



The P2XFloater [™] - an efficient technology for monetizing remote renewable resources in sensitive environments



The green future of maritime operations,
Nuuk, 05-10-2022
Ove T. Rylandsholm, H2Carrier AS



P2XFloater™ at a glance

Input



Remote environments

Superior wind efficiency in places without/limited grid connection



Combined environments

Continuous advantage through combining wind, solar, hydro and tidal



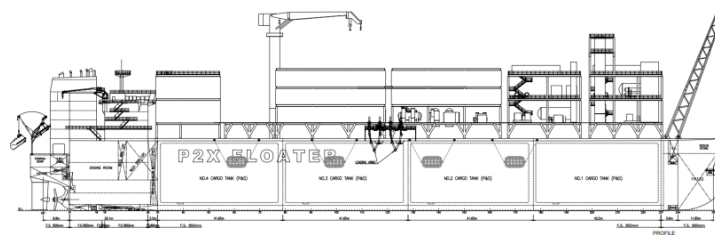
Power rich environments

Utilizing surplus electricity from existing production infrastructure



Utilizing curtailed, trapped and low cost green power

Production & Storage



- ✓ Hydrogen and Ammonia production from renewable electricity
- ✓ Minimal costly onshore infrastructure
- ✓ Built-in export facility ready for ammonia feeder vessels
- ✓ Cost competitive solution based on effective construction and scalability



Output



Liquid green ammonia

Refrigerated or pressurized



Transport and Shipping

Global export infrastructure in place through the LPG shipping market or dedicated feeder vessels



Exploitable side streams

Such as oxygen and warm water



Green ammonia to market



Advantages compared to land-based plant

- **Centralized construction**
 - P2XFloater™ has a significant cost and time advantage due to a fast track centralized fabrication with an optimized design and construction period with less logistics
- **Environmentally friendly**
 - No permanent structural foundations using recyclable steel and with no impact on land
- **Mobility**
 - The P2XFloater™ is able to relocate if circumstances regarding the power source should change
- **Public and regulatory affairs**
 - Reduced regulatory regime compared to land-based production





Floating production of oil and gas - FPSO

FPSO – 50 years of safe operations



Offshore installation of renewable energy





Management

**Mårten
Lunde**



**Chief Executive
Officer**

Mårten is the former CEO of HydrogenPro, a stock listed electrolyser company, primarily focused on high pressure alkaline equipment. Prior to this, Mr. Lunde held several positions as CFO and CEO within the shipping and offshore industries, including CEO of Fred.Olsen Production. Mr. Lunde was also CEO of Troms Offshore Supply which was owned by HitecVision and later sold to US based Tidewater Inc.

**Raymond
Bjøntegård**



**Chief Operating
Officer**

Raymond started as terminal manager for the gazelle company Air Cargo Logistics before working for the municipality of Oslo. During his Bsc in Renewable Energy at the Norwegian University of Life Science, he eyed the hydrogen economy as a game changer for the energy industry through his involvement in Xynteo's Exchange. Specialized in circular economy, impact and resource assessments, Raymond supervise operations to ensure a sustainable trajectory

**John Bruun
Andersen**



Founder

John pioneered the first global marine environmental and anti pollution company, Nordan, which became a leading environmental ship salvage company. John founded WindCarrier, the world's first dedicated offshore wind turbine installation vessel company. WindCarrier was successfully divested to Fred Olsen and is today a global market leader in the offshore wind turbine market. Master Mariner from Fanø Navigations School Denmark.

**Sebastian
Kihle**



**Chief Technology
Officer**

Sebastian has written his Masters thesis on hydrogen electrolyzer optimization using a new cloud sensor for short term power forecast together with NEL. MSc in Environmental physics and renewable energy with specialization in energy physics, programming and machine learning from Norwegian University of Life Sciences.

**Ove Tideman
Rylandsholm**



**Head of Marine
Operations**

Ove is a talented naval architect and marine engineer with experience within wind turbine jack-ups, vessel design and FPSO conversions from his time in the Fred. Olsen group. Mr. Rylandsholm represents most of the naval architectural knowledge in H2Carrier MSc in Naval Architecture and Marine Engineering from Norwegian University of Science and Technology (NTNU).



Floating production, storage and off-take

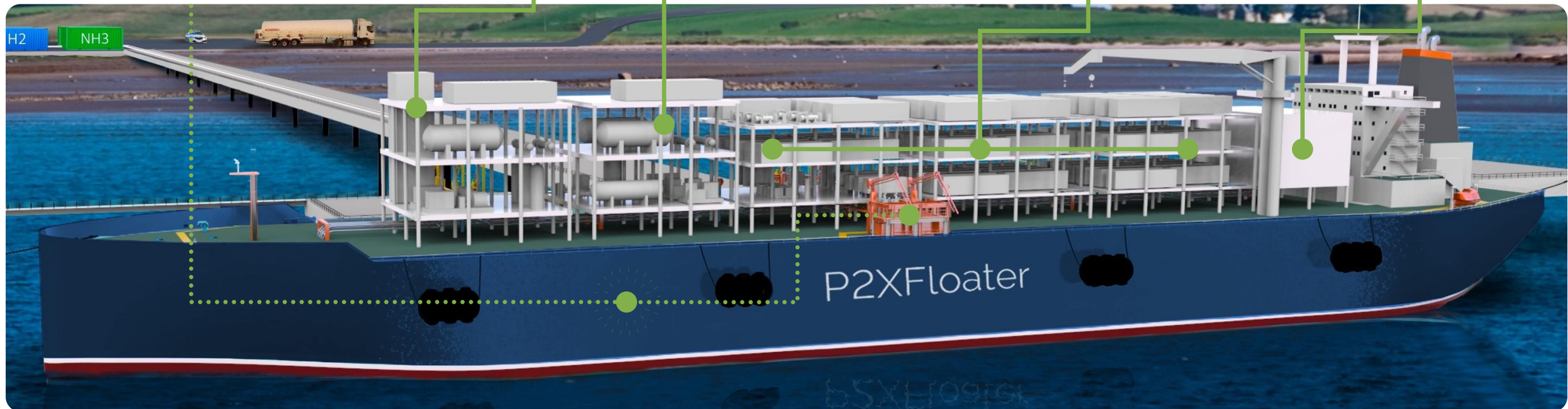
**Transfer utility and
storage tanks**

**Ammonia
production**

**Nitrogen
production**

**Skid-mounted
electrolyzers**

**Power distribution
and automation**





Marine bunkering





H2Carrier



Build, own and operate

Development



EPCI



Operation



Decommissioning



Location & energy supply



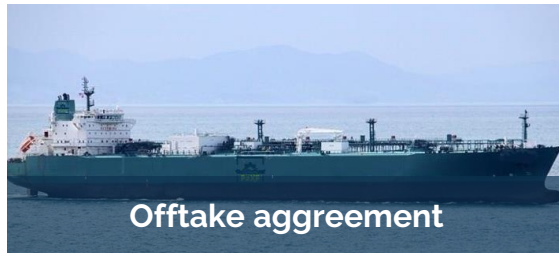
EPCI contract



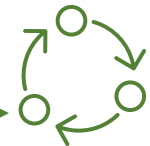
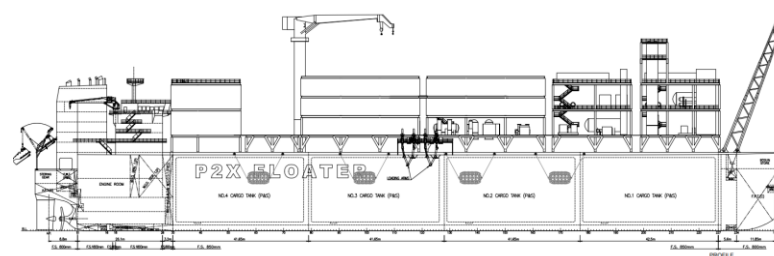
O&M services



Ship recycling contract



Offtake agreement





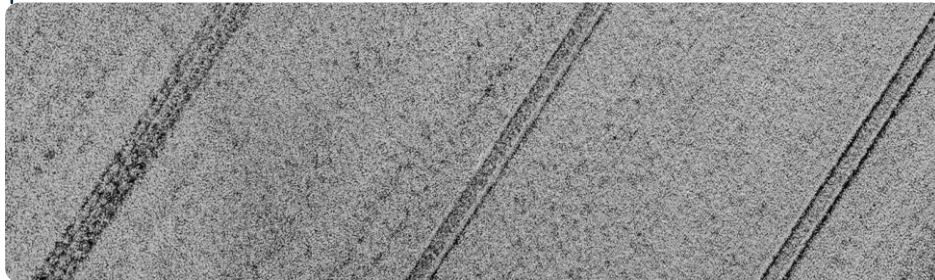
Ammonia market outlook

Potential demand of up to 600m tonnes of green ammonia across multiple industry sectors by 2050

180 million tonnes of ammonia to be substituted by green ammonia in addition to a potential 200 million tonnes in new demand for fuel for deep sea shipping and 30 million tonnes for power production

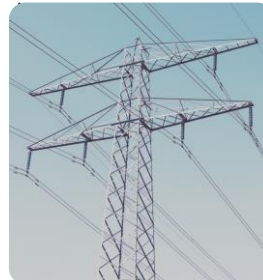
● Current grey ammonia market

180 m tonnes



Power production

+30m tonnes



Industry

+40m tonnes



Fertilizer

+100m tonnes



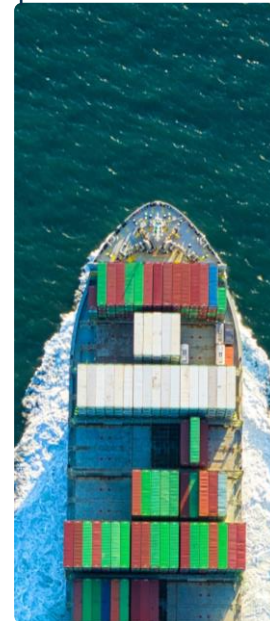
Hydrogen carrier

+130m tonnes



Maritime fuel

+200m tonnes





Recent deals related to green ammonia



Large volumes of green ammonia and hydrogen being traded today

- **Canada export green ammonia to Germany (1)**
 - German Uniper makes deal to buy 500 000 tonnes green ammonia annually from 2025
 - The ammonia is produced using hydroelectric power in Canada
- **Yara imports green ammonia from Oman (2)**
 - Yara will import 100 000 tonne green ammonia produced by ACME and Scatec
- **Australia export hydrogen to Germany (3)**
 - Fortescue makes deal with E.ON. in Germany for offtake of 5 million tonnes of green hydrogen
- **Japan's JERA conduct competitive bidding for procurement of green ammonia (4)**
 - Up to 500 000 tonnes green ammonia annually from 2027
- **First Ammonia (USA) orders 5GW electrolysis for green ammonia production (5)**
 - 5GW electrolysis will be used to build two plants, one in Germany (Wilhelmshaven) and one in the US
 - Annual production of about 5 million tonnes

1) <https://www.uniper.energy/news/everwind-secures-offtake-from-key-german-partner-uniper-for-canadas-first-green-hydrogen-hub-in-nova-scotia>

2) <https://www.yara.com/news-and-media/news/archive/news-2022/yara-acme-and-scatec-sign-term-sheet-for-sale-of-green-ammonia-from-oman/>

3) <https://www.ammoniaenergy.org/articles/fortescue-secures-german-off-taker-for-five-million-tonnes-green-hydrogen-per-year/>

4) https://www.jera.co.jp/english/information/20220218_853

5) <https://www.rechargenews.com/energy-transition/topsoe-wins-world-s-largest-ever-hydrogen-electrolyser-order-in-5gw-green-ammonia-deal/2-1-1299119>



Ecosystem

Oxygen and **heat** can be offered to industry or community services in addition to ammonia. Minor additions to the system can be made to offer **clean water** and **hydrogen**.





Project in the Hebrides

Isle of Lewis has **limited grid capacity** and development of new wind power depends on a new subsea power cable to enable power generation and export. The cost of a power cable is estimated to **£600 million**



Illustration of the P2XFloater™ at the Hebrides



Renewable wind power: 129MW

Capacity factor: 44.1%

Green NH₃ production: 52 000 t/y

CO₂ emissions saved: 68 000 t/y

Electrolyzer capacity: 112MW

Hydrogen production: 9 300 t/y

Rotterdam 700 nm





Offshore project



Statkraft is engaged in development of **offshore wind power**. Statkraft and H2Carrier have entered into a MoU and a project study regarding the use of the P2XFloater™ in a more **harsh offshore environment**. The study will be completed before year end 2022.



Illustration of the P2XFloater™ located at an offshore wind farm





Finnmark project

H2Carrier has entered into a **co-operation agreement** with Lebesby municipality in Finnmark, Northern Norway. The purpose of the co-operation is to operate a P2XFloater™ in Lebesby to **produce and export green ammonia** and also, supply ammonia locally as demand gradually increases.

H2Carrier has prepared the contents of a feasibility study and is currently in discussions about arrangements for a soft financing of such study



Illustration of the P2XFloater™ located in Lebesby, Finnmark



Lebesby Municipality



Production parameters

Renewable power: ~200MW

Capacity factor: 100%

Green NH₃ production: 105 000 t/y

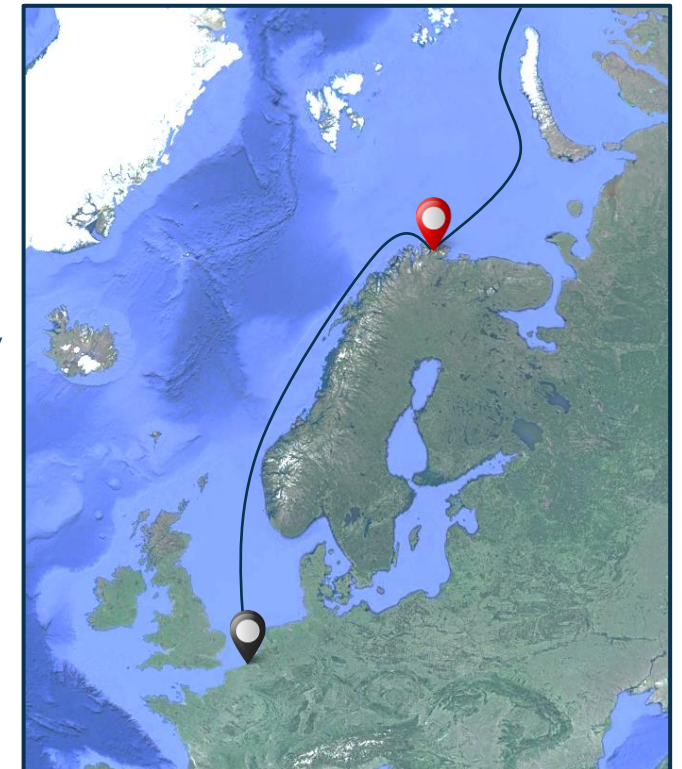
CO₂ emissions saved: 136 000 t/y

Electrolyzer capacity: 175MW

Hydrogen production: 18 700 t/y

Rotterdam 1 500 NM

Yokohama 6 000 NM





Kalaallit Nunaat



Unit sizes

Renewable power: **200MW**

Capacity factor: 100%

Green NH₃ production: **153 000 t/y**

CO₂ emissions saved: 195 000 t/y

Electrolyzer capacity: 175MW

Hydrogen production: **27 300 t/y**

Hull size: L: 230m x B: 32m

Annual revenues: €153m (€1000/t)

Renewable power: **500MW**

Capacity factor: 100%

Green NH₃ production: **383 000 t/y**

CO₂ emissions saved: 490 000 t/y

Electrolyzer capacity: 438MW

Hydrogen production: 68 400 t/y

Hull size: L: 270m x B: 50m

Annual revenues: €383m (€1000/t)

Renewable power: **1000MW**

Capacity factor: 100%

Green NH₃ production: **767 000 t/y**

CO₂ emissions saved: 900 000 t/y

Electrolyzer capacity: 875MW

Hydrogen production: 138 000 t/y

Hull size: L: 320m x B: 60m

Annual revenues: €767m (€1000/t)

