University of Stuttgart
IER Institute of Energy Economics
and Rational Energy Use

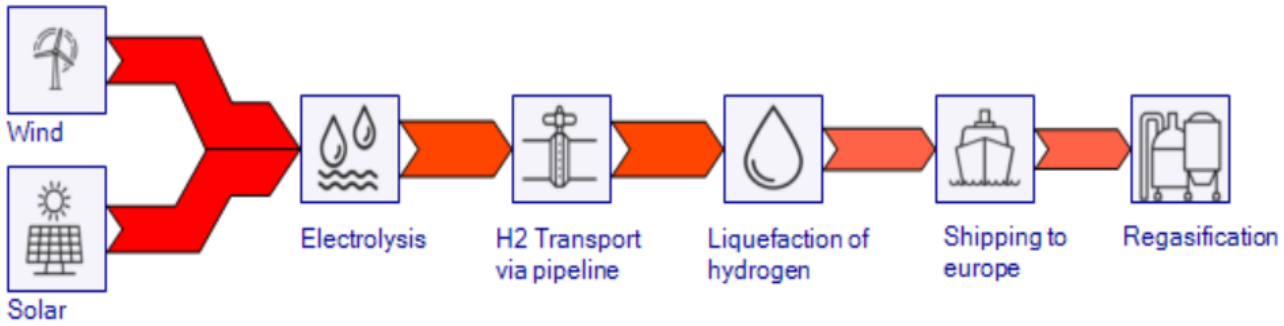
Fact sheet – IER project Hy4Daures Namibia

2.1 Techno-economic assessment of the liquefied hydrogen value chain

BACKGROUND

The hydrogen production in Namibia is just the starting point. The big question is, what comes next and there are frankly several options that might be considered. To deepen the understanding, what can come next and what is attractive from a technical and economic standpoint a so-called techno-economic assessment (TEA) will be conducted. The following factsheet gives an insight into the value chain of exporting hydrogen in a liquid state.

LIQUEFIED HYDROGEN VALUE CHAIN FOR REGASIFICATION



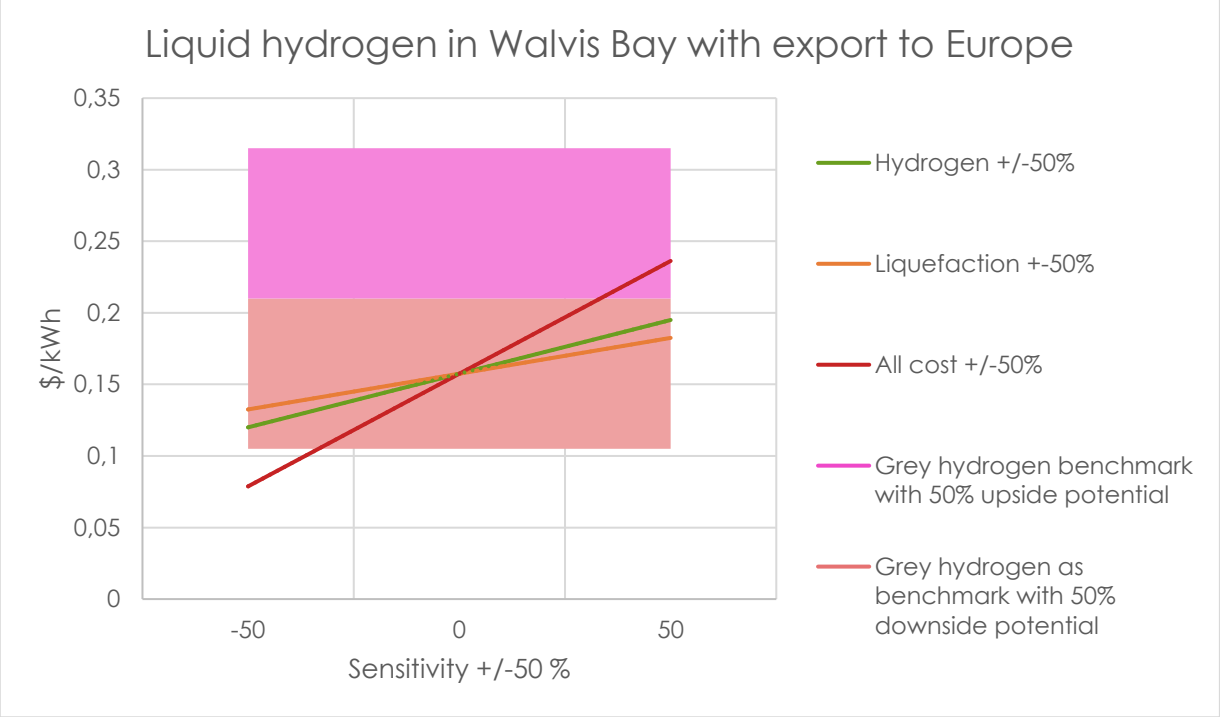
The first hydrogen value chain involves no synthesis. The produced hydrogen will be transported via pipeline to Walvis Bay, where the gasous hydrogen will be cooled, liquefied and shipped to europe, where it can be regasified and feed to the natural gas grid. In the future it is also imaginable, that a pipeline grid will be built, which is completely dedicated to hydrogen. This means that the gasous hydrogen wouldn't be used as a combustion fuel, but can also be used as pure hydrogen for steel production for instance.

RESULTS

In the following preliminary results are presented for producing LH2 and exporting it to Germany (incl. regasification). The overall cost along this hydrogen value chain equates to roughly 16 ct/kWh for gasous hydrogen in Germany. The sensitivity analysis shows the impact of reducing/increasing three cost components by 50 %.

The orange line shows the sensitivity for the cost component "liquefaction", the green line for "hydrogen" and the red one for "all cost components" considered in the calculation.

The diagram also shows two stripes, which represent a benchmark. The intersection of the two stripes represent the cost for grey hydrogen produced with natural gas at a purchase price of 150 EUR/MWh. The stripes present the price sensitivity, if the cost for grey hydrogen is reduced or increased by 50 %. This result shows, that exporting hydrogen from Namibia to Germany can be competitive with grey hydrogen produced from natural gas, if the natural gas prices will be at its higher peaks.



Source for benchmark: "Site-specific, comparative analysis for suitable Power-to-X pathways and products in developing and emerging countries" by Fraunhofer ISE

CONCLUSIONS / FURTHER WORK

The results show that producing green hydrogen and transporting it to Germany as liquefied hydrogen can be cost competitive. The cost for that hydrogen value chain is slightly higher, compared with exporting it as ammonia and reconvert it back to hydrogen in Germany. But it might make sense to pay that higher price, because the purity of regasifying liquid hydrogen is much higher than reconverting ammonia.

Though it is to mention, that the current natural gas price is resulting in hydrogen production, that is much cheaper than the imported hydrogen from Namibia. Current cost for producing grey hydrogen is somewhere around 0,08 $/kWh.

Besides the economics the imported hydrogen is much more climate friendly compared with the grey hydrogen. That fact can also justify to pay a premium for the green hydrogen from Namibia. Further research should calculate the environmental improvement and measures the GWP reduction and set that in relation to the higher price.

FOR FURTHER INFORMATION AND FEEDBACK

Have a look at our other Fact Sheets covering topics from Project Descriptions, Use Cases, Techno-Economic analysis, Indicators, Energy System Analysis, Macro-Economic modelling, and many more:

https://github.com/IER-Hy4Daures/Fact-Sheets

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In collaboration with