

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

UNITED NATIONS DEVELOPMENT PROGRAMME

United Nations Development Account project  
**Promoting Energy Efficiency Investments  
for Climate Change Mitigation and Sustainable Development**

Case study

## BELARUS

**REMOVING BARRIERS TO ENERGY EFFICIENCY IMPROVEMENTS IN THE  
STATE SECTOR IN BELARUS**



*Empowered lives.  
Resilient nations.*



## **Sector Characteristics**

Belarus used to be the most industrialized country among the former Soviet republics and so far it succeeded in preserving its industrial structure after its independence in 1991. In the early 1990s, the Republic of Belarus was one of the first post-USSR countries where the national policy on renovation of power industry and energy efficiency improvements advanced. Throughout the most recent decades, the energy sector was developed under the conditions of an acute need to achieve and ensure a required degree of energy security, economy growth and living standards.

First of all, this policy was driven by the fact that the country does not possess its own natural energy resources. In conditions of gradually elevating prices of imported fossil fuels, the country often faces problems related to its economy's negative trade balance and low competitive ability. The country's dependency on only one single energy resources supplier (80-85% of the gross energy supply still originates from Russia) and on only one dominant fuel (95-96% of the power industry is still fueled by natural gas; almost 75% share of gross fuel consumption) was historically built during former Soviet Union times, and it is of vital importance now to diversify this sector and reduce the share of imported fuels.

Secondly, in recent decades the GDP of Belarusian economy demonstrates relatively high growth rate (in average about 8% annually) progressing in the same way as in most of emerging economies, e.g., the BASIC countries. In addition to this, Belarus' personal fossil energy consumption is about 2.6 t.o.e. per capita, i.e. almost twice as low compared to the OECD Member Countries with similar climate conditions, who have more than 5.0 t.o.e. per capita, i.e. the given index for Belarus is thereby the least one that results in relatively low living standards. This requires expansion of power generation accordingly on the one hand, and reduction of energy intensity of the national economy on the other hand. In this context it is worth noting that the energy sector's fixed basic assets represent 24% of the GDP.

Belarus inherited from the Soviet time quite large but inefficient power industry with very high specific fuel consumption per unit of energy produced (ca 0.245 t.o.e./MWh). The power industry applies a lot of efforts to retrofit the outdated power generation facilities, but even today the accumulated depreciation of main assets remains quite high (52.1%). Losses in the energy mix including auxiliaries are almost twice as much as in the EU. While the heat supply system consumes 70% of the gross energy consumption, the heat supply pipelines have out-of-repair rate of 50-60% with the resulting heat supply losses, which are in order of magnitude higher than in the EU.

Such conditions clearly predetermine not only an acute need of efficient and durable energy mix, but also a strong energy conservation policy. Without reforms in the energy sector the power industry will not be able to provide further accelerated development of national economy.

Although the country since 2005 shows the world top energy intensity reduction rate of 6% annually compared to business-as-usual development scenario, more than two-fold carbon intensity reduction and doubling the use of renewable energy sources, it is unable to demonstrate a durable decoupling of economy growth and emission trends (Fig. 1). The today's trend of GHG emission is approx. 1-2% increase per year. The GHG emission prognosis proves that emissions will be increasing at least until 2020 (Fig. 2). Without efficient climate change mitigation policy Belarus will not succeed to perform a low-carbon development scenario and meet its long-term GHG emission limitation objectives.

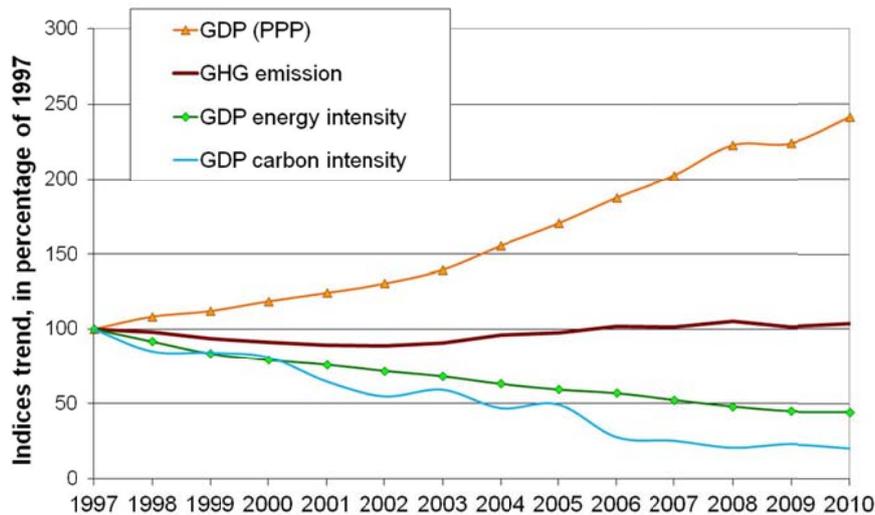


Figure 1: Trends of major indices as compared with 1997

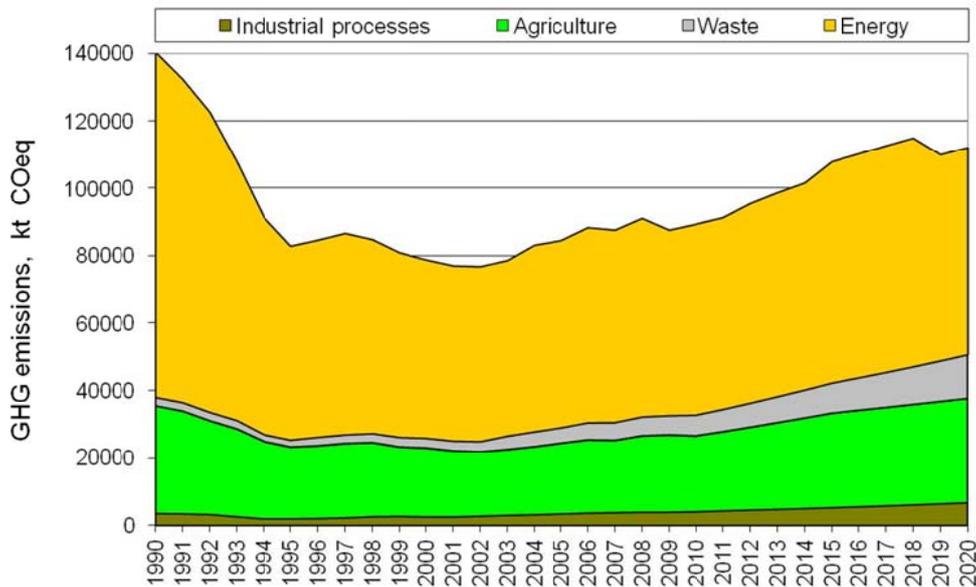


Figure 2: Trends of GHG emissions per sectors (1990-2010) and projected GHG emissions (2011-2020)

Another reason for strengthening climate change mitigation policy is significant share (approx. 65%) of export products in total GDP that requires increased level of competitiveness that in turn requires extensive deployment of effective and low-carbon technologies. And final reason, but not least, is that in conditions of lacking foreign investments the country counts on the international carbon market, which along with the National ETS would attract additional effective capitals and minimize financial burden on public funds. The participation of local industries in flexible project-based mechanisms would provide incentives for speeding up of deployment of best available technologies, hands-on experience transfer and adoption of the best international practice.

In view of the above national circumstances, the Government plans and implements actions that are to incentivize introduction of the policy leading to extensive use of renewable energy sources and energy efficiency improvement both in energy supply and demand sides. The current picture, as of January 2012, of the situation in the national power industry can be briefly summarized as follows:

- annual gross consumption of primary energy resources is 27.3 Mt.o.e. (317.5 thousand GWh);
- total installed capacity is 8,445.4 MW, including
  - o two condensing turbine power plants of 3,417.6 MW total,
  - o 34 combined heat-and-power plants of 4,519.1 MW total,
  - o 22 hydro power plants of 9.4 MW total,
  - o a wind power unit of 1.5 MW, and
  - o 119 mini-CHPs of 497.8 MW total;
- annual power output is 29.66 thousand GWh;
- annual heat output is 40.30 thousand GWh;
- spread of power supply network is 35,760 km;
- length of heat supply pipeline 5,900 km;
- annual investments (2011) is about \$767 million USD directed mostly to modernization of existing assets.

The dynamic of the main indices of the integrated power system since 1990 till 2011 is distinctly demonstrated in Fig. 3.

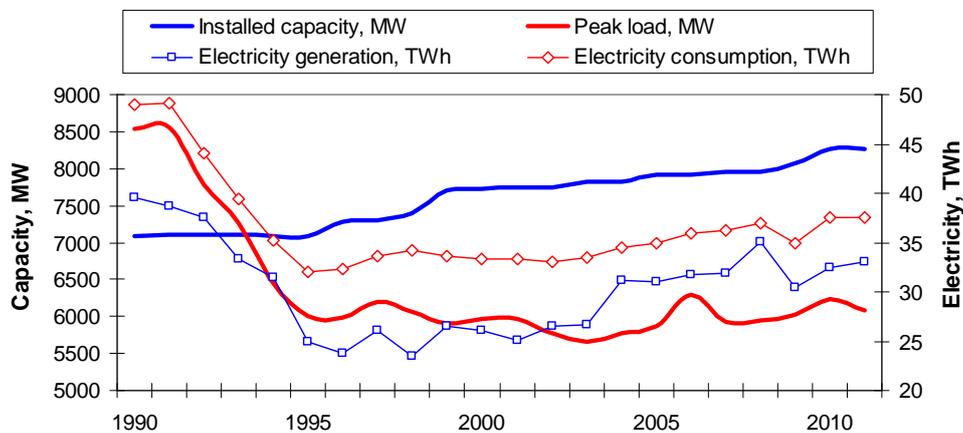


Figure 3: Dynamic of main indices of integrated power system in Belarus

From this chart it is clear that the post-Soviet initial energy deficit of the country was eliminated since 1994, and since that time the installed capacities significantly overtop the maximal power load. Nevertheless, the annual power demand is higher than the domestically generated power, and usually the energy system imports necessary power to make up the shortage of power supply. This is partially caused by relatively high cost of power generation given low efficiency due to, as already mentioned, critical accumulated depreciation of main assets, relatively high specific fuel consumption factor and losses in power grid.

The electrical energy is generated mainly by CHPs and condensing power units with presence of small but increasing number of independent energy producers (mini-CHPs) (see Fig. 4). The heat is generated almost evenly by CHPs and district heat boilers (see Fig. 5).

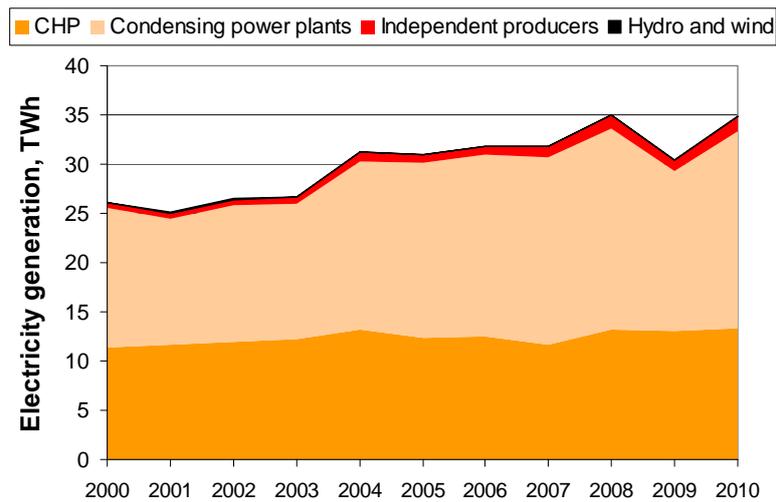


Figure 4: Power supply by different categories of power plants

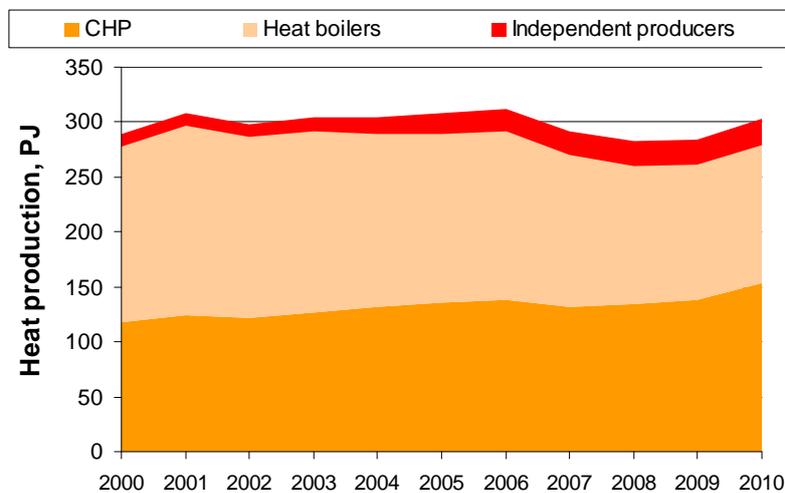


Figure 5: Heat supply by different categories of plants

### (a) Current Policy

The energy efficiency policy and measures for the energy sector on the supply side (i.e. production and transmission of heat and power) are mainly focused on five major approaches:

- reduction of fuel specific consumption per unit energy produced through retrofitting old inefficient power generation facilities;
- introduction of cogeneration schemes and combined cycles;
- renovation of power transmission systems;
- replacement of old inefficient boilers with CHPs;
- renovation of heat supply pipelines;
- introduction of RES.

The policy and measures for energy efficiency improvements and energy savings on the demand side are mainly focused on eight major approaches:

- reduction of energy specific consumption per unit industrial product through the introduction of energy saving technologies and energy management techniques;
- introduction of frequency converters for variable speed drives;
- thermal control of heat loads;

- increase of the use of secondary energy resources (waste heat, high pressure, heat pump technology);
- municipal solid waste recycling and energy conversion of its biodegradable and combustible fractions;
- building standards, operation and maintenance standards;
- record keeping;
- introduction of energy saving technologies in lighting.

Belarus, as an Annex I Party to the UNFCCC and a Party to the Kyoto Protocol, is obliged to implement relevant provisions and, where appropriate, concrete policies and measures to reduce greenhouse gas emissions, particularly in the energy, heavy industry, waste management and agriculture sectors. Therefore, energy efficiency issues were acknowledged and noted in a number of national, subnational and sectoral strategies and development programs including such basic legal acts as National Strategy for Sustainable Socio-Economical Development up to 2020 (of May 16, 2004) and Socio-Economical Development Program for 2011-2015 (of April 11, 2011). The principal legal framework in the field of energy efficiency is covered by the following provisions:

Policy document (effective date)	Provisions in brief
The Republic of Belarus' National Security Concept (Sep 17, 2007, add. Nov 9, 2010)	The Decree covers many spheres, which determines national security, including energy security. It emphasizes the importance of energy efficiency policy to secure the sustainable development of the country.
Energy Potential Development Strategy of the Republic of Belarus (Aug 9, 2010)	This is one of the core documents that provide legal framework and technical standards for a low-carbon energy development roadmap. The document sets up the main goals of fuel-energy complex development. It is planned to build: <ul style="list-style-type: none"> <li>• combined cycle gas turbine unit with installed capacity 400 MW on Lukoml Power Plant;</li> <li>• combined cycle gas turbine unit with installed capacity 400 MW on Beresa Power Plant;</li> <li>• coal power plant with installed capacity up to 920 MW in 2015;</li> <li>• nuclear power plant with installed capacity up to 2340 MW by 2020.</li> </ul>
Measures to Increase the Efficiency of Using Fuel and Energy Resources for the Period Until 2012 (Feb 22, 2010)	The annex of the document consists of a number of concrete measures and projects including <ul style="list-style-type: none"> <li>(i) introduction of mini-CHPs;</li> <li>(ii) reconstruction of heat network with re-isolated pipes, renovation of heat supply systems as a whole and modernization of local heat points, phasing out with further excluding from operation the boiler equipment with specific fuel consumption exceeding 160 kg of coal equivalent per 1 Gcal, etc.;</li> <li>(iii) reduction of electricity losses in the country power grid;</li> <li>(iv) decentralization of selected heat supply systems in small cities and region administrative centers.</li> </ul>

Policy document (effective date)	Provisions in brief
State Comprehensive Program of Modernization of Basic Production Assets 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 (Nov 15, 2007)	The Program consists of a number of measures in about 55 energy installations to retrofit old inefficient power generation capacities and reduce accumulated depreciation of main assets. Realization of these measures led to 1 575 million t.c.e. of energy saving during the 2006-2010 (the fact). It is expected that by the end of this program the total effect will exceed 1.15 million t.c.e.
Republic's Programme on Transforming Boiler Houses into Mini CHP for the Period 2007-2010 (Sep 28, 2007)	The program supports a number of measures in 62 former boiler houses to convert them into mini-CHPs with total capacity of 132 MW and efficiency of not more than 160 t.c.e. per 1 GWh.
State Power Industry Development Programme until 2016 (Feb 29, 2012)	The program suggests to continue modernization of the power generation, transmission and distribution installations
Law of the Republic of Belarus "On Renewable Energy Sources" (Dec 27, 2010)	The Law establishes some important instruments, which raise incentives for RES investors and producers through introduction of feed-in tariffs, green certificates, the RES Cadastre and other arrangements. It is further suggested to extend some of provisions of the Law to some other energy efficiency improvement options such as mini-CHP, ORC-technology, heat pumps, etc., what would make these projects viable and commercially attractive.
National Programme of Developing Local and Renewable Energy Sources in 2011-2015 (May 10, 2011)	These resolution supports a number of measures directed to effective use of local fuel resources, including wood fuel, secondary thermal energy resources and other renewable energy options.
State Programme of Building Energy Sources Powered by Local Fuels in 2010 – 2015 (July 19, 2010)	These resolution supports about 161 measures directed to effective use of local fuel resources, including wood fuel, secondary thermal energy resources and other renewable energy options.
State Programme of Building Hydroelectric Power Stations in the Republic of Belarus in 2011-2015 (Dec 18, 2010)	This document supports rehabilitation of existing small hydropower plants all over the country and building a number of new cascade hydropower installations.
State Programme of Building Energy Sources Powered by Biogas in 2010 – 2012 (June 9, 2010)	This document is very much consistent with the Renewable Energy Law and enables the most attractive provisions of the said law through its application to utilization of biogas from agricultural waste, communal sewage, landfill, and livestock waste. (i) biogas fired CHPs at livestock and poultry farms with total capacity of 19.8 MW; (ii) nine wastewater treatment plants with installation of mini-CHPs of 13.6 MW total.
Energy Potential Development Strategy of the Republic of Belarus (Aug 9, 2010)	(i) a wind park of total capacity 160 MW, Dzerzhinsk region, 2011–2014; (ii) ca 300 MW of total wind power capacity, 2011-2015; (iii) hydro power plants with total installed capacity not less than 120 MW by 2015.

Policy document (effective date)	Provisions in brief
Law of the Republic of Belarus “On energy conservation” (first introduced on July 5, 1998; five amendments until 2009; new edition approved by the House of Representatives in the first hearing on Dec 20, 2012)	This basic law establishes overall legal and institutional framework for energy saving (see more details below this table).
Directive of the President «Saving and thrift are the main factors of economical security of the state» No.3 of June 14, 2007	This document provides basic directions to energy and economical security and gives indications to republican and local authorities, industries, other institutions and organization on developing programs, policies and measures for energy efficiency improvement.
National Programme of Energy Conservation for 2011-2015	In this program, the country adopted an ambitious low-carbon energy roadmap - to reduce GDP energy intensity by 50% in 2015 compared to 2005 level. The program includes a number of energy efficiency improvement measures with total effect of about 11.7 million tCO <sub>2</sub> eq of GHG emission reduction compared to business as usual scenario.
National Programme of Energy Conservation for 2006-2010	The program includes a number of energy efficiency improvement measures with total effect of about 12.8 million tCO <sub>2</sub> eq of GHG emission reduction compared to business as usual scenario.
National Programme of Energy Conservation for 2001-2005	The program includes a number of energy efficiency improvement measures with total effect of about 19.0 million tCO <sub>2</sub> eq of GHG emission reduction compared to business as usual scenario.
National Programme of Energy Conservation for 1996-2000	The program includes a number of energy efficiency improvement measures with total effect of about 11.6 million tCO <sub>2</sub> eq of GHG emission reduction compared to business as usual scenario.
Measures to Increase the Efficiency of Using Fuel and Energy Resources for the Period Until 2012 (Feb 22, 2010)	The annex to this resolution consists of a number of concrete measures and projects including (i) fittings and illuminating equipment; (ii) utilization of secondary energy resources; (iii) introduction of pump equipment with variable-frequency electric drives at water supply points and utility companies; (iv) modernization of technological equipment.
Programme of Technical Retrofitting and Modernization of Foundry, Thermal, Galvanic and Other Energy Intensive Production Facilities for 2007 – 2010 (October 31, 2007)	The program includes many energy saving measures in more than 230 installations (88 foundry, 120 thermal treatment and 24 galvanic installations).
Activities on Implementing the Directive No. 3 dated June 14, 2007 of the president of the Republic of Belarus (Aug 31, 2007)	The document specifies a set of measures for energy efficiency improvement in different industries to enable the energy saving provisions established by the Directive No.3.

Policy document (effective date)	Provisions in brief
State Comprehensive Programme on Development of Material and Technical basis for Building sector in 2006-2010 (Sep 1, 2006)	The program envisages the share of the new energy efficient dwelling houses (with specific energy consumption for heating not more than 60 kWh/m <sup>2</sup> ) will increase. The reduction of energy consumption for heating to 30-40 kWh/m <sup>2</sup> up to 2020) in buildings for 60% up to 2015 is planned.
Building Sector Development Concept in 2011-2020 (2010)	The concept envisages further increase of annual production of cement up to 10 million tons until 2020.
Comprehensive Programme on Design, Construction and Reconstruction of Energy Efficient Houses in the Republic of Belarus for 2009-2010 and up to 2020 (June 1, 2009)	The program supports a number of measures to produce binding materials with lower content of clinker in cement mixtures. It also envisages to introduce coal-fired facilities (instead of natural gas) in cement production plants to produce the clinker.
State Program for Development of Railway Transport of the Republic of Belarus in 2011-2015 (Dec 20, 2010)	Set of measures are adopted for further development of this mean of transportation
State Program for Development of Automobile Transport of the Republic of Belarus in 2011-2015 (Dec 24, 2010)	Set of measures are adopted for further development of this mean of transportation: <ul style="list-style-type: none"> <li>• acquisition of new freight rolling stock</li> <li>• acquisition of passenger new rolling stock</li> <li>• renovate the fleet of trucks</li> <li>• update production equipment;</li> <li>• reconstruction of existing capital assets;</li> <li>• construction of new facilities</li> </ul>
Programme of Technical Retrofitting and Modernization of Foundry, Thermal, Galvanic and Other Energy Intensive Production Facilities for 2007 – 2010 (October 31, 2007)	The program includes many energy saving measures in more than 230 installations (88 foundry, 120 thermal treatment and 24 galvanic installations).
State Comprehensive Programme on Development of Material and Technical basis for Building sector in 2006-2010 (Sep 1, 2006)	The document envisages annual production of cement – 5 million tons by 2010 and annual production of lime carbonate – 1.43 million tons by 2010. The program supports a number of measures to produce binding materials with lower content of clinker in cement mixtures.

Appropriate basic principles for the energy efficiency policy were presented in the Law of the Republic of Belarus “On energy conservation” (July 5, 1998; five amendments until 2009), which stipulated provisions for energy efficiency related institutional framework and establishes national energy saving monitoring and reporting systems. The Law for the first time introduced the institution of the National Energy Conservation Programmes and the systems and procedures for:

- mandatory accounting of fuel and energy resources;
- the rationing of fuel and energy consumption to ensure the setting of technically and economically progressive fuel and energy consumption rates;

- energy audits of enterprises, institutions and organizations;
- the State supervision of the rational use of fuel and energy resources.

The new version recently approved in the first hearing by the Parliament (as of Dec 20, 2012) is focused at policy and measures leading to sufficient reduction of energy intensity of national economy and introduces a number of new elements, which make the law harmonized with relevant EU directives, like energy audits and energy management, fiscal instruments, MRV requirements, mechanisms of incentives, etc. The Law regulates, *inter alia*, relations between subjects engaged in the following activities:

- extraction, processing, transportation, storage, production, use and disposal of all types of fuel and energy resources;
- manufacturing and supply of energy generating and energy consuming equipment, machinery, mechanisms, materials, as well as devices for metering, controlling and regulating the consumption of fuel and energy resources;
- activities relating to the development and application of unconventional and renewable energy sources, and the use of waste energy;
- development and introduction of efficient energy conservation control systems and controls for the efficient use of fuel and energy resources.

One of the basic principles of the Law is creating a system of financial and economic mechanisms that provide economic incentives to producers and users for the efficient use of fuel and energy resources, the use of unconventional and renewable energy sources in the fuel and energy sector, as well as the investment of funds in energy saving activities.

Some of the provisions of the Law stipulate that users and producers of fuel and energy resources that conduct energy conservation activities may be provided with state support. The energy supplied to the national grid by any small-sized and unconventional energy generating facilities with high efficiency and using renewable energy sources shall be paid for at the prices that provide incentives for the construction of such facilities.

#### **(b) Energy Efficiency Potential**

Since 1996 through 2012, three National Energy Saving Programmes were successfully implemented. As a result, the GDP energy intensity has dropped by 65% compared to 1995. During 1996-2012 the annual GDP energy intensity reduction rate was never less than 4%. The energy saving was from 1.5 to 2.5 million tons of coal-equivalent (t.c.e.) per year, i.e. about 5-6% of primary energy consumption. During this period almost 5-fold carbon intensity reduction was achieved and the share of the renewable energy sources was doubled.

Further energy conservation measures and energy efficiency goals are a part of the country's sustainable low-carbon development strategy that envisages further improvement of energy efficiency at the supply and demand sides and extended introduction of renewable energy sources. The National Energy Saving Program for 2011-2015, approved by the Resolution of the Council of Ministers of 24.12.2010 № 1882, envisages the following targets:

Reduction of the GDP energy intensity in 2015 in comparison with 2005 levels by:

- at least 50 per cent in 2015;
- at least 60 per cent in 2020.

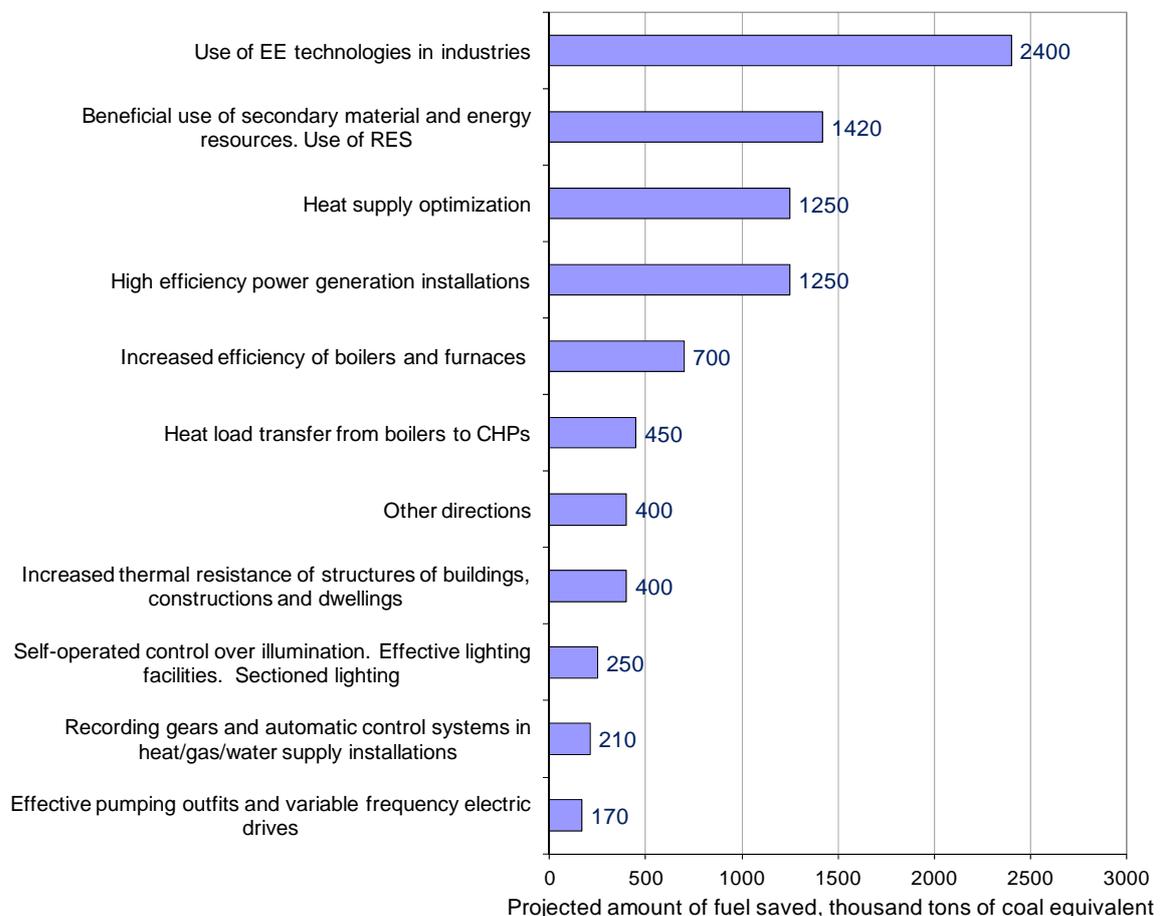
The above targets can be achieved when the GDP energy intensity is purely comparable to the best practice in the countries with similar climatic conditions, which is in

the range of 0.20 tons of oil equivalent (t.o.e.) per thousand 2000 USD. In Belarus, in 2010, this figure was about 0.28 t.o.e. per thousand 2000 USD. Thus, the difference between current GDP energy intensity and the best energy efficiency practice would be the overall aggregated potential for energy efficiency improvement.

If one takes into account projected GDP growth rate and GDP structure for 2011-2020, the energy saving potential for the next five years will be 7.1-8.9 million t.c.e. of aggregated value, i.e., about 5-6% of gross energy consumption in the country. This energy potential value is presented below in the table by sectors, and in the picture by measures.

**Energy saving potential for 2011-2015:**

Sector	Energy saving potential, thousand t.c.e.
Construction and Architecture	414-560
Industrial Processes	2563-2842
Power Industry	1346-1596
Transport	122
Agriculture	550-997
Housing and Communal Services	885-1055
Defense, Healthcare, Education, Communication and Information	318
Others	902-1360



**(c) Assessment Methodology: a description of the analytical tool or models used to assess the potential efficiency improvement and to measure results including energy savings and CO2 reductions - 2-3 pages;**

For any country like Belarus who is lacking own fuel resources an optimal and efficient energy mix is of the utmost priority. The first attempts of using the systems approach were made back in 1995, when the Institute for Power Engineering Problems (currently the SOSNY Joint Institute for Power and Nuclear Research) of Belarusian Academy of Sciences first exercised learning and incorporation of a number of tools for energy planning and prognosis, such as ENPEP, GEMIS, HOMER, LEAP, MESSAGE, REAP, RETScreen, TIMES/MARKAL, GTMax, etc. The latest works in this direction using LEAP and ENPEP were published in some national reports. In general, the results of these studies provided a well grounded rationale for energy mix optimization and energy efficiency improvement and were used for such basic national strategies like the Republic of Belarus' National Security Concept; Energy Potential Development Strategy of the Republic of Belarus for 2011-2015 and National Energy Security Concept.

The modeling tools described above were used to provide GHG emission projections until 2020<sup>1</sup>. These results along with recent GHG inventory data<sup>2</sup> are presented in the tables below by sub-sectors of the energy sector and by gases for two scenarios. In the scenario entitled "With Additional Policy and Measures" it was supposed that the said barriers for energy efficiency improvement policy would have been removed.

**"With Existing Policy and Measures" scenario (in thousand tons of CO2eq)**

	1995	2000	2005	2007	2010	2015	2020
Energy (fuel combustion), of which:	57102	52568	55367	56040	69250	82612	93238
energy industry (CO2)	33371	30579	32007	30456	40173	46837	50762
energy industry (CH4)	15	16	16	17	19	20	22
energy industry (NO2)	0,04	0,05	0,04	0,04	0,07	0,14	0,20
leakages (CH4)	59	70	76	76	68	75	84
other sub-sectors	23657	21903	23268	25490	28990	35680	42370

**"With Additional Policy and Measures" scenario (in thousand tons of CO2eq)**

	1995	2000	2005	2007	2010	2015	2020
Energy (fuel combustion), of which:	57102	52570	55367	56040	69210	78782	87812
energy industry (CO2)	33371	30579	32007	30456	40133	43006	45338
energy industry (CH4)	15	16	16	17	19	20	21
energy industry (NO2)	0,04	2,00	0,04	0,04	0,07	0,14	0,20
leakages (CH4)	59	70	76	76	68	76	83
other sub-sectors	23657	21903	23268	25490	28990	35680	42370

<sup>1</sup> - [http://unfccc.int/resource/docs/natc/blr\\_nc5\\_en.pdf](http://unfccc.int/resource/docs/natc/blr_nc5_en.pdf)

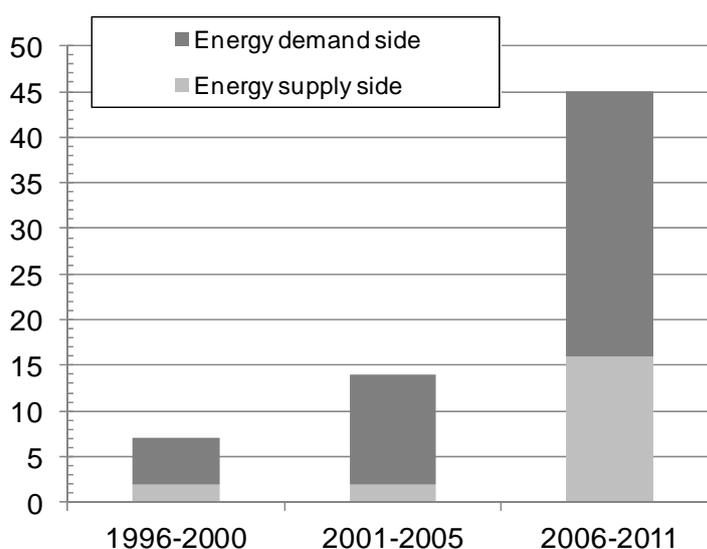
<sup>2</sup> - ([http://unfccc.int/national\\_reports/annex\\_i\\_ghg\\_inventories/national\\_inventories\\_submissions/items/6598.php](http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php))

**(d) Economic, Environmental and Policy Analysis: an appraisal of the overall impact of the policy measures - 8-10 pages;**

Based on an analysis of the existing legal framework and also taking into account the presence of corresponding technical standards and rules (technical regulations, state standards, technical codes of established practices, specifications, etc.), it can be concluded that, as a whole, the legislative basis for the realization of the national energy development policy is being generated as a mature and effective system. Judging by recent legal acts approved in 2010-2012, this system continues to develop quickly, being approximated to the corresponding legislative basis and standards of the European Union in line with the President's Directive No.3 entitled "Saving and thrift are the main factors for the economic security of the state" dated 14 June, 2007.

Evidently, the policy of Belarus in the energy field has been based, to a certain degree, on organizational-technical measures, especially in the second half of the 1990s, and this yielded fast and essential results in terms of a decrease in the economy's power consumption during the period following the recession. The specific cost per 1 t.c.e. saved, as a result of the energy saving policy and measures, was less than 100 dollars in the late nineties. At the present time, these expenses have already grown by a factor of 7 and more. Therefore, in Presidential Directive No.3, the problem of creating a comprehensive integral policy and measures system to promote the efficient use of all kinds of fuel and energy was underscored. An important component of such a system would be measures directed toward raising incentives and motivation for the effective production and consumption of energy.

The transformation from purely administrative measures towards measures based on economic incentives and market mechanisms was difficult and not always coherent although it happened quite fast. Indeed, the energy development policy gradually drifted from the former to the latter over the last decade, and it is still being developed. The evidence can be found in evolution of legal framework developments. In 2003-2005, the national policy for sustainable and efficient energy development was regulated by only few documents. The bulk of the legal framework was developed later. Number of energy efficiency related legislative acts are as follows:



However, the decision-making process with regard to a mid- and long-term optimal shape of national power supply system always meets barriers and distortions related to the

nonmarket environment, extensive social obligations, the lagging-behind legislation and underdeveloped by-laws.

It is also necessary to emphasize that this policy and, largely, respective practices in Belarus are not always in harmony with each other or with themselves. Sustainable and non-sustainable energy compete for policy priority, as do simultaneous needs to maximize and minimize energy consumption. The relatively fast growing economy in conditions of significant depreciation of almost all generating units, energy independence issues, ambitious nuclear programme and lacking investment resources pose the country uncertain with regard to balancing its strategic action plans between the extended introduction of new sustainable and effective power generation technologies and the retrofit of old high capacity installations.

In the said conditions of delayed practical implementation of the systems approach the Government applies, in increasing frequency, such instruments as sectoral and specific development programmes, often conflicting to each other, and exercises frequent alterations in regulations in order to “manually tune up” the development of national power industry and respond to momentary needs and challenges using current performance capabilities.

One of the examples can be found in information about difficulties in implementation of some state programmes like the Measures to Increase the Efficiency of Using Fuel and Energy Resources for the Period Until 2012 (Feb 22, 2010), the 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 (Nov 15, 2007) and Republic's Programme on Transforming Boiler Houses into Mini-CHP for the Period 2007-2010 (Sep 28, 2007). Good intentions stated by these documents with regard to decentralizing energy supply in regions, bringing energy utilities close to consumers and minimizing thereby specific fuel consumption were not realized in full due to a number of regulation barriers and negative reacts of the SPA BelEnergo, an energy generating and distributing monopoly structure of the power industry, towards independent producers. This makes mini-CHP and many RES projects commercially unviable. The SPA BelEnergo should not be directly interested in high capacity reservation rate (i.e., a ratio between total installed capacity and actual pick load in the energy mix), which is quite redundant deviating around 135% (normative minimum being 95%), and this in turn increases energy prices.

Other barriers to energy efficiency improvement can be listed as identified by analytical studies of the legal and institutional frameworks and existing practices in Belarus.

### **Institutional and Policy Barriers**

The basic barrier to investments in energy efficiency improvements and renewable energy development in Belarus is the well known dominant participation of the state in economic activities and the centralization (monopolization) of the production and transport of energy. Its cause is the current policy of the Government, but there are plans to liberalize the electricity market and this is why it is now so important to develop and suggest relevant improvements.

In Belarus, there is an effectively applied mechanism for the development, financing, monitoring and updating of republican, regional and departmental energy conservation programmes, which are mutually coordinated and also adjusted to targets (indicators) of five-year plans for social and economic development. At the same time, there is a number of methodological discrepancies in estimations and projections of the energy saving potential, so that the energy intensity reduction targets are established with a certain extent of subjectivity.

In Belarus, there are still no legislative bases for the development of efficient organizational forms on the energy efficiency market such as the energy service company (ESCO) concept. In conditions where cost-based principles on the establishment and structuring of energy tariffs exist, according to which, should there be a decrease in power consumption per unit product, the costs also decrease, the classic performance contracting scheme does not work. As demonstrated by the project, this form would be the most in demand in Belarus, especially in the housing and communal services sectors with about a 20% total energy saving potential for the country, on the condition that legal and institutional frameworks are adopted for this purpose.

There are some gaps in the approximation of Belarusian energy efficiency related standards to the EU's, especially in the certification of conformity to best energy efficiency practices, energy efficient product labeling, energy savings accounting and verification and energy management.

Because of legislation, local authorities and power distribution companies must support the legal entities that are small independent energy producers operating in the field of alternative energy (mini-CHPs and renewable energy sources). The connection of the given equipment to the grid, irrespective of their patterns of ownership, is guaranteed. Nevertheless, many questions remain unresolved in the legal and organizational frameworks, which essentially diminish the implementation of many energy efficiency projects, especially the installation of distributed small but efficient energy sources (e.g. mini-CHPs, small RES, micro-trigeneration systems, biogas installations, etc.).

### **Financial Barriers**

Provisions for soft loans to finance energy efficiency projects were first introduced in 1998 and amended in mid-2006. They provide up to 50% compensation for the interest on credit at the expense of the state or local budgets for any legal entity that borrows these resources to implement energy efficiency projects. This barrier consists in a very complex procedure to obtain a soft loan (eventually a special resolution of the Council of Ministers should be adopted), it is therefore much easier to apply for and receive non-repayable grant resources than soft loans.

Existing legislative documents establish feed-in tariffs only for organizations that supply generated electric power to the grid with the use of renewable energy sources if the renewable energy installation was built without financing from the state (or local) budget. It is important to recall that such tariffs launched by the first edition of the Ministry of Economy's Resolution (2006) bore a rather reverse effect. According to the said provisions, in the five years after the introduction of any RES, the stimulating factor to the one-part tariff decreases from 1.3 to 0.85, and in the following five years – to 0.7. Therefore, under such conditions the internal rate of return would not exceed 15% in the best scenarios and based on the existing value of the one-part tariff. The second edition of the Ministry of Economy's Resolution (2010) provides more attractive conditions, i.e. the feed-in tariff was established to be equal to the one-part tariff multiplied by a raising factor of 1.3 and this condition would remain in force for 10 years of operation of the RES installation; when the installation is operated for more than 10 years, the 0.85 factor would be applied. These conditions lead to an internal rate of return of up to 17%, which may still not be attractive for investments when bank interest rates are high (currently in the Republic of Belarus, the refinancing rate exceeds 30%).

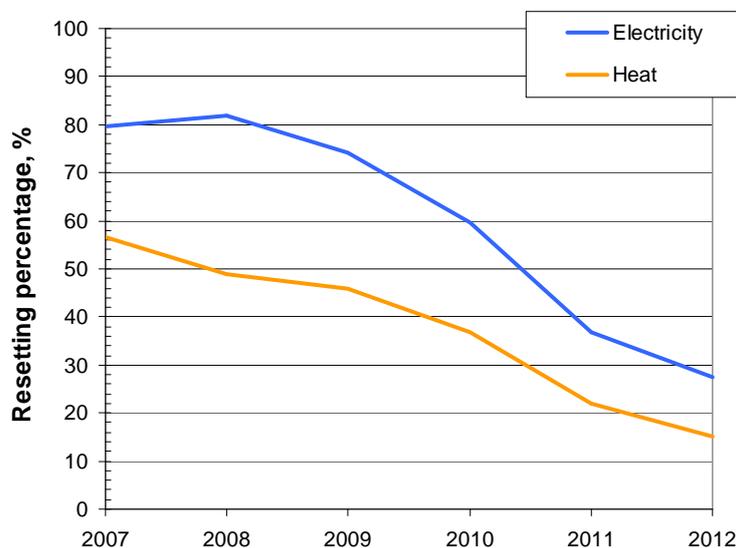
The feed-in tariff system is currently not attractive for financing renewable energy sources and some other independent producers. Several suggestions were submitted to the

Ministry of Economy and discussed by the Government. Currently the feed-in tariff is strongly linked to the one-part tariff, which may be volatile depending on the market price for imported fuel, currency exchange problems, and the SPA BelEnergó’s state of business. The root of the problem is in the said monopoly. It is deemed important to immediately begin the development of such laws as “On electric power industry”, “On CHPs”, “On ESCOs”, etc. In chapter 4 of the given report, the tariff issues are viewed in more details.

It becomes of vital importance to change the approaches to the energy consumption rationing and tariffs policy. Without a timely and appropriate revision of the legal and institutional frameworks, it will be difficult to secure investments in energy efficiency projects, especially in the housing and communal services sectors.

Grant funding for energy efficiency improvement measures in the state owned power industry does not create incentives to provide maximum fuel savings and motivations to manage energy systems with independent producers. Therefore since 2007 a more sustainable model of investment financing in the energy sector was outlined with a reduced share of state grants and an increased share of equities and borrowings. This happened because of the targeted state policy and efforts to enable an appropriate legal and institutional environment for domestic and external investments. The policy, however, was not always successful and efficient and was sometimes attributed with certain side effects. Some of the barriers remained strong and durable, derived from the known national social policy. The strongest barrier of this type was (and currently is) a cross-subsidy practice, and, as a result, some efficient investment schemes being proposed are not expected to be viable.

In Belarus, households and municipal services consume about 20% of total final consumption of electricity and about 40% of total final consumption of heat. Currently the cost value of final energy supplied to households by the SPA BelEnergó utilities is covered by the population in the extent of less than 30% because of cross-subsidies exercised in the country. The extent of this problem is demonstrated below:



The SPA BelEnergó is therefore interested to maximize its sale of energy supply to industry and other sectors to meet such social obligations to the population. Under these conditions the SPA BelEnergó is already insolvent, the industrial sectors are less competitive, and energy efficiency improvement in industrial sectors would worsen the situation for the SPA BelEnergó.

The cross-subsidization is certainly a crucial cause of refinancing deficit, and therefore the available public funds and vast majority of its equity capital are allocated by the SPA to renovation of its depreciated assets. The SPA BelEnergO is hardly capable to borrow any market loan. The only loan capital of appropriate price can be taken from Chinese commodity bound borrowed capital (i.e., from China Development Bank and Export-Import Bank of China). Making use of these resources of about \$1.25 billion USD for a 3% discount rate and a 12-15 year credit payment term, the SPA currently works to further expand power supply through installation of about 2.5 GW of highly efficient generation capacities, e.g., CCPPs and gas turbine units (30% of currently installed capacities), while decommissioning 1.8 GW of inefficient units. Much less attention is drawn to RES as it is a less commercially viable option.

### **Awareness Barriers**

With significant delays, capacity building is provided for state organizations to help them address the issues of attracting energy efficiency investments. They are caused by insufficient knowledge on the part of administration personnel and key specialists in state sector enterprises in terms of finding and managing economically effective investments. As a whole, the generic business framework for the development and implementation of energy efficiency projects in Belarus, which would allow to attract and mobilize investments in the field of energy efficiency improvements, should be widely introduced. The project did not reveal any crucial lack of investments and interested investors, but rather a significant shortage of experience and knowledge about the energy efficiency business model.

It is crucial that awareness be raised in the field of energy savings in buildings for housing proprietors, joint ownership partners and condominium management companies.

The needs of some legal provisions are getting more and more acute in the absence of a full-fledged wholesale electricity market and respective legislation, e.g. the Law “On electric power industry”. Such provisions are needed for:

- relations between the owner of an independent source and a power supply system regarding specifications and requirements for connection and capacity delivery in a network;
- justified tariffs for connection to the grid and electric power transmission;
- installed capacity reservation assessment and respective cost of this service provided by energy supplying companies;
- the balanced loading rules in case of the emergency shutdown of a power supply system.

### **(e) Policy Design Considerations: implications for promoting this successful policy more widely on a national basis - 4-5 pages;**

The further policy design should be based on some achievements of the best national practices and should focus on the following measures in order to remove the said barriers.

The energy mix decentralization through supported initiatives and the development of the independence of small energy producers should become a guarantee for the development of the use of nonconventional and renewable sources of thermal and electric energy. It was pointed out that the Government should grant equal conditions to the production and transmission of energy from alternative energy sources and renewable energy sources to power supplying organizations. In addition, taking into account the increasing number of decentralized sources, it was also noted that it was necessary to ensure the reliable

functioning of the country's energy mix through the introduction of innovative IT technologies for regulation and control (“smart grid”).

There would be considerable practical interest in developing and establishing a standard methodology on the evaluation of the energy saving potential of selected sectors, especially of such energy-intensive industries as steel foundry plants, aluminum plants, cement production plants, paper mills, glass works, brick factories, ammonia production, oil refineries, etc. It was felt that energy savings reserves should be estimated as a result of the analysis of specific energy consumption per unit product using the best accessible technologies and comparing them to specific energy consumption data in enterprises. Unfortunately, in Belarus, these data are not aggregated by manufacturers / technologies and are not analyzed through statistics.

It is of a vital importance to develop and introduce regulations concerning ESCO contractual rules, financing schemes with third parties involved in the public sector, the introduction of typical forms for energy performance contracts, systems and methodologies for the monitoring, assessment and verification of energy savings, as well as establishing consulting services in the energy efficiency field. It was determined that the known principles of the relationship between energy supplying companies, energy consumers and ESCOs should be included in respective legal forms; it is therefore proposed respective amendments to existing regulations, which would further contribute to the draft Law “On electric power industry” that would regulate, as expected, this part of the electricity market, including the activities of private (independent) power producers and ESCOs. Without this Law, under conditions experiencing payment deficiencies in housing and municipal services, cross-subsidizing, subsidized financing from local budgets, non-transparent financial flows by activities (e.g. in the power transmission circuit), a high level of centralization, etc., any effective developments in the direction of energy efficiency enhancement would be problematic. It is also recommended a number of other commercially viable schemes for energy efficiency investment financing and management under Belarusian conditions (simple partnerships, disclosed partnerships, BOT, etc.).

It should be first paid attention to the adopted Belarusian standards on “Energy Management. Requirements and Application Guide” (2009), which, in its actual introduction, demanded the expansion of informational support and training provided to industrial leaders, engineers and specialists. In order to provide this expansion, it is suggested to collaborate with BelLIS JSC., the company that developed the said standard and that is an entity in the certification of home appliances and industrial products, services, quality management systems and an accredited testing laboratory.

Many questions remain unresolved in the legal and organizational frameworks and this issue essentially diminishes the implementation of many energy efficiency projects, especially projects of distributed small energy sources (e.g., mini-CHPs, small RES, micro-trigeneration systems, biogas installations, etc.). In particular, the following questions are to be settled with authorities:

- Relations between the owner of a source and a power supply system regarding specifications and requirements for connection and capacity delivery in a network;
- Justified tariffs for connection to the grid and electric power transmission;
- Installed capacity reservation assessment and respective cost of this service provided by energy supplying companies;
- The balanced loading rules in case of the emergency shutdown of a power supply system.

The complex procedure of obtaining soft loans for energy efficiency projects in the state sector should be simplified. Other measures could be suggested for the improvement of economic indices of projects dealing with energy efficiency on the energy supply side, i.e., cutting down capital costs (using local company investments and preferences provided for small city developments, using local constructors and operators, lowering equipment costs using some preferences provided for energy efficiency projects, etc.), and more appropriate feed-in tariffs as should be developed in by-laws under the Renewable Energy Law (2010). In any case, there is still one important shortcoming, i.e., the feed-in tariff depends on the one-part tariff, which may be volatile depending on the market costs for imported fuel and the tariff structure of BelENERGO, the industrial association energy generating and distributing monopoly. This issue should be addressed as soon as possible.

The legal acts are necessary that would establish provisions on retaining the energy norms without changes during the payback period of energy efficiency measures plus one year, provisions on calculating tariffs for energy efficiency projects as well as provisions on reduced tariff rates for some categories of consumers introducing certain projects under energy saving measures, for example heat pump installations. In this regard, it should be noted that the differentiated tariffs established by Resolution No. 99 of the Ministry of Economy (2010) were hardly stimulating for such distributed efficient energy producers as mini-CHPs. With the introduction of low night tariffs, this direction became unattractive for investors, for the Resolution laid down unequal conditions for independent energy producers vs. large state power supplying organizations. Similar negative effects became apparent after Decree No. 72 issued by the President (2011) “On some questions of price control (tariffs) in Belarus”, which was enforced as a follow-up of Presidential Directive No. 4 (2010) “On the enhancement of entrepreneurial initiatives and stimulation of business activity in Belarus”. The given legal act excludes the state regulation on tariffs for the electric power supplied to the grid by independent producers (block-stations, mini-CHPs), thus leaving this function to the market. Such an approach leads to tariffs that are such that the business activities of independent electricity generation installations based on the most effective technologies (gas-piston CHPs and gas-turbine CHPs) are unprofitable. As a result, the introduction of cogeneration power installations in the housing and communal services enterprises became economically meaningless. Therefore a methodology should be proposed to calculate regulated and differentiated tariffs for independent energy producers.

The generic business framework for the development and implementation of energy efficiency projects in Belarus should be widely disseminated. This energy efficiency business model included possible schemes for investment financing and their optimization, the issues of business planning and investment appraisals, rules and modalities for investment agreements, tendering procedures, preparation of bank offers, business planning, the preparation of bankable proposals and loan applications. In the tutorial “Generic model of project and investment cycles for the implementation of energy efficient projects in the Republic of Belarus” (UNDP/GEF Project No.00050819 // Minsk, Oct 2011. – 276 pages), that was prepared and issued by the UNDP/GEF Project “Removing Barriers to Energy Efficiency Improvements in the State Sector in Belarus”, the knowledge on typical designs, project cycles and investment cycles for the basic categories of energy efficiency projects in Belarus was provided.

**(f) Conclusions and Recommendations: for future policy development nationally and implications for adoption of a similar approach in neighbouring countries - 1-2 pages.**

The sustainability of all energy efficiency project initiatives in Belarus relies on three key pillars:

- The existence of an appropriate national regulatory framework;
- Financing arrangements and partnerships with financial institutions in Belarus;
- A reliable system for the Monitoring and Verification of energy savings and /or the energy generated.

With the aim of promoting energy efficiency investments in the state sector, the relevant authorities should legally and institutionally set up the energy management network in state facilities as a priority.

At the end of the day, the establishment, under the auspices of the given UNDP/GEF Project, of the International Energy Center (IEC) CJSC as a joint-venture with a Belarusian financial institution is, in terms of resource mobilization, the major outstanding achievement of the project. Although a few stakeholders made some comments once again on this direct support of a private entity, one can say that, in the absence of an investment strategy within the state sector, the IEC with its financial tools and financing resources is now a key player in the field of energy efficiency investments. The question is now to establish whether this support to a private energy efficiency service company fits in with the UNDP's objectives and regulations. Based on many similar projects carried out in SEA and CIS over the last 5 years, projects supporting the private sector have a better performance record in terms of energy efficiency investments and resource mobilization.

The new budgeting model to promote energy efficiency investments should enabled state-owned enterprises (SOEs), institutions or other government bodies to retain the same budget provisions for energy consumption over the whole payback period of their energy efficiency investments. The money made available because of such a policy should be reinvested in order to implement other energy efficiency projects within the facilities. To be effective, this type of budgeting rule must be supported by a transparent and accurate M&V protocol and a reliable energy consumption reporting system. In addition, such a scheme works if there is, in each major state facility, an Energy Manager responsible for identifying energy efficiency measures, to act as the proponent of energy efficiency project initiatives and reporting on and monitor the impacts.

The implementation of these new budgeting rules should be an incentive measure within facilities and been in accordance with the ESCO business model. In the absence of a new regulation on that matter, the ESCO business model that the IEC was in a position to finance and implement could not work because of the current budgeting rules in the state sector.

The review of work in each SOE involved in investment schemes provided by the given UNDP/GEF Project allowed to sketch the following algorithm of measures that could result, based on the project's experience, in successful energy efficiency investment decision making:

- (i) express energy audits;
- (ii) technical and design solutions, consulting;
- (iii) business planning;
- (iv) feasibility studies;

- (v) capital investment appraisals and capital budgeting;
- (vi) negotiation with investors or financial institutions;
- (vii) calendar progress charts and schedules.

A significant gap still remained between existing and best practices in regard to the implementation of the said measures, the enhancement of project cycles and the preparation of quality bankable documents.

To this end, an additional improvement stage would be required to promote best practices. The UNDP should consider this type of support in its upcoming projects, including projects not related to the energy sector.

Difficulties working with SOEs and issues to be addressed:

<b>SOE type</b>	<b>Distinctive features related to EE investment</b>	<b>Difficulties in EE investment decision making process</b>
Budgetary Organization	Republican or municipal property. The state, as a unitary shareholder, always invests non-repayable state budget resources.	Lack of incentives. Short budgeting period. Energy consumption quota setting is reestablished every year upon achieved rate of energy savings. EE investment source: only grants stipulated by state budget and allocated through energy saving programmes.
Republican Unitary Enterprise	Republican property. The state retains the majority of its portion of investments in the form of non-repayable financing from the state or local budgets in order to secure its rights as a unitary shareholder.	Lack of incentives. Short budgeting period. Energy consumption quota setting is reestablished every year upon achieved rate of energy savings. EE investment source: grants and repayable loans stipulated by state budget and allocated through energy saving programmes; repayable loans from financial institutions; equity (net earnings); no direct investments.
Communal Unitary Enterprise	Municipal property. The local government retains the majority of its portion of investments in the form of non-repayable financing from local budgets in order to secure its rights as a unitary shareholder.	Lack of incentives. Short budgeting period. Energy consumption quota setting is reestablished every year upon achieved rate of energy savings. The net earnings are directed solely to expansion of production. Bank loans are used mainly to cover nominal wages. EE investment source: grants and subsidies stipulated by local budget and allocated through Oblast energy saving programmes; repayable loans from financial institutions; equity (net earnings); no direct investments.
Joint Stock Company (Public or Closed Corporations)	The state is interested in investing non-repayable funds if it is going to increase its share in a stock capital.	Lack of incentives. Short budgeting period. Energy consumption quota setting is reestablished every year upon achieved rate of energy savings. Inconsistent tariff policy. Bank loans are used mainly to expand production. Debt-to-equity ratio is usually very high. EE investment source: grants and repayable loans stipulated by state or local budget and allocated through energy saving programmes; repayable loans from financial institutions; equity (assets and net earnings); direct investments.