BELARUSIAN-GEORGIAN EXPERT REVIEW:

Localization of SDGs 7 & 13 and Energy Saving at the Local Level in Belarus and Georgia

LOCALIZING THE SDGs

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The Review includes materials and proposals, provided by other Belarusian experts.

Belarusian-Georgian Expert Review focuses on the localization of SDGs 7 & 13 and energy saving at the local level in Belarus and Georgia. The review contents general description and key data of the energy sector and energy efficiency system and mapping stakeholders in this area in both countries. Energy efficiency promotion instruments, access to finance and energy efficiency technologies in Belarus and Georgia are described. The conclusions and recommendations for the localization of SDGs 7 & 13 and energy saving at the local level based on the international global energy efficiency trends, exchange of experience on energy efficiency between Belarus and Georgia taking account of the national differences in energy efficiency systems are provided.

Conclusions and recommendations of the Review are addressed to the policy-makers, municipal and community leaders, small and medium businesses and NGOs involved in Georgia and Belarus as well as in other Eastern European countries.

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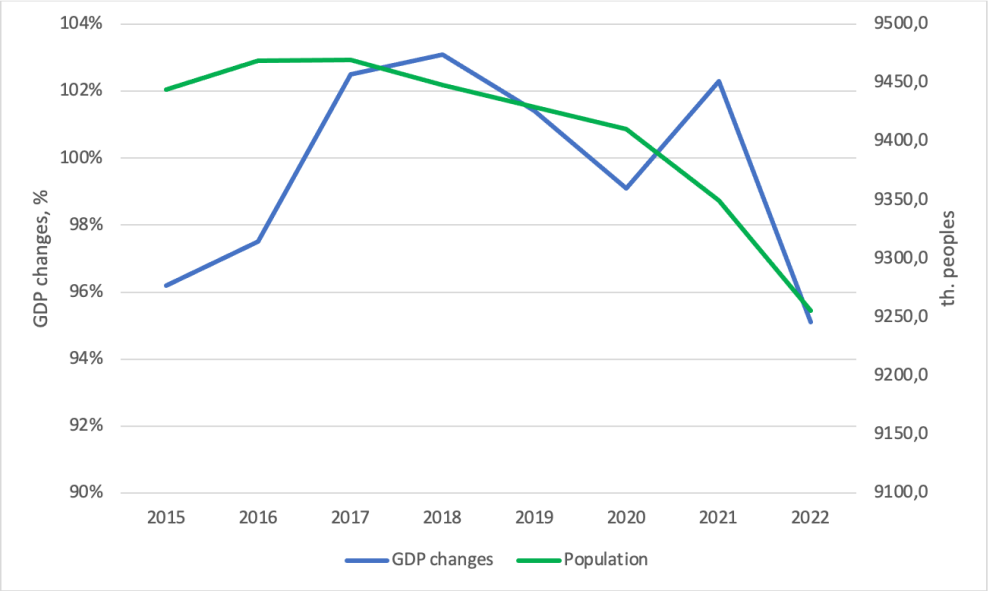
CONTENT

1. GENERAL DESCRIPTION OF THE ENERGY SECTOR AND ENERGY EFFICIENCY SYSTEM

BELARUS

As a demonstration of the general socio-economic situation in which the work of the energy system of Belarus will be analyzed, a graph of changes in two indicators is given: the country's GDP and population.

Figure 1 - General information

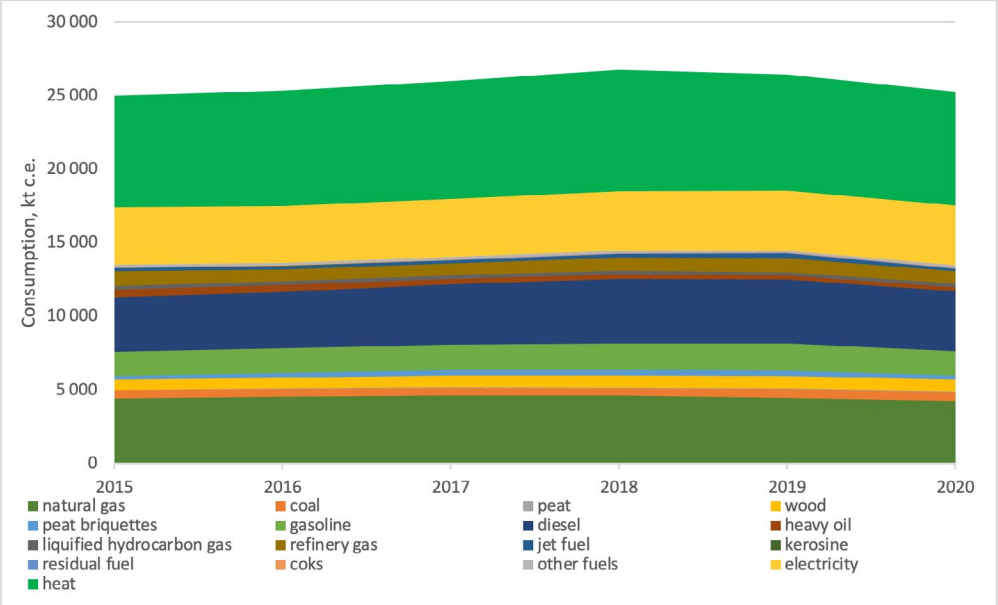


Starting from 2018, economic growth rates have been declining, as depicted in the graph. In 2020, the GDP contracted by 1%, and despite a 2% post-COVID growth, it further decreased by 5% due to the imposition of sanctions. As a result, there is a noticeable trend towards an economic recession within the next 5 years. The population dynamics present a similar scenario, as the growth observed until 2017 has transitioned into a reduction phase, which is being accelerated by the political crisis and repressions that have led to an increase in emigration. These are crucial indicators of development that are frequently discussed and published. However, it is worth noting that the National Statistical Committee stopped publishing the annual Energy Bal-

ance compilations from 2021, with the latest available data being for 2020. Therefore, in the absence of other data, we need to analyze the data for 2020, while considering the impact of the economic and social aspects on potential changes in the energy sector.

Final energy consumption by types of energy is shown in the figure 2.

Figure 2 - Final consumption

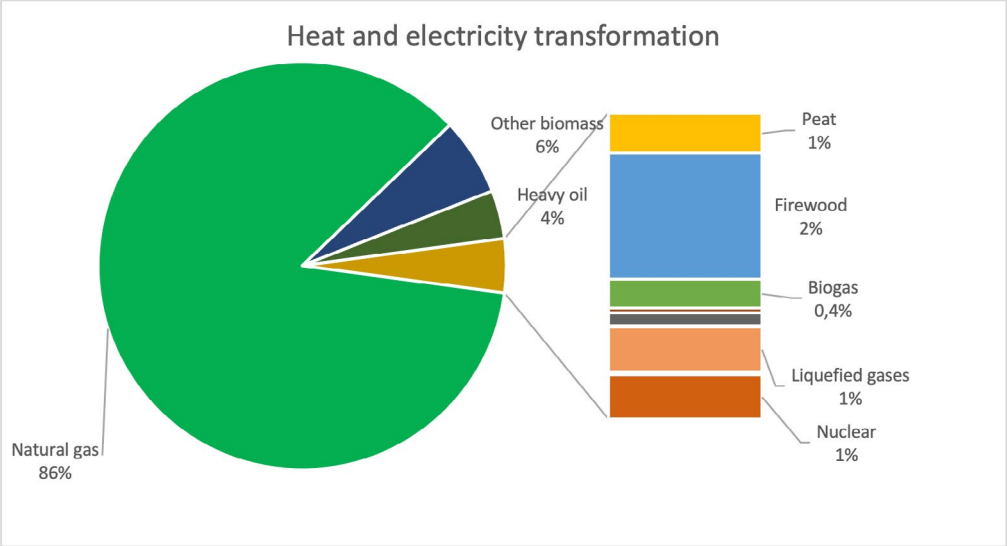


The graph shows a recent decline in final energy consumption in Belarus, with electricity, heat, and natural gas being the primary sources of energy consumed. Diesel fuel and gasoline are also significant sources of energy consumption.

The transformation sector is comprised of two sub-sectors: the production of heat and electricity, and oil refining.

Most of the electricity and heat production is achieved using natural gas. “Belenergo”, a state production association, represents this sector, acting as a monopoly in the electricity transmission and transportation sector. Belenergo is also the primary producer of both electrical and thermal energy, accounting for more than 90% of electricity production and over half of all heat energy produced in the country.

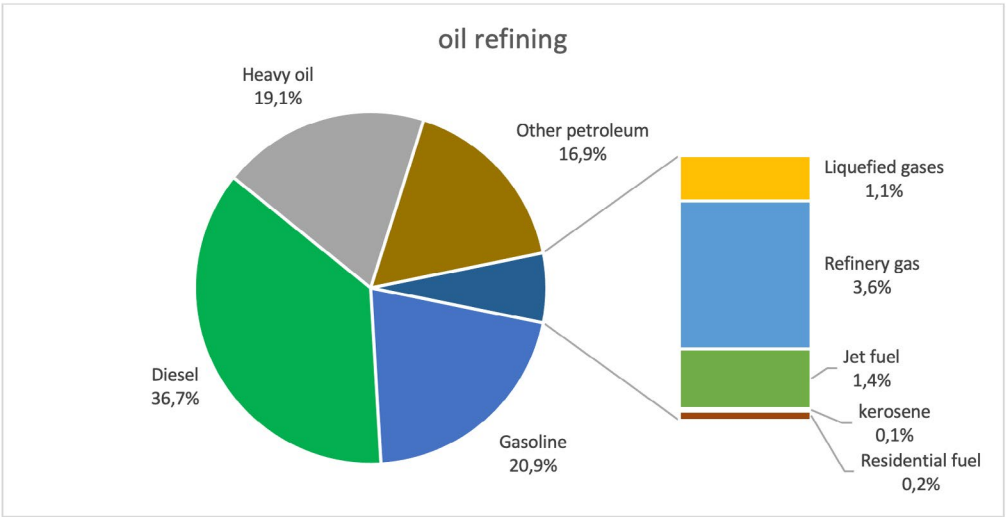
Figure 3 - Transformation sector



Belenergo, as a state production association, falls under the jurisdiction of the Ministry of Energy, which also oversees another production association named Beltopgaz. Beltopgaz is responsible for the transportation and distribution of natural gas, firewood, and peat (in the form of peat briquettes). Additionally, Beltopgaz is involved in peat extraction. District boiler houses, owned by state utility companies and overseen by the Ministry of Housing and Communal Services, are another source of heat energy.

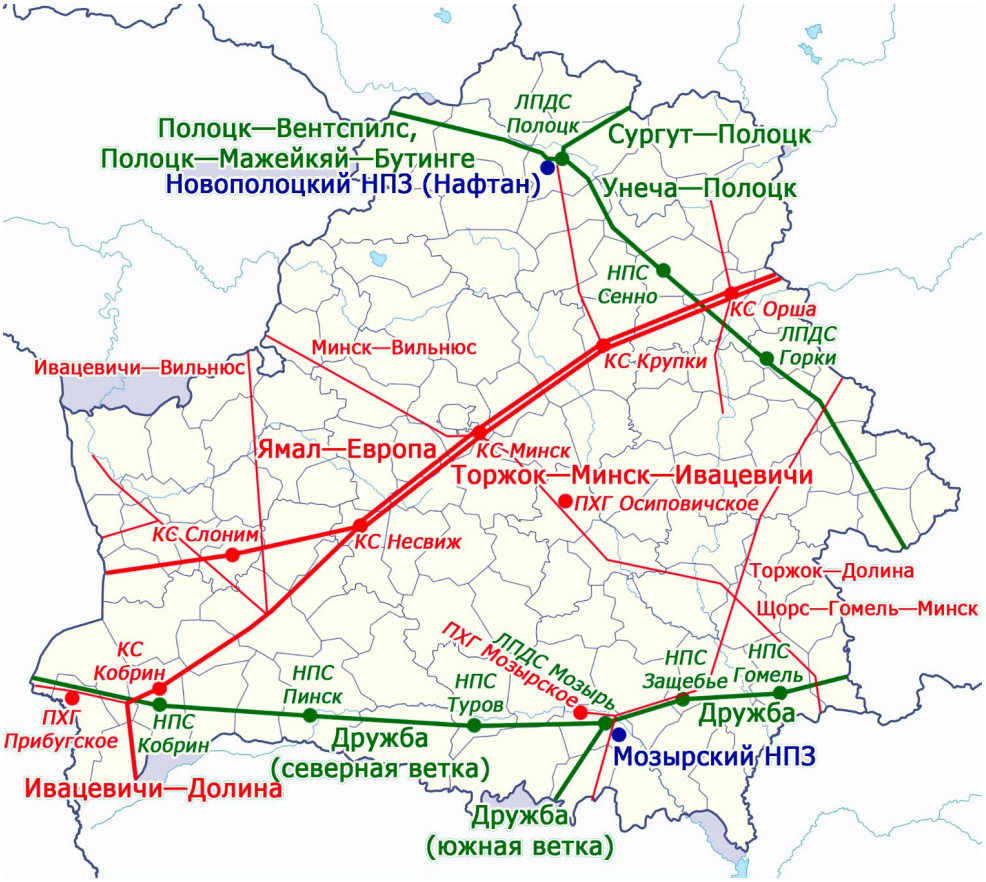
The oil refining industry in Belarus consists of two major oil refineries, OAO Naftan and OAO Mozyr Oil Refinery, which are both under the supervision of the Belneftekhim concern.

Figure 4 - Refineries



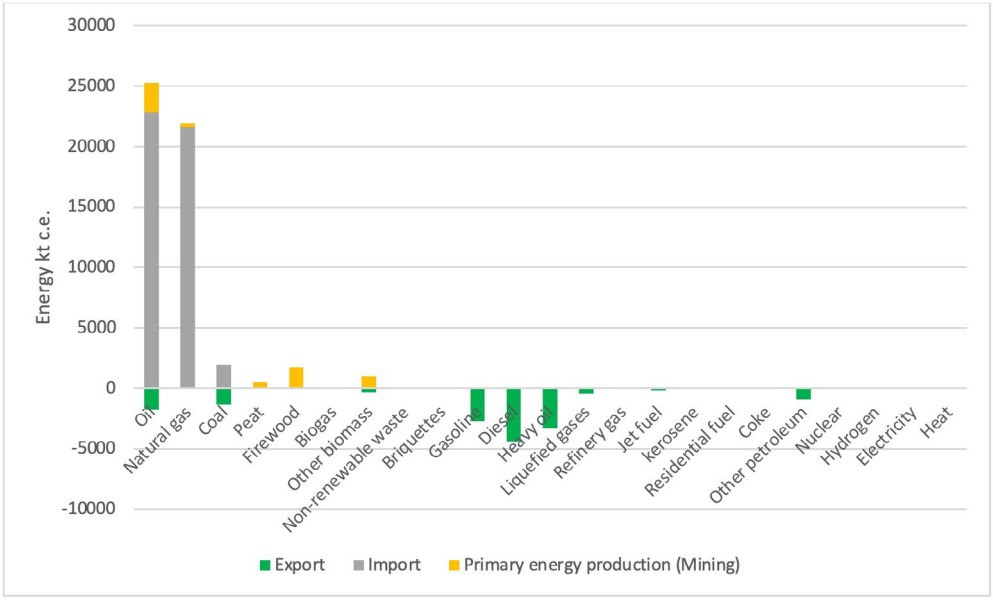
The energy demand in Belarus is primarily provided through energy imports, with oil and gas being the main imported fuels. Belarus relies heavily on Russia for these energy resources, which results in significant dependence both in terms of energy and economy. Figure 5 shows the system of oil and gas transportation through Belarusian territory.

Figure 5 - Energy supply system
red lines – gas pipelines, green lines – oil pipelines



In recent times, Belarus has nearly halted the import of oil products from Russia, as well as the export of petroleum products to Russia. Belarus receives oil via the Druzhba oil pipeline to the Mozyr Oil Refinery and the Surgut-Polotsk oil pipeline to Naftan. In terms of gas supply, three gas pipelines from Russia, the "Torzhok-Minsk-Ivatsevichi" and "Torzhok-Dolina" main pipelines, enter Belarus. These pipelines provide gas to Belarus and transit gas to other countries. Additionally, the Yamal-Europe transit gas pipeline, with a capacity of 33 billion cubic meters per year, passes through Belarus, but gas supplies to Belarus do not come from it as it is a transit pipeline.

Figure 6 - Energy import, export, and production



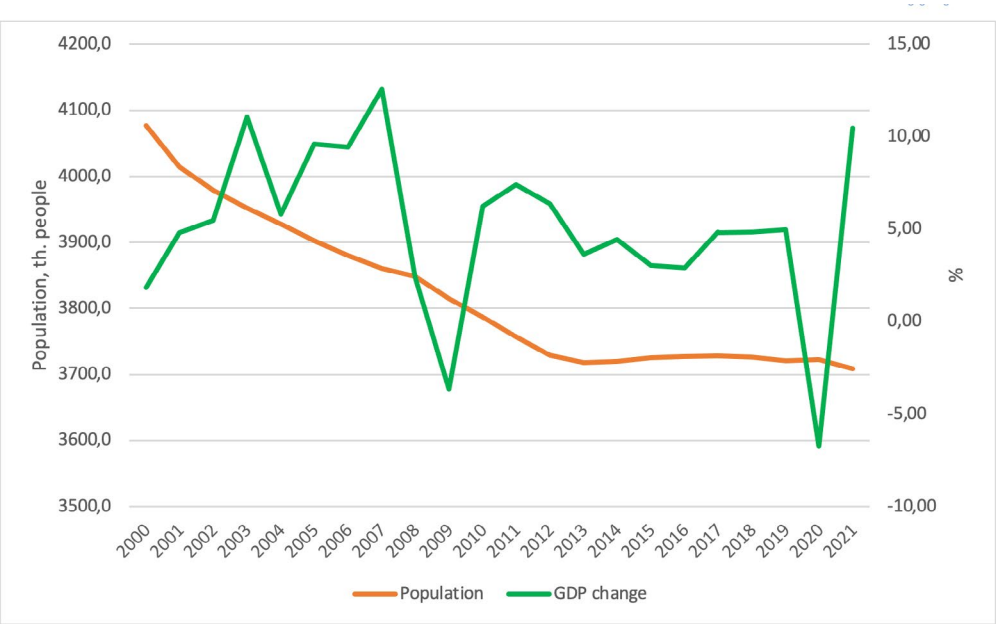
Some oil is extracted locally, but it is not enough to meet the country's energy needs, so imported oil is used for processing. The produced oil products are partly exported and partly used for domestic needs. Peat and biomass are utilized from local resources, and there has been a recent increase in the use of biogas.

The Department of Energy Efficiency under the State Standardization Committee of Belarus is responsible for developing the national policy on promoting the energy efficiency and renewable energy and control over the implementation of this policy.

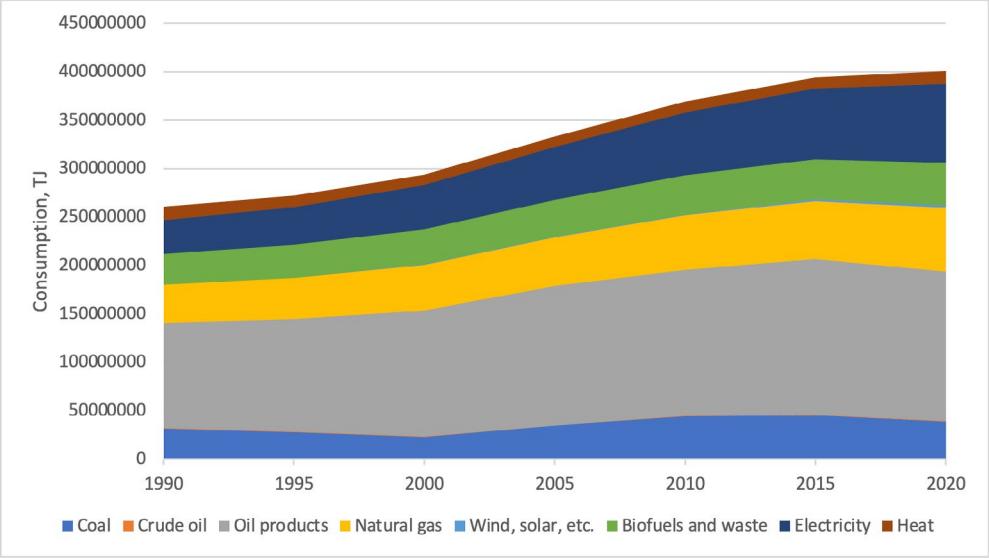
GEORGIA

Figure 7 displays a graph that illustrates the population of Georgia and the annual change in its GDP. Like many post-Soviet countries, Georgia experienced a decline in population during the 1990s and early 2000s. However, since 2012, the population has stabilized and even slightly increased. Unfortunately, after 2020, the downward trend resumed, which is a concerning sign

Figure 7 - General information

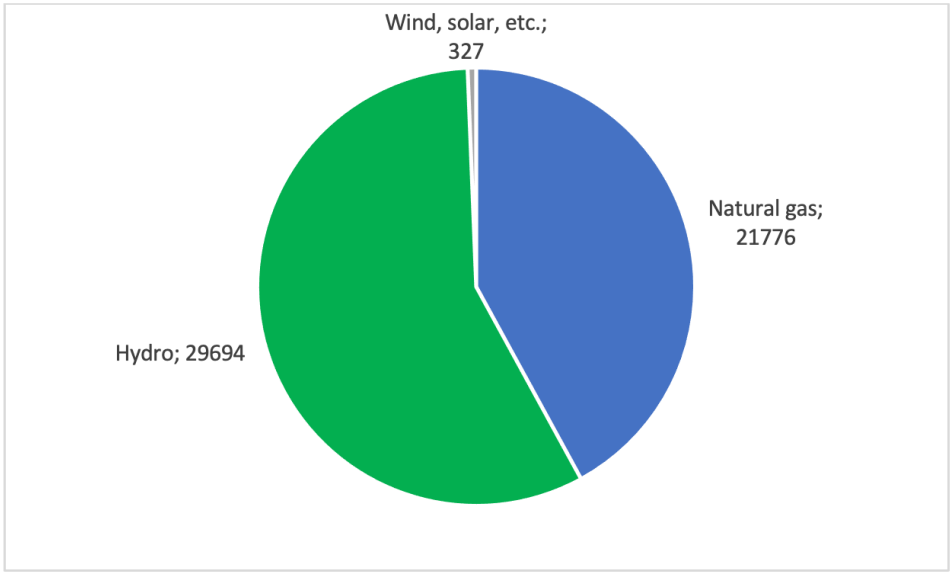


Georgia's GDP has consistently positive values, negative GDP growth was observed only in 2009 (Global financial crisis) and 2020 (COVID-19 pandemic).



The trend of final energy consumption in Georgia has been rising since 1990, with the main fuels being petroleum products and natural gas. The country also has a significant power consumption. In recent years, there has been a shift in the consumption of energy sources, with a decline in the use of coal and oil products, and an increase in the consumption of natural gas, electricity, and biofuels. This shift is in line with the emerging trend towards cleaner fuels and reducing greenhouse gas emissions. The increased use of electrical energy is particularly noteworthy in terms of decarbonization, as it aligns with the structure of electricity generation in the country (as shown in Figure 8).

Figure 8 – Electricity generation in Georgia



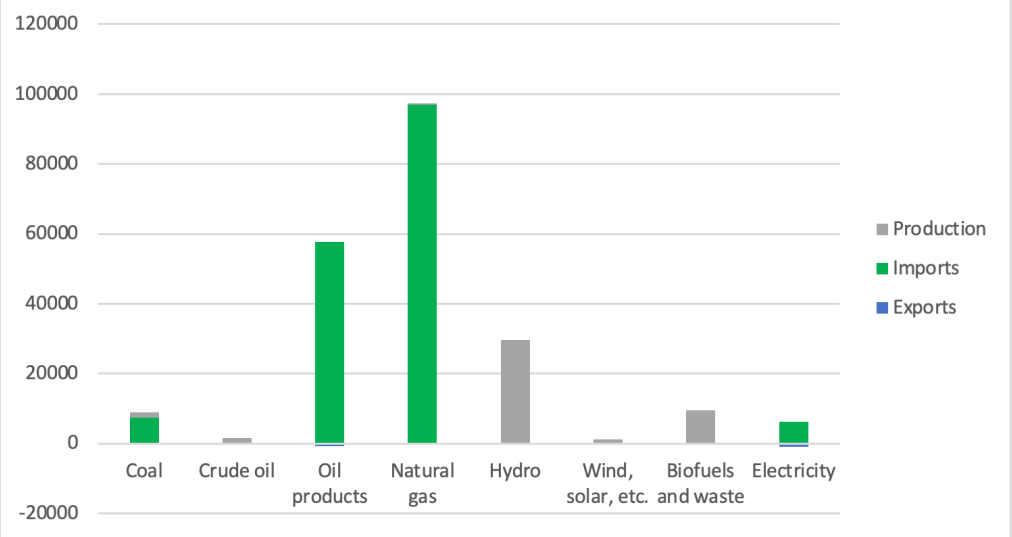
The production of electricity in Georgia heavily relies on water energy as the primary source. The country boasts several large hydroelectric power plants (HPPs) that have a vital role in electricity production and the economic growth of the country. Among the significant HPPs in Georgia is the Enguri

HPP, located in Western Georgia on the Enguri River, with an installed capacity of 1,200 MW, making it one of the largest in the Caucasus region. Another notable HPP is the Vardnecha hydroelectric power station situated near the city of Tbilisi, on the Mtkvari River, with an installed capacity of 170 MW, and one of the key HPPs in the country. Additionally, the Khrami HPP located on the Khrami River in Shida Kartli (east of Georgia), with an installed capacity of 84 MW, is a significant energy source for local residents and industries.

The country is also investing in new hydropower plants like the Namakhvani HPP situated in Western Georgia, with an installed capacity of 433 MW, and the Khudon HPP located in the Svaneti Mountains, with an installed capacity of 187 MW. The hydropower plants are crucial energy sources for Georgia, contributing to economic development and reducing dependence on energy imports. However, it's worth noting that the construction of these plants can have adverse environmental effects, such as changing the ecosystem of rivers and reducing biodiversity in the region.

Despite the significant potential in hydropower, Georgia still needs to rely on fossil energy to meet its needs.

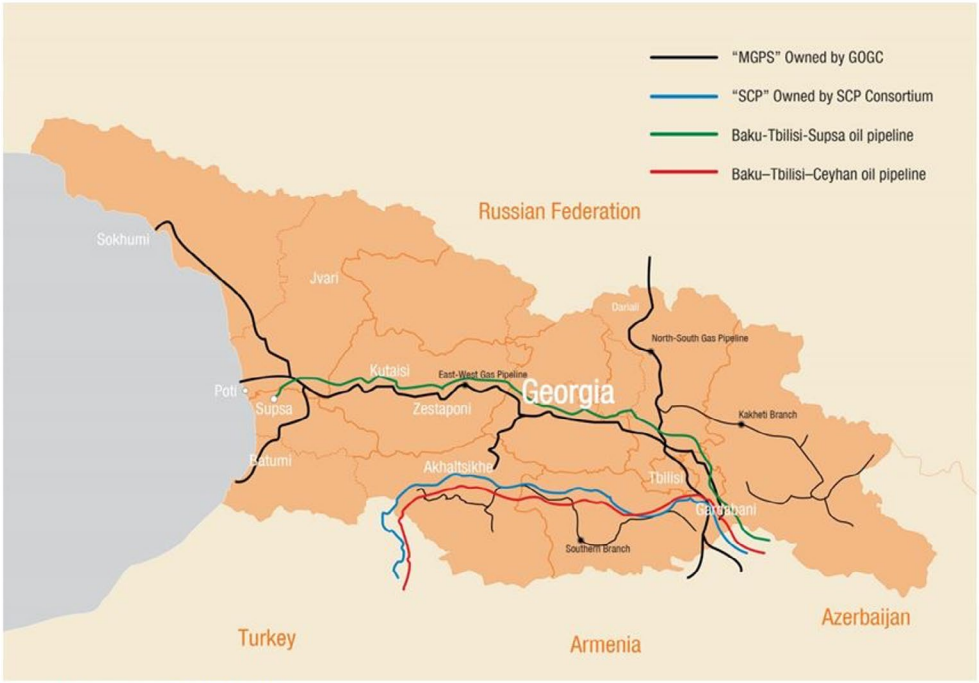
Figure 9 - Import, export and fuel production



Georgia heavily relies on imports for almost all its required volumes of oil products and natural gas, which are the primary fuels used for energy production in the country. Although Georgia has significant hydroelectric power potential, natural gas is the second-largest fuel consumed for electricity generation. It's important to note that there is no district heating in Georgia.

Figure 9 depicts the main gas and oil pipelines that serve as the lifeline for Georgia's energy supply chain. As the country lacks domestic sources of oil and gas, these pipelines are crucial for maintaining a steady flow of fuel imports.

Figure 10 – Gas and oil pipelines



Source: Company data, Galt & Taggart Research

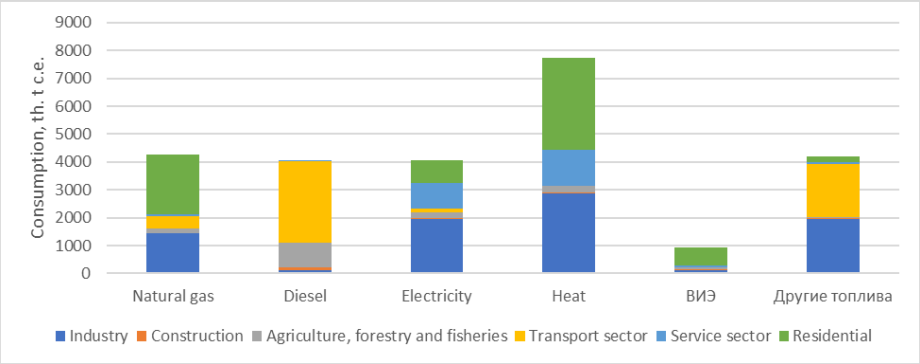
Georgia heavily relies on oil products, and the country imports almost all of its necessary volumes from Russia and Azerbaijan. "Socar Georgia Petroleum" company is the major importer of oil products from Azerbaijan, while "Lukoil Georgia" company imports from Russia.

2. KEY DATA OF THE ENERGY SECTOR

BELARUS

Chart 11 shows the structure and volume of final consumption of energy resources by types and sectors of the economy.

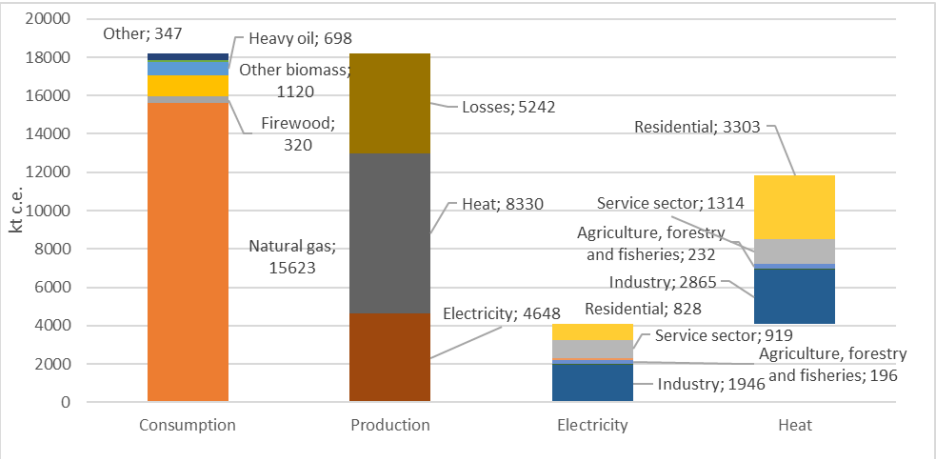
Figure 11 - Final consumption



The industrial sector is the largest consumer of energy, it uses substantial amounts of gas, electricity, heat, and other types of fuel not depicted in the graph. The residential sector is also a significant consumer, particularly with regard to natural gas and heat energy. Meanwhile, the transportation sector heavily relies on oil products, particularly gasoline, as well as other fuel types.

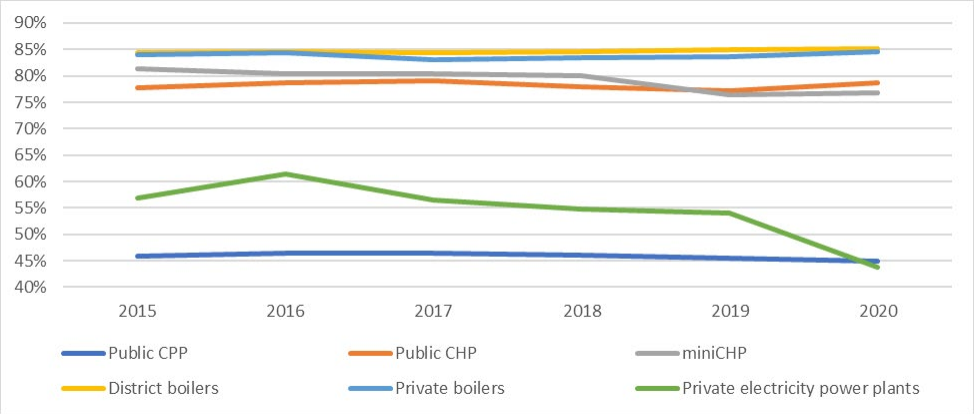
The composition of electricity and heat production in Belarus is illustrated in Figure 12.

Figure 12 - Consumption in transformation sector



In the production of heat and electricity, natural gas is mainly used. Fuel oil and biomass are also marginally used. The total efficiency of the energy system in 2020 was enough high - 71% via using CHPs and big share of heat consumption.

Figure 13 – Energy system efficiency



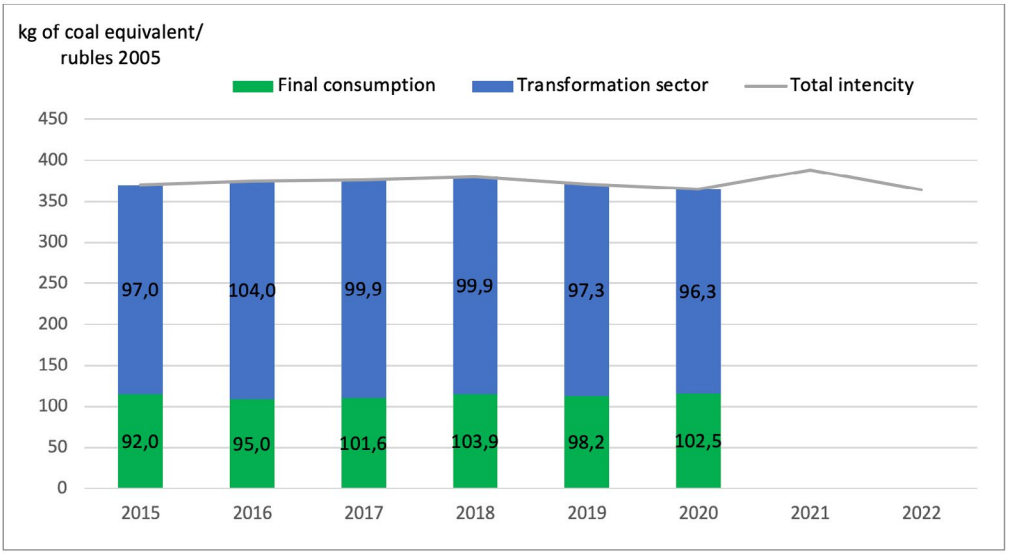
The high efficiency of combined heat and power (CHP) in Belarus is attributed to the substantial consumption of thermal energy, primarily in the industrial sector, which makes CHP an attractive option for electricity generation. This results in a fuel utilization rate of approximately 80% for CHP and boiler houses, whereas the average efficiency of conventional power plants is around 45%, due to the lower utilization of thermal energy.

In Belarus, the energy intensity of GDP is calculated based on two components: the final energy consumption (energy component) and the energy consumption contribution of the transformation sector (non-energy component). The non-energy component of gross consumption of fuel and energy resources is calculated as the sum of energy consumption values for the sectors "Transformation sector," "Non-energy sector," and "Distribution losses" of the consolidated fuel and energy balance. This non-energy component of GDP energy intensity represents the energy consumption of energy enterprises, excluding final consumption.

On the other hand, the energy component of the gross consumption of fuel and energy resources is based on the "Final Consumption" sector of the consolidated fuel and energy balance.

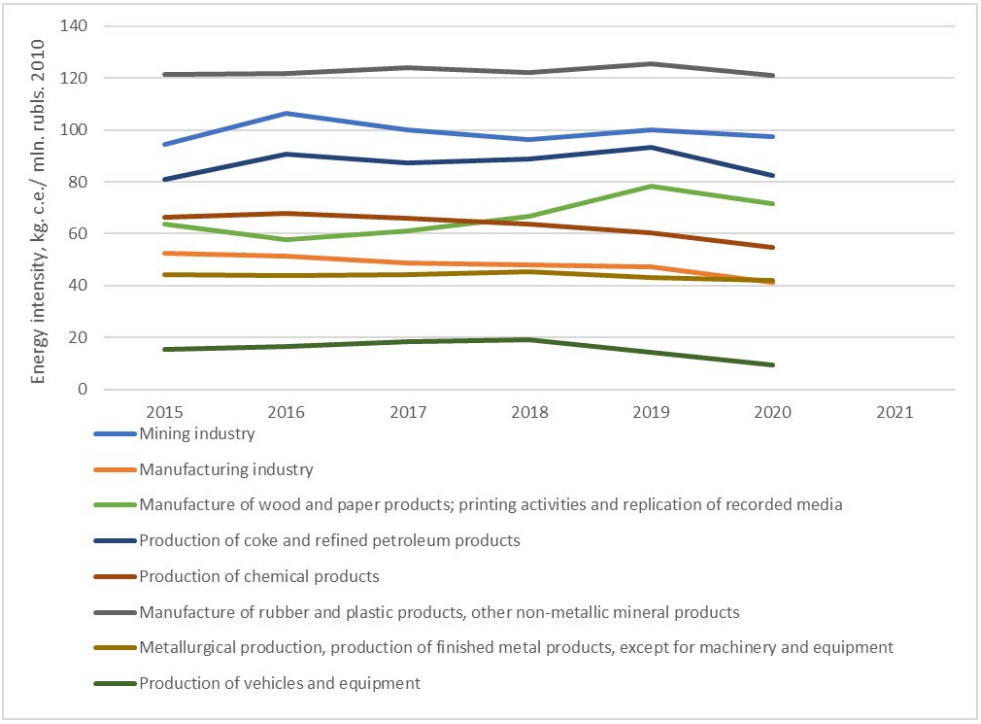
There are no data on the structure of energy intensity after 2020.

Figure 14 - Energy efficiency in Belarus



If we consider the energy intensity of individual sectors of industry, we can see a significant difference for different sectors.

Figure 15 - Energy intensity by sectors



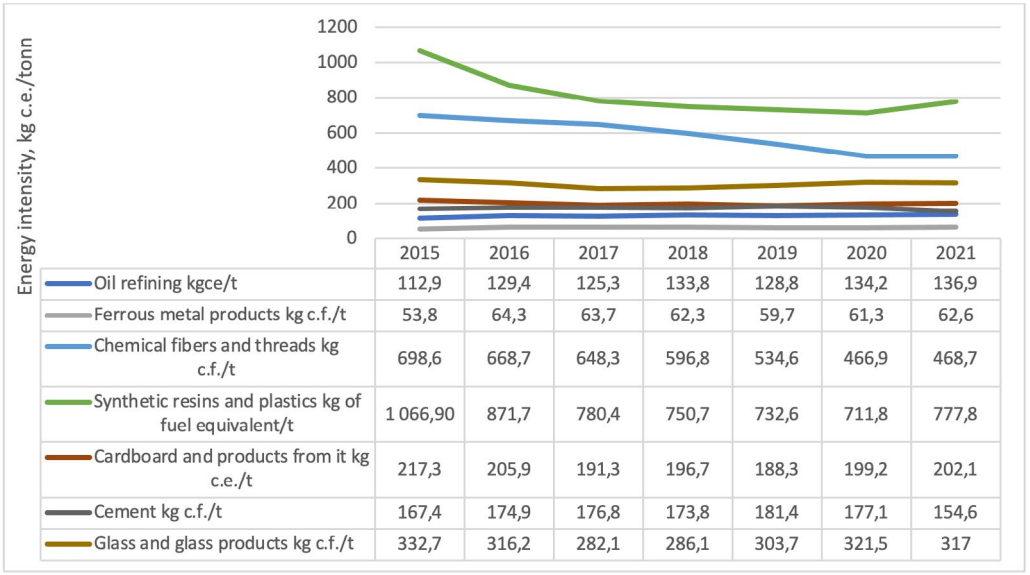
The overall trend of energy intensity in industry is determined by the energy intensity of two groups - the mining and processing industries. The processing industry has shown a strong trend towards reducing energy intensity at an almost constant rate, while the energy intensity of the mining industry has slightly increased over the five-year period but is generally trending towards maintaining a certain constant value with fluctuations.

The graph highlights the most interesting economic activities, but it does not show all types of foreign economic activity. However, for most sectors, the

general trend indicates a decrease in energy intensity. Notable exceptions are the woodworking, petroleum products, and non-metal products industries (which includes cement production). These three sectors have failed to reduce their energy intensity or have even increased their energy consumption per unit of value added, despite undergoing large-scale modernization in the previous 5-10 years. These trends raise concerns about the effectiveness of new equipment and applied technologies.

It's important to note that reducing energy intensity in industry can significantly contribute to energy efficiency and reducing greenhouse gas emissions. Efforts to improve the efficiency of equipment, modernize technology, and increase the use of renewable energy sources can help to reduce energy intensity in these sectors, contributing to a more sustainable and energy-efficient economy.

Figure 16 - Energy intensity by products



	2015	2016	2017	2018	2019	2020	2021
Oil refining kgce/t	112,9	129,4	125,3	133,8	128,8	134,2	136,9
Ferrous metal products kg c.f./t	53,8	64,3	63,7	62,3	59,7	61,3	62,6
Chemical fibers and threads kg c.f./t	698,6	668,7	648,3	596,8	534,6	466,9	468,7
Synthetic resins and plastics kg of fuel equivalent/t	1 066,90	871,7	780,4	750,7	732,6	711,8	777,8
Cardboard and products from it kg c.e./t	217,3	205,9	191,3	196,7	188,3	199,2	202,1
Cement kg c.f./t	167,4	174,9	176,8	173,8	181,4	177,1	154,6
Glass and glass products kg c.f./t	332,7	316,2	282,1	286,1	303,7	321,5	317

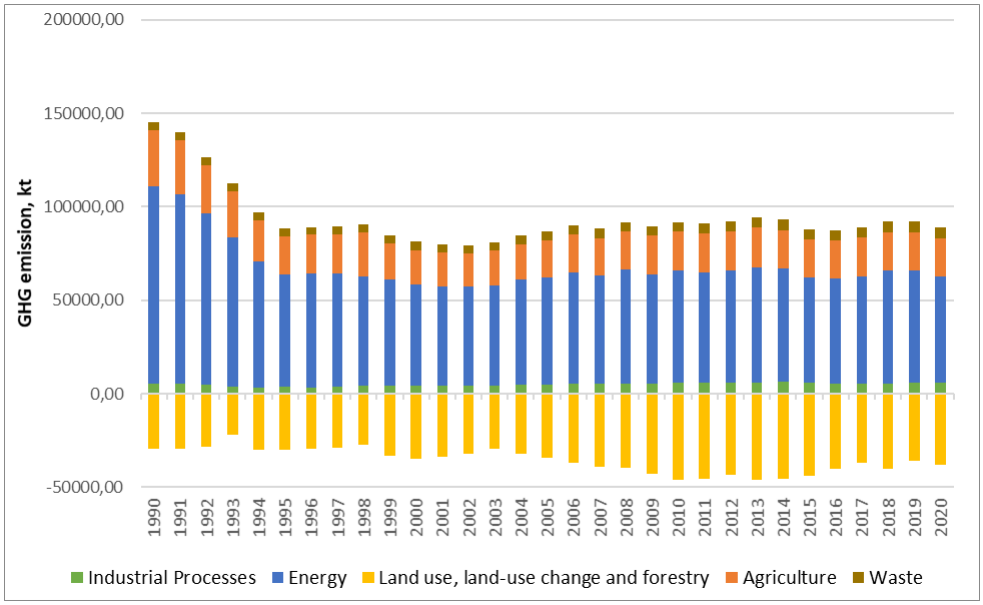
Analysis of the energy intensity of specific industries reveals that some sectors have been more successful than others in reducing their energy consumption. Unfortunately, some of the industries that have undergone deep modernization, such as oil refining, ferrous metal rolling, and cement production, have the worst results in terms of reducing energy intensity. However, as mentioned above in general implementing modernization projects allows to increase the effectiveness.

On the other hand, the most significant reduction in specific energy consumption was observed in the production of resins and plastics, as well as fibers and threads. Although the media did not actively cover large-scale modernization programs in these sectors, it is evident that the enterprises carried out activities to upgrade their technological equipment, which indirectly resulted in a reduction of fuel and energy consumption.

In 2020, Belarus emitted about 90 million tons of greenhouse gases, of which approximately 40 million tons were absorbed by the Land Use, Land-Use Change and Forestry (LULUCF) sector. This means that total emissions were about 50 million tons, corresponding to a reduction of 56% compared to

1990. Under the nationally determined contribution, Belarus has pledged to achieve a 35% reduction by 2035.

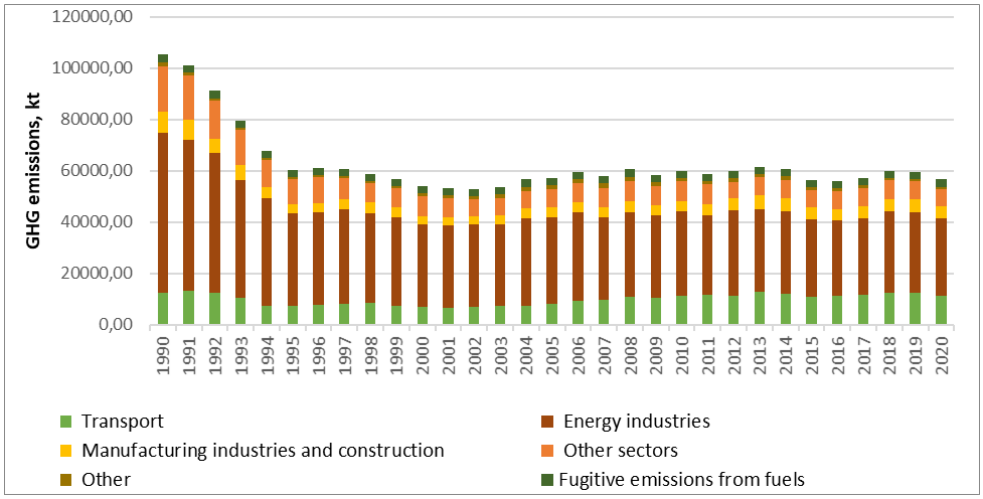
Figure 17 -Greenhouse gas emissions



The graph indicates that there was a notable decrease in greenhouse gas emissions in the early 1990s, which can be attributed to a significant economic crisis that occurred because of the collapse of the planned (non-market-driven) economy. After that, by implementing energy-saving measures and shifting away from the use of fuel oil in the energy balance, emissions were stabilized at a relatively constant level.

When examining the energy sector alone, it becomes apparent that the primary source of greenhouse gas emissions is the energy industry, which includes emissions from the production of electricity and heat.

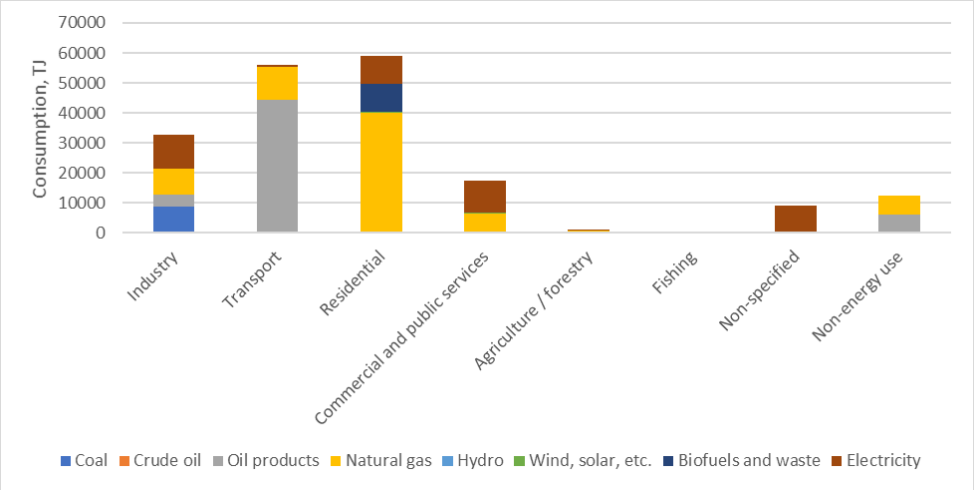
Figure 18 - GHG emissions from energy sector in Belarus



Emissions from the transport sector and other sectors (which also includes emissions from the use of fuels by the population) are also quite significant.

GEORGIA

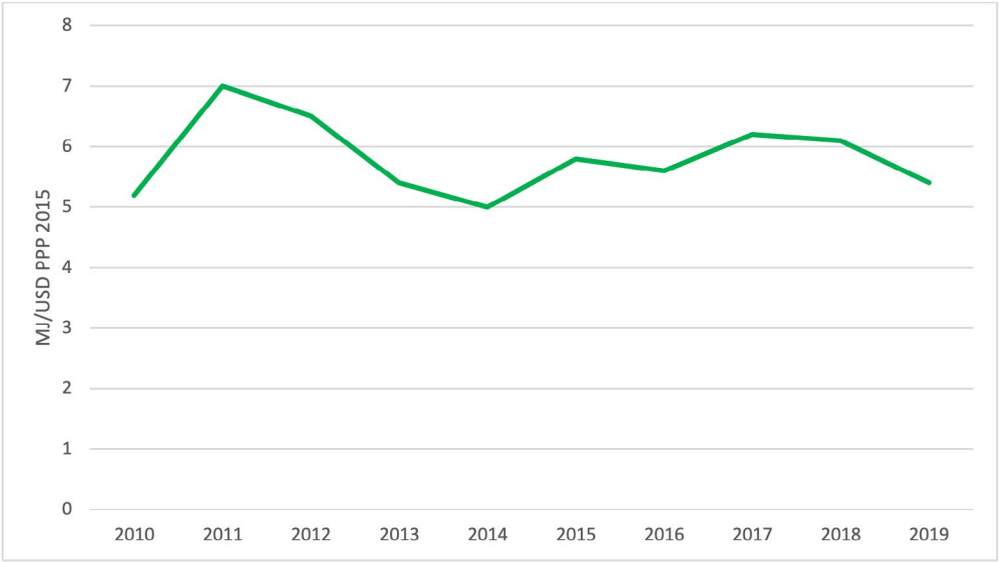
Figure 19 - Final consumption



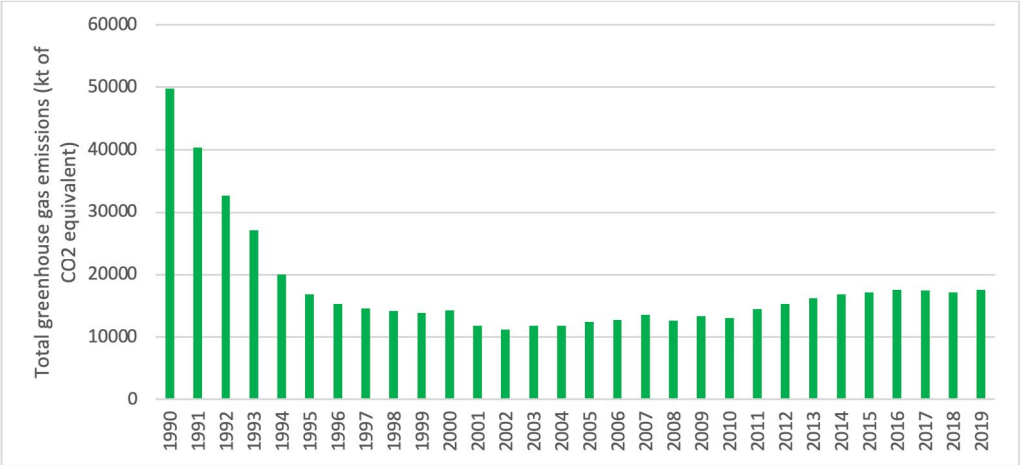
The final consumption structure reveals that the primary consumers in Georgia are the transport and residential sectors, with natural gas being a significant fuel source in both. Industry accounts for a smaller share of energy consumption, with electricity, natural gas, and coal being the main energy sources.

It's worth noting that district heating is not widespread in Georgia, and electricity production is highly efficient, largely due to the significant portion of energy generated from hydroelectric power plants. However, it's important to mention that electricity is the sole form of energy produced with a conversion efficiency of 77.5%.

Figure 20 - Energy intensity of GDP in Georgia



The energy intensity of Georgia's GDP has been at a relatively constant level for a long time, and even increased in the period from 2014 to 2017, which is a rather alarming trend and indicates a lack of efforts to improve energy efficiency. After 2017 there has been a trend towards a decrease in energy intensity.



Greenhouse gas emissions were reduced in the 90s, which is typical for all post-Soviet countries and is associated with the economic crisis in the re-structuring of the planned economy to market rules. Further, the level of emissions somewhat stabilized and even began to grow in the period from 2010 to 2019. Significant efforts are needed to reduce greenhouse gas emissions in Georgia.

3. NATIONAL POLICIES ON SDGs 7&13 AND ENERGY EFFICIENCY

BELARUS

To provide a better understanding of national policies aimed at improving energy efficiency and reducing greenhouse gas emissions from fossil fuel use, this section will review the adopted regulations and mechanisms used to implement such policies. However, before delving into the specifics, it is important to examine the broader legislative framework that governs the functioning of these policies. By analyzing the general legislative conditions, we can better understand the context in which these policies operate and the challenges.

1. **The Law "On Energy Saving"**[1] adopted on December 27, 2010 (last amended May 24, 2021). This law regulates relations in the field of energy conservation. The law defines the responsibilities and powers of various authorities, regulation of energy resources consumption, mechanisms for monitoring the rational use of fuel and energy resources, rules and requirements for conducting energy audits, the education and training.

2. **The Law "On Renewable Energy Sources"** dated December 27, 2010 No. 204-Z[2] - The law defines the basic terms and principles, regulates the actions of various stakeholders in relation to renewable energy sources. The key norms approved are the special tariffs for the energy produced from RES and the the obligation of energy supply organizations to purchase the renewable energy.

   But since then, this law has been significantly limited by Presidential Decrees (according to Belarusian legislation, Decrees have higher priority than laws). So, the Decree of the President of the Republic of Belarus No. 209 “On the use of renewable energy sources” dated May 18, 2015 limits

[1] The Law “On Energy Saving

[2] The Law “On Renewable Energy Sources”

the commissioning of new renewable energy capacities (sets quota for each type of RES) and prohibits installations of RES exceeding the approved quota. Another Decree No. 357 of September 24, 2019 introduces the regulation of the daily schedule of RES by Belenergo, which actually means limits on production of renewable energy. Also, the Law of the Republic of Belarus was adopted on May 30, 2022, No. 173-Z, which canceled both the obligation to purchase electricity from renewable energy sources and all investment protection mechanisms in the form of a feed-in tariff (it was replaced by a minimum incentive coefficient) and in the form of maintaining these coefficients for 10 years after the construction of RES installations. At the same time, the commission for the distribution of quotas decided that after 2021, quotas for commissioning new capacities will be zero for any installations producing electricity from RES, effectively blocking the development of renewable energy sources into electricity.

3. According to the Decree of the President of the Republic of Belarus of April 10, 2000[3] Belarus has ratified the **United Nations Framework Convention on Climate Change (UNFCCC)[4], adopted on June 12, 1992. Belarus became a full party to the UNFCCC on August 9, 2000.**

4. According to the Decree of the President of the Republic of Belarus of September 20, 2016 No 345 "On Adoption of International Agreement", the Republic of Belarus became the party to the **Paris Agreement[5], adopted at the 21st session of the Conference of the Parties to the UNFCCC in Paris on December 12, 2015, that entered into force on November 4, 2016[6]**

Since 1993 the Committe on Energy Saving under the Council of Ministers of the Republic of Belarus has been established, later in 2006 it was reorganized into the Department for Energy Efficiency under the State Committee for Standardization of the Republic of Belarus. The Department is an authorized government body in the field of energy saving and supervision of energy efficiency. One of its functions is the development and implementation of the **state programs in the field of energy saving every 5 years[7]. The program is being developed based on the Decree of the President of the Republic of Belarus 289 07/25/2016 On the procedure for the formation, financing, implementation, and evaluation of the effectiveness of the implementation of state programs[8]**

In addition, Belarus has a system of technical regulation.

TCP 45-1.02-295-2014 "Construction. Project documentation. Composition and content". The Technical Code of Practice establishes the requirements to and content of the operational and technical passport of the construction project. Necessary parameters of the building in this passport include among others the class of the energy efficiency, energy consumption per square meter of area, heat energy consumption and thermal resistance of all elements of building envelope.

TCP 45-2.04-196-2010 "Thermal protection of buildings. Thermal power characteristics. Definition rules" establishes the calculation methodology for the thermal energy characteristics of newly constructed and reconstructed (modernized) buildings of various types and establishes the norms of annual heat consumption for residential and public buildings. TCP sets requirements

[3] The Decree of the President of the Republic of Belarus of April 10, 2000

[4] United Nations Framework Convention on Climate Change (UNFCCC)

[5] The Decree of the President of the Republic of Belarus of September 20, 2016 No 345 "On Adoption of International Agreement"

[6] Paris Agreement

[7] State programs in the field of energy saving

[8] The Decree of the President of the Republic of Belarus 289 07/25/2016

for the energy passports of newly designed, completed and operated buildings, the energy efficiency classification of residential and public buildings. Design of newly constructed residential buildings of classes C, D, E, G is not allowed.

Some technical standards in Belarus are harmonized with EU codes[9]:

- GOST EN 15217 “Energy Efficiency of Buildings Methods for determining energy efficiency and the procedure for energy certification of buildings”.
- STB EN 15603 “Energy Performance Of Buildings General energy use and determination of nominal energy performance”.
- GOST EN 15316-1, GOST EN 15316-2, GOST EN 15316-3 – A group of standards on methods for calculating energy characteristics and efficiency indicators of heating systems and hot water supply.
- STB EN 15316-4-1, STB EN 15316-4-2, STB EN 15316-4-3, STB EN 15316-4-4, STB EN 15316-4-5, STB EN 15316-4-6, STB EN 15316-4-7 – A group of standards on methods for calculating energy characteristics and efficiency indicators of heating systems and hot water supply.
- STB EN 15239 STB EN 15240 - A group of standards on methods for calculating the energy performance and efficiency of ventilation systems in buildings.
- STB ISO 6242-1 “Construction Of Buildings. Customer requirements. Part 1: Requirements to thermal performance”.
- STB EN ISO 7345, STB ISO 9869 – A group of standards for thermal protection of buildings.
- STB EN ISO 13789, STB EN 13829, STB EN 15255, STB EN 15265 – A group of standards for thermal characteristics of buildings.
- STB EN 15241 STB EN 15242 STB EN 15243 A group of standards on methods for calculating the energy performance and efficiency of ventilation systems in buildings.

Support for the population for improving energy the efficiency is suggested only for energy efficient refurbishment of apartment buildings. It is regulated by **the Decree of the President of the Republic of Belarus dated September 4, 2019 No. 327 "On Improving the Energy Efficiency of Apartment Buildings"**. The decree establishes the subsidy for homeowners in amount of up to 50% costs of insulating the facade of buildings and other energy-saving measures in case if the homeowners’ association approves the decision to invest own resources in remaining 50% of costs. It is paid by homeowners in equal installments over 10 years.

[9] Technical standards in Belarus that are harmonized with EU codes

GEORGIA

Climate Change Strategy 2030 and Action Plan for 2021-2023

In 2020 the Ministry of Environment Protection and Agriculture (MEPA) with technical assistance of GIZ developed Georgia's Climate Change Strategy until 2030 and Action Plan (CSAP) for 2021-2023. The CSAP identifies measures and actions that support the development of the Georgian economy and infrastructure in a way which sets Georgia on a pathway to meet its international obligations and national ambitions for climate change mitigation. It serves as an action plan for the implementation of Georgia's existing NDC, but also as an important orientation to inform the determination of an appropriate and realistic level of ambition when updating the NDC in future revision cycles.

The action plan CAP will be updated on a 2-3 year cycle, to be aligned with future revisions of the NDC and the NECP – ensuring coherence between sectoral policies, the NDC, and the NECP. The Climate Strategy and Action Plan identifies a long-term vision for the reduction greenhouse gas emissions for 2030 and Specific activities for 2021-2023. By 2030 overall greenhouse gas emissions should not exceed 29.25 Mt CO2eq. Sectoral targets to reduced emissions by 2030 compared to business-as-usual include: Energy generation and transmission 15%, Industry 5%, Transport 15%. The Plan also sets a target to increase CO2 Absorbtion capacity of forests 10% from 2015 level, and deploy climate friendly technologies in Buildings, Agriculture and Waste management.

Ten-Year Network Development Plan of Georgia 2021-2031

This Ten-Year Plan presents measures over the period to 2031 to reinforce infrastructure of the national power transmission system, address existing problems, and respond to future challenges and implement new opportunities. The Ten-Year Plan aims at presentation and analysis of the future environment and reducing uncertainties to obtain plausible projections and establish unified and well-structured vision about transmission grid development. The Ten Year Network Development Plan of Georgia is elaborated and updated annually according to the "Law Of Georgia On Energy And Water Supply". 18 projects of systemwide importance have been identified to strengthen internal power transmission system and interconnection lines with neighbouring countries. Total investment needs: 700 million EUR.

The Law of Georgia on promoting the generation and consumption of energy from renewable sources

The law was adopted in 2019 to encourage the generation and consumption of energy from renewable sources and to implement the Directive 2009/28/EC. The Law establishes support schemes, statistical transfers and joint projects of Georgia and the Energy Community Contracting Parties, joint projects of Georgia and third countries, certificates of origin, administrative procedures, network access norms, biofuel sustainability.

The Law of Georgia on Energy Efficiency of Buildings, Directive #2010/31/EU on Energy Performance of Buildings (EPBD)

This Law adopted in 2020 aims to promote the rational use of energy resources and to improve the energy efficiency of buildings, taking into account the external climate and local conditions of buildings, the demand for indoor climate conditions and cost-effectiveness. The law transposes Directive 2010/31/EU on Energy Performance of Buildings Directive (EPBD). Provisions of the EPBD: - include the requirement to develop energy performance certificates to be included in all advertisements for the sale or rental of buildings, - establish inspection schemes for heating and air-conditioning systems (or put in place measures with equivalent effect), - set minimum energy performance requirements for new buildings, for the major renovation of buildings and for the replacement or retrofit of building elements; and - draw up lists of national financial measures to improve the energy efficiency of buildings.

Rule for Accounting the Energy Received from Thermal Pumps

Rule for Accounting the Energy Received from Thermal Pumps

Rule for Normalization of Accounting Electricity generated from Hydro Energy and Wind Energy

Rule for Normalization of Accounting Electricity generated from Hydro Energy and Wind Energy - Ministerial order No 1-1/119,

Support Scheme for Renewable (Hydropower) Generation - Resolution 403

The "Renewable Energy Production and Use Support Scheme (Hydroelectric Power Plants)" defines measures to facilitate the construction and operation of a hydroelectric power plant (HPP) with a private investor of more than 5 MW. The support scheme includes:

- a support period of ten years from the issuance of the HPP commissioning and production license, within 8 months per year;
- a premium tariff of USD 0.015/kWh paid as a supplement to the wholesale price fixed for the relevant hour. If the difference between the wholesale price and USD 0.055 is less than USD 0.015, then the premium tariff will be calculated by the above difference.

Also Georgia has adopted a number of EU and International standards for energy intensity of various equipment. For example:

- EN 14511-2:2018 - test methods and standards for air conditioners, liquid chilling packages and heat pumps
- EN 14511-3:2018 - test methods for air conditioners, chillers and heat pumps
- EN 14511–4:2018 - standard on Air Conditioners
- MEPS for cooling equipment (EN 14511-1:2018)
- EN 442–1&2:2014 Radiators and convectors
- EN 12464–1:2011 Lighting of work places
- EN 12193:2007 Sports lighting
- EN 15251:2007 - the indoor environmental parameters which have an impact on the energy performance of buildings
- EN 215:2004/A1:2006 - thermostatic radiator valves - Requirements and test methods

4. MAPPING ENERGY SECTOR STAKEHOLDERS

BELARUS

The beneficiaries or deterrents in terms of improving energy efficiency are:

1. **Population** is the obvious beneficiary of increased energy efficiency, since citizens pay less either for energy resources, or for goods due to lower energy costs along the entire production chain and product lifecycle. On the other hand, the population is not motivated in energy saving measures in circumstances when their investments in it do not pay off in reasonable period. In Belarus, the population supports energy efficiency improvements in general, but interest for own investments is rather low due to low energy tariffs for households, which are subsidized by industry sector.

2. **Small business** is a beneficiary only if the technological processes are energy-intensive, which is generally not typical for small businesses. In addition, often small businesses rent space and equipment, which reduces the ability to manage their own energy consumption. Separately, it is worth noting a small business that is engaged in the implementation of energy-saving measures or sells energy-efficient equipment. This segment is very interested in promotion of energy efficiency in the country.

3. **Large commercial organizations** are interested in the implementation of energy saving measures, since the effect can be quite considerable. At the same time, most of Belarusian large enterprises are owned by the state and are not always aimed at maximizing profits. Also, previously implemented inefficient projects led to a high debt burden on factories and difficulties in attracting additional financing for energy saving.

4. **Local authorities** have high interest in energy saving as it allows them to save their limited resources and use them for other needs. In addition, the implementation of energy-saving measures often leads to a positive social effect through improving the quality of services provided (education, culture, healthcare).

5. **State (municipal) budgetary organizations** are interested in meeting the agreed norms (limits) of energy consumption, but they don't have the access to financing mechanisms (e.g. loans), which sharply limits their ability to improve energy efficiency. Besides, according to national legislation it is impossible to use financial savings from energy savings for other purposes within organization, which also reduces interest.

6. **Electricity and heat supply organizations** as a stakeholder are not interested in the implementation of energy saving measures for the end consumer, as this reduces their market. At the same time, these organizations are interested in reducing consumption for their own processes (improving the efficiency of production of electricity and heat energy and their transmission networks), since any reduction in consumption for their own needs allows for a proportional reduction in costs. Also, since opening of the nuclear power plant these organizations support some activities for the end user, which are associated with the transition to the use of electric energy instead of other types of fuel.

7. **The Department of Energy Efficiency** is the most interested beneficiary of energy efficiency in the country, as the work of this government body is evaluated by results in the field of energy efficiency.

8. **The banking sector** is a stakeholder with several concerns in energy saving. As energy consumers, the banks are not significant players, and the energy efficiency of the banking sector itself does not have a significant impact on the operational efficiency of the bank. Depending on the conditions, banks can become either an interested parties that make profit on financing the energy-saving measures, or an opponent, if credit privileges are fixed by law without compensating banks for their losses.

9. **Producers of energy efficiency equipment and RES** are direct beneficiaries and most motivated stakeholders in any circumstances, as it's their market interest.

10. **Forestry and forest processing organizations** like any other commercial organizations are interested in increasing their own efficiency. In addition, they are interested in promotion of biomass as RES in order to expand their product sales market.

11. **Peat mining companies** are a specific stakeholder in Belarus. They get considerable state support as producers of local fuels, however, they oppose to the development of renewable energy sources and decarbonization, as they are the producers of one of the most carbon-intensive fuels. Peat is used for heating mostly by rural households.

12. **RES owners** are the most interested parties in the development of RES, as they are the direct beneficiaries of this trend.

After analyzing the situation in Belarus, we can conclude that various stakeholders have different motivation and influence on energy efficiency in the country. The population and small businesses may have a limited interest in this matter, especially in comparison to the large industrial organizations with high potential to increase the efficiency of their business processes. Forestry sector is a stakeholder with financial interests in biomass as one type of RES. The Department for Energy Efficiency, as well as owners and investors in renewable energy sources, are the most active drivers. Suppliers and manufacturers of energy-efficient equipment can also play a very positive role. Municipal organizations and local authorities can have an impact on the development of energy efficiency, but they are very limited in financing. Banks can be interested parties under certain circumstances, but without

appropriate regulation, they can also act as opponents. Power generating organizations and peat industry are not interested in raising the efficiency of end-use energy consumption.

GEORGIA

The stakeholder analysis for energy efficiency and RES in Georgia shows similar results:

Rural population is very interested in improving energy efficiency, as their budget is completely dependent on excess energy costs and the use of alternative energy.

Urban population is also the beneficiary of energy efficiency improvements, as they can pay less for energy resources if they invest in energy saving measures. Bit in Georgia, the cost of energy saving projects is much higher than energy tariffs for population and it negatively influences the motivation.

Small businesses and large commercial organizations are interested in the implementation of energy saving measures, since the effect of their implementation can be quite considerable. In Georgia, almost all enterprises are private organizations, they are very interested to save costs due to energy efficiency improvements. It is in their interests to implement energy-saving measures or purchase energy-efficient equipment. The energy tariffs for commercial organizations are two and three times higher than for population, and the payment for water is 20 times higher. Since recently, small businesses have been actively engaged in the manufacturing of energy-efficient installations for the population (stoves, water heaters, heaters, etc.)

State (municipal) budget organizations and local authorities are also interested in energy saving as it allows to save budget funds and use it for other purposes. But with the new Law on Energy Efficiency adopted recently the municipalities face additional obligations related to monitoring of the construction design for the new buildings without receiving additional funding for additional obligations. On the other hand, there is an opportunity to receive grants from foreign donors, which also increase their interest. The state must fulfill the obligations assumed under the associated agreement of the European Union, as well as under the Covenant of Mayors.

Energy supply organizations (electricity and gas providers) in general are not interested in implementing energy saving measures by the end consumer, as this reduces their profit.

The banking sector is an interested party, as foreign donors have recently financed energy efficiency projects on preferential terms through local banks, and the bank receives certain royalties for its operations.

Manufacturers and exporters of energy equipment are among the most motivated stakeholders in any circumstances, as any efforts to promote energy efficiency increase their market.

5. ENERGY EFFICIENCY PROMOTION INSTRUMENTS

BELARUS

The Resolution of the Council of Ministers of the Republic of Belarus No. 103 dated February 24, 2021 approved[10] the current Energy Saving Program for 2021-2025. It includes the main tools to promote energy efficiency in all sectors of economy. Previously five similar programs were implemented in the periods of 1996–2000, 2001–2005, 2006–2010, 2011–2015 and 2016–2020.

The program sets the targets of energy efficiency for the period 2021-2025 and establishes the methodology for evaluating the achieved results. The highest priority areas for improving energy efficiency are the electric and heat power generation, the industrial sector, housing and communal services.

The program provides administrative mechanisms for improving energy efficiency, namely the calculation and approval procedure of the energy efficiency targets. This indicator generally represents the reduction in energy consumption compared to the previous year, expressed as a percentage under constant conditions. EE target is determined for the country as a whole, for each region and district and for each organization. But the obligation of achieving the target indicator is often not provided with relevant funding support, and the organizations themselves may be not even engaged in the calculation of the target indicator. There is also a practice of applying the same target indicator for all organizations of the same profile (e.g. all schools in the district, all kindergartens, etc.). This practice allowed to eliminate the obvious energy losses and to stimulate implementation of low-cost measures, but since then it also causes negative effects as some organizations have to decrease the quality of services (e.g. reduce the temperature in the premises, limit the use of hot water, etc.) in order to meet the target.

[10] The Resolution of the Council of Ministers of the Republic of Belarus No. 103 dated February 24, 2021

The program also describes the approaches to information dissemination on energy saving among organizations and the wide public. For organizations a specialized magazine "Energy Efficiency" is issued bimonthly by the Department on Energy Efficiency, and the annual competition "Leader of Energy Saving" is organized annually. The seminars are held regularly for enterprises about calculation of energy efficiency targets, reporting and innovative technologies.

Information campaigns for wide public are carried out in the form of school contest “Energomarathon” annually, social advertisement on energy saving in public places, press-releases and articles in mass media, etc. The International Energy Saving Day on November 11 as well as Earth hour in March is celebrated by the Department on Energy Efficiency every year. Until 2020, NGOs were actively engaged in awareness raising activities together with various state bodies, but after 2020 this practice has stopped due to liquidation of almost all NGOs in Belarus and negative attitude towards the few remaining ones from the state.

The Program suggests a certain list of energy efficiency activities to achieve the targets set by the government. But this approach is not sufficiently progressive and inclusive for the current stage of development. A large number of other activities could be implemented with higher efficiency, even though they are not mentioned in the program. In addition, the lack of incentive measures does not promote the engagement of several important sectors of the economy, such as housing and small business. These sectors could apply a large variety and big amount of energy efficiency measures with relatively small single energy effect, but big cumulative result for the economy. It is impossible to form such a list of potential activities in the program, therefore the policy document does not consider small-scale activities and rather focus on the housing sector (with high cost and high impact from each individual project) or the large industry enterprises in the public sector.

Thus, we can conclude that the planned energy efficiency activities for 2021-2025 (as well as in the previous periods of the program) mostly represent direct financing of selected activities from the budget or from borrowed resources. Some measures implemented within another state programs are also mentioned for their enegy saving effect. The current energy saving program does not include the incentives for different stakeholder groups to improve the energy efficiency.

In addition to prescribing the direct energy-saving measures, the legislation also limits the use of equipment with low efficiency. For example, the Program defines “putting into operation only energy-efficient boiler equipment that runs on natural gas, with a specific consumption of fuel for the supply of heat not more than 155 kg of coal equivalent/Gcal, boiler equipment that runs on wood fuel with mechanized fuel supply with a specific consumption of fuel for supply heat energy not more than 170 kg of coal equivalent/Gcal;”. The above mentioned technical standards also set requirements for heat resistance of building envelope, power equipment, etc.

Thus, the energy saving program in Belarus is focused primarily on financing measures for big-scale energy consumers (industrial enterprises from public sector and residential housing) and supervising the implementation of energy consumption norms by organizations, primarily state ones. No incentives are mentioned. Also, no measures are envisaged for small companies, the private sector and the population, except for awareness raising.

Another mechanism for improving energy efficiency is mandatory energy audits. Each enterprise that consumes more than 1 thousand tons of coal equicalent per year is obliged to undergo energy audits every 5 years, which include an analysis of the energy resources consumption, the technologies and equipment used, measures to improve energy efficiency and calculate the economic efficiency of these measures. These activities are later taken into account in energy efficiency programs, as well as in the development of a target for the organization, which creates a negative incentive to reduce the scope of possible measures to eliminate possible administrative penalties for not meeting the target.

The implementation of a number of energy-saving measures at the expense of local and republican budgets is implied. The Energy Efficiency Department announces a competition for funding, which lists all the main parameters (dates of the competitions, amount of funding, rules for determining the winners). At the same time, in this competition, funding is distributed according to the departmental affiliation of organizations and, as a rule, funding is not offered for organizations that are not subordinate to state organizations or bodies (private organizations). Also, individuals cannot participate in the competition. Thus, the very fact of this competition is a positive trend in the development of incentives for energy efficiency (there was no such mechanism in the first programs). However, in this direction there are restrictions on the type of participants.

GEORGIA

Georgia adopted the Law On Energy Efficiency in 2020. It aims to:

a) increase energy saving, energy supply security and energy independence, as well as the maximum removal of obstacles to improving energy efficiency in the energy market;

b) define the general legal framework for the measures necessary to promote and introduce energy efficiency in the country to ensure the achievement of the goal set by the protocol “On Georgia's Accession to the Treaty Establishing the Energy Union”;

c) establish the procedure for developing a national energy efficiency target;

d) establish the procedure for adopting an action plan for energy efficiency;

e) establish an energy efficiency commitment scheme and/or alternative policy measures to achieve energy savings;

f) implement the energy efficiency policy, coordinate, control, supervise and monitor it in the country.

The implementation of this package of laws is supported by the European Union, this is provided for by the terms of the Association Agreement between Georgia and the European Union. The main energy efficiency legislation has been developed by the government of Georgia in cooperation with Secretariat of the Energy Union, the EU-supported EU4Energy initiative and the European Bank for Reconstruction and Development (EBRD). EU4Energy deals with energy supply, security and connectivity in the Eastern Partnership countries, as well as the promotion of renewable energy and energy efficiency.

BUILDINGS

The adopted laws will help the country fulfill its international obligations to combat climate change and strengthen energy ties with the European Union. The new legislation will also help Georgia improve the energy efficiency of new buildings in line with the EU standards and set minimum energy standards for new buildings and may also initiate requirements for major repairs or renovations of existing building codes.

The issue of energy efficiency of buildings in the directives is a complex topic, and certain steps have already been taken in order to meet the requirements of the directives. And various activities are planned, but first of all, it is necessary to introduce building codes and set the energy efficiency requirements. It is expected that due to climatic conditions it will be difficult to introduce average national standards and climate zoning will be necessary.

INDUSTRY

Given the relatively small size of Georgian industrial sector, the government supports energy saving in this sector by introducing mechanisms for investment support in energy efficiency. In addition, it is planned to introduce a carbon tax on fossil fuels and electricity. Besides, starting from 2025, it is planned to increase prices for hydrocarbon energy carriers for industry. This fee may be reduced through the voluntary agreement with coefficients depending on the achieved performance indicators. It is also planned to increase the prices for energy production, which should reflect the market price (and no more). All mechanisms and policies that could lead to higher energy prices will be examined carefully to avoid negative impacts on the industry sector, for example through financial support for energy efficiency.

TRANSPORT

The increase in the number of hybrid and electric vehicles in the automotive market, and the gradual replacement of vehicle fleets, will a;;ow to increase the demand for renewable energy. Instead of electricity from fossil fuels, there will be a transition to renewable energy sources.

As part of this measure, the government reduced the cost of excises on the purchase of hybrid cars over 6 years old by 50%, and on vehicles less than 6 years old by 60%. The ministry has also abolished excises (i.e. a 100% reduction) on the purchase of an electric car. One issue that needs to be addressed is that it is currently not included in legislation. The exact definition of "hybrid vehicles" creates certain tax problems in the customs administration.

With regard to public and non-motorized transport, a number of measures are being taken to improve their energy efficiency. Relevant measures are taken in the municipalities of Tbilisi, Batumi, Rustavi and Gori. **They include the following:**

- Optimization of the routes of the public transport system with the help of modern technologies and automated systems;
- Establishing and enforcing tariffs for public parking, as well as creating cycle routes;
- Improvement of road infrastructure and traffic management systems;
- Renewal of the public transport fleet, an increase in the number of buses and reducing the routes of the so-called "local minibuses' routes".

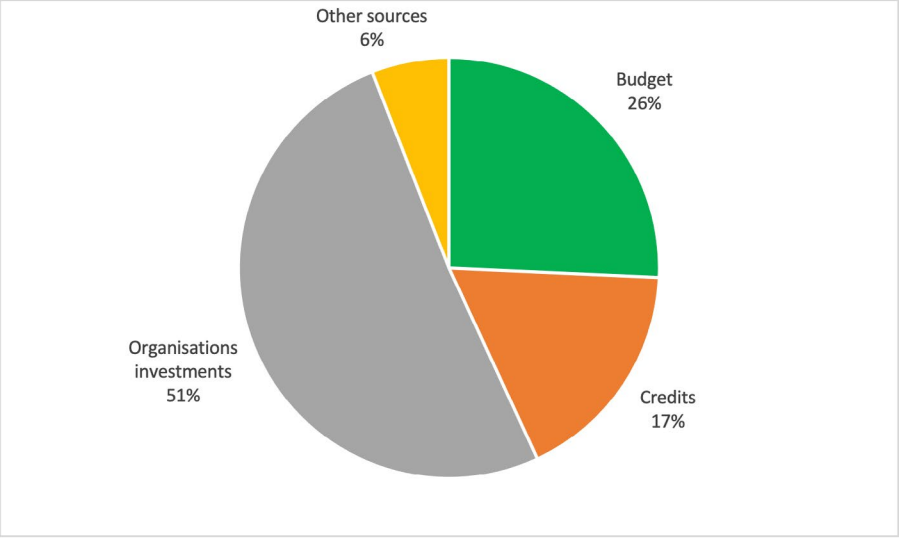
6. ACCESS TO FINANCE AND ENERGY EFFICIENCY TECHNOLOGIES

BELARUS

Funding for projects up to 2020 could be divided into several major sources:

- Funds of the republican and local budgets;
- Own funds of organizations;
- Loans from international financial organizations.

Planned funding for 2016-2020 was 4.7 billion euros[11], however, the actual amount of financing was about 2.7 billion euros (56% of the planned). The distribution of actual funding sources is shown in the graph.



[11] The Resolution of the Council of Ministers of the Republic of Belarus No. 116 dated February 9, 2023

More than half of the events are the organization's own funds. Another quarter is the republican and local budgets, and the remaining 25% are loans from international financial organizations.

According to statistical information, based on the results of work for 2020, 1.16 billion rubles (about 400 million euros or 44.8% of the plan) were allocated to finance the overall range of energy saving measures from all sources of financing, of which 0.92 billion rubles (340 million euros or 7%) were allocated to finance energy efficiency measures, an increase in the use of local fuel and energy resources, including renewable energy - 0.24 billion rubles (88 million euros or 21%).

Statistics on the implementation of plans to finance the development of the local fuels and RES shows that it is not possible to attract the planned funds. This is probably due to administrative restrictions on the development of renewable energy sources in the absence of demand for peat and the possibility of developing other local fuels.

It should be especially noted that the category "Other sources" also includes investments that were made as part of grant support to Belarus from the European Union and other international donors.

For 2022 data, the downward trend in funding has continued. The amount of financing for the general complex of energy-saving measures of the State Program for 9 months of 2022 is determined in the amount of 710.6 million rubles (284 million euros), for the year - 962.7 million rubles. 385 million euros), with planned costs in 2020 of about 1 billion euros. Thus, even the planned volumes of energy saving costs have been reduced by almost 3 times. According to operational data, from all sources the amount of funding amounted to 63.5% of the plan, that is, even this plan is still not being fulfilled. At the same time, if the financing of energy saving measures is still relatively complete (89.4%), then the increase in the use of local fuel and energy resources, including renewable energy sources, was financed by only 10.6% of the plan, which suggests an almost complete halt in the development of renewable energy sources in Belarus.

The amount of funding for the program for the period 2021-2025 is about 1.4 billion euros. This is almost 3 times less than planned in the previous five-year period. The structure of the program, as expected, will not change - the own funds of enterprises are about half. Credit resources and other sources were planned at the level of about 15% of the total volume or 200 million euros. And from these sources, it was planned to attract at least 20 million euros through international loans, which were significantly reduced after the seizure of power in 2020 (only Russian or Chinese loans are possible).

GEORGIA

Just like in Belarus, in Georgia, funding for the projects of the year could be divided into several large sources:

- Funds from the republican and local budgets;
- Grants from international financial organizations
- Loans from international financial organizations.
- Own funds of organizations;

From the Law of Georgia "On the State Budget of Georgia for 2023". It can be noted that the technical assistance project in support of the Georgian Energy Sector Reform Program (GESRP) (EU-NIF, KfW) played a major role in the implementation of the energy reform provided for by the Association Agreement between Georgia and the European Union, which implies the fulfillment of obligations taken into account by the Protocol on accession of Georgia to the Agreement Establishing the Energy Union. **The adoption, approval and implementation of by-laws provided for by the laws on energy efficiency and energy efficiency of buildings within the framework of this reform pursues the following goals:**

- Creation of 110 system of accreditation and certification of energy auditors;
- Implementation of mandatory energy audit rules;
- Implementation of training programs for energy auditors in the industry and construction sector, evaluators of building energy performance certificates (EEC), inspectors of heating and cooling systems;
- Increasing the energy efficiency of the production cycle;
- Implementation of energy efficiency standards in the construction sector (existing and under construction);
- Renovation of buildings in accordance with the norms established by the minimum requirements for energy efficiency;
- Technical support and computer programs necessary for the introduction of energy efficiency in buildings at the municipal level, training of personnel of the relevant services of municipalities;
- Inventory of public buildings and creation of a register for the implementation of energy efficiency;
- Creation of a platform for monitoring, reporting and validating energy savings resulting from energy efficiency measures.

PRIORITIES AND PROGRAMMS OF THE STATE BUDGET

A comprehensive legal framework and standards for energy efficiency is currently being developed through the exchange of international best practices, for which relevant laws and regulations will be adopted and projects supported by various donor organizations will be implemented;

In the context of increasing demand for electricity, in order to ensure its availability and improve the quality of energy security, special strategic importance is attached to the construction of regulating hydroelectric power plants;

The construction of hydroelectric power plants of systemic importance will be continued in compliance with the principle of sustainable energy development;

The promotion of the development of renewable energy sources (wind, solar, biomass) and the introduction of new technologies will continue;

Grants from international financial organizations (thousand lari. 1 dollar = 2.7 lari)

Programs and projects	2021	2022	2023
Georgia Energy Sector Reform Program (KfW)	3 663,7	5 000,0	3 500,0
Tbilisi Public Schools Rehabilitation and Energy Efficiency Project (E5P, CEB)	1 315,0	6 750,0	2 900,0
Energy Efficiency Improvement of Public Buildings in Georgia and the Use of Renewable Energy Sources ((NEFCO, E5P)	1744,9	0,0	0,0
Vardnili and Enguri Hydro Power Plant Rehabilitation Project (EBRD, EIB, EU)	0,0	0,0	10 000,0
Energy efficiency of public buildings (KfW, EBRD)	0,0	0,0	1 600,0
Open Energy Sector Program (KfW)	622,9	0,0	0,0
Energy efficiency of public buildings (KfW, EBRD)	0,0	0,0	1 440,0
Total	7346	11750	19500

Loans of international financial organizations (thousand lari. 1 dollar = 2.7 lari)

Programs and projects	2021	2022	2023
Improving the Energy Efficiency of Public Buildings in Georgia and the Use of Renewable-Alternative Energy (NEFCO, E5P)	4 174, 8	1 100,0	0,0
Tbilisi Public Schools Rehabilitation and Energy Efficiency Project (E5P, CEB)	9 301,9	27 200,0	13 800,0
Total	13476	28300	13800

As for the own funds of organizations, private companies seek to use alternative energy for private business. Tariffs for commercial organizations in Georgia are twice as high as for the population, so private companies are trying to meet their own needs through renewable energy, and the rest is purchased on the market. Also, when generating a large amount of alternative energy, you can sell the energy market. For these purposes, international organizations allocate both loans and grants under different conditions and in different sizes. Such types of support do not pass through state budgets and are not centrally accounted for.

7. INTERNATIONAL GLOBAL ENERGY EFFICIENCY TRENDS

In recognition of their substantial cost-effective energy savings potential and other benefits, more than 100 countries now use mandatory minimum energy efficiency performance standards (MEPS) and/or energy labels for the most common appliances. However, policies are still absent in a range of markets where growth in ownership of appliances is rising rapidly, especially in emerging economies.[12]

Market-based instruments (MBIs) are commonly used programmes that specify an outcome, such as energy savings or cost-effectiveness, to be delivered by market actors, such as utility companies, without prescribing the delivery mechanisms. MBIs for energy efficiency generally fall under two main types of programmes: Energy Efficiency Obligations (EEOs) and Auction mechanisms.
• EEOs - including white certificate programmes - require obliged market actors to carry out a defined level of energy savings without specifying the delivery route. In some cases (e.g. some Australian states), governments may develop a range of specific methods to demonstrate savings, and energy utilities or customers can choose from the options. Some schemes offer up-front incentives based on estimated deemed lifetime savings while others require ongoing monitoring to determine regular payments.

Auction mechanisms - including tendering programmes and forward capacity auctions - allow market actors to bid for funds to deliver specific energy savings

BUILDING

As a critical part of addressing energy performance of buildings, energy codes set minimum energy standards for new buildings and can also trigger requirements for major refurbishments or renovations to meet aspects of existing building codes.

To ensure building energy codes are aligned towards achieving net zero-carbon status, a new voluntary appendix to the International Energy Conser-

[12] Energy Efficiency 2022

vation Code 2021 works towards providing such a standard. For residential buildings, the supplementary energy can be generated through local projects, such as on-site solar PV arrays.

Proposed energy efficiency technologies presented in Table [13]

economy	Climate	Technology	
		New construction	Retrofit
		Insulation, air sealing and double-glazed low-e windows for all buildings*	
Developed	Hot climate	• Architectural shading • Very low-SHGC windows (or dynamic glass/shading shades/ windows) • Reflective walls/roofs • Advanced roofs (integrated design/BIPV) • Optimised natural/mechanical	• Exterior window shading and dynamic • Reflective roofing materials and coatings • Reflective wall coatings • Window film with lower SHGC • New low-SHGC windows. ventilation.
	Cold climate	• Highly insulated windows • Passive heating gain (architectural feature /dynamic glass/ shades) • Passivhaus-equivalent performance based on LCC limitations.	• Highly insulated windows • Low-e storm or interior panels • Insulated shades and other insulating attachments (low-e films) • Exterior insulating wall systems • Interior high-performance insulation.
Developing	Hot climate	• Exterior shading and architectural features • Low-SHGC windows • Reflective roofs and wall coatings z Optimised natural/ mechanical ventilation.	• Exterior shading • Reflective coatings (roof and wall) • Low-cost window films • Natural ventilation.
	Cold climate	• Highly insulated windows (possibly double-glazed with low-e storm panel) • Passive heating gain (architectural feature) • Optimised low-cost insulation and air sealing.	• Low-e storm or interior panels • Insulated shades and other insulating attachments (low-e films) • Exterior insulating wall systems • Cavity insulation, lower-cost (e.g. expanded polystyrene) interior insulation.

[13] Technology Roadmap - Energy Efficient Building Envelopes

INDUSTRY

There are a lot of different technological processes in industry, and develop a complete list of measure impossible. But we can select same common technologies for all sectors of industries.

With higher energy prices and inflationary pressures upending business operations everywhere, companies are increasingly turning to energy management systems (EnMS) to achieve critical cost savings.

Electric motors and motor-driven systems account for around 70% of the total global electrical use of the industrial sector. Governments use International Efficiency (IE) standards to specify efficiency levels for the minimum energy performance of low voltage (AC) motors. The IE standards have four distinct levels, ranging from IE1 to IE4 or "super-premium efficiency" motors. In 2022, 57 countries have MEPS (minimum energy performance standards) for industrial electric motors in place, covering about 50% of the global electricity consumption of industrial motors, up from 20% ten years ago.

TRANSPORT

New technologies in transport we can split for low- and heavy-duty, railway and aviation.

For low- duty perspective technologies content:

- Hight efficiency vehicles with fossil fuels;
- Electric cars;
- Changing of transport modality.

For heavy - duty perspective technologies content:

- Hight efficiency vehicles with fossil fuels;
- Changing of transport modality;
- Hydrogen transport

For railway transport:

- Hight efficiency vehicles with fossil fuels;
- Electrification
- Hydrogen transport

Aviation

- Hight efficiency vehicles with fossil fuels;
- Hydrogen transport

The EU's Fit for 55 emission reduction targets for new cars and commercial vehicles aims to speed up the transition to zero- and low-emission mobility. A new target of a 100% reduction for 2035 has recently been introduced, meaning all new cars or vans sold in the EU from 2035 will be zero-emission vehicles. As part of the EU Fit for 55 program, the Alternative Fuels Infrastructure Regulation (AFIR) sets targets for the deployment of (re)charging and hydrogen (re)fuelling infrastructure for cars, vans, trucks and buses. It also

sets targets for deploying infrastructure to provide electricity to ships, inland waterway vessels and aircraft when these are stationary.

While global car sales in the first half of 2022 were lower than those of 2021, sales of more efficient cars, and especially electric vehicles, were performing relatively strongly compared with less efficient petrol and diesel cars.

Globally, over 3 million hybrids have been purchased so far in 2022, making up around 8% of sales. They have played a key role in Europe, where their proportion of total sales increased from around 5% at the end of 2020 to almost 20% in the first half of 2022.

Electrification has also been growing in other transport modes. Sales of electric buses increased by 40% in 2021 and electric truck sales more than doubled. China accounted for over 90% of these sales, although registrations in Europe and the United States also increased. Electric medium- and heavy-duty truck sales, however, represented less than 0.3% of the total number of registrations for medium- and heavy-duty vehicles worldwide.

8. EXCHANGE OF EXPERIENCE ON ENERGY EFFICIENCY BETWEEN BELARUS AND GEORGIA

The exchange of experience and research results presented in the previous sections shows the following common features.

State regulation is focusing on big companies. In Belarus and Georgia, energy conservation regulation primarily targets large companies, often through administrative approaches that include imposing restrictions, monitoring their activities, and setting targets for energy consumption reduction or energy efficiency improvement. This is a common practice in many countries around the world, as large companies are significant energy consumers and can be easily administered, with each enterprise's situation assessed separately. However, the focus on large companies alone is insufficient, and it is essential to develop tools that encourage small businesses and individuals to save energy. Well-designed tools can be even easier to administer than those for large companies since they can be unified and applied to thousands of small businesses with similar characteristics. Furthermore, even small energy savings achieved by thousands of small companies can have a significant impact on reducing energy consumption and greenhouse gas emissions. Therefore, it is crucial to create incentives and mechanisms that encourage small businesses and the population to participate actively in energy conservation efforts. In conclusion, while targeting large companies is an effective approach to energy saving, it should be complemented by measures that incentivize small businesses and individuals to participate actively in energy-saving activities. By doing so, we can achieve greater energy savings and reduce greenhouse gas emissions at a larger scale.

Low tariffs for residential decrease stimulus for population. In order to improve the welfare of the population, both in Belarus and Georgia, energy prices for certain groups of the population (or for the population as a whole) are lower than economically justified. The difference is financed either through higher tariffs for enterprises and other groups (cross-subsidization) or through direct additional payments to energy companies from the budget (direct subsidies). In addition to the negative economic effect, this also reduces the economic attractiveness of energy saving measures, which creates an economic barrier to improving energy efficiency.

Relatively high energy intensity of GDP. Relative to world indicators for economies with similar value-added generation structures, both Belarus and Georgia have a fairly high level of GDP energy intensity, which indicates a significant potential for increasing the efficiency of the use of fuel and energy. And the world experience, as well as the experience of solving similar problems in various countries of the former Soviet Union, can give a good effect here.

Energy efficiency investment limited. In both Belarus and Georgia, the financial services market is underdeveloped for energy asving. The current energy saving system is largely limited by the amount of cheap financing available. The instability of the financial system does not allow the use of progressive mechanisms for raising funds for energy saving, such as public-private partnerships, energy service companies and revolving funds. The situation in Georgia is somewhat better due to the possibility of attracting grants or loans from international financial institutions at low interest rates (in Belarus, this possibility is not currently available), but these sources do not provide the necessary amount of funding.

Low meter coverage. Both Belarus and Georgia have relatively low metering coverage. The situation is somewhat better if we consider group consumption (one meter for an apartment building or for several houses in a common point). However, apartment-by-apartment metering of heat energy and natural gas consumption remains at a rather low level. This excludes the creation of incentives for energy saving at the level of individual households.

Low human resource. Both countries suffer from a lack of qualified specialists for a sustainable movement towards energy conservation. Here, the sphere of municipal and national budgetary organizations, as well as service organizations, is especially distinguished. The budget limits does not allow each municipality to have a separate specialist in energy or energy saving, and state regulation of the salary level for civil servants does not allow municipalities to compete with private companies that can offer a significantly higher level of income. As a result, municipalities and service organizations cannot implement energy saving projects at the required level, and sometimes they are forced to refuse to finance and implement activities simply because of the lack of competencies for their implementation. Often, the lack of qualified service personnel leads to a poor quality of service for installed equipment. Because of this, it often breaks down, and funds for restoration and repair are usually not available. As a result, equipment already purchased and installed can stand idle, while older and inefficient equipment is used, because it is easier to maintain.

9. DIFFERENCES IN ENERGY EFFICIENCY SYSTEMS IN BELARUS AND GEORGIA

Non-government financial resource. Georgia in its plans largely relies on the possibility of financing activities from non-state sources. These can be grants or loans from international financial organizations (EBRD, WB, GEF, GIZ, etc.), as well as a large number of various international competitions. Until 2020, there were also some opportunities in Belarus to attract international funding and participate in competitions to finance activities in the field of energy saving and decarbonization. However, after 2020, a significant part of these projects was suspended, and in 2022, after the outbreak of the war, almost all activities were stopped. At the moment, neither the government of Belarus nor independent organizations in Belarus have much of an opportunity to attract external funding to improve energy efficiency.

NGO actions. The activities of NGOs are supported in Georgia. They have significant opportunities for activities, attracting funding, working with the population (various groups of the population). At the level of the national government, there is an understanding of the benefits of the work of NGOs. In Belarus, almost all NGOs were closed in 2021, and many activists were detained and jailed. State propaganda promotes the narrative that any NGO is an enemy of society, the scope of their activities is not important, the very fact of working outside the state for non-state sources of funding is equated with a crime. Thus, in Belarus there is practically no opportunity for the legal activities of NGOs.

Cooperation with local authorities. Support for the activities of NGOs, as well as awareness of their usefulness for society as a whole, creates a charitable basis for cooperation between NGOs and local authorities. Such cooperation significantly increases the effect on the implementation of projects, as it allows to improve the quality of services that the state provides to the population, and this is usually the most massive and most in demand services. Such cooperation is supported by donors, which increases the amount of funding. Moreover, there are NGOs that specialize in studying and applying international experience at the national level in Georgia. These NGOs are involved in the development of national reforms, which also has a positive impact on the quality of these reforms. In fact in Belarus no possibility to work NGOs with local authorities.

Weather and geographic conditions. Belarus is generally a flat country with the same climate and weather conditions throughout the territory, has no access to the sea or mountains, and therefore living conditions and climatic conditions practically do not differ for different regions of the country. This makes it possible to develop more universal mechanisms and methods in working with the population or in general to improve energy efficiency. Unlike Belarus, Georgia has coastal areas with access to the sea, mountainous areas with completely different weather conditions, and this makes it necessary to develop different energy saving approaches for different regions of Georgia.

Urban and rural people. Geographical and weather differences also affect the way of life of the population. Belarus is characterized by a similar way of life for the population in urban and rural areas. The high level of developed infrastructure of the gasification power supply network leads to the fact that the structure of fuel consumption and the level of efficiency of their consumption practically does not differ between cities and regions, and a high level of urbanization allows you to concentrate on energy saving in cities. At the same time, it is uncharacteristic for Belarus to single out different groups by geographical zoning and create separate economic conditions for them in the form of different tariffs and economic support systems. For Georgia, on the contrary, the way of life and the level of economic well-being of the population largely depend on their geographical location. The population of high mountain areas tends to have a lower level of economic well-being and have a higher level of support from the state. also the structure of consumption and the volume of energy consumption is different for different groups in different parts of the country.

10. CONCLUSIONS AND RECOMMENDATIONS

Low access to regulation mechanisms for small companies and population. Same as in Belarus, in Georgia, the regulation of energy saving in small companies and among the population is at a rather low level, as noted earlier. Therefore, this area is quite convenient for collaboration. Until 2020, work in this direction has already begun in Belarus, some projects have been completed and successful results have been obtained, but this work has been stopped and has not been widely disseminated at the national level. The experience of launching these projects can be transferred to the conditions of Georgia. It should prove to be quite useful and maybe widely implemented in many organizations, municipalities or communities. Thus, we can recommend Georgian NGOs to actively work in this direction, and local authorities to pay attention to such forms of stimulating energy efficiency growth that do not require administrative management but create economic incentives for small businesses and the population to reduce energy consumption. At the initial stage, the experience of Belarus in introducing such mechanisms can be used.

Absence of energy efficiency stimulation instruments. This recommendation repeats the previous one in some aspects. Namely, in the proposal to actively develop incentive measures to improve energy efficiency that will create economic incentives to reduce energy intensity without the use of administrative and manual control or targeted recommendations for individual enterprises.

Absence of energy management system. To ensure a qualitative improvement in the situation with energy saving, it is necessary to significantly improve the level of energy management, especially at the level of municipalities or individual communities. This problem is typical for both Georgia and Belarus. In both countries, there are not enough resources to ensure quality management at the municipal level, the level of individual small enterprises or houses and neighborhoods. Therefore, we recommend organizing separate energy efficiency centers provided with sufficient material and human resources to ensure quality management at the municipal level. To support such work, it is proposed to enable these centers to provide commercial services and provide them with specialized software to minimize the load. Train the representatives of the Department of Economics of Municipalities to use this software as well.

Low quality operation of installed equipment. An important problem remains not only the implementation of energy saving measures, but also the maintenance of installed equipment in working condition and periodically repair. To do this, it is necessary to improve the personnel service quality,

create a system for monitoring the quality of service and form the necessary funds for the timely purchase of spare parts and parts for installed energy-efficient equipment. Quite often, the replacement of equipment (for example, lighting lamps) does not require high qualifications, but is not carried out simply because of the lack of communication between employees of the municipal organization by the operating organization. For this type of work, it is proposed to attract young people, high school students who can undergo additional education to gain some experience in handling household appliances and energy-efficient equipment, as well as get acquainted with the energy sector as a profession and possibly decide on a profession after graduation.