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

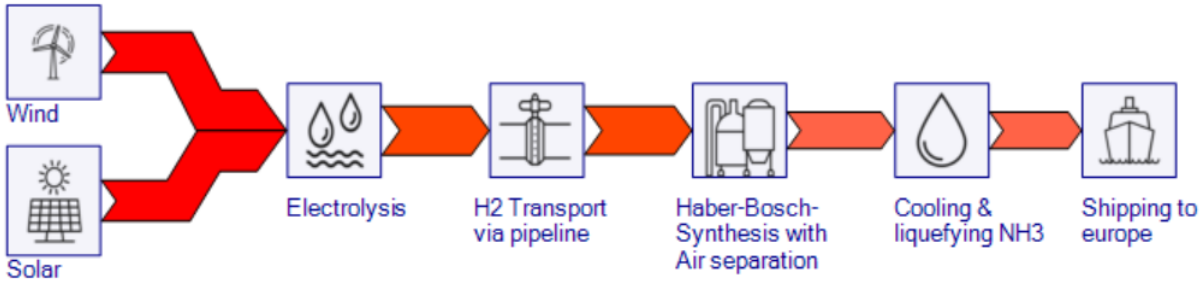
Fact sheet – IER project Hy4Daures Namibia

2.2 Techno-economic assessment of ammonia synthesis via the Haber-Bosch process

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 synthesizing ammonia with the Haber-Bosch-process.

AMMONIA SYNTHESIS WITH HABER-BOSCH



The second hydrogen value chain shows the ammonia pathway. The produced hydrogen will be transported via pipeline to Walvis Bay, where a Haber-Bosch synthesis takes place. The required nitrogen will be taken from ambient air. The produced ammonia will be cooled, liquefied and shipped to europe, where it can be directly used as a chemical feedstock, energy carrier or reconverted to hydrogen.

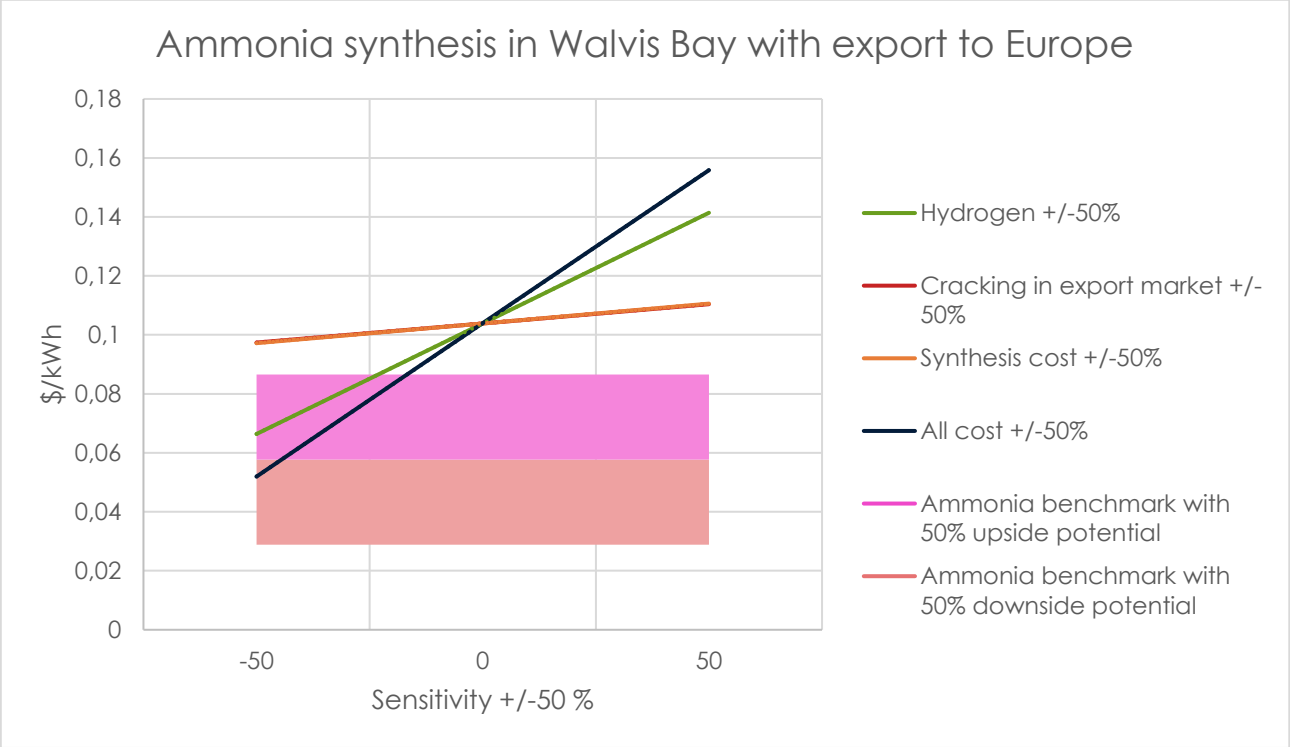
RESULTS

In the following preliminary results are presented for producing ammonia and exporting it to Germany (incl. cracking). The overall cost along this hydrogen value chain equates to roughly 10 ct/kWh of gasous hydrogen in Germany. The sensitivity analysis shows the impact of reducing/increasing severall cost components by 50 %. As a result, the cost for the initial hydrogen production has the biggest influence on the overall cost.

The diagram also shows two stripes, which represent a benchmark. The intersection of the two stripes represent the cost of ammonia at the world market. The stripes present the price sensitivity, if the price for ammonia is reduced or increased by 50 %.

As a first outcome of the ongoing research study, this result shows, that exporting ammonia from Namibia to Germany has a slightly higher cost than conventional ammonia. Adapting learning curves, which result in lower levelized cost of hydrogen as well considering environmental aspects, ammonia production in Namibia can be attractive anyways.

Factsheet No 2.2
Version 1, March 2024



Source for benchmark: "The cost of CO2-free Ammonia" by Bunro Shiozawa published on November 12, 2020 in Ammonia Energy Association

CONCLUSIONS / FURTHER WORK

The analysis shows that producing ammonia in Namibia with export to Germany and final reconversion is not competitive with current market prices. The sensitivity analysis shows, that hydrogen production has the biggest impact on the cost (it has the highest slope). Reducing the hydrogen production by 50 % increases the economics enormously and leads to a position, where it is almost cost competitive with conventional ammonia. Synthesis, transport and cracking the ammonia has a very little impact on the overall cost. The difference between the variation of "hydrogen" and "all cost" is very little. The small spread between those two lines shows the little impact of the other cost factors besides the hydrogen production itself. Reducing "all cost" by 50 % and forecasting a price increase by ammonia results in a viable business case for ammonia production in Namibia.

It is also to mention, that green ammonia production brings intangible value to the product due to its lower carbon footprint. This increases the value of green ammonia compared with the conventional grey ammonia, that is currently dominating the market.

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