

Belarus

The best practices in sustainable energy in Belarus, on gaps in implementing sustainable energy practices, challenges for their implementation

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List of abbreviations

BYN	Belorussian Ruble
CCGT	Combined-cycle gas turbine
CIS	Commonwealth of Independent States
CO ₂	Carbon-dioxide
COP21	The 21st session of the Conference of the Parties to the UNFCCC
CPI	Corruption Perception Index
CSP	Concentrated solar power
DNI	Direct normal irradiance
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EET	Energy efficiency technology
EEU	Eurasian Economic Union
EMS	Energy management system
ESCO	Energy service company
ESPC	Energy savings performance contracts
EU	European Union
Gcal	gigacalorie
GDP	Gross domestic product
GHG	Greenhouse gas
GHI	Global horizontal irradiance
GW	gigawatt
GWh	gigawatt hour
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
ICSHP	International Center on Small Hydro Power
km ²	squared kilometre
kW	kilowatt
kWh	kilowatt hour
kWh/m ²	kilowatt hours per square metre
ktoe	kilo tonne of oil-equivalent
LPG	Liquefied petroleum gas
m ³	cubic metre
MWh	megawatt hour

MtCO ₂ -eq	million tonnes of carbon dioxide equivalent
NPP	Nuclear power plant
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
RES	Renewable energy sources
RUE	Republic's Unitary Enterprise
SPA	State Production Association
TPES	Total primary energy supply
USD	United States Dollar
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization

Executive summary

Belarus does not have sufficient primary energy sources and is heavily dependent on oil and gas imports, mainly from the Russia. Imports of fuel and energy are around 85% of the total consumption of primary energy resources. The country has developed an infrastructure for transporting oil, oil products and electricity. These factors determine the key principles of the state energy policy: ensuring energy security through improving the fuel and energy mix in parallel with the rational use of energy resources, increased use of local fuels and renewable energy sources (RES) and promotion of energy efficient and environmentally friendly clean technologies in all sectors of the economy.

Since the beginning of the 1990s, Belarus has pursued a consistent governmental policy aimed at improving the energy efficiency of the economy, including the establishment of a regulatory framework, an institutional infrastructure, mechanisms of state support and incentives, a system of key performance indicators and state programmes with respective monitoring instruments.

The significant growth of GDP has not resulted in a material change in primary and final energy consumption. Over two decades (1990–2010) the energy intensity of Belarus' GDP decreased 2.7 times, and the gross consumption of fuel and energy resources decreased 1.6 times, with GDP increasing by more than 1.5 times.

Through the implementation of programmes and measures following governmental policy the share of domestic energy resources in the energy balance increased up to 20.7% in 2010 as compared to 12.8% in 1990.

The current energy and energy efficiency policy and strategy of Belarus for the period until 2020 are set forth and their implementation in the area of energy saving is aimed at restructuring and modernising the national economy based on energy efficient technologies.

The key objective in the electricity sector is to ensure a significant improvement in the efficiency of energy production and reliability of the energy supply. The construction of a nuclear power plant (NPP) of 2,340 MW by 2020 is also foreseen in the Belarusian Government's plans.

The country pays a great deal of attention to renewable energy development. The government has adopted regulations and a system of incentives for electricity produced from RES, and guarantees its purchase and the connection of respective generation capacities to the state power grid.

Future improvement of the energy sector management structure is aimed at a gradual transition to market principles and includes energy system restructuring with the establishment of wholesale and retail markets.

The government plans to reduce cross-subsidies in tariffs for electricity and heat sold by the distribution companies of Belenergo State Production Association (Belenergo SPA), through the elimination of preference energy tariffs for certain legal entities and individual entrepreneurs and a gradual increase in the share of power supply costs covered by households.

Legislation on energy and energy saving is constantly being improved.

Introduction (status of national energy sector)

Energy security is one of the main objectives of energy policy in Belarus. It has a high reliance on oil and natural gas imports from Russia and is looking to increase energy efficiency and to develop renewable energy sources. Sustainable energy can help to promote national security through increasing energy independence, ensure environmental stewardship and reduce energy and carbon intensity, and generate continued economic growth through innovation in energy technologies and expansion of green jobs. Sustainable and clean energy sources have significantly lower total and per unit greenhouse gas emissions and reduce dependence on imported energy sources. Sustainable energy sources are affordable, safe, and available in sufficient quantity to enable continued economic and social development while promoting environmental stewardship.

Achieving a sustainable energy economy requires attention to both near- and long-term energy needs. Near-term needs include: developing mechanisms for conserving energy; encouraging energy efficiency; and identifying, developing, demonstrating, and deploying both existing and emerging sustainable energy technologies. The near-term solutions should be capable of supporting continued economic growth, manifesting proper stewardship of the environment, and adapting to future environmental conditions as necessary. Long-term needs include: understanding and applying the basic science related to climate and the carbon cycle; accelerating innovation in sustainable energy technologies and facilitating their transfer into the marketplace; exploring the potential of new materials for better energy storage and conversion from one form to another; and educating and training a workforce to operate in the new energy economy. These efforts require robust support for science and engineering research related to sustainable energy, as well as significant attention to the economic, social, and environmental impacts of energy technologies.

Background

The Republic of Belarus (Belarus) is a landlocked country in Eastern Europe, bordered by Russia to the northeast, Ukraine to the south, Poland to the west, and Lithuania and Latvia to the northwest. Belarus covers an area of 207 595 square kilometres (km²) (40% of which is forested) with 9.5 million inhabitants. Minsk, the largest city, is the national capital and home to about 20% of the population while the majority lives in rural areas.

Despite a lack of natural resources and the economic downturn after the breakup of the Soviet Union, Belarus has achieved solid economic growth through manufacturing and exports, including machinery and equipment, mineral products, chemicals, metals and textiles.

Little structural reform has occurred in the country since its independence, and private and foreign investment remains relatively low (mainly in small enterprises). The energy sector is owned and operated by the government and the president holds the exclusive right to all strategic decisions. The electricity sector is operated by a single vertically integrated national energy company, BelEnergO, while the gas distribution sector is operated by BelTopGaz. The government believes that having control over the entire sector provides a secure and stable energy supply.

According to the World Bank's "ease of doing business" indicator, Belarus was ranked 44th among 189 countries in 2016. A high ranking on the ease of doing business index means the regulatory environment is more conducive to the start-up and operation of a local firm. This index averages the country's rankings on ten topics, made up of a variety of indicators, giving equal weight to each. Belarus has continuously improved its business environment over the years, increasing its ranking from 57/189 in 2014.

According to the Corruption Perceptions Index (CPI) prepared by Transparency International, which measures the level of perceived corruption in public systems, Belarus ranked 107th among 168 countries in 2015, with a score of 32. This is a relatively high score for perceived corruption in the country, as a score of 100 represents no corruption, albeit it is also improving over time.

The main priority of energy policy and strategy in Belarus is to provide a reliable and sustainable energy supply for the national economy, while reducing dependence on energy imports and improving the

financial stability of the sector. The government is looking at diversifying fuels in its power generation sector, including more coal and renewables. It has introduced a green feed-in tariff to attract more investment in renewables. The government is also improving energy efficiency in electricity and heat production and is in the process of phasing out subsidies for electricity, heat and gas, which is expected to improve the attractiveness of the energy sector for private investment and make it more market-focused.

Belarus is a member of the Eurasian Economic Union (EEU) that came into force on 1 January 2015. Other members include Russia, Kazakhstan, Armenia and Kyrgyzstan. The EEU includes free movement of goods, capital, services and people and provides for common transport, agriculture and energy policies, with provisions for a single currency and greater integration in the future. Belarus also participates in the European Commission's Eastern Partnership programmes and is involved in the implementation of a number of interstate and international treaties in the field of energy, including participation in the Commonwealth of Independent States (CIS) Agreement on the co-ordination of interstate relations in the power sector, and the treaty on the parallel operation of power systems of the CIS.

Energy Supply

In recent years, there has been a tendency to reduce consumption of primary energy resources, and in particular, from 2012 to 2016, consumption decreased by 18.3%: from 30 655 to 25 049 ktoe, which is caused by a slowdown in GDP and government policies intensive energy saving.

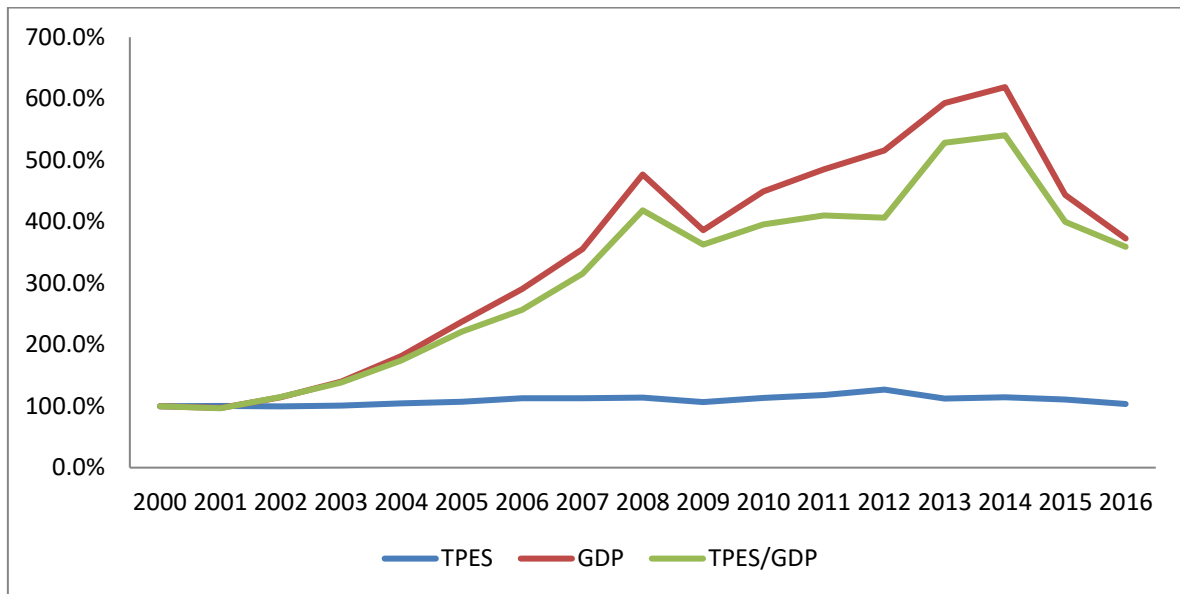


Figure 1 Main energy indicators

The structure of consumption of primary energy carriers does not change significantly, the main amount belongs to heat energy, the share of which is constantly decreasing: from 35.0% in 2000 to 31.8% in 2016, and the share of electricity varies from 25% to 27%; of heating oil - 22% - 24%, oil products - rising from 11.7% in 2000 to 15.4% in 2016.

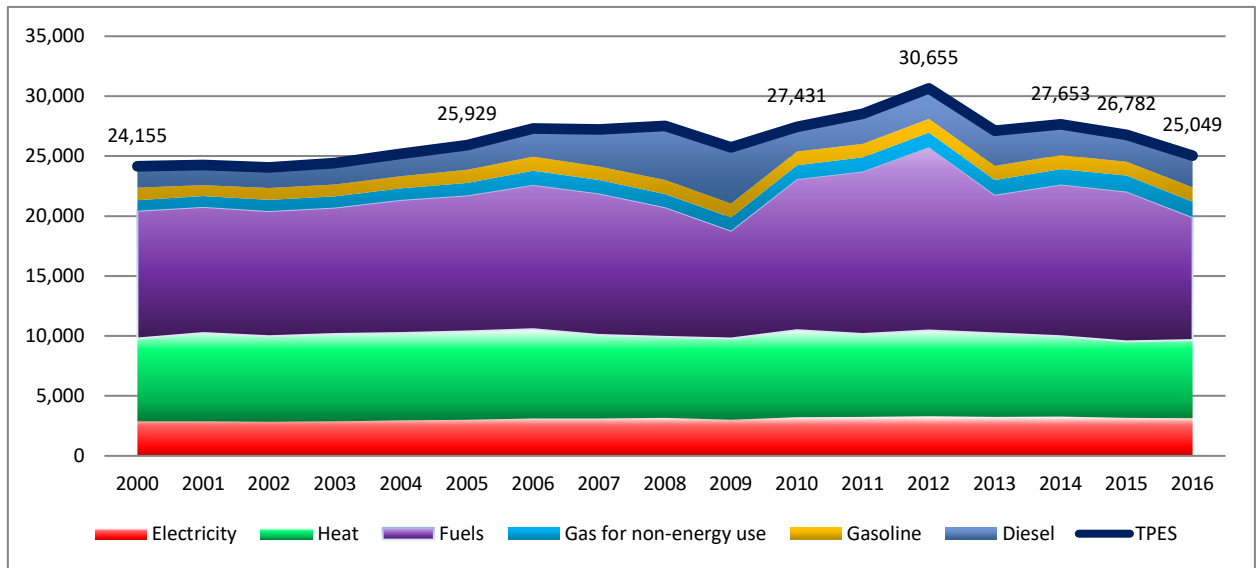


Figure 2 Dynamics of primary energy consumption by types, ktce

The structure of electricity generation shows a constant decrease in the share of objects of the state company "Belenergo" and the constant growth of objects of other economic entities. The share of facilities based on renewable energy sources (RES) is low, but increased from 2012 to 2016 16 times - from 0.019% to 0.306%.

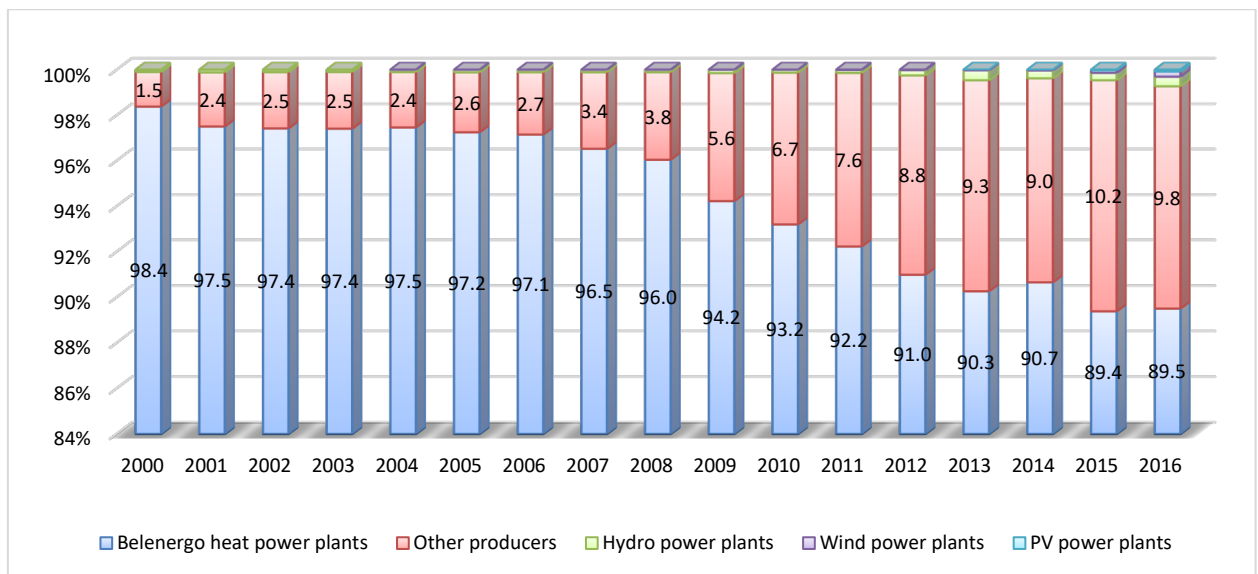


Figure 3 Structure of electricity generation

Total installed capacity of RES is 249.9 MW. SPA "Belenergo" operates 25 hydropower plants with total installed capacity of 88.2 MW and 1 wind power plant with installed capacity 9 MW.

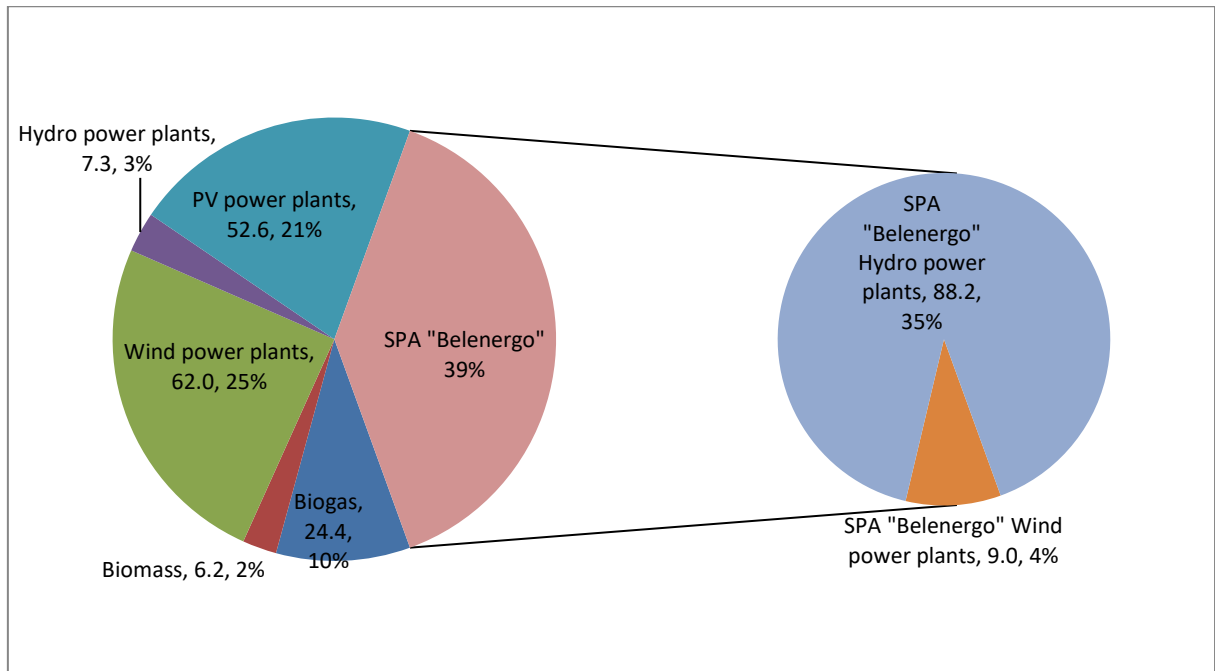


Figure 4 Structure of installed capacity

In the production of heat energy, there is a tendency for a constant decline, and in particular, for the last 5 years from 2012 to 2016, the reduction was 9%. The share of boiler plants is constantly decreasing, and the share of power plants is growing and, consequently, the share of the most efficient method of combined production of heat and electric energy is increasing. According to the methodology for drafting the fuel and energy balance and calculating the energy intensity of the gross domestic product and energy independence that existed up to 2016 waste heat is indicator that sets amount of the energy potential generated in process units that is not used in the unit itself, but can be partially or fully used for power supply to other consumers. Waste heat is utilized in contact-surface water heaters using latent heat of vaporization and condensation of water vapor in heat supply systems, heat water boilers, flue gas heat recovery etc.

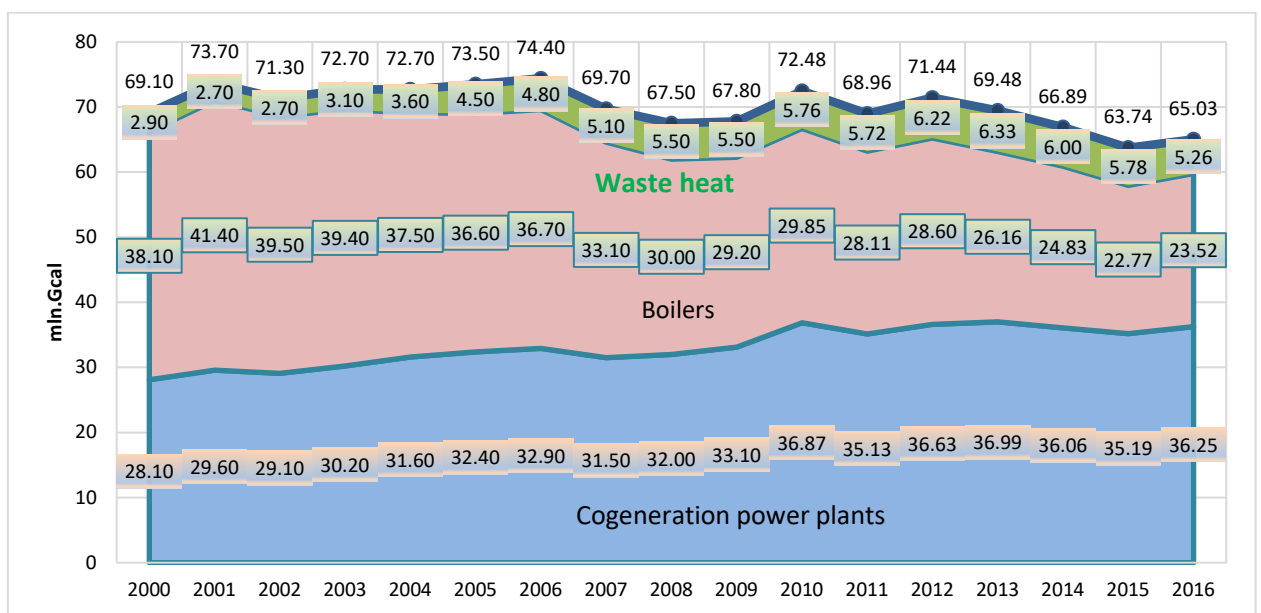


Figure 5 Structure of heat production

Energy Demand

In the structure of electricity consumption, at almost the same level, the share of residential sector-(16% - 18%). From the analysis of the graph in Figure 3, it follows that the change in the volume of electricity consumption does not directly correspond to the change in GDP production, which, in turn, indicates a large share of fixed use by its consumers and significant part of it is spent on a permanent basis without production of products, provision of services and the formation of value added.

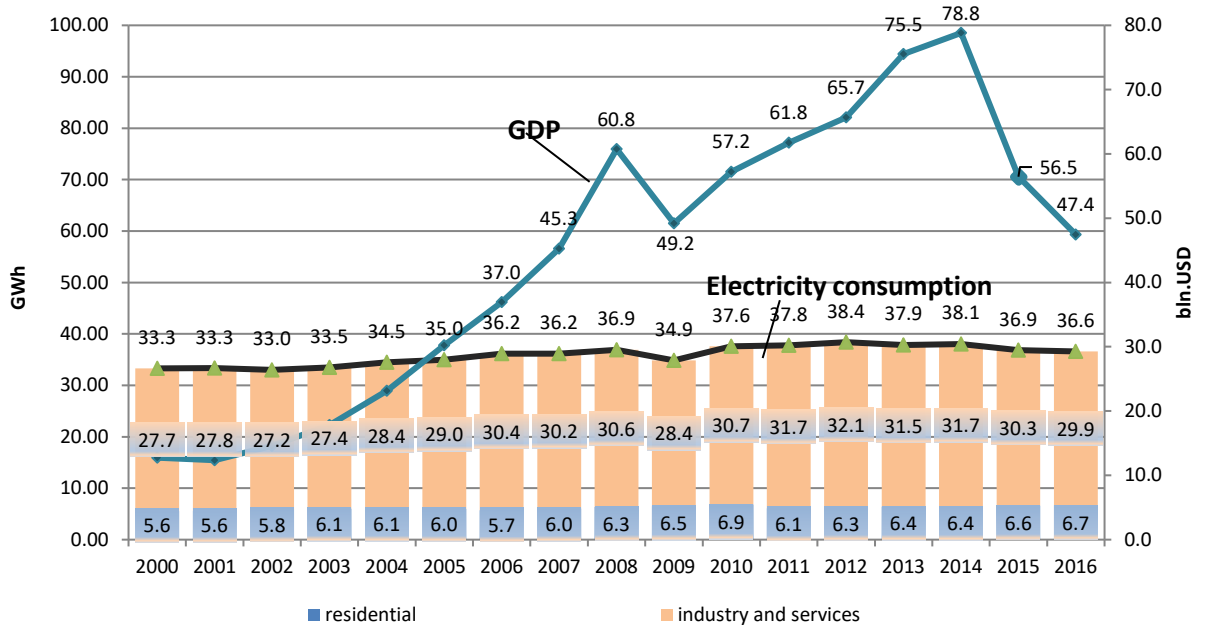


Figure 6 Electricity consumption and the production of GDP

There is a tendency for a constant decline of heat energy consumption, and in particular, for the last 5 years from 2012 to 2016, the reduction was 9%. Fluctuations in the total consumption of heat energy do not correspond to the rates of change in GDP production, but depend mainly on changes in the average temperature and duration of the heating season, which indicates an insignificant share of heat use in production processes, mainly for heating, ventilation and hot water supply of residential, public and production buildings. The share of the residential sector is constant and amounts to 34-35%.

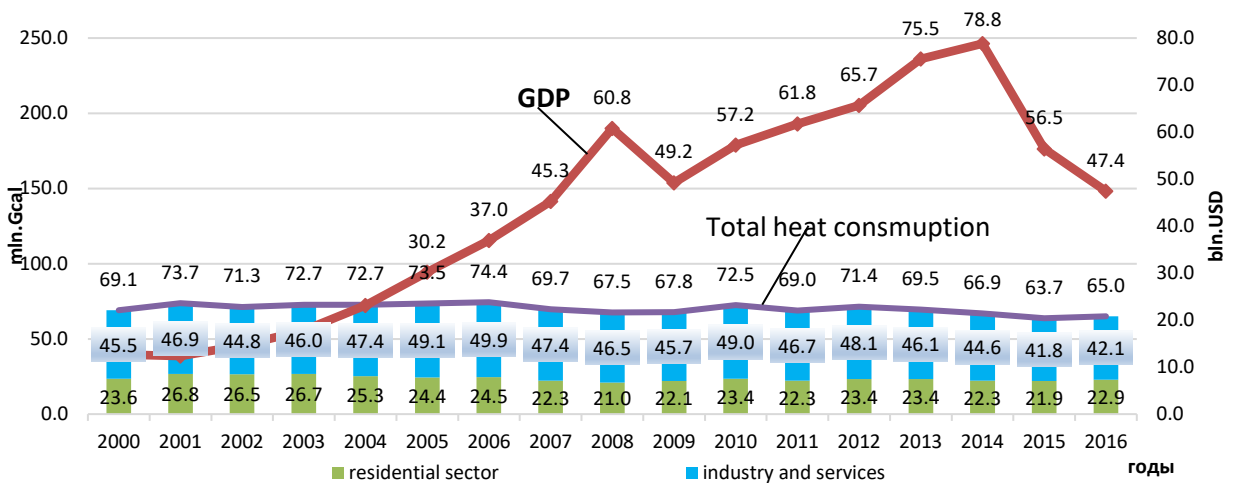


Figure 7 Heat consumption and the production of GDP

Market structure

Electricity and heat

The electricity and heat sectors are owned and operated by the State Production Concern BelEnergO (BelEnergO), a vertically integrated state-owned association. Its management is under responsibility of the Ministry of Energy. BelEnergO is responsible for electricity and heat generation, transmission, distribution and retail services. It provides technical support and is the instigator of relevant investment projects. BelEnergO functions through a number of subsidiaries, including six regional distribution companies known as oblenergos. BelEnergO covers about 50% of the heat supply while the remainder is provided by local district heating entities which are owned by municipalities. At the end of 2014, the government was considering a possible future law on electricity that includes electricity sector unbundling and the separation of transmission, distribution and retail operations of BelEnergO.

Natural gas and oil

Gazprom-TransGaz (previously BelTransGaz) owns and operates high-pressure transportation, transit and storage systems, and is responsible for new construction and maintenance. The company is fully owned by Russian Gazprom. Gas transit matters, including infrastructure, system operation, tariff structure and technical services are carried out under a bilateral agreement with Russia's Gazprom.

The natural gas distribution infrastructure is owned by the state, along with responsibilities for technical services, tariffs, and upgrade and maintenance programmes. The distribution network is operated by the State Production Concern of Fuel and Gasification BelTopGaz (BelTopGaz) which is managed by the Ministry of Energy. BelTopGaz includes seven distribution companies which serve Minsk and six other regions. The petrochemical sector of Belarus is operated by enterprises and organisations of the Belarusian State Concern for Oil and Chemistry BelNeftekhim (BelNeftekhim), which reports directly to the Council of Ministers. BelNeftekhim includes more than 80 companies and organisations which carry out oil exploration and production, transportation, refining and retailing, as well as the production of a wide range of chemical and petrochemical products. The Mozyr oil refinery is owned by several Russian companies.

Institutional framework

The Ministry of Energy is responsible for the fuel and energy sector of Belarus. It manages the vertically integrated state-owned natural gas supplier, BelTopGaz, and the vertically integrated state-owned electricity producer, supplier and retailer, BelEnergO. This ministry also oversees the State Institute for Management of Construction of Nuclear Power Plants and other state-owned organizations operating in the energy sector. It is responsible for the implementation of the new State Programme on the Development of the Electricity System of Belarus for the Period to 2016.

State regulation of the energy sector, including energy efficiency and renewable energy, is carried out through decrees, directives of the president, government decisions and the Ministry of Economy. Other relevant ministries and departments are active participants.

The Department of Energy of the State Standardization Committee is responsible for the development and implementation of national energy efficiency and renewable energy policies. It also monitors and ensures state control over rational use of fuel, electricity and heat.

The National Statistical Committee is responsible for administering the laws on national data services. It collects, processes and publishes national statistics, including energy data. The Statistical Committee is responsible for preparation of energy balances, which it does in close co-operation with the Ministry of

Energy and energy enterprises. Local councils, executive authorities and administrative bodies implement state energy policy. There are a number of public and non-governmental organisations active in the field of energy efficiency, renewable energy and environmental protection in Belarus.

Belenergo SPA incorporates six republican (oblast) energy supplying companies (RUEs of Oblenergo), construction/installation/adjustment companies and other organizations. The main areas of Belenergo's activities include the operation of the Belarusian energy system, generation, transmission, distribution and sale of electricity and heat, operational dispatch management, maintenance of power plants, power and heat supply networks and organization of activities for the purposes of energy system development (demand forecasting, investments, rehabilitation, construction, etc.)

Beltopgas SPA incorporates seven distribution companies (unitary state enterprises), which supply gas to Minsk and six regions of Belarus.

Energy policy framework

The main priority of energy policy and strategy in Belarus is to provide a reliable and sustainable energy supply for the national economy, while reducing dependence on energy imports and improving the financial stability of the sector. Both renewable energy and energy efficiency have been identified as priorities to achieving these aims; however most of the change in the energy sector will be due to a new planned nuclear power station, expected to become partially operational by 2020.

In accordance with the "National Strategy for Sustainable Social and Economic Development of the Republic of Belarus for the period until 2030", the strategic goal is to ensure high living standards of the population and conditions for the harmonious development of the individual within the transition to a highly efficient economy based on knowledge and innovation, while maintaining a favourable environment for present and future generations.

Among the strategic priorities, the main goal is to create a high-tech economy sector, introducing energy-efficient and environmentally friendly technologies, developing high-value-added industries, information and engineering services, and to improve the institutional environment and to create an enabling business environment that implies ensuring its stability and transparency, elimination of excessive and unjustified state interference in the activities of economic entities, improving the quality of public services, financial accessibility, etc.

To improve the energy efficiency of the economy, it is planned, by 2030, to reduce the energy intensity of GDP from 0.398 in 2005 to 0.154 toe per thousand. BYN. (in 2005 prices), i.e. by 2,6 times, and at preservation of such rate it will decrease by 3,0 times till 2035.

Among the main directions of the industrial complex development is to create "green" industrial technological platform based on energy saving, introduction of ecological "green" technologies, renewable and alternative energy sources, and effective technologies for waste processing.

The long-term goal of fuel and energy complex developing is to meet the needs of the economy and the country's population in energy carriers based on their most effective use while reducing the burden on the environment.

Achieving this goal involves the implementation of tasks that include:

- modernization and development of power system generating sources, electric and heat networks through the introduction of highly efficient equipment, the use of modern advanced technologies with decommissioning of less economical and outdated equipment;
- diversification of the types and suppliers of fuel and energy resources in the formation of the fuel and energy balance of the country with increasing volumes of their storage;

- financial recovery of energy supplying organizations.

At the first stage (until 2020), the development of the fuel and energy complex will be aimed at improving the energy efficiency of existing heat power plants and developing non-carbon energy sector.

First priority tasks at this stage are:

- reconstruction and modernization of existing and replacement of retiring capacities with the introduction of innovative energy-efficient technologies;
- completion of oil refineries modernization and production increasing of light oil products with high added value;
- formation of the wholesale electric power market of Belarus and its integration into the common electric energy market of the EEU member states;
- implementing policies aimed at eliminating non-economic barriers, providing transparent, predictable and flexible incentives for the development of renewable energy.
- In order to achieve the set objectives, it is envisaged:
- introduction of steam-gas, gas-turbine and gas-engine technologies for the electric and heat energy production that meet the advanced modern requirements of science and technology in this field;
- commissioning of two units of the Belarusian nuclear power plant with a total capacity of about 2,400 MW, construction of facilities on local fuels;
- increasing the depth of oil refining from 73.7 percent in 2014 to 92 percent in 2020;
- development and adoption of the Law of the Republic of Belarus “On Electric Power Industry”;
- ensuring costs transparency at all stages of production, transmission (transportation), distribution and sale of electricity, heat and natural gas;
- development of regulatory legal acts that stimulate the use of renewables and local fuels.

Taking into account the introduction of Belarusian NPP, additional measures will be required to ensure the electric capacities balance at night. For this purpose, the following technical and organizational arrangements are envisaged:

- construction of electric boiler houses for heat energy generation during night hours;
- designing heat supply projects for new buildings with use of electrified and combined heating;
- use of highly manoeuvrable power capacities;
- introducing electricity tariffs distanced by the day and night for auto producers, applying this tariffs for consumers;
- organization of electricity exports;
- creation of energy-intensive industries that will work at night; charging of industrial and municipal electric vehicles, etc.

While cooperating with the EEU member states, there also will be active cooperation with international energy organizations, including the International Energy Agency, as well as the IRENA, whose main task is to distribute technical and other information on new technologies in renewable energy.

In the medium term (2021-2030), the main goal of the fuel and energy complex development will be to increase the country's energy security by involving nuclear fuel and renewable energy sources in the energy balance. It is necessary to expand cooperation with the European Union, China and international organizations within the CIS, promoting the transfer of technologies and system solutions in the field of renewable energy sources energy efficiency.

The main directions of development of the fuel and energy complex in the part of RES will be:

- construction of wind parks with large installations with a unit capacity of at least 2 MW and stage-by-stage localization of their production;

hydropower:

- reconstruction and modernization of small hydroelectric power stations, construction of hydroelectric power stations on large rivers. In the case of economic and environmental feasibility, it is possible to build a pumped storage station to regulate the consumption of electricity after the commissioning of the Belarusian NPP;

biogas:

- creation of biogas plants at livestock complexes, at the food production plants, at garbage dumps in large cities, as well as its technological application. The use of biogas should be carried out both for the production of electric and heat energy, and for various types of transport and in everyday life (gasification of villages). It is planned to organize the production of domestic biogas plants;

solar:

- use of solar water heaters and various solar plants to intensify the processes of drying and heating water in agricultural production and household purposes, and use of solar energy to generate electricity;

geothermal:

- the introduction of heat pumps, also through distanced tariffs by day and night times, the creation of domestic heat pumps in Belarus (individual components).

In addition, it is planned to build energy sources on wood fuel and to localize the production of equipment (units, parts, structures) for them.

To achieve the set goals, in addition to use own funds, it is envisaged to create conditions for attracting direct foreign investments.

A new Concept of Energy Security came into force on 1 January 2016, the main energy policy document in Belarus. Policy objectives have remained the same compared to the previous policy document, including: an increase in the use of local fuels and a reduction of gas import dependency; expanding trade and regional cooperation; strengthening state control while allowing legal protection for smaller private companies; developing new technologies; and a reduction in GDP energy intensity of Belarus.

The main strategic directions of the new Concept are as follows:

- Reduction in import dependence and development of own energy resources;
- Diversification of import suppliers and increase in energy transit;
- Reduction in natural gas in the energy mix;
- Improving reliability through rehabilitation and modernisation, and increasing oil reserves;
- Enhancing demand energy efficiency measures and reducing GDP energy intensity;
- Enhancing energy efficiency of production and distribution of energy;
- Improving customer affordability while phasing-out subsidies;
- Regional and global cooperation and trade/export development;
- Improving energy sector management;

On 1 March 2016, the government approved the Comprehensive Development Plan for the Electricity Sector to 2025 and Beyond, allowing for integration of the planned nuclear power plant (NPP) and the necessary changes in the regulatory and technical framework. The Plan also includes allowances for network rehabilitation and development, as well as tariff subsidy phase-out. On 6 April 2016, a new Energy Efficiency and Energy Savings plan for 2016-20 came into force.

GHG emissions and climate policy

The Belarusian government is also concentrated on climate change and reducing greenhouse emissions. In 1992, Belarus joined the United Nations Framework Convention on Climate Change and the Kyoto Protocol in 2005. The State Programme of Measures to Mitigate the Effects of Climate Change for 2013-20 sets a target of to reduce GHG emissions by 8% in 2020 from 1990 levels, about 10 million tonnes of carbon dioxide equivalent (MtCO₂-eq). Measures include energy efficiency improvements, increases in forest areas, restoration of peat lands and improved legal and regulatory approaches. Belarus submitted its Intended Nationally Determined Contribution (INDC) to COP21 in September 2015, with a pledge to reduce emissions by at least 28% in 2030 compared to 1990 (UNFCCC, 2015). Belarus supports the collective efforts of the Parties to the United Nations Framework Convention on Climate Change to achieve the major milestone of this century – keeping average global temperature rise below two degrees Celsius as compared to the preindustrial period. In order to contribute to the prevention of dangerous climate change, Belarus submits its intended nationally determined contribution to these efforts and undertakes by 2030 to reduce greenhouse gas emissions by at least 28 per cent of the 1990 level, excluding emissions and removals in the land use, land-use change and forestry sector and without any additional conditions.

Analysis of best practices in sustainable energy in Belarus

Energy efficiency

In 2011, the Council of Ministers of the Republic of Belarus approved the National Programme on Energy Saving for the period from 2011 to 2015 (Resolution № 1882, 2011). The Programme set ambitious targets of reducing the energy intensity of GDP by 29-32% by 2015 compared with 2010 and increasing the share of local energy resources in the fuel balance to 28% by 2015. A wide range of measures was envisioned to achieve these objectives. The approach assumes growth in both real GDP and energy demand. The level of energy intensity in 2012 was 0.21 tonnes of oil equivalent (toe) per USD 1 000 GDP PPP, which is 39% lower than 2002 levels. Belarus's energy intensity is the fifth-lowest compared to other EECCA countries. The government approved a Law on Energy Savings in December 2014. The law stipulates energy efficiency technology implementation and the energy-efficient equipment requirements. The total amount of required funding from all sources was estimated at USD 8.6 billion of which 38% were identified as own resources of enterprises; national and local budgets were planned to contribute 27% and 15%, respectively; loans and other resources were planned to account for the remaining 20%.

However, according to Department of Energy Efficiency, the total amount of funds provided from the national and regional budgets for energy saving measures amounted to USD 1 439 million, which is about 40% from what was initially planned for the duration of the Programme. The 2011-2015 Programme's energy efficiency targets have not been achieved either. According to the new National Programme on Energy Saving for the period from 2016 to 2020, adopted by Resolution № 248 of the Council of Ministers of 28 March 2016, in 2011-2014 the energy intensity of Belarus' GDP dropped by 8,3% (the GDP grew by 9.8%, but energy consumption practically did not change). The official data for 2015, the last year of the previous programme, is not yet available, there was a significant change in neither GDP nor energy consumption in 2015 compared with 2014. 8.3% is a considerable decrease in energy intensity over 2011-2014, but it is more than three times lower than the target set in 2011.

According to the Government Programme "Energy Saving" for 2016-2020, which was adopted in March 2016 (Council of Ministers, 2016), energy intensity of GDP will be reduced by at least 2% by 2021 compared with 2015. The share of domestically sourced primary energy in total energy consumption is planned to reach at least 16% (mainly thanks to the inauguration of the nuclear power plant), including 6% coming from renewable energy sources. The funding for implementation of these energy saving measures, based on social and economic development parameters of Belarus, is envisaged at BYN 11 064.26 million (USD 5 625 million).

BelEnergO is expected to bring a total of 1.8 GW of capacity on line in the period 2011-15 which will include more efficient technologies. As a consequence, 906 MW of inefficient generation capacity is to be decommissioned in line with the need to reserve capacity for system reliability until the nuclear power plant is operational. Electricity grids will replace obsolete equipment and develop intelligent control systems. Plus, no less than 1 500 km of 0.4-10 kV lines will be rehabilitated. These measures are expected to deliver a two-percentage-point reduction in losses compared with 2010 levels.

For heat supply, the main efficiency improvements are heat production plants, the automation of controls and metering. In order to modernise necessary assets and increase customer connections (including industrial and residential), the network will require an annual replacement of 100-120 km of supply pipelines and 550-660 km of distribution pipelines. The efficiency gains are expected to reduce losses by two percentage points in 2015 compared with 2010 (or 8% in total).

Public awareness of energy efficiency in Belarus is relatively high as information is regularly shared through media campaigns, information sessions, publications, educational seminars and other information dissemination approaches.

Industry sector

The industry sector has undergone a programme of modernisation over the past decade, with the aim of increasing capacity, improving competitiveness and expanding exports. Under the national programme of modernisation which totalled approximately USD 1.2 billion, a number of key facilities have been modernised, mainly in the sphere of cement, wood processing and machinery, but also food and textile.

Under the Concept on Energy Security and the National Programme on Energy Efficiency and Energy Savings for 2016-20, the following policies, targets and measures are aimed at improving industry energy efficiency:

- A reduction of 2% in energy consumption by the manufacturing sector from 2015 to 2020;
- Continuation of restructuring of state-owned enterprises, and modernisation of processes;
- Closures of the least efficient state-owned enterprises;
- modernisation and technical re-equipment of production processes;
- Electrification of processes where possible, particularly in heating of facilities.

In accordance with sectoral energy saving programs for 2016, 511 energy-saving measures are envisaged with an expected amount of savings of 36 601 toe. In fact, 415 activities were implemented in full (81% of the plan), in addition, 38 events were partially implemented. Actual saving of fuel and energy resources amounted to 39 260 toe (107.2% of the plan).

The Energy Efficiency Department monitors energy savings within the industry sector. Enterprises plan for a reduction in energy consumption through their 5-year programmes, and are financially rewarded/penalised for final outcomes. The 5-year energy consumption reduction plans are based on compulsory energy audits and calculations that take into account previous five years consumption patterns and future output and economic activity. The Law on Energy Saving requires mandatory energy audits for legal entities with annual fuel and energy consumption of more than 1 050 toe.

Services

The main subsectors of the services sector are housing and utilities, health care and education, social security, etc. Sectoral and regional energy saving programmes determine the objectives for fuel and energy saving and the share of local fuel use, energy saving projects and measures at enterprises and organisations of respective ministries and departments.

The energy intensity per unit of GDP in the manufacturing sector is twice as large as that in the services sector, or even more than this. The share of services in the GDP structure should increase from 40.3–50%. In addition, the plan is to change the structure of exports to provide for an increase in services. This will allow the energy component of exports and the energy dependence of the country to be reduced.

Residential sector

Belarus has established the state system of technical regulations and standards in construction.

Thermal energy passports for buildings have been introduced, and are included in the package of design and certification/acceptance documents. Energy efficiency classification of buildings has been introduced.

According to the World Bank report (2015), more than 80% of the country's residential stock was built before 1996. Building thermal protection standards were significantly strengthened in 1993 and updated in 2010. Pre-1996 buildings consume, on average, nearly twice as much energy per square meter as

buildings constructed in the last four years. Deep thermal retrofits in these residential and public buildings could result in dramatic energy savings.

The newly approved Concept of Energy Security is the key policy document for energy efficiency measures in Belarus at the moment. Planned measures to increase energy savings and improve efficiency in the residential sector are mainly in the form of a shift to energy-efficient construction and refurbishment of existing buildings. Specific measures for the residential sector under the national programme on Energy Efficiency and Energy Savings for 2015-20 include:

- Modernisation of thermal networks, optimisation of heat supply schemes, decentralizing the heat with the liquidation of long mains;
- Reduction of heat network losses by 10% by 2020, through rehabilitation of infrastructure, minimum 4% of the total;
- Decommissioning of aged equipment;
- Improving insulation within building materials for residential buildings;
- Projects with floor heat and low-potential heat on heat pumps and solar heating;
- Reconstruction and modernisation of boilers in the direction of deep recycling flue gas heat and water vapour condensation heat of the flue gas;
- Metering requirements and introducing individual automated heat control systems in apartments in buildings of 8 apartments or more;
- Heat recovery devices, controlled ventilation and drains;
- Building small CHPs, solar water heaters in hot water supply systems;
- Energy efficient lighting;
- Energy efficiency standards and labelling for appliances;
- Buildings certification by energy efficiency classes;
- Energy data reporting;
- Public awareness and involvement of the population in energy conservation and efficiency in residential complexes.

The total area of energy-efficient multi-apartment housing, put into operation at the end of 2016 is 1 341, 5 thousand square meters. The share of the total area of multifamily energy-efficient residential buildings in the total volume of commissioned housing (excluding individual residential buildings) was 55%. In some areas, this indicator is significantly exceeded. According to the Brest regional executive committee, the share of energy-efficient housing in the Brest region was 79.1%.

The draft resolution of the Council of Ministers of the Republic of Belarus on the approval of the technical regulation "Energy Efficiency of Buildings" was developed in 2018. The project is aimed at further systemic development of energy saving policies in construction, the establishment of mandatory technical requirements to improve the energy efficiency of buildings and facilities, the development of common principles and approaches for assessing energy efficiency and energy conservation.

Transport sector

The transport sector is the third largest energy consuming sector in Belarus, and its demand is growing rapidly, compared to industry and the residential sector.

The consumption of oil products equals about 60% of the fuel and energy consumption by the transport sector enterprises. Starting in 2010, the Belarusian Government has established indicators of the reduction in the consumption of light oil products (LOP) for republican governmental bodies. The 2012 indicators (ratio of LOP savings achieved through organizational and technical measures during the

reporting period of the respective year to their actual consumption during the respective period of the previous year) are higher than those for 2011.

For the purposes of achieving these goals the annual sectoral programme of LOP saving has been developed and is being implemented, and this includes 188 measures in a number of areas. The sectorial program includes the replacement of rolling stock and improvement of the fuel consumption monitoring system. Operating standards for fuel consumption have been developed and approved with respect to all vehicles. A package of measures on the optimization of traffic routes has been implemented, online dispatch control systems are being introduced on a large scale and fuel consumption standards per traffic routes have been developed. The Belarusian Railway, as the main consumer of LOP, has implemented a program of locomotive modernisation and equipment with new diesel units. Fuel consumption in the air transportation subsector has been reduced through putting advanced fuel efficient types of aircraft into operation.

A reduction in the emissions of polluting substances (carbon oxide, carbon deposit, hydrocarbons, sulphur dioxide and nitrous oxides) and greenhouse gases (GHGs) into the atmosphere is an important result of the measures undertaken in the transport sector.

In its national programme on Energy Efficiency and Energy Saving for 2016-20, the government has the following plans for improving the energy performance of the transport sector, particularly concerning the public transport fleet:

- vehicles, machinery and equipment renewal and decommissioning of aged vehicles and machinery;
- installation of fuel consumption control systems, development of fuel consumption rules, and the introduction of differentiated fuel consumption rationing;
- introduction of modern equipment for diagnostics, maintenance and repair of vehicles and machinery;
- implementation of automated systems of dispatching control and management;
- optimisation of the structure of the vehicle fleet;
- increasing biodiesel consumption;
- the electrification of railway stations (Molodechno-Hudahai-State border, Zhlobin-Kalinkovichi);

The state enterprise Belkomunmash has constructed its own electric bus model. The practice of operating electric buses showed positive results. The number of electric buses is expected to increase in the structure of passenger transport.

Under the Comprehensive Development Plan for the Electricity Sector to 2025 and Beyond, the government has drafted plans to increase the electrification of the vehicle fleet and build the necessary infrastructure in order to utilise the excess electricity that would come online after 2020 with the two new nuclear reactors. Plans for the development of electric vehicles are the following, based on two scenarios:

- 30 800 electric cars and 1 880 electric buses by 2025 under the optimistic scenario (9 960 electric cars and 590 electric buses under the pessimistic scenario) by 2025
- 252 GWh of electricity usage under the optimistic scenario (78 GWh under the pessimistic scenario) by 2025
- around 1 500 charging stations (different modes) by 2025
- plans for the development of electric vehicle parts manufacturing.

If implemented, these measures are expected to result in 31.3 ktoe and 169 ktCO₂ savings under the optimistic scenario and 9.7 ktoe and 52.6 ktCO₂ under the pessimistic scenario. The plan is expected to cost in the range of USD 84-243 million and is expected to be financed by Belenergo, local power companies, credit funds, private equity and public-private partnerships.

Action plan for the Directive of the President of the Republic of Belarus, 2007 No. 3 on June 14"On priority directions for strengthening the economic security of the state" provides for:

- The implementation of investment projects for the electrification of railway lines
- The development of production facilities to increase the production of electric vehicles and hybrid cars
- The expansion of the fleet of electric vehicles and hybrid cars, the development of an appropriate infrastructure that provides for the construction of at least 25 places for charging electric vehicles for every 50 thousand people for cities with a population of more than 100 thousand people

Vehicle standards and fleet renewal:

According to UNEP (2015), Belarusian official dealers must meet Euro IV emission standards from 1 January 2011. Euro V standards are required for cars produced in Belarus for export markets. On 1 January 2015, Customs Union technical regulation Safety of Wheel Motor Vehicles came into force, which envisages Euro V vehicle standard for all vehicles, without plans for Euro VI HDV standards. According to the Belarusian Transport and Communications Ministry (Glusk Regional Executive Committee, 2015), as of 1 October 2015 over 11 200 trucks were in use in Belarus, of which 60% has Euro IV and Euro V emission standards.

Belarus has 55 agreements on international transport with 44 countries, with plans to further liberalise the terms of agreement. In 2014, cargo transport permits were abolished between Belarus and Switzerland and permits for bilateral transportation, transit transportation, and transportation between the Eurasian Economic Union member states were abolished on 1 January 2015 (Glusk Regional Executive Committee, 2015).

Education and Awareness Raising

Belarus has established a multi-level system of education in energy efficiency and energy saving: educational games in kindergartens, thematic lessons, competitions and energy marathons at secondary schools, the Fundamentals of Energy Saving specialty at institutions of higher education, the Energy Efficient Technologies and Energy Management specialty at four institutions of higher education in the republic and numerous professional development courses.

Systemic measures implemented in the country include international and national exhibitions, forums and conferences, awareness raising and educational workshops and training courses at the regional and sectorial levels, month and day campaigns on energy and energy efficiency, thematic campaigns, media tours, press conferences, online conferences on the rational use of energy resources and the best practices for introducing energy efficient technologies.

Permanent exhibitions have been arranged, as well as museums dedicated to energy saving being set up in a number of cities and educational institutions. There are a number of thematic publications: the research journal Energy Efficiency and educational books on the rational use of energy resources for children, as well as training and methodological papers and reference guides. Awareness raising and educational initiatives are being implemented through mass media and social advertising.

Energy Efficiency Resource Standards and Renewable Portfolio Standards

A priority for efficiency is to introduce international technical norms and standards. From 2007 to 2010, 129 technical regulations were developed, with more than 80 harmonised with international and European requirements, based on the Programme for Developing the System for Technical Regulation, Standardisation and Conformity Attestation in the Field of Energy Saving.

The Energy Efficiency Department (EED) of the State Standardisation Committee is the entity responsible for implementing and monitoring policies on energy savings, energy efficiency and renewable energy. The EED develops proposals for energy efficiency improvements, develops technical regulations and

standardisation of energy equipment, provides state supervision of the efficient use of energy and develops legal and financial measures to stimulate energy efficiency. There are seven regional EED offices.

Renewable energy

The Belarussian government has expressed renewable energy as one of the key priorities for the energy sector, as it provides for energy security through a reduction in imports and it reduces greenhouse gas emissions. In 2011, the National Programme on Local and Renewable Energy Development for 2011-2015 was developed, with detailed plans and projections for the development of all local resources, with a particular focus on biomass and biogas development.

As a result of the implementation of measures to introduce energy sources on local fuels, biogas, construction of hydroelectric power stations in the Republic of Belarus,

104 energy sources on local fuels with a total installed electric capacity of 13.5 MW and heat power of 500.1 MW, including 7 mini-cogeneration plants for local fuels with a total installed electric capacity of 13.5 MW and a thermal power of 48.3 MW;

12 biogas complexes with a total installed capacity of 19 MW;

7 hydroelectric power plants with a total installed capacity of about 19 MW;

35 wind power plants with a total installed capacity of more than 25 MW.

There is no binding target for renewables as a share of the energy mix in the new Concept of Energy Security, however the government is aiming to reach a 9% share by 2035 (up from just under 6% in 2013). Electricity generation from renewables is expected to grow by 10-fold to 2.6 TWh by 2035, albeit this is not a key policy target.

In 2015 the Belarussian government amended the regulation on renewable energy that was governed by the Law on Renewable Energy Sources adopted in 2010. In May 2015, the government approved the Presidential Decree on the Use of Renewable Energy and in August 2015 it approved the resolution on a new methodology for feed-in tariffs. In March 2016 the government approved the Comprehensive Development Plan for the Electricity Sector to 2025 and in April 2016, the state programme on energy savings for 2016-20 was approved.

The new legislation on renewables in May and August 2015 effectively changes the previous feed-in tariffs and it legislates quotas on grid-interconnected renewable energy development (new plants and modernisation/rehabilitation that leads to an increase in capacity). Off-grid developments and developments under contract before 20 May 2015 are not subject to the said quotas. According to the government, the new tariffs are more likely to attract investors while the quotas maintain the sustainability of renewables development and grid balancing. At end-2015, the Ministry of Energy was working on developing a new National Programme for the development of renewables for 2015-20. Table 1 indicates the year-to-year quotas per RETs.

Table 1 RES development

Наименование	Solar	Wind	Biogas	Bioenergy	Hydropower	Total
Total on 01.01.2018	152,556	73,787	24,945	6,23	95,27	352,788
Quotas for 2018-2022	14,175	61,365	48,13	5,62	1,15	130,44

Investment agreements 2018-2022	112	130,95	0,92	9,9		253,77	
Non-allocated quotas 2018-2022	1.275		4,38	5,256	58	68,911	
International technical assistance projects 2018-2022	0,1		0,6	0,8		1,5	
Without quotas		7,8				7,8	
Off-grid		54,8				54,8	
Total for 2018-2022	127,55	254,915	54,03	21,576	59,15	517,221	
Total RES for 2022	MWh	280,106	328,702	78,975	27,806	154,42	870,009
	%	32,2	37,8	9,0	3,2	17,8	100

Solar

While Belarus does not have a very favourable solar regime, its potential is significant, mainly in the south and southeast of the country. Most of Belarus only receives between 1 100 kilowatt hours per square metre (kWh/m²) and 1 400 kWh/m² (GHI) and around 1 000 kWh/m² (DNI). This means that CSP generation is impractical, but that production by means of solar PV is possible. There is also the potential to use solar energy in solar water heaters and other systems for water heating and drying in agriculture, water heating and space heating in buildings, and low-temperature process heat in industry and services. Total solar potential is estimated at 49.7 Mtoe/year.

Wind

The energy potential of wind is estimated to be up to 1 600 MW, with 1 840 potential wind farm sites in three regions: Hrodna, Minsk and Mogilev. Total wind potential is also estimated at 0.47 Mtoe/year.

This is not a high quality resource, but still acceptable in certain places, given the recent development of low-wind speed turbines. These potential estimates seem conservative given the wind regime. Modern wind technology developments have increased the scale of turbines (now with an average size of over 2 MW per turbine) and the energy yield, particularly at lower wind speed sites. It is therefore recommended that an updated estimate of wind potential should be undertaken, taking account of these developments and modern best practice in spacing and siting of turbines.

Bioenergy

Wood fuel

The area of the forest fund of Belarus is 9565.8 thousand hectares (39.8 percent of the territory). The total stock of standing wood is estimated at 1.7 billion cubic meters, and the specific weight of mature and over mature stands in the total amount of wood reserves of the republic was 13.6%. The total annual average forestry stock change is 32.6 million cubic meters. The wood fuel production amounted to 5.6 million cubic meters in 2016. And with the growth of its use by organizations for heat and electricity generation by more than 20% since 2010, there has been a significant decrease (by 40%) in residential sector due to high rates of gasification of rural settlements. According to the planned level of local fuels capacities construction and in accordance with the State Program "Belarus Forestry" for 2016-2020, it is planned to further increase the use of wood fuel by 0.5 mln. t.c.e. , including through fast-growing tree species planting for fuel and energy purposes.

To this date, 5,861 wood fuel capacities operates with a total heat capacity of more than 6,000 MW (including 2,994 in the housing and communal services amenities with a capacity of 3,800 MW). Until

2020, according to the Energy Saving State Program it is planned to construct additional 128 local fuels capacities with the primary use of wood fuel with a total installed heat capacity of 678.1 MW.

Until 2030, based on the planned trends in price increase of imported natural gas, the economic attractiveness of the heat generation from wood fuel will increase especially taking into account the lack of district heat supply system. It should be noted the transformation of the wood fuel sector with the change from firewood direct burning to the production of value-added products - fuel chips and pellets, which in addition to the convenience of end use have a high export potential. It is necessary to intensive development of new technologies for biomass gasification, as well as extensive introduction of equipment for deep utilization of waste gas heat, which will increase the energy efficiency of biomass use by 8-10%.

Logging waste

The economically and environmentally appropriate amount of use of logging waste for energy purposes is about 0.5 million cubic meters. meters, as part of logging wastes is used for technological needs, and is also left in the forest to preserve and improve soil fertility and biological diversity in accordance with the requirements of regulatory legal acts and forest certification.

The potential for logging waste, suitable for energy use, should be fully involved in the production of wood fuel chips.

Waste wood processing

The amount of processed wood in sawmilling and woodworking industries allow annually to receive and use for energy purposes up to 1.5 million cubic meters of woodworking waste, the cheapest raw material for the production of wood fuel chips.

Waste wood processing is also a raw material for the production of granulated wood fuel - export products, which are in high demand on the foreign market.

Crop waste

The annual total potential of agricultural residues is estimated at 1.46 million t.c.e. . According to the straw balance in agricultural companies in 2016, available straw resources is amounted to 887 thousand tons (equivalent to 213 t.c.e.) out of 7461 thousand tons obtained from grain and leguminous crops. Decisions on sustainable potential of their combustion for fuel purposes should be made taking into account the specific needs of the farms on an individual basis.

Biogas

17 biogas plants operate in Belarus with a total electrical capacity of 25.7 MW and total potential of 330 MW. According to the distributed quotas until 2019, it is planned to construct additional 48 MW biogas plants. Further development of this sector should be considered taking into account the availability of raw materials at specific facilities, as well as comparison of environmental and economic benefits from the introduction of biogas plants. The use of biogas is oriented to the electric energy generation, and heat energy is considered as a by-product.

Hydropower

Hydropower resources in Belarus are considered to be scarce, albeit with opportunities for small hydro in the northern and central parts of the country (UNIDO and ICSHP, 2013). Potential hydropower in Belarus is estimated at 850 MW, including technically available potential of 520 MW and economically viable potential of 250 MW (0.44 Mtoe/year).

Geothermal

Belarus's geothermal potential is relatively undiscovered, with only a few regions tested. Of the tested regions, the most promising geothermal energy potential lies in the Pripyat Trough (Gomel region) and

the Podlasie-Brest Depression (Brest region), in dozens of abandoned deep wells. Other areas studied include the shallow sedimentary horizons in the western part of the country, while potential for low-enthalpy geothermal energy is believed to exist within the whole territory.

In February 2016, the first geothermal atlas of Belarus was published, consisting of around 50 detailed maps showing where renewable resources from geothermal wells can be used.

Analysis of gaps in implementing sustainable energy practices and existing challenges for their implementation in Belarus

Energy subsidies

From 1992 until now energy pricing in the Republic of Belarus was based on a complex system of cross-subsidization. The legislative framework of this policy is enshrined in the Law № 255-3 "On Pricing" (from 10.05.1999) and Presidential Decree № 72 "On some issues of regulation of prices (tariffs) in the Republic of Belarus" (from 25.02.2011). In the future, in order to ensure the balance of interests of consumers and power supply companies, the Council of Ministers on March 17, 2014 adopted Decree No. 222. In this Regulation approved basic procedure for formation rates of natural gas and LPG, as well as heat and electricity. The resolution also regulates the formation of so-called "base prices" (tariffs for the full recovery of economically justified costs, reflecting all production and transportation costs, including expenses for repair services, depreciation of fixed assets, wages and social contributions, taxes and insurance premiums, as well as regulatory income). According to the Resolution, investment needs are covered by reflecting in the tariffs components such as depreciation, credit and regulatory income. In addition, the budget and government extra-budgetary funds can also be used to meet investment needs.

ESCO

There is no specific government fund dedicated to providing financial incentives to the energy efficiency programmes, while the Energy Efficiency Department monitors the level of investment in energy efficient technologies.

Energy service companies (ESCOs) do not exist in Belarus at present and awareness of the concept and the benefits is low. ESCOs provide energy audits and consultation but also finance or arrange financing for EE operations and measures, with remuneration directly tied to the energy savings achieved. Development of an ESCO market can build capacity, address public procurement and financing issues, lower costs, increase potential for bundling of project, and provide other operational improvements in energy efficiency measures.

Centralized heating system

The shortcomings of the existing heat supply system include:

- the lack of a regulatory framework for providing of effective interaction between heat energy producers of various departments, organizations that carry out its transmission, distribution and consumers;
- discrepancy between actual and project temperature conditions;
- heat supply to consumers is carried out according to the dependent scheme, which limits the possibilities of creating a competitive market;
- absence of automatic control systems for the district's heat supply complex in general (generation-transmission-consumption);
- about 60 percent of heating system elements exceeded the normative service life.

Transport

The number of electric vehicles remains negligible compared to cars with internal engines. Barriers for the operation of electric vehicles are high costs, high taxes, lack of charging infrastructure. In the period from September 1, 2016 to September 1, 2017, import duties were abolished. During this period, the number of electric vehicles has grown.

RES

While renewables could play an important role in meeting Belarus strategic needs to reduce fuel imports and to reduce energy related greenhouse gases, the current Belarusian policy framework does not provide a strong supportive framework for future renewables development, as it lacks clear targets for RET development and it does not have binding goals. The main aim of the policy is to provide energy security for Belarus by diversifying its energy mix through an increase in the use of local fuels, in a number of ways other than investing in renewables, leaving the future of this investment in uncertainty.

Indeed, the quota system, which is intended to constrain deployment of some variable renewable generation technologies, will dissuade investors who will be seeking signs that there will be a substantial market over coming years, in order to justify their investment in acquiring market knowledge and information. Equally, the monopolistic structure of the energy sector at present presents limitations to investor confidence and can result in preferential treatment due to monopolistic power.

Within the Comprehensive Development Plan for the Electricity Sector to 2025 (approved on 1 March 2016), the main planned changes to the regulatory framework include amendments to the Law on Electricity and the Law on Heat Supply, to account for the development of the new NPP, to include incentives for attracting investment in electricity and heat from local energy sources, and to plan for the rehabilitation of both systems. These amendments are expected to lead to a more stable and transparent regulatory framework, which in turn should stimulate the necessary investment.

Non-discriminatory access to the grid

The key limitation to RET development, as envisaged by the government under its strategy, is grid connectivity and balancing. Third-party electricity grid connection in Belarus has been allowed since 2013, after decades of restricted access to the vertically-integrated monopoly BelEnergO. BelEnergO has indicated potential problems with lack of regulation of grid connections of renewable technologies, including problems with overloading, balancing and cost recovery of the connection. However, experience elsewhere indicates that relatively high levels of renewables can be successfully integrated without technical problems or high costs by adopting some technical and management measures.

Outline of possible solutions for applying best practices from other countries

Energy subsidies

In accordance with the Comprehensive Development Plan for the Electricity Industry until 2025, taking into account the commissioning of the Belarusian Nuclear Power Plant the main directions of improving the tariff policy include the following provisions:

1. Elimination of cross-subsidies in electricity tariffs, taking into account the planned increase in real incomes of the population and the system of targeted subsidies to certain categories of citizens - 2016-2020;
2. Development of legal acts regulating the issues of formation of tariffs for electricity by type of activity in market conditions (generation, transmission, distribution and sale) on the basis of separate accounting and in accordance with the stages of reforming the energy system - 2016-2020;
3. Optimization of tariff levels for electricity used for heating and hot water supply - 2016;
4. Optimization of tariff levels for electricity for consumers performing electricity settlements at tariffs rated by time periods 2016-2020;
5. Expansion of the list of categories of consumers performing payments for electricity at tariffs rated by time periods - 2016-2020.

To implement these tariff policy measures, it is necessary to develop a number of methodological materials on the rules for determining the amount of tariffs by types of activity, to ensure optimal conditions for the combination of regulated and unregulated tariffs for electricity, etc.

ESCO

ESCOs market development can be challenging in predominantly state-owned markets, due to centralised financial management and lack of commercial incentives. In Belarus, it is expected that future ESCO market development will involve foreign investors, foreign ESCOs and foreign technology, which required supportive legislation and regulation of foreign investment and private-public partnerships. In December 2015, the Belarusian government adopted a Law on Public Private Partnerships, in accordance with international practices and in collaboration with UNECE, IFC and EBRD, aimed at foreign investments. This law and supporting mechanisms on foreign investment attraction should improve the potential of the ESCO market development in Belarus in the medium term.

Centralized heating system

To eliminate these barriers and further increase the efficiency of heat supply systems, it is proposed, in accordance with the Concept of Heat Supply Development of the Republic of Belarus, to implement the following measures.

Concerned republican state administrations and other state organizations subordinate to the Government of the Republic of Belarus, together with the regional executive committees and the Minsk City Executive Committee, should prepare proposals for adjusting existing and developing normative legal acts on issues that:

- determine legal, economic and social bases for the functioning and development of heat supply systems;

- establish the degree of state participation in the management of this process;
- regulate basic principles of the formation and functioning of the market of heat energy;
- determine the role of local executive and administrative organizations;
- provide protection and safety of heat supply to consumers;
- involve relations of participants in the market of heat energy;
- determine the methodology for the formation of tariffs for heat energy, including the costs of heat energy transmission to the consumer;
- regulate the design, construction and operation of heat supply systems;
- regulate the contracts agreement with heat consumers and estimation of heat release and consumption;
- regulate the procedure for installing meters for the release and consumption of heat and coolant.

In order to ensure integrated management, it is proposed to create a regulatory body in cities that provides optimal integrated management of the city's entire heat supply system, regardless of the departmental ownership of individual links, from design to automatic control during operation.

To adjust the actual temperature mode of the heat supply networks with the design ones, it is necessary to revise and, if necessary, adjust the existing regulatory documents for the design of heating networks.

To carry out a heat supply of consumers according to an independent scheme, which will ensure:

- effective management with different options for the balance of the elements of the system;
- automatic control of the hydraulic characteristics of the heat network;
- quantitative regulation of heat consumption and operation of several heat sources for a single heat network;
- effective regulation of heat consumption at customer facilities;
- reduction of heat-releasing fluid losses and maintenance of its quality characteristics at the required level.

It is necessary to begin the development of automatic control systems for the district heating complex in general for cities and large settlements, regardless of the departmental belonging of the individual elements of the complex.

To provide a competitive environment in heat supply systems it is required to assess the effectiveness and practical ability to form market relations, identify possible organizational arrangements and develop a draft regulatory act that defines the conditions of the heat energy market operation.

Considering the significant amount of heat networks that exceed of normative service life, it is required to determine the volumes and terms of their replacement or modernization based on the condition diagnosis. Approximately, about 80 - 100 km per year.

RES

It is recommended to transpose the legal requirements and to adopt a target for renewable energy in transport fuels in line with the EU Renewable Energy Directive.

To involve RES into the energy sector is required to ensure:

- construction of wind parks with unit capacity over 2 MW;
- reconstruction of small hydro power plants and construction of new ones on large rivers;
- biogas plants construction;
- construction of solar energy facilities as for electricity generation and for heating water and various products in agriculture and for domestic purposes;

- the implementation of heat pumps for geothermal energy with the creation of their production in Belarus.

Non-discriminatory access to the grid

The proposed unbundling of activities refers to the effective split of energy chains that are competitive from regulated work areas, in particular, the unbundling of segments, which are usually considered competitive, such as generation, wholesale, retail supplies from natural monopolies of electricity networks (i.e. transmission and distribution networks, and supplies).

The competition in generation and retailing depends on fairness and non-discriminatory access to the transmission and distribution network. The following chains can be distinguished for the unbundling.

The unbundling by type of activity is necessary to achieve a sufficient level of transparency in the cost / use of the resources used, as well as the quality of the services provided.

Effective competition can not extend to all areas of the electricity value chain. In particular, the areas of transmission and distribution of electricity are natural monopolies in which these services can be effectively provided by only one company. Therefore, a clear unbundling of competitive and non-competitive spheres is a prerequisite for an economically reasonable competitive environment, and effective regulation of non-competitive spheres.

To ensure non-discriminatory access of all market participants (retail deliveries / generation) to transmission and distribution networks, it is necessary to ensure a clear unbundling of the distribution from the transmission sector, since vertically integrated energy companies have strong motivations for pursuing a policy of discrimination against other companies competing in the markets of generation and retail deliveries, providing them with access to their networks.

Conclusions and recommendations

The following recommendations are offered to promote policies for Sustainable energy in Belarus.

General Recommendations

- The Government sets strategic goals in the area of energy efficiency and energy saving to ensure energy security and improve the living standards of the population and the competitiveness of the national economy. To achieve these goals the government should implement energy sector reform, which will provide with market mechanisms and the potential for investments in energy efficient technologies and RES.
- The Government should promote grid integration of renewable energy, ensure attractiveness of green tariffs to the grid operators/electricity distribution branches; establish detailed, clear and transparent rules for third-party access to electricity grids
- The government should encourage and stimulate co-operation between national scientific institutions and the international scientific and engineering community for the further development of advanced technologies and the implementation of pilot projects on energy efficiency and renewable energy.

Energy Reforms and Pricing

- The government should deliver an adoption of market oriented principles and a respective regulatory framework on the basis of international experience when developing energy sector legislation.
- The government should consistently pursue the policy of restructuring energy prices (tariffs) to remove cross-subsidies.
- The government should continue with planned activities on energy pricing reform to achieve the level of prices that reflects the costs of production.
- Differentiated electricity tariff rates should be developed by categories of consumers, by periods of the year, by time of day and the share of cross-subsidization in tariffs should be reduced before its complete abolition.

Energy Efficiency Funding

- The government should analyze and identify a system of measures aimed at the accelerated improvement of energy efficiency and the RES financing structure to increase the share of equity capital, private capital, loans and borrowings.
- The government should encourage the establishment and functioning of ESCOs and other market mechanisms for attracting investments in energy efficiency and to initiate an exchange of experience, training and pilot projects in co-operation with international organizations.
- The government should strengthen co-operation with commercial banks to establish and promote financial and credit products in the area of energy efficiency technologies and energy saving equipment.

Specific Energy Efficiency programs and Measures

Heat supply system

- In order to ensure integrated management, it is proposed to create in the cities a regulatory body that provides optimal integrated management of the city's entire heat supply system, regardless of the departmental ownership of individual links, from design to automatic control during operation.

- To adjust the actual temperature conditions of the heating networks with the design ones, it is necessary to revise and, if necessary, adjust the existing regulatory documents for the design of heating networks.
- It is necessary to begin the development of automated control systems for the district heating complex in general for cities and large settlements, regardless of the departmental belonging of the individual elements of the complex.
- To create a competitive environment in heat supply systems, it is required to assess the effectiveness and practical ability to form market relations, identify possible organizational arrangements and develop a draft regulatory act that defines the conditions for the functioning of the heat energy market.
- Considering the significant volumes of heat networks that exceed their normative service life, it is required to provide their replacement or modernization based on the diagnosis of their condition, about 120 - 150 km per year.

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