JUST TRANSITION FOR UKRAINE

CONTENTS

1

ENERGY MARKETS IN UKRAINE: LIBERALISATION OF ELECTRICITY AND GAS MARKETS IN UKRAINE

Energy prices and fuel poverty have become one of Ukraine's most acute problems. According to Ukraine's Statistics Service, about 30% of rural residents and 17% of urban residents stated that they did not have enough funds to cover their heating costs in 2019. The increase in gas prices hit the residents of rural areas the most, as they often use natural gas for heating. In 2020, fuel poverty became worse due to the Covid-19 pandemic. With the Russian invasion of Ukraine on 24 February 2022, much of Ukraine's energy infrastructure was damaged or destroyed. It is estimated that Ukraine's power generation fell by 40%, whie gas production decreased by 30%. Coal production is also estimated to have fallen by about 30% since then. The Zaporizhzhia nuclear power plant — Europe's largest — has been occupied by Russian forces since March 2022. The ongoing war is going to further exacerbate the economic situation in Ukraine, including the issue of fuel poverty. Moreover, the war will also result in high energy and food prices globally.

This part of the article focuses on Ukraine's utilities policy. It examines the liberalisation process of electricity and gas markets in Ukraine and addresses issues related to natural monopolies, the role of regulatory authorities. Additionally, it elaborates on the challenges of a free market in the electricity and gas sector.

To understand how energy prices are formed in Ukraine, it is necessary to consider Ukraine's regulatory authority, which is responsible for setting tariffs for public utilities. This function is performed by the National Commission for State Regulation of Energy and Public Utilities (NEURC, or the regulator). In tariff policy, local governments also play a crucial role. The regulator is defined as a government body that performs state regulation, monitoring and control over the activity of firms operating in energy and utilities.

One of the central concepts to understand utilities policy is that of a natural monopoly. A natural monopoly exists when average aggregate costs continuously decrease as a manufacturing company gets larger. Energy networks such as the networks for transmission and distribution of electricity and gas are examples of natural monopolies. The effect of scale of a natural monopoly is so great that a product can be produced with lower costs by one company than if it is produced by several companies.

Involving local governments, the regulator conducts open hearings on tariffs for natural monopolies. After collecting proposals from local governments, tariffs are approved by the NEURC, which implies that the regulator plays a key role in setting tariffs for natural monopolies.

HOW DID THE ELECTRICITY MARKET EVOLVE IN UKRAINE?

Since 2020 a new model of the electricity market has been put in place as a result of Ukraine's commitments to the European Union and the condition of receiving €500 million of financial assistance. The law "On the Electricity Market" was adopted to implement the EU's third energy package, under which Ukraine is obliged to liberalise the electricity sector ensuring the transition from regulated tariffs to market prices. This is typically implemented by breaking up vertically integrated companies with the aim to split up the generation, transmission, distribution and retail activities known as the unbundling process.

Retail and wholesale electricity markets were set up to open the electricity market to free competition. Oblenergo, regional energy companies responsible for both distribution and supply, were split into two separate companies including a distribution system operator and a supplier company. The companies currently dominating the market are Dnipro Energy Services LLC, Kyiv Energy Services LLC and Donetsk Energy Services LLC, all of which are unsurprisingly owned by Rinat Akhmetov's DTEK, the largest private energy company in Ukraine.

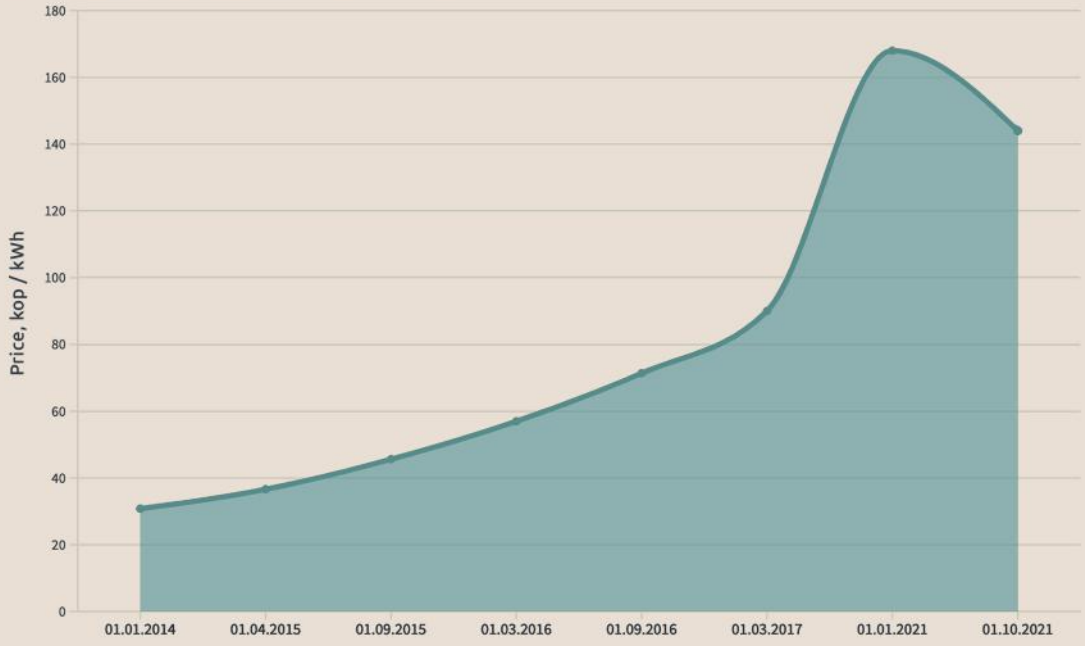
By introducing choice at the retail stage through retailing companies or even direct access to the wholesale electricity market, consumers are assured of the unique opportunity to choose the cheapest supplier offering a plethora of promotions and digital services. However, the international experience demonstrates that a variety of retailers competing for consumers does not necessarily contribute to lower prices. On the contrary, their additional expenditures to attract and retain customers, which a natural monopoly would not normally have because of its dominating position on the market, might lead to an increase in prices for consumers. Based on the example of AGL Energy Ltd, Australia's biggest electricity generator, it can be clearly demonstrated that marketing costs are passed on to customers in the form of higher electricity bills. Additionally, 24% of the average residential customer's electricity bill goes to AGL shareholders in the form of profit. This corresponds to $450 of pure profit of the $1,855 average bill for a retail customer.

Thus, the ability to choose a retailer does not reduce electricity prices. After the opening of the retail market, electricity prices grew by 22% in Belgium by 30% after three years in Ireland, by 36% after three years in the Netherlands, by 37% after three years in Spain, and, finally, by 60% after

* Figure 1. Change in electricity prices for residential consumers (for consumption up to 100 kWh).

CHANGE IN ELECTRICITY PRICES FOR RESIDENTIAL CONSUMERS IN UKRAINE (for consumption up to 100 kWh)

FIGURE 1



two years in Greece. Therefore, when the electricity market starts to operate fully and the fixed electricity tariff is abolished, Ukrainians could anticipate further price increases.

The following image depicts the main components of the electricity tariff based on the example of Kyiv according to the data from 2021.

It can be anticipated that the final electricity price will significantly increaseHowever, despite the government's liberalisation agenda, it still regulates electricity prices for consumers. The current "transitional" price is supposed to mitigate the transition to a market price, which has already caused a 30% decrease in payments of electricity bills from households.

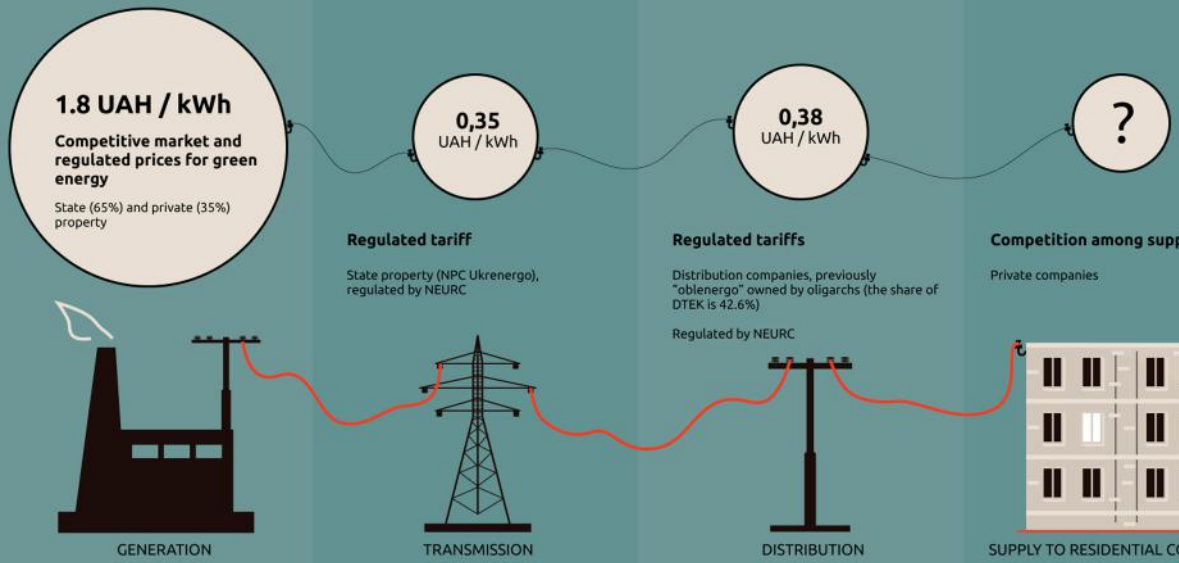
As a member of the European Energy Community, Ukraine committed to adopt the energy-relevant parts of the EU legislation. In 2017, Ukraine signed an agreement on its connection to Europe's grid with the European Network of Transmission System Operators for Electricity (ENTSO-E). Although the agreement set out technical steps to complete the synchronisation with the continental grid, both Ukraine and the EU had to carry out necessary measures that would have been implemented no earlier than January 2023. Until recently, most of the Ukrainian power system, except for the part called Burshtyn island, was synchronised with the power systems of Russia and Belarus.

As part of the synchronisation process with the European power grid, it was expected that the Ukrainian power system would operate in an isolated mode from 24 February 2022 to 27 February 2022 to prepare it for ENTSO-E synchronisation. On 27 February 2022, as a result of the Russian invasion, Ukraine's Transmission System Operator (TSO) "Ukrenergo" sent a request to the Continental Europe TSOs for emergency synchronisation of Ukraine's power system. As a result, Ukraine joined the European power system ENTSO-E on 16 March 2022. It is expected that it would increase the stability of the Ukrainian power system, as well as provide more energy security in the future.

* Figure 2. Structure of the electricity tariff for the population after the transition to market prices (based on the example of Kyiv).

Structure of the electricity tariff for the population after the transition to market prices (based on the example of Kyiv)

FIGURE 2



Competition at the supply stage does not have much influence on the final price of electricity. The regulator should rather reduce inflated electricity prices at the stage of its generation and distribution.

HOW WAS THE GAS MARKET FORMED?

On August 1, 2020 the retail gas market was launched in Ukraine.

The following chart shows a drastic increase in gas prices in 2015 hitting its peak in November 2018 after negotiations between Ukraine's government and the International Monetary Fund (IMF) to raise gas prices for consumers*.

In January 2021, only half a year after the market for household gas was liberalised resulting in price increases, mass protests erupted all over the country forcing the government to cap the price.

The following image outlines the main components of the natural gas price based on the example of Kyiv according to the data from 2021**.

Figure 4. Gas price for residential consumers after transition to market prices (based on the example of Kyiv).

Following the signing of the memorandum with the IMF in November 2021, Ukraine's largest gas production company "UkrGasVydobuvannya" is expected to sell 50% of its gas at market prices starting from May 2022. From 2024 onwards, all of its gas will be sold at market prices, which means a significant price increase that will negatively impact consumers.

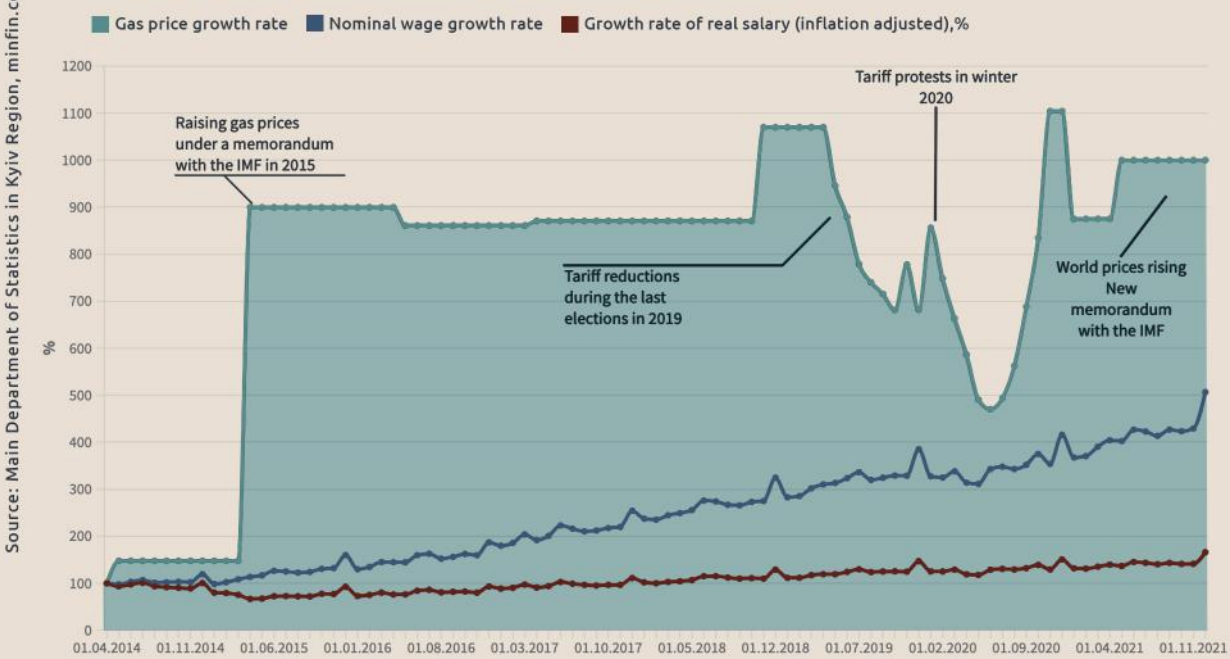
* Figure 3. Changes in natural gas prices for the population (for cooking purposes and water heating, on the example of Kyiv).

** Figure 4. Gas price for residential consumers after transition to market prices (based on the example of Kyiv).

FIGURE 3

RISING GAS PRICES AND WAGES IN UKRAINE

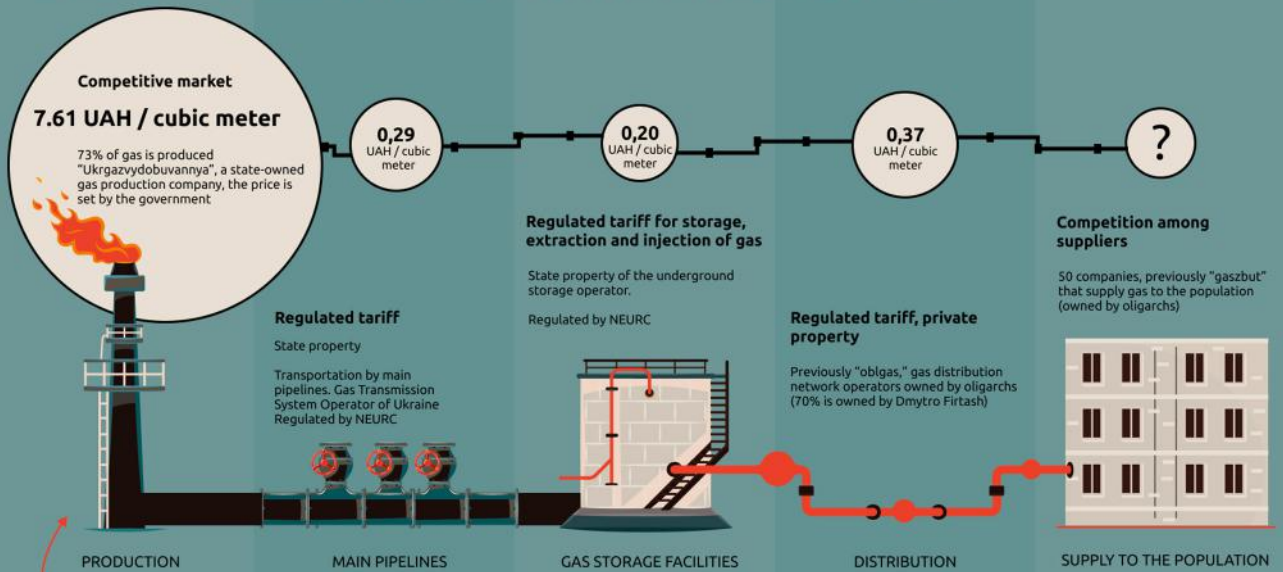
On the example of wages and gas prices in the Kyiv region. (Kyivoblgaz Zbut LLC)



Source: Main Department of Statistics in Kyiv Region, minfin.com.ua

Electricity price for residential consumers after transition to market prices (based on the example of Kyiv)

FIGURE 4



! Gas tariffs could be meaningfully reduced at the extraction stage, not at the distribution or retail stage. The government could do this by setting a fair price for gas extracted in Ukraine.

WHAT ARE NATURAL MONOPOLIES AND WHY IS COMPETITION NOT A SILVER BULLET?

Natural monopolies occur when one firm can produce certain goods at a lower cost than two or more firms can. In the case of natural monopolies, introducing competition by encouraging new firms to enter the market creates a potential loss of efficiency.

Electricity is a commodity that cannot itself be stored, but it can be converted to other forms of energy that can be stored and later converted back to electricity if there is demand

Four stages of electricity production have been typically identified: generation, transmission, distribution and supply to consumers. Electricity is produced in generators at power plants. After entering a transmission substation at the power plant, the electricity is stepped-up to high voltages for long-distance transmission by transformers. For electricity to be used in homes or business, it is stepped-down from the high-voltage transmission system to a lower voltage to make it suitable for the local distribution system of a particular area.

Electricity generation, transmission and distribution have been traditionally associated with large investments and high costs. In the case of natural monopolies, it is more efficient to allow only one company to supply the market because introducing competition would imply a wasteful duplication of resources. The very high costs of building a power transmission or distribution system would prohibit new companies from entering the market. It is common that there are technological and price barriers for new market entrants. To society, the high costs associated with building and operating additional networks would be wasteful.

Regional electricity distribution companies are in charge of distribution substations that lower voltage from the high-voltage transmission to a lower voltage to supply electricity to industrial and domestic consumers. In Ukraine, distribution companies are almost entirely owned by oligarchs. For example, Akhmetov's DTEK bought 68% of Odesaoblenergo shares and almost 94% of Kyivoblenergo shares in 2019. Among other owners of Oblenergo are Ihor Kolomoisky, Konstantin Grigorishin, Alexander Babakov, Igor

Surkis and other Ukrainian and Russian business representatives with significant political influence. However, what is often missing in the public discourse on natural monopolies is that they are subject to state regulation regardless of the form of ownership.

There is a widespread belief that private sector companies are generally more efficient, in electricity and other sectors. The Ukrainian discourse is dominated by a belief that natural monopolies are outdated interfering with an efficient development of markets, whereas natural monopolies are erroneously perceived as evil and corrupt monopolies. However, given that natural monopolies exist everywhere, the Ukrainian media should rather focus on scrutinizing the work of Ukraine's regulatory authority. That being said, the NEURC is usually composed of energy business representatives lobbying for gas, coal or nuclear interests.

Numerous studies demonstrated that privatisation and liberalisation do not lead to a reduction in electricity prices; on the contrary, prices tend to increase for consumers. The experience of the United Kingdom indicates a significant increase in prices after market liberalisation. The process of unbundling loses the economies of vertical integration, which results in a decrease in efficiency of the sector as a whole. Competing companies incur additional costs associated with raising capital, advertising and marketing as well as customer retention. For instance, Australian AGL spends $ 101 per customer annually to retain consumers.

Similar to the electric power industry, the gas sector consists of four vertically connected components: production (gas extraction), transmission (transport through a high-pressure pipeline network), distribution (transport through local or regional pipeline networks) and supply to consumers. Akin to electricity, competition in transportation and distribution of gas is rather irrational.

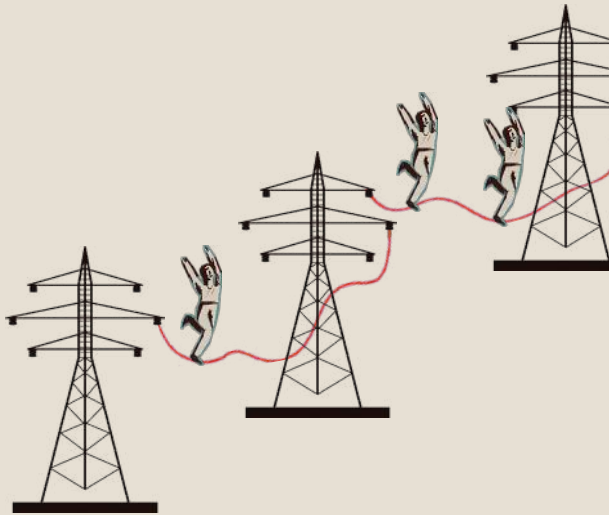
Distribution of gas is a highly controversial topic in Ukraine. Regional gas distribution companies were privatized in the 1990s. More than 70% of them are now controlled by Dmytro Firtash, another famous Ukrainian oligarch. He and other private owners had to pay for gas transportation through state-owned gas distribution pipes. However, according to a 2012 resolution issued under prime minister Azarov, the pipes were granted for use to regional gas distribution companies for free. In fact, they have been using state-owned distribution pipes free of charge since 1996. This is where a regulatory authority failed to meet its responsibilities to ensure the independence and transparency of distribution system operators.

WHAT SHOULD BE A FAIR PRICE?

The price should not far exceed the production cost of electricity or gas. Countries with a liberalised electricity and gas market demonstrate inflated prices, the reason for which is linked to both privatisation and lack of the fact that the regulator does not protect the interests of consumers.

Private companies are less transparent, as they can always refer to their commercial confidentiality. For example, the cost of electricity from nuclear power is published in a report of Energoatom, a state-owned nuclear company, while the cost of thermal electricity, most of which is produced at private thermal power plants of DTEK, is classified.

However, state-owned companies are not a silver bullet by definition. The winning formula would be to ensure that natural monopolies operate under conditions of accountability and transparency, involve consumer representatives, as well as take into account the interests of the population.



2

ELECTRICAL ENERGY MARKET REFORM. THE THREAT OF DEREGULATION

This section focuses on the liberalisation process of the electricity market in Ukraine. It examines the main regulatory models of the power market and looks at the experience of the UK, France and Poland in their approaches to reorganising the power sector.

WHAT DOES ELECTRICITY LIBERALISATION MEAN, AND WHAT ARE THE MODELS OF ELECTRICITY MARKETS?

During the transition to a competitive market, the electricity system is divided into separate operating segments including generation, transmission, distribution and retail. In developed countries, the aim of liberalisation was to reduce electricity prices by increasing production efficiency. At the same time, states intended to shift their responsibility to private actors. In developing countries, deregulation of electricity can be explained by a lack of public funds for the development of the power industry and the search for private investment. These are often the arguments presented in Ukraine.

It is worth taking a look at countries where liberalisation led to a significant increase in prices, which is often omitted in debates about the benefits of unbundling the electricity sector. Some countries have returned to regulated electricity markets, such as France, Japan and some US states. Interestingly, even the United States, known for its liberal policies, is highly regulated, and the Federal Energy Regulatory Commissions, as well as regional energy commissions cap the profits of energy companies and regulate prices.

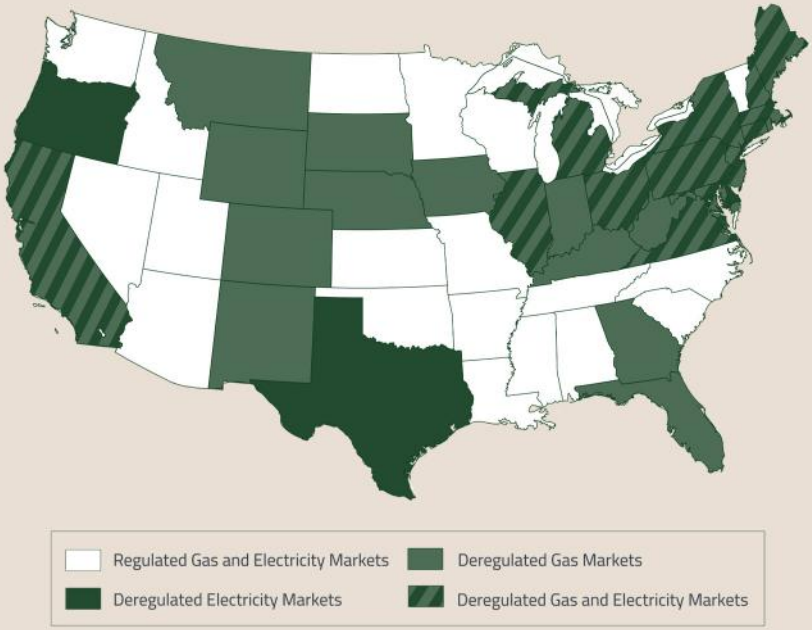
This map* shows that most states have regulated gas and electricity markets.

To dive deeper into the developments in Ukraine's energy markets, it is necessary to understand which regulatory models of energy markets exist.

The first regulatory model is associated with centralised long-term planning by a publicly owned or publicly controlled institution. These are typically vertically integrated companies responsible for the generation, transmission, distribution and retail of electricity.

* Figure 5. Methods of regulating natural gas prices in the United States

FIGURE 5


Regulated Gas and Electricity Markets
Deregulated Gas Markets
Deregulated Electricity Markets
Deregulated Gas and Electricity Markets

The second regulatory model is known as the so-called Single Buyer model. The generation is divided into several companies that compete for electricity retail to a single purchasing agency. The latter buys electricity from producers at various tariffs approved by the regulator and supplies it to consumers at an average weighted price. Until recently, the Single Buyer model existed in Ukraine, where its functions were performed by the state-owned company Energorynok created in 1997. The Single Buyer is the designated monopsony purchasing electricity from generating companies competing for long-term power purchase agreements.

The third model is associated with a liberalised wholesale market, in which electricity generating and distribution companies compete. Transmission is carried out by a separate, usually state-owned, company that delivers generated electricity to the distribution grid in a populated area. In Ukraine, this function is performed by the National Power Company Ukrenergo. Prices in the wholesale market are subject to competition, while the activities of distribution companies and retail electricity prices are regulated.

The fourth model involves a fully liberalised retail market with no regulated prices.

CHARACTERISTICS OF THE ELECTRICITY MARKET DEVELOPMENT IN UKRAINE

The first attempts to reform the electricity sector in Ukraine began in 1996 with the Wholesale Electricity Market of Ukraine (WEM) based on the "single buyer" regulatory model. In 2000, the state-owned company "Energorynok" was founded, following the example of the Electricity Pool of England and Wales. Generating companies produced electricity and sold it to Energorynok, which, in turn, sold it on the wholesale market to distribution companies and independent suppliers. In the late 1990s, distribution companies, known as the so-called "oblenergos", were mostly privatised. As a result, the vast majority of them are now wholly or partly owned by the oligarchs.

Energorynok served as a wholesale supplier of electricity until July 2019. Later, state enterprises "Market Operator" and "Guaranteed Buyer" were created instead. The former organises the sale and purchase of electricity and monitors the functioning of a day-ahead and intraday market. The latter was created to purchase electricity at a higher feed-in tariff from renewable energy producers. With the introduction of the market, Guaranteed Buyer buys electricity from Energoatom and Ukrhydroenergo to sell it at a regulated price for households.

The state still has the leverage to keep the price for the population relatively low. Despite liberalisation, electricity distribution is regulated as a natural monopoly. However, the new scheme excludes thermal power generation owned by private businesses. Oligarch-controlled thermal power plants can sell electricity to businesses at market prices, while state-owned nuclear power plants and hydropower plants have special responsibilities (PSOs), a mechanism that provides a "reduced" price for the population.

INTERNATIONAL EXPERIENCE

The experience of many EU countries shows that a reduction in electricity prices promised in the wake of liberalisation was not achieved. Following the introduction of a competitive wholesale electricity market in 2004–2008, the EU faced a significant rise in prices that exceeded previously regulated tariffs*.

Research has shown that prices increased due to the marginal pricing principle that established the market price of electricity. According to marginal pricing, the most expensive generation unit needed to cover the demand for electricity establishes the price to be paid by all consumers, as well as the profit received by all generating companies within one zone.

To understand what electricity liberalisation looks like in practice, it is worth considering different examples including the UK, France and Poland, which demonstrate a different extent of liberalisation of the power sector.

UNITED KINGDOM

The United Kingdom was one of the first countries to liberalise the power sector in the late 1980s. There are four regional TSOs that own and operate the transmission system in England and Wales, Scotland and Northern Island. The National Grid Electricity System Operator (National Grid ESO) operates the transmission system in England, Wales and Scotland as a whole and ensures the stable and secure operation of the national transmission system**.

14 distribution network operators, which belong to six different groups, own, operate and maintain distribution networks based on geographic areas. Interestingly, only 11.5% of distribution networks are owned by British companies, while 47% are in possession of American ones.

Ofgem, the Office of Gas and Electricity Markets, is Great Britain's energy regulator responsible for protecting consumer's interests. Ofgem is in charge of setting the price controls applicable to each of the three companies that own high-voltage transmission system in Great Britain. The RIIO (Revenue=Incentives + Innovation + Outputs) is the model used for regulation of network charges, which sets a limit on

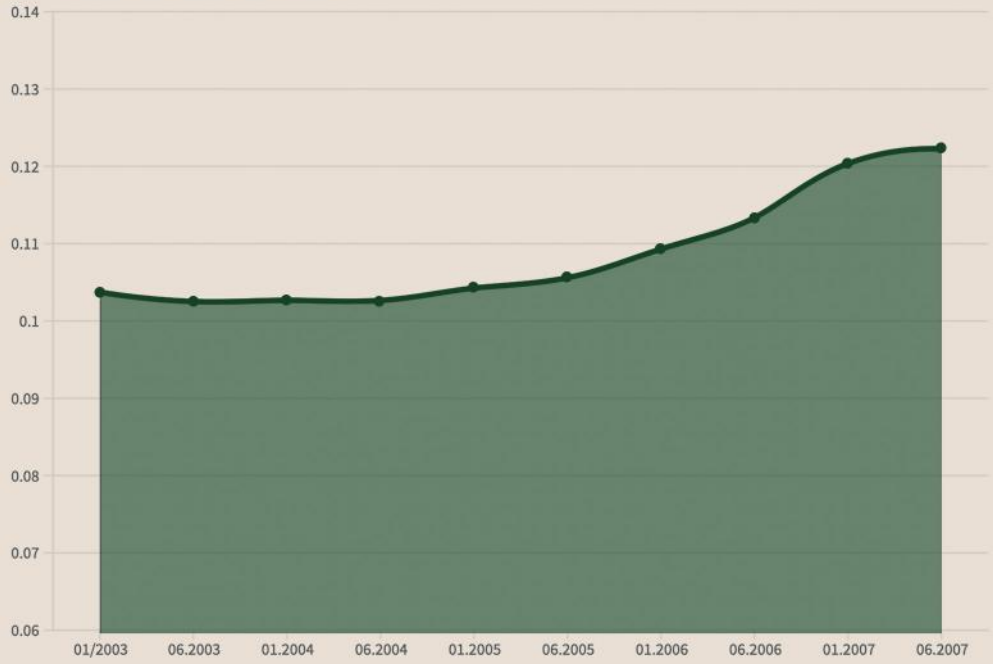
* Figure 6. The average price of electricity for household consumers (for 15 EU Member States).

** Figure 7. The price of electricity for household consumers in the UK.

FIGURE 6

THE AVERAGE PRICE OF ELECTRICITY FOR HOUSEHOLD CONSUMERS

(for 15 EU Member States, EUR / kWh)



Source: EUROSTAT

FIGURE 7

THE PRICE OF ELECTRICITY FOR HOUSEHOLD CONSUMERS IN THE UK EUR / kWh

Source: EUROSTAT

the amount a transmission and distribution system operator may charge. Transmission and distribution network owners must report on their performance against the price control every year.

Ofgem also operates the energy price cap, a limitation on the amount that energy suppliers can charge customers who have standard variable and prepayment tariffs, as standard variable tariffs usually comprise the most expensive prices on the market.

FRANCE

The electricity sector was liberalised in 2007 in France. As it can be seen on the graph below, electricity prices have significantly increased in France, a trend following the liberalisation across the European Union*.

Despite the liberalisation and opening of generation to competition, the lion's share of electricity generation and retail in France is still held by EDF, a French power utility, largely owned by the state. Additionally, transmission and distribution are regulated and operated by subsidiaries 100% owned by EDF. RTE, France's transmission system operator and an EDF Group subsidiary, is the monopoly regulated by the French Energy Regulatory Commission (CRE). RTE income is not linked to a market price but rather to a tariff for transmission known as the Public Transmission User Tariff, which is set by the CRE based on projected network expenditure. Enedis, an EDF Group subsidiary, is the distribution system operator covering 95% of French communes, which is also subject to regulation by the CRE. The distribution network is owned by local authorities, such as French municipalities, which sign concession contracts with Enedis.

With France being the world's second largest nuclear power producer, EDF owns all 56 nuclear power plants, which produce more than 70% of electricity in the country. The French state currently owns 84% of EDF, but due to the energy crisis triggered by the Russian war against Ukraine, the state is seeking to take full control of EDF, offering to pay 9.7 billion euros. According to French law, EFD is obliged to sell parts of its nuclear electricity to the competition at a fixed price (€42/MWh) and buy it back at a market price, which currently stands above €200/MWh. The scheme implies that the company operates at a loss, which trade unions have called a "plundering" of EDF.

* Figure 8. The price of electricity for household consumers in France.

FIGURE 8

THE PRICE OF ELECTRICITY FOR HOUSEHOLD CONSUMERS IN FRANCE EUR / kWh

Source: EUROSTAT

POLAND

There are four nationwide vertically integrated energy companies in Poland — PGE, Tauron, Energa and Enea, which serve four regions. In three of them, the state owns most shares. Despite competition in generation, the Polish "big four" produced about 70% of electricity in 2019. The transmission system operator PSE is the sole operator of Poland's high-voltage transmission lines responsible for the transmission of electricity whose sole shareholder is the Polish State Treasury. There are five large distribution system operators on the market, which carry out distribution activities based on regions. Despite a growing number of suppliers in the retail market, the share of companies from outside the four biggest Polish energy groups is still small. The leaders still cover more than 90% of the market. Network tariffs are approved by the President of URE, Poland's Energy Regulatory Office*.

* Figure 9. The price of electricity for household consumers in Poland.

FIGURE 9

THE PRICE OF ELECTRICITY FOR HOUSEHOLD CONSUMERS IN POLAND EUR / kWh

Source: EUROSTAT

MAIN CHARACTERISTICS OF THE ELECTRICITY SECTOR

1. High capital intensity and long-term construction of power plants

In conventional power plants, it usually takes from several years to decades for new power plants to be designed and constructed, as well as the investments to be paid off. This implies a major risk for investors. The market theory about investors' reaction to prices does not really work. Spot markets are supposed to provide "price signals" for attracting investments in production capacities to secure more demand. However, years of spot markets showed extremely fluctuating prices. The participation in such markets takes place under variable costs without considering fixed costs of power plants.

2. Economies of scale

An important characteristic of electricity production has been the existence of economies of scale. In the case of natural monopolies, average total costs keep decreasing because of continuous economies of scale. Large companies and projects are more efficient. It can be demonstrated based on the example of Poland and Germany where four largest energy companies dominate the market. However, such a situation is described as an oligopoly, which implies imperfect competition and difficulties for new producers to enter the market.

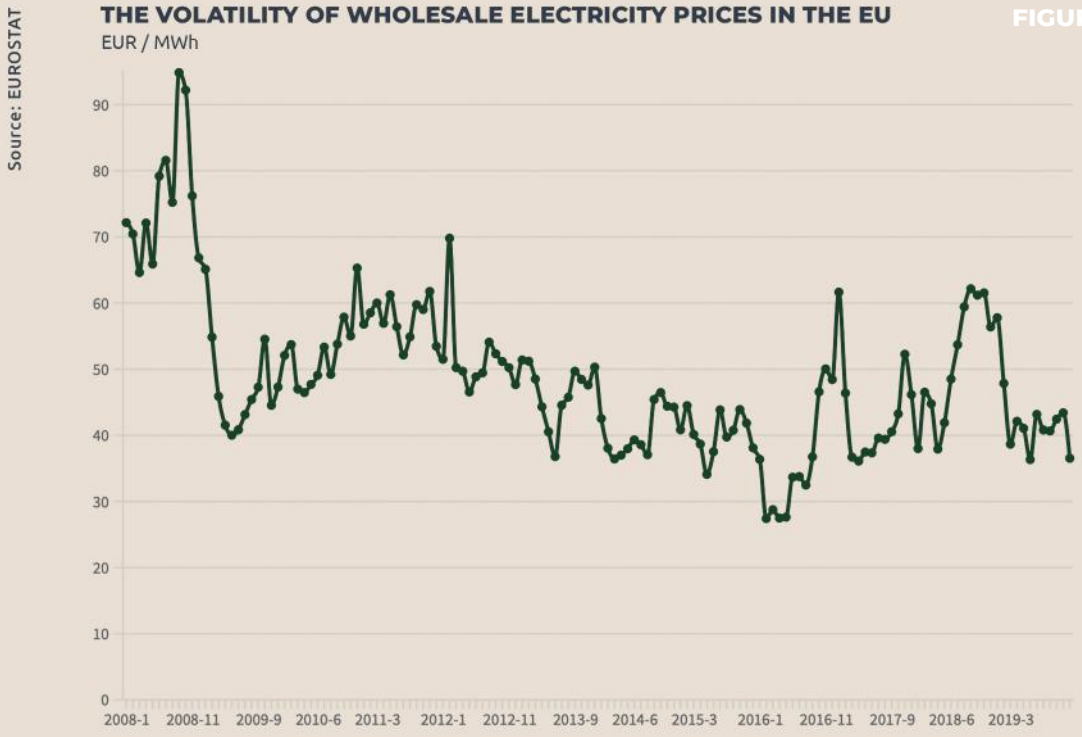
3. A competitive electricity market makes investments less attractive

In regulated electricity markets, the investment component is included in the tariffs of all consumers served by a vertically integrated company. In a competitive market, investment in new power plants must be compensated by the electricity generated by the new company. It makes it hard to attract investment and threatens a shortage of electricity generation capacity.

Therefore, investors prefer fixed tariffs. Due to the fixed feed-in tariff for renewable energy producers, their capacities have boomed in Ukraine (a tenfold increase between 2014 and 2021, to 9.2 GW).

* Figure 10. The volatility of wholesale electricity prices in the EU.

FIGURE 10



Source: EUROSTAT

4. In a competitive wholesale market, equilibrium prices are set at the level of the most expensive power plants

Marginal pricing implies that a price is established based on the common theory of supply and demand. Electricity is traded on the exchange between producers and buyers. For electricity producers, their price bids are arranged in an ascending order, and for buyers — in descending. This is how the "curves" of supply and demand are formed. The marginal price is determined at their intersection. Producers with higher prices can sell electricity in the balancing market, and buyers can give up consumption or buy electricity in the balancing market. As a result, wholesale equilibrium prices always exceed the average weighted cost of generating the electricity system, which leads to inflated prices for consumers.

Some manufacturers can sell goods at lower prices. But they will also sell electricity at a marginal price. This is how "producer surplus" is created, the difference between the equilibrium market price and the actual costs of more efficient producers. The producer will effortlessly receive this surplus at the expense of the consumer. This is a mechanism for pricing in a competitive market, which does not include fixed costs of power plants that differ significantly depending on the type of power plant. It is a paradoxical situation when the transition to a competitive market leads to higher prices.

5. The possible effect of competition in retail electricity markets is lower than the cost of their organisation

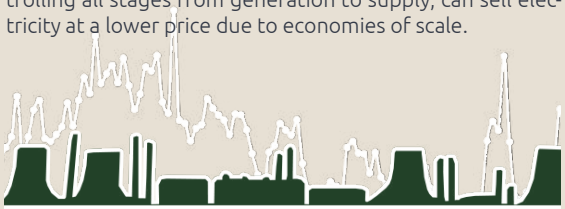
The opening of the retail electricity market is expected to extend the choice of suppliers. The share of costs at the retail stage is insignificant and does not usually exceed 5% of the price. Reducing this component through competition can only lead to insignificant results. It will not cover the costs of retail markets functioning. Although consumers will be able to choose their supplier, the price of electricity will likely increase.

Ukraine began liberalising the electricity sector in the 1990s by creating a regulated wholesale electricity market. However, this model applied to state-owned nuclear and hydropower plants, which produce most of the electricity. Instead, private coal generation sold electricity at an inflated price. This created favorable conditions for oligarchs who made extra profits, while state-owned companies sold electricity at prices close to production cost. Privatised regional distri-

bution companies have not been modernised to be made more efficient; however, the quality of their services remains relatively low.

In Ukraine, under the guise of European integration, the fragmentation of the electricity sector continues through the creation of competitive wholesale and retail markets. The latter opens the door to new suppliers. But this will not reduce prices for consumers. Suppliers will buy electricity on the wholesale market at an already inflated single price. Sales companies can optimize their markup, but the sales component in the final tariff will remain insignificant.

The market price for electricity is usually higher than the regulated tariff, as it is based on the costs of the marginal producer. In contrast, vertically integrated companies controlling all stages from generation to supply, can sell electricity at a lower price due to economies of scale.



3

RENEWABLE ENERGY IN UKRAINE: BALANCING BETWEEN ENERGY POVERTY AND CLIMATE CHANGE EFFECTS

The climate crisis is an urgent issue, and one of its key solutions is decarbonisation of the energy sector. It is also referred to as energy transition, which implies a pathway toward transformation of the energy system from fossil fuels, such as oil, natural gas and coal, to renewable energy sources (RES).

Renewable energy comprises a heterogeneous class of technologies such as solar energy, wind energy, hydropower, bioenergy, geothermal energy, and ocean energy. The deployment of renewable energy sources has seen a rapid increase in recent years caused by various factors ranging from different types of government policies, the declining cost of many renewable energy technologies, an increase of energy demand and changes in prices on fossil fuels (IPCC, 2011). Although rather in the nascent phase compared to economies with a big chunk of renewable power generation, the share of RES in Ukraine's electricity generation has reached 7.3% in 2020 excluding large-scale hydropower plants. Renewable energy capacity has increased from 0.7 GW in 2015 to 7.2 GW in 2021 demonstrating its consistent growth over the past five years.

In the Ukrainian context, it is important to note that the development of renewable energy projects cannot be attributed to an agenda pushed by big business groups benefiting most from high feed-in tariffs. In contrast, it is scientifically proven that the historic increase in greenhouse gas (GHG) emissions resulted from the provision of energy service associated with fossil fuels (IPCC, 2011). In addition to renewable energy's great potential to mitigate climate change, it demonstrates wider benefits such as social and economic development, energy access, as well as those reducing negative impacts on the environment and health.

HOW MUCH GREEN ENERGY IS PRODUCED IN UKRAINE?*

The EU-Ukraine Association Agreement does not outline specific provisions to be implemented in the renewable energy sector in Ukraine. It rather focuses on cooperation for the development of renewable energy and environmental protection. Most of Ukraine's energy commitments are related to its membership in the Energy Community.

In 2017, a new Energy Strategy of Ukraine until 2035 "Security, Energy Efficiency, Competitiveness" was adopted. It envisages an increase in the share of RES to 12.6% by 2030. By 2025, it is planned to complete a reform of Ukraine's energy system and its integration with the EU energy sector. The share of renewables is planned to be increased by 12% in 2025 and by at least 25% by 2035. The strategy defines the role of the state as follows: "The state must refrain from investing but contribute to bolstering the energy sector's attractiveness to investors by creating a favorable investment climate."

The development of renewable energy is directly related to Ukraine's climate commitments as a result of the Paris Agreement adopted in 2015. Ukraine has recently submitted its updated Nationally Determined Contribution (NDC) committing to reduce its GHG emissions by 65% by 2030 from the level of 1990. To achieve this target, electricity production from renewable energy sources must increase by 170% by 2030, which would be expensive for consumers in light of high feed-in tariffs and the states' growing debt to renewable energy producers. The question is how to pursue this policy in a socially balanced way without shifting the burden to consumers.

CO2 emissions per capita have decreased more than three times in 30 years. It happened primarily due to deindustrialization**.

There is a similar trend in per capita energy consumption in Ukraine. It lags far behind the EU level***.

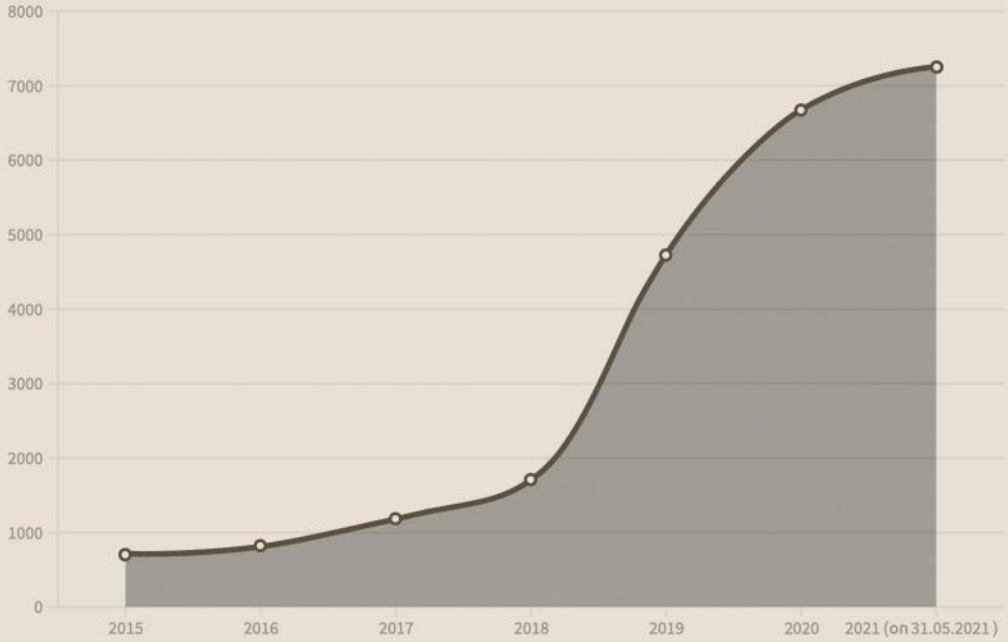
* Figure 11. Renewables capacity in Ukraine (wind, solar power stations and biofuel ones).

** Figure 12. CO2 emissions in Ukraine per capita.

*** Figure 13. Primary energy consumption (electricity, transport, heating).

FIGURE 11

RENEWABLES CAPACITY IN UKRAINE (WIND, SOLAR POWER STATIONS AND BIOFUEL ONES) kWh



Source: Ukrenergo

CO2 EMISSIONS IN UKRAINE PER CAPITA TONNE

FIGURE 12

Source: World Data Atlas

PRIMARY ENERGY CONSUMPTION (ELECTRICITY, TRANSPORT, HEATING) FIGURE 13

kWh / year per capita

Source: Our World in Data

Although Ukraine has decided to follow suit and committed itself to strengthening its climate policies, there are several pressing issues that need to be addressed in this context. Energy poverty, interpreted as the "inability to keep homes adequately warm", is a major problem for the Ukrainian population. Many people cannot meet their basic needs because of the lack of access to energy services such as heating, hot water and electricity. In 2019, 65% of households received utility subsidies to help consumers cover their utility bills. In 2010, an average Ukrainian family with one child spent about 6,5% of its income on utility bills, while these expenditures rose to 13,5% in 2021. The UK's definition of energy poverty, which was broadly adopted by other countries, states that "a household is said to be fuel poor if it needs to spend more than 10% of its income on fuel to maintain an adequate level of warmth". With this definition in mind, an average Ukrainian family spending 13,5% on utilities would be considered energy poor, let alone socially vulnerable groups, including the elderly, the unemployed and people with disabilities. However, the state aims to cut utility subsidies, which have already decreased by 6.9% in 2021. In addition, Ukraine's 2050 Green Energy Transition Concept aims to reduce the share of utility subsidies to the EU average of less than 10% of recipients. However, Ukraine's ambition to follow European trends is rather controversial given the gap between the EU and Ukraine in virtually all spheres.

FEED-IN TARIFFS AND OLIGARCHS' PROFIT

Feed-in tariffs are policy mechanisms designed to encourage investment in renewable energy technologies by providing long-term contracts to renewable energy producers. Their goal is to provide price certainty in the form of long-term contracts, which reduce investment risks for RES producers.

This table shows feed-in tariff rates depending on the type of RES and capacity in Ukraine*.

It is essentially worth looking at examples of other countries to compare approaches to feed-in tariffs. In Germany, the feed-in tariff for residential rooftop solar panels amounts to 7.47 euro cents per kWh. The feed-in tariff for solar power plants (SPP) for non-commercial producers is 8.5 euro cents per kWh in Slovakia, while it is 10.31 euro cents per kWh in Hungary. Compared to the feed-in tariffs currently used in Ukraine, these are significantly lower. Yet Ukraine's high feed-in tariffs allow renewable energy project developers to recoup their investment in about four or five years. While this leads to a growing number of renewable energy projects contributing to the overall development of the sector, the Ukrainian state has accumulated significant debts to renewable energy producers being increasingly unable to pay for renewable electricity on time.

Interestingly, the feed-in tariff for solar energy in Ukraine is among the highest worldwide, which was even higher back in 2009 when it was first established. At the time, more than 90% of all solar energy projects belonged to the Klyuyev brothers, influential officials from the inner circle of the former President of Ukraine Victor Yanukovych. The brothers' companies received land for free when they were in power, and obtained loans from Ukrainian state-owned banks, while renewable electricity was sold to the Ukrainian state five times higher than the wholesale price. Consequently, their companies did not return about $1 billion to Ukrainian public banks, which the state had to pay from the state budget. That said, it has been calculated that each Ukrainian taxpayer contributed about $75 to paying off the debts. Following this bitter experience with first renewable energy projects, a widespread belief that renewable energy is necessarily linked to oligarchs has become deeply ingrained in the perception of renewables over time. That is why it is widely believed that renewable energy is something connected to the oligarchs. It is thus crucial to consider the distribution of ownership in the renewable energy sector in Ukraine today.

* Table 1: Green tariff rates in Ukraine.

TABLE 1.
GREEN TARIFF RATES IN UKRAINE.

Type of the power plant	Power plant capacity and other factors affecting the feed-in tariff rate	Tariffs for installed objects, euro cents per kWh		
		From 2017 to 2019	From 2020 to 2024	From 2025 to 2029
Wind power plants	600 kW or less	5,82	5,17	4,52
	From 600 kW to 2 MW	6,79	6,03	5,28
	2 MW and more	10,18	9,05	7,92
Solar power plants	Ground SPP	15,02	13,52	12,01
	Solar on the roofs and facades of buildings	16,37	14,75	13,09
Biopower plants	Biomass and biogas	12,39	11,15	9,91
Geothermal power plants	Geothermal energy	15,02	13,52	12,01
Hydroelectric power stations	Micro-HPP (up to 200 kW)	17,45	15,72	13,95
	Mini-HPP (from 200 kW to 1 MW)	13,94	12,55	11,15
	Small HPPs (from 1 MW to 10 MW)	10,45	9,42	8,35
Small-scale renewable energy	Solar, up to 30 kW	18,09	16,26	14,49
	Wind, up to 30 kW	11,63	10,45	9,32

There are three main RES producers in Ukraine:

1) 4417 MW (70.3%) are distributed among over 700 companies that do not belong to the top ten largest owners.

2) 1,085 MW (17.3%) belong to Rinat Akhmetov's DTEK.

3) 779 MW (12.4%) were installed by more than 30,000 household owners.

Although Rinat Akhmetov's DTEK is the largest national investor with 1 GW of solar and wind energy capacity, the renewable energy sector can be overall considered the most diversified energy subsector.

Notwithstanding the fact that big businesses profit from renewable energy projects most, the sector still cannot be reduced to oligarchs' pursuit of profit. There is good reason for consumers to be outraged about the increase in electricity prices, which is partly due to the growth of renewable energy capacity and high feed-in tariffs. However, it is also essential to communicate to the population that Ukraine has one of the highest death rates from air pollution worldwide due to the burning of fossil fuels. Therefore, it is a matter of fact that the development of renewable energy, which would contribute to improving air quality and therewith human health, serves the interests of people.

The state-owned company "Guaranteed Buyer" purchases electricity from renewable energy producers paying from subsidies from "Ukrenergo", a state-owned company performing the function of the transmission system operator of Ukraine, as well as proceeds from cheap nuclear electricity sales. However, these sources were not enough to compensate a growing number of renewable energy producers for electricity generation. The "Guaranteed Buyer" has thus accumulated a debt to RES producers meaning that payments under feed-in tariffs were delayed. As a result of being increasingly unable to pay to producers of renewable electricity, which has to be given a priority over other types of electricity as per laws on renewable energy, the authorities tried to reduce feed-in tariffs retrospectively.

The state's debt to renewable energy producers led to investors' lawsuits against the state's contact breaches. The negotiations between the Ukrainian state and investors ended with the signing of a Memorandum of Understanding on the Settlement of Problematic Issues in the Renewable Energy Sector, referred to as the Memorandum of Understanding

(MoU). According to this MoU, the state committed to ensure full repayment of debts to producers of green energy, as well as timely payment for electricity supplied from RES in the future. In exchange for these conditions, the producers agreed to the reduction of the current feed-in tariffs. While a 15% reduction is envisaged for solar power plants, the feed-in tariff for wind energy is expected to decrease by 7.5%. However, given the extremely low labor costs in Ukraine and falling prices for RES technologies worldwide, investments in this sector would still remain profitable.

After the efforts taken to reduce feed-in tariffs, the state was accused of breach of its contractual obligations and the lack of the rule of law. This goes in line with a widespread neoliberal myth that the state is guilty of all sins. However, as the regulatory authorities are currently run by the representatives of business groups, the state must ensure transparent recruitment procedures, as well as independence of the energy regulator acting on behalf of consumers.

WHO SHOULD INVEST IN RENEWABLE ENERGY?

Although the Energy Strategy of Ukraine calls for a limited role of the state restricted to creating a favorable investment climate, the Ukrainian state should be more proactive in developing renewable energy sources and boosting storage capacities. The state-owned company "Ukrhydroenergo", the largest hydro-generating company in Ukraine, has announced plans to implement several projects on constructing solar power plants with electric storage batteries. They are planned to be installed at Ukrhydroenergo's hydropower plants and pumped storage power plants, including Kaniv and Middle Dnieper HPPs, the Cascade of Kyiv HPPs and PSPs branch, the Dniester Cascade of Hydropower Plants and the Kremenchuk Reservoir. However, the Ukrainian state does not engage much in renewable energy project development, and thus the state-owned Ukrhydroenergo can be considered rather an exception.

However, other countries adopt a different approach by not only creating conditions for private investments in RES but also investing themselves. The leading French state-owned company EDF Renewables is expanding renewable energy in more than 20 countries. It also plans to double its global renewable capacity from 28 GW to 50 GW in 2030.

Another example is the Norwegian energy company Equinor, whose controlling stake is state-owned. It has been actively investing in offshore wind power plants in the United Kingdom, the Northeastern United States and the Baltic Sea. The company, known as one of the largest oil suppliers in the world, has introduced plans to produce ten times more renewable energy in 2026 compared to today's levels.

In Poland, state-owned energy companies cooperate to build large offshore wind power plants in the Baltic Sea. Poland considers this project to be key to the national economy and energy security.

When considering examples outside of Europe, it is worth looking at Costa Rica, a country that is often mentioned as a leader in the area of renewable energy development. RES provide 99.7% of electricity production there, with 66% being produced by the state-owned company ICE and the other 7% by energy cooperatives and local communities.

These examples demonstrate that the state does not necessarily have to wait for private investors to come and expand renewable energies. However, a reliable way to ensure public access to clean energy and timely implementation of Ukraine's climate commitments is the state's direct contribution to the development of renewables.

4

(UN)JUST TRANSITION. THE FUTURE OF COAL REGIONS IN UKRAINE

Under the Paris Agreement, countries agreed to curb greenhouse gas emissions with a view to "holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels". To reach this goal, the energy sector should be scrutinized as the source of around three-quarters of GHG emissions globally. Although it is clear that main changes must take place in energy systems to mitigate climate change, there are significant challenges linked to this transition.

Among energy sources, coal is both the largest source of electricity production and the largest single source of CO2 emissions, presenting a serious challenge for energy transition globally. According to the IPCC Climate Change Report 2014, an increase of the share of coal in the global fuel mix and a growing energy demand have been the main contributors to GHG emissions growth (IPCC, 2014). It is a matter of fact that extraction and combustion of coal pollutes the air and water, damages ecosystems and contaminates soil. Although coal consists predominantly of carbon, there are other constituents such as sulfur, nitrogen, organometallic compounds and minerals, which contribute to the formation of extremely toxic secondary compounds that come in contact with the atmosphere. The continuous exposure to these hazardous substances causes numerous diseases including respiratory and cardiovascular disease, systemic inflammation and neurodegeneration (Gasparotto and Martinello, 2021).

However, in addition to providing about a third of global electricity production, coal still plays an essential role in industries such as iron and steel. That being said, it is estimated that coal will continue to be crucial for these industries until newer technologies are available on a large scale. .

It should be noted that the share of coal in electricity generation remains significant in Ukraine, accounting for more than 30%. This means that phasing out coal without a socially balanced approach would result in a substantial loss of jobs To avoid negative economic and social consequences, policies aimed to phase out fossil fuels should be based on fair distribution of the costs and benefits of the transition. This idea is often referred to as “just transition”, which implies that those who stand to lose economically as a result of such transition should be supported.

Thus, this part of the publication focuses on the coal sector and its main trends in Ukraine and globally. In the context of coal phase-out, it is essential to examine the concept of just transition, as well as the approaches towards its implementation. Finally, the embedding of Ukraine’s coal policy in the international coal policy landscape is vital to understand the opportunities and risks of future policy shifts.

CURRENT TRENDS IN THE COAL INDUSTRY

While coal generation and consumption have been steadily declining in Europe and North America, China, India and other Asian countries have substantially increased their coal consumption. Together they account for around 75% of global coal demand. Notably, China is the world's biggest producer, importer and consumer of coal, accounting for around 65% of global coal consumption alone.

Although climate scientists have for years warned that there can be no more investments in the coal industry, financial institutions and commercial banks continue to invest in fossil fuel companies. According to a study on financing of the global coal industry by Urgewald, commercial banks invested over USD1.5 trillion in the coal industry between January 2019 and November 2021. The study also identified that institutional investments of over USD1.2 trillion were allocated to the coal industry. Additionally, banks from only six countries including China, the US, Japan, India, the UK and Canada accounted for 86% of overall bank financing for the coal industry.

To be in line with the Paris Agreement, it is estimated that OECD countries should phase out coal entirely by 2030. Among EU countries, there are currently 12 countries that already abandoned coal or announced their plans to do so by 2030. As of January 2022, Belgium, Austria, Sweden and Portugal are considered the four EU countries to go coal free. However, it should be noted that closures of coal-fired power plants were not always a result of planned policy for the benefit of the environment. Belgium, which was the first to abandon coal in 2016, closed its aging coal-fired power plants as a result of EU pollution control regulations.

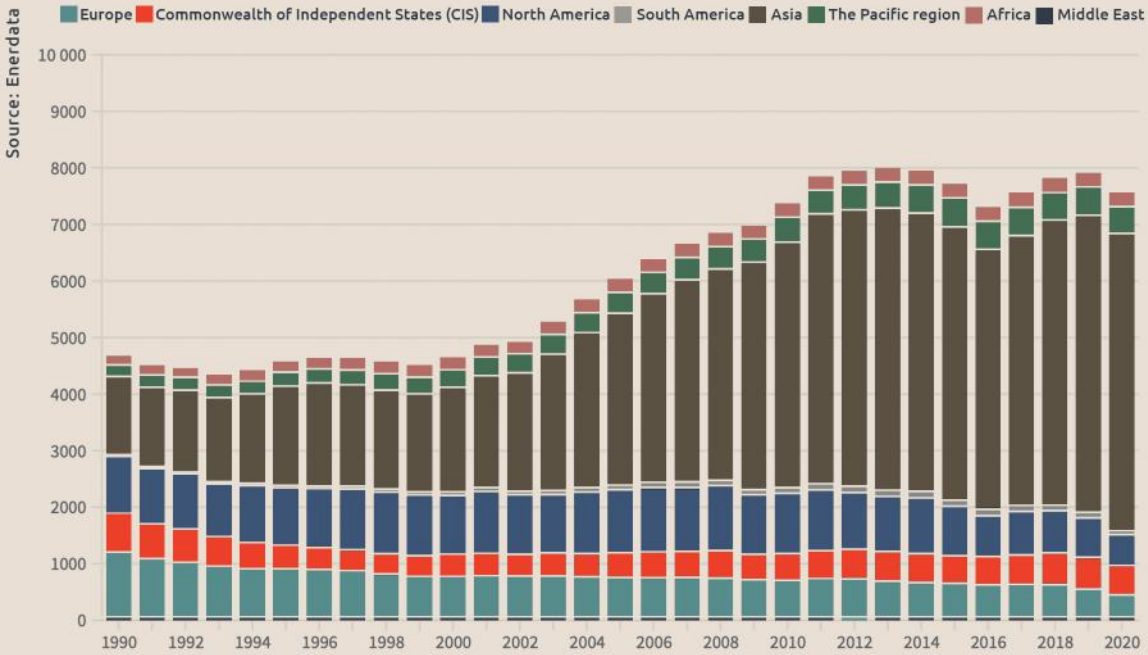
In contrast, Poland, Germany, Bulgaria, the Czech Republic and Romania are most reliant on coal in the EU. Germany and Poland alone account for 51% of the EU's installed coal capacity and 54% of emissions from coal Considering these countries' dependence on coal, they have shown signs of reluctance to implement policies aimed at phasing coal out of its electricity sector. Germany adopted its plans to exit coal by 2038, one of the latest dates in the EU besides Bulgaria aiming to phase out coal by 2040. Moreover, the German government has promised 4,35 billion euros in compensation to operators of lignite-fired power plants, which caused

* Figure 14. Dynamics of coal production in the world.

FIGURE 14

DYNAMICS OF COAL PRODUCTION IN THE WORLD

(1990-2020, Mt)



another wave of strong criticism among the public. While Germany's supreme constitutional court ruled that the German government has to strengthen its 2030 climate targets, the new coalition confirmed its aim to phase out coal by 2030, without specifying concrete steps.

Currently, Poland is the only EU country that has not yet launched a discussion on phasing out coal. There is an agreement between the Polish government and unions that foresees the exit by 2049. However, this date is fully inconsistent with the goal of achieving net zero emissions by 2050 set by the European Union, which has resulted in increased tensions between the Polish government and EU institutions.

The UK, known as the cradle of the Industrial Revolution, in which coal played a crucial role, became the first country in the world to announce plans to phase out coal in 2015. Both a pioneer in the mining industry and decades later in its proposal to go coal free, the UK presents an interesting example of transition policies.

In the wake of the miner's strike of 1984–85, the British coal industry underwent massive job losses. Overall, since the beginning of the 1980s, there have been some 250,000 jobs lost, which principally put an end to the mining industry in most parts of the UK. Interestingly, there is no official record of what happened to the tens of thousands of miners who were forced to leave the industry between the mid-1980s and early 1990s. According to the State of Coalfields Report conducted by the Coalfields Regeneration Trust, high unemployment rates, a low job density, low level of qualifications among residents, a higher incidence of poor health are some distinguishing characteristics of the coalfields. Moreover, a combination of a shortfall in job opportunities and poor health have led to unusually high numbers in receipt of welfare benefits among the coalfields residents.

These socio-economic conditions in the coalfields are a direct result of the job losses that followed in the wake of the miner's strike that continues shaping the everyday life of the coalfields communities. As these challenges were not mitigated by progressive social policy, the communities have thus not been successfully restored to full social and economic health. Taking into account the experience of the UK and other countries, it is essential to undertake an in-depth examination of Ukraine's mining industry and its developments over the past decades. Acknowledging the severe socio-economic challenges following the coal exit, it is of paramount importance to not only examine the issue from the perspective of climate protection, but also focus on different approaches to "just transition", including those currently adopted and pursued in Ukraine.

DEVELOPMENT OF THE COAL INDUSTRY IN UKRAINE

Similar to other countries, the coal industry in Ukraine has been steadily declining. To compare: while there were 276 state-owned mines in 1991, they accounted for only 33 in 2021 prior to the Russian invasion of Ukraine in February 2022. In addition to the overall decline of the coal industry, one of the reasons for this significant decrease was that 95 coal mines remained in occupied territories as a result of the war in Eastern Ukraine since 2014. However, 68 state-owned coal mines have been closed since 2004. There are currently only 12 privately-owned pits.

DTEK, the largest private coal and coal-generating company, has announced that it aims to achieve net zero emissions in electricity production by 2040.

The number of miners in Ukraine fell from 1 million in 1991 to 56,000 in… *

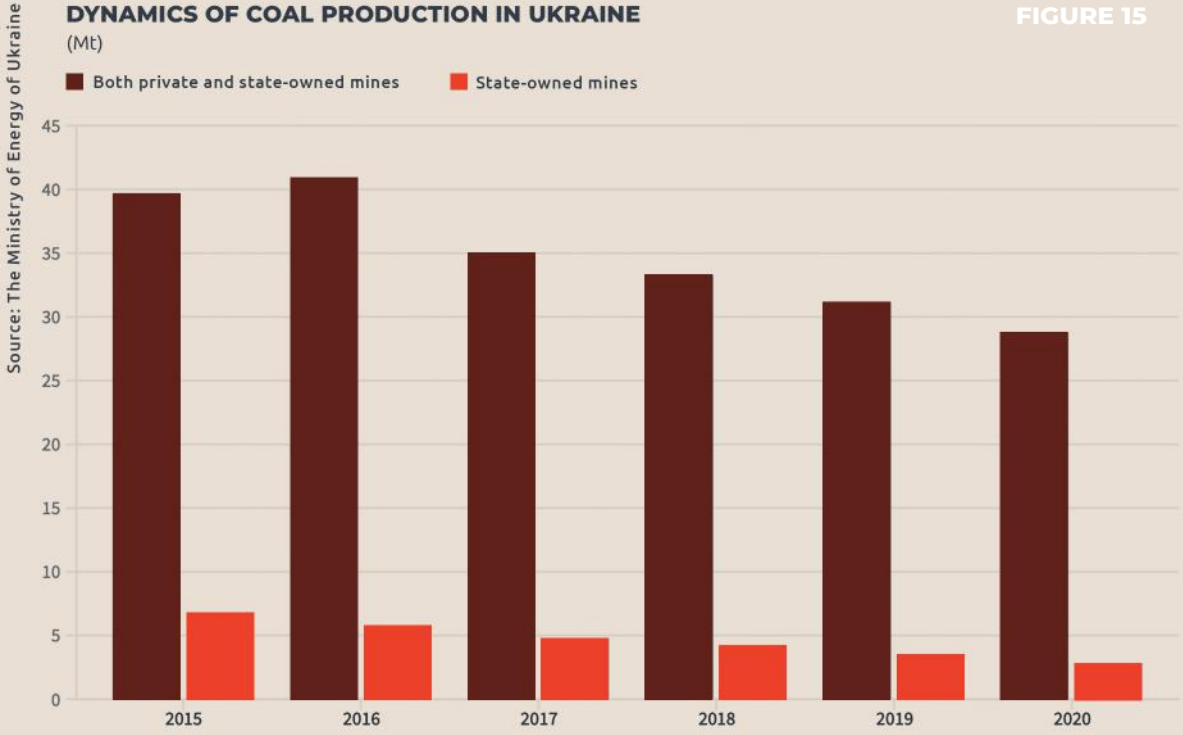
The cost of coal production is increasing. State-owned coal mines suffer an average loss of €230 per tonne of coal produced. Therefore, the state continues to subsidize the sector, currently spending more on coal subsidies than on energy efficiency measures. According to the report on direct subsidies to the coal sector during 2018–2019, Ukraine is among the leaders in providing subsidies to the coal sector. In 2018, direct subsidies amounted to € 275.4 million and increased to € 476.1 million in 2019. It is estimated that shutting down unprofitable mines would reduce government spending by 35%, even considering the cost of mine decommissioning and compensation for workers.

According to a national concept of reforming the coal industry, current issues of the coal sector amount to a lack of investments in modernisation and energy efficiency of coal mines. Ukraine's energy strategy until 2035 envisages solutions limited to the privatization and closure of inefficient coal mines, which need to be carried out "in line with the best practices in the EU ". However, it is not clear which "best practices" the government referred to.

According to a draft concept for just transition of the coal industry, transition is expected to affect five coal mining regions in Ukraine, comprising about a million people. Governmental strategies refer to creating an enabling environment for investors to create new jobs for miners. The government assigned a central role in job creation to private investors.

* Figure 15. Dynamics of coal production in Ukraine

FIGURE 15


DYNAMICS OF COAL PRODUCTION IN UKRAINE
(Mt)
Both private and state-owned mines
State-owned mines
Source: The Ministry of Energy of Ukraine
45
40
35
30
25
20
15
10
5
0
2015
2016
2017
2018
2019
2020

However, in contrast to high feed-in tariffs that make investments in renewables rather attractive, creating jobs for former miners, including retraining expenses, would not be a priority for private investors. This is where a regulating role of the state is needed.

International partners provide funding to improve knowledge and capacity for implementing just transition policies. In this context, the project of the Energy Community "Initiative for coal regions in transition in the Western Balkans and Ukraine" aims to support countries in transitioning away from coal towards a carbon-neutral economy, while ensuring that this transition is fair. In Ukraine, Donetsk region, Luhansk region, Lviv region and Volyn region were selected to participate in the initiative. The initiative will create an open platform for sharing experiences, knowledge and best practices.

The Ukrainian government aims to implement just transition policies that are aligned with those in the EU. Today, the European Green Deal is a comprehensive action plan to increase resource efficiency via transition to a clean circular economy, conservation of biodiversity and reduction of greenhouse gas emissions.

WHAT IS BEHIND THE JUST TRANSITION IN THE EU?

In January 2020, the European Commission proposed a Just Transition Mechanism to achieve the objectives of the European Green Deal. While the European Green Deal is a comprehensive set of policies aimed at making the EU climate neutral by 2050, the Just Transition Mechanism is a tool to alleviate the social and economic impact of the transition. The EU Just Transition Mechanism has three pillars:

1) A Just Transition Fund consisting of €19.2 billion in current prices. It is expected to mobilise around 25.4 billion euros in investments.

2) InvestEU "Just Transition" scheme expected to mobilise €10–15 billion in mostly private sector investments.

3) A Public Sector Loan Facilitywill combine €1.5 billion of grants from the EU budget with €10 billion of loans from the European Investment Bank (EIB), to mobilise €18.5 billion of public investment.

In addition, EU countries have access to other funding programmes to support their transition efforts. The Modernisation Fund is a programme to support 10 lower-income EU countries in their transition to climate neutrality by helping modernise their energy systems and improve energy efficiency. The Innovation Fund provides funding for innovative low-carbon technologies. Overall, EU countries have different options to mobilise resources that can be useful in their transition. Although Ukraine has some financial support from the EU and other partners to implement pilot projects, Ukraine still lacks access to large funds and mechanisms that would systematically support the transition. Even among Eastern European countries, with two-thirds of the Just Transition Fund allocated to them, there are concerns about successful energy transition and the future of whole regions. During the climate negotiations in 2018, the Polish government proposed the Just Transition Silesia Declaration, sending an important signal that workers should not be sacrificed in an effort to curb emissions.

THE UKRAINIAN WAY OF "JUST TRANSITION"

The Ukrainian government announced that main problems of coal regions were identified by conducting a survey among residents of seven coal towns in the Donetsk region. Economic and environmental problems, low quality of medical and communal services, shabby urban infrastructure, as well as issues related to education and retraining were listed as key problems of Ukraine's coal regions. However, it should be noted that these issues pertained to the whole of Ukraine before the start of the full-scale war in February 2022. However, these problems have been exacerbated by the Russian invasion since then, which has resulted in more than 30% of Ukraine's infrastructure destroyed. The study on conditions in the coal regions, cited by the government, was conducted by the NGO "*Ecodiya*". It presented results of the survey among citizens of the coal regions, who were asked about their understanding of just transition. Consultations with the local population, establishing new industries in the region, retraining for coal workers and social benefits were mentioned as responses to this question.

To solve the problems of coal regions, the government promised to create a multi-donor fund. It is currently known that "the fund will be established to provide transparent and effective mechanisms for financing regional and community projects". However, more clarity is needed to assess the potential effectiveness of the fund. High hopes are pinned on the German-Ukrainian energy partnership signed in 2020 to provide expert support and assistance in the transformation of coal regions.

WHAT ARE THE ALTERNATIVES?

The process of coal phase out is not unique and limited to Ukraine. Germany experienced a decline in coal and steel production, particularly in the Ruhr area. With more than 400,000 workers employed in the coal industry in the 1960s, there were slightly over 3,000 of them left in 2018.

Today, the Ruhr area comprises 270,000 students studying at universities and technical schools, which were founded in the 1960s and later. More than 30,000 people work at various research institutions. In addition, other sectors of the economy have developed over the years, most notably, healthcare, logistics and the chemical industry. Healthcare alone currently employs more than 330,000 people. The example of the Ruhr area shows that structural changes often require state intervention to create prospects for the pop-ulation regardless of private investments.

The Czech Republic is the only country in Central and Eastern Europe that implemented the Re: Start Coal Region Transition Programme in 2015. Re: Start created a framework for cooperation between ministries, local authorities and investors. The programme provides support to miners and creates education and employment opportunities for youth and the unemployed.

A unique example of workers' self-organisation to bring about a just transition process can be traced back to Canada. Iron & Earth was founded by former Canadian oil workers. The organisation built a base of over 1000 fossil fuel industry workers and carried out various activities to help build political, industry and public support for a transition towards climate neutrality, as well as develop careers in climate solutions.

Finally, there is no single approach on how to create jobs and which areas are the most urgent ones. Various regions have different socio-economic conditions. The development of the renewable energy sector and the implementation of other climate projects will help create more jobs. However, the transition should not be limited to the social support of former fossil fuel industry workers. On the contrary, it must be structural: investments should be directed to the infrastructure of the regions, the development of new industries and the fight against unemployment.


H2

5

WILL HYDROGEN SAVE UKRAINE FROM THE CLIMATE CRISIS AND ECONOMIC DEPENDENCE?

One of the alternatives to fossil fuels is considered hydrogen, which can be produced from a variety of sources.Industries are primarily interested in using fossil fuels and suggest producing hydrogen from gas or coal. It is still cheaper than hydrogen from renewable energy sources, which is the reason why hydrogen is also often associated with the gas and oil lobby. It is essential to consider development trends of hydrogen production and its features as an energy source. Not least important is the experience of other countries, which will help identify the place given to Ukraine in the development of the global hydrogen market.

TRENDS IN THE DEVELOPMENT OF HYDROGEN PRODUCTION

By 2021, more than 30 countries have adopted roadmaps on the role of hydrogen in energy systems. At the same time, governments have pledged $ 70 billion in government funding to develop hydrogen technologies. Industries have announced more than 200 hydrogen projects and ambitious investment plans, which primarily differ based on hydrogen production processes: some countries prefer hydrogen from renewable electricity (Germany, Portugal, Spain), while others do not specify its origin (France's hydrogen strategy mentions renewable and low-carbon electricity, which might include electricity from nuclear energy)*.

Figure 16. Global production of electricity from renewable energy sources.

Hydrogen production causes CO_2 emissions that are equivalent to the CO_2 emissions of the United Kingdom and Indonesia combined. The amount of emissions is not surprising, as roughly 95% of global hydrogen production comes from fossil fuels. Hydrogen is needed in the industry, primarily for ammonia synthesis, methanol production, and the oil refining industry. It is also used in the transport sector, but its competitiveness depends on the cost of fuel cells and hydrogen filling stations. Hydrogen can also be used for heating houses and supplying hot water. However, there are other more efficient alternatives in the sector such as heat pumps. Hydrogen can be used as a way of storing energy, an "energy carrier". So far, these technologies are less efficient than rechargeable batteries.

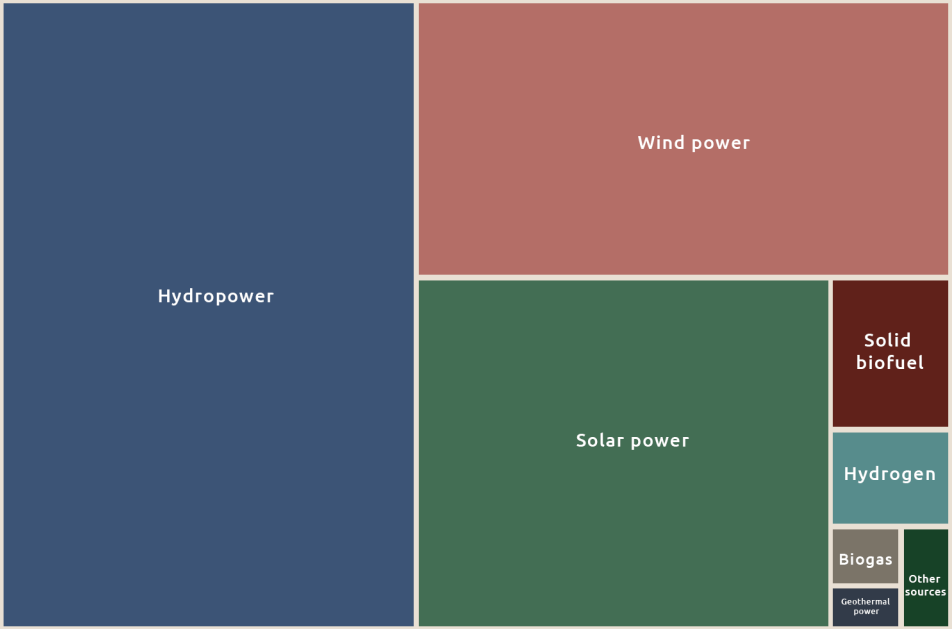
Environmental organisations support green hydrogen produced from excess electricity from renewable energy on hydrogen, which people can produce from fossil fuels pretending hydrogen is a sustainable alternative, but on building energy efficiency measures and renewable energy.

* Figure 16. Global production of electricity from renewable energy sources.

GLOBAL PRODUCTION OF ELECTRICITY FROM RENEWABLES

2020, GW

FIGURE 16



Source: International Renewable Energy Agency

HOW IS HYDROGEN PRODUCED?

Hydrogen can be obtained from diverse resources, including fossil fuels, biomass and water electrolysis with electricity. Its combustion product is simple water. However, not all types of hydrogen are environmentally friendly. The industry has different designations for its types depending on the method of production and energy source for it.

Gray hydrogen is the most common form of hydrogen, produced from natural gas through a process known as "steam methane reforming (SMR)".

Brown hydrogen is the most environmentally damaging, as it is made from brown coal, or lignite.

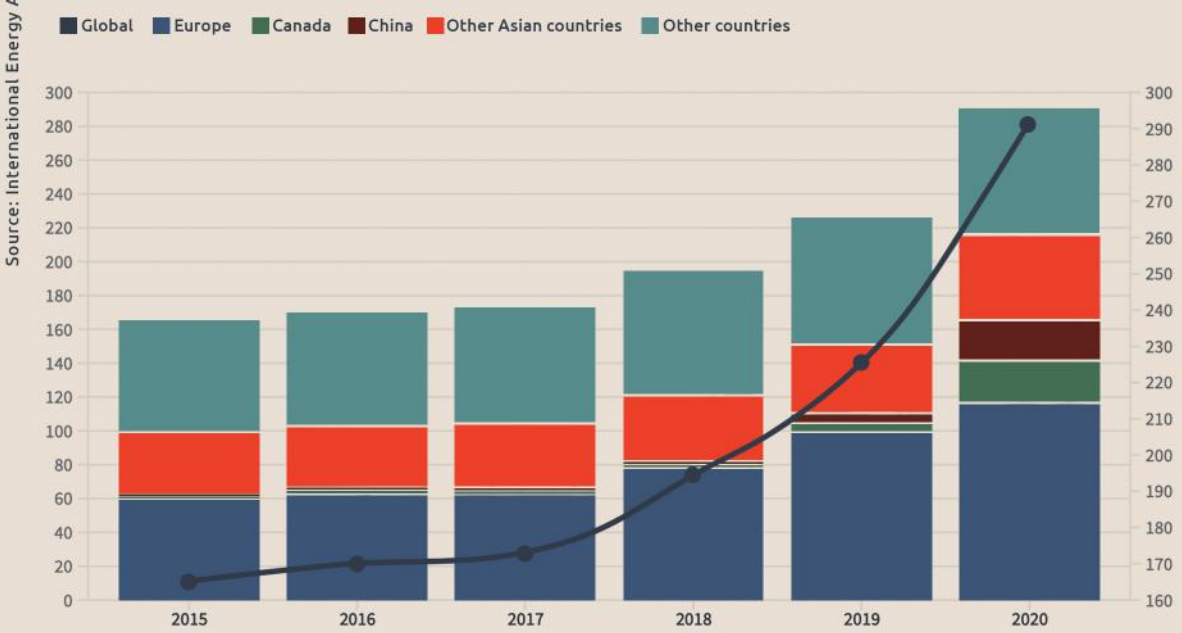
Blue hydrogen meets the low-carbon threshold but is derived from natural gas, which is decarbonized through expensive carbon capture, use and storage technologies. This type of hydrogen is primarily supported by the industry as a low-carbon alternative, but it also involves the use of depleted resources and relies on zero emissions, in which emissions are compensated but not reduced.

Finally, low-carbon **green hydrogen**, which is obtained from renewable energy sources through water electrolysis, is key to decarbonization. Although it is a sustainable solution in the long run, there are particular drawbacks to it. First, the cost of electrolyzers is still high. Secondly, there should be a large amount of purified water, which requires even more expensive renewable electricity. Third, there are losses of a significant amount of energy produced, which can reach 50%. Fourth, there are difficulties in transporting hydrogen, which must be converted into a liquid or compressed gas.

* Figure 17. Introduction of new capacities of electrolysers for production of green hydrogen.

FIGURE 17

INTRODUCTION OF NEW CAPACITIES OF ELECTROLYSERS FOR PRODUCTION OF GREEN HYDROGEN 2015-2020 (MW)



Source: International Energy Agency

WHAT IS THE HYDROGEN POLICY IN THE EUROPEAN UNION?

The EU aims to become a leader in hydrogen technologies and create up to 1 million jobs in this area. EU investments in green hydrogen are expected to range €180 to € 470 billion by 2050. Acknowledging an important role of hydrogen in the European Green Deal to support the EU's commitment to reach climate neutrality by 2050, the EU adopted a separate hydrogen strategy for a climate-neutral Europe, in which it explored how renewable hydrogen could help decarbonise the EU economy.

Hydrogen is responsible for less than 2% of Europe's current energy consumption and is primarily used in chemical production. 96% of hydrogen production comes from natural gas, resulting in the release of 70 to 100 million tonnes CO_2 in the EU every year.

In response to the Russian invasion of Ukraine, the EU announced the REPowerEU plan to move away from Russia's fossil fuel exports. The plan aims to produce 10 million tonnes and import 10 million tonnes of renewable hydrogen in the EU by 2030. Besides a €300 million funding package for hydrogen and REPowerEU's Hydrogen Accelerator announced by the EU, the green hydrogen market has seen a major boost since Russia's invasion of Ukraine. While the war has sent prices of fossil-fuel based forms of hydrogen production surging, there is a consistent downward price trend of green hydrogen.

To this end, the EU has been actively building green hydrogen partnerships with neighboring countries. Before the full-scale war, Ukraine was attributed a special role in the development of green hydrogen and called a "priority partner" in the EU's hydrogen strategy. As the main gas transit country bordering the EU, Ukraine is viewed as one of the main sources of green hydrogen. Taking into account Ukraine's favourable wind, solar and biomass resources, as well as much space for developing large-scale renewables, the EU recognized a huge potential to develop green hydrogen in Ukraine and make its imports profitable.

Before the invasion, Ukraine aimed to build up to 10 GW of green hydrogen production capacity by 2030, with 7.5 GW of this allocated to exports to the EU, and the rest used domestically.

However, Southern Ukraine, one of the regions where the war is centered, comprises about 66% of all renewable generation. Since the start of the war, about 90% of Ukraine's wind power plants and 30% of solar power plants have been destroyed or occupied by Russia. Thus, the destruction and occupation of the vast majority of Ukraine's renewables creates serious challenges for both the renewable energy and green hydrogen sector.

Despite the ongoing war, the European Union and some of its member states such as Germany, in particular, are still highly interested in Ukraine's renewables and green hydrogen, considering the increasing pressure to transit away from Russia's fossil fuels. Shortly before the invasion, Germany intended to open a hydrogen diplomacy office in Ukraine to prioritise the development of renewable energy and green hydrogen as an element of bilateral economic cooperation. However, in view of the war in Ukraine, Germany has turned to other countries such as Saudi Arabia to develop hydrogen cooperation. Notwithstanding this contradictory decision and the failure of the concept "Wandel durch Handel", or "change through trade", Saudi Arabia became a host of Germany's second hydrogen diplomacy office.

WHAT DOES HYDROGEN POLICY IN UKRAINE LOOK LIKE?

Following the path of EU integration, Ukraine aims to adopt its own hydrogen strategy. Looking at the existing proposals for hydrogen development in Ukraine, it becomes clear that the Ukrainian government is open to other types of hydrogen, other than green hydrogen, if it is not for export. As the seventh-largest producer of nuclear electricity in the world and a country with large scope for further domestic gas development, Ukraine also considers producing hydrogen from natural gas and nuclear power.

It is expected that demand for green hydrogen will grow in Ukraine. The steel industry is one of the key export industries in Ukraine, providing almost a quarter of the country's GDP and employing over half a million people. As one of the most carbon-intensive industries, which is among the three biggest producers of CO_2, the steel industry is increasingly facing decarbonisation challenges.

Hydrogen is considered a realistic alternative for these energy-intensive industries. In addition, the EU plans to introduce a carbon border adjustment mechanism (CBAM), an instrument introduced by the EU to avoid carbon leakage and create a level playing field between imports of carbon-intensive products that are subject to no or laxer environmental regulations in other countries and domestic producers in Europe that are exposed to rising carbon costs under the European Union Emissions Trading System (EU ETS). The mechanism will primarily apply to o exports of steel, aluminium, cement, fertilizers and other products of carbon-intensive industries. Ukraine's industry, which is mostly carbon-intensive due to its outdated and inefficient technologies, would be forced to pay extra costs for carbon emissions. Therefore, the decarbonization of Ukraine's industry should be a priority. To this end, large capacities of renewable electricity are needed to produce green hydrogen. As of the first quarter of 2021, the share of electricity production from renewable energy sources together with large hydropower plants was 11.4%. These capacities are likely to grow. However, both Russian aggression and further debt accumulation to renewable energy producers pose a threat for the development of the renewable energy sector.

Although there is a domestic need for hydrogen to decarbonize carbon-intensive industries, the government is increasingly focusing on hydrogen exports to the EU. Not-

withstanding the talk about the necessity of green reconstruction for Ukraine, the actions of the government do not indicate that the decarbonisation of Ukraine's economy is a priority. Developing gray and yellow hydrogen would cause further emissions that are planned to be compensated through expensive carbon capture and storage technologies, a solution often proposed by the oil and gas lobby.

Whereas the European Union openly speaks about its strategic interest in Ukraine's resources to decarbonise the EU economy, Ukraine depends on Western loans, making it not easy to ignore policy proposals from Western partners and creditors. The partnership between the EU and Ukraine is certainly not on an equal footing, and it is thus the responsibility of the Ukrainian government to push for conditions favourable for the Ukrainian population, not the EU industry or creditors. Ultimately, hydrogen is unlikely to save the world from the climate crisis and help Ukraine reduce its economic dependence.

JUST TRANSITION FOR UKRAINE

Center for economic justice (CEJ) is a nonprofit organization that promotes progressive socio-economic policies in taxation, social protection, utility tariffs, land issues, housing policy, public and private investments.

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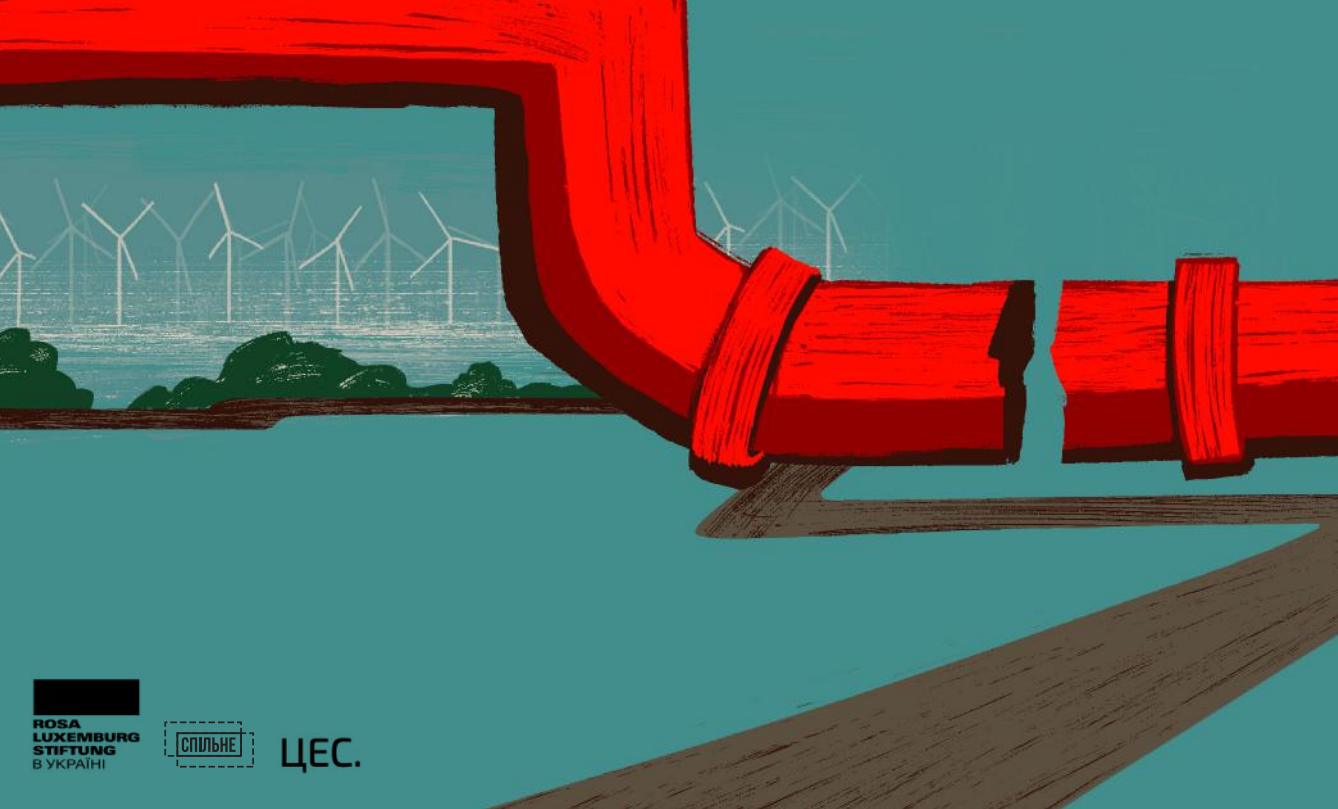

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