NTNU
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MOZEES
Mobility Zero Emission Energy Systems

SINTEF

Economics of hydrogen fuels in heavy-duty transport

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Which cost has decarbonized freight transport towards 2050 by using hydrogen fuels?

Short-sea:
7680 GT vessel

~ 9,450 t

Competitive?

Long-haul:
40 t semi-truck

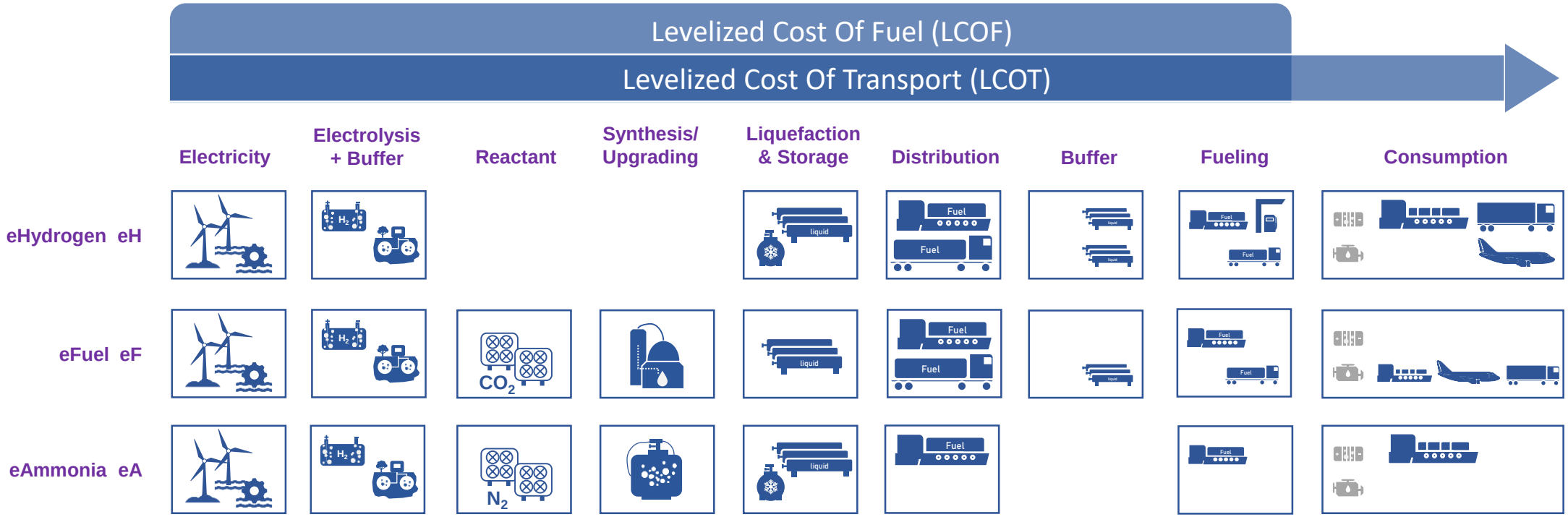
~25 t

Short/mid-haul:
A320 freighter

~20 t

Sources:
Plane: elbeflugzeugwerke.com
Ship: confeeder.com
Truck: scania.com

Bringing hydrogen into transport



Methodology: Levelized cost of X

Step 1) Electricity

Step 2) Fuel

Step 3) Transport

$$LCOX = \frac{Capex_x * ucrf + Opex_{x,fix}}{Output_x} + Opex_{x,var}$$

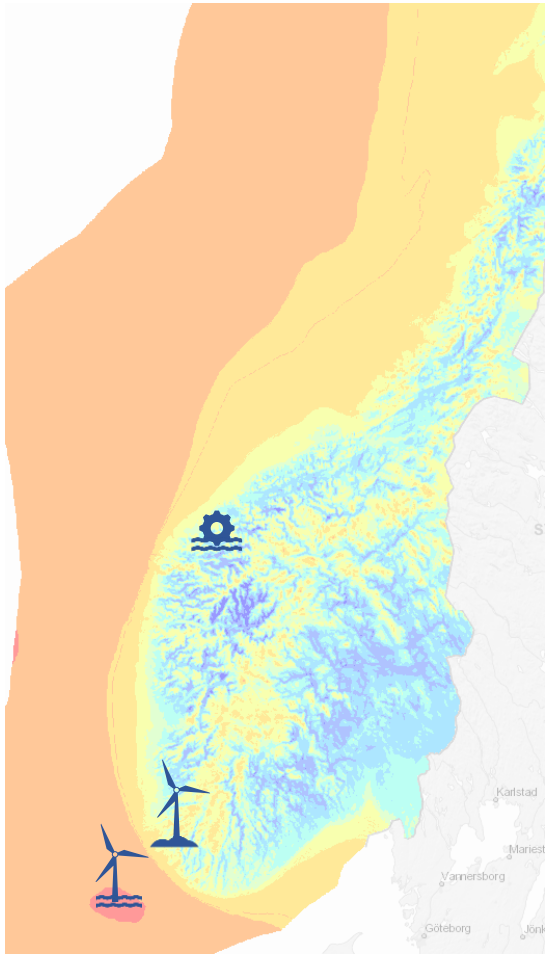
ucrf uniform capital recovery factor

$$ucrf = \frac{WACC * (1 + WACC)^N}{(1 + WACC)^N - 1}$$

WACC weighted average cost of capital (6 %)

- ~ 140 techno-economic parameters along the value chains
- Excluding any governmental intervention by taxes or subsidies

Step 1) Levelized cost of electricity



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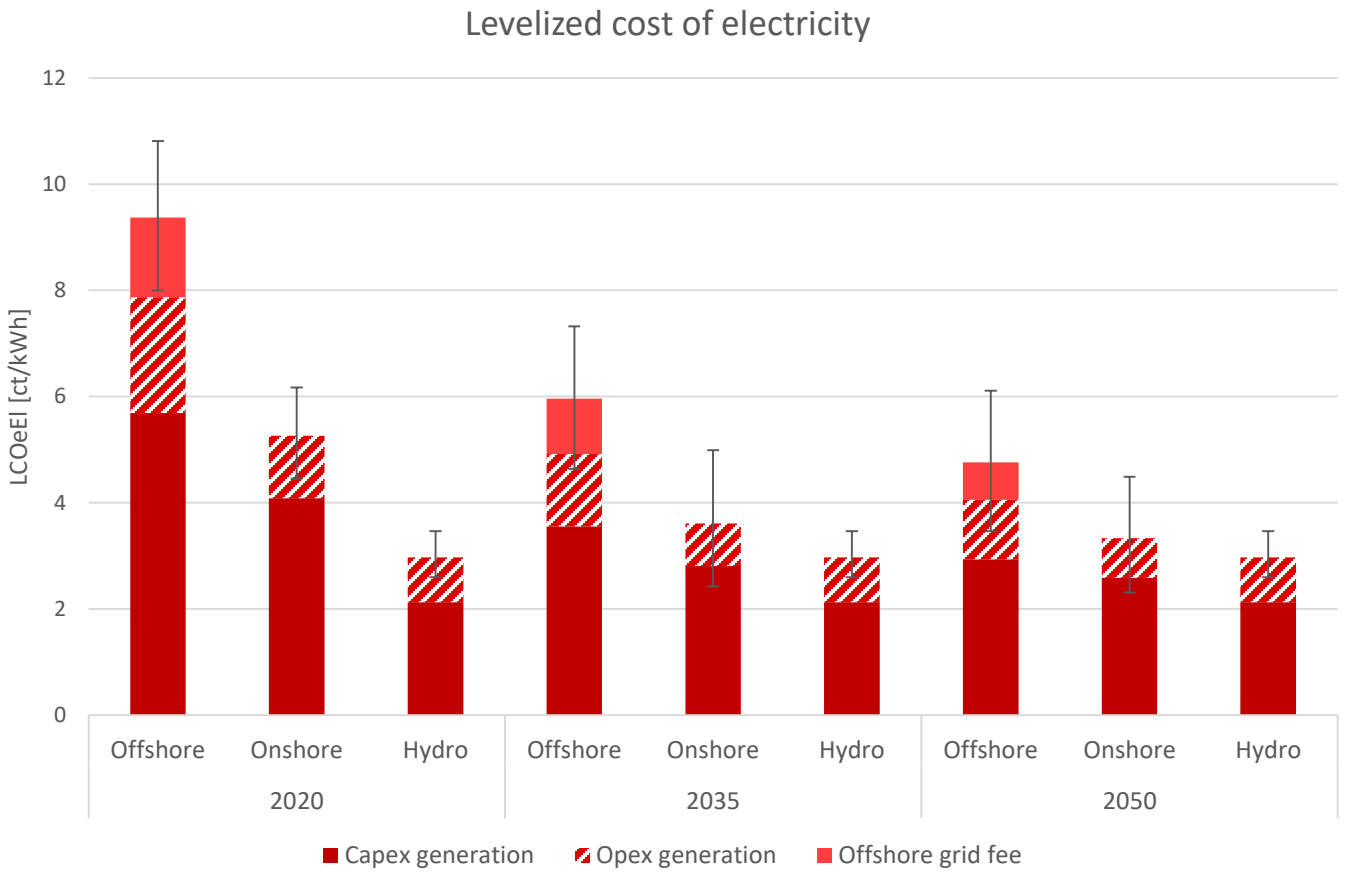
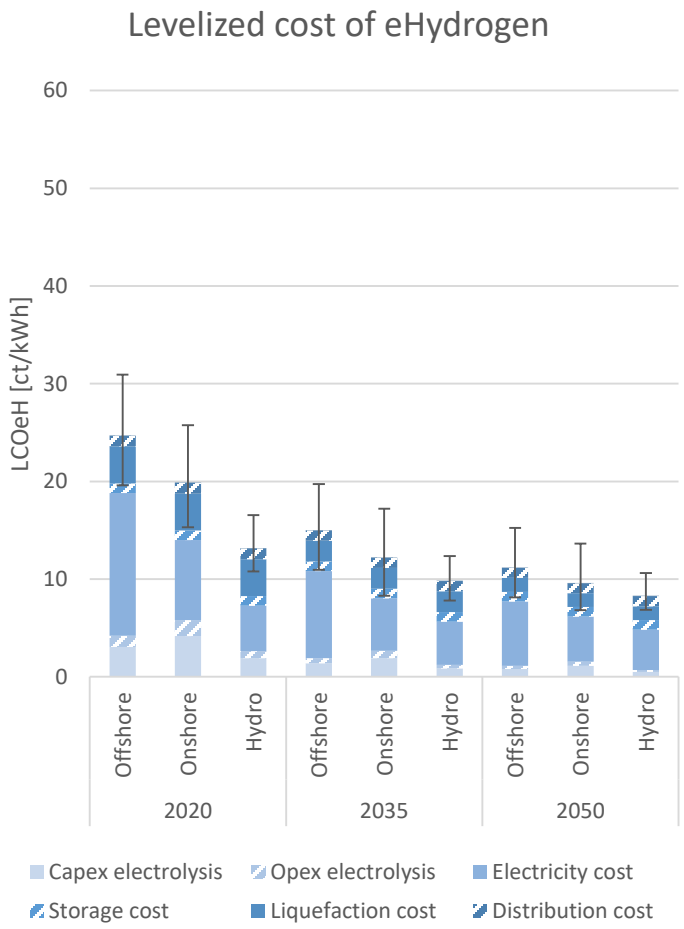
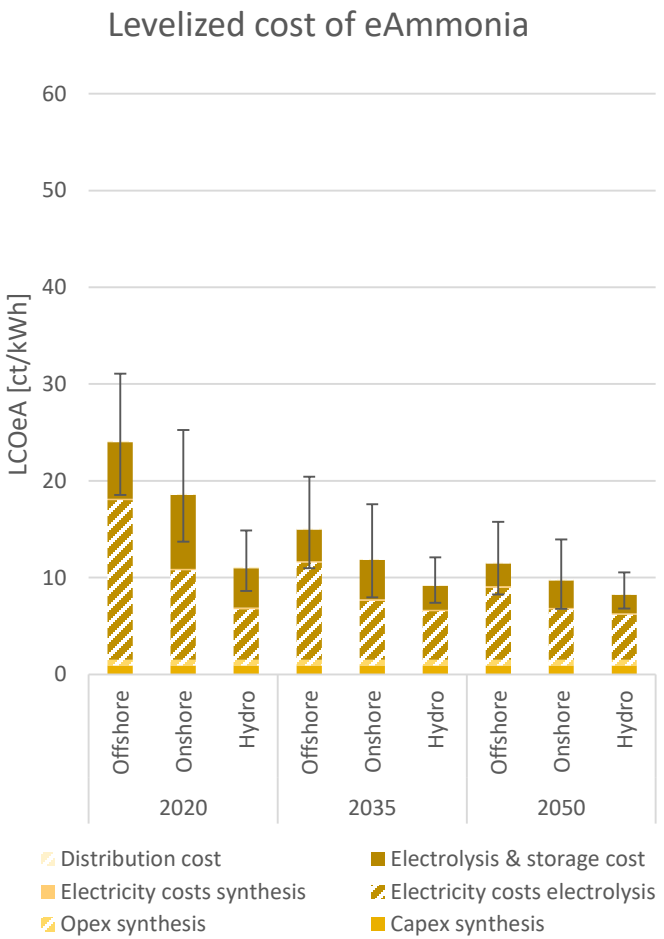
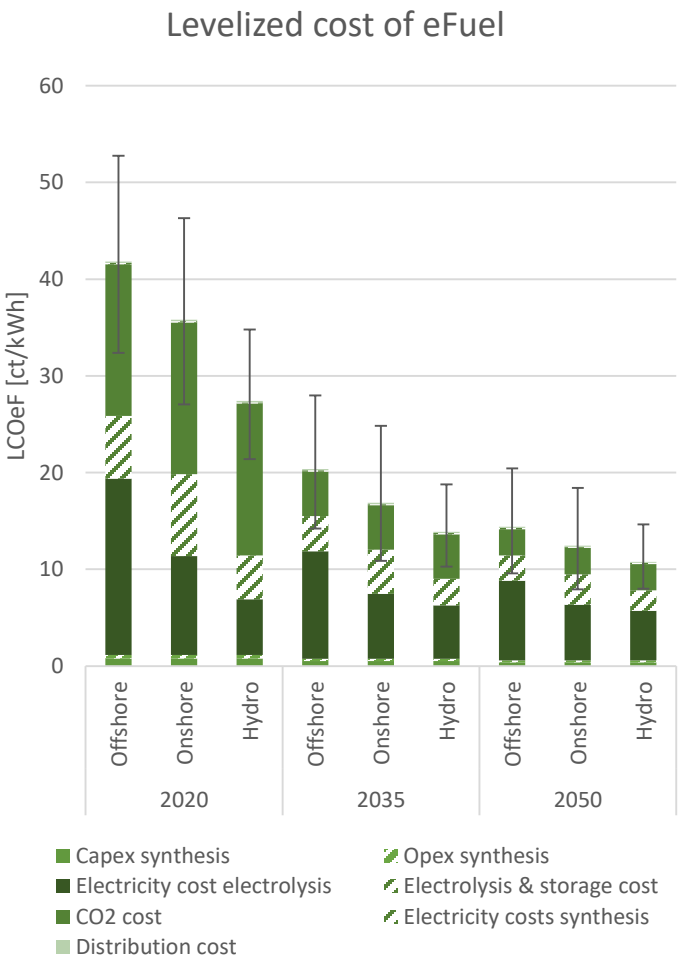


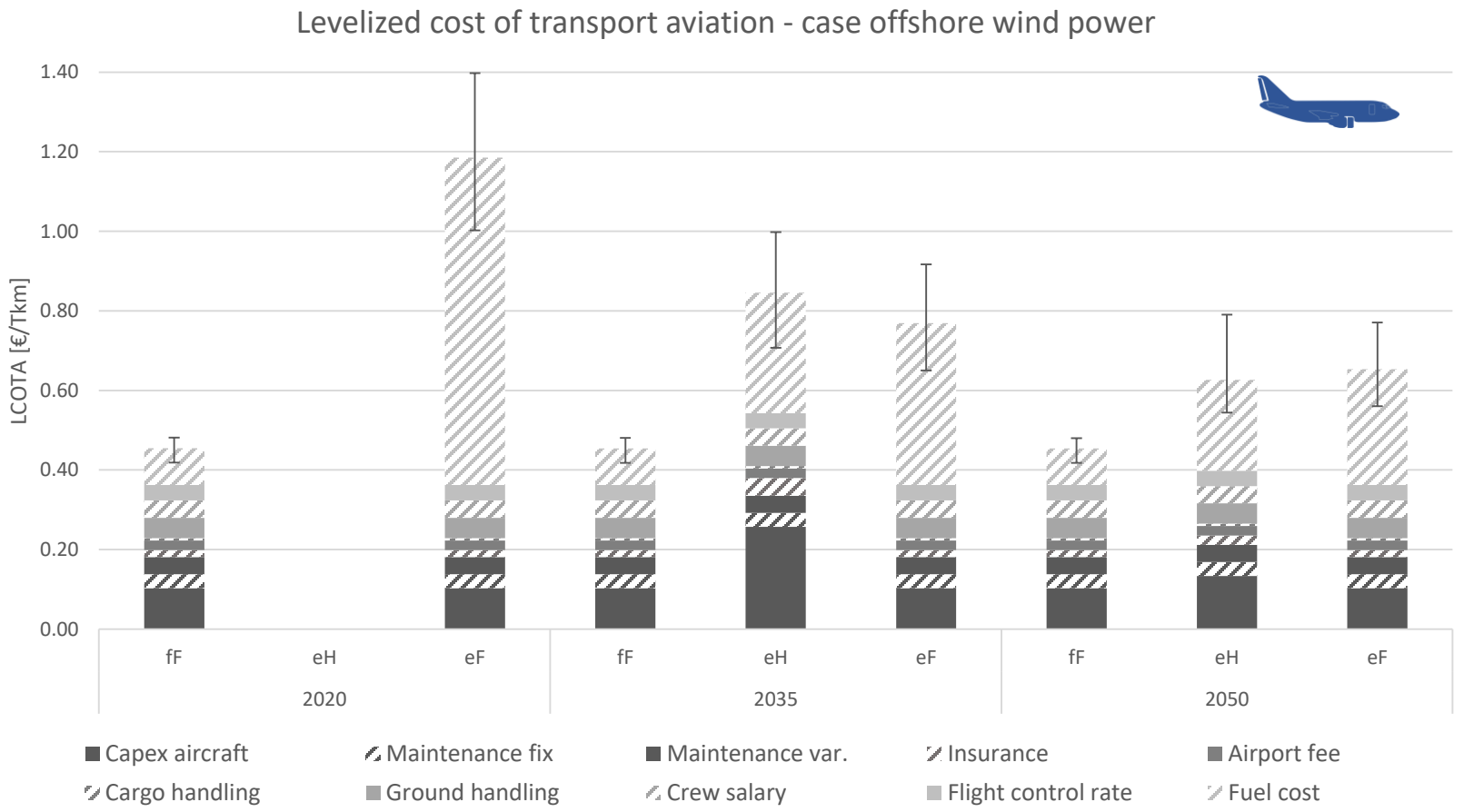
Step 2) Levelized cost of fuels







Step 3) Levelized cost of transport



Key takeaways

1) **Optimal fuel choices** are eH for trucking, eA and eH for shipping, eF first and later eH for aviation

2) **Shipping** cost are most **sensitive** if it comes to sustainable hydrogen fuels

3) Among the transport modes, alternative fuels do **not change the overall cost ranking**

4) The choice of **electricity sources** has significant impact on **early transport** decarbonization

5) Decarbonization pathways are **out of reach without** the use of **economic instruments** by 2050

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Paper coming soon.

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Thank you.

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