IRENA
International Renewable Energy Agency

Renewables Readiness Assessment

THE REPUBLIC OF BELARUS

JULY 2021

Citation: IRENA (2021), *Renewables Readiness Assessment: Belarus*, International Renewable Energy Agency, Abu Dhabi.

ISBN 978-92-9260-353-3

About IRENA

The International Renewable Energy Agency (IRENA) serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. An intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. **www.irena.org**

Acknowledgements

This report benefited from reviews and comments by Mikhail Malashenko, Vladimir Shevchenok, Andrei Minenkov (State Committee for Standardisation of the Republic of Belarus), Sergey Greben (Ministry of Energy of Belarus), Andrei Molochko (consultant) and Ivan Filiutsich (UNDP Belarus).

IRENA colleagues Gürbüz Gönül, Binu Parthan, Petya Icheva, Nopenyo Dabla, Ute Collier, Diala Hawila, Emanuele Bianco, Costanza Strinati, Luis Janeiro, Imen Gherboudj, Sonja Malićević, Jack Kiruja, Aleksandra Prodan, Laura Camarut and Stephanie Clarke also provided valuable input.

This report was developed under the guidance of Gürbüz Gönül, Binu Parthan and Petya Icheva (IRENA) and authored by Tijana Radojičić (consultant).

Available for download: **www.irena.org/publications**

For further information or to provide feedback: **publications@irena.org**

Renewables Readiness Assessment

THE REPUBLIC OF **BELARUS**

JULY 2021

FOREWORD

from the Chairman of the State Committee for Standardization of the Republic of Belarus

Valentin Boleslavovich Tataritsky

Chairman of the State Committee for Standardization of the Republic of Belarus

The Republic of Belarus recognises the key role that modern, energy-efficient and carbon-neutral technologies play in the successful economic development of countries. Along with the international community, Belarus is continuously modernising and introducing innovations in the country's energy sector, including measures to develop renewable energy and replace fossil fuels with renewable sources. This work is aimed at creating favourable living conditions for the citizens of Belarus, increasing the competitiveness of the national economy and reducing negative environmental impacts, as well as fulfilling domestic and international obligations and goals.

The Republic of Belarus, as a member State of the International Renewable Energy Agency (IRENA), requested that IRENA conduct a Renewables Readiness Assessment. This study, prepared in co-operation with the State Committee for Standardization and representatives of government agencies and organisations, presents the key aspects of the current state of the energy sector. It proposes significant short and medium-term measures to improve the legislative and cross-sectoral environment to increase the development of renewables.

This comprehensive assessment is based on the results of working consultations with relevant stakeholders from government authorities and other organisations leading the renewable energy sector in Belarus, which helped to identify opportunities and develop solutions for increasing the use of renewables. The assessment also describes the factors hindering the development of renewable energy and measures to accelerate the pace of development of renewables in our country.

The implementation of the Renewables Readiness Assessment for Belarus will certainly help to enhance the positive image of the Republic of Belarus in the international community. It will form the basis for the development of new areas of co-operation with other countries and international and financial organisations in the field of renewable energy. The presentation and publication of the Renewables Readiness Assessment will also open up new opportunities for the Republic of Belarus to co-operate with international partners on the implementation of regional and cross-border projects of international technical assistance, investment, and infrastructure projects contributing to the achievement of national and global sustainable development goals, including Goal 7, "Ensure access to affordable, reliable, sustainable and modern energy for all".

On behalf of the State Committee for Standardization of the Republic of Belarus, I express my gratitude to the International Renewable Energy Agency for the preparation of the Renewables Readiness Assessment for Belarus. I also express my gratitude to all international and national experts, government officials and stakeholders who contributed to this process and shared their best practices, knowledge and experience. The proposals and recommendations collected in the assessment will definitely have a positive effect and a direct impact on the implementation of a long-term energy strategy in Belarus, allowing us to create a sustainable and environmentally friendly future for our country.

FOREWORD

From the IRENA Director-General

As the world moves towards a low-carbon future, the energy sector is undergoing deep transformations to rise to this challenge. Through renewable energy, a less carbon-intensive development model is now within reach, with numerous positive spillovers for the economy and society.

Currently, fossil fuels make up more than 90% of the energy mix in Belarus, with natural gas taking the lion's share. Power generation is also predominantly fossil fuel-based, with very limited integration of renewable sources. Energy imports amount to 84.8% of the total primary energy supply and come primarily from a single source supplier, exposing the country to price volatility and putting its energy security at risk.

Renewable energy is the response to many of these challenges. Clean, reliable, available locally and increasingly cheaper, renewable energy would strengthen the energy security of Belarus by reducing its reliance on fossil fuel imports. It would contribute to economic growth, job creation and improved air quality, thereby enhancing the peoples' well-being. Although still in a nascent stage in the Belarusian energy sector, renewable energy has been growing steadily over the past decade, accounting for 7.1% of the country's final energy consumption in 2019. While most of Belarus's renewable energy production comes from biofuels, there is significant potential for biomass, solar and wind development and integration across all end use sectors. Setting ambitious renewable energy targets, designing renewable energy auctions, adopting a grid code to support the integration of renewables, de-risking investments, and enhancing human and institutional capacities are among the key actions identified by IRENA that could harness the potential of renewable energy sources in Belarus.

Since 2011, nearly 40 countries in regions from Latin America and the Caribbean to Africa, the Middle East, Asia and the Pacific have undertaken Renewables Readiness Assessment, exchanging knowledge and fostering international co-operation to accelerate the deployment of renewables. Each process has been country-led, with IRENA providing technical expertise and highlighting regional and global insights, along with facilitating national stakeholder consultations.

IRENA thanks the State Committee for Standardization of the Republic of Belarus (Gosstandart) for its close co-operation and engagement in the development of this RRA. The report has also benefitted from the valuable input of numerous other government agencies and national stakeholders. I am confident that the observations and recommendations presented here will be valuable in addressing the challenges of the energy sector in Belarus by highlighting the path to uptake the deployment of renewables.

Francesco La Camera

Director-General
International Renewable
Energy Agency

CONTENTS

FIGURES

TABLES

BOXES

ABBREVIATIONS

bcm	Billion cubic metres
BelEnergo	Belarusian State Production Association of the Electric Power Industry
BelSEFF	Belarusian Sustainable Energy Finance Facility
BelTopGas	Belarusian Fuel and Gasification State-Owned Production Association
BELSTAT	National Statistical Committee of the Republic of Belarus
BYR	Belarusian ruble
°C	Degree Celsius
CES	Common Economic Space (of Armenia-Belarus-Kazakhstan-Kyrgyzstan-Russian Federation)
CHP	Combined heat and power
CIP	Climate Investment Platform
CIS	Commonwealth of Independent States
DNI	Direct normal irradiance
EAEU	Eurasian Economic Union
EaP	Eastern Partnership (of the European Union)
EBRD	European Bank for Reconstruction and Development
EDB	Eurasian Development Bank
EU	European Union
EUR	Euro
FiT	Feed-in tariff
GCF	Green Climate Fund
GDP	Gross domestic product
GHG	Greenhouse gas
GHI	Global horizontal irradiation
Gosstandart	State Committee for Standardization of the Republic of Belarus
GW	Gigawatt
GWh	Gigawatt hour
ha	Hectare
HPP	Hydropower plant
IFC	International Finance Corporation
IFI	International finance institution
INDC	Intended nationally determined contribution
IPP	Independent power producer
IRENA	International Renewable Energy Agency
km	Kilometre
ktoe	Kilotonnes of oil equivalent
kV	Kilovolt
kVA	Kilovolt-ampere
kW	Kilowatt
kWh	Kilowatt hour
kW_p	Kilowatt-peak
LCOE	Levelised cost of energy
LPG	Liquid petroleum gas
LULUCF	Land use, land use change and forestry sector
m^2	Square metre
m^3	Cubic metre
m	Metre
MART	Ministry of Anti-Monopoly Regulation and Trade
mm	Millimetre
m/s	Miles per second
Mt	Megatonnes
$MtCO_2$-eq	Megatonnes of carbon dioxide equivalent
Mtoe	Million tonnes of oil equivalent
MW	Megawatt
NDC	Nationally determined contribution
NEFCO	Nordic Environment Finance Corporation
NPP	Nuclear power plant
NWP	Numerical weather prediction
PPA	Power purchase agreement
PV	Photovoltaic
RRA	Renewables Readiness Assessment
SE4All	Sustainable Energy for All
SME	Small and medium-sized enterprise
Tcal	Tera calorie
TFEC	Total final energy consumption
TPES	Total primary energy supply
TWh	Terawatt hour
V	Volt
VA	Volt-ampere
VAT	Value added tax
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
USSR	Union of Soviet Socialist Republics

EXECUTIVE SUMMARY

The Republic of Belarus is a landlocked country in eastern Europe with a population of approximately 9.5 million people. After the dissolution of the Union of Soviet Socialist Republics (USSR) in 1991, the economy of Belarus contracted, but it soon resumed growth due to an increase in labour productivity, favourable trading terms – mainly with the Russian Federation and the European Union (EU) – and further development of the manufacturing industry and exports.

The Belarusian economy is highly energy intensive, and the country's energy sector is overwhelmingly fossil-fuelled and import-dependent. The country's total primary energy supply (TPES) in 2019 was composed of 62% natural gas and 28% oil, with the remainder comprising mainly biomass, waste, coal and peat. Energy imports are mainly from the Russian Federation, and amount to about 85% of all energy supplied in the country. The largest fuel import dependency is on natural gas, of which only 2% supplied is produced domestically. This makes Belarus one of the world's most energy import-dependent countries and dramatically compromises the country's energy security.

Renewable energy is at an early stage of development in the Belarusian energy sector. The share of renewables, although steadily increasing over the past decade, stood at just 7.1% of the TPES in 2019. This share comprises largely biofuels and, to a lesser extent, solar photovoltaic (PV) and wind. Nonetheless, the country is well endowed with renewable energy resource potential that presents a viable and sustainable pathway for the development of the energy sector. Biomass is the most abundant renewable energy resource, but there is also significant wind and solar PV potential in almost all areas of the country. For solar PV and solar thermal applications, the south and southeast of the country have the highest irradiation levels and annual direct normal irradiance (DNI), respectively. Indeed, these regions have considerable potential for solar thermal applications, such as space and water heating and low-enthalpy process heat in the industry and services sectors. Geothermal potential, although not extensively studied, is deemed to be most suitable for low-enthalpy heat processes throughout the country.

Apart from renewable energy resources, Belarus does not have significant local energy resources. Thus, through the increased deployment of renewable energy technologies, Belarus would be able to increase its domestic energy supply, which would have a direct contribution towards the country's gross domestic product (GDP), economic growth and energy sector security. Furthermore, greening the energy sector would directly reduce emissions, thereby supporting a sustainable and environmentally sound development pathway for the country. Increased renewable energy deployment would also contribute to local value creation, including employment opportunities and industrial development.

With a view to informing the development of a sustainable and secure energy sector in Belarus, this Renewables Readiness Assessment (RRA) identifies critical actions that could significantly increase the scale-up of renewable energy in the country, outlined in a number of key recommendations.

Revising renewable energy targets

To guide the development of renewables, Belarus has set out various renewable energy targets through multiple policy documents and plans. However, the targets are not always consistent with one another, and while some technology-specific targets were not met by the end of 2020, the national renewable energy target for 2025 has already been reached. This mismatch creates uncertainty about near-term continued renewable energy development and raises questions about the targets' ambitiousness and relationship to other development objectives, such as energy security. Current targets need to be revised, streamlined and made consistent.

Renewables in Belarus comprise largely of biofuels, followed by solar photovoltaic and wind, and increased steadily over the past decade to reach 7.1% of the total primary energy supply in 2019

Improving the quota allocation for renewables

The development of renewables in the power sector is enabled through yearly quotas that allocate the amounts of installed capacities per renewable energy technology for the coming three-year period. However, these quotas have been subject to many revisions and reductions that have adversely impacted investor confidence and limited the pace of the renewable energy sector's growth. In addition, the quota allocations do not encourage larger-scale investments. To accelerate the development of renewables and allow for larger-scale investments, especially for solar PV and wind technologies, it is imperative that the allocated quota amounts be increased. Furthermore, the quotas should allow for biomass power development, and the current hydropower quotas should be allocated to other renewable technologies. Finally, the quota systems should not include renewable energy prosumers, and the quota allocation period should be extended to five years to allow investors to gauge the development of the sector.

Designing renewable energy auctions

Renewable energy producers in Belarus sell their electricity to the off-taker at a feed-in tariff (FiT) that is calculated by applying different multiplier coefficients on the electricity base tariffs. However, electricity base tariffs do not truly reflect the unit cost of production, and the multiplier coefficients are low, leading stakeholders to deem the FiTs too low to attract the necessary investments at scale. To attract renewable energy investments, the country should look into developing renewable energy auctions, which can allow for market-based tariff setting of renewable power generation and have the potential for real price discovery. Furthermore, auctions can allow for well-planned and cost-efficient renewable energy deployment, and their transparent design and implementation can instil confidence in investors and reduce perceived market risks.

Developing a law on energy and heat

Belarus has no primary act or base law on energy that holistically governs the energy sector, defining the energy system and the roles of the different energy sector entities. To compensate, local regulations ultimately fill this gap, creating inconsistencies among different regions. A telling example of this gap is that Belarus does not have a specific law governing its heat sector. As such, there is no comprehensive legal framework to incentivise the development of renewable energy in the respective end-use sector and support the sector's decarbonisation. A dedicated and comprehensive legal framework for the energy sector is needed to assign legal enforcement mechanisms for the development of various energy sector programmes. Furthermore, a dedicated heat law could incentivise the development of renewables in heat supply and would signal a political commitment to the decarbonisation of the energy sector.

Harnessing renewable energy potentials in heating

Belarus has high biomass potential, but the calorific value of different biomass feedstocks and fuel products needs further improvement. This is key because the country relies on outdated resource assessment standards that do not take into account different technological advancements for thermal extraction and processing of feedstocks into more calorie-dense fuel products. Furthermore, the unit price of biomass is based on mass or volume of the fuel, rather than per unit calorific value. Therefore, standardising the quality of biomass feedstocks and ensuring trading prices are based on quality standards are necessary in ensuring the technical and economic viability of biomass for heating. Moreover, the increased use of renewable energy sources in heating should be based on the integration of modern, technically and economically feasible energy-efficient technologies, harnessing the country's biomass, low-enthalpy geothermal and solar thermal resources, as well as energy-efficient heat pumps.

Developing an energy sector master plan with higher shares of renewables

The development of the energy sector in Belarus is guided by a number of cross-sector state programmes. However, it is necessary to integrate these cross-sector strategies into a master plan for an integrated development of the energy sector. The development of such a plan would facilitate sector-wide policy assessments, including environmental impacts and the infrastructural and financial needs of fulfilling wider development objectives. Furthermore, a master plan would allow for a more co-ordinated and holistic development approach to various renewable targets, quota allocations and auction rounds.

Adopting a grid code for renewables

The Belarus power system is in a relatively early stage of managing variable renewable power injection on the grid. To avoid any disturbances on the grid, renewable power producers are not given priority dispatch, but instead have to feed in power generated according to dispatch control centre schedules. In addition, a lack of technical standards for integration and uncertainty about technical requirements to connect to and feed into the grid introduce transmission or grid risks and significantly increase the cost of financing for renewables. A well-formulated national renewable energy grid code outlining procedural and technical requirements for variable renewable power producers feeding into the central grid will help to alleviate investment risk and allow for a level playing field for all power producers while also maintaining power system stability.

Improving variable renewable power generation forecasting

Variable renewable power forecasting is an essential and cost-effective tool for managing power system operations, balancing power supply and maintaining grid stability in power grids to which variable renewable power generators are connected. Currently in Belarus, wind and solar PV forecasting is not optimally integrated into daily scheduling and dispatch operations for power system balancing, and renewable energy generators are obliged to participate in the day-ahead scheduling. Short-term (zero to six hour) forecasting is crucial in predicting renewable energy production, and when intra-day adjustments of forecasted renewable energy production are not accounted for, power production uncertainty is created. This leads to unnecessary power curtailments for which renewable power producers are not compensated and which adds to power market risk for investors. To alleviate this investment risk and facilitate the increased integration of renewable power plants, short-term forecasting must be integrated into generation scheduling and dispatch operations.

Improving de-risking mechanisms for renewable energy investments

Financing for renewable energy projects in Belarus is very low, and there is an overall shortage of both debt and equity financing. In particular, the local financial sector is inexperienced in green financing. Most investments have been facilitated through international capital. Furthermore, local financing comes at a very high cost, and commercial lending entails high interest rates and high collateral requirements due to numerous perceived risks. Clear financial sector policies for green financing should be developed with the national development bank, which should also include small-scale financing. Furthermore, establishing a dedicated renewable energy fund could be an effective way of providing public loans and de-risking mechanisms for renewable energy investments.

Currency risk also adversely impacts the cost of international debt and equity financing. A significant amount of foreign financing in Belarus comes from Europe, so fixed prices in power purchase agreements (PPAs) should be at least partially indexed to the euro to increase the bankability of renewable energy investments. To alleviate off-taker risk, clear mitigation clauses should be included in a standardised PPA along with government-backed guarantees and letters of support. To mitigate the risk associated with permitting procedures, information on grid connection points should be made publicly available, and permitting procedures should be streamlined and consistent in each administrative region of the country.

Standardising power purchase agreements

PPAs for different renewable energy technologies in Belarus are not standardised, and the clauses within the contract are individually negotiated between the off-taker and the developer. Furthermore, PPAs are only signed once the renewable power plant has been built and commissioned, which introduces a significant risk for the developers, may jeopardise the bankability of their project and weakens their negotiating position. The lack of a PPA in the development phase of the renewable power project also adversely impacts the developer's ability to obtain debt financing for the project in the first place. Standardised PPAs for different renewable energy technologies need to be developed, applied in all regions of the country and concluded with the developers after successful bidding. Throughout the duration of the PPA contract, a guaranteed fixed price for the sale of electricity needs to be applied, and clauses that clearly define non-compensable and compensable power curtailments need to be included.

Building human and institutional capacities for renewable energy development

Developing an energy sector with an increased share of renewables requires competencies beyond those of the conventional fossil fuel-based system. These competencies are needed both at the institutional and the individual level. Within the public sector, planning and facilitating renewable energy deployment through incentive schemes are the two priority areas that require capacity strengthening. These include improvements in statistical data collection pertaining to electricity generated by renewable energy prosumers and capacity building in renewable energy auction design.

The private sector's capacity to ensure due diligence in the preparation of renewable energy project documentation also needs to be strengthened. Furthermore, practical skills at academic institutions and on-the-job training need to be enhanced to ensure a qualified workforce for the development of a renewable energy sector. Within the financial sector, there is a continued need for development partners to support local financial institutions with technical assistance in project appraisals, the creation of a local renewable energy financing impetus and the facilitation of experience sharing in renewable energy financing. The capacity of local institutions to innovate in the area of renewable energy technology should be enhanced through comprehensive co-operation of national scientific organisations with industrial and energy enterprises, international organisations, development partners and foreign researchers.

1 INTRODUCTION

1.1 RENEWABLES READINESS ASSESSMENT

The Renewables Readiness Assessment (RRA) is a tool developed by the International Renewable Energy Agency (IRENA) to comprehensively evaluate the conditions for accelerated renewable energy deployment in a country. It is a country-led, multi-stakeholder consultative process that allows for the identification of existing challenges for renewable energy deployment and recommends short to medium-term actions to guide decision makers and other stakeholders in addressing these challenges.

The RRA for Belarus was initiated by the State Committee for Standardisation of the Republic of Belarus (Gosstandart) in technical cooperation with IRENA. It has greatly benefitted from stakeholders' inputs. Stakeholders in the RRA process included officials from ministries, utilities, power project developers, development partners, financial institutions, civil society and academia.

As a first step of the RRA process, a background report on the energy sector in Belarus was developed that provided an overview and preliminary analysis of the energy sector context in Belarus. Thereafter, various interviews were held with institutional energy sector stakeholders in the country, supplemented with a set of detailed questionnaires aimed at further assessing the energy sector and determining the main barriers for renewable energy deployment. Based on desktop research, bilateral interviews and the questionnaires, an issue paper was developed highlighting some of the challenges for renewable energy deployment in the country.

On this basis, a multi-stakeholder consultative workshop was organised by IRENA and Gosstandart on 9-10 February 2021. Over 35 representatives from governmental institutions, the private sector, development partners, civil society and academia attended. The workshop facilitated further discussions among stakeholders on the challenges in renewable energy deployment and allowed for the identification of recommended actions in overcoming these challenges. The outcomes of the consultation workshop, along with insights gained from bilateral consultations and the supporting documentation that was developed, constituted the basis for this RRA report. The RRA, with its recommended short to medium-term actions, was validated on 20 April 2021 at a virtual multi-stakeholder validation workshop attended by over 35 representatives from the energy sector in Belarus.

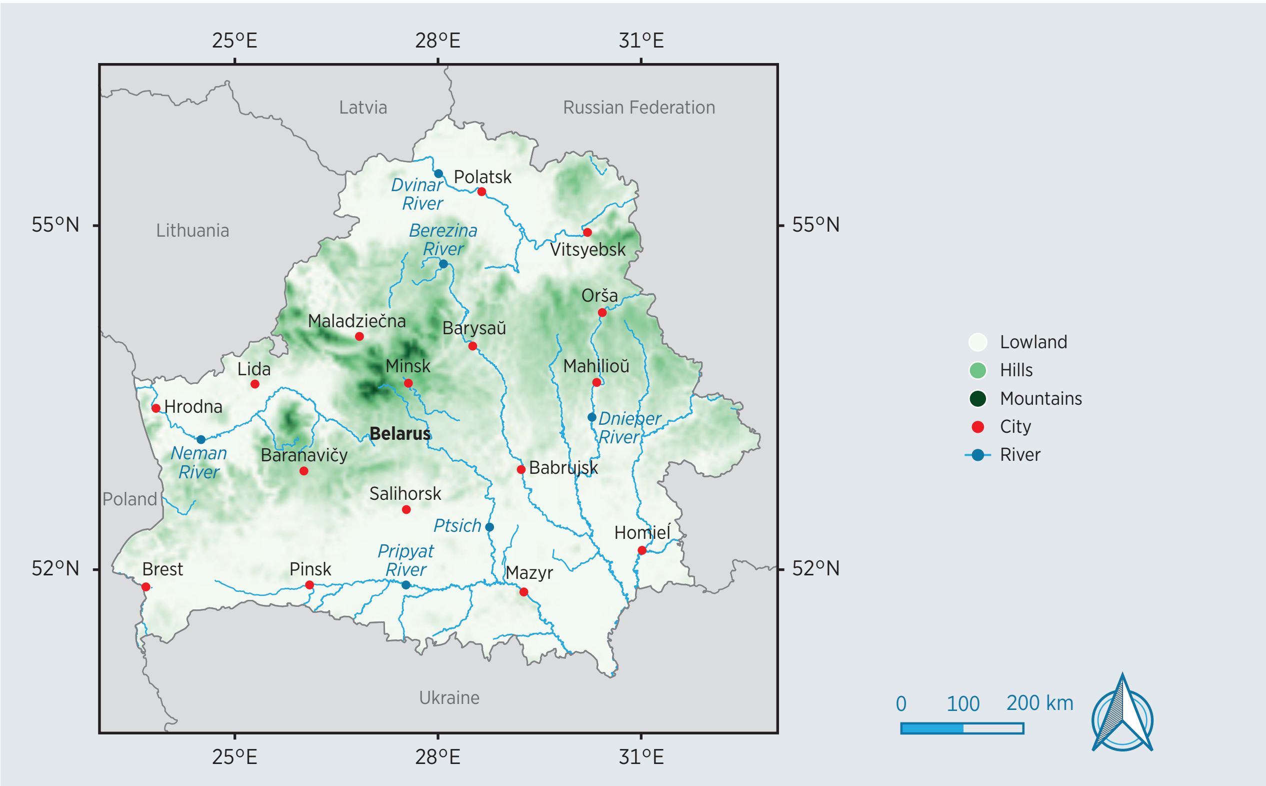
1.2 COUNTRY OVERVIEW

The Republic of Belarus is a landlocked country located in Eastern Europe bordered by the Russian Federation, Ukraine, Poland, Lithuania and Latvia. Its capital city is Minsk, located in the centre-west of the country.

Belarus covers an area of 207 600 square kilometres (km^2), spanning about 650 km from east to west and 560 km from north to south. The topography of Belarus is mainly flat and low-lying. More than half of the country's surface area is below 200 m of altitude, with the highest point of elevation at 346 m above sea level at Dzyarzhynskaya Hara in the vicinity of Minsk (Encyclopedia Britannica, 2020). Over 90% of the country is covered by natural vegetation, and about 40% of it is forested. The north of the country is predominantly characterised by gently sloping hills with many lakes, while the south is predominantly low-lying and mainly marshland. The largest and most significant river is the Dnieper, flowing through the east of the country, but other notable rivers include the Dvinar, Neman and Pripyat.

Belarus has a temperate continental climate, with warm summers and cold, humid winters. Average temperatures in winter range from -4.5 degrees Celsius (°C) in the southwest to -8°C in the northeast, while average temperatures in summer range between 17°C in the north to 18.5°C in the south (Belarus.by, 2020). Average annual precipitation ranges between 550 millimetres (mm) and 700 mm, with the highest precipitation seen in June and July (89 mm). Snow falls from November to March and is heaviest in January with an average of 24 snow days (Weather Atlas, 2020).

Figure 1 Map of Belarus



Source: IRENA Global Atlas; Map data: Shuttle Radar Topography Mission global coverage data (2021); ArcWorld (2021); United Nations administrative boundaries (2021).

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

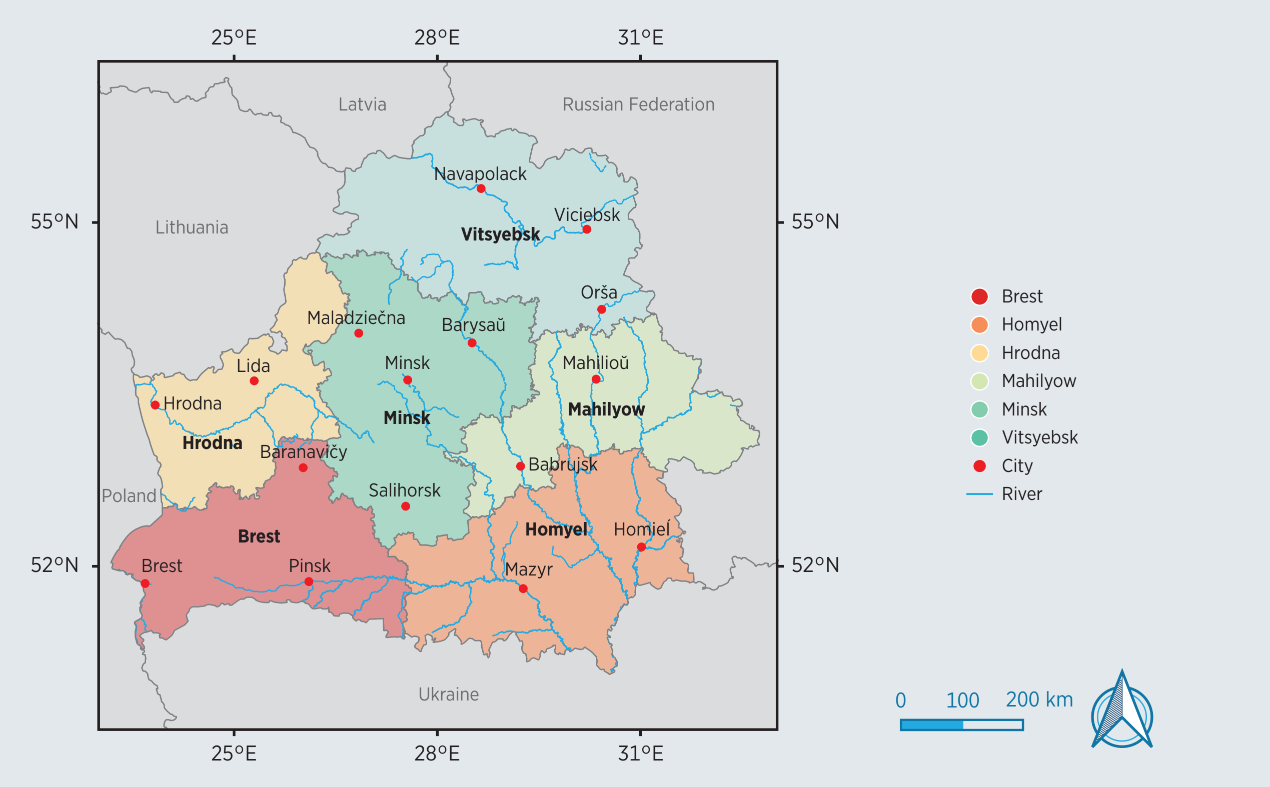
Social indicators

The population of Belarus numbered almost 9.5 million in 2019, with a decrease in population of 32 900 from the previous year. The population is largely urban: 78.4% of the population lives in urban settings, and over a fifth of the population, just under 2 million people, live in the capital city. More than half (57%) of the population is of working age (*i.e.,* between the ages of 15 and 65 years) (BELSTAT, 2020a). The unemployment rate has been declining over the past few years and stood at 4.2% in 2019 (BELSTAT, 2020b). The country has a universal literacy rate, a 99% effective transition rate of students from primary to secondary education, and 87.4% gross enrolment in tertiary education (UNESCO Institute of Statistics, 2020).

Governance structure

The government of Belarus consists of the prime minister, deputies and ministers who are accountable to the president and answerable to Parliament. The territory of the Republic of Belarus is divided into six regions (*voblasti*) and one municipality (*horad*). The regions (Brest, Gomel, Grodno, Minsk, Mogilev and Vitebsk) are administrative territorial units, while Minsk City is a municipality. The regions and municipality are further subdivided into 118 districts, whereby Minsk City alone has 9 districts. Furthermore, Belarus has 1151 rural councils (BELSTAT, 2020c).

Figure 2 Map outlining the territorial regions and municipality of Belarus



Source: United Nations administrative boundaries (2021); Global Administrative Areas (2021); ArcWorld (2021)

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

Economy

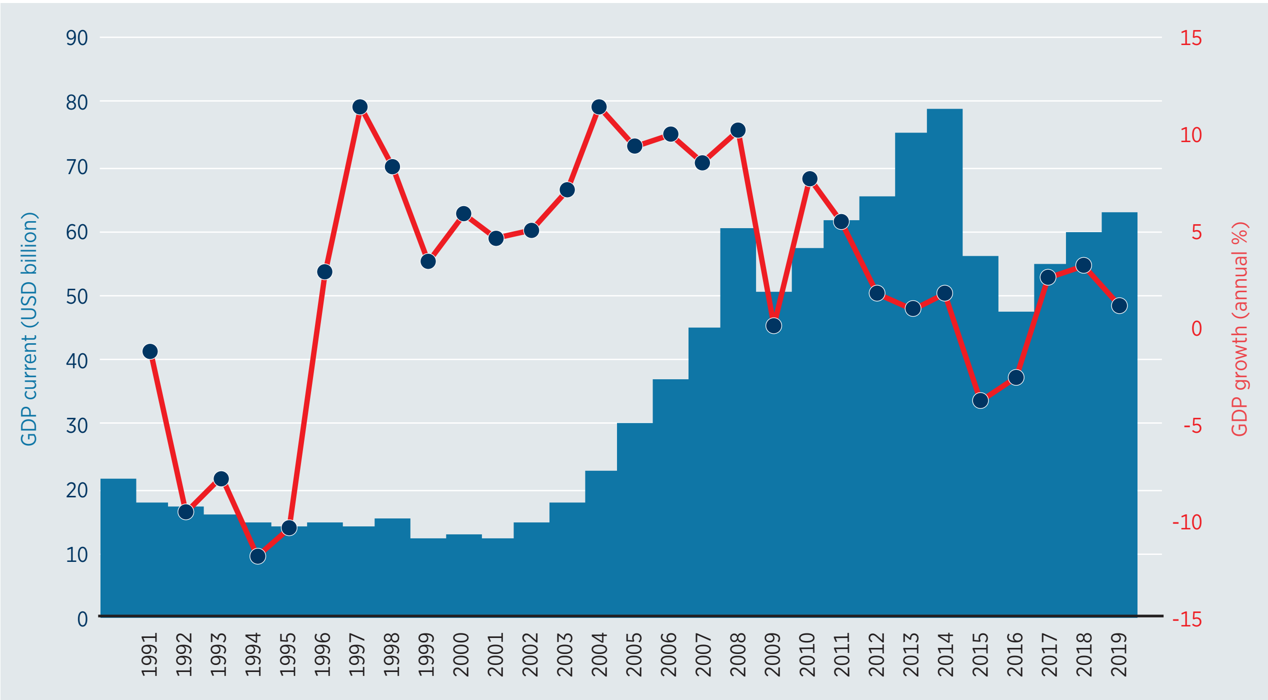
After the dissolution of the Union of Soviet Socialist Republics (USSR) in 1991, Belarus experienced an economic downfall. In 1994, gross domestic product (GDP) declined by as much as 11.7%.[1] As shown in Figure 3, soon thereafter, the economy started to grow due to an increase in labour productivity, favourable trading terms (mainly with the Russian Federation and the European Union [EU]), further development of the services and manufacturing industries, and an increase in exports. The largest contributor to the country's GDP is the services sector (49%), followed by manufacturing (22%), agriculture (7%), construction (6%), and, lastly, supply of energy and mining (BELSTAT, 2020d).

Within the services sector, wholesale and retail trade, motor vehicle repairs, transpiration, storage, information and communication, and real estate activities are some of the largest contributors to GDP. The country's manufacturing industry includes machinery, minerals and metals, chemical products, textiles, and foodstuffs.

Following the global economic crisis in 2009, negative economic growth forced the government to introduce stringent monetary and fiscal policies that returned growth to the economy. In 2015, economic difficulties in the Russian Federation, a major trading partner, resulted in Belarus's economy again declining by 3.82% (OECD, 2018).

In 2019, the country's GDP stood at approximately BYR 134 billion (Belarusian rubles; USD 61 billion [United States dollars]) with an annual increase of 1.6% over the previous year. In 2020, Belarus's GDP fell to approximately 99.1% of its 2019 levels,[2] a decline mainly attributed to the global COVID-19 pandemic (BELSTAT, 2020d).

Figure 3 GDP (USD billion) and GDP growth (%), 1991-2019



Source: World Bank and OECD (2020)

1 *Compared to the previous year.*

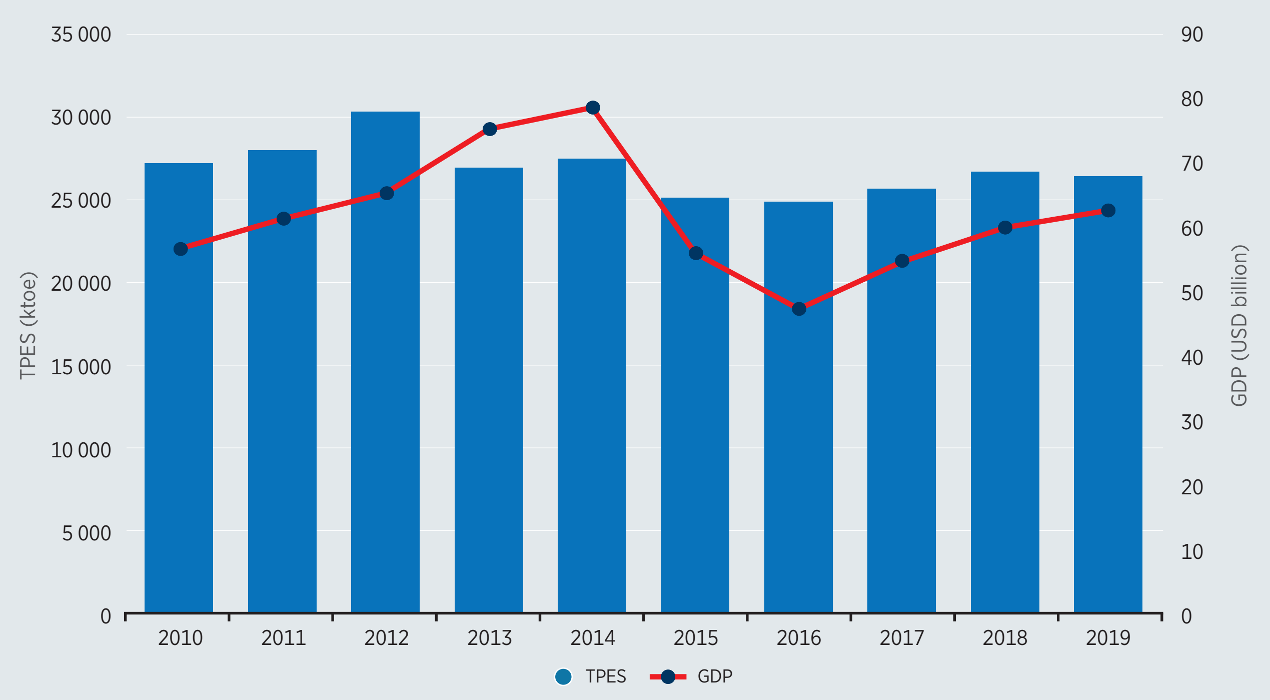
2 *At constant prices.*

Compared to 1990 emissions levels, the energy sector's greenhouse gas emissions decreased by 41%

The supply[3] of electricity, gas, steam and hot water contributes only 3% of GDP (BYR 3.95 billion, USD 1.9 billion) (BELSTAT, 2020d). This is largely due to very low domestic production of energy and an overreliance on energy imports. This in turn contributes to the seemingly weak correlation between total primary energy supply (TPES) and GDP as shown in Figure 4. Belarus imports most of its energy, particularly natural gas, from the Russian Federation at inexpensive prices. This has over time resulted in the high use of gas in both electricity and heat generation. Crude oil is also imported and refined into petroleum products for domestic use and for exports, mainly to Ukraine. In 2019, gross energy imports amounted to USD 9.9 billion and the net energy import balance was USD 3.6 billion (BELSTAT, 2020c), which significantly contributed to the country's trade deficit.

Although energy supply is not significantly correlated to GDP, the energy intensity of the economy (*i.e.*, the ratio of gross inland energy consumption to GDP) is high in relative comparison to EU countries, which signals a continued need for energy efficiency measures. As is shown in Figure 5, the energy intensity by power purchasing parity of Belarus is much higher than the EU average.

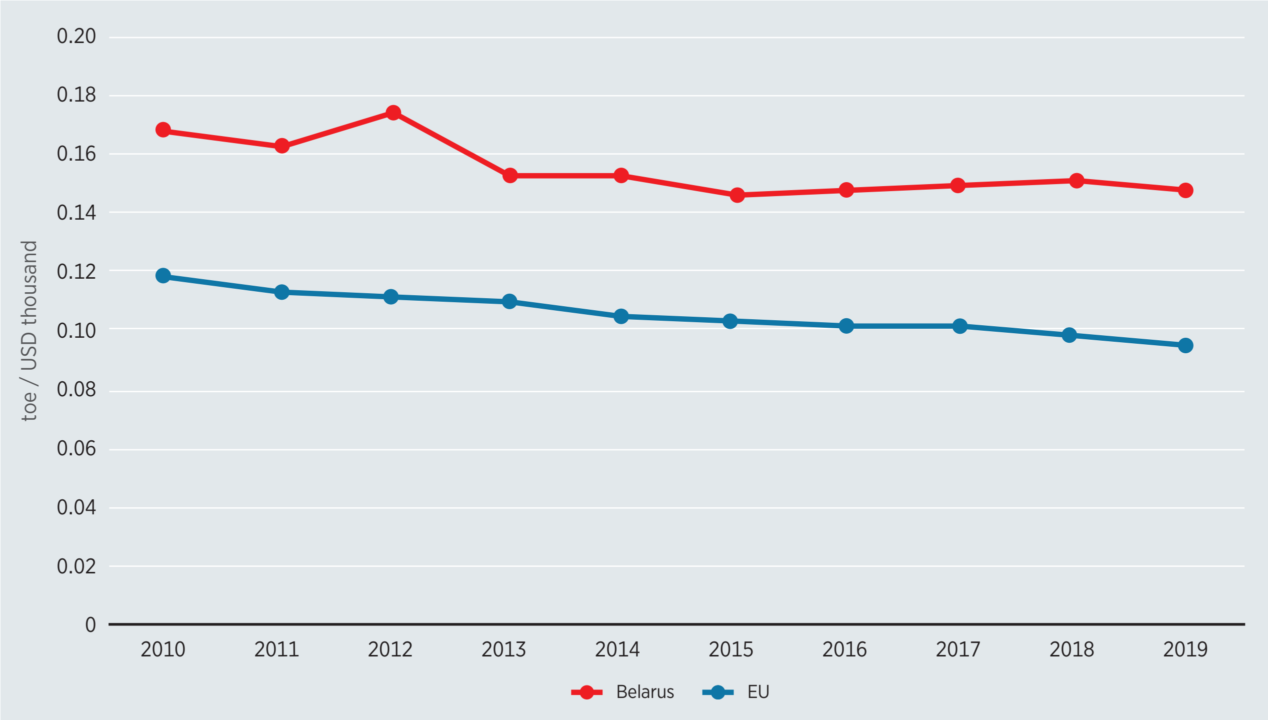
Figure 4 Correlation between TPES and GDP



Source: BELSTAT (2020e)
Note: ktoe = kilotonne of oil equivalent

3 Supply refers to all domestically produced electricity, gas, steam and hot water, and domestically provided services such as distribution and transmission and the sale of the same.

Figure 5 Energy intensity of GDP of Belarus compared to EU, 2010-2019



Source: Adapted from EUROSTAT (2020), BELSTAT (2020e)
Note: toe = tonne of oil equivalent

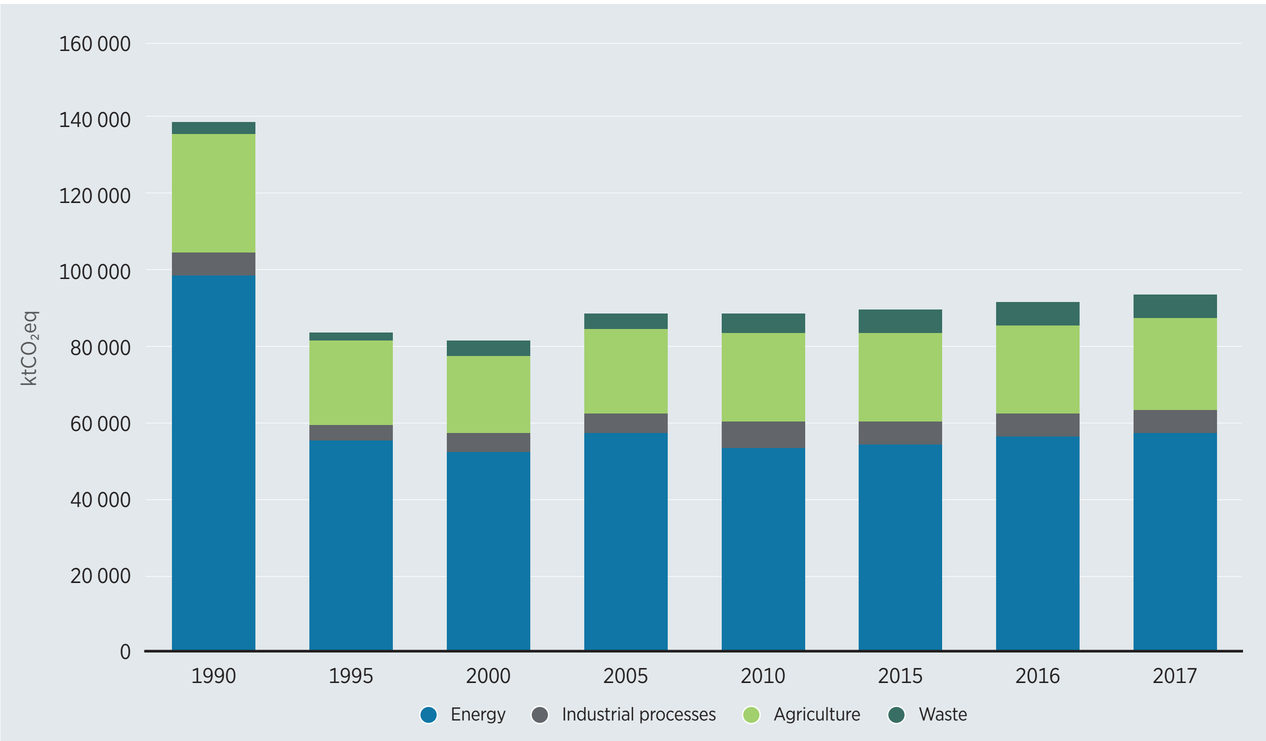
Greenhouse gas emissions

As shown in Figure 6, and according to the latest greenhouse gas (GHG) inventory, GHG emissions decreased by 32.5% in 2017 (93.96 megatonnes of carbon dioxide equivalent [$MtCO_2$-eq]) from their 1990 levels (139.27 $MtCO_2$-eq) excluding the land use, land use change and forestry sector (LULUCF). This fall can mainly be attributed to a decrease in emissions from the energy sector. The energy sector, which includes transport fuels, is the largest contributor to GHG emissions, contributing 61% of the total national emissions in 2017. However, when compared to 1990 emissions levels, the energy sector's GHG emissions have decreased by 41%, owing to reduced energy consumption, the implementation of energy efficiency policies, and a change in fuel consumption structure with the decreased use of highly GHG-emitting coal and oil products in the industrial and services sectors. The agricultural sector is the second-largest contributor to GHG emissions (26%; 24.04 $MtCO_2$-eq) but has decreased by 25% compared to 1990 levels owing to a decrease in agricultural production. Emissions from industrial processes and waste each contribute a further 6.5% of total GHG emissions (UNFCCC, 2019).

Investment environment

Capital investments in Belarus amounted to USD 11.3 billion in 2019. Investments were primarily in the manufacturing industry (USD 2.58 billion) and real estate (USD 2.57 billion), followed by USD 1.3 billion in agriculture, forestry and fisheries and USD 1.2 billion in the supply of electricity, gas, steam, hot water and air conditioning (BELSTAT, 2020f). Foreign investment in the country is relatively limited, but has been rising in recent years. In 2019, gross foreign investment flow into Belarus amounted to just over USD 10 billion, and the net inflow of foreign direct investment was USD 1.33 billion (BELSTAT, 2020g).

Figure 6 Change in GHG emissions, 1990-2017



Source: UNFCCC (2019)
Note: $ktCO_2eq$ = kilotonne of carbon dioxide equivalent

The corporate tax rate stands at 18% and at 25% for banks, insurance companies and foreign exchange companies. A flat tax rate of 13% is imposed on personal incomes, and the standard rate of value added tax (VAT) is 20% on most supplied products, services and imports, rising to 25% for telecommunications (Deloitte, 2021).

According to the World Banks' Ease of Doing Business ranking, Belarus is ranked 49th globally (out of 190) and 11th (out of 24) in the European and Central Asian region (World Bank, 2020a). The highest ranking category is "getting electricity", for which Belarus ranks third in the European and Central Asian region. This is due to minimal administrative procedures for electricity connection, the costs for each procedure, and the reliability of electricity supply and transparent communication on tariffs and tariff changes. There are only three administrative procedures for obtaining an electricity connection, which take approximately 105 calendar days to complete. The cost for electricity connection is 84.4% of the average monthly income per capita, which is considered relatively low in comparison to the region (World Bank, 2020a). Moreover, the reliability of electricity supply is high, with a system average interruption duration index[5] of 0.5, owing to the country's automated tools for monitoring outages and restoring services efficiently. Effective tariffs are readily available online and customers are notified of tariff changes well ahead of billing cycles.

Financial sector

The financial sector in Belarus is dominated by banks, of which commercial banks represent approximately 85% of the total financial assets (valued at about three-quarters of the national GDP). The Belarus Development Bank represents 7% of total financial assets, while leasing, microcredit and insurance companies account for roughly 5%. The banking sector comprises 27 banks, of which 19 have some degree of foreign capital. Nonetheless, the sector is dominated by state-owned banks, which account for about 65% of the banking sector's assets. Five of the largest banks account for close to three-quarters of the capital.

At the end of 2017, the loan-to-deposit ratio stood at 140%, rendering banks relatively non-liquid. Thus, intermediation levels were low, and domestic credit to the private sector amounted to 25.8% of GDP in 2016. Non-performing loans stood at 13%. Performing loans were largely household borrower loans which, as a result, are rated as least risk. The banking sector is highly dollarised, with the share of foreign currency deposits at 70% (EIB, 2018). As such, it is subject to risks in exchange rate depreciation. Nonetheless, most of the state-owned enterprises, with their significant contribution of deposits to the banking sector and critical role in the economy, are unhedged from currency risk.

Table 1 Ease of doing business ranking for Belarus

	Ease of doing business	Starting a business	Dealing with construction permits	Getting electricity	Getting credit
Global ranking	49	30	48	20	104
Ranking in Europe and Central Asia	11	9	10	3	22

Source: World Bank (2020a)

4 The system average interruption duration index, also known as SAIDI, is an indicator of electrical supply reliability and reflects the number of hours of interruption incurred by an average customer in a year

Concessional financing by international financial institutions (IFIs) has been the largest proponent of green financing in Belarus, although the IFIs' involvement has slowed down recently. Although IFI financing is provided with more favourable terms, for public project financing, IFIs perceive municipalities and state-owned enterprises to have rather low creditworthiness and therefore almost always require a sovereign loan guarantee. Such guarantees need to be approved by Parliament before lending. Given that the state is wary of the level of debt, such financing instruments are not always readily taken up.

A bond market is also present in Belarus. Foreign bonds, *i.e.,* bonds issued by foreign entities in local currency, can only be accessed by the state and are otherwise not possible in Belarus. Local bonds make up only about 10% of the total bond market and are mainly issued by the administrative regions. Bond revenues that are tax exempt exist, but their interest rates are high and their tenures are short, which ultimately impedes their utilisation (EuropAid, 2020).

Regional co-operation

Belarus participates in several regional unions and bilateral agreements. It is a member of the Commonwealth of Independent States (CIS)[5] along with 11 neighbouring countries. The CIS member states have agreed to form a common economic space for the free movement of goods, services, workforce and capital, and to harmonise monetary policies on tax, pricing, customs and external relations (CIS, 2020). Through the CIS, Belarus committed to implementing various bilateral and international treaties concerning regional energy sector relations and power system operations.

In advancing the agreements under the CIS, since 2015, Belarus has been a member of the Eurasian Economic Union (EAEU), along with Armenia, Kazakhstan, Kyrgyzstan and the Russian Federation. The EAEU members agreed to "develop long-term mutually beneficial cooperation in the energy sector, conduct coordinated energy policies and gradually create common energy markets with a view to ensuring energy security" (EnC, 2018). The member states are working towards conceptualising the creation of a common electricity market based on agreed principles, including a stepwise transformation and unbundling of vertically integrated state-owned power companies, a common electricity market model and a synchronous operation of member states' power systems.

Belarus also participates in the Armenia-Belarus-Kazakhstan-Kyrgyzstan-Russian Federation Common Economic Space (CES). The CES's objectives are to facilitate the free movement of goods, services, capital and workforce among its member countries. Belarus also participates in the European Commission's Eastern Partnership (EaP) programme, which aims to strengthen relations between the EU's member states and its eastern neighbouring countries, namely Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine (European Commission, 2020). Under the EaP, four main priority areas for co-operation are established, including economy, governance, connectivity (power connectivity, energy efficiency, climate change) and society. Belarus is also a part of the EU4Energy Programme, which aims to strengthen energy statistics, energy policy design and regulatory frameworks and facilitate access to information among the partner countries of the programme.

5 *The CIS includes the following member states: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, the Kyrgyz Republic, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.*

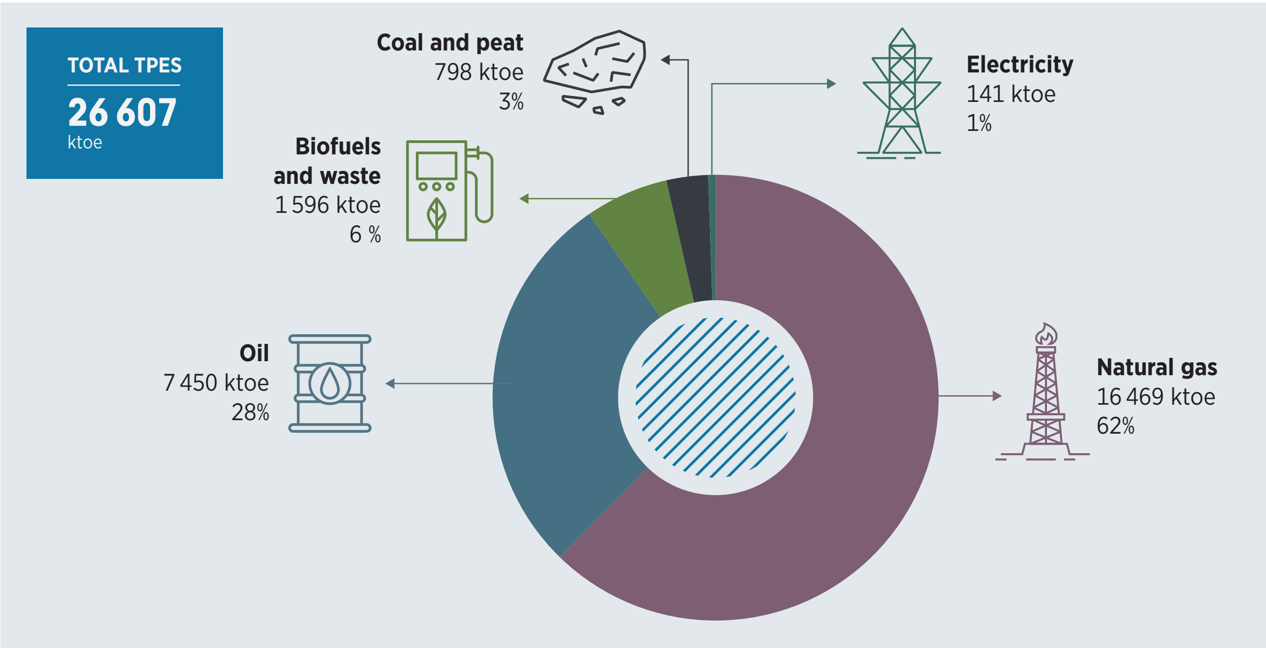
2 ENERGY SECTOR CONTEXT

2.1 ENERGY BALANCE

Total primary energy supply

The energy mix of Belarus is overwhelmingly fossil-fuel based. In 2019, Belarus's TPES amounted to 26 607 ktoe, of which the largest share was natural gas at 62% of TPES, followed by oil at 28%, and biofuel and waste at 6%. The total share of renewables in the TPES was 7.1% (BELSTAT, 2020e).

Figure 7 Total primary energy supply by fuel, 2019



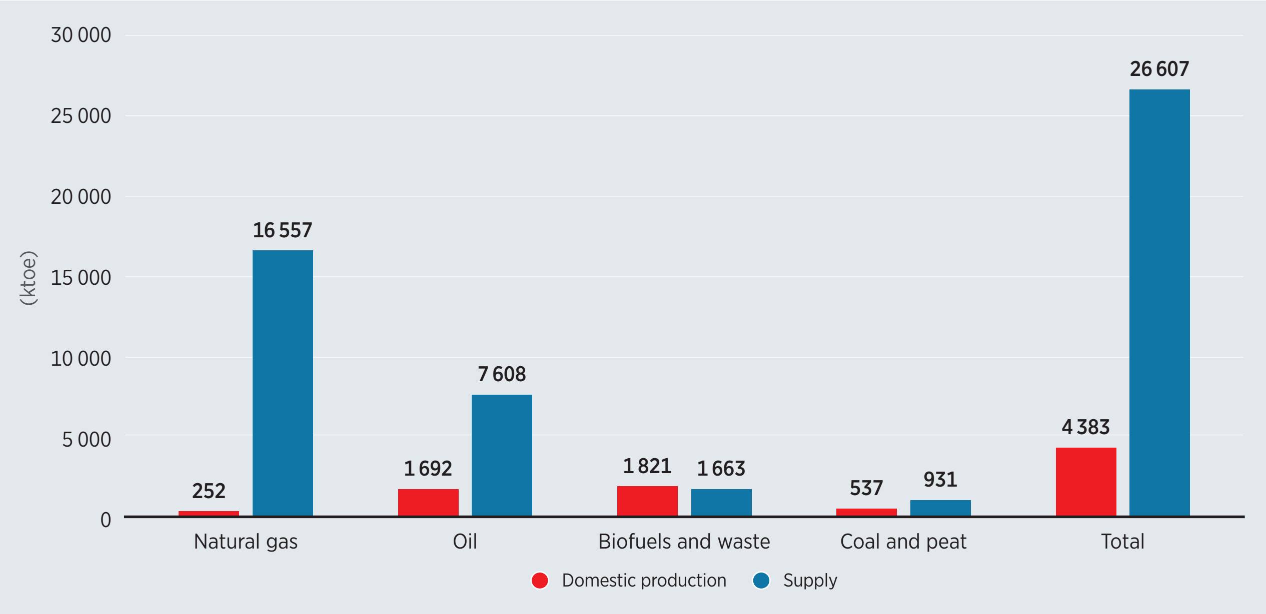
Source: BELSTAT (2020e)

Energy exports and imports

Belarus is highly dependent on energy imports, mainly from the Russian Federation, and is one of the world's leading energy import-dependent countries. The country's energy sufficiency, or the ratio of energy produced nationally compared to TPES, is valued at only 16.5%. The bulk of the energy supply is covered by energy imports, which amount to 84.8% of the TPES (BELSTAT, 2020c).

Figure 8 compares domestic energy production and supply of energy by fuel. The largest fuel import dependency is natural gas. Only 2% of natural gas supplied is produced locally, which makes Belarus one of the countries most dependent on natural gas imports in the world. Crude oil is imported in similar quantities, but is refined and exported in significant amounts to Ukraine.

Figure 8 Domestic production vs. supply of energy by source, 2019

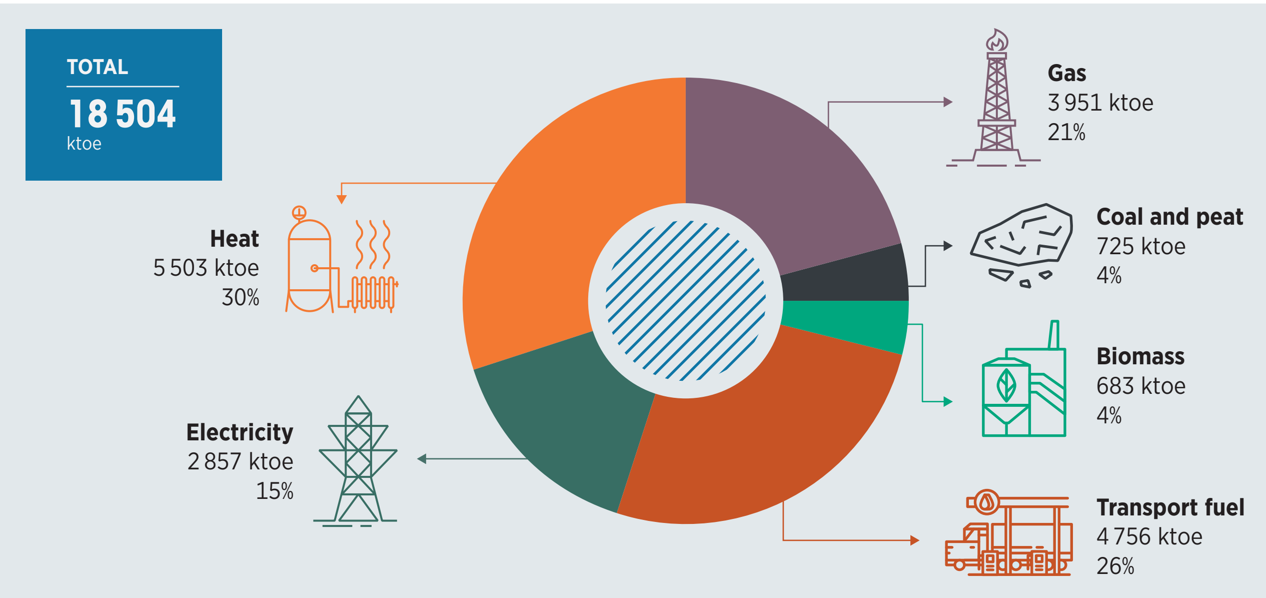


Source: BELSTAT (2020e)

Final energy consumption

The final energy consumption is 70% of the TPES (*i.e.,* 18 505 ktoe), with transformation, distribution and non-energy use losses accounting for 15%, 4% and 12%, respectively. As is shown in Figure 9, heat[6] is the largest share of final energy consumption (30%), followed by transport fuel (26%), natural and liquid petroleum gas (21%), electricity (15%), and lastly by biomass, coal and peat (BELSTAT, 2020e).

Figure 9 Final energy consumption by energy type, 2019



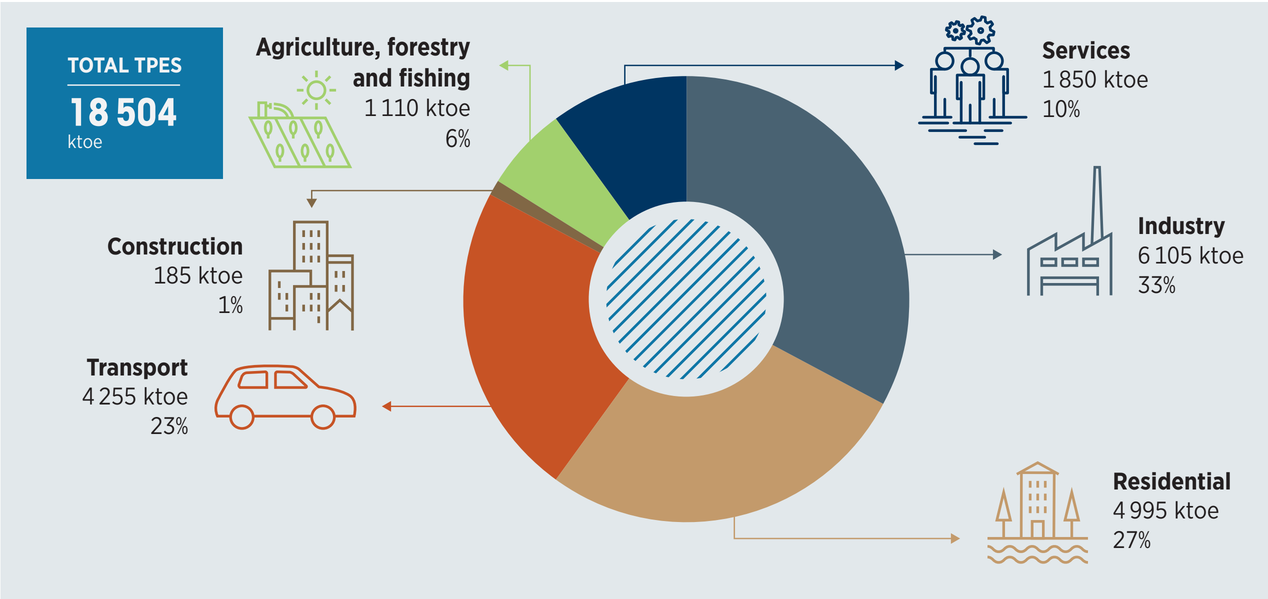
Source: BELSTAT (2020e)

6 *Heat in statistical reporting of final energy consumption refers to distributed heat (including district heat supply, hot water supply and steam supply for industrial processes) and heat produced from local boilers with installed capacities of less than 0.5 gigacalories per hour (593 kWthermal).*

Figure 10 shows final energy consumption by sector. The industrial sector is the largest energy consumer, consuming a third of total final energy, followed by the residential sector (27%), the transport sector (23%), services (10%), and agriculture, forestry and fishing, and the building sector (BELSTAT, 2020e).

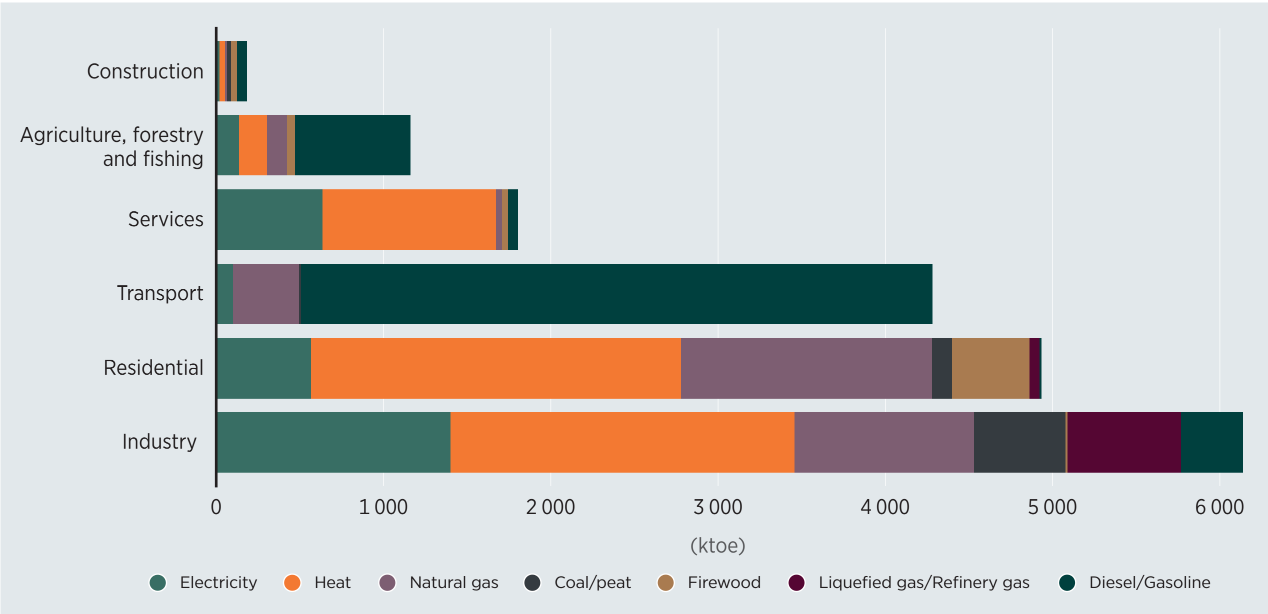
Figure 11 shows the breakdown of each sector's final energy consumption by carrier or fuel. The industrial sector largely consumes heat (33.7% of the sector's energy consumption), followed by electricity (22.7%) and natural gas (17%). The residential sector's energy consumption is largely composed of heat (44.8%), followed by natural gas (20.8%) and electricity (11.4%), while the transport sector is the largest consumer of fossil fuel such as motor gasoline and diesel (88.2% of the sector's energy consumption).

Figure 10 Final energy consumption by sector, 2019



Source: BELSTAT (2020e)

Figure 11 Final energy consumption in sectors by carrier/fuel, 2019

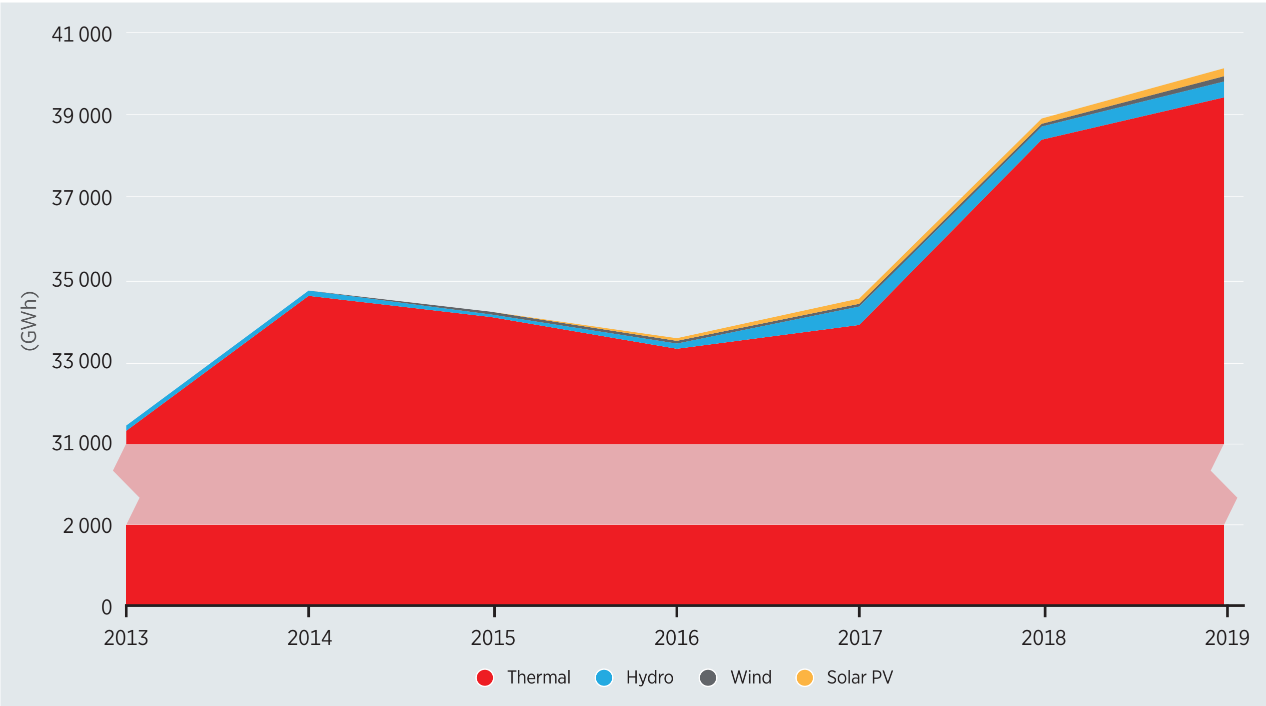


Source: BELSTAT (2020e)

2.2 ELECTRICITY BALANCE

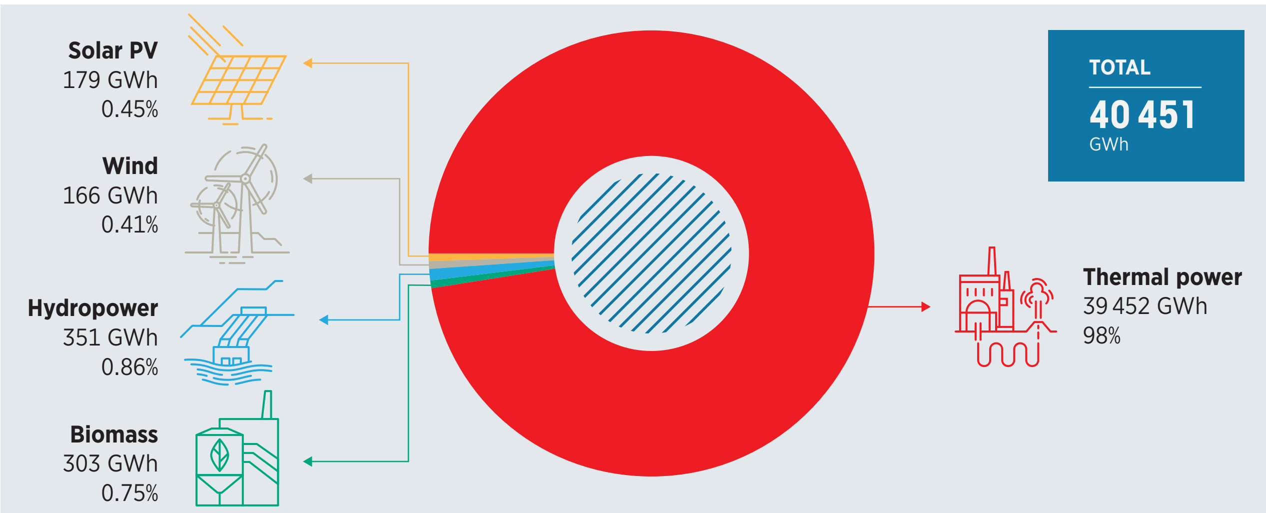
The production of electricity has significantly increased in recent years with increased installed capacities. Since 2005, when electricity production stood at 31 terawatt hours (TWh), production has increased by over 30%. In 2019, production amounted to 40.5 TWh. Figure 12 shows the steady increase in electricity production over recent years and a very slight increase in the renewable energy share. Electricity is largely produced by thermal power plants (98.3% of total electricity production), which are predominantly fuelled by natural gas. Hydropower, solar PV and wind power account for 0.9%, 0.5% and 0.4% of electricity production, respectively (BELSTAT, 2020h).

Figure 12 Electricity production, 2005-2019



Source: BELSTAT (2020h)
Note: The Y-axis is truncated. GWh = Gigawatt hour

Figure 13 Electricity production by source, 2019

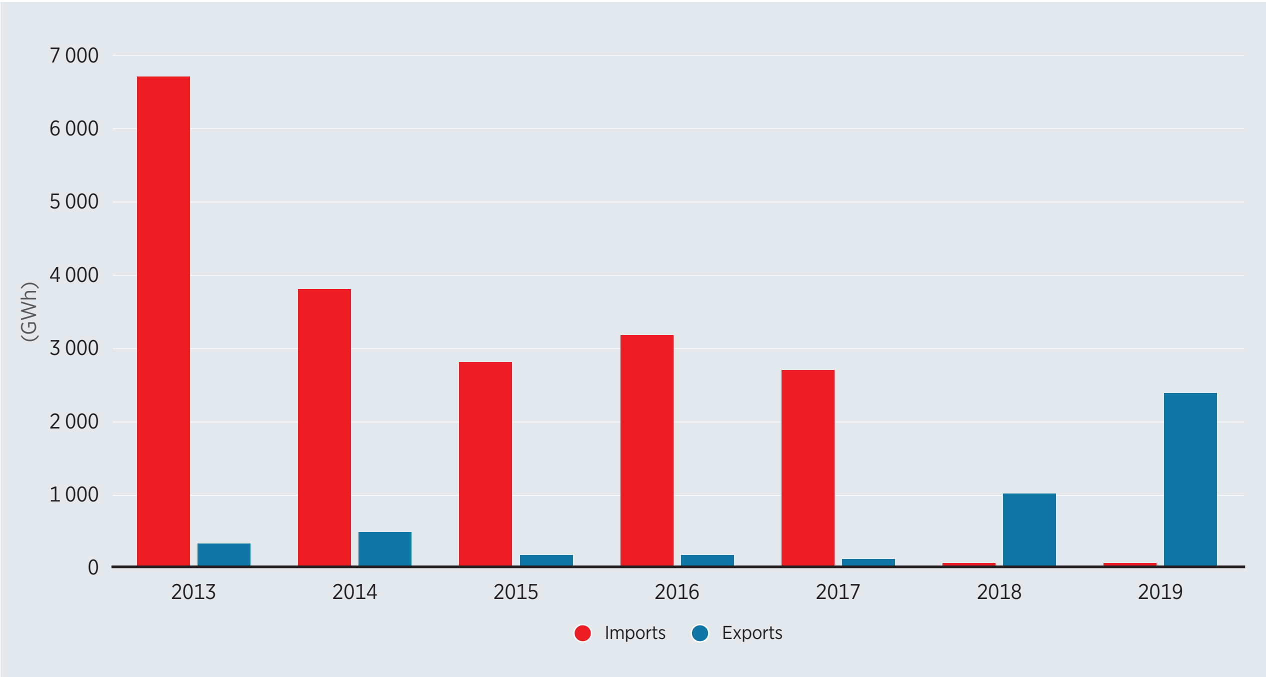


Source: BELSTAT (2020h)

Until 2017, Belarus imported more electricity than it exported. However, with the additional installed capacities and energy efficiency measures, in 2018 it became a net electricity exporter, net exporting 2 338 gigawatt hours (GWh) of electricity by 2019 – the equivalent of 5.8% of its total electricity production (BELSTAT, 2020h). Electricity is exported to Ukraine and the Baltic states.

In 2019, after accounting for exports and imports, the total available electricity supply amounted to 38.1 TWh, of which 94.3% was supplied by BelEnergo (35.9 TWh) (BelEnergo, 2020a). Finally, after accounting for own power use by power plants (2.2 TWh; 5.8%) and electricity transmission and distribution losses (2.7 TWh; 7.1%), the final electricity consumption in 2019 was 33.2 TWh (BELSTAT, 2020h).

Figure 14 Electricity imports and exports, 2013-2019

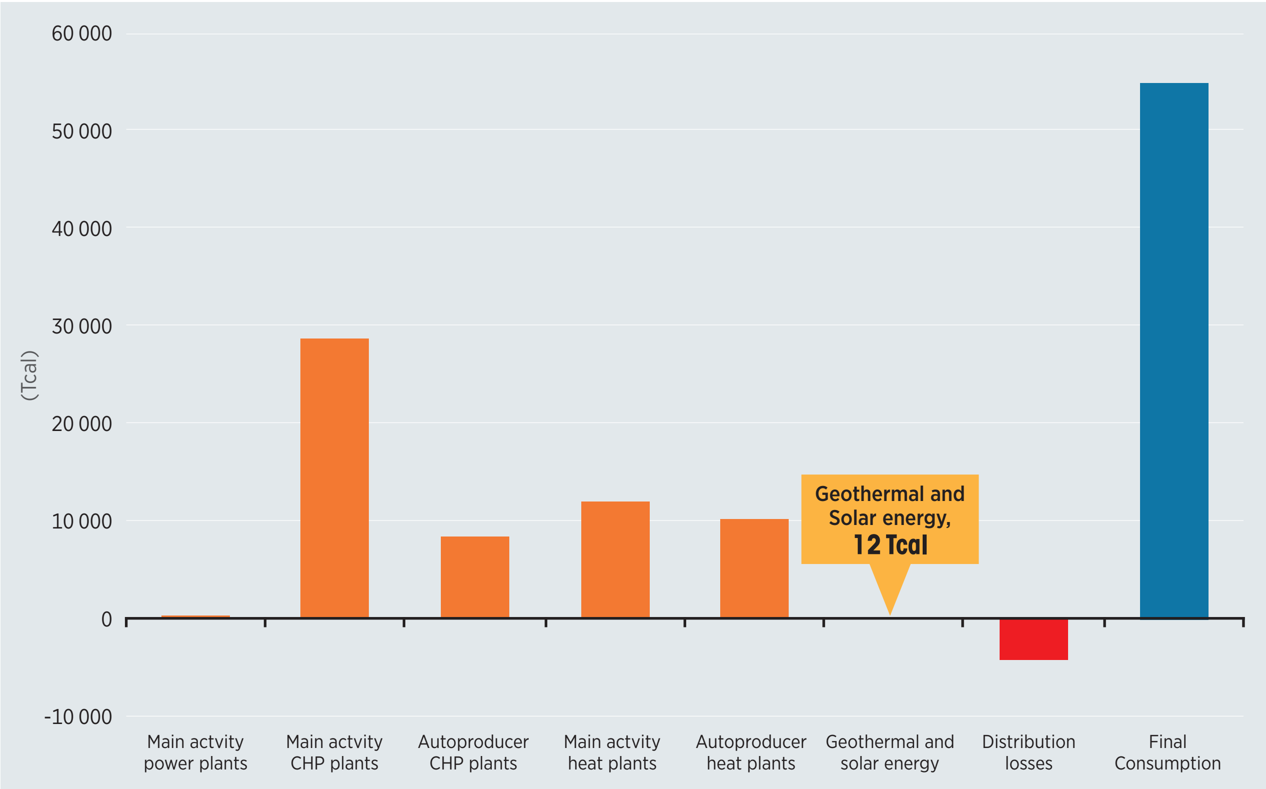


Source: BELSTAT (2020h)

2.3 HEAT BALANCE

Belarus has a vast district heating network serving about 70% of the population (Euroheat & Power, 2017). Heat is largely produced by combined heat and power (CHP) plants fuelled by natural gas, while renewables account for 10.6% of the total heat production. The renewable share in heat production is almost entirely based on biomass, and negligible amounts (0.02%) of geothermal and solar thermal heat production. In 2019, the total heat production amounted to 59 269 tera calorie (Tcal). Heat distribution losses accounted for 7.3% of production, which rendered final heat consumption 54 971 Tcal (BELSTAT, 2020i).

Figure 15 Heat production by type of plant, 2019



Source: BELSTAT (2020i)

2.4 POWER INFRASTRUCTURE

At the end of 2019, installed power generation capacities in Belarus amounted to 10 297 megawatts (MW), of which 391.8 MW were renewable energy power plants. Solar PV was the largest renewable energy installed capacity (154.3 MW), followed by wind (106.1 MW) and hydropower (95.7 MW). Over 86% of installed capacities were owned by BelEnergo, while the rest were owned privately or by local districts. BelEnergo's power plants included 42 thermal power plants, 25 hydroelectric power plants and 1 wind power plant. In November 2020, Belarus commissioned its first 1.11 GW nuclear power plant.

Table 2 Installed power generation capacities, end 2019

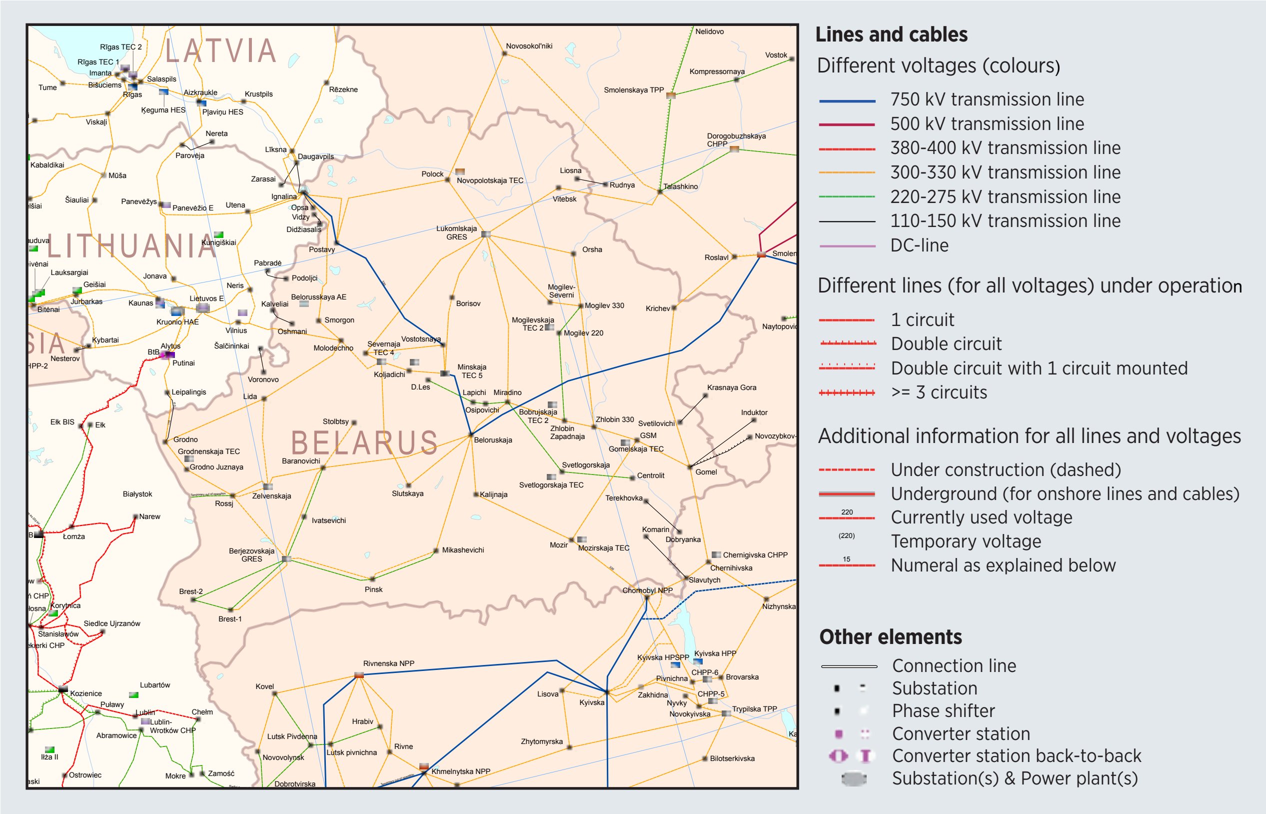
Type of power plant	Installed capacity (MW)	BelEnergo (MW)
Thermal power plant	9 685.9	8 829.9
Renewable energy plant	412.3	117.5
Hydro	95.3	88.3
Solar PV	154.3	-
Wind	102.7	9.0
Biogas	34.4	0.5
Biomass-wood fuel	25.7	19.7
TOTAL:	**10 098.2**	**8 947.4**

Source: Ministry of Economy (2018), BelEnergo (2020)

Belarus's power grid system consists of 279 730 km of transmission, distribution and interconnection lines and a total of 1 357 transformer substations. Distribution lines are exclusively 0.4 kilovolts (kV) to 35 kV, while 110 kV lines serve both distribution and transmission of power. As shown in Figure 16, the main transmission network is represented by 110-330 kV transmission lines, 110-330 kV substations and high-pressure power plant switchgears. In terms of regional interconnections, one 750-kV overhead line, along with three 330-kV lines, connect the Belarusian power system with that of the Russian Federation. Furthermore, two 330-kV lines connect Belarus to Ukraine, five 330-kV lines connect to Lithuania, while one 220-kV and two 110-kV lines connect to Poland. Belarus transits electricity from mainland Russian Federation to the Russian region of Kaliningrad, Poland and, until recently, to Lithuania. Since the commissioning of Belarus's nuclear power plant, Lithuania has blocked the electricity inflow from Belarus.

In terms of e-mobility infrastructure in Belarus, there are currently some 350 electric cars, public transport fleets (including 119 electric buses and 1 900 trolley buses) and 251 fast and slow charging stations owned by the Belarusian automobile fuel retailer Belorusneft. The uptake of electric cars has gained momentum, and the country plans to install 600 charging stations by the end of 2021 and have 30 000 electric vehicles on the road by 2025 (EMEurope, 2019).

Figure 16 Power grid map



Source: ENTSO-E (2020)

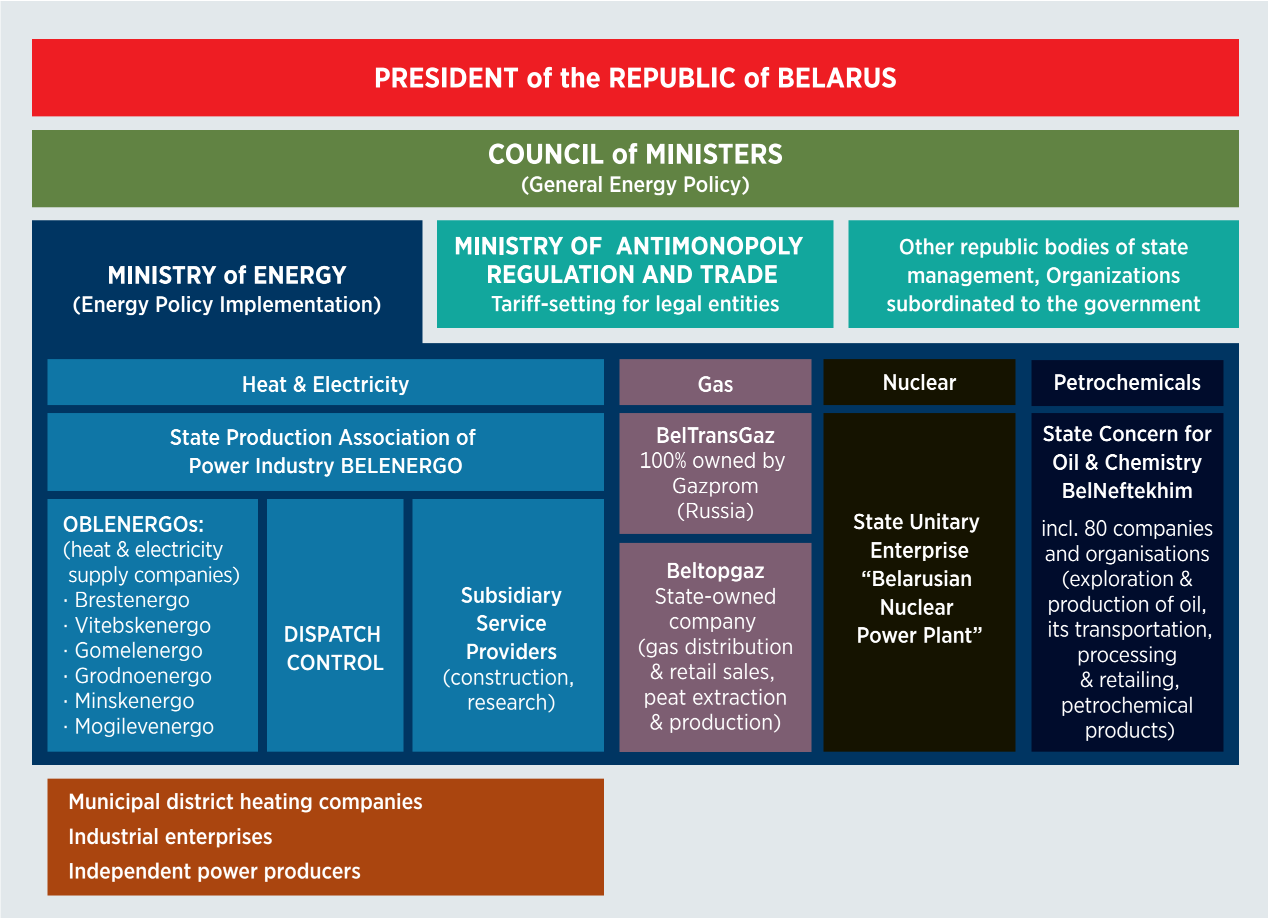
This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

2.4 INSTITUTIONAL FRAMEWORK

State policy and regulation within the energy sector, including energy efficiency and renewable energy, is ultimately implemented through decrees and directives adopted by the president of the Republic of Belarus. The Council of Ministers adopts resolutions to guide energy sector development strategies, ensure the implementation of policies and regulate residential end-user energy tariffs upon the president's approval. Legislative measures within the energy sector are prepared by the Ministry of Energy and experts in the sector before they are submitted for approval through the National Assembly.

In terms of energy sector regulation, there is no single independent body acting as an energy regulatory authority. Instead, residential energy tariffs are regulated by the Council of Ministers and approved by the president, while electricity and heat tariffs for all non-residential sectors, including tariffs for electricity and heat sales to industry and for electricity sale by independent power producers (IPPs), are regulated by the Ministry of Anti-Monopoly Regulation and Trade (MART). The role of key institutional stakeholders in the energy sector is discussed below, and Figure 17 schematically outlines the institutional governance structure of the sector.

Figure 17 Institutional structure of the energy sector



Source: Adapted from IEA (2020a)

The Ministry of Energy is responsible for the energy sector of Belarus and ensures the appropriate use of fuel and energy to meet the demands of the economy and the population. It is tasked with developing energy sector policies, guidelines and strategies; monitoring their implementation; and putting forward measures for improving energy security. The ministry manages and oversees operations of the natural gas supplier Beltopgas; the electricity producer, supplier and retailer BelEnergo; and the Belarusian Nuclear Power Plant as well as other state-owned energy sector institutions. It is also authorised to ensure guaranteed connection of renewable energy generation to the state grid (Ministry of Energy, 2020b).

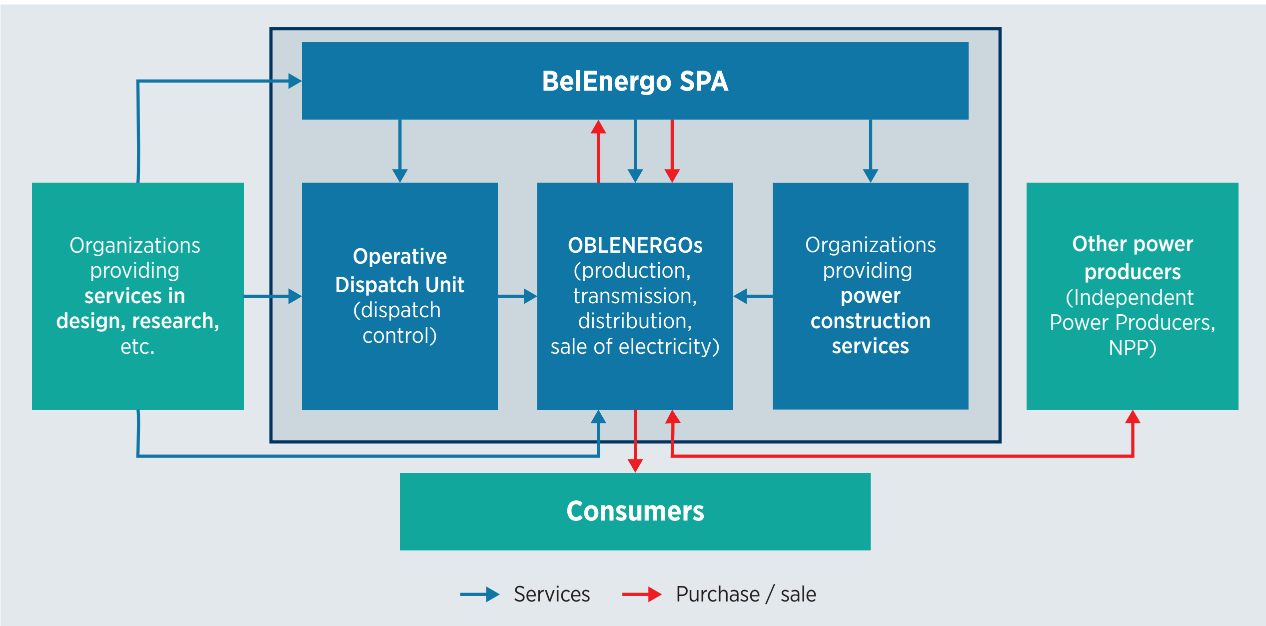
MART is responsible for the implementation of state policies that prevent monopolistic activities and promote fair competition, while also implementing trade policies. MART regulates natural monopolies and, specifically in the energy sector, it sets tariffs for electricity and heat sold by BelEnergo and its subsidiaries to non-residential entities. MART also sets electricity tariffs for independent energy suppliers.

The Ministry of Natural Resources and Environmental Protection is responsible for the exploitation of natural resources, environmental protection and implementation of environmental policies. It is also in charge of identifying suitable locations for renewable energy project development, maintaining the state register of renewable energy projects and issuing certificates of origin to renewable energy generators.

The ministry is the focal point for the United Nations Framework Convention on Climate Change (UNFCCC) and oversees the work of the Republic Unitary Enterprise "Centre for International Environmental Projects, Certification and Audit", which is tasked with the implementation of the commitments under the Paris Agreement and the nationally determined contributions (NDC).

BelEnergo State Production Association of the Electric Power Industry (BelEnergo SPA) is primarily a vertically integrated, fully state-owned electricity and heat producer, supplier and retailer. The association employs 65 000 employees and comprises 27 organisations including regional energy supplying companies; companies for construction, design and installation of energy; and other organisations, such as training institutions. Its main operational objective is to ensure reliable and uninterrupted electricity and heat supply to end users. BelEnergo's main activities include the production, transmission, distribution and sale of electricity and heat; operational dispatch control; power plant and supply network maintenance; and other responsibilities for energy system development (*e.g.,* demand forecasting, investment planning, etc.). BelEnergo is a natural monopoly for energy transmission and distribution, as required by law.[7] It is the dominant electricity generator and the supplier of about 50% of the heat supply. The remainder of the heat supply is provided by municipal district heating companies (IEA, 2020a). Electricity and heat generation, transmission, distribution and sale are carried out by six regional vertically integrated subsidiaries of BelEnergo, *Oblenergos*: Minskenergo, Brestenergo, Vitebskenergo, Gomelenergo, Grodmoenergo and Mogilevenergo (BelEnergo, 2020c). BelEnergo reports to the Ministry of Energy annually and to Parliament occasionally. By monitoring electricity and heat supply and demand trends it prepares energy forecasts and energy sector development plans to guide investments in energy infrastructure.

Figure 18 Operational structure of the electricity system in Belarus



Source: Adapted from EnC (2018)

7 *Regulations on the Association Council approved by the order of BelEnergo, No. 323, 19 December 2014, www.energo.by/content/about/sovet-gpo-belenergo/.*

BelTransGas is fully owned by Russia's Gazprom and is tasked with the operation of the natural gas transit pipelines in Belarus, and thereby the transportation of natural gas from the Russian Federation to neighbouring countries/regions such as Ukraine, Poland, Lithuania and Kaliningrad, as well as to Germany through the Yamal-Europe transmission pipeline.

BelTopGas Fuel and Gasification State-Owned Production Association (BelTopGas SPA) is the state-owned supplier of gas to Minsk and the six regions of Belarus. It incorporates seven regional supply companies and is answerable to the Ministry of Energy. It is tasked with providing a reliable and uninterrupted supply of natural and liquefied gas to consumers, operating the gas distribution network, and building gas retail and sales infrastructure. It is also responsible for peat extraction and processing as well as the production of fuel briquettes for local consumers and export (Beltopgas, 2020).

The National Statistical Committee of the Republic of Belarus (BELSTAT) is tasked with administering national data services by collecting, processing and publishing national statistics. As part of energy statistics, BELSTAT prepares energy balances, which it collects and prepares in co-operation with relevant stakeholders, such as the Ministry Energy and energy enterprises.

The Department of Energy Efficiency at the State Committee for Standardisation of the Republic of Belarus (Gosstandart) is tasked with the drafting and implementation of energy efficiency and renewable energy policies. Furthermore, it sets out standards, norms and requirements for achieving energy efficiency through monitoring compliance of energy-saving products and services, technical and economic compliance of energy generating equipment, and rational use of energy and fuel resources in the country. It also develops financial measures for encouraging energy efficiency.

The Ministry of Economy is responsible for regulation and manages analysis and forecasts pertaining to social and economic development in Belarus. It is tasked with the development and implementation of economic reforms and policies. This includes nurturing entrepreneurship and investments, and privatisation of state-owned enterprises (Ministry of Economy, 2020a).

IPPs are also numerous and have been increasing their presence in the energy landscape of Belarus. IPPs are predominantly renewable energy power producers who sell their electricity to the off-taker, BelEnergo, at feed-in tariff (FiT) prices. In addition, legal entities produce renewable power for self-consumption. These account for about 50% of the renewable energy production in Belarus.

2.5 ENERGY SECTOR POLICY AND LEGISLATION

Belarus's energy policy strives for a reliable, affordable and sustainable energy sector with greater energy security through the reduction of energy imports. As such, the sector aims to reduce over-reliance on imported oil and gas and promote renewable energy and energy efficiency while also commissioning its first nuclear power plant. Developing local energy resources, reducing energy intensity through energy efficiency measures and diversifying away from natural gas in the energy mix have been embraced as critical in achieving the overall sector goals. While there is no comprehensive law on energy, nor specific laws on heat and electricity, several normative legal acts govern the energy sector instead, as outlined below.

Resolution of the Council of Ministers On Approval of Electricity Supply Rules No. 1394, dated 17 October 2011 with the latest amendment on 25 May 2020, governs procedures for connections to the state electricity grid by legal entities, individual entrepreneurs and citizens. It obliges the regional electricity companies (*Oblenergos* – see Chapter 2, Section 5) to offer energy suppliers access to the grid and defines the technical conditions for connection. The resolution sets out the responsibilities of each entity and obliges renewable energy producers to relay real-time information on power production to the *Oblenergos*. It also sets out the procedure for concluding a power supply contract with energy producers.

Law On Energy Savings 2015 specifies the use and implementation of energy-efficient technologies, as well as the requirements for energy-efficient equipment. The law also makes provisions for the creation of energy efficiency policies.

Resolution of the Council of Ministers On Issues in the Field of Heat Supply No. 609, 11 September 2019, approved the heat supply regulations concerning end user relations with suppliers, payment procedures and the connection of individual heat consumption systems to the heat network (Council of Ministers of the Republic of Belarus, 2019).

The energy sector is further governed by the Law on Gas Supply (2003) and the Law on Nuclear Energy (2008). Also relevant to the energy sector are the Law on Industrial Safety and the Law on Environmental Protection.

Currently, there is no specific legislation governing the electricity sector or an electricity market in Belarus. In 2019, Belarus signed the amended Treaty on EAEU for the formation of a common EAEU electricity market. However, given that Belarus does not have a law on electricity markets that includes rules governing wholesale and retail of electricity in a market framework, there is currently no basis for energy companies to participate in the EAEU's common energy market. There are, however, plans to develop a law on electricity markets that would restructure the power sector and set out separate activities for competitive and non-competitive market segments, and govern the relations between electricity providers and end users. The Ministry of Energy has drafted such a law, which has been submitted to the Council of Ministers, but not yet passed on to Parliament. The draft law also aims to harmonise national legislation with the EAEU Treaty and strives for satisfying domestic electricity demand before trading across borders.

Specific renewable energy legislation is further outlined in Chapter 3, Section 2.

The main policy document for the development of the energy sector in Belarus is the third edition of the **Concept of Energy Security of the Republic of Belarus**, approved by the Council of Ministers by Resolution No. 1084 in 2015 and effective as of 2016. It lays out the long-term policy guidelines for the development of the energy sector until 2035 and includes the following key objectives (Council of Ministers of the Republic of Belarus, 2015):

- decreasing dependence on energy imports by increasing energy sufficiency[8] to 20% in 2030 (14% in 2015; 16.5% in 2019)
- diversifying energy resources through a greater participation of renewable energy and nuclear power in the energy mix
- diversifying energy suppliers by reducing the share of the major energy supplier in total energy imports to 70% in 2035 (90% in 2015)

8 The ratio of energy produced nationally compared to energy consumed.

- ensuring reliability of energy supply
- increasing energy efficiency in end use through modernisation of the energy system
- increasing economic and energy efficiency in energy generation and distribution through enabling legal frameworks and upgrading of grid infrastructure
- ensuring end user affordability of energy while phasing out subsidies for electricity and heat
- developing international co-operation with leading energy organisations and expanding energy exports to EU countries
- developing a dedicated law on electricity
- creating a wholesale electricity market
- providing a scientific evidence base for the development of the energy sector including technological advances, energy resource assessments, environmental safeguarding, and demand and supply side management.

A summary of the key targets for the development of the energy sector until 2035 are highlighted in the table below.

In April 2016, the **State Programme for Energy Saving 2016-2020** reinstated some of the targets above, set forth further targets for the deployment of renewable energy by 2020 and identified monitoring measures in tracking the progress of those targets on an annual basis. It defined financial resources and various challenges in achieving the planned targets; however, it lacked concrete implementable measures to achieve the same. Solar PV and wind capacity targets were not reached by the end of 2020. The key targets set out in the programme included (EnC, 2018):

- renewable energy share in the TPES to reach at least 6% by 2020
- domestically sourced primary energy to account for at least 16% of TPES by 2020
- energy intensity of GDP to be reduced by at least 2% by 2020 compared to 2015 levels
- operationalisation of 135 power plants using renewable resources by 2020
- total hydropower capacity of 80 MW by 2020

Table 3 Key targets for energy sector development by 2035

Key targets	2010	2015	2020	2025	2030	2035
Domestic production as share of gross energy consumption (%)	14	14	16	17	18	20
Renewable energy share of TPES (%)	5	5	6	7	8	9
Dominant import supplier (%)	96	90	85	80	75	70
Gas share of gross energy consumption (%)	64	60	57	55	52	50
Gas share in heat and electricity generation (%)	91	90	70	60	50	<50
Energy intensity of GDP (ktoe/BYR[9])	426	378	370	353	317	268

Source: Council of Ministers of the Republic of Belarus (2015)

9 At BYR value in 2015.

- total solar PV capacity by of 250 MW by 2020 and additions of solar PV distributed systems
- total wind power capacity of 200 MW by 2020
- increased production and use of biomass, including increased use of biofuels in the transport sector (without targets)
- increased uptake of solar water heaters, such as for drying products in agriculture, and water heating in the residential sector (without targets).

In February 2021, a new **State Programme for Energy Saving 2021-2025** was adopted that set out a new renewable energy target by 2025, namely an 8% share of renewable energy production in the TPES in 2025. The programme also aims to reduce the energy intensity of the GDP by 2026 by at least 7% compared to its 2020 level. It also puts forward increased energy efficiency strategies and specific projects for the development of biomass and electric heat pumps in heat supply. Furthermore, the document lays out the financial resources for the programme and defines the risks and risk mitigating mechanisms for the execution of the programme. The main risks are related to adequate funding for the programme, timely adjustment of the consolidated targets and indicators in the Concept of Energy Security, and timely registration of planned changes in legislation.

Specifically for the power sector, the **Comprehensive Plan for the Development of the Electric Power Industry until 2025** was approved by the Decree of the Council of Ministers by Resolution No. 169 in 2016, and lays out specific implementation activities and timelines for the development of the electricity sector until 2025. It includes the following key elements:

- phase out electricity tariffs subsidy by 2020
- unbundle the electricity sector by 2025
- create a wholesale and retail electricity market
- commission a nuclear power plant (NPP) of 2 400 MW by 2020
- integrate the NPP grid by installing 985 MW of electric boilers with BelEnergo
- reduce the share of natural gas in heat and electricity supply to 60% by 2025
- increase reserve power capacity by an additional 800 MW

expand charging infrastructure for e-vehicles .

The **Sectoral Programme of Electricity System Development for 2016-2020** foresaw the restructuring of the power sector, and the unbundling of vertically integrated BelEnergo into separate generation, transmission, distribution and sales entities – activities that to date have not been achieved. In addition, the programme aimed to develop legislation for electricity regulation by setting out the operational relations between the state and power sector entities, limiting the degree of state involvement in regulating energy tariffs, and drawing up the foundations for a wholesale and retail energy market (IEA, 2020a).

Although not a state programme initiated by the Council of Ministers, the **Programme for the Development of Charging Infrastructure and Electric Transport 2016-2025** supplements the Presidential Decree on Stimulating the Use of Electric Vehicles. The decree passed an incentive that all electric vehicle permits will be issued with waived fees and that the state enterprise Belorusneft will be the state operator for the creation and development of a charging network for electric vehicles. The programme foresees the introduction of up to 30 000 electric vehicles by 2025 (EMEurope, 2019).

The government of Belarus also put in place various policies on mitigating the effects of climate change and the reduction of GHG emissions. In 2005, Belarus ratified the Kyoto Protocol whereby the country committed to the reduction of GHG emissions by 8% compared to 1990 levels within the 2008-2012 period, and a 12% reduction for the period 2013-2020. The target of 12% was later revised to 8% at the Doha Conference of Parties in December 2012. Consequently, a **State Programme of Measures to Mitigate the Effects of Climate Change for 2012-2020** was enacted that aimed to reduce GHG emissions by 8% in 2020 compared to 1990 levels. This amounts to approximately 11 million tonnes of carbon dioxide-equivalent ($MtCO_2$-eq). In 2016, Belarus submitted its intended nationally determined contribution (INDC) following the 21st Conference of the Parties (COP21) in Paris, pledging to reduce its GHG emissions by at least 28% in 2030 compared to its 1990 levels (excluding LULUCF). The achievement of this target is not dependent on carbon market mechanisms or development funds. The INDC is in line with the National Sustainable Development Strategy of the Republic of Belarus. The measures to achieve this reduction include increasing energy efficiency, reforestation (to 41% of forest cover in 2030), restoration of peat lands (to at least 60 000 hectares [ha] by 2030), conservation of natural ecosystems (with protected areas covering 8.8% by 2030), and improved legal and regulatory approaches (UNFCCC, 2016). However, the INDC does not feature potential renewable energy contributions. An updated NDC is currently being drafted and is to be finalised by the end of 2021.

2.7 ENERGY PRICES

Consumer energy pricing in Belarus is based on a complex system of cross-subsidisation whose tariff-setting procedure is based on Law No. 255-3 "On Pricing", and the Resolution of Council of Ministers No. 222. The tariff-setting methodology is based on a "base price" tariff that should represent the real cost of the unit energy production, transport, repair services, depreciation of funds, salaries and social contributions, taxes, and normative profits. The Ministry of Anti-Monopoly Regulation and Trade sets the base tariff based on information provided by BelEnergo (for heat and electricity cost estimates) and BelTopGas (for natural gas and liquid petroleum gas [LPG] cost estimates). However, it is argued that the base price does not truly reflect cost recovery. For certain groups of end-users, energy tariffs are set below the base tariff, and the shortfall is cross-subsidised from higher-tariff end users.

For natural gas, the import price is agreed upon between BelTransGas and the Ministry of Energy. Tariffs for gas consumption by residential consumers are cross-subsidised by higher base tariffs for industrial consumers, although some industrial consumers, such as glass, chemical and fertiliser manufacturers, are also subsidised. Residential consumer tariffs are differentiated by period of year (*i.e.,* during the heating season, tariffs are lower), total consumption volumes and whether the household uses gas boilers and meters.

Heat tariffs are differentiated by type of consumer, *i.e.,* residential, industry, public institutions and by region. According to a World Bank study, residential heat tariffs are between 10% and 21%[10] of the actual unit production cost (World Bank, 2014).

Electricity tariffs are set according to the consumer group and are further differentiated by time of consumption (*i.e.,* peak and off-peak hours). For industrial consumers with a connection capacity of up to 750 kVA (including electrified public transport, pubic institutions and public lighting) a flat rate tariff is applied, while industrial consumers with a connection capacity above 750 kVA have a monthly fee on top of the flat-rate tariff. For residential consumers, the tariff is differentiated by time of consumption and by electricity use (*i.e.,* households with electric stoves have a lower tariff than households using gas stoves). Organisations such as health clinics and other public institutions and religious institutions have a residential tariff applied (OECD, 2018).

Table 4 Consumer tariffs by energy type, 2020

Energy type	Category	Price (USD)*
Electricity / kWh	Residential	0.074
	Industry	0.095
Heat / Mcal	Residential	0.0075
	Industry	0.048
Natural gas / m^3	Residential	0.004
	Industry	0.02
Gasoline / litre	at fuel stations	0.66-0.75**
Diesel / litre	at fuel stations	0.70-0.76**
Methane gas / m^3	at fuel stations	0.29
Propane gas / m^3	at fuel stations	0.36

Source: Adapted from tarify.by (2020)

* *prices are approximated/averaged due to numerous differentiations of price tariff for electricity and heat supply*

** *depending on type and quality*

Note: m^3 = cubic metre; Mcal = megacalories

10 *Depending on the size, condition and fuel used in the district heating system.*

3 RENEWABLE ENERGY SECTOR DEVELOPMENT

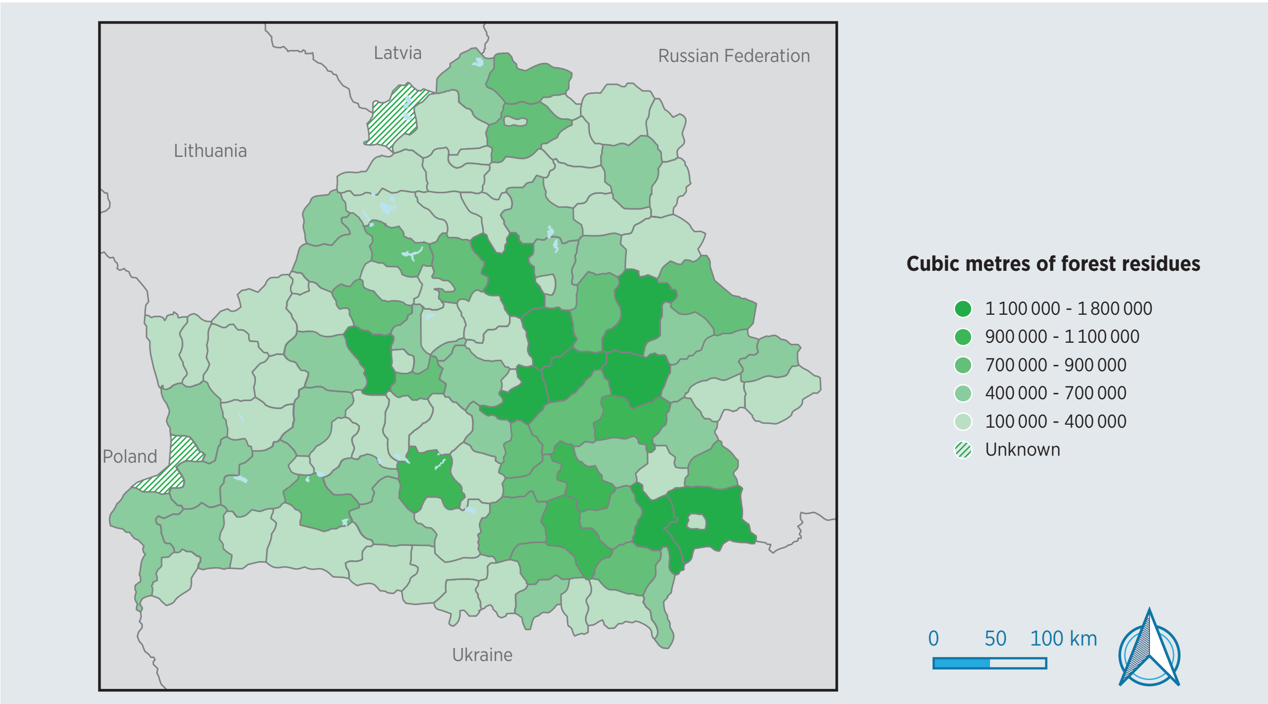
3.1 RESOURCE POTENTIAL

Renewable energy is in a nascent stage in the Belarusian energy sector. The share of primary energy supply from renewables has been steadily increasing over the past decade and in 2019 stood at 7.1%. This share largely comprises biofuels and, to a lesser extent, solar PV and wind. Nonetheless, the country is well endowed with renewable energy resource potential that presents a viable and sustainable pathway for the development of the energy sector.

Biomass

Biomass is the most abundant renewable energy resource in the country. Much biomass potential lies in wood resources, including residues, given the vast expanses of forests[11] covering approximately 40% of the country's surface area. Waste wood resources that can be used for bioenergy production are estimated at 1.5 billion cubic meters (bcm) with an annual growth of 0.03 bcm (IEA, 2016). According to the National Programme on Local and Renewable Energy Development for 2011-15, solid biomass potential is valued at 2.2 million tonnes of oil equivalent (Mtoe)/year, while a further 1.7 Mtoe/year is estimated from agricultural waste (crop residues and straw). Currently, solid biomass is utilised for heat production in heat and cogeneration power plants and boilers, and 8.9 MW is installed for power production (Ministry of Economy, 2018).

Figure 19 Forest residue resources in Belarus



Source: IEA (2016)

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

11 Large forest covers are predisposed to radioactive contamination dating from the Chernobyl nuclear disaster, which renders some quantities of forest residues potentially contaminated and not applicable for onward processing or use.

The potential for biogas production is significant in Belarus, owing to the large quantities of manure available from cattle and poultry farming, residues from crop farming, waste from the food industry, municipal waste and sewage from treatment facilities. Resource assessment studies for biogas potential from these waste sources have not been extensively undertaken; however, several approximations have been made. Namely, these potentials include 2.3 Mtoe/year of biogas production from animal manure and 0.3 Mtoe/year from municipal solid waste. In 2019, the installed capacity of biogas power plants was 26.8 MW (Ministry of Economy, 2018).

Table 5 Technical potential of biogas generation from animal waste

	Cattle	Pigs	Poultry	TOTAL
Manure output (Mt/year)	69.4	4.5	3.2	**77.1**
Biogas potential (bcm/year)	3.1	0.26	0.2	**3.5**

Source: Greenworld.org (2020)

Biofuel production in the form of bioethanol and biodiesel is deemed significant, albeit understudied. The potential for biofuel production is due to the significant agricultural activities, sugar production, and starch and cellulose industries in Belarus.

Hydropower

Given Belarus's relatively flat topography, the country's potential for large hydropower development is insignificant, although the potential for small-scale hydropower (<10 MW) production is feasible in the northern and central regions of the country. The potential hydropower capacity of all bodies of water in Belarus is estimated at 850 MW, of which the technical potential is estimated at 520 MW and economic potential is estimated at 250 MW (UNIDO and ICSHP, 2013).

Historically, Belarus had a large number of very small-scale hydropower plants for electricity production in rural areas and for productive uses, such as sawmills and flourmills. With the expansion of the centralised grid, most of these plants became obsolete and were decommissioned. Currently, the installed hydropower capacity is 95.7 MW, of which 88.1 MW is owned by BelEnergo (BelEnergo, 2020b).

Wind

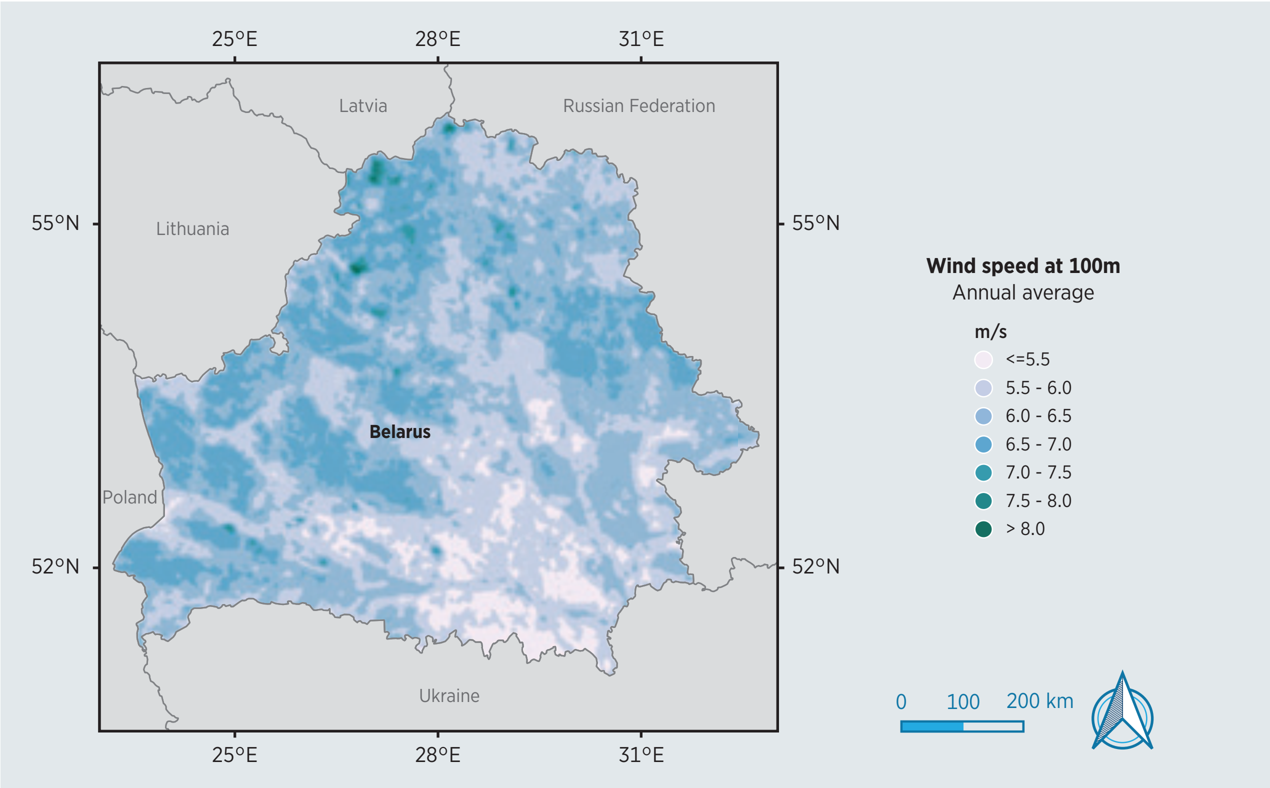
Average annual wind speeds are above 6 m/s (at 100 m hub height) in almost all areas of the country (see Figure 20). In the north, northwest and around Minsk, average annual wind speeds can reach up to 8 m/s, signalling high-quality resource potential for wind power development in the country. In 2019, the installed wind power capacity was 106.1 MW, of which 9 MW were owned by BelEnergo (BelEnergo, 2020b).

Solar

The annual global horizontal irradiation (GHI) in Belarus is between 1000 kWh/m^2 and 1170 kWh/m^2, with the highest irradiation in the south and southeast of the country, indicating significant potential for solar PV development (see Figure 21). In the high-potential areas, solar PV generation yield can reach over 1100 kWh/kW_p annually. In the rest of the country it can reach well above 1020 kWh/kW_p (see Figure 22).

For solar thermal applications, the regions with the highest potential are Brest and Gomel in the south and southeast of the country, which receive on average 60 clear days per year and a direct normal irradiance (DNI) of more than 1050 kWh/m^2 (see Figure 23). In general, the country has potential for solar thermal applications, such as for space and water heating and low-enthalpy process heat in the industry and services sectors (IEA, 2016).

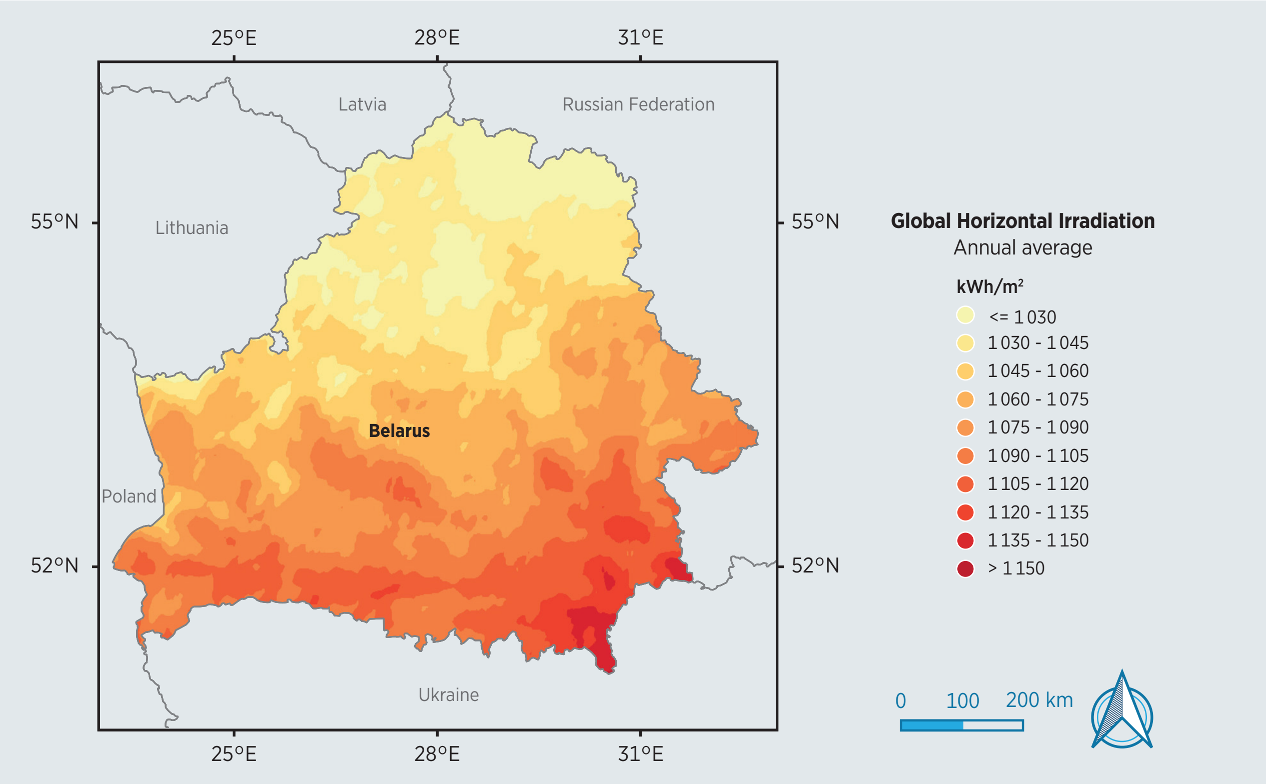
Figure 20 Annual wind speed map at 100 m hub height



Source: IRENA: Global Atlas; Map data: Technical University of Denmark (2021); United Nations administrative boundaries (2021).

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

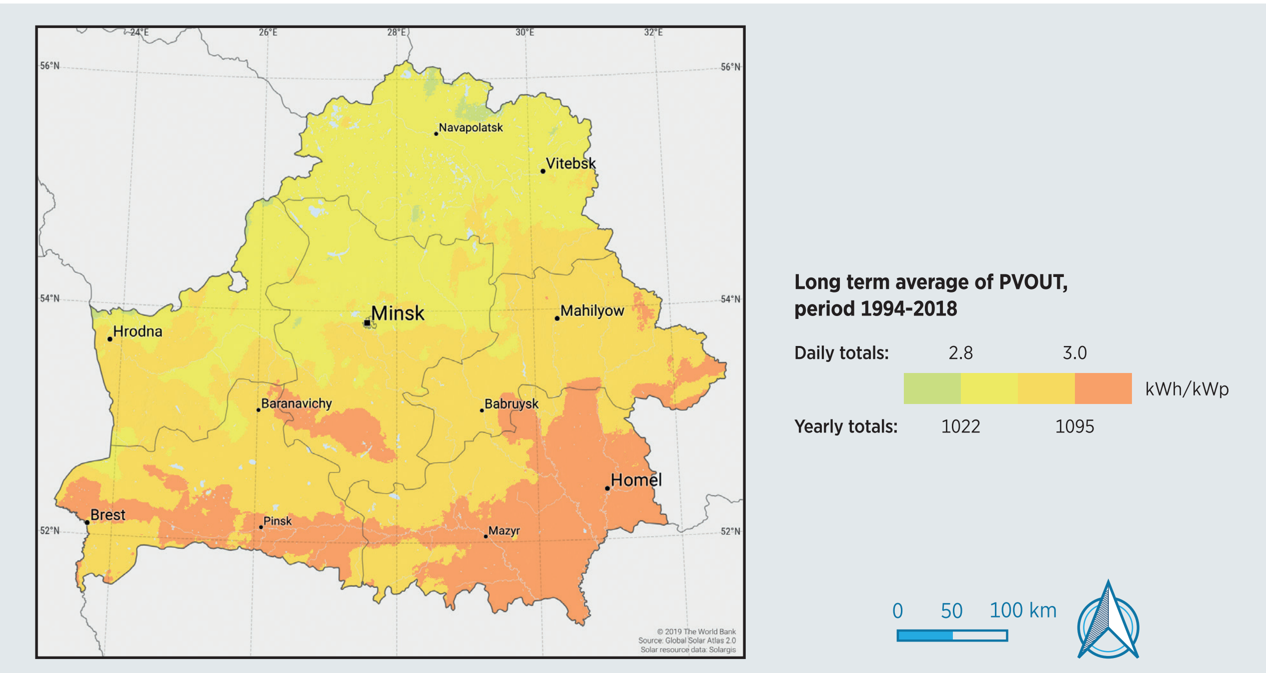
Figure 21 Global horizontal irradiation in Belarus



IRENA: Global Atlas; Map data: World Bank, ESMAP (2021); United Nations administrative boundaries (2021)

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

Figure 22 Solar PV potential in Belarus

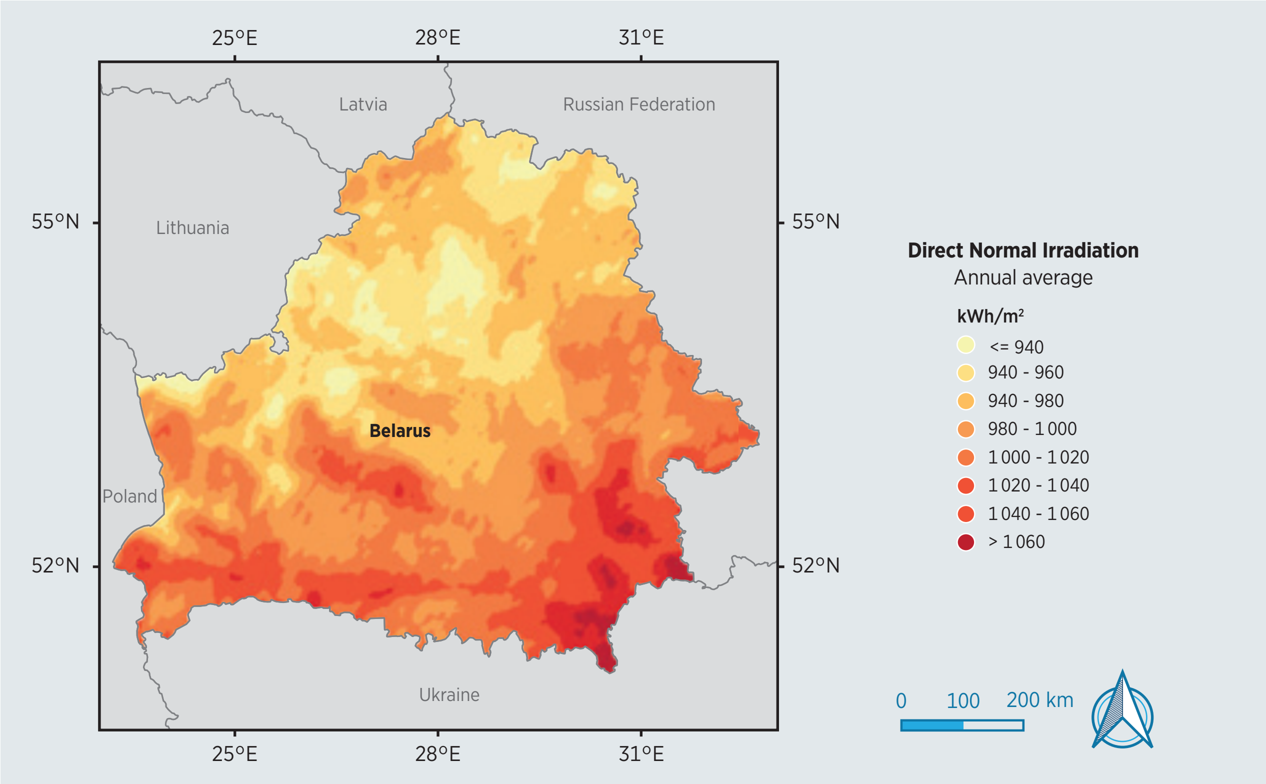


Source: World Bank –ESMAP (n.d.)

Note: PVOUT = the amount of power generated per unit of the installed PV capacity

This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

Figure 23 Direct Normal Irradiance in Belarus



Source: IRENA: Global Atlas; Map data: World Bank, ESMAP (2021); United Nations administrative boundaries (2021)
This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply the expression of any opinion on the part of IRENA concerning the status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

Geothermal

The potential for geothermal is inadequately assessed to date, with studies carried out on only a few regions. In 2018, the first geothermal atlas of Belarus was published, consisting of around 50 detailed maps of the Pripyat Trough showing the most promising geothermal wells at depths between 100 m and 4 km. The atlas includes geothermal gradients, heat flow density and geothermal resources. Although some estimates show that temperatures of 150°C to 180°C are available within the crystalline basement of up to 6 km depths, they are not economically feasible for exploitation. As such, Belarus's geothermal resources are not deemed significant enough for power generation (Dubanevich and Zui, 2019).

In general, geothermal potential is deemed to be most suitable for low-enthalpy heat processes throughout the country. The most promising sites are in the Pripyat Trough in the south of the country and in the Brest region (IEA, 2016). Given the potential for the integration of low-enthalpy geothermal resources into Belarus's district energy systems, in February 2021, IRENA, together with the State Committee for Standardisation of the Republic of Belarus and with technical input from Aalborg University in Denmark, organised a workshop titled "Integrating low-temperature renewable energy sources in district heating and cooling systems". The objective of the workshop was to equip district heating stakeholders in Belarus (including policy makers at the national, regional and local levels; urban planners; and district heating operators/utilities) with various options and tools for integrating low-temperature renewable energy sources in district heating networks.

As of 2019, Belarus had just under 300 geothermal heat pump installations of under 13 MW of installed capacity, which are mainly used for space heating and hot water supply in cottages and hospitals. The largest geothermal installation (two heat pumps with a collective output of 1010 KW) is located at a greenhouse complex in the Brest region, where the water temperature reaches 24°C and flows at about 42 m^3 per hour (Dubanevich and Zui, 2019).

3.2 RENEWABLE ENERGY POLICY AND REGULATION

As discussed in Chapter 2, Section 6 (2.5 Energy sector policy and legislation), the energy sector aims to reduce its over-reliance on imported oil and gas and promote renewable energy and energy efficiency while also commissioning the country's first nuclear power plant (NPP). Developing local energy resources, reducing energy intensity through energy efficiency measures and diversifying away from natural gas in the energy mix have been embraced as critical in achieving the overall sector goals. As such, the deployment of renewables is central in fulfilling the energy sector's development goals. According to the newly adopted State Programme on Energy Saving 2021-2025, the renewable energy target by 2025 is an 8% renewable energy share in the TPES, which differs from the 7% renewable energy share of the TPES by 2025 as set out in the Concept for Energy Security. Several legal acts governing the deployment of renewables in Belarus are discussed below.

In 2010, Belarus passed its first law **On Renewable Energy Sources** No. 204-3. The key elements in the law are outlined below.

- regulation of the promotion of the use of renewable energy sources and installations and the manufacturing and procurement of renewable energy equipment
- provision for private investors to build and operate renewable energy generation plants
- guarantee for non-discriminative connection to the grid for renewable energy suppliers
- provision for favourable pricing of renewable energy supply to encourage the use of and investment in renewables
- provision for tax concessions in accordance with legislation for renewable energy investments
- obligation of the *Oblenergos* to purchase electricity from renewable energy generation
- exemption of customs duties for imported equipment related to the generation, transmission, consumption, storage and conversion of electricity from renewable energy sources.

The State Programme on Energy Saving 2021-2025 sets out a renewable energy target by 2025 of 8% renewable energy share in the total primary energy supply

In 2015, the **Resolution of the Council of Ministers On the Establishment, Distribution, Release and Withdrawal of Quotas for the Creation of Installations for the Use of Renewable Energy Sources** No. 662 was passed. The resolution set out the regulation for setting of annual capacity quotas for various renewable energy. Soon thereafter, in 2017, the **Resolution of the Council of Ministers No. 305** revised the procedure for determining and allocating energy generation quotas. The resolution redefined the composition of the committee for the determination and allocation of quotas for renewable energy generation. It further stipulates that if, during the tender bidding process, more than one bidder submits the same bid, the committee is authorised to invite the bidders for negotiation. The allocated quotas have been revised several times. The current approved quotas for the period 2021-2023 are presented in Table 6.

Table 6 Quota allocations, 2021-2023

RE technology	Approved quotas and investment agreements (MW)		
	2021	2022	2023
Biogas	10.47	1	-
Wind	35.5	19.5	9
Solar PV	2.5	109	9.23
Hydro	-	4.76	0.12
Biomass	0.9	10.3	-
Geothermal and waste	-	-	-
Total	**49.37**	**144.5**	**18.35**

Source: Ministry of Energy (2020a)

In 2019, the **Presidential Decree On Renewable Energy Sources** No. 357 was passed that supersedes various aspects of the aforementioned Law on Renewable Energy Sources. Specifically, the decree stipulates that only renewable energy generation suppliers that use new equipment are permitted to partake in tenders under the quota allocations and that the FiTs at which they sell their electricity to the off-taker are set for a ten-year period. The off-taker is the *Oblenergo* in the region where the renewable energy plant is located. The FiT is calculated by the application of a multiplying coefficient to the market electricity price. The market price is calculated as follows: *market price = base price * (0.31 + 0.69 C/Ca)*, whereby *C* is the exchange rate of BYR against the USD at the time of payment and *Ca* is the exchange rate at the time when the base price was approved. This is used to adjust the rates of inflation and index the tariff to the USD. The FiT coefficient is dependent on the type of renewable energy, installed capacity and/or lifespan of the installation, as shown in Table 7.

Table 7 Overview of coefficients for FiT calculation

Technology	Coefficient
Wind power **Irrespective of capacity with an operating life of:**	
<5 years	1.1
>5 years	1.01
Hydro power	
up to 300 kW	1.3
301 kW – 2 MW	1.25
>2 MW	1.2
Biomass, incl. wood fuel	
up to 300 kW	1.3
301 kW – 2 MW	1.25
>2 MW	1.2
Biogas	
up to 300 kW	1.2
301 kW – 2 MW	1.15
>2 MW	1.1
Solar PV	
up to 300 kW	1.3
301 kW – 2 MW	1.25
>2 MW	1.2
Geothermal	
up to 300 kW	1.2
301 kW – 2 MW	1.15
>2 MW	1.1

Source: Roedl and Partner (2020)

The presidential decree also obligates renewable energy generators to produce only according to schedules set by the dispatch control centre to offset potential instability on the grid system.

According to the tax code of the Republic of Belarus, renewable energy equipment, components and spare parts for renewable energy generation are exempted from VAT upon import and may further be exempted from custom duties. Land tax is also waived for renewable energy facilities and plants. Furthermore, to promote electric mobility uptake, VAT for electric vehicle imports is waived. If the vehicles are purchased inland, the buyer is eligible for a VAT rebate. Further incentives for electric car owners include free public parking and free public road usage tax (Export.by, 2020).

3.3 RENEWABLE ENERGY FINANCE AND CO-OPERATION

Credit provided by Belarusian banks for the distribution of energy, gas, steam and warm water amounted to 6% of total credit disbursed in 2016, and their involvement remains limited. Commercial bank lending in Belarus, in local currency, is done at relatively high interest rates of 9.023% (in 2019), and loan tenures are rather short (Trading Economics, 2020). Local green financing is almost negligible, so most investments are supported by IFIs or through credit lines provided by international development partners to the local banking sector.

IFIs – such as the World Bank, European Bank for Reconstruction and Development (EBRD), the Nordic Environment Finance Corporation (NEFCO) and the Eurasian Development Bank (EDB) – have been active in Belarus by offering concessional loans at attractive interest rates, partial grant schemes and technical assistance for local banks. However, for public projects, IFIs almost always require a sovereign loan guarantee because they perceive public institutions, such as municipalities and state-owned enterprises, to have low credit-worthiness. Table 8 highlights some of the available financing opportunities for the renewable energy sector.

The Republic of Belarus co-operates with various international organisations for the development of the energy sector.

The EBRD co-operates with Belarus on the development of renewable energy and energy efficiency through programmes such as the Finance and Technology Transfer Centre for Climate Change, known as FINTECC. The programme offers investment, policy and technical support to a number of countries, including Belarus. Furthermore, EBRD has supported Belarus with over USD 500 million in funding for the implementation of energy efficiency investment projects. In renewable energy, the bank provided a senior loan of USD 18.4 million (of the USD 26.3 million total project cost) for the development of three biogas power plants with a total installed capacity of 15 MW.

Table 8 IFI financing opportunities for renewable energy investments

Financing Organisation	Details
European Bank for Reconstruction and Development (EBRD)	Equity, loans and loan guarantees for 15 years for renewable energy developers.
EBRD's Belarusian Sustainable Energy Finance Facility (BelSEFF)	Loan of USD 50 million for private and public entities investing in renewables. Project requirements are positive net-present value over 10 years using 8% discount rate in hard currency cash flow.
Eurasian Development Bank (EDB)	Loans (USD 30-100 million) for renewable power generation projects.
Nordic Environment Finance Corporation	Medium to long-term loans and loan guarantees Equity and shares subscription to facilitate mobilising equity base for private investors. EUR 1 million credit-line to Belarus People's Bank for electric vehicle and charging station loans.
International Finance Corporation (IFC)	Concessional loans to small and medium-sized businesses (SMEs) in the green energy sector.

Source: Ministry of Economy (2020), UNDP (2015)

The plant will be fully owned by the Lithuanian-based Modus Group, which will sell the generated electricity to the regional subsidiaries of the state-owned utility company BelEnergo (EBRD, 2020a). EBRD is also assisting BelEnergo's subsidiary MinskEnergo in developing electricity infrastructure that will connect to the Minsk Free Economic Zone (FEZ Minsk). Specifically, the bank is providing a sovereign loan of EUR 14.5 million (euros) (USD 17.4 million) for the construction of a 110/10 kV low voltage substation in the town of Fanipol (EBRD, 2020b). Furthermore, the cities of Minsk and Pinsk are both members of EBRD's Green Cities Initiative supporting the preparation of the Green City Action Plan. The plan identifies investment needs and provides technical support to city administrators and local stakeholders in sectors including waste and water management, urban transportation, energy, and green buildings (EBRD, 2020c). Through its BelSEFF, EBRD supports projects in energy efficiency and small-scale renewable energy by working with local financial institutions to on-lend the funds to small and medium-sized businesses, corporate and residential borrowers, and renewable energy project developers. BelSEFF has financed energy-efficient heating technologies in the Minsk region and a 1.78 MW solar PV plant in the Mogilev region (EBRD SEFF, 2020).

The World Bank, through its lending arm, the International Bank for Reconstruction and Development, supports Belarus on the Sustainable Energy Scale-Up Project (2020-2025) with a total project cost of USD 202.25 million. The borrower is the State Committee for Standardisation and the implementing agencies are the Energy Efficiency Department and Belinvestenergosberezhenie (authorised agency for the implementation of energy conservation projects financed by loans from the International Bank for Reconstruction and Development). The project aims to scale up the efficient use of energy in space heating of multi-apartment buildings and in woody biomass utilisation for heating in selected localities. The components of the project include (World Bank, 2020b):

- renewable wood biomass heating to support fuel switching to renewable biomass and efficiency improvement of heating systems through biomass heating investments
- thermal renovation of multi-apartment buildings to support thermal renovation by piloting a partially payable grant scheme selected by the government and the bank
- technical assistance to the thermal renovation pilot and the thermal renovation programme, as well as for overall project implementation support.

Furthermore, the World Bank committed USD 90 million to support the Belarus Biomass District Heating Project between 2014 and 2021. The project's objectives are to expand the efficient utilisation of biomass in heat and electricity supply in selected towns of Belarus (World Bank, 2020c).

Through the IFC, the World Bank further invested USD 850 million for private sector development and provides concessional loans to SMEs in the energy sector. It also provides investment advice to the government to support the inflow of foreign capital and increased private sector engagement. Specifically, between 2019 and 2022, the IFC has committed to working on capacity building activities for promoting investment with MART, supporting SMEs through the development of conducive regulatory frameworks with the Ministry of Economy and improved access to finance with the National Bank of Belarus, and enhancing accreditation systems in Belarus with Gosstandart (Ministry of Economy, 2020b).

The United Nations Development Programme (UNDP) and Global Environment Facility, in co-operation with the Ministry of Natural Resources and Environmental Protection of Belarus, launched the Removing Barriers to Wind Power Development in Belarus project in 2015. The objectives of this project, budgeted at USD 3.345 million, are to assist in the development of the wind power sector and enable investment for the construction of five wind farms with a total installed capacity of 60.7 MW. The project has carried out two year wind speed measurements and detailed feasibility studies. It also assisted in obtaining various permits that saw the commissioning of 9 MW of wind power in the small town of Novogrudok as well as other planned wind power plants in the rest of the country (UNDP, 2019). Belarus has also been working closely with the United Nations to develop the next United Nations Sustainable Development Cooperation Framework for 2021-2025 (UNSDG, 2020). The draft National Sustainability Strategy 2035 was also developed with expert support of the United Nations entities in Belarus.

The EDB, as the regional financial institution established to promote economic growth in its member states by extending trade, economic and investment ties among them, has supported Belarus by financing the construction of a 21.75 MW hydropower plant at Polotsk on the western Dvina River. The plant was commissioned in 2017 and is operated by BelEnergo's subsidiary Vitebskenergo. The total project costs were USD 79.97 million (EDB, 2019).

NEFCO is an IFI established in 1990 through an intergovernmental treaty between sovereign states, the Nordic countries of Denmark, Finland, Iceland, Norway and Sweden. NEFCO exclusively finances small and medium-size environmental and climate-related projects. As an example, NEFCO along with Swedfund provided a EUR 1.2 million (USD 1.44 million) loan for a landfill gas-to-electricity project in Vitebsk that is privately owned by Vireo Energy (NEFCO, 2019). NEFCO further supports the Belarusian People's Bank with a EUR 1 million (USD 1.2 million) credit line for electric vehicle loans and loans for charging stations (EMEurope, 2019).

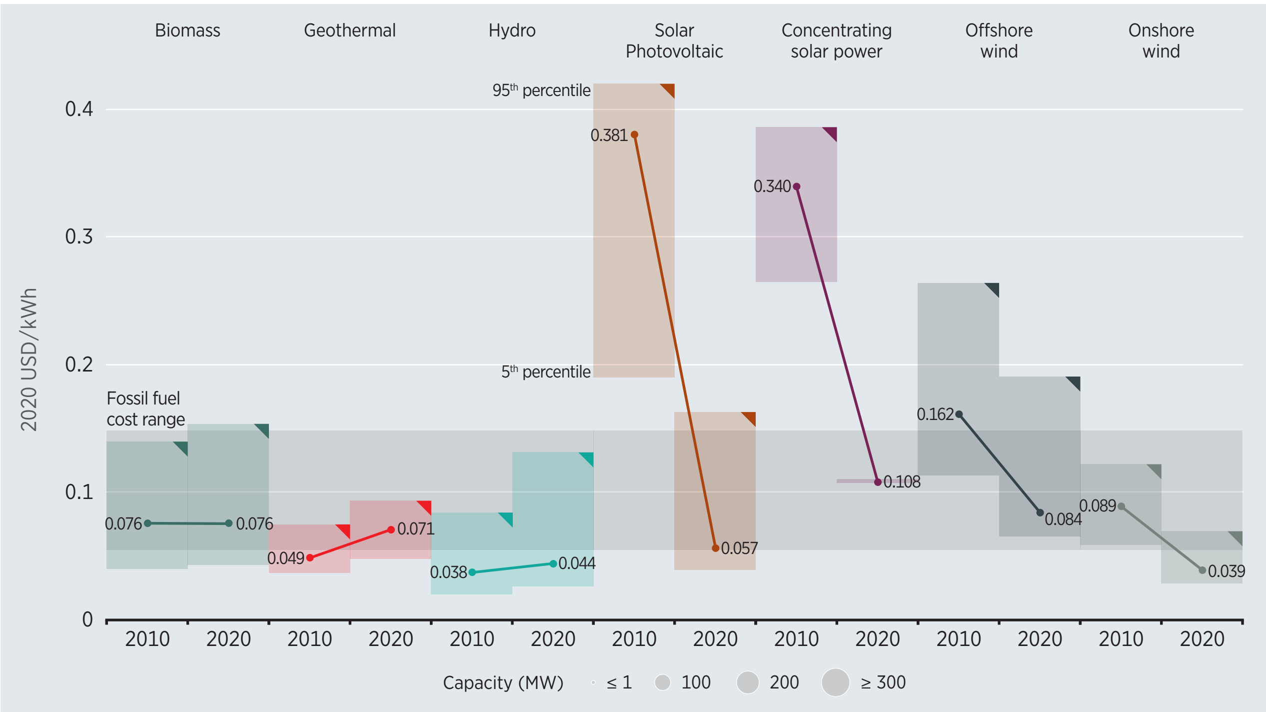
4 RATIONALE FOR RENEWABLE ENERGY DEVELOPMENT

4.1 FALLING COSTS OF RENEWABLE ENERGY TECHNOLOGIES

Over the past two decades, global renewable power generation capacity has drastically increased, from 754 GW in 2000 to 2 799 GW in 2020. In fact, in 2020, renewables accounted for a record share (82%) of all new power generation capacities. In view of the COVID-19 global pandemic and the consequent adverse economic effects, it is clear that global renewable energy supply chains proved to be resilient and adaptable in dire crises.

The increasing pace of renewable power capacity additions was facilitated by falling renewable energy technology costs due to technological advancements, economies of scale and competitive supply chains. In the past decade (*i.e.,* between 2010 and 2020), the costs of power production from utility-scale solar PV, concentrated solar power and onshore wind have decreased by 85%, 68% and 56%, respectively. A shown in Figure 24, the global weighted-average levelised cost of energy (LCOE) of solar PV fell from USD 0.381/kWh in 2010 to USD 0.057/kWh in 2020, and for onshore wind from USD 0.089/kWh in 2010 to USD 0.039/kWh in 2020. This not only indicates that renewables are able to compete with the cheapest fossil fuels, but that they are able to surpass them in terms of cost and new installed capacities. This trend is firmly expected to continue in the coming years. As an example, based on data from IRENA's Renewable Auction and PPA Database, utility-scale solar PV projects that have won recent competitive procurement processes and that are expected to be commissioned by 2022 could have an average price of USD 0.04/kWh, which is 27% less than the cheapest fossil fuel competitor, namely coal-fired plants.

Figure 24 Global LCOEs from newly commissioned, utility-scale renewable power generation technologies, 2010-2020



Source: IRENA (2021a)

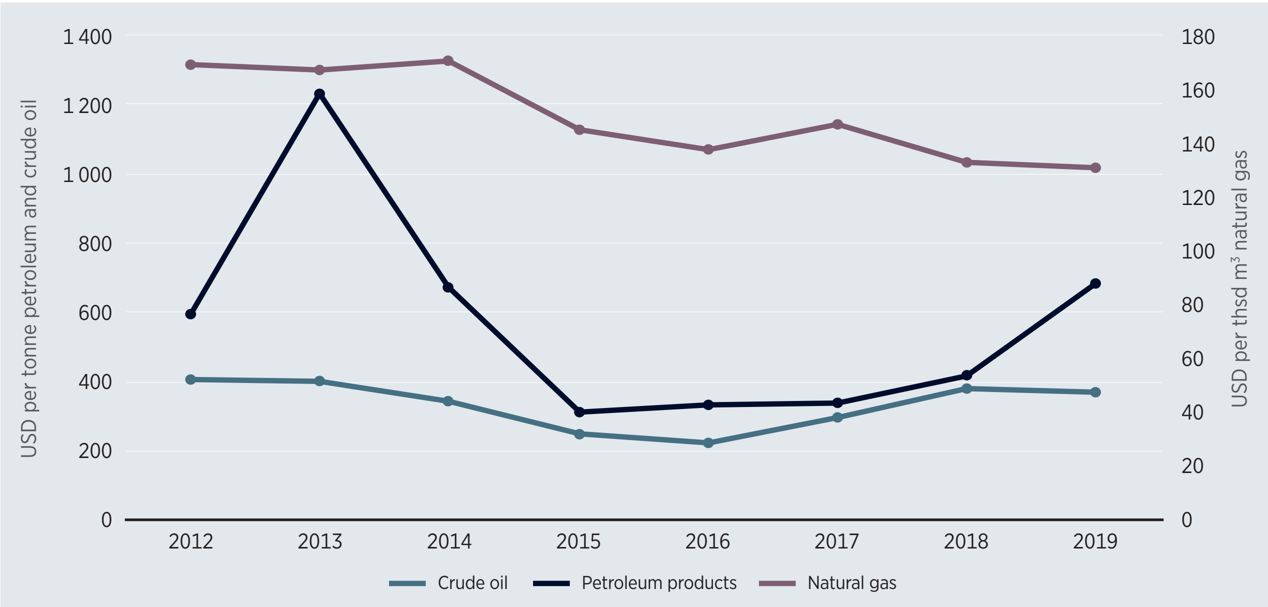
4.2 INCREASED ENERGY SECURITY

The Belarusian energy sector is heavily based on fossil fuels and highly dependent on energy imports. The current energy demand is insufficiently met by locally available resources and, as a result, the energy sector relies to a great extent on imports of oil and gas. With energy imports amounting to 84.8% of the TPES, Belarus is one of the world's most energy import-dependent countries. The highest fuel import dependency is on natural gas, of which only 2% of demand is produced domestically. Furthermore, most of the energy imports are from a single source supplier, which additionally jeopardises the country's energy security.

Belarus imports most of its energy from the Russian Federation. Traditionally, such imports of natural gas and oil from the Russian Federation have benefitted from favourable import prices that are only a fraction of the prices charged to other European countries. Nevertheless, because of Belarus's overreliance on energy imports, high energy insecurity and extreme vulnerability to price changes, any increases in import prices have always been met with strong opposition. Figure 25 shows the strong fluctuations in import prices of fossil fuels between 2012 and 2019.

Belarus has set forth various targets to increase its energy sector security. These have been outlined in the main energy policy document on the Concept of Energy Security up to 2035 and include increasing the share of domestic energy production in gross energy consumption, decreasing dependence on energy imports, diversifying energy resources, diversifying import energy suppliers and reducing the share of the major energy supplier in total energy imports. Accelerating the deployment of renewable energy is therefore critical in meeting these targets. Renewable energy resources, although currently untapped, are abundantly available in Belarus and present a way for the energy system to reduce its import dependence, alleviate vulnerability of energy import prices and promote domestic energy production, thereby improving the country's energy sector security. This in turn would lead to an economically sustainable and environmentally sound energy sector.

Figure 25 Import prices of fossil fuels, 2012-2019



Source: Adapted from BELSTAT (2020c)

4.3 CONTRIBUTION TO ECONOMIC GROWTH

Belarus relies heavily on energy imports to meet its national energy demand. In 2019, gross energy imports amounted to USD 9.9 billion while the net energy import balance was USD 3.6 billion (BELSTAT, 2020c). In relative terms, the net energy import balance equates to approximately 5.5% of the country's GDP, contributing significantly to the country's trade deficit. Also, given this high reliance on energy imports and the fact that the primary energy supply is not predominately domestically sourced, the energy sector is not a significant direct contributor to the country's GDP. In fact, the supply[12] of electricity, gas, steam and hot water contributes to only 3% of the national GDP (BYR 3.95 billion, USD 1.9 billion) (BELSTAT, 2020d).

Therefore, the exploitation of local energy sources is crucial to enable the country to reduce its trade deficit and its expenditures on energy imports. In this regard, renewable energy deployment presents one of the most viable options, given the country's abundant and diverse renewable energy resource potential. Moreover, apart from renewable energy resources, Belarus does not have other significant energy resources. By boosting the deployment of renewable energy technologies, Belarus would be able to increase its domestic energy supply, which would have a direct contribution towards the country's GDP while also advancing towards sustainable and environmentally sound economic growth in the country. To facilitate the technical and economic viability of renewable energy deployment across all economic sectors, energy efficiency measures must also be enforced. In consequence this will contribute to the country's national development targets of reducing the energy intensity[13] of the economy.

4.4 REDUCTION OF GHG EMISSIONS

In Belarus, energy utilisation alone is responsible for about two-thirds of the country's current greenhouse gas emissions, which is similar to the global average. To achieve the GHG emission goals set out in the Paris Agreement, the transformation of the energy system is of vital importance. At the same time, economic growth and energy security need to be maintained while achieving these goals. For the first time in decades, in 2014 and for the next three-year period, energy-related global GHG emissions stabilised despite continued economic growth (IEA, 2020b) due to the decreasing dependence of economic growth on GHG-emitting energy sources and a decrease in the energy intensity of the global economy. This was facilitated by the increased deployment of renewable energy technologies and increased energy efficiency measures. In Belarus, GHG emission stabilisation has been observed since 2005. This is attributed mainly to the restructuring of the economy over the past few decades and the fact that energy efficiency measures have steadily been introduced across all economic sectors.

12 *Supply refers to all domestically produced electricity, gas, steam and hot water, and domestically provided services such as distribution, transmission and sale of the same.*

13 *The energy intensity of the economy is the ratio between gross inland energy consumption and GDP. It is a measure of the energy efficiency of an economy. The more energy intense an economy is, the more energy it takes to produce the same unit of GDP and the less the net value added of the service or good that is contributing to the GDP.*

Under a business-as-usual scenario,[14] Belarus's energy demand is projected to increase some 42% by 2050 from its 2018 level. However, realising the need to reduce the energy intensity of its economy, the country has committed to continually enforcing energy efficiency measures. In fact, with ambitious renewable energy and energy efficiency targets, the energy demand of Belarus could potentially fall well below its 2018 levels by 2050[15] (Simon *et al.*, 2019). This means that any further deployment of renewable energy will be able to directly displace current fossil fuel utilisation and directly contribute towards GHG abatement.

4.5 LOCAL VALUE CHAIN CREATION

The development of the renewable energy sector presents opportunities for developing domestic industries, creating jobs along the value chain, generating income and harnessing wider socio-economic benefits. To maximise these benefits and contribute to local value chain creation through renewables, a country needs to leverage its existing economic activities, or develop new ones, and build on its local supply chains.

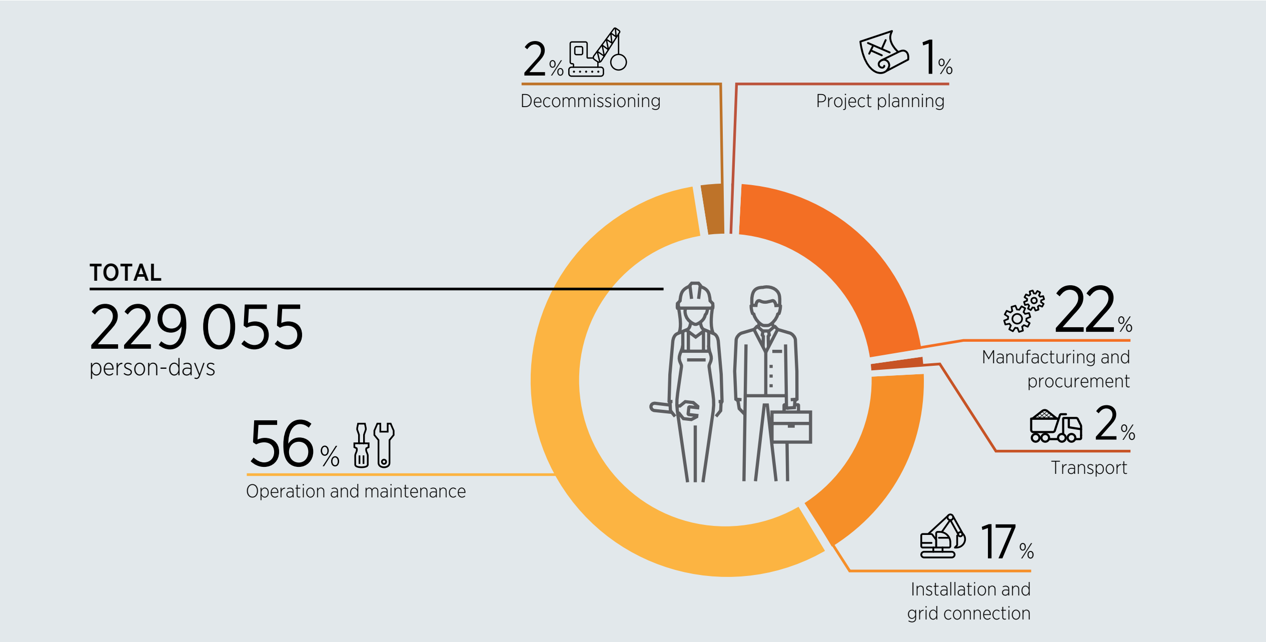
Local industrial development in Belarus can be enhanced by leveraging local materials and industries. These include glass, steel, concrete and aluminium for solar PV development, as well as concrete, steel, polymers and fibreglass for wind project development. Furthermore, renewable energy development can boost economic activities along the various renewable energy value chain segments, which include project planning, procurement of raw materials and components, component manufacturing, transport, installation, grid connection, commissioning, operation and maintenance, and decommissioning.

According to IRENA's analysis, the development of a typical 50 MW solar PV plant requires approximately 230 000 person days along the value chain (IRENA, 2017a). Figure 26 shows the distribution of human resources required along the value chain. Although various segments of the value chain, such as manufacturing, are concentrated in only a few countries, much of the value chain – such as transport and construction – can immediately be facilitated by the domestic workforce of existing industries within the country. Installation and grid connection segments involve the most labour-intensive activities, such as site preparation and civil works, which can also easily be sourced locally and have the potential to create local employment opportunities, especially for low- to medium-skilled workers (IRENA, 2017b). Furthermore, by building a certified and skilled workforce in other value chain segments – such as installation, operation and maintenance – over 70% of the value chain requirements can be sourced locally, creating significant socio-economic benefits.

14 Reflecting a continuation of current energy demand trends.

15 According to a scenario, Energy [R]evolution, designed to achieve a set of environmental policy targets resulting in an optimistic and feasible pathway towards a decarbonised energy system.

Figure 26 Distribution of human resources required along the value chain for the development of a 50 MW solar PV plant, by activity



Source: IRENA (2017b)

In 2017, IRENA published two reports, ***Renewable energy benefits: Leveraging local capacity for onshore wind***, and ***Renewable energy benefits: Leveraging local capacity for solar PV***. To harness the potential for local value creation, the reports assess the types of jobs that can be created along the value chain of the two technologies and aims to inform policy makers on the human resources and skills required to produce, install and decommission renewable energy plants. The reports assess the materials and equipment needed in each segment of the value chain and identify ways to leverage existing local industries (IRENA, 2017b) (IRENA, 2017c).

5 CHALLENGES AND RECOMMENDATIONS

5.1 POLICY AND REGULATORY FRAMEWORKS

Scaling up the deployment of renewables requires ambitious supporting policies and conducive regulatory frameworks. Although Belarus has over the years put in place various frameworks and incentives for the development of renewables, they are still in an early stage, and the pace of their deployment has not taken advantage of the abundance of their resource potential. Some of the policy and regulatory reasons for this slow uptake have included unambitious and incoherent renewable energy targets. Furthermore, the deployment of renewables in power generation has been facilitated through yearly quota allocations that have been prone to revisions, reductions and low pricing of FiTs, which have consequently deterred investments. To allow for a more conducive environment for renewable energy deployment, recommended actions include increasing the ambitiousness of renewable energy targets, improving the quota allocations and their pricing methodology, as well as introducing renewable energy auctions for pricing that is more market-based, especially for large-scale investments.

Action 1: Revising renewable energy targets

Renewable energy targets can be drivers for multiple interconnected policy objectives that lead to the development of the country's energy sector and its further development. Targets facilitate transparency in policy development, provide signals for investors regarding investment opportunities in the short- and long-term, and indicate any data or methodology discrepancies that need improvement as the sector develops. They also provide an indication of the government's commitment to energy security, environmental sustainability and overall socio-economic development.

For the development of renewables in Belarus, various renewable energy targets have been set through multiple policy frameworks. These frameworks have sometimes lacked coherence or have been misaligned, and some have only been partially achieved. As discussed in Chapter 2, Section 6, the State Programme for Energy Saving to 2020 set various technology-specific renewable energy targets that were not met by the end of 2020. On the other hand, however, the overall renewable energy target by 2020 (*i.e.*, 6% renewable energy production of TPES) was achieved, as set out in the main policy document of the Concept of Energy Security of the Republic of Belarus. In fact, even the renewable energy target for 2025 laid out in the same document was achieved in 2020 (*i.e.,* 7% renewable energy production of TPES).

The fact that the target was achieved five years in advance presents uncertainty about the impetus for continued renewable energy development in the near-term. It also brings into question the ambitiousness of the targets and their relation to other development objectives, given that a 14% renewable energy share of the TPES was set as an acceptable level of energy security.

Although current targets as laid out in the Concept of Energy Security have encouraged the development of renewables thus far, it is recommended that these targets now be revised, streamlined and increased in ambition and coherence. These actions will allow the energy sector to transition from its current early stage of renewable energy development and to continue to build momentum while working towards overall development objectives.

As a first step, it is suggested that the current renewable energy target set out in the Concept of Energy Security be revised and aligned with the target set in the most recently adopted State Programme for Energy Saving 2021-2025 (*i.e.,* 8% share of renewable energy production of the TPES by 2025), which would incentivise the continued development of renewables in the near-term. Furthermore, renewable energy targets in end uses, such as electricity, heat and transport, need to be clearly defined and should be consistent with all energy sector development objectives, such as increased energy security and gas share reduction. In this case, it is necessary to harmonise targets with indicators adopted by the Republic of Belarus within the framework of the Paris Agreement on climate and with the United Nations Sustainable Development Goals.

Target setting needs to be founded on metrics and clearly articulated objectives, while also taking into consideration political, institutional and economic aspects. They can be set in absolute terms (*i.e.,* a specific quantity of energy to be supplied or capacity to be installed) or relative to a moving baseline (*i.e.*, generation output as a share of final energy supply in percentage terms). Absolute targets for technology-specific installed capacities may have the advantage of easier monitoring, but they do run the risk of counting idle or under-performing capacities towards the capacity target when in reality they do not actually contribute significantly towards energy supply. It is therefore recommended that both absolute and relative targets be combined to allow for monitoring of renewable energy development in terms of output and capacity. This can better facilitate the implementation of such targets and relate them to specific policy measures such as quota allocations, FiTs and auctions. Furthermore, technology-specific targets should not be considered to be a cap on installed capacities and should be regularly reviewed and revised in case one renewable energy technology proves more economically viable than another. Targets also need to be enacted by law, with clear compliance and enforcement mechanisms. This reduces the market risk for investors and clearly signals the country's commitment to renewable energy development (IRENA, 2015).

Renewable energy targets can facilitate transparency in policy development, provide signals for investors regarding investment opportunities in the short- and long-term

Action 2: Improving the quota allocation for renewables

The development of renewables in the Belarusian power sector is enabled through yearly quotas that allocate the amounts of installed capacities per renewable energy technology. The quotas are allocated for the coming three-year period, but they have been subject to many revisions, a circumstance that has adversely impacted investor confidence. In 2015, the Resolution of the Council of Ministers on the Establishment, Distribution, Release and Withdrawal of Quotas for the Creation of Installations for the Use of Renewable Energy Sources No. 662 was passed, which regulates the setting of quotas for various renewable generation capacities (Council of Ministers of the Republic of Belarus, 2018). In 2017, however, a revised Resolution of the Council of Ministers No. 305 was passed that revised the procedure for determining and allocating energy generation quotas, ultimately decreasing the quota amounts to slow the initial influx of variable renewable power. This limits the pace of the renewable energy sector's growth. For example, in the period 2017-2019, applications received amounted to 770 MW of installed power capacity, whereas the allocated quotas for the same period were seven times less (117.42 MW) (Simon *et al.*, 2019).

Moreover, the quotas allocated to investors for the current three-year period 2021-2023 have been revised downward twice and have amount to only 38.8 MW out of the total 129.5 MW allocated for the same period. This amounts to approximately a third of the quota allocation and is considered by stakeholders to be unambitious. The revision annulled the previously allocated quotas for geothermal and waste-to-energy for the three-year period and reduced the total 2023 quota for all technologies from the previous allocation of 102.16 MW to 18.3 MW. In addition, the quota allocations do not encourage larger-scale investments, which tend to be cheaper. For example, the allocated solar PV quota for 2021 is only 2.5 MW, whereas the quotas for both solar PV and wind in 2023 are set to 9 MW each, and no quotas have been allocated for biomass in 2022.

The methodology for quota allocations has been described by national energy stakeholders as being insufficiently transparent, not facilitating wider stakeholder engagement, and allowing various revisions without justification. Furthermore, the FiT incentives (*i.e.*, the multiplier coefficients applied to the base price determining the FiT price for renewable energy technology) allocated under the quota system are not attractive for investors. This is apparent in the number of previously concluded investment agreements that have been terminated, especially in the construction of biomass/biogas power plants.

To address these challenges and accelerate the development of renewables, it is imperative that the allocated quota amounts be increased and that the multiplier coefficients be appropriately determined for each technology to ensure economic viability for investors, especially for solar PV, biomass and wind technologies. Through the RRA stakeholder consultation process, stakeholders have asserted that given the country's limited hydropower resources, quotas should not be allocated to hydropower but should instead focus on solar PV, biomass and wind power development. In addition, recommendations were made that renewable energy prosumers[16] should not be included in the quota system because their power production would have limited consequences for the power grid. Furthermore, some stakeholders in Belarus believe that the quota allocation period should also be extended from the current three years to five years to allow investors to gauge the development of the sector.

16 Energy prosumers are both producers and consumers of energy.

In these efforts to improve quota allocations, extensive energy stakeholder engagement (including representation from the Renewable Energy Association) is crucial to ensure transparency in the process. Multi-stakeholder engagement during the revision stages would allow for a more varied and objective consideration in setting the optimal quota allocations per technology. Such considerations should include, among others, investor readiness, which calls for increased quota allocations, as well as technical bottlenecks, which call for more controlled increments.

Action 3: Designing renewable energy auctions

Renewable energy producers in Belarus sell their electricity to the off-taker, the respective regional subsidiary of the state-owned BelEnergo, at a FiT set out by MART. As discussed in Chapter 3, Section 2, the FiTs per technology are calculated by applying different multiplier coefficients on the electricity base tariffs. Given that FiT calculations are based on electricity tariffs that do not truly reflect the unit cost of production, and further compounded by the fact that the multiplier coefficients are low, stakeholders report that the FiTs in turn are too low to attract the necessary investments at scale. More specifically, the FiTs are considered particularly low for wind and solar PV technologies, whose multiplier coefficients are on par with otherwise cheaper technologies, such as hydropower. Furthermore, the methodology for setting the multiplier coefficients lacks transparency, and it is unclear why some multiplier coefficients are differentiated by lifetime of the project, as is the case for wind, while others are differentiated by capacity size.

To attract renewable energy investments, especially at a larger scale, it is recommended that the country look into developing renewable energy auctions that can allow for market-based tariff setting of renewable power generation and the potential for real price discovery. Auctions are one of the most successful policy support mechanisms for the development of renewables globally, specifically for utility-scale renewable energy plants. They allow for well-planned and cost-efficient renewable energy deployment, and their transparent design and implementation can instil confidence in investors and reduce the perceived market risks. A key strength of auctions is their ability to determine the real market tariff for renewable power generation in a structured, transparent and competitive process, while considering the development and maturity of national markets and the development of local supply chains. Furthermore, auctions can facilitate contractual agreements between the power producer and the off-taker that clearly lay out the commitments and liabilities of the two parties, and in turn offer more regulatory certainty. Nevertheless, the eventual success of auctions relies on eliminating any potential for bidder collusion and ensuring fair competition while offering terms that can attract a critical number of bidders.

Box 1 **Successful auction design: The case of Kazakhstan**

In 2013, Kazakhstan set an ambitious target of generating 50% of its electricity from renewable energy sources by 2050. FiTs were introduced in 2014 to attract renewable energy investments, and although they did initially boost renewable energy deployment, the FiTs did not capture the rapidly falling costs of solar PV and wind technologies. This led the country to design renewable energy auctions that would allow for more competitive price setting and increased transparency of energy procurement. In 2018, the first auction bidding round was announced, along with guidelines on eligible renewable energy technologies, project capacity limits for bidders, dedicated land plots for project development, assigned grid connection points and ceiling prices equivalent to FiT prices from 2014. At the same time, the country also announced its planned auction schedules going forward, which encouraged a pipeline of renewable energy projects in the subsequent auction rounds. In only two years since the auction launch, Kazakhstan has completed 28 auctions with a contracted capacity of 1.07 GW, of which 609 MW is wind, 356 MW is solar PV, and the remainder are hydro and biomass power plants. Furthermore, in the same time period, the auction bids were at least 15% and as much as 66% lower that the previously set FiT prices, depending on technology (USAID, 2020). The design of the auctions in Kazakhstan was supported by IRENA.

IRENA has served as a global reference for renewable energy auctions since 2012, when the agency produced its first study on auctions, ***Renewable energy auctions in developing countries***. In 2015, IRENA, together with the Clean Energy Ministerial, developed a six-volume guidebook on the design of auctions, ***Renewable energy auctions: A guide to design***, which has advised policy makers on various approaches to auction design and their implications. The report highlights key auction design elements and offers choices and recommendations to support optimal decision-making in different contexts with a view to ensuring cost-effectiveness, security of energy supply and socio-economic development objectives (IRENA and CEM, 2015). This guidebook has been used by several governments and development banks, such as EBRD, the World Bank and the United States Agency for International Development (USAID), to support countries in designing their auctions. Since then, IRENA has published three reports on the topic. The latest, ***Renewable energy auctions: Status and trends beyond price*** (2019), demonstrates how auctions can be designed to support other objectives. Building on this knowledge, IRENA supports countries with the design and implementation of renewable energy auctions according to specific country circumstances and broader objectives and provides capacity-building workshops and more tailored advice upon request.

5.2 RENEWABLES IN END USES

Heat accounts for the largest share (30%) of final energy consumption in Belarus, and given that it is overwhelmingly fossil-fuelled, its decarbonisation is imperative for ensuring a sustainable and energy-secure development future for Belarus. Currently, the heat sector does not have a dedicated law governing its development, decarbonisation and subsidisation. This has subsequently led to the slow uptake of renewables in heating and an over-subsidisation of the otherwise fossil-fuelled sector. Although the country plans for more integration of biomass in heating, sustainable biomass resource potentials are insufficiently assessed, and the methodologies for the estimation of their energy content are outdated. Furthermore, alternative renewable energy technologies – such as geothermal and solar thermal, which would allow for a more diversified and decarbonised heat supply – are insufficiently accounted for in planning, despite their potential. It is therefore recommended that a law governing the broader energy sector, and heat supply specifically, be developed that would make provisions for decarbonisation and appropriately allocated subsidies that are more conducive to renewables. Finally, the development of heat supply in Belarus should be diversified and based on the integration of modern, technically and economically feasible energy-efficient technologies harnessing the country's renewable energy potential.

Action 4: Developing a law on energy and heat

As discussed in Chapter 2, Section 6, Belarus has enacted several laws and legal acts governing the country's energy sector. Nevertheless, there is no primary act or base law on energy that holistically governs the energy sector, defining the energy system and the roles of the different energy sector entities, including suppliers, consumers and prosumers and their operational obligations, reporting and deliverables, and the appointment of monitoring and enforcement agencies. To compensate for the lack of a state-wide law on energy, local regulations ultimately fill this gap and tend to leave room for inconsistency among different regions. A telling example is that Belarus does not have a specific law governing this end use sector. As such, there is no comprehensive legal framework to incentivise the development of renewable energy in heating and support its decarbonisation.

Heat accounts for the largest share (30%) of final energy consumption in Belarus, but only 10.6% of heat production comes from renewable energy sources – mainly biomass. Furthermore, there are no specific renewable energy targets for the heating supply except for targets to reduce the gas share in the heat supply, as defined in the Concept for Energy Security (see Chapter 2, Section 6) and technology-specific targets for the development of biomass and heat pumps for heating, as defined in the State Programme on Energy Saving. Solar thermal and geothermal technologies remain unexploited despite the country's potential to harness such renewable energy sources for heating and hot water supply and thereby effectively reduce the sector's overreliance on imported natural gas.

The increased uptake of renewables in heating is further hindered by a lack of cost-competitiveness compared to alternatives, such as relatively low-cost natural gas, and the high degree of subsidisation of end user heat tariffs, which is a measure to address energy poverty. According to energy stakeholders in the country, the methodology for setting consumer tariffs lacks full transparency and the base price for heat production does not reflect the true cost of heat production.

The state spends up to an estimated USD 800 million annually to subsidise heat supply. Residential heat tariffs alone are estimated to be between 10% and 21%[17] of the actual production cost (World Bank, 2014). Given the high degree of subsidisation, it is increasingly difficult for renewable energy investments to compete. There is a need to shift these subsidies to more sustainable sources of energy to reduce the long-term cost of support while supporting the energy transition. A dedicated and comprehensive legal framework for the energy sector would be a starting point in addressing this challenge and assigning legal enforcement mechanisms for the development of various energy sector programmes. Furthermore, a dedicated heat law and accompanying bylaws could incentivise the development of renewables (including geothermal, solar thermal and modern biomass) in heat supply and would signal the political commitment to the decarbonisation of the sector. Policies to phase out fossil fuels, eliminate distortions and incentivise energy transition solutions are described in detail in the joint IRENA, IEA and REN21 report Renewable energy policies in a time of transition: Heating and cooling (IRENA, IEA and REN21, 2020) and in IRENA's World energy transition outlook (IRENA, 2021).

Action 5: Harnessing renewable energy potentials in heating

Belarus places great importance on the development of biomass for heating. It is endowed with great biomass potential, both from agricultural waste and vast expanses of forest cover, which can be used to increase the share of renewables in the heat supply – both for space and water heating. However, despite the high potential, securing good quality and continuous biomass feedstock supply from sustainable sources is crucial to ensuring the technical viability and sustainability of projects. The country's biomass supply is characterised by seasonal fluctuations in supply availability, which largely depends on the type of feedstock and can be offset with feedstock storage facilities and combinations with other feedstocks that offer seasonal complementarity. Biomass resource assessments in Belarus have been undertaken to various degrees. However, assessments of the calorific value of different feedstocks and fuel products need further improvement, especially because the country relies on resource assessment standards that are outdated and do not take into account different technological advancements for thermal extraction and processing of feedstocks into more calorie-dense fuel products. Furthermore, standardisation and costs accompanying logistical supply chains of feedstocks and fuels also require consideration.

Biomass feedstocks must be available in reasonable quantities within an acceptable distance to make any investments economically viable because transportation costs factor significantly into the final unit price of the fuel. Currently, the unit price of biomass is based on mass or volume of the fuel, rather than per unit calorific value. This introduces discrepancies, especially as different qualities, chemical and physical characteristics of feedstock arise. For example, feedstocks that have low energy density and high moisture content present challenges for storage and transportation and may not be technically viable unless pretreated through drying and densification, which in turn affects its economics. Therefore, standardising the quality of biomass feedstocks and ensuring trading prices based on such quality standards, such as per unit energy density, is necessary to ensure the technical and economic viability of biomass for heating. Furthermore, innovative technologies for biomass and waste-to-energy require development, demonstration and evaluation of economic efficiency, especially for district heat supply.

---

17 Depending on the size, condition and fuel used in the district heating system.

The development of bioenergy also needs to be sustainable. Relevant aspects of sustainability include biodiversity and ecosystem benefits (including flood mitigation, water and soil quality) and impacts (on biodiversity and land and water use), as well as social issues such as food security, impacts on gender and job creation. Belarus already has vast areas of disturbed peatland forests (UNDP, 2018), and further damage must be avoided. It is important to recognise the significant risks related to negative impacts, both on the climate and in terms of wider sustainability, and to introduce measures to mitigate them. Such measures, and broader policies to support the deployment of bioenergy, are presented in IRENA's report *Recycle: Bioenergy* (IRENA, 2020).

Geothermal energy is another option for decarbonising heat supply. The resource assessment of the potential of geothermal energy has only been carried out in a small number of sites, mainly in the south of the country. Further resource assessments need to be undertaken to more concretely estimate the enthalpy of geothermal potential in Belarus and how it can most efficiently be tapped and integrated into heat networks. Furthermore, the most appropriate technology application for harnessing geothermal energy in district and individual heating systems requires greater research.

The increased use of renewable energy sources in heating should be based on the integration of modern, technically and economically feasible energy-efficient technologies harnessing the country's biomass, low-enthalpy geothermal and solar thermal resources, as well as energy-efficient heat pumps. To advance renewable energy use in the heat supply, the National Academy of Sciences of Belarus should be supported in its efforts to fully develop and implement resource assessments and demonstrate the technical and economic feasibility of pilot projects.

5.3 PLANNING AND INTEGRATION OF RENEWABLES

The integration of renewables can present various challenges for an energy system which, if not appropriately accounted for, can deter their wider development. Adequate planning is required to align different cross-sector development objectives, and in Belarus, the implementation of a holistic master plan for the energy sector with a higher share of renewables is imperative. Specifically in the power sector, renewable integration at a larger scale is hampered by the lack of adequate grid codes that provide technical guidelines for the connection and operation of renewable power generation facilities and a lack of short-term variable renewable generation forecasting, which has resulted in power system operations that are non-conducive to wider renewable energy deployment. To address these challenges and facilitate the wider integration of renewables, it is recommended that an energy sector master plan with higher shares of renewables be developed, along with grid codes and improved variable renewable energy forecasting in power system operations.

The implementation of a holistic master plan in Belarus is imperative to achieve a higher share of renewables in the energy sector

Action 6: Developing an energy sector master plan with higher shares of renewables

The development of the energy sector in Belarus is guided by a number of state programmes such as the Concept of Energy Security by 2023, State Programme for Energy Saving by 2025, Comprehensive Plan for the Development of the Electric Power Industry until 2025 and the Programme for the Development of Charging Infrastructure and Electric Transport by 2025. However, to foster an effective integration of renewables and ensure coherence among the various sub-sector programmes and the feasibility of attaining each programme's objectives, it is necessary to integrate these cross-sector strategies into a master plan for an integrated development of the energy sector.

For example, the State Programme on Energy Saving plans for an increased electrification of heat supply in Belarus that has implications for the development of the power sector. The power sector would need to align its development objectives even more intensively towards renewables to make sure that electrification of heating, and even transport, does not call for increased fossil-fuelled power production. The power sector would need to reflect timely infrastructure deployment, regulatory frameworks and demand-side management measures, among others, to align with the development objectives of heat supply and electric transport.

Moreover, the decarbonisation of the energy sector requires a long-term vision incorporated into such coherent planning. This entails the determination of short, medium and long-term objectives and commitments that can also guide the timely implementation of all international commitments, national development objectives, reforms and infrastructural advancements, etc., that are related to the energy sector. In other words, in striving for an increased share of renewable energy, the master plan should also ensure its alignment with international commitments, such as the Paris Agreement on climate change, as well as overall national development objectives, such as acceptable levels of energy security.

The increased participation of renewables leverages broader energy sector objectives, existing infrastructure and operational complementarity with current technologies. While renewables present various integration challenges, a master plan would allow for a preview of such challenges and offer ways to address them and methods to leverage existing and planned infrastructure to facilitate larger shares of renewables. The development of such a plan, and the accompanying energy system modelling, would facilitate sector-wide policy assessments, environmental impacts, and infrastructural and financial needs of fulfilling wider development objectives. Furthermore, a master plan would allow for a more co-ordinated, coherent and holistic development approach to various renewable targets, quota allocations and auction rounds, as discussed in Chapter 5, Section 1.

Action 7: Adopting a grid code for renewables

The Belarus power system is in a relatively early stage of managing variable renewable power injection. The system has been built around thermal power production, which amounts to 98% of electricity supply, and BelEnergo has limited operational experience with renewable power plant connections, grid management and stability with higher shares of renewables. As a precautionary measure to avoid any disturbances on the grid, renewable power producers are not given priority dispatch, but instead have to feed in power generated according to dispatch control centre schedules.

Furthermore, there is a lack of technical standards for the integration of variable renewable power to the grid and uncertainty about technical requirements that the developers need to abide by to connect and feed in to the grid. This introduces transmission or grid risks and significantly increases the cost of financing for renewables. A well-formulated national renewable energy grid code that outlines the procedures and technical requirements for variable renewable power producers feeding into the central grid will help to alleviate investment risk and allow for a level playing field for all power producers, while also maintaining power system stability.

Of immediate importance to Belarus are the development and adoption of connection and operation codes that would take into account different renewable energy technologies and different capacity sizes. Connection codes regulate the generator connection, and operating codes regulate operational security, planning and scheduling as well as load frequency and emergency procedures. Various aspects for consideration during grid code development include the size of the power system; the level of interconnection with other countries' power grids; the voltage levels of connection whereby requirements for connecting to lower voltages differ from higher voltage levels; distribution and flexibility of load and generation, which is also dependant on the geographical locations of connection points; the characteristics of conventional generators, such as the combined cycle gas turbines and their operational flexibility; energy policy and planning; and current and planned grid operational practices (IRENA, 2016). It is also important that grid codes are regularly reviewed and updated to take into account policy changes, the experience gathered with the implementation of the grid code and planned development of the power grid system. Grid codes should anticipate the future of the system requirements and align with national energy development goals. Furthermore, the participation of various energy stakeholders, such as policy makers, system operators and power plant producers, in the revision of grid codes is crucial in ensuring that system security is not compromised and that the responsibilities are justly distributed among all actors.

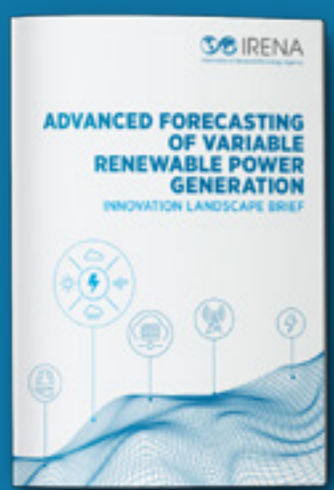
In 2016, IRENA published ***Scaling up variable renewable power: The role of grid codes***, which provides guidance to national stakeholders such as policy makers and system operators on how to develop and implement grid connection codes to enable a higher share of variable renewable power by considering different aspects of a country's power system context. It also highlights specific examples of variable renewable energy grid code implementation from other countries (IRENA, 2016).

Action 8: Improving variable renewable power generation forecasting

Variable renewable power (such as solar PV and wind) forecasting is an essential and cost-effective tool for managing the power system operations, balancing of power supply and maintaining grid stability in power grids to which variable renewable power generators are connected. It becomes an increasingly essential part of power system management as higher shares of renewables, *i.e.*, above 5%, are integrated into the grid. Currently in Belarus, wind and solar PV forecasting is not optimally integrated into daily scheduling and dispatch operations for power system balancing.

In Belarus, all renewable energy generators above 1 MW are obliged to participate in the day-ahead scheduling. However, given the variability of renewable power generation, short-term (zero to six hour) forecasting is crucial in predicting renewable energy production in the next few hours and down to the next few minutes. Specifically, when intra-day adjustments of forecasted renewable energy production are not accounted for, power production uncertainty is created, resulting in discrepancies between the actual variable renewable energy that could have been fed into the grid and the scheduling set out by the dispatch control centre. This leads to unnecessary power curtailments for which renewable power producers are not compensated and which adds to the power market risk for investors in Belarus.

To alleviate this investment risk and facilitate the increased integration of renewable power plants as the sector develops, it is imperative that short-term forecasting be integrated into generation scheduling and dispatch operations. This will allow for reconfiguring peaking plant operations (such as gas turbines) to allow for more renewables power injection, which has a zero marginal cost of production, and offset the need for costly fossil fuel utilisation. Such short-term forecasts are based on numerical weather prediction (NWP) models of weather conditions at site locations of the renewable energy power plants. Such meteorological data is converted to power forecasts combining both physical and/or statistical methods. An example of a physical method to predict wind power production is Preventio, developed by the University of Oldenburg in Germany, which uses current NWP data to calculate wind speeds at wind turbine hub heights and thereby forecast power production. An example of a statistical method is the Wind Power Prediction Tool, developed by the Technical University of Denmark, which perpetually calibrates various data flows, such as weather conditions and past power production patterns, and uses statistical methods to predict power production (Zieher, Lange and Focken, 2015).



In 2020, IRENA published ***Innovation landscape brief: Advanced forecasting of variable renewable power generation***, which provides an overview of advanced weather forecasting and its importance for variable renewable power integration into power systems. The publication discusses the importance of short and long-term weather forecasting for both renewable generators as well as power system operators and presents key requirements for the implementation of such forecasting, together with best-practice examples from different countries (IRENA, 2020b).

5.4 RENEWABLE ENERGY FINANCING

Financing levels for renewable energy projects in Belarus is very low, and there is an overall shortage of both debt and equity financing. In particular, the local financial sector has an inadequate track record in green financing, and most investments have been facilitated through international capital. Furthermore, local financing is very costly, and commercial lending incurs high interest rates and demands high collateral requirements due to numerous perceived risks. Such risks include the non-standardisation of PPAs in Belarus and the fact that contracts are negotiated on a case-by-case basis and signed only after commissioning of power plants. This ultimately introduces significant risks for investors and jeopardises their ability to secure financing for projects in the first place. These and other risks can be alleviated through various policy and financial de-risking mechanisms, including the standardisation of PPAs, as discussed in the recommended action points below.

Action 9: Improving de-risking mechanisms for renewable energy investments

The financial sector risk presents a challenge for equity financing of renewable energy investments in Belarus and significantly contributes to the high cost of equity financing. This is largely due to a lack of financial sector policy for investing in renewable energy infrastructure and a general non-prioritisation of green financing in the sector. It is further compounded by a lack of local financing products, including those from the national development bank, in supporting renewable energy developers to access various funding opportunities. Small-scale investors, such as individual residential units, also lack appropriate financing mechanisms. It is therefore recommended that clear financial sector policies for green financing be developed with the national development bank creating a dedicated green financing portfolio and taking the lead in local green financing efforts. These should also include small-scale financing, such as the inclusion of rooftop solar PV, heat pumps and electric vehicles under housing and vehicle loans with the appropriate tailoring of loan tenures. Other financial sector policies could also encourage green financing through obliging financial institutions to report on their green financing portfolios as part of corporate social responsibility measures. Furthermore, a dedicated renewable energy fund could be an effective way of providing public loans and de-risking mechanisms for renewable energy investments. Such a fund can be sustained by taxes on GHG emissions, waste water pollution and natural resource exploitation, for example.

Currency risk also adversely impacts the cost of international debt and equity financing. The Belarusian ruble is prone to considerable fluctuations and has depreciated in the recent past compared to hard currencies such as the euro or the US dollar. Currently, FiTs are dependent on the base price of electricity, which in turn is correlated to the price of imported fossil fuels. As such, according to legislation, the local currency FiTs are partially indexed to the US dollar. However, this indexation has decreased in recent years, and there is much uncertainty about how the newly added nuclear energy production will impact the indexation because the base tariff for electricity will have less influence from imported fossil fuel prices. Moreover, there is currently no indexation of local currency FiTs with the euro, which adversely affects financing from European countries. To increase the bankability of renewable energy investments, it is recommended that fixed prices in PPAs (as recommended in Action 3) should be at least partially indexed to the euro to decrease currency risks, and this indexation should be enforced in legislation.

Off-taker risk is also a contributor towards the high costs of financing. The off-taker, the state-owned BelEnergo, is not perceived to have a high degree of credit-worthiness. This is mainly due to a lack of transparency in its financial reporting and the country's highly subsidised energy tariffs. This poses a risk that the off-taker may default or delay payments to the renewable energy developers. Clear clauses to mitigate this risk need to be part of a standardised PPA. Additionally, government-backed guarantees and letters of support with the PPA can alleviate the off-taker risk.

Risk associated with permitting procedures also poses a challenge for renewable energy investments. For example, the country has a well-developed atlas of solar PV and wind sites indicating high resource potential areas that are favourable for project development. However, there is limited access to grid data to discern the possibility of connecting eventual renewable power generation to the grid. Data on the status and utilisation of power grids are not holistically available, and it is not always apparent to potential developers whether they will eventually be able to connect to their power plants to the grid in a timely manner or obtain the necessary permits. Therefore, including available grid connection points in the renewable energy atlas would allow investors to better assess the technical and economic feasibility of project development and help in alleviating permitting risk. Furthermore, permitting procedures should be streamlined and consistent in each administrative region of the country.

IRENA publishes a series of reports on measures for risk mitigation and financing mechanisms for renewable energy projects.

IRENA started its analytical work on renewable energy finance and investment in 2016, when it launched the publication ***Unlocking renewable energy investment: The role of risk mitigation and structured finance***. The report highlighted the need to scale up renewable energy investment, outlined the challenges of attracting private investment and proposed ways to overcome barriers.

In January 2018, IRENA joined forces with the Climate Policy Initiative, a leading institution in the tracking and analysis of climate finance flows, and launched the joint report ***Global landscape of renewable energy finance 2018***. The report looks at key global investment trends in 2013-2016 by region and sector, maps the roles of different financial instruments, and explores key differences between private and public actors.

In January 2020, IRENA published three finance briefs looking at sovereign guarantees and other risk mitigation options (***Renewable energy finance: Sovereign guarantees***), providing recommendations to harness institutional investment for renewable energy projects (***Renewable energy finance: Institutional capital***) and highlighting the need for more green bonds to drive sustainable, climate-safe energy finance (***Renewable energy finance: Green bonds***).

Institutional investors – including pension funds, insurance companies, sovereign wealth funds, and other endowments and foundations – represent an enormous global capital pool that has yet to be harnessed for the energy transition. ***Mobilising institutional capital for the energy transition*** considers ways to attract institutional investors into the sector on the necessary scale. Its recommendations are aimed at policy makers, public capital providers, capital market regulators and other stakeholders, including major institutional investors that could channel capital into renewables.

Action 10: Standardising PPAs

PPAs are legally binding long-term contracts signed between independent power producers (IPPs, the sellers of power generated) and the off-taker (the purchaser of the power). The contract defines the price at which power will be sold and includes various clauses that define the legal obligations of both contractual parties, thereby allocating risk accordingly. Well-formulated PPAs are a crucial link in securing project financing for renewable power developers and allow for ascertaining the bankability of a project and the various risks associated with the operation of the project during the lifetime of the contract.

PPAs for different renewable energy technologies in Belarus are not standardised. The clauses within the contract are individually negotiated between the off-taker, *Oblenergo*, and the developer. Furthermore, PPAs are only signed once the renewable power plant has been built and commissioned, which introduces a significant risk for the developers, may jeopardise the bankability of their project and weakens their negotiating position. Moreover, not having a PPA in the development phase of the renewable power project adversely impacts the ability of the developer to obtain debt financing for the project in the first place.

Currently, the prices that are set out in the PPAs are not fixed. On the contrary, the FiT prices are susceptible to annual changes depending on the changes in the base tariff for electricity production, which is largely based on the costs of the natural gas imports (see Chapter 3, Section 2 on FiT-setting methodology). Therefore, fluctuations in natural gas prices indirectly cause fluctuations in the FiT, which can significantly impact the economic viability of the project and increase the power market risk for investors. A further challenge affecting the economic viability of renewable energy projects is the dispatch scheduling, which can lead to unnecessary power curtailments for the IPPs and for which they are currently not compensated.

As the country looks towards attracting more renewable energy investments, standardised PPAs for different renewable energy technologies need to be developed and applied in all regions of the country. PPAs should be concluded with the developers after successful bidding, and well before the commissioning of the power plants to facilitate financing. Throughout the duration of the contract, a guaranteed fixed price for the sale of electricity needs to be applied to alleviate the power market risk. Fixed prices can be set through eventual auction bidding rounds as recommended in Chapter 5, Section 1, Action 3. Furthermore, the contracts should include clauses that clearly define non-compensable and compensable power curtailments. For example, a non-compensable curtailment may occur in the event that power cannot be dispatched due to grid maintenance, in which case the IPP would not be compensated for the deemed[18] energy generated. On the other hand, compensable curtailment may occur in the event that the off-taker cannot accept power due to balancing issues, in which case the IPP would be compensated for the deemed generation. The compensable curtailment – the so-called "take-or-pay" mechanism – is essential in creating certainty of the project revenue stream for the developer, especially in cases of power curtailments that are beyond the control of the power producer. There could also be a limit to non-compensable power curtailments, and/or the PPA may makes provisions for extensions of the duration of the agreement to allow for recovery of missed energy production. Further clauses that need to be included in the standardised PPAs should obligate power producers to maintain minimum thresholds of guaranteed availability in the case of wind power (usually set at 95% of mechanical availability) and minimum thresholds of committed power generation in the case of solar PV (usually set at 85% of committed energy supply).

18 Deemed generation is the electricity that a power plant was capable of generating but had to curtail due to power system conditions beyond the control of the power plant.

IRENA and Terawatt Initiative's Open Solar Contracts platform provides support for streamlining project development and finance processes by offering simple and universally applicable legal agreements that decrease transaction costs, shorten project development timelines and facilitate balanced risk allocation, making contracting much faster and less costly. With the support of several top-tier law firms, the contracts are publicly available on the Open Solar Contract website and include: Power Purchase Agreement, Implementation Agreement, Operation and Maintenance Agreement, Supply Agreement, Installation Agreement and Finance Facility Term Sheet. These contracts are fine-tuned for small and medium-sized, grid-connected solar PV projects. Going forward, a similar process will be initiated for wind projects. Upon request, IRENA provides training on the use of the Open Solar Contracts and how to tailor them to the needs of project proponents.

IRENA's project facilitation through the Climate Investment Platform

The Climate Investment Platform (CIP) is a global initiative supported by IRENA, the United Nations Development Programme (UNDP) and Sustainable Energy for All (SEforAll) in co-operation with the Green Climate Fund (GCF). The CIP's objective is to step up climate action and translate ambitious national climate targets into concrete investments on the ground. While initially focused on energy transition, the ultimate goal of the initiative is to accelerate investments in renewable energy and enable the success of the NDCs.

The platform offers an avenue to strengthen existing collaboration and presents an opportunity to consider new ways for more effectively bringing together stakeholders to catalyse action, all within existing institutional structures and in line with the respective mandates of the partner organisations. In this context, investment forums, a key element of IRENA's strategy to facilitate investments in renewable energy, offer an effective organising framework for the implementation of the CIP through a sub-regional approach.

In operationalising the CIP, IRENA intends to work with multilateral, bilateral and local financial institutions; private companies and investors; and development partners who are prepared to provide financial and technical resources and support the realisation of projects.

5.5. INSTITUTIONAL CAPACITIES AND SKILLS

Developing an energy sector with an increased share of renewables requires competencies beyond the conventional fossil fuel-based system that currently exists. These competencies are both at the institutional level in enabling an overall systematised deployment of renewables and at the individual level in building a qualified workforce at all stages of the value chain to adequately support renewable energy deployment. In Belarus, there is a need to strengthen both human and institutional capacities for renewable energy deployment across all sectors, including within the public sector on renewable energy target setting and reporting, in the private sector on due diligence of project preparations, in the financial sector on green financing, and in academia in nurturing technological research and innovation.

Action 11: Building human and institutional capacities for renewable energy development

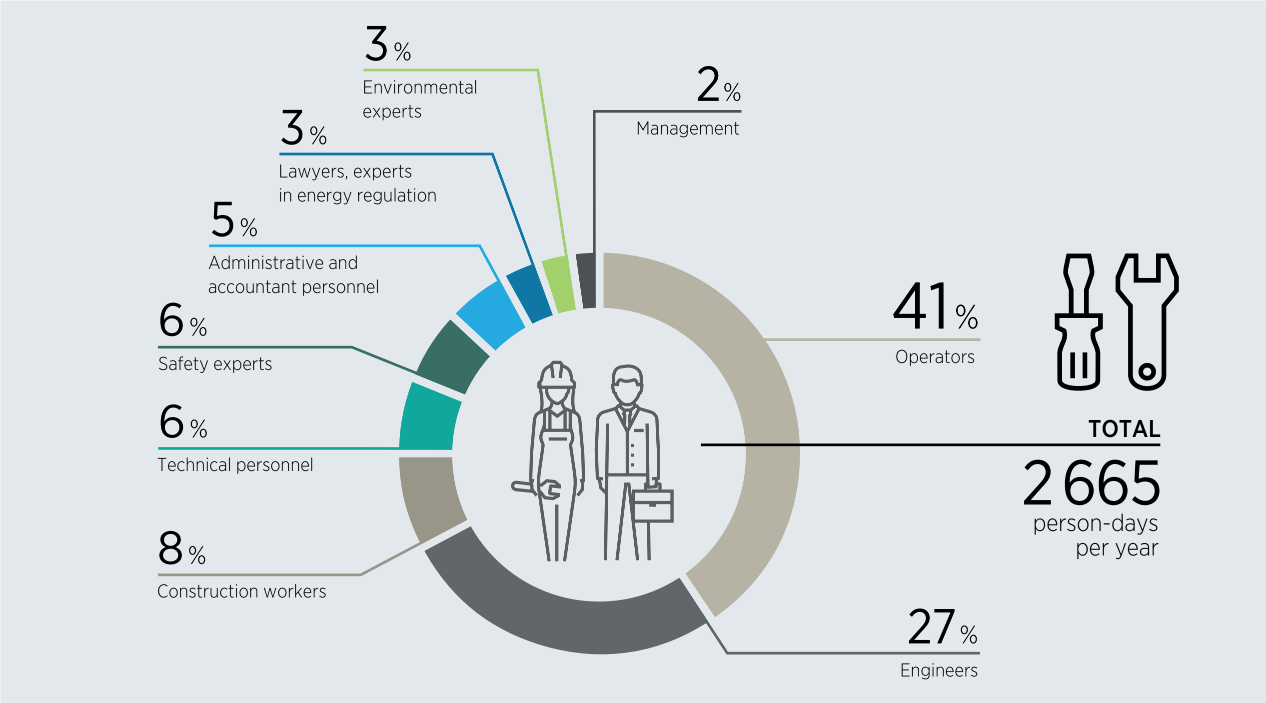
Within the public sector, planning and facilitating renewable energy deployment through incentive schemes are the two priority areas that require capacity strengthening. In planning for renewable energy investments, a holistic statistical basis is required. Energy sector statistics in Belarus are regularly updated, publicly reported and comprehensive. However, reporting on renewable energy generation needs to be improved. Currently, electricity generated by renewable energy prosumers, such as solar PV installations for self-consumption in the residential sector, is largely unaccounted for in official statistics. This skews reporting on the achievement of energy targets and does not enable a holistic understanding of the degree of uptake, the efficiency and operational experience of installed systems, and potential for further deployment. This in turn offsets appropriate planning and the need for developing various policy incentives such as the development of a prosumer strategy and appropriate incentives. Forming a working group is necessary to design a methodology for the assimilation of renewable energy production by decentralised and stand-alone systems, which would capacitate BELSTAT and other public institutions in collecting and utilising such data for further energy sector planning and policy development. Furthermore, renewable energy auction design is another policy mechanism that requires capacity-building efforts in public institutions and among policy makers.

Within the private sector, insufficient due diligence in preparation of renewable energy project documentation also hinders project financing. This can be mainly attributed to the lack of local skills in project development and engineering design. For example, there tends to be a lack of high-quality energy audits; design estimates on technical, financial and economic viability; long-term operational projections; and estimated return of investment. All of this hinders potential investors and financiers in assessing the economic viability of proposed projects. Usually, international experts are relied upon to carry out various feasibility studies.

Electricity generated by renewable energy prosumers needs to be accounted for in official statistics

Inadequate competences are also reported in the various segments of the value chain of developing renewable energy projects, including procurement and manufacturing, installation (especially for PV and wind), operation, and maintenance. A local workforce in such areas is not readily available, evidenced by the fact that most larger projects have been implemented by Russian and other European companies. As such, practical skills at academic institutions and on-the-job training need to be enhanced to ensure a qualified workforce for the development of a renewable energy sector in Belarus. The practical skills of the workforce can be developed by adjusting the curriculum for the relevant higher education institutions to include more practical training on renewable energy technologies and by facilitating individual training programmes for the construction, installation and operation of renewable energy technologies. Figure 27 shows an example of human resource requirements for the operation and maintenance of onshore wind projects.

Figure 27 Distribution of human resources required to operate and maintain a 50 MW wind farm, by occupation



Source: IRENA (2017c)

The local financial sector in Belarus is inexperienced in financing renewable energy projects, and it has insufficient capacities for and a lack of expertise in appraising renewable energy project proposals. Most commercial lending has been done through credit lines facilitated by IFIs which have also, to some extent, provided technical assistance in project appraisals. Nevertheless, such experience gained by local financial institutions is not readily shared among the financial sector, and there is a continued need for development partners to support local financial institutions with technical assistance in project appraisals and create the impetus for local renewable energy financing.

In terms of research and development, there is a low demonstration of working effectiveness of renewable energy technologies in Belarus and low levels of technological innovations locally. This leads to an over-reliance on equipment imports and studies that are not specific to the local context. It is necessary to determine the priority directions for the development of scientific research in the field of renewable energy and ensure comprehensive co-operation of national scientific organisations with industrial and energy enterprises, international organisations, development partners and foreign researchers to build the capacities of local institutions in renewable energy technology innovation.

REFERENCES

Belarus.by (2020), *Climate and weather in Belarus,* www.belarus.by/en/about-belarus/climate-and-weather.

BelEnergo (2020a), *Electricity production,* www.energo.by/content/deyatelnost-obedineniya/proizvodstvo-elektricheskoy-energii/ [in Belarusian].

BelEnergo (2020b), *Installed capacities of generating energy sources,* www.energo.by/content/deyatelnost-obedineniya/osnovnye-pokazateli/h [in Belarusian].

BelEnergo (2020c), *The composition of the association,* www.energo.by/content/about/sostav-obedineniya/ [in Belarusian].

BELSTAT (2020a), *Annual data,* National Statistical Committee of the Republic of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/Demographic-and-social-statistics/population-and-migration/population/annual-data/.

BELSTAT (2020b), *Employment,* National Statistical Committee of the Republic and Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/Demographic-and-social-statistics/employment/.

BELSTAT (2020c), *Statistical yearbook 2020,* National Statistical Committee of the Republic of Belarus, Minsk.

BELSTAT (2020d), *Gross domestic product by kinds of economic activity,* National Statistical Committee of the Republic of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/national-accounts/annual-data/ (accessed 29 June 2021)

BELSTAT (2020e), *Energy balances*, National Statistical Committee of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/energy-statistics/annual-data/ (accessed 12 November 2020).

BELSTAT (2020f), *Fixed capital investments,* National Statistical Committee of Belarus, www.belstat.gov.by/ofitsialnaya-statistika/realny-sector-ekonomiki/investitsii-i-stroitelstvo/investitsii-v-osnovnoy-kapital/godovye-dannye/ (accessed 11 December 2020).

BELSTAT (2020g), *Annual data: Foreign investment*, National Statistical Committee of the Republic of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/foreign-investment/annual-data/ (accessed 10 December 2020).

BELSTAT (2020h), *Annual data: Energy balances,* National Statistical Committee of the Republic of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/energy-statistics/annual-data/ (accessed 25 November 2020).

BELSTAT (2020i), *Heat production by types of plants,* National Statistical Committee of the Republic of Belarus, www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/energy-statistics/graghical-data-graphs-diagrams/heat-production-by-types-of-plants/index.php (accessed 25 November 2020).

BELSTAT (2019), *Energy balance of the Republic of Belarus - Statistical book,* National Statistical Committee of the Republic of Belarus, Minsk.

Beltopgas (2020), *Construction complex*, Fuel and Gasification State-Owned Production Association, www.topgas.by/upload/medialibrary/Beltopgaz_EN.pdf.

CIS (2020), *Interregional and cross-border cooperation*, Commonwealth of Independent States, https://e-cis.info/cooperation/2861/ [in Russian].

Council of Ministers of the Republic of Belarus (2019), *Resolution of the Council of Ministers "on Issues in the Field of Heat Supply" No. 609,* Council of Ministers of the Republic of Belarus, Minsk.

Council of Ministers of the Republic of Belarus (2015), *Resolution of the Council of Ministers "on Approval of the Concept of Energy Security of the Republic of Belarus" No. 1084*, Council of Ministers of the Republic of Belarus, Minsk.

Deloitte (2021), *International Tax Belarus highlights 2021,* https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Tax/dttl-tax-belarushighlights-2021.pdf.

Dubanevich, M. and V. Zui (2019), *Geothermal field and geothermal resources, country update for Belarus,* European Geothermal Congress, Den Haag.

EBRD (2020a), *Modus Biogas Portfolio Phase II,* European Bank for Reconstruction and Development, www.ebrd.com/work-with-us/projects/psd/modus-biogas-portfolio-phase-ii.html.

EBRD (2020b), *FEZ Minsk electricity network upgrade project,* European Bank for Reconstruction and Development, www.ebrd.com/work-with-us/projects/psd/51524.htmlh.

EBRD (2020c), *About Green Cities,* European Bank for Reconstruction and Development, www.ebrdgreencities.com/about.

EBRD SEFF (2020), *Case study: Solar energy project in Belarus,* European Bank for Reconstruction and Development Sustainable Energy Financing Facility, http://seff.ebrd.com/solar%20photovoltaic%20plant%20zharinov%20belarus.

EDB (2019), *Construction of Polotsk HPP on the Western Dvina River is completed,* Eurasian Development Bank, https://eabr.org/en/press/news/construction-of-polotsk-hpp-on-the-western-dvina-river-is-completed/.

EIB (2018), *Republic of Belarus: Financial sector review and private sector financing,* European Investment Bank, Luxembourg.

EMEurope (2019), *State of the art survey No. 1 – National, regional and EU measures to establish and support electric mobility,* Electric Mobility Europe, www.electricmobilityeurope.eu/?media_dl=1125.

EnC (2018), *Energy governance in Belarus - Policy recommendations,* Energy Community Secretariat, Vienna.

Encyclopedia Britannica (2020), *Belarus*, Encyclopedia Britannica, www.britannica.com/place/Belarus.

Energy Charter Secretariat (2013), *In-depth review of the energy efficiency policy of the Republic of Belarus,* Energy Charter Secretariat, Brussels.

ENTSO-E (2020), *ENTSO-E Grid Map,* www.entsoe.eu/data/map/ (accessed 27 April 2021).

EU4Business (2019), *Belarus: EIB supports energy efficiency and small businesses,* https://eu4business.eu/news/belarus-eib-supports-energy-efficiency-and-small-businesses/ (accessed 24 May 2021).

EU4Energy (2020), *Belarus,* www.eu4energy.iea.org/countries/belarus.

Euroheat & Power (2017), *District energy in Belarus,* www.euroheat.org/knowledge-hub/district-energy-belarus/ (accessed 29 June 2021).

EuropAid (2020), *Municipal finance study on energy, climate and environment sectors in Eastern Partnership Countries,* EuropAid, Landell Mills International, Danish Energy Management A/S and Linpico SARL, Dublin.

European Commission (2020), *European Neighbourhood Policy And Enlargement Negotiations,* (ec.europa.eu/neighbourhood-enlargement/neighbourhood/eastern-partnership_en).

EUROSTAT (2020), *Energy intensity,* https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_ei&lang=en.

Export.by (2020), *Government measures to facilitate production of electric cars in Belarus,* https://export.by/en/news/government-measures-to-facilitate-production-of-electric-cars-in-belarus.

Greenworld.org (2020), *Energy scenarios in the Republic of Belarus,* http://www.greenworld.org.ru/?q=ang_monografy_2.

IEA (2020a), *Belarus energy profile,* International Energy Agency, www.iea.org/reports/belarus-energy-profile#country-overview.

IEA (2020b), *Global energy review: CO_2 emissions in 2020,* International Energy Agency, www.iea.org/articles/global-energy-review-co2-emissions-in-2020 (accessed 30 June 2021).

IEA (2016), *Clean energy technology assessment methodology pilot study - Belarus,* International Energy Agency, Paris.

IEA (2015), *Enabling renewable energy and energy efficient technologies - Opportunities in Eastern Europe, Caucasus, Central Asia, Southern and Eastern Mediterranean,* International Energy Agency, Paris.

IRENA (2021a), *Renewable power generation costs in 2020,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2021b), *World energy transition outlook,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2020a), *Recycle: Bioenergy,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2020b), *Innovation landscape brief: Advanced forecasting of variable renewable power generation,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2017a), *Renewable energy benefits: Understanding the socio-economics,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2017b), *Renewable energy benefits: Leveraging local capacity for onshore wind,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2017c), *Renewable energy benefits: Leveraging local capacity for solar PV,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2016), *Scaling up variable renewable power: The role of grid codes,* International Renewable Energy Agency, Abu Dhabi.

IRENA (2015), *Renewable energy target setting,* International Renewable Energy Agency, Abu Dhabi.

IRENA and CEM (2015), *Renewable energy auctions – A guide to design,* International Renewable Energy Agency and Clean Energy Ministerial, Abu Dhabi.

IRENA, IEA and REN21 (2020), *Renewable energy policies in a time of transition: Heating and cooling,* IRENA, IEA and REN21.

Ministry of Economy (2020a), *Main tasks,* www.economy.gov.by/en/pravovie-osnovy-en/.

Ministry of Economy (2020b), *General information on the cooperation with international organizations,* www.economy.gov.by/en/general-inform-w-int-org-en/.

Ministry of Economy (2018), *On development of renewable energy sources in the Republic of Belarus*, Presentation by Deputy Minister of Energy Olga Prudnikova, www.windpower.by/files/files/ppt/On_Development_of_Renewable_Energy_Sources_in_the_Republic_of_Belarus.pdf.

Ministry of Energy (2020a), *Republican Interdepartmental Commission on the Establishment, Distribution, Release and Withdrawal of Quotas for the Creation of Installations for the Use of Renewable Energy Sources November 2020,* Minsk

Ministry of Energy (2020b), *Construction progress,* https://minenergo.gov.by/en/.

NEFCO (2020), *Energy supply system at Keramika Plant,* Nordic Environment Finance Corporation, www.nefco.org/case-studies/modernization-of-energy-supply-system-at-keramika-plant-in-vitebsk-belarus/.

NEFCO (2019), *Waste transformed into energy in Vitebsk,* Nordic Environment Finance Corporation, www.nefco.org/case-studies/waste-transformed-into-energy-in-vitebsk/.

OECD (2018), *Inventory of energy subsidies in the EU's Eastern Partnership countries,* Organisation for Economic Co-operation and Development, Paris.

Roedl and Partner (2020), *Latest developments in the renewable energy sector in Belarus,* www.roedl.com/insights/renewable-energy/2017-08/developments-renewable-energy-sector-belarus#:~:text=During%20the%20convention%2C%20the%20Committee,and%20other%20biomass%20%E2%80%93%2013.0%20MW.

Simon, S. *et al.* (2018), *Energy [R]evolution: A sustainable Belarus energy outlook,* Heinrich Boll Foundation, Kyiv.

tarify.by (2020), *Electricity, heat and fuel prices,* www.tarify.by/стоимость-топлива/ [in Belarusian].

Trading Economics (2020), *Belarus - Lending interest rates,* https://tradingeconomics.com/belarus/lending-interest-rate-percent-wb-data.html.

UNDP (2020), *UNDP Belarus project briefs 2019,* www.by.undp.org/content/belarus/en/home/library/undpinbelarus/undp_project_briefs.html.

UNDP (2019), *Taking the risk out of investing in wind power,* United Nations Development Programme, www.undp.org/blogs/taking-risk-out-investing-wind-power (accessed 21 June 2021).

UNDP (2018), *More than 12,000 ha of disturbed peatland forests to be restored in Belarus by "Wetlands" project,* United Nations Development Programme, www.by.undp.org/content/belarus/en/home/presscenter/pressreleases/2018/10/News.html (accessed 30 June 2021).

UNDP (2015), *Renewable energy snapshot: Belarus,* United Nations Development Programme, Minsk.

UNESCO Institute of Statistics (2020), *Belarus,* UNESCO Institute of Statistics, http://uis.unesco.org/country/BY.

UNFCCC (2019), *Belarus 2019 national inventory report,* United Nations Framework Convention on Climate Change, https://unfccc.int/documents/194790.

UNFCCC (2016), *NDC Registry - Belarus,* United Nations Framework Convention on Climate Change, www4.unfccc.int/sites/NDCStaging/Pages/Party.aspx?party=BLR&prototype=1.

UNIDO and ICSHP (2013), *World small hydropower development report 2013,* United Nations Industrial Development Organization and International Center on Small Hydro Power.

UNSDG (2020), *Belarus,* https://unsdg.un.org/un-in-action/belarus.

USAID (2020), *Kazakhstan renewable energy auctions case study,* United States of America Agency for International Development, Washington, DC.

Weather Atlas (2020), *Minsk, Belarus,* Weather Atlas, www.weather-atlas.com/en/belarus/minsk-climate#humidity_relative.

World Bank and OECD (2020), *GDP - Belarus,* https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=BY.

World Bank (2020a), *Doing business - Measuring business regulations,* www.doingbusiness.org/en/rankings?region=europe-and-central-asia.

World Bank (2020b), *Sustainable energy scale-up project,* https://projects.worldbank.org/en/projects-operations/project-detail/P165651.

World Bank (2020c), *Belarus Biomass District Heating Project,* https://projects.worldbank.org/en/projects-operations/project-detail/P146194.

World Bank (2014), *Heat tariff reform and social impact mitigation: Recommendations for a sustainable district heating sector in Belarus,* World Bank, Washington, DC.

World Nuclear Association (2020), *Nuclear power in Belarus,* www.world-nuclear.org/information-library/country-profiles/countries-a-f/belarus.aspx.

WorldAtlas (2020), *Belarus,* www.worldatlas.com/maps/belarus.

Zieher, M., M. Lange and U. Focken (2015), *Variable renewable energy forecasting: Integration into electricity grids and markets: A best practice guide,* Deutsche Gesellschaft fuer Internationale Zusammerarbeit (GIZ), Bonn.

www.irena.org