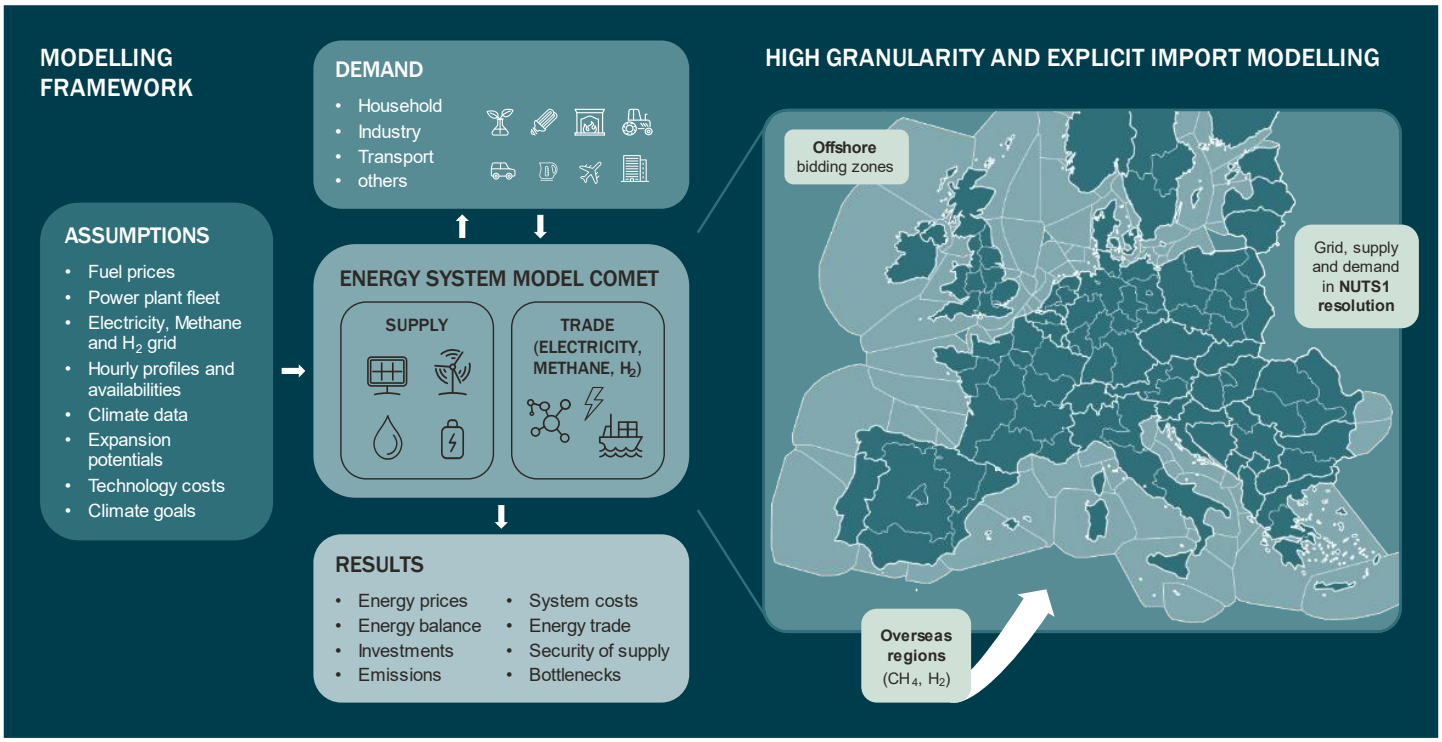
INTRODUCING

COMET

frontier economics

The energy transition is one of the major challenges of our time – demanding coordinated action across sectors, geographies, and the entire value chain. As the system grows more complex, with diverse energy carriers and interdependent technologies, advanced energy market models are essential.

COMET – our **Cross-sector Optimisation Model for the Energy Transition** – provides policymakers, system planners, and investors with critical insights into the design of tomorrow's decarbonised energy system. Covering electricity, gases (methane and hydrogen), liquids, biofuels, and emerging energy carriers, COMET evaluates the infrastructure, technologies, and supply pathways required to build an affordable, efficient, and resilient energy system through 2050 and beyond.



HIGHLIGHTS

- **Integrated sector coupling:** All sectors, all technologies, all fuels.
- **Long-term development:** Cost-optimal investment and dispatch until 2050.
- **Security of supply** in periods of low renewable generation and peak demand (Dunkelflaute).
- **International cooperation:** European and global market dynamics.
- Optional **final demand optimisation**.
- **High geographic resolution:** Detailed insights for up to 100+ regions.
- **High temporal granularity:** Hourly energy balance for representative weeks. 8760-hour high-resolution dispatch.
- **Detailed representation of final demand:** Over 30 final demand sectors.
- Demand-side flexibility.
- Optional **infrastructure optimisation**.

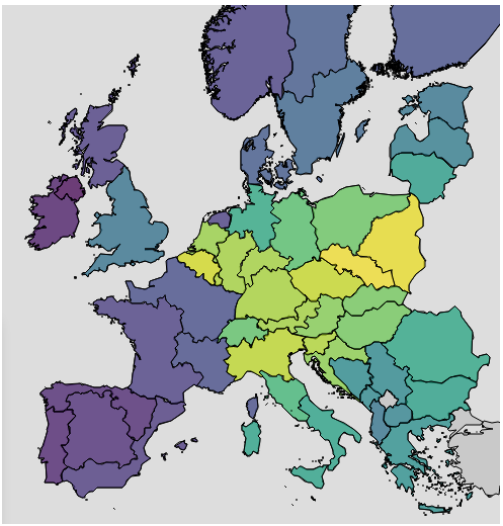
KEY INSIGHTS

Discover the optimal future technology mix

COMET identifies the most cost-effective technology and supply mix to meet final energy demand, selecting from multiple energy carrier options – such as biomethane, natural gas, or synthetic methane – for each demand category. While minimising total costs, COMET also respects security of supply needs – based on over 40 years of detailed weather data used to identify periods of extreme system stress that needs to be prepared for.

By analysing the costs of supplying energy, COMET derives hourly and daily wholesale market prices for all energy carriers (including electricity, hydrogen and methane). These price indicators help assess

Costs of electricity supply



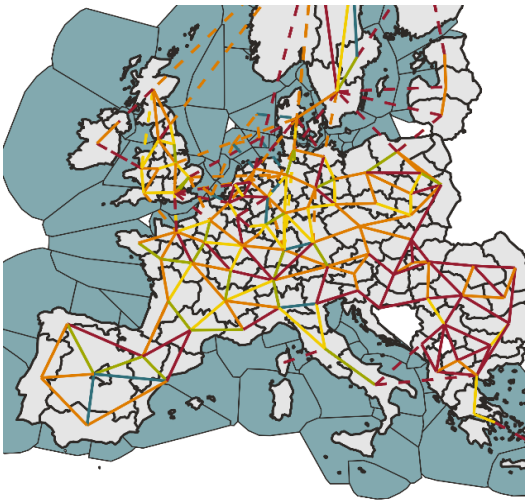
Source: Frontier

Identify infrastructure bottlenecks to inform infrastructure expansion planning

As the energy system evolves, so does the demand for energy transmission and transport. Variable renewables, electrification, electrolysers, battery storage, and the growing role of hydrogen are reshaping infrastructure.

COMET is a powerful tool to analyse future electricity, hydrogen, and methane transmission. By assessing regional energy flows, COMET helps identify infrastructure bottlenecks and evaluate the optimal combination between grid-/pipeline-capacity expansions, additional storage capacity, and repurposing of existing capacity for new application (for example converting exiting methane storage to hydrogen).

Electricity grid congestion



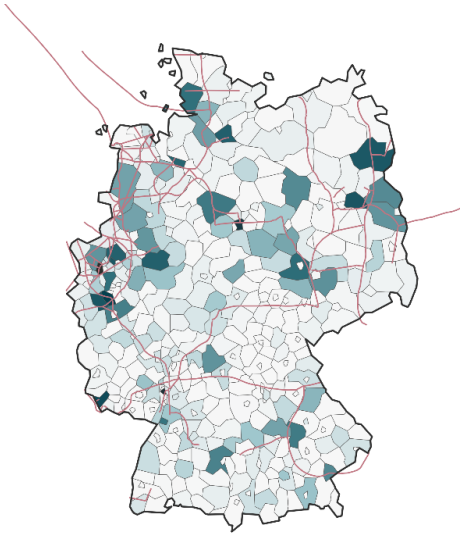
Source: Frontier - Ensuring resilience in the European Energy Transition

Provide insights into how regional energy demand could develop and should be served

COMET runs with a high spatial resolution, covering over 100 NUTS-1 regions across Europe (with input data collected down to NUTS-3 level). We differentiate between more than 30 final demand sectors – including industry, buildings, and transportation. This provides precise insights into the scale and geographic distribution of future energy demand – and how regional demand can be served.

Optionally, COMET optimises investments in final demand technologies, identifying the most cost-effective mix of interdependent solutions such as building insulation upgrades and modern space

Distribution of hydrogen demand



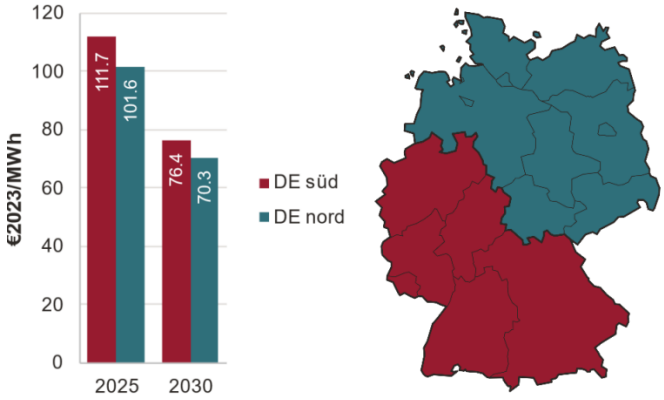
Source: Frontier - Ready4H2

Inform policy makers of implications of market design changes

Policies and regulations critically shape energy markets – and are subject to constant re-evaluation and modification.

With COMET, we can quantify the impact of a wide range of changing circumstance, including concerning decarbonisation targets, wholesale market design, technology support schemes/subsidies and phase-outs, energy efficiency regulation, and the availability of carbon storage.

Implications of bidding zone split



Source: Frontier - Bidding zone split

MEET OUR EXPERT

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GET IN TOUCH

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