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To
Editorial Board of IOP Environmental Research Letters

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Cover letter for manuscript submission

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_2 sequestration. To facilitate reaching these targets, investments into large-scale, trans-national CO_2 and hydrogen infrastructure is needed. For the first time, the European Commission has included CO_2 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_2 see their primary values in the decarbonisation of hard-to-abate sectors, including industry, transport, shipping, and aviation [1, 10, 12]. To produce the needed synthetic fuels, including methanol, Fischer-Tropsch fuels, and methane, hydrogen is expected to serve as a precursor and CO_2 as a feedstock. Already by 2030, the EU aims to supply hydrogen from at least 40 GW electrolysis capacity domestically [2, 3, 5]. Remaining CO_2 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_2 by 2030 [3]. Beyond investments into renewable capacity, electrolysers 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 [4]. While recent studies have begun to explore the interplay between hydrogen, CO_2 infrastructure and the electricity system [6–9], 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 [11] — a gap our study directly addresses. We show that a delay in CO_2 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.

Article length justification: We acknowledge that the manuscript somewhat exceeds the 4,000-word limit for letters (∼5,100 words). However, the topic necessitates a thorough discussion of the role of hydrogen and CO_2 in decarbonised energy systems, as well as a comprehensive presentation of our scenario-specific findings. We have taken care to keep the manuscript concise and focused while providing sufficient depth. Additional information that supports but is not essential to the main findings is included in the Supplementary Material.

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

References

[1] Simonas Cerniauskas, Antonio Jose Chavez Junco, Thomas Grube, Martin Robinius, and Detlef Stolten. Options of natural gas pipeline reassignment for hydrogen: Cost assessment for a Germany case study. *International Journal of Hydrogen Energy*, 45(21): 12095–12107, April 2020. ISSN 0360-3199. doi: 10.1016/j.ijhydene.2020.02.121.

[2] European Commission. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A hydrogen strategy for a climate-neutral Europe, 2020.

[3] European Commission. REPowerEU Plan. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2022) 230 final, Brussels., 2022.

[4] European Hydrogen Backbone Initiative. European Hydrogen Backbone: A European hydrogen infrastructure vision covering 28 countries. Technical report, European Hydrogen Backbone, 2022.

[5] European Parliament and Council of the European Union. Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on establishing a framework of measures for strengthening Europe's net-zero technology manufacturing ecosystem and amending Regulation (EU) 2018/1724 (Text with EEA relevance), June 2024.

[6] Fabian Hofmann, Christoph Tries, Fabian Neumann, Elisabeth Zeyen, and Tom Brown. H2 and CO2 network strategies for the European energy system. *Nature Energy*, pages 1–10, April 2025. ISSN 2058-7546. doi: 10.1038/s41560-025-01752-6.

[7] Ioannis Kountouris, Rasmus Bramstoft, Theis Madsen, Juan Gea-Bermúdez, Marie Münster, and Dogan Keles. A unified European hydrogen infrastructure planning to support the rapid scale-up of hydrogen production. *Nature Communications*, 15(1):5517, June 2024. ISSN 2041-1723. doi: 10.1038/s41467-024-49867-w.

[8] Fabian Neumann, Elisabeth Zeyen, Marta Victoria, and Tom Brown. The potential role of a hydrogen network in Europe. *Joule*, 7(8):1793–1817, August 2023. ISSN 2542-4351. doi: 10.1016/j.joule.2023.06.016.

[9] Fabian Neumann, Johannes Hampp, and Tom Brown. Green energy and steel imports reduce Europe's net-zero infrastructure needs. *Nature Communications*, 16(1):5302, June 2025. ISSN 2041-1723. doi: 10.1038/s41467-025-60652-1.

[10] Gunhild A. Reigstad, Simon Roussanaly, Julian Straus, Rahul Anantharaman, Robert de Kler, Maxine Akhurst, Nixon Sunny, Ward Goldthorpe, Lionel Avignon, Jonathan Pearce, Stefan Flamme, Gianfranco Guidati, Evangelos Panos, and Christian Bauer. Moving toward the low-carbon hydrogen economy: Experiences and key learnings from national case studies. *Advances in Applied Energy*, 8:100108, December 2022. ISSN 2666-7924. doi: 10.1016/j.adapen.2022.100108.

[11] Evelina Trutnevyte. Does cost optimization approximate the real-world energy transition? *Energy*, 106:182–193, July 2016. ISSN 0360-5442. doi: 10.1016/j.energy.2016.03.038.

[12] Koen van Greevenbroek, Johannes Schmidt, Marianne Zeyringer, and Alexander Horsch. Little to lose: The case for a robust European green hydrogen strategy. *Joule*, page 101974, June 2025. ISSN 2542-4351. doi: 10.1016/j.joule.2025.101974.