ASSESSING THE IMPACT OF GREEN ECONOMY INVESTMENTS IN BELARUS:

A sectoral study into energy efficiency and renewable energy

2016

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1. Introduction

This study identifies and assesses key sectors for green transition and impacts of green investments in support of Belarus' transition towards a green economy. The Government of Belarus (GoB) has actively sought the implementation of sustainable measures in the sectors of Energy and Renewable Energy through various policies and programs. The Government has also pursued a path toward a green economy since 2004, and under its newest national direction for 2030, *National Strategy for Sustainable Socio-economic Development 2030*, the GoB sets out green economy priorities for the country for the short term (2016-2020) on structural and institutional investments to support green economy transition, while for the mid-term (2021-2030) it seeks to foster human development by investing on human capital via knowledge intensive industries and services. The benefits of shifting to a green economy are well aligned with the country's long-term development goals, as highlighted in a number of Belarus' sectoral strategies.

In order to frame a comprehensive policy and investment context for an inclusive green economy, a quantitative assessment of policy options is needed to measure progress towards the aspired goals and objectives (UNCSD, 2012). In light of this, GoB requested the United Nations Environment Programme's (UNEP's) assistance to identify options for the country's transition to a resource-efficient green economy within the framework of sustainable development.

The potential benefits for a green economy in Belarus are numerous. Modelling of a Belarussian green economy in 2040 highlights the potential for energy efficiency savings over US$1,700 million, avoided thermal capacity investment of nearly 2,000 million, avoided greenhouse gas (GHG) emissions of nearly 29 million tons, and employment growth of over 20,000 jobs. With these basic figures the rationale for, and potential benefits of a green economy become immediately clear.

1.1 Review and modelling methodology:

UNEP provides targeted country support through policy advice, technical assistance and capacity building that assists countries, including Belarus, in developing and implementing locally-tailored green economy approaches (UNEP, n.d.). This is one in a series of studies, and it assesses intervention options and the effects of green economy investments in areas that were identified as priorities among Belarusian stakeholders:

- **Energy Supply:** Green economy modelling examines the impacts of an energy supply scenario where increasing renewable energy is built into the grid at a rate to reach 10 percent of power generation by 2030 and 14-18 percent by 2040, with a corresponding reduction in fossil fuel generation
- **Energy Demand:** Impacts are also measures for a scenario on an increase in energy efficiency of 1 percent per year above BAU from 2016 to 2040. This improvement would be equal across residential, industrial, transport and other sectors.

Taking stock of Belarus' energy sector (including renewables) this study identifies and examines challenges and opportunities a green economy approach offers to the sector, along with enabling conditions needed for green economy transition to occur. Overall, it is concluded that this green economy scoping study supports Belarus' green transition by providing qualitative and quantitative analysis on actions that will drive transition as well as the enabling conditions that will strengthen Belarus' pathway to a green economy.

2. Country profile and policy landscape

2.1 Economic profile

After the independence from the Soviet Union, obtained in 1990, Belarus retained direct management of most the state economy (World Bank, 2014b). As a result, economic growth in the last three decades has been supported by public subsidies, especially for agricultural production, and has been sustained by imports of crude oil and natural gas from Russia, at preferential prices (World Bank, 2014b).

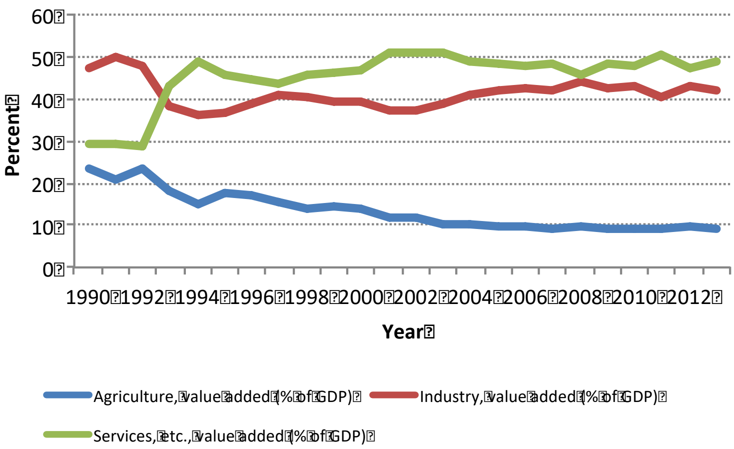


Figure 1: Sectoral contribution to GDP (Source: WDI)

The country has a broad agricultural and industrial base, as well as a large tertiary sector. The economy experienced economic expansion between 2001 and 2008, when Belarus ranked as the country with the best growth performance in the region (World Bank, 2014b) – showing GDP growth of 8.3 percent, while slowing to 3.2 percent from then to 2013 (Figure 2) (World Bank 2014). This was driven by the growing export of goods, such as oil products and fertilizers, which saw steep price increases during that period. The main sectors that have driven economic expansion in the last decade are industrial production (mainly machine-building, consumer goods, food processing, chemical and petrochemical) and services (e.g. construction, transport and trade). In 2013, agriculture value added accounted for 9.1 percent of national GDP, while industry contributed 42.2 percent, and services 48.7 percent (World Bank, 2014a).

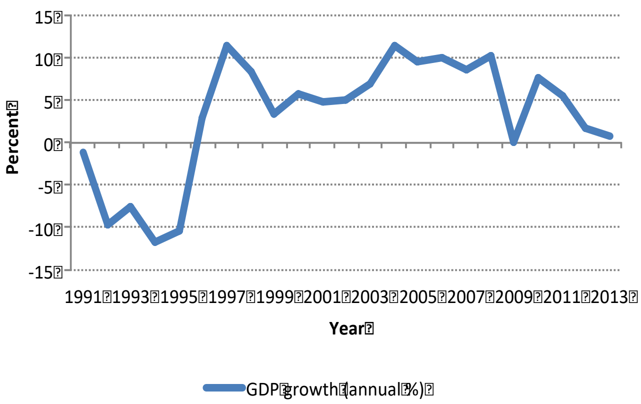


Figure 2: Annual GDP growth rate (Source: WDI)

In addition, government finances have gradually improved over time, with the annual cash balance reaching parity, and surplus, regularly between 2000 and 2008.

Despite the positive economic performance observed between 2001 and 2008, macroeconomic vulnerabilities started to become visible from 2006, when Russia progressively removed preferential prices on its energy exports to Belarus, and the current account deficit begun to widen (World Bank, 2014b). In addition, the 2008 global financial crisis strongly impacted on the national economy, which was heavily dependent on international trade, where the sudden drop in prices and export volumes caused a contraction of GDP growth. Currently, due to decrease in demand from its major markets, Russia and Ukraine, the country's GDP growth continues to decline, with outlooks into entering a recession for 2015 and expected to continue to 2016 (World Bank, 2015).

The introduction of tight fiscal and monetary policies led to the restoration of macroeconomic stability after devaluation and inflation in 2011 (World Bank, 2014b), with the support by the partial re-establishment of preferential prices on oil and natural gas imports from Russia, finalized in exchange for the sale of the Belarusian gas pipeline to Russian state-owned Gazprom. As a result, current inflation is contained to less than 20 percent, and the trade balance went from a deficit of 3 percent of GDP in 2011 to a surplus of 4.6 percent of GDP in 2012 (World Bank, 2014a).

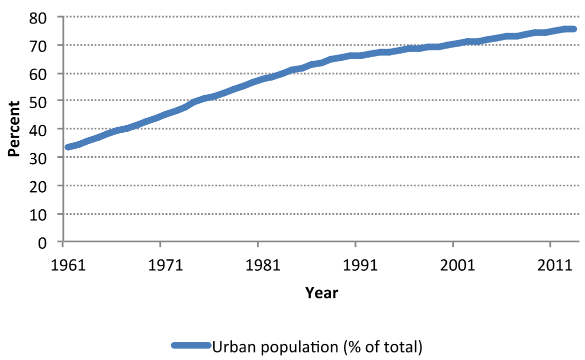
Transitioning to a green economy requires pursuing economic stability and development without sacrificing environmental performance and social development. The transition in Belarus will call for expansion of renewable energy and energy efficiency at its core. This shift will create jobs, reduce emissions, and just as importantly reduce Belarus' reliance on energy imports, thereby increasing energy security.

2.2 Social profile

This section explores some of the driving forces that have led Belarus to its current social development status.

2.2.1 Population dynamics

According to the latest estimates, Belarus has a population of about 9.47 million people (World Bank, 2014a). Two simultaneous trends are recognizable in the last two decades, namely a decline in total population (approximately a 7.5 percent reduction between 1993 and 2013), and a steady increase in rural-urban migration trends. In the latter, rural populations have moved to urban centres to obtain better education and job opportunities and to have access to improved infrastructure and services, such as health care and education (Bobrova, Shakhotska, & Shymanovich, 2012).



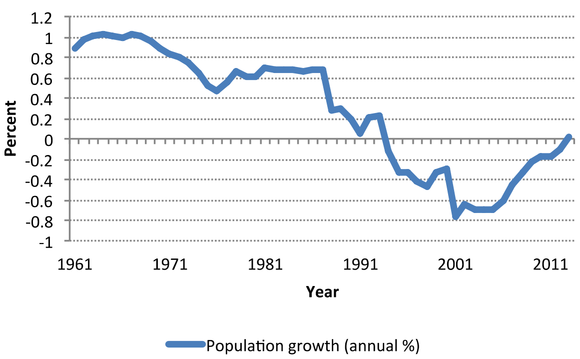


Figure 3: Share of urban population (left) and population growth rate (right) (Source: WDI)

2.2.2 Employment, income and poverty

Given the high GDP growth rates, combined with targeted government policies to preserve the capacity of the workforce and stimulate demand, there has been a considerable reduction in unemployment rates in recent years. More precisely, the share of labor force without employment declined from 3.1 percent in 2003 to roughly 0.6 percent in 2011 and 2012 (IMF, 2014), (GoB, 2009). In line with this positive trend, real wages also experienced a notable increase, growing 3.3 times between 2001 and 2010 (GoB, 2012).

2.2.3 Poverty and wealth distribution

According to national and international data, the proportion of Belarusian citizens with a level of disposable income below the subsistence wage (enough money on which to live on) decreased from 41.0 percent in 2000 to 12.7 per cent in 2005, 7.3 percent in 2011, and 5.5 percent in 2013 (GoB, 2012; World Bank, 2014a). Despite its positive economic performance over the last 20 years contributing to the reduction of poverty and an overall improvement in living conditions of the population, the GINI coefficient[1] has remained in the range 0.30 – 0.26 since the year 2000 (World Bank, 2014a)

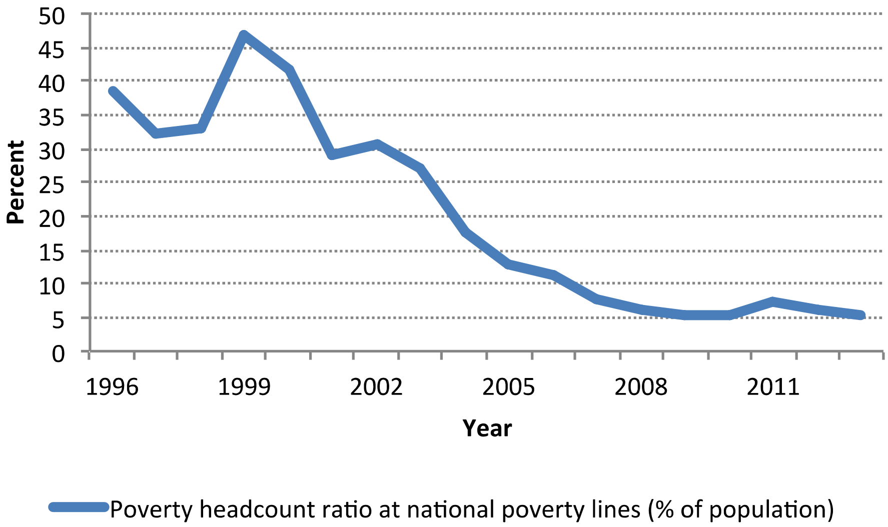


Figure 4: Poverty headcount ratio (Source: WDI)

The country's Human Development Index (HDI) was 0.786 in 2013, ranked 53rd out of 187 in terms of human development in 2013 (UNDP, 2014), being above the world average (0.694) as well as the European and Central Asia average (0.771). Its high ranking is largely due to the achievements in education where the average number of school years has progressively increased to 15.7 years in 2013 indicating that the majority of individuals aged 25 and over have received tertiary education (World Bank, 2014b; UNDP, 2014).

2.3 Environmental profile and challenges

The transition towards a green economy is seen as viable path towards a more sustainable utilization of natural capital in socio-economic development (GoB, 2012). A country rich in natural resources, such as Belarus, requires coordinated efforts to ensure the preservation of natural capital from potential

[1] GINI coefficient is a function of income distribution among residents in a country and it is used as a statistical measure for inequality based on the Lorenz curve. The GINI coefficient varies between 0 and 1, where 0 represents perfect equality while 1 corresponds to perfect inequality (World Bank, 2011).

overexploitation driven by inefficient and high material intensive economic growth. This section explores Belarus natural resources and outlines some of its challenges.

2.3.1 Forests and biodiversity

Belarus is endowed with vast natural resources and biodiversity, primarily thanks to the extensive forest cover, the abundance of water resources and the different habitats and ecosystems these create. Forests cover an area equal to over 40 percent of the total land of Belarus (World Bank, 2014a; Energy Charter Secretariat, 2013). According to the latest National Forest Inventory, forestland extends for a total of 9.4 million hectares (GoB, 2012). Successful reforestation and forest preservation policies in the last decade led to a 2.6 percent growth in forest cover between 2002 and 2012. Under the national forest policy, the annual average reforestation and afforestation amounts to 46 thousand hectares (GoB, 2012).

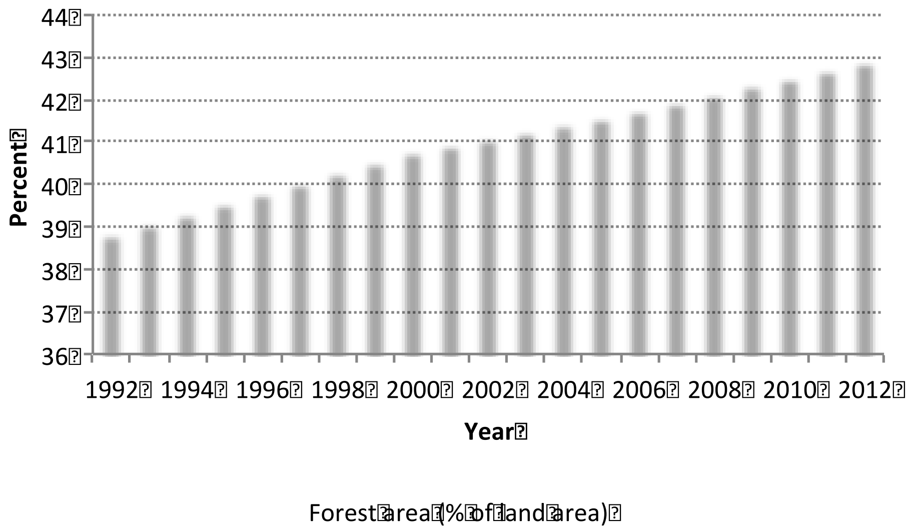


Figure 5: Total forest area as a percentage of land area (Source: WDI)

The government intends to further strengthen the protection of sensitive areas in the future, and has approved a variety of national and international legal instruments to support the effort of biodiversity and ecosystem preservation. For instance, in November 2010, the Council of Ministers of the Republic of Belarus approved a national strategy in line with the provisions of the Convention on Biological Diversity (CBD) (GoB, 2010).

2.3.2 Water

Belarus is endowed with abundant freshwater resources, due to the many rivers that cross its territory, reaching an overall length of 90.6 thousand kilometres (GoB, 2012). These favorable conditions, together with the implementation of policies for improving the access to clean water resources, have ensured that 99 percent of the population is supplied with standard quality drinking water, 92 percent of which is derived from the large reserves of groundwater (GoB, 2009; World Bank, 2014a).

The government has already implemented measures for water conservation, which led to an overall improvement in water use efficiency, and a considerable reduction of water intake from natural water bodies (a 46 percent decrease between 1990 and 2010). With respect to wastewater, targeted policies allowed to reduce sewage water discharge into water bodies, with positive sanitary and environmental effects. The positive effects of water efficiency policies are reflected in the trends of water productivity, which almost doubled between 2002 and 2011 (See figure 6).

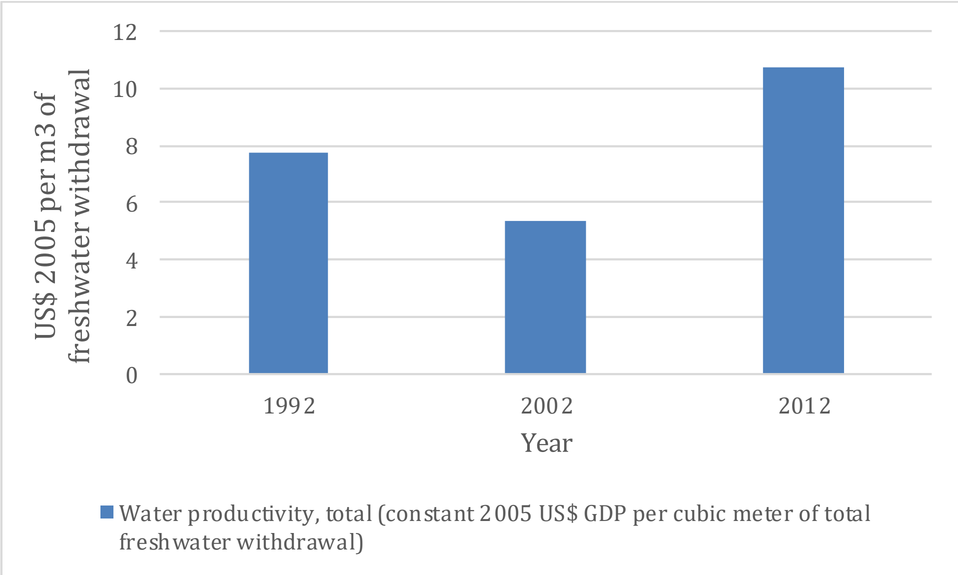


Figure 6: Water productivity (Source: WDI)

2.3.3 Agriculture

Agricultural policies implemented by the government in the recent years have led to an overall increase in agricultural productivity. In particular, investments were made into new technologies for more efficient production, as well as into building capacity for effective agricultural practices and new forms of land management (GoB, 2012). Such an improvement in the agriculture and animal breeding sectors allowed the government to successfully address food security challenges.

Nevertheless, the observed increase in crop yields over the last years can also be attributed to an increase in the use of chemical fertilizers. Indeed, despite the decrease of total agricultural land over the last two decades (from 6 million hectares in 1992 to 5.5 million hectares in 2011), the consumption of fertilizers has more than doubled between 2002 and 2009 (World Bank, 2014a). Intensive fertilizer use can lead to harmful environmental effects, such as soil erosion and groundwater pollution, which could offset the productivity benefits in the long-term. This is particularly relevant in the case of Belarus, where soil erosion is already affecting 6.2 percent of total agricultural area, and 8.6 percent of the country's arable land. Another environmental concern is the radiation levels. Belarus was affected by the 1986 Chernobyl nuclear explosion, and in 2011 it was estimated that 20 percent of the country continues to be contaminated with elevated levels of long-lived isotopes of caesium (Drakenberg & Smith, 2010; European Parliament, 2014).

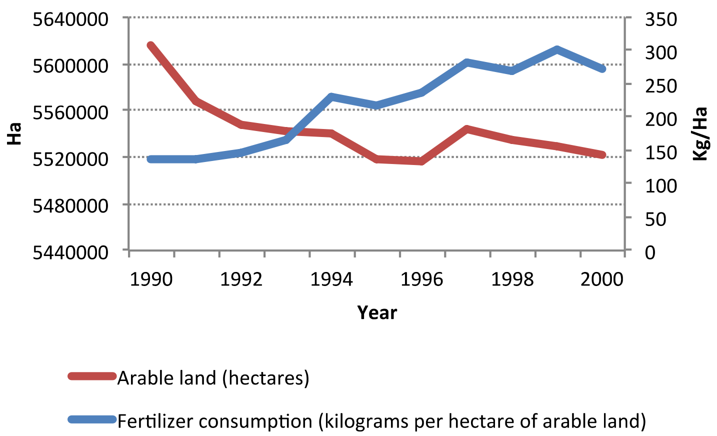


Figure 7: Arable land and fertilizer consumption (Source: WDI)

2.3.4 Climate Change and GHG emissions

Belarus faces challenges both on vulnerability to climate change impacts, as well as challenges to reduce its GHG emissions. On vulnerability, climate change contributes to the county's environmental problem, including climatic risks to its agriculture, forestry, water sectors and its natural ecosystems. These risks may escalate with projected climate and variability changes. Regionally, observed temperature trends have indicated an increase since the 1980s, coupled with an increase in precipitation of up to +70 mm per decade, and these trends are expected to continue. Projected climate change and variability for the region indicate warming during the winter season in Northern Europe[2], affecting long-term mean snowpack toward 2100; however, it is projected continuity of snow-rich winters overall. Projected climate change will negatively impact water flows in some parts of Northern Europe, however seasonal variability may lead to increased autumn and winter rainfall. Extreme climate events are also projected to increase, where increased floods may occur, as well as increase in sea level rise, with expected indirect costs for land-lock countries (IPCC, 2014). These projected changes will have direct and indirect impacts to economic activities, including rail delays due to weather events, decrease in ski season (tourism), human health (heat waves, food-borne diseases), recovery costs due to flooding (social, economic and environmental damages), and access and quality of water resources.

On its mitigation to climate change efforts, GHG emissions continue to be a challenge. As stressed by the 2009 National Communication to the UN Framework Convention on Climate Change (UNFCCC), the sectors that mainly contribute to greenhouse gases emissions in Belarus are energy, agriculture, waste, manufacturing and transport (GoB, 2009) (Figure 8, Table 1). Overall emission levels (as well as per capita emissions) have remained roughly constant since the mid-1990s. However, emissions intensity (measured as total emissions over GDP) have greatly declined during the 90s, mainly due to a progressive shift to less energy-intensive industries and the replacement of heavy fuels with natural gas in several production processes. Continued economic growth has led to a trend on the rise again during the years 2000s (Figure 9).

[2] For the purpose of observed and projected climate change and its related impacts, the IPCC includes Belarus as part of Northern Europe.

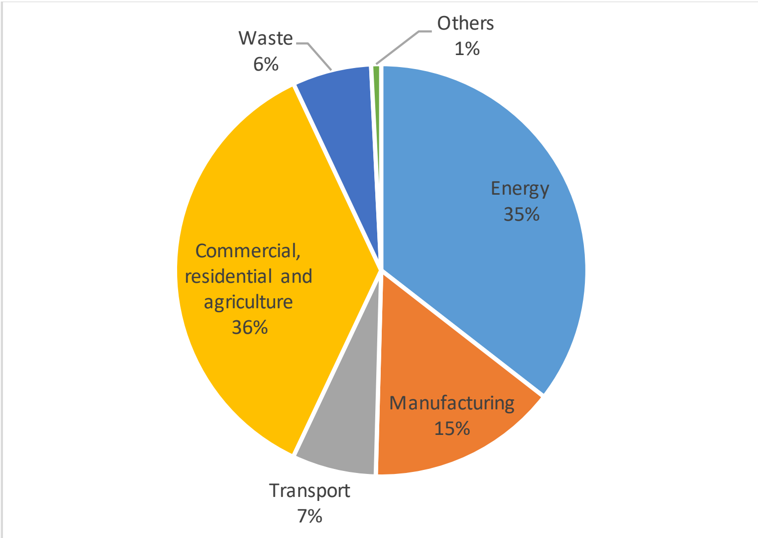


Figure 8: GHG emissions by sector (Source: GoB, 2009)

Table 1: Key sectors and emissions in Belarus

Sector	$MtC0_2e$
Energy	30,515.1
Manufacturing	12,814.6
Transport	56,73.6
Commercial, residential and agriculture	30,916.4
Waste	5,337
Others	676.6
Total	**85,933.3**

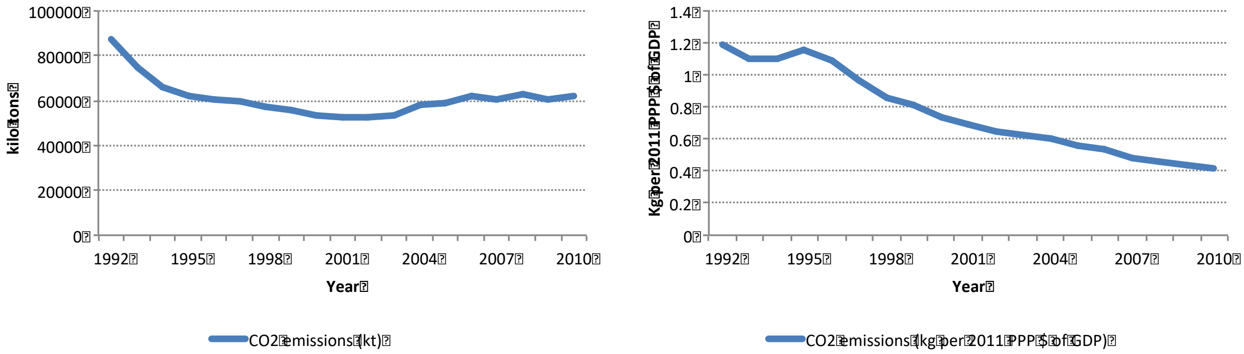


Figure 9: CO_2 emissions: total amount, per unit of GDP and per capita (Source: WDI)

2.4 Green Economy policy landscape

Belarus has launched two mid-term national strategies for sustainable development for the country, *National Strategy for Sustainable Socio-economic Development in the Republic of Belarus up to 2020* (NSDS 2020) (approved in 2004) and *National Strategy for Sustainable Socio-economic Development in the Republic of Belarus up to 2030* (NSDS 2030) (approved in 2015). Both strategies aim to secure sustainable prosperity for Belarus, and since the 2004 strategy, the need to introduce governance and sectoral objectives that enable a green economy was identified as a priority for the country (GoB, 2015;

GoB, 2004). Energy plays an important role in both strategies, however increased priority and measures are introduced in NSDS 2030.

In terms of its current national direction, The *National Strategy for Sustainable Socio-economic Development 2030* sets out green economy priorities for the country for the short term (2016-2020):

> *Transition to high-quality balanced growth of the economy on the basis of its structural and institutional transformation taking into account the principles of "green" economy, the priority development of high-tech industries, which will become the foundation for increasing the country's competitiveness and quality of life (GoB, 2015).*

While focusing on the following in the mid-term (2021-2030):

> *A stable sustainable development, on the principles of the growth of spiritual and moral values and achievement of a high quality of human development, accelerated development of knowledge-intensive industries and services, further strengthening of "green economy" while maintaining the natural capital (GoB, 2015).*

As illustrated above, Belarus under the NSDS 2030 seeks to transform its national economic model toward a green economy, focusing its transition particularly on production, development of high-tech and service sectors, and human potential (GoB, 2015). At the highest level there is a desire to increase the proportion of green sectors to 2-3 percent of GDP, while at the same time decreasing energy intensity against GDP by 35 percent over the 2015-2030 time frame, and reduce GHG emissions by 15 percent below 1990 levels (GoB, 2015). Additional goals include promoting efficiency of production and stimulating green economy transition through financial/tax policy.

In terms of its energy sector, nuclear and renewable energy generation are identified as essential to the diversity of Belarus' energy mix, while green buildings, energy efficient technologies, and alternative and cleaner fuels, are among the main elements that contribute toward energy conservation and efficiency for Belarus (GoB, 2015). A number of specific tasks are identified by Belarus to help achieve these goals including modernization of the power system; diversification of fuel and energy resources, and use of local resources in meeting energy needs.

In addition to the sustainable development strategies, another overarching program is the *Programme of Socio-Economic Development of Belarus for 2011 - 2015.* The program was approved in 2011, and has as its main objectives the improvement on energy efficiency, deployment of energy efficiency technology, use of alternate energy, and advancements in transportation and the built environment, as well as sustainable practices and use in natural resources, biodiversity and waste. For energy efficiency, the program seeks to develop new types of building materials that are energy efficient, as well as increase its exports on petroleum products to existing and new markets, and introduce sustainable management practices such as ARISING ISO 9001 and ISO 14001 (GoB, 2011b). For the use of alternate energy, nuclear energy and peat extraction are identified. Related to energy, in the housing sector, the program seeks to improve efficiency in water, heat and electricity use. The program also includes component in mitigation to climate change, including the implementation of GHG inventory program by 2015 (GoB, 2011b). In addition to energy the plan also addresses sustainable agriculture, improved drinking water quality and its more rational use, reduced water pollution, preservation of soils, improved air quality, waste minimization and recycling.

3. Energy sector for a Green Economy transition

Gas and oil make up the biggest share of energy supply in the country, 81 percent and 18 percent respectively. The remaining 1 percent is made up of biomass, hydroelectricity, wind, waste, and coal. Belarus thermal energy matrix is made up of gas (75 percent), biofuel (5 percent), and coal and peat (1.5 percent) while the remainder is generated by waste (Andreenko, et al., 2013). Domestic production of crude oil feeds approximately 8 to 10 percent of the national demand, and produces high-class oil products for export markets. In 2010 export production amounted to 14.7Mt, while local production was 1. Mt, with net oil products exports amounted to 9.62Mt (Energy Charter Secretariat, 2013).

In Belarus most of the domestic electricity supply is managed under state control, however the number of independent electricity producers has been on the rise, and foreign investors are able to take ownership of newly constructed plants (primarily for hydro and wind power). Under the *Strategy of Energy Potential Development*, independent producers are guaranteed connection to the state power grid, where special incentives play a role when local fuel sources and energy efficient technologies are utilized (Energy Charter Secretariat, 2013). An overview of past and present policies relevant to the energy sector in Belarus is included in Annex 1.

Most of Belarus' energy supply is imported primarily from Russia, and contributes to an estimated 85 percent of the energy supply of the country (Andreenko, et al., 2013; Energy Charter Secretariat, 2013). As a way to encourage energy security, the GoB seeks to expand its storage of energy reserves of natural and liquefied gas, oil and hydrocarbons, in conjunction with the increased use of local and renewable energy sources. (Andreenko, et al., 2013)

3.1 Energy efficiency

3.1.1 Sectoral Overview and Policies

Industrial electricity consumption in Belarus has increased over the past where industrial electricity consumption increased from 30, 581 GWh in 2005 to 31,657 GWh in 2014; while residential has increased from 4,416 GWh to 6, 397 GWh in the same time period (National Statistical Committee of the Republic of Belarus, 2015a). On the other hand, heat consumption has gone down for industrial (49,088,000 Gcal to 44,592,000 Gcal) and residential consumption (24,408,000 Gcal to 22,301,000 Gcal) between 2005 and 2014 (National Statistical Committee of the Republic of Belarus, 2015b). Moreover, since the inception of state energy savings programs, the country has successfully achieved 4.3 percent reduction in energy intensity annually between 1997 and 2010, while obtaining GDP growth rates of 7 percent in the same time period (Energy Charter Secretariat, 2013) Yet, Belarus still has among the highest energy intensity from European OECD countries, exceeding countries with similar climatic conditions by a factor of 1.5-1.8, however lower than post-Soviet countries (Energy Charter Secretariat, 2013). There are targets in place through the NSDS to improve this energy intensity by roughly 35 percent, as well as targets to reduce fossil fuel usage, and energy imports which both can have implications for efficiency (Table 2)

As part of energy efficiency, the housing sector plays a role. Combined, housing and the construction industry consume 40 percent of heat resources and produce up to 35 percent of GHG emissions in the country, and the housing sector in Belarus alone consumes about 23 percent of the energy supply (Andreenko, et al., 2013). To address the high level of energy consumption, in the last 10 years modern architecture in the country has embraced green building concept, where more than 810,000 meters square of housing has been built under energy efficient designs (GoB, 2012). Difference in energy consumption between older building and newer ones is quite visible, with pre-1994 buildings consuming between 150-200 KWh/m2 annually, while newer buildings consume on average 60 kWh/m2 annually.

However, despite these advances, some challenges are faced in energy efficiency for the housing sector. These include the assumption of internal temperature in houses as well as living space per inhabitant. The average temperature is assumed to be 18°C, while most central heated homes run their average temperature at 20°C. Also, the state seeks to enhance the average living space, which currently is lower than most western European standards. Thus there are two separate uses of energy for the same building; the first is the energy consumption of about 40 kWh / m2 / year for the calculation under Belarus' standards, while having a different measure of 80 kWh / m2 / year for the calculation under Western practice. Secondly, under the 18°C estimation, residential buildings that do not meet the energy efficiency requirements and consume above the estimated average use per person will be required to make renovations to meet the energy efficiency standards and pay higher tariffs for their energy use (Andreenko, et al., 2013)

One of the challenges the sector faces is cross-subsidies between individual groups of consumers. Under the *Strategy of Energy Potential Development* the phase out of preferential cross-subsidies will be executed, primarily in natural gas and energy use for certain legal entities and industries to provide for an estimated 60 percent for energy household tariffs by 2015 (Energy Charter Secretariat, 2013). The phase-out will take into account real income per capita "supported by targeted allowances to certain groups of citizens from national and local budgets" (Energy Charter Secretariat, 2013: 53). A recent study by the World Bank argues that the current cross-subsidies, which are structured so that industry pays a higher rate for energy, supporting lower household rates, are counter-intuitive, given that industry simply increases the price of goods as a measure of cost recovery, ultimately affecting households, particularly low-income ones (Grainger, Zhang, & Schreiber, 2015).

3.2 Renewable energy

3.2.1 Sectoral Overview and Policies

Belarus is endowed with abundant renewable energy sources, including wind (estimated potential of 1.9-2 Mtoe per year), solar (1–1.25 Mtoe per year) and biomass (crop waste, animal breeding waste gas, wood and wood waste, plant and municipal waste). Despite such high potential, renewable energy remains largely unexploited, contributing only 0.4 percent of total electricity generation in 2010. Under the *National Program for Local and Renewable Energy Sources Development*, Belarus is looking to take advantage of its renewable sources and increase the share of local and renewable energy sources to no less than 30 percent (IEA, 2015). Historically, share of renewable energy in the grid has been negligible, however, this is expected to change in the post-2015 timeframe as the cost of renewable energy sources declines, making it a more attractive option for inclusion into national energy supply.

Due to the underutilised renewable potential, most of the energy sources in Belarus come from fossil fuels, of which 85 percent are imported primarily from Russia (GoB, 2011a).

Some of the energy targets under the NSDS 2030 are outlined in Table 2. For more details on other policies and programs that influence Belarus' green economy transition see Annex 1.

Table 2. NSDS 2030 targets for Energy (GoB, 2015)

Sector	Target

Energy (including alternate and renewable energy)	• Reduce energy intensity of GDP kg of standard fuel/mln. (in 2005 prices) from 340 in 2015 to 220 (or 35.5 % reduction in energy intensity) by 2030 • Increase renewable energy production to the gross consumption of energy resources from 5% in 2015 to 8% by 2030 • Achieve an index of energy in self-sufficiency of 18% by 2030 • Reduce the share of the dominant type of fuel (natural gas) in the gross domestic consumption of fuel and energy resources from 60 % in 2013 to 52% in 2030; • Reduce the share of the dominant energy supplier (Russia) in the total import of fuel and energy resources from 98 % in 2013 to 75% in 2030; • Substitute 5 billion cubic meters of imported natural gas in the fuel balance and reduce the level of greenhouse gas emissions by 7-10 million tons per year after the launch of the Belarusian Nuclear Power Plant (NPP); • Improve the level of energy independence of the country (a ratio of production volume of primary energy to gross energy consumption of fuel and energy resources) from 14.5% in 2013 to 18% in 2030.

4 Simulation analysis

The following section presents a comparison between business as usual and green economy scenarios on how a shift to a green economy-focused investment in Belarus can drive revenues, savings and economic development. The results clearly outline the potential benefits of a green transition in these sectors.

4.1 General methods, data sources and assumptions/macroeconomic forecasts

Two main scenarios are simulated and analysed in this study, as presented below.

- A **Business as Usual (BAU)** case that assumes the continuation of historic trends. This includes all policies and interventions currently active and enforced, but excludes policies planned but not yet implemented. BAU also simulates an expansion of nuclear capacity with the commissioning of two new units with a total capacity of 2,400 MW and progressively operational from 2020. Under this scenario, no additional investments are made in the expansion of renewable energy capacity, or in energy efficiency improvements.
- A set of **Green Economy (GE)** scenarios that simulate additional interventions that reduce energy intensity across sectors and increase the use of renewable energy for electricity generation. The specific interventions and assumption simulated in the GE scenario are listed below. GE scenario also simulates additional investments for expanding renewable energy capacity (in addition to the expansion of nuclear power) and reducing electricity demand through energy efficiency improvements. In particular, the scenario simulates an increase in renewables up to 10 percent of power generation by 2030 and 14 percent to 18 percent by 2040, with a corresponding reduction in fossil fuel capacity. Moreover, the GE scenario simulates an increase in energy efficiency of 1 percent per year above BAU from 2016, until 2040. The

improvement would be performed equally across key sectors, including residential, industrial, transport and others.

Two sets of assumptions are applied to the scenarios described above, considering (1) favorable and (2) adverse external macroeconomic conditions, as follows:

1. GDP growth: 0.5 percent average annual growth between 2014 and 2020 in the adverse case and 1.9 percent in the favorable case.
2. Population growth: -0.8 percent annual growth from 2013 to 2030
3. Energy prices: constant natural gas and coal prices in real terms, and an annual increase for petroleum prices (average 2 percent per year between 2015 and 2020, accounting for the recent decline in crude oil prices, and 4.1 percent annual growth rate after 2020 in line with the 2011 – 2013 average annual petroleum price change).

The following assumptions have also been made on energy employment creation and costs:

Table 3. Summary of main assumptions used for the simulation of BAU and GE scenario for energy.

Energy efficiency employment	Method 1: Job years per GWh: 0.59 (source: Wei et al., 2010); Method 2: Job years per Mn EUR: 8.37 (source: ITUC, Millennium Institute, 2012).
Renewables construction cost	US$ 1.79 Mn per MW (IEA, 2014)
Renewables maintenance cost	US$ 46,000 per MW (IEA, 2014)
Hydro construction cost	US$ 2.27 Mn per MW (IEA, 2014)
Hydro maintenance cost	US$ 53,000 per MW (IEA, 2014)
Fossil fuels construction cost	US$ 2.00 Mn per MW (IEA, 2014)
Fossil fuels maintenance cost	US$ 60,000 per MW (IEA, 2014)
Nuclear construction cost	US$ 6.60 Mn per MW (IEA, 2014)
Nuclear maintenance cost	US$ 198,000 per MW (IEA, 2014)
Energy efficiency investment	US$ 50 per avoided ton of CO_2 emissions from electricity generation. (IEA, 2013)
Average emissions from fossil fuel electricity generation	Based on power source and technology used. Highly influenced by the commissioning of nuclear power. From 150 ton/TJ in 2014 to 90 ton/TJ in 2025.

4.2. Energy Efficiency

4.2.1 Sectoral results - Energy demand

Total annual energy demand is projected to reach 940,500 TJ/year by 2040 under the BAU scenario (Figure 10). In the GE scenario, energy efficiency improvements lead to a reduction in total energy consumption by 24.7 percent relative to the BAU case.

The improvement in energy efficiency mentioned above corresponds to a reduction in energy intensity (estimated as energy consumption per unit of GDP), relative to 2015, of 36.6 percent for the GE Favorable (Figure 11).

To put these improvements into context, they should be compared to the national goal of reducing GDP energy intensity by 35.3 percent by 2030 (as indicated in table 2). In this respect, while the GE Favorable scenario reaches the target, more aggressive interventions in energy efficiency should be pursued in the GE Adverse scenario.

Energy efficiency improvements in the residential sector would lead to energy consumption per m2 ranging from a 5.5 percent reduction in 2030 relative to 2015 in the GE Favorable scenario, to a 24.4 percent reduction during the same period for the GE Adverse scenario. This is due to the str onger impact that GDP growth would have on residential energy consumption in the GE Favorable scenario.

What this means is that in the favourable scenario (where GDP grows higher than the adverse scenario) there is a greater progress towards the energy intensity target. Meanwhile in the adverse scenario, where GDP grows less, the target is not achieved, and additional effort is needed. Meanwhile in the residential sector, increased GDP is impacting energy consumption meaning that if GDP grows it will be more difficult to meet the residential target, and additional effort will be needed.

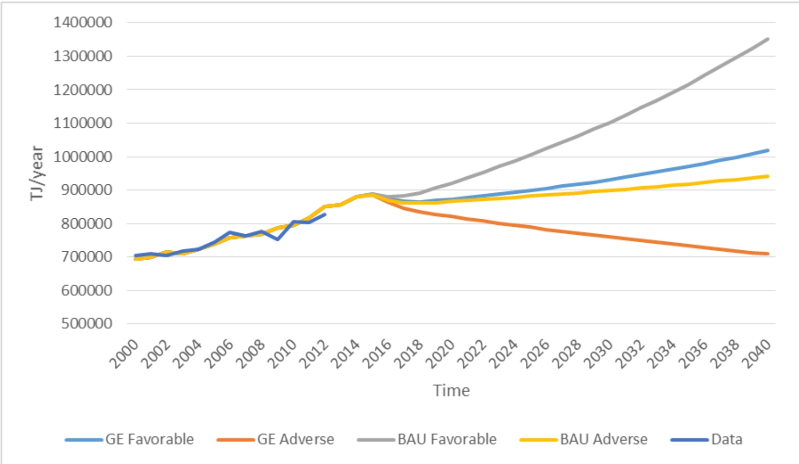


Figure 10: Historical and future projections of total energy consumption, under BAU and GE scenarios.

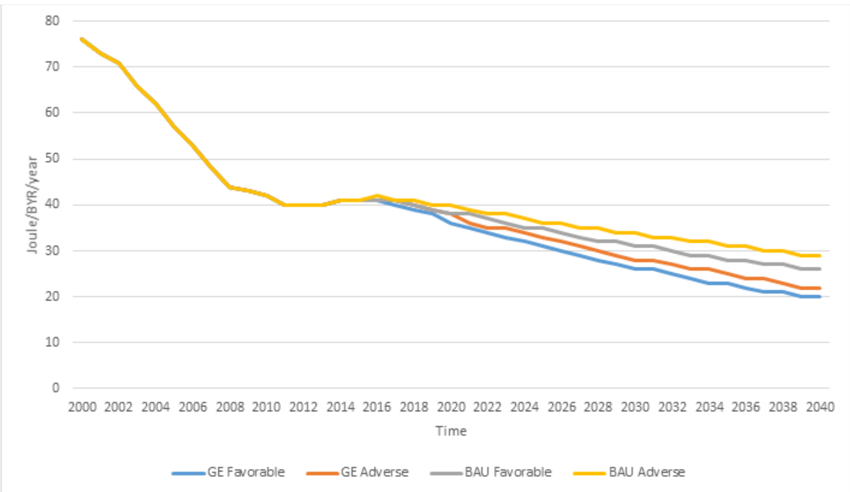


Figure 11: Energy intensity. Projections under BAU and GE scenarios.

4.2.2 Investment Required

The annual investment required to reach the energy efficiency targets assumed for the GE scenarios amounts to about US$ 124.6 million and US$ 120.5 million per year on average between 2015 and 2030, and US$ 226.6 million and US$ 206.2 million per year on average between 2015 and 2040. The total (cumulative) investment in energy efficiency would amount to US$ 1.9 - 2 billion for the period 2015 – 2030, and US$ 5.3 – 5.9 billion for the period 2015-2040 for the GE scenarios.

4.2.3 Avoided Costs

The improvement of energy efficiency is projected to generate cumulative savings on energy consumption of about US$ 6.2 - 7 billion between 2015 and 2030, and US$ 17.3 – 20.7 billion by 2040, with a yearly average of approximately US$ 388 - 432 million between 2015 and 2030, and US$ 667 - 800 million by 2040 for the GE Adverse and Favorable scenarios respectively. These avoided costs can be directly compared with the energy efficiency investment (ranging between US$ 120.5 - 124.6 million per year on average between 2015 and 2030, and US$ 206.2 - 226.6 million per year on average between 2015 and 2040 in the GE scenarios), which indicates that this intervention is very likely to generate consistent positive economic returns. Importantly, avoided costs are also expected from the reduced use of fossil fuels (primarily natural gas) for thermal power generation.

4.2.4 Employment and Revenue

Figure 12 shows that under the energy efficiency scenario, for the GE Adverse and Favorable cases respectively, a total of 1,140 – 1,200 (method 1) to 750 - 780 (method 2) full time direct jobs would be created by 2020, while a total of 3,700 – 4,300 (method 1) and 2,200 – 2,400 (method 2) direct jobs would be created by 2030. The number grows to a maximum of 8,200 and 4,600 jobs in 2040.

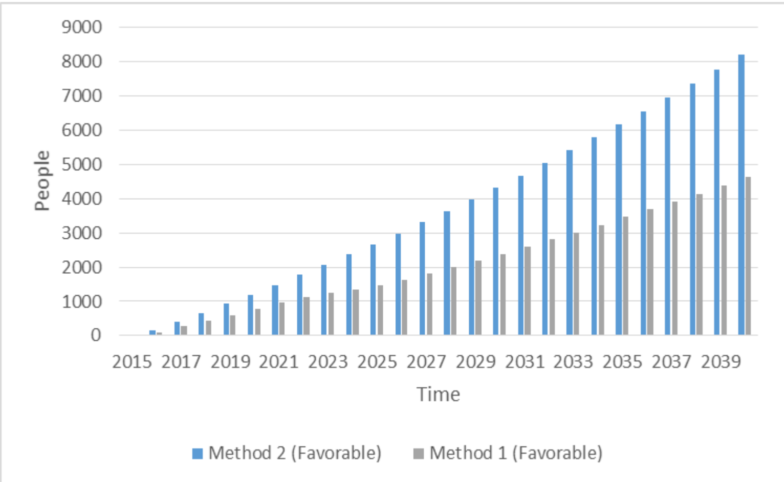


Figure 12: Energy efficiency additional jobs, projections under method 1 and method 2 for the Favorable scenarios.

'Method 1' is calculated based on annual energy consumption (jobs/year/GWh), while 'Method 2' represents the number of jobs created per financial resources invested (jobs/year/Mn US$).

4.3 Renewable Energy

4.3.1 Sectoral results – Generation capacity

- *Power generation capacity*

Under the BAU scenario, electricity is almost entirely generated from fossil fuels, particularly natural gas. On the other hand, the commissioning of nuclear power is expected to considerably change the electricity generation mix starting from 2020. At that time, nuclear power will represent 27.2 percent of electricity generation capacity, thermal will decline to 76.0 percent and hydro will reach 0.5 percent. Projections for the GE scenario show instead the marked increase of power capacity from renewable energy sources (especially wind and solar), which would comprise 9.7 percent of the national power capacity mix by 2020, 29.2 percent by 2030 and 41.2 percent by 2040.

- *Electricity generation*

Figure 13 presents past and projected electricity generation under the BAU and GE scenarios (2000-2040).The total electricity generated would be lower under the GE scenario thanks to lower electricity demand due to energy efficiency improvements. In particular, the total electricity generated in 2030, as an example, would be GWh 32,740 (Adverse) and 38,260 (Favorable) under the GE scenario compared to GWh 37,818 (Adverse) and 42,466 (Favorable) under BAU, corresponding to a 12 percent reduction in the Adverse case and 10 percent reduction in the Favorable case.

Projections for the GE scenario show that electricity supply from fossil fuels and nuclear would remain almost unchanged between 2020 and 2030, while additional electricity would be produced from renewables.

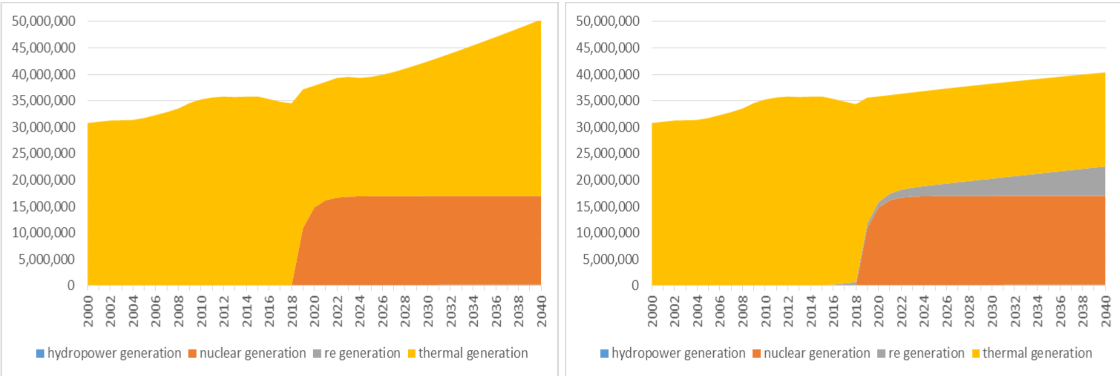
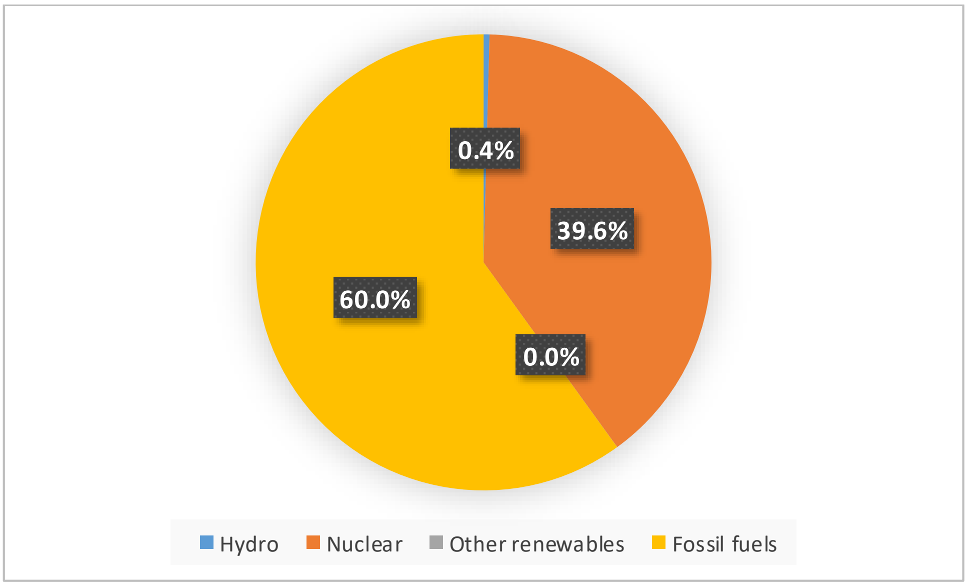


Figure 13: Electricity generation by energy source (Million MWh). Historical and future projections, BAU and GE Favorable scenarios.



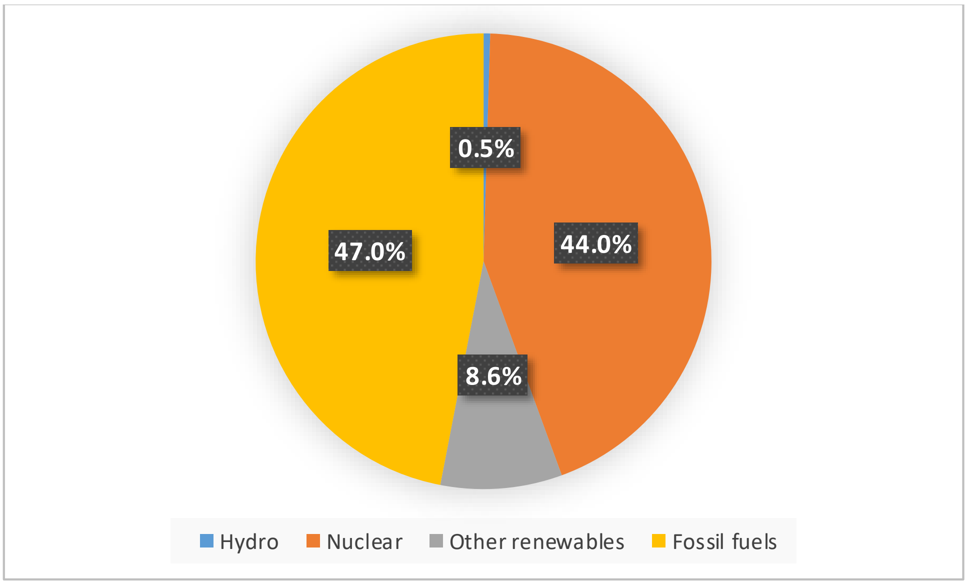


Figure 14: Share of electricity generation by 2030 under BAU (top) and GE (bottom) Favorable scenarios.

The increased share of renewable energy in electricity generation highlights the synergies existing between renewable energy and energy efficiency interventions. Energy efficiency lowers demand and the required generation capacity, which means that the same investment in renewable energy leads to higher penetration rates and fewer emissions (or that a lower level of investment in renewable energy is required to reach the stated percentage of the grid target if gains in efficiency are realized). This creates a synergy because with one investment (in energy efficiency) progress is made towards three national targets, namely those on (1) expanding the use of renewable energy as a share of total energy supply, (2) reducing energy intensity and, as a result of the two interventions, (3) lowering CO2 and GHG emissions.

4.3.2 Investment Required

The average annual investment required to expand renewable energy power supply is projected to be approximately US$ 287 million between 2015 and 2030, or US$ 6.3 billion cumulatively. While this investment may seem high, it is worth noting that the total investment for electricity supply is actually lower in the GE scenarios than in the BAU cases. This is due to the synergy with energy efficiency (which reduces energy demand, and hence the need to invest in increased supply).

4.3.3 Avoided Costs

While the upfront investment required for the expansion of renewable energy power generation capacity is comparatively high, it contributes to the reduction of capital costs for building thermal power plants, allows savings on energy imports (e.g. natural gas), and creates jobs.

The avoided annual cost for fossil fuel capacity expansion would amount to US$ 150 – 620 million in the GE Adverse and Favorable scenarios respectively, on average between 2015 and 2040, or US$ 3.6 – 15.7 billion cumulatively. The total investment in the power sector until 2040 will therefore be 6.7 percent and 23.9 percent lower in the GE scenarios

Reduced capacity expansion and generation from natural gas also translates in savings from the import and purchase of this fossil fuel. It is estimated that savings reach US$ 815 million per year on average between 2015 and 2030 (totalling US$ 13 billion cumulatively) and US$ 1.5 billion per year on average between 2015 and 2040 (totalling US$ 39 billion cumulatively) in the GE scenarios relative to the BAU cases.

Based on the above calculations, it is possible to estimate the net returns on investments in the electricity sector, including both energy efficiency and renewable energy investments under the GE scenario. Total annual net investment is calculated as renewable energy, energy efficiency investments, and operation costs minus avoided fossil fuel capacity expansion costs and savings on fuel (for power generation only) and electricity consumption. The results of this calculation reveal that significant upfront investment is required in the first years of policy implementation, and that added value and avoided costs result in positive and increasing returns. In particular, the net economy-wide annual cash flow would be higher than BAU from the year 2022, and they would become positive from the year 2031 (Figure 15, 16). This essentially means that after 2031 the upfront investment cost of the renewable energy is fully paid off, and the country benefits from continued avoided costs associated with imported power in the BAU scenario. In 2040, net revenues under the GE scenario would amount to approximately US$ 3.7 billion or US$ 25.2 billion cumulatively between 2015 and 2040.

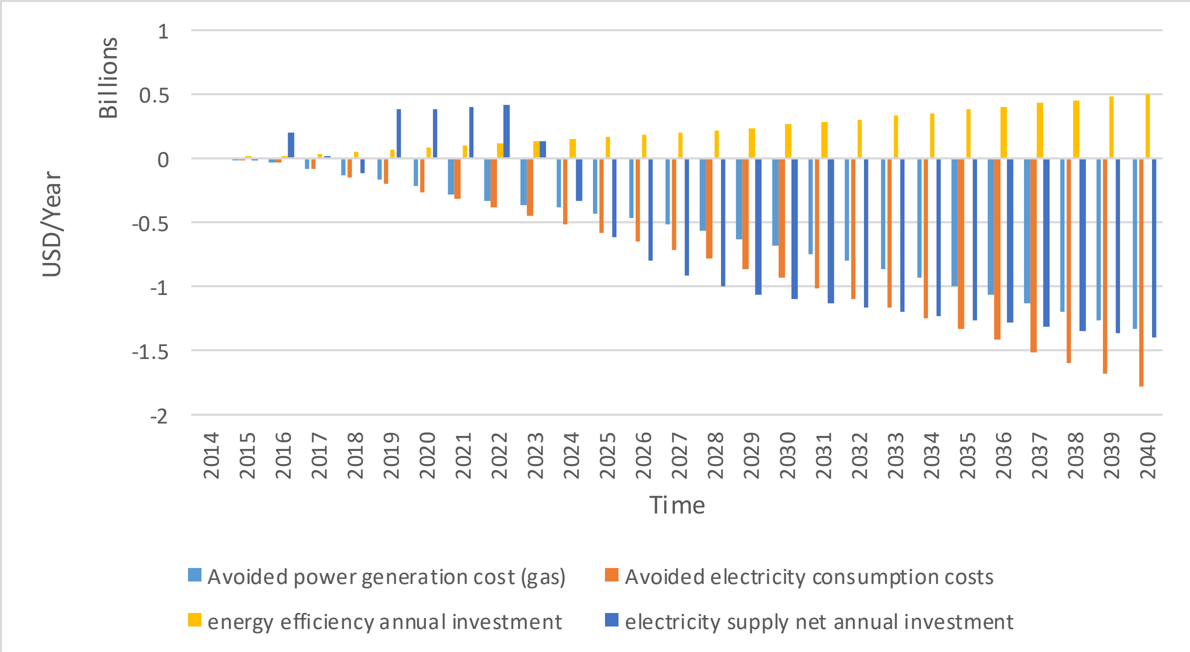


Figure 15: Annual investment (energy efficiency and renewable energy) and avoided costs (avoided energy consumption and fuel consumption for power generation) under the GE Favorable scenario.

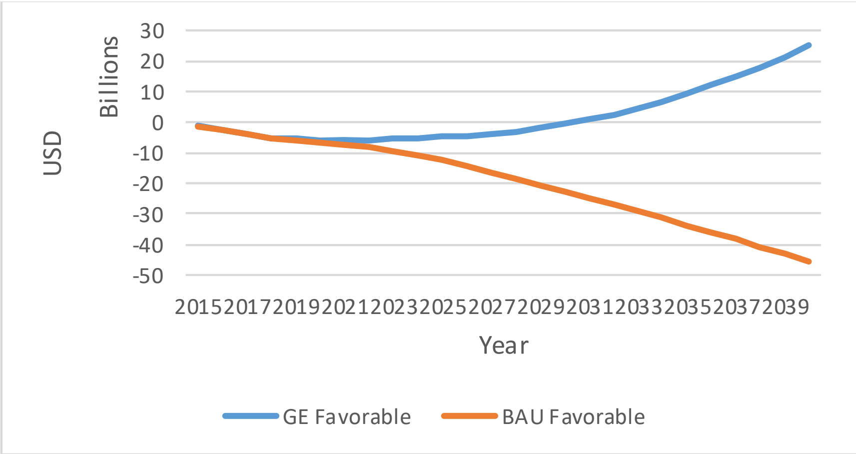


Figure 16: Cumulative Net Investment in the energy sector (USD). Projections under BAU and GE Favorable scenarios.

4.3.4 Employment and Emissions

The expansion of renewable energy capacity is likely to generate employment through the construction of new plants, as well as creating new jobs for the operation and management of wind turbines, solar panels and new hydro plants. The share of renewable energy jobs in total energy employment would increase to approximately 50 percent between 2015 and 2030, while it is projected to remain close to zero under the BAU scenario. When adding renewable energy jobs to projected new, energy efficiency-related jobs (up to 4,300 new jobs by 2030), the additional employment created would be up to 12,000 total additional jobs on by 2030 (Figure 17).

Investments in renewable energy are expected to reduce CO_2 emissions arising from fossil fuel-based electricity generation; investments in energy efficiency are instead expected to reduce energy consumption, leading to an overall reduction in emissions. The combination of these two interventions in the GE scenarios leads to a reduction of CO_2 emissions of 19.9 percent and 18.8 percent in 2030 when comparing the GE Adverse and Favorable scenarios with their respective BAU simulations. The reduction relative to 2015 is 12 percent and 29.4 percent in the BAU and GE Adverse scenarios and an increase of 9 percent and decline of 11.38 percent in the BAU and GE Favorable scenarios (Figure 18). These reduction lead to per capita emissions being below 7 ton/person/year in the GE Favorable scenario and around 5 ton/person/year in the GE Adverse scenario in 2030.

In this regard, thanks to a combination of energy efficiency, renewable energy and nuclear power investments, all the GE scenarios reach the emission reduction target stated by the government, and in particular, effective gains are made in the power sector. Detailed simulation results are included in Annex 2

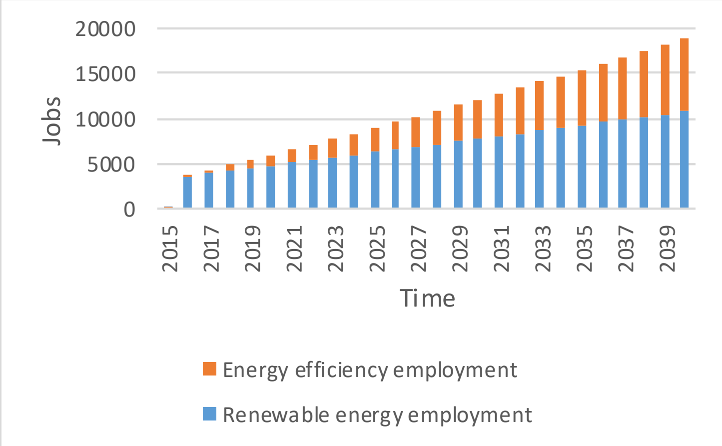


Figure 17: Additional employment (cumulative) created in the energy sector under the GE scenario. Projections for energy efficiency and renewable energy sectors.

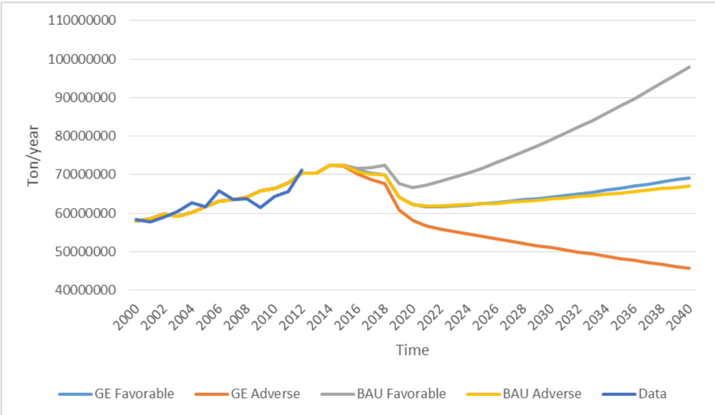


Figure 18: Total emissions under the BAU and GE scenarios.

5 A way forward for a Belarus green economy

Two of the priority areas for green economy policy-making are limiting government spending in areas that deplete natural capital and promoting investment and spending in areas that stimulate a green economy (UNEP, 2011). The simulation analysis in the previous section shows that abiding by these two priority areas can have significant benefit for Belarus in terms of the energy sector. By shifting investment from fossil fuel development and import to energy efficiency and renewable energy Belarus would see lasting economic benefits as well as environmental benefits, most notably reduced GHG emissions.

Beyond this there are some more detailed suggestions for Belarus given its push to implement an overall green economy transition, as well as focus on the key sectors highlighted in this report. Tools at the disposal of Government for this task include:

- Regulatory frameworks and standards that create non-monetary drives for green transition and/or reduce barriers to implementation;
- Economic and fiscal instruments that support the development of green technologies and practices through fiscal incentives, as well as removing supports (e.g. subsidies) for

unsustainable activities and costing activities that create negative environmental impacts (e.g. GHG emissions);

- Institutional and policy processes create the frameworks for green transition to occur, and can indicate a government leading by example (i.e. green procurement); and
- Informational and voluntary instruments can provide supports to workers, the private sector and residents by building education and capacity on green transitions, while providing bridging mechanisms to the regulatory and fiscal measures discussed above.

Examples of mechanisms that have been proven either in Belarus or elsewhere and are suggested for consideration or elaboration in Belarus include:

5.1 Policy considerations

It is expected that Belarus will be able to meet its GHG emissions reduction target of stability at 2011-2015 levels in the short term due to the introduction of nuclear power into the energy grid, reducing reliance on higher-polluting fossil fuels. However, in the post-2020 time frame as GDP and energy demand are predicted to grow, it is necessary for Belarus to take additional actions to ensure maintenance of its GHG levels long-term. This can entail greater renewable energy in the grid, but should also include actions in other sectors, particularly transport where the number of cars, and as a result emissions, are projected to continue to grow.

Simulation analysis highlights that the creation of new jobs declines over time. This is not a reduction in absolute jobs, just a decline in creation of new jobs. This makes sense as more jobs will be created early on but once the construction and development of new infrastructure is undertaken the amount of 'new' jobs will decrease. By this point the capacity needed in these green sectors will have largely been met. It is important to note that this decline in new jobs is not a decline in total, absolute number of jobs overall.

At a sectoral level, with proper specific enabling conditions Belarus can achieve its vision for a green economy, including:

Renewable Energy

- The government has already indicated a desire to drive green economy transition through financial/tax policy. Some of the fiscal mechanisms the Government should continue to support include guaranteed connection to the power grid, tax concessions, exemption from custom duties for imported technology, an encouraging investment environment (e.g. tax breaks, low interest loans), and favourable pricing policies toward renewable energy use and production (e.g. removal of fossil fuel subsidies, polluter pays systems, feed-in tariff systems) (GoB, 2011a).
- The simulation shows that there is a defined long-term economic benefit to the up-front investment in renewable energy. Considering these projects in the long-term is essential to building support for renewable energy development. The Government should undertake efforts to educate key stakeholders and the public on not only the security and environmental benefits to renewable energy development, but also the long-term economic benefits.
- The *Strategy of Energy Potential Development* already recognizes the perverse effects of cross-subsidies and the need for them to be reformed. Reforming energy subsidies of all kinds is very important to green transitions to ensure that a) fossil fuels are not being subsidized, placing renewable energy at a disadvantage b) renewable energy subsidies are not having perverse effects on rate payers and c) when subsidies are reformed, it does not result in price shocks for rate payers.

Energy Efficiency

- Programming to support energy efficiency on the demand side can be a major benefit to rate payers. It lessens energy demand, reduces emissions, and most importantly reduces energy prices for households. This can include educational campaigns on efforts such as the benefits of energy efficient building materials and appliances, as well as fiscal incentives for switching to energy efficient appliances, such as rebates for trading in old products. This programming should be particularly targeted at lower-income households, which are typically the most exposed to energy prices, but also least able to afford the actions, materials and technologies to improve their efficiency.
- The simulation on energy efficiency noted the effects on GDP growth on energy efficiency can be positive or negative depending on the circumstances. On one hand, with greater GDP growth, national targets on energy efficiency are easier to achieve as efficiency is measures against units of GDP. The higher that GDP is the better this measure becomes. However, when energy efficiency is measured against another indicator (such as energy consumption per m^2 in the residential sector) a higher GDP growth could actually make efficiency targets harder to achieve as GDP growth affects energy usage patterns. This provides an important indication to Belarus to be extremely careful in setting targets for efficiency and to fully consider all potential outcomes and outside effects on target achievement. It is also important to ensure that commitments are regularly reviewed and that policies are adaptive to changes in economic condition.
- Educational campaigns about the environmental and economic benefits of consumer-driven activity such as anti-idling, proper tire inflation, and regular vehicle maintenance can also improve the energy efficiency and emissions of the existing vehicle fleet.
- The figures for energy use in buildings indicate a major difference between performance of existing and new building stock. For this reason, fiscal mechanisms targeted directly at renovation could make a marked improvement in building efficiency. These mechanisms can include low interest loans, grant programs, technology supports and tax credits.
- Energy efficiency labelling for buildings and appliances is also becoming an increasingly common way to support the green transition and build consumer capacity to choose greener options.

5.2. Policy Roadmap

It is clear that the issue of energy, its production and its use, are the fundamental dynamics that will drive the future of Belarus' green transition. A review of the macroeconomic conditions in the country, the current policy structure, and a simulation analysis of a GE Scenario highlight the environmental, economic and employment benefits associated with a shift to greater presence of renewable energy in the grid and an increased focus on energy efficiency. A concerted shift from imported power also supports Belarus' push for energy security.

Belarus has exhibited substantial development progress since 2000, and while there has been a recent restraint in growth due to global economic conditions and reliance on imported energy, the economic outlook is still positive. The fundamental challenge for Belarus is to secure its energy supply, while also looking at ways to continue to grow its GDP, but in a manner that will not generate negative environmental impacts, notably increased GHG emissions as the country has adopted a stability target for its current emissions levels.

The Government has shown a desire to support green transition, and has enacted several policies that will support this transition, most notably the *National Strategy for Sustainable Socio-economic Development 2030* which codifies the green economy as a desired approach.

With respect to its key sectors of focus, achieving this vision will include a shift to integrate renewable energy into the national energy grid, adopting and meeting aggressive energy efficiency targets, and taking concerted steps to improve the energy efficiency of its existing and new building stock. A green transition that is already underway can assist Belarus in developing the sectoral approaches for a green economy.

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Annex 1: Sectoral Policy Overview

To foster its efforts to diversify its energy mix obtain energy security, and shift to a green economy over the past 15 years the Government of Belarus has developed a series of legislation that supports this direction for the country.

These legislation and strategy documents, and some of their highlights are outlined in the table below.

Table 4: Key sectors and current and historical actions by Government of Belarus

Sector	Legislation/Strategy/Policy and Highlights

Renewable Energy Development	• *Law of the Republic of Belarus "On Renewable Energy Sources" of December 27, 2010, No.204-3.*
	  ○ Outlines the potential for increased power generation from hydroelectricity, wind power, biomass, solar, natural cold, municipal solid waste, biodiesel, and agricultural waste (plant and livestock).
	• *Strategy of Energy Potential Development of the Republic of Belarus* (approved by the Resolution of the Council of Ministers of the Republic of Belarus of August 9, 2010, No.1180).
	  ○ Instituted improvements in the fuel and energy sector's market competitiveness through innovation and improved standards and regulatory framework
	• *National Development Programme for Local and Renewable Energy Sources in 2011-2015*
	  ○ Four year program to increase the use of domestic energy sources by 2015, where local energy sources will comprise no less than 30 percent of the energy mix used for heating purposes
	  ○ Sources identified include wood, straw, municipal waste, peat, biogas, wind, solar installations, heat pumps, and the construction and rehabilitation of hydropower plants
	  ○ Target: Domestic energy source target of 30 percent

Energy Efficiency	• Law of the Republic of Belarus «On Energy Conservation» of July 15, 1998, No.190-3.
	• Republican Programme on Energy Conservation for 2011-2015 (approved by the Resolution of the Council of Ministers of the Republic of Belarus of December 24, 2010, No.1882).
	  ○ Target: By 2015 a 50 percent reduction in energy intensity of GDP relative to 2005 level and increase by 28-30 percent its domestic energy resource in the energy balance
	  ○ Target: 60 percent reduction in energy intensity of GDP and 32-34 percent of local resources in the energy mix by 2020
	• Directive of the President of the Republic of Belarus «Saving and Thrift are the Main Factors of Economical Security of the State» of June 14, 2007, No.3.

	• Energy Safety Concept of the Republic of Belarus (approved by the Decree of the President of the Republic of Belarus of September 17, 2007, No.433). • "On Use of Nuclear Power" (GoB, 2009) • "State Comprehensive Program of Modernization of Basic Production Capacities of The Belarusian Energy System, Energy Saving and Raising the Proportion in Using Local Fuel-Energy Resources in the Republic for the Period until 2011"

Transport	• Automobile Industry Development Program of the Republic of Belarus for 2007- 2010
	    o Aimed to reduce harmful effects from transport sector to the environment, including replacement of 10% of vehicles to more environmental friendly versions (GoB, 2009)
	• State Program for the production of biodiesel in the Republic of Belarus for 2007- 2010.
	    o The aim of this program is the country's environmental and energy security though reduction of toxic emissions from vehicles by 40% by 2010 (GoB, 2009)
	• Air Code of the Republic of Belarus
	    o Directed the improvements in operating procedures of aircrafts to align with global ecological requirement (GoB, 2009)
	• State Development Program Civil Aviation of the Republic of Belarus for 2006- 2010
	    o Aimed at the improvements in maintenance and upgrading of core aviation facilities in line with ICAO (GoB, 2009)
	• *State Program of Development of Railway Transport of the Republic of Belarus 2011-2015*
	    o Focus on electrification of trucks to reduce costs and emissions, with the objective to have the electrification of both Transport Corridor II and IXB branch complete by 2015
	• *Cycling in Minsk for the years 2012-2015*
	    o Outlines the construction and organization of up to 500 km of bicycle paths in the city
	•

Housing	• *Master Plan – On the Architecture, Urban Planning and Construction Activities in the Republic of Belaru*s and *Guidelines for State Urban Development Policy in the Republic of Belarus 2011- 2015.*
	    o Supports the green cities concept
	• *State Environmental Expertise*
	    o regulates state expert assessment of urban development projects
	• *Resolution of the Council of Ministers № 706 "On Approval of the Comprehensive Program for the design, construction and reconstruction*

	of energy efficient residential buildings in the Republic of Belarus for 2009-2010 and until 2020 o 11 year housing program focusing on the construction and reconstruction design on energy efficiency in housing setting out specific targets, including reduction in thermal heating to 60 kWh/m2 per year to 2015, and further reduction to 30 to 40 Kwh/m2 per year by 2020. o Includes "thermal upgrading of existing residential buildings, mass replication of energy-efficient housing, organization of the production of virtually all products needed for furnishing homes, introduction of the European practice of calculating costs for the entire life cycle of the building" (GoB, 2012) o Mandates that starting in 2015, at least 60 percent (or 6 million m^2) of the total housing under construction in Belarus should be built using energy-efficient technologies, with a vision to have 100 percent of housing using energy efficiency by 2020 (Andreenko, et al., 2013; Energy Charter Secretariat, 2013). • *Resolution of the Council of Ministers № 964 "On energy audits organizations"* o energy audits are required for business that consume more than 1.5 thousand tons of fuel at least once every 5 years under the 2006 (Andreenko, et al., 2013)
Education, training and public awareness	• *Article 77 of the Law of the Republic of Belarus "On Environmental Protection"* (GoB, 2009). o Seeks to increase public awareness through the dissemination of ecological, environmental protection and climate change information o Objective is to establish a social framework to support sustainable development through social responsibility on ecological protection
General Policy and Measures (GoB, 2009: 81-82)	Laws: • *The strategy for cutting emissions and increasing greenhouse gases absorption by sinks on the territory of the Republic of Belarus for 2007 - 2012 (2006);* • *State program of innovation development in the Republic of Belarus, 2007-2010 (2007);* • *The national program of mitigation of climate change consequences for 2008-2012 (2008);* • *The Law of the Republic of Belarus «On Protection of Atmospheric Air» (2008);* • *The Provision on the procedure of submission, review and monitoring of projects on voluntary reduction of greenhouse gases* • *emissions (2009);* • *The Law of the Republic of Belarus «On Protection of Climate» (2009);*

	The Decree of the President: • *No. 205 of 30 April 2007 on the adoption of amendments to Annex B to Kyoto Protocol to the United Nations Organization* • *Framework Convention on Climate Change;* Resolutions of the Council of Ministers: • *of May 4, No. 585, 2006, on approval of provisions on National Greenhouse Gas Inventory System;* • *of April 10, 2006 N 485, on approval of provisions on the state inventory of anthropogenic emissions from sources and greenhouse gases absorption by sinks;* • *of August 25, 2006 No. 1077, on the National Register of carbon units of the Republic of Belarus;* • *of September 5, 2006 No. 1144, on approval of provisions on the procedure of submission, review and monitoring of projects* • *designed for joint implementation;* • *of September 5, 2006 No. 1145, on the establishment of the state Commission on problem of climate change;* • *on April 14, 2009 No. 466 «On the Order of Presentation, Review and Monitoring of Projects for the Voluntary Reduction of Greenhouse Gas Emissions»;* The Order of the Ministry of Natural Resources and Environment Protection of the Republic of Belarus of December 29, 2005 No. 417 «About an Inventory Center for Greenhouse Gases; The Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus of January 22, 2007 No. 4 on approval of the instructions on the procedure of formation and maintenance of the National Registry of carbon units of the Republic of Belarus.

Annex 2: Detailed Simulation Results

Table 4. Main results of the analysis of the impact of EE and RE interventions

Timescale (Year)	2015	2020	2025	2030	2035	2040
ANNUAL INVESTMENT (US$ Million)						
Energy efficiency						
BAU - low growth	-	-	-	-	-	-
GE (RE+EE) - low growth	0.94	81.54	160.37	241.59	333.69	427.10
BAU - high growth	-	-	-	-	-	-
GE (RE+EE) - high growth	0.94	84.39	160.15	259.37	376.00	502.54
Renewable energy (capital)						

Timescale (Year)	2015	2020	2025	2030	2035	2040
BAU - low growth	5.37	6.00	6.75	7.54	8.38	8.87
GE (RE+EE) - low growth	5.37	396.64	447.92	497.69	545.94	600.76
BAU - high growth	5.37	6.00	6.75	7.54	8.38	8.87
GE (RE+EE) - high growth	5.37	396.64	447.92	497.69	545.94	600.76
Thermal and nuclear energy (capital)						
BAU - low growth	891.27	1,886.62	493.35	930.68	999.40	1,042.23
GE (RE+EE) - low growth	876.29	1,886.62	10.10	-	-	-
BAU - high growth	932.08	1,886.62	1,071.17	1,589.21	1,794.02	1,987.51
GE (RE+EE) - high growth	917.06	1,886.62	10.10	-	-	-
Total annual energy investment and O&M costs						
BAU - low growth	1,441.96	2,668.85	1,218.60	1,637.65	1,698.80	1,762.82
GE (RE+EE) - low growth	1,427.85	3,145.29	1,343.32	1,447.24	1,569.24	1,729.06
BAU - high growth	1,482.95	2,691.34	1,841.63	2,376.52	2,611.62	2,868.31
GE (RE+EE) - high growth	1,468.80	3,169.66	1,393.19	1,543.35	1,718.11	1,939.14
EXPENDITURE AND SAVINGS (US$ Million)						
Electricity expenditure savings						
GE (RE+EE) - low growth	4.35	246.54	521.55	801.73	1,085.68	1,372.50
GE (RE+EE) - high growth	4.36	259.70	578.69	936.85	1,335.87	1,777.81
Avoided thermal capacity investment						
GE (RE+EE) - low growth	14.98	-	483.25	930.63	999.39	1,042.22
GE (RE+EE) - high growth	15.02	-	1,061.07	1,589.16	1,794.01	1,987.50
Total savings and avoided costs						
GE (RE+EE) - low growth	19.32	246.54	1,004.79	1,732.36	2,085.06	2,414.72
GE (RE+EE) - high growth	19.37	259.70	1,639.76	2,526.01	3,129.88	3,765.32
NET INVESTMENT (SAVINGS – INVESTMENT) (US$ Million)						
Total net annual savings minus investment						
GE (RE+EE) - low growth	(1,408.53)	(2,898.75)	(338.53)	285.12	515.82	685.66
GE (RE+EE) - high growth	(1,449.43)	(2,909.96)	246.57	982.66	1,411.77	1,826.17

Timescale (Year)	2015	2020	2025	2030	2035	2040
EMISSIONS (tons)						
Avoided annual emissions from fossil fuel-based electricity generation						
GE (RE+EE) - low growth	65,328	4,220,304	8,468,332	12,671,708	17,027,284	21,367,580
GE (RE+EE) - high growth	65,504	4,445,056	9,215,372	14,853,320	21,358,556	28,723,256
EMPLOYMENT						
Electricity employment (Person)						
BAU - low growth	4,735	7,917	3,883	4,900	5,155	5,355
GE (RE+EE) - low growth	4,701	12,523	8,710	10,033	11,384	12,732
BAU - high growth	4,827	8,029	5,395	6,767	7,514	8,260
GE (RE+EE) - high growth	4,793	12,631	8,961	10,425	11,917	13,405
Energy efficiency employment (Person)						
BAU - low growth	-	-	-	-	-	-
GE (RE+EE) - low growth	20	1,139	2,410	3,704	5,016	6,341
BAU - high growth	-	-	-	-	-	-
GE (RE+EE) - high growth	20	1,200	2,674	4,329	6,172	8,214