

Economics of sustainable hydrogen fuels for trucking, shipping and aviation

-Working Paper-


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

Long-haul:
40 t semi-truck

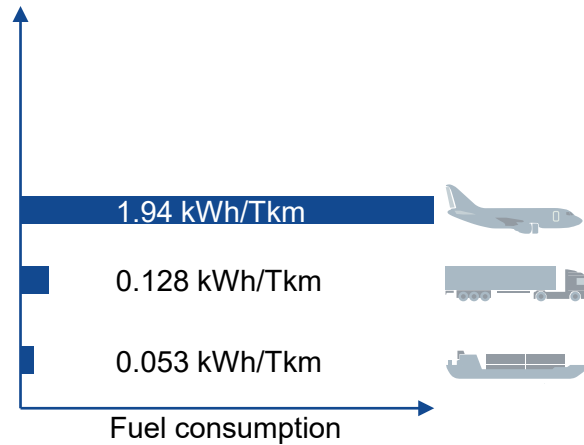
 ~25 t



Short-sea:
7680 GT vessel

 ~ 9,450 t

Competitive?

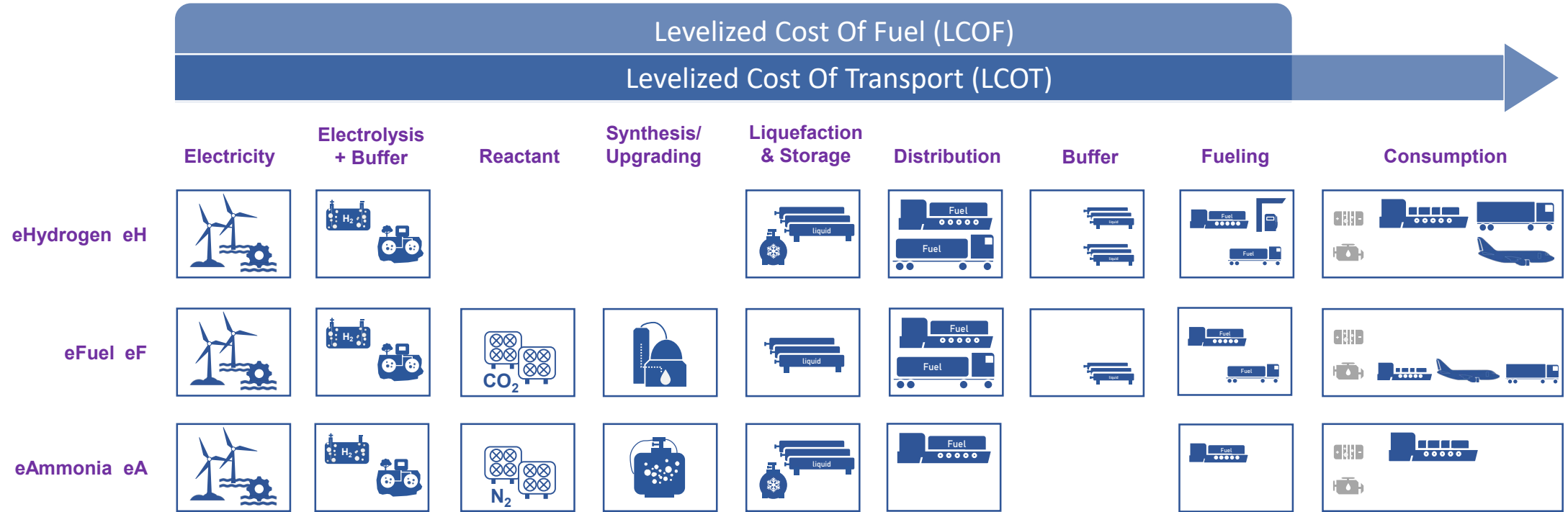


Short/mid-haul:
A320 freighter

 ~20 t

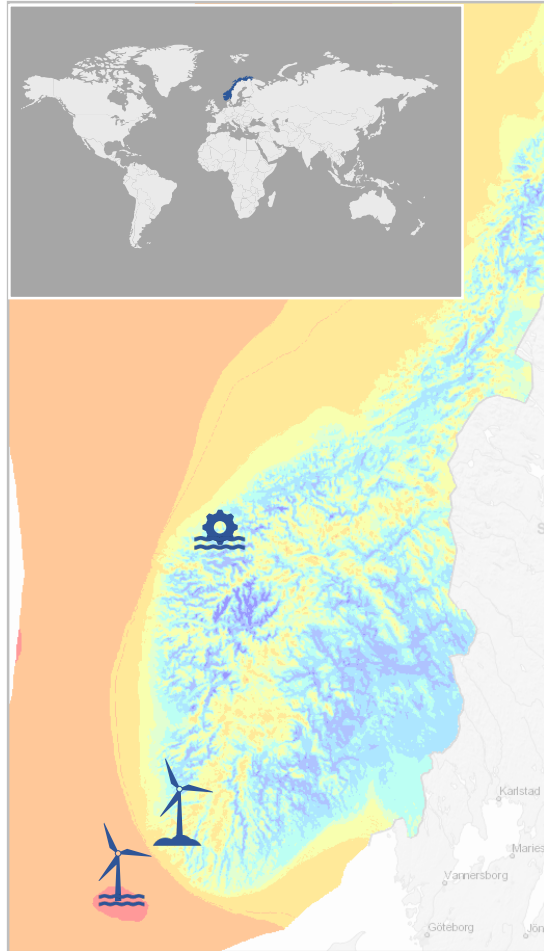
Sources:
Plane: elbeflugzeugwerke.com
Ship: confeder.com
Truck: scania.com

A dynamic cost model covering the whole value chain

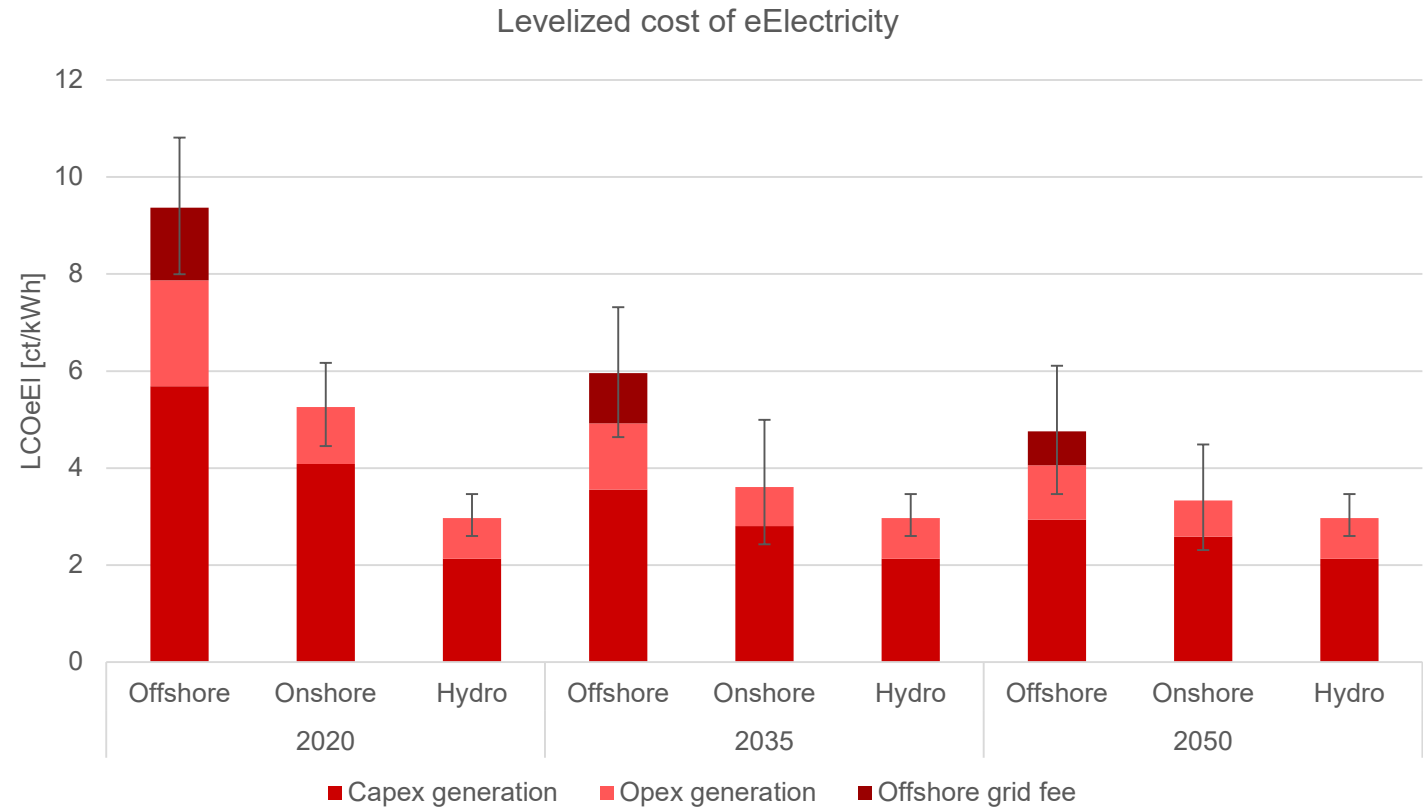


- ➡ ~ 140 techno-economic parameters along the value chains
- ➡ Excluding any governmental intervention by taxes or subsidies

Step 1) Levelized cost of electricity

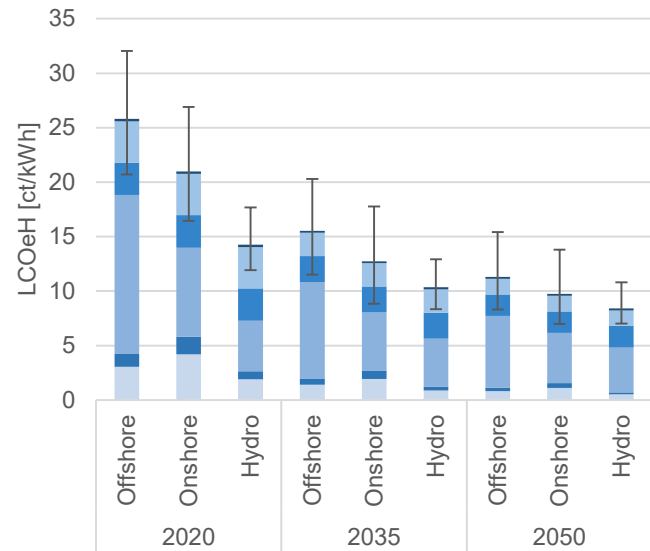


Source: <https://atlas.nve.no/Html5Viewer/index.html?viewer=nveatlas#>



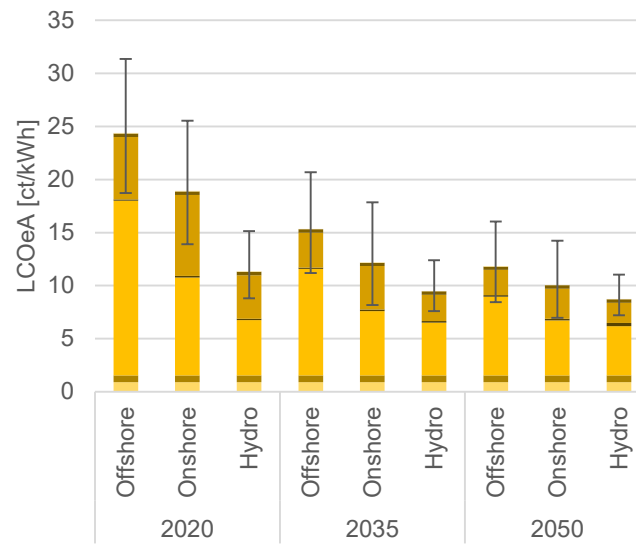
Step 2) Levelized cost of fuels

Levelized cost of eHydrogen



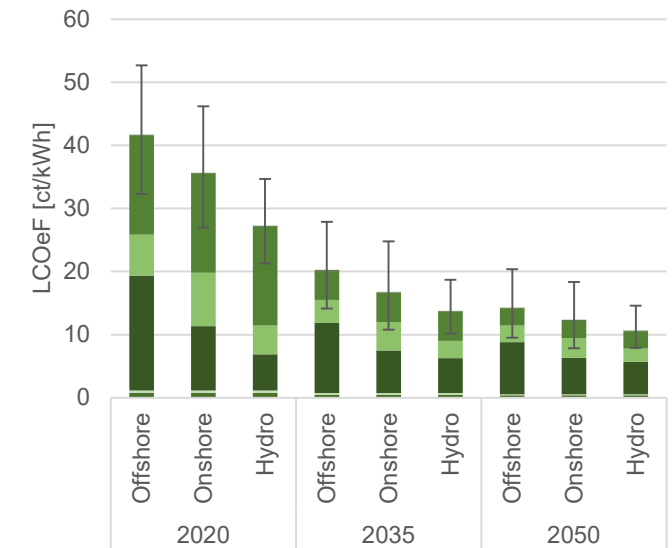
Capex electrolysis Opex electrolysis Electricity cost
Storage cost Liquefaction cost Distribution cost

Levelized cost of eAmmonia



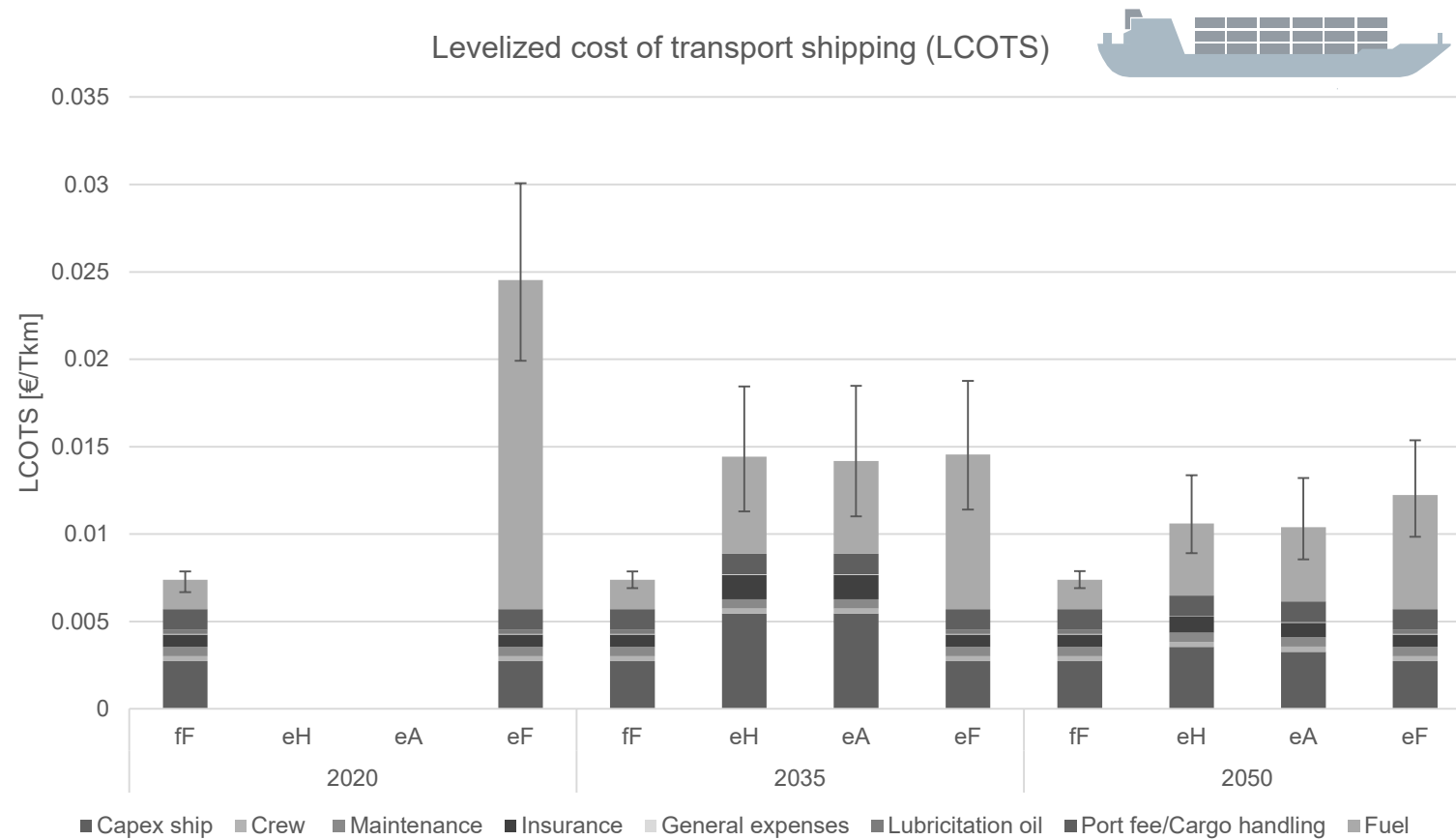
Capex synthesis Opex synthesis
Electricity cost synthesis Electricity cost synthesis
Electrolysis & storage cost Storage cost
Distribution cost

Levelized cost of eFuel



Capex synthesis Opex synthesis
Electricity cost synthesis Electricity costs synthesis
CO2 cost Electrolysis & storage cost
Storage costs Distribution cost

Step 3) Levelized cost of transport

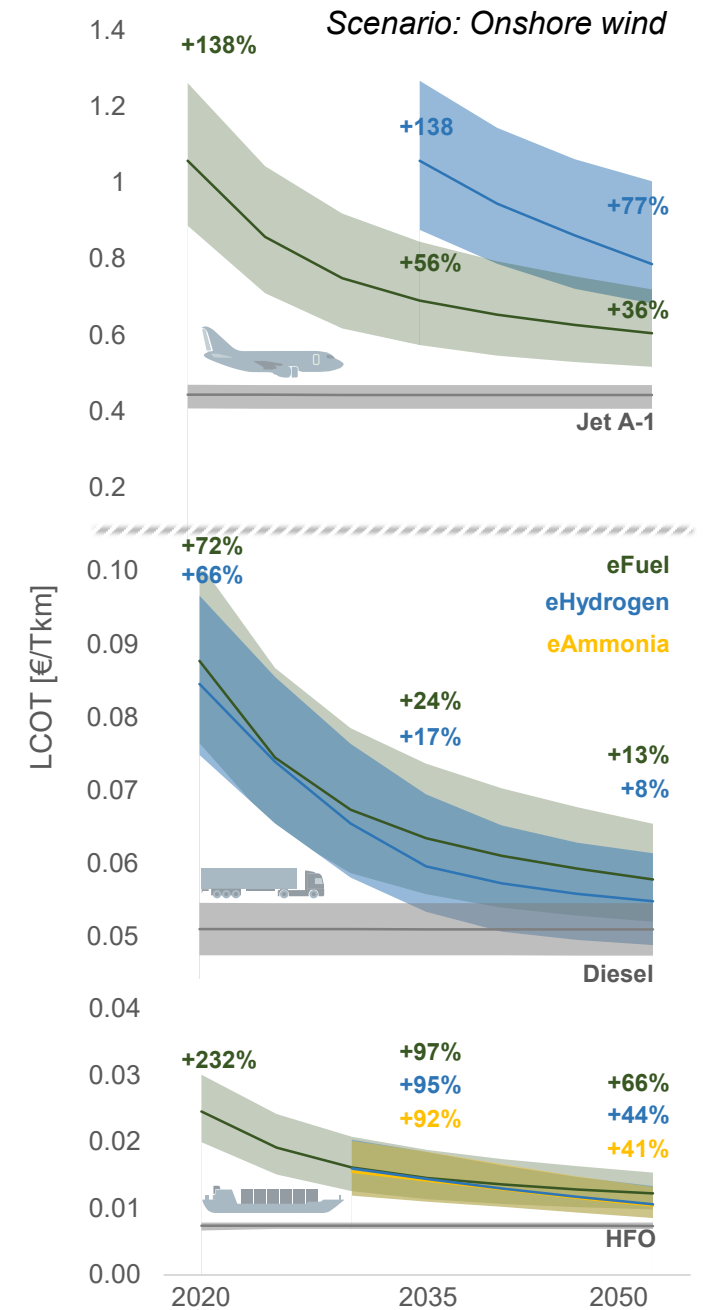


Scenario:
Onshore wind

fF fossil Fuel | eH eHydrogen | eA eAmmonia | eF eFuel

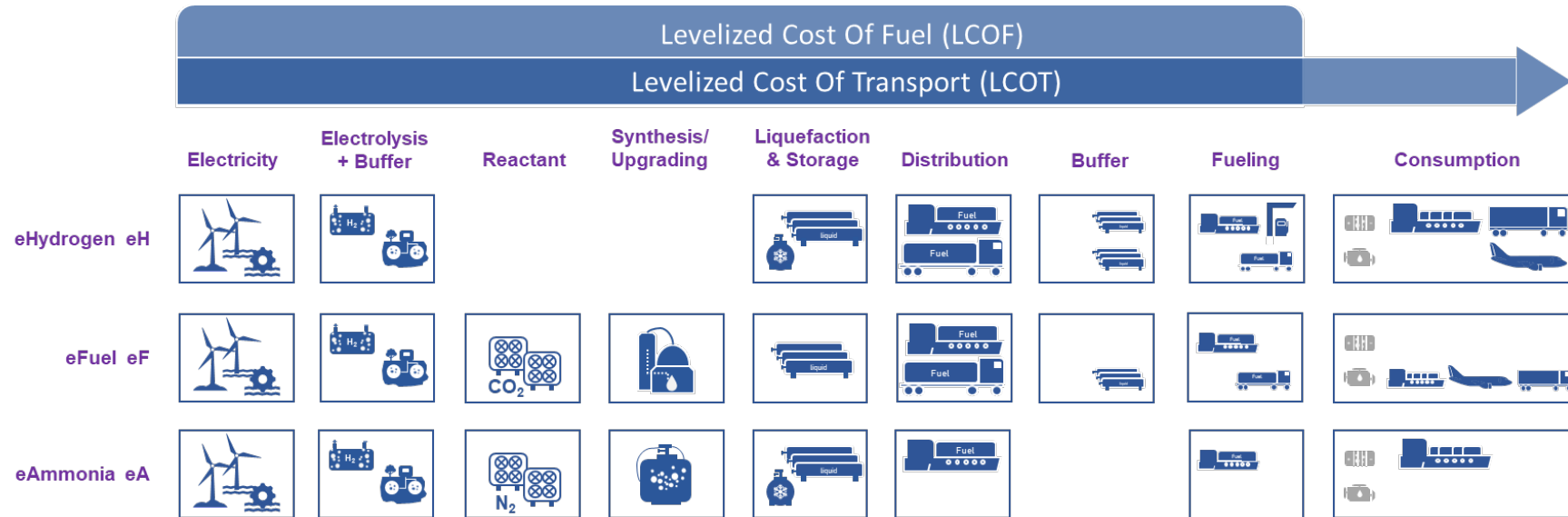
Key takeaways

- 1) **Optimal fuel choices** are eH for trucking, eA and eH for shipping, eF 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



Outlook

Where to allocate policy instruments to make SHF economically competitive in heavy-duty transport?



Thank you.

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