

DeepWind Cluster: ORION and NE1

9th February



Image courtesy of Equinor

Programme

10.30 Introduction

10.35 ORION Clean Energy Project – Gunther Newcombe, Project Co-ordinator

10.55 NE1 ScotWind site – Paul O’Brien, DeepWind Cluster Manager

11.15 Q&A

11.30 End of webinar





Clean
Energy
Project



Shetland
Islands
Council

Technology
Driving
Transition

OGTC



Clean
Energy
Project

Providing clean affordable sustainable energy for our future

Oppportunity **R**enewables **I**ntegration **O**ffshore **N**etworks

Ambition



- **Enable offshore oil & gas sector transition to net zero by electrification utilizing onshore and offshore wind power**
- **Transform Shetland's current dependency on fossil fuels to affordable renewable energy**
- **Create on Shetland a green hydrogen export business at industrial scale by harnessing offshore wind power**

Transformational shift towards producing clean energy

Objectives

Hydrogen	Supply 32TWh of low carbon hydrogen annually, 12% of the expected UK total requirement, by 2050
Transform	Produce green hydrogen, utilizing wind and tidal energy, to fuel domestic heating, road, and marine transportation in Shetland
Electrification	Provide more than 3GW of wind generated electrical power to Shetland, to produce green hydrogen, supply the UK grid, electrify onshore and the offshore oil and gas sector
Net Zero	Enable all West of Shetland hydrocarbon assets to be net zero potentially by 2030 and abate ca. 8Mt/year CO2 by 2050
Revenue	Generate £5bn in annual revenue by 2050 and contribute significantly to the UK Exchequer
Employment	Provide sustainable employment for 1,750 people, both regionally and locally, whilst maintaining a pristine environment

Transformational objectives both locally and regionally

Onshore wind



Viking Wind Farm

Under construction with 103 x 4.3MW WTG's with total output of 443MW with a targeted load factor of 48%. Linkage to 600MW HVDC cable to mainland. Operational late 2024



Energy Isles Wind Farm

Energy Isles, consortium of 50 local business partners & Statkraft, with 23 turbines with 180 MW output located on Yell. Currently seeking planning approval with construction late 2025



Local Wind Farms

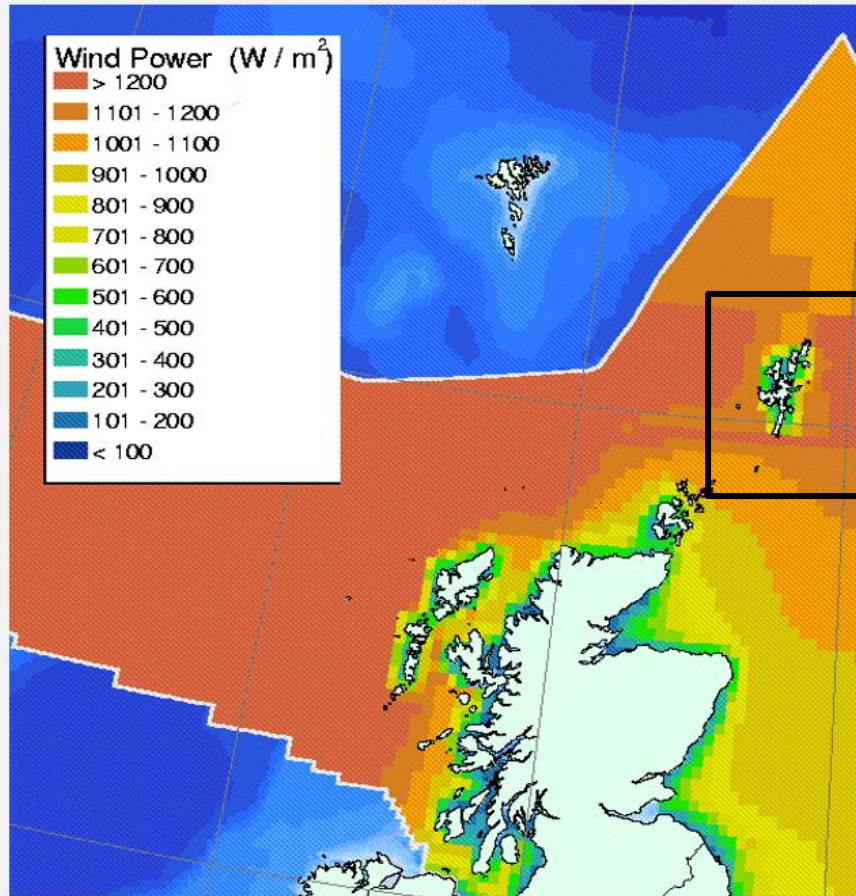
Burradale windfarm, operated by Shetland Aerogenerators since 2000, generates 3.68MW powering 2000 homes with an average load factor of 52% making Burradale the most productive wind farm in the world per unit of installed capacity



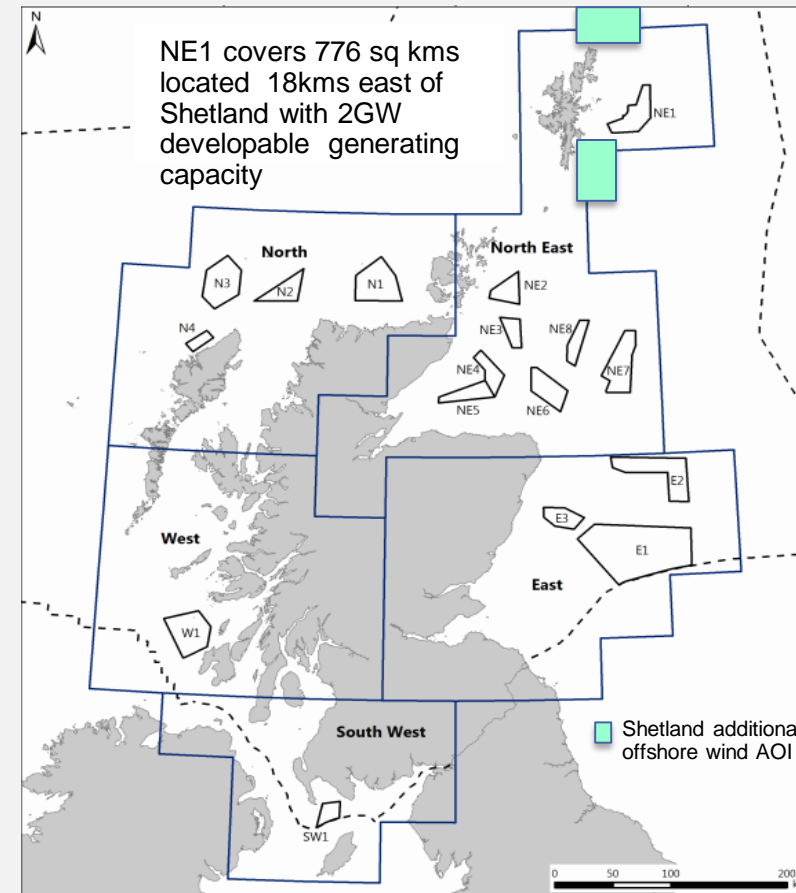
Peel Energy is seeking final planning permission for Beaw Field on Yell with 17 WTF's providing 72MW output and Mossy Hill near Scalloway with 12 turbines providing 50 MW of output.

Peel Energy Wind Farms

Offshore wind



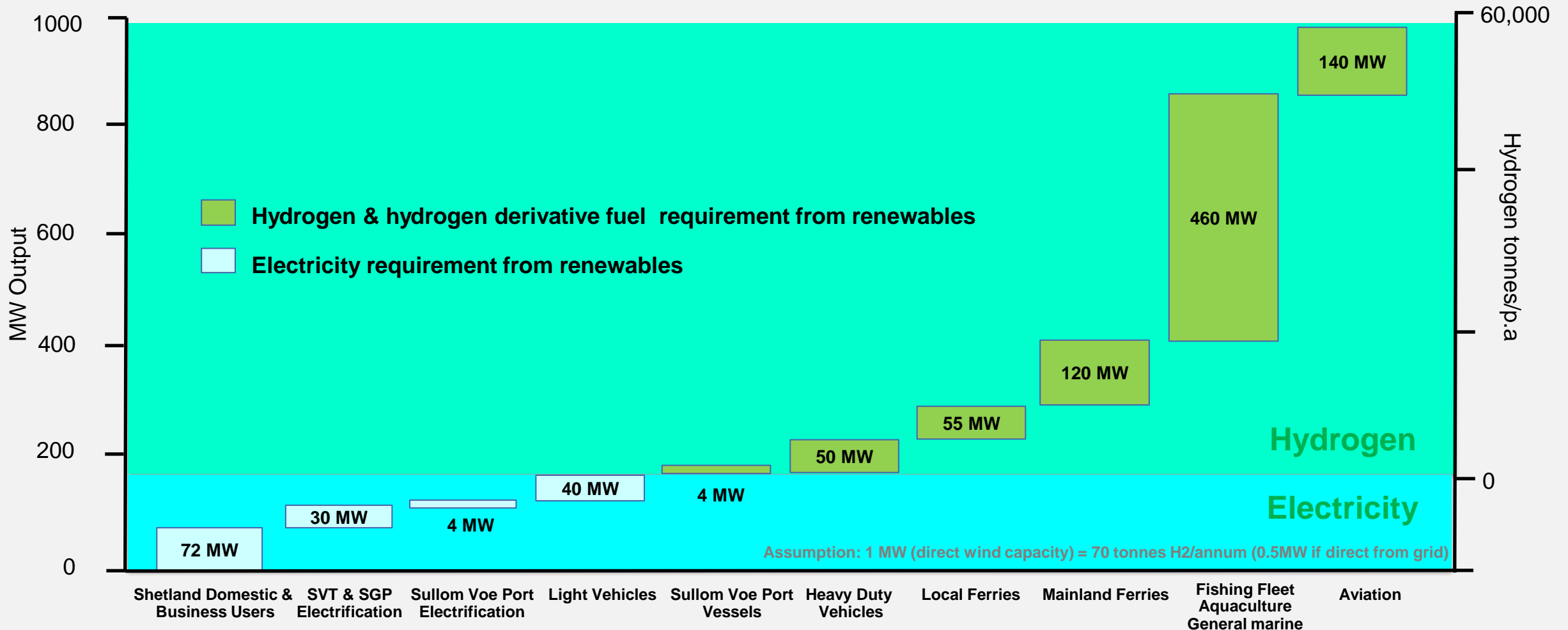
Substantial wind resource in Shetland region



ScotWind round applications by end 1Q2021

Offshore floating wind potential in Shetland region 5 - 10GW

Shetland energy requirement



Onshore Shetland renewable energy requirement ca 1.0 GW

Blue hydrogen

-  **Natural Gas** Gas supply from Laggan Tormore gas condensate fields and associated gas from West Shetland current oil production e.g. Clair and future developments providing about 10% of UK current gas supply exported to St Fergus
-  **Industrial Site** Sullom Voe Oil & Gas Terminal (1000 acres) with 50% site currently not used, Shetland Gas Plant Site with (133 acres) , Sullom Voe port with loading and construction jetties and Scatsta airport for both helicopter and fixed wing operation
-  **Export** There are two options for hydrogen export namely by pipeline mixing with natural gas in SIRGE and FUKA, via EOSPS pipeline system, or export by tanker via Sullom Voe port using LOHC, ammonia or methanol
-  **CO2 Transport** CO2 transportation is primarily a bi-product from blue hydrogen production utilizing current pipeline infrastructure such as EOSPS or redundant oil lines or liquified tanker export
-  **CO2 Storage** CO2 flood for EOR at Magnus or stored in East of Shetland depleted oil and gas fields such as Frigg and Brent
-  **Workforce** Skilled workforce and supply chain with more than 40 years experience in the Oil & Gas sector & associated industries



All key ingredients available for production of blue hydrogen

Green hydrogen



Offshore Wind

Offshore wind energy source (2GW+) converted to electricity and exported to shore utilizing an offshore gathering station to produce hydrogen onshore



Repurposing

Removal of topsides during decommissioning of mature East of Shetland (EOS) oil fields and repurposing for hydrogen production utilizing offshore wind



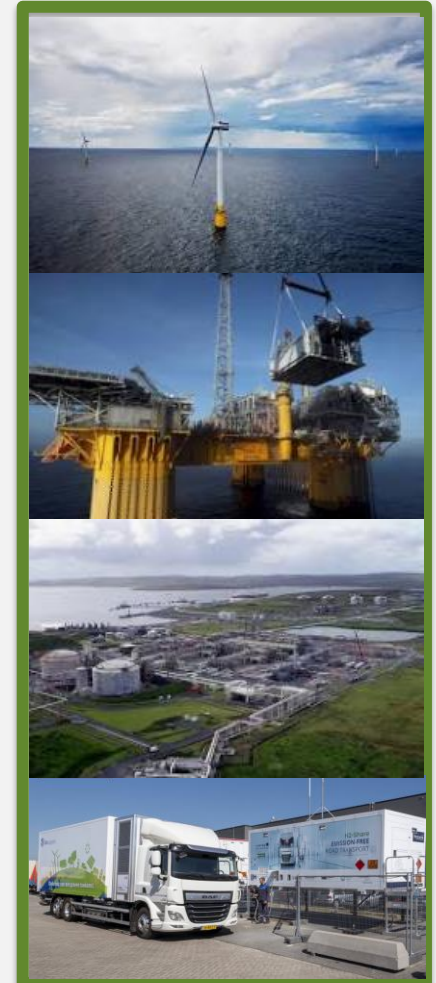
Onshore Industrial

Onshore wind and tidal power electrifying SVT, SGP and port facilities with surplus output (200MW+) to produce H2 for conversion into marine fuel or H2 derivatives

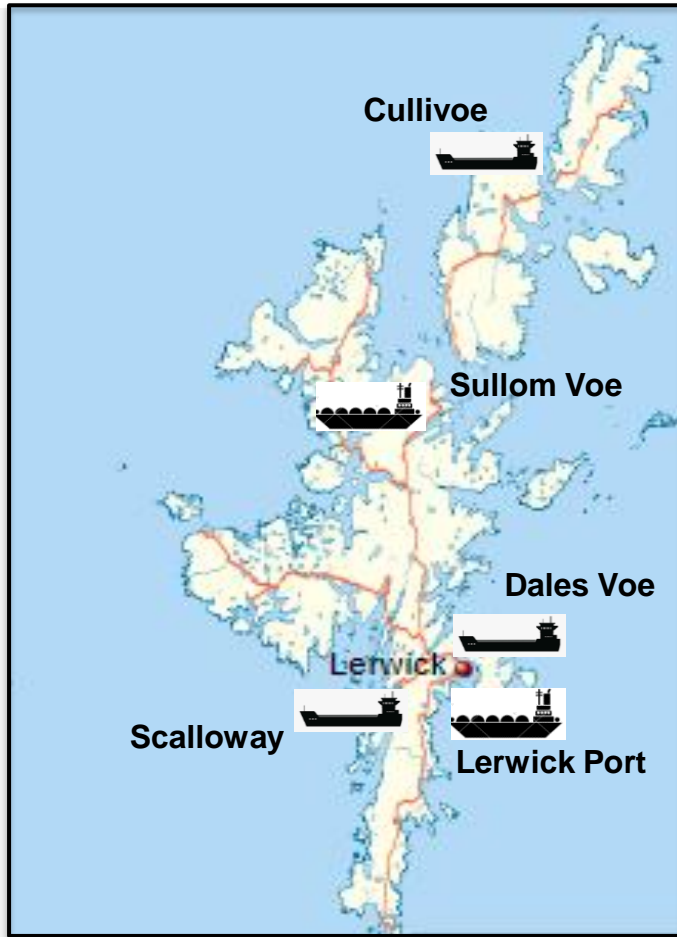


Onshore Local

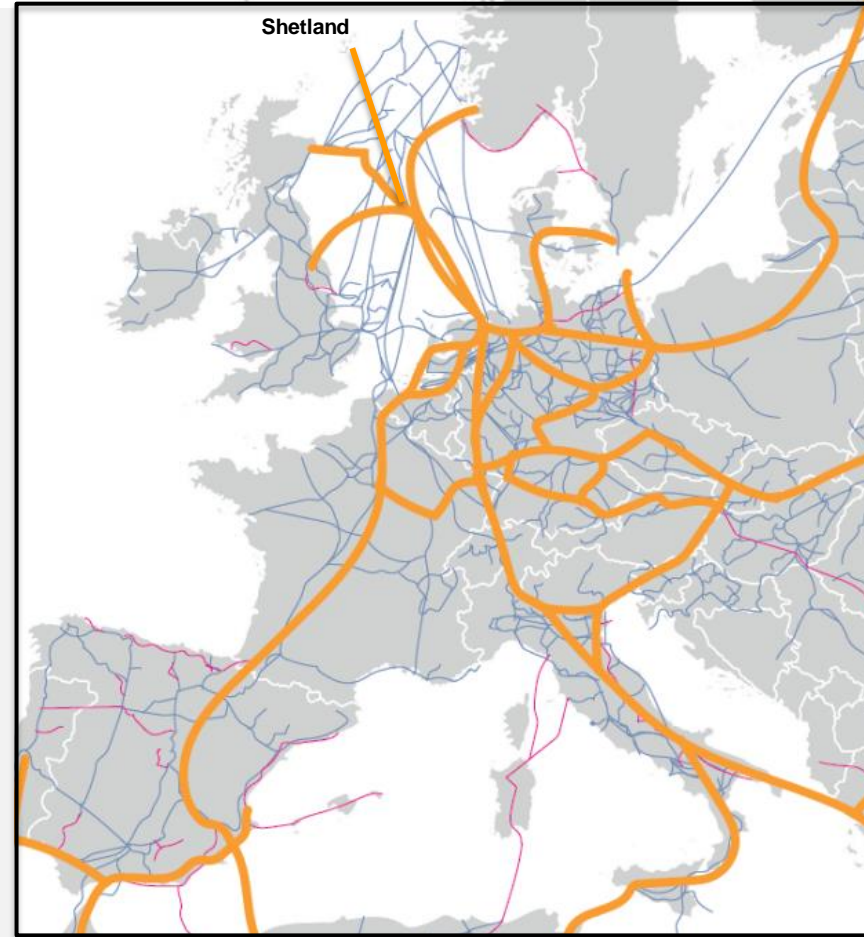
Onshore wind power to create hydrogen, utilizing curtailed wind, for use in fueling heavy duty vehicles, home heating & power and aquaculture



Port facilities



Shetland Main Ports



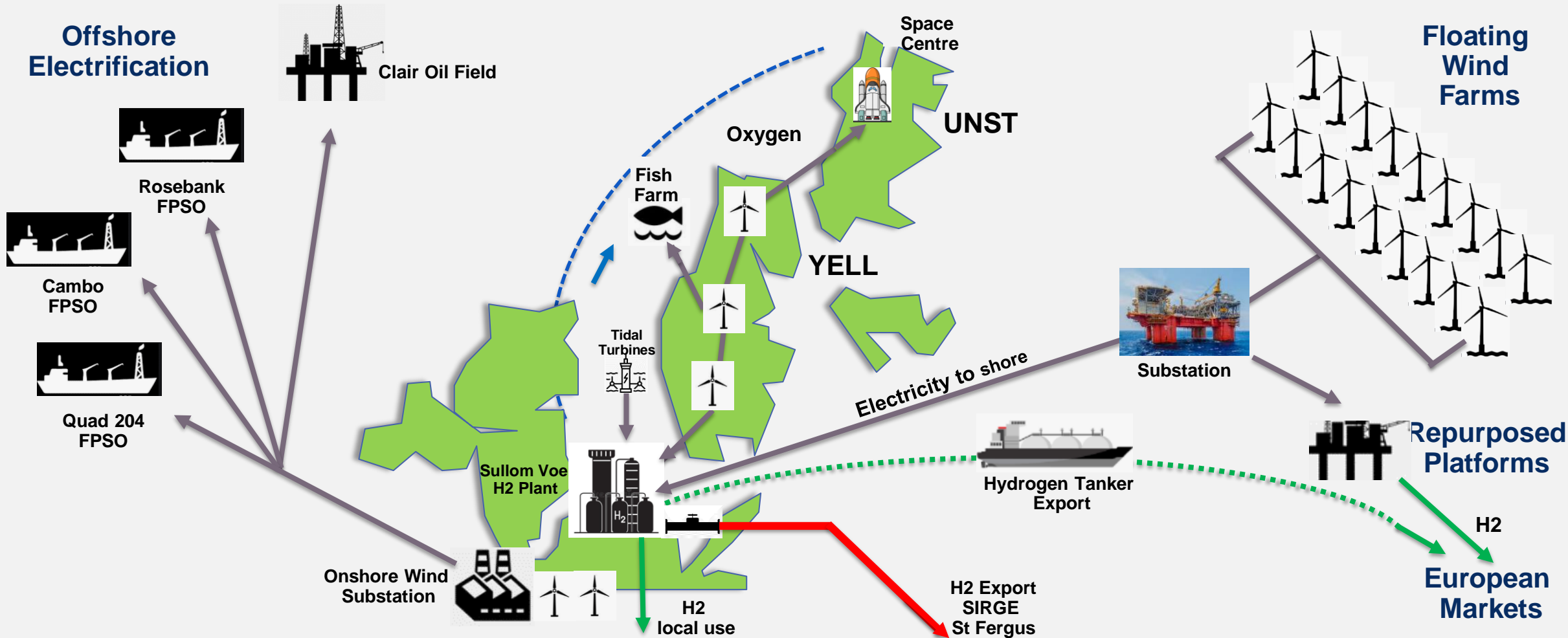
European Hydrogen Backbone



- 40 years tanker experience at Sullom Voe
- Sullom Voe berthing facilities 25m water depth
- Sullom Voe & Dales Voe support offshore wind
- ORION linked EU & UK government port initiative

Shetland ports have experience and capability to support H2 export & offshore wind sector

Electrification & hydrogen hub



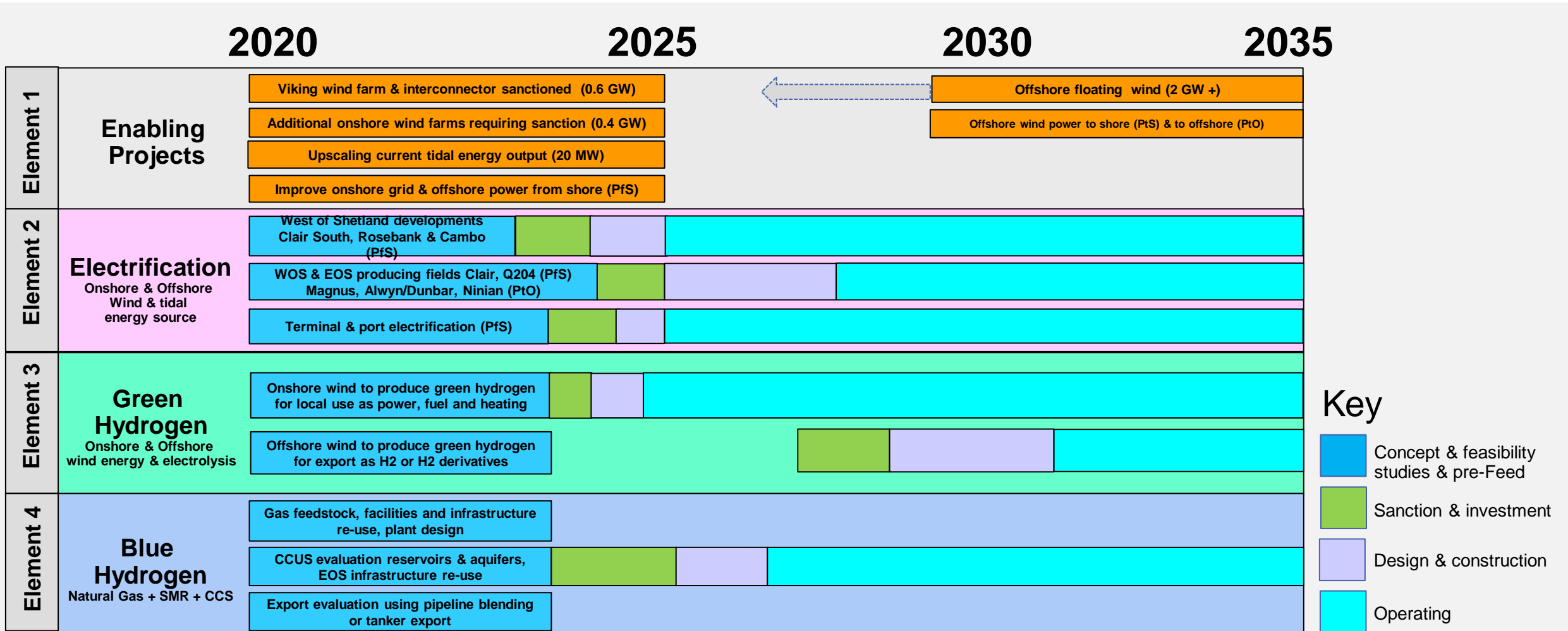
Wind and tidal energy used to electrify onshore, offshore & produce green H2

Conclusions

- Shetland onshore wind can only provide sufficient energy to adequately electrify WOS developments with established production, including EOS, requiring offshore wind or electricity from Norway
- Shetland onshore wind, both sanctioned and unsanctioned, can only supply a portion of Shetlands hydrogen fuel needs, the remainder requiring offshore wind energy
- The export of green H2 from Shetland at industrial scale requires offshore wind
- Critical to approach energy in a holistic way & develop wind resource

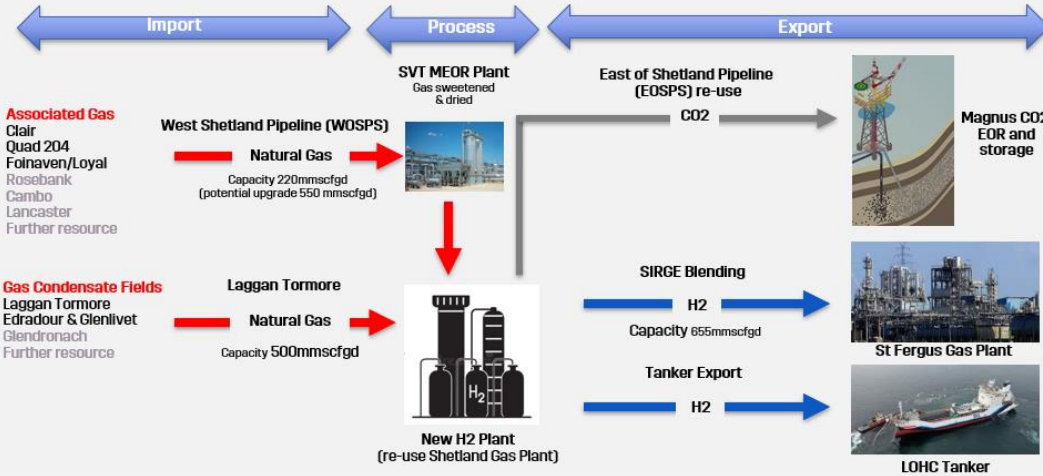
Development of offshore wind required to realize ORION ambitions

Project timings



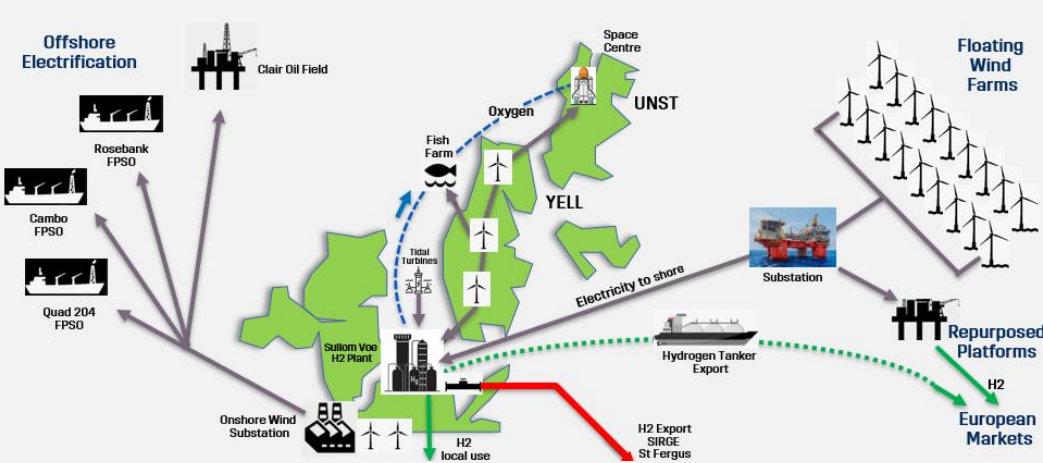
Timings dependent on outcome of studies & other factors

Summary



Blue Hydrogen

- Shetland Island Council & OGTC working together in partnership with industry to develop an energy island
- Electrification of offshore using a combination of onshore & offshore wind
- Produce clean fuels on Shetland to replace imported fossil fuels
- Harness offshore wind to develop green hydrogen at scale for export
- Port facilities to support the offshore wind sector
- Repurpose onshore infrastructure to develop both green & blue hydrogen
- Utilize the skills & experience of a highly competent work force



Green H2 & Electrification

Develop UK's first green energy island

The background of the image is a vibrant aurora borealis (northern lights) display. The colors range from deep blue and purple at the top to bright green and yellow at the bottom. The aurora consists of vertical, shimmering curtains of light that appear to be dancing across the sky. The overall effect is ethereal and dynamic.

ORION

Clean
Energy
Project

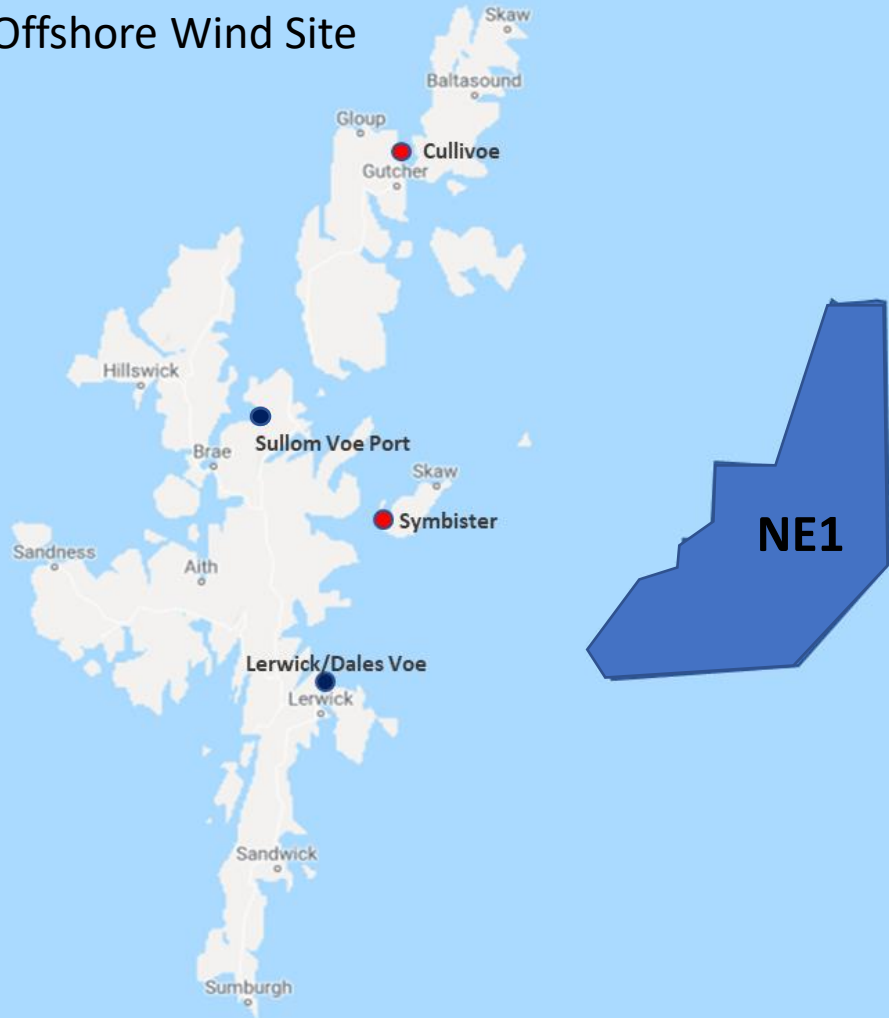
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Image courtesy of Equinor

NE1 - Floating Offshore Wind Site



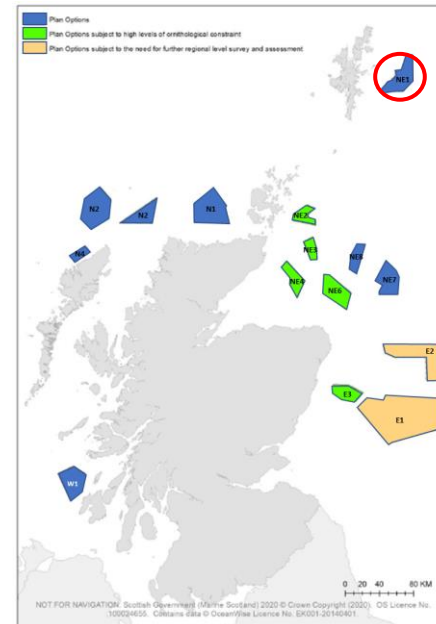
- Construction Port option
- O&M and Support Port option

Fair Isle

Google

NE1 – Shetland Isles

Site	NE1
Region	North East
Total DPO Area (km ²)	751
Realistic Max GW	2
Realistic Max as % of area	53%
Minimum Water Depth	>100m
Maximum Water Depth	>100m



ScotWind Leasing process

To be completed by Crown Estate Scotland

- All site bids to be submitted by end of March 2021
- Not known, as yet, if any developer is on NE1
- Outcome to be public by Q2-3 2021
- A Clearing Round may be required

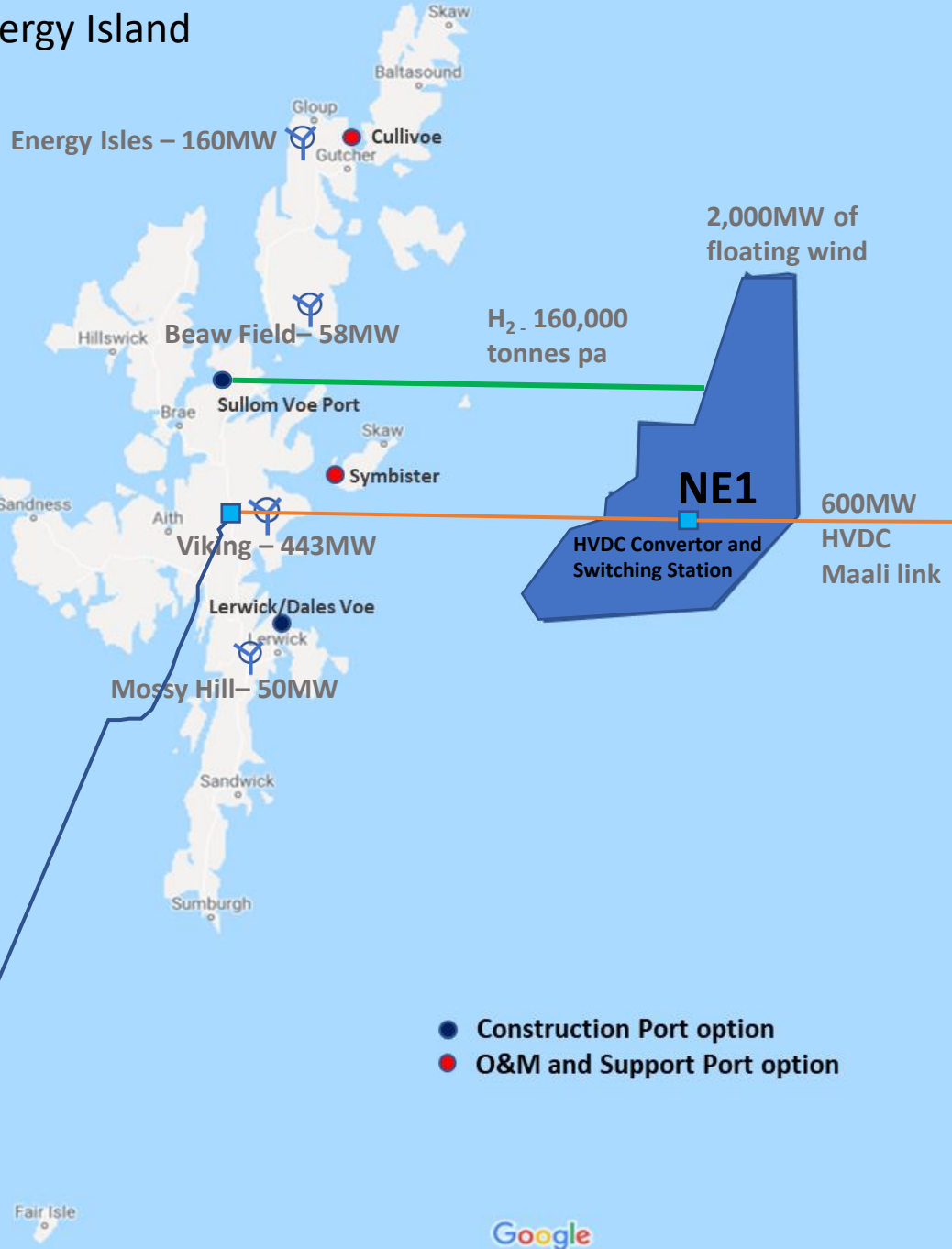
Projects

- Initial floating wind projects expected to be in the region of 300-500MW but could be as large as 1GW (66-80 turbines and substructures)
- Up to £1.8bn Capex
- Early stage site development in the order of £30-50m

Shetland and SE1



Shetland – Energy Island



Offshore Wind to Hydrogen

Floating offshore wind project of up to 2GW

Capacity factor in excess of 50% based on record breaking onshore wind sites in Shetland

Subsea cable or pipeline?

Floating hydrogen production platform of up to 1GW of electrolyser plant or hydrogen production at each turbine?

7,860,000 MWh of electricity per annum

160,000 metric tonnes of hydrogen per annum

Grid Infrastructure

New 320/132kv upgrade to Upper Kergord substation and new HVDC convertor station for the 275km HVDC cable for the 600MW Shetland link

A new 132 kV Switching Station located on Yell to connect Energy Isles and Beaw Field Windfarms

A new 132 kV transmission connection from Yell Switching Station to Kergord 132 kV Substation and HVDC Converter Station. This will include a subsea cable between Yell and Mainland Shetland

The Shetland link will make landfall at Noss Head in Caithness where it will link up to the existing Caithness-Moray HVDC multi-terminal system through a new HVDC switching station

The Shetland link and the Caithness-Moray link together are part of the first planned HVDC multi-terminal system in Europe. SSEN designed the system to be expandable with up to 5 nodes.



NKT
Cable Supplier

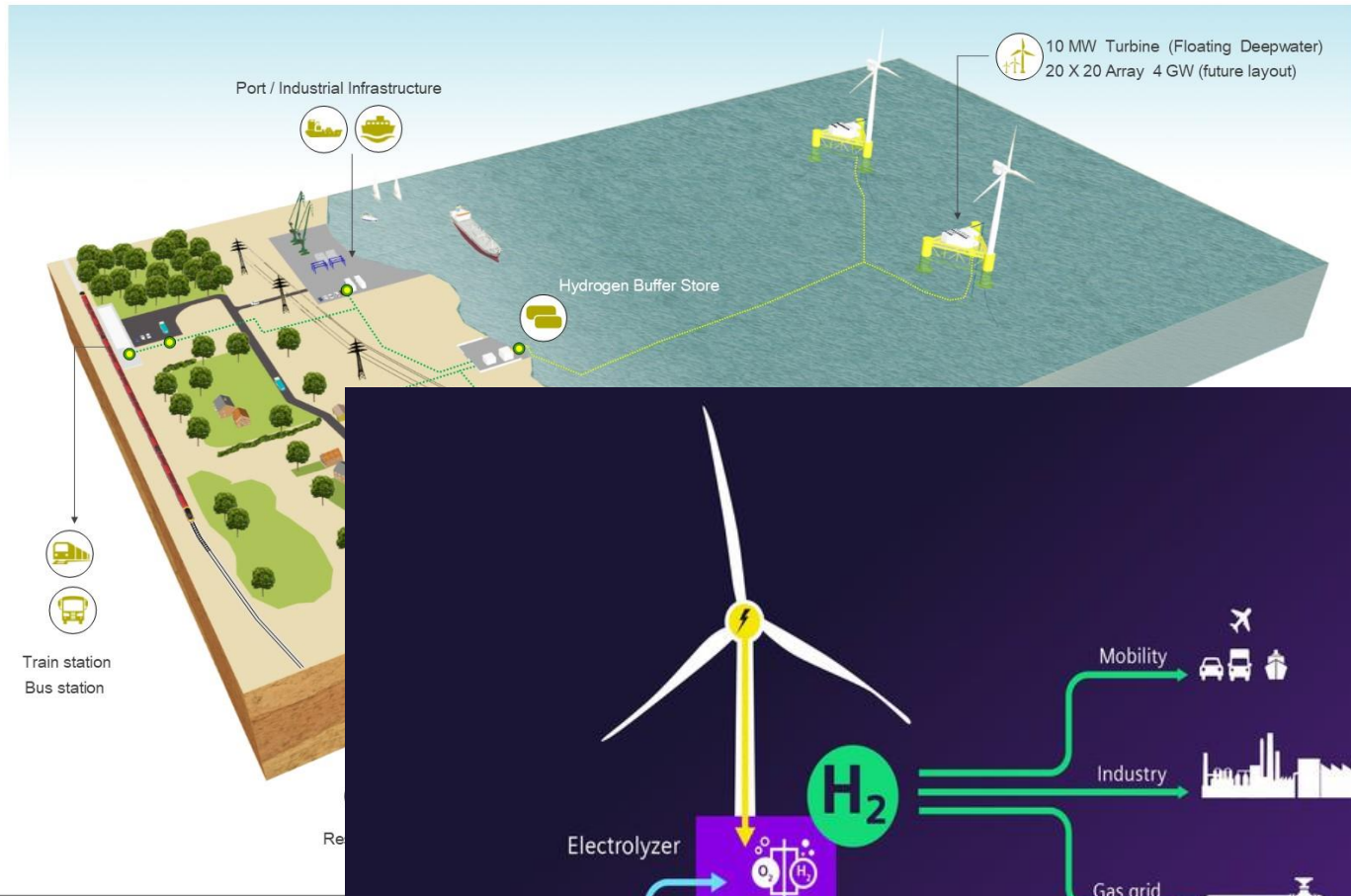
HITACHI
ABB
HVDC Technology
Supplier

bam
nuttall
Civils Supplier

DeepWind
North of Scotland Offshore Wind Cluster

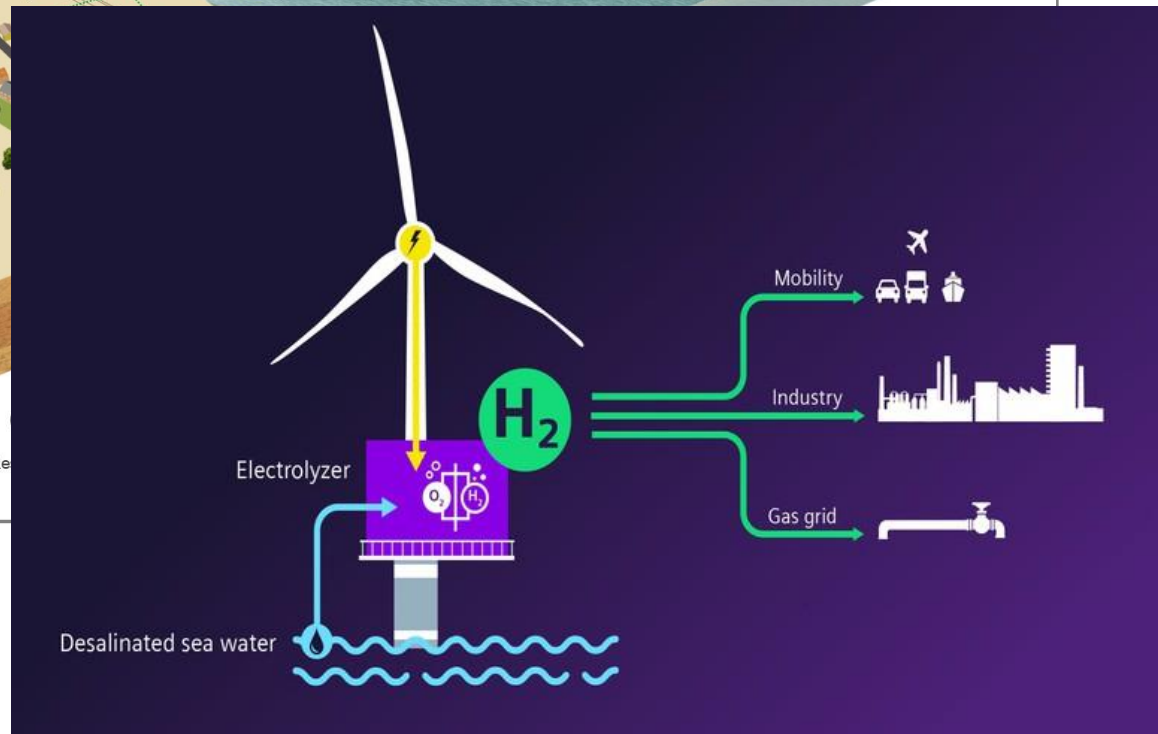
ERM DOLPHYN Hydrogen Project

Schematic for Deepwater Offshore Production of Hydrogen



Offshore production of hydrogen?

- Projects such as ERM's Dolphyn and TechnipFMC's DeepPurple propose to use floating wind to produce green hydrogen at scale
- Turbine OEMs looking at producing hydrogen as an integral part for their wind turbines
- Power for offshore platforms and export to UK mainland and Europe
- Bulk liquid carriers using LOHC (Liquid Organic Hydrogen Carrier) or Ammonia (NH₃)





Hydrogen Infrastructure

- 1) Electrolyser banks
- 2) Hydrogen storage
- 3) Ammonia Synthesis plant
- 4) Liquid storage (Ammonia)
- 5) LOHC Hydrogenation plant
- 6) LOHC Liquid Storage
- 7) Ammonia export loading berth
- 8) LOHC export loading berth



Equinor - SparBouy



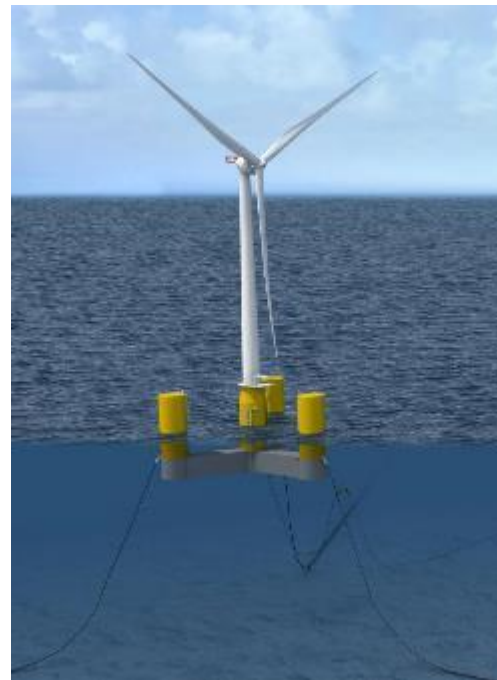
SBM Offshore



Ideol - FloatGen



Principle Power
- WindFloat



Naval Energies

ScotWind
Floating wind
substructure
design companies



Axis Energy
Project Group

Ecosse IP



Gicon



Bluewater
Energy Services



Toda Corporation



Floating Power Plant



NOV GustoMSC



Seawind Ocean
Technologies



Dolfines SAS



Nautilus Floating
Solutions

Lerwick Port Authority



Burn of Kebister

11 Acres

130m

Dales Voe

Gremista Industrial Estate

Gremista

Shetland College UHI

9 Acres

Greenhead Base

100m

470m

210m

4.5 Acres

18.5 Acres

Dales Voe



3D



Dales Voe and Ultra Deep Water Quay



Courtesy of Boskalis

Floating Wind

- Water depth at quayside, 12.5m, is suitable for many of the semi-sub designs currently being considered for ScotWind leasing round
- At 130m the quayside is suitable for the largest of these substructure designs, which are up to 80-90m in diameter. Further investment could extend the quayside to 340m
- Dales Voe could be suitable for turbine assembly on the substructure at the quayside
- Dales Voe is also the proposed facility to house the UK's Ultra Deep Water Quay which was intended for the largest of the decommissioning projects. This would increase the water depth at the quayside to 24m



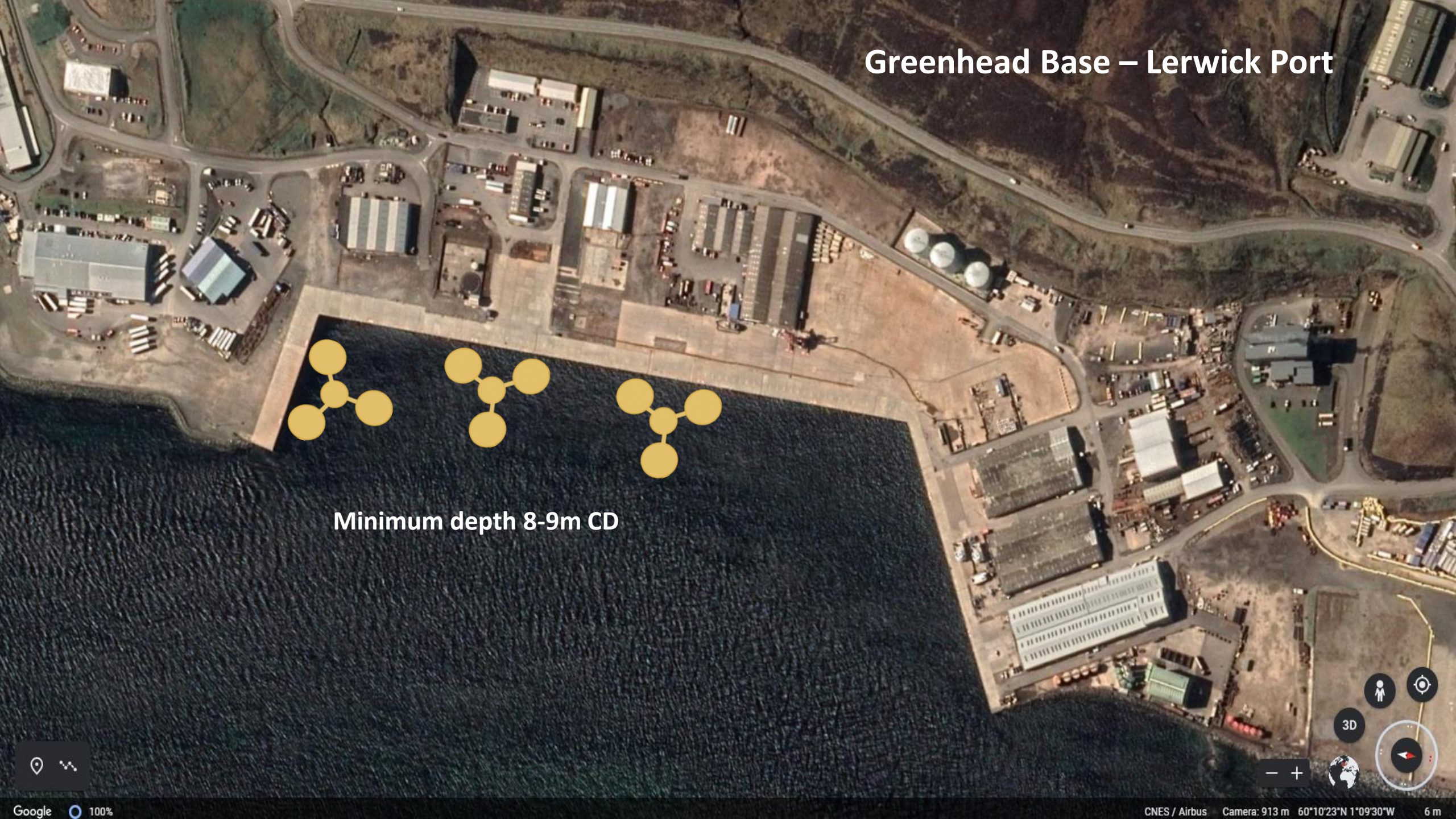
Courtesy of Lerwick Port Authority



Greenhead Base – Lerwick Port



Minimum depth 8-9m CD



Thank you

To join the cluster

Email: paul.obrien@hient.co.uk

Or visit: www.offshorewindscotland.org.uk

