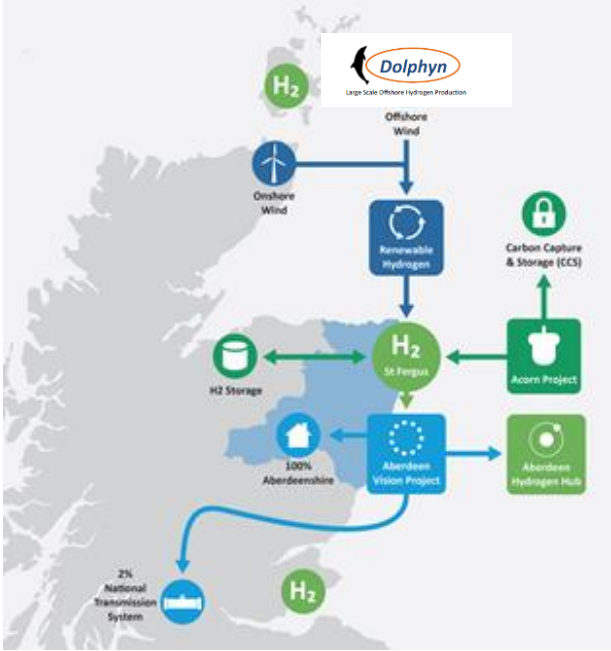


National Development Programme: ERM Dolphyn Project

<p>Name of Proposed National Development</p>	<p>ERM Dolphyn – Production of green hydrogen at scale from offshore wind</p>
<p>Brief Description of Proposed National Development</p>	<p>The ERM Dolphyn project concerns the production of ‘green’ hydrogen at scale from offshore wind. It comprises an innovative floating semi-submersible (floating platform) design with integrated wind turbine, PEM electrolysis and desalination facilities. It will enable UK North Sea wind resources to be accessed in deep water at distances from land up to several hundred kilometres. A single 10MW unit will produce in excess of 800 Te of hydrogen per year, exported back to shore via a pipeline. It does not require any external power source.</p> <div data-bbox="507 810 1393 1391" data-label="Image"> <p>DOLPHYN Conceptual Scheme for Deepwater Offshore Production of Hydrogen © Copyright 2019 by ERM Worldwide Limited</p> <p>10 MW Turbine (Floating Deepwater) 20 X 20 Array 4 GW</p> <p>Standby Power Hydrogen Storage Desalination Unit Solar Panels (on roof of Electrolyser Building) Electrolyser Building</p> <p>Hydrogen out to Manifold (Medium Pressure) Seawater in</p> </div> <p>The system is designed such that it can be deployed as multiple connected units to form an offshore hydrogen wind farm. A 400 turbine ‘farm’ (20 x 20 array) would have a capacity of 4GW, producing over 320,000 Te of hydrogen per annum, sufficient to heat more than 1.5 million UK homes with no carbon emissions.</p> <p>The design has been developed through a detailed technical and financial evaluation process to achieve the lowest predicted cost for producing hydrogen from offshore renewables at scale in the UK. The Pre-FEED Engineering work is now complete and the FEED and detailed design is now in progress. The project will progress to a final investment decision on a 2MW prototype and 10MW pre-commercial facility by March 2021. The initial two units will be located around 15km offshore Aberdeen.</p> <p>The development plan for the project has a target date for the operational</p>

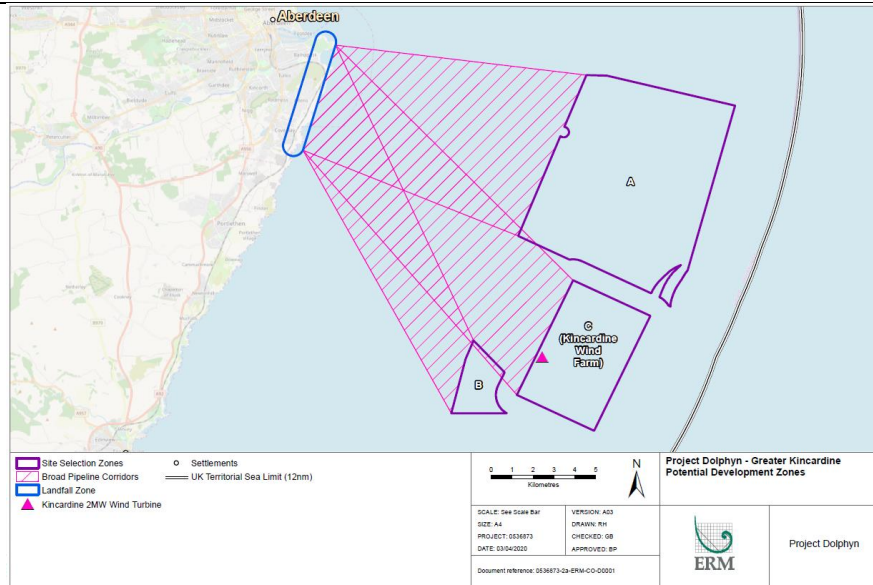
start-up of the 2MW prototype facility of Summer 2024. The 10MW full scale pre-commercial facility is planned to follow by 2026. The project complements both the Acorn hydrogen/CCS project lead by PBD and the Aberdeen Vision project led by SGN. An overview of the three projects, illustrating the linkage between them is shown below:



Location of Proposed National Development

The initial 2MW and 10MW Dolphyn units will be located approximately 15km offshore Aberdeen (Greater Kincardine Area) with proposed location as shown below:





Expansion of ERM Dolphyn into GW scale offshore hydrogen wind farms further out into the North Sea are planned with potential to tie-in to SGN's Gas Network and Industrial project (offshore hydrogen super-grid pipeline). Each wind farm will consist of a 20 x 20 array of 10MW units giving a 4GW capacity. Potential locations for the first 10 wind farms (illustrative only) are shown below:



What part of the development requires planning permission or other consent?

- Location of 2MW and 10MW floating units offshore Aberdeen
- New small diameter hydrogen pipeline to shore 1-3 km south of Aberdeen
- New onshore hydrogen pipeline (small diameter) 1-3km south of Aberdeen
- Construction of hydrogen reception compound 1-3 km south of Aberdeen, comprising isolation valve, hydrogen storage and hydrogen/natural gas blending and injection facility

	<ul style="list-style-type: none"> • New or re-purposed hydrogen trunk line into North Sea for commercial hydrogen wind farm development • Commercial offshore wind farm consent for up to 4GW capacity • Hydrogen reception terminal connected to hydrogen trunk line at St Fergus 										
<p>When would the development be complete or operational?</p>	<ul style="list-style-type: none"> • 2MW unit and pipeline installed and operational at Aberdeen, Summer of 2024 • 10MW unit installed and operational at Aberdeen, Summer of 2027 • First commercial hydrogen wind farm, 2032 <p>Development plan shown below:</p> <table border="1" data-bbox="727 707 1179 1232"> <thead> <tr> <th>Dolphyn Hydrogen Project: Size of Development</th> <th>Operational from</th> </tr> </thead> <tbody> <tr> <td>2MW - prototype (single operating unit)</td> <td>2024</td> </tr> <tr> <td>10MW – pre-commercial facility (single operating unit)</td> <td>2027</td> </tr> <tr> <td>100 MW- first commercial offshore hydrogen wind farm (10 x 10MW turbines)</td> <td>2032</td> </tr> <tr> <td>4GW – first full scale 20 x 20 array hydrogen wind farm (400 x 10MW turbines)</td> <td>2034</td> </tr> </tbody> </table>	Dolphyn Hydrogen Project: Size of Development	Operational from	2MW - prototype (single operating unit)	2024	10MW – pre-commercial facility (single operating unit)	2027	100 MW- first commercial offshore hydrogen wind farm (10 x 10MW turbines)	2032	4GW – first full scale 20 x 20 array hydrogen wind farm (400 x 10MW turbines)	2034
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<p>Is the development already formally recognised – for example identified in a development plan, has planning permission, in receipt of funding, etc</p>	<p>The project is currently at FEED stage with a final investment decision (FID) due in March 2021. The plan is to locate the 2MW and 10 MW turbines within the Kincardine consented area offshore Aberdeen, subject to agreement from Crown Estate Scotland and Marine Scotland. The project is currently being funded by BEIS (£3.7m) which will take it to FID (March 2021). Discussions with several potential investors are ongoing to fund the project through construction and operation from March 2021 onwards.</p>										
<p>Contribution of proposed national development to the National Development Criteria (max 500 words):</p>											
<p>Hydrogen is seen as essential for decarbonising heat and transport in Scotland and the UK. In a recently published report, the Energy Networks Association (ENA)¹ provided a roadmap to the world’s first net zero gas network by 2050. It will require 10% of gas energy to be delivered by hydrogen by 2030 and 60% by 2050. This will require a massive scale up of hydrogen production, initially by blue hydrogen from natural gas, with CCS, and increasingly by green hydrogen from renewables. The Dolphyn technology is designed for generating bulk scale green hydrogen at lowest cost. It is developed for deep water, covering more than 80% of the UK’s offshore wind resources.</p>											

The Scottish Government will publish a Hydrogen Policy Statement and Hydrogen Action Plan later this year and it is expected that green hydrogen will feature strongly. The UK strategy for hydrogen will also be issued.

Scotland has the opportunity to be a World Leader in bulk scale green hydrogen production due to three key advantages:

- Excellent offshore wind resources in the North Sea
- World class Oil and Gas Industry and offshore infrastructure
- Leading offshore wind industry

The ability of the gas network to accept an early hydrogen blend (up to 20%) from the mid 2020's, will provide a significant early demand for hydrogen and kick-start a major new industry. Meeting this demand from the North Sea with green hydrogen will generate and protect a large number of jobs, particularly in the North East of Scotland and along the East coast. A 4GW ERM Dolphyn wind farm comprising a 20 x 20 array of 10MW turbines will require a CAPEX of around £12 billion. Around 20 such wind farms would be required to meet the 2050 target for hydrogen in the UK network. Integrating ERM Dolphyn production with the hydrogen infrastructure developed by the Acorn and Aberdeen Vision projects provides flexibility to produce, use and transport hydrogen for heat and transport, creating unrivalled opportunities for investment, jobs, trade and overseas export.

Renewable energy in the form of hydrogen will enable the coupling of power and gas networks and, with CCS, is central to our ability to meet Net Zero. It will enable a major expansion of renewables without grid constraint and is increasingly being seen by Governments across Europe, and by influential organisations such as the Climate Change Committee, as a key part of the decarbonisation roadmap. Without such an approach there will be significant implications for Scotland's and the UK's economy, people's health and wellbeing as well as the sustainability of Scotland's industry, towns and biodiversity.

The development of ERM Dolphyn offshore hydrogen wind farms can provide a sustainable offshore energy future for Scotland and the UK. It can facilitate a smooth transition from Oil and Gas to renewables in the North Sea over a number of decades, utilising existing people skills and offshore experience. It can also facilitate the potential reuse or repurposing of existing industrial infrastructure in the form of onshore and offshore pipelines, re-cycled steel from existing platforms, mooring lines, anchors, helicopters, in-field maintenance vessels, etc. The industry can also breathe new life into ports, towns and ship yards, local communities and supply chains and enhance prosperity and energy security across the entire country.