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Support Energy Efficiency Deployment with the Multiple Impacts CAlculation Tool

POLICY BRIEF

A cleaner EU energy system strengthens resilience to fossil fuel price shocks

Energy efficiency, electrification and renewables can reduce external fuel price shock transmission to consumers and the wider economy

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HIGHLIGHTS

- External fossil fuel price shocks increase energy costs across the EU energy system sectors
- The energy transition while essential for mitigating climate risks it can also reduce the impact of fossil fuel price shocks
- Between early- and highly-decarbonised system states, price pass-through falls from 7.5% to 1.0% for electricity, from 22.3% to 10.9% for household gas, and from 11.9% to 9.0% for gasoline
- Induced increase in household energy costs falls from 14.6% to almost zero in buildings and from 15.1% to 4.1% in transport
- Resilience gains are strongest in buildings, followed by transport and then industry
- Resilience policy should complement decarbonisation policy, with targeted support for industrial transformation and equitable access to clean heating and mobility

INTRODUCTION

Recent crises brought at the forefront the influence that international fossil fuel price shocks have on the energy system. Shocks are realised by raising electricity, heating and transport prices, thus weakening industrial competitiveness and straining household budgets spent on energy and transport. The EU energy transition mitigates this exposure and increases resilience. Lower demand for energy, greater electrification and domestic energy supply from renewables reduce both direct fossil fuel use and the transmission of potential international fossil fuel price shocks to end users. This policy brief asks the question on *how an identical external fossil fuel price shock would affect the EU energy system at different stages of transition?*

The transition reduces structural exposure

Based on a modelled pathway anchored at the EU energy transition, the region is projected to progressively use less energy to deliver a growing volume of services, substitutes direct

59%. → 23% Fossil fuel dependency	**53%. → 20%** Import exposure	**7.5%. → 1.0%** Electricity pass-through	**14.9%. → 6.9%** Fuel-expenditure impact

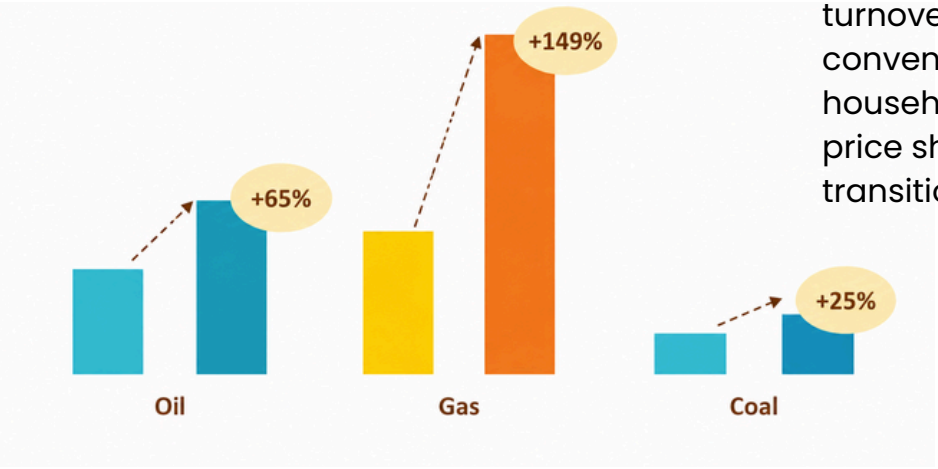
Resilience indicators on the transition to an energy efficient, renewables- and electrification-based system state

fossil fuel use with electricity and increasingly supplies that electricity from renewables. These changes distance the connection between EU energy consumption and volatile international fuel markets. Efficiency reduces the volume of energy exposed to price changes. Electrification removes direct exposure to oil and gas. A power supply and fuel mix rich in renewables limits direct exposure through diversified supply and indirect exposure through electricity prices. In a highly resilient system state by 2050, fossil fuel dependency falls to 23.1%; electricity reaches 48% of final energy demand; renewable electricity rises to 83.2%. Liquid fossil fuel dependency in transport drops from 91% to 33%, while buildings reach 56% electrification share.

Cleaner system states absorb more of the price shock

The analysis applies the same relative shock in 2025, 2040 and 2050: oil +65%, natural gas +140% and coal +25% in a Shock scenario compared with baseline prices.

Increase in international fossil fuel price in the Shock vs the Baseline scenarios



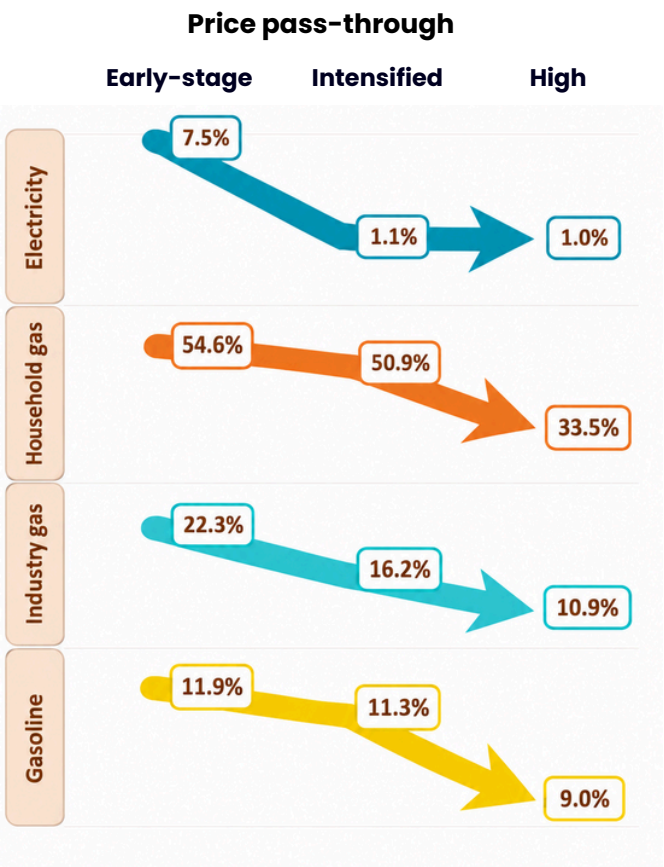
Demand, installed technologies and end-use activity are held fixed to the baseline, mimicking the inertia of structural changes by the agents to unanticipated short-term price disturbances. Differences therefore reveal the resilience provided by the structure of each system state.

Different sectors move at different speeds

Buildings experience the strongest and earliest resilience gains due to the transition. Renovation and more efficient equipment reduce energy demand, while heat pumps progressively replace fossil fuel heating. Together, these changes lower the sector's shock transmission factor from 0.74 in early-stage to 0.29 in high system state. Under the modelled price shock, the increase in fuel expenditure falls from 13.5% to 2.8%, while the increase in total system costs declines from 8.2% to 1.3%. The shock-induced increase in household energy costs associated with buildings falls from 14.6% early-stage to almost zero.

As electrification advances, **transport** becomes more resilient with benefits emerging gradually. A relatively slow turnover rate of vehicles means that conventional fuels continue to expose households and fleet operators to oil price shocks during much of the transition.

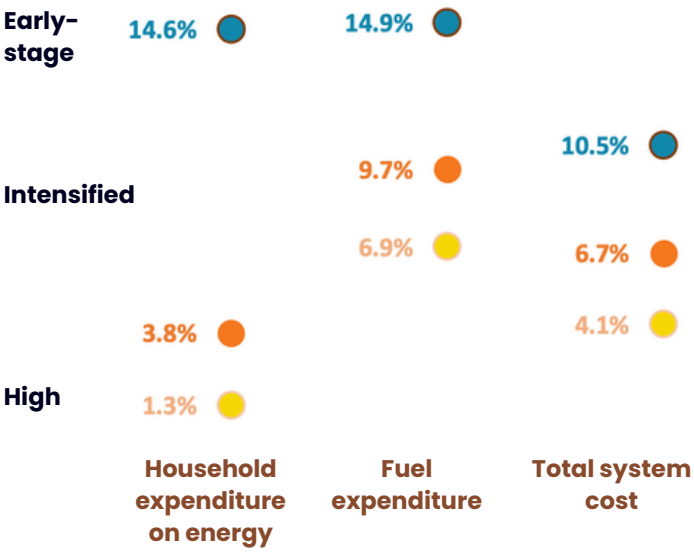
Nevertheless, transport electrification across all fleets increases from 3% in 2025 to approximately 39% in high system states, while fossil fuel dependency falls from 91% to 33%. As a result, the transport shock transmission factor declines from 0.62 to 0.34, and the shock-induced increase in household transport energy costs falls from 15.1% to 4.1%.



Industry retains the greatest exposure, despite improvements in efficiency, electrification and fuel switching. Compared to the other sectors, the industrial shock transmission factor declines moderately, from 0.40 in early-stage to 0.36 in high system state. In the highly decarbonised system state, the imposed shock still increases industrial fuel expenditure by 14.5% and total system costs by 11.1%.

This reflects continued fossil fuel use in energy- intensive and high-temperature processes, as well as indirect exposure through electricity and intermediate energy carriers. Low electricity price pass-through should therefore not always be interpreted as low overall vulnerability, as this may vary by industrial sector.

Transmission of price increase across different system resilience states



Detailed sectoral results are presented in the underlying study supporting this brief (Kokkinos et al. 2026).

Policy interpretation and priorities

Resilience as a co-benefit for decarbonisaton. Resilience indicators alongside emissions, affordability and security metrics in EU and national policy can be particularly complementary to the energy transition discourse.

Efficiency, electrification and renewables should be valued also for their capacity to reduce exposure to imported fossil fuel price volatility.

Front-load measures with immediate household benefits. Accelerate deep renovation, efficient equipment and heat-pump deployment. Design and apply finance and delivery schemes around income and building type so that vulnerable households can access resilience gains early in time.

Speed up transport electrification while eliminating potential divides. Support faster fleet turnover, charging infrastructure and efficient mobility options, where possible. Address constraints faced by lower-income households and rural areas or users without charging alternatives to reduce their exposure to oil price shocks.

Develop a dedicated industrial resilience agenda combining process integration, electrification, renewable heat, material efficiency and low-carbon fuels. Emphasise on sectors where substitution options are limited and exposure remains high.

Make electrification resilient by design. Combine the anticipated rise in electricity demand with renewable generation, grids, storage, demand-response, and inter-connection. Electrification buffers fossil fuel price shocks only once the power system is sufficiently diversified and flexible.

METHODOLOGICAL NOTE

PRIMES is a partial-equilibrium model of the EU energy system and is used to compare along one projected decarbonisation pathway three milestone years with distinctly different resilience states: 2025, 2040 and 2050. Resilience is assessed through structural exposure, shock transmission and welfare indicators. The shocks are unexpected and short-term, which entails that end-use demand, activity and installed technologies remain fixed, while supply can adjust only within existing capacity. Findings can be interpreted as the immediate resilience of alternative system states, not as projections of a specific future crisis. Aggregation to the EU level consolidates differences among Member States and households, which can be pronounced owing to specificities of each country. Fuel-specific shock magnitudes differ, and the analysis does not capture behavioural responses, emergency policies or new investment that may be triggered after a shock, setting the grounds for future work.

Underlying study: Kokkinos, C. et al., *"Energy system resilience to fossil fuel price shocks along the EU energy transition: the role of energy efficiency, electrification and renewables"*, SEED-MICAT Deliverable D5.2.

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