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Société Générale Economic and Sector Studies

EU energy dependence has eased, but still bites

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Efforts to reduce EU energy dependence in the wake of Russia's invasion of Ukraine back in 2022 have paid off, allowing the EU to face the latest energy shock from a better position. To track these developments, we introduce a set of Energy Dependence Indicators (EDIs) for the EU, taking on values between 0 and 1. Our Supply EDI shows a decline from 0.35 to 0.27 between 2010 and 2025, with most of the improvement coming from the post-2022 supply chain reconfiguration. Our Oil and Gas Price EDI fell more markedly from 0.36 to 0.20, supported by steady energy efficiency gains and a shift towards other energy sources. While the EU27 has made undeniable progress, further efforts are required to reduce energy dependence. Moreover, such efforts need to go beyond the EU's 2030 climate targets, which, together with REPowerEU, currently provide its main route to reducing energy dependence.

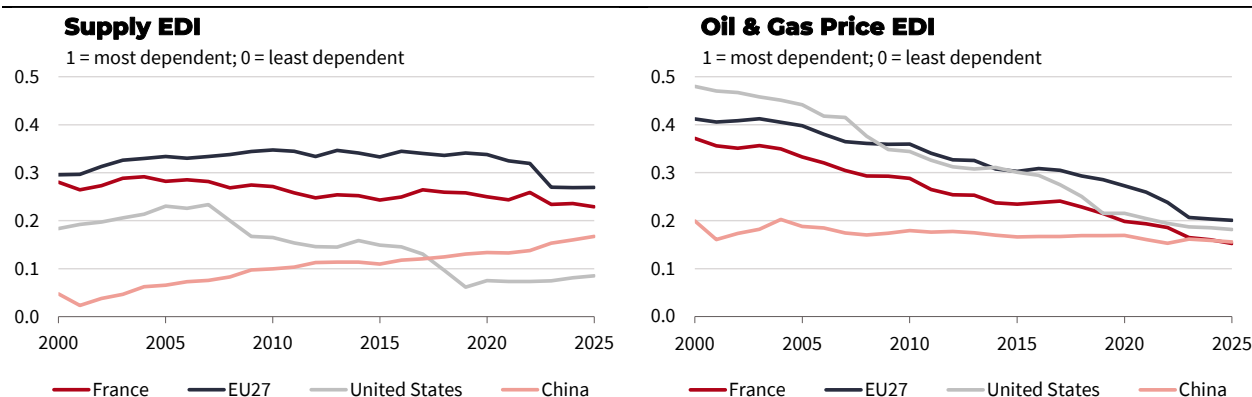
Geopolitical shocks accelerated a rethink

Russia's invasion of Ukraine on 24 February 2022 delivered a twin energy shock that sent European gas prices soaring and threatened supplies. The Middle East conflict that began on 28 February 2026 delivered a second twin shock in just four years.

Our Energy Dependence Indicators (EDIs) show that the EU entered this latest shock in a stronger position, but dependence remains.¹ Our Supply EDI takes the power mean of energy imports as a share of gross available energy and import concentration, as measured by the Herfindahl–Hirschman Index (HHI).² A score of 1 hence represents a country that imports all its energy from one single other country. Our Oil and Gas Price EDI then takes the power mean of the Supply EDI and the economy's oil and gas intensity. The indicator therefore assigns lower dependence scores to more energy-efficient economies and to those less reliant on oil and gas, particularly imported oil and gas.

¹ Both EDIs use the power mean $EDI_p(x, y) = \left[\frac{x^p + y^p}{2} \right]^{1/p}$, with $p = 0.5$, as compromise between a simple and geometric mean, giving more weight to imbalances than the simple mean while avoiding the geometric mean's sensitivity to values close to zero.

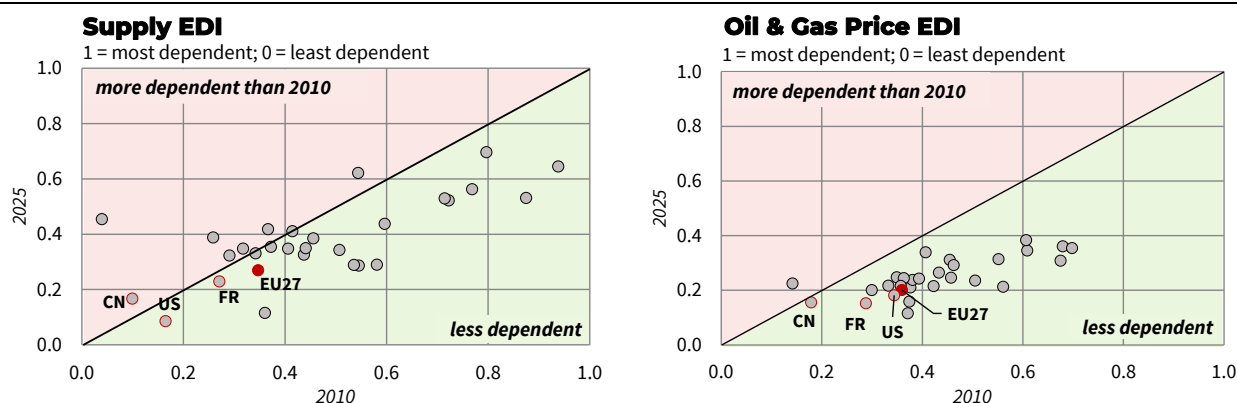
² The Herfindahl–Hirschman Index (HHI) measures import concentration by summing the squared shares of imports from each supplier; higher values indicate greater concentration and import dependence.

Chart 1: While EU price dependence has declined steadily, supply dependence did so only recently

Sources: Eurostat, SG Economic and Sector Studies; Note: (1) The Supply EDI is the power mean of energy imports as a share of total energy available, and import concentration measured by the Herfindahl-Hirschman Index. (2) The Oil and Gas Price EDI then takes the power mean of (1) and the normalised oil and gas intensity of the economy to account for exposure to price volatility. The EU27 aggregate should be interpreted as an illustrative benchmark because aggregation effects mask country-level progress and vulnerabilities.

As illustrated in Chart 1, the EU's Supply EDI increased between 2000 and 2010, largely due to growing dependence on Russian gas. The year 2010 serves as a relevant benchmark, as this was also when the EU's climate efforts began to accelerate following the adoption of the 2020 Climate and Energy Package in April 2009. The Supply EDI has since stabilised and then declined, and sharply so after Russia's invasion of Ukraine in 2022, but remains well above that of the US, whose Supply EDI has declined sharply since 2016 due to the expansion of shale production. Turning to the Oil and Gas Price EDI, the EU appears less disadvantaged. This reflects both improved energy efficiency and diversification away from oil and gas, as discussed in more detail below.

There have been broad improvements in both EDIs, but improvements in price dependence have dominated those in supply dependence (Chart 2). The Supply EDI has declined for 20 member states and has also become less dispersed, as the

Chart 2: Energy Dependence Indicators (EDIs) have declined for most EU countries over 2010-25

Sources: Eurostat, SG Economic and Sector Studies; Note: (1) The Supply EDI is the power mean of energy imports as a share of total energy available, and import concentration measured by the Herfindahl-Hirschman Index. (2) The Oil and Gas Price EDI then takes the power mean of (1) and the normalised oil and gas intensity of the economy to account for exposure to price volatility. The EU27 aggregate should be interpreted as an illustrative benchmark because aggregation effects mask country-level progress and vulnerabilities.

range declined from 0.9 to 0.6, with the more dependent countries catching up. The Oil and Gas Price EDI shows improvements across a greater number of countries.

Digging deeper into the underlying metrics, three observations stand out. First, the speed at which the EU diversified its energy supplies was impressive. Following the sudden reduction of Russian gas, the EU reconfigured its supply chains rapidly. Secondly, increased renewable energy production has both boosted domestic energy output and supported electrification. Thirdly, the focus on energy efficiency has delivered important gains. Significant stockpiles provided further support, allowing the EU and other economies to draw on oil and gas inventories during the 2026 energy shock. Combined, these improvements allowed the EU to enter the 2026 energy shock from a stronger position. Owing to data limitations, however, we have not yet included stockpiles in our EDIs, but they are considered in the analysis below.

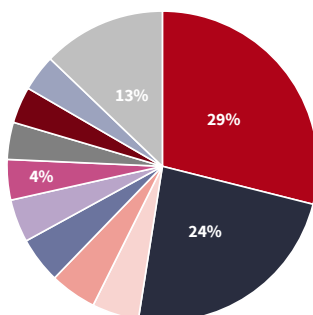
1. Fast-track import supply diversification

The 2022 energy shock pushed the EU to diversify rapidly away from Russia, sharply reducing its import concentration. Russia's share of total extra-EU energy imports increased from 17% in 2000 to a peak of 28% in 2013. Import concentration rose in tandem: measured by the HHI, concentration increased from 0.13 to 0.18 over the same period (see Charts 3 and 4). The risk materialised in 2022, when cuts to Russian energy supplies forced the EU to rapidly reconfigure its sources of supply. By 2025, the EU had replaced around 85% of its former energy imports from Russia in volume terms, mainly through additional imports from a wider set of existing partners, notably the US (+9pp), Norway (+4pp) and Kazakhstan (+3pp). This broadened the EU's import base and reduced concentration risk, with the HHI falling from 0.15 in 2021 to 0.07 in 2024.

Chart 3: The EU rapidly reconfigured its supply sources since the 2022 energy shock...

EU: energy imports by source country

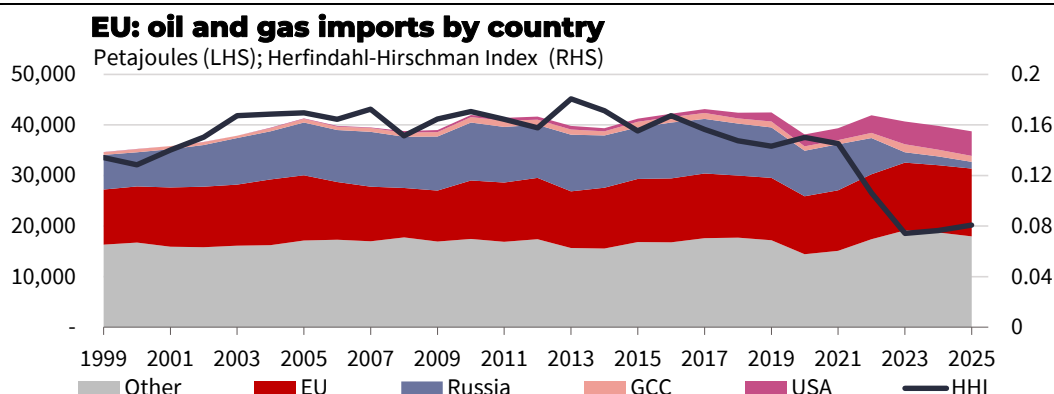
2019



2025



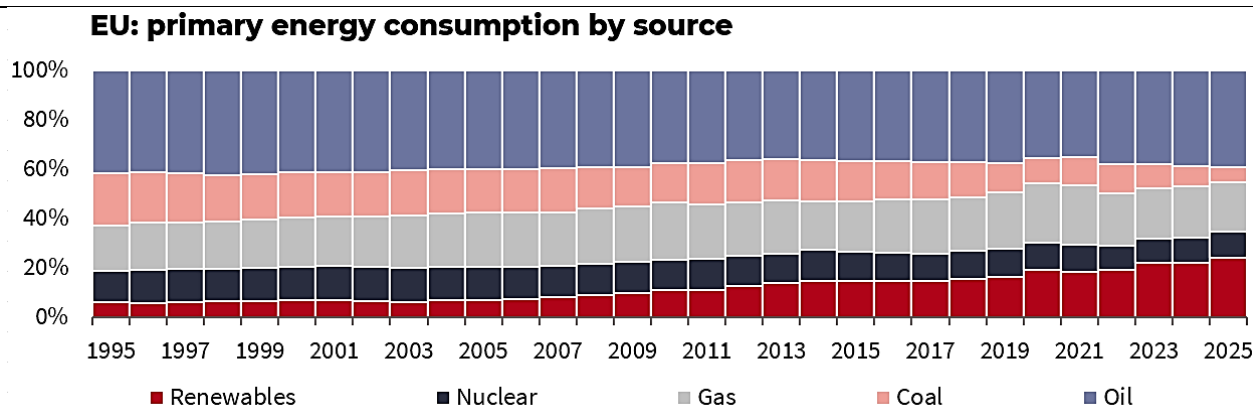
Sources: Eurostat, SG Economic and Sector Studies; Note: The sample includes the EU's top 10 sources of energy imports;

Chart 4: ...leading to a significantly reduced import concentration of its energy imports

Sources: Eurostat, SG Economic and Sector Studies; Note: EU includes EFTA; GCC refers to the Gulf Cooperation Council countries (Qatar, Bahrain, Kuwait, Oman, Saudi Arabia, and the UAE); HHI refers to the Herfindahl-Hirschman Index for import concentration from non-EFTA countries.

2. Accelerated domestic production

Since 2010, the EU's decarbonisation agenda has accelerated the shift towards domestically produced renewable energy and reduced the economy's reliance on oil and gas. Between 2010 and 2025, renewable intensity increased twice as fast as it did between 1995 and 2009. Over the longer period, the share of renewables in primary energy supply rose from 6% in 1995 to an estimated 24% in 2025. Nuclear power, whose share in the energy mix has remained broadly stable at around 12%, remains an important source of domestically produced energy (see Chart 5).

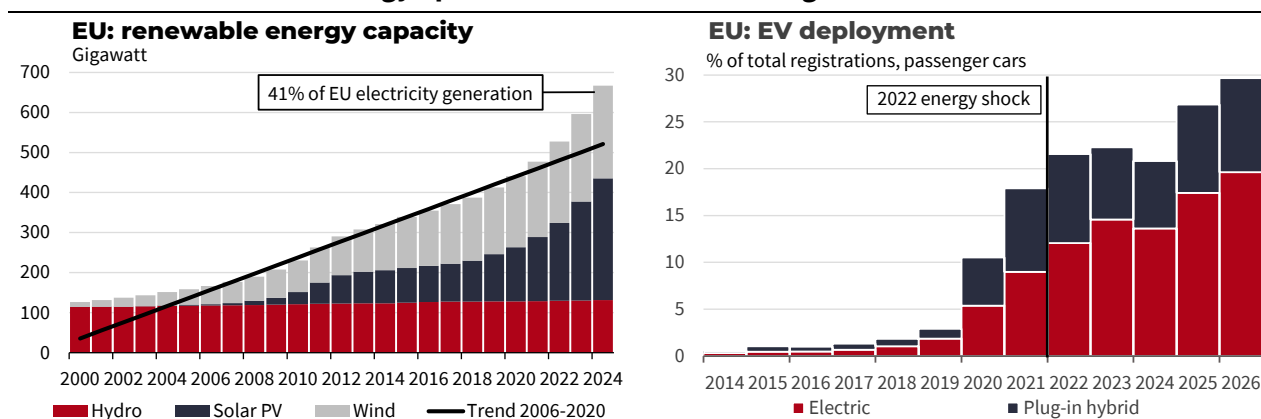
Chart 5: A growing role of domestically produced renewables

Sources: Eurostat, Our World in Data, SG Economic and Sector Studies; Note: the 2025 figure is an estimate based on the 2022-2024 linear trend

The 2022 energy shock accelerated this trend. Higher gas prices and threatened supply strengthened incentives to invest in domestic energy sources. Since 2022, the domestic share of primary energy production has increased from 37% to 43% in 2025, a 6pp increase in just three years. Higher gas prices also improved the relative economics of local generation, helping wind, solar and hydropower capacity move

above their long-term trends after 2022. Electrification has reinforced the shift, with EVs approaching 30% of new passenger car registrations so far in 2026 (see Chart 6).

Chart 6: Renewable technology uptake has risen above its long-term trend since 2022



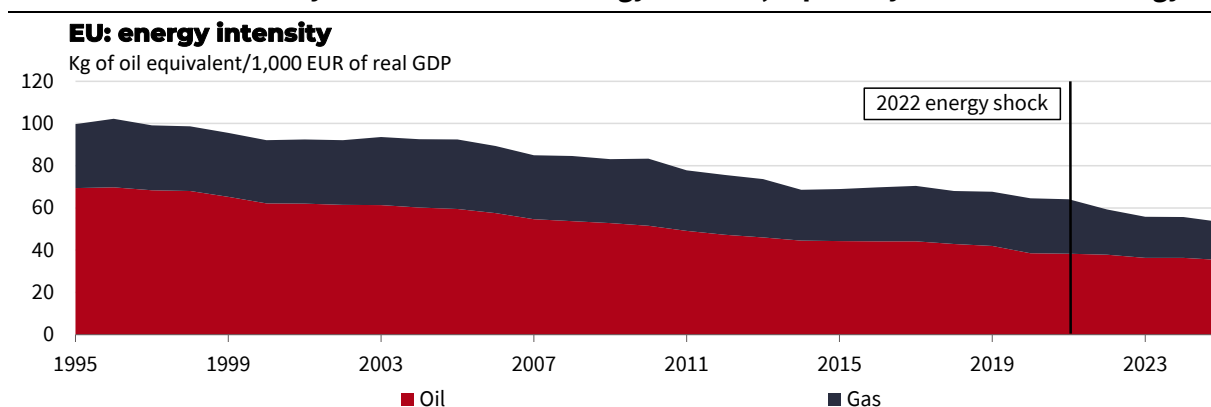
Sources: Bruegel, European Commission, SG Economic and Sector Studies

3. Steady energy efficiency gains

Over 2010-25, oil and gas intensity declined faster than total energy intensity.

This suggests that the decline reflects not only overall energy efficiency gains, but also the replacement of oil and gas with other energy sources. This development reflects more efficient processes, production capital, electrification and innovation, as well as the economy's shift towards less energy-intensive services. The result is an economy that now needs less energy to produce the same output. Taking a longer-term view, the EU used around 100 kg of oil equivalent (kgoe) of oil and gas per EUR 1,000 of real GDP in 1995; by 2025, we estimate that it required only 53 kgoe. In other words, the EU's exposure to oil and gas price shocks has almost halved (see Chart 7).

Chart 7: The EU economy has become more energy efficient, especially since the 2022 energy shock



Sources: Eurostat, Our World in Data, SG Economic and Sector Studies; Note: the 2025 figure is an estimate based on the 2022-2024 linear trend

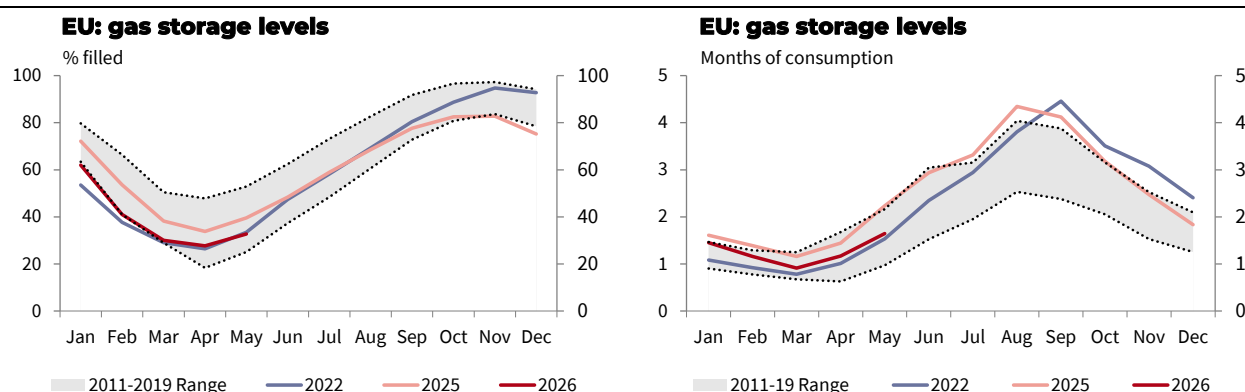
4. Larger energy stockpiles provide a cushion

Declining gas consumption and the EU's 2022 Gas Storage Regulation supported a structural improvement of gas stockpiles. Storage provides a short-term buffer against supply disruptions and winter demand spikes, reducing the need for immediate rationing or abrupt price adjustments. Adjusted for heating demand, average EU gas stocks improved materially from 1.6 months of consumption in 2012 to 2.5 months in 2024, with the intra-year range rising from 0.9-3.0 months to 1.9-5.1 months. Downward-trending gas consumption and the EU's 2022 Gas Storage Regulation, which requires storage facilities to be 90% full ahead of winter, partially explain this development.

Yet lower than required fill levels and particularly low temperatures exposed renewed vulnerabilities in early 2026. Ahead of the 2025-26 winter, stocks were only 83% full, thinning the EU's buffer when the 2026 energy shock unfolded. This partly reflected expectations of abundant LNG supply, which reduced the incentive to hold large seasonal stocks and encouraged the view that LNG could serve as a backstop in the event of a "major disruption in supply", according to the European Network of Transmission System Operators for Gas (ENTSOG).³ A much colder-than-usual January exacerbated the situation. However, as the war in the Middle East erupted, the EU's gas storage stood at 1.2 months of consumption, compared to 0.9 months in February 2022 – leaving the region better positioned to absorb a renewed supply shock than storage fill levels alone would suggest (see Chart 8).

Oil inventories became a key shock absorber during the 2026 energy shock as physical supply disruptions rapidly tightened global oil markets. Under the IEA framework, member countries must hold emergency oil stocks equivalent to at least

Chart 8: Early-2026 gas-storage conditions were stronger than headline fill levels suggested after adjusting for consumption and heating demand



Sources: Eurostat, GIE, SG Economic and Sector Studies; Note: The chart divides stockpile levels by realised monthly natural gas consumption to account for declining overall consumption and adjusts monthly natural-gas consumption for the number of heating degree days in the EU.

³ ENTSOG (2025)

90 days of net oil imports, creating a buffer for severe supply disruptions. When the 2026 energy shock hit, that buffer was used: global oil inventories fell at a rate of around 4 mb/d in March-April, while the IEA coordinated a record 400 mb release to stabilise markets.⁴ Europe also relied on inventories, with OECD Europe refinery processing volumes falling to five-year lows in March as refiners managed tighter markets and shifting trade flows.⁵ However, unlike EU gas inventories, which are reported daily, oil stocks are harder to track because they are held across commercial storage facilities leased by governments, as well as in stocks stored abroad under arrangements with other member states.

Given the differences in the accounting treatment of oil and gas stockpiles, they have not yet been included in the EDIs but are expected to feature in future iterations.

Old dependencies persist and new ones loom

A further material reduction in the EU's energy dependence will require policy action beyond meeting the 2030 climate targets. External shocks have accelerated the bloc's efforts to reduce its energy dependence, while its climate ambitions support greater domestic low-carbon energy production, electrification and energy efficiency. By 2030, the EU aims to cut net greenhouse-gas (GHG) emissions by at least 55% and source at least 42.5% of its energy from renewables, with the ambition of reaching 45%, thereby reducing demand for traditionally imported fuels. This illustrates how reduced energy dependence, improved competitiveness and the decarbonisation of energy supply go hand in hand – a key message from the 2024 Draghi Report on European Competitiveness. Using the Joint Research Centre's latest projection, which assumes delivery of the EU's current climate plans, the Supply EDI edges down from 0.27 to 0.25 by 2030.⁶ This only modest improvement reflects the assumption of unchanged import concentration, highlighting the potential gains from further diversification. At the same time, the Oil and Gas Price EDI falls from 0.20 to 0.14 as the economy becomes less oil- and gas-intensive, consistent with the EU's emissions-reduction objectives and energy efficiency gains (see Chart 9).

Tomorrow's energy dependence is already taking shape. As renewable technologies scale up, energy security will increasingly depend not only on oil and gas imports but also on the supply chains behind new energy equipment. Rare earth elements are sourced entirely from outside the EU, with high-purity rare earths and permanent magnets coming almost entirely from China. Solar panels show a similar concentration, with 98% sourced from China. Europe is reducing its old

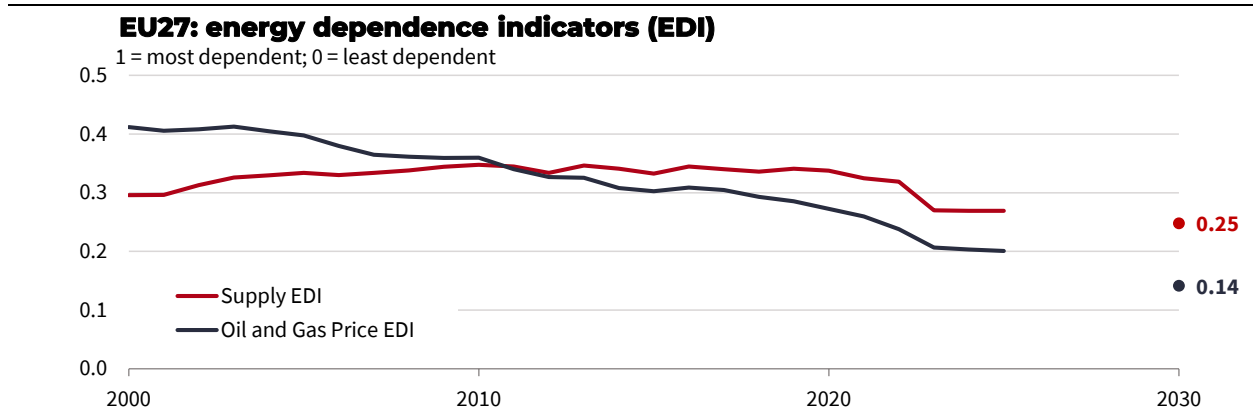
⁴ [IEA \(2026\)](#)

⁵ [IEA \(2026\)](#)

⁶ [European Commission Joint Research Centre \(2026\)](#)

dependencies but already needs to manage new ones. On a positive note, the European Commission is already supporting this effort through the Green Deal Industrial Plan, notably the Critical Raw Materials Act and the Net-Zero Industry Act. The hope is that it will not take another crisis to accelerate those efforts and deliver the intended results.

Chart 9: Progress beyond the EU's climate targets is needed to reduce energy dependence



Sources: Eurostat, JRC, SG Economic and Sector Studies; Note: (1) The Supply EDI is the power mean of energy imports as a share of total energy available and import concentration measured by the Herfindahl-Hirschman Index. (2) The Oil and Gas Price EDI then takes the power mean of (1) and the normalised oil and gas intensity of the economy to account for exposure to price volatility. The values for 2030 correspond to projected progress in line with the EU's climate targets.

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