



Moving **H**ydrogen – by Road, Rail, Sea or ... Alchemy?

Make it; Move it; Use it

wood.



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Hydrogen Vectors



- Compressed hydrogen via tube trailer
- Liquid hydrogen via tube trailer



- Compressed hydrogen via pipeline
- Ammonia via pipeline

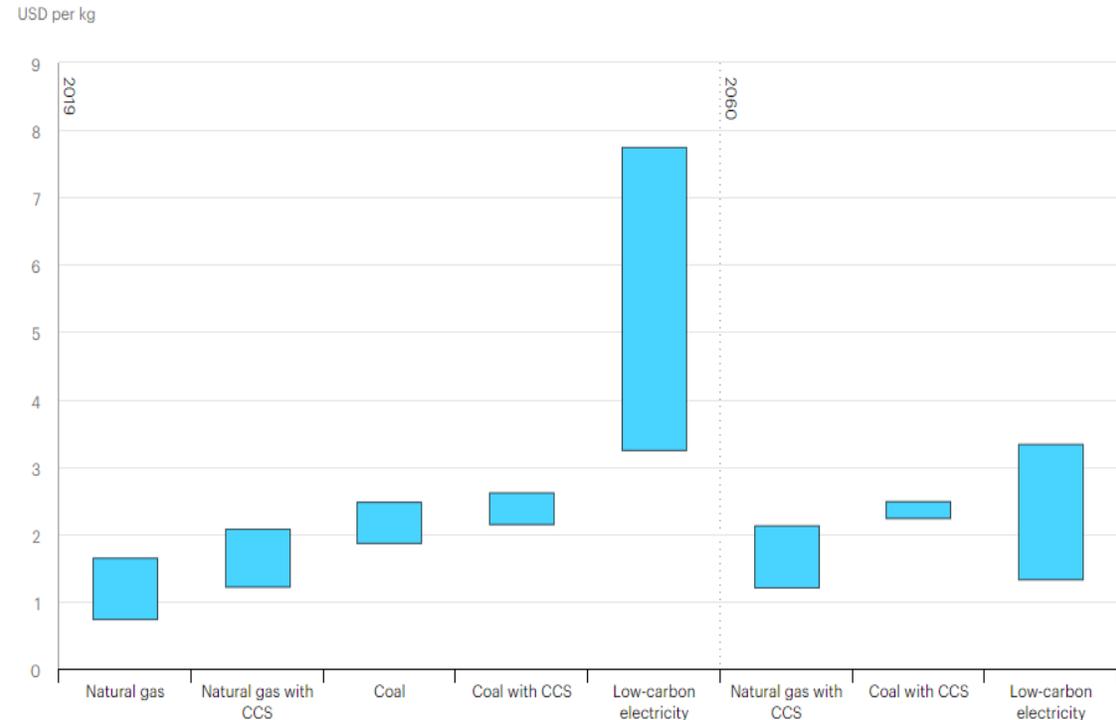


- Liquid hydrogen via shipping
- Ammonia via shipping
- Methanol via shipping

Production costs and centralisation

- Cost of renewable electricity massive factor
- Highly variable
- Trending down
- Supports centralised production
- Puts emphasis on lowering transport and distribution costs

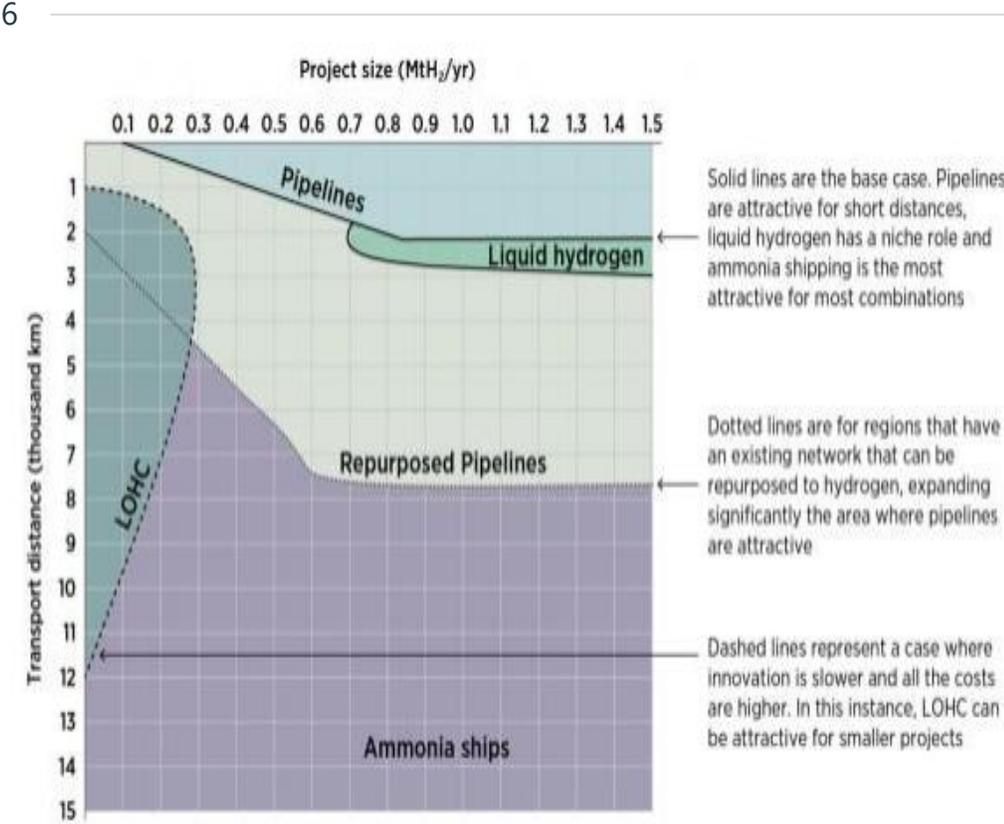
Hydrogen costs by production method



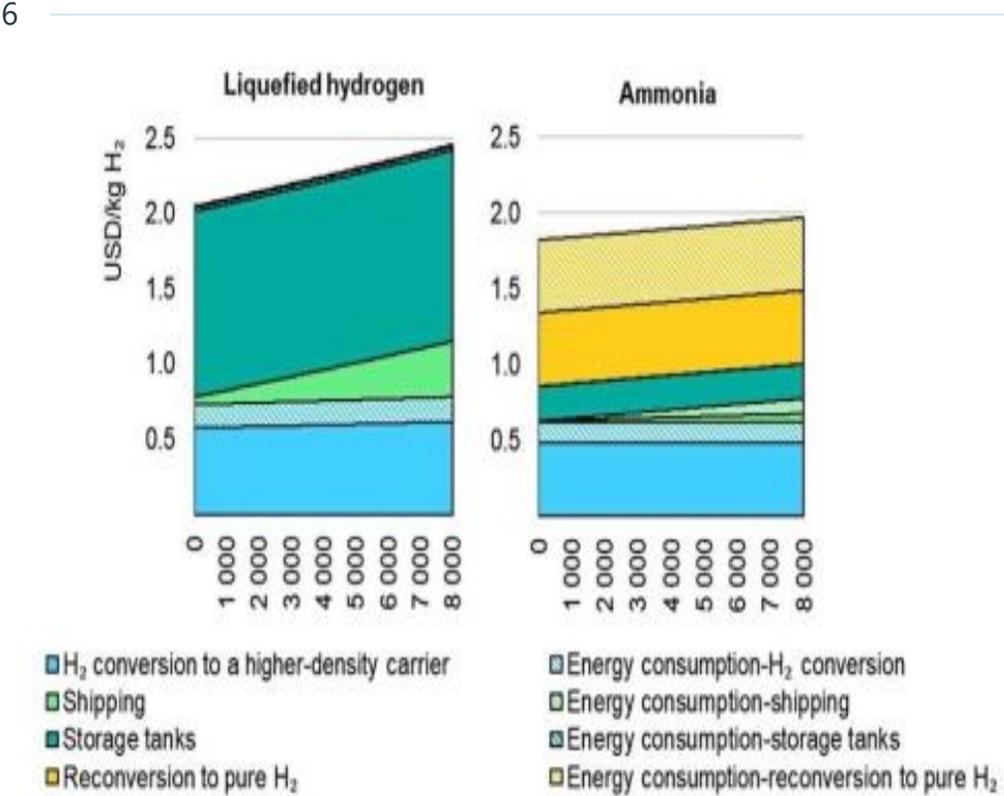
IEA. Licence: CC BY 4.0

Current Literature

Vector Comparison, IRENA (2022)

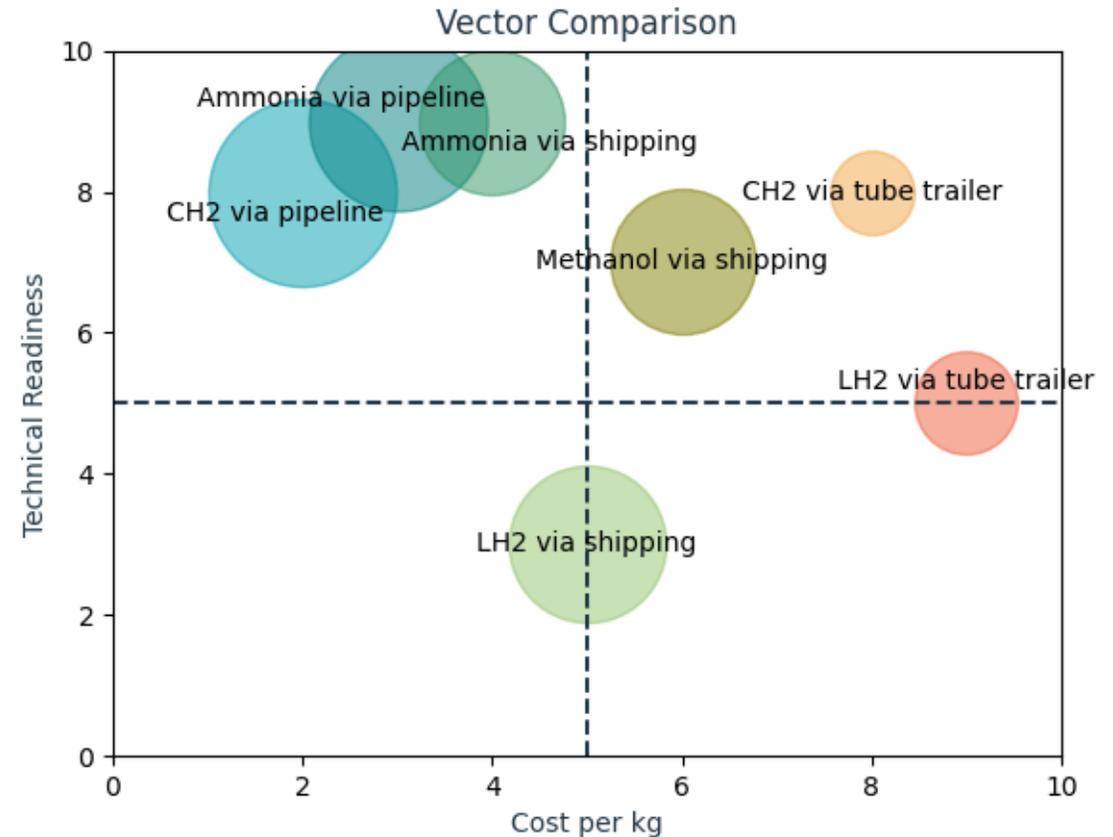


Component Breakdown, IEA (2023)



Qualitative Vector Comparison

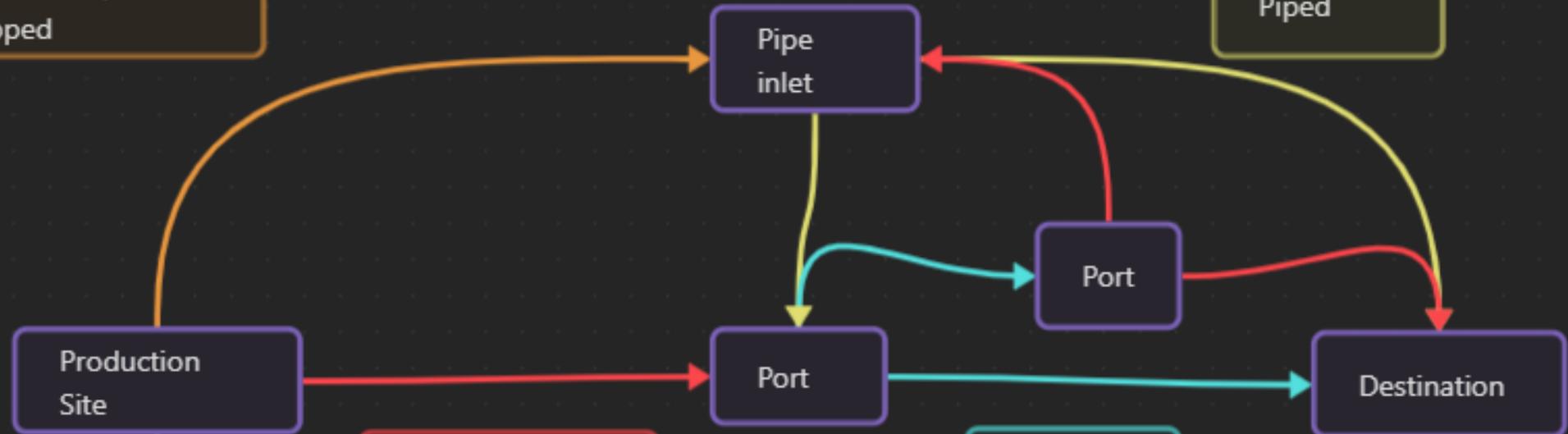
- Current focus on low CAPEX, proven technology such as tube trailers
- Pipelines and ammonia shipping likely to be cost-effective options once production has scaled sufficiently
- Carriers such as LH2 and methanol may have niche roles



Hydrogen Pathways

Tube trailer /
shipped

Piped

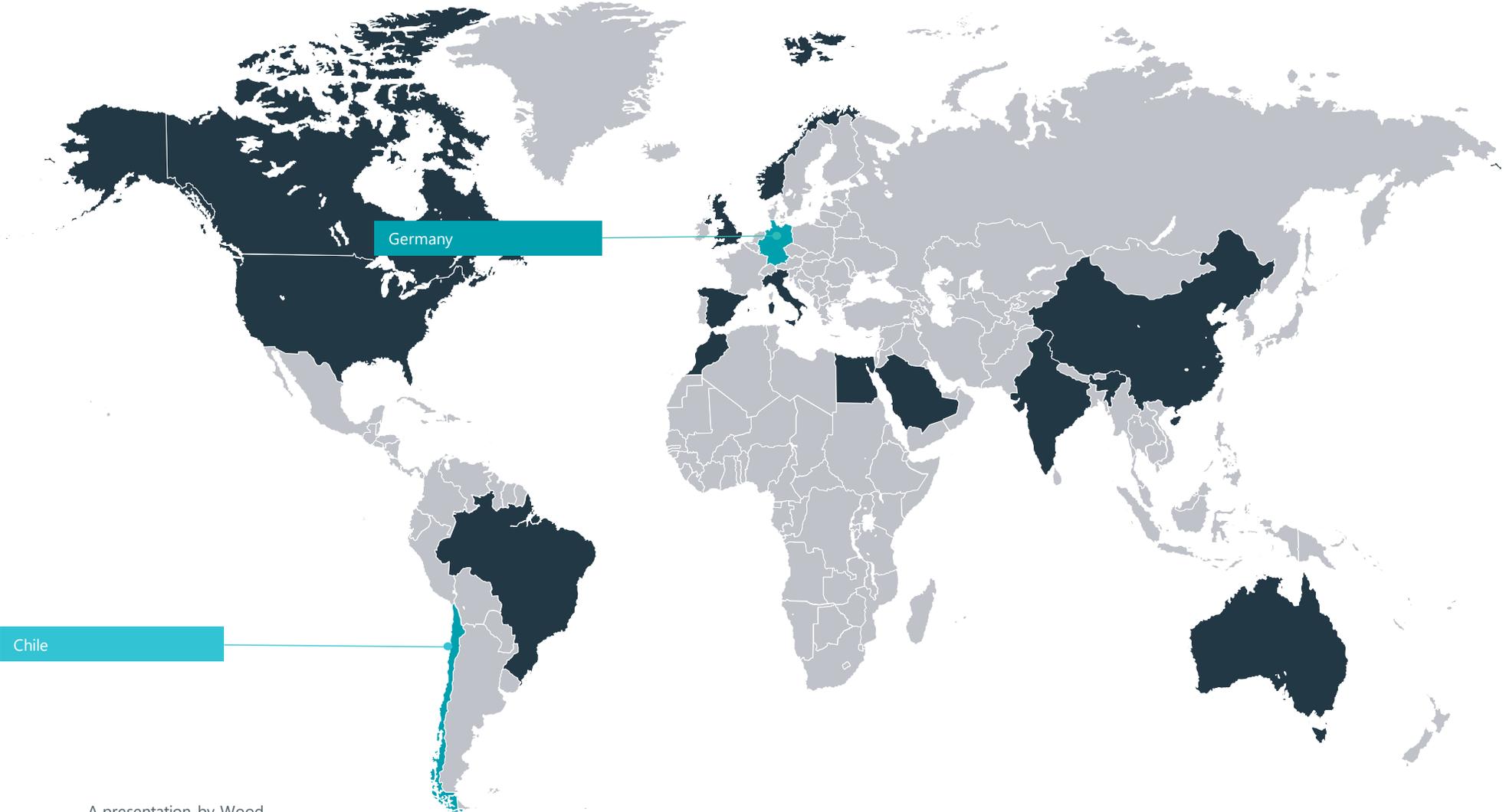


Tube trailer /
piped

Shipped

Tube trailer / piped /
shipped

Chile to Germany

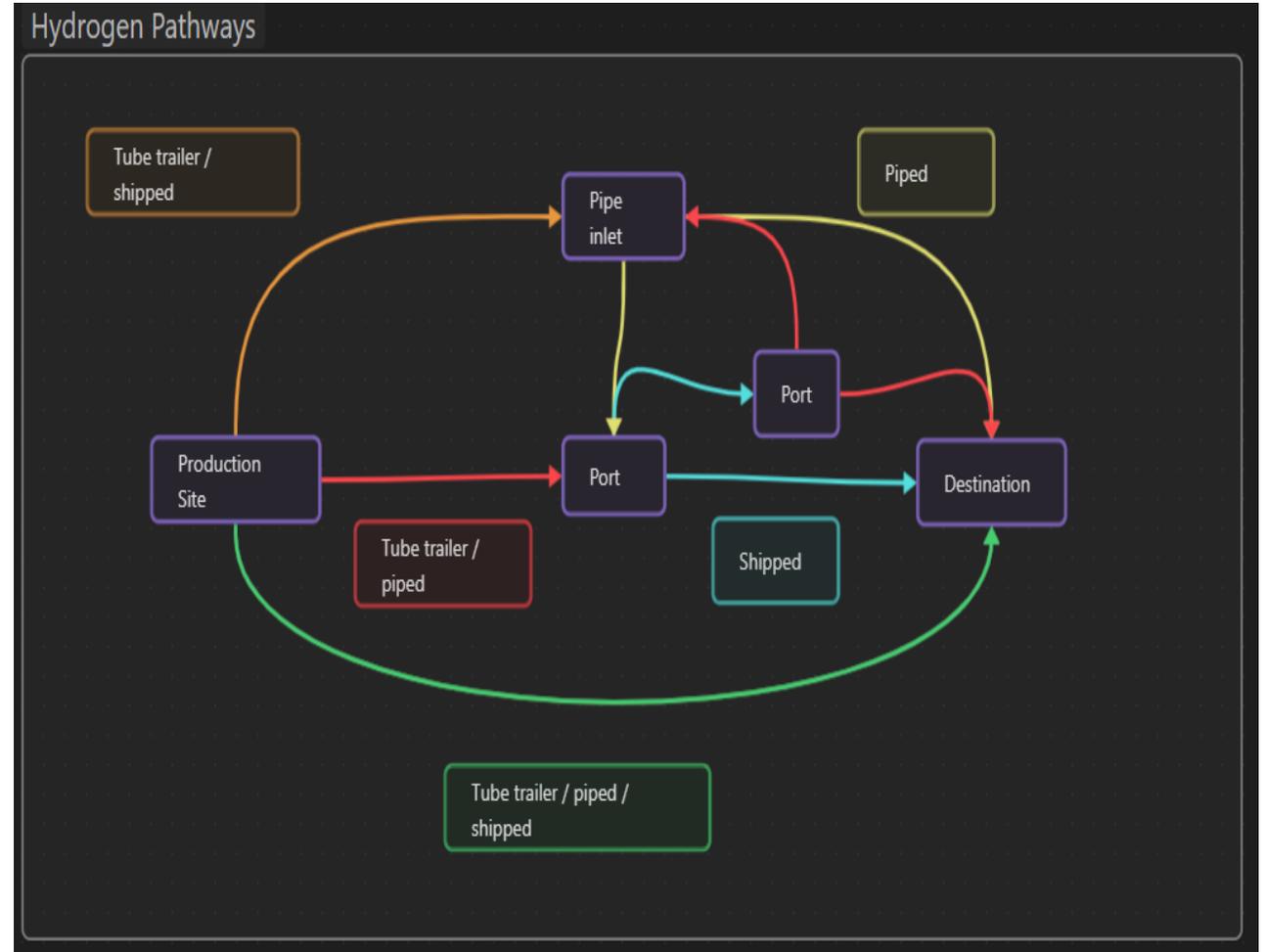


Example: Chile to Germany

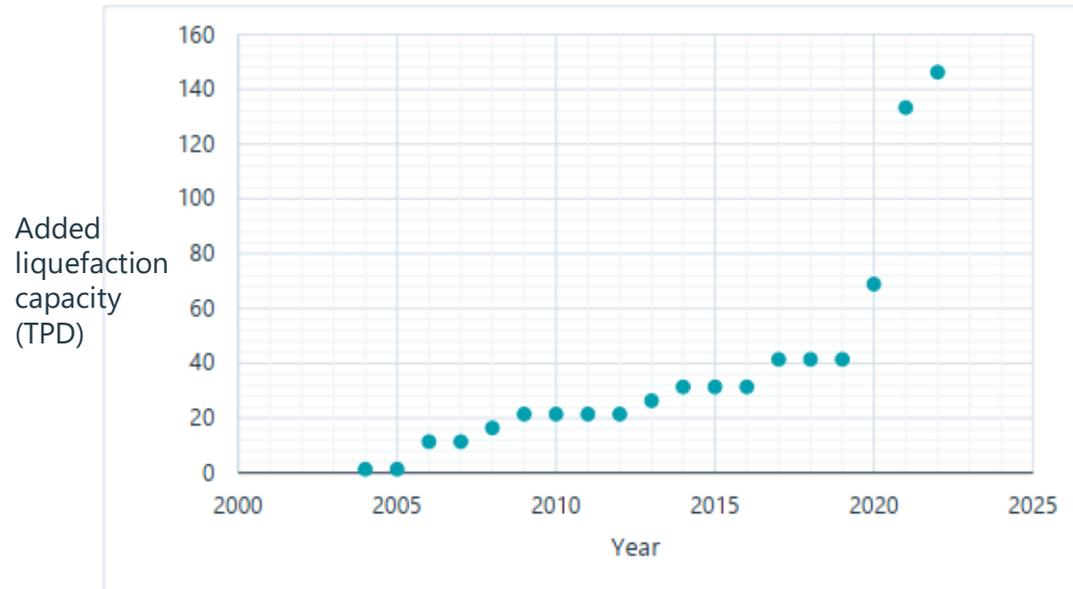


Summary

- Many hydrogen vectors to choose from
- Low regional renewable electricity cost promotes centralisation of hydrogen production
- Real projects likely to be multi-vector
- Savings and efficiencies may be realised by considering the combinations of vectors used



All vectors picking up pace, including LH2



MF Hydra



- LH2 fuel cells
- 300 passengers
- 80 cars

Offshore-energy.biz

wood.