

ERM Dolphyn Project

Large Scale Offshore Hydrogen Production

Presented to: British Chamber Energy Working Group, Myanmar

Presented by: Craig A. Reid, ERM

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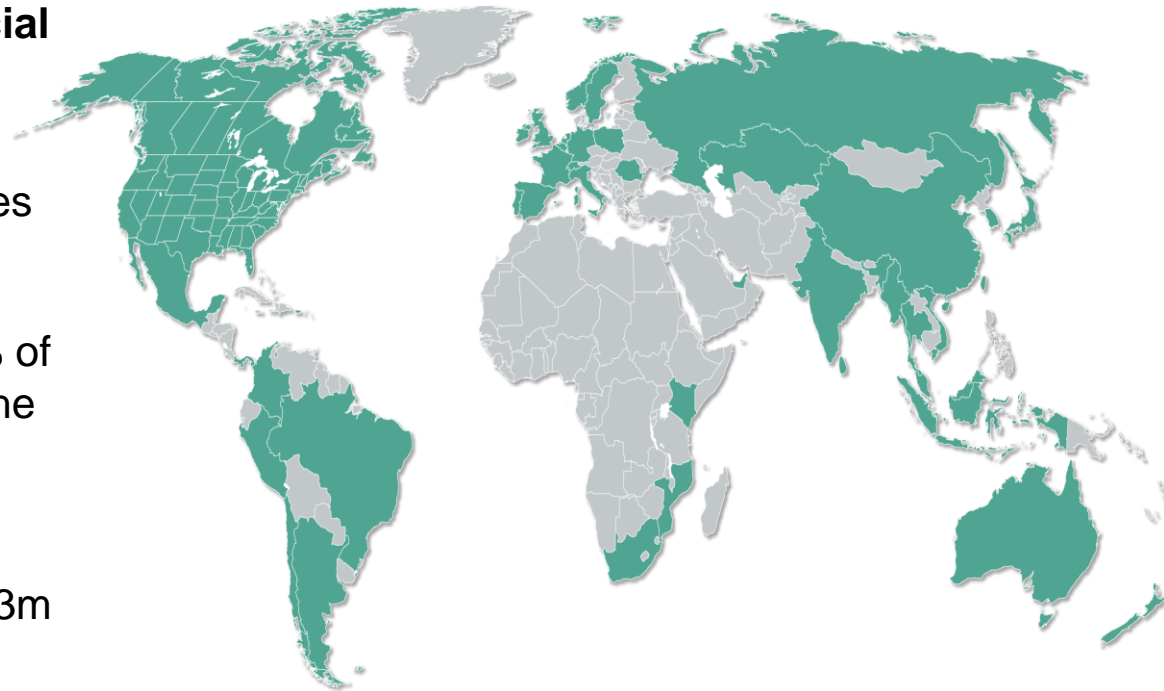
The business of sustainability

Introduction to ERM



ERM is a leading global provider of **environmental, health, safety, risk, social** consulting services and **sustainability** related services.

- 160 offices in 40 countries and territories
- 5,000+ employees
- We have worked closely with over 50% of the Global Fortune 500 companies in the past five years
- Projects in more than 170 countries
- Annual Global Gross Revenues of \$983m (FY19)
- Over 50-year history



ERM in Myanmar

- **ERM** have been working in Myanmar since **1996**
- Opened our Yangon office in **2015**, currently have **15** full time Professional Staff
- Specialise in **Environmental and Social Impact Assessments** for Energy Sector Clients, ie Oil & Gas, and Power Generation / Distribution Projects
- Our clients include TOTAL, PTTEP, POSCO, PETRONAS, Woodside, Shell, Chevron, eni, Statoil, CNPC, Berlanga, as well as the IFC, ADB and others
- ERM is also supporting a number of **renewable projects** in Myanmar related to onshore wind, hydropower, and solar investments



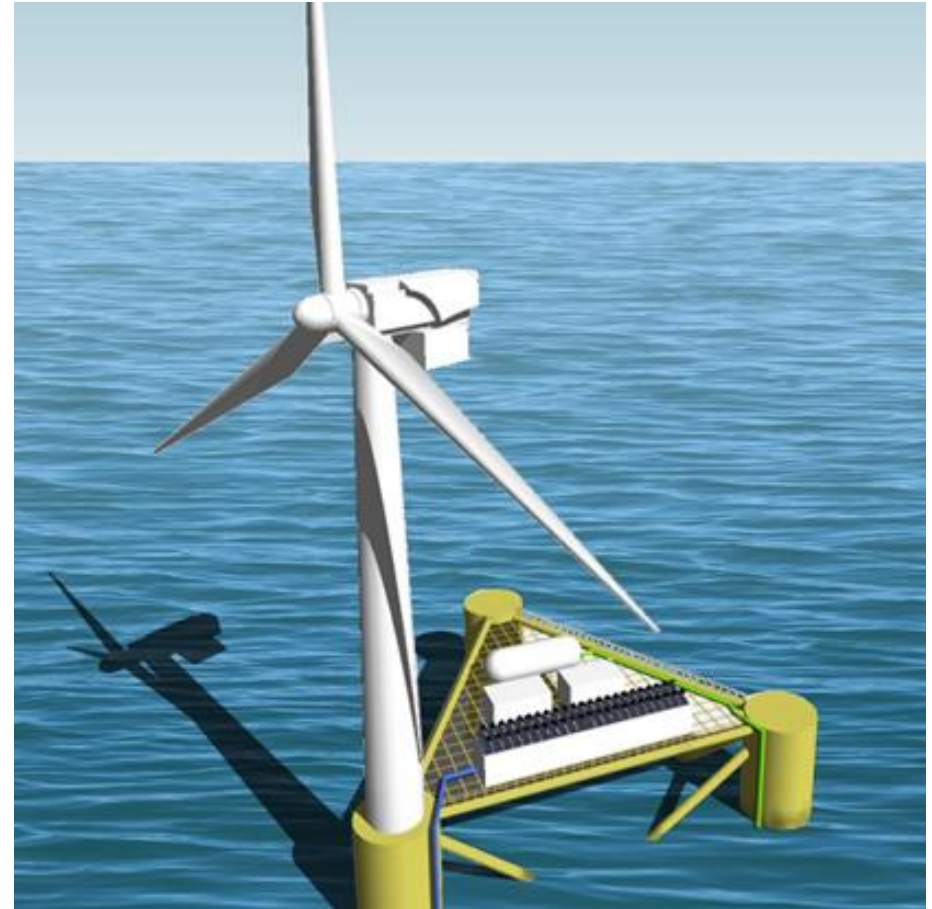
The Dolphyn Project

ERM has developed a concept design for the production of large scale 'green' hydrogen from offshore floating wind.

The project is called **Dolphyn - Deepwater Offshore Local Production of HYdrogen**

We have been awarded **£3.12m** from the **UK Government**, under the BEIS Energy Innovation Programme, to develop the Dolphyn project.

We believe through our Dolphyn project a **400 turbine 'farm'** (20 x 20 array) will have a capacity of **4GW**, producing sufficient supply to heat more than **1.5 million UK homes** with no carbon emissions.



Phase 1 Summary - Complete



- The Dolphyn Concept integrates a **wind turbine**, **desalination unit** and **electrolysis** onto a **single floating sub-structure** to produce hydrogen that can be transported to shore via pipeline.
- Phase 1 involved the evaluation of the ERM Dolphyn concept and **two alternative** floating wind, hydrogen production options, and identify the most advantageous economic and technically feasible concept solution
- Phase 1 also included a **Feasibility Study** and **FEED** development for selected concept (Prototype)
- Finally, Phase 1 would produce a **Plan** for short term and long term development (to full scale commercialisation)

OGUK

Cadent
Your Gas Network



TOTAL

HSE
Health & Safety
Executive

ENGIE



Scottish Enterprise

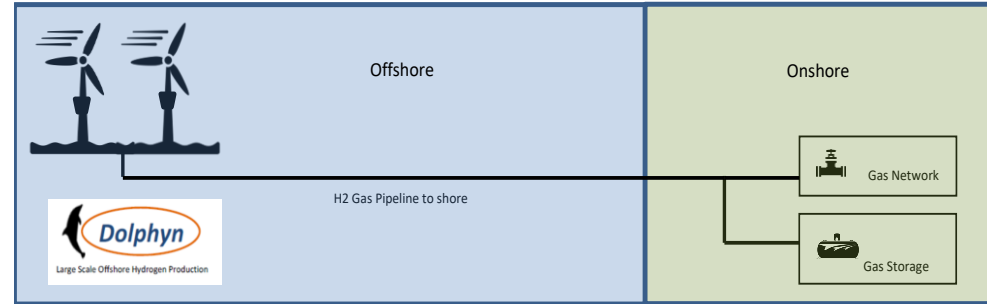
SGN
Your gas. Our network.

Overview of Concepts

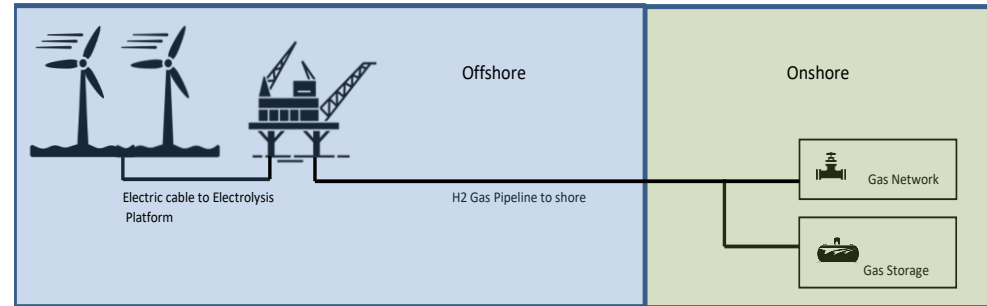


Case 1 - ERM Dolphyn Concept:

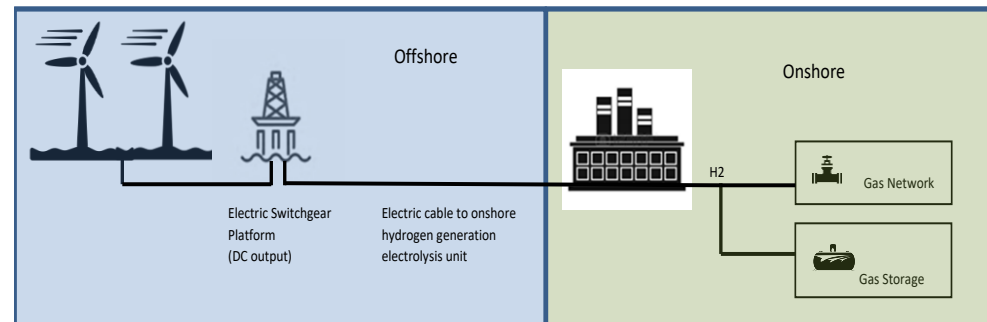
- a) Semi-submersible base
- b) Spar structure



Case 2 - desalination and electrolysis performed on separate offshore platform and pipeline export



Case 3 - Onshore hydrogen production, using electrical cables to bring power back to shore with all electrolysis performed on land

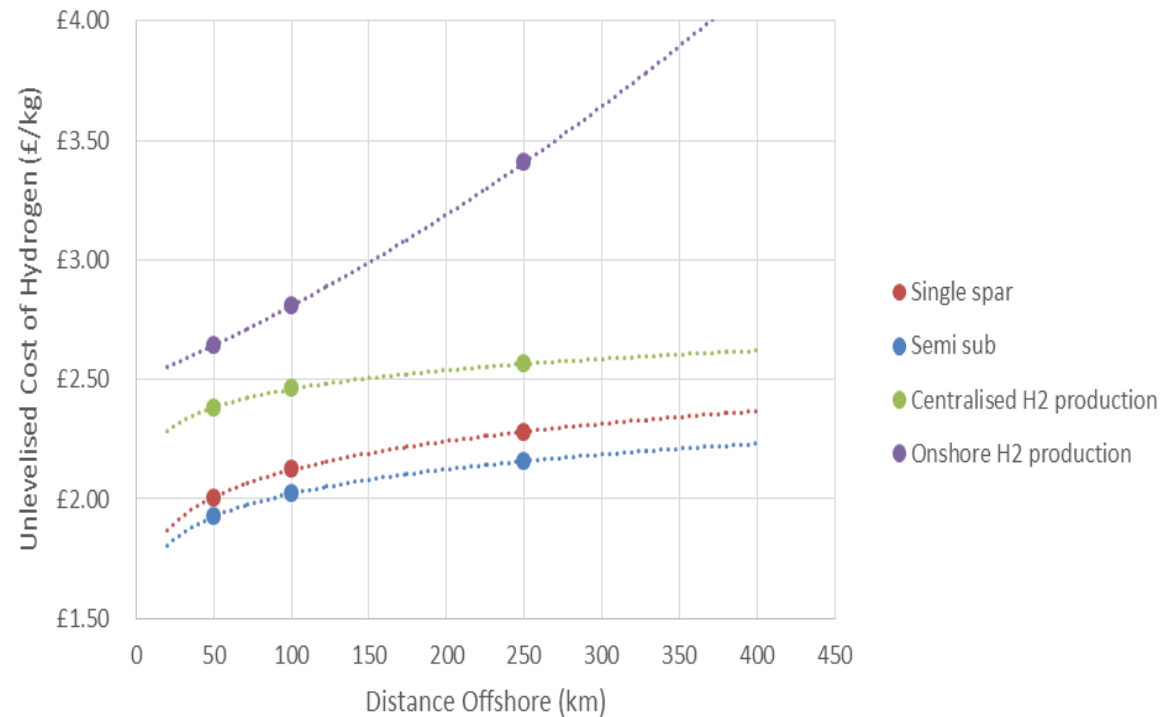


All of the design concepts had the same objective - **to develop hydrogen at a large scale without carbon emissions at the point of generation or end use**

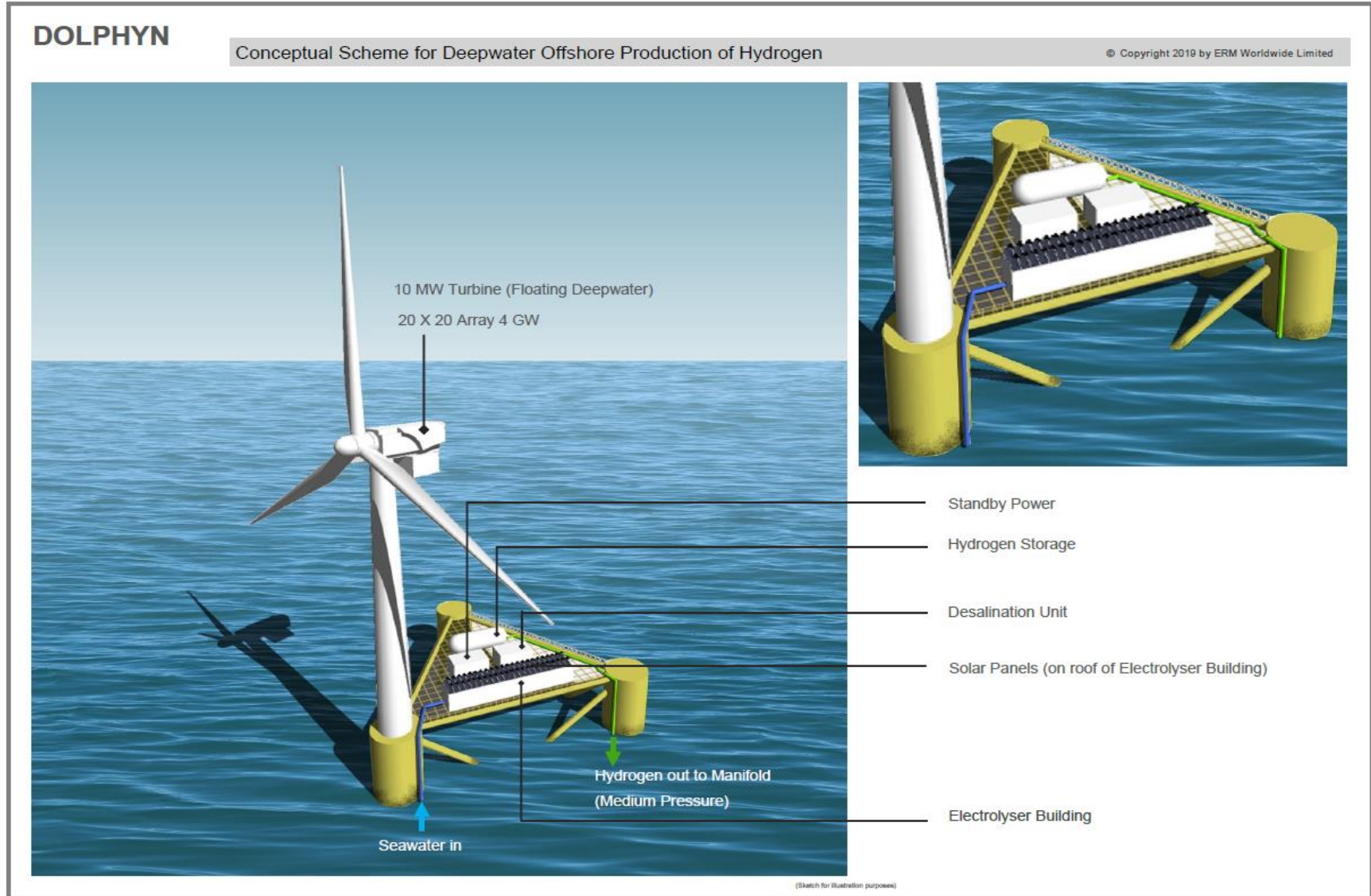
Results



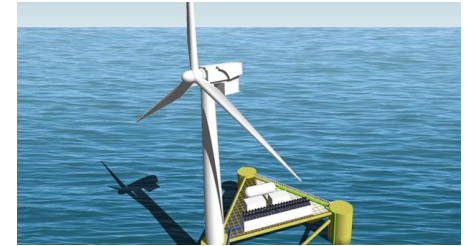
- The results from the evaluations indicate that the Dolphyn (Case 1) semi-submersible design concept is the most **economically advantageous** solution for the bulk production of green hydrogen.
- The next most advantageous is the option with centralised hydrogen production (Case 2) with Case 3 being the **most expensive** option.
- Case 3 is also the option in which costs increase most significantly with **distance offshore**



Result: Semi-Sub Dolphyn Concept Selected



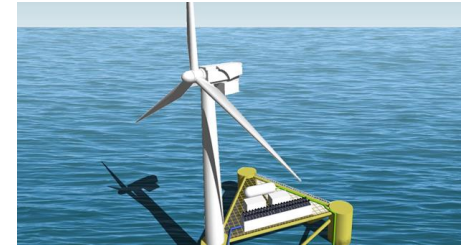
Dolphyn – Phase 2 and Phase 3



- The short term development plan for **Phase 2** is to develop a **2MW prototype** which will be operational and producing around 180 Tc of green hydrogen per year by the Summer of 2023.
- **Phase 3** involves accelerating the design and development of a full scale **10 MW facility** in parallel with the 2MW prototype under a separate ‘increased investment’ project.
- Future developments include potential **100MW** and **4GW** wind farm plans

Dolphyn Hydrogen Project: Size of Development	Operational from	Location	Cost (CAPEX) (£m)	Hydrogen Production Rate (Tonnes/yr)	Hydrogen Production Rate (TWh/y)
2MW - prototype (single operating unit)	2023	Orkney or Aberdeen	16m	180	0.006
10MW – pre-commercial facility (single operating unit)	2026	Aberdeen	40m	900	0.03
100 MW- first commercial offshore hydrogen wind farm (10 x 10MW turbines)	2032	Northern North Sea	~ 300m	9,000	0.30
4GW – first full scale 20 x 20 array hydrogen wind farm (400 x 10MW turbines)	2037	Northern North Sea	~ 12 billion	360,000	12.0

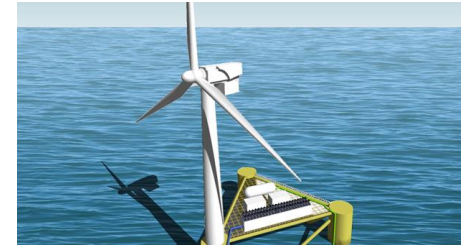
A Design for the Future



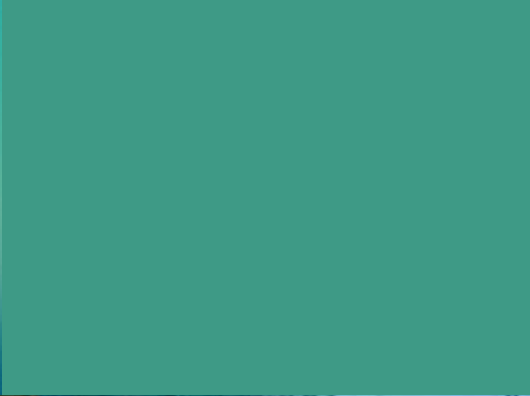
- This illustration shows how a **Dolphyn offshore wind farm** network could be developed in the North Sea.
- The design is based on an initial **10 wind farm** locations with a **40GW** capacity
- Such a design could replace **50% of UK natural gas needs** by **2065**



Dolphyn – Accelerating a Bulk Low Carbon Economy



- The potential **climate change, social** and **economic benefits** that could be delivered in the full transition to green hydrogen using **Dolphyn** include:
 - Production of **green hydrogen at scale**, comparable to projected prices for natural gas
 - New employment of over **8.4 million FTE** years cumulatively to 2100
 - **Investment** in UK Ports and traditional areas of manufacturing (particularly UK East Coast)
 - Delivery of UK's **carbon emissions** reduction target by 2050
 - No **future reliance** on gas imports
 - Potential to **export** UK hydrogen technology and services to the rest of the world
 - **Transition** opportunity for the UKNS oil and gas industry
 - Delivery of cumulative Gross Value Add (GVA) of **£270bn** to 2100



**For any enquiries,
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