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European Department

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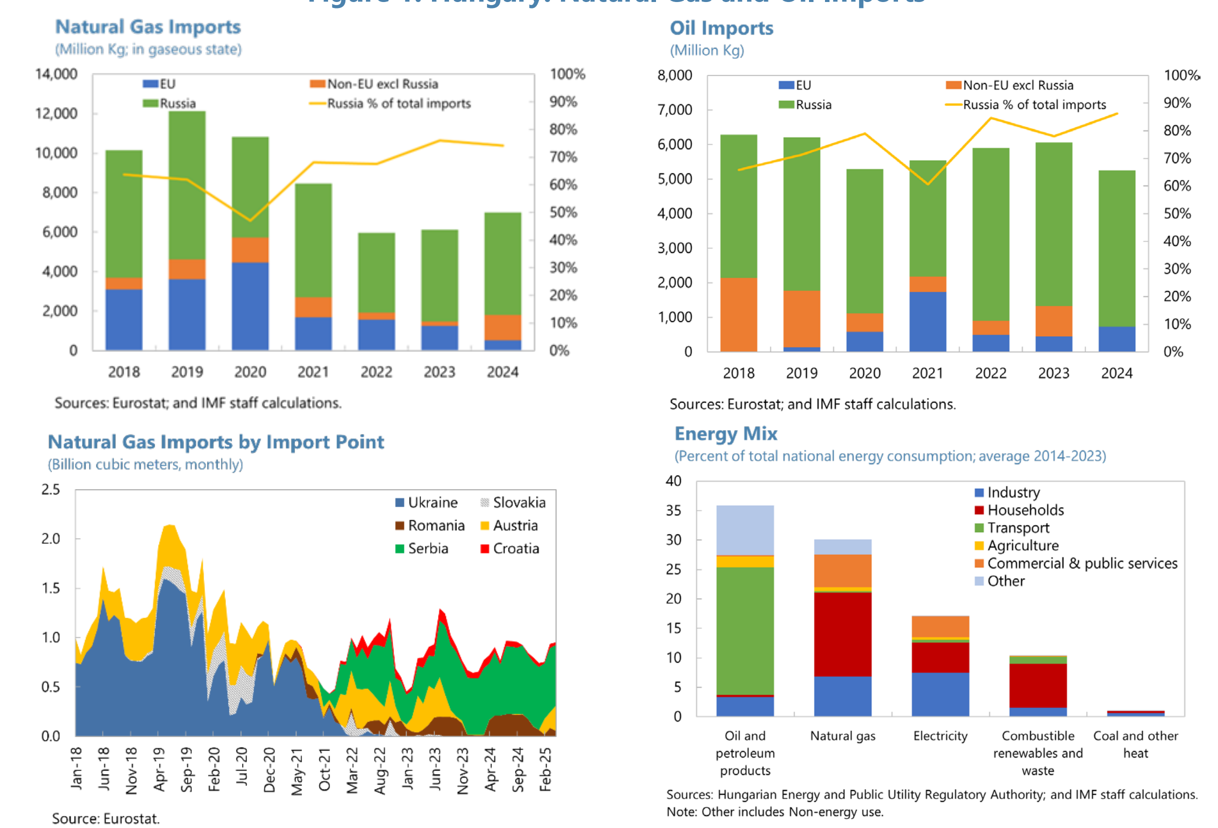
PROMOTING ENERGY SECURITY IN HUNGARY: A MODEL-BASED ANALYSIS

A. Introduction

1. **Russia's war in Ukraine brought energy security to the policy forefront, and highlighted Hungary's vulnerability to energy supply shocks.** As supply disruptions and concerns about frictions in the gas pipeline network to Europe led to a price spike in mid-2022, Hungary's current account deficit doubled as a percentage of GDP to -8.5 percent of GDP and its retail gas, electricity and fuel subsidies surged from 0.1 percent of GDP in 2021 to 1.1 percent in 2022 and 1.9 percent in 2023.

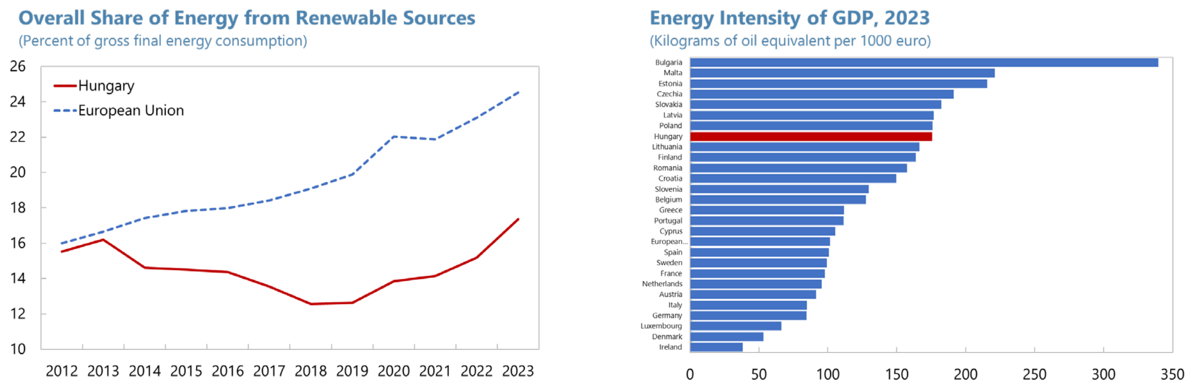
2. **Despite recent progress in diversifying the energy mix, Hungary remains heavily reliant on Russian energy imports.** In 2024, up to three-quarters of Hungary's gas and oil consumption was imported, with 74 percent of gas and 86 percent of oil sourced from Russia—up from 64 and 66 percent in 2018. Beyond high dependence, energy flows to Hungary rely on a few critical transit routes, notably TurkStream via Serbia and the Adria pipeline via Croatia, increasing vulnerability to disruption. Efforts to diversify supply—such as new imports from Azerbaijan and Turkey—remain limited in scale. While electricity generation is largely domestic, driven by nuclear and a growing share of solar, Russian energy continues to dominate Hungary's overall supply mix.

Figure 1. Hungary: Natural Gas and Oil Imports



3. At the same time, Hungary is one of the most energy-intensive economies in Europe. Hungary uses significantly more energy per unit of GDP than the EU average, reflecting structural inefficiencies and a legacy of energy-intensive production. Industry accounts for a large share of final energy demand, particularly in sectors like chemicals, basic metals, and automotive manufacturing—where energy costs are a major determinant of output and investment.

Figure 2. Hungary: Overall Share of Energy from Renewable Sources and Energy Intensity of GDP



Source: Eurostat.

Source: Eurostat.

4. A full EU-wide phaseout of Russian energy supply would weigh heavily on the Hungarian economy, underscoring the urgency and macro-criticality of energy security reforms. As the EU moves to phase out Russian energy imports by end-2027, the case for decisive policy efforts on energy security has grown stronger. With limited alternative supply routes and high energy intensity, Hungary is especially vulnerable to both supply disruptions and price shocks. Findings from IMF staff's research (Di Bella et al. 2024) show that Hungary could face the steepest output losses in the event of an EU-wide Russian natural gas cutoff—exceeding 4 percent of GDP. This highlights the critical need to accelerate energy diversification, improve efficiency, and promote stronger integration in the regional electricity market.

5. This paper examines the energy security implications of alternative policy scenarios for Hungary. Using a model-based framework, the paper investigates energy security outcomes under a comprehensive policy package that combines EU-wide instruments with complementary domestic measures. The remainder of the paper is organized as follows. Section B defines and outlines the framework for measuring energy security. Section C describes the modeling approach. Section D presents the policy scenarios. Section E discusses the simulation results, while section F concludes.

B. Measuring Energy Security

6. Energy security is a multidimensional concept that can be quantified in many ways. Following the recent literature (Dolphin et al., 2024; Kim et al., 2025), our focus is on two dimensions, security of supply and economic resilience to energy shocks.

- **Security of Supply**: This refers to the risk associated with disruptions in foreign energy supplies, which is evaluated using a composite energy insecurity index à la Cohen et al. (2011). The index incorporates two components—energy import dependence and the geographic concentration of energy sources—and is formally defined as a weighted Herfindahl-type measure (Equation 1):

$$\sum_i \left(\frac{(net\ energy\ imports)_i}{energy\ consumption}\right)^2 (non\text{-}European\ indicator)_i \quad (1)$$

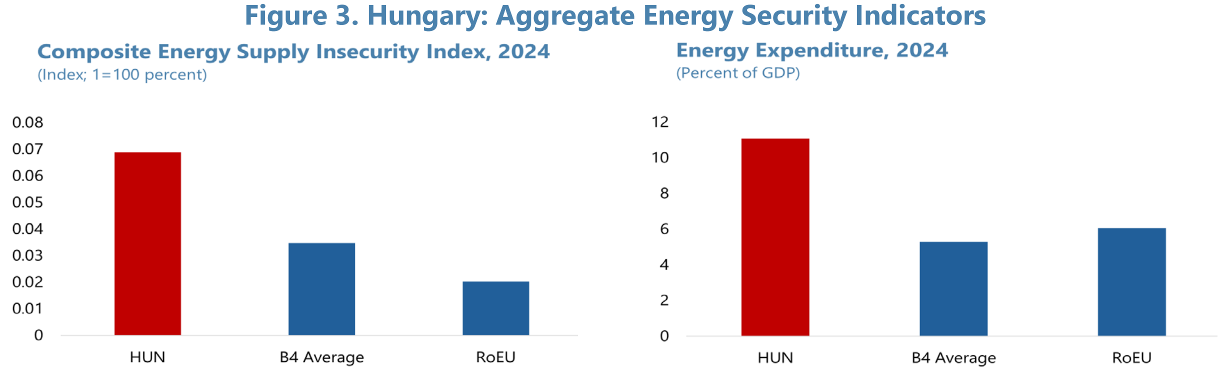
where i indexes non-European supplier countries. A distinguishing feature of our approach—based on Dolphin et al. (2025)—is that energy imports from within the EU, EFTA, and the UK are assigned zero risk weight, reflecting their integration within a common regulatory and infrastructure framework. By contrast, non-European suppliers receive unit weight, reflecting higher geopolitical and logistical risks. This measure captures both import dependence and source concentration, with higher index values signaling greater vulnerability to external shocks.

- **Economic Resilience:** To capture an economy's ability to absorb energy price and supply shocks, we use the energy expenditure share of nominal GDP (Equation 2). This ratio serves as a proxy for macroeconomic vulnerability to energy price volatility. Higher energy intensity signals greater exposure, while lower values reflect stronger resilience. Combined with the supply security index, this metric offers a dual perspective on cross-country energy vulnerability and underpins the empirical foundation of our model-based analysis.

$$Economic\ Resilience\ Index = \frac{Energy\ Expenditure}{Nominal\ GDP} \quad (2)$$

7. Hungary scores poorly on both measures of energy security, with a composite energy supply insecurity index that is nearly twice the average of the EU's four largest economies and more than double that of the rest of Europe—reflecting high import dependence and low diversification of non-EU import sources. Hungary's energy expenditure share of GDP is also elevated, about twice that of Western European peers, largely indicating the energy-intensive nature of the country's key sectors such as automotive manufacturing, chemicals, and metals.

Figure 3. Hungary: Aggregate Energy Security Indicators



Sources: International Energy Agency (2024); IMF staff calculations.
Note: B4 average refers to average of France, Germany, Italy, and United Kingdom.
RoE= Rest of Europe.

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C. Model Description

8. A state-of-the-art global CGE model is employed to assess Hungary's energy security risks relative to other EU economies. The IMF-ENV model is a recursive dynamic computable general equilibrium model that integrates standard neo-classical optimization of production, consumption, trade, and factor markets—with an energy module that explicitly links energy demand and supply to greenhouse gas (GHG) emissions. The model is particularly suitable for our analysis due to its unique features. For example, goods are differentiated by origin (Armington, 1969), allowing for substitution between domestic and imported energy while capturing infrastructure and transport frictions (e.g., LNG vs. pipeline gas). Capital is modeled by vintage, distinguishing flexible allocation of new investment from the rigidity of existing capital stock. The model is calibrated to Hungary using the GTAP-Power database together with macroeconomic projections from the IMF's *World Economic Outlook* and electricity generation projections from the JRC-GECO (Keramides *et al.* 2025). It compares a baseline to policy counterfactuals through 2030 to evaluate effects on GDP, energy mix and intensity, and emissions. The latest version of the model is fully described in Chateau et al. (2025).

9. **A few of the key model equations—that are directly relevant for our analysis—are summarized below**.

- *The generic CES production function:* Output (V_i) is derived from composite inputs using a constant elasticity of substitution (CES) production function, governing how sectoral output responds to relative input prices (P_i) and productivity ($A\lambda_i$) differences (Equation 3).

$$V_i = \alpha_i^{\sigma}(A\lambda_i)^{\sigma-1}\left(\frac{P}{P_i}\right)^{\sigma} X_a \ , \quad P = \frac{1}{A}\left[\sum_i \alpha_i \left(\frac{P_i}{\lambda_i}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \qquad (3)$$

- Overall *production* is modeled as a nested CES function, which each node using the generic CES function defined above. One of these nodes includes the energy price aggregation that combines electricity and non-electricity energy sources into a composite energy bundle ($PNRG_{r,a,v}$), allowing substitutions across energy types based on elasticity ($\sigma^{e}_{r,a,v}$) while capturing changes in technology, regulation, and supply mix:

$$PNRG_{r,a,v} = \left[\alpha^{ely}_{r,a,v}\left(PA^{ely}_{r,a,v}\right)^{1-\sigma^{e}_{r,a,v}} + \alpha^{nely}_{r,a,v}\left(PNELY_{r,a,v}\right)^{1-\sigma^{e}_{r,a,v}}\right]^{\frac{1}{1-\sigma^{e}_{r,a,v}}} \qquad (4)$$

- *Carbon pricing mechanism:* Region-specific climate and energy policy instruments (e.g., carbon tax, ETS permit prices) apply to taxable (τ^{a}) prices of origin-differentiated goods ($PAT_{r,i,aa}$), with Pigouvian-type carbon tax (τ^{emi}) levied on GHG emissions (emi):

$$PA_{r,i,aa} = \left(1+\tau^{a}_{r,i,aa}\right)PAT_{r,i} + \sum_{em} \tau^{emi}_{r,em,i,aa} \cdot Emi_{r,em,i,aa} \qquad (5)$$

D. Policy Options for Strengthening Energy Security and Advancing the Green Transition

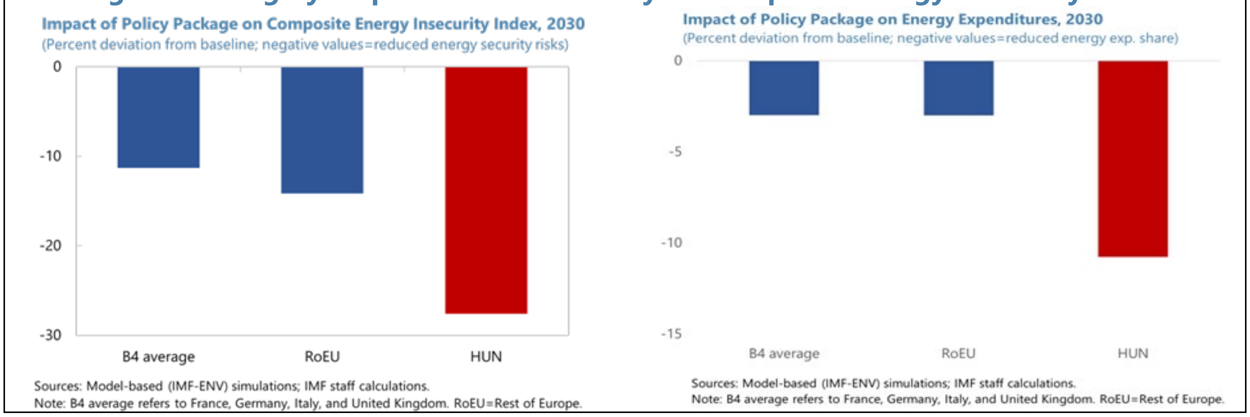
10. EU-wide and domestic policy scenarios are calibrated to assess their impact on Hungary's energy security and macroeconomic resilience. While EU measures shape the broader policy landscape, Hungary's structural vulnerabilities require complementary domestic reforms to reduce import dependence, raise efficiency, and accelerate the energy transition. The calibrated policy measures are summarized below, with the specific model shocks provided in Annex A.

- EU-level Instruments:
  - *Higher EU-wide carbon prices*: a significant increase in carbon prices under the EU and UK Emissions Trading Systems (ETS), reaching €110 by 2030.
  - *Deeper EU Energy Union:* This scenario models increased cross-border electricity trade driven by lower trade costs under deeper European market integration. It explores how greater import dependence within the EU—offset by reduced reliance on concentrated non-European suppliers—can enhance energy supply security across the EU, including in Hungary.
- Complementary domestic policies:
  - *Tighter standards for transport and buildings*: this scenario simulates stricter energy efficiency standards, including for road transport and buildings. It captures the effects of regulatory policies aimed at reducing energy demand by improving the performance of vehicles, buildings, and household consumption behavior.
  - *Accelerated renewables permitting:* this scenario assumes 40 percent faster permitting processes for wind and solar energy projects, modeled as a significant improvement in deployment efficiency. The objective is to reflect the potential gains from cutting administrative delays, thereby facilitating greater investment in renewable energy infrastructure.
  - *Tighter energy efficiency standards for households:* This scenario represents tighter household energy efficiency standards, combined with targeted public investment toward the adoption of heat pumps. It reflects a structural shift in residential energy use away from fossil fuels and toward electricity, aligned with broader goals of electrification and energy transition.
  - *Fossil fuel subsidy removal:* this scenario simulates the full phaseout of fossil fuel subsidies by 2030, calibrated using pre-crisis estimates. It captures the impact of removing price distortions that artificially lower the cost of fossil fuel consumption, thereby aligning energy prices more closely with environmental and security objectives.

E. Simulation Results

11. A comprehensive policy package comprising the layers above could greatly enhance Hungary's energy security and macroeconomic resilience. The results suggest that such a policy package can help diversify Hungary's energy supply and reduce energy security risks by up to 30 percent and cut the energy expenditure share of GDP by up to 10 percent over the next five years. These gains reflect Hungary's high reliance on imported fossil fuels and its energy-intensive economy, making it particularly responsive to measures that lower import concentration, boost efficiency, and accelerate the clean energy transition.

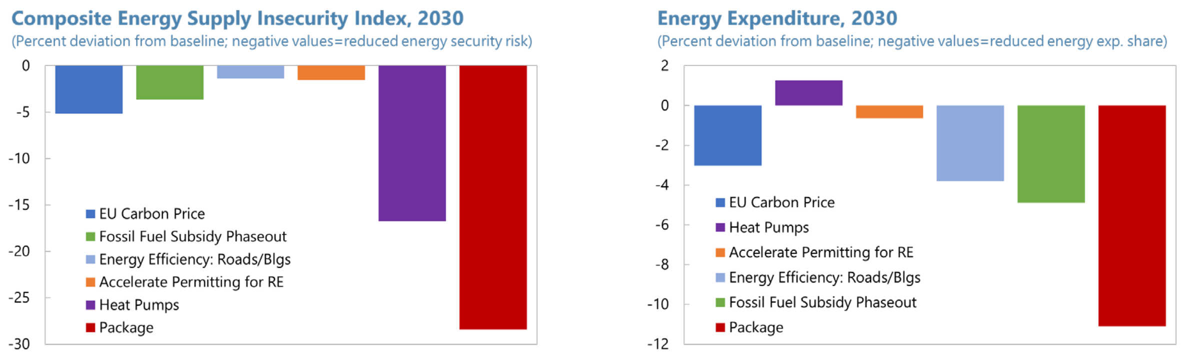
Figure 4. Hungary: Impact of Climate Policy on Composite Energy Insecurity Index



12. Domestic policies will be critical to reap energy security gains. While EU-level initiatives—such as carbon pricing and electricity market integration—can strengthen market price signals and incentivize efficient energy use and investment, their effectiveness hinges on complementary national measures. In Hungary, tighter household energy efficiency standards, especially from investment in heat pumps[1], deliver the largest benefits by reducing dependence on imported natural gas. Phasing out fossil fuel subsidies further strengthens resilience by correcting entrenched price distortions. Eliminating bureaucratic red tape to accelerate permitting processes for investment in renewable energy can also promote energy security, including by strengthening reliance on secure domestic energy production. In short, fully realizing the energy security dividends of the green transition will require bold domestic reforms—particularly to enhance energy efficiency, streamline permitting processes in the energy sector, tighten building standards, and eliminate inefficient subsidies.

[1] The upfront cost of installing heat pumps, which is estimated to be modest, would be covered by EU RRF funds.

Figure 5. Hungary: Decomposition: Domestic versus EU-wide Measures



Sources: Model-based (IMF-ENV) simulations; and IMF staff calculations.
Note: B4 average refers to France, Germany, Italy, and United Kingdom. RoEU=Rest of Europe.

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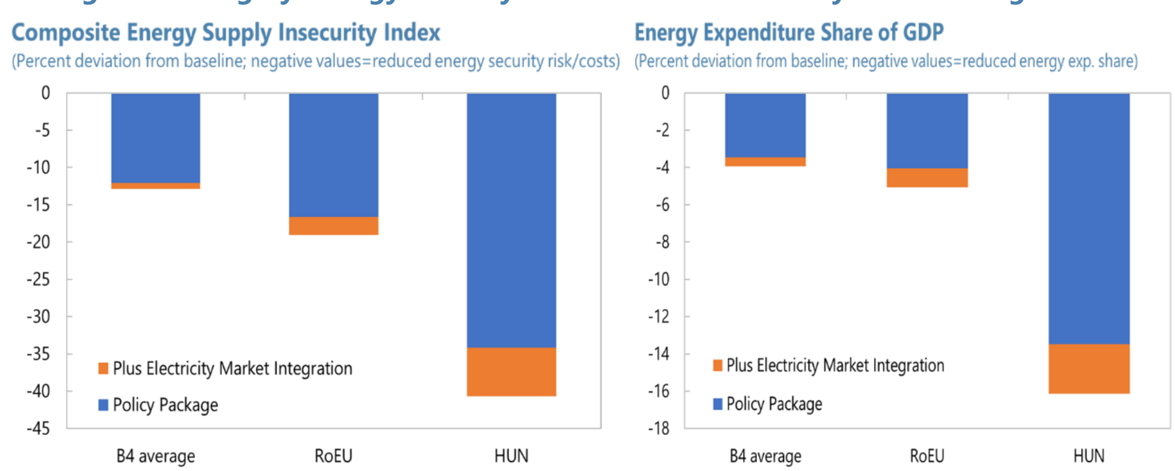
13. Hungary would reap further gains from a deeper EU energy union. Advancing electricity market integration—through regulatory alignment and investment in cross-border grid infrastructure—would strengthen energy security across the EU. For Hungary, the additional benefits are substantial, with supply risk falling by up to 7 percentage points and energy expenditure dropping by up to 3 percentage points of GDP by 2030.

Figure 6. Hungary: Energy Security Gains from EU Electricity Market Integration



Sources: Eurostat; International Energy Agency (2024); and IMF staff calculations.
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14. Combined, these policies could cushion the impact of a full Russian energy cutoff. As discussed in the introduction (¶4), the planned EU-wide phaseout of Russian energy imports by end-2027 would pose a critical stress test for the Hungarian economy, given the country's high energy intensity and continued reliance on Russian supplies. To evaluate the energy security implications, we simulate two scenarios: (i) a business-as-usual path with no additional measures, and (ii) a comprehensive policy package combining domestic reforms with deeper EU electricity market integration.

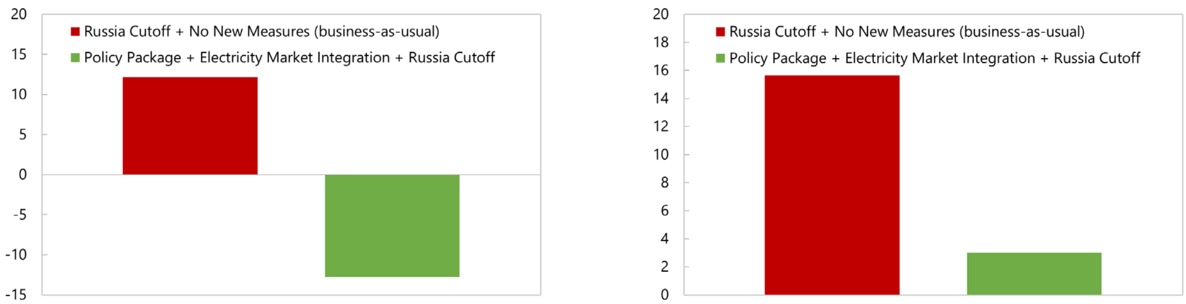
- *Under business-as-usual* (red bars), Hungary would face a marked deterioration in energy security. The full cutoff of Russian energy raises both import risk and energy expenditure significantly, exposing the economy to heightened vulnerability. This outcome reflects the continued reliance on concentrated, high-risk external suppliers and the absence of mitigating domestic or regional policy responses.

- *With the full policy package* (green bars), these risks could be largely contained. The combination of tighter efficiency standards, renewables permitting reforms, subsidy phaseout, and EU electricity market integration substantially reduces both energy insecurity and costs. The shock is transformed from a severe disruption into a manageable adjustment, demonstrating the payoff from coordinated, forward-looking policy action.

Figure 7. Hungary: Energy Security Outcomes of Potential Russia Energy Flow Cutoff to Europe

Composite Energy Insecurity Index, 2030 (Percent deviation from baseline; negative values=reduced energy security risk)

Energy Expenditure, 2030 (Percent deviation from baseline)



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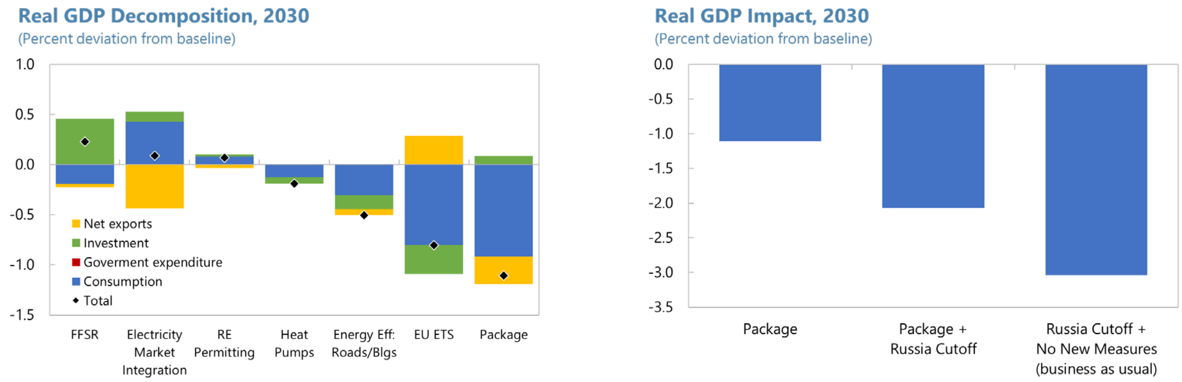
B4 average refers to France, Germany, Italy, and United Kingdom. RoEU=Rest of Europe.

15. The proposed energy security policies would have a modest impact on growth. While largely illustrative, the simulation results show that these policies would have a modest impact on real GDP growth over the medium term, reflecting trade-offs and complementarities across policy instruments (left chart, Figure 9). The removal of fossil fuel subsidies provides the largest GDP gains, as it improves allocation efficiency and decreases the government budget deficit. Market-enhancing measures, such as electricity market integration and streamlined permitting for renewables, yield modest growth benefits by improving efficiency and spurring private investment. In contrast, the EU ETS can weigh on short-term output—although conditional on how the revenues are recycled. Partial recycling of carbon pricing revenues to households can help build political support for the green transition, but using the revenues to reduce the fiscal deficit and/or increase public investments could have more favorable growth outcomes. Enhanced energy efficiency standards, while imposing short-term cost burdens on firms and households, can strengthen long-run resilience. Importantly, the competitiveness and diversification gains from these proactive policies could significantly mitigate potential output losses from a full Russian energy cutoff while promoting long-term resilience (right chart, Figure 9).

Figure 8. Hungary: Illustrative Growth Effects Across Policy Scenarios

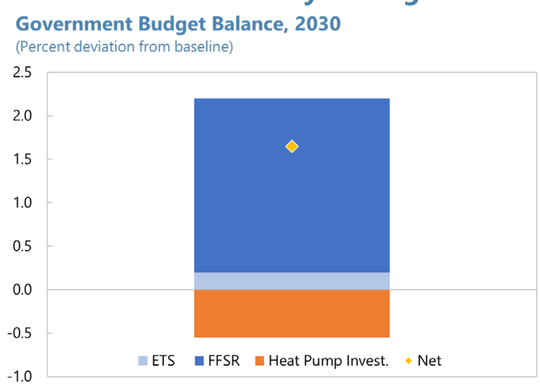


Sources: IMF staff calculations based on IMF-ENV model.

Source: IMF staff calculations based on IMF-ENV model.

16. Well designed, the policy package could generate strong fiscal dividends. The simulation results in Figure 10 show that the combined fiscal gains from fossil fuel subsidy removal (FFSR) and EU ETS carbon pricing revenues more than offset the public investment required for heat pump deployment. By 2030, the net improvement in the budget balance—about 1.7 percent of GDP—demonstrates how targeted reforms can expand fiscal space while advancing energy security and supporting structural transformation.

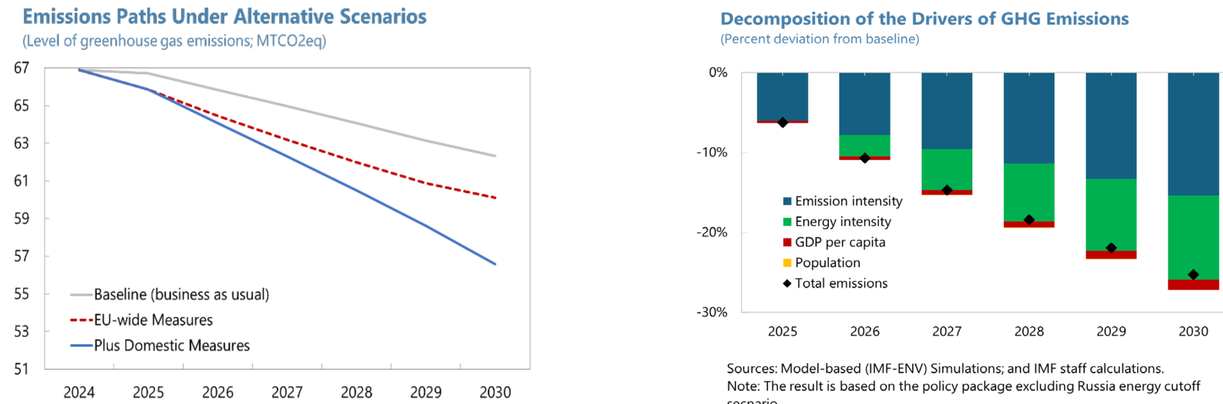
Figure 9. Hungary: Illustrative Fiscal Effects of Policy Package



Sources: IMF staff calculations based on IMF-ENV model.

17. These measures would also greatly contribute to Hungary's decarbonization agenda. As a member state, Hungary is committed to the EU Fit-for-55 target of cutting national emissions by 55 percent (relative to 1990) by 2030 and achieving climate neutrality by 2050. While EU-wide policy carbon pricing (ETS) and other instruments are underpinning the broad policy direction for advancing the green transition across all member states, complementary domestic policies are also essential to put Hungary on a credible path to climate neutrality. EU-wide carbon pricing helps reduce emissions (left chart). However, the energy security and emissions reduction gains are larger when EU-wide carbon pricing is combined with national measures. These complementary measures act through key channels: they reduce Hungary's high energy intensity, promote a shift toward cleaner energy sources, and decouple GDP growth and emissions (right chart).

Figure 10. Hungary: Emissions Paths under Alternative Scenarios and Decomposition of the Drivers of GHG Emissions



Sources: Model-based (IMF-ENV) Simulations; and IMF staff calculations.

Sources: Model-based (IMF-ENV) Simulations; and IMF staff calculations.
Note: The result is based on the policy package excluding Russia energy cutoff secnario.

F. Conclusion

18. **Strengthening Hungary's energy security will require a comprehensive domestic reform agenda.** While EU-wide initiatives such as deeper electricity market integration and higher carbon pricing through the EU-ETS can support resilience, their full benefits depend on complementary national actions. Targeted domestic measures—enhancing energy efficiency, accelerating renewable permitting, phasing out fossil fuel subsidies, and tightening building standards—can significantly reduce Hungary's energy security risks and energy expenditure while advancing decarbonization goals. Seizing these opportunities will be critical to building a more resilient, sustainable, and competitive economy.

References

Armington, P. S. (1969). A theory of demand for products distinguished by place of production. International Monetary Fund Staff Papers, 16:159–76.

Chateau, Jean, Hugo Rojas-Romagosa, Sneha D. Thube, and Dominique van der Mensbrugghe. 2025. *IMF-ENV: Integrating Climate, Energy, and Trade Policies in a General Equilibrium Framework*. IMF Working Paper No. 2025/071. Washington, DC: International Monetary Fund. https://www.imf.org/en/Publications/WP/Issues/2025/04/11/IMF-ENV-Integrating-Climate-Energy-and-Trade-Policies-in-a-General-Equilibrium-Framework-565817

Cohen, Gail, Fred Joutz, and Prakash Loungani. 2011. "Measuring Energy Security: Trends in the Diversification of Oil and Natural Gas Supplies." *Energy Policy* 39 (9): 4860–4869. https://doi.org/10.1016/j.enpol.2011.06.034

Di Bella, Gabriel, Mark Flanagan, Karim Foda, Svitlana Maslova, Alex Pienkowski, Martin Stuermer, and Frederik Toscani. 2024. "Natural Gas in Europe: The Potential Impact of Disruptions to Supply." *Energy Economics* 138 (October): 107777. https://doi.org/10.1016/j.eneco.2024.107777

Dolphin, Geoffroy, Romain A. Duval, Hugo Rojas-Romagosa, and Galen Sher. 2024. *The Energy Security Gains from Strengthening Europe's Climate Action*. IMF Departmental Paper No. 2024/010. Washington, DC: International Monetary Fund. https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2024/05/17/The-Energy-Security-Gains-from-Strengthening-Europes-Climate-Action-544924

Keramidas, Kyriakos, François Fosse, Francisco Aycart Lazo, Fergus J. Dowling, Riccardo Garaffa, Jorge Ordoñez, Srdjan Petrovic, Pieter Russ, Bettina Schade, Anne Schmitz, Angel Soria Ramirez, Cécile Van Der Vorst, and Matthias Weitzel. 2025. *Global Energy and Climate Outlook 2024: Updating NDCs and Closing the Ambition Gap – Indicators for 1.5°C Alignment*. Luxembourg: Publications Office of the European Union.

Kim, Jaden, Florence Jaumotte, Augustus J. Panton, and Gregor Schwerhoff. 2025. "Energy Security and the Green Transition." *Energy Policy* 198: 114409. https://doi.org/10.1016/j.enpol.2024.114409

Annex I. Description of Shocks

Policy shock	Model shocks	Associated costs / savings
Higher EU-wide carbon prices	We assume in the baseline that the implicit carbon prices from the EU (and UK) ETS are 70 euro per ton between 2024 and 2030. For the policy shock, the carbon price is gradually increased to 110 euro in 2030.	We assume that all revenues from the EU-ETS are transferred back to households.
Deeper EU Energy Union	We assume that changes in regulation and internal market developments reduce the barriers on electricity trade such that overall trade increases by 50 percent.	No explicit costs are modeled, although investments in the European grid would be required.
Tighter regulations on energy efficiency in road transport and buildings	Increased energy efficiency in Europe's transport services sector, proxied by 13 percent reduction in consumption compared to the baseline. To capture tighter regulations on buildings, energy efficiency improves in the "other business services" sector (which includes real estate activity, the main economic sector that operates buildings) to reduce its energy consumption by 5 percent. Households, which contribute to both transport and building emissions, adjust their preferences to reduce their energy consumption by 8 percent.	Dolphin *et al.* (2024) estimate these energy efficiency measures to cost 0.6 percent of yearly gross fixed investment in the case of road transport and 2.2 percent in the case of buildings. The total (2.8 percent) gross fixed investment is deducted from total investments in the model each year.
Accelerated Permitting Procedures	This is estimated to increase TFP of wind and solar power operations, which encourages investment and raises wind and solar power generation by 10 percent relative to the baseline by 2030. This 10 percent improvement is consistent with a 40 percent improvement in the speed of renewable deployment, as would arise if the median European country's permitting times could match those of the country at the top quartile.	No explicit costs are modeled.
Tighter energy efficiency standards for households	To simulate this policy, European households' preferences are shifted away from energy, reducing their overall demand by 6 percent. This is achieved by simulating that European households reduce their demand for coal and gas by 50 percent and increase their electricity demand by 15 percent.	The public investment in heat pumps in residential buildings in Europe is estimated to cost 0.42 percent of gross fixed investment per year (see Dolphin *et al., 2024)*. For Hungary this represents around USD 236 million per year.
Removing fossil fuel subsidies	Using information provided by the authorities, total energy subsidies are estimated to be close to 2 percent of GDP in 2023. Of this, 75 percent represent subsidies to household consumption of natural gas and the remaining 25 percent to household consumption of electricity.	50 percent of the savings are transferred back to households and 50 percent are used to reduce the budget deficit