In cooperation with

iSANS

German Economic Team

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POLICY BRIEFING BELARUS

Energy sector monitor Belarus

by the iSANS Team, Dinara Saparova, Julian Grinschgl, Pavel Bilek and Robert Kirchner

Executive summary

- The Belarusian energy system is characterised by a high degree of crude oil and gas consumption
- The industrial sector was the largest consumer of energy in 2021, mostly due to processing of imported crude oil at domestic refineries for exports (6.2% of total exports). Since the imposition of sanctions and the start of the war in Ukraine, information about the sector has been restricted
- The energy sector remains characterised by vertically integrated state-owned enterprises and subsidized retail tariffs for households
- Electricity demand has been steadily growing in recent years, but may decrease due to reduced economic activity resulting from the imposed sanctions, and outflow of population and companies
- Most electricity (almost 100%) is generated by thermal (TPP) and a new nuclear power plant; both are almost fully dependent on fuel imported from Russia
- The renewable energy sources account for less than 1% of total electricity generation with no plans on their expansion
- The construction of the Astravets nuclear power plant (NPP) has resulted in excess generation capacities. Given that the export of electricity is currently not possible, different measures were introduced to stimulate domestic demand. Additionally, excess base load capacities (thermal and nuclear) limit the deployment of renewable energy sources
- Investments are channelled into grid infrastructure to incorporate the NPP and into the replacement of thermal units which will be decommissioned

Structure

1. Introduction
2. Primary energy mix and imports
3. Final energy consumption
4. Sector organisation
5. Electricity
   - Demand
   - Generation and transmission
   - Potential of international integration
   - Peak and base load management
   - RES potential
   - Investment plans
   - Modelling the optimal power plant park
6. Final energy prices
7. Gas sector issues
8. Energy efficiency
9. Emissions

1. Introduction

Background

1. The political unrest and large-scale protests in 2020, as well as the support for Russia in the war against Ukraine have led to economic sanctions being imposed on Belarus
   - These sanctions restrict financing, equipment supply and its maintenance, as well as exports of (energy) goods, all of which negatively affect the economy
2. The commissioning of the nuclear power plant in 2020 (the second unit to be commissioned in 2023) with a total installed capacity of 2,218 MW significantly changed the structure of the electricity system and resulted in excess generation capacity
3. Belarus is highly dependent on the import of most primary energy sources (natural gas, oil and nuclear fuel) from Russia

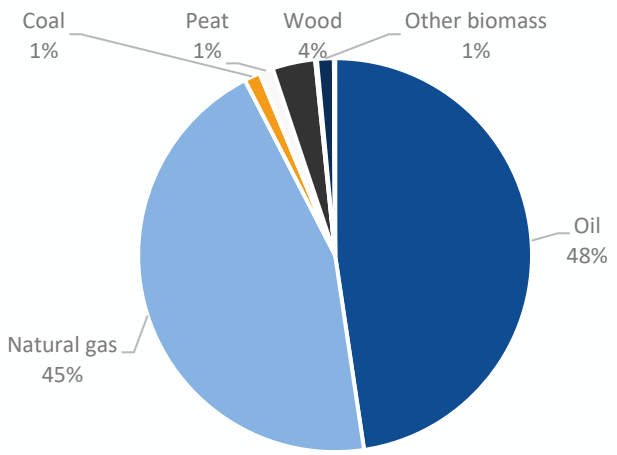
Purpose of this Policy Briefing

» Provide an overview and update on the status of the Belarusian energy system

Note: Due to limitations in data availability, not all slides adopt a coherent approach regarding years and sources of data

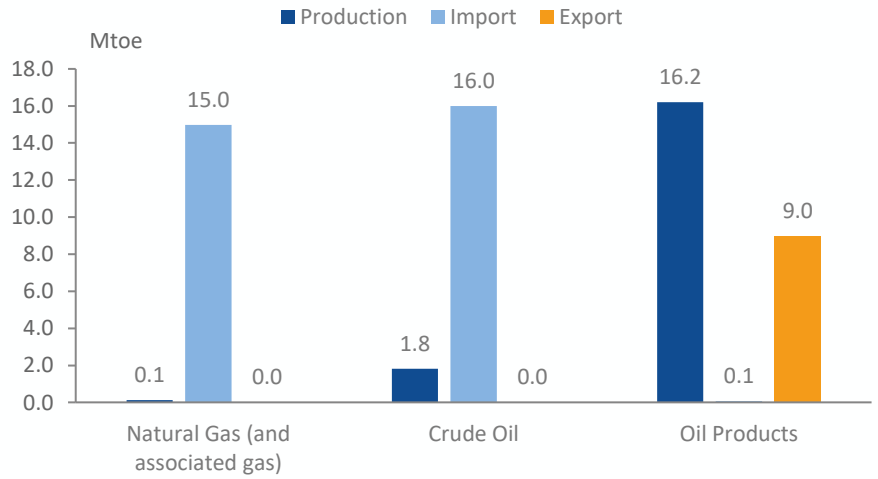
2. Primary energy mix and imports

Total primary energy supply by source 2020 (27 Mtoe)



Source: Belstat

Production, imports and exports 2020



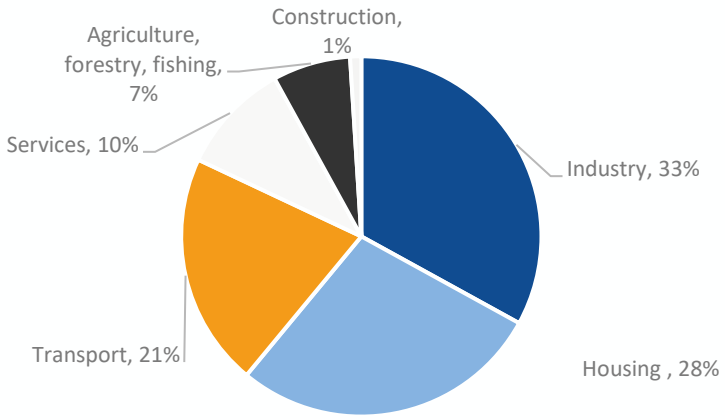
Source: Belstat

- The energy mix of BLR in dominated by oil and natural gas, with a negligible share of renewables and biomass
- The country is highly import dependent and imports about 99% of its natural gas and 90% of its crude oil, almost exclusively from Russia
- The new NPP units, commissioned in 2020 and 2023, are expected to generate about 18500 GWh of electricity and reduce the usage of natural gas
- BLR has a large crude oil refining sector. More than half of its oil product production is exported, accounting for a significant share of its export revenues

- **BLR is highly dependent on imported natural gas and oil from Russia**
- **This entails serious security of supply and price risks**

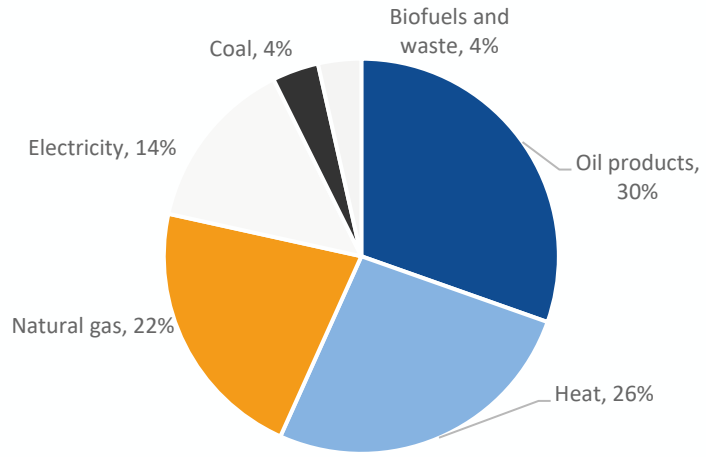
3. Final energy consumption

Final energy consumption by sector 2020 (19 Mtoe)



Source: Belstat

Final energy consumption by source 2020 (19 Mtoe)



Source: Belstat

Sectoral consumption

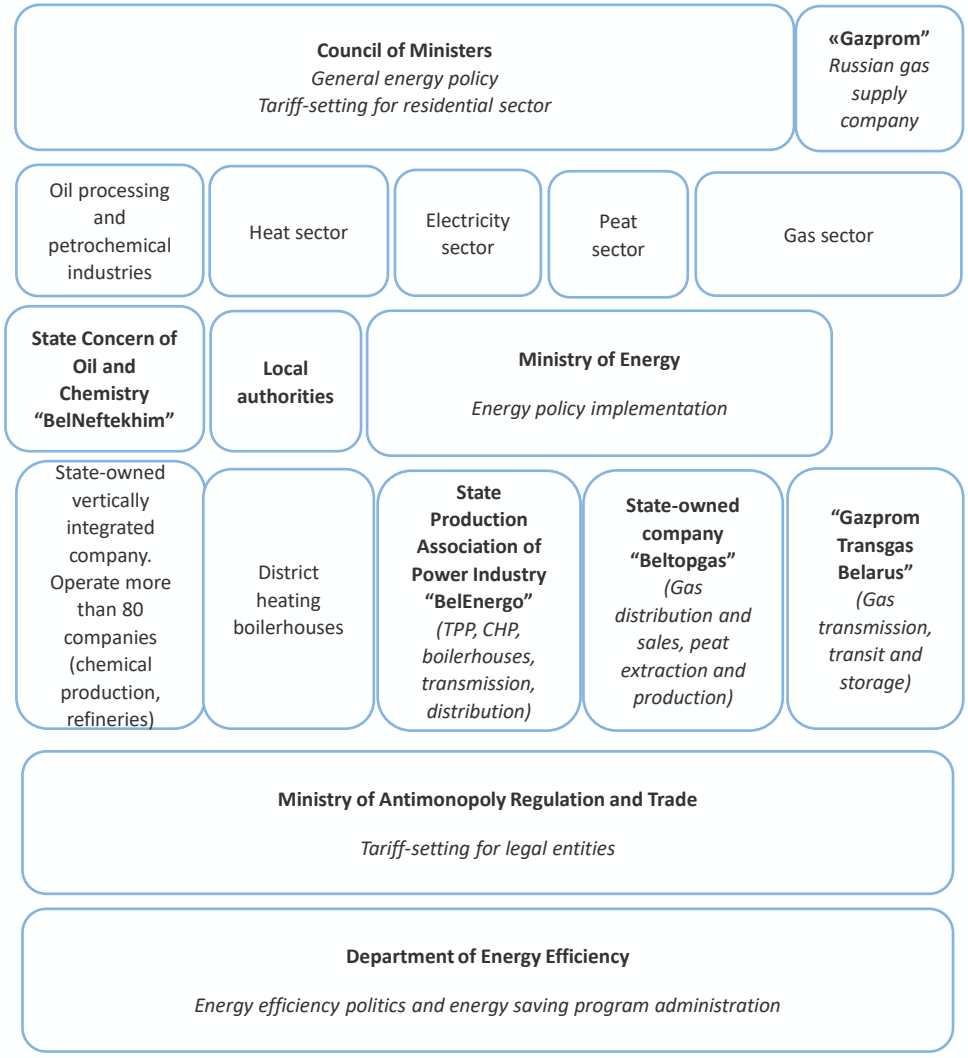
- The industrial sector is the largest consumer of energy (33%), using mostly electricity and heat
- Residential housing is the 2nd largest consumer (28%), consuming mostly heat, natural gas and all final consumption of RES (wood and other biomass)
- Transport is the 3rd largest energy consumer, accounting for 21% of total final consumption and using mainly oil products like diesel and gasoline

Final consumption

- Final energy consumption consists mainly of oil products (30%), in particular diesel and motor gasoline
- Heat, natural gas and electricity account for over 64% of final consumption
- **The country's economy and provision of heat, electricity and transport services depend heavily on fossil fuels**

4. Sector organisation

Belarus energy sector structure



Source: Council of Ministers of the Republic of Belarus

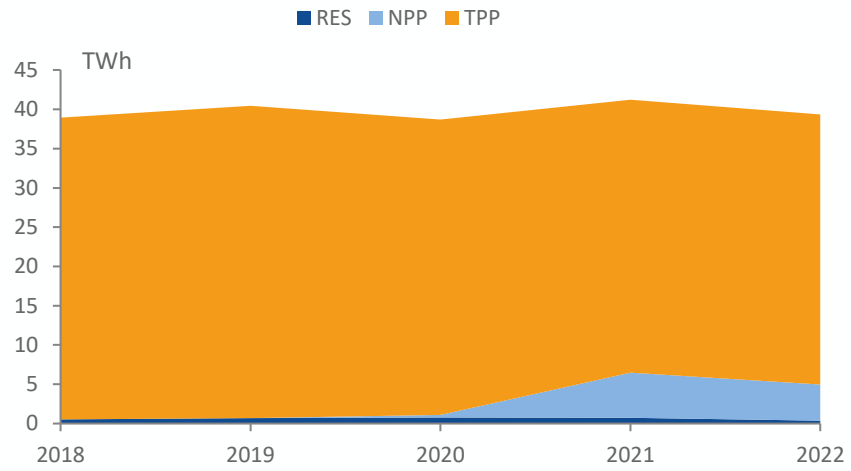
Governance and legal structure

- The **Ministry of Energy** is the main actor overseeing state-owned companies in the areas of electricity, gas and heating
- Tariffs for legal entities are approved by the **Ministry of Antimonopoly Regulation and Trade**, tariffs for the population are approved by the **Council of Ministers**
- The gas transmission system is owned by Gazprom (Russia). The gas distribution system is owned by Beltopgaz, subordinate to the Ministry of Energy
- **Policies in the field of energy savings and renewable energy** is formed by the **Department of Energy Efficiency** (independent of the Ministry of Energy)

➢ **The energy sector remains dominated by vertically integrated state-owned enterprises**

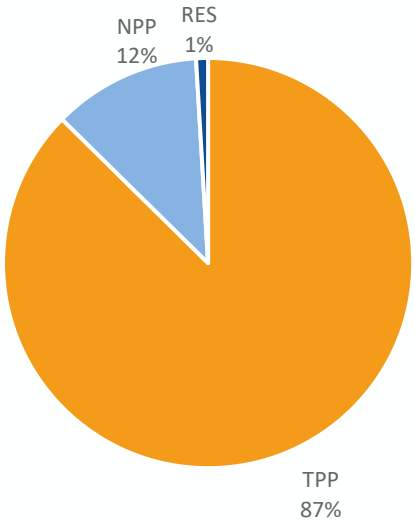
5. Electricity – generation and transmission

Electricity generation by source



Source: Belstat, Minenergo

Generation by sources, 2022



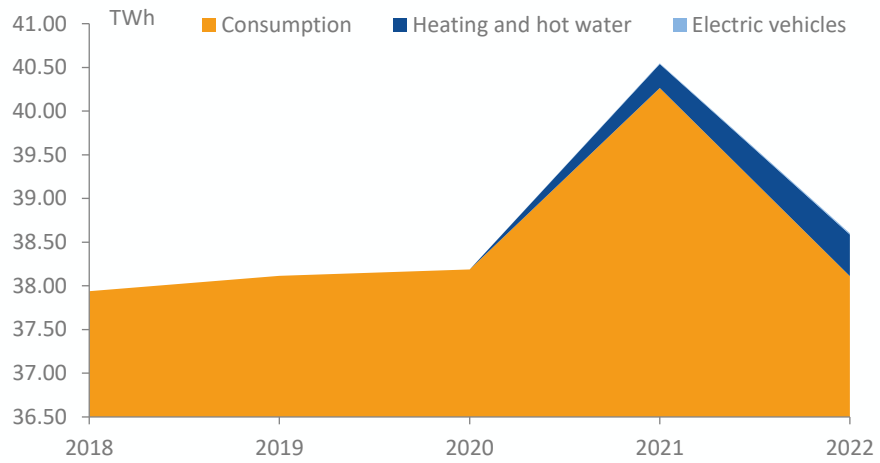
Source: Belstat

- The electricity sector is fully state-controlled and vertically integrated:
  - BelEnergo, a state-owned company, performs the generation, transmission, distribution and supply of electricity
- As of 2021, **total installed capacity is 11.4 GW**: TPP – 9.8 GW, NPP – 1.2 GW, RES – 0.4 GW;
- Generation by TPP prevails (87%), which is highly dependent on natural gas supplies from Russia
- The NPP is not yet operating at its full capacity, the 2nd unit to be launched in 2023
  - The electricity generated is expected to be used for the domestic market and gradually to substitute natural gas consumption
  - Nuclear fuel is fully imported from Russia

➢ **Electricity generated from gas and nuclear power, with both sources overwhelmingly dependent on fuel imported from Russia**

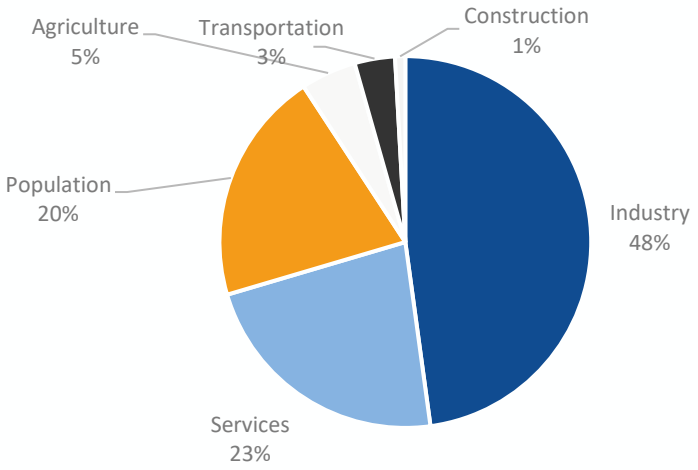
5. Electricity – demand

Final electricity consumption



Source: Belstat, Minenergo

Final electricity consumption by sector 2020 (38 TWh)

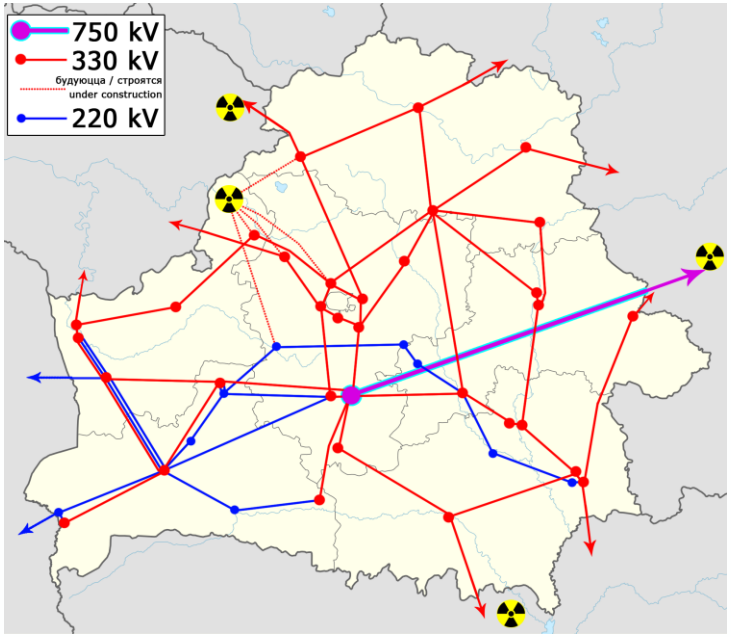


Source: Belstat

- Final electricity consumption has steadily been growing, reaching 40.5 TWh in 2021 followed by a drop to 38.6 TWh in 2022
- The 2021 spike is mostly related to the NPP launch during which the state stimulated domestic consumption via:
  - Installation of electricity boilers
  - Reduced tariffs for electricity-based heating Construction of apartment buildings with electric heating
- The demand was also affected by reduced economic activity due to:
  - Negative impact of the sanctions and the war in Ukraine (stopped export of petroleum products)
  - Outflow of population (20% of final demand) and companies (industry - 48% and services - 23%)
- **Electricity consumption has fluctuated in recent years. On the one hand, government measures aim to boost demand; on the other, lower economic activity has the opposite effect**

5. Electricity – potential of international integration

Cross-country transmission lines of Belarus



Source: BelEnergo

Export and import of electricity, 2022 (GWh)

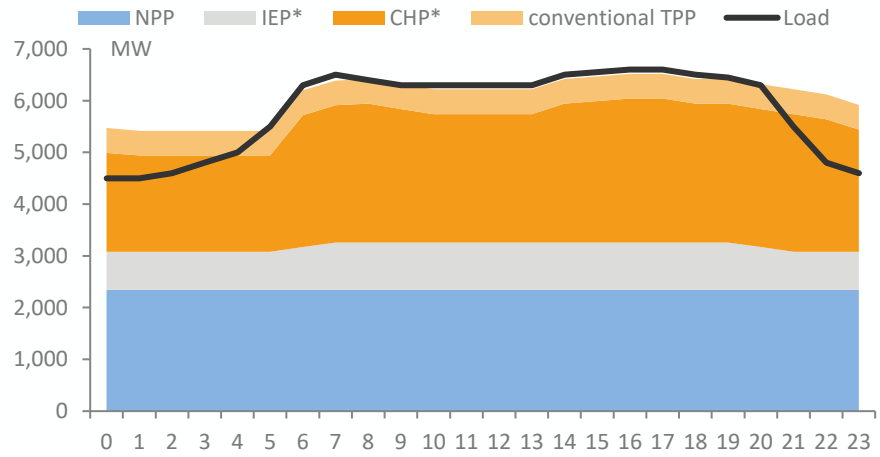
	Export	Import
Russia	0	30
Ukraine (before the war)	800	0
Total	**800**	**30**

Source: Energy Strategy journal

- Electricity system of BLR is a part of IPS/UPS electricity system
- BLR previously exported electricity to Ukraine which is now not possible since Ukraine disconnected from IPS/UPS and synchronised with the European Electricity System (ENTSO-E)
  - BLR will be able to export to Ukraine and Poland if it also synchronises the system with ENTSO-E or builds DC links at the borders
- Technically, Baltic states are still synchronised with IPS/UPS system via Lithuania (with plans to de-sync in 2024/2025 or possibly earlier)
  - Lithuania decided to stop importing electricity from BLR due to disputes related to the NPP construction
- Russia's electricity prices are comparatively lower, hence BLR exports to Russia may not be competitive
- **International electricity trading opportunities for BLR are rather limited. Currently, there is the technical possibility to export to Lithuania and Russia only**

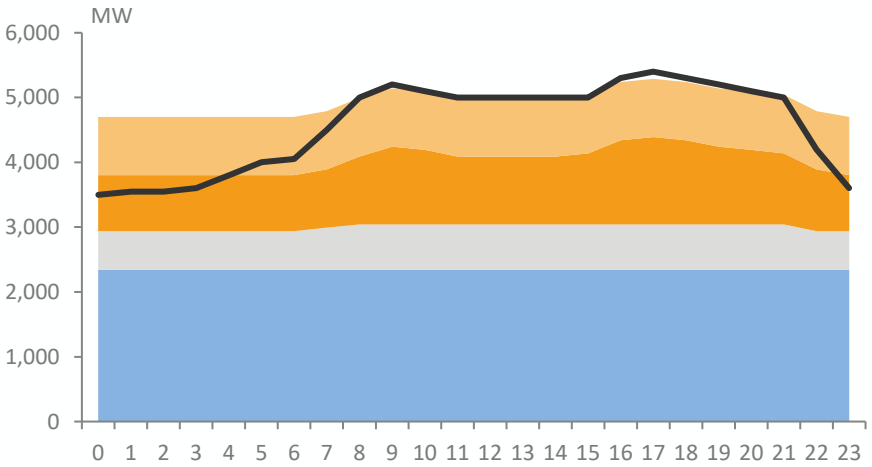
5. Electricity – peak and base load management

Hourly load curve in winter



Source: ODU (TSO, closed in 2019)

Hourly load curve in summer



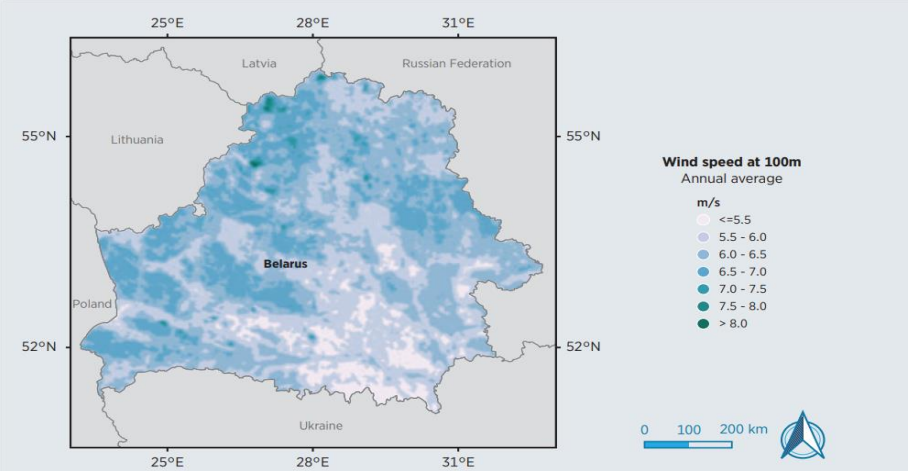
Source: ODU (TSO, closed in 2019)

- BLR meets its peak load and possesses high reserve margin
- Electricity generation at NPP, CHP and TPP during off-peak hours (night) exceeds demand
  - Adjustments in base load generation are challenging, thus potential RES applications are limited and possibly curtailed
- To stimulate domestic demand, especially in absence of export opportunities, the government is focused on increasing domestic consumption
- **BLR's excess capacity is concentrated in base load generation, hindering RES deployment**

CHP - combined heat and electricity plants*
IEP – independent electricity producers (not included in BelEnergo structure, production for own needs by industry)*

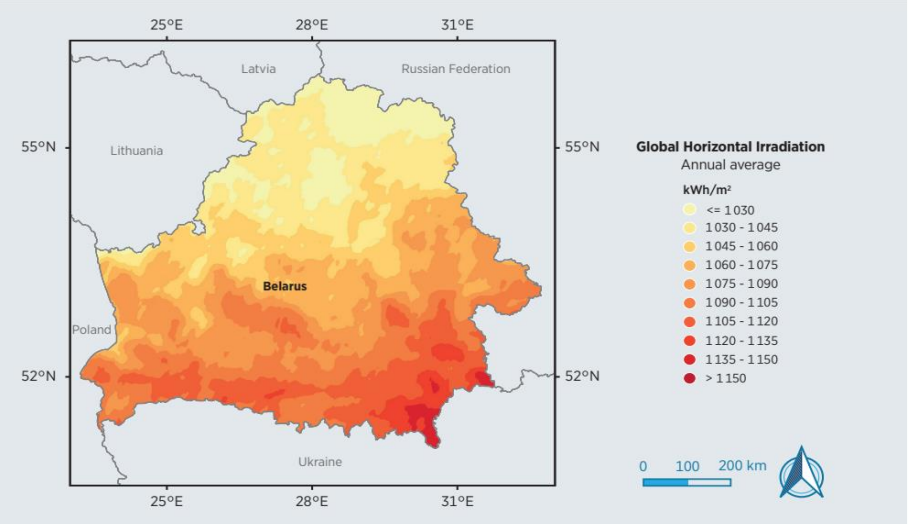
5. Electricity – RES potential

Annual wind speed



Source: Renewables Readiness Assessment for Belarus

Global horizontal irradiation



Source: Renewables Readiness Assessment for Belarus

Wind

» Estimated total potential up to 1,600 MW with potential locations for wind farms in Hroda, Minsk and Mogilev regions

Solar

» There is significant estimated solar potential of 578 TWh/year. Production is possible via solar PV, while concentrated solar power is impractical given the country's irradiation levels

Hydropower

» Large hydropower potential is insignificant due to flat topography, small-scale is feasible: 850 MW, of which the technical potential is 520 MW and economic potential 250 MW

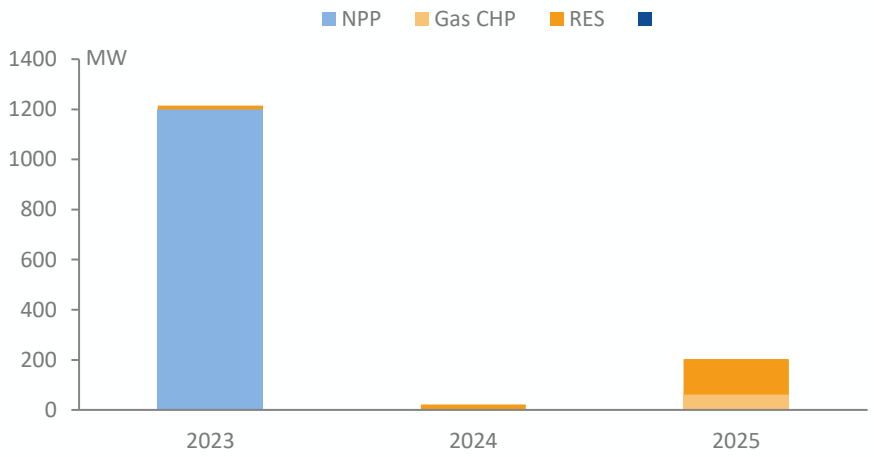
Biomass

» Potential is significant as 40% of country's territory is forested: wood and its processing waste – 26 TWh/year, crop waste – 12 TWh/year and straw - 8 TWh/year

➢ **Overall, BLR possesses significant RES potential, especially in solar and biomass**

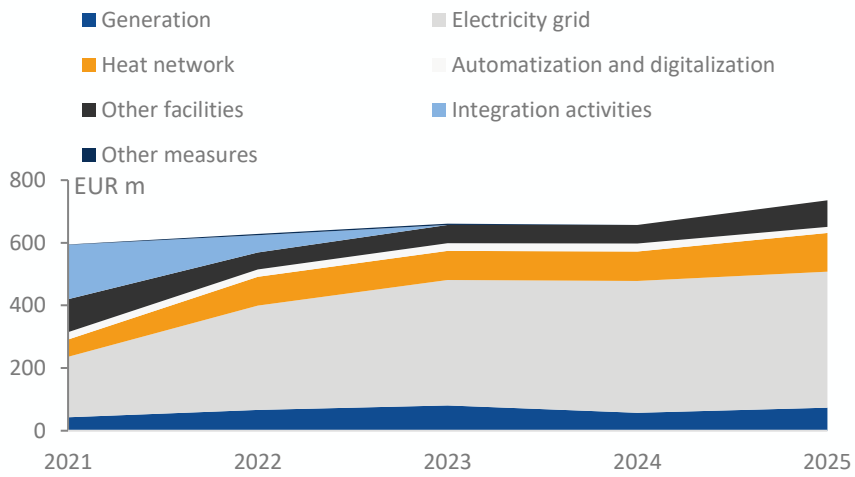
5. Electricity – investment plans

Expected commissioning of new capacity



Source: MinEnergo

Investments planned

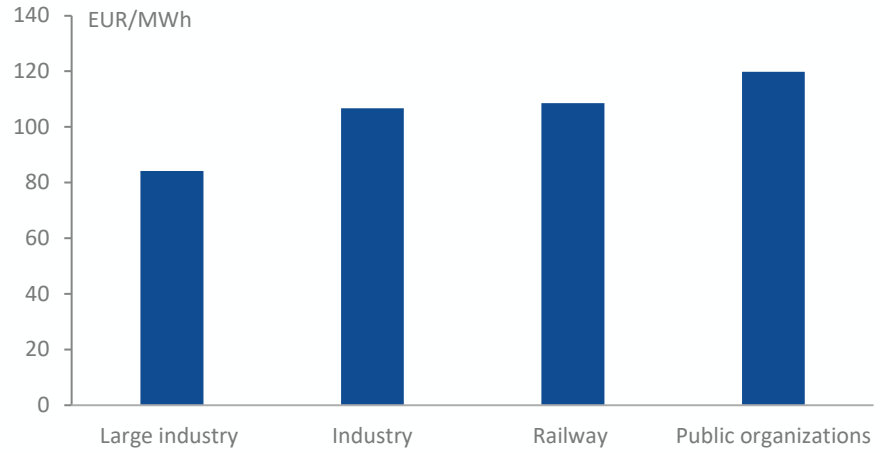


Source: MinEnergo

- The main recent investment has been the construction of the NPP (approx. EUR 6.4 bln per unit) with the second unit to be launched in 2023
- The capacities of gas-based power plants are gradually being decreased by 2025 (1.3 GW to be decommissioned and 0.06 GW – commissioned)
- Limited capacities of RES (0.2 GW) are expected to be deployed until 2025
- Significant investments into the electricity grid amounting to EUR 1.8 bn are planned
- Integration of a fully operating NPP will require EUR 230 m (e.g. main integration measure is increasing energy system flexibility by installing electric boilers to offload CHP turbine units as well as consume excess NPP-generated electricity)
- **Investments are focused on the infrastructure to incorporate the NPP into the grid as well as to replace decommissioned thermal units**

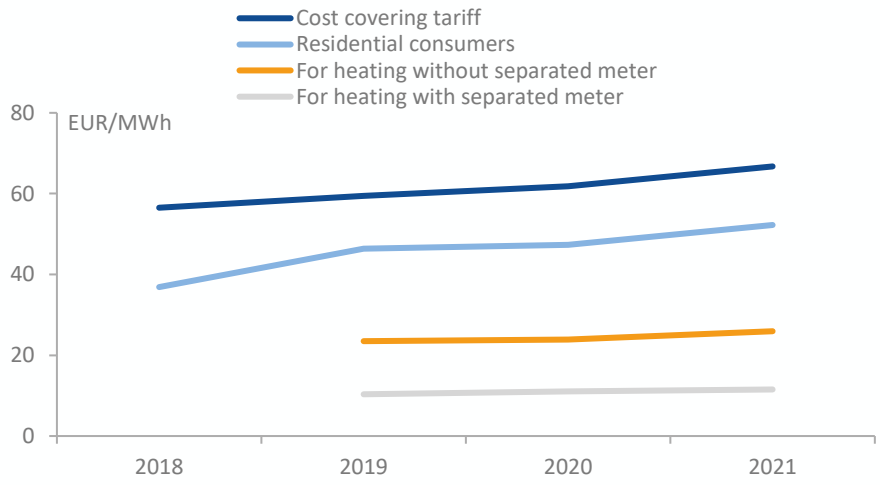
6. Final energy prices

Electricity tariffs for organizations in 2022



Source: MinEnergo

Electricity tariffs for households



Source: MinEnergo

Tariffs for industry/public organisations

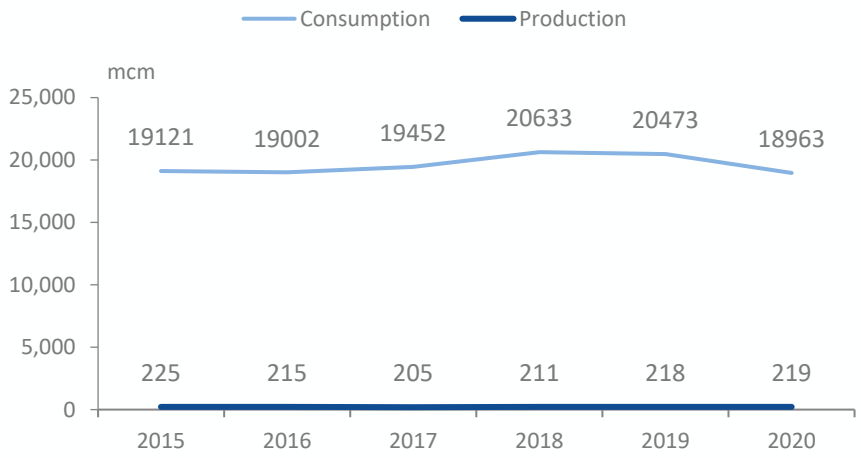
- Industry and public organisations are cross-subsidizing the household sector

Tariffs for households

- Despite increases in 2019, tariffs for the residential sector remain heavily subsidized and are not cost covering
- In 2021, electricity tariffs for residential consumers were set at ~52 EUR/MWh (EU average: 93 EUR/MWh)
- Plans to stimulate electricity consumption for heating would require the adoption and continued usage of very low tariffs for heating
- **Electricity tariffs will have to remain low if goal is to stimulate demand**
- **Households are being subsidized by artificially low energy tariffs**

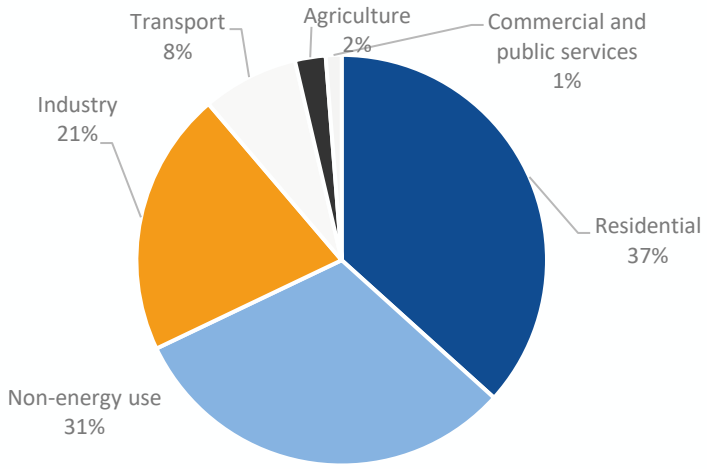
7. Gas sector issues

Natural gas production and consumption



Source: Belstat Energy balance of the Republic of Belarus

Natural gas final consumption by sector 2020



Source: Belstat

Full dependence on Russia

- BLR imports 99% of its natural gas, exclusively from Russia
  - The small domestic gas production is only a by-product of its oil production ("associated gas")
- The natural gas sector consists out of two companies:
  - **GazpromTransGaz Belarus (fully owned by Gazprom)**, which operates high-pressure transportation, transit and storage systems
  - **BelTopGaz (fully state owned)**, which handles gas distribution and retail sales
- BLR was a key transit node for Russian gas to Western Europe with an annual capacity of up to 33 bcm

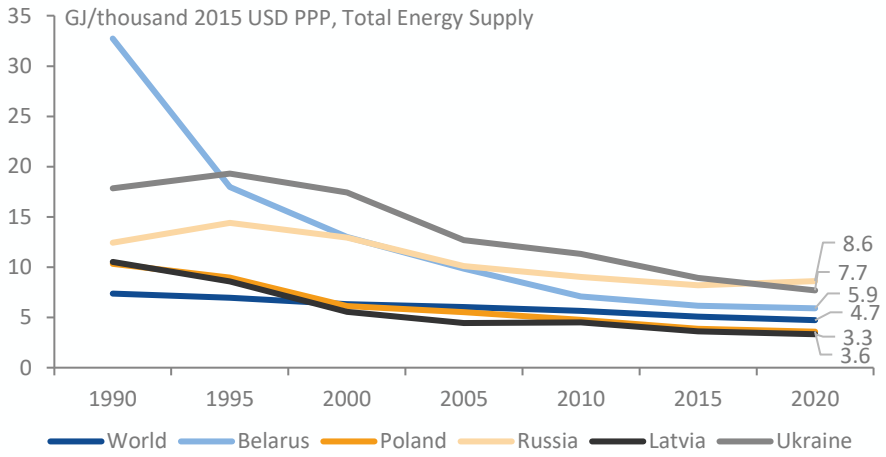
Gas consumption

- Gas is mainly used to supply **heat to the residential and industry sectors** (58%)
- About 31% are used for non energy purposes, i.e. petrochemical products and nitrogen fertilisers

➢ **BLR is almost fully dependent on gas imports from Russia**

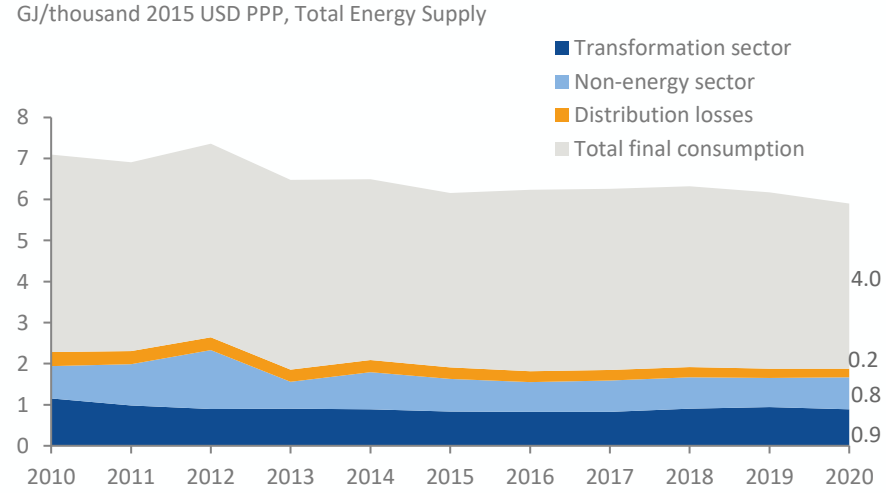
8. Energy efficiency

Energy intensity



Source: IEA

Energy efficiency



Source: Belstat

Limited progress

- The energy intensity of the Belarusian economy declined continuously since the 1990's until progress slowed after 2013
- The energy intensity in BLR is higher than the world average and neighboring Eastern European countries
- Final consumption was ~68% of total energy supply in 2020

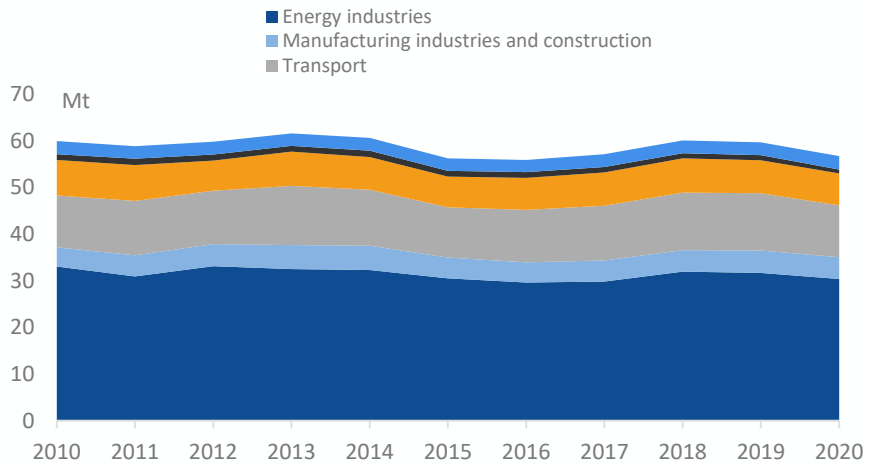
Barriers to increasing energy efficiency

- Low energy prices due to subsidized tariffs disincentive energy savings
- The administrative approach to energy efficiency without adopting incentives does not allow to use the full potential of energy savings
- Financial constraints, also due to sanctions

➢ **Despite some progress, the Belarusian economy remains very energy intensive**

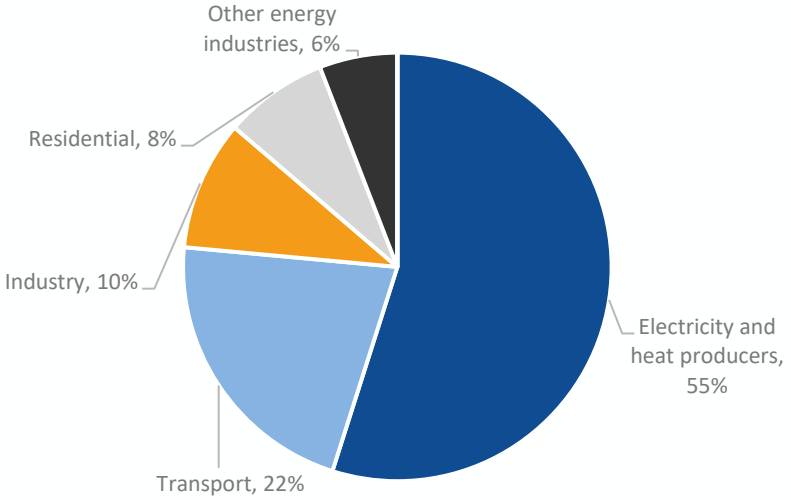
9. Emissions

Total CO2 emissions



Source: GHG Inventory

CO2 emissions by sector 2020 (52.5 Mt)



Source: IEA

Emission development

- Current GHG emissions are 56% of 1990 levels
- Since 2010 emissions remained relatively constant with small fluctuations, despite some economic growth
- Expectations that the NPP commission can reduce GHG emissions by about 4 Mt
- BLR NDC includes target to reduce GHG emission by 65% from 1990 levels by 2030

Sectoral emissions

- Electricity and heat production are responsible for more than half of all emissions. The main source is natural gas combustion
- Natural and petroleum gas are the main sources of GHG emission in industry

➢ **The emissions intensity of the Belarusian economy is declining while absolute emissions remain steady**

About the German Economic Team

Financed by the Federal Ministry for Economic Affairs and Climate Action, the German Economic Team (GET) advises the governments of Ukraine, Belarus*, Moldova, Kosovo, Armenia, Georgia and Uzbekistan on economic policy matters. Berlin Economics has been commissioned with the implementation of the consultancy.
**Advisory activities in Belarus are currently suspended.*

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