THE DECARBONIZATION OF SHIPPING

A German-Korean Perspective

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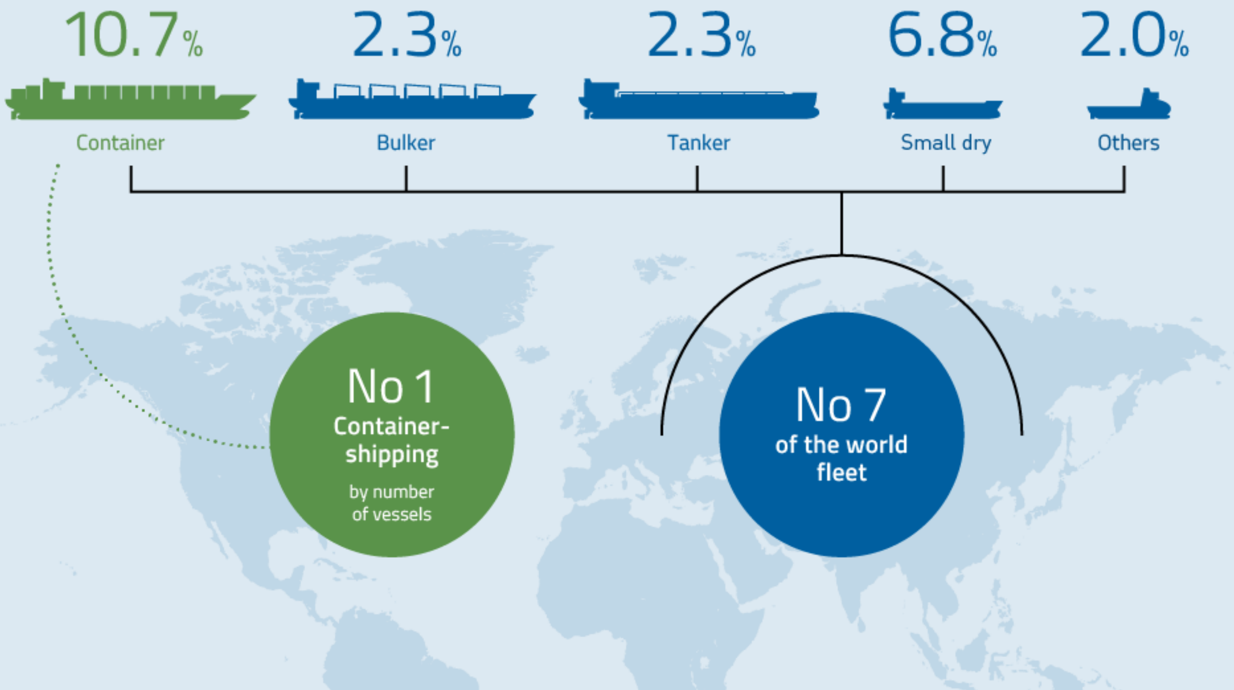
Market share 2022

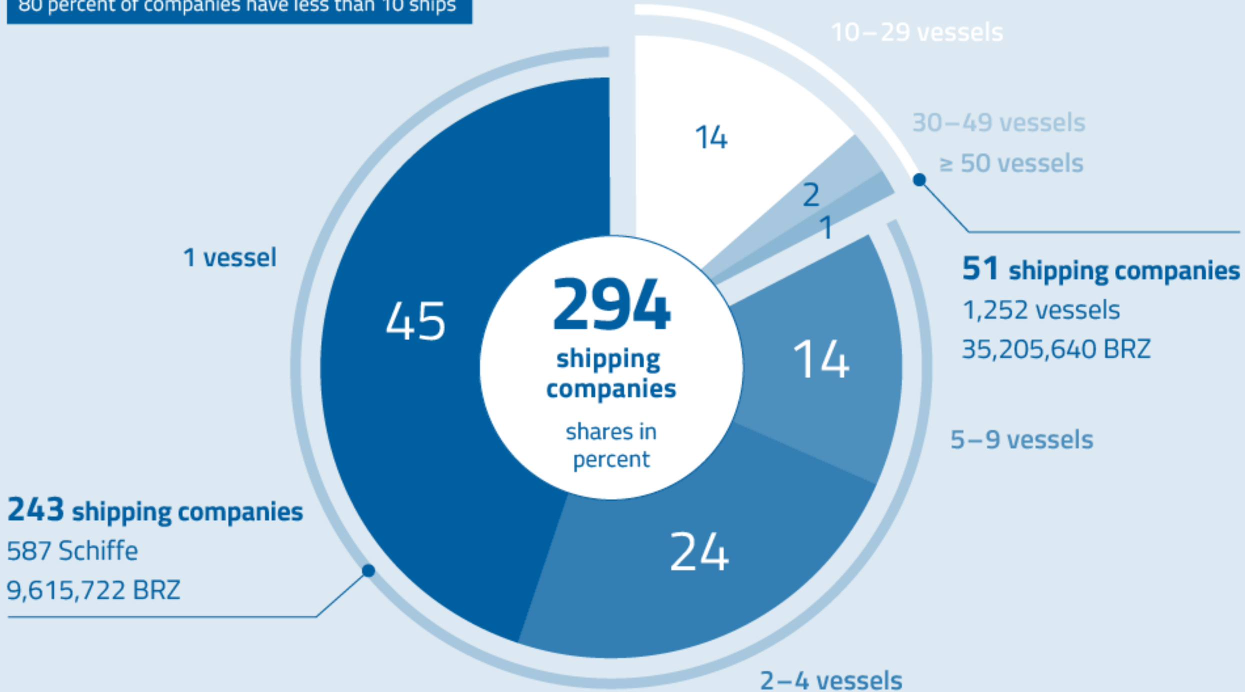
German share of the world fleet by vessel type and number of vessels



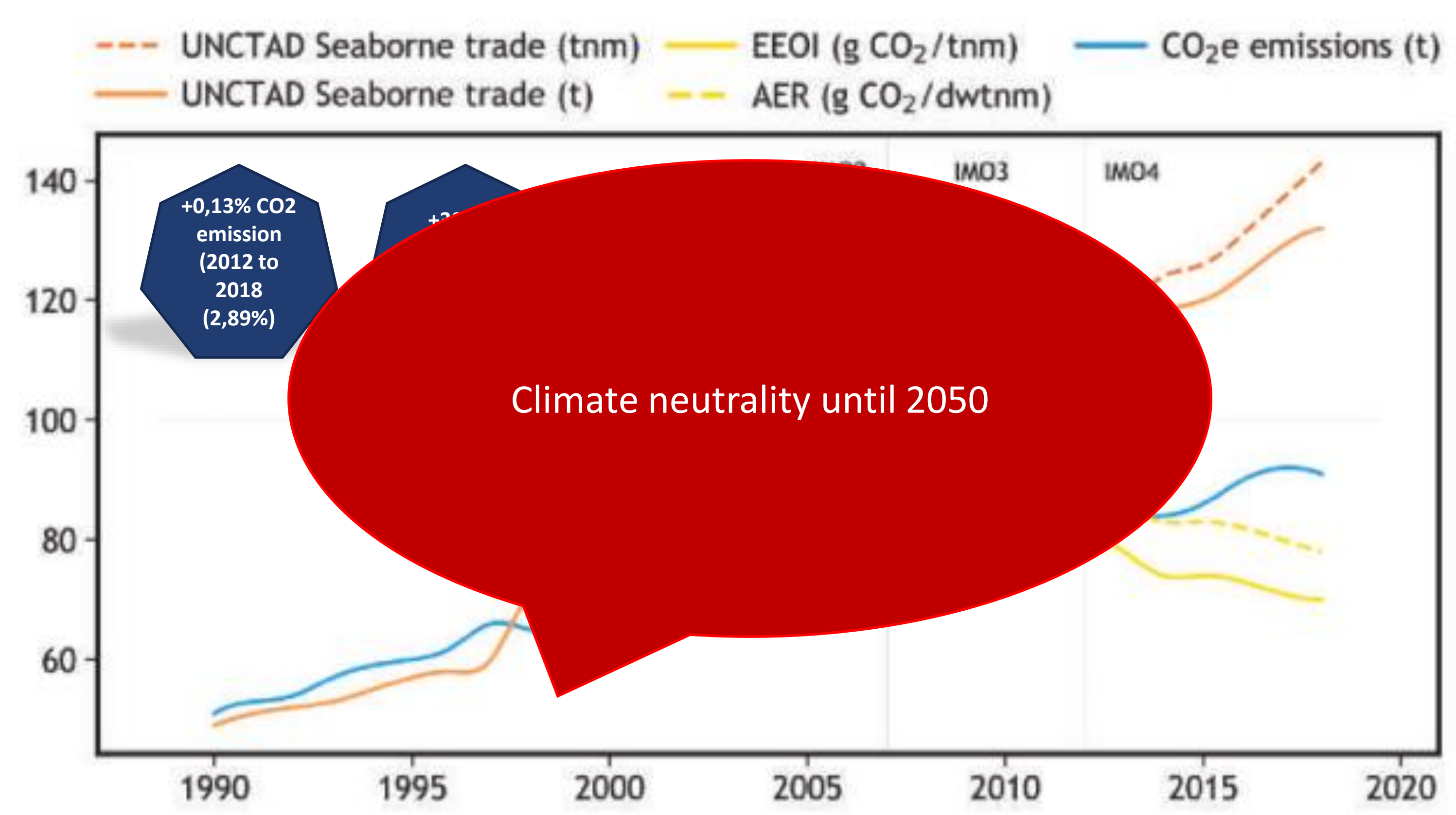
Source:
IHS/SeaWeb;
VesselsValue/
vesselsvalue.com;
as of 02.2023

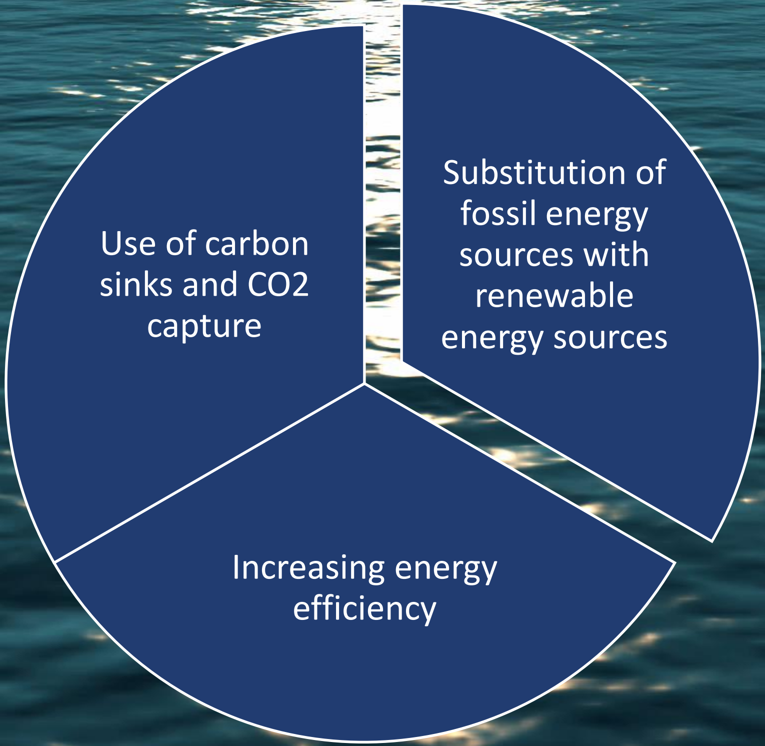
Corporate structure in maritime SMEs

80 percent of companies have less than 10 ships



Source: Federal Maritime and Hydrographic Agency, www.bsh.de/ VDR; as of 31.12.2022; rounded values


UNCTAD Seaborne trade (tnm)
EEOI (g CO_2/tnm)
CO_2e emissions (t)
UNCTAD Seaborne trade (t)
AER (g CO_2/dwtnm)
IMO3
IMO4
140
120
100
80
60
1990
1995
2000
2005
2010
2015
2020
+0,13% CO2 emission (2012 to 2018 (2,89%)
Climate neutrality until 2050


Use of carbon sinks and CO2 capture
Substitution of fossil energy sources with renewable energy sources
Increasing energy efficiency

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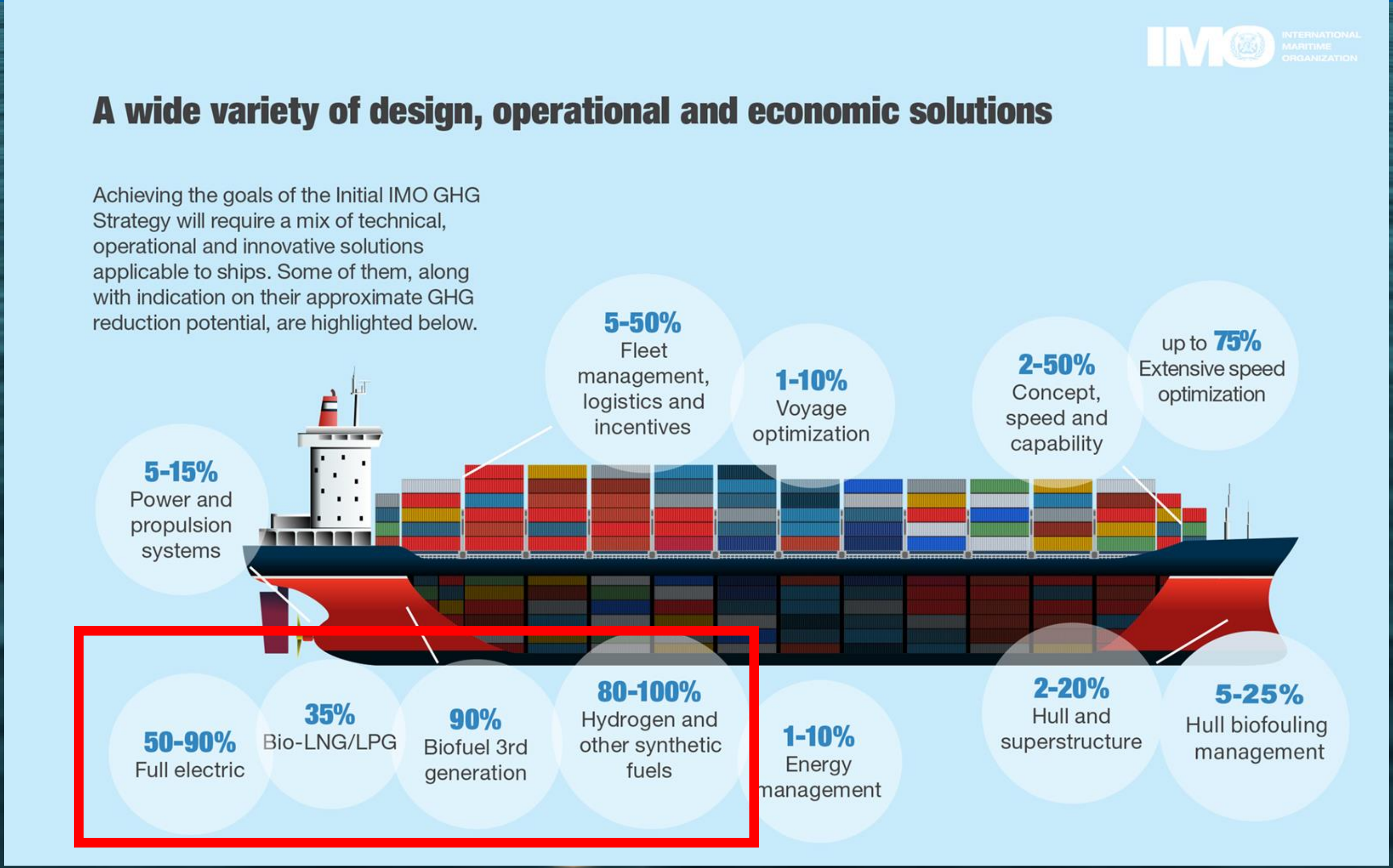
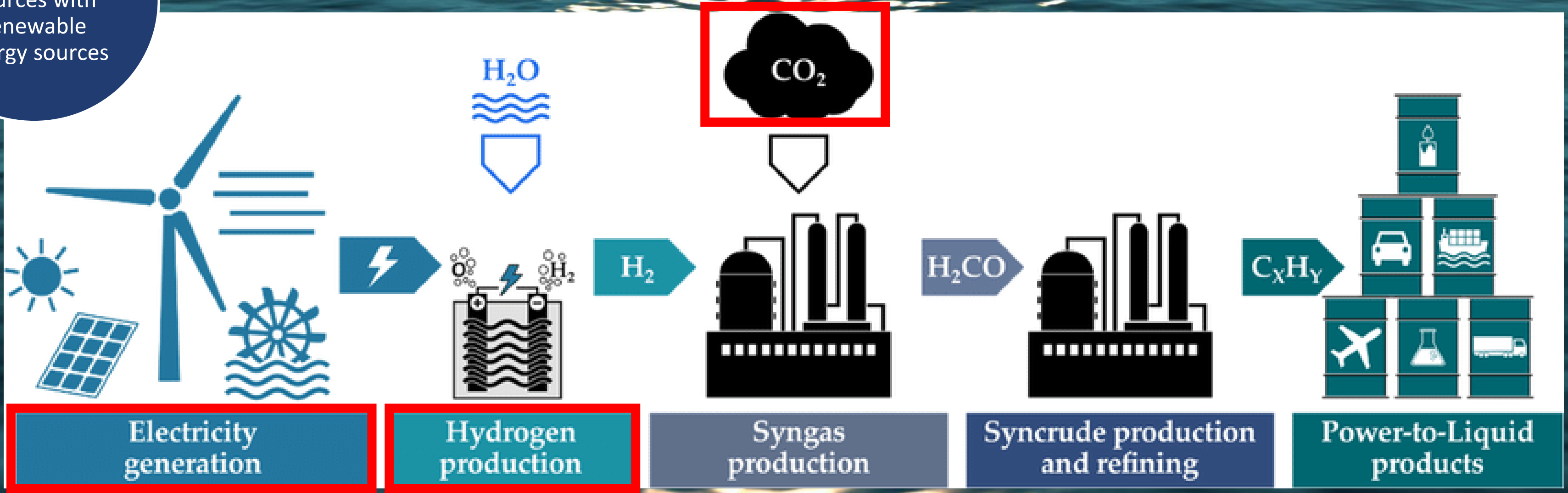
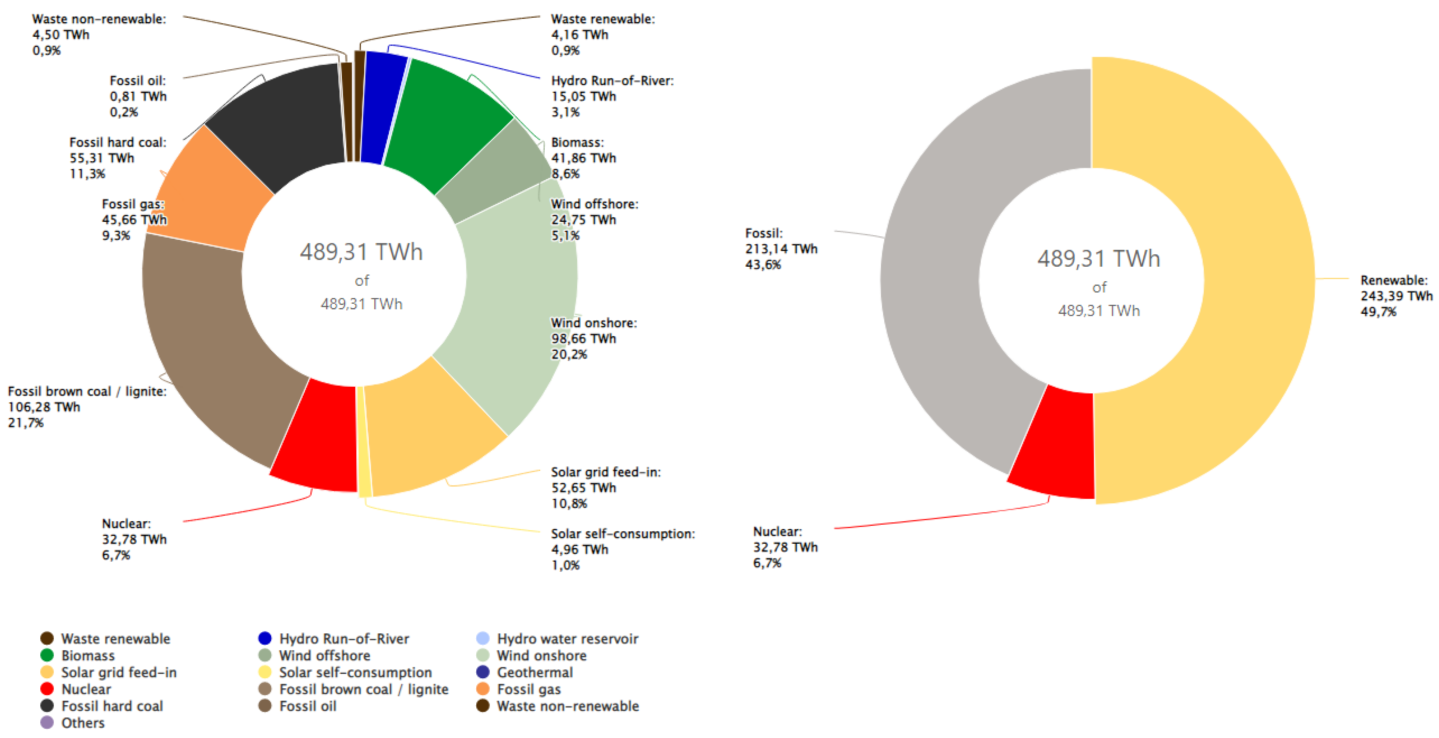


Substitution of fossil energy sources with renewable energy sources



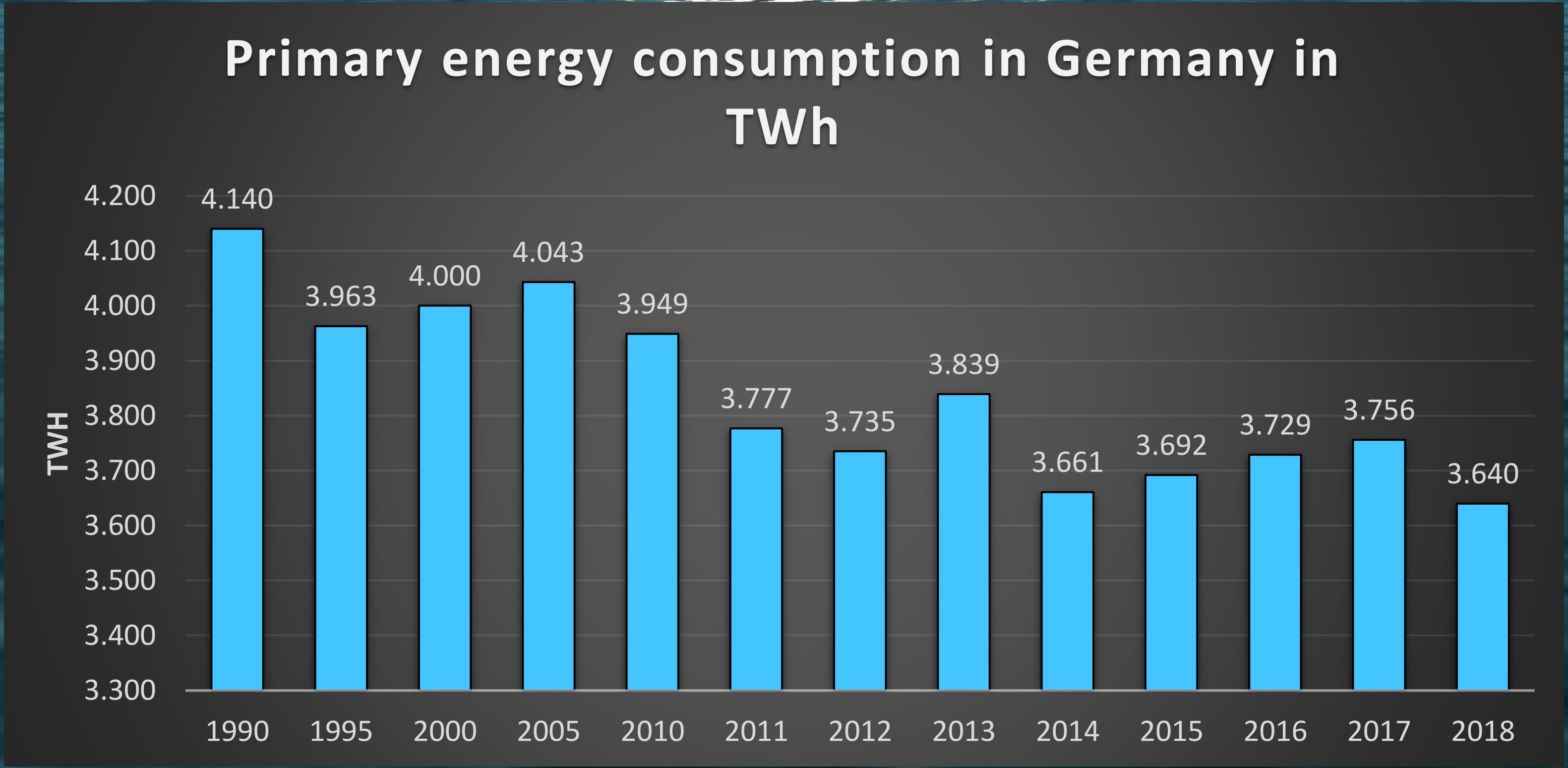
Quelle: A. Meurer, J. Kern, 2021 Fischer-Tropsch Synthesis

Public net electricity generation in Germany in 2022



Energy-Charts.info - last update: 28.02.2023, 22:56 MEZ

Quelle: www.energy-charts.info



Quelle: Bundesministerium für Wirtschaft und Energie

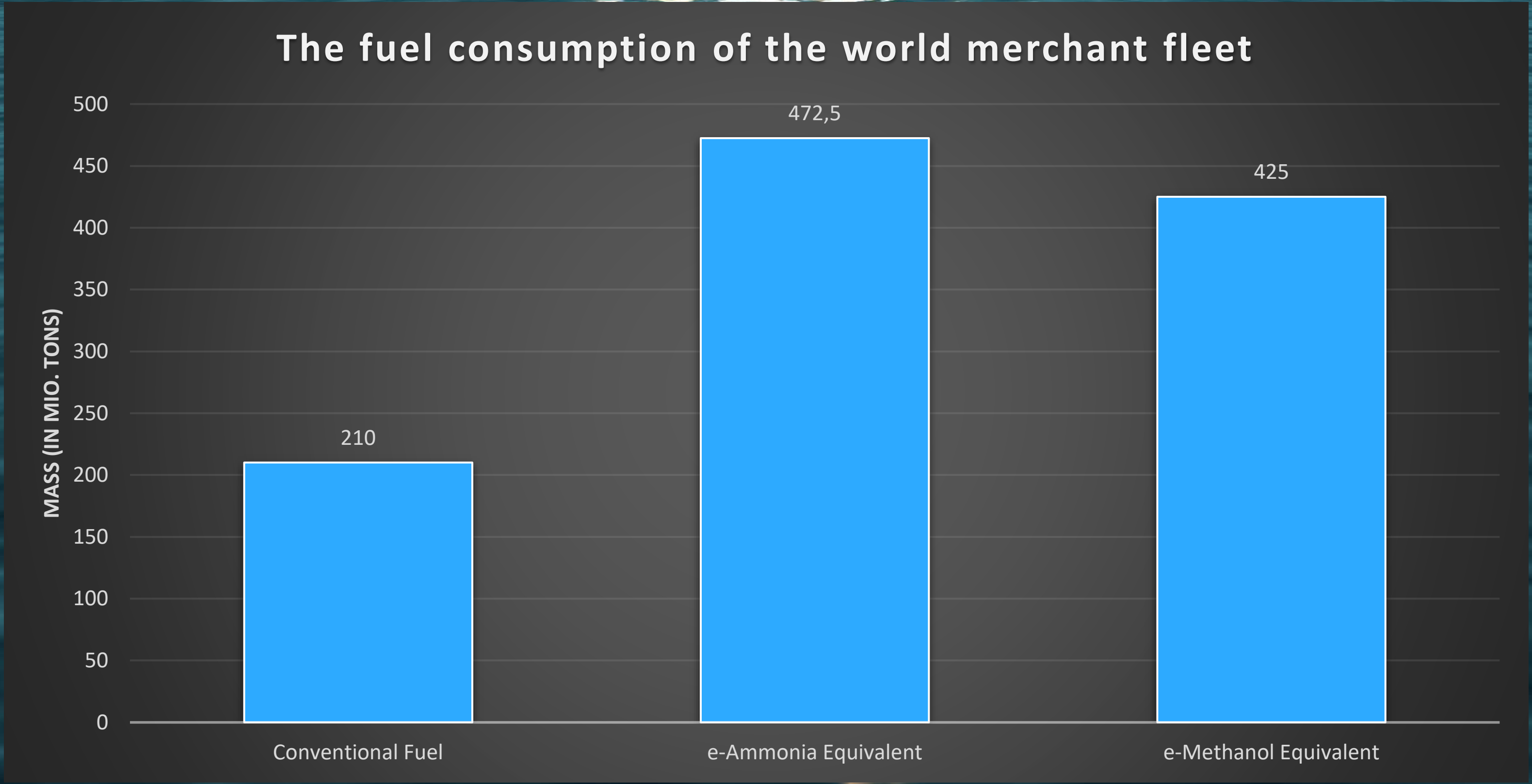
Öko-Institut e.V. based on the electricity mix in 2018:

306 gCO_2 per kWh through the use of diesel

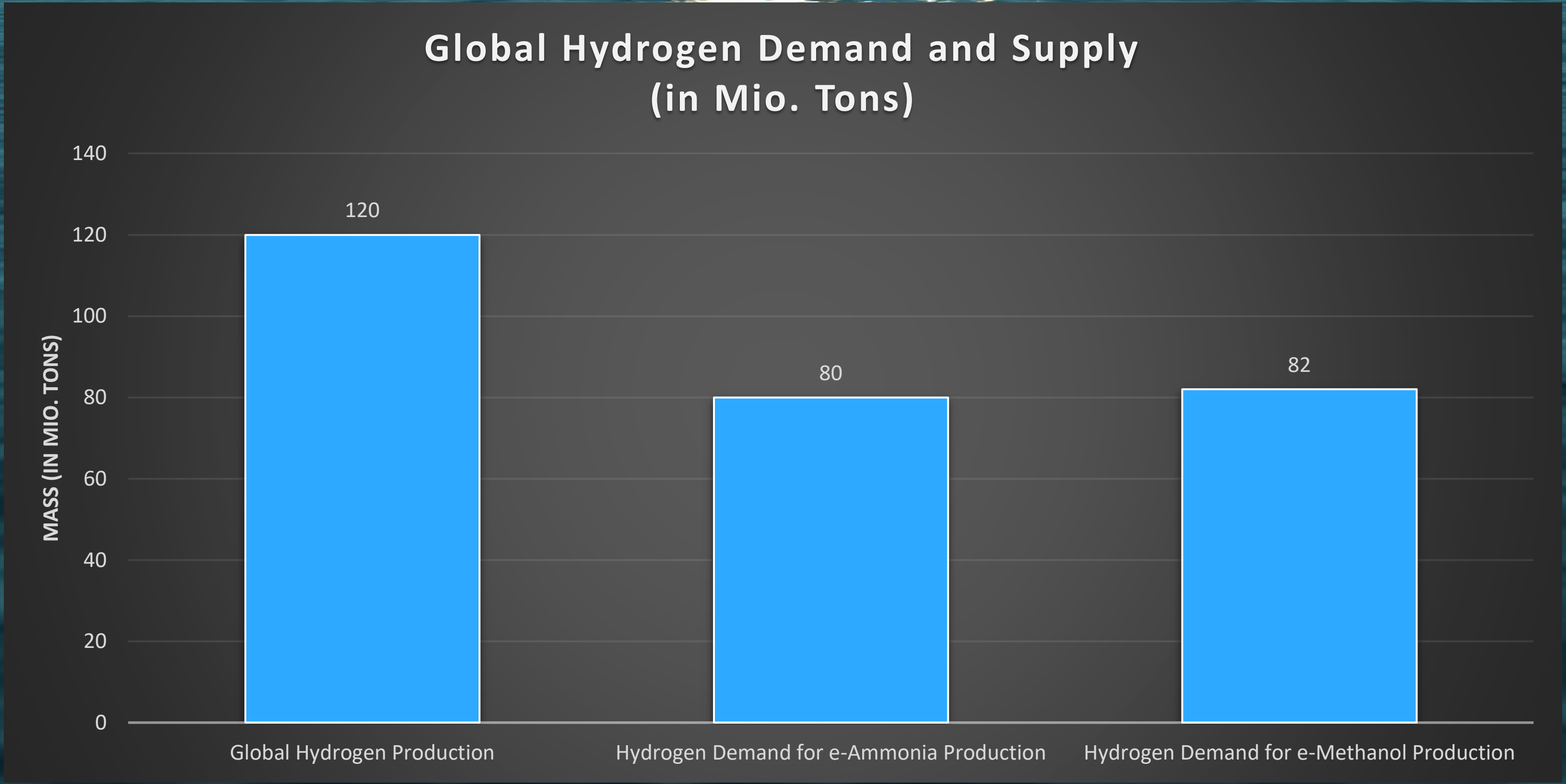
241 gCO_2 per kWh through the use of natural gas

700 - 1100 gCO_2 per kWh through the use of PtX fuels

Quelle: Vgl. Öko-Institut e.V. - Strombasierte Kraftstoffe: die Zukunft von PtX



Quelle: VDR s. Getting to Zero Coalition – Closing the Gap, 2022



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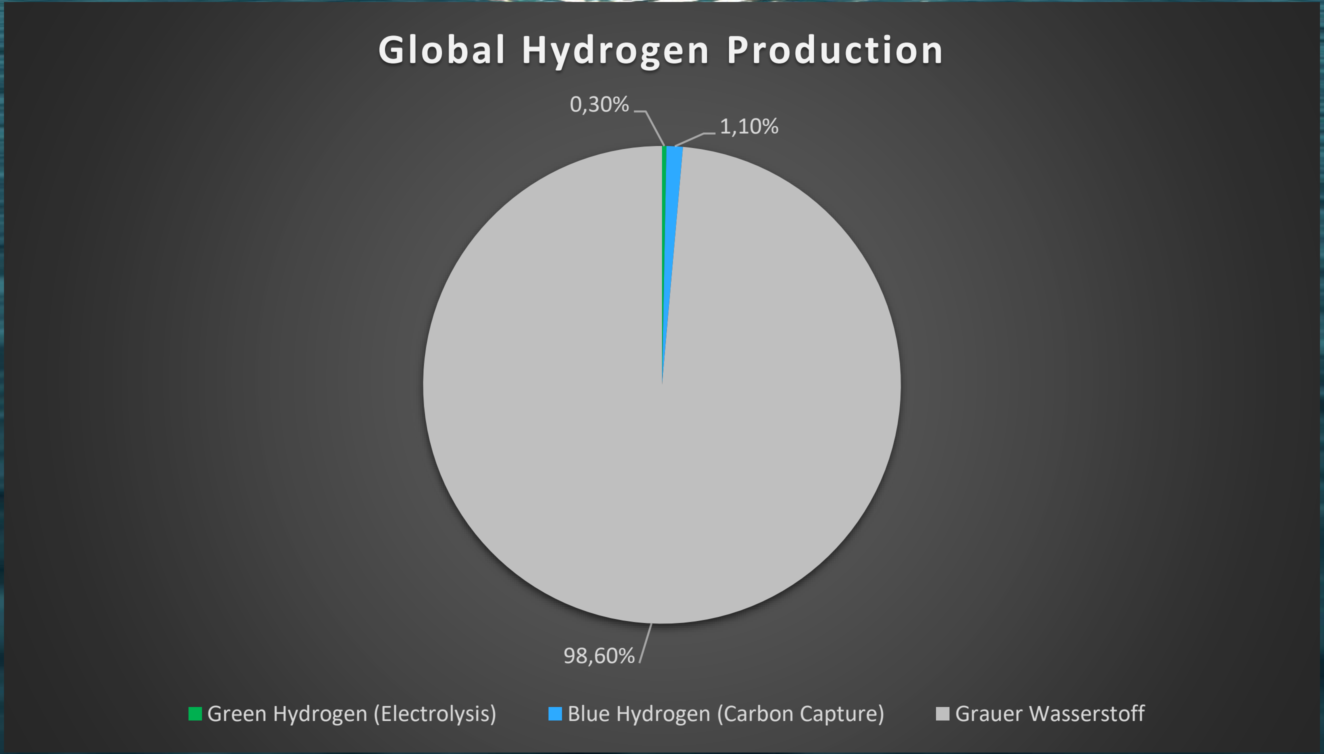

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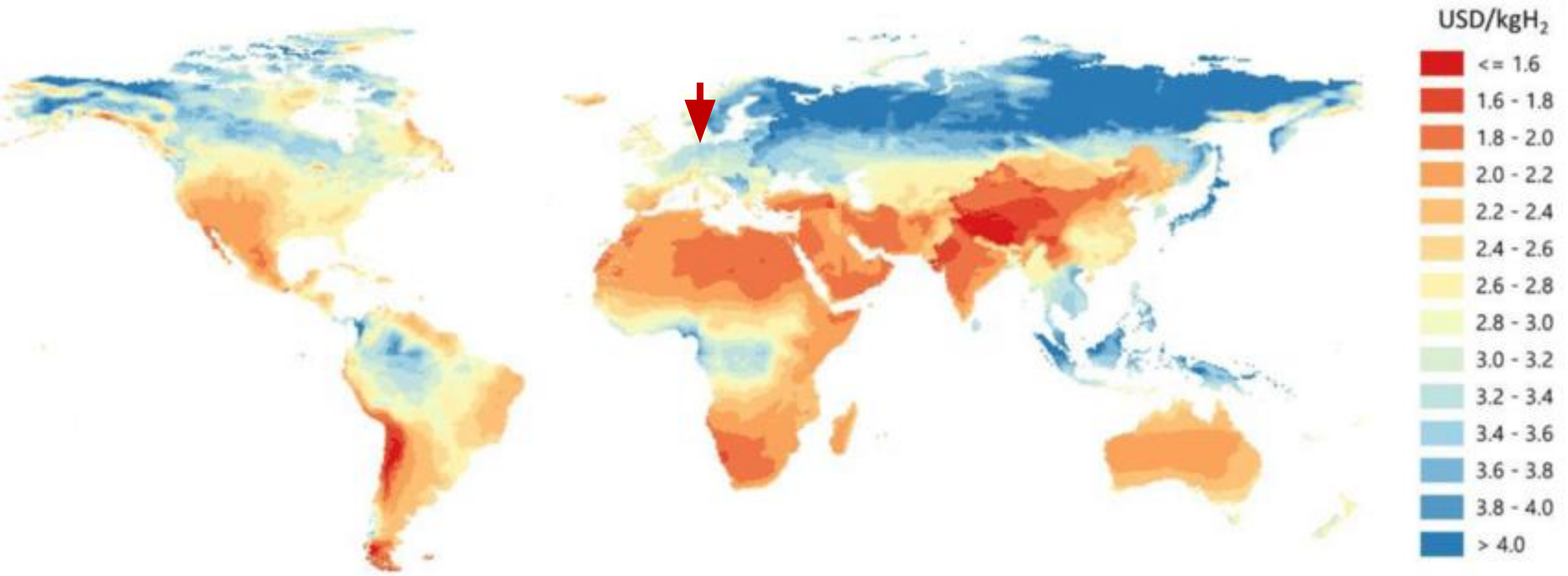
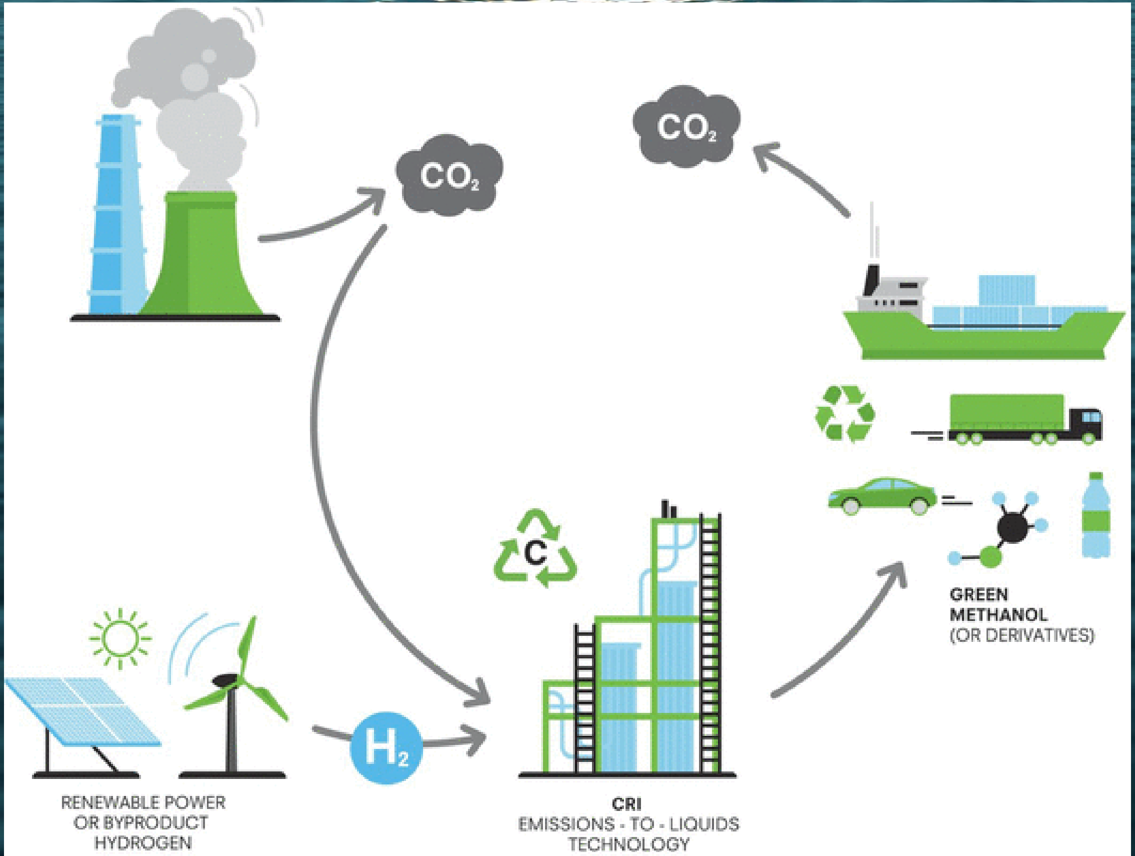
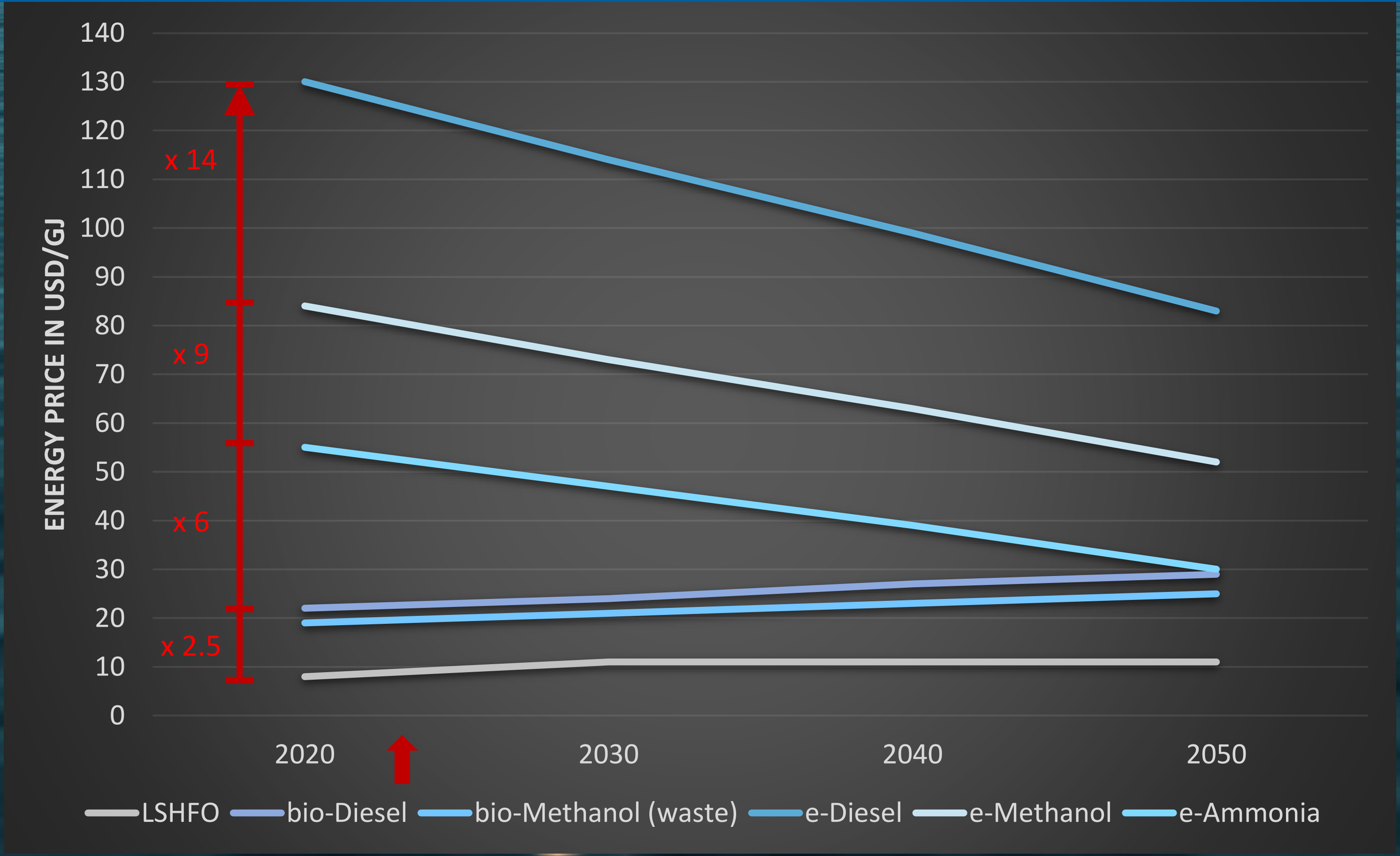


Hydrogen Production Costs based on Solar and Wind

Quelle: Thomas Roos, Jarrad G. Wright – Powerfuels and Green Hydrogen, 2021

Use of Carbon Capture and Carbon sinks





Quelle: VDR s. Getting to Zero Coalition – Closing the Gap, 2022

Key Take Aways and Conclusion

1. Climate Neutrality unitl 2050 is possible to achieve.
2. Ramp-up of renewable energies, electrolyser capacities and port infrastructure is the basis for maritime climate action.
3. A comprehensive national and European hydrogen economy including an import strategy is more necessary than ever.
4. Increase investment and planning security for Energy and Shipping Sector
5. Fleet modernisation and renewal with significant investment risk
   - OPEX and CAPEX
   - Global availability of energy sources
6. Dual- and multi-fuel engines allow flexibility (gaseous / liquid)