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To  
Editorial Board of IOP Environmental Research Letters

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Dear Prof. Kammen

Hereby we submit a manuscript titled «*The role of Projects of Common Interest in reaching Europe's energy policy targets*» for consideration in IOP Environmental Research Letters.

**Quick summary:** The European Union (EU) has set ambitious climate and energy policy targets to reach net zero by 2050, including hydrogen production and CO<sub>2</sub> sequestration. To facilitate reaching these targets, investments into large-scale, trans-national CO<sub>2</sub> and hydrogen infrastructure is needed. For the first time, the European Commission has included CO<sub>2</sub> and hydrogen infrastructure in the so-called list of Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI). Building on the open-source, sector-coupled model PyPSA-Eur, this article assesses the role and value of PCI-PMI projects in reaching the EU's energy policy targets. It further evaluates the effect of short-term events, such as policy changes, project delays or cancellations using a regret-analysis.

**Pitch:** There is a growing consensus that hydrogen and CO<sub>2</sub> see their primary values in the decarbonisation of hard-to-abate sectors, including industry, transport, shipping, and aviation [?, ?, ?]. To produce the needed synthetic fuels, including methanol, Fischer-Tropsch fuels, and methane, hydrogen is expected to serve as a precursor and CO<sub>2</sub> as a feedstock. Already by 2030, the EU aims to supply hydrogen from at least 40 GW electrolysis capacity domestically [?, ?, ?]. Remaining CO<sub>2</sub> emissions will need to be stored in geological formations, such as depleted oil and gas fields. Here, the European Commission foresees a sequestration target of 50 million tonnes of CO<sub>2</sub> by 2030 [?]. Beyond investments into renewable capacity, electrolyzers and storage, large-scale continent-wide investments into pipeline and storage facilities will be required to transport these carriers to where they are needed. Initiatives like the European Hydrogen backbone envision a hydrogen pipeline network of almost 53000 km by 2040 [?]. While recent studies have begun to explore the interplay between hydrogen, CO<sub>2</sub> infrastructure and the electricity system [?, ?, ?, ?], key aspects remain underexplored. In particular, the role of real-world planned infrastructure, dynamics of transformation pathways, and impact of future uncertainty are often overlooked. This can lead to the exclusion of infrastructure options that are not strictly cost-optimal, but have a high likelihood of implementation due to strong political backing [?] — a gap our study directly addresses. We show that a delay in CO<sub>2</sub> infrastructure creates significant economic regrets and forces the system to pivot to costly Direct Air Capture, if Europe maintains its climate and energy policy goals.

We respectfully acknowledge that our manuscript exceeds the typical 4000-word limit for letters in your journal. However, we believe the complexity of the topic, as well as the multidisciplinary nature of our modelling and regret analysis, warrant a more detailed treatment. We have made every effort to ensure the manuscript is concise and focused, while still providing the necessary depth and breadth to address the topic comprehensively.

Ultimately, the aim of this article is to reduce uncertainty surrounding the ‘chicken-and-egg’ dilemma in infrastructure investment — whether to develop CO<sub>2</sub> and hydrogen infrastructure in advance or wait for demand to materialise. By explicitly including real-world PCI-PMI planned projects, we demonstrate that social welfare can be increased by more than €26 billion annually from 2040 onwards compared to a system without any pipeline infrastructure. Our findings offer a data-driven foundation for aligning infrastructure policy with Europe's long-term decarbonisation goals, ensuring that strategic investments

today yield systemic benefits tomorrow.

We hope you agree that the topic is timely and of broad interest to the IOP Environmental Research Letters readership.

Kind regards,

Bobby Xiong (corresponding author), Prof. Dr. Tom Brown & Dr. Iegor Riepin

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