

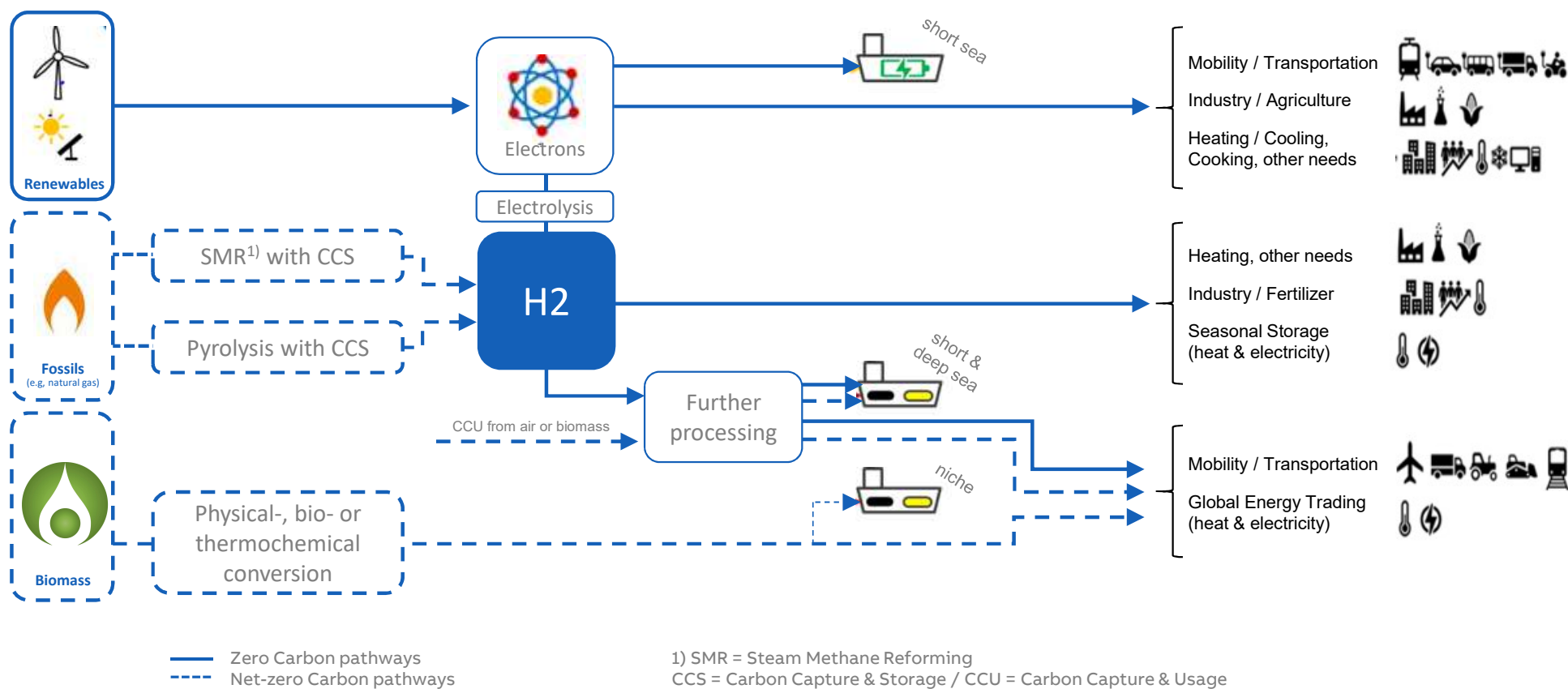
(Net) Zero Carbon Energy Sources for Shipping

Marintec, December 2019

CIMAC GHG strategy groups' «position in a nut shell»

- (Net) Zero carbon fuels represent the most promising option for the future of shipping
- The ICE is likely to remain the major prime mover in future marine propulsion systems
- Hydrogen with a (net) zero carbon footprint is the starting product for the main future fuels in shipping
- Biofuels can play a role as long as volume constraints are solved without compromising on sustainability
- Apart from phasing-in (net) zero carbon fuels, the increase of operational and technical efficiencies continue to be a main driver

The bigger picture (simplified schematic view)



Biofuels – availability & sustainability

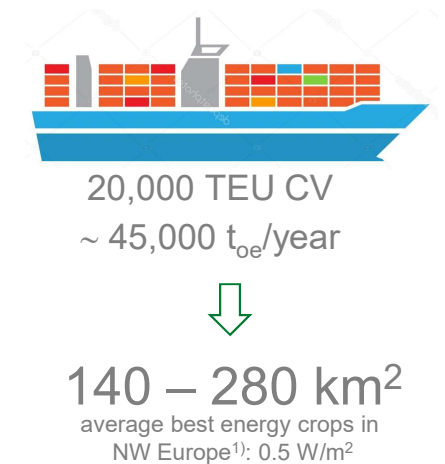
1st generation biofuels (crops produced on farmland)

- high land use
- issue of indirect land use change (ILUC)
- potential negative net impact on GHG emissions
- most 1st generation biofuels banned in EU by 2030

2nd generation biofuels (wastes and residues)

- traceability problem
- limited global resources; e.g. in EU 6.3 – 7.8 Mtoe of adv. biofuels in 2030²⁾ – not even enough to supply the targeted 3.6% for road and rail transportation in the EU

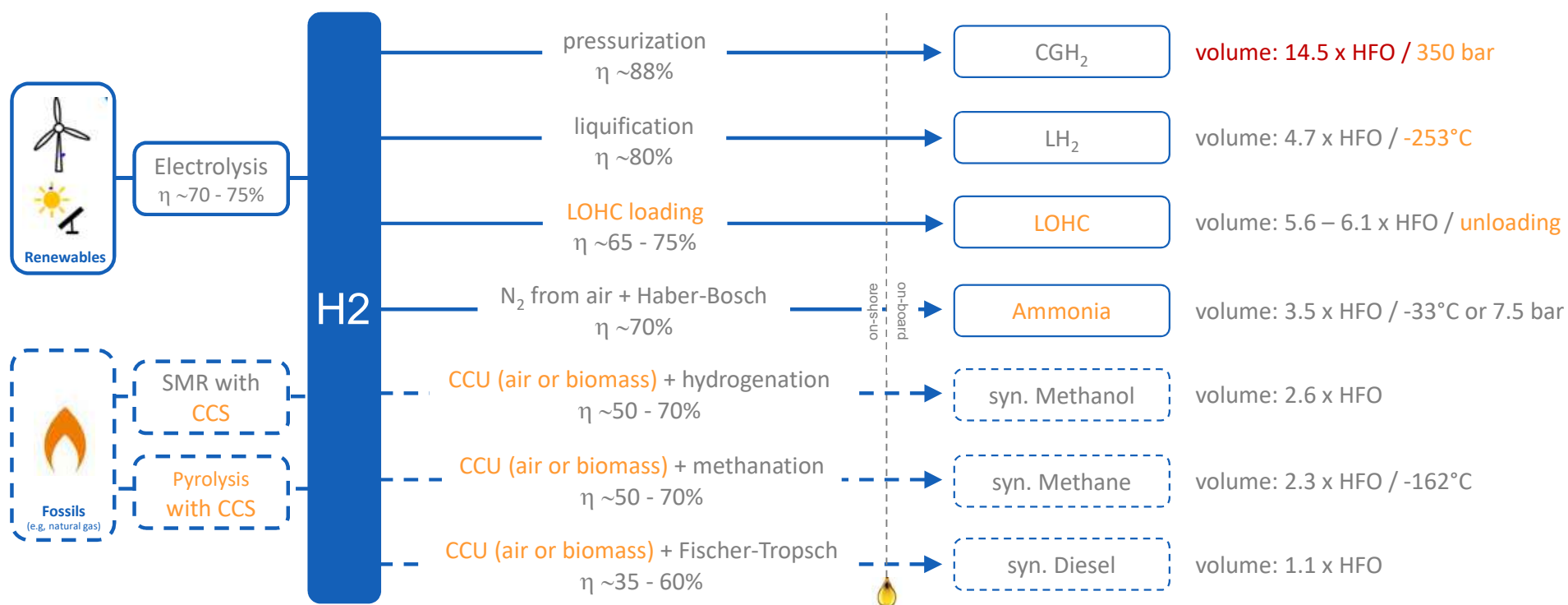
... and competition with increasing demand for nutrition – social acceptance?



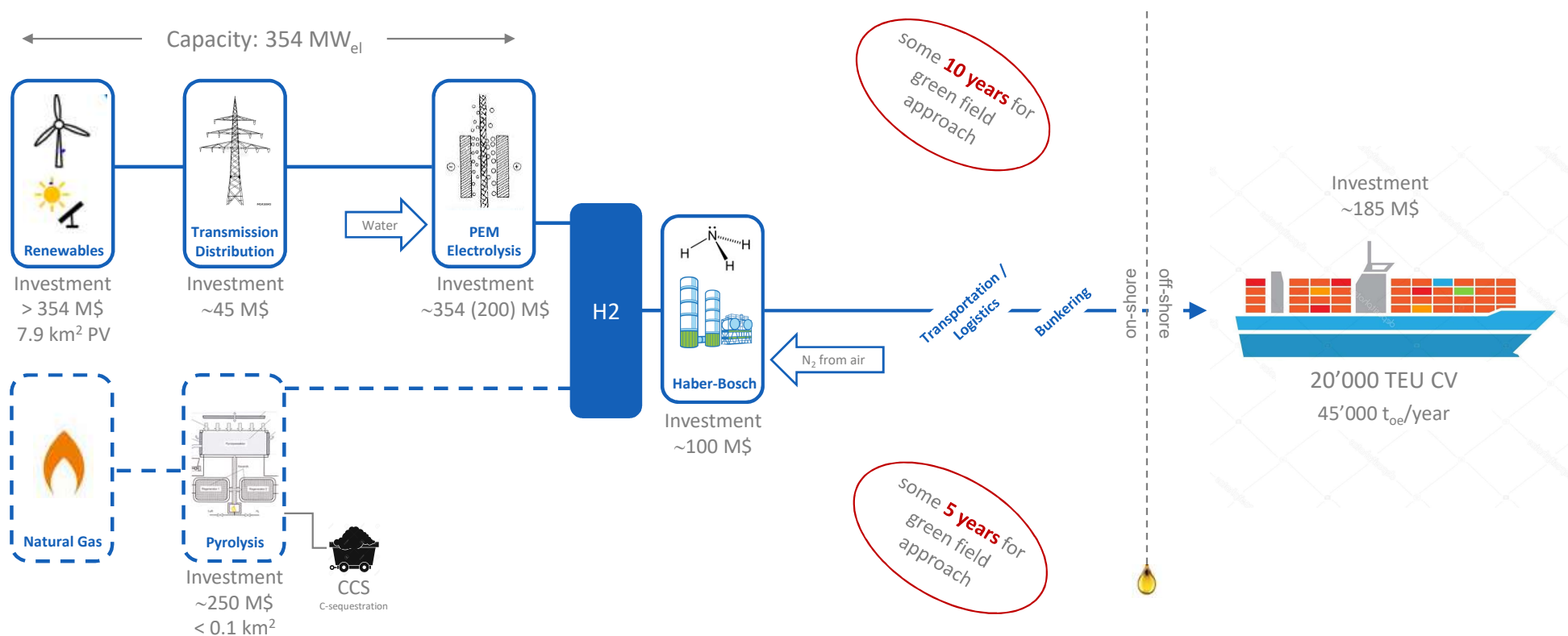
1) Best energy crops in NW Europe: 0.5 W/m² [Sustainable Energy — without the hot air, Version 3.5.2. November 3, 2008]

2) www.transportenvironment.org/sites/te/files/2017_06_Advanced_biofuels_target.pdf, accessed September 2019

Hydrogen – fuel pathways & efficiencies (non exhaustive)



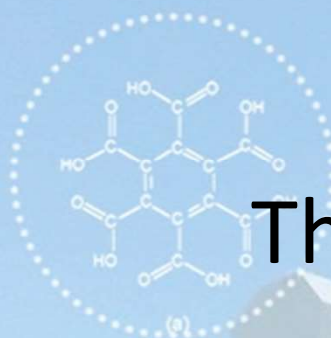
Hydrogen – fuel pathways & investments (non exhaustive)



Investments indicative only

Conclusions so far

- Various hydrogen based fuel pathways with decent maturity exist
- Competition from various industries; the right fuels will not just be available for Shipping
- Significant upfront investments required, dominated by build up of fuel production and supply chain
- To enable a faster reduction of GHG emissions, the production of hydrogen from Natural Gas with CCS could pose an alternative
- The IMO must adopt binding measures until 2023 to phase-in zero and net-zero carbon fuels, otherwise no investment in the production of these fuels can be stimulated to have respective amounts ready for take up for the 2030 decade



Thank you for your attention

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