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EDITORIAL

Complexities in the energy-transport co-transformation

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Managing the transformation to a global low-carbon energy sector is challenging. Long-lived assets, large capital projects, and long lead times require multi-decadal transition plans. Of course, the end state of the energy system depends on the evolution of demands from energy-consuming sectors. This can perhaps best be illustrated in the changing relationship between energy supply and transportation energy demand. As the transport sector substitutes low-carbon fuels, including electricity, for fossil fuels, the locations of energy production and distribution supply chains are likely to shift. With different production processes for these fuels and different efficiencies of the vehicles that consume them, the energy intensity of transport is going to be different. Moreover, as transport begins to rely more on direct electrification, the temporal coupling of energy supply and transportation demand will tighten dramatically. While this coupling will provide some opportunities, such as vehicle-to-grid services, it will also present challenges to existing markets and traditional grid management strategies. Thus, effective management of the global energy transition requires a sensitivity to the simultaneous co-transformation in transportation.

The papers in this collection illustrate the breadth of impacts on the energy sector from different ways the transport sector could plausibly evolve in a low-carbon future. Exactly how the transportation transformation will unfold remains to be seen, and it may evolve differently, and over different timelines, in different regions. Nevertheless, despite the uncertainty, the global energy system should prepare to provide the amounts and types of energy the transportation sector might need when and where it needs them.

Transport change a: fuels. Grahn *et al* (2022) and Brynolf *et al* (2022) survey the feasibility of electrofuels for different modes of transport. Electrofuels place different demands on the energy system than do fossil-based transport fuels. The energy needs (type of energy, amount, location, and timing) for producing new transport fuels differ from those for producing fossil-based liquid fuels. Adopting electrofuels in transport will require coordination across the energy system.

Transport change b: vehicle technologies. The electrification of transport makes the relationship between transport fuel usage and energy provision near-real-time. To provide electricity to power transportation, the energy system needs to anticipate the timing of transport activities in a way that has not been required historically. Zeng *et al* (2022) and Muratori *et al* (2021) look at the introduction of new clean vehicle technologies, including battery electric vehicles (BEVs) and electric buses (EB). Zeng *et al* (2022) suggest changing EB operation to maximize battery lifetime, yielding an alternative spatio-temporal EB charging demand from current practice. Muratori *et al* (2021) look at the technology implications of increased BEV adoption, including the broader effects on the future power system.

Transport change c: travel demand. The perspective by Yeh *et al* (2022) on the mutual effects of changing mobility patterns (due to, i.e. changing regional socio-demographics, behaviors, and policies) and changing transport technologies (i.e. new vehicles, fuels, and information and communication technologies) on their co-evolution provides a warning of the danger of extrapolating historical travel patterns into the future, or of applying mobility characteristics from one region to another.

These five papers illustrate three changes in transport that have the potential to alter features of the global energy system transition. Collectively, they argue for the importance of energy system planners and modelers not to anchor on projections of historical energy demand patterns, but to consider the variety of potential feedback effects of the transportation transformation on the evolution of the global energy system.

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References

Brynolf S, Hansson J, Anderson J E, Skov I R, Wallington T J, Grahn M, Korberg A D, Malmgren E and Taljegard M 2022 Review of electrofuel feasibility—prospects for road, ocean, and air transport *Prog. Energy* **4** 042007

Grahn M, Malmgren E, Korberg A D, Taljegard M, Anderson J E, Brynolf S, Hansson J, Skov I R and Wallington T J 2022 Review of electrofuel feasibility—cost and environmental impact *Prog. Energy* **4** 032010

Muratori M *et al* 2021 The rise of electric vehicles—2020 status and future expectations *Prog. Energy* **3** 022002

Yeh S *et al* 2022 Improving future travel demand projections: a pathway with an open science interdisciplinary approach *Prog. Energy* **4** 043002

Zeng Z, Daniels D and Qu X 2022 Limitations and suggestions of electric transit charge scheduling *Prog. Energy* **4** 023001