



Hamburg
14 Nov 2019



UNIVERSITY OF
BIRMINGHAM

H2SHIPS
NWE project

Deployment of Hydrogen-based Fuels in Shipping

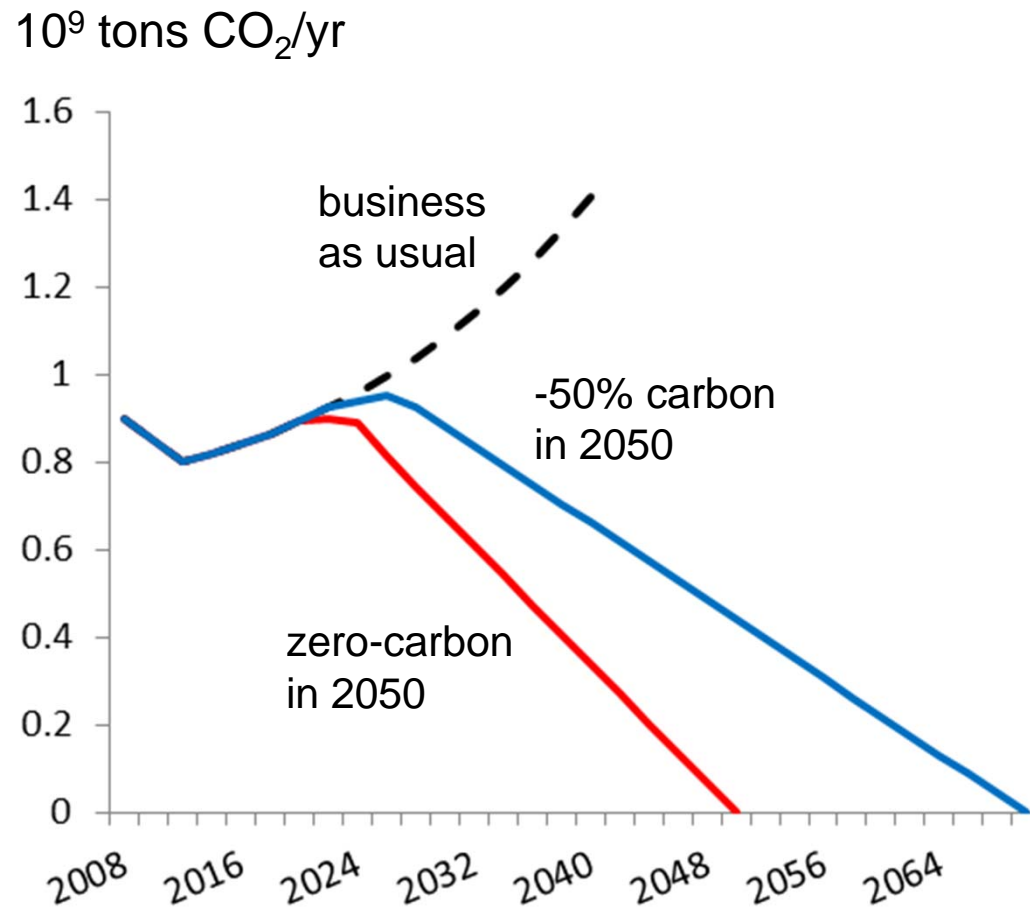
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School of Chemical Engineering
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Emission-Reduction-Scenario of the IMO



so what now?

- LNG?
- hydrogen?
- methanol?
- ammonia?
- methane?



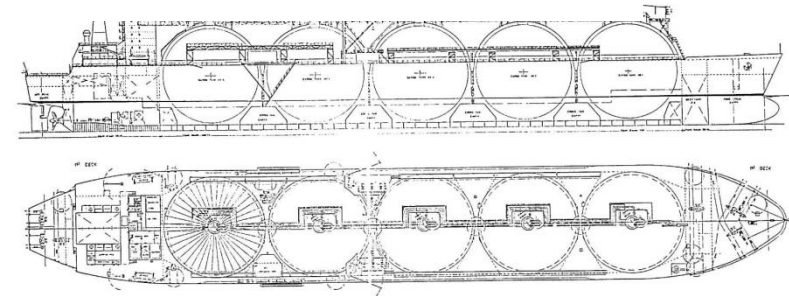
Hydrogen Propulsion in Practice



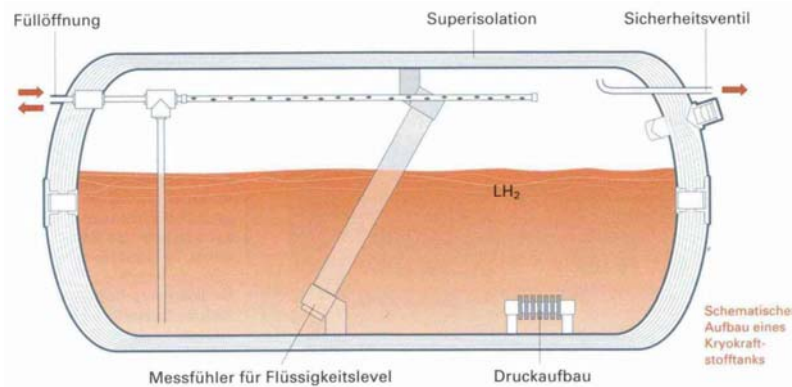
Transport and Bunkering

LH2 as 'successor' of LNG?

- LNG 120 K
- LH2 20 K (air freezes)



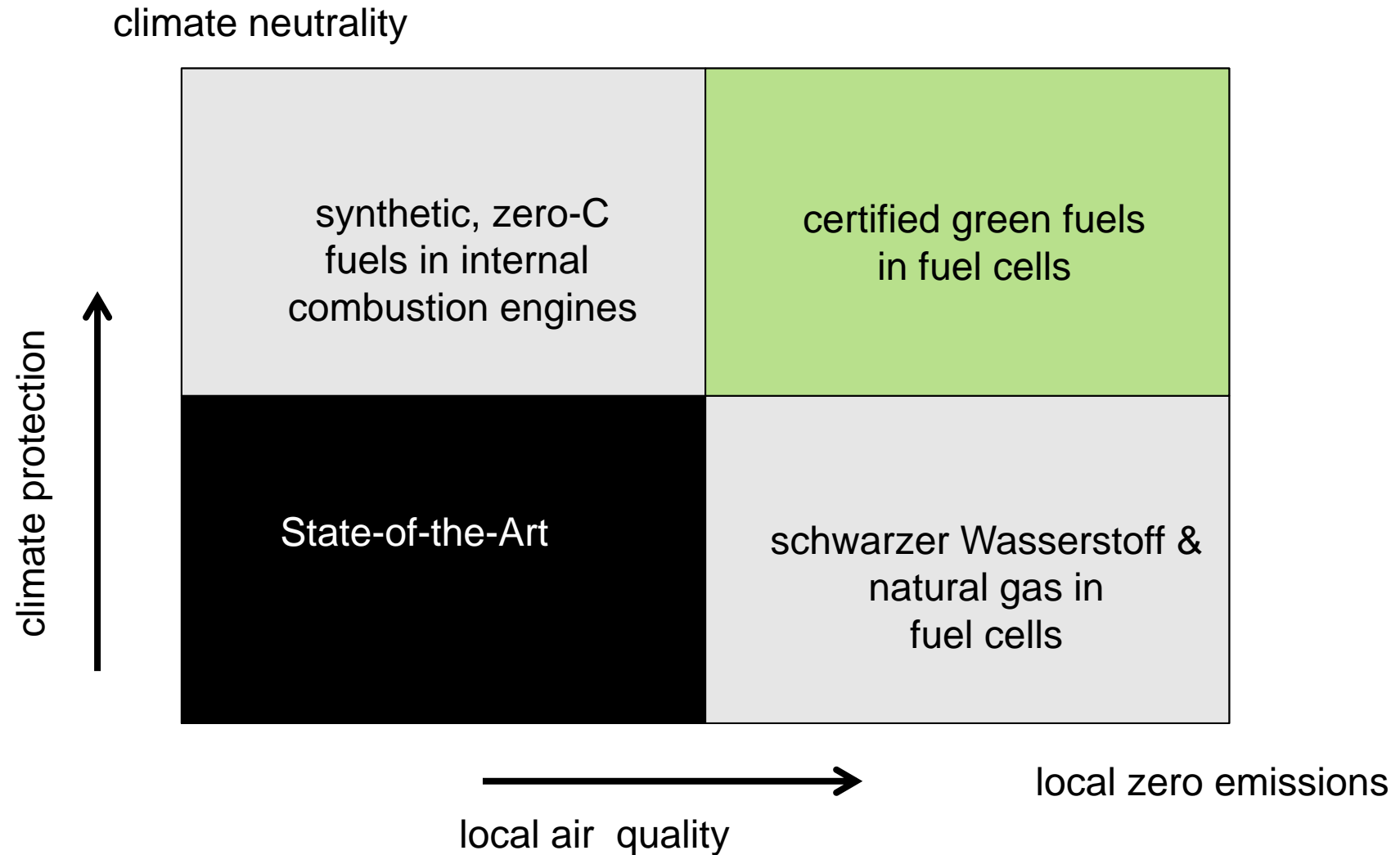
Kawasaki Heavy Industries LH2 carrier w/Shell
2018, 13 kn, 40 days Australia → Japan
Diesel-electric, use of LH 'boil-off'



sources: BMW, www.MaritimeCyprus.com

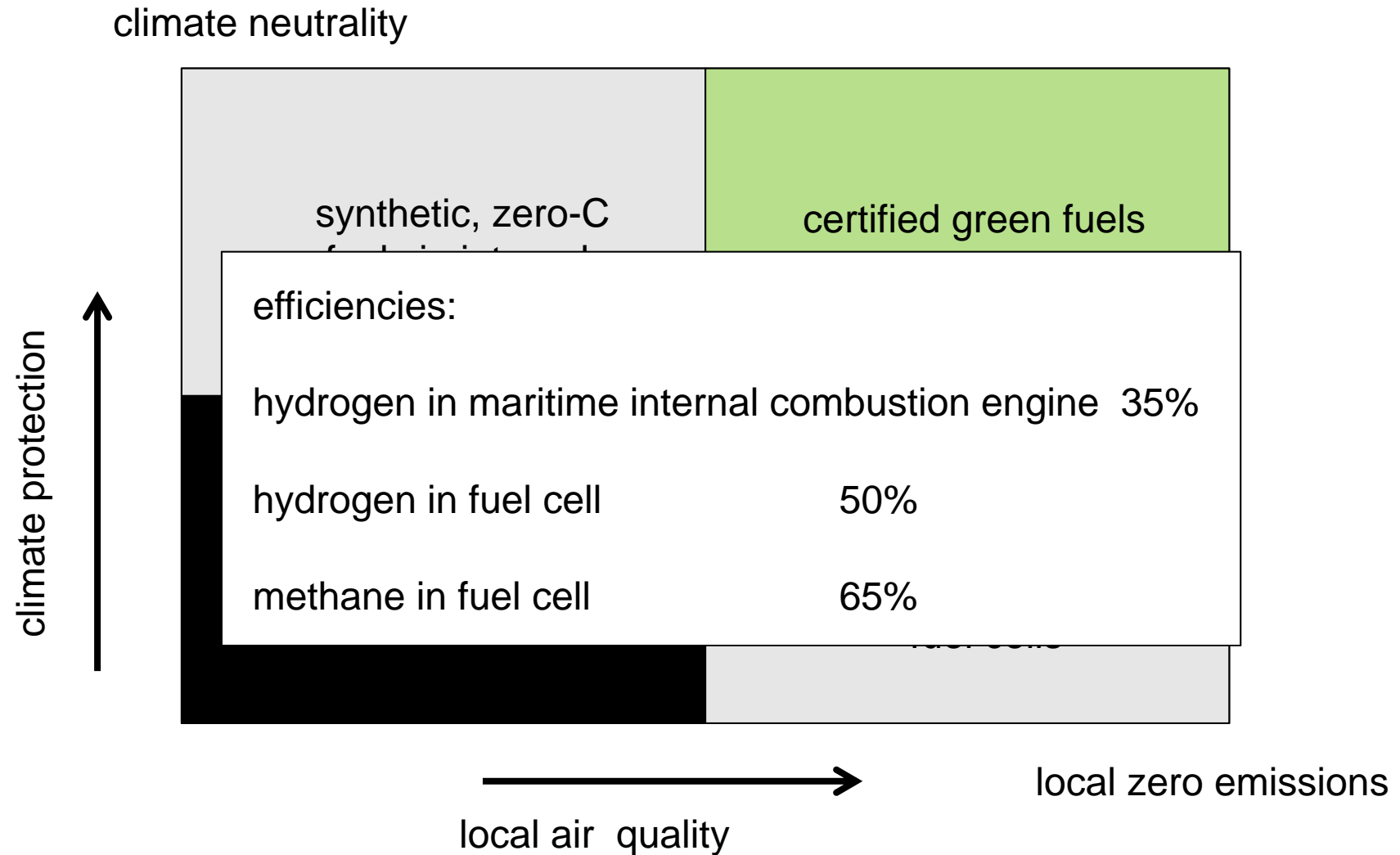


Local and global Emissions

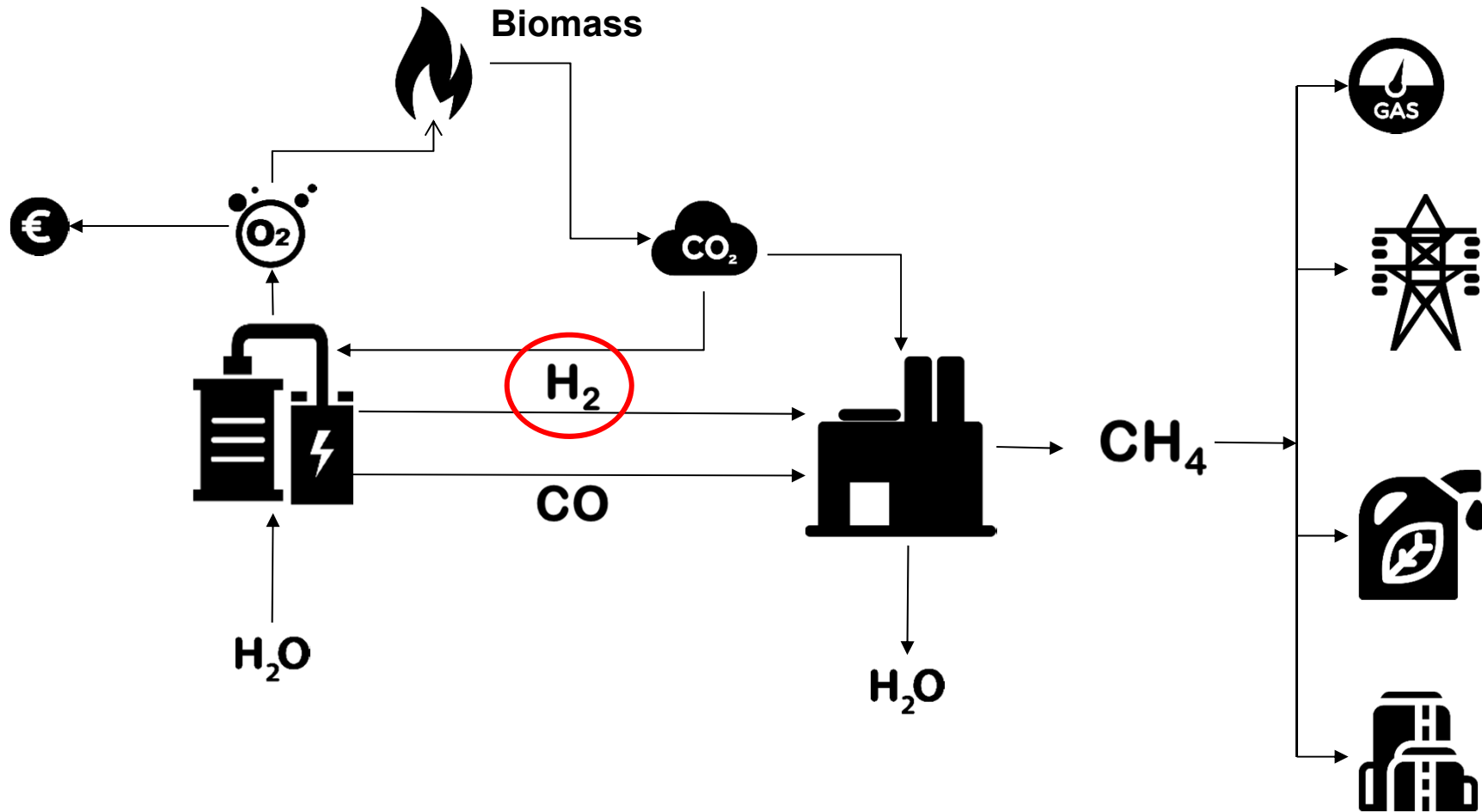




Local and global Emissions



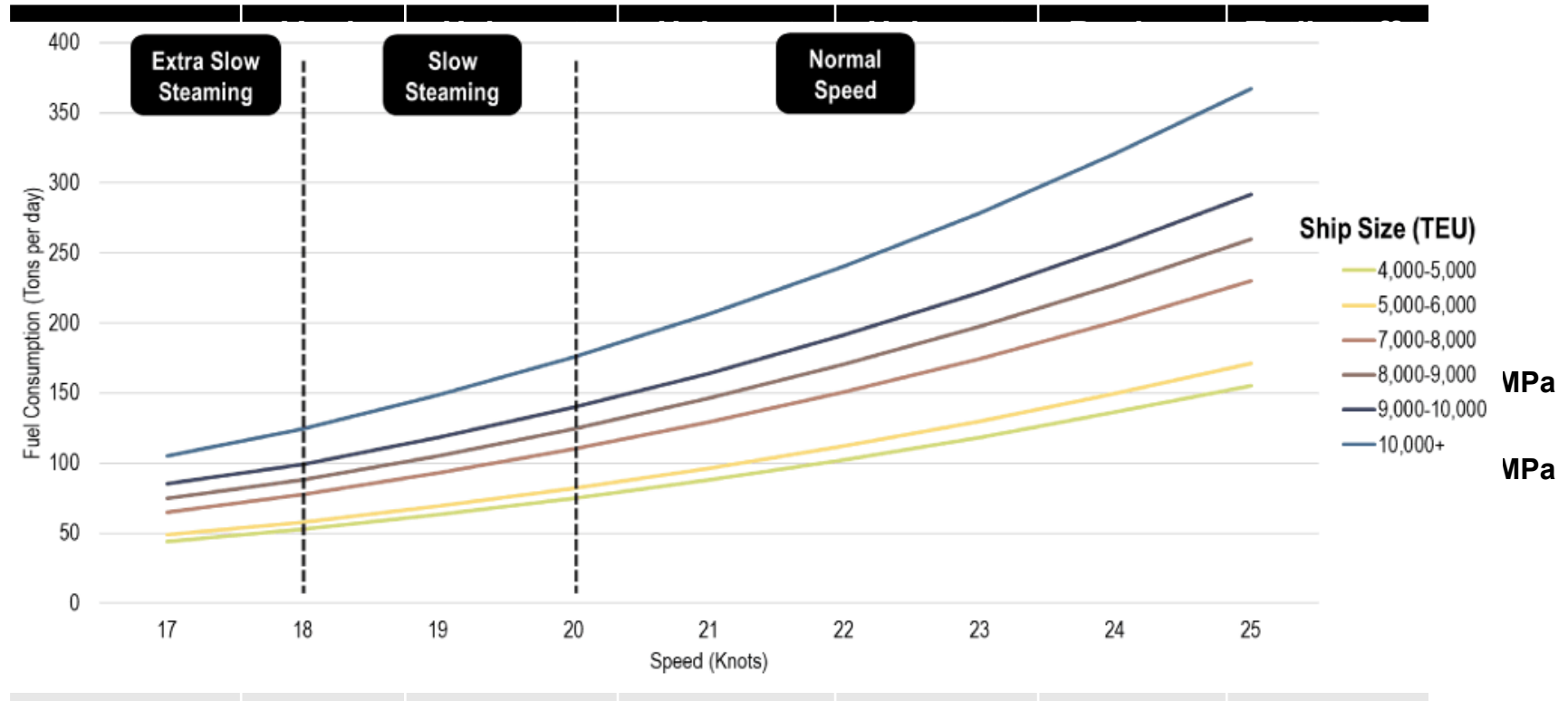
Carbon-Recycling-Szenario





Comparison: Fuel amounts to bunker

- route 10 days, 150 to/dy, 16 500 MWh (container/Transatlantic)





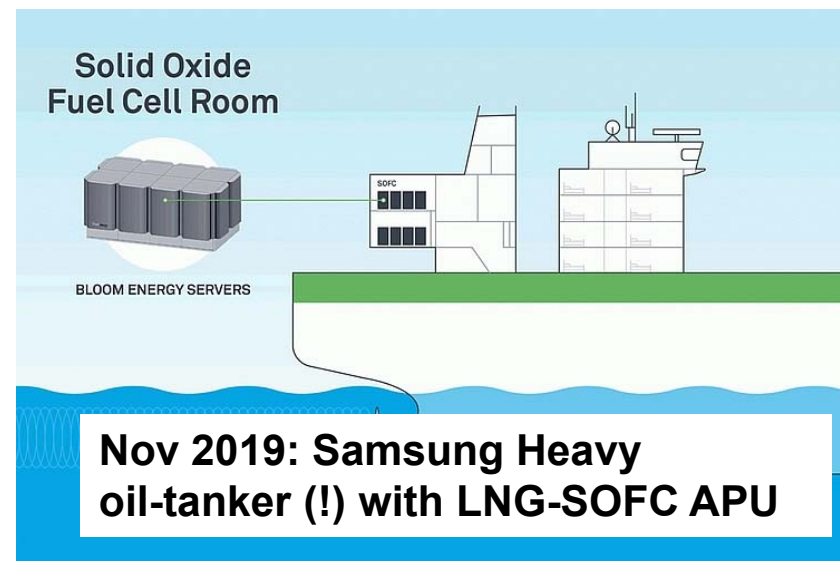
Comparison: Fuel amounts to bunker

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	Evap. Temp. [K]	Heat.Val. [kWh/kg]	Heat.Val. [kWh/L]	Heat.Val. [kWh/Ncbm]	Bunker-volume [cbm]	Fuel weight [to]	
LH2	20	33	2.3	---	7000	500	
LSNG	111	14	6.3	---	3200	1200	
LNG	120	12.5	5.6	---	3500	1300	
H2	---	33	---	3	9900	500	70 MPa
CH4	---	14	---	9	8900	1300	25 MPa
NH3	240	5.2	3.2	3.9	5200	3350	
CH3OH	---	5.5	4.4	---	3750	3250	
M.Diesel	---	12	10	---	1500	1500	

Outlook

- besides the fuels, efficiency and emissions from shipping main engines play a major role in the emissions management in harbours
- electric propulsion based on fuel cells is a key technology to tackle harbour emissions
- today's decisions should already prepare for this pathway
- the choice of fuel should be based on the complete picture of emissions and energy use



source: www.MaritimeCyprus.com



Thank you for listening and happy to answer questions!

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Master Course in fuel cells & hydrogen technologies

www.teachy.eu



Events in 2020:

Fuel Cell Systems Workshop – 26/27 May 2020, Brugge, Belgium.

JESS 2020 – Joint European Summer School,
7-11 / 14-18 Sept 2020, Vouliagmeni (Athen).



acknowledgments go to the NEW InterReg programme for financial support of the H2SHIPS project