Monitoring of energy security of the Republic of Belarus

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Abstract. Energy security is considered as one of the key elements of the national energy policy of the Republic of Belarus. Diversification of national energy mix, development of nuclear and renewable energy, improving energy efficiency are the most important energy goals in the country. To cope with energy security threats a system of quantitative indicators was adopted. Such an approach allows to implement effective monitoring of energy security state, helps energy sector decision makers to adopt right measures to eliminate potential risks as well as provides comprehensive tool for long-term energy sector planning.

1 Introduction

The key aspects of energy security of the Republic of Belarus were laid in several strategic documents adopted on the national level. These documents determine the main priorities for country's energy in short-term, middle-term and long-term perspective.

The Concept of Energy Security (here and below referred as the Concept) was approved by Decree of the Council of Ministers of the Republic of Belarus #1084 on 23.12.2015 and was considered the main document determining current and perspective state of energy security in the country as well as the main approaches for providing its reliable energy supply up to 2035 [1].
According to this Decree the National Academy of Sciences of Belarus was appointed the main national institution for implementation of monitoring of energy security. The Academy is responsible for annual reporting of state of energy security to the Council of Ministers.

2 Estimation of main energy security indicators

The method of indicative analysis was applied for quantitative assessment of energy security in Belarus [2]. According to this method assessment of state of the country's energy security is made on the basis of three possible values of indicators: normal, subcritical and critical.

The normal state of energy security implies normal values of almost all indicators.
Subcritical state of energy security is characterized by considerable threats to country's energy supply, its reliability, energy independence, energy efficiency investment activity. As a result, these threats require some correcting actions to prevent further worsening of energy security state.

According to the Concept energy security system of Belarus includes 11 indicators as well as its threshold and perspective values till 2035. It allows to implement an objective monitoring and control of energy security state.

Currently Belarus faces several considerable threats to sustainable and reliable energy supply. The main of them are:

- low geographical and structural diversification of energy import;
- possible restrictions of energy import from the dominant supplier because of economic and political reasons;
- development of energy transit routs by neighboring countries alternative to Belarus;
- high share of one energy source (natural gas) consumption for heat and electricity production;
- low per capita specific electricity consumption in Belarus in comparison to developed countries with similar climate conditions;
- expected increased imbalance of electric capacities in night hours after commissioning of Belarusian nuclear power plant.

Most of threats mentioned have a long-term character. As a result, Belarus needs a systematic approach to achieve main goals indicated in the Concept.
In 2016 both positive and negative tendencies of energy security in Belarus were indicated.
The main positive factors were :

- growth of share of domestic energy sources in total primary energy supply to 14.9% compared to 14.0% in 2015;
- domestic production of oil and natural gas in Belarus remained stable;
- in 2016 production of peat and wood fuel achieved 2.6 Mtce and increased to 0.3 Mtce compared to 2015;
- in 2016 Belarus continued to be an important transit country. Volume of oil supplied over the territory

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of Belarus towards Adamovo hub (Poland) was 39.0 mio. t and to Brody hub (Ukraine) – 13.9 mio. t.

Table 1. Energy Balance of Belarus in 2015-2016

Indicator	Unit	2015	2016
Total primary energy supply	Mtce	36,5	35,6
Total primary energy production :	Mtce	5,1	5,3
oil	Mtce	2,4	2,3
natural gas	Mtce	0,4	0,4
peat	Mtce	0,3	0,5
biomass	Mtce	2,0	2,1
renewable electrycity	Mtce	0,02	0,02

- in 2016 average specific energy consumption of Belenergo power plants for electricity production was 230.4 g ce/kWh compared to 235.5 g ce/kWh in 2015;
- Belarus continued to increase its renewable generation capacity. It achieved 164.1 MW, or 1.8% of total installed capacity (as for 01.07.2016) compared to 141.1 MW in 2015;
- in 2016 decline of average price for imported natural gas took place in Belarus. For example, costs of imported natural gas for power generation sector reduced by 16.1% to 176.04 USD/thousand m. cub. compared to 2015 level. Average price of natural gas for gas distribution sector went down by 5% to 149.5 USD/thousand m. cub. compared to previous year.

In 2016 the main challenges for energy sector of Belarus were decline of electricity and heat consumption by national companies, increase of debts of energy consumers as well as investment cuts.

For example :

- total electricity consumption in Belarus was 36.1 billion kWh compared to 36.7 billion kWh in previous year. Decline of electricity demand in the country is considered a serious threat to national energy security taking into account start of operation of the nuclear power plant scheduled for 2020 and its expected annual generation of 18 billion kWh. While increase of electricity export is considered one of possible options to optimize load curve after commissioning of nuclear power plant only 160 mio. kWh were exported in 2016;
- decline of oil refineries' output took place in 2016 in Belarus. Two national refineries processed 18.6 tons of oil that was only 80.9% of 2015 level ;
- a considerable increase of electricity supply disruptions was fixed in 2016 in comparison with previous year (30416 and 21401 disruptions respectively). Most of electricity supply disruptions took place in grid 0,4-10 KV due to extreme climatic conditions;
- total debt for electricity purchased by consumers increased from 426.8 mio. BYN in 2015 to 764 mio BYN in 2016. Debt for heat supplied increased to 103.2 mio BYN compared to 64.7 mio. BYN in 2015.

Besides, there are some important issues in bilateral relations between Russia and Belarus which affect negatively energy security, including annually agreed volumes of oil supply to Belarusian refineries and tariff setting principles for natural gas market in both countries.

In 2016 the following tendencies of energy security were identified in Belarus:

- 4 indicators (domestic primary energy production to total primary energy consumption ratio; share of a dominant supplier in total energy import; energy sector capital expenditures to initial fixed assets value ratio; share of a dominant fuel in total energy consumption for electricity and heat production) had critical values;
- 4 indicators (total installed electrical capacity to maximal load ratio; energy sector accumulated depreciation to initial fixed assets value ratio; average number of daily electricity supply disruptions to total locality number ratio; energy import value to gross domestic product ratio) had normal values;
- 3 indicators (renewable energy production to total primary energy consumption ratio; share of a dominant fuel in total energy consumption; energy intensity of gross domestic product) had subcritical values.

In 2016 both indicators, characterizing energy independence of the country were improved. For example, total primary energy production to total energy consumption ratio amounted to 14.9% compared to 14% in 2015. Renewable energy production to total primary energy consumption ratio in 2016 achieved a subcritical value of 6%.

Decline of global prices for hydrocarbons was another factor which affected positively energy security of Belarus in 2016. Energy import value to gross domestic product ratio declined to 15.4% that corresponds to normal level of this indicator.

Diversification of national energy mix continued to be a challenge for the country in 2016. Share of a dominant fuel in total energy consumption amounted to 61.4% and increased by 1.4% in comparison with 2015. As a result this indicator had subcritical value. Belarus is still having a critical dependence on Russia in terms of energy imports: more than 99% of total primary energy were imported from that country in 2016 that implied critical value of the energy security indicator "Share of dominant energy supplies in total energy import".

Share of a dominant fuel (natural gas) in total energy consumption for electricity and heat production for national power company Belenergo was also extremly high and reached 96.7% in 2016. That means unsatisfactory deversification of energy supply by the national power sector and its high vulnerability to potential fuel supply disruptions.

Decline of electricity demand in the country due to recession of the national economy resulted in achieving value of energy security indicator "Total installed electrical capacity to maximal load ratio" of 175%.

Normal value was attributed to the indicator characterizing depreciation of fixed assets of energy sector of Belarus (amounted to 44% in 2016). However, investment activity of national power utility was below the critical threshold in 2016.

Table 2. Energy Security Indicators of Belarus

Indicator	Threshold Level		Value	
	Normal	Critical	2016	2035
Energy Independence				
Domestic primary energy production to total primary energy consumption ratio, %	30	16	14,9	20
Renewable energy production to total primary energy consumption ratio, %	14	5	6	9
Diversification of Energy Suppliers and Types of Energy				
Share of a dominant supplier in total energy import, %	65	85	>99	70
Share of a dominant fuel in total energy consumption, %	50	70	61,4	50
Reliability of Energy Supply, Reserve Capability and Distribution of Energy				
Total installed electrical capacity to maximal load ratio, %	140	95	175	145
Energy sector accumulated depreciation to initial fixed assets value ratio, %	45	75	44	<45
Energy sector capital expenditures to initial fixed assets value ratio, %	6	4	3,7	6,5
Share of a dominant fuel in total energy consumption for electricity and heat production, %	50	80	96,7	< 50
Average number of daily electricity supply disruptions to total locality number ratio, %	0,5	2	<0,5	0,4
Energy Efficiency and Economic Sustainability of Energy Sector				
Energy intensity of gross domestic product, kg ce/ MBYN (2005 prices)	160	485	378	268
Energy import value to gross domestic product ratio, %	15	30	15,4	15

To cope with these energy security challenges the following measures should be adopted in Belarus in short-term and mid-term perspective:

- to assure implementation of investment projects indicated in the State Program of Energy Saving for 2016-2020, the State Program of Energy Sector Development for 2016-202, the State Program of Comfortable Housing for 2016-2020 and other strategic and local documents and plans;
- strict implementation of construction schedule of the Belarusian nuclear power plant;
- to support activities aimed to increase electricity consumption in the country after commissioning of the nuclear power plant;
- to intensify bilateral negotiations with neighboring countries in terms of electricity export from Belarus;
- to support transition to a single market of oil, natural gas and electricity in the Eurasian Economic Union;
- to cooperate with Poland, Ukraine, Lithuania, Latvia in terms of diversification of oil and natural gas imports routs;
- to intensify dialog with the European Union in the field of energy cooperation to balance interests of Belarus as a transit country and Russia and EU – as a supplier and a buyer of energy resources respectively;
- to develop a national roadmap for Smart Grid technologies in Belarus taking into account increased disruptions of electricity supply;
- to assure implementation of obligatory expertise of large-scale investment projects in terms of their correspondence to the world's best practices in energy efficiency;
- to introduce a practice of development of regional sustainable energy plans for the period up to 2025-2030 which will include indicative targets of energy consumption, energy efficiency improvement, energy intensity and greenhouse emissions reduction;
- to introduce a practice of annual energy security monitoring not only on the national, but also on regional level.

3 Conclusion

Implementation of these measures will allow to achieve forecasted goals of the Concept as well as to reduce risks for energy security of Belarus and to promote sustainable development of the country.

References

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2. A. Mikhalevich. *Energy Bulletin*, **№ 20**, p. 61-72, (2015).