# National Strategy to Increase Foreign Direct Investment in Ukraine

## Section 2.2: Energy

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# Disclaimer

# Key terms and abbreviations (1/4)

## Names and Companies

| | |
|---|---|
| **AGPU** | Association of Gas Producers of Ukraine |
| **BP** | British Petroleum |
| **CMU** | Cabinet of Ministers of Ukraine |
| **EA** | SE “NNPC “Energoatom” |
| **EBRD** | European Bank for Reconstruction and Development |
| **EIB** | European Investment Bank |
| **ENTSO-E** | European Network of Transmission System Operators for Electricity |
| **EU** | European Union |
| **GB** | Guaranteed buyer |
| **GTSO** | Gas transmission system operator |
| **IBRD** | The International Bank for Reconstruction and Development |
| **IFI** | International financial institution |
| **IMF** | International Monetary Fund |
| **MEU** | Ministry of Energy of Ukraine |
| **Naftogaz / NAK** | National Stock Company “Naftogaz of Ukraine” |
| **NEURC** | National Energy and Utilities Regulation Commission |
| **OECD** | Organisation for Economic Co-operation and Development |
| **OPEC** | Organization of the Petroleum Exporting Countries |
| **SSSU** | State Statistics Service of Ukraine |
| **Ukrenergo** | National Energy Company “Ukrenergo” |
| **World Bank, WB** | The World Bank Group |

## Periods

| | |
|---|---|
| **1H20XX, 2H20XX** | Periods from January 1, 20XX to June 30, 20XX and from July 1, 20XX to December 3, 20XX (unless stated otherwise) |
| **1Q20XX, 3Q20XX** | Periods from January 1, 20XX to April 31, 20XX or September 30, 20XX (unless stated otherwise) |

## Power Plants types

| | |
|---|---|
| **BPP** | Biofuel power plant |
| **CHPP** | Combined heat and power plant |
| **HPP** | Hydro power plant |
| **NPP** | Nuclear power plant |
| **PSPP** | Pumped storage power plant |
| **RES** | Renewable energy sources |
| **SPP** | Solar power plant |
| **TPP** | Thermal power plant |
| **WPP** | Wind power plant |

## Nuclear power plants

| | |
|---|---|
| **KhNPP** | Khmelnytska nuclear power plant |
| **RiNPP** | Rivnenska nuclear power plant |
| **UuNPP** | Uzhnoukrainska nuclear power plant |
| **ZaNPP** | Zaporizka nuclear power plant |

## Thermal power plants

| | |
|---|---|
| **BuTPP** | Burshtynska thermal power plant |
| **DoTPP** | Dobrotvirska thermal power plant |
| **KrTPP** | Kryvorizka thermal power plant |
| **KuTPP** | Kurahivska thermal power plant |
| **LaTPP** | Ladyzhynska thermal power plant |
| **LuTPP** | Luhanska thermal power plant |

# Key terms and abbreviations (2/4)

| | |
|---|---|
| **MyTPP** | Myronivska thermal power plant |
| **PdTPP** | Prydniprovska thermal power plant |
| **SlTPP** | Sloviansk thermal power plant |
| **StTPP** | Starobeshivska thermal power plant |
| **TrTPP** | Trypilska thermal power plant |
| **VuTPP** | Vuhlehirska thermal power plant |
| **ZaTPP** | Zaporizka thermal power plant |
| **ZmTPP** | Zmiivska thermal power plant |
| **ZuTPP** | Zuivska thermal power plant |

## Combined heat and power plants

| | |
|---|---|
| **CHPP 5** | Combined heat and power plant 5 |
| **CHPP-5** | Combined heat and power plant - 5 |
| **CHPP-6** | Combined heat and power plant - 6 |

## Hydro and pumped storage power plants

| | |
|---|---|
| **DsHPP** | Dnistrovska hydro power plant |
| **DsPSPP** | Dnistrovska pumped storage power plant |
| **KaHPP** | Kanivska hydro power plant |
| **KhHPP** | Kakhovska hydro power plant |
| **KrHPP** | Kremenchutska hydro power plant |
| **KyHPP-PSPP** | Kyivska HPP-PSPP |
| **SdHPP** | Serednodniprovska hydro power plant |
| **TshPSPP** | Tashlytska pumped storage power plant |

## Wind power plants

| | |
|---|---|
| **DE WPP** | “Drohobych Energy” wind power plant |
| **OE WPP** | “Ovidiopol Energy” wind power plant |
| **OvWPP** | Overianivska wind power plant |
| **OV-2 WPP** | “Ovid-Wind 2” wind power plant |
| **Pr-1 WPP** | “Prymorska-1” wind power plant |
| **ThWPP** | Tylihulska wind power plant |
| **VKT WPP** | “Wind Kraft Tavria” wind power plant |

## Solar power plants

| | |
|---|---|
| **IE SPP** | “Inhulets-Energo” solar power plant |
| **KiSPP** | “Kilia” solar power plant |
| **PE SPP** | “PodilskEnergo” solar power plant |
| **TkSPP** | “Tokmak” solar power plant |
| **VS SPP** | “Voskhod Solar” solar power plant |

## Countries

| | |
|---|---|
| **BY** | Republic of Belarus |
| **CZ** | Czech Republic |
| **DE** | Germany |
| **FR** | France |
| **HU** | Hungary |
| **MD** | Republic of Moldova |
| **PL** | Republic of Poland |
| **RO** | Romania |
| **RU** | Russian Federation |
| **SK** | Slovak Republic |
| **UAE** | United Arab Emirates |
| **UK** | The United Kingdom of Great Britain and Northern Ireland |
| **USA / US** | The United States of America |

# Key terms and abbreviations (3/4)

## Units

| | |
|---|---|
| **°C** | Celsius |
| **b** | Billions |
| **bbl** | Barrel |
| **cm** | cubic metres |
| **gr** | Gram |
| **GW, GWh** | Gigawatt, gigawatt-hour |
| **ha** | Hectares |
| **kcal/kg** | Kilocalorie per kilogram |
| **km / km$^2$** | Kilometers / kilometers squared |
| **kV** | Thousand volts |
| **kW, kWh** | Kilowatt, kilowatt-hour |
| **m / mln** | Millions |
| **m$^2$ / m$^3$** | Meter squared / meter cubic |
| **mg/nm$^3$** | Milligram per nanogram cubic |
| **Min** | Minute |
| **mm** | Millimeter |
| **MVA** | Mega volt-ampere |
| **MW, MWh** | Megawatt, megawatt-hour |
| **sec** | Second |
| **t / tn** | Tons |
| **ths / k** | Thousands |
| **toe** | Tons of oil equivalent |
| **TW, TWh** | Terawatt, terawatt-hour |
| **Y** | years |

## Macroeconomics and Finance

| | |
|---|---|
| **CAGR** | Compound annual growth rate |
| **CapEx** | Capital expenditures |
| **FDI** | Foreign direct investments |
| **GDP** | Gross domestic product |
| **GDP** | Gross domestic product |
| **LIBOR** | London Interbank Offered Rate |
| **LTI** | Long-term inflation |

## Other

| | |
|---|---|
| **ATO / JFO** | Anti-terrorist operation zone/Joint Forces operation |
| **BEI** | Burshtyn energy island |
| **BRP** | Balance Responsible Party |
| **BSP** | Balancing Service Provider |
| **DAM** | Day-ahead market |
| **DER** | Distributed energy resources |
| **DHC** | District heating and cooling |
| **DSO** | Distribution System Operator |
| **E&P** | Extraction and Production |
| **EMIS** | Analytics agency |
| **EUR** | Euro |
| **GTS** | Gas transmission system |
| **HHI** | Herfindahl-Hirschman Index |
| **ICE** | Internal combustion engine |
| **IDM** | Intra-day market |
| **IPO** | Initial public offering |
| **IPS** | Integrated power system (CIS) |
| **JSC** | Joint stock company |
| **JV** | Joint Venture |
| **LLC** | Limited liability company |
| **LNG** | Liquified natural gas |
| **LPG** | Liquified petroleum gas |

# Key terms and abbreviations (4/4)

| | |
|---|---|
| **M&A** | Mergers and Aqcuisitions |
| **MMS** | Market Management System |
| **N/A** | Not applicable |
| **NES** | National Energy Strategy |
| **NJSC** | National Joint Stock Company |
| **P&U** | Power and Utility |
| **PJSC** | Public Joint Stock Company |
| **PrJSC** | Private Joint Stock Company |
| **PSA** | Production Sharing Agreement |
| **PSO** | Public service obligations |
| **PU** | Power Unit |
| **PVOUT** | Power output |
| **R&D** | Research and development |
| **RAB** | Regulatory asset base |
| **RUB** | Russian ruble |
| **SAIDI** | System Average Interruption Duration Index |
| **SAIFI** | System Average Interruption Frequency Index |
| **SE** | State Enterprise |
| **SFEC** | Specific fuel equivalent consumption |
| **SOE** | State owned enterprise |
| **SoLR** | Supplier of Last Resort |
| **TSO** | Transmission system operator |
| **TUT** | Temporary uncontrolled territories |
| **UAH** | Ukrainian hryvnia |
| **UES** | Ukrainian Energy System |
| **UGS** | Underground gas storage |
| **UPS** | Uninterruptible power source |
| **USD** | US dollar |
| **WMP** | Wholesale market price |

# Section 2.2

# Energy

# CONTENTS

# Executive Summary

# Executive Summary: Introduction

Energy is the lifeblood of an economy. As trivial and overused by global media, as this statement is, it is an axiom: none of the sectors of the economy, basic or cultured, run without energy – with the exception of extreme wildlife tourism. **Affordable energy sources are essential for the development of internal production and its viable competitiveness in foreign markets.** Moreover, the energy sector sufficiency and import independence are crucial for national security; hence, continued investments are critical for its going concern.

Global approach to energy, however, has been shifting dramatically over the past decade, driven by two key factors: **technological progress** unlocking the potential of diverse energy sources and a global push for **sustainability-**driven by both material and perceived effects of climate change on the global economy and livelihood of the planet's population.

By the end of 2020, in part due to COVID-19 shock therapy, several key trends crystallized that we deem key to any analysis of the sectoral potential. These are spread across the general sector matrix we use in our analysis: coal, power (traditional generation, renewables, transmission, distribution, retail), utilities (mainly district heating), gas (extraction, transmission, distribution, processing, storage, retail), oil (extraction, processing, transmission, retail).

**Coal**: As the world pursues the Paris Agreement target of 1.5°C rise over the pre-industrial level, raising carbon price and changing societal behavior, **coal use is expected to inevitably decline as an old-fashion and carbon intensive solution.**

- Private initiatives against new plants: In 2020 General Electrics and Net-Zero Asset Owner Alliance, incl. leading global insurers, announced cease of new thermal coal plants supplying and funding
- Growing competition: The decline in fossil energy consumption entails greater competition among resource owners, increasing the bargaining power of consumers

**Oil**: The drop in fuel consumption due to COVID-19, the ever-growing share of electricity, biofuels and hydrogen used in transport, phasing out fossil fuels, and new ICE technologies will lead to the **future reduction in global demand for oil.**

- Demand reduction: Global demand for oil is steadily reducing, primarily due to the increasing energy efficiency and electrification of road transportation
- Innovations in transportation drive the market: The new energy efficient ICE cars, development of electric robotaxi and utilization of biofuels and hydrogen in aviation and marine narrow the oil market

**Natural gas**: The global shift from fossil to renewable energy sources **leads to a gradual drop in natural gas use in the long run**, though its role of available and affordable low-carbon energy source warrants **steady natural gas demand in the mid-term perspective.**

- Role in decarbonization: The demand for gas is maintained by its wide use within decarbonization initiatives, in conjunction with carbon capture use and storage (CCUS) technology
- Growing LNG trade: Due to the carbon-to-gas shifting in the course of economies decarbonization, the countries become more dependent on the imported LNG

- Change in natural gas use among sectors: The projected decrease in natural gas consumption in buildings is partially offset by the gas used for power generation and blue hydrogen production

**Power**: High carbon prices, falling costs of production, availability of energy sources and stimulating national and regional policies contribute to the **robust growth in the renewable energy market, restrained in the long run by growing balancing costs.**

- Demand growth: Electricity consumption keeps growing across all sectors due to road transport electrification and energy efficiency measures in building and industry
- RES expansion: The need for reduction in the carbon intensity of power generation leads to the rapid growth in renewable energy use, primarily wind and solar power
- Need for balancing technologies: The intermittency of key RES spawns the need for balancing solutions, i.e., HPPs, hydrogen, gas with CCUS and bioenergy, to enable a steady supply

**Utilities**: New trends in energy consumption and societal behavior, intense urbanization, new government programs and digital technologies prompt the **rapid global transformation of the sector, disabling old solutions and revealing new niches**

- Rise of DERs: Governmental policies, financial incentives and customer demand drive the expansion of distributed energy resources (e.g., rooftop solar panels, etc.)
- Decline of conventional technologies: Growing diversification of energy sources spawns competition, requiring a rapid reduction in losses and specific fuel consumption for conventional solutions

Within the framework of the overall FDI enhancement Strategy, we consider the Ukrainian energy sector as a noticeably important FDI target – the following pages will highlight niches and directions we believe will carry the greatest mid-term potential for investments, as well as explain why we see some of the traditional sub-sectors long considered politically important carrying lesser weight in the long-term and thus, less worthy of FDI enhancement efforts.

However, much more importantly, we see it as that proverbial lifeblood – the key economic enabler that in many instances makes or breaks FDI potential of other sectors and the investment destination attractiveness of Ukraine as a whole. Hence, we deem it important to review and provide recommendations regarding gaps and barriers beyond those that are important for direct FDI into the sector.

Importantly, this analysis laser focuses on the mid-term success of the sector both as an FDI target and as an economic enabler. Hence, some of the longer-term trend niches, like the hydrogen sub-sector, are not covered within this sectoral review – they are included as part of the ‘Next 10 Big Ideas’ sub-section provided later in the Strategy.

Ukraine’s energy sector is in many ways a remnant of the Soviet critical infrastructure capabilities – and deficiencies. Coupled with the country’s physical size and geographical positioning, this means that the transformation and attractiveness of the sector are not as easily achievable as with some of its geo-peers. Yet, the potential is there; let’s see how strong a current runs through the sector.

# Executive Summary: Attractiveness Factors and Development Directions

Based on our analysis, **we identified the following**

## KEY FACTORS

influencing the potential attractiveness of the power subsector for investors

**For power subsector:**

- implementation of new electricity market model;
- introduction of RAB-methodology for DSOs;
- upcoming full integration with ENTSO-e after 2025;
- expected elimination of PSO model for households;
- introduction of capacity auctions for maneuverable capacity (gas peaking) and storages.

**For natural gas subsector:**

- elimination of PSO model for households in August 2020 and its expected cancellation for DHCs;
- unbundling of GTSO and its successful certification;
- introduction of electronic auctions for special permits;
- ongoing market development by GTSO and GSSO;
- improved market participants' financial sustainability.

The energy sector in Ukraine could be considered as an attractive one for potential FDI. **We see the following**

## KEY DIRECTIONS

**I** Construction of new maneuverable capacity and storages underpinned by transparent and competitive capacity auctions

**II** Privatization of the state-owned DSOs accompanied by the RAB-methodology implementation

**III** Commissioning of biogas and biofuel power plants supported by the justified feed-in tariff

**IV** Joint ventures for nuclear power units construction

**V** Promotion of PSA mechanism armored by government commitments

**VI** Privatization of PJSC "Centrenergo" reinforced by vertical integration with state-owned coal mines

**VII** IPO of NJSC "Naftogaz of Ukraine" strengthened by the expected full liberalization of the natural gas market

**VIII** Development of new interconnectors as a result of integration with ENTSO-e

# Executive Summary: Gaps, barriers and enablers

Based on our analysis, **we identified the following**

## KEY GAPS

limiting the potential attractiveness of the power subsector for investors

### For power subsector:

- unreasonable price caps for day-ahead and balancing markets distort sustainable business model;
- defective design of PSO model for households blurs price and investment signals for market players;
- cross-border trading restrictions (import bans and dispatching charge for export) limit competition;
- ongoing debt accumulation aggravates the problems;
- inefficient RES support model disappoints investors.

### For natural gas subsector:

- ineffective PSO model for DHCs leads to a further debt accumulation through the heat supply chain;
- unauthorized off-takes and unpaid imbalances threaten the financial stability of the market;
- the low liquidity of the short-term market allows market manipulations distorting price mechanism;
- inefficient permit procedure for subsoil use;
- inconsistency between currency and PSA regulations.

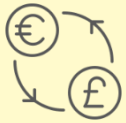
Nevertheless, gaps and barriers could be effectively mitigated, **underpinned by the following**

## KEY ENABLERS

**Sectoral FDI activators**

Near-shoring

**FDI-through-trade activation**



**Auxiliary Sectors Activation**

Lean / additive production

Industrial and tech parks

**Digitizing infrastructure and services**

Supply chain optimization solutions

Private professional education

**Localization incentives**

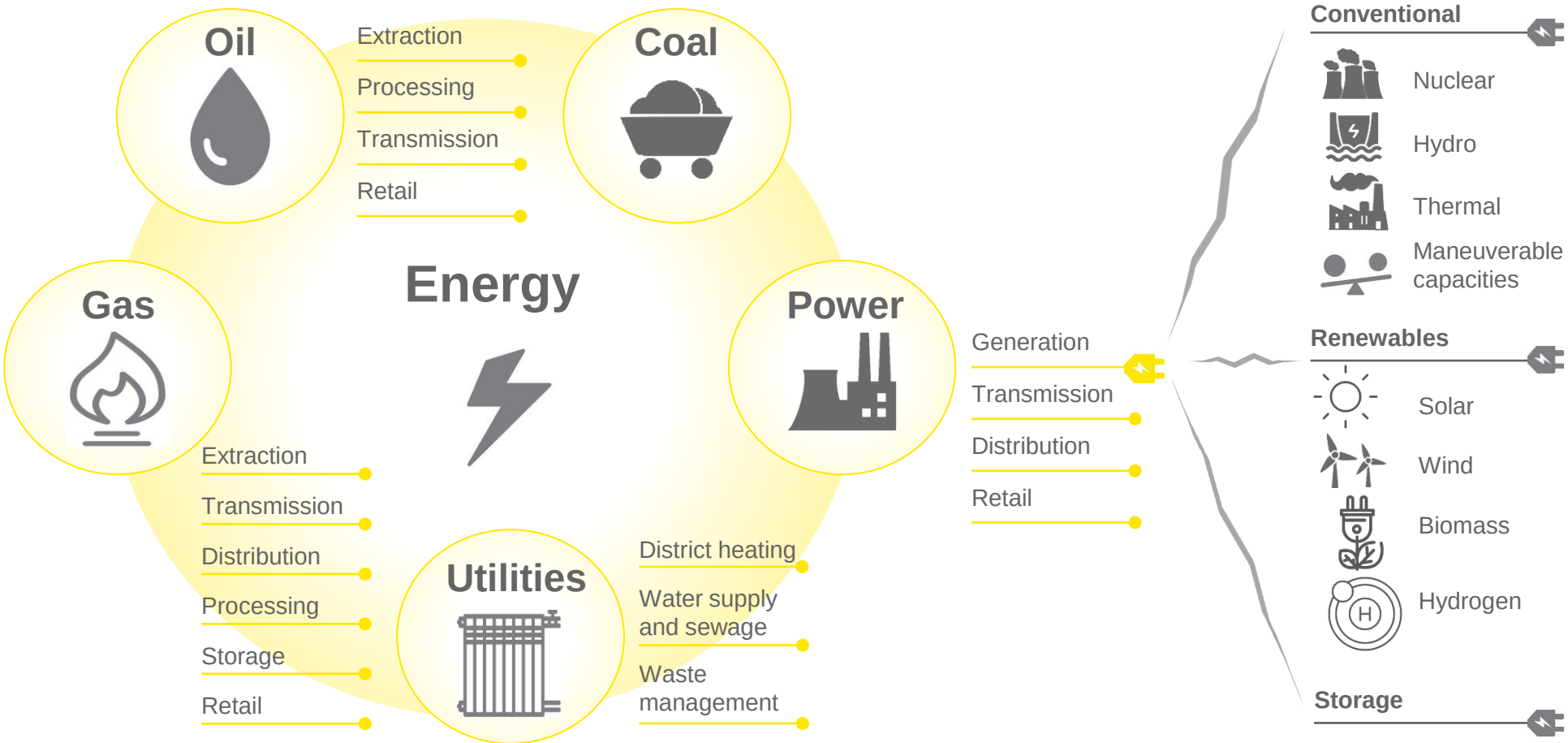
**Inbound R&D Incentives**

Enabling International Technical Agreements

# 2.2.1. Introduction

### 2.2.1. Introduction

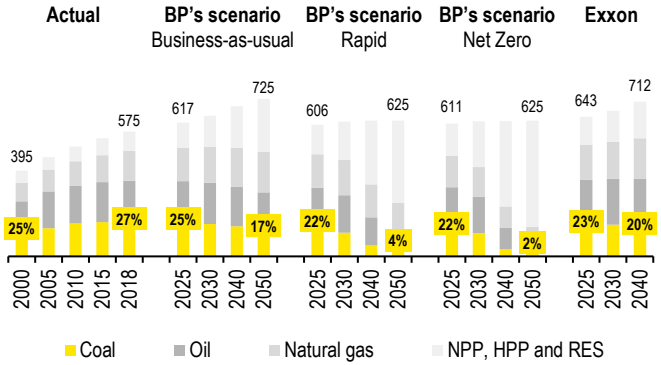
For sectoral analysis, we identified the following key subsectors for the Ukrainian energy industry: power, utilities, energy coal, oil, natural gas




**Utilities, oil, and coal subsectors are not covered in detail within the sectoral analysis as we do not see clear FDI potential for them in Ukraine. Nevertheless, we provided an overview of the global trends for each subsector and also explained our logic for its exclusion from the analysis.**

## 2.2.1. Introduction
Global trends: Coal

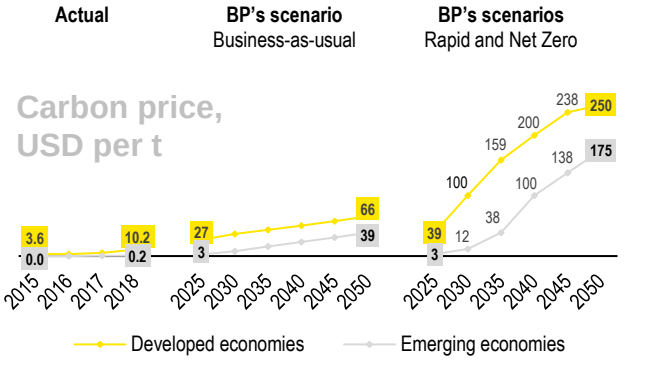
**Share in consumption, EJ**




# Coal

As the world pursues the Paris Agreement target of 1.5°C rise over the pre-industrial level, raising carbon price and changing societal behavior, **coal use is expected to inevitably decline** as an old-fashion and carbon intensive solution.

**Key driver**




### Minimum consumption by 2050

Despite the decarbonization trend, the absolute coal consumption is partially maintained by the growing energy use, mainly in the quickly urbanizing regions

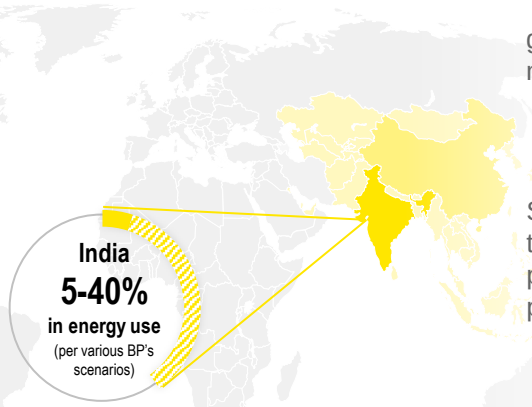
### Private initiatives against new plants

In 2020 General Electrics and Net-Zero Asset Owner Alliance, incl. leading global insurers announced cease of new thermal coal plants supplying and funding

### Growing competition

The decline in fossil energy consumption entails greater competition among resource owners, increasing the bargaining power of consumers

### Major consumers by 2050*




1. Regions with relatively higher % of source in projected energy consumption

### Asia is considered the key market

Though Asia, esp. China is expected to contribute greatly to coal use reduction, it will remain the key market in 2050, given the growing demand for energy

### Power and industry drive fall in coal use

Sill, upon the reduction in coal consumption during the next 30 years, the remaining coal use is projected to concentrate in the power sector and $H_2$ production

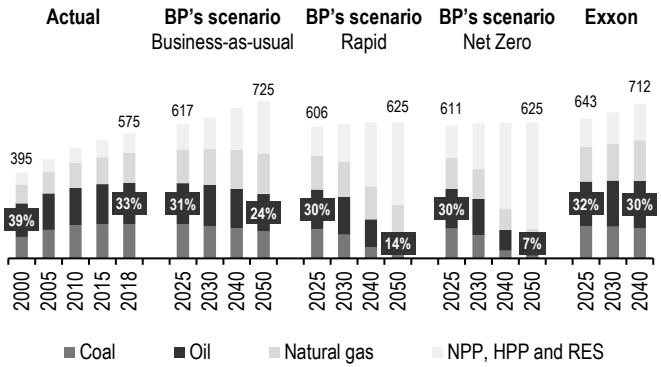
### Impact of COVID-19

The effect of a global pandemic on coal consumption stems from a general reduction in energy demand in connection with a decrease in global GDP

**Source:** BP Energy Outlook by 2050, ExxonMobil Outlook for Energy by 2040, EY analysis

## 2.2.1. Introduction
Global trends: Oil

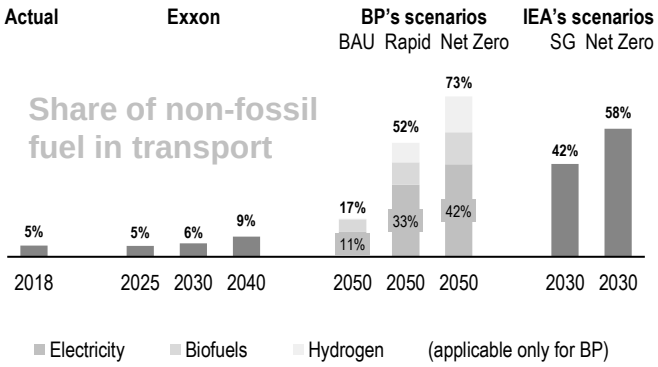
**Share in consumption, EJ**




# Oil

The drop in fuel consumption due to COVID-19, the ever-growing share of electricity, biofuels and hydrogen used in transport, phasing out fossil fuels, and new ICE technologies will lead to the **future reduction in global demand for oil.**

**Key driver**




### 1 Demand reduction

Global demand for oil is steadily reducing, primarily due to the increasing energy efficiency and electrification of road transportation

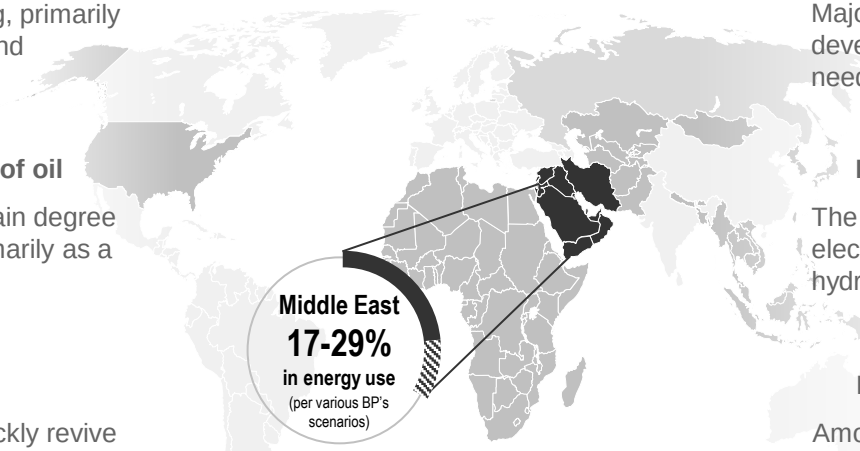
### 2 Potential of non-combusted use of oil

The oil market is expected to gain a certain degree of support from non-combusted use, primarily as a feedstock in the petrochemicals sector

### 3 Growing competition

The US tight oil sector is expected to quickly revive from COVID crisis and rule the market, though it will be partially phased out by the OPEC in long-run

**Major consumers by 2050***




1. Regions with relatively higher % of source in projected energy consumption

### 4 Developed countries lead in oil use fall

Major drop is expected in the OECD and China while developing Asia and Africa with growing transportation needs, and key oil suppliers keep the market

### 5 Innovations in transport drive the market

The new energy efficient ICE cars, development of electric robotaxi and utilization of biofuels and hydrogen in aviation and marine narrow the oil market

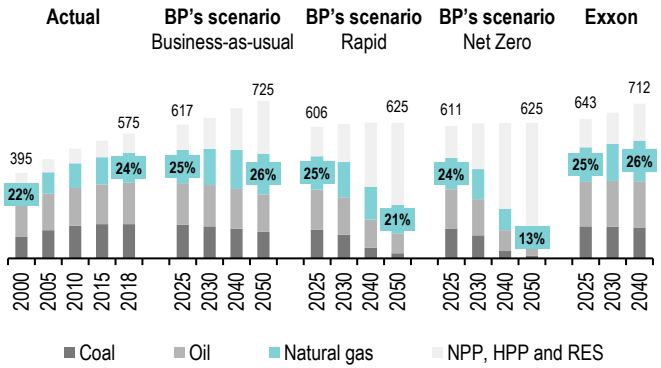
### 6 Impact of COVID-19

Among all energy sources, oil is considered to undergo the sufficient effect of the pandemic, mainly due to reduction in transport use

**Source:** BP Energy Outlook by 2050, ExxonMobil Outlook for Energy by 2040, IEA World Energy Outlook by 2030, EY analysis

## 2.2.1. Introduction
# Global trends: Natural gas

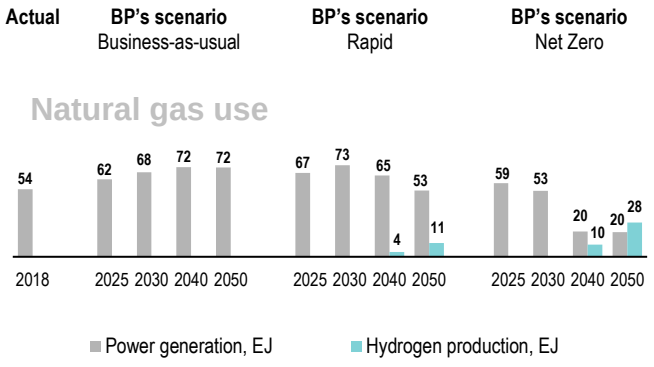
**Share in consumption, EJ**




# Natural Gas

The global shift from fossil to renewable energy sources leads to a gradual drop in natural gas use in the long run, though its role of available and affordable low-carbon energy source warrants **steady NG demand in the medium term.**

**Key driver**




### Role in decarbonization

The demand for gas is maintained by its wide use within decarbonization initiatives, in conjunction with carbon capture use and storage (CCUS) technology

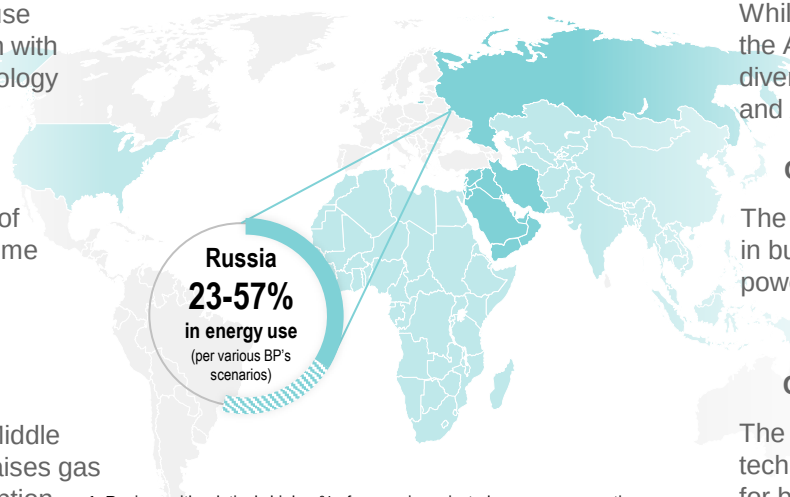
### Growing LNG trade

Due to the carbon-to-gas shifting in the course of economies decarbonization, the countries become more dependent on the imported LNG

### Key markets unchanged

Despite the reduced gas use, Russia and the Middle East remain the key consumers, though Asia raises gas consumption as the cheaper decarbonization option

**Major consumers by 2050***




1. Regions with relatively higher % of source in projected energy consumption

### Global competition

While the demand side is represented primarily by the Asian market, the LNG supply is rather diversified, including the US, Middle East, Russia and Africa.

### Change in NG use among sectors

The projected decrease in natural gas consumption in buildings is partially offset by the gas used for power generation and blue hydrogen production

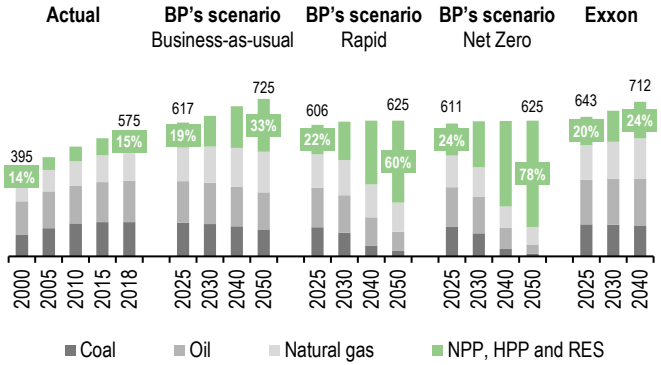
### Growing demand for other gases

The tightening of environmental requirements and technological advancements entail the rise in demand for biogas, biomethane and hydrogen

**Source :** BP Energy Outlook by 2050, ExxonMobil Outlook for Energy by 2040, EY analysis

## 2.2.1. Introduction
Global trends: Power

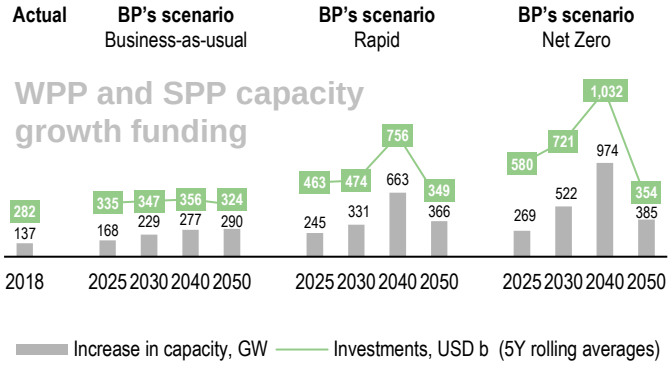
**Share in consumption, EJ**




# Power

High carbon prices, falling costs of production, availability of energy sources and encouraging national and regional policies contribute to the **robust growth in the renewable energy market,** restrained in the long run by growing balancing cost.

**Key driver**




1

### Demand growth

Electricity consumption keeps growing across all sectors due to road transport electrification and energy efficiency measures in building and industry

2

### RES expansion

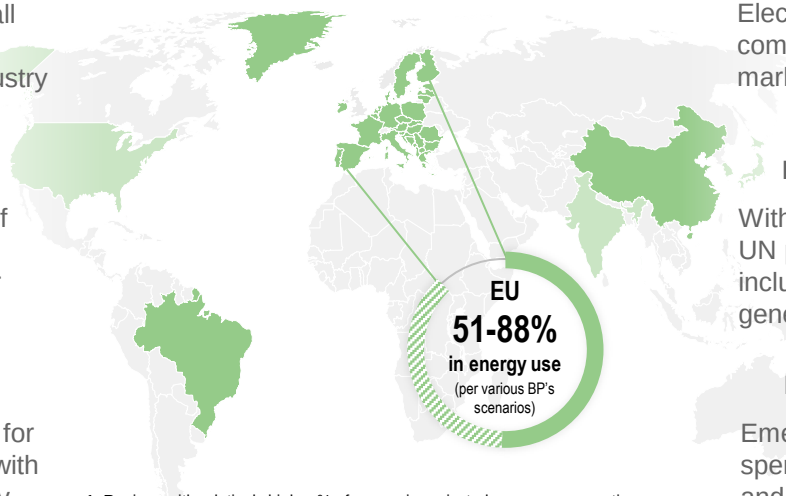
The need for reduction in the carbon intensity of power generation leads to the rapid growth in renewable energy use, primarily wind and solar power

3

### Need for balancing technologies

The intermittency of key RES spawns the need for balancing solutions, i.e., HPPs, hydrogen, gas with CCUS and bioenergy, to enable a steady supply

### Major consumers by 2050*




1. Regions with relatively higher % of source in projected energy consumption

4

### Market localization

Electricity and hydrogen are more costly to transport compared to hydrocarbons, which entails energy markets being more localized

5

### Improved access to electricity

Within the Sustainable Development initiative, the UN promotes improved access to electricity including, decentralized and off-grid power generation

6

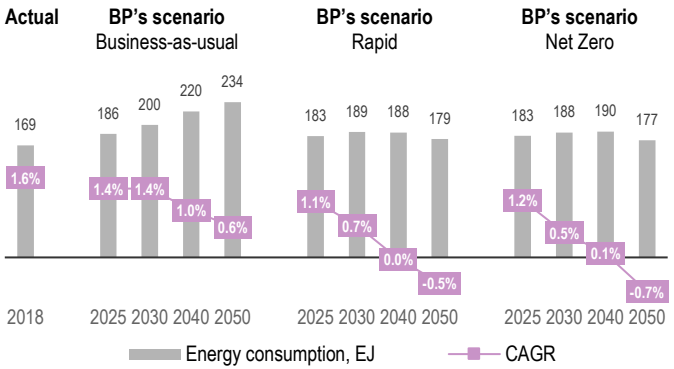
### Electricity grids retard the growth

Emerging markets encounter disparity between the spendings required for smart and flexible networks and the revenues available to grid operators

**Source :** BP Energy Outlook by 2050, ExxonMobil Outlook for Energy by 2040, EY analysis

## 2.2.1. Introduction
Global trends: Utilities

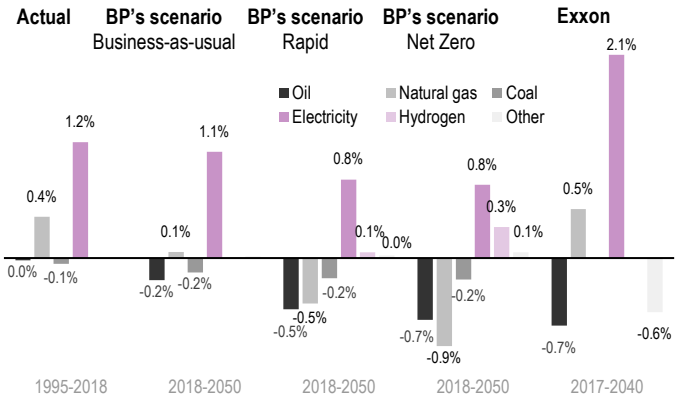
**Energy use in buildings**




# Utilities

New trends in energy consumption and societal behavior, intense urbanization, new government programs and digital technologies prompt the **rapid global transformation of the sector,** disabling old solutions and revealing new niches.

**CAGR per resource for buildings**




### 1 Rise of DERs

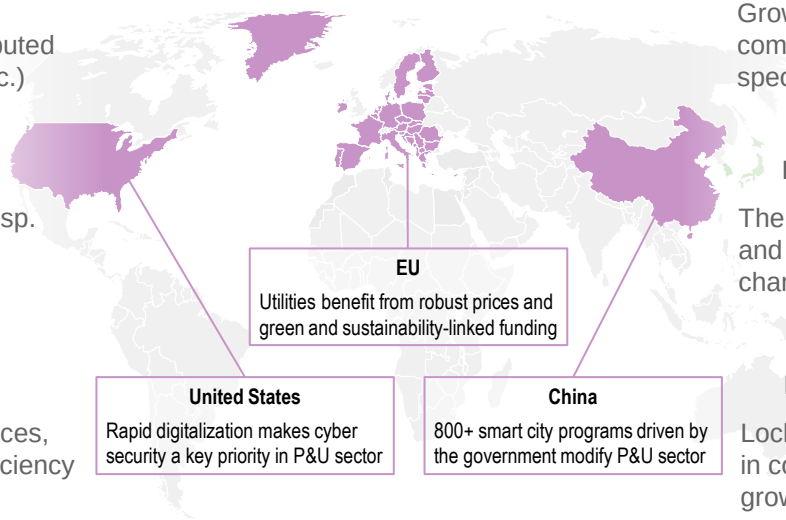
Governmental policies, financial incentives and customer demand drive the expansion of distributed energy resources (e.g., rooftop solar panels, etc.)

### 2 Growing investments in infrastructure

Funds are spent on the proliferation of DERs, esp. those involving RES, and advanced metering systems

### 3 Benefits of digitalization

Smart metering technologies and smart appliances, e.g. boilers or heat pumps, will raise energy efficiency and flexibility, addressing the load shift issue




### 4 Decline of conventional technologies

Growing diversification of energy sources spawns competition, requiring a rapid reduction in losses and specific fuel consumption for conventional solutions

### 5 New opportunities

The involvement of utilities in smart city programs and the increasing need for electric vehicles charging infrastructure shape new growth prospects

### 6 Impact of COVID-19

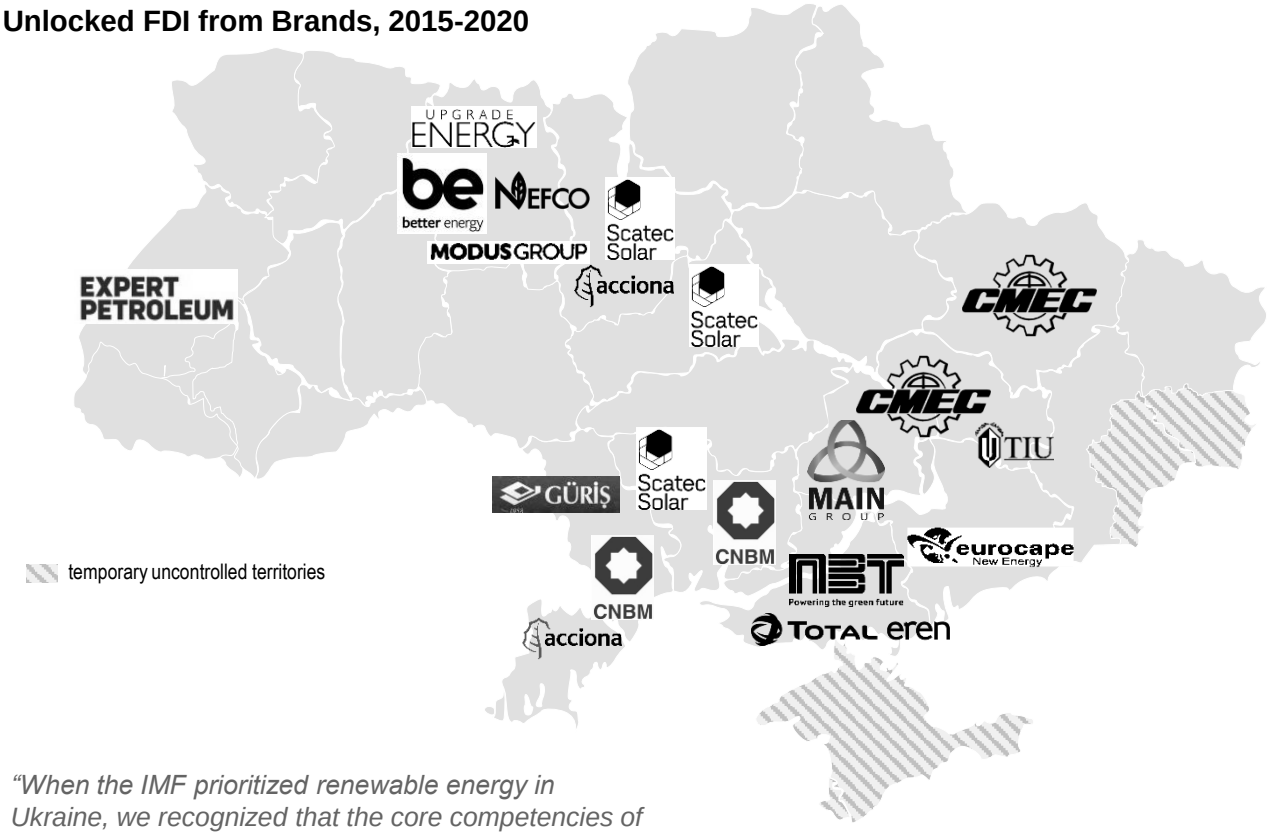
Lockdown measures due to pandemic led to the drop in consumption, especially by industry and commerce, growth in bad debts and supply chain frictions

**Source :** BP Energy Outlook by 2050, ExxonMobil Outlook for Energy by 2040, EY analysis

## 2.2.1. Introduction

Energy sector FDI has been predominantly focused on renewables, driven mainly by feed-in-tariffs and increased interest from foreign investors

**Unlocked FDI from Brands, 2015-2020**




*"When the IMF prioritized renewable energy in Ukraine, we recognized that the core competencies of Canada created considerable investment opportunities for us in Ukraine. We see strong parallels between Ukraine's current energy independence efforts and the 1980s-2010s hydrocarbons boom in Canada."*

**Michael Yurkovich**
TIU Canada CEO

*"The Nikopol solar power plant will become the largest solar power generator in Ukraine and Europe. The joint work of DTEK and CMEC will be an example of cooperation for other Ukrainian and Chinese companies."*

**Mr. Zhang Chun Chairman of China**
Machinery Engineering Corporation

**Unlocked FDI, 2015-2020**

**$1.9b**

**Declared FDI, 2015-2020**

**$4.9b**

**Source:** "Ukraineinvest"

**Wind energy**

**$960 m**

**Solar energy**

**$900 m**

**30**

New production facilities (solar and wind)

**500**

Jobs created since 2015

**Source:** "Ukraineinvest"
**Note:** Unlocked FDI is already released in the Ukrainian economy. Declared FDI is still not invested in the Ukrainian economy, but approved and declared.

## 2.2.1. Introduction

The coal mining subsector is not considered as attractive for investments due to high production costs, decreasing demand and environmental issues

### Reasons for omitting subsector analysis

**Coal**

- Need for significant capital investment
- Old-fashioned technology
- Social tension in the coal-mining sector

### Total number of Ukrainian coal mines

**148**

**102** – state-owned

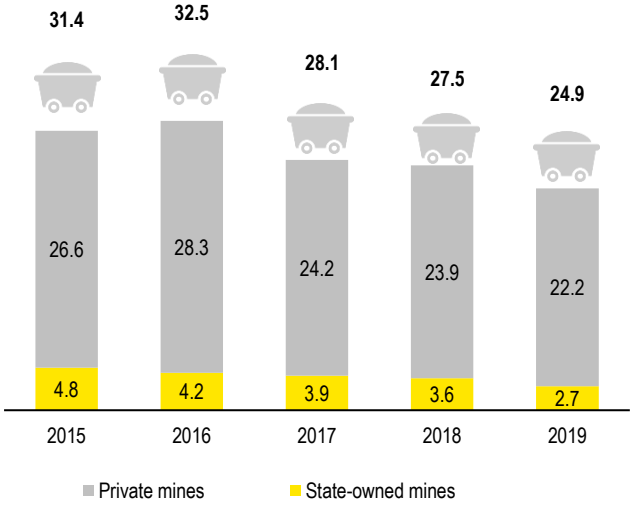
**46** – private

**67** Located on the temporary uncontrolled territory

**33** Operating coal mines

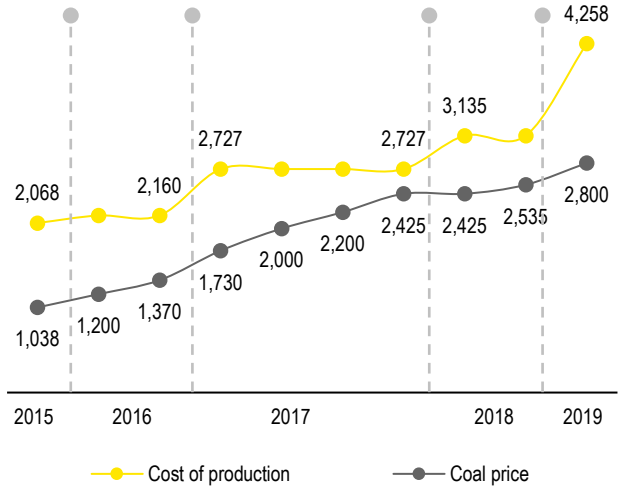
**2** Non operating coal mines

### Dynamics of energy coal production by private and state-owned mines, mln t




Source: Ministry of Energy

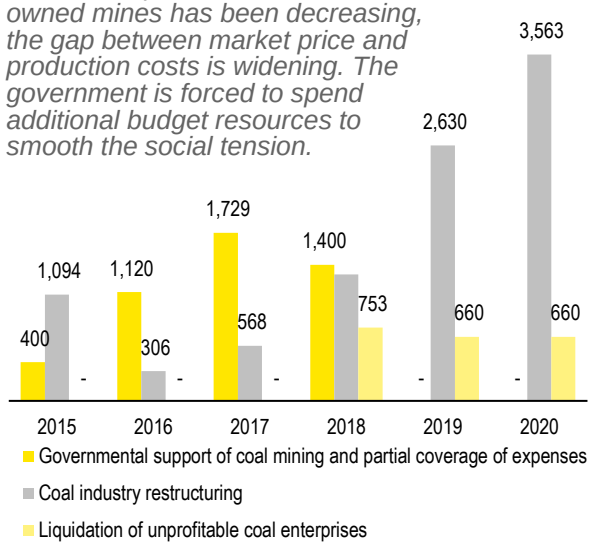
### Dynamics of coal production costs and coal price for state-owned mines, UAH/t




Source: Ministry of Energy

### Subsidies for the coal industry, UAH m

*As the coal production of state-owned mines has been decreasing, the gap between market price and production costs is widening. The government is forced to spend additional budget resources to smooth the social tension.*

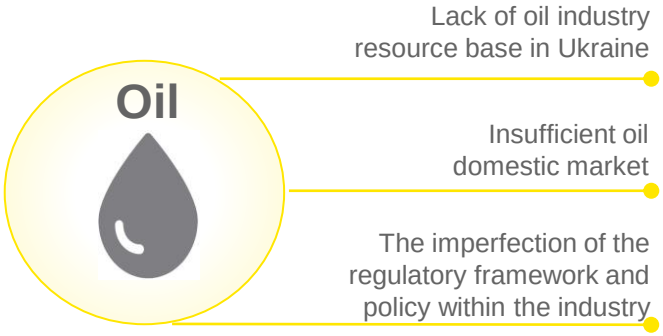



Source: state budget

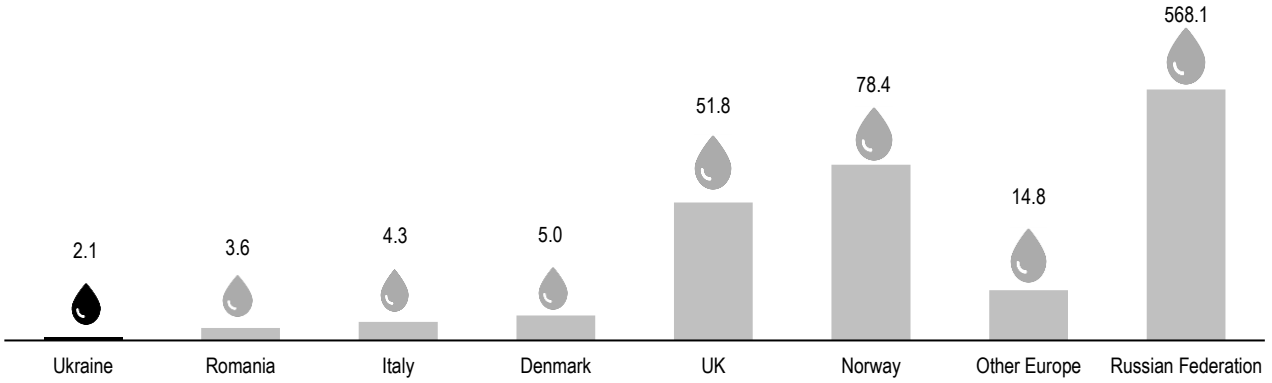
## 2.2.1. Introduction

# The investment potential of the oil industry is limited due to the absence of significant oil deposits, weak internal demand and low margin through the business chain

### Reasons for omitting subsector analysis




### Oil production in Ukraine and selected countries 2019, mln t




**Source:** BP Energy Report 2020

### Ukrainian oil production and proven reserves

Ukraine's oil industry largely depends on the activities of the state because oil production is carried out mainly by enterprises that are subsidiaries of NJSC "Naftogaz of Ukraine". In 2019, only 6% or 0.13 mln t of total oil production was performed by private companies. The remaining 71% and 23% were produced by PJSC "Ukrnafta" and PJSC "Ukrgasvydobuvannya", correspondingly. Opportunities for the Ukrainian oil production industry in the short and medium-term are limited, as the main fields in Ukraine are depleted, and potential sources of oil extraction are not used due to lack of investment. According to official data from the State service of geology and subsoil of Ukraine, there are 110 mln t of technically available oil reserves in Ukraine as of 2020, which is less than in other countries: Russian Federation - 14,700 mln t, Kazakhstan – 3,900 mln t, Norway -1,100 mln t, UK - 400 mln t, etc.

### Ukrainian oil refining capacities and their owners

| | | |
|---|---|---|
| **Kremenchug 18.6 mln t** | Operating | UkrTatNafta |
| **Lisichansk 16.0 mln t** | Stand idle after 2012 | Rosneft |
| **Kherson 1.1 mln t** | Stand idle after 2005 | Continuum Group |
| **Drogobytch 3.2 mln t** | Stand idle after 2012 | PrivatBank Group |
| **Odessa 2.8 mln t** | Stand idle after 2010 | N/A |
| **Nadvornaya 2.6 mln t** | Stand idle after 2012 | PrivatBank Group |
| **Shebelynsky 1.0 mln t** | Operating | Naftogaz Group |

### Oil refining is the most vulnerable subsector

Despite its large refining capacity of 922,000 bbl per day, the Ukrainian refining sector is in a poor state. All but two of Ukraine's refineries remain closed, leading to a severe underutilization of its refining capacity. The country's six refineries - which date back to the Soviet era – lack competitiveness and have seen drastic underinvestment. Historically operating at below 40% utilization rates, the economic crisis, political tensions and Joint Forces Operation since 2014 have seen utilization rates fall further, to under 5% over the past three years. Domestic refinery production has reached historical lows and Ukraine is increasingly dependent on refined fuel imports to satisfy its muted domestic demand. There is a process of fuel production modernization within Ukraine's oil refining industry to meet European fuel production standards. This should be an incentive for further market expansion.

## 2.2.1. Introduction

# The absence of investment stimulus, dependence from local authorities and regulation gaps discourages investors from entering the utilities subsector

### Reasons for omitting subsector analysis


- Dependence on local authorities
- Lack of investment incentives
- The imperfection of the regulatory framework and policy within the subsector

District heating is divided into 3 separate activities, i.e., heat production by heating plants and cogeneration (CHPs, TPPs, NPPs and cogeneration units), transportation comprising heating transmission and distribution networks with heat points and heat supply. According to Law 1682-III, "On Natural Monopolies," heat transportation services refer to the natural monopolists' scope of operations, while production and supply services are considered adjacent markets. Both categories are subject to state regulation that is performed by NEURC and by local authorities. The key goal of NEURC's tariff regulation is to enable DHCs to function under self-financing.

As of 31 July 2020, 108 entities in Ukraine have valid NEURC licenses. Among them, 27 DHCs engage in heat generation, transportation and supply, 7 – in heat transportation and supply, 2 – only in heat supply and 72 – solely in cogeneration. The entities include state-owned, municipal, public, limited liability companies.

**21**
**thousands of boilers**

44.5% of boilers that are used over 30 years needs reconstruction

**21**
**thousands km of heat networks**

83.9% of heat networks that are used over 25 years needs reconstruction

**7.4**
**bcm of gas consumption by DHCs in 2019**

DHC consumption for households' need equals to 4.6 bcm, for needs of industrial clients - 2.8 bcm

According to the NEURC's estimates, one of the key issues in district heating in Ukraine is the high degree of physical depreciation. Meanwhile, the reduction in heat output entails a decrease in funding compared to the amounts envisaged in investment programs. In 2019, actual funding by depreciation and investments in profit was 22% and 32% lower, respectively, than the planned one. Apart from investment programs, reconstruction projects are funded by external resources provided by the international financial institutions, including the World Bank, EBRD and NEFCO. Currently, these institutions provide funding for seven projects involving eight NEURC licensees in the amount of USD 147.2 m and EUR 56.7 m. Interest payments, as well as other expenses related to IFIs' funding, are included in the tariff structure as financial expenses. The projects typically include the reconstruction of boilers and heat networks, as well as the installation of individual heat points and biofuel boilers. In 2019, the share of IFIs in total DHCs' equipment reconstruction funding amounted to 64.6%.

### Weaknesses of the Ukrainian DHCs

**Tariffs level adequacy**

The key driver of tariffs for heat is the price for natural gas, given the share of gas, cost amounts to about 80% in tariffs. The growth in gas price may potentially lead to the excess of DHCs' costs over the tariffs assigned that entails losses for DHCs.

**Insufficient level of payments from consumers**

DHCs face the problem of insufficient level of payments from consumers, in particular from the households, which resulted in a low percentage of payments for natural gas consumed by DHCs.

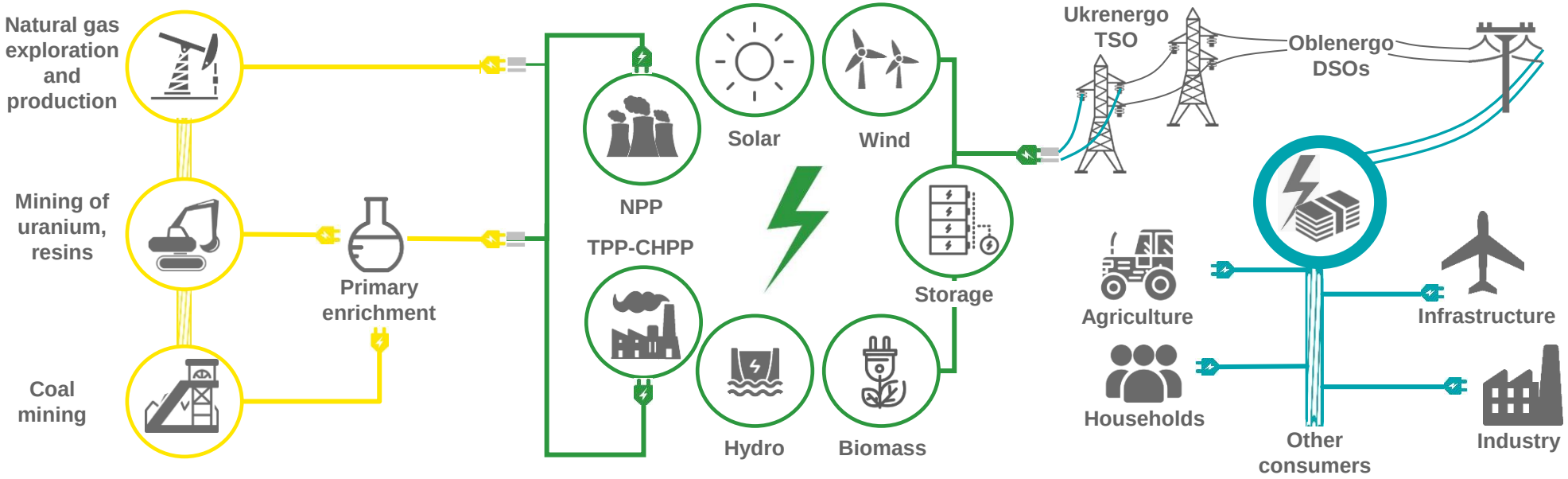
**Potentially required support from local authorities**

In 2019, the subsidies from the local budget were reduced to zero. However, some DHCs are still accumulating losses due to the low level of collections, thus some support may still be required.

# 2.2.2. Power

## 2.2.2. Power

Within the operational flow of the power subsector, the analysis was focused on the electricity generation, transmission, distribution and consumption (retail)




### Raw materials production and primary enrichment

There are three primary energy sources that could be used for power generation: mining of uranium for NPPs, mining of coal for TPPs, exploration and production of natural gas for CHPs and CCGTs. Additionally, lithium can be mined and used for battery production.

Gas coal should be enriched at processing plant to be used in power generation. Anthracite could be delivered directly to the power plant. Natural gas is also used at coal TPPs as a backlight.

### Electricity generation

Electricity generation is a conversion of sources of energy such as coal, natural gas, oil, nuclear power, and so on to electricity. Electricity generated through renewable energy sources such as hydro, wind, solar, biomass and biogas is called “green.” At the same time, electricity produced at NPPs and CCGTs could also be called “green” as their emissions almost zero.

Another important and quite new type - storages and maneuverable capacity is rapidly evolving.

### Transmission, distribution and consumption of electricity

The electricity that power plants generate is delivered to consumers over transmission and distribution power lines (high voltage transmission minimizes the number of power losses as electricity flows from one location to the next).

This complex system is called the “grid” and includes substations, transformers, and power lines that connect electricity producers and consumers. DSOs purchase electricity by a regional transmission reliability organization.

## 2.2.2. Power

# Current legislative framework and legislative initiatives (1/2)

### Association Agreement between the European Union and Ukraine

- Provides that Parties should not adopt or maintain a measure resulting in a higher price for exports of energy goods to the other Party than the price charged for such goods when intended for domestic consumption
- Customs duties and quantitative restrictions on the import and export of energy goods and all measures having equivalent effect are prohibited between the Parties
- Sets priority on the integration of energy systems

### Energy Community Treaty

- Under the Treaty, Ukraine undertakes to follow the missions of the Community:
  - Establishment of a stable regulatory and market framework capable of attracting investment in power generation and networks
  - Creation of an integrated energy market allowing for cross-border energy trade and integration with the EU market
  - Enhancing the security of supply to ensure stable and continuous energy supply
  - Improvement of the environmental situation in relation to energy supply, renewable energy, and energy efficiency

### Energy Charter Treaty

Provides a multilateral framework for energy cooperation. It is designed to promote energy security through the operation of more open and competitive energy markets while respecting the principles of sustainable development and sovereignty over energy resources.

Has rules and mechanisms covering:

- Protection of foreign investments, based on the extension of national treatment or most-favored national treatment (whichever is more favorable) and protection against key non-commercial risks
- Non-discriminatory conditions for trade in energy materials, products, and energy-related equipment based on WTO rules and provisions to ensure reliable cross-border energy transit flows through pipelines, grids, and other means of transportation
- Resolution of disputes between participating states, and - in the case of investments - between investors and host states
- Promotion of energy efficiency and attempts to minimize the environmental impact of energy production and use



### Law of Ukraine "On Electricity Market"

- Establishes the regulatory framework for the electricity market and its governing authority - the National Energy and Utilities Regulatory Commission of Ukraine (NEURC)
- Says which infrastructural objects can be owned privately by the companies and/or individuals and which ones are exclusively in the public ownership. For instance, the power production and DSOs can be privately owned, whereas the transmission grid is entirely state-owned. Concession and privatization of the transmission grid is prohibited
- Introduces a mechanism of state support to incentivize construction of generation capacity under the tender procedure

### Law of Ukraine "On Alternative Energy Sources"

Introduces the feed-in tariff as a policy incentive for the renewable energy producers, providing the higher rate for purchasing the “green” energy by a designated state-owned enterprise

### Market Rules, approved by Resolution of the NEURC No. 307 dated 14 March 2018

Determines the procedure for registration of market participants, resolution of disputes between market participants and other parties, and balancing the forecasted and actual energy outputs as well as the procedure for ensuring the proper discharge of obligations under the agreements on the settlement of electricity imbalances

### Regulation on Tender Procedure for the Distribution of Support Quotas, approved by Resolution of the CMU No. 1175 dated 27 December 2019

Supplements the Law of Ukraine **"**On Alternative Energy Sources**"** by specifying the mechanism for operation of “green capacity auctions” and the bidding procedure where the new renewable energy producers can compete for the state support in the form of the support quotas (higher feed-in tariff)

### Transmission System Code, approved by Resolution of the NEURC No. 309 dated 14 March 2018

Governs the relationships between the TSO and other market participants and establishes the procedure for equal access to the transmission grid for all market players. TSO should carry out its business impartially and competitively

### Distribution Systems Code, approved by Resolution of the NEURC No. 310 dated 14 March 2018

- Governs relationships between the distribution system operators and other market players
- Establishes the procedure for granting access to the distribution grid
- Sets out the general rules on the operation of the distribution grid

## 2.2.2. Power

# Current legislative framework and legislative initiatives (2/2)



**Regulation on the Imposition of Special Responsibilities on Participants of the Electricity Market to Ensure the Public Interest in the Operation of the Electricity Market, approved by Resolution of the CMU No. 483 dated 5 June 2019**

Sets state-regulated tariffs on electricity for household consumers in the form of PSO for major state-owned power producers, state-owned TSO and suppliers

**Regulation on Tender Procedure for the Construction of Generation Capacity and Implementation of Demand Management Measures, approved by Resolution of the CMU No. 677 dated 10 July 2019**

Sets out a tender procedure for granting governmental support for the construction of generation capacity to cover the demand for electricity in a certain area

**Rules of the Electricity Retail Market, approved by Regulation of the NEURC No. 312 dated 14 March 2018**

Govern relationships between the market participants and consumers, provide the relevant sample contracts for these arrangements

**Regulations Governing the Activity of the Guaranteed Buyer and Purchase of Electricity at the "Feed-in" Tariff and at the Auction Price, approved by Resolution of the NEURC No. 641 dated 26 April 2019**

- Establishes the contractual procedure, terms and conditions for trading in the "green" energy at a feed-in tariff
- Standardizes power purchase agreement (PPA) in respect to the "green" energy and sets forth the auction rules

**Amendments to the Procedure on Determining the Regulatory Asset Base of the Natural Monopolies in the Electricity Sector, approved by Resolution of the NEURC No. 1607 dated 26 August 2020**

- Establish a higher tariff (regulatory asset base (RAB) tariff) for the operators of the distribution grid to encourage investment in renovation and renewal of such grids
- Set out a tariff rate of 16.74% of the assets value of the electricity distribution facilities under construction
- Set out a tariff rate of 3% of the assets value of the existing electricity distribution facilities

**Procedure on the Introduction of Tariffs on the Electricity Distribution Services, approved by Resolution of the NEURC No. 1175 dated 5 October 2018**

Specifies how tariffs for the electricity distribution services, including RAB tariffs, can be established

**Energy Strategy of Ukraine for the Period up to 2035 "Security, Energy Efficiency, Competitiveness":**

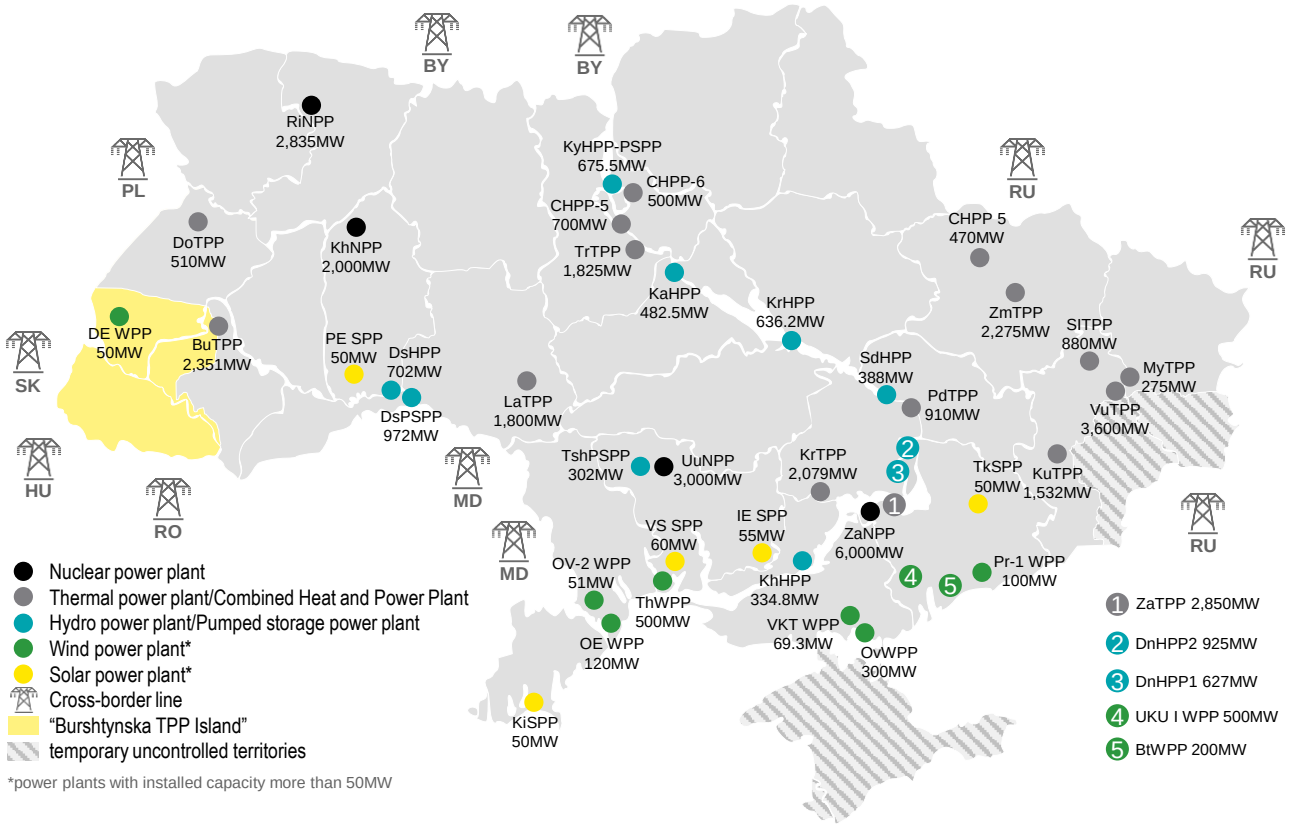
- Provides for liberalization of the energy market and reduction of government-run monopolies. Transparency, alignment with the EU legal framework and enhancement of regulatory mechanisms are seen as key preconditions for attracting investments
- Provides for implementation of a reliable and predictable renewable energy policy
- Aims to introduce a mechanism to attract the investments in the state program on replacement of obsolete facilities with new infrastructure, especially in respect of large combustion plants
- Further stresses the need to develop the RES sector and attract new businesses in RES
- Envisages the development of "Smart Grids" energy network
- Establishes the policy priorities to encourage the development of innovative technological parks in the energy sector

### Legislative initiatives:

- **Establishment of energy storage regulation**. Draft Law No. 2582 sets out general rules relating to the energy storage technology and its operators, allowing its use in the balancing of the state energy market. It has not been adopted in the first reading yet. The review of the Draft Law has pointed out several deficiencies, particularly inconsistency with the EU Directive 2019/944 on common rules for the internal market for electricity
- **Unbundling of TSO in accordance with ISO model of EU Directive 2009/72/EC** is proposed by the Draft Laws No. 3267 and No. 3364-1. This will create preconditions for acquiring a full membership in ENTSO-e, accessing the joint financing mechanisms, adopting the joint mechanism for compensation of costs from the cross-border transmission of electricity to the requirements of EU Regulation 838/2010, and for performing the international obligations of Ukraine, in particular, those relating to the TSO certification
- **Shortening of terms of the tender procedure for generation capacity construction** (from 6 to 3 months on publication of tender condition) is envisaged by Draft Law No. 3657
- Draft Law of Ukraine "On Amendments to Certain Legislation of Ukraine Regarding the Improvement of the Procedure for the Use of Land Plots under Energy Facilities" simplifies access to electricity facilities by reducing the timeframes for allocation of the land plots under such facilities and granting land easements. The Draft Law has been made available on the MEU's web site for public discussion since 29 September 2020
- **Ban on purchase of electricity** from Russia is proposed by the Draft Law No. 3262-1

## 2.2.2. Power

The national power system is one of the largest in Europe, but is still technically integrated with former USSR countries, which limits its potential




**Installed generation capacity, 2019**

**52.8GW**

**Cross-border capacity, 2019**

**5.5GW**

**Generation output, 2019**

**154.0TWh**

Source: NEC "Ukrenergo"

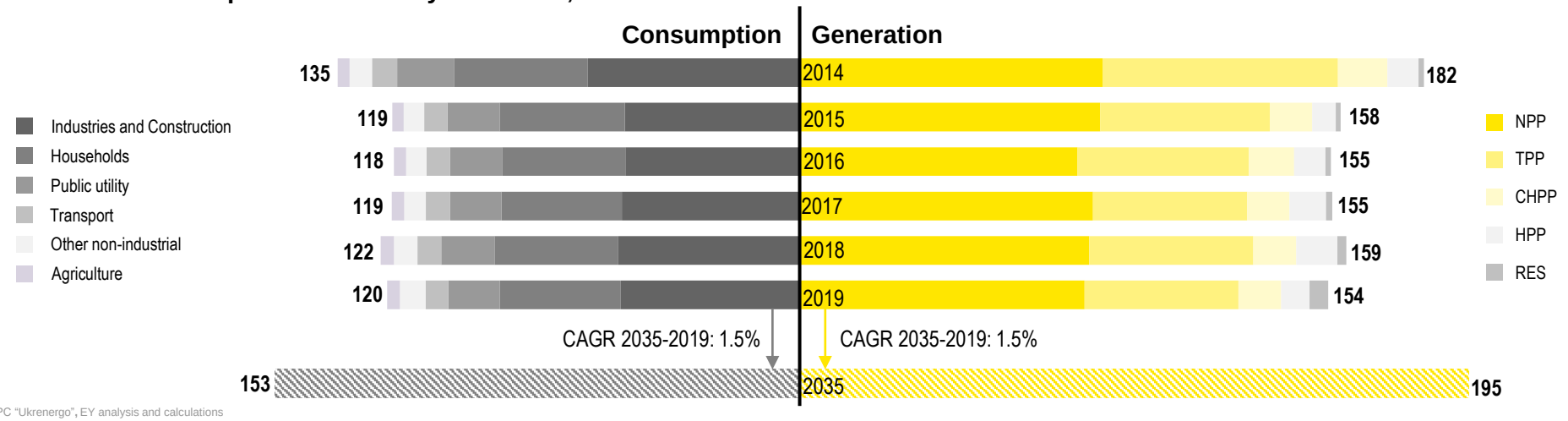
The Ukrainian Energy System (UES) is integrated with IPS/UPS (Russia, Moldova, Belarus) but the part of the system (so-called "Burshtynska TPP Island") is functioning in parallel with ENTSO-E, which allows to export/import electricity to/from the EU (Hungary, Romania, Slovakia). According to Ukrainian Energy Strategy 2035, the integration with ENTSO-E is expected in 2025. The majority of electricity companies (TPPs and DSOs – oblenergo's) were privatized during 2010-2013. NPPs, HPPs and some DSOs and TPPs are state-owned. NEC "Ukrenergo" is a transmission system operator responsible for dispatching and cross-border flows of electricity.

Electricity industry is regulated by two main authorities: Ministry of Energy and Environmental Protection of Ukraine (MEU, develops energy policy, including strategy, main laws, and also conducts the supervision of state-owned energy enterprises) and National Energy and Utilities Regulation Commission (NEURC, the Regulator implements energy policy, develops secondary legislation, monitors the activity of natural monopolies, approves investment programs and sets tariffs). The Energy and Utilities Committee of the Parliament plays an active role as well (considers draft laws which must be approved by the Parliament and makes necessary amendments).

## 2.2.2. Power

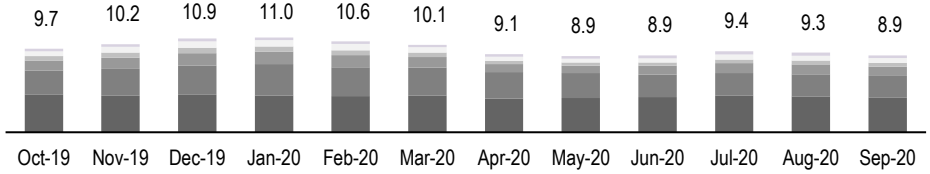
# Despite the decrease of consumption of recent years, stable growth is expected, underpinned by electrification, EV and appliances penetration

### Generation and consumption of electricity in Ukraine, TWh

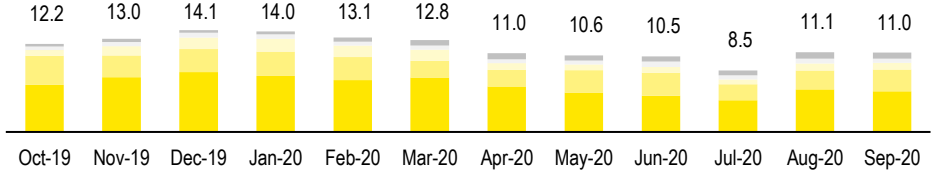



**Source:** NPC "Ukrenergo", EY analysis and calculations

The decline in consumption was driven by conflict in the Donbas region. The Ukrainian economy has lost large industrial enterprises, which were stopped or were left on the temporarily uncontrolled territory. Difficult economic situation and an increase in electricity prices both for industrial consumers and households have placed additional pressure on the level of consumption. Nevertheless, consumption has stabilized since 2016 at the level of ~118-122 TWh and is going to reach 153 TWh in 2035 (+27.5% compared to 2019, CAGR 1.5% according to the target scenario of NEC "Ukrenergo"). The main share belonged to industrial consumers, 43.4% in 2019. The share of households was equal to 29.3% in 2019. Warm winter resulted in a moderate decline in electricity consumption in 2019. Consumption drivers till 2035 would be the following: the increasing penetration of electrical appliances, the increasing energy efficiency, and the electrification of the economy.




The sharp decrease in a generation (from 181.9 TWh in 2014 to 157.7 TWh in 2015) was caused by a drop in consumption due to armed conflict in the Donbas region (Crimea annexation mainly influenced data for 2013-2014, there was another drop in generation up to 11.6 TWh for that period). Moreover, in 2014 and 2015, NPC "Ukrenergo" technically was limiting consumption during peak periods as the lack of coal led to a generation capacity deficit. Nevertheless, a generation has stabilized since 2016 and NPC "Ukrenergo" expects it will reach 195 TWh in 2035 (+26.6% compared to 2019, CAGR 1.5%, according to NPC "Ukrenergo"). The significant increase in generation in 2035 is explained by the increasing demand for conditioning due to global climate change, the development of the agro-industrial sector and armament industry, transport electrification, the realization of infrastructure projects, implementation of robot-assisted automation.



## 2.2.2. Power

# Growth of trading operations could be achieved, especially with Europe considering interconnectors and installed generation capacity surplus

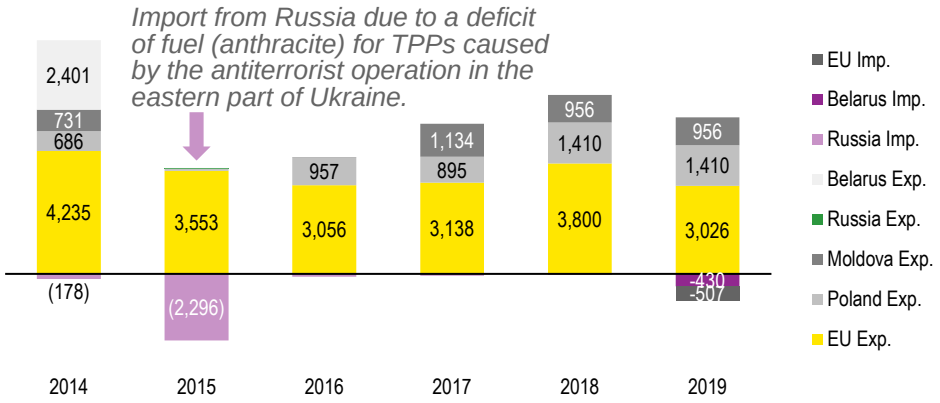
Companies are able to supply electricity to all neighboring countries. For such purposes, they need to buy the right to use cross-border capacity from TSO. The supply to Poland is carried out directly from DoTPP. The supply to ENTSO-e (HU, RO, SK) is ensured mainly by BuTPP. The available capacity of mentioned TPPs has a direct impact on the ability of companies to export electricity. Cross-border capacity is allocated by TSO during yearly, monthly and daily electronic auctions. According to Ukrainian Energy Strategy, till 2035, UES should be integrated into ENTSO-e not later than 2025 (connections with IPS/UPS will be terminated).

Export to Moldova and Belarus became unprofitable in 2015 as the government decided to include subsidies in the price of electricity sold by SOE “Energorynok” to exporters. As a result, the price rose by 30% and Ukrainian companies were replaced by Russian suppliers. Export to Moldova was renewed in April 2017.

The main EU export direction is Hungary – prices there are higher than in Romania and Slovakia. The volume of export to the EU has been decreasing in 2016-2017 as the prices for electricity and cross-border capacities in Ukraine have been rising.

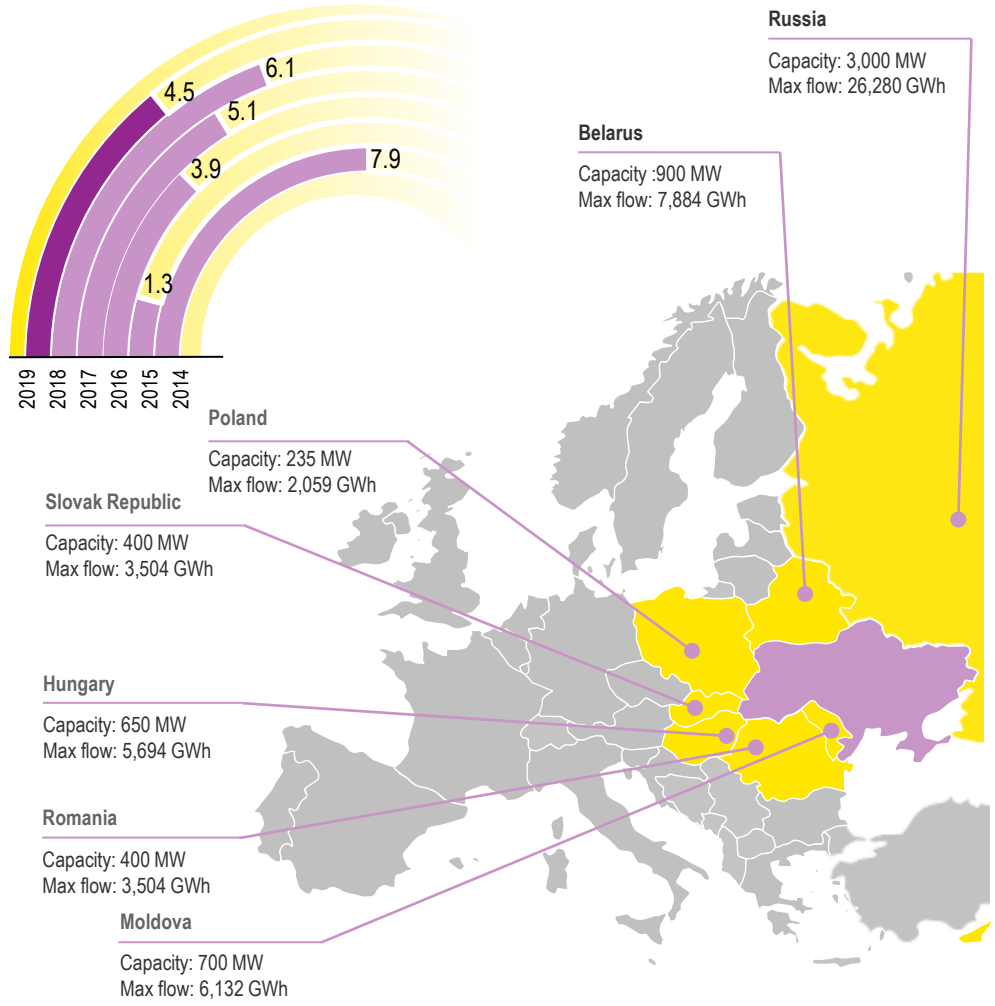
Before July 2019 import of electricity was prohibited for private companies, but now it is actively used by traders. Import from Russia and Belarus was allowed after the new market model introduction but now is being banned due to political tensions.

### Export and import of electricity, breakdown by countries, GWh




**Source**: Ukrenergo

### Total net export (TWh) and technical indicators for interconnectors




**Source**: Ukrenergo

## 2.2.2. Power

# Ukrainian government is going to finish the construction of two power units at KhNPP and considers involvement of the foreign investors for the Project

## Key features

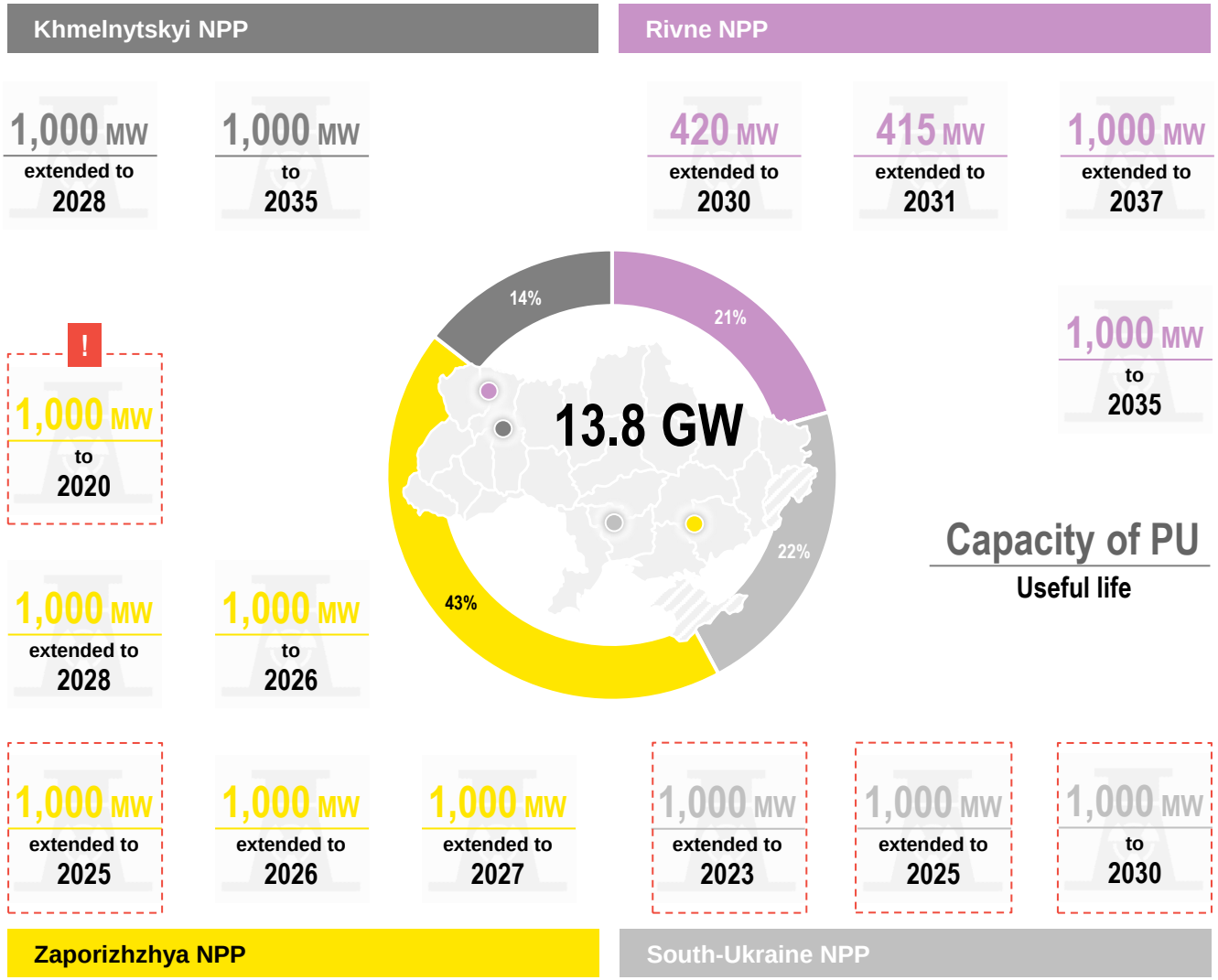
- In 2019, nuclear power amounted to 53.9% of total power generation in Ukraine
- All nuclear power plants in Ukraine are managed by one state-owned enterprise, i.e., SE “NNPC “Energoatom”
- One of the key priorities in nuclear power in Ukraine is the extension of power units’ useful life

NPPs operate in the base load mode. Since the cost of nuclear power is significantly lower, as compared to other sources, NPPs provide their product at the lowest price that is their key competitive advantage. Hence, other producers cannot penetrate their niche.

The projected 30-year useful life of 10 nuclear power units has expired. The justified duration of additional useful life ranges from 10 to 20 years and is determined specifically for each unit based upon the results of security revaluation. Currently, the projected useful life of 1 more 1 GW power unit is about to expire and the possibility of its extension has still been considered. If the extension is not approved, the UES will face a capacity reduction of 1 GW. Besides, the useful life periods of 3 PUs, which were extended by 10 years in 2013 and 2015 are to expire within next 5 years that may enlarge capacity reduction by 3 GW.

In order to provide the system with cheaper and cleaner energy, Ukraine plans to resume construction of two power units at Khmelnytskyi NPP. As of now, PU#3 is completed by 75%, PU#4 by 28%. NNPC Energoatom is considering different financing mechanisms including involvement of the western companies, such as Barkclays, EDF, Westinghouse.

### Nuclear power generation capacity in Ukraine




**Source**: Ukrenergo

## 2.2.2. Power

# Additional 3 GW of hydro capacity should be commissioned by 2026 to ensure the security of supply, but involvement of investors is not considered

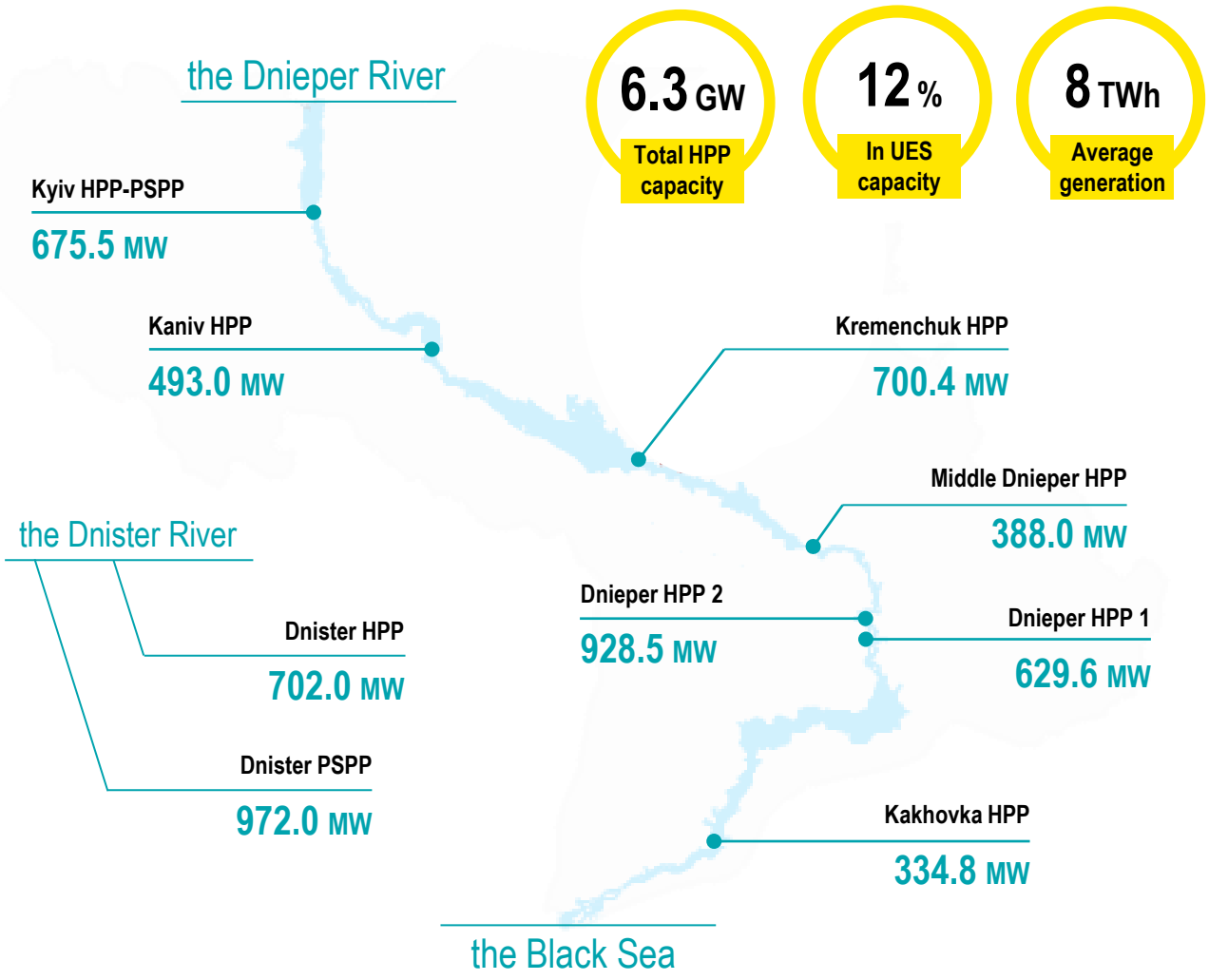
### Key features

- In 2019, hydro power amounted to 5.1% of total power generation in Ukraine
- All operating hydro power plants and pumped storage power plants are managed by state-owned enterprise PJSC "Ukrhydroenergo"
- HPPs and PSPPs are the most flexible peak power producers in Ukraine

Though hydro power is the essential driver of power balance, the installed capacity is not provided with sufficient hydro resources for efficient load regulation. In fact, the output in 2019 was the minimum for the past four years due to the abnormally high temperature in winter 2019-2020, as well as the lack of precipitation and the absence of snow banks. Meanwhile, the demand for balancing services increases, driven by the transition to the new market model and growth in RES capacity. This entails the active involvement of HPPs in balancing.

According to the TSO's 10Y Development Plan, Ukraine is going to increase the capacity of HPPs by 112 MW via reconstruction of existing plants, i.e., Kaniv HPP, Kremenchuk HPP, Dnieper HPP and Middle Dnieper HPP. Furthermore, the plan includes the launch of the 4th hydroelectric generating unit of Dnister PSPP and the construction of Kaniv PSPP with the launch of two units. Initially, the Plan envisaged the construction of Kakhovka HPP-2, but currently, the project is still pending regarding the environmental issues. Overall, the hydro power generation capacity of Ukraine is expected to increase by nearly 3,000 MW.

**Hydro power generation capacity in Ukraine**




**Source**: PJSC "Ukrhydroenergo"

## 2.2.2. Power

4 out of 5 companies engaged in TPPs operation in Ukraine are private.
Privatization of state-owned PJSC “Centrenergo” is expected in 2Q2021

There are five companies engaged in TPPs operation presented as follows:

| 880 MW | 4,800 MW | 4,661 MW | 5,940 MW | 3,027 MW |
|---|---|---|---|---|

Installed capacity (excl. gas and fuel oil power units, and power units located on the TUT)

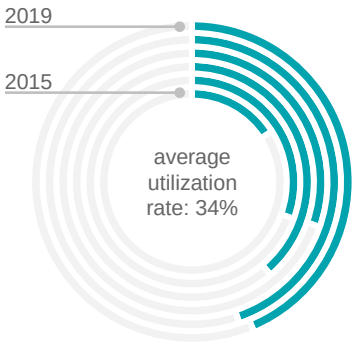
lost TPPs, located on the TUT

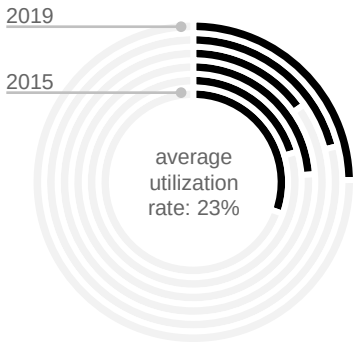
| PJSC “Donbasenergo” | PJSC “Centrenergo” | PJSC “Zakhidenergo” | PJSC “Dniproenergo” | “Skhidenergo” LLC |
|---|---|---|---|---|
| Sloviansk TPP | Vuhlehirska TPP | Burshtynska TPP | Kryvorizka TPP | Luhanska TPP |
| Starobeshivska TPP | Trypilska TPP | Dobrotvirska TPP | Prydniprovska TPP | Kurakhivska TPP |
| | Zmiivska TPP | Ladyzynska TPP | Zaporizka TPP | Zuivska TPP |

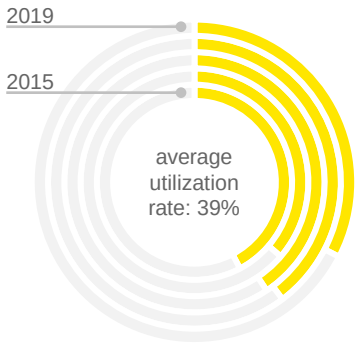
PJSC “Donbasenergo” is a private power generating company: 60.9% belongs to PJSC “Energoinvest Holding”, whereas the state owns 25%+1 share of the company. In 2017 Donbasenergo lost control over Starobeshivska TPP, which is located on the TUT. Therefore, Sloviansk TPP is the only one operating TPP of Donbasenergo.

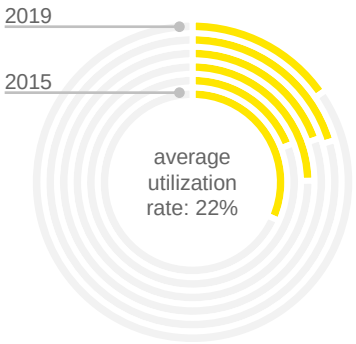
PJSC “Centrenergo” is a state-owned company operating 3 TPPs with a total installed capacity of coal-fired power units (4,690 MW) and gas and fuel-oil power units (3,000 MW). TPPs were built mainly during 1960-1973. In 2018 the government tried to privatize the company, but as of now, this process is not finished.

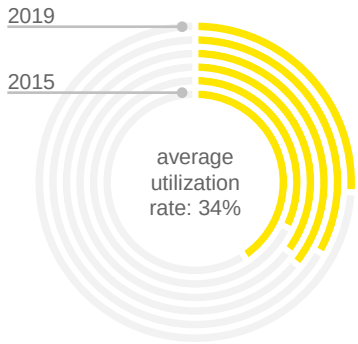
DTEK is a vertically integrated holding developing four business streams in the energy sector – its companies produce coal and natural gas, generate electricity at TPPs, SPPs and WPPs, distribute and supply heating and electricity to final consumers, and provide energy services. It is a part of the financial and industrial group System Capital Management which is owned by the richest Ukrainian citizen – Rinat Akhmetov. TPPs were built mainly during 1958-1977, but the company invested in the complex retrofitting program during 2010-2017. Given the scope of operations, DTEK is fairly secured in terms of electricity generation business (the coal extracted at the company’s mines is used in electricity generation). However, TUT imposes certain limitations on the company’s activities – the control over Zuivska TPP, as well as anthracite mines of DTEK located on the TUT, was lost in 2017. As a result, DTEK began to import coal from Poland, the USA, South Africa and Russia (Russia hsa blocked the supply in 2019). It also has already switched 4 power units from Anthracite to coal G.



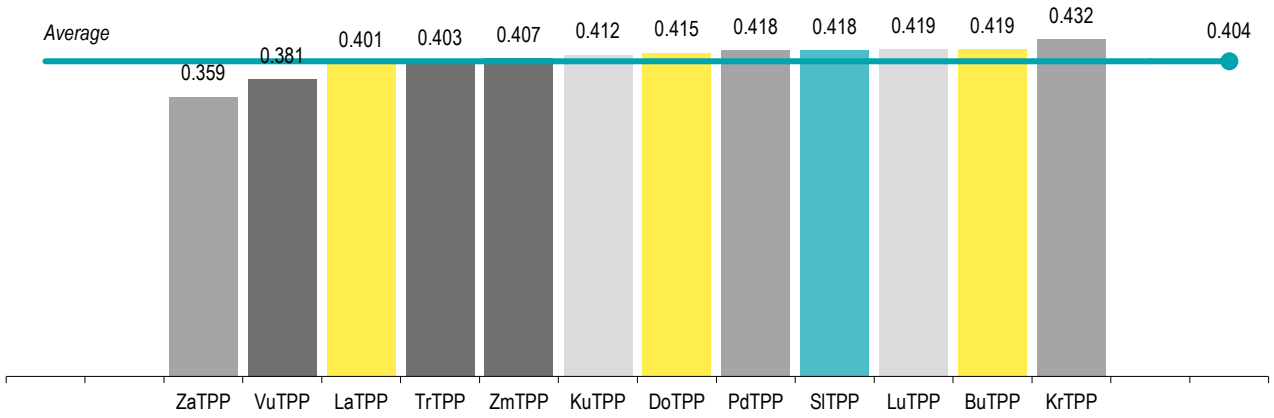



## 2.2.2. Power

# The competitive positioning of TPPs is crucial for market understanding as their power units are marginal and determine the wholesale market price

### Competitive position based on specific fuel equivalent consumption rates (SFEC), toe per MWh

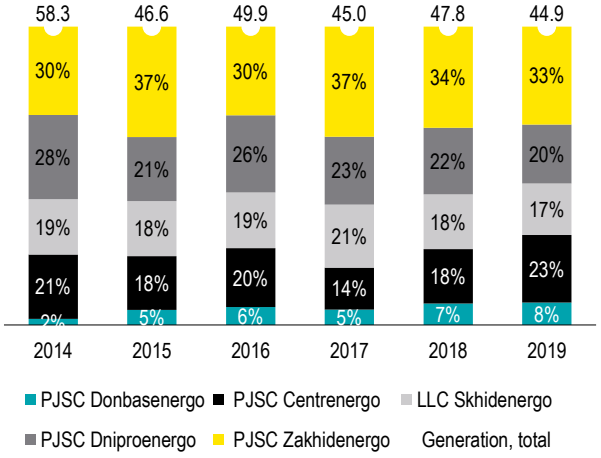



**Source**: Ministry of Energy, EY calculations and analysis

The competitive position within the market is based on the two main factors: coal purchase price and specific fuel equivalents consumption rate (SFEC, how much coal is needed to sell kWh of electricity). The data about the coal purchase price of TPPs is not public. Nevertheless, it is reasonable to assume that all companies should use the energy coal market price (or its transparent benchmark) to avoid cross-subsidization between margin in coal segment and margin in the generation segment. Taking it into account, the competitive position of the TPP's power unit should be based on the SFEC. The Ministry of Energy disclosed aggregate data (by TPP, see chart to the left) about SFEC for 2018. On average Ukrainian PUs consumed 450 gr to sell 1 kWh during 2018 (pay attention, that output should be used to calculate SFEC).

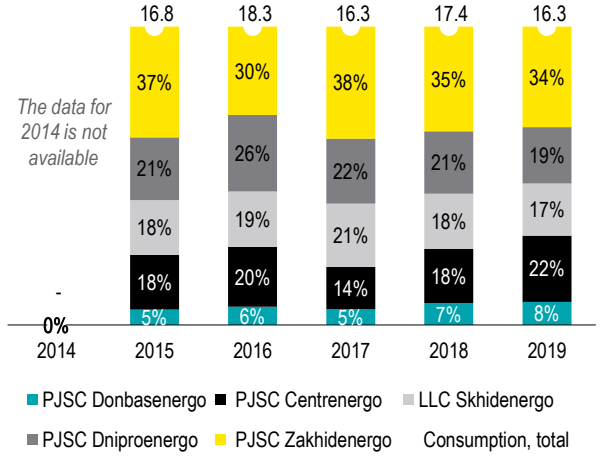
It is important to pay attention to SFEC considering the following: 1) the price of the day-ahead market is determined by the last (marginal) sold power unit; 2) for Ukrainian power system, this marginal PU generates electricity from energy coal (TPPs have the highest cost of generation and they close the ranking of the capacity sold within day-ahead); 3) TPPs nominate their bids for day-ahead market taking into account only variable expenses; 4) coal (fuel) accounts for more than 90% of variable expenses and is the main driver for the bid level. For 2018 ZaTPP (owned by DTEK, the majority of PUs were recently reconstructed) has the most efficient power units based on SFEC (350 gr per kWh). The second place went to VuTPP (state-owned PJSC "Centrenergo," which is subject to privatization, was reconstructed during 2013-2014).

### TPPs' electricity generation structure, TWh




**Source**: Ministry of Energy

### TPPs' coal consumption structure, toe mln




**Source**: Ministry of Energy

## 2.2.2. Power

RES achieved abnormal growth in recent years, but now investors are suffering from untimely payments and technological limitations of load



**Solar power (SPP)**

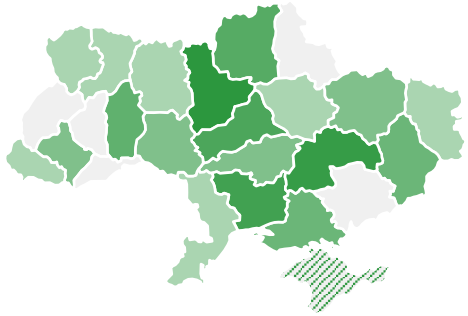
**4.94 GW**

Installed generation capacity

**Wind power (WPP)**

**1.07 GW**

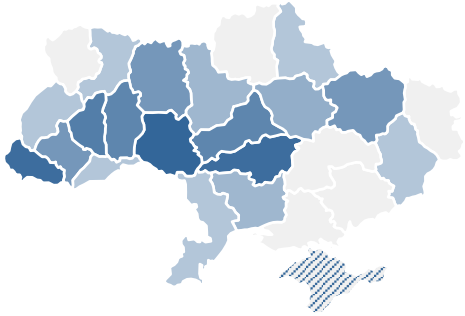
Installed generation capacity



**Biomass and biogas (BPP)**

**177 MW**

Installed generation capacity



**Hydro power (Small HPP)**

**184 MW**

Installed generation capacity

Considering the significant resource base and state support for renewable energy producers, Ukraine is a very promising market for renewable energy sources. In fact, it has areas with great wind energy potential, which include regions near the Black Sea and the Azov Sea, the Carpathians and elevated terrains in Donetsk, Luhansk and Dnipro regions. As well, the regions near the Black Sea and the Azov Sea have a high photovoltaic power potential – up to 1314-1387 kWh/kWp (long term average PVOUT for 1994-2015, according to the World Bank data. These factors drive the growth in both RES capacity and output.

In 2019, renewable power amounted to 3.6% of total generation in Ukraine. Moreover, during the past 3 years, renewable power generation was growing by 54.2% annually, on average. The most significant increment was observed in 2019 (more than by 2 times, as compared to the previous year). The key drivers of such growth were solar power and wind power. In fact, 2,667 MW of SPPs and 704 MW of WPPs were placed into operation in 2019 (466 MW and 61 MW, respectively, in 2018). During the first half of 2020, the SPPs' capacity increased by 21.1%, while the WPPs' and BPPs' capacity grew by 2.7% and 19.6%, respectively. The output of RES sources is seasonal based on weather factors. HPPs produce the most electricity during spring, which is caused by an increased level of river water due to snow melting. As well, the speed of the wind is the fastest during winter, and irradiation is higher in summer.

According to the National Energy Strategy of Ukraine, until 2035, "Security, energy efficiency, the competitive ability," the share of renewable power in a total generation is expected to grow to 25% in 2035. At present, the investment attractiveness of the RES industry in Ukraine is questionable, as a result of the feed-in tariff restructuring process in 2020 and the debt accumulation by Guaranteed Buyer (the level of settlement with producers eligible for a feed-in tariff is 40.6% for 2020).

## 2.2.2. Power

# The unreasonably high feed-in tariff skyrocketed the investments and RES capacity commissioning, which led to loss-loss situation for all stakeholders

## Feed-in tariff

- Feed-in tariff as a supporting scheme for RES was introduced in 2009 when Ukrainian Parliament adopted the new legislation. It was established to encourage the commissioning of new RES capacities upon joining European Energy Community, Ukraine committed that RES reached 11.0% of total consumption.
- The state guarantees that after the feed-in restructuring process in July 2020 the feed-in tariff will not be changed or canceled (but it guaranteed the same before restructuring).

## Feed-in tariff formula

Feed-in tariff value for each generation type

The coefficient, dependent upon power unit capacity and its commissioning time. Generally, the coefficient decreases with the increase in capacity being installed and the time of installation

$$T = K * F * (1 + P)$$

Premium for the usage of Ukrainian equipment (local premium)

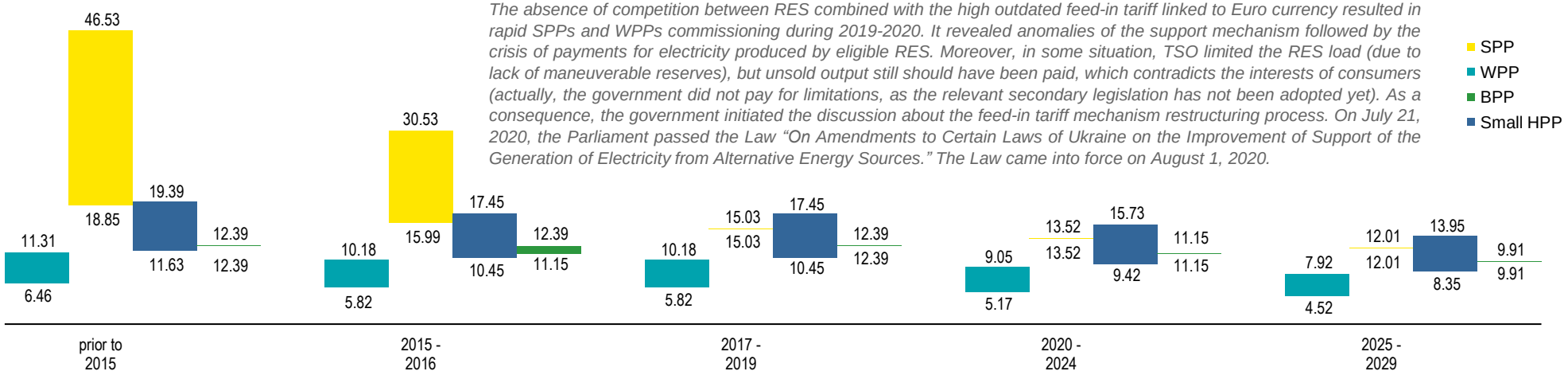
| Level of usage | Premium |
|---|---|
| No less than 30% | 5% |
| No less than 50% | 10% |

**Source**: the Law of Ukraine "On electricity market"

Fixed rate set by NEURC on December 23, 2008 equals EUR **0.05385** per kWh

### Feed-in tariff[1] for different generation types depending on the commissioning period, Eurocent/kWh

*The absence of competition between RES combined with the high outdated feed-in tariff linked to Euro currency resulted in rapid SPPs and WPPs commissioning during 2019-2020. It revealed anomalies of the support mechanism followed by the crisis of payments for electricity produced by eligible RES. Moreover, in some situation, TSO limited the RES load (due to lack of maneuverable reserves), but unsold output still should have been paid, which contradicts the interests of consumers (actually, the government did not pay for limitations, as the relevant secondary legislation has not been adopted yet). As a consequence, the government initiated the discussion about the feed-in tariff mechanism restructuring process. On July 21, 2020, the Parliament passed the Law "On Amendments to Certain Laws of Ukraine on the Improvement of Support of the Generation of Electricity from Alternative Energy Sources." The Law came into force on August 1, 2020.*



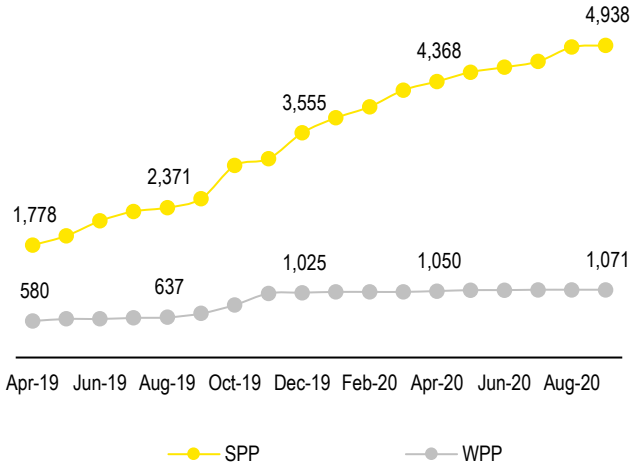

1. Tariff varies depending on the capacity being installed. Therefore, ranges for each commissioning time are presented.

**Source**: NEURC, EY calculations and analysis

## 2.2.2. Power

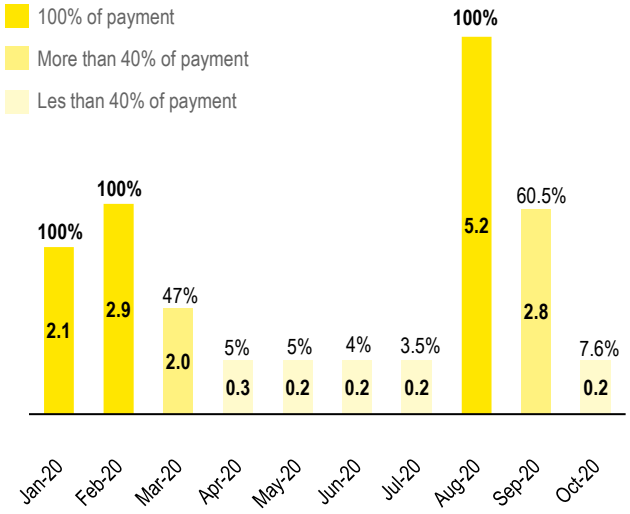
Combined with restructuring process, the introduction of capacity auctions for RES should improve the overall situation with RES support mechanism

### SPP and WPP capacity dynamics, MW



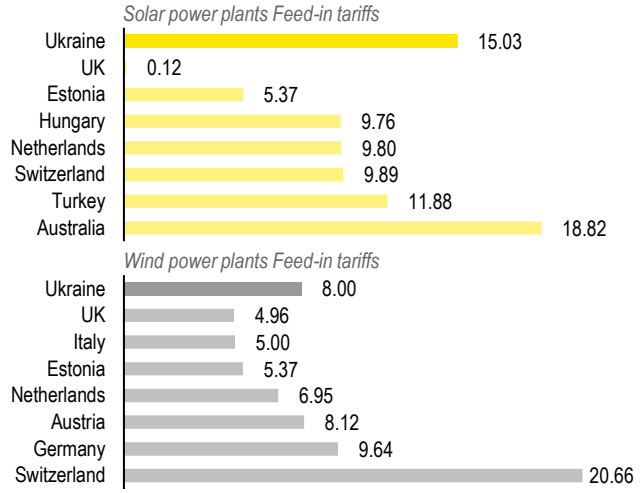

**Source**: Ukrenergo, EY analysis and calculations

### Payments within Feed-in tariff 2020, b UAH




**Source**: GB, EY analysis and calculations

### Feed-in tariffs in the world 2019, Eurocents/kWh




**Source**: OECD, EY analysis and calculations

On 10 June 2020, the Ukrainian government signed the Memorandum on fixing problematic issues in the renewable energy sector of Ukraine. As the continuation of the signed Memorandum, Verkhovna Rada registered the Draft Law on restructuring of "green" tariff and improvement of auctions regulation and the Parliament Energy Committee approved it. Terms of the Law about feed-in tariff restructuring can be view as follows: RES auctions to be launched in 2021 and the model of holding auctions is being improved; compensation for curtailments of renewable generation; certain measures are envisaged to improve settlements with RES producers going forward; Government of Ukraine is instructed to develop law on mechanisms for settlement of the Guaranteed buyer's historical debt (approx. UAH 16 billion as of July 2020); reduction of Feed-in tariff rates without extension of the Feed-in tariff validity period; strengthening liability for imbalances.

According to the Law, the tariff for WPPs commissioned from 1 July 2015 till 2019 will be reduced by 7.5% (by 2.5% for those commissioned from 2020). The reduction for under and over 1 MW SPPs commissioned from 1 July 2015 till 2019 will amount to 10% and 15%, respectively (2.5% for all SPPs commissioned from 2020 and 60% for over 1 MW SPPs commissioned from 1 August 2020). At the same time, the RES operators are provided with the stabilization provisions, since the government guarantees that "green" tariffs will not be changed or cancelled from 1 July 2020 till 31 December 2029.

Since feed-in tariff scheme in Ukraine had led to extremely high profitability, the new Law of Ukraine No.2712-VIII "On Introduction of Certain Changes to Laws of Ukraine regarding Ensuring Competitive Conditions for the Generation of Electricity from Alternative Energy Sources" was adopted on 25 April 2019, that implemented the capacity auctions for RES producers that should improve the situation due to the lack of government payments within Feed-in tariff.

## 2.2.2. Power

# Procedure for executing a PPA with State Company “Guaranteed Buyer”

### Background

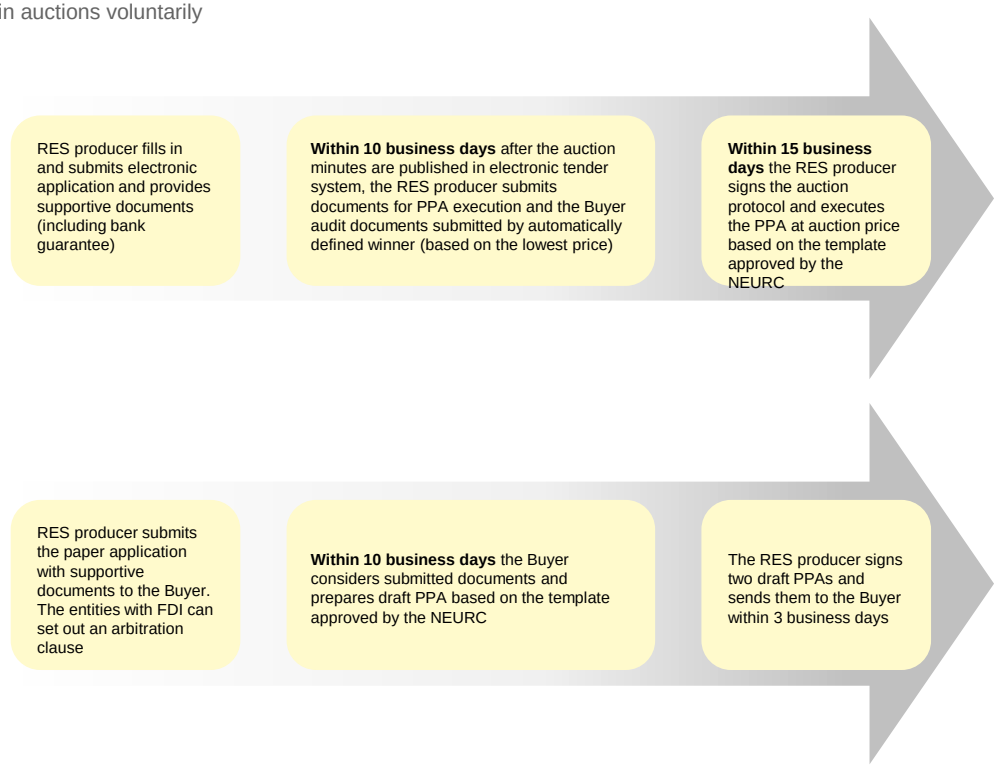
- The feed-in tariff is a special tariff purchased by the State Company “Guaranteed Buyer” of Electricity Produced from RES. This tariff was established in 2008 by Amendments to the Law on Alternative Energy Sources and was subject to major limitations during the recent years
- In April 2019 the Law of Ukraine “On Amendments to Certain Laws of Ukraine for Ensuring Competitive Conditions for Electricity Production from Alternative Energy Sources” aiming to reduce the financial burden of feed-in tariff by introducing the competitive principle of selection of an electricity producer through auctions with a decrease in price (“green capacity auctions”) was adopted
- In July 2020 the Law of Ukraine “On Amendments to Certain Laws of Ukraine on Improving the Conditions for Supporting Electricity Production from Alternative Energy Sources” **further limited the application of feed-in tariff by reducing its rate with respect to plants commissioned before 2020 and by imposing financial liability for the imbalance of actual and accepted (forecasted) schedules of power production**. After these changes (Article 9-1 of the Law of Ukraine on Alternative Energy Sources), the feed-in tariff is available for the power plants that are: 1. Commissioned before 1 January 2020 regardless of the installed capacity, 2. Commissioned after 1 January 2020 and are exempted from auctions under the law (small plants with total capacity < 5 MW for wind power plants, < 1 MW for solar power plants and small HPPs), 3. Defined in the PPAs at feed-in tariff executed before 31 December 2019 and will be put in operation within two or three years (for solar power plants) from the date of execution of these PPAs
- From 1 January 2020 producers of wind energy (with capacity > 5 MW) and sun energy (with capacity > 1 MW) **can execute PPAs at auction price** (Article 9-3 of the Law of Ukraine “On Alternative Energy Sources“). Small power plants are exempted from the auction procedure, but may participate in auctions voluntarily

### The procedure for executing the PPA at auction price

- The Procedure for Holding Auctions for the Distribution of the Support Quota provides for the best price offer mechanism for entering into the PPA at auction price with the State Company “Guaranteed Buyer” based on supported quotas that are annually defined by the CMU (firsts support quotas shall be set up in December 2020)
- The scope of quotas depends on how many new capacities the state needs and is ready to embrace in its energy market. Proposals for them are prepared to take into account international obligations for the development of renewable energy, Ukraine’s Energy Strategy, the sufficiency of generation capacity, state of implementation of already approved projects, etc. The total quotas are divided into three lots - sun, wind, and other RES. The competition takes place between projects in one category (although the law provides for the possibility of technology-neutral auctions)
- The auctions are based on principle that bidder offering the lowest price wins. The auctions should be held twice per year by the end of 2029
- The starting price is the level of feed-in tariff established by the law. The auction participants further offer the lower tariffs at the reduced rates in their bids
- Winner gets the opportunity to build the new energy capacities and sell electricity to the state at the price determined under the auction for 20 years from the date of commissioning a power station

### The procedure for executing the PPA at feed-in tariff

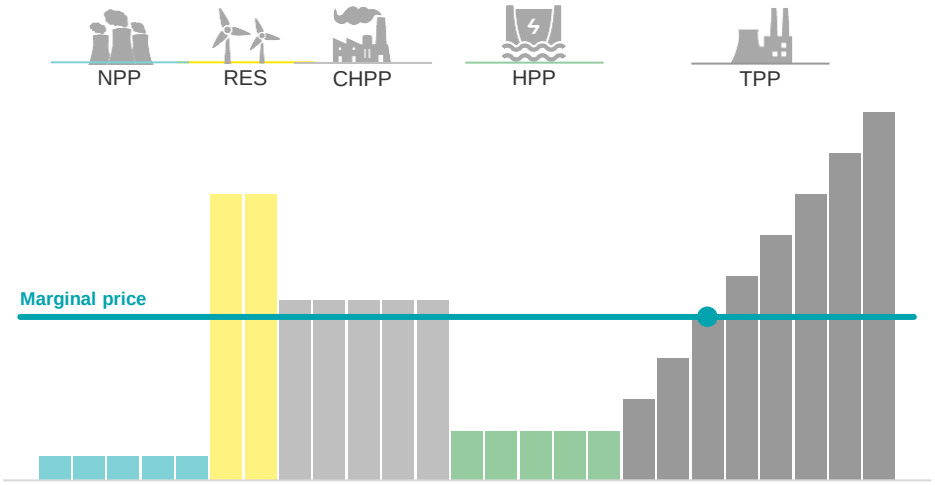
- RES producer enters into the PPA at feed-in tariff with the State Company “Guaranteed Buyer” under the Procedure specified by the NEURC
- **Note:** as of 1 January 2020 PPAs at the feed-in tariff are not executed in respect of the facilities producing electricity from wind energy with a capacity of > 5 MW, facilities with three wind turbines, regardless of the installed capacity, and facilities producing electricity from solar radiation with a capacity > 1 MW



## 2.2.2. Power

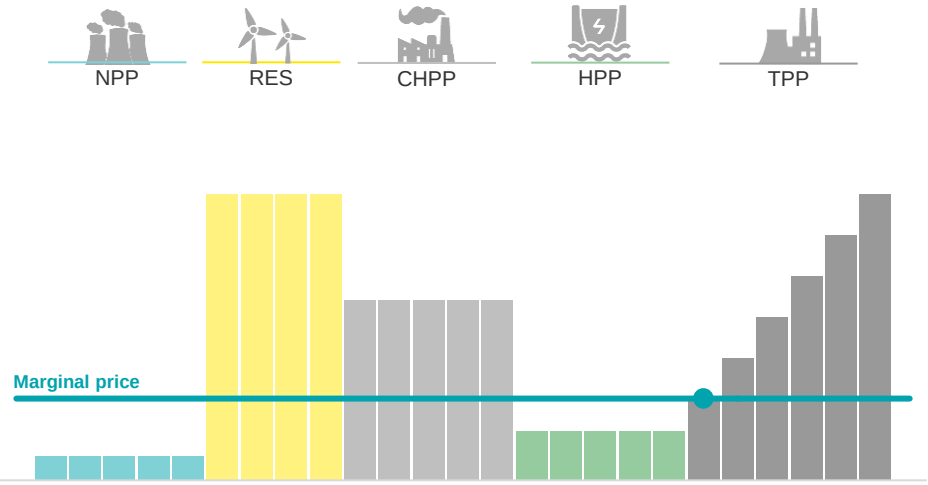
At the same time, penetration of RES should positively contribute to the market development resulting in wholesale price decrease in the long-term

### Demand and supply curves before RES capacity growth




**Source**: EY analysis, European Commission "Energy prices and costs in Europe" dated 09/01/2019

### Demand and supply curves after RES capacity growth




**Source**: EY analysis, European Commission "Energy prices and costs in Europe" dated 09/01/2019

#### Subsidies for RES create the merit order effect

Feed-in tariffs, contracts for difference, investment grants or other types of support for renewables lead to decrease of day-ahead market price through the so-called "merit order effect".

#### Renewables supersedes the traditional generation

The essence of the merit order effect is that new RES capacity very quickly displaces traditional power plants from the market, which do not have time to adapt to new conditions.

#### The wholesale electricity price exhibits downward trend

Studies show that an increase in the share of RES in Germany by 1% leads to a decrease in wholesale market prices by 0.5 EUR/MWh. In Ukraine the effect is blurred by market gaps.

#### The total cost of electricity could be also decreased

As the marginal price goes down, traditional generation earns less, while RES subsidies are spread between consumers. If subsidies < lost revenue of traditional plants, the society wins.

## 2.2.2. Power

# Construction and commissioning of maneuverable capacity and storages will be supported and funded by capacity auctions held by the government

### Maneuverable capacity

**2 GW**

Ukrenergo determines that commissioning of such maneuverable capacity would be enough to meet power reliability compliance requirements until 2030.

The rapid penetration of RES capacity in Ukraine contributes to the creation of duck-curve effect and to the deficit of maneuverability within power system. Available TPPs were developed to work in baseload regime and its participation in frequency regulation leads to assets deterioration and obsolesce. HPPs and PSPPs capacity are not enough to meet the demand for reserves in full. Consequently, one of the most pressing issues for the security and reliability of supply – commissioning of maneuverable capacity.

**Gas peaking stations** designed to balance the volatile load schedule. Natural gas peaker plants are usually used at peak hours to keep frequency within predefined limit, so their average utilization is about 10% per year.

**Source**: Ukrenergo

### DTEK becomes the first in Ukraine to install a 1MW industrial energy storage system

July 22, 2020, DTEK and Honeywell announced an agreement to launch Honeywell's Experion Energy Program in Ukraine, the core element of an initiative by DTEK to develop the country's first grid-scale energy storage system. The system will help maintain Ukraine's energy system, enable the integration of renewables into the energy mix and decrease fossil fuel power generation. Moreover, the energy storage system will increase the flexibility of Ukraine's power grid and help pave the way for the country to join Europe's energy community (ENTSO-E).

Honeywell and DTEK will execute Honeywell's Experion Energy Program as a pilot project, based around a 1.5 MWh lithium-ion energy storage system located at DTEK's Zaporizhzhya Power Plant. The construction, installation and commissioning of the system will take place during 2020-2021.

DTEK Honeywell

**Source**: DTEK

### Energy storage systems

**2 GW**

Ukrenergo determines that commissioning of such energy storage systems would be enough to support the construction of the additional maneuverable capacity.

Affordable, scalable, energy storage technologies are highly desirable for balancing electricity supply and demand, allowing higher penetration of intermittent renewables, and the exploitation of price arbitrage for inflexible electrical power generation. It will be an additional source of frequency balancing for Ukrainian TSO, enabling more competitive and flexible provision of ancillary services.

Through this pilot project with Honeywell, DTEK will develop best practices in the installation and scaling-up of energy storage systems that can be shared with other stakeholders to help create a completely new market segment that supports a more flexible, sustainable and secure energy sector.



**Source**: Ukrenergo

### Maneuverable capacity

Maneuverable or peaking capacity is power plant which can quickly change the load to balance the frequency within the power system. It could be gas peaking power plants, combined-cycle power plants, hydro pumped storage power plants.

### Energy storage systems

Energy storage systems are essential for the operation of power system. They ensure continuity of energy supply and improve the reliability of the system. Energy storage systems can be deployed in many different forms and sizes.

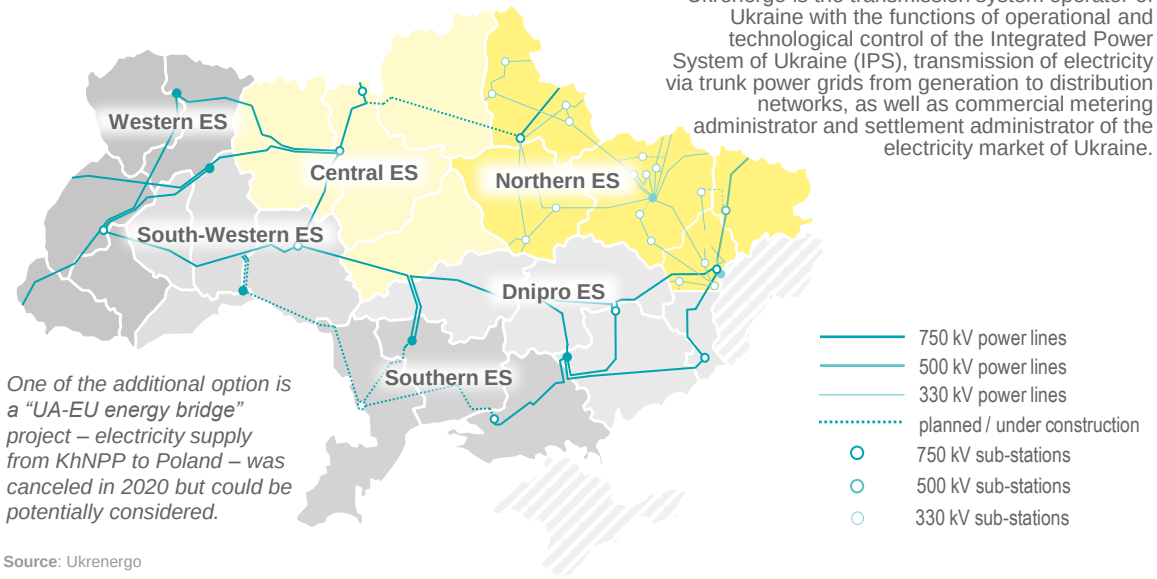
## 2.2.2. Power

# Even for TSO as a natural monopoly FDI potential could be considered through the mechanism of cross-border interconnectors construction

### Regional energy systems (ES) and power grid in Ukraine

**NPC "Ukrenergo"**

Ukrenergo is the transmission system operator of Ukraine with the functions of operational and technological control of the Integrated Power System of Ukraine (IPS), transmission of electricity via trunk power grids from generation to distribution networks, as well as commercial metering administrator and settlement administrator of the electricity market of Ukraine.




*One of the additional option is a "UA-EU energy bridge" project – electricity supply from KhNPP to Poland – was canceled in 2020 but could be potentially considered.*

**Source**: Ukrenergo

17.3% of transforming sub-station equipment and 66.7% of power lines have been used for over 40 years that results in power losses in the transmission systems and risk to the reliability of the UES. To mitigate such risk, Ukraine has launched the Program for reconstruction, automation, and modernization of sub-stations that comprises all regional systems and is funded by EIB, EBRD, KfW, and IBRD. The completion of projects within the program in 2021-2023 is expected to reduce power loss at sub-stations by 30-35%. Furthermore, according to its 10Y Development Plan, Ukrenergo is going to build/reconstruct 3.3 k km of power lines during the next 10 years.

As stated in the 10-year Network Development Plan, the part of Central ES and Northern ES possess a deficit in load and electricity due to: 1) the use of its TPPs in the coverage of irregularities in the daily load; 2) fuel shortage. Other parts of ES possess a surplus in load and electricity, so the deficit is covered by the electricity inflow from adjacent energy systems. To reduce losses, TSO is planning to complete the construction of sub-stations in 2020 and 2023.

TSO is state-owned enterprise and its full or partial privatization is strictly prohibited.

### Key features

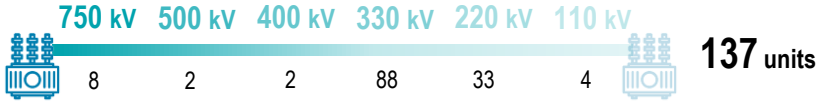
- The Ukrainian Energy System (UES) of Ukraine is one of the biggest power pools in Europe
- The UES comprises 6 regional energy systems and 33 DSOs.
- The functions of TSO are performed by NPC "Ukrenergo"

### Transmission system: power lines


**23.0 k km**

The core of power grid is the 220-750 kV bulk-power and international transmission networks which transmit electricity from power units to regional distribution grids and facilitate exports and imports of power.

### Transmission system: transforming sub-stations




**137 units**

The voltage transformation is provided by 750/500 kV, 750/330 kV, 330/220 kV, 400/330 kV, 330/110(150) kV, 220/110(150) kV and 150/110 kV autotransformers and transformers with the total capacity of 78,553.1 MVA.

### Distribution system

0.4-150 kV overhead power lines and cables: **> 1,000 k km**

6-150 kV transforming sub-stations: **~ 200 k units**

## 2.2.2. Power

# The upcoming technical integration with ENTSO-e will unlock the unlimited potential of European electricity market for Ukrainian energy companies

### Integration into ENTSO-e

**On June 28, 2017 in Brussels**

Agreement on the Conditions for Future Interconnections of Power System of Ukraine with Power System of Continental Europe was signed. Integration of the Ukrainian power system and ENTSO-e continental Europe zone in an operational mode is expected by 2025.

**Agreement took effect July 7, 2017.** The agreement contains:

- Catalogue of Measures
- List of necessary additional researches
- Road Map

The deadline for the implementation of all activities of the Catalogue of Measures is 5 years. Another year is needed to work in an isolated mode (technically disconnected from the systems of the Russian Federation, Belarus and ENTSO-e).

Under the agreement, Ukrainian TSO NPC “Ukrenergo” undertakes to implement the technical provisions contained in the catalogue of measures, and to check the island mode of operation of the integrated power system.

The implementation of all activities and operation in an island mode should be a condition for a positive decision of ENTSO-e to switch to parallel work with Ukraine and Moldova. It is also a key goal of Ukrainian National Energy Strategy till 2035.

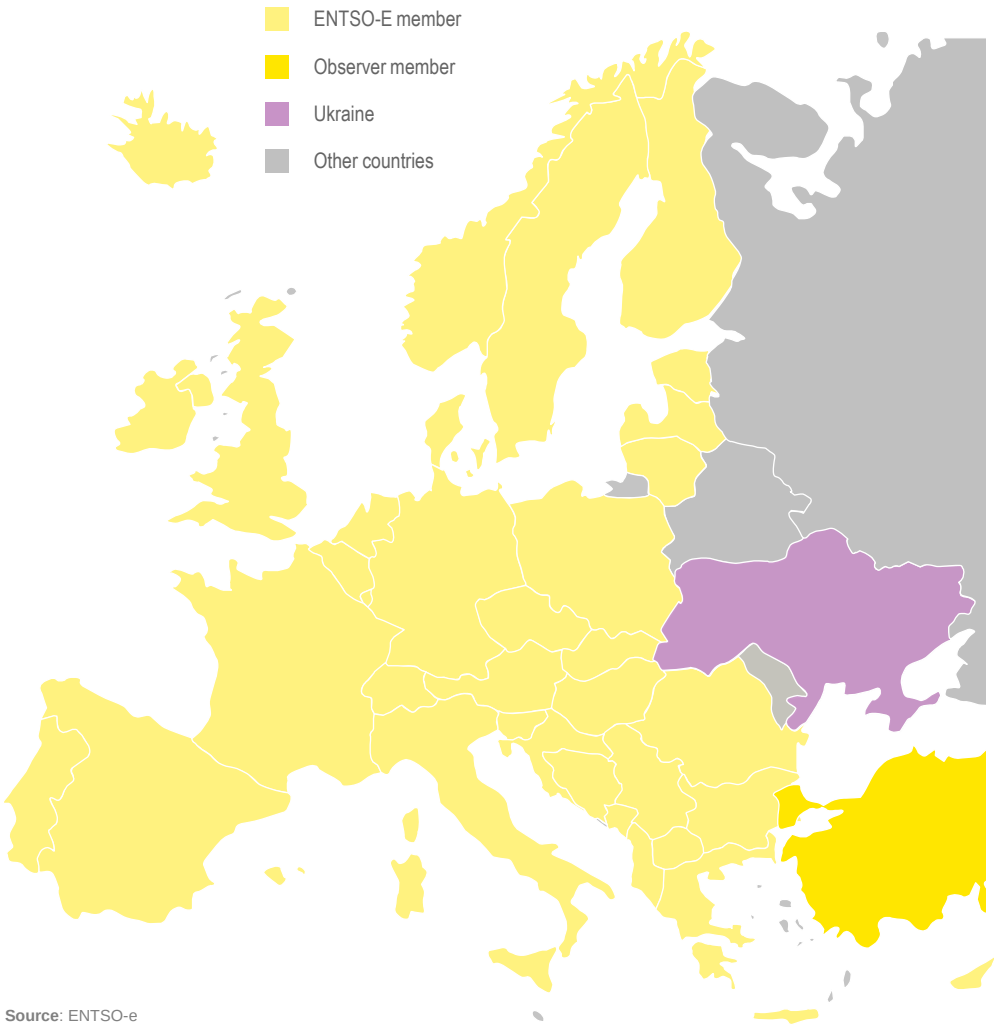
### Benefits of integration of the IPS of Ukraine into ENTSO-e

Significant increase of stability and flexibility of Ukrainian power system

Opportunity to receive emergency assistance from the power systems of ENTSO-E member countries

Increase in electricity trade with Europe – from today’s 4-5 billion kWh up to 18-20 billion kWh

### ENTSO-e Transmission System Map

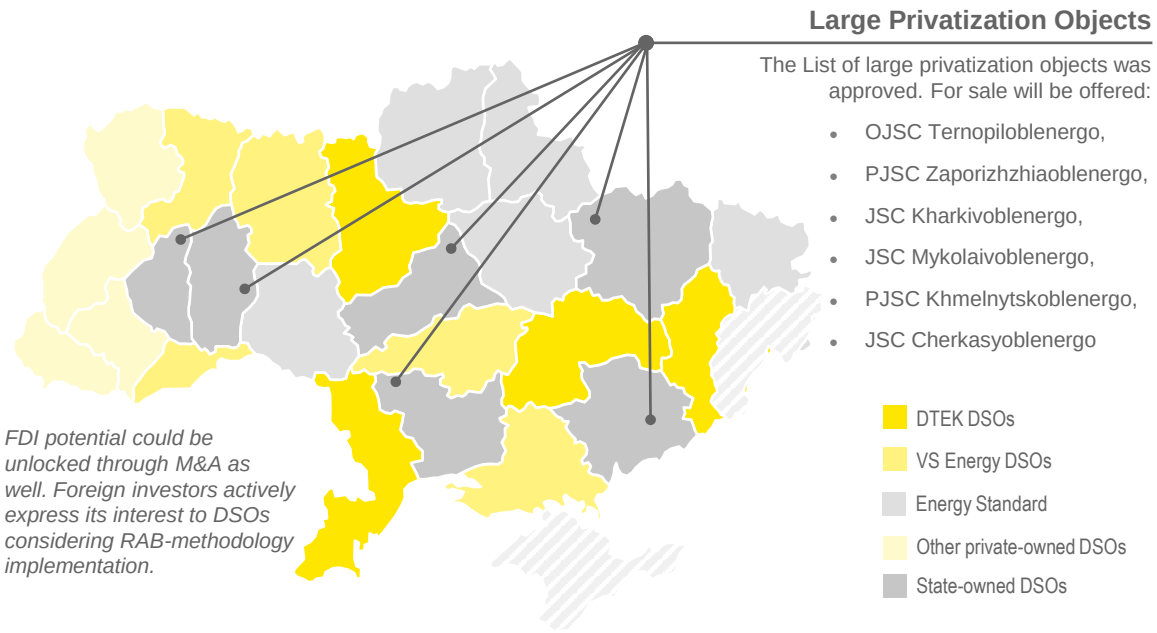



**Source**: ENTSO-e

## 2.2.2. Power

# Privatization of DSOs accompanied by RAB-methodology implementation will be one of the most attractive factors for FDI in electricity subsector

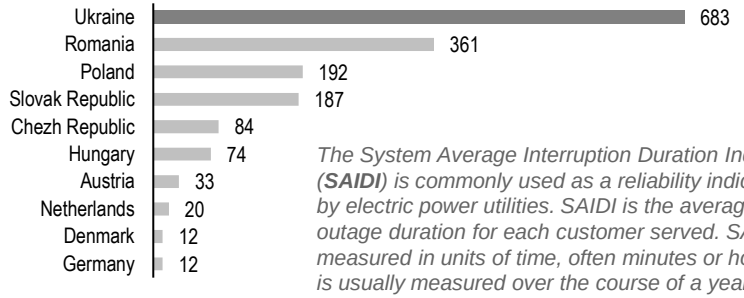
### Electricity distribution system operators in Ukraine




*FDI potential could be unlocked through M&A as well. Foreign investors actively express its interest to DSOs considering RAB-methodology implementation.*

**Source**: State Property Fund of Ukraine

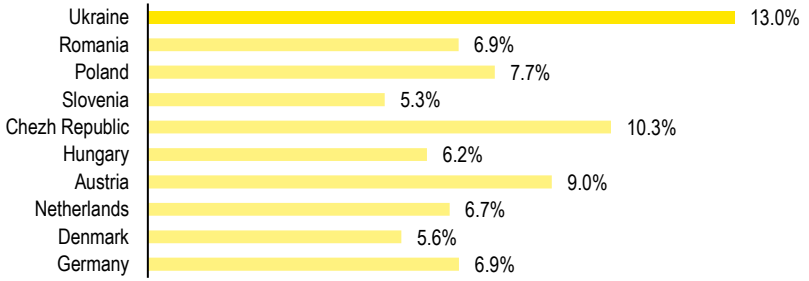
### SAIDI indicators for European countries 2019, min




*The System Average Interruption Duration Index (**SAIDI**) is commonly used as a reliability indicator by electric power utilities. SAIDI is the average outage duration for each customer served. SAIDI is measured in units of time, often minutes or hours. It is usually measured over the course of a year.*

**Source**: NEURC, CEER

### RAB tariffs rates of return for European countries 2019*




**Source**: NEURC, CEER Report 2020
**Note**: Rate of return on equity before taxes in EUR. Ukrainian rate of return was recalculated to EUR through LTI

In order to comply with the Law "On electricity market", in 2018 there was a legal unbundling of electricity distribution activities from other activities of vertically integrated economic entities. As of December 2019, 33 electricity distribution system operators were functioning (compared to 25 originally created in 2018), which will also perform the function of the universal service supplier (supply electricity to households under regulated prices) within the assigned territory. In October 2020, NEURC has pre-agreed RAB (regulatory asset base) tariffs for several electricity distribution system operators: Ternopiloblenergo, Rivneoblenergo, and Kirovogradoblenergo. In November 2020, it has been pre-agreed RAB tariff for additional 19 DSOs. Total profits in 2020 for 22 DSOs set according "cost+" methodology were equal to UAH 1.5 billion compared to UAH 7.2 billion in 2021 pre-agreed according to RAB methodology. RAB tariff is a system of long-term tariff design aimed primarily at encouraging investment in the expansion and modernization of infrastructure. Global experience have shown that RAB-based tariff regulation for the electric grid sector has several advantages for both companies and customers over the existing cost-plus tariff system. Companies within the RAB-tariff provide a secure payback and return on investment sufficient to service loans and generate profits. Under this methodology, they are stimulated to reduce their costs, as RAB methodology allows them to retain the funds resulting from cost-cutting, unlikely to Ukraine's conventional cost-plus methodology. As for customers, the RAB system's advantages are a more reliable power supply and services of better quality. It is achieved by requirements regarding SAIDI and SAIFI indicators decreasing to receive RAB tariffs. According to the approved methodology, rate of return for the new asset-base - 16.74%, for the old asset-base - 3% (50% of which is compulsive reinvesting as CapEx of DSOs).

## 2.2.2. Power

# Procedure of obtaining RAB-tariff and incentives for construction of power generation facilities

## RAB-tariffs

On 26 August 2020, the National Energy and Utility Regulatory Commission ("NEURC") approved a new methodology for incentive pricing (regulatory asset base regulation) for distribution system operators ("DSOs"). At present, Ukraine uses the cost-plus-tariff setting system for DSOs, which reportedly has negative consequences for the condition of power networks. The relevant Methodology provides for a rate of return of 16.74% on the new asset base and a rate of return of 3% on the old asset base. However, according to the approved Methodology, 50% of funds that are revenues to the old asset base must be reinvested in the modernization of networks of distribution system operators. The market rate of return on the new asset base creates new opportunities for distribution system operators to attract investment through new instruments in capital markets (both equity and debt).

Pursuant to the Procedure for Introduction (Development) of Tariffs for Electricity Distribution Services (paragraph 2.2), in order to reconsider the tariff according to RAB-model a DSO should submit to the NEURC an application supplemented by the following documents:

- Report on an independent valuation of assets conducted in accordance with the approved methodology
- Review of the report on the independent valuation of assets by the competent state authority
- Copy of the procedure on the distribution of assets, expenses and income within different types of commercial activity
- Copy of audit statements of economic activity and the order on its approval
- Calculation of the regulatory base of assets
- Calculation of basic controlled operating costs and uncontrolled operating costs in respect of the electricity distribution activities
- Action plan to ensure the reliability of data for monitoring of the quality of services

The application with the attached documents should be submitted to the NEURC not later than 90 days before the beginning of a regulatory period when the tariffs will be effective. NEURC reviews results of an independent valuation of assets and may request additional supportive documents. After reviewing the application and supporting documents NEURC takes decision on reconsidering the tariffs no later than 20 days before the beginning of a year when they are expected to come into force. The tariffs are set based on resolution of NEURC

## Incentives for construction of power generation facilities

On implementation of demand management measures if the available power generation facilities are insufficient to meet and cover the projected demand for electricity (Article 29 of the Law of Ukraine "On Electricity Market"). Competitive procedures are used to ensure the security of the electricity supply. CMU initiates these tenders based on the offer from the Ministry of Energy

The following incentives can be provided to the investors for construction of a power generation facility:

- Provision of payment for the service of the generation capacity development
- Application of PPP mechanisms
- Provision of state aid from the state or municipal resources

Specific incentives applicable to each particular case will be determined by the CMU in its tender decision. Investor cannot benefit from both payment and state aid incentives

The tender procedure is governed by the CMU's Regulation No. 677 dated 10 July 2019

The Ministry of Energy prepares the draft decision on tender conditions, approves it with the NEURC and submits it to the CMU within 90 calendar days from the date of receipt of conclusions and proposals of the TSO

CMU takes decision on tender based on proposal from the Ministry of Energy and determines the terms of the tender and technical requirements. One of the main requirements is that an applicant must have experience in installation of the generation capacity of at least 20 MW. Ministry of Energy establishes a tender committee which approves the tender documents (including documents on land plot and project documentation) prepared by the TSO within three months from the date of the CMU's decision

The participant should provide a guarantee (security) for participation in the tender in the equivalent of EUR 10k for 1 MW of capacity in UAH and submit technical and financial proposals

The tender consists of two stages:

- Qualification of participants in accordance with the requirements set forth by the tender documentation within 30 calendar days
- Selection of winner based on the financial bids of the qualified participants within 20 calendar days from the date of publication of the decision on the results of qualification

The winner should make the guaranteed payment equivalent to EUR 30k for 1 MW of generating capacity in UAH and provide an irrevocable bank guarantee to ensure the fulfillment of obligations and conclude agreement with TSO

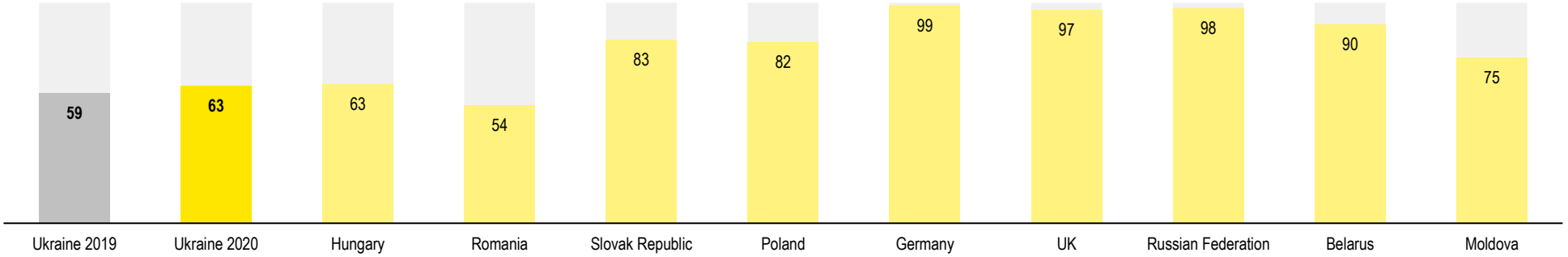
If the PPP mechanism is used to develop generating capacity and demand management measure the tender is conducted in accordance with the Law on PPP

TSO monitors performance of investor's obligations under the agreement on construction of generation capacity

## 2.2.2. Power

Ukraine has scored 63 out of 100 points in Doing Business Getting electricity Ranking in 2020 which is far below leading EU countries

**Position of Ukraine and other EU countries in Doing Business (getting electricity)**




**Source**: Doing Business
**Note:** Data for EU countries presented for 2020

**Getting electricity**

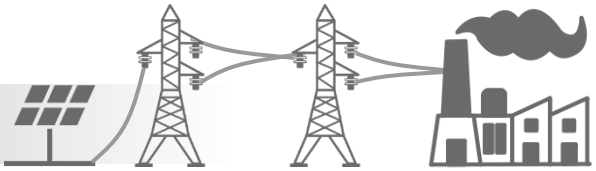
Procedures, time, and cost to get connected to the electrical grid; the reliability of the electricity supply; and the transparency of tariffs

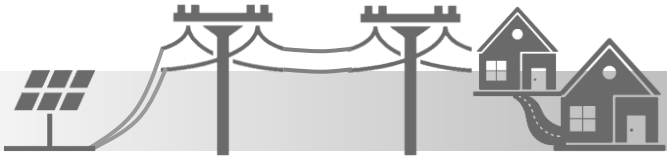
In Report Doing Business 2020 was mentioned that Ukraine made getting electricity easier by streamlining the issuance of technical conditions and by implementing a geographic information system. Ukraine also improved the reliability of power supply by introducing an outage compensation mechanism.

All connections to the grid are regulated by the main Law of Ukraine No. 2019 “On electricity market” and by secondary legislation. Consumers have two options for connection to the grid: 1) connection to the transmission system; 2) connection to the distribution system.

Payment for connection to the transmission system is calculated by NPC “Ukrenergo” (TSO) individually for each case taking into account available system capacity. TSO published on its website the detailed connection cost calculator, which takes into account: region, substation, index of network voltage, type of power line, distance to the grid.

There are two types of connection to the distribution system: standard (up to 50 kW and less than 300 m from available line) and non-standard (more than 50 kW and more than 300 m from available line). Payments for both are regulated by NEURC and should be approved for every calendar year for each distribution system operator.





## 2.2.2. Power

In July 2019 the new competitive and transparent electricity market model was introduced, which converged market rules to European legislation

### Current market model overview:

07/01/19 the current market has become functioning. It includes a few segments: day-ahead and intraday markets (managed by the market operator and regulated by “day-ahead rules”), balancing and ancillary services markets (managed by the transmission system operator and regulated by “market rules”), and bilateral contracts. Generating companies are able to sell electricity to anyone at any price (excluding NPPs and HPPs under PSO model) and all suppliers are able to buy at any price. Only natural monopolies like TSO and DSO are regulated. Consumers got a right to choose the supplier, and the cross-subsidization (when industrial consumers are charged at higher prices to subsidize the lower prices of households) was partially eliminated (it was transformed to PSO model). The transition period was introduced for the purpose of smoothing the hike in electricity prices. It was achieved by additional fees paid by NPPs and HPPs to cover feed-in tariffs (consumers are not paying for RES support scheme) and to support low-income households (PSO model). It is unclear when the transition period will be canceled.

**1. Limitations during transition period:**

After 07/01/2019 state-owned generating companies are eligible to sell electricity via bilateral market only by using electronic auction;

Until 2021 the duration of bilateral contracts should not exceed 1y;

Generating companies have to sell at least 10% of electricity via DAM.

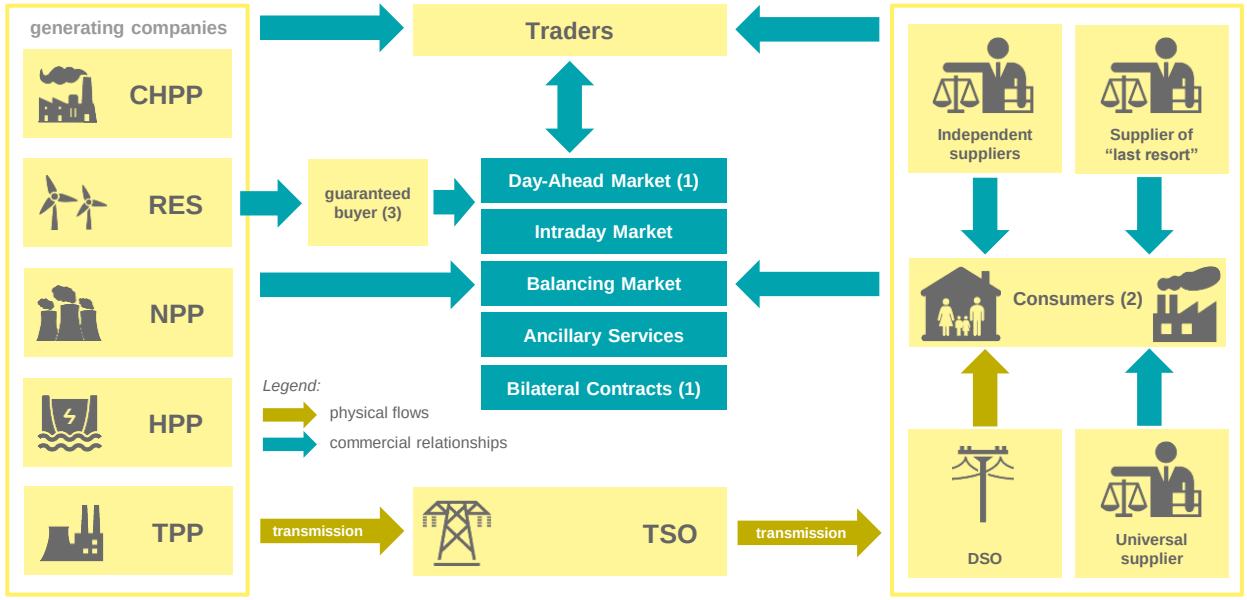
**2. Supply peculiarities:**

All consumers will be able to buy electricity directly from generating companies (only if such consumers are responsible for their balance);

New universal suppliers will be appointed after the end of the transition period. They will be selected during the contest by the price criterion.

**3. Features of RES support during transition period:**

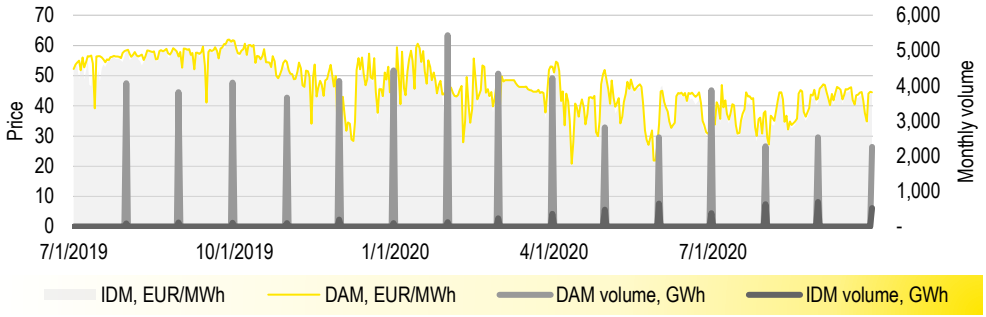
RES will sell all electricity to the guaranteed buyer at the feed-in tariff. Then guaranteed buyer will have to sell it at day-ahead market. The difference between feed-in tariff and market price will be covered by NPPs (calculated by guaranteed buyer; approved by the Regulator).




## 2.2.2. Power

# Wholesale electricity prices in Ukraine are higher compared to European markets as a result of regulation loopholes and cross-border limitations

### Ukrainian DAM and IDM prices and monthly volume dynamics




**Source**: Market operator

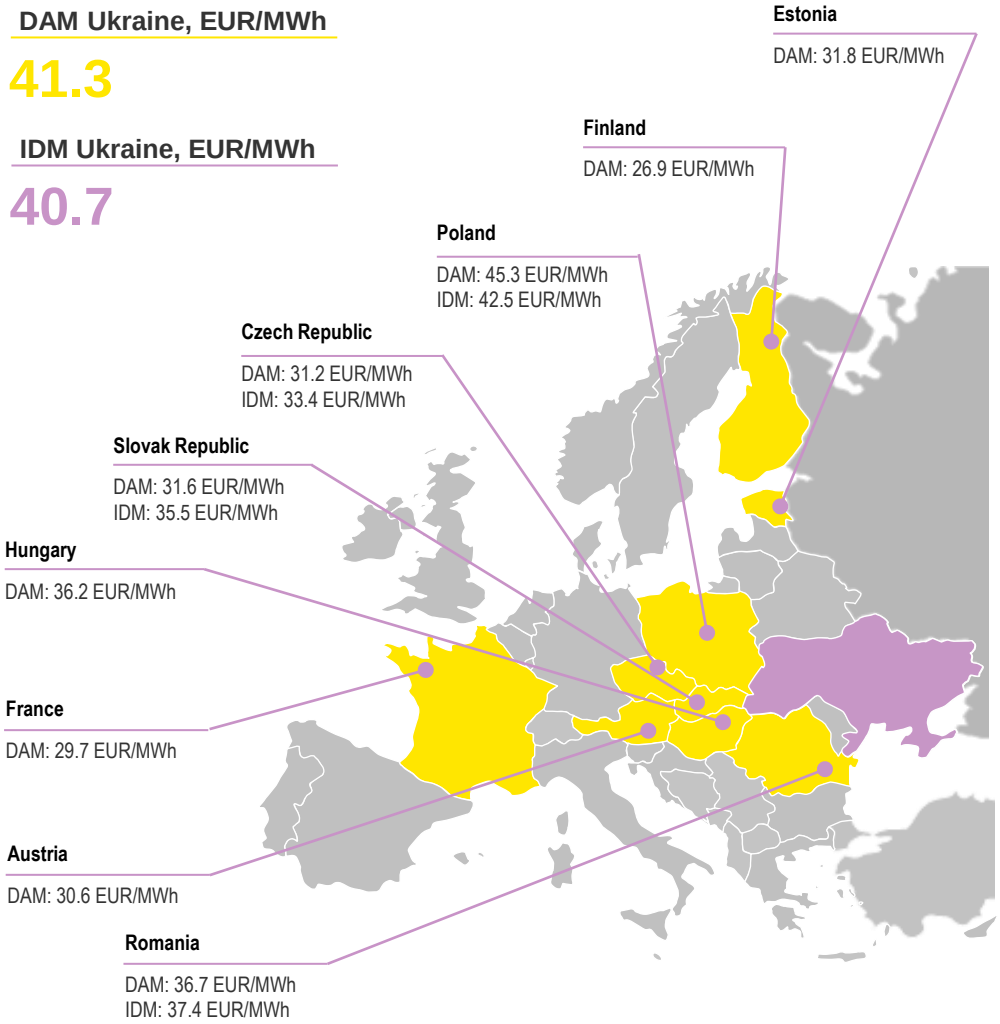
The state company «Market Operator» established on June 18, 2019, in accordance with the Law of Ukraine «On Electricity Market». The company is responsible for the organization of sale and purchase of electricity on the Day-Ahead Market and the Intraday Market.

At the Day-Ahead Market (DAM), electricity is sold and bought on the next day after the auction. Market prices at the DAM have a clear seasonal trend and dependent on weather conditions. The highest prices are observed in January (increase in demand due to increased use of heaters) and in August (increase in demand due to increased use of air conditioners). The price are typically low during March-April, when the water levels increase due to floods, so the generation of hydroelectric power plants creates a surplus of power energy output. In addition, DAM prices always decrease on weekends and holidays due to declining demand and increase during scheduled repairs of large power plants.

At the Intraday Market (IDM), electricity is sold and bought continuously after day-ahead auctions and after the physical supply of electricity have been completed. It is worth mentioning that prices on DAM and IDM differ: In case of low demand and access supply, IDM prices are lower than DAM, and vise versa.

Average daily prices on the Ukrainian DAM and ID markets for the period from July 2019 till October 2020 ranged from 20.79 to 61.98 EUR\MWh and on average were higher compared to adjacent markets. It is explained by different market gaps, including rigor price caps, ban of electricity import from Russia and Belarus, ineffective bidding under PSO model. Still, even considering higher prices power generation companies (NPPs, TPPs, RES) experienced losses or cash deficit.

### Average DAM and IDM prices 2020, EUR/MWh

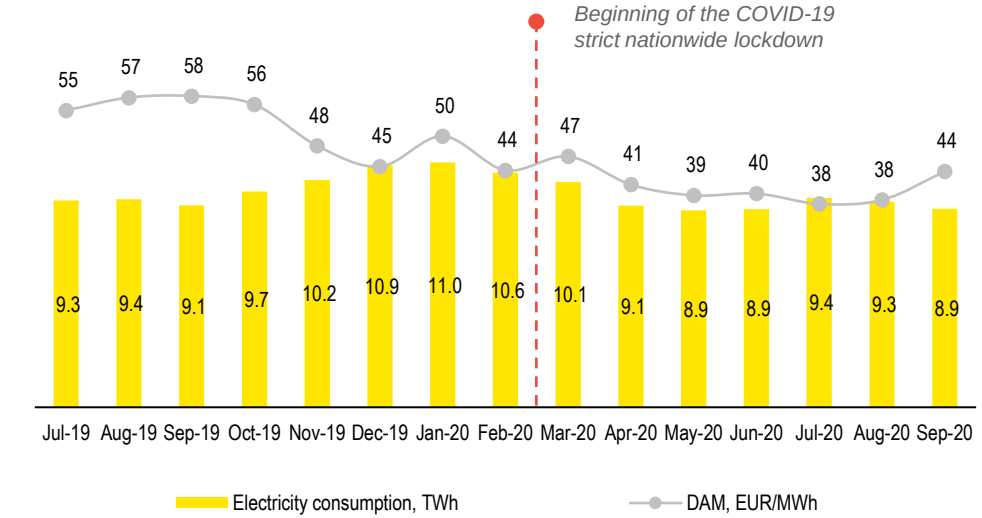



**Source**: Ukrenergo, HUPX

## 2.2.2. Power

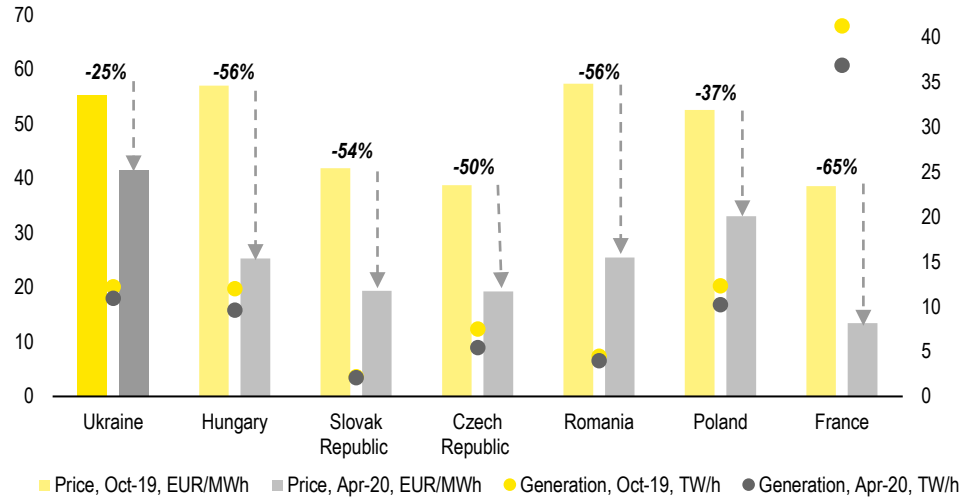
# COVID-19 impact on power subsector resulted in decreasing electricity consumption but influence on prices is unclear due to market gaps

### Electricity prices and consumption before and after COVID-19 lockdown




**Source:** Market Operator, Ukrenergo, EY analysis and calculations

### DAM prices and Generation 6-months relative change




**Source:** Market Operator, Ukrenergo, ENTSO-E, HUPX, EY analysis and calculations

### COVID-19 impact

The COVID-19 strict nationwide lockdown was enacted from March 12 till May 11, 2020. During this time, the electricity consumption (temperature-adjusted) has decreased by 5% compared to the previous year. At the same time, the DAM price dropped following a decrease in DAM demand. It was identified that DAM demand decrease was faster than overall consumption reduction (explained by UAH FX rate depreciation and changes to the balancing market rules from March 1, 2020 which led to flow of demand from DAM to IDM and resulted in DAM price decrease).

In April 2020, the first month after the implementation of the strict lockdown in Ukraine, overall electricity consumption and load decreased by 7% and 11%, correspondingly, compared to April 2019. The most significant drop was noticed in industry consumption - 10%. Moreover, consumer demand has flown to a household subsector of consumption that shown increase equal to 7%. The strict lockdown was abolished, electricity consumption and load in September 2020 was resumed almost in full - decreased by 2% and 1% compared to the previous year.

### Conclusions

- The decrease of DAM demand and DAM price during March 2020-June 2020 was mostly driven by changes to the market rules in March 2020. The COVID-19 lockdown effects did contribute as well but did not have a decisive role.
- Linking the measures targeted at the electricity market and the epidemiological situation in Ukraine seems to be irrational, as the situation after the lockdown being gradually lifted did not affect the market performance, and DAM demand continued to decrease. The market situation was mostly driven by problems in the PSO design and balancing market rules, not the quarantine measures.
- he DAM price and peak load decrease in Ukraine were also lower if compared to other EU countries. This confirms that Ukraine's wholesale market price is not a product of effective competition but rather a product of administrative regulation in a highly concentrated market.

**Source**: Low Carbon Ukraine "Monitoring of Electricity Market Opening"

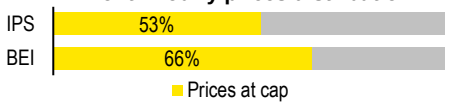
## 2.2.2. Power

# Electricity market opening was aimed at shifting to a competitive liberalized model in accordance with European legislation and best practices, but…

### Price caps design

Implementation of price caps is an effective tool to restrain rapid price growth. Whereas, imposition of such measures provides for dictation of market prices in a highly concentrated market.

**12-month hourly prices distribution**



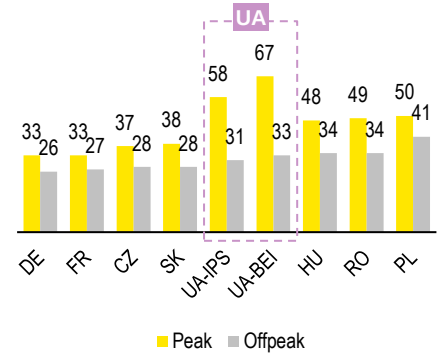

Despite price caps effectively limit prices at the predefined level, the average prices are higher than the ones at the European markets.

As market players are able to adjust and bid close to price caps due to tight market concentration, there is no real competition.

Price caps inefficiently shape demand patterns as they do not reflect scarcity.

Current market-wide bid caps encumber long-term investment signals.

**Average DAM prices in European countries, Jul19-Jun20, EUR/MWh**

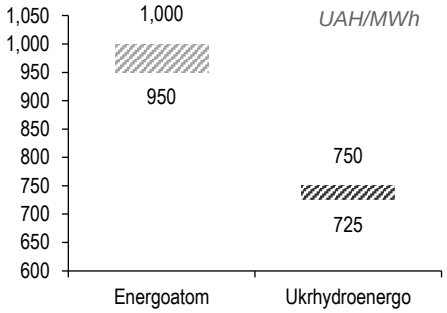



### Design of the PSO for households

The existing PSO design does not correspond to liberalized market model. It violates the EU acquis and provides for the large distortions:

1. It provides opportunities for manipulation for DSOs and universal services suppliers (USSs) within one vertically integrated group and offers them a competitive advantage over other suppliers, giving exclusive access to cheap electricity.
2. Changes policy decision-making process, by simulating the administration towards price regulations.
3. Constraints competition in terms of different market segments
4. It gives an advantage to market players, which are not under PSO regulation and allows for strategic bidding and arbitrage across market segments.

**De-facto occurred minimum price cap for state-owned generators based on their operational cost of production in 1H2020**




### Market power goes unchecked

The Ukrainian electricity market is highly concentrated and resembles an oligopoly structure.

Regulation of market power is not executed evenly and affects only state-owned companies.

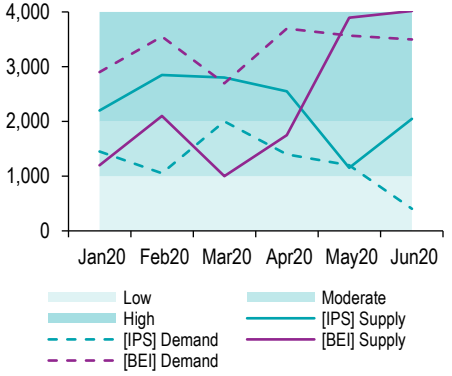
State-owned companies are obliged to disclose information due to existing regulations which allow unburdened market participants to amend their strategies.

Because energy from RES is marketed by a solo market off-taker, it does not increase the competition level within the market.

DTEK is able to exercise market power across various market segments due to its vertically integrated structure. It gives the possibility to influence both demand and supply.

However, the market power is obvious in the BEI trading zone, it is not yet regulated.

**HHI market concentration index on DAM**




### Cross-border trading limitations

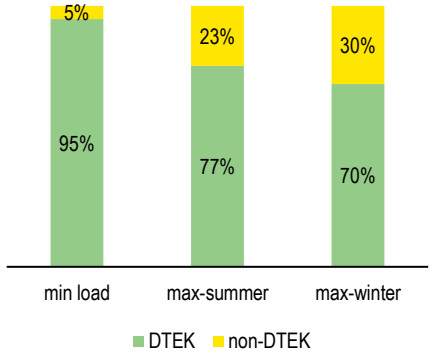
In the IPS, imports from Russia are a political problem and are now forbidden. Competition with Russian and Belarusian imports can be effective by reducing the market power of existing companies, given that Ukraine's security of supply is not jeopardized.

DTEK exercises its market power and covers more than 70% of demand in the BEI, due to the small size of the trading zone, existing balancing restraints and cross-border auctions rules, which are under development.

During some periods, both demand and supply in the DAM exceeded the BEI's total load. It may be related to re-export activities and may indicate profit shifts to other jurisdictions or schemes of tax optimization.

Additional issue is a charge for dispatching set for all export volumes which creates extra financial pressure on traders and contradicts European market rules.

**Potential coverage of BEI demand**




**Source**: Low Carbon Ukraine "Monitoring of Electricity Market Opening"

## 2.2.2. Power

…with a lot of restrictions, market gaps and distortions, the market performance is still far from perfect and further improvements are required

### Debts accumulation

The origin of some debts is still unaddressed, which affects the new market model.

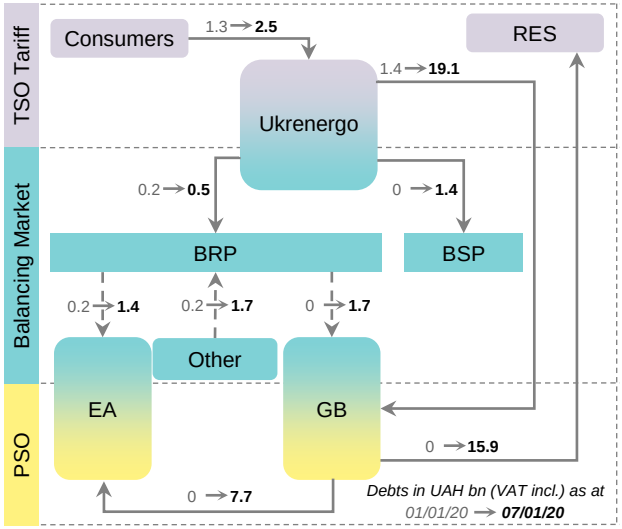
Because of the improvident political decisions and inefficient market regulations new debt has accumulated too fast.

PSO for households' debt and RES debt are difficult to fund through established mechanisms due to the GB dilemma and political reluctance to direct costs on final consumers.

Inefficient market design, price caps and delays in MMS software implementation are the reasons behind balancing market debt

To prevent market collapse where small players are hurt the hardest, debts' sources must be addressed and financed.

**Debts accumulation scheme**




**Source**: Low Carbon Ukraine "Monitoring of Electricity Market Opening"

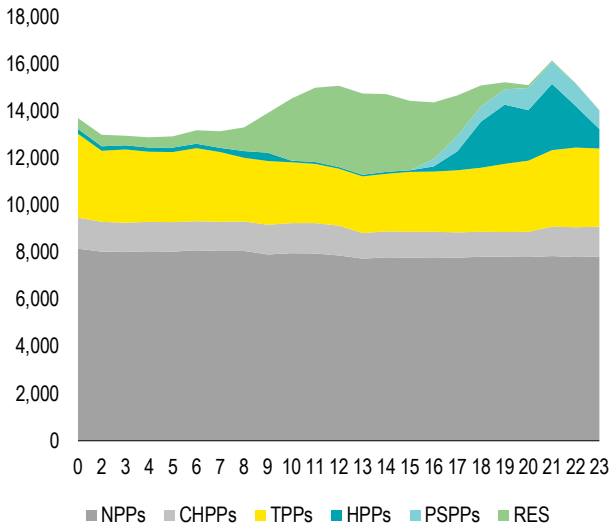
### RES Duck curve

There are peak and off-peak electricity consumption periods within a day, during which consumption sharply changes. To balance this changing demand, power generating companies ramp up and down power plants to control their load and meet the existing demand.

Stations on RES are limited in working hours. As RES meets more demand during the day, less conventional energy is needed. However, RES production decreases at night, conventional energy needs to ramp up quickly to meet demand in the evening. Due to that reason, other power plants are underloaded, during the working hours of RES.

The output of RES should be limited, whereas payments for generated electricity are to be made in full. To solve this issue highly-maneuverable capacities need to be installed.

**Daily load as of 8/23/2020, MW**




**Source**: NPC "Ukrenergo"

### Other problems of market design

**Potential abuse in auctions rules for state-owned power generation companies**

Existing auction rules for state-owned companies contain significant flows that can lead to collusion and / or corruption. It may result in shortfall of revenue or even losses for state-owned enterprises. The design of the auction allows to create fictitious barriers to entry, restricts access to electricity for small players (to the benefit of the larger ones), and significantly decreases market competition. It leads to lower sales prices and distorted market signals. The average sales price of the state-owned PJSC «Centrenergo» was 10% below the DAM price, which could indicate a potential abuse of the auction design. This spread could have enabled buyers to resell electricity with a high margin in the future. The same situation can be observed for Energoatom. Only corporatization and implementation of best corporate governance practices will eliminate such abuses.

**Market design encourages gaming/strategic bidding and market manipulations**

Balancing and reactive regulatory changes have created gaps in the market. Although the first loophole was eliminated in March 2020, inefficiencies remain. Existing regulations were insufficient to prevent strategic biddings. Ensuring and intensifying downward regulation in a balancing market is not representative of actual physical regulation; i.e. turning generating units off. Balancing market rules, together with the design of price caps, create the possibility for manipulation and distort DAM. DAM can be used by market participants to get a profitable BM price below their marginal cost. Strategic biding is possible due to restrictions for Energoatom and GB compared to other market participants. Existing market regulations have shortcomings and can lead to increased $CO_2$ and system costs.

## 2.2.2. Power

# Legal barriers for investments in power subsector

### Limitations in application of feed-in tariff

- **Debts under the PPAs.** Reportedly, the State Company "Guaranteed Buyer" had difficulties paying its debts under the PPAs at feed-in-tariff due to the insurmountable debt of NPC "Ukrenergo" and issues with financing from the state budget
- **Feed-in tariff rate reduction.** In 2020, the law retrospectively reduced the feed-in tariff, which caused widespread discontent of investors leading to potential arbitrations
- **Uncertainty in the procedure for setting support quotas for RES.** A new system of RES development incentives is based on support quotas. According to the Law of Ukraine "on Alternative Energy Sources" (Article 9-3) and Procedure for Holding Auctions for the Distribution of Support Quotas the quotas and auction schedule for each year are determined by the CMU by 1 December based on an application from the Ministry of Energy. The preparatory stage for setting quotas has uncertainties in the stakeholder coordination mechanism (regarding terms of approvals and provision of comments). Complexities in multiple stages of the procedure make it prone to the risk of not meeting the respective deadlines, which may in turn lead to delays in auctions
- **Potential remedies:** initiatives to address the aforementioned issues may include (i) ensuring settlement of debts under the PPAs at feed-in tariffs, (ii) regaining investor's trust by introducing doable guarantees with clear possibility of their transparent application in the nearest mid-term perspective (iii) streamlining the quota establishment procedure

### Suspended privatization of "Oblenergos"

- Due to the pandemic, the auctions for the privatization of large objects, including five state-owned distribution system operators, were suspended for the quarantine period under the law
- **Potential remedies:** unlock the privatization considering the investment enabler: RAB-tariff

### Uncertainty with PSO tariff at electricity market

- The tariffs for households are set by the governmental regulations establishing PSO (effective until 1 April 2021) for State Company "Guaranteed Buyer", electricity producers, and universal service providers. These tariffs are not quite feasible from an economic perspective and lead to the reduction of income generated by the major state-owned generation companies - SE "NNEGC Energoatom" and PJSC "Ukrhydroenergo" as well as universal service providers
- It is not clear whether the PSO system will be extended for the next year and further
- **Potential remedies:** we understand that the PSO mechanism was meant to be transitional and would eventually move on to a market model. Development and communication of the transition plan from PSO to market model would be advisable in this respect

## 2.2.2. Power

Considering described analysis we identified the following key factors influencing the potential attractiveness of the subsector for investors

### Implementation of the new electricity market model

The competitive European model became functioning in July 2019 including: DAM, IDM, balancing market and ancillary services. Now consumers have a right to choose supplier without any limitations.

### Introduction of the RAB-methodology for DSOs

In August 2020 NEURC adopted the new methodology for DSOs' tariffs calculation to encourage investments in the modernization of DSOs' assets. 22 DSOs have already got new tariffs in November.

### Upcoming full integration with ENTSO-e after 2025

TSO is leading the ongoing process of full technical integration with ENTSO-e which will unlock the unlimited potential of European electricity market for power generation companies and traders.

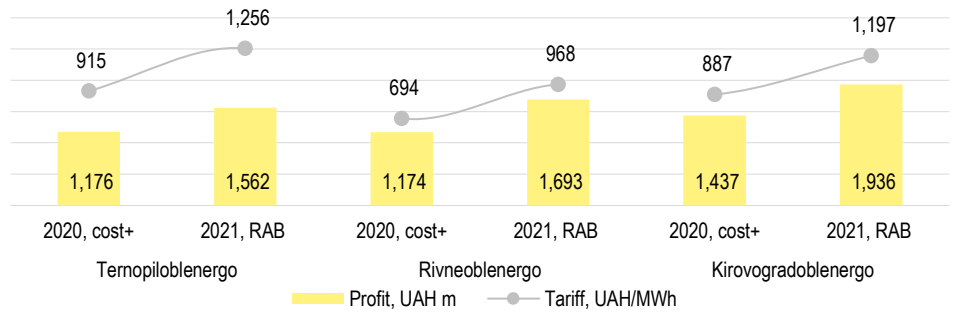
### Expected elimination of PSO model for households

The cross-subsidization of households should have been canceled as a result of implementation of the new market model, but it was transformed to PSO. Its elimination will heal existing market gaps.

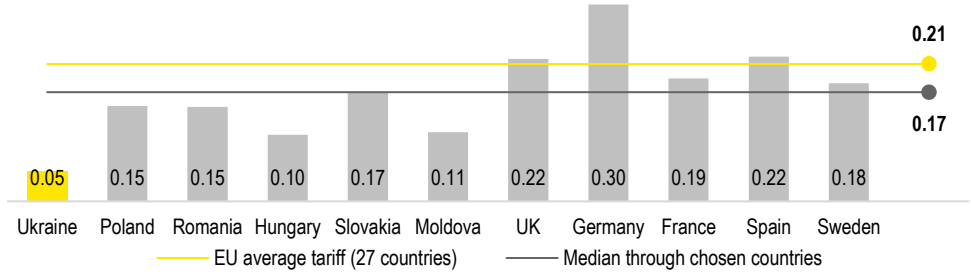
### Capacity auctions for maneuverable capacity and storages

According to TSO, UES needs up to 2 GW of peaking maneuverable capacity and 2 GW of storages. Its construction will be supported by the government through the mechanism of open capacity auctions.

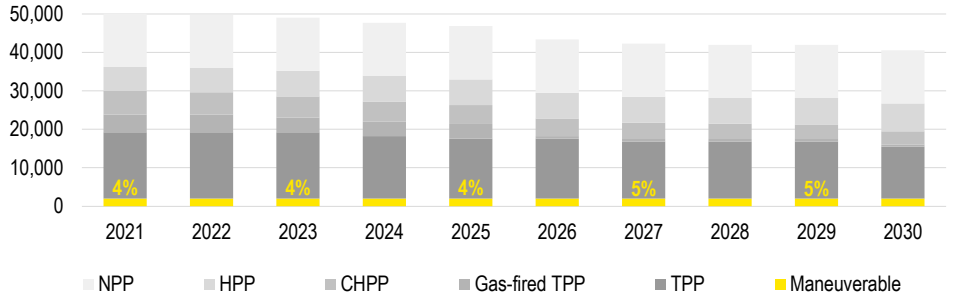
### The difference in profits envisaged by RAB and cost+ methodologies




### Comparison of tariffs for household for different countries, EUR\MWh



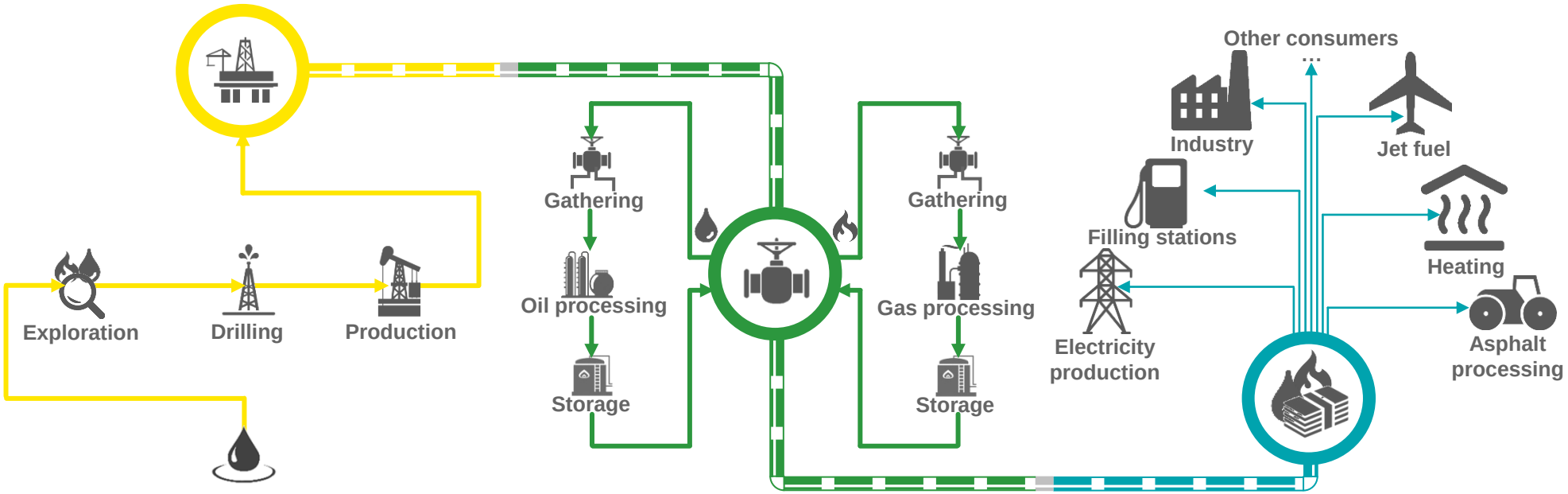

### Installed capacity of traditional generation, TSO's target scenario, MW



# 2.2.3. Natural gas

## 2.2.3. Natural gas

Ukrainian natural gas potential is still not revealed, and ongoing market liberalization could benefit both society and business in the long run




### Exploration and production

Exploration and production include the search for potential underground or underwater fields of crude oil and natural gas, drilling of post holes, as well as further drilling and operation of drilling wells, production of crude oil, and natural gas. The exploration and production sector includes gas production from non-traditional sources.

### Transportation, storage and gas processing

Gathering, processing, transportation, and storage of crude oil and natural gas make up the midstream sector. Fractional plants that remove gas condensate liquids from oil and gas streams are generally considered to be components of the Transportation, Storage, and Processing sector. Sales of crude oil and natural gas are also taking place in this business segment.

### Oil refining and sale of oil products and gas

Oil refinery and sales of petroleum products include refinement of crude oil, crude natural gas, natural-gas stripping as well as distribution and marketing of products derived from crude oil and natural gas. Products in this sector reach consumers through petroleum products such as gasoline, kerosene, jet fuel, diesel fuel, fuel oil, liquid fuels, lubricants, wax, asphalt, natural gas, and LNG, as well as hundreds of petrochemical products.

## 2.2.3. Natural gas

# Current legislative framework and legislative initiatives (1/2)



### Association Agreement between the European Union and Ukraine

Provides for integration of gas sector of Ukraine into EU and harmonization of market rules. Key provisions relate to operation of the gas and oil market, equal competition in the market, transparent price and tariff policies, safety requirements, information about gas supplies, buyers and consumers

### The Code of Ukraine on Subsoil

- Provides that mineral resources of state significance (including those with oil and gas potential) may only be transferred into temporary use based on permit for subsoil use
- Sets out various rules regarding the subsoil use (key terms and conditions, powers of state authorities, grounds for termination/suspension of subsoil use)

### Law of Ukraine "On Oil and Gas"

permits to use oil and gas resources are issued based on competitive procedure involving evaluation of financial, technological and other capabilities of candidates. Rights under the permit may not be alienated, transferred or delegated to other parties

### Law of Ukraine "On Natural Gas Market"

- Establishes the rules on competition in the gas market
- Stipulates that the courts settling disputes in his area should take into account precedents, cases and practice of EU Court, European Commission and Secretariat of Energy Community
- Provides that transportation, storage and supply of gas are all subject to licensing
- Sets out special limitations on ownership of energy infrastructure: privatization or concession of GTS objects owned by the state is prohibited, GTS cannot be privatized, gas storages may be privately owned

**Law of Ukraine "On Customs Tariffs"** sets customs tariff on imported gas at 0% rate

### Procedure for Issuing Special Permits for Subsoil Use, approved by Resolution of the CMU No. 124 dated 19 February 2020

Provides terms and conditions for issuing special permits for subsoil use without a tender and the list of respective categories of usage for which such permits can be granted

### Procedure for Conducting Auctions for the Sale of Special Permits for Subsoil Use, approved by Resolution of the CMU No. 993 dated 23 September 2020

Sets the rules of procedure for carrying out electronic auctions for the sale of special permits for subsoil use

### Order of the MFU "On Approval of Amendments to Regulation of the Ministry of Finance of Ukraine" No. 292 dated 27 February 2017

Provides that starting from 2017 the gas storage facilities will be subject to the regime of the customs warehouses. This means that the gas that owned by a foreign or Ukrainian entity is stored under customs control, with conditional full exemption from customs duties and without the application of the non-tariff regulations

### Licensing Conditions for Conducting Economic Activity on the Natural Gas Market approved by Resolution of NEURC No. 201 dated 16 February 2017

sets out the rules for obtaining a license for transportation, storage (injection, off-taking), distribution and supply of natural gas

### Gas Transmission System Code approved by Resolution of the NEURC No. 2493 dated 30 September 2015

- Sets forth the market rules for gas transmission services
- Stipulates that a GTS operator provides services to a gas market participant on contractual basis
- Introduces the principle of balancing neutrality and balancing neutrality charges
- Stipulates that interconnectors' capacities are distributed via electronic auction

### Gas Distribution Systems Code approved by Resolution of the NEURC No. 2494, dated 30 September 2015

- Provides that a gas distribution system operator is an entity that carries out activities on distribution of natural gas by the gas distribution system based on license for the benefit of third parties (customers) and specifies the principles of the operator's business
- The gas distribution systems can be private
- The operators carry out their activities based on principles of equal competition and goodwill

### Gas Storages Code approved by Resolution of the NEURC No. 2495 dated 30 September 2015

- Governs the activity of market participants in respect of use of gas storages
- Sets out safety regulations
- Provides that gas storage facilities operate based on principles of equal competition and goodwill

## 2.2.3. Natural gas

# Current legislative framework and legislative initiatives (2/2)



### Short haul

In 2019 Section IX of the GTS Code was supplemented with Subsection 8 introducing a new type of service provided by LLC "Gas TSO of Ukraine" – "short haul" or "facility with limitations", allowing foreign gas traders to use Ukrainian GTS for transmission of gas between European countries

"Short haul" may be combined with use of gas storages under the regime of customs warehouse for up to 1095 days without payment of taxes and duties. The service allows to transmit gas between Poland, Romania, Slovakia and Hungary. In order to use short-haul, shippers should sign a template contract with TSO, register on TSO's informational platform, receive a separate shipper-code for the short-haul product, book a monthly product or work on a day-ahead basis and prepare a preliminary customs declaration

### Law of Ukraine "On Amendments to Certain Legislation of Ukraine on Deregulation in the Oil and Gas Industry"

Cancelled 20 permits required for subsoil use in 2018, particularly, mining allotment for oil and gas production

### Law of Ukraine "On Amendments to the Law of Ukraine "On Public Procurement" Regarding the Purchase of Natural Gas"

Adopted by the Parliament on 2 December 2020 and will be come in force after its promulgation, and certain provisions on 1 July 2021. This law reconsiders the approach to accessing gas commodity exchange allowing the GTS Operator (GTSOU) to make daily purchases on the gas trading exchange to balance the system better, based on production and technological costs. Access is granted to gas commodity trading platform for purchasing gas for balancing purpose. This is expected to improve balancing procedure and secure transparent pricing of balancing neutrality charge

### Draft Law of Ukraine No. 2553

introduces kW as a gas measurement unit to indicate the total calorific value of gas sold and transported. In this way, consumers will pay not for the volume of gas consumed, but for the energy consumed, because gas differs in its chemical and physical characteristics. However, the gas itself must meet the standards and requirements of energy efficiency, so such a change will not lead to a significant increase in quality, but rather aims to harmonize Ukrainian market regulations with EU legislation

### Draft Law of Ukraine No. 3800

Envisages the possibility of using bank guarantees to ensure payment for natural gas transmission services and introduce special accounts that will automatically distribute consumers' payments between the GTS operator and DSOs

### Draft Laws of Ukraine No. 4187 and No. 4187-1 regarding the simplification of subsoil use

- Provide for creation of interactive map of minerals of Ukraine
- Ban investors from Russian Federation from subsoil use
- Stipulate that documents for tender should be submitted in electronic form only
- Abolish the procedure for approving the allocation of land by a local council
- Allow alienation (including sale) of permits for subsoil use
- Amend the list of rights and obligations of a subsoil user and slightly change the grounds for termination and suspension of a permit

### New Code of Ukraine on Subsoil

Ministry of Environmental Protection and Natural Resources of Ukraine developed and published for public consideration the new edition of the Code of Ukraine on Subsoil aimed at boosting the development of extraction industry in Ukraine and eliminating the existing drawbacks in the area of the subsoil use. The new version of the Code:

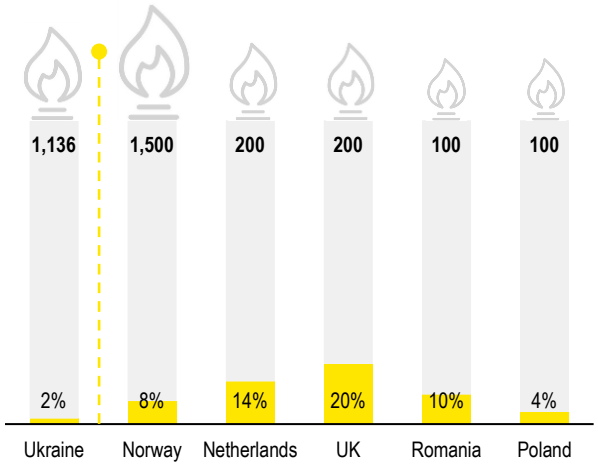
- Implements EU Directive № 94/22 on the conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbons
- Provides for digitization of geological information and free access to it
- Amends provisions in respect of geological exploration of subsoil
- Changes the validity terms for permits for subsoil use
- Introduces the transparent procedures for the allocation of permits for subsoil use through auctions as well as separate non-auction procedures

## 2.2.3. Natural gas

# Ukraine has enough natural gas reserves to materially substitute import and in case of domestic production increase to become net-exporter

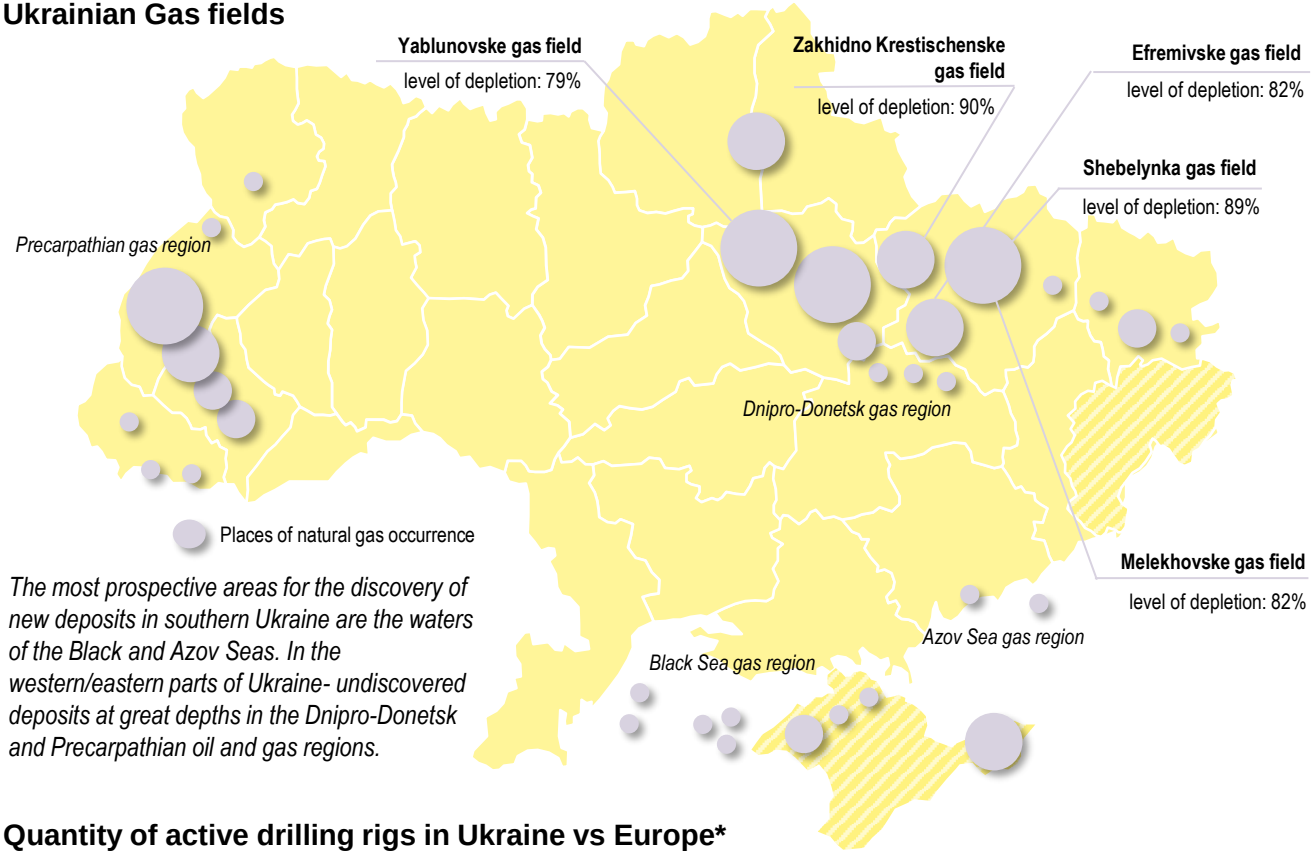
Despite the country's more than 100-year history of oil and gas production, Ukraine remains rich in conventional gas reserves and possesses vast untapped unconventional potential. The R/P ratio is close to 56 years illustrate that there are very substantial remaining resources. This suggests that Ukraine has the geological potential not only to achieve energy self-sufficiency, but also itself to become a major gas supplier to Europe. In Ukraine, only 2% of natural gas reserves are extracted every year, versus at least 4% as in other countries. Plentiful resources, extensive gas transportation infrastructure and the low intensity of natural gas extraction indicate a huge opportunity to increase natural gas production in Ukraine to cover local demand and support future gas exports to Europe.

### Top EU countries by proven natural gas reserves and their factor of production, bcm



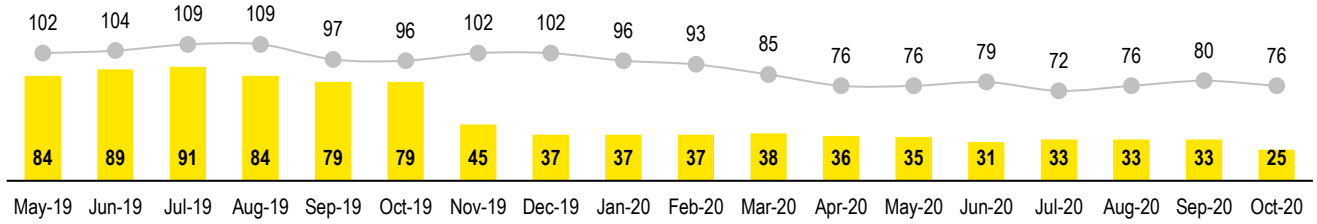

**Source**: BP Report 2020, EY analysis

### Ukrainian Gas fields




*The most prospective areas for the discovery of new deposits in southern Ukraine are the waters of the Black and Azov Seas. In the western/eastern parts of Ukraine- undiscovered deposits at great depths in the Dnipro-Donetsk and Precarpathian oil and gas regions.*

### Quantity of active drilling rigs in Ukraine vs Europe*

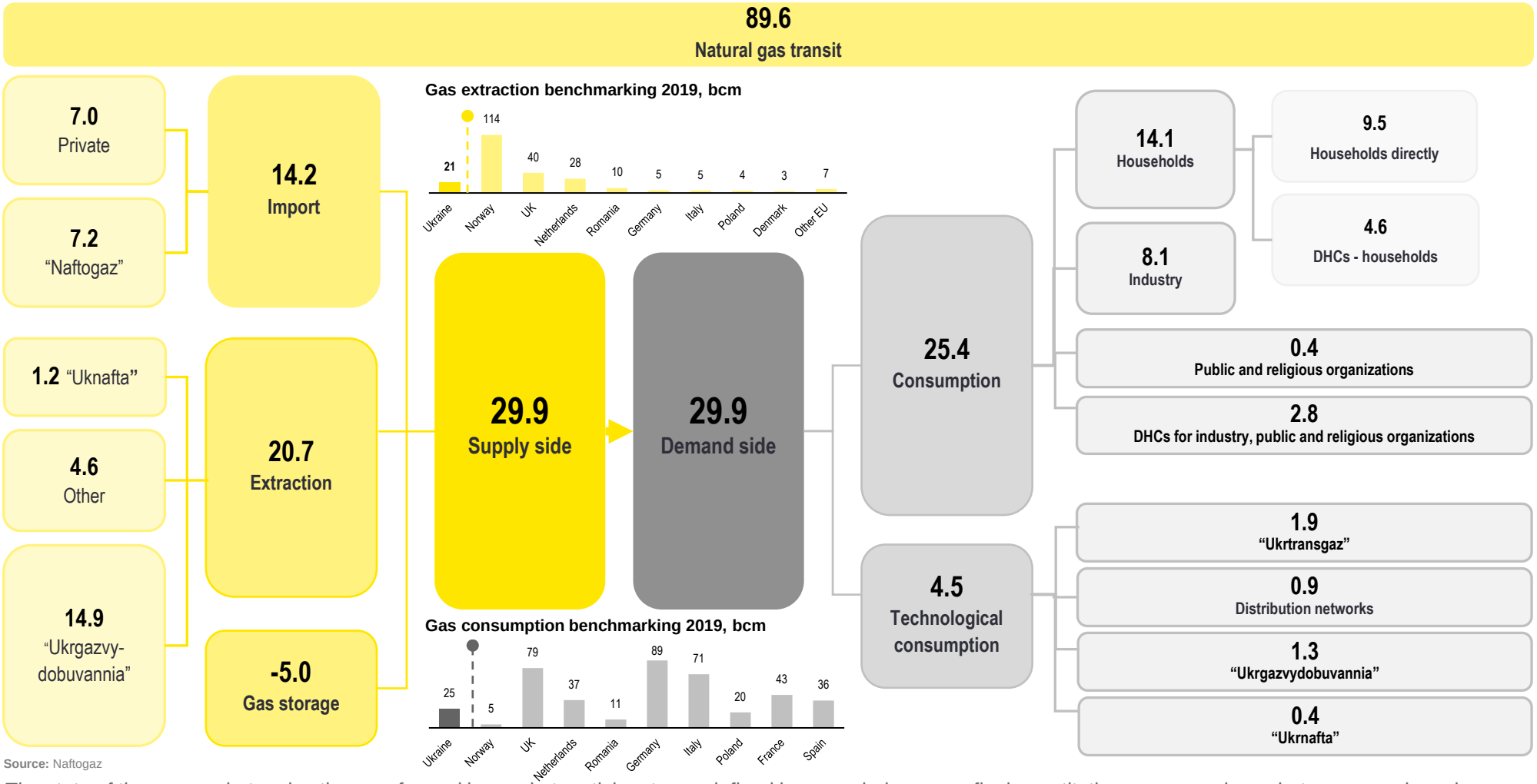



**Source**: Baker Hughes, EY analysis
**Note:** At the initiative of the AGPU, Ukraine was included in the world-famous index of operating drilling rigs Baker Hughes Rig Count in May 2019.

## 2.2.3. Natural gas

# Internal natural gas market is currently balanced and closely connected with European adjacent markets through import and transit activities

### Equation of the gas balance




**Source:** Naftogaz

The state of the gas market and actions performed by market participants are defined by a gas balance – a final quantitative correspondence between supply and demand (the general equation of the gas balance is shown above). At the same time, TSO is responsible for balancing supply and demand of gas in the GTS.

## 2.2.3. Natural gas

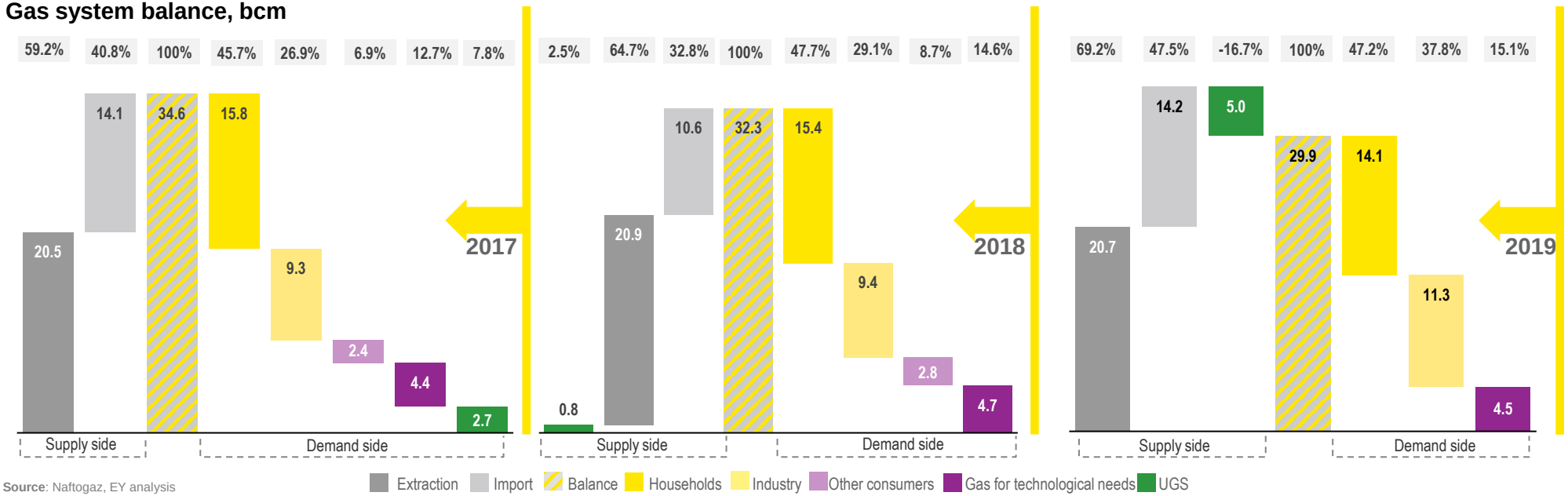
# Demand for natural gas in Ukraine shows a steady decline due to the warm weather, reduction in industrial production volumes, efficiency improvement

In 2019, Ukrainian companies produced 20.7 bcm of gas: 80% was provided by the companies owned by NJSC “Naftogaz of Ukraine” (Ukrgazvydobuvannya, Ukrnafta and Chornomornaftogaz) and 20% by private producers (DTEK, Burisma, UNB, PNGV and others). As historically the total consumption was above the production, traders and suppliers used to cover the lack of domestic resources by import. Gas imports to Ukraine grew to 14.2 bcm, which is 34.9% higher compared to 2018. Ukraine has been importing gas exclusively from the European market for more than four years. Additionally, some part of gas was withdrawn from gas storages (5.0 bcm). These three sources define the supply side (29.9 bcm).

Use of gas begins with technological consumption of the E&P companies that transform the production volumes into marketable ones. Together with imported volumes and natural gas withdrawn from storages, they are transported by TSO (high-pressure pipelines) to DSOs networks entry points (low-pressure pipelines), adjacent TSO cross-border entry points (export of natural gas could be performed by traders and suppliers) and in some cases to direct consumers. The process of gas transportation is also accompanied by technological consumption, so TSO must buy natural gas to cover its own consumption at free competitive prices. DSOs (44 companies, 20 of them belong to one group RGC) must cover its technological consumption as well. Together, the technological consumption (E&P, TSO, DSOs) amounted up to 4.5 bcm in 2019.

As a result, marketable volumes are converted to consumed volumes (25.4 bcm in 2019), which could be divided in four main groups: households (incl. DHCs that consume gas for households needs); industrial enterprises; public and religious organizations; and DHCs (consuming gas for non-households needs). To ensure the reliability of the supply, the technical part must be in line with the commercial one, which could be divided into wholesale and retail segments. On the wholesale market, E&P companies sell gas to market participants, traders buy gas from other participants as well as from foreign traders, DSOs and TSO buy gas to cover their technological consumption, and suppliers buy gas to cover the demand of its consumers. On the retail market, the different types of final consumers buy gas from its suppliers.

**Gas system balance, bcm**

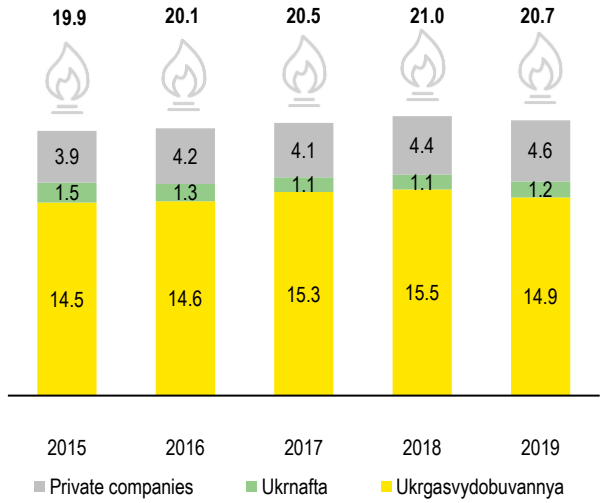



**Source**: Naftogaz, EY analysis

## 2.2.3. Natural gas

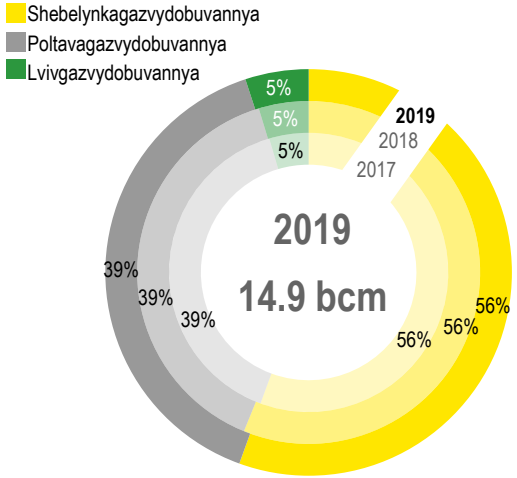
Internal gas production is not enough to cover the demand, so one of the key targets is to stimulate additional investments, including through PSA

### Structure of Ukrainian gas production, bcm



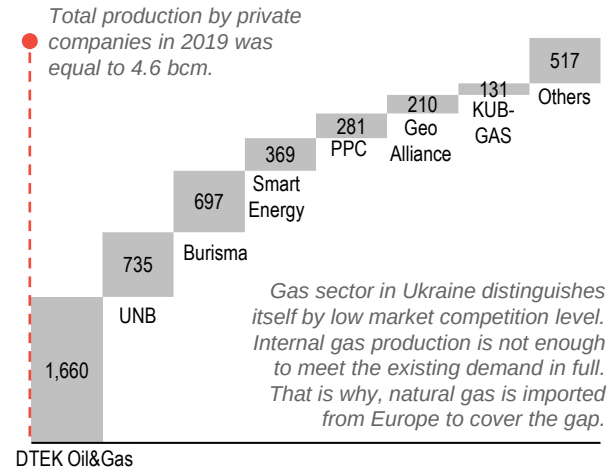

**Source**: Naftogaz, EY analysis

### UGV production in 2019 by enterprise




**Source**: Naftogaz, EY analysis

### Production by private companies 2019, mcm




**Source**: Naftogaz, EY analysis

### Ukrgasvydobuvannya

In 2019, UGV, which is part of Naftogaz, produced 70.9% of Ukraine's total gas volume. This includes 1.3 bcm used for technological consumption. The decline in production by 1.5 bcm in comparison with 2018 was due to gas reserves depletion in major fields.

As at May 29, 2019, UGV and Vermilion signed a memorandum of joint participation in tenders for PSAs, which will be held at several sites in accordance with the decisions of the CMU of December 18, 2018, as well as about the prospects for further cooperation. Nevertheless, as of now expected PSA is not signed. Also the company is considering the option to go public (IPO) which potentially could be a great opportunity for FDI attraction.

### Ukrnafta

In 2019, Ukrnafta, 50%+1 share is owned by Naftogaz Group, increased gas production to 1.16 bcm, which is 7% more compared to 2018. The volume of marketable gas was 830.8 tcm. The Company operating fund includes 24 drilling rigs, owns one of the largest filling stations network in Ukraine. As of January 1, 2020, Ukrnafta had 537 filling stations.

### DTEK Oil&Gas

DTEK Oil&Gas is the largest private gas company in Ukraine. DTEK Oil&Gas produced 1.66 bcm of natural gas in 2019, up by 0.66% year on year, which broke the record both for the company and private gas production sector of Ukraine.

### UNB

PrJSC "MC "Uknaftoburinnya" is one of the leading private oil and gas production companies in Ukraine. The company operating fund includes 28 wells with depth of 3 800 - 5 750 m. Sakhalin field is located in the Krasnokutsk area of Kharkov region and belongs to medium-sized fields with a complex geological structure.

### Burisma

Burisma Group is a vertically integrated holding engaged in the exploration, production, service, and sale of hydrocarbons. (15% - market share among private gas producers). Gross year production in 2019 was equal to 0.7 bcm (1.1 bcm in 2018).

## 2.2.3. Natural gas

# Procedure for executing PSAs

Under PSA the Government grants to the investor access to exploration and extraction of minerals, including natural gas in a certain area (areas) of subsoil, and the investor performs the assigned work at its own expense and at its own risk, with a subsequent compensation of expenses and receipt of payment (remuneration) in the form of a portion of profitable products

PSAs may be executed in respect of certain subsoil areas within which deposits of mineral resources are located, including subsoil areas within the continental shelf and the exclusive (maritime) economic zone of Ukraine

The validity term of PSA is determined by the parties, but may not exceed fifty years from the date of its signing

The state grants and ensures issuance of all necessary permits and provides the land for implementation of the PSA

The PSA is executed on a competitive basis based on the results of tender initiated by the CMU or upon the request of the investor to the CMU or to the special Interdepartmental Commission (such request should be considered within three months)

Tender for a particular subsoil area is held if any of the following conditions are met (paragraph 2 of Article 6 of the PSA Law):

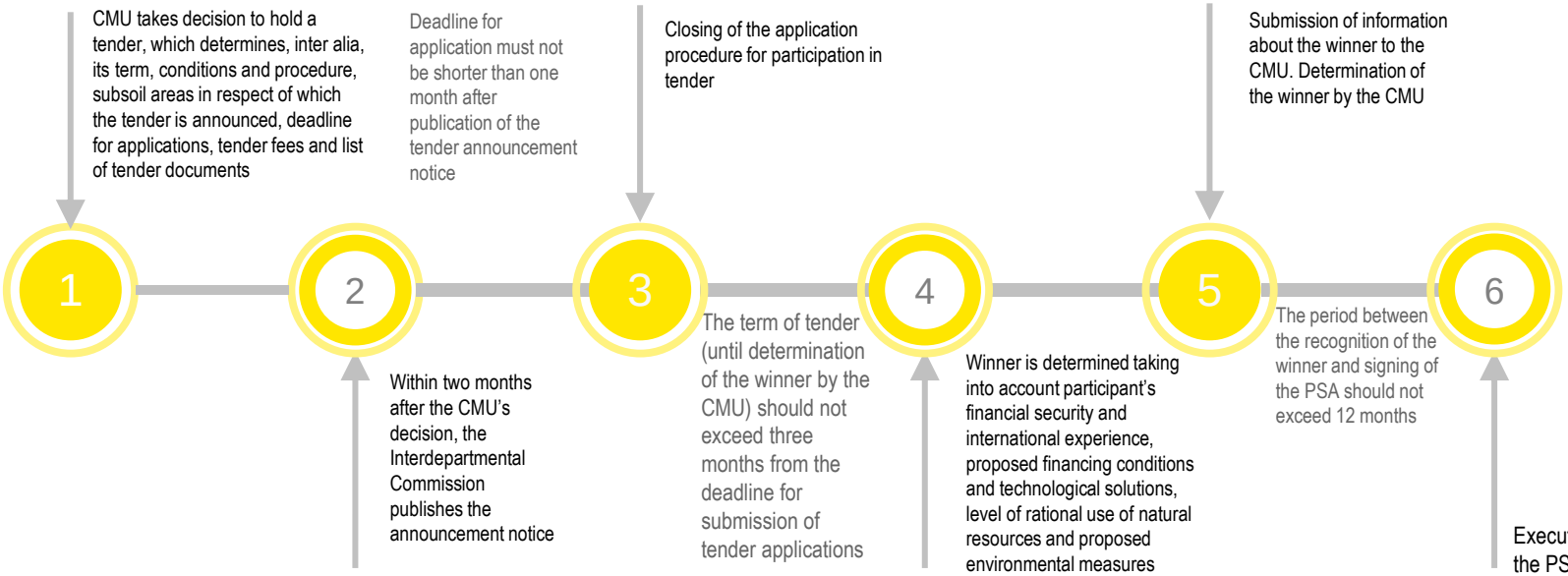
1. It is unprofitable for the subsoil users and the state to continue the development of mineral deposits due to existing factors; 2. Lack of state funding and technical means for development of new large mineral deposits; 3. Need to attract special high-cost technologies; 4. Need to provide the regions with their own fuel and energy raw materials or to create new jobs in the areas with low employment rate; 5. Need to introduce the latest technologies and equipment; 6. Need to develop mineral deposits, the development of which is carried out in particularly difficult conditions (sea areas, hard-to-reach deposits etc.); 7. Need for additional exploration, additional or in-depth exploration of the subsoil area.

In the case of subsoil deposits with a small forecasted margin, PSA may be executed without a tender

Draft PSA should be prepared by investor or Interdepartmental Commission (upon decision of the CMU) within three months following official publication of the tender results and is subject to mandatory examination of financial, legal and other issues. Procedure for preparing a PSA is governed by the Instruction for Drafting, Negotiating and Signing a Production Sharing Agreement

After submission of draft PSA to the Interdepartmental Commission (if investor prepared the PSA independently) the Commission registers it. The Commission provides the investor with conclusions, comments, results of examinations regarding the draft PSA or with a new version of the draft PSA that should be further reviewed by the investor. At the completion stage the draft PSA is approved by investor, CMU and respective local councils where targeted deposits are located. The final draft is submitted to the CMU and investor for signing

## Tender procedure (according to the Articles 7, 10, 11 of the PSA Law and Instruction for Organizing a Tender for the Execution of a PSA)




### Recent investment

Aspect Energy and SigmaBleyzer (acting jointly through a special-purpose project company Ukrainian Energy, L.L.C.) signed the PSA with the State of Ukraine on 14 January 2021

The contract period is 50 years for the Varvynska block comprising approximately 3,500 km$^2$

USD 39 m of investments are expected during the first years of the exploration period

## 2.2.3. Natural gas

Production Sharing Agreement is one of the most efficient mechanisms for subsoil use. See below examples of the biggest international PSA in 2019

### Agreement for oil and gas exploration in UAE

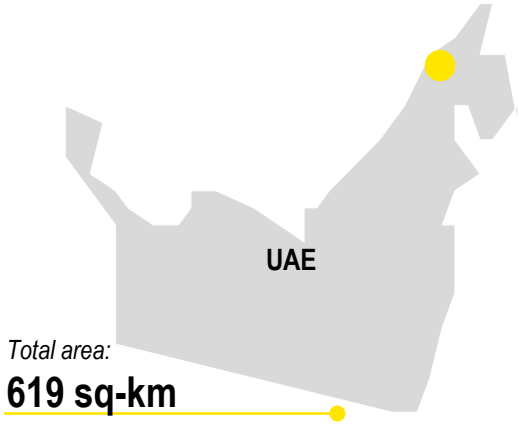
PGNiG

**January 16, 2019**

Representatives of PGNiG SA, the Ras Al Khaimah Petroleum Authority and RAK GAS LLC have signed an agreement whereby the Polish company is permitted to explore for and produce hydrocarbons in the emirate of Ras al Khaimah. PGNiG won a tender for acquisition of rights to explore for, to appraise and to produce hydrocarbons in Ras Al Khaimah in December 2018. The agreement allocates obligations and provides for a split of costs and profits under the license. The Ras Al Khaimah Petroleum Authority is the regulator of the oil and gas sector in the emirate. RAK GAS LLC is the emirate's national oil company.

*Term of production phase after 2-year exploration:*

**30 years**




*Total area:*

**619 sq-km**

### BP and Eni sign the agreement in Oman

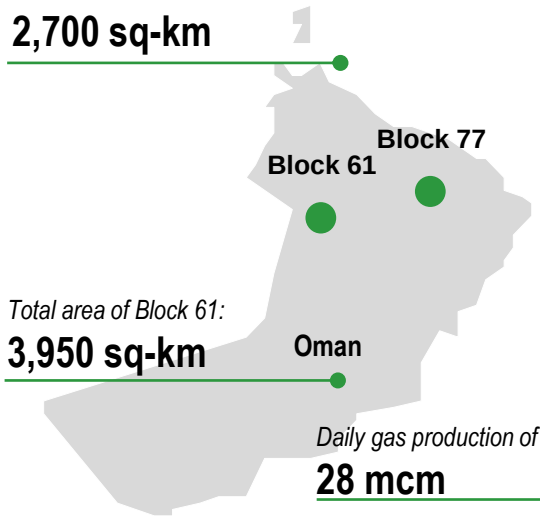
Eni

**July 31, 2019**

BP and Eni have signed an exploration and production sharing agreement for Block 77 in central Oman with the Ministry of Oil and Gas of the Sultanate of Oman. BP and Eni will each hold a 50% interest in the EPSA, with Eni acting as operator during the exploration phase. Block 77 is located 30 kilometres east of the BP-operated Block 61, which contains the already-producing Khazzan gas project as well as the Ghazeer project, currently under development. BP successfully brought the major Khazzan project into production in 2017. Ghazeer, the second phase of development on Block 61, is currently under construction and is scheduled to come on stream in 2021.

*Total area of Block 77:*

**2,700 sq-km**




*Total area of Block 61:*

**3,950 sq-km**

*Daily gas production of Block 61*:*

**28 mcm**

**Note:** UGV average daily production equal to 38 mcm

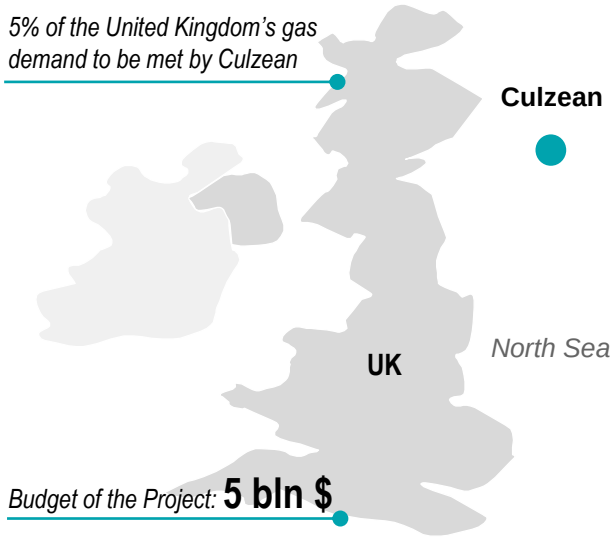
### Culzean: a large gas project in the North sea

TOTAL

**June 11, 2019**

Culzean is a gas condensate field located in the North Sea, 230 kilometers off the coast of Aberdeen. It was discovered in 2008 in an area that had been left unexplored for a long time. The field is made up of two deep reservoirs, with reserves estimated at between 250 million and 300 million barrels of oil equivalent, making it the largest gas project developed in the United Kingdom in the last 25 years. Culzean is Total's most advanced digital offshore facility. Right from the earliest stages of the project, new technologies were used to ensure safety and performance and to facilitate communication and collaboration within the operations teams.

*5% of the United Kingdom's gas demand to be met by Culzean*

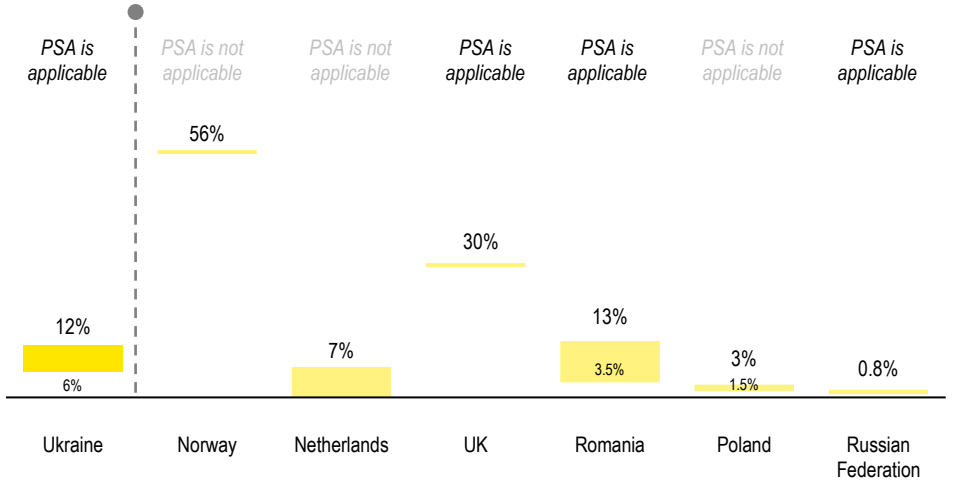



*Budget of the Project:* **5 bln $**

## 2.2.3. Natural gas

# Subsoil use charge, especially for new wells, should be determined to make investments in the E&P activities attractive compared to other countries

### Subsoil use charges for natural gas extraction in Ukraine and other countries

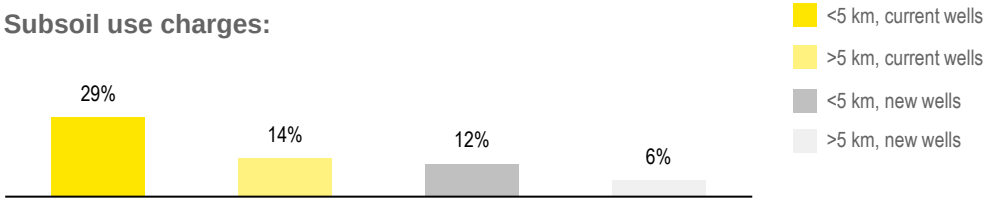



**Source:** Global oil and tax guide, EY analysis and calculations

### Ukrainian natural gas subsoil use charges

Subsoil use charge for the use of resources for the production of minerals (royalties) are payable by all subsoil users producing mineral resources in Ukraine (including during the exploration stage). Charges on hydrocarbons are calculated as a percentage of the value of produced hydrocarbons. The value of produced gas is determined as the average customs value of imported natural gas in the reporting period calculated by the State Fiscal Service. In addition, the Government of Ukraine introduced a ban for five years (till 1 January 2023) on raising subsoil use charges for natural gas extracted from new wells.

**Subsoil use charges:**




We have selected top-5 European countries with the biggest proven reserves of natural gas and the Russian Federation as the neighboring country with the greatest reserves of natural gas all over the world to compare their tax legislation regarding natural gas extraction

Two possible options for attracting foreign investors in the industry of gas exploration and production are the introduction of a low level of subsoil use charges for natural gas extraction or the Production Sharing Agreements (PSA). It was noticed that PSA is applicable to countries with a higher level of royalties and conversely.

### Norway natural gas subsoil use charges

A company involved in extractive (upstream) activities within Norwegian territorial borders or on the Norwegian continental shelf is subject to a tax rate of 56% resource rent tax on the net operating profits derived from its extractive activities.

### Netherlands natural gas subsoil use charges

| Bracket, units of mcm | Gas royalty |
|---|---|
| 0-199 | 0% |
| 200-599 | 2% |
| 600-1,199 | 3% |
| 1,200-1,999 | 4% |
| 2,000-3,999 | 5% |
| 4,000-7,999 | 6% |
| 8,000 and above | 7% |

The amount of charges depends on the turnover. It is determined by multiplying the units produced (mcm) with the arm's-length price at which the units are sold. Subsoil use charges are paid on a return basis. The ultimate filing date is 1 April of the year following the calendar year in question.

### Russian Federation natural gas subsoil use charges

The fiscal regime applied in Russia to the petroleum industry provides for a combination of charges (called mineral extraction tax (MET). Natural gas charge equals RUB 35 (0.4 EUR) per tcm adjusted by coefficients. The rate of 0.8% was calculated by the use of Gazprom's average natural gas price 2020 per tcm to compare tax rates within countries under analysis.

## 2.2.3. Natural gas

# Obtaining permits for subsoil use

According to the Code of Ukraine on Subsoil natural gas extraction should be carried out after obtaining a special permit for subsoil use

In 2018 the permit procedure was simplified by the Law of Ukraine "On Amendments to Certain Legislation of Ukraine on Deregulation in the Oil and Gas Industry". Changes provide that investor can either choose a subsoil area from Investment Atlas of Subsoil User issued by the CMU or pick another one on its own by submitting application to the State Service of Geology and Mineral Resources of Ukraine

Pursuant to the Procedure for Issuing Special Permits for Subsoil Use permits can be granted for different validity terms:

- 10 years - for geological exploration of oil and gas bearing subsoil, including pilot development of oil and gas fields
- 20 years - for oil and gas extraction
- 30 years - for oil and gas extraction on the continental shelf and within the exclusive (maritime) economic zone of Ukraine

There are tender and non-tender procedures for obtaining a permit. State Service of Geology and Mineral Resources of Ukraine can grant permits for subsoil use in respect of the natural gas without holding a tender in the following cases:

- Extraction, if applicant at its own expense carries out a geological study of the subsoil area and a calculation of the mineral reserves
- One-time expansion of the subsoil area by no more than 50%
- Geological exploration of subsoil at the expense of the state budget
- Carrying out operations under PSAs

To obtain a permit under a non-tender procedure an applicant should submit the documents specified in the respective regulation in both paper and electronic form to the State Service of Geology and Mineral Resources of Ukraine. Within 30 days after the documents are provided, State Service of Geology and Mineral Resources of Ukraine takes decision on issuing a permit

Permit under the non-tender procedure is granted within 20 business days after payment of full amount of the administrative charge

In case of PSA the Interdepartmental Commission carries out the administrative formalities on behalf of investor(s)

Permits for subsoil use in other cases are granted through an electronic tender. A foreign legal entity can also take part in such tender

Tenders are governed by the newly approved Procedure for Tenders for the Sale of Special Subsoil Use Permits dated 23 September 2020

### Preparation stage

► Preparation of tender proposals based on applications and supporting materials

► Reconciliation of the proposals for auction lots between the State Service of Geology and Mineral Resources of Ukraine and the Ministry of Ecology and Natural Resources of Ukraine

► Issuance of an order approving a list of subsoil areas

► Issuance of a decision on holding the auction

### Bidding stage

► Auction should be carried out via the system of electronic bidding in 90 calendar days following the date of its announcement (for oil and natural gas)

► Registration of participant via web (electronic) platform and payment of the guarantee fee in the amount of 20% of the lot price are required

► The auction is a repetitive process of raising prices, in three rounds in real time

► The winner is the bidder that submitted the highest bid for the lot, if it made at least one step of the auction or, in the case of identical bids, – a bidder that submitted the bid earlier

► If the first auction is unsuccessful, the second auction should be scheduled with a reduction of the lot's price by 50%. If this auction does not result in the sale of permit, an auction with a step-by-step reduction of price should be appointed

### Closing stage

► Upon completion of the auction, electronic system automatically generates the auction minutes for each lot and makes them publicly available through electronic platform

►The winner signs a protocol and pays the remaining price of the lot

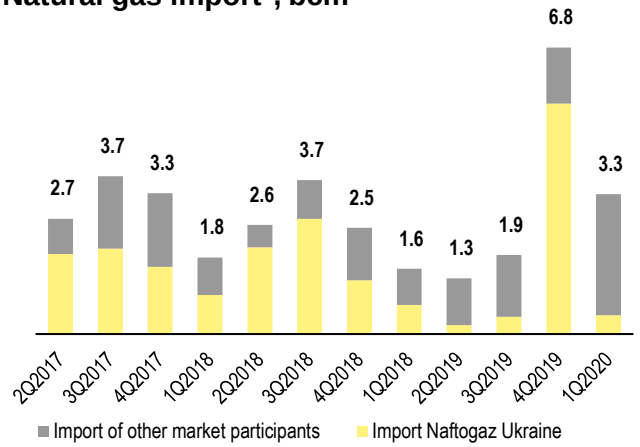
► If the winner fails to sign minutes, pay the price or register a representative office in Ukraine (for foreign companies), the electronic system automatically generates minutes designating second best bidder as the winner

►Winner applies to the State Service of Geology and Mineral Resources of Ukraine with a proposal to enter into the agreement on sale of permit. This agreement should be executed within 20 business days after issuance of the electronic auction minutes

## 2.2.3. Natural gas

# Short-haul and custom warehouse services is an important step in a strategy to integrate into the EU gas market and create a gas hub

### Natural gas import*, bcm



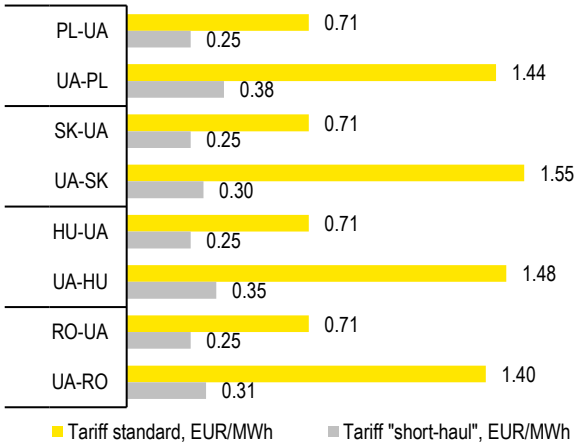

**Source**: Naftogaz, EY analysis
**Note:** Last available information for 1Q2020

Ukraine remains heavily reliant on gas imports. In January-September 2020, natural gas imports from the EU reached 14.8 bcm. This is 3.2 bcm, or 28%, more than in the same period previous year. That is also 26% more than the average in 2016-2019. During the nine first months of 2020, imports from Slovakia were about 9.7 bcm (+33% compared to the same period last year), from Hungary – 3.7 bcm (+14%), from Poland – 1.5 bcm (+33%). It should be noted that import volumes also include a virtual reverse on Polish, Slovak and Hungarian routes, which became available for the first time since this year – 6.9 bcm. As of today, all imported volumes of natural gas come exclusively from EU countries. Since November 2015, Ukraine has not been importing gas from the Russian Federation. Gas transit volumes through the territory of Ukraine grew with a CAGR 7.6% during 2015-2019, reaching 90 bcm in 2019 and 40 bcm as of October 2020.

### Short-haul services

Short-haul – is a special service, which allows discounted transmission between dedicated interconnection points with adjacent countries. The short-haul service provides the instrument for traders and shippers to use the capacities under very attractive tariffs, reaching the markets of Poland, Hungary, Slovakia, and Romania via Ukrainian GTS. This product is only for transit services and does not provide access to the Ukrainian VTP and internal market. Increase in gas inflow from EU countries is explained by growing demand for a new short-haul service, which Gas TSO of Ukraine has launched since 2020. In January-September, Ukraine received 6.1 bcm of gas throughout short-haul (from Hungary – 25%, from Poland – 8%, from Slovakia – 67%). It should be noted, that traders allocated all these volumes to storage in Ukrainian UGS in the “customs warehouse” mode.

### Tariffs comparison




**Source**: GTSO, EY analysis

### Russia to transit 65 bcm of gas through Ukraine in 2020 under new deal of Gazprom

#### Five-year transit agreement

Under the newly reached five-year agreement, transit volumes of Russian gas through the GTS of Ukraine to Europe will amount up to 65 bcm in 2020 and is expected to decrease up to 40 bmc annually during 2021-2024

#### Stockholm court decisions

By its first decision on Naftogaz-Gasprom case in 2017, the SAC* fully satisfied the demands of the Naftogaz, savings for Ukraine $1.8 b for the gas purchase. In 2019, SAC obliged Gasprom to pay in favor of Naftogaz $ 2.9 b.

#### Russian gas for Ukraine

Ukraine contemplates the direct purchase of Russian gas at a discount, given that all terms of the Minsk Agreements, signed in December 2019 by both sides, will be fulfilled

**Note**: SAC – Stockholm Arbitration Court

### Custom warehouse services

In 2017, Ukraine's gas transmission system operator launches the specified customs regime allows Customers to store natural gas in 10 underground gas storage facilities of Ukraine within 1095 days without paying taxes and customs duties.. The storage services are offered at the most competitive tariffs in Europe (approx. 0.4 EUR/MW per storage cycle). The launch of the custom warehouse services in Ukraine is an important step in long-term strategy to integrate into the European gas market and create an Eastern European gas hub based on Ukraine's vast and reliable gas transmission and storage infrastructure. Currently demand for the service exceeds expectations.

## 2.2.3. Natural gas

# Ukrainian gas transmission system ensures the reliable and secure transit of gas to Europe as well as access to gas storages and interconnectors

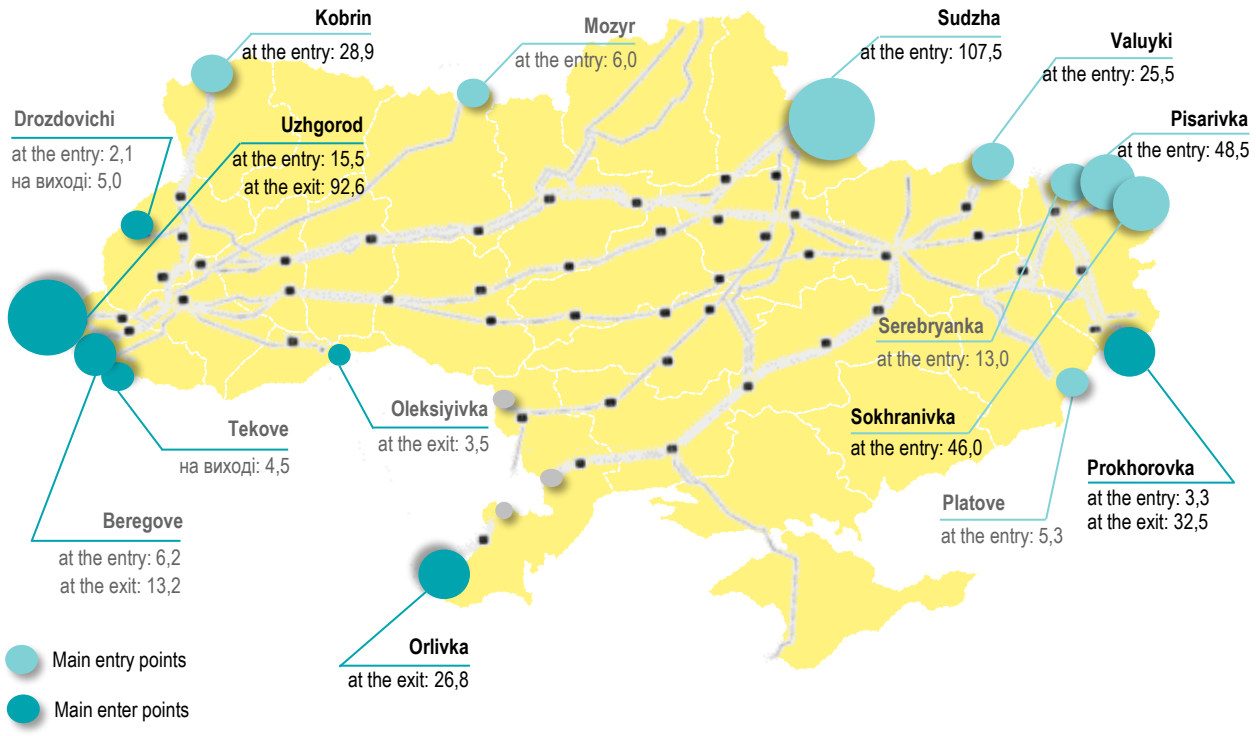
The gas transmission system of Ukraine is one of the most powerful networks of the trunk gas pipelines in the world. It performs two main functions: transmission of natural gas to domestic customers, as well as the transit of natural gas through the territory of Ukraine to the countries of Western and Central Europe. Moreover, GTS Operator of Ukraine is responsible for scheduling, balancing, natural gas metering, and exchange of information, procedures related to nominations / renominations, provision of other services to market participants.

The main components of the gas transmission system are a network of gas pipelines, compressor stations, gas metering stations and gas distribution stations, which is the entire technological complex that functions in continuous operation. The Ukrainian GTS is interconnected with natural gas transmission systems of Russia, Belarus, Poland, Slovakia, Hungary, Romania and Moldova.

The key challenges in this area are the reduction in gas consumption in Ukraine, off-takes of natural gas, high level of depreciation of gas pumping units (60-80%) and ensuring of natural gas transit after 2024.

Stable operation of the GTSO is possible in the case when the GTSO is remunerated in full for the efficient costs caused by transmission of natural gas: 1) capital and operating expenses required for transmission must be compensated through the tariff; 2) balancing - as payment for imbalances (including neutrality fee). The potential problem arises when TSO is not fully compensated for these costs due to the unauthorized off-takes and unpaid imbalances.

**Capacity of the gas transmission system of Ukraine and volumes of transported gas, bcm**




Distribution gas pipelines **2.4** th km

Gas transmission pipelines **33.1** th km

Annual entry point capacity **281** bcm

Annual exit point capacity **146** bcm

Compressor stations **57**

Gas metering stations **33**

**Source:** UTG

## 2.2.3. Natural gas

Unbundling and certification of the independent GTSO in 2019 brought Ukrainian subsector legislation in compliance with the main EU acquis

### Ratification of the EU Agreement

By signing and ratifying the Association Agreement with the EU, Ukraine was obliged to implement the provisions of the Third Energy Package, in particular, Directive 2009/73/EU on common rules for the internal gas market, primarily to ensure the independence of the domestic GTS operator to promote non-discriminatory infrastructure access to the network and market transparency.

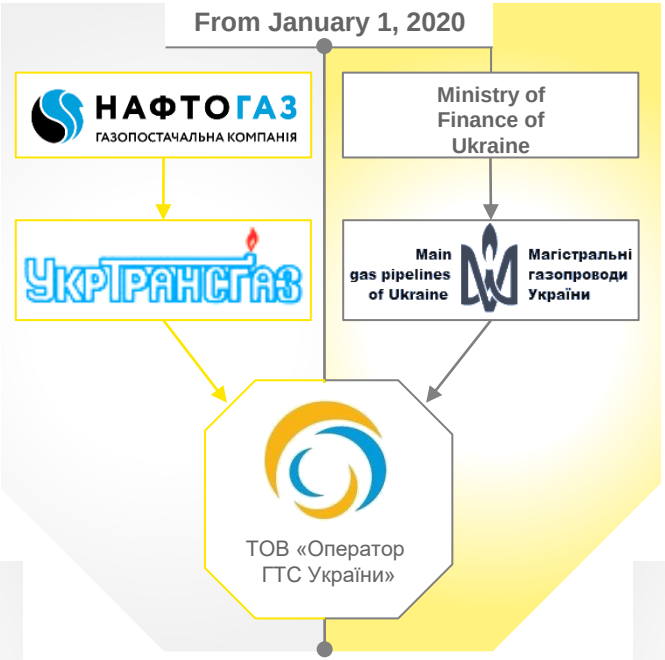
### Adoption of the Law of Ukraine "On the Natural Gas Market"

The law sets obligations to the ownership structure of GTSO. Controlling stake of the entity must be owned by the state and the minority share - by GTS Partners, who meet certain requirements. The law in question regulates the certification process of GTSO according to the OU (GTSO is the owner of TSO) and ISO models (the state remains the owner of the GTS).

### Approval of Restructuring plan of NJSC "Naftogaz of Ukraine"

The plan provided for the establishment of JSC "Main Gas Pipelines of Ukraine", which was wholly owned by the State. At the same time, corporate rights were managed by the Ministry of Energy. JSC "Main Gas Pipelines of Ukraine" was determined as the subject of property management, which belonged to the state. Assets accounted for on the balance of UTG and was used in the field of the transportation and storage.

### From January 1, 2020




### Start of GTSO operation

Before January 1, 2020 GTSO was a fully-owned subsidiary of UTG responsible for GTS technical maintenance under SLA agreement. The branch "GTS Operator of Ukraine", as a licensee for transmission and transit, carries out commercial activities, dispatching, procurement and coordination of the process of natural gas transmission.

### Start of GTSO functioning

After confirmation of certification by the NEURC and the Energy Community, as well as after the expiration of the current gas transit contract with PJSC Gazprom, GTSO started an independent natural gas transmission services in Ukraine.

### Approval of the Action Plan to comply with the requirements for the unbundling and independence of GTSO

The plan contains a list of necessary steps to ensure the full performance of GTSO as an functional operator. It provides for the procedure for obtaining state-owned assets used in the process of natural gas transmission activities, in particular.

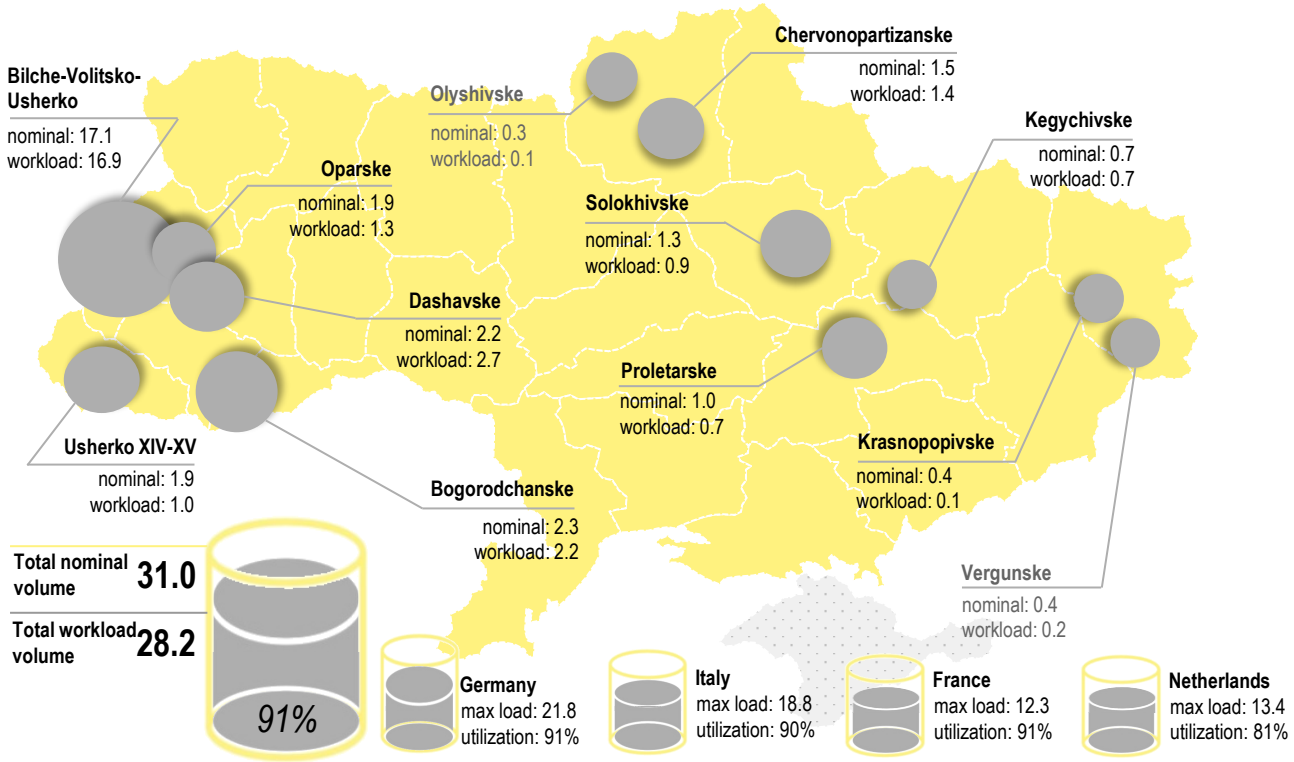
September 16, 2014 — April 9, 2015 — July 1, 2016 — December 1, 2017 — July 1, 2019 — September 18, 2019 — January 1, 2020

**Establishment of a branch of GTSO**

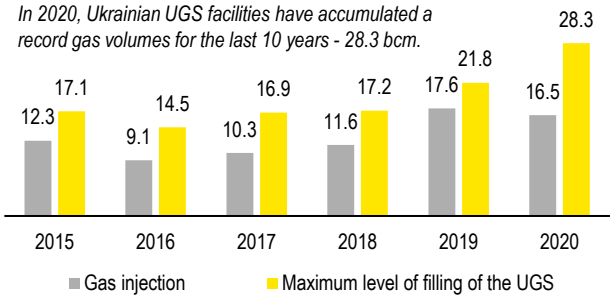
## 2.2.3. Natural gas

# The capacity of Ukrainian underground gas storages facilities is the largest in Europe and could be actively used by foreign traders throughout the year

### Underground gas storages volume and exploitation as November 2020, bcm

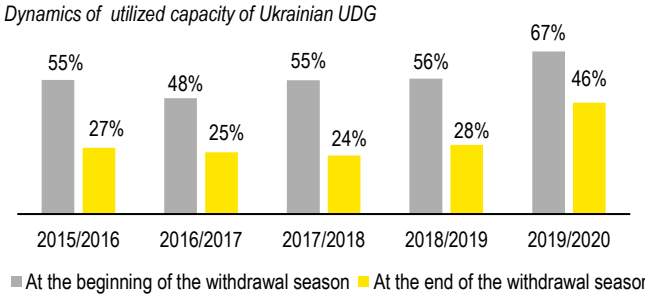



*In 2020, Ukrainian UGS facilities have accumulated a record gas volumes for the last 10 years - 28.3 bcm.*




**Source:** Naftogaz

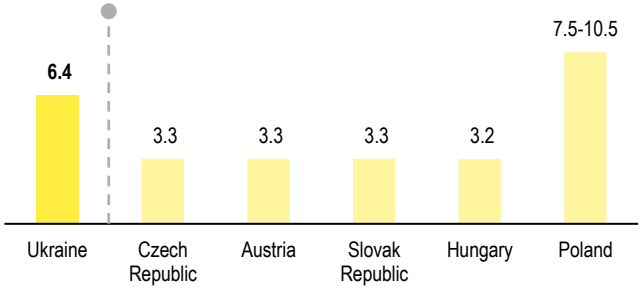
*Dynamics of utilized capacity of Ukrainian UDG*




**Source:** Naftogaz

- Ukraine has the most powerful network of underground gas storage facilities in Europe with the total capacity of 30 bcm. The capacity of Ukrainian gas storages is equal to a quarter of the EU's storage capacity.
- 10 out of 12 UGS facility are located on the basis of gas and condensate deposits (Chervonopartizanske and Olyshivske UGS are created in water formation). Most underground gas storages were put into operation in the 70s and 80s of the last century, but due to the short period of use of the equipment during the year, the overall level of depreciation is 23.3%.
- Currently, 2 underground gas storage facilities are out of operation. Vergunske, which is located on the temporarily uncontrolled territories, and Olyshivske, which (since the 2012/2013 season) is not used due to unfavorable geological conditions in the natural gas reservoir.
- The level of filling of the underground gas storage facilities as of the end of Q3 2020 was 91% of the design capacity under the results of monitoring by the NEURC. However, it was the largest level for this period in comparison with Q3 of 2018 and 2019.

### UGS services tariffs, EUR/MWh

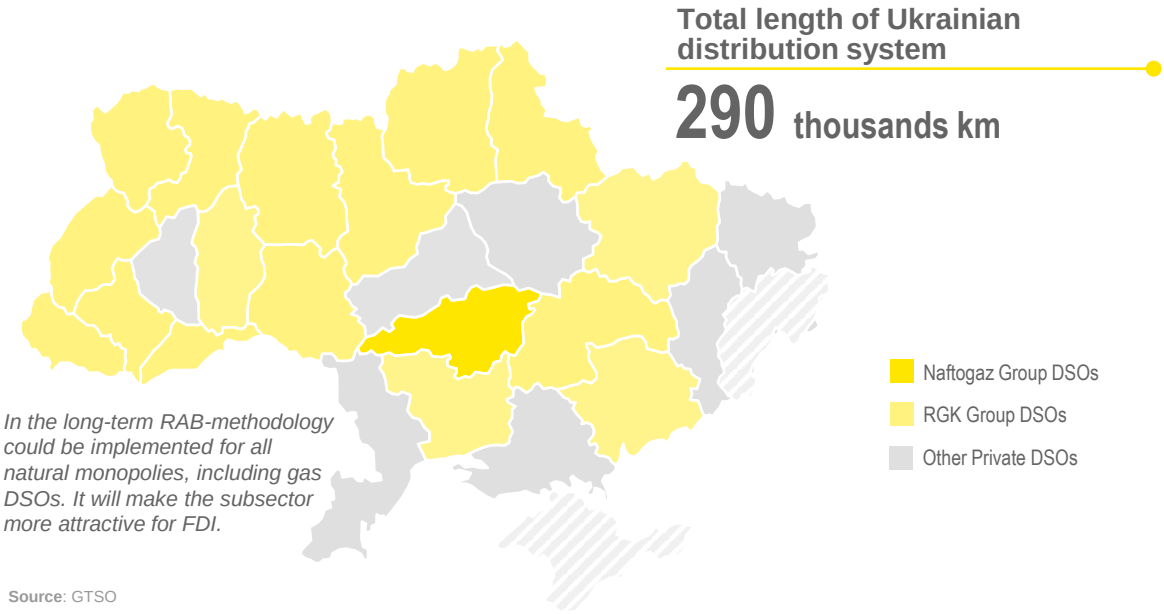



**Source:** UTG, RWE, MMBM, Gas Storage Poland

## 2.2.3. Natural gas

# Widespread gas distribution system operated by DSOs ensures the connection and natural gas supply for more than 12 million consumers

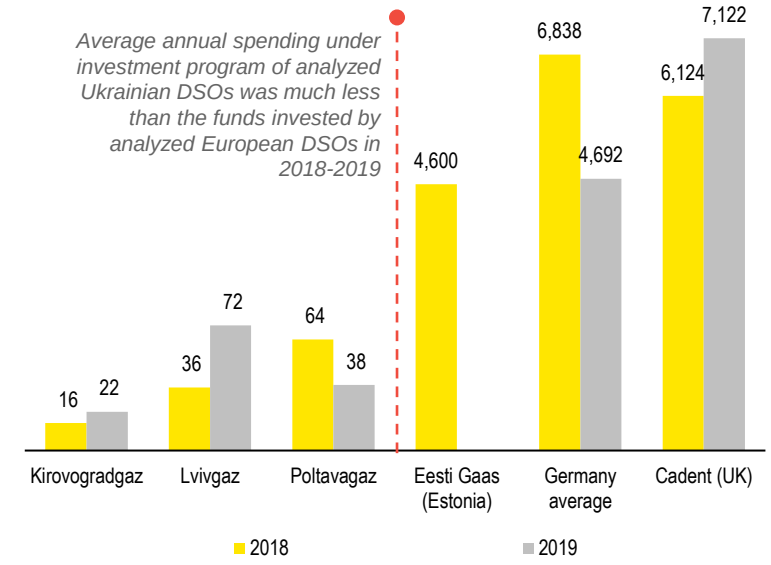
### Gas distribution system operators in Ukraine




*In the long-term RAB-methodology could be implemented for all natural monopolies, including gas DSOs. It will make the subsector more attractive for FDI.*

**Source**: GTSO

### Comparison of investment programs, EUR/km of GDS

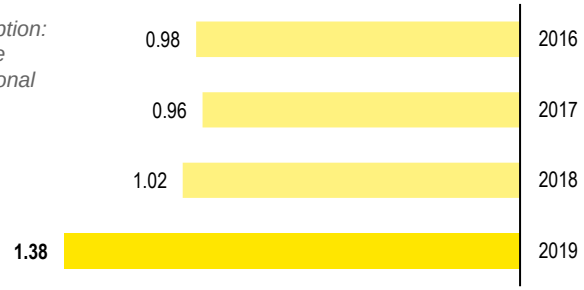



**Source**: NEURC

DSOs work as the intermediary between TSO and final consumers in terms of physical gas delivery. As the end of 2019, there are 44 DSOs, 20 of them belong to one group - Regional Gas Company. Part of the shares of 15 DSOs was state-owned. KryvorizhGas is fully-owned by the government and KremenchukGas with a government stake of 51%. Only KirovogradGas on 71.54% owned by Naftogaz Group. The remaining shares of DSOs are owned by other legal entities and individuals. Operation of obsolete networks is accompanied by high level of gas consumption for technological needs and normative gas losses in distribution system. To ensure the reliable and safe operation of Ukraine's gas distribution system in accordance with European standards, it is necessary to fully modernize the gas networks including installed equipment. Such modernization requires large amounts of investment. As of November 2020 DSOs exhibit the following issues: correct technological consumption assessment for tariff calculation, justified approach and procedure to tariff revision, reasonable adjustment of the DSOs' tariff calculation methodology, etc.

### Level of gas consumption for technological needs and normative gas losses dynamics, bcm

*Technological consumption: it is the most disputable DSO issue, as the national methodologies are too complicated, and calculations are not transparent.*




**Source**: NEURC

## 2.2.3. Natural gas

# After PSO elimination the competition should increase, but price will be still determined by import parity making producers indifferent about pricing

### Natural gas market in Ukraine

**Retail market model**

*Please, see the next slide*

**Wholesale market model**

The wholesale segment is a set of relations for the sale of natural gas between sellers and buyers, for example suppliers, traders, E&P companies, TSO and DSOs (up to 347 companies in 2019, no need to get the license).

### Regulated market segment

Before August 2020 the regulated segment was functioning under the Clause 11 of the Law "On natural gas market", taking into account the PSO Regulation (defines the general conditions of PSO regime) and CMU Regulation No. 293 dated of 03.04.2020 (envisages the obligation of NJSC "Naftogaz of Ukraine" to sell natural gas under PSO regime at prices below the regulated level). According to the PSO Regulation:

- The state-owned E&P companies JSC "Ukrgasvydobuvannya" and JSC "Chornomornaftogaz" are obliged to sell the natural gas to Naftogaz at regulated price
- Naftogaz is obliged to buy the natural gas from the state-owned companies at regulated price as well as from other market participants at free competitive to ensure sufficient gas volumes, necessary for PSO fulfillment
- Naftogaz is obliged to sell the natural gas to regional suppliers under regulated price (then they sell it to final customers with mark-up equal to or less than 2.5%).

### Unregulated market segment

On the unregulated segment of the gas market the relations between its participants are determined by contracts regarding the volumes, prices and delivery specifications of gas supplies. Wholesale prices in the unregulated market segment depend on seasonality, increasing during the heating season. During 2018-2019, average gas prices in Ukraine were decreasing following EU trend.

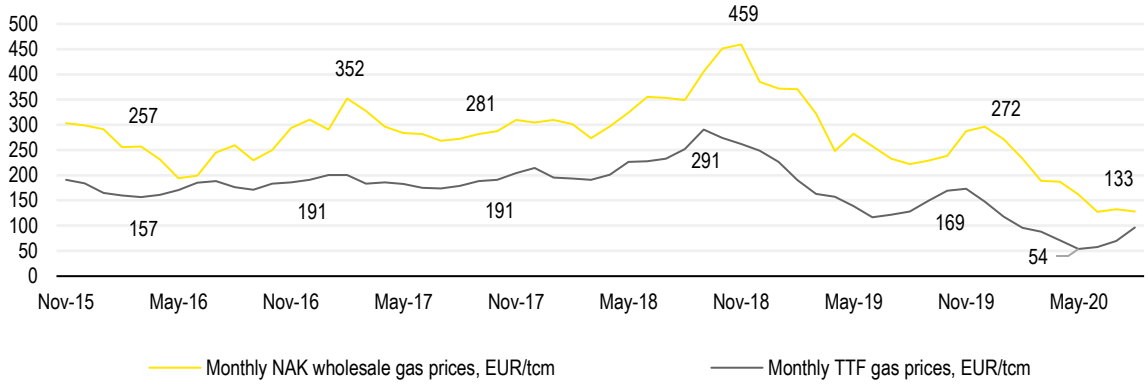
### PSO Regulation was abolished starting from August 1, 2020

- From the August 1, 2020 for regional suppliers the PSO model was eliminated and regional suppliers have to buy natural gas at free competitive prices. At the same time, the switch of customers between suppliers has become more flexible, so now they are able to choose the supplier with the most suitable and beneficial terms.

### Price determinants on the regulated wholesale market

Until October 2018, the PSO system envisaged two possible options of natural gas price, i.e. 4,942 UAH per tcm or the import parity price in case the latter exceeds the former by more than 10%. Since November 2018, the calculation methodology for natural gas price under PSO regime was amended and until April 2019 the price at which NJSC "Naftogaz of Ukraine" was obliged to supply gas to heat production companies and DSOs for the needs of households had been calculated by applying the discount factor to the average gas price in 3Q2018. The discount factor was determined by the CMU at 0.6943 and was expected to increase to 0.8 since May 2019. Nevertheless, the price calculation methodology was amended once again in April 2019 to increase the flexibility of the market and still protect consumers against the gas price fluctuations. According to the new methodology, the PSO price is the minimum among the import price, the UEEX price, the previous month price applied in transactions envisaging advanced payments and the price calculated under the former methodology.

### Average wholesale Ukrainian and European natural gas prices dynamics, EUR/tcm




**Source**: Naftogaz, Capital IQ

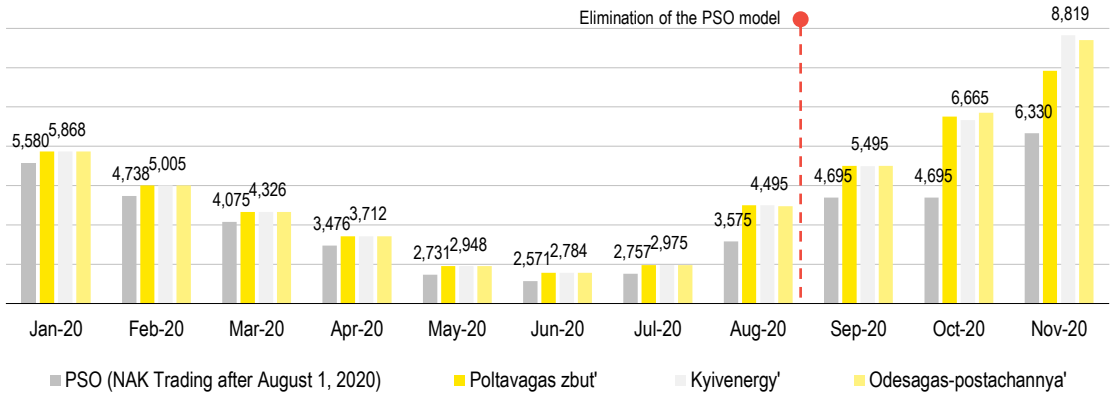
## 2.2.3. Natural gas

# Moreover, elimination of PSO for households should unlock the retail market potential and to establish correct price signals for investors

### Regulated market segment

Since August 1, 2020, the new rules became effective, the gas market was opened, and the mark-up establish at supplier's discretion (see gas prices before and after elimination of the PSO below).

**Gas prices for regulated segment before and after the elimination of PSO, UAH per mcm**

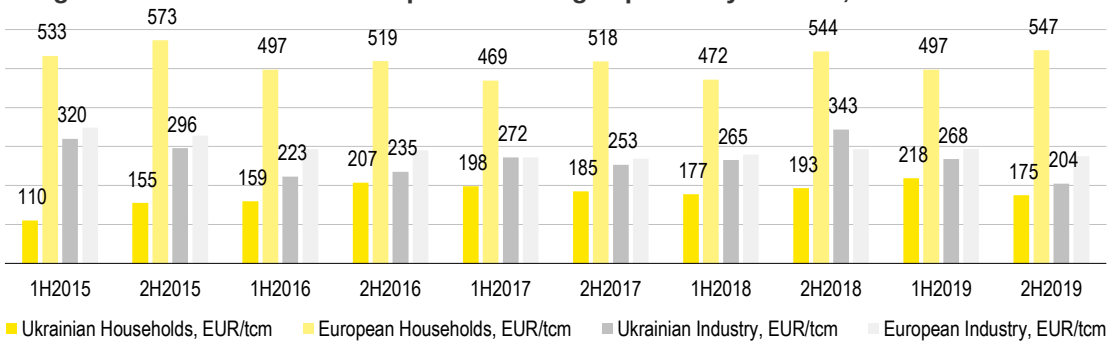



**Source:** NEURC

The elimination of the PSO model resulted in an increase in gas prices of all suppliers under the analysis. In addition to establishing higher mark-up for consumers, increased prices were affected by a new regulation – reduction in the amount of permissible deviation from nomination (tolerance) from 10% to 3%.

### Unregulated market segment

**Average retail Ukrainian and European natural gas prices dynamics*, EUR/tcm**




**Source:** NEURC, Eurostat
**Note:** Households is regulated segment of the retail market, industry - unregulated

### Natural gas market in Ukraine

**Retail market model**

The retail segment covers interactions between final consumers (up to 12.57 m, incl. households 12.46, industrial consumers 0.11 m, 152 Direct consumers) and suppliers (up to 249 companies in 2019, incl. 37 under PSO regime, all of them should have a license)

**Wholesale market model**

*Please, see the previous slide*

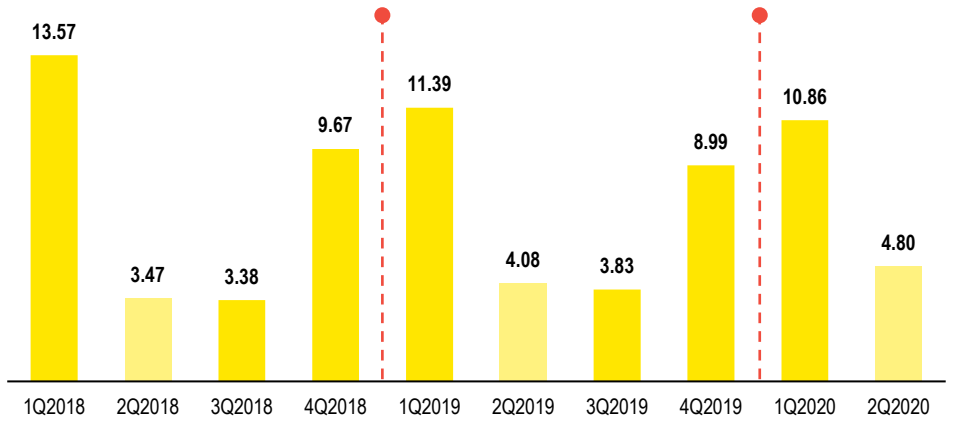
### From August 1, 2020, the natural gas market was opened

Before August 1, 2020, the significant share of sales of regional suppliers took place in a regulated market part (varied from 72% to 94%), where suppliers could not influence sale prices. As the share of the unregulated part was insignificant, companies did not have enough profit received from the unregulated part to cover losses and obligations arisen in the regulated part of regional suppliers' business. Now they are free to set prices and payment terms without limitations, but the fierce competition within the market under the new rules is expected.

## 2.2.3. Natural gas

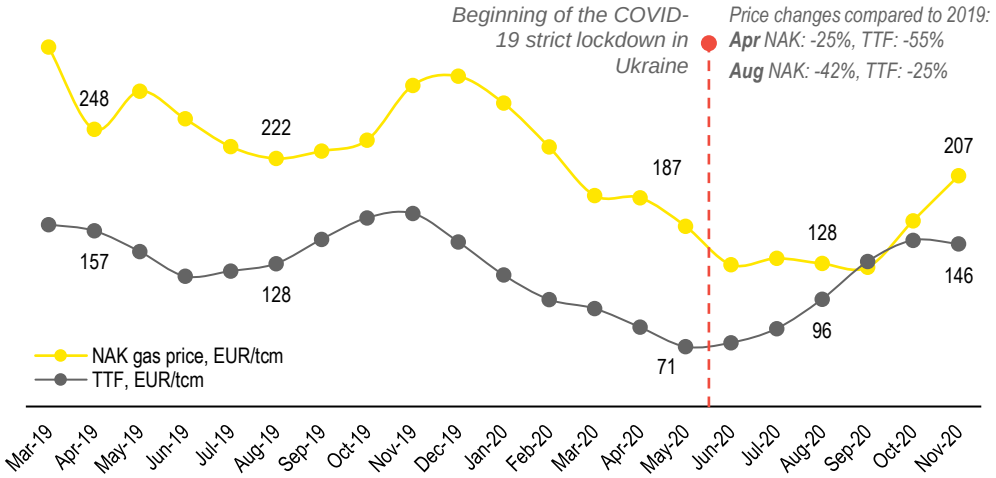
# Despite the price drop in spring-summer, COVID-19 impact on natural gas subsector is blurred by seasonal factors and high utilization rate of storages

### Gas consumption volumes dynamics in Ukraine, bcm




**Source:** NEURC, EY analysis and calculations

### Ukrainian and European price dynamics before and after lockdown




**Source:** Naftogaz, Capital IQ,, EY analysis and calculations

### COVID-19 impact

In 2020, the industry was affected by mild winter (gas prices in Europe were abnormally low during the heating season), high storages utilization rates and a decline in production due to severe quarantine in spring and early summer.

The gross consumption of natural gas in the 2Q2020 was equal to 4.8 mcm, which is 56% less comparing 1Q2020 and 17.6% more than in the same period a year before. COVID-19 lockdown was enacted from March to October when there were no demand for heating services and the overall gas consumption level in the 2Q and 3Q is lower compared to the 4Q and 1Q of each period annually. Due to seasonal factors, the ability to evaluate the effect of the COVID-19 pandemic on gas consumption is limited.

Gas demand has been falling since 2010, dropping to 29.9 bcm in 2019. According to the Economist Intelligence Unit, there is an expected further drop in consumption in 2020 owing to the coronavirus by 7.4% compared to 2019 with modest growth of 0.2% each year from 2021 till 2029.

Natural gas prices have decreased due to the declining business activity and energy sources demand by reason of beginning of the COVID-19 strict lockdown. Moreover, low prices for natural gas make gas processing less profitable within the full process chain. A decline in natural gas extraction volume will result in a decrease in local and state budget revenue. TTF has partly recovered in August 2020 compared to the Ukrainian price. Naftogaz's price continued dropping since April 2020 with the lowest point in June 2020.

The second wave of the coronavirus pandemic and a possible new lockdown could hurt Ukraine's gas production industry. As of October, the number of active drilling rigs decreased by almost 70% compared to 2019. As the result, the second lockdown will bring more losses to the economy. AGPU executive director broadcasted that situation is difficult for industry and the help of the government would be necessary to cope with it. Moreover, gas producers have pointed out that the industry needs government support in the form of fiscal incentives for investing acceleration. Otherwise, the stagnation of the gas industry is inevitable.

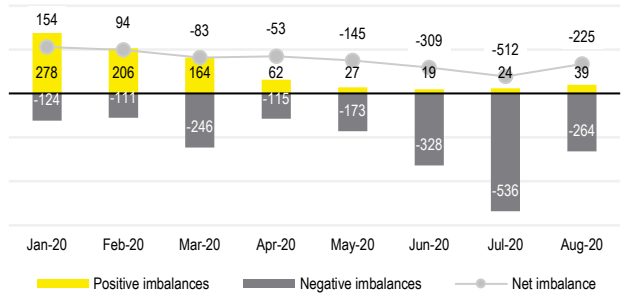
## 2.2.3. Natural gas

# Despite the outstanding reform path in the natural gas subsector, it is still struggling from inefficient PSO model for DHCs and unpaid gas imbalances

### The absence of an intraday gas market lead to market manipulations

There are positive and negative gas imbalances in the GTS. Most of the positive imbalances arose during the 1Q2020 of operation of the GTSO and amounted to 648 mcm (79% of the total amount of positive imbalances during 8 months of 2020). At this time, the amount of negative unbalances was small, which led to a positive monthly balance. Starting from March 2020, the balance turned negative, with the gap between the unbalances constantly widening. Thus, by the middle of the year (the period from June to August), 1,128 mcm of negative unbalances were accumulated, which amounted to 59.5% of the total volume of negative imbalances during 8 months of 2020.

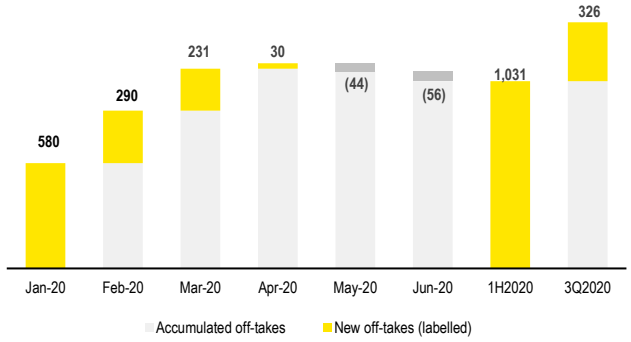
**Volume of gas imbalances (monthly), mcm**




Traditionally, volumes of gas imbalances depend on prices – in case when the base gas price for the imbalance is lower than the market one, network users take benefits by creating negative imbalances and buy gas from GTSO. Otherwise, if the base price is higher than the market one, network users create positive imbalances and sell gas to GTSO. 1Q2020 was quite unusual as due to sharp drop in gas prices, trader could create positive imbalances (by making quasi-sale to GTSO) to benefit from higher compensation for positive balance. However as soon as price dynamics changed and corrective measures were introduced, "usual normal" (negative imbalances) became frequent.

### Deviant off-takes of natural gas from the GTS affect the financial standing of the GTSO

**Accumulated off-take debt, due to the GTSO, UAH m**



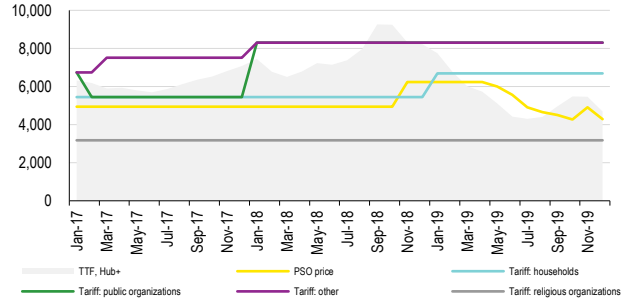

**Summary list of reasons for issues with deviant off-takes**

1. DSOs' failure to fulfill their balancing responsibilities
2. Contradictions in the PSO regime
3. Non-automatic transfer of consumers to the SoLR
4. Non-application of allocation of neutrality charges
5. Unequal levels of late payment penalties for commercial market participants and household consumers
6. Tariffs level adequacy
7. Metering and consumption norms
8. Insufficient level of payments from consumers
9. Accumulated debts and sources for penalties coverage
10. Quality of consumption forecasts and related imbalances
11. Absence of effective options to collect debts
12. Statutory prohibition to cut-off certain protected consumers

### PSO regime for DHCs and households* including debts under PSO

Commercial relationships within both wholesale and retail segments used to be regulated to provide natural gas at affordable prices (PSO regime), but they are gradually being eliminated and simplified for the sake of development of the competitive and transparent natural gas market. As it was previously mentioned, PSO regime for households has been abolished starting from August 1, 2020. The new rules initiated the gas market open and free mark-up establishment, unlike it was during PSO. As of November 2020, indebtness to NAK for the natural gas amount to UAH 70.4 billion, incl. debts under PSO Regulation - UAH 66.6 billion.

**The collation of TTF Hub+ price, the price under PSO regime and the cost of natural gas, UAH per tcm**




Nevertheless, PSO abolishment did not solve the problem of significant accumulated debts under the Regulations. The analysis has shown regional suppliers' debts higher than consumers' ones. Therefore, even the full repayment of consumers' debt would be not enough to ensure financial stability and cover all obligations of suppliers. Most of the regional suppliers operate at a loss and continue to accumulate their debts. Secondly, PSO regime for DHCs remains valid until May, 2021. At the same time, the Government does not carry out its duty regarding compensation of fulfillment of PSO obligations by NAK. As of December 31, 2019, the amount of compensation to be paid equaled UAH146 billion, according to NAK.

## 2.2.3. Natural gas

# Legal barriers for investments in natural gas subsector

### Need to streamline permit procedure for subsoil use

- **Complicated procedure on cancelation "sleeping licenses" on subsoil use.** It is reported that the companies that obtained a permit for a particular subsoil area in certain cases do not carry out the necessary works for a long time, reserving the subsoil area for later use. Such practice unfairly restricts other investors from accessing these mineral resources. Both the CMU and the National Association of Extractive Industries of Ukraine have admitted this issue. From a formal perspective, Ukrainian legislation already has the rules which may be applied to address this procedural issue. Specifically, the Code of Ukraine on Subsoil says that if a subsoil user has not started to perform works specified in the permit for subsoil use (for oil and gas-promising areas and oil and gas fields) without a proper reason within 180 calendar days, its permit should be terminated. However, such procedure is not always provided in time due to the moratoriums on audits, the procedure of permit cancelation is underregulated and time consuming due to lack of the State Service for Geology and Subsoil of Ukraine and lengthy court proceedings on the appeal of the permit cancelation decisions
- **Absence of qualification requirements.** Current Procedure for Conducting Auctions on Sale of Permits for Special Use of Subsoil, like previous procedural rules, does not take into account the experience and technical ability to carry out gas extraction works as the criteria for admission to the tender. Reportedly, in practice this leads to the situation where permits for subsoil use are granted to companies unable to perform any gas extraction. Because of this procedural deficiency, the investors willing and able to produce gas at such subsoil areas are prevented from doing business there since the relevant areas are occupied by unqualified users with valid permits
- **Investor cannot transfer permit for subsoil use.** Ukrainian legislation (article 14 of Law of Ukraine "On Oil and Gas") does not allow to transfer a permit for subsoil use to another party. Such limitation is burdensome for investors, since in case of failure of a project they will be deprived of the opportunity to recoup part of the investment by selling a permit to another company. This option would also allow a buyer of a permit to obtain a subsoil site with a certain stage of development
- **Potential remedies.** 1 Strengthening of the State Service for Geology and Subsoil of Ukraine authorities and streamline the audit procedure; 2. Including a qualification and/or relevant experience requirements for potential subsoil users; 3. There are draft laws allowing the transfer of permits on subsoil (Draft laws No. 4187 and No. 4187-1). Such procedural rules are common in Kazakhstan, Romania, and Poland

### Inconsistency between currency and PSA regulations

- The PSA Law sets certain special rules and benefits for investors operating under a production sharing agreement, including in terms of applicable currency control regime for foreign investors (Article 33 provides for the special regime for investors' account for PSA operations, Article 34 has several guarantees for a foreign investor, including the exemption from the 365-day term of mandatory settlement under export and import transactions)
- Since 2012, when the effective PSA regime was established, a number of other laws and regulations were changed. These changes do not always take into account the peculiarities of the PSA Law, including in currency control area. The root of the problem is that the PSA Law sets out the prevailing effect of the currency control rules of the PSA Law, and at the same time the Law on Currency Control says that only its rules may deal with all currency control issues, which also reflects the prevailing effect of the provisions of the Law on Currency Control
- Currency control guarantees are important for the foreign investors since they ensure free circulation of the obtained foreign currency under the PSA. These provisions are not reflected in the Law on Currency Control and respective subsidiary regulations of the National Bank of Ukraine that have been recently amended to clarify certain rules for control of PSA transactions. Current inconsistencies regarding the status of the bank accounts and limitation on mandatory settlement of the cross-border transactions create uncertainty of the applicable currency control rules to PSA, for example:
  - There is no guarantee for foreign investors to be exempted from obligatory currency sale if this protective measure is established by the NBU
  - Subordinate regulations do not provide a viable mechanism for exemption from the term of mandatory settlement under export and import transactions
  - Subordinate regulation only stipulates that legal regime of bank account of representative office of foreign PSA investor is equal to one of resident legal entities. At the same time the provisions on respective legal regime do not grant any privileges provided by the PSA Law

- **Potential remedies**: we suggest reconciling the provisions of the PSA Law and the Law on Currency Control to eliminate the inconsistencies in application of the PSA guarantees, as well as further amendments of the subordinate regulations. While the extent of the guarantees provided is a sovereign decision of the state, in order to encourage investments in PSAs it is paramount that the guarantees that are provided by the law on paper are practically implemented

# 2.2.4. Conclusions

## 2.2.4. Conclusions

The challenges for the labor market are a drop in employment due to the JFO; a decrease in the number of positions, which require low qualification

### Labor supply and demand

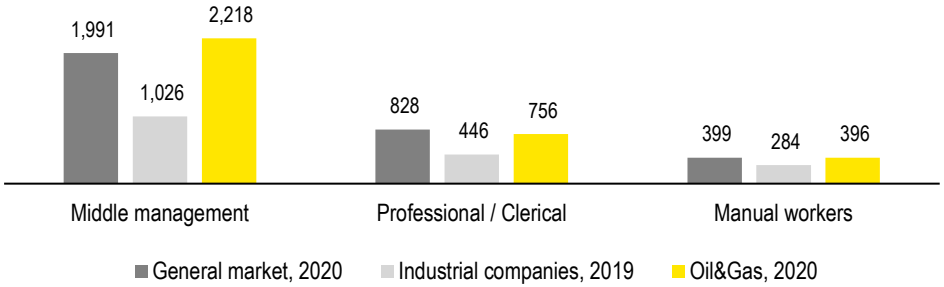
The energy sector constitutes only 5% of the total amount of the employed population in Ukraine (e.g. manufacturing - 15%, agriculture – 18%).

At the same time, we observe a significant decrease in the population employed in this sector during recent years (decrease by 30.5% from 2013 to 2017). Such a trend is more considerable for the coal subsector, while the situation for the power subsector remained unchanged. The highest decrease of the employed population in the sector was observed in 2014 as Ukraine was hit by the military conflict in the Eastern part of Ukraine (where a significant part of energy companies were located), followed by the economic crisis. With regards to job levels, the highest decrease was observed for positions, which require the lowest skills (elementary occupations). Moreover, 43% of oil and gas companies experience problems with labor migration abroad[1], in particular, among manual staff. Energy companies mentioned turners, fitters, mill operators, welders, locomotive operators among positions, which are hard to find and/or retain.

COVID-19 had a significant impact on labor supply and demand. The number of employees, who were laid off in Jan – Oct 2020 increased by 144% compared with the similar period in 2019 (third highest after HoReCa and manufacturing). Moreover, the number of unemployed employees in the sector remained comparatively unchanged (~30 th in Jan-Oct 2020). However, there is still a gap between labor supply and demand[2]

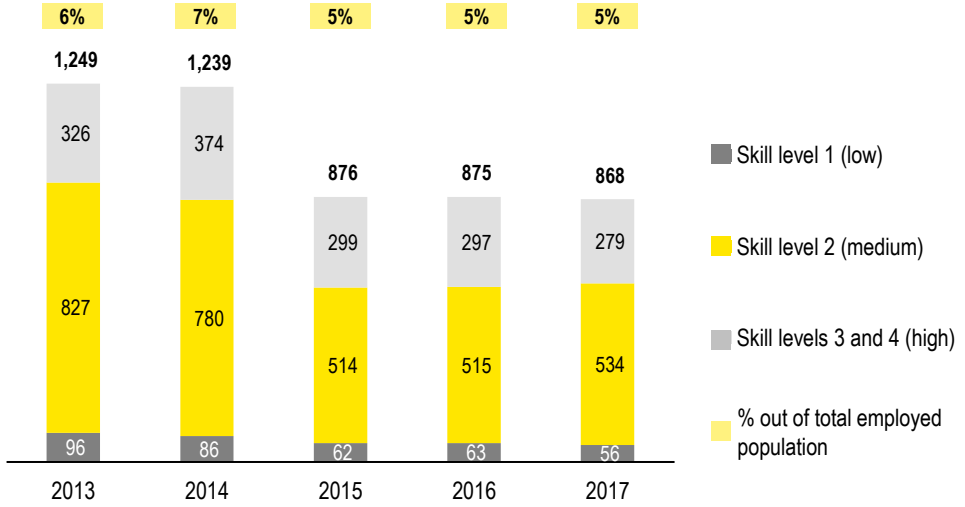
**Sources:** 1. EY Express-Survey, Q1 2019; 2. The State Statistics Service of Ukraine

### Monthly remuneration level by category of employee, USD gross




**Source:** EY Compensation and Benefits Surveys

### Total number of working-age population employed by skill level*




**Source:** International labor organization; The State Statistics Service of Ukraine; EY analysis
**Note:** For energy sector

### Remuneration

Monthly fixed remuneration for oil and gas companies is competitive to the general market (even slightly higher for middle management). At the same time, remuneration levels for industrial companies (which also include data from energy companies) are significantly lower than the general market for middle management, professionals and manual workers.

Moreover, the rate of salary growth in oil and gas subsectors is significantly higher than on the market in general. In 2019, the average market salary growth was 15% on median compared to 23% on median for oil and gas sectors. Such growth could be a solid attractiveness factor for employment. However, in 2020 oil and gas subsectors was significantly impacted by COVID-19 lockdown and financial crises and only 12% of oil and gas companies increased salaries (vs 66% of companies the on the general market)[1].

**Sources:** 1. EY Compensation and Benefits Surveys – 2019-2020.

## 2.2.4. Conclusions

# The energy sector, with a low turnover compared to the general market, struggles to attract employees among students and experienced candidates

### Turnover and average age

The energy sector has a much lower turnover rate compared with the general market1 (12% vs 16%). At the same time, the average age of an employee in the energy sector is significantly higher than on the general market (45 vs 39 years)[1]. This means that older personnel is less willing to change their job and young specialists are not driven to be employed within this sector. Together with migration problems, this may lead to a labor shortage in the long term. Energy companies have to pay attention to succession and career development plans in order to ensure sustainable development and transfer of knowledge.

### Sector attractiveness for employment

Energy sector struggles attracting employees (both students and professional candidates). For example, oil and gas subsectors were 14th most attractive in 2019 according to professional candidates (out of 18)[2]. However, some companies are popular among professional candidates (e.g. DTEK, NJSC "Naftogaz of Ukraine", etc.). At the same time, these companies have lower attractiveness among students due to the lack of innovative technologies and hard working conditions. Moreover, employers also mention, that there is a gap between students' knowledge and business needs.

### Education and training

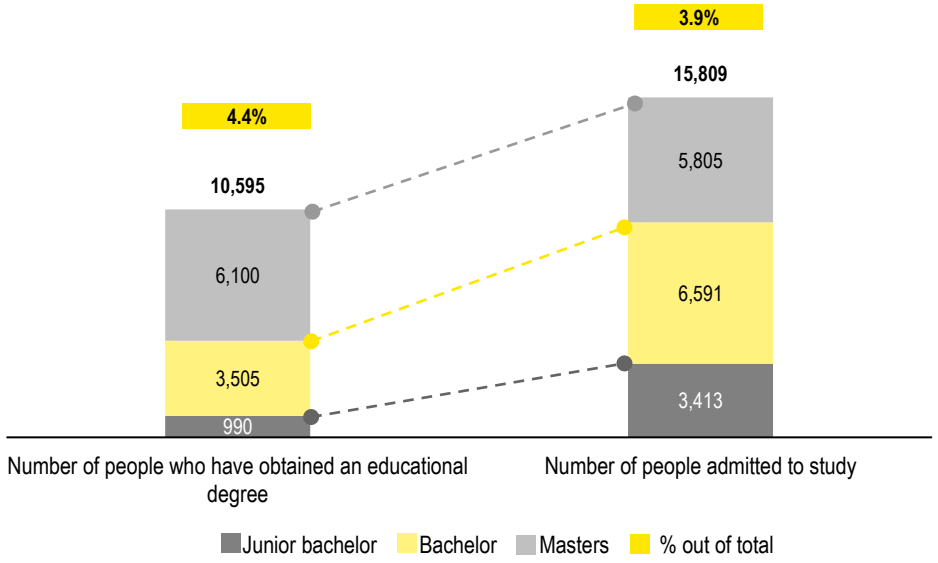
In 2020 the share of people enrolled in higher education on energy field of study out of the total is lower than the share of graduates (3.9% vs 4.4%), which means, that this field of study lack attractiveness. Moreover, only 1% of applications during the university admission process were directed to the energy field of study. In case this trend continues, the labor supply in the sector will further decrease.

Ukraine may improve the situation by transforming the educational system, in particular, in the area of vocational training, promoting dual education in cooperation with employers, popularizing the industry among young professionals.

Renewable energy is a subsector, which has a significant growth potential. At the same time, employers indicate the low level of knowledge of specialists working in this sector. To tackle this issue, employers are forced to run internal training programs. Indeed, 89% of employers from this subsector mentioned, that the quality of the workforce has increased as a result of their investment in training.

As for other subsectors, the majority of companies provide their employees with additional learning and development programs. At the same time, there is a lack of special educational training centers for energy specialists. There are several training centers, that mainly deliver industry-specific English language courses.

**Number of people, who obtained an educational degree and admitted to study in energy specialties, 2020**




**Source:** 1. EY Compensation and Benefits Surveys 2. EY Best Employer Survey, 2019

**Source:** The State Statistics Service of Ukraine

## 2.2.4. Conclusions

The energy sector is continuously evolving and considering its importance for the economy, it must be supported by breakthrough innovations



### Vilniaus Vandenys plans to start processing edible fat from restaurants and cafes into biogas to generate electricity

The project, implemented by the largest water supply and sewage company in Lithuania - Vilniaus Vandenys, will effectively dispose of more than 500 t of edible fat annually. Edible fats mixed with wastewater roll up on the walls of drain pipes, clog them and lead to accidents. However, there is an efficient way to use this waste to produce biogas that could generate nearly a thousand kilowatt-hours of "green" electricity.

### Turning plastic waste into hydrogen gas and carbon nanotubes

A team of researchers from the UK, China, and Saudi Arabia has developed a process for converting plastic waste into hydrogen gas and carbon nanotubes. The researchers report that the conversion process lasted just 30-90 seconds, and resulted in a recovery of 97% of the hydrogen in the plastic.

### Liquefied gas of biological origin has been used at gas stations in the Czech Republic.

The use of biogas from sugar-cane and edible wastes will reduce CO2 emissions by 90%. In addition, the existing infrastructure of gas stations can be used to distribute it. The Czech Liquefied Petroleum Gas Association has reported that biogas is chemically identical to natural one.



### Brazilian scientists have developed a method of processing birds' bones into biodiesel fuel

According to the agricultural research company Embrapa Agroenergia, it is planned to determine the chemical components of bio-oil for the production of biodiesel fuel from birds' bones. The project will last for two years in order to develop a similar, but a more stable and more calorific product with characteristics similar to diesel fuel from fossil sources.

### Solar Energy Isn’t Available in the Dark, So Researchers Designed an Efficient Low-Cost System for Producing Power at Night

Researchers have designed a radioactive cooling system that can efficiently produce power at night. This approach uses the temperature difference resulting from heat absorbed from the surrounding air and the radiant cooling effect of cold space to generate electricity. The system could help meet the need for nighttime lighting in urban areas or provide lighting in developing countries.

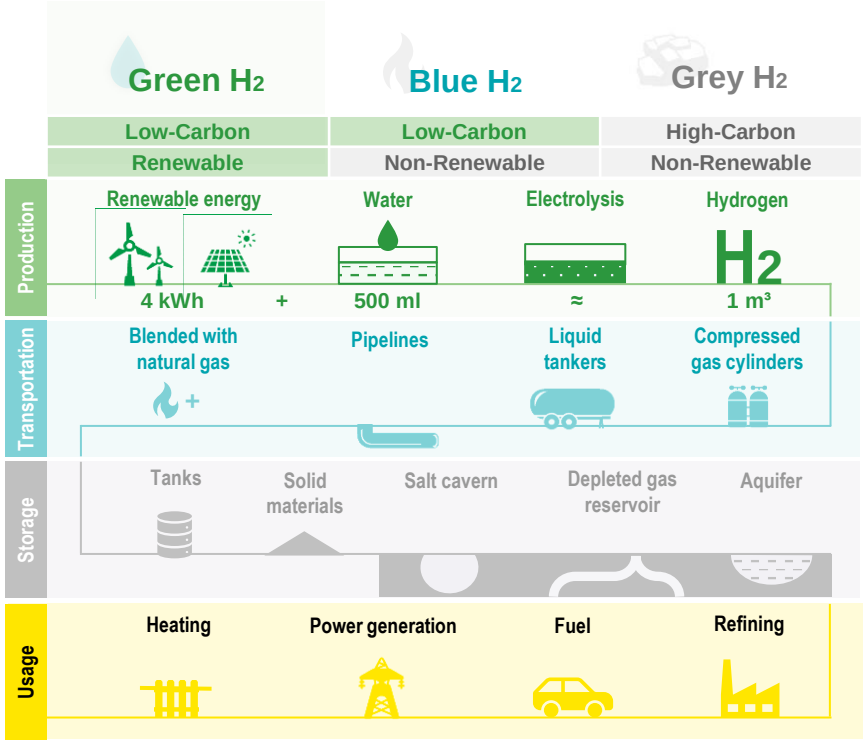
### New Zealand enterprise is developing world-first commercial long-range, wireless power transmission

The startup has developed a method of safely and wirelessly transmitting electric power across long distances without the use of copper wire. The second-biggest distributor in New Zealand is investing in Emrod, whose technology appears to be able to shift large amounts of electricity much more efficiently, between any two points that can be joined with line-of-sight relays.

## 2.2.4. Conclusions

# Considering surplus of installed generation capacity and GTS availability hydrogen may become the new unifying force between Ukraine and Europe

**Green hydrogen ($H_2$)** is expected to play the key role in providing clean, secure and affordable energy. Though currently the $H_2$ production is based primarily on fossil fuels, the share of green $H_2$ keeps growing.




## Benefits

| Flexibility | Abundance | Heating value |
|---|---|---|
| Once produced, $H_2$ can be instantly used in energy, industry and utilities | $H_2$ is available anywhere, so the price will not rise due to scarcity | HV per mass for $H_2$ exceeds that of common fuels (3x that of gasoline) |
| **Closed life cycle** | **Storage** | **Decarbonization** |
| The only by-product received upon hydrogen usage is water again | Hydrogen is a scalable long-term storage solution capable of load shifting | No harmful emissions in course of hydrogen production and usage |

## Initiatives and plans

| EU: Carbon neutrality by 2050 | France |
|---|---|
| 40GW capacity and 10m t output by 2030 (6GW/1m t by 2024): industrial value chain enhancing, demand boosting, regulation improvement, R&D promotion | EUR 7b plan for 6.5GW of green $H_2$ plants and industry decarbonization |

| Germany | Poland | Slovak Republic |
|---|---|---|
| 5GW and 10GW of green $H_2$ plants by 2030 and 2040, respectively | 2-4 GW capacity by 2030. Now is the 5-th largest grey $H_2$ producer in the world | EU-funded WPP and green $H_2$ plant, blue $H_2$ plant and $H_2$ filling stations |

## Potential in Ukraine

**Institutions**

Ukrainian Hydrogen Council
Department for low-carbon $H_2$ technology (MoE)
Working group (National Security and Defense Council)
Sci-tech council “Hydrogen Energy” (MoE)

**Regulation**

The Draft Ukrainian Green Deal and the Energy Strategy till 2035 envisage the $H_2$ sector growth, now limited by fragmented legal base and scarce incentives

**Demand**

Primary hydrogen usage options in Ukraine include fueling and blending with natural gas (RGC’s tests since July 2020). Large local energy companies, i.e. DTEK, “Naftogaz of Ukraine”, support $H_2$-related researches

**Capacity**

The estimated $H_2$ capacity in Ukraine is 505b m³ and exceeds the demand, so the EU market is considered for Ukrainian $H_2$ with GTSO-based transfer option

| July 2020 | August 2020 | August 2020 | September 2020 | October 2020 | Future |
|---|---|---|---|---|---|
| Regional Gas Company (Ukrainian distributor) started testing hydrogen use in gas networks | NBT (Norway) announced its plans to build 800MW WPP and 200MW hydrogen facilities in Ukraine | Ukrainian NNEGC “ENERGOATOM” and THE H2 LLC executed a memorandum of cooperation on $H_2$ plant (USD 300m) and data center construction | As of September 2020, there is only one green $H_2$ plant in Ukraine, developed by Ukrainian scientists and launched in Kyiv region in 2019 | The Minister of Energy met Siemens and other German companies to discuss their $H_2$-related practice | Ministry of Energy (MoE) is going to develop the national strategy for hydrogen implementation |

## 2.2.4. Conclusions

During recent years some foreign companies have a negative experience when trying to invest, caused by government obligations' non-fulfillment

### In 2001, AES won the tender for the Kyivoblenergo and Rivneoblenergo

AES paid USD 70 million during the privatization of 75% stake in Kyivoblenergo and overbid Electricite de France for a 75% stake in Rivneoblenergo. The US-based company announced in 2013 that it had agreed to sell two regional electricity distributors to a Russian group VS Energy for a total of USD 113 million.

*AES Executive Vice President Tom O'Flynn explained the decision to sell both Ukrainian assets as follows: "We continue to exit markets that are not part of our strategic vision. This transaction represents another step in the process to simplify our structure so we can focus on creating value in markets where we have a compelling competitive advantage."*

### Ukrainian Feed-in-tariffs' struggles

According to the effective legislation in Ukraine, the state guarantees the payments under the "feed-in tariff" mechanism till the end of 2029. Nevertheless, there were a few cases when the Ukrainian parliament was adopting changes to the main Law which led to the decrease of the applied feed-in coefficients: in 2015 and 2016.

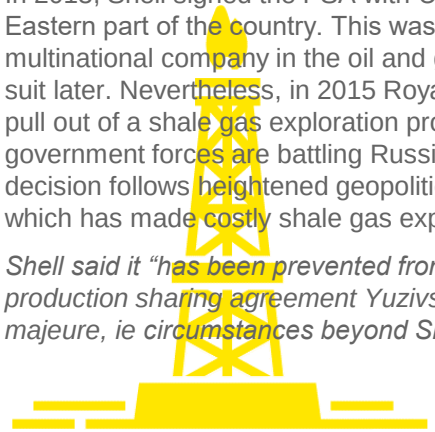
Due to the sharp decrease in available electricity capacity caused by armed conflict in the Donbas region, NEURC adopted Resolution No. 492 that decreased the feed-in tariff for electricity producers that use alternative energy sources by 50-55%. This Resolution was valid for only one month and was canceled on March 3, 2015. As result, private and public investors suited NEURC and won their cases which resulted in compensation payments for the mentioned period.

On 10 June, 2020, the Memorandum of Understanding on the Settlement of Problematic Issues of the Ukrainian RES was signed by the Prime Minister of Ukraine. On July 21, 2020, the Law on Feed-in Tariff Restructuring was passed by the Ukrainian Parliament. Nevertheless, after the enactment of the Memorandum and the Law, the State has not fulfilled the prescribed obligations towards investors.

### Ukraine signs landmark USD 10 billion shale gas deal with Shell

In 2013, Shell signed the PSA with Ukraine for unconventional gas extraction in the Eastern part of the country. This was Ukraine's first big project with a large multinational company in the oil and gas sector, and Chevron was likely to follow suit later. Nevertheless, in 2015 Royal Dutch Shell has notified Ukraine that it will pull out of a shale gas exploration project in the east of the country, where government forces are battling Russian-backed separatists. The company's decision follows heightened geopolitical risk and a sharp plunge in global oil prices, which has made costly shale gas exploration projects less attractive.

*Shell said it "has been prevented from performing its commitments under production sharing agreement Yuzivska for an extensive period of time due to force majeure, ie circumstances beyond Shell's control".*



### UGV and Vermilion participated in 4 tenders for conclusion of PSA

In 2019, UGV and Vermilion Energy submitted joint applications for participation in 4 tenders for conclusion of PSAs. In July 2019, Balakliiska and Ivanivska areas were submitted under UGV and Vermilion after winning the tender. UGV and Vermilion are obliged to make investments and share the gained profits in equal proportion, but the agreement has not signed yet. In the end of November 2020, Vermilion Energy has pulled out of the joint project with UGV.

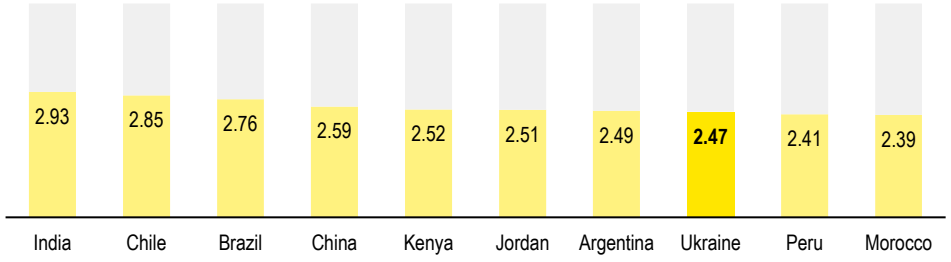
*According to the Chairman of the board of directors NJSC "Naftogaz of Ukraine" Kobolev, one of the controversial issues is the equivalent of the state's share of the produced products in the form of money or hydrocarbons. "It is necessary to make a decision on how the mutual settlement will look like. It should be further discussed whether companies should pay to the state either in gas or in money", he said.*

## 2.2.4. Conclusions

Capacity and technological base are a strong point of Ukraine in global energy ratings, whereas regulatory-based metrics are the weak ones

### Top countries by Bloomberg New Energy Finance research 2019

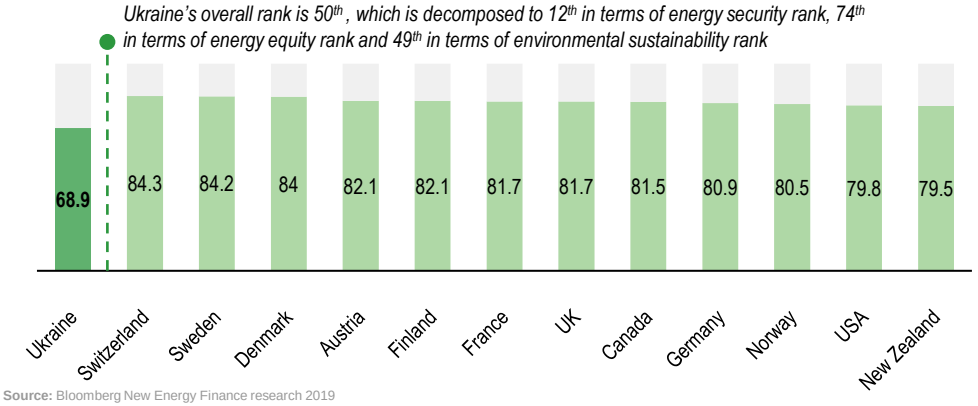
Ukraine takes 8th place among 104 emerging markets in the attractiveness of investments in renewable energy sources




**Source:** Bloomberg New Energy Finance research 2019

Climatescope takes into accounts 167 indicators to create a composite overall score for each of the 104 countries in the survey.

### Top countries by World Energy Trilemma Index 2020

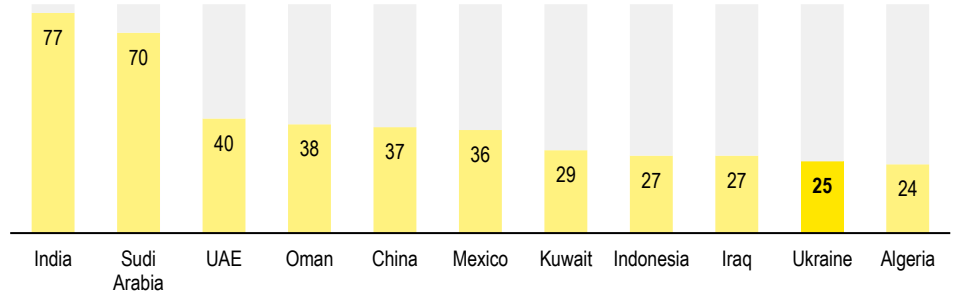



**Source:** Bloomberg New Energy Finance research 2019

The World Energy Council's Energy Trilemma Index tool ranks countries on their ability to provide sustainable energy through 3 dimensions: Energy security, Energy equity (accessibility and affordability), Environmental sustainability. Index should be used to assess the sustainability of national energy policies.

### Top countries by Baker Hughes Rig Count October 2020

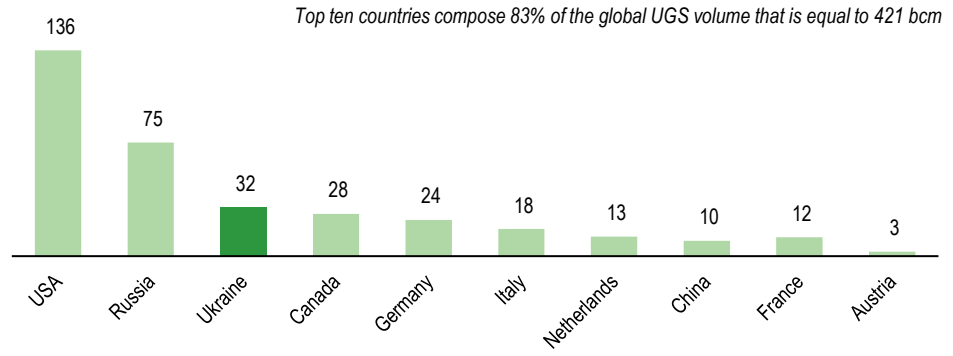
Ukraine takes 9th place among 105 countries in the international monthly rig count performed by energy technology company – Baker Hughes




**Source:** Bloomberg New Energy Finance research 2019

The Baker Hughes Rig Counts are an important business barometer for the drilling industry and its suppliers initiated in 1975.

### Top countries by Cedigaz Underground gas storages Report 2019, bcm




**Source:** Cedigaz Insights 2019

The top five countries (United States, Russia, Ukraine, Canada, and Germany) account for 70% of the worldwide underground gas storage facilities capacity. Ukraine has 11 UGS depleted fields and 2 aquifers which allow storing large volumes of gas and is mainly used to balance seasonal swing in gas demand.

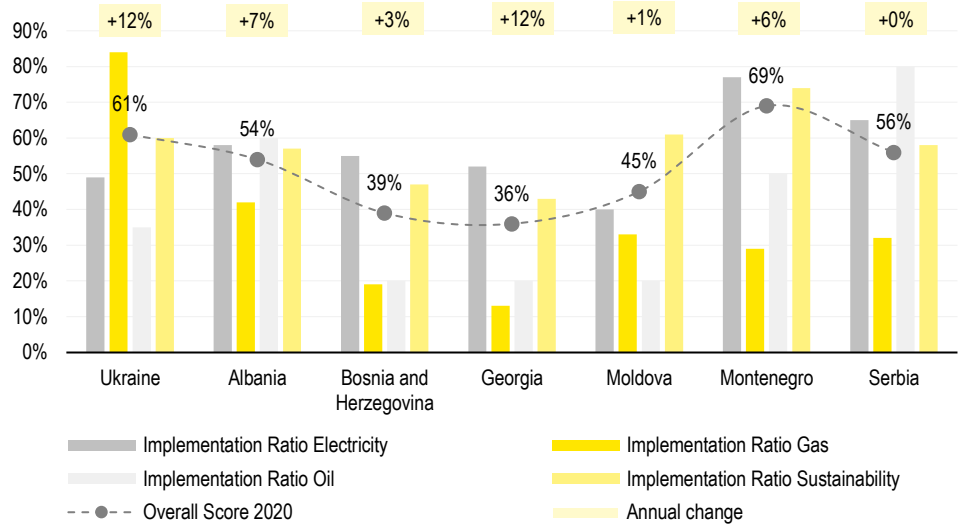
## 2.2.4. Conclusions

# Annual Implementation Report of Energy Community Secretariat positively recognized the progress of sector reforms, especially compared to peers

### Ukraine Summary Implementation

| Indicators | Transposition assessment | Implementation status | Descriptions |
|---|---|---|---|
| Electricity | ✓ | 49% | Implementation in the electricity sector of Ukraine is moderately advanced |
| Gas | ✓ | 84% | Implementation in the gas sector of Ukraine is almost completed |
| Oil | ✓ | 35% | Implementation in the oil sector of Ukraine is still at an early stage |
| Renewable Energy | ✓ | 52% | Implementation in the RES of Ukraine is moderately advanced |
| Energy Efficiency | ✓ | 67% | Implementation in the energy efficiency sector of Ukraine is well advanced |
| Environment | ✓ | 64% | Implementation in the environment sector of Ukraine is well advanced |
| Climate | ✓ | 51% | Implementation in the climate sector of Ukraine is moderately advanced |
| Infrastructure | ✗ | 8% | Implementation in the infrastructure sector of Ukraine is yet to begin |
| Statistics | ✓ | 81% | Implementation in the statistics sector of Ukraine is almost completed |
| Cybersecurity | ✓ | 35% | Implementation in the cybersecurity sector of Ukraine is at an early stage |

### Implementation performance of Ukraine and its peers




**Source:** Energy Community

The Energy Community Secretariat is responsible for review of the progress made by the countries in transposition and implementation of the European energy law incorporated by the Energy Community Treaty. Annual report reflects progress made by each Contracting Country. This is an important indicator for the overall assessment of the implementation of European regulations.

In 2020, Ukraine has advanced in the following indicators based on Annual Implementation Report 2019: Gas - by 36%, Oil - by 25%, Environment - by 3%, Climate - by 24%, Infrastructure - by 8%, and Statistics - by 12%. The main accelerator for the improvement in the gas sector was the Law on the Gas Market and certification of a new transmission system operator - GTSOU. A draft law on minimal stocks of crude oil and petroleum products, which is currently undergoing approval by the State authorities resulted in advances within the oil sector. In terms of environmental and climate safety, one of the main challenges is the reduction in emissions from outdated coal plants, which should be resolved by the adoption of the National Emission Reduction Plan (instead of complying with the emission limit values on an individual basis).

## 2.2.4. Conclusions

As a result, by applying predefined measures within the subsector it is possible to achieve FDI activation for other sectors in the long-term (1\3)

| Sectoral FDI activators | Near-shoring | **FDI-through-trade activation** | **Auxiliary Sectors Activation** | Lean / additive production | Industrial and tech parks | **Digitizing infrastructure and services** | Supply chain optimization solutions | Private professional education | **Localization incentives** | **Inbound R&D Incentives** | Enabling International Technical Agreements |
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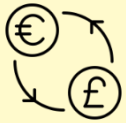
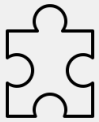
| |  |  |  |  |  |  |  |  |  |  |  |

**Construction and commissioning of the new capacity**

Capacity auctions for maneuverable peaking plants, storages and renewables could enable additional FDI inflow in the mid-term, boosting new jobs creation, GDP growth and innovations.

**Finalization of PSA mechanism in natural gas subsector**

PSA mechanism could be considered as one of the primary localization incentives, which could decrease import dependence and will drive investments into R&D, E&P and infrastructure.

**Decrease of electricity prices in the long-term**

Implementation of the competitive market model combined with integration with ENTSO-e and RES penetration will create additional downside pressure on wholesale and retail prices.

**Improvement of the quality and security of electricity supply**

Simplification of the connection to the Grid procedures as well as mandatory improvement of SAIDI and SAIFI due to RAB tariffs implementation will decrease the risk of non-getting electricity.

**Mechanisms to achieve described FDI activators: 1) privatization and\or IPO of state-owned enterprises; 2) M&A activities; 3) capacity auctions; 4) construction of interconnectors; 5) PSA, including JVs.**

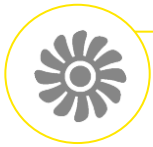
## 2.2.4. Conclusions

As a result, by applying predefined measures within the subsector it is possible to achieve FDI activation for other sectors in the long-term (2\3)

| Sectoral FDI activators | Near-shoring | FDI-through-trade activation | Auxiliary Sectors Activation | Lean / additive production | Industrial and tech parks | Digitizing infrastructure and services | Supply chain optimization solutions | Private professional education | Localization incentives | Inbound R&D Incentives | Enabling International Technical Agreements |
|---|---|---|---|---|---|---|---|---|---|---|---|

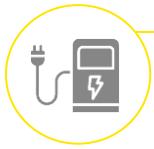
**Increase of natural gas, uranium and lithium mining**

Expected investments in storages, gas-peaking maneuverable capacity, and nuclear power units will create additional demand for the primary energy resources considering its availability.



**Stimulation of auxiliary industries grows and evolution (1\2)**

Production of turbines, generators, transformers, switchgears, boilers, and other equipment could be boosted as a result of additional investments by generating companies and DSOs.



**Acceleration of electric and hybrid vehicles penetration**

Green energy transition trend combined with electrification and decarbonization will positively affect the retail segment of the energy market and activate demand for EVs and charge stations.

**Stimulation of auxiliary industries grows and evolution (2\2)**

Pipelines, booster compressor stations, gas-compressor units and other modern equipment could be added to the existing infrastructure under investments according to PSA mechanism.

**Mechanisms to achieve described FDI activators: 1) privatization and\or IPO of state-owned enterprises; 2) M&A activities; 3) capacity auctions; 4) construction of interconnectors; 5) PSA, including JVs.**

## 2.2.4. Conclusions

As a result, by applying predefined measures within the subsector it is possible to achieve FDI activation for other sectors in the long-term (3\3)

| Sectoral FDI activators | Near-shoring | FDI-through-trade activation | Auxiliary Sectors Activation | Lean / additive production | Industrial and tech parks | Digitizing infrastructure and services | Supply chain optimization solutions | Private professional education | Localization incentives | Inbound R&D Incentives | Enabling International Technical Agreements |
|---|---|---|---|---|---|---|---|---|---|---|---|

### Geology requires breakthrough and modern technologies

Growth of drilling activities will require additional investments in advanced seismological and geological analysis supported by comprehensive IT-solutions which could be created locally.

### Development of IT-infrastructure and value-added services

Penetration of distributed generation, smart metering, smart grids, electric vehicles and demand-response technologies will enable the rapid growth IT-related infrastructure and solutions.

### Evolution of hydrogen as a next-generation energy source

With reasonable investments hydrogen could become a truly breakthrough technology for local energy sector combining elaboration of both Ukrainian power and natural gas markets.

### Facilitation of R&D and innovations within the industry

Considering the advance nature of the subsector, additional investments in capacity and other assets will accelerate value-added innovations and R&D through the whole business chain.

**Mechanisms to achieve described FDI activators: 1) privatization and\or IPO of state-owned enterprises; 2) M&A activities; 3) capacity auctions; 4) construction of interconnectors; 5) PSA, including JVs.**

## 2.2.4. Conclusions

International foreign investment conferences and other industry events

| Event | Location | Place | Next dates | Description |
|---|---|---|---|---|
| WECA X | Over 800 senior Oil & Gas executives joined WECA from across the globe | London, UK | 30 November-02 December 2020 | The meeting place for senior energy executives, investors, and financiers to find investment and do deals |
| WindEnergy Hamburg | It is one of the largest 4-days wind energy event that is organized every two years | Hamburg, Germany | 01-04 December 2020 | It is a global trade fair for the wind energy sector that promotes the entire value chain in the onshore and offshore sectors |
| European Gas Conference | The most important, geopolitical discussion in the midstream gas calendar | Vienna, Austria | 26-28 January 2021 | The annual meeting place for an exclusive network of C-Level executives |
| Ukrainian Energy Forum | Representatives of 128 energy companies from 38 countries and a wide range of visitors | Kyiv, Ukraine | February 2021 (TBD) | The annual event to hear first-hand about the reform process from Ministers, Regulators, Law-makers, and CEOs of state energy companies |
| CERAWeek | The top conference includes 840 speakers, 85 countries, 650 CEOs, 5,500 delegates | Houston, USA | 01-05 March 2021 | For nearly forty years, CERAWeek has been providing an integrated framework for understanding what's ahead for global energy markets, geopolitics, and technology. |
| Energy Storage Europe | Exhibitors from 60 counties as well as experts and representatives. | Dusseldorf, Germany | 16-18 March 2021 | The event will turn to the most pressing current issues, focusing on decarbonization and sustainability, integrated energy, improving the security of supply |
| DistribuTECH Conference | The conference includes 400 speakers, 520 exhibitors, and 13,000 attendees across the globe | Orlando, USA | 30 March-01 April 2021 | The Conference is the leading annual transmission and distribution event that offers information, products, and services related to electricity delivery automation |
| Powergen International | The exhibition includes 340 speakers, 900 exhibitors, and 14,000 attendees across the globe | Orlando, USA | 30 March-01 April 2021 | International exhibition and summit serve as a business and networking hub for electricity generators, utilities, and solution-providers engaged in power generation |
| Caspian Oil & Gas Conference | Representatives of 212 energy companies and a wide range of visitors | Baku, Azerbaijan | 01-03 June 2021 | An event is a meeting place for leading oil, gas, and energy professionals where memoranda, agreements, and contracts for future cooperation are signed |
| ETCSEE | The event featuring over 50 high-level speakers and over 400 attendees | Prague, Czech Republic | 15 June 2021 | The conference explored all major developments in the power and gas traded markets, market supervision, and renewable energy |
| Hydrovision International | Participants from 48 countries across a range of roles and hydropower segment | Portland, USA | 15-17 June 2021 | The event is the largest gathering of hydro professionals worldwide |
| World Gas Conference | Companies and visitors from 90 countries, 12,000 participants, and 500 speakers | Daegu, Korea | 21-25 June 2021 | The exhibition at the world's largest natural gas conference will cover the entire spectrum of the gas industry including producers, buyers, solution providers |
| ERTC | The event includes 98 speakers, 251 refiners, 650 attendees across the globe | Madrid, Spain | 15-18 November 2021 | It is Europe's largest meeting place for the downstream leaders, bringing together refineries and technology providers to address issues affecting the industry |
| Enlit Europe | The event includes 450 speakers, 800 exhibitors, 18,000 attendees across the globe | Milan, Italy | 30 November-02 December 2021 | Enlit is a series of energy events that for 365-days a year will collaborate and innovate to solve the most pressing energy-related issues |

**Source**: organizers' websites and other open sources

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ED None.



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