthened their independence.

As Jonathan Elkind argues "being states in search of their political and economic identities, BTC provides the participating states with a basis for their strategic role of suppliers and transit countries of the world's most important commodity: energy. Summing up the idea, it should be noted that that Baku-Tbilisi-Ceyhan pipeline faced many problems and many experts thought about it as a dream or illusion, but due to efforts of involved and interested parties actually the project came into the reality from illusion, and that was a real victory and benefit for all involved parties.

In the end, the BTC project also supported future natural gas projects in the country. The Southern Gas Corridor which is the inter-regional energy project to supply Azerbaijani gas to the European energy markets, became a reality after successful realization of BTC project. Today the country is important and reliable crude oil and natural gas to the global energy markets.

The Southern Gas Corridor (SGC)³⁴

The project aims to increase and diversify European energy supply by bringing gas resources from the Caspian Sea to markets in Europe. The Southern Gas Corridor comprises the following four projects;

I. operation of Shah Deniz natural gas-condensate field ("SD1" project) and its full-field development ("SD2" project),

³⁴ <u>https://www.sgc.az/en</u>

- II. the operation of the South Caucasus Pipeline ("SCP" project) and its expansion ("SCPX" project),
- III. the construction and operation of the Trans-Anatolian Natural Gas Pipeline ("TANAP" project) and
- IV. the construction and operation of the Trans Adriatic Pipeline ("TAP" project) (SD2, SCPX, TANAP and TAP collectively, the "Projects").



Picture 6: The Southern Gas Corridor

Source: <u>www.sgc.az</u>

The Projects have an estimated investment cost of approximately US\$40 billion. Upon completion, the SD2 project will add a further 16 bcm of natural gas per annum to 10.9 bcma (maximum production capacity) already produced under SD1 project. Total length of the newly constructed SCPX, TANAP and TAP pipelines will be more than 3,200 kilometres. The entity holding and managing the participating interests of the Republic of Azerbaijan in the Projects is Southern Gas Corridor CJSC.

South Caucasus Pipeline (SCP)³⁵

The SCP was built to export Shah Deniz gas from Azerbaijan to Georgia and Türkiye. The pipeline starts from the Sangachal terminal near Baku. It follows the route of the Baku-Tbilisi-Ceyhan (BTC) crude oil pipeline through Azerbaijan and Georgia to Türkiye, where it is linked to the Turkish gas distribution system.

The pipeline has been operational since late 2006 transporting gas to Azerbaijan and Georgia, and starting from July 2007 to Türkiye from Shah Deniz Stage 1. The length of the pipeline is 691km, with 443 km in Azerbaijan and 248 km in Georgia. The diameter is a 42-inch. The SCP has been operational since late 2006, transporting Shah Deniz gas to Azerbaijan, Georgia and Türkiye. The expanded section of the pipeline commenced commercial deliveries to Türkiye in June 2018 and to Europe in December 2020.

As from 20 March 2020 technical operatorship of the South Caucasus Pipeline (SCP) has been transferred from BP Exploration (Shah Deniz) Limited to SOCAR Midstream Operations Limited, a fully-owned subsidiary of SOCAR. The transfer of technical operatorship was carried out in fulfilment of the obligations undertook in the revised SCPC Pipeline Owners' Agreement, signed in December 2013 as part of the Final Investment Decision on the Shah Deniz Stage 2 and South Caucasus Pipeline Expansion (SCPX) projects.

According to the State Statistical Committee, Azerbaijan exported more than 20 billion 803.7 million cubic meters of gas via the Baku-Tbilisi-Erzurum (the South Caucasus Pipeline) pipeline in 2022, which accounts for 53 percent of total natural gas export.³⁶

The Trans-Anatolian Natural Gas Pipeline (TANAP)³⁷

TANAP project is one of the most significant indicators of the successful cooperation between the sister countries of Turkey and Azerbaijan in the field of energy – is the most important section of the Gas Corridor linking to the South Caucasus Pipeline (SCP) and the Trans Adriatic Pipeline (TAP). TANAP can claim to be the longest (1,811 km) natural gas pipeline and to have the largest diameter (56") in Turkey, the Middle East and Europe, and was built to transport

³⁵ <u>https://www.bp.com/en_az/azerbaijan/home/who-we-are/operationsprojects/pipelines/scp.html</u> 36

https://azertag.az/en/xeber/Azerbaijan exports up to 21 billion cm of natural gas via Baku Tbilisi Erzur um_pipeline_in_2022-2454740

³⁷ <u>https://www.tanap.com/en/tanap-project</u>

the natural gas extracted in Azerbaijan's Shah Deniz Region first to Turkey and then to Europe.

TANAP begins from the Georgian-Turkish border connecting to the SCP system, go through the territory of Turkey ending at Ipsala region near the Greek border and further connecting to TAP (European leg of the SGC) system for delivery of natural gas to Europe. Gas delivery via TANAP to Turkish energy consumers has been already implemented very successfully.

This is the interregional energy project, which supports connectivity and regional cooperation. TANAP plays a very crucial role as the project has both economic and geopolitical significance. Firstly, Azerbaijan showed ambitious desire to be a net gas exporter to the European energy market, which is highly dependent on Russian gas sources, and the security of supply and sources is a sensitive issue for the EU energy security. Delivering new gas sources from the Caspian Sea to European energy consumers, Azerbaijan will contribute to EU energy security.

The initial capacity of the pipeline is 16bcm/year and with a maximum 31 bcm/year, Azerbaijan will be able to increase the volume of natural gas by transporting not only the natural gas from the SD field but also from other gas fields directly to Europe. TANAP is important for Turkey because Turkey will meet both growing natural gas demand and become a transit country. Energy projects make Turkey a regional energy hub and increase its geopolitical importance.

It is worth noting that Azerbaijan supplied 8.4 bcm of gas to Turkey (38% of all exports), alongside 2.5 bcm to Georgia (11% of all exports). A total of 5.6 bcm of gas were supplied to Turkey in the reporting period through the TANAP pipeline. ³⁸ It is clear that TANAP contributes to the further development strategic partnership between Azerbaijan, Turkiye and Europe. By this, Azerbaijan became as alternative and reliable gas source for Europe and the second largest gas supplier to the Turkish energy consumers.

- ³⁸ <u>https://interfax.com/newsroom/top-</u>
- stories/86873/#:~:text=Azerbaijan%20supplied%208.4%20bcm%20of,period%20through%20the%20TANAP%2
 Opipeline.

Trans Adriatic Pipeline (TAP)³⁹

The TAP pipeline is a new inter-regional export gas pipeline for bringing gas to the European consumers from the Shah Deniz 2 offshore gas field in the Caspian Sea (SD2). TAP offers reliable transmission services to shippers, providing direct access to the gas markets of Greece, Albania and Italy, and indirect access to the wider region including Bulgaria. The pipeline starts at the Turkish-Greek border at Kipoi, connecting Greece, Albania and ending in the final destination in the southern part of Italy. The initial capacity of the pipeline is 10 bcm/year of gas, and a future expansion will increase the pipeline's throughput capacity up to 20 bcm/year. The commercial operations commenced at the end of 2020.

The TAP project became a reality due to the cooperation of all involved actors. It is a mega energy project, which involves several countries, international energy companies, as well as financial institutions such as ADB, EBRD and EIB.

From a geopolitical standpoint, TAP is the first pipeline supplying Caspian gas to Europe. Taking into account the volatility in oil markets, it was highly important for the country to be a net gas exporter. TAP demonstrated cooperation and integration between Azerbaijan, Turkey and European countries. In addition, the pipeline contributes to economic, political as well as energy security of all involved actors.

For Europe, first of all, TAP pipeline is a diversification of gas sources and supply routes. Azerbaijani gas supplies will reach South Eastern, Central and Western Europe, and those regions have high gas dependence on a few suppliers.

Another important point is the role of gas interconnectors, because the EU is interested in developing natural gas interconnectors and invests in them. TAP pipeline creates favorable conditions for countries to support energy security by developing gas interconnectors.

For instance, the Gas Interconnector Greece – Bulgaria (IGB) connects Greece to Bulgaria. For south-east Europe, TAP can provide an exit point to the planned Ionian Adriatic Pipeline (IAP) to link to the markets in Croatia, Albania, Montenegro, and Bosnia and Herzegovina. Now, it is very obvious that TAP is a

³⁹ <u>https://www.tap-ag.com/about-tap/tap-mission-and-vision</u>

direct and cost-effective transportation route to south-east European countries and beyond.⁴⁰

After signing of the "Memorandum of Understanding on a Strategic Partnership in the Field of Energy" between Azerbaijan and Europe in 2022, Azerbaijan will increase imports of Azerbaijani natural gas to Europe by at least 20 billion cubic meters (bcm) per year by 2027.

In general. in 2021, the country exported around 19 bcm of gas; in 2022, the figure was 22.6 bcm; and in 2023 gas exports are expected to be about 24.5 bcm. Last year, approximately 11.4 bcm of gas were delivered to Europe. ⁴¹ During January-March 2023 natural gas export increased by 11.2%. During this period 2.9 bcm of gas was exported to European energy markets, 2.7 bcm to Türkiye, and 0.9 bcm to Georgia⁴².

The realization of all segments of SGC underscores yet again Azerbaijan support for inter- regional projects. In the South Caucasus, the end of the 44-day war between Armenia and Azerbaijan has brought new realities and economic perspectives to the region. Azerbaijan also welcomes Central Asian countries to join the SGC network to supply gas to Europe. Full economic integration of the region and opening of transportation corridors will create additional economic opportunities for the states in the region in the future. This may well be the strongest factor for durable peace in the region and its stability.

Conclusion

The former Armenia-Azerbaijan war and the ongoing war between Russia and Ukraine are serious danger to critical energy infrastructure in Eurasia. During the war between Armenia and Azerbaijan, Armenian forces tried to attack Azerbaijani energy infrastructure. Armenia's attack in Azerbaijani Tovuz district was attack not only against Baku but also attack against European partners. All above mentioned energy projects created backbone for close cooperation between Azerbaijan and partners, and Azerbaijan supports energy security and sustainable development for Europe through all these energy projects. Thus, critical energy infrastructure is very important for our European partners.

⁴¹ <u>https://caspiannews.com/news-detail/azerbaijan-boosts-gas-supplies-to-european-markets-2023-2-6-0/</u>

⁴⁰ <u>https://www.euractiv.com/section/azerbaijan/opinion/the-news-you-possibly-missed-tap-pipeline-up-and-running/</u>

⁴² <u>https://apa.az/en/energy-and-industry/azerbaijans-gas-export-increases-by-more-than-11-in-iq2023-400614</u>

Armenia also attacked another energy infrastructure in Azerbaijan by launching missiles towards the Mingachevir Dam, a civilian infrastructure project that is also a vital component of Azerbaijan's largest hydroelectric power plant. In case of destruction of dam, it would cause massive environmental catastrophe as well as civilian causalities. By targeting critical energy infrastructure in Azerbaijan, Armenia aimed at jeopardizing inter-regional energy cooperation.

It is worth noting that especially today when Western sanctions hit Russian energy exports, diversification of energy supply sources and routes is crucial for Europe. Azerbaijan increases both crude oil and natural gas supplies to Western energy markets and support their efforts to ensure long-term energy security. In 2021, the country exported around 19 bcm of gas; in 2022, the figure was 22.6 bcm; and in 2023 gas exports are expected to be about 24.5 bcm. Last year, approximately 11.4 bcm of gas were delivered to Europe. During January-March 2023 natural gas export increased by 11.2%. During this period 2.9 bcm of gas was exported to European energy markets, 2.7 bcm to Türkiye, and 0.9 bcm to Georgia.⁴³

Today, the EU and Azerbaijan opened up a new era in energy cooperation. Important documents signed between EU and Azerbaijan support export both fossil fuels and renewable energy from Azerbaijan to Europe. The "Memorandum of Understanding on a Strategic Partnership in the Field of Energy" signed on July 18, 2022 envisages increased volume of the Azerbaijani gas to Europe via the Trans Adriatic Pipeline (TAP), and reach at least 20 billion cubic meters (bcm) per year by 2027. Currently, Azerbaijan exports its natural gas to Georgia, Turkiye, Greece, Bulgaria, Italy and Romania.

It is also worth noting that the ongoing war in Ukraine continues to destroy critical energy infrastructure in the country. Between October 2022 and February 2023, there were significant attacks on Ukraine's energy infrastructure, resulting in emergency power outages that lasted up to three days in some instances. However, in cities like Kyiv, energy supply was maintained on a schedule, with electricity being turned off for a few hours and then turned back on. Despite intermittent electronic transport, heating, and water supply, local administrations and volunteers set up heating points with electric generators and charging points for electrical appliances.

⁴³ <u>https://apa.az/en/energy-and-industry/azerbaijans-gas-export-increases-by-more-than-11-in-iq2023-400614</u>

Many shops continued to operate using diesel electric generators, and private electric storage stations, powerful power banks, and household gasoline generators became increasingly popular. Despite the challenges, citizens showed resilience and endurance, with no signs of dissatisfaction that the Russian power was counting on. In the end, Azerbaijan has managed to protect all its critical energy infrastructure, but in Ukraine, there are many destructions. Ukraine will need billions to restore critical infrastructure destroyed during the war. All the above-mentioned, confirms once again that the protection of critical energy infrastructure is highly important for both energy producers and consumers.

Authors;

Shahmar Hajiyev, Senior advisor at the Center of Analysis of International Relations.

Viacheslav Potapenko, National Institute for Strategic Studies of Ukraine, Head of Center for Domestic Policy Study, Dr. of Sciences in Economy, PhD.

The opinions expressed are those of the author(s) alone and they do not necessarily reflect the opinions or views of the AIR Center and its website.