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Macroeconomic Effects of the Third Unit of the Belarusian NPP: A CGE Assessment

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Policy Paper

ABSTRACT:

The construction and commissioning of the third power unit of the Belarusian NPP, planned by the Belarusian authorities, will lead to changes in the structure of power generation through an increase in the share of nuclear energy and a reduction in natural gas imports. In this regard, an important task is to assess the macroeconomic effects of the project, including the role of its financing conditions. This analytical note presents an approach to quantitatively assessing the impact of launching the third power unit on the Belarusian economy. The methodological basis is a computable general equilibrium (CGE) model for the Belarusian economy. The CGE-based simulation results show that the launch of the third power unit stimulates output growth in energy-intensive industries, increases household income and consumption, and boosts investment. Accounting for the repayment of the Russian loan for the construction of the power unit through the budget and the inclusion of loan payments in tariffs significantly weakens the positive macroeconomic effects, and in the case of exchange rate rigidity, the equilibrium level of investment in the economy will decline.

Keywords: BelNPP, nuclear energy, GDP, price, revenues, investments, CGE, modeling.

1. Introduction

The Belarusian authorities have decided to construct a third power unit of the Belarusian Nuclear Power Plant (BelNPP) and plan to sign a framework agreement with Rosatom by the end of 2026.¹ It is planned to build a reactor with a capacity of 1,200 MW, similar to the two currently operating at the BelNPP. The Belarusian authorities intend to commission the new power unit in 2035–2038.² Additional nuclear generation capacity could potentially increase the share of nuclear energy in Belarus's electricity production from about 40% in 2024–2025 to 55–60% by 2040.³ This will be accompanied by a reduction in natural gas imports, improved efficiency of the energy sector, and a favorable price shock for the economy.

Studies on the development of nuclear energy in Belarus have mainly focused on issues of energy security, diversification of energy sources, and institutional aspects of energy policy.⁴ We are not aware of studies that quantitatively analyze the macroeconomic effects of the launch of the BelNPP and the planned commissioning of its third power unit. Assessing such effects requires taking into account intersectoral linkages in the economy. A reduction in electricity costs affects not only the energy sector but also the cost structure in other industries, the reallocation of production resources, the structure of foreign trade, and aggregate demand. At the same time, the macroeconomic consequences of substituting natural gas with nuclear energy will largely depend on the terms of provision and repayment of Russian borrowed funds that may be attracted for the project's implementation. Partial equilibrium approaches do not fully capture these transmission mechanisms and do not allow for an accurate assessment of changes in the economy's equilibrium after the shock.

In this study, a computable general equilibrium (CGE) model for the Belarusian economy (Beleconomy, 2025) is used to quantitatively assess the macroeconomic effects of launching the third power unit of the BelNPP. CGE models make it possible to account for intersectoral linkages, endogenous price formation, and resource reallocation, as well as to analyze the macroeconomic consequences of structural shocks in terms of general equilibrium.

¹ See: <https://belta.by/economics/view/belarus-i-rossija-planirujut-do-kontsa-goda-podpisat-soglashenie-o-tretjem-energobloke-belaes-765563-2026/>.

² See: <https://belta.by/economics/view/v-kakom-godu-v-belarusi-mozhet-pojavitsja-tretij-energoblok-belaes-rasskazal-ministr-energetiki-755580-2025/>.

³ See: <https://belta.by/economics/view/dopolnitelnyj-impuls-dlja-regiona-energeticheskij-effekt-minenergo-o-stroitelstve-tretjego-energobloka-771679-2026/>.

⁴ For example, see: Mikhalevich & Grebenkov (2023), Mukha & Tsilibina (2024).

The CGE-based simulation results show that the launch of the third power unit of the BelNPP will have modest positive effects on household income and consumption, as well as on Belarus's GDP as a whole in the new steady-state equilibrium. At the same time, the macroeconomic effects of the project are sensitive to its financing conditions and to the exchange rate policy parameters of the National Bank.

This analytical note is structured as follows. The second section discusses the methodological approach and describes the assumptions for scenario modeling. The modeling results are presented in the third section. The fourth section analyzes the robustness of the results to changes in the CGE model specification regarding exchange rate flexibility. Conclusions and limitations of the approach are discussed in the final section.

2. Research method

2.1 Brief description of the CGE model for Belarus

A CGE is a system of equations that describes the interaction between households, firms, the government, and the external sector within a consistent general equilibrium framework.

Simulations within a CGE framework make it possible to analyze how a shock in one sector of the economy (or in external conditions) propagates across all interconnected sectors and economic agents, as well as to quantitatively assess the consequences of such a shock for sectoral output, public and private consumption and investment, foreign trade operations, and GDP as a whole.

The CGE model for Belarus includes 22 production sectors and a single external sector (without regional disaggregation). The model is based on data from input-output tables, national accounts, government finance statistics, the balance of payments, and data from the World Bank and GTAP (Global Trade Analysis Project) on import tariffs and substitution elasticities between factors of production, domestically produced, exported, and imported goods and services. For the presented model, 2019 is taken as the base year. The choice of this year is explained by the fact that it was the last year with a full set of available data and the last year when the Belarusian economy was close to its equilibrium state (Beleconomy, 2025).

2.2 Design of simulations based on the CGE model

The commissioning of the third reactor of the Belarusian NPP is expected to be accompanied by a reduction in domestic natural gas consumption. Precisely estimating the volume of gas import reduction is difficult. Before the launch of the BelNPP, the Belarusian authorities projected the substitution of about 4.5 billion cubic meters of natural gas after the two power units of the plant reached full capacity.⁵ In 2025, it was reported that in 2024 the BelNPP made it possible to replace 4.24 billion cubic meters of gas.⁶ Based on these data, it can be assumed that the commissioning of the third reactor of the BelNPP will reduce gas consumption by an additional approximately 2 billion cubic meters. This volume was incorporated into the CGE simulations.

The reduction in intermediate consumption of natural gas by the energy sector implies a decrease in the share of total intermediate consumption in the output of the energy sector and a corresponding increase in the share of value added. It is assumed that demand for electricity responds to changes in its price resulting from changes in the structure of output in the energy sector. At the same time, the increase in electricity generation capacity following the commissioning of the third power unit does not in itself imply an increase in actual demand for electricity and its consumption. In the long term, demand will be determined by economic growth and changes in its structure under the influence of institutional policies, while the expansion of nuclear generation capacity can only create more favorable conditions for such growth and structural changes. In this regard, structural transformations were not considered in the CGE simulations. Only the economic effects of a reduction in the share of intermediate consumption in energy sector output – corresponding to the volume of substituted natural gas – and the associated increase in the share of value added were modeled.

Scenario 1 “Gas substitution” considers only the above-described effect of replacing natural gas.

Scenario 2 “Loan repayment” additionally assumes the repayment of a Russian loan that may be attracted for the construction of the third power unit of the BelNPP. The cost of this construction has not yet been determined.

⁵ See: Interview with D. Moroz. 2021. Newspaper "Energy of Belarus". No 18 (469). PP. 4–5.

⁶ See: <https://www.sb.by/articles/energiya-s-polozhitelnyim-zaryadom-.html>.

Approximately \$5.36 billion of a Russian loan was spent on the launch of the BelNPP with two power units.⁷ Since the third unit is expected to expand the existing plant, auxiliary construction costs are likely to be lower compared to the construction of the plant itself. Therefore, in the simulation of macroeconomic effects of repaying the Russian loan for the construction of the additional reactor, its volume was set at \$2 billion.

It is assumed that the loan will be provided in Russian rubles. The interest rate is set at 4% per annum, which roughly corresponds to half of the neutral key rate of the Bank of Russia.⁸ The loan term is assumed to be 12.5 years, which is twice shorter than the previous loan. As a result, the annual payment of the Belarusian government on the loan can be estimated at around \$206 million (in equivalent terms), or about 0.3% of 2019 GDP. This amount was included in the simulation of the second scenario as a transfer from the Belarusian government to non-residents, while all assumptions of the first scenario were retained.

Scenario 3 “Tariff increase” additionally assumes the transfer of the loan repayment burden to firms and households. Under the second scenario, repayment of the Russian loan is carried out through a reduction in government consumption. However, it can be assumed that loan payments will be incorporated into electricity tariffs for domestic consumers. In this case, the burden of servicing borrowed funds will be shifted to households and businesses. To simulate this scenario, in addition to the assumptions of the first two scenarios, an increase in production taxes for the energy sector is incorporated into the CGE model. This shock within the model will be accompanied by a corresponding increase in the producer price index for energy goods (Beleconomy, 2025). The magnitude of the tax increase is calibrated as the ratio of the annual payment on the Russian loan to the nominal output of the energy sector (in the base period). As a result, the effective production tax rate for the energy sector increases from 1.9% in the base period to 6.4% in the new equilibrium state.

The results of CGE simulations reflect changes in the state of the economy in the long term (when production sectors and economic agents complete their adjustment to the changed operating conditions) relative to the base period. This study analyzes the effects of commissioning the third power unit on the sectoral structure of the Belarusian economy, domestic demand, foreign trade, household income, and overall GDP.

⁷ See: <https://www.atomic-energy.ru/news/2023/10/03/139191>.

⁸ See: http://cbr.ru/statistics/ddkp/mo_br/. The rate for the previous loan was set at 3.3% per annum.

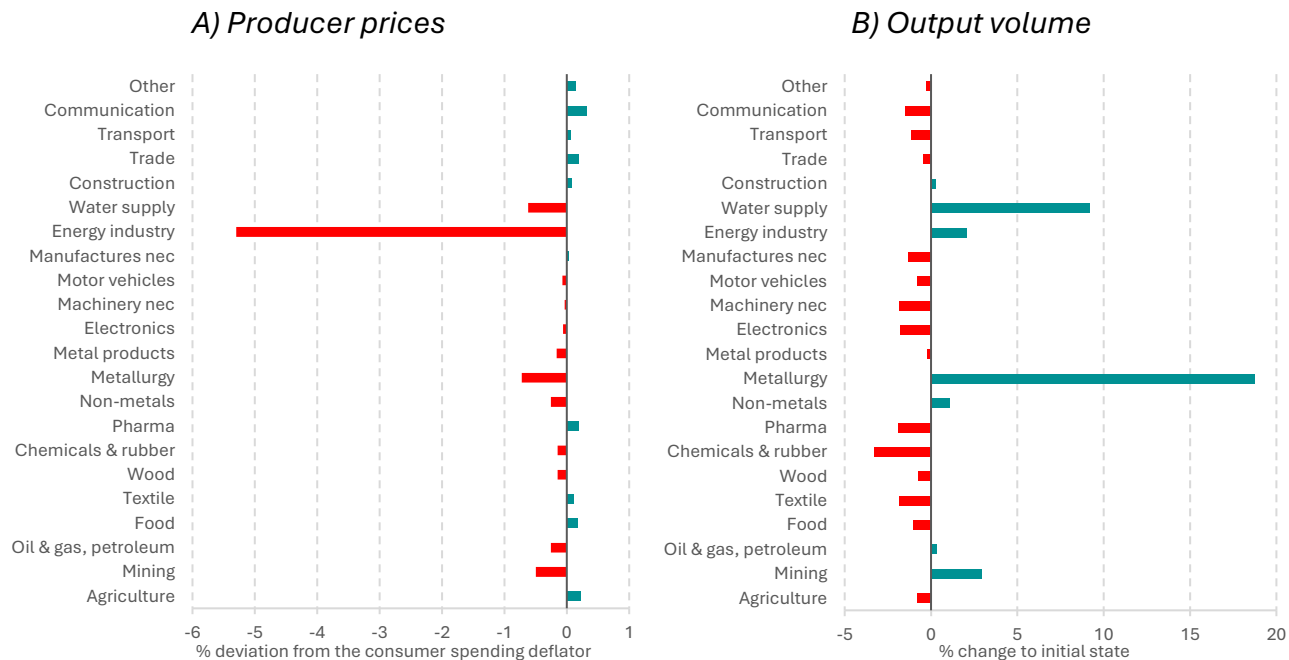
The simulation results are valid only *ceteris paribus* and represent solely an assessment of the impact of lower electricity prices on changes in the equilibrium state of the economy. The modeling does not take into account the economic effects of the construction phase of the power unit, which are temporary in nature and, all else being equal, will have a minimal impact on changes in GDP in the new steady state. The potential accelerated development of certain energy-intensive industries (for example, those related to data processing and storage) or, for instance, an increase in the share of electric transport and electrically powered housing are also not reflected in the CGE-based simulation results.

3. Simulation results

3.1 Scenario 1 “Gas substitution”

An increase in the efficiency of the energy sector (due to a higher share of value added) leads to a decline in the production price of the energy sector relative to the average price level in the economy (Fig. 1.A).

Figure 1: Sectoral effects: results of scenario 1 simulation



Source: authors’ calculations based on the CGE model for Belarus (Beleconomy, 2025).

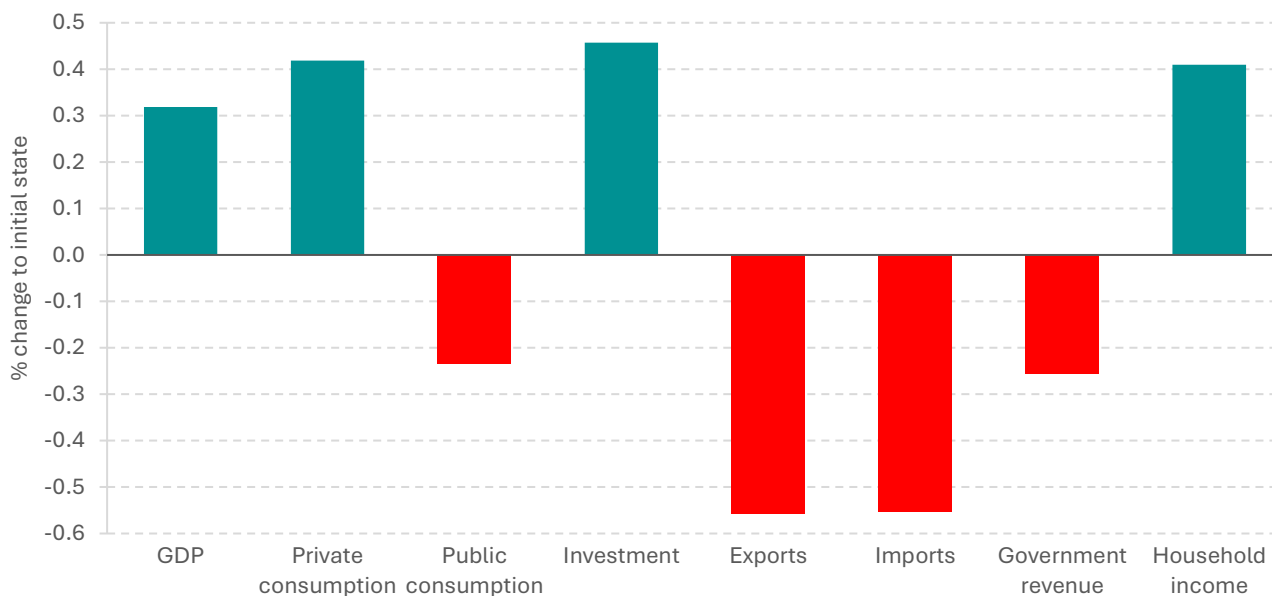
With regard to price indicators, the results of CGE simulations reflect changes in prices not relative to their values in the base period, but relative to the household final consumption expenditure deflator. This indicator is used in the model as the price numeraire. In both the base equilibrium and the new equilibrium after the simulation, the deflator is fixed at one.

This makes it possible to determine all other prices as relative and thereby eliminate uncertainty regarding the general price level in the model. At the same time, fixing the deflator does not imply the absence of its economic change after the shock. It means that the new level of the deflator is normalized to one, while changes in other prices are interpreted as changes relative to the general price level.

Energy-intensive industries benefit the most from the relative decline in electricity prices: metallurgy, mining, construction materials production, water supply, and the energy sector itself have the potential to increase output (**Fig. 1.B**). Since output growth in these sectors requires the involvement of labor and capital resources, which are reallocated from other industries, most other sectors of the economy slightly reduce their output volumes (**Fig. 1.B**).

An increase in household income and consumption by 0.4% in the gas-to-nuclear substitution simulation indicates that this shock, ceteris paribus, will be reflected in a decrease in the overall price level. As a result, the commissioning of the third power unit may contribute to an increase in household welfare. This leads to a rise in resources available for investment, which increases by almost 0.5% relative to the base period (**Fig. 2**).

Figure 2: Macroeconomic effects: results of scenario 1 simulation



Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

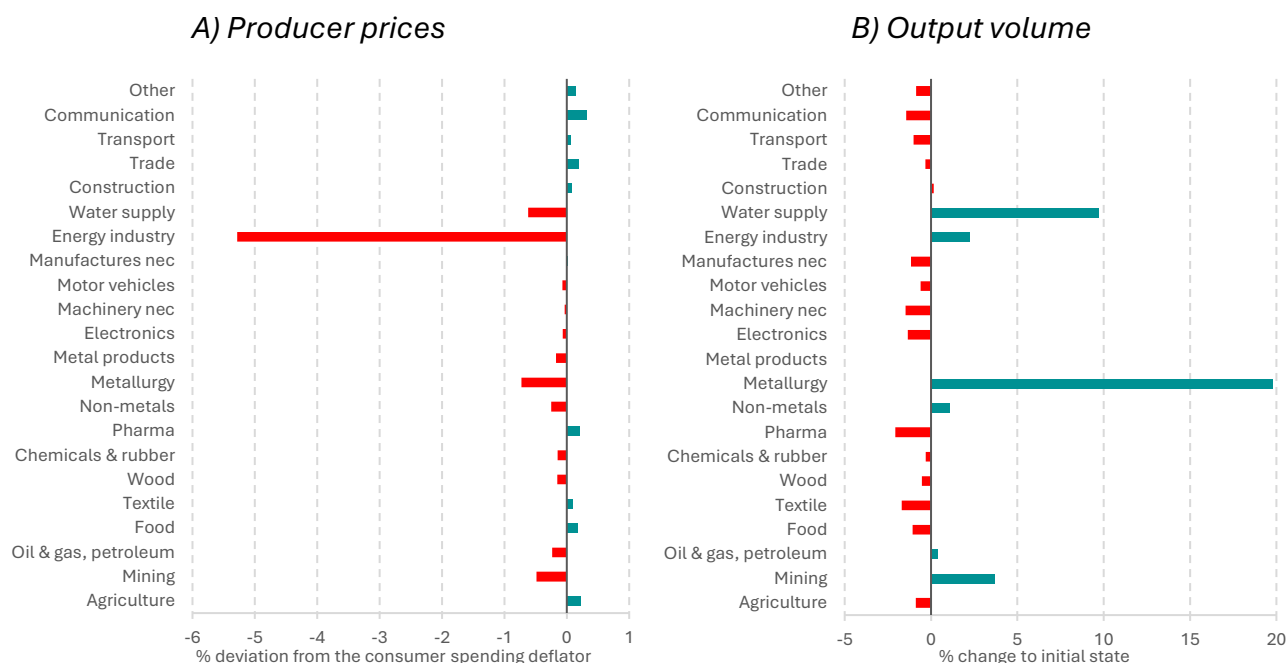
An increase in domestic demand, with unchanged volumes of labor and capital resources and technology levels, leads to a higher share of produced goods and services supplied to the domestic market, while exports decrease by almost 0.6% (**Fig. 2**). The reduction in imports is mainly explained by a decline in supplies of goods from the oil and gas sector (gas substitution) by 3.3% relative to the base period and from the energy sector by 13.2%.

Tax revenues and government consumption decline slightly due to a reduction in the nominal volume of output and imports and, consequently, the tax base. As a result, the overall effect of substituting natural gas consumption following the commissioning of the third reactor of the BelNPP on Belarus’s GDP, *ceteris paribus*, is estimated to be positive at around 0.3% (**Fig. 2**).

3.2 Scenario 2 “Loan repayment”

The sectoral effects of commissioning the third power unit under the assumption of repayment of the Russian loan are close to the results of the first scenario (**Fig. 3**), where such repayment was not taken into account. This is largely explained by the small scale of the shock (the annual payment is assumed to be about 0.3% of 2019 GDP).

Figure 3: Sectoral effects: results of scenario 2 simulation

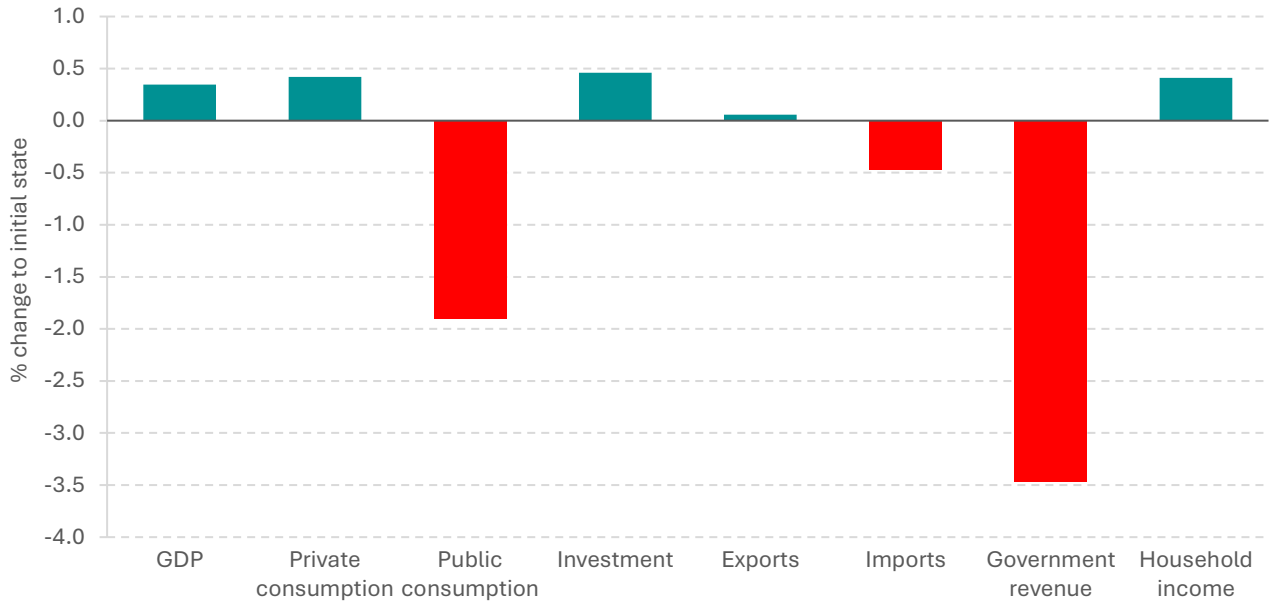


Source: authors’ calculations based on the CGE model for Belarus (Beleconomy, 2025).

The differences in macroeconomic outcomes between the scenarios are significant. An increase in transfers from the government to non-residents reduces the volume of resources available to the government sector by 3.5%, which is reflected in a decrease in government consumption by 1.9% relative to its level in the base period (**Fig. 4**).

A lower level of domestic demand forces producers to more actively seek demand for their products in external markets. In Scenario 2, exports remain almost unchanged relative to the base period, in contrast to a 0.6% decline in Scenario 1. As a result, the overall change in GDP remains close to the estimate under Scenario 1 – an increase of about 0.3%, driven by the positive effects of lower prices on household consumption and investment (**Fig. 4**).

Figure 4: Macroeconomic effects: results of scenario 2 simulation

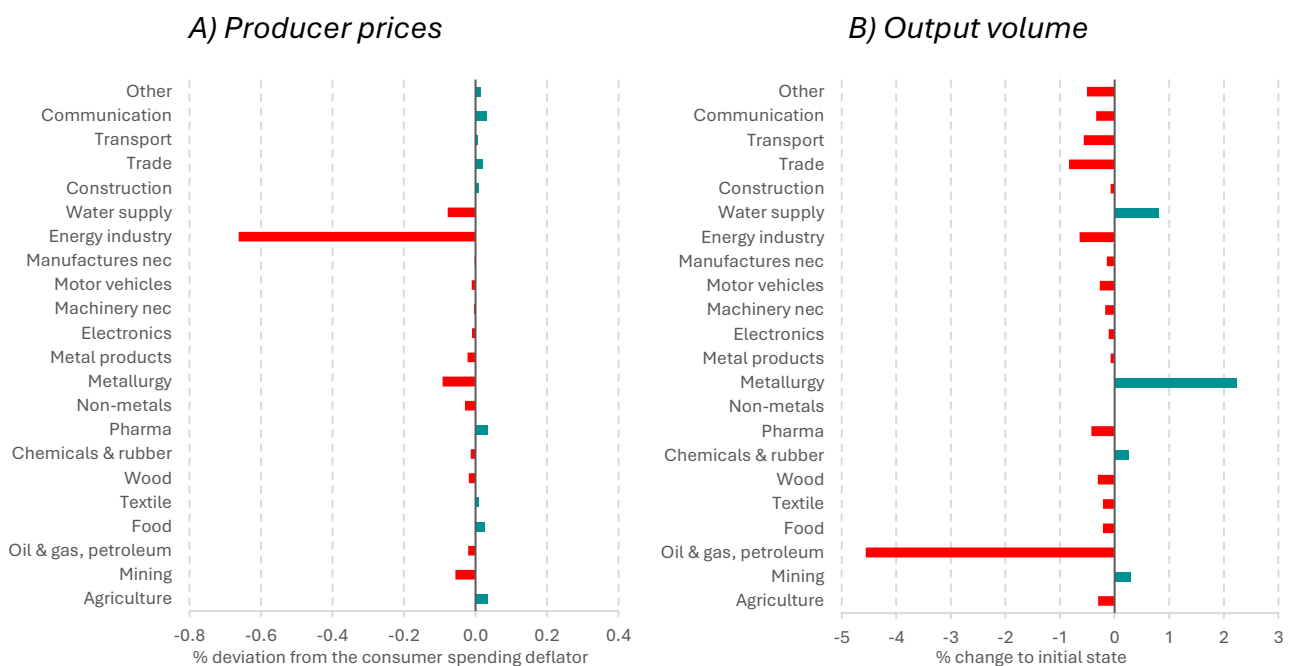


Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

3.3 Scenario 3 "Tariff increase"

When loan repayment is incorporated into electricity tariffs, the direction of sectoral effects from the commissioning of the third power unit generally remains unchanged compared to the first two scenarios. At the same time, the scale of changes in relative prices becomes smaller, as the cost of electricity for consumers declines less significantly (**Fig. 5**).

Figure 5: Sectoral effects: results of scenario 3 simulation



Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

Household incomes, expenditures, and domestic investment grow much more slowly due to less pronounced positive price effects (**Fig. 6**). At the same time, the resources and consumption of government authorities decrease less significantly compared to their changes in Scenario 2, as the burden of loan repayment is shifted to households and businesses. Exports decline by 0.8% relative to the base period, while imports decrease by 1.3% (largely due to reduced gas supplies). The resulting impact of commissioning the third reactor of the BelNPP on GDP remains positive, but declines to 0.2% (**Fig. 6**).

Figure 6: Macroeconomic effects: results of scenario 3 simulation



Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

In summary, the commissioning of the third power unit of the Belarusian NPP may be accompanied by small positive effects on household welfare, investment, and Belarus's GDP due to a reduction in the overall price level. These positive effects generally persist even when loan repayment is incorporated into electricity tariffs, but they become significantly smaller in magnitude (**Table 1**).

At the same time, it should be taken into account that the simulation results assume a "ceteris paribus" condition and depend significantly on the assumptions regarding the terms of the Russian loan, the volume of natural gas substitution, and its price.

Table 1: Comparison of scenario results*(change relative to the level in the base period, in %)*

	Scenario 1	Scenario 2	Scenario 3
GDP	0.3	0.3	0.2
<i>Private consumption</i>	0.4	0.4	0.1
<i>Public consumption</i>	-0.2	-1.9	-0.9
<i>Investment</i>	0.5	0.5	0.1
<i>Exports</i>	-0.6	0.1	-0.8
<i>Imports</i>	-0.6	-0.5	-1.3
Government resources	-0.3	-3.5	-1.6
Household income	0.4	0.4	0.1

Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

4. Robustness check

4.1 Fixed exchange rate and change in the current account norm

A debatable feature of the baseline CGE model is the fixation of the current account of the balance of payments (Beleconomy, 2025). After the shock, the economic system described by the model undergoes a rebalancing process, and the nominal current account balance returns to its base-period value. Under the assumption of price flexibility in the long term (including the exchange rate), such a specification is theoretically justified. At the same time, it can be assumed that in the scenarios considered, the reduction in natural gas imports due to the commissioning of new nuclear generation capacity will lead not only to an exchange rate adjustment but also to a change in the equilibrium level of the current account for Belarus.

In the CGE model, it is necessary to fix either the exchange rate or the current account balance to obtain a solution. Therefore, to simulate the three scenarios under the assumption of a variable current account (rather than a fixed exchange rate as in the baseline specification), the model was adjusted by changing the fixed parameter from the current account balance to the exchange rate. The simulation results under the alternative CGE specification, as in the baseline case, show the effects of commissioning the third reactor for extreme scenarios.

The realistic scale of the macroeconomic effects of the shock, *ceteris paribus*, lies within the range of estimates obtained from the two CGE specifications (**Table 2**).

Table 2: Comparison of scenario results for two CGE model specifications

(change relative to the level in the base period, in %)

Scenario	1		2		3	
	Baseline	Alternative	Baseline	Alternative	Baseline	Alternative
GDP	0.3	0.4	0.3	0.4	0.2	0.2
<i>Private consumption</i>	0.4	0.4	0.4	0.4	0.1	0.1
<i>Public consumption</i>	-0.2	-0.1	-1.9	-1.8	-0.9	-0.8
<i>Investment</i>	0.5	-14.7	0.5	-13.3	0.1	-0.8
<i>Exports</i>	-0.6	4.5	0.1	4.7	-0.8	-0.5
<i>Imports</i>	-0.6	-3.0	-0.5	-2.7	-1.3	-1.5
Government resources	-0.3	-0.0	-3.5	-3.3	-1.6	-1.6
Household income	0.4	0.4	0.4	0.4	0.1	0.1

Source: authors' calculations based on the CGE model for Belarus (Beleconomy, 2025).

The resulting impact of commissioning the third power unit of the BelNPP on GDP volume is similar across all simulations under both the baseline and alternative CGE specifications (**Table 2**). Minimal differences are observed for household and government income and consumption. The key differences between the two model specifications are concentrated in foreign trade and domestic investment. With a fixed exchange rate (alternative specification), domestic investment and imports are significantly weaker compared to the case of a fixed current account balance (baseline specification), while exports are substantially stronger.

With a fixed exchange rate, the decline in domestic prices due to cheaper electricity increases the competitiveness of Belarusian producers – exports become more attractive compared to supplying the domestic market. As a result, exports increase significantly in scenarios that do not include loan repayment in electricity tariffs, and their decline is smaller in the scenario with tariff adjustments. Under a flexible exchange rate, its appreciation in response to reduced imports largely offsets this effect.

Given fixed volumes of labor and capital and unchanged technologies, an increase in exports leads to a reduction in domestic sales of goods and services, which is reflected in a decrease in domestic demand in its most flexible component – investment. As a result of lower domestic investment demand, imports decline more significantly under a fixed exchange rate compared to the case of a fixed current account balance.

At the same time, in the most realistic third scenario – which incorporates loan repayment into electricity tariffs – the difference in simulation results between the baseline and alternative CGE specifications is not critically large. This generally indicates the robustness of the results to changes in the CGE specification regarding the mechanisms for balancing external economic operations.

4.2 Increase in interest rate on Russian loan

Additionally, a robustness check of the baseline model specification was conducted by varying the interest rate parameter on the Russian loan. In baseline Scenarios 1–3, the rate is assumed to be 4% per annum. In the risk-based third scenario, the rate was calibrated such that the size of the loan payment, which is passed through to electricity tariffs, would neutralize the positive effects of commissioning the third power unit on household income and consumption. The resulting threshold value of the interest rate is about 6.5%. Therefore, holding other loan parameters constant, an interest rate above 6.5% would lead to a decline in household welfare relative to its level in the base period.

5. Conclusion

The commissioning of the third power unit of the BelNPP may have positive but moderate macroeconomic effects for Belarus in the long term. The potential reduction in electricity prices will contribute to an increase in household income and consumption, as well as, under the condition of exchange rate flexibility, domestic investment. This will result in an increase in GDP by 0.2–0.3% in the new steady state compared to its level in the base equilibrium.

At the sectoral level, the greatest gains are expected for energy-intensive industries. Metallurgy, mining, construction materials production, water supply, and the energy sector itself have the potential to increase output.

Sectoral and macroeconomic effects of commissioning the third reactor will largely be determined by the financing conditions of its construction. If payments for repaying a potential Russian loan are incorporated into electricity tariffs, the positive effects on household welfare and GDP will weaken significantly, and investment, in the case of exchange rate rigidity, will decline.

The obtained results should be interpreted with several limitations in mind. In particular, the modeling does not take into account the economic effects of the construction phase of the power unit, which are associated with increased investment, employment, and demand for construction materials, but are temporary in nature and, *ceteris paribus*, will not lead to changes in GDP in the new steady state.

In addition, the modeling does not consider possible structural changes in the economy associated with the development of new energy-intensive activities, such as data processing centers, electric transport, or electrification of the housing stock.

Significant uncertainty also remains regarding key project parameters, including the cost of constructing the third power unit, the volume of natural gas substitution, and the necessity and terms of Russian financing. Changes in these parameters may substantially affect the quantitative estimates of macroeconomic effects.

The long implementation period of the project (around 10 years) also creates high uncertainty in assessing its macroeconomic effects based on current economic conditions.

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