The Energy Transition as a Shield Against Fossil Fuel Price Shocks

How energy efficiency, electrification and renewable energy strengthen the resilience of the energy system and the economy

SEED MICAT
Support Energy Efficiency Deployment with the Multiple Impacts CAlculation Tool

INTRODUCTION

- Recent energy crises exposed the EU's dependence on international fossil fuel markets
- Rising fuel prices translate into higher energy costs for households, businesses and the wider economy
- Energy efficiency, electrification and renewables can reduce exposure to future energy price shocks
- This study investigates how different stages of the EU energy transition affect exposure to identical fossil fuel price shocks

RESEARCH QUESTIONS

Can decarbonisation protect Europe from future energy crises?

METHODOLOGY

The assessment was performed using the PRIMES energy system model at a member state level, aggregating the results for the EU27. Identical fossil fuel price shocks were applied to three representative energy-system states corresponding to different stages of the transition pathway.

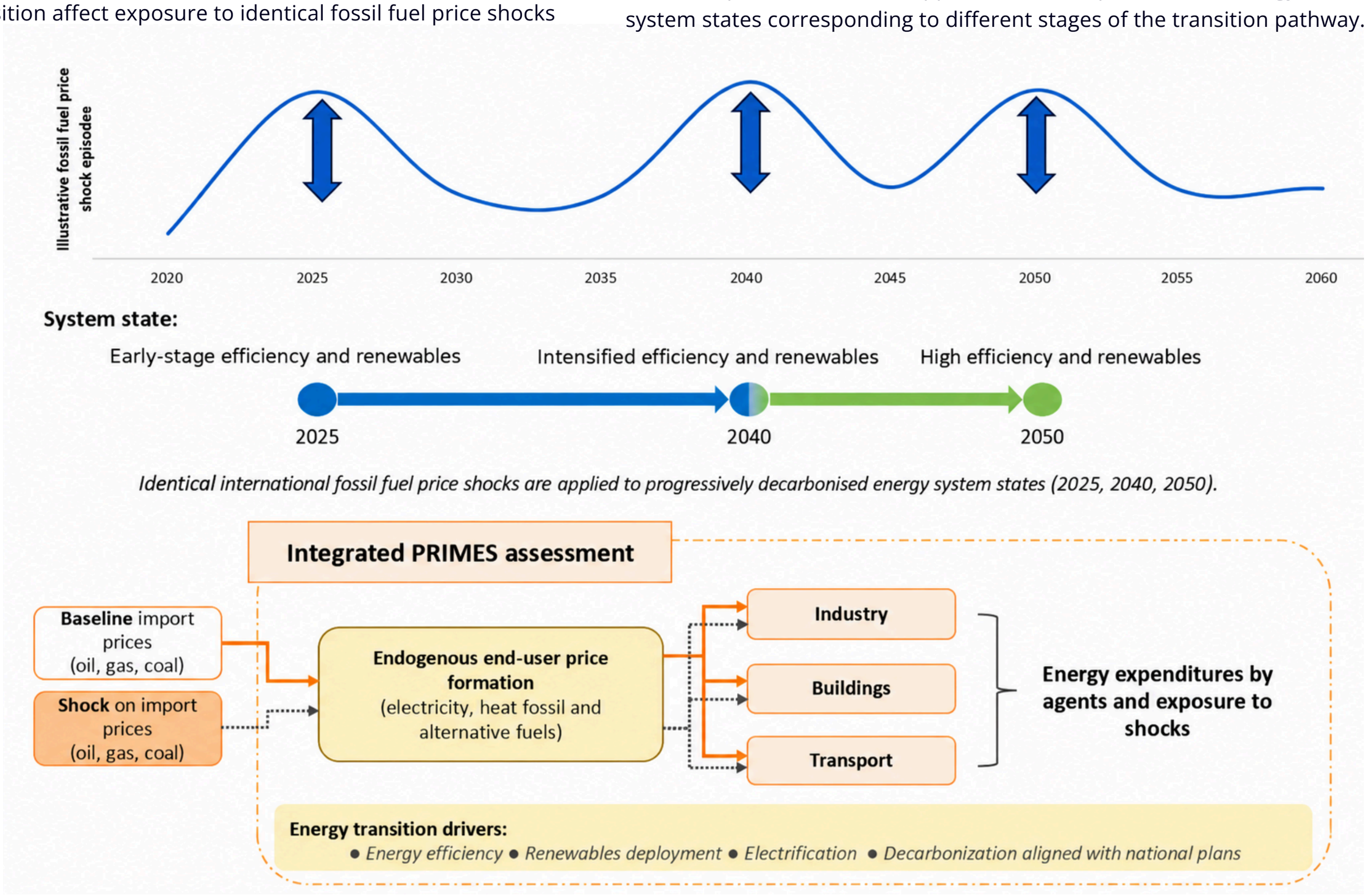

Figure 1. Methodological framework followed for the case study

KEY RESILIENCE GAINS ALONG THE ENERGY TRANSITION

- Fossil fuel dependency: 59% → 23%
- Import exposure: 53% → 20%
- Electricity price pass-through: 7.5% → 1.0%
- Household fuel-expenditure impact: 14.9% → 6.9%
- Household exposure to price shocks: 91% lower by 2050
- Economy-wide cost impacts: 60% lower by 2050

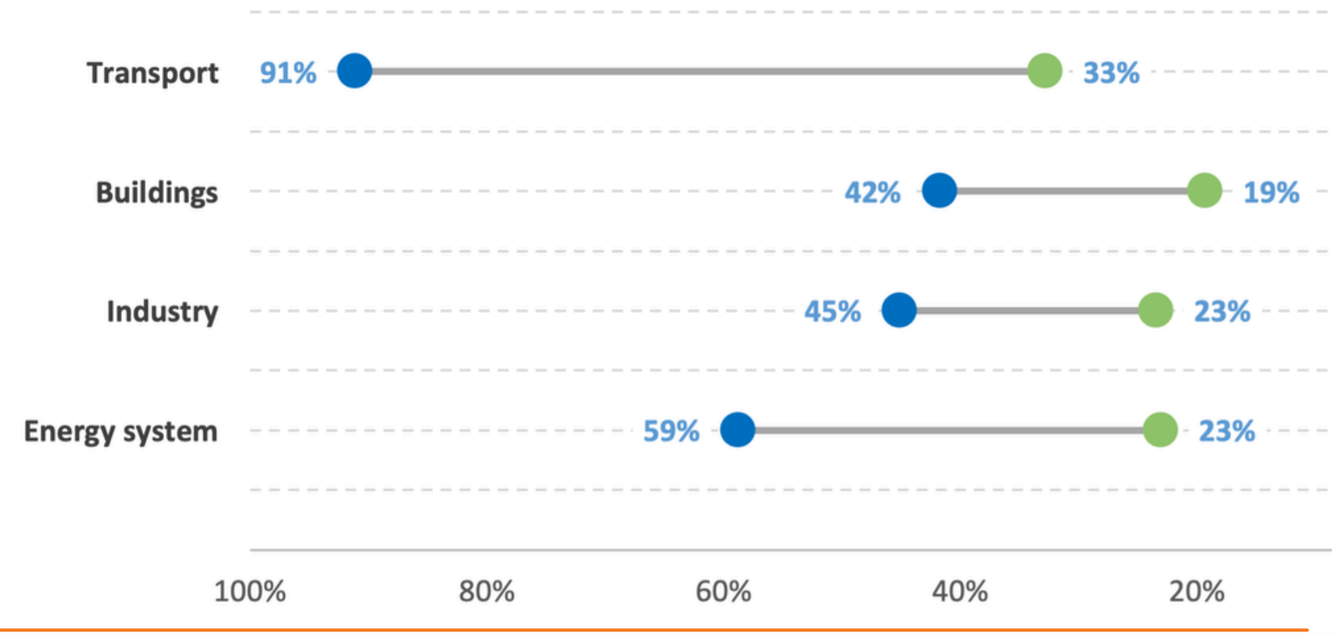

Figure 2. Fossil fuel dependency declines substantially across all sectors, with transport remaining the most fossil-intensive sector in 2050 (33%)

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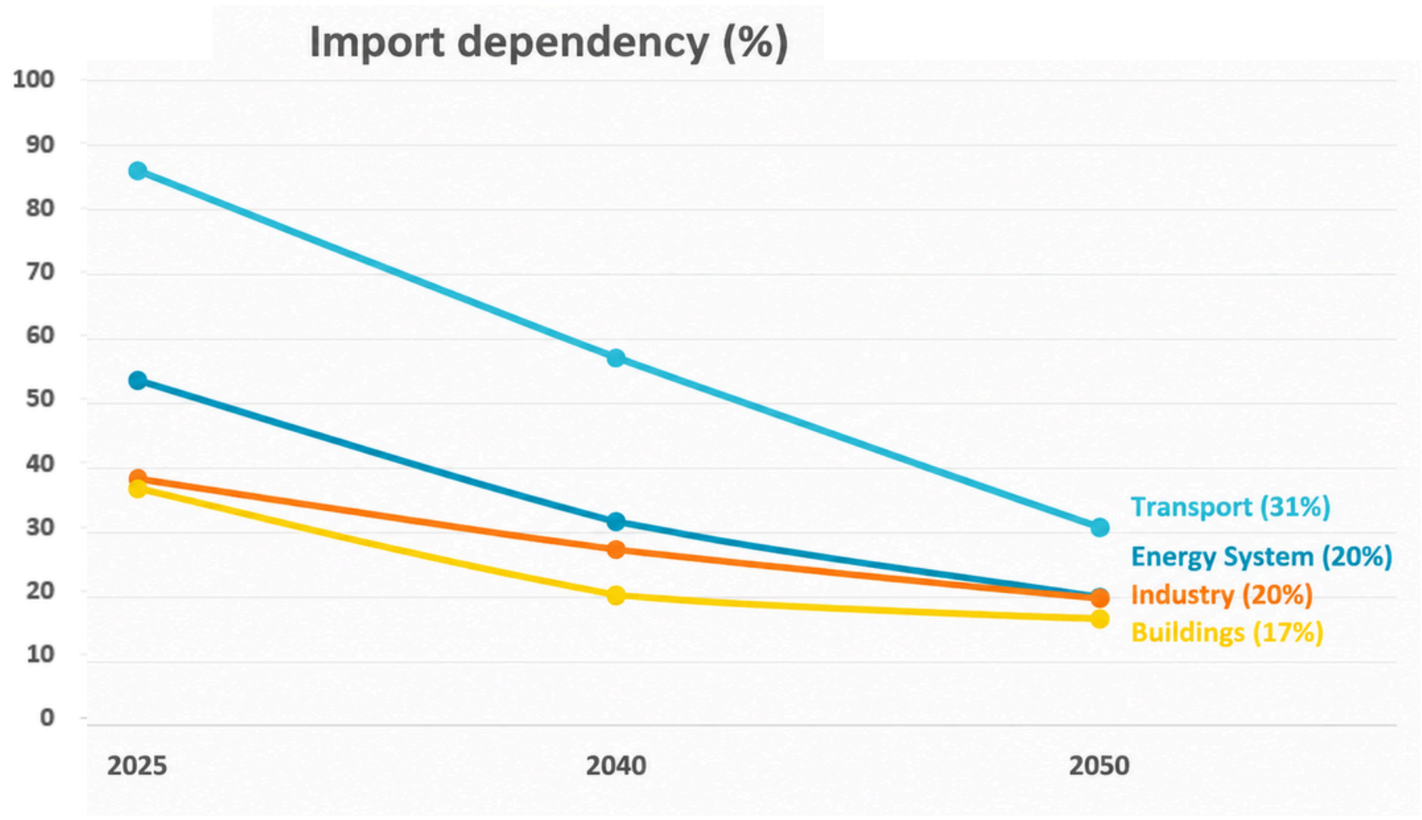

Figure 4. The same fossil fuel price shock results in a 91% reduction in additional household energy expenditure by 2050 as the energy transition progresses.

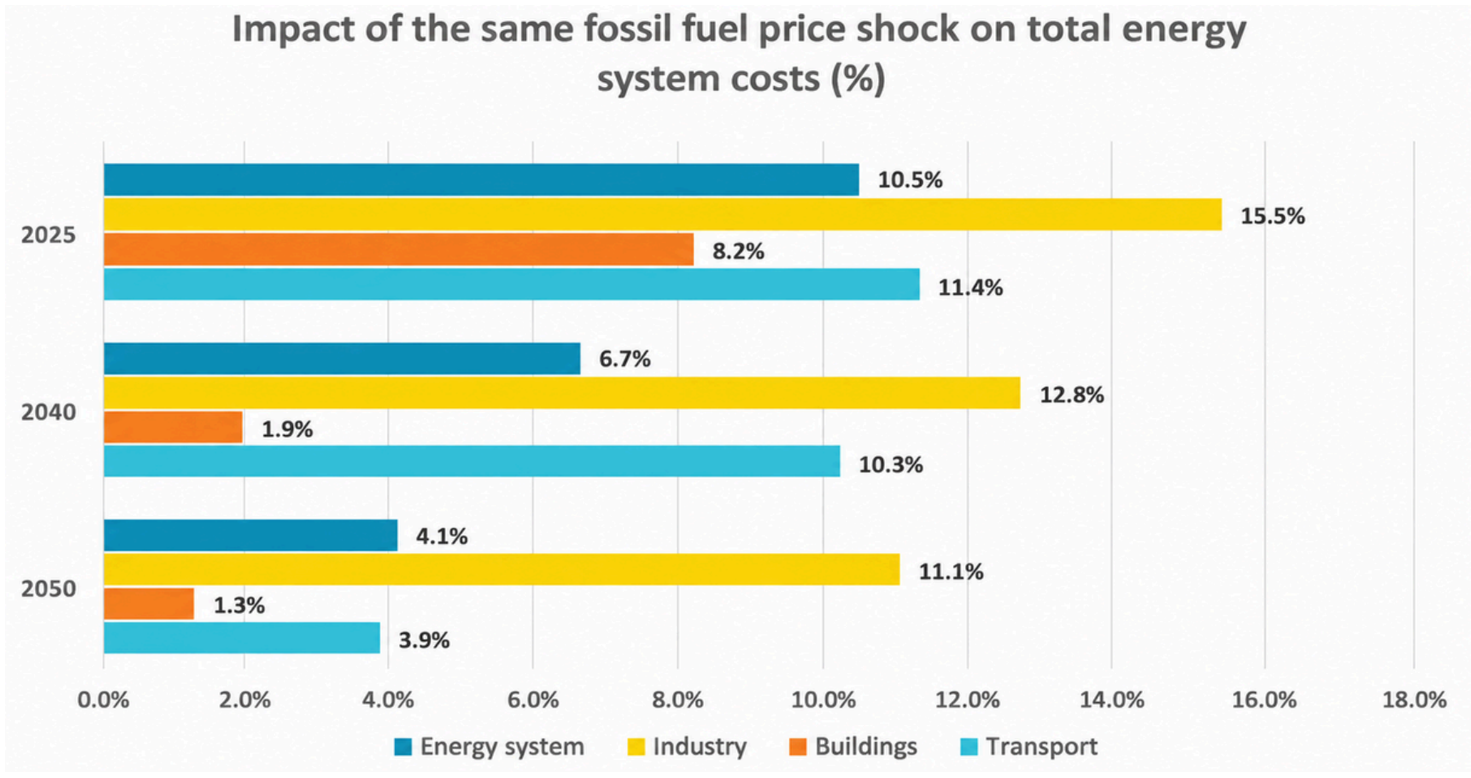

Figure 5. The same fossil fuel price shock causes approximately 60% lower economy-wide cost impacts in a highly decarbonised energy system.

POLICY IMPLICATIONS

Energy efficiency, electrification and renewable energy deployment deliver benefits beyond emissions reduction. They also:

- Reduce fossil fuel dependency
- Improve energy security
- Lower import exposure
- Strengthen economic resilience
- Protect households against future energy crises
- Reduce the economic consequences of fuel price volatility

Indicator	Indicator	Indicator	Indicator
Measures effectiveness	Largest resilience gains due to renovation and heat pumps	Gradual resilience gains through vehicle electrification	Remains comparatively vulnerable
Cost impact	Household energy-cost impact falls from 14.2% to nearly zero	Household transport-cost impact falls from 15.1% to 4.1%	Fuel expenditure still rises by 14.5% under the shock scenario

CONCLUSIONS

The energy transition is not only a decarbonisation strategy, but also a resilience strategy.

As fossil fuel dependence declines and electrification and renewable energy deployment increase, identical fossil fuel price shocks generate progressively smaller impacts on households and the wider economy. By 2050, household exposure to fossil fuel price shocks is reduced by approximately 91%, while economy-wide cost impacts fall by around 60%.

Resilience gains are not uniform across sectors. Buildings benefit the most from energy efficiency improvements and heat pump deployment. Transport becomes progressively more resilient as electrification expands, while industry remains comparatively exposed because some energy-intensive processes continue to rely on fossil fuels.

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