

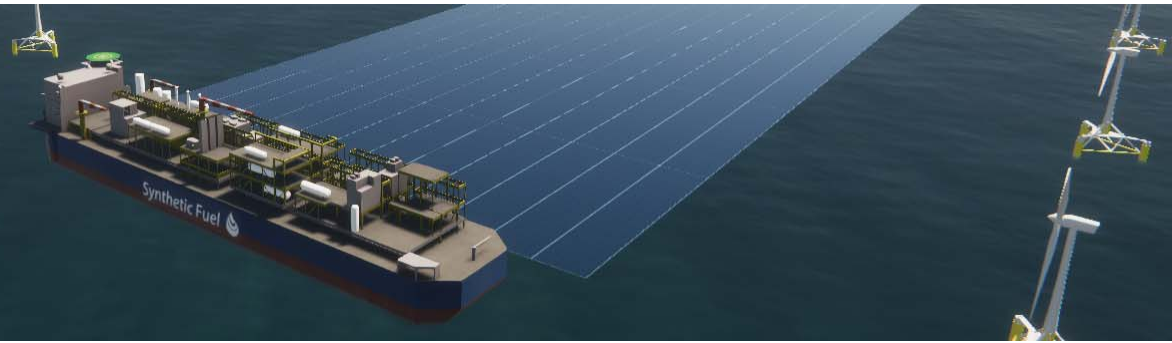


BETTER SHIPS, BLUE OCEANS

Initiative for 'Blue FPSO JIP'

Blue Week Forum 2021

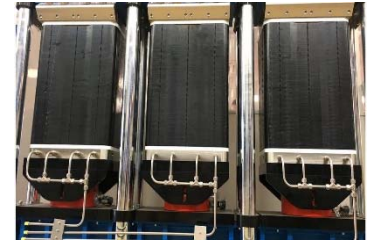
Jaap de Wilde, MARIN, Wednesday 2 June 2021



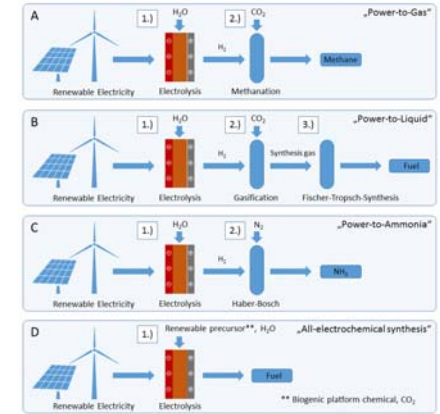
- ❑ *Project aims to see how **FPSO technology** can be integrated into the renewable energy system to enable large scale remote **hydrogen** and **synthetic fuel** production.*
- ❑ ***Business case** for green H2 FPSO may still be far away but developments are fast and transition to net-zero is needed by 2050.*
- ❑ *Need for **early H2 or NH3 production**, when the energy export grid is not yet in place.*

- *Far offshore (> 500 km) and deep water (> 100 m)*
- *Atlantic Ocean, Mediterranean Sea and Northern North Sea*
- *Possibly in combination with floating PV?*
- *Delivery of product at EU main ports*
- *Target market price below 5 €/kg for green H₂*
- *Low TRL research and innovation action (RIA)*

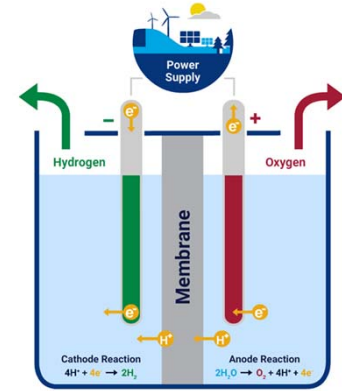
- Selection of suitable *energy carrier*: H_2 , NH_3 , CH_3OH or $NaBH_4$?
- How should a *Blue FPSO* look like?
- Deck space needed? Cryogenic or high pressure? Motion constraints?
- How to bring *product to market*?



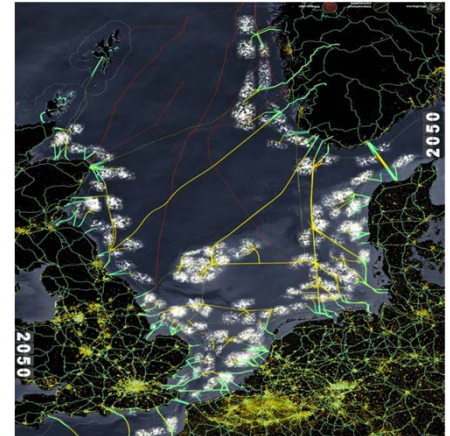
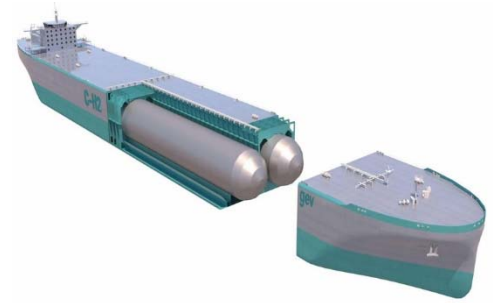
- What are the *energy losses*?
- Can it help the *energy transition*?
- *Environmental impact and societal impact*?
- *EU Green Deal* objective: “does not significantly harm”
- *Legislation*, energy security and geopolitics



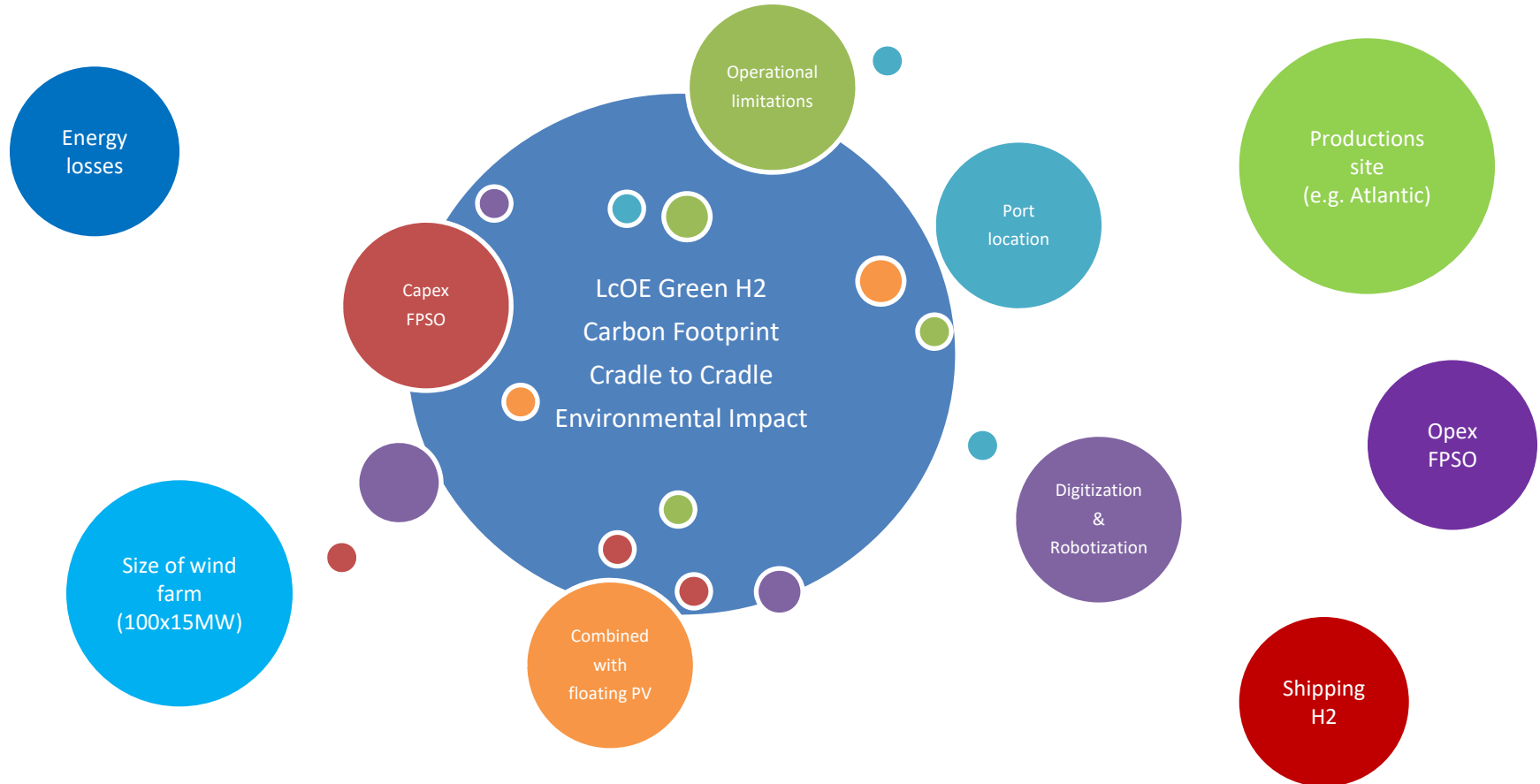
- Can we achieve *market price* below 5 €/kg?
- Develop *CAPEX cost model* for H₂ and NH₃ FPSO
- Develop *OPEX cost model* for H₂ and NH₃ FPSO
- Can the FPSO be *remotely operated*?
- Is a separate floating island or flotel needed?
- Model for carbon footprint of *O&M activity*



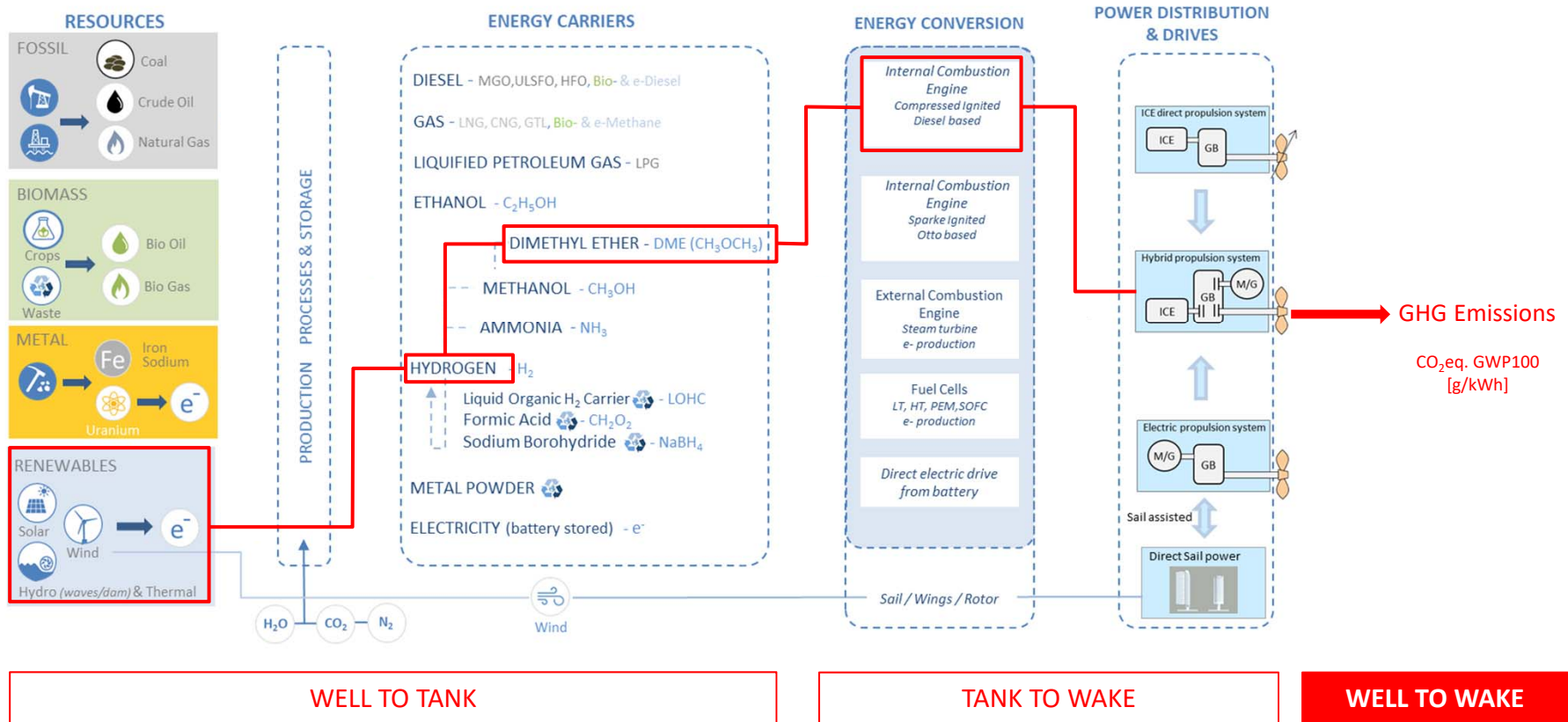
- Compare against alternative of *copper cable* or *pipeline*
- Break-even for distance (miles) offshore
- Tapping into existing infrastructure
- Subsea *storage* in caverns or salt domes?
- *Early production* in relatively shallow water such as Dutch North Sea?



Main deliverable: Blue JIP Knowledge Tool (software)



Something like this?

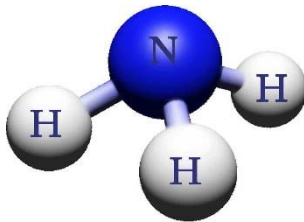


Energy content of H₂ and NH₃

Liquid Hydrogen (H₂)

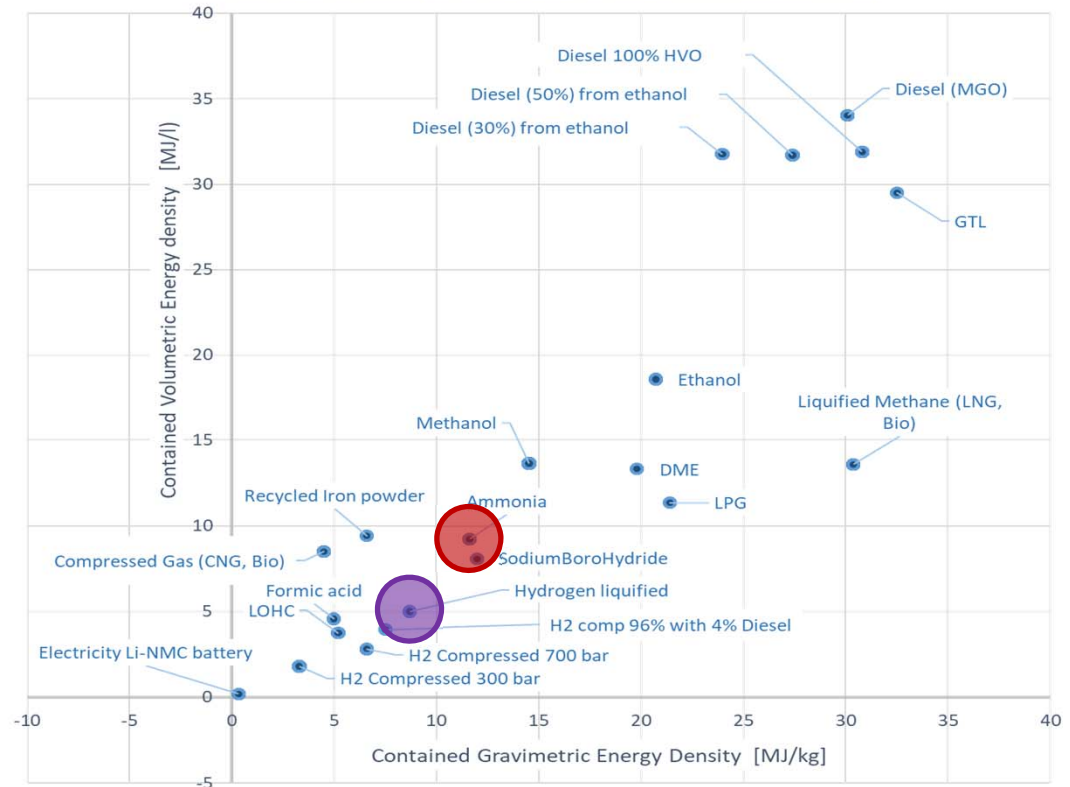


Liquid Ammonia (NH₃)



Contained Energy Density of energy carriers (volumetric & gravimetric)

Weight & Volume of the containment system is included in the density



EU Aims for 300+ GW of Offshore Wind by 2050

EU HORIZON-CL5-2021-D3-02-02

- next generation of renewable energy technologies
- research and innovation actions (RIA), TRL 3-4
- 10 projects of 3 million
- deadline 5 January 2022 for CL5-2021

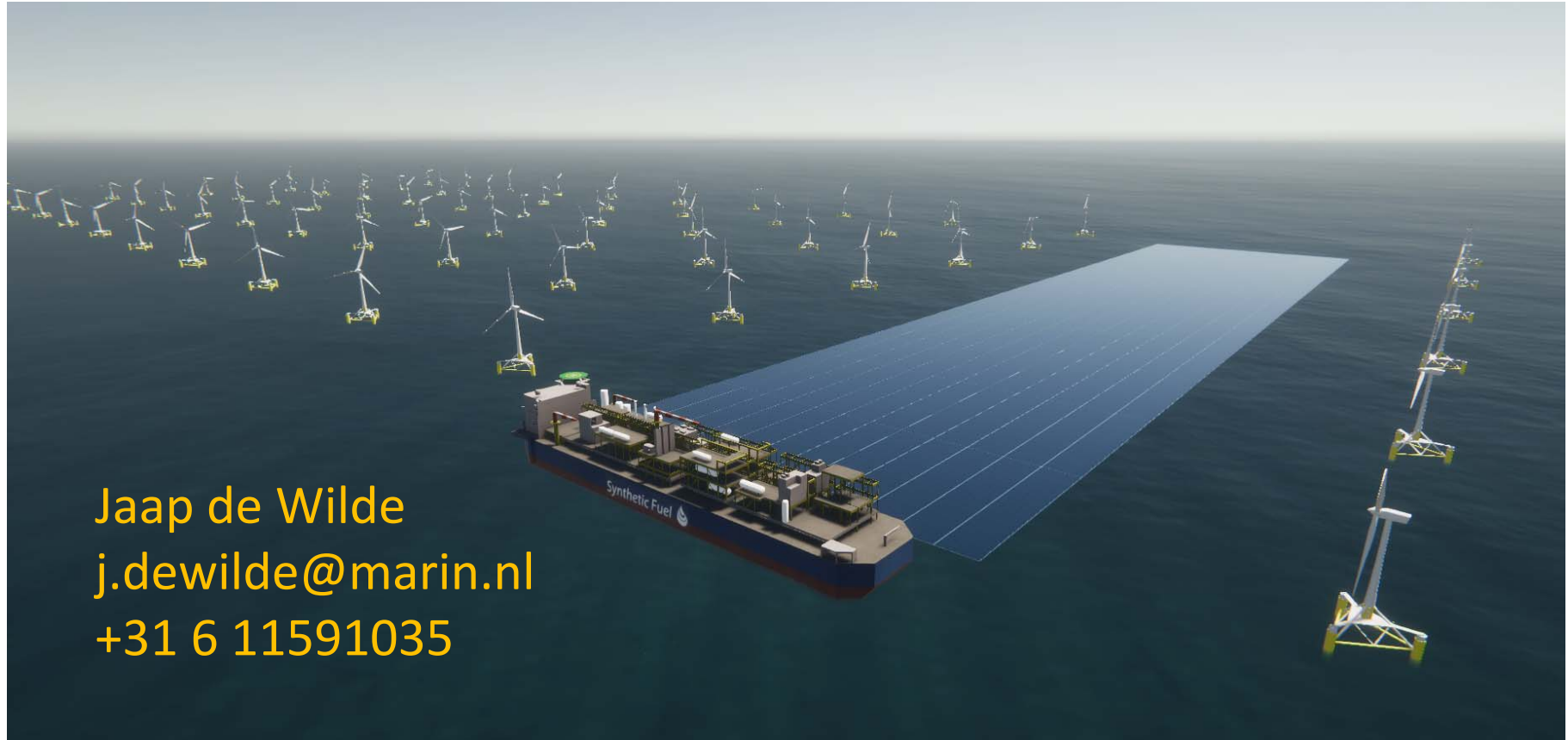
€ 2M project

80% EU

20% Industry

‘Available breakthrough and game changing renewable energy technologies enabling a faster transition to a net-zero greenhouse gas emissions EU economy by 2050’

We are open for match making!



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