

How to catalyze the hydrogen transition in the Dutch IWT sector?

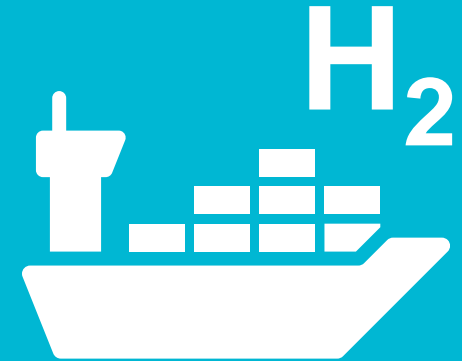
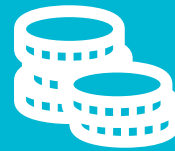
25-05-2023

 **TU Delft**



Universiteit
Leiden

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What's required?

I evaluated the effect of policy measures by simulating the decision-making process of all active ships in the Netherlands based on the economic trade-off between diesel- and hydrogen-powered drivetrains

How does the simulation model work?

What happens in 2050 if no policy is introduced?

Which policy interventions are most effective?

How to ensure zero emissions in 2050?

Aren't there any limitations to the simulation model?

How can the simulation model be used in practice?

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Input



Assumptions



Policy

- CO2 price
- HBE obligation
- Ban on (diesel) ICE

1

Simulation

Decision-making of 5000+ ships (NL)



When?



What?

2

Output



Fleet development



Emission reductions

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Hydrogen demand

3

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What happens in 2050 if no policy is introduced?



10% Fuel cells
50% Hydrogen-powered ICE
35% Stage-V engines
5% Old engine



-63% CO₂
-66% NO_x
-87% PM

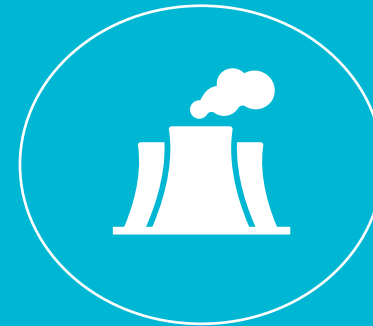


14 PJ

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Which policy measures are most effective?

Price-based CO2 price

240 euro per ton

Uncertain

Quantity-based CO2 price

ETS

Effective

HBE obligation

Renewable fuel obligation

Effective

Ban on new (diesel) ICE

Ban in 2030 → 75% CO2
reduction in 2050

Uncertain

Hydrogen blending obligation

Forced switch

Effective, but inefficient

What's necessary to achieve zero emissions in 2050?

Possible settings

- 100% HBE obligation in 2050
- HBE price €34 per GJ in 2050

Output



100% fuel cells



100% reduction

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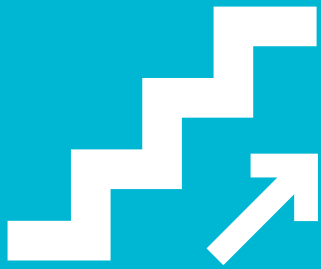
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What's necessary to achieve zero emissions in 2050?

- ✓ Quantity-based economic instruments
- ✓ Financial support for ship operators
- ✓ Improved bunkering infrastructure and regulations

Aren't there any limitations of the simulation model?

What's next?



Qualitative considerations

Uncertainty

Alternative fuels?

How can the simulation model be used in practice?

Ship operators

Policy makers

Scenario	Fuel cells
Base scenario (thesis)	10%
40% higher diesel price	70%

Thank you!

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