Future environmental impacts of hydrogen production and its use in container shipping

Wei, S.

Stellingen

Behorende bij het proefschrift

Future environmental impacts of hydrogen production and its use in container shipping

1. Low-carbon hydrogen is expected to decarbonize hard-to-abate sectors, but its production will consume a non-negligible share of the carbon budget (Chapter 2).
2. Developing water electrolysis powered by low-carbon electricity is a more climate-friendly and future-proof option for decarbonizing hydrogen production than using fossil-fuel based processes with Carbon Capture and Storage (Chapters 2).
3. Decarbonizing maritime shipping with hydrogen-based fuels comes with environmental trade-offs (Chapter 3 and 4).
4. Effective decarbonization of maritime shipping requires overcoming key bottlenecks in renovating the fleet, scaling up hydrogen-based fuel production and electrolyzer capacity, and ensuring sufficient renewable electricity supply (Chapter 5).
5. Renewable hydrogen-based fuels can substantially reduce emissions from maritime shipping, but they are not a silver bullet for achieving net-zero targets, making negative emission technologies necessary (Chapter 5).
6. The role of emerging low-carbon technologies in climate change mitigation should be comprehensively quantified in a systematic and long-term manner.
7. Scenario-based analysis is necessary to map the consequences of different future trajectories and to effectively inform policymakers in developing decarbonization roadmaps.
8. Far more ambitious policies focused on renewable hydrogen-based fuels, compared to existing policies for decarbonizing hydrogen production and maritime shipping, are required to approach net-zero targets.
9. Decarbonizing maritime shipping calls for coordinated policies across sectors, which can be promoted by legally binding requirements on the life cycle greenhouse gas emissions intensity of fuels used on ships.
10. Researchers should dare to imagine and assume what may happen in the future, even at the cost of being bold, in order to produce thought-provoking research.

Shijie Wei

Leiden, 11 February 2026