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SCENARIOS OF THE BELARUS ELECTRICTY GENERATION SYSTEM DEVELOPMENT

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OVERVIEW

Access to cheap energy has become essential to the functioning of modern economies. However, the uneven distribution of energy supplies among countries and the critical need for energy has led to significant vulnerabilities. Threats to individual person's and national energy security include the political instability of several energy producing countries, the manipulation of energy supplies, the competition over energy sources, attacks on supply infrastructure, as well as accidents and natural disasters. It is also the limited supplies of the most common forms of primary energy, i.e. Oil and Gas that changes perceptions on this topic. The potential need to change our primary energy sources in the foreseeable future is the crux of the energy security question leading to higher prices, more limited access to sources of energy, competitions and political troubles, which in turn make the threat even larger. One of actual problems of sustainable development of Republic of Belarus is expansion of using of local renewable energy resources as well as decrease in dependence on import of natural gas and the electricity.

METHODS

The temporal scope is the period 2010 to 2030; the geographical scope is the territory of Belarus and the system scope is the country's electricity and heat supply infrastructure. Energy system analysis tool MESSAGE was used to simulate the vintage, operational specificity and performance as well as the current production structure of Belarus' heat and power system and to model future system development options.

Based on exogenously determined annual electricity and heat demand profiles over the planning horizon, the model's objective is to meet demand at least total system costs. It does so by accounting for the vintage structure of existing plant and equipment, domestic energy resource occurrence, energy trade links and prices, a menu of technology options for both capacity expansion and replacement of retired capacities, as well as relevant energy policy constraints. The key technology options included in this study are 350 MW coal-fired power units and 100 MW coal-fired CHP, 1 200 MW nuclear power plants, combined cycle gas turbines, simple gas turbines, gas-fuelled as well as wood and peat-fuelled cogeneration plants, hydro power plants and wind turbines. Each technology is characterized by several techno-economic parameters such as investment and operating costs, operating profile, service life time, conversion efficiency, etc.

RESULTS

The present report describes results of the study of different scenarios of the power system of Belarus with the aim to determine the criteria of power security "Fraction of dominating

energy resource (natural gas) in generation of thermal energy and electricity" lower than 50 %. This criteria is established by the State Conception of the energy security of Belarus.
Two basic scenarios were simulated during the study. The first scenario is based on the assumption that Russia does not implement an export tax regarding Belarus. The second scenario assumes that Russia implement from 2011 the export tax for Belarus by selling the natural gas. Forecast for energy resources prices implemented in this study are shown in Fig. 1.
Results of our computer simulation shows that an optimal scenario of power development in Belarus in case of an absence of export duty for the Russian natural gas requires putting into operation two units of NPP (2016 and 2022), putting into operation coal CHP with total capacity 1000 MW, 3 coal units each 350 MW(el) (2013, 2014 and 2027), hydro plants with total capacity 250 MW as well as some wind plant with total capacity 140 MW.
In case of implementation of export duty for natural gas the optimal scenario requires putting into operation three units of NPP (2016, 2020 and 2029), putting into operation coal CHP with total power 1000 MW, 2 coal generation units each 350 MW(el) (2013 and 2014), hydropower plants with total capacity 250 MW as well as some wind plants with total capacity 200 MW.

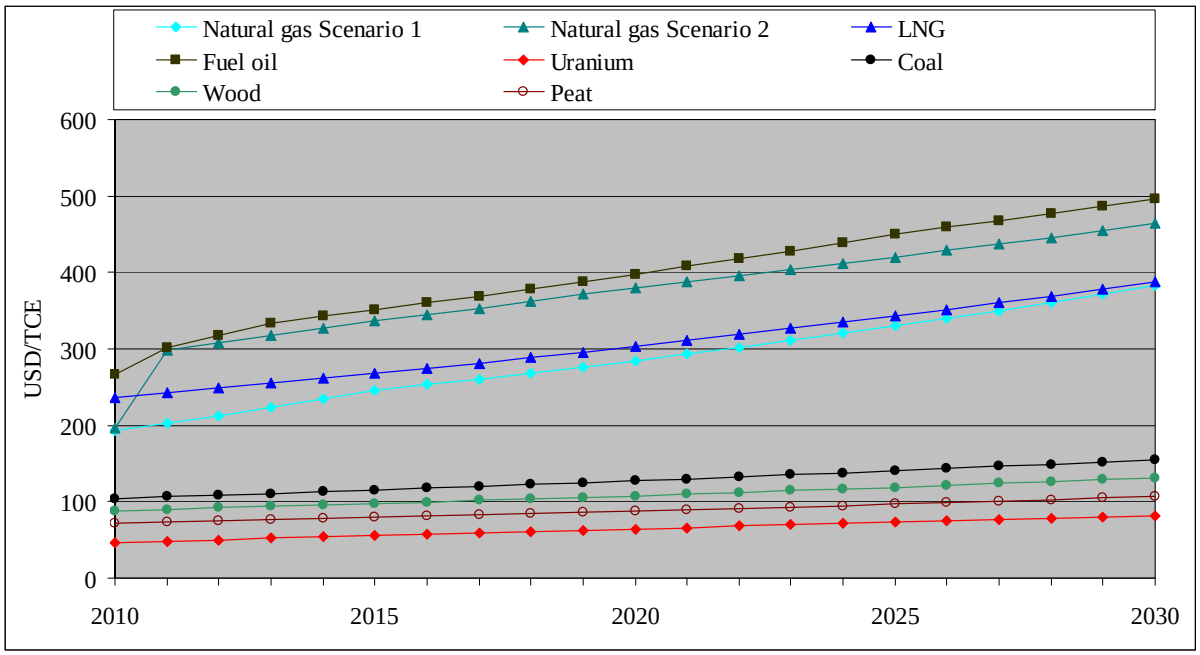

Fig. 1. Prices forecast for energy resource

CONCLUSIONS

Results of this study show that development of the nuclear power will promote diversification of the electricity generation capacities. High natural gas price will stimulate nuclear and wind power development. Share of the nuclear power in electricity production will consist not less than 30 % to 2030. Coal will be responsible for 20-25 % of electricity generation, and natural gas – for not more than 40 % in both scenarios.