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Optimised transport decarbonization under EU energy market and policy scenarios

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Short abstract
This study examines the impacts of both CO2 emission restrictions and energy import/export policies, on the Italian transport sector using Euro-Calliope model, i.e. an integrated model of transport and energy systems at the European level.

Abstract
This paper assumes different scenarios for EU energy market and policies (such as CO2 emission targets and energy import/export constrains) and identifies optimized configurations for transport consumption needs and investments in Italy.
The analysis utilizes the Euro-Calliope model, an optimization energy system model representing various energy sectors, including transport, power, heat, and industry across 35 countries. Similar to other sectors, transport encompasses diverse technologies with varying consumption parameters and primary fuels. The Calliope software optimizes the transport mix based on a cost-minimization objective function, distinguishing among passenger cars, light-duty vehicles, heavy-duty vehicles, aviation, rail, and shipping.
The model considers two variants of CO2 targets: one where Europe aims for carbon neutrality, allowing countries to offset emissions abroad, and another with individual carbon targets for each Country. Three assumptions are considered to account for the interconnectedness of Italy and Europe. Firstly, import and export of fuels are restricted to promote domestic supply chains, with full capacity assumed for electricity interconnectors. Secondly, fuels can be freely traded between European countries, but electricity connections are limited. Lastly, no limitations are considered for either fuels or electricity.
Results from the above six (2x3) simulated scenarios show that the transport sector, with its adaptable demand among various carriers like electricity or synthetic fuels, plays a significant role in maintaining energy system flexibility and adaptability to external disruptions. Particularly, the impacts of energy system configuration changes and transport mix for each transport mode (i.e. passenger cars, light-duty vehicles, heavy-duty vehicles, aviation, rail, and shipping) are analyzed. Additionally, scenarios are compared based on total costs of energy and transport systems as separate outcomes, marginal costs of commodities, yearly energy balance, and hourly dispatch to identify bottlenecks or seasonal supply shortages.
The approach, though applied to Italy, holds relevance for all European countries. It underscores the vital importance of considering the interconnectedness of various sectors, particularly transport and energy, in planning sustainability for future systems. By adopting such a holistic approach, policymakers can ensure the reliability and resilience of transport systems, which must align with planning efforts in other sectors.

Programme committee
Global Trends Impacting Transport

Topic
Labour, resource and energy challenges