



スコットランドの洋上風力発電でネットゼロへ **Scotland Offshore Wind Journey to Net Zero**

-更なる日本・スコットランドのイノベーションを構築-
- Building on Japan and Scotland Innovation -

2022年11月9日

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ご挨拶 **MESSAGES**



**スコットランド国際開発庁
日本代表
アジア太平洋地域投資統括ダイレクター**

スティーブン・ベーカー

私はスコットランド国際開発庁にて日本代表を務めておりますスティーブン・ベーカーと申します。スコットランド国際開発庁はスコットランド政府の経済開発を行う機関です。

私たちは今、世界中で発生している極端な気候変動の影響を受け、その状況は「気候の緊急事態」という言葉で表現されています。

そのため、世界の国々は温室効果ガスの排出量を削減するための努力を行っております。

スコットランドにおいては、いくつかの具体的な目標を設定しています。例えば2030年までに、温室効果ガスの排出量を1990年比で70%削減し、このプロセスを継続して、2045年までには、排出量をゼロにすることを目指しています。これらは単なる目標ではなく、法律に基づいて規定されており、必ず達成しなければなりません。

これらの困難な目標を実現するためには、本日プレゼンテーションをお聞きの企業様の行動・取り組みが必要になります。

このプレゼンテーションを通じて、これらの目標を実現するための実際の取り組みとビジネスの機会をご紹介します。こうしたビジネスチャンスの一部は、日本を含めた外国からの直接投資を通じて実現する可能性があります。

スコットランドが脱炭素社会を実現するために、こうしたビジネスチャンスを活用し御社がどのように貢献頂けるかについて、是非議論させて頂ければ幸いです。

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“Project to Cultivate Marine Pioneers of the Future”

Announced by Former Prime Minister Shinzo Abe

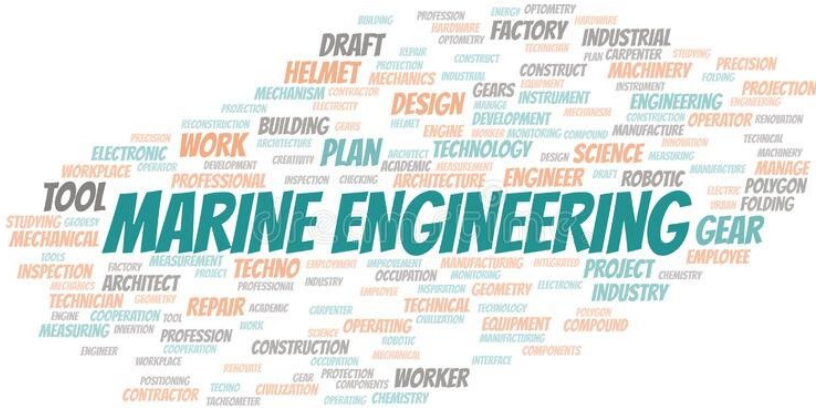
20th Marine Day, on July 20th, 2015

The launch of “Project to Cultivate Marine Pioneers of the Future”

A consortium made by government, industry, and academia

To increase by fivefold the number of engineers engaged in marine resource development

10,000 engineers by 2030



The Nippon Foundation Ocean Innovation Consortium

On the 4th of October 2016, the "Ocean Innovation Consortium" officially started providing educational opportunities for engineering students and young engineering professionals

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RGU - NIPPON FOUNDATION SUMMER SCHOOL



- Introduced Scottish Universities and their Marine Engineering Curriculum
- Supported visits to Selected Universities
- Supported initial Summer School at Robert Gordon University
- First Programme in 2016
- **5th programme now in 2022**
 - 13 Japanese engineering students and young professionals
 - Eight different universities and three international businesses (Marubeni, JX Nippon Oil and Gas Exploration Corporation and Mitsubishi Ship Building)

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NIPPON FOUNDATION AND SCOTLAND JOINT R&D Programme

- Aberdeen 2017
- The Nippon Foundation and Scottish Enterprise launched a joint R&D programme.
- Supporting basic R&D research to foster leading innovation in offshore development.
- Both parties provided equal funding of a total of 20 million US dollars
- To support joint projects that push boundaries and challenge conventions in ocean innovation.



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R&D COLLABORATIONS – Digital Oil Field

Mitsubishi Heavy Industries

- *Coda Octopus* - development and integration of realtime 3D sonar with AUV
- *Hydrason Solutions / Heriot Watt University* – development and integration of wideband sonar with AUV for cable survey
- *ISC Ltd* – development of control system for underwater docking of AUV

Japan Marine United

- *Enovate Systems / Heriot Watt University* – R&D and design for all electric work boats deck tooling

Kawasaki Heavy Industries

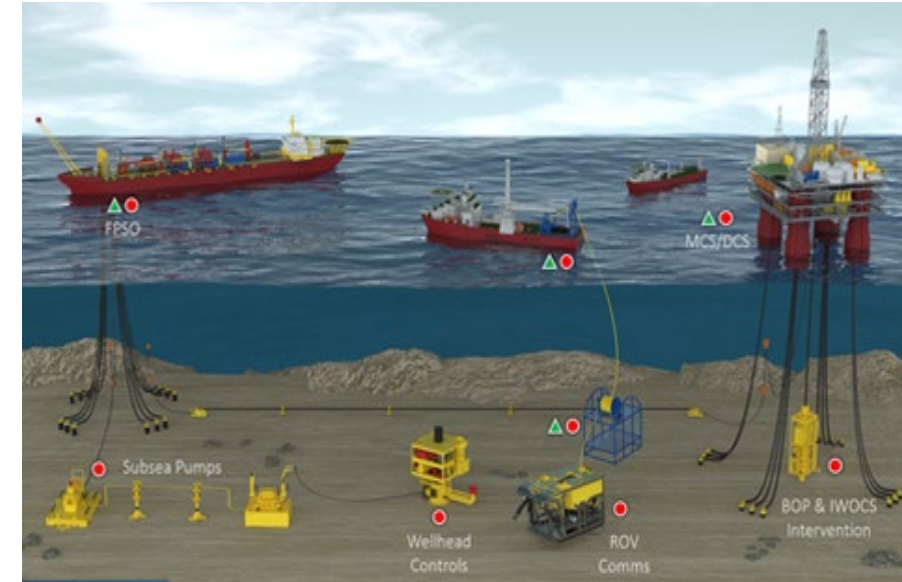
- *Hydrason Solutions / Heriot Watt University* – development and Integration of wideband sonar with AUV for pipeline survey

NEC Networks (NESIC) / JAMSTEC

- *Tritech International* – development and integration of subsea 3D sonar for cable network security

Yokokawa

- *EC-OG / Hydrafact / SMS Oilfield / WFS Technologies / BP* – development and integration of subsea IIOT for flow assurance, asset integrity , autonomous operations networking



R&D COLLABORATIONS – Blue Economy

Toda Corp

- *Bridon / TTI Renewables* – R&D, design and manufacturing of composite rope mooring systems for deep water FOWT

Yokogawa

- *EC-OG / Precision Impulse / Sustainable Marine Energy / Trittech / Sensorworks* – development and integration subsea IIOT system in aquaculture, FOWT anchor systems and CCUS reservoir seismography

JDC / JMU

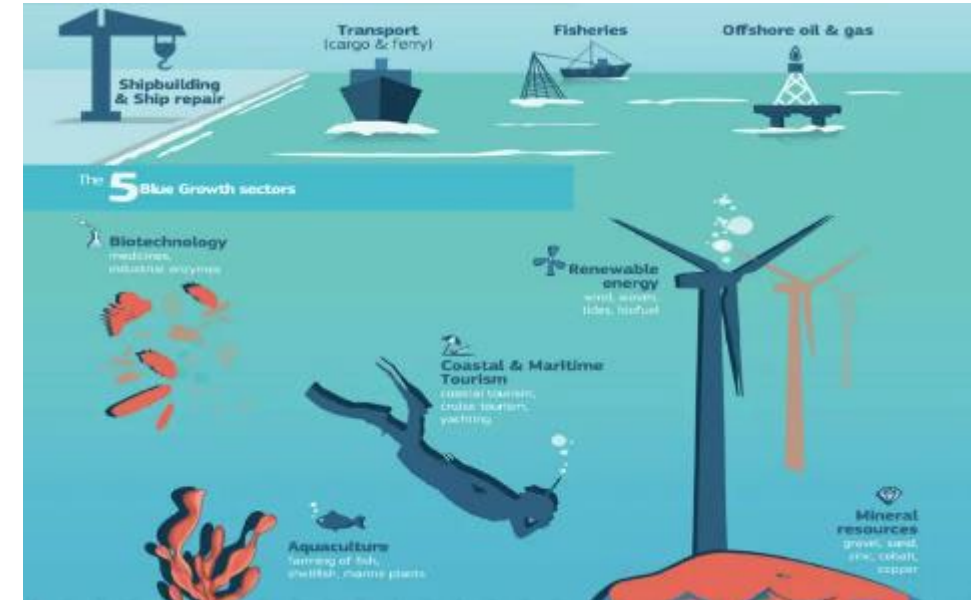
- *Eccose Subsea / Xodus* – design concept for ambient lifting system and subsea micropile

IHI

- *Sustainable Marine Energy* – deep water rock anchor foundation

Mitsubishi Shipbuilding

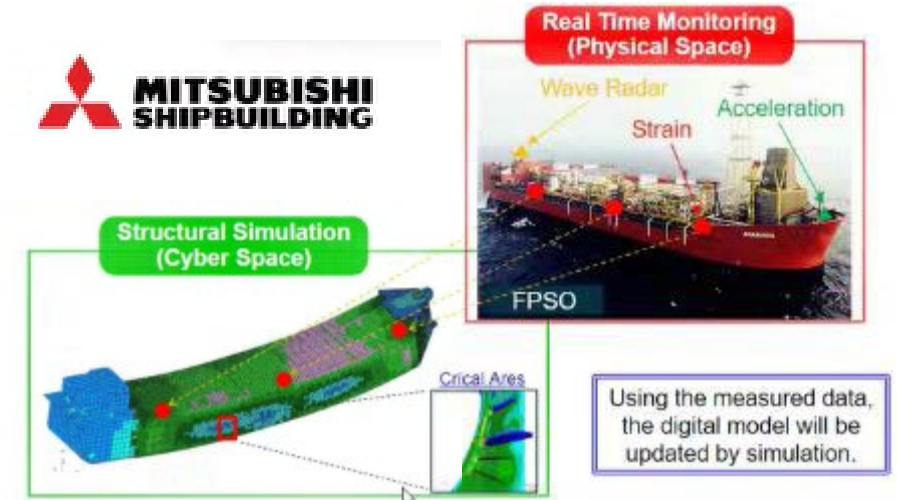
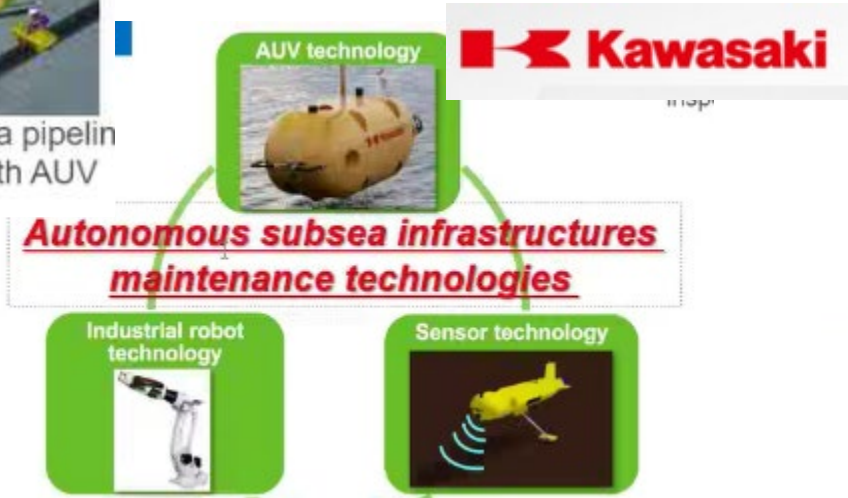
- *SMS Ltd / Strathclyde University / Ithaca FPSO* – development of condition monitoring for floating offshore structures and digital twin



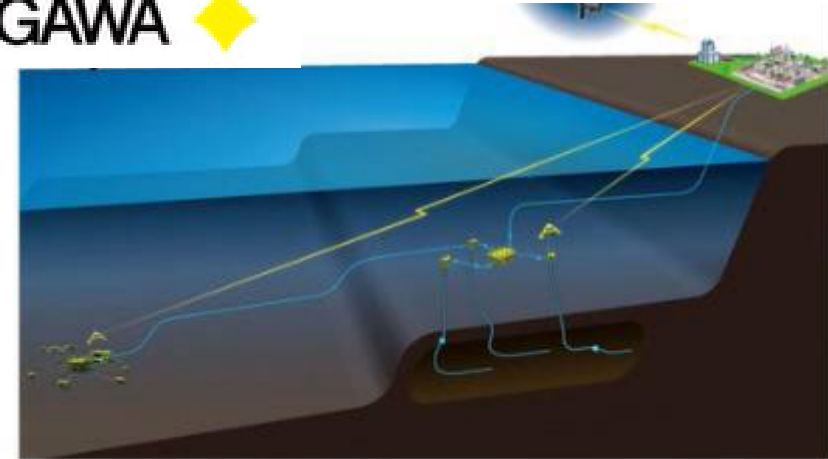
R&D COLLABORATIONS



Image of subsea pipeline inspection with AUV

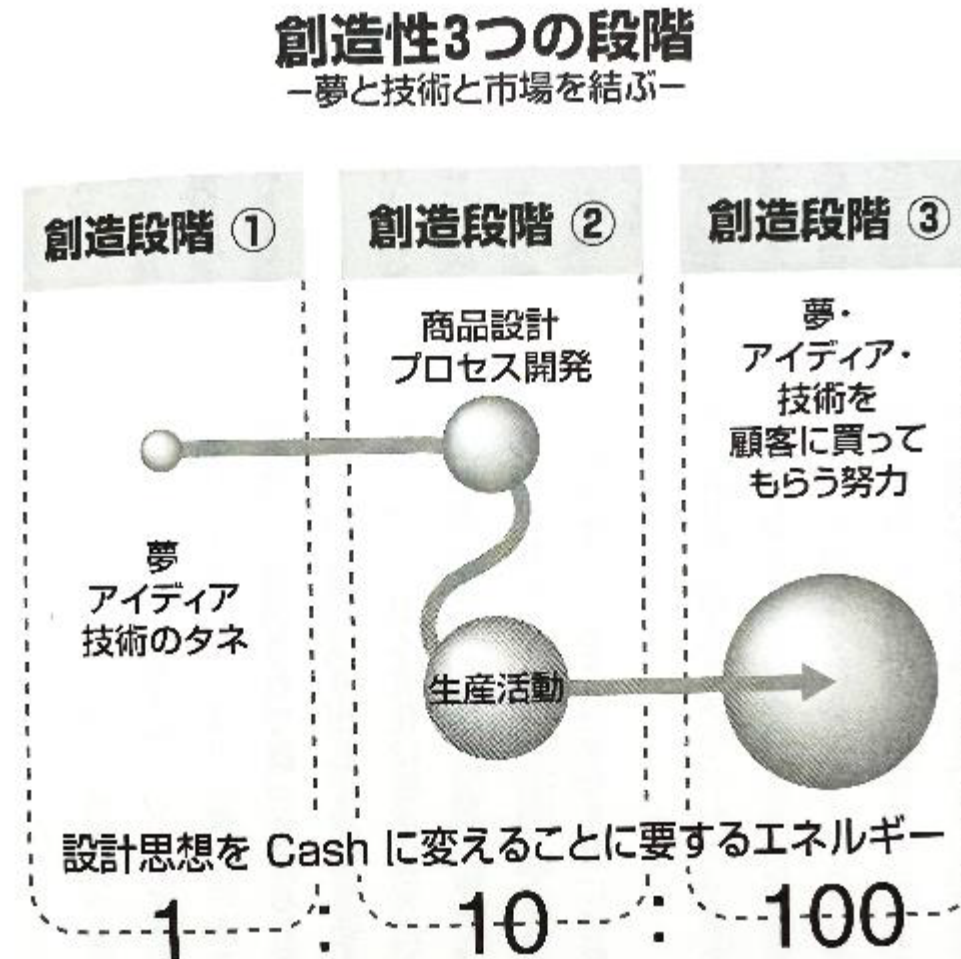
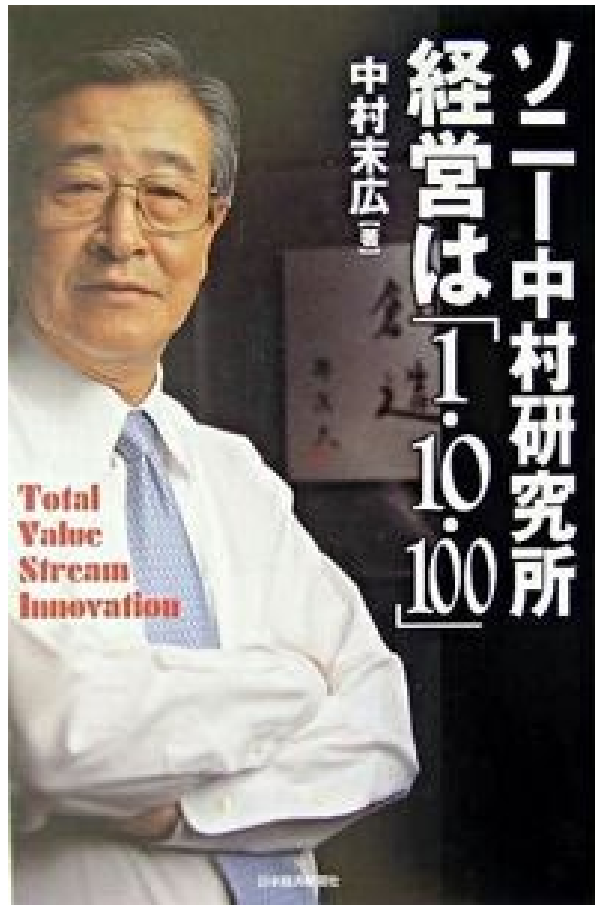


YOKOGAWA 



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R&D – on the path to commercialization

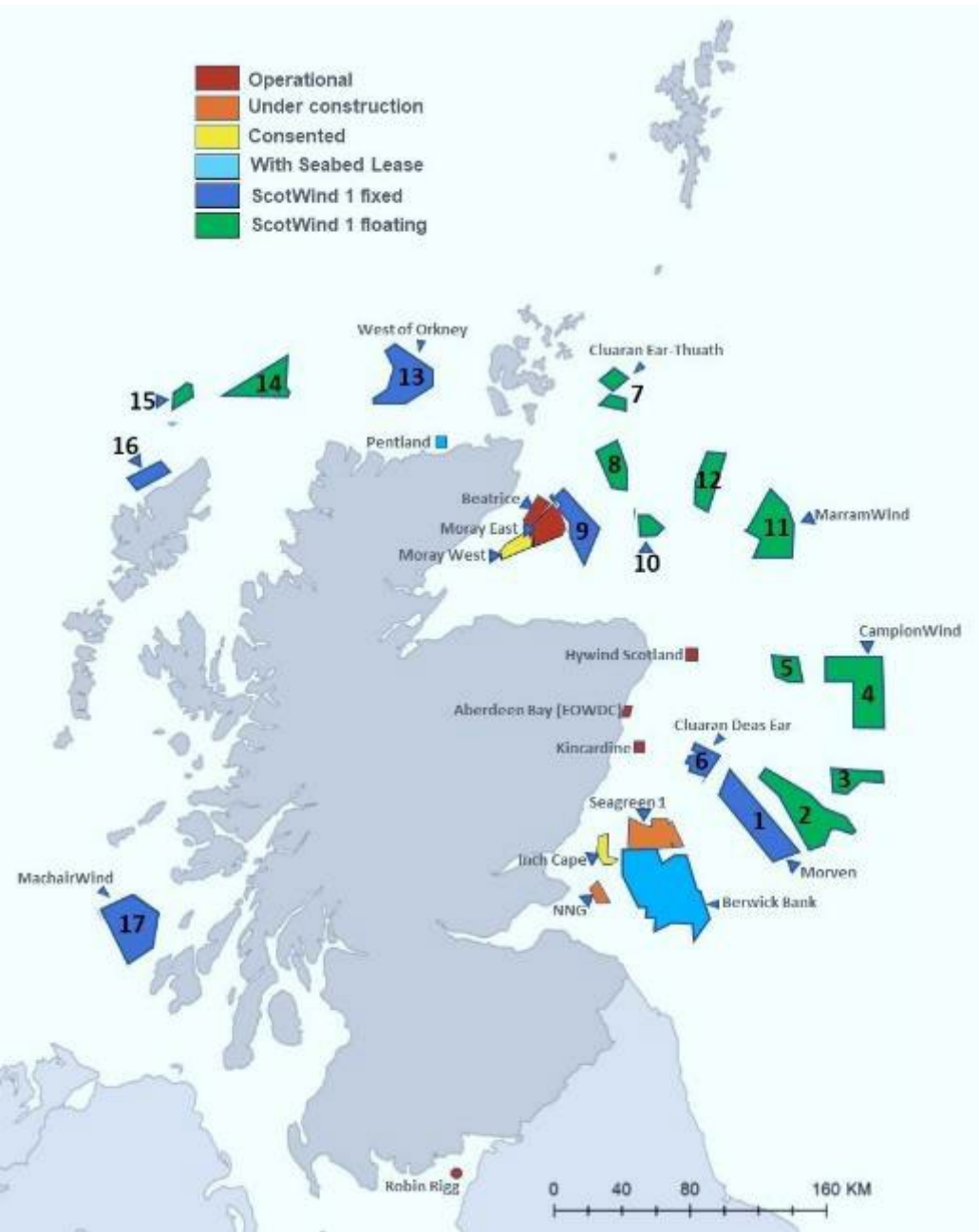


A wide-angle photograph of an offshore wind farm in Scotland. Several large white wind turbines with three blades each are spaced out across a deep blue sea. In the background, there are low, hazy mountains under a sky filled with white and grey clouds. A small red and white service vessel is visible in the lower right foreground, moving towards the left and leaving a white wake. Another smaller vessel is visible further out in the water near the center.

OFFSHORE WIND IN SCOTLAND

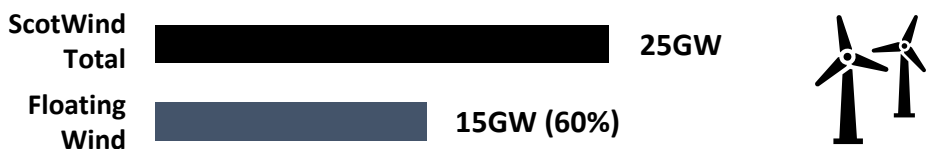
スコットランドにおける
洋上風力発電の取り組み

SCOTWIND – SCALE OF OPPORTUNITY



ScotWind Leasing Successful Floating Bids

The scale of the floating wind projects in the ScotWind leasing round will make Scotland the largest market in the world for this emerging technology and offers the potential for a large proportion of the components for these wind farms to be manufactured in Scotland.



Site	Developers	Floating Capacity
2	SSE Renewables, CIP and Marubeni	2,610MW
3	Falck Renewables and BlueFloat Energy	1,200MW
4	Shell and ScottishPower Renewables	2,000MW
5	Vattenfall and Fred. Olsen Renewables	798MW
7	DEME, Aspiravi and Qair	1,008MW
8	Falck Renewables, Ørsted and BlueFloat Energy	1,000MW
10	Falck Renewables and BlueFloat Energy	500MW
11	Shell and ScottishPower Renewables	3,000MW
12	Floating Wind Alliance (BayWa r.e., Elicio, BW Ideol)	960MW
14	Northland Power	1,500MW
15	Magnora ASA and Technip UK	495MW

“ We want to help build strong local supply chains capable of competing nationally and internationally. This also supports local communities and provides opportunities to learn new skills and have long-term careers in a huge variety of roles.

Danielle Lane, UK Country Manager, Vattenfall

”

BUILDING CRUTIAL CAPABILITY

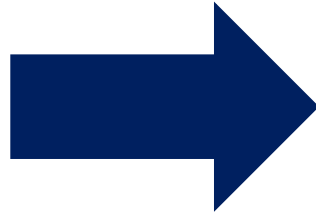
ScotWind and beyond

Before ScotWind



Small demonstration scale projects, MW Scale

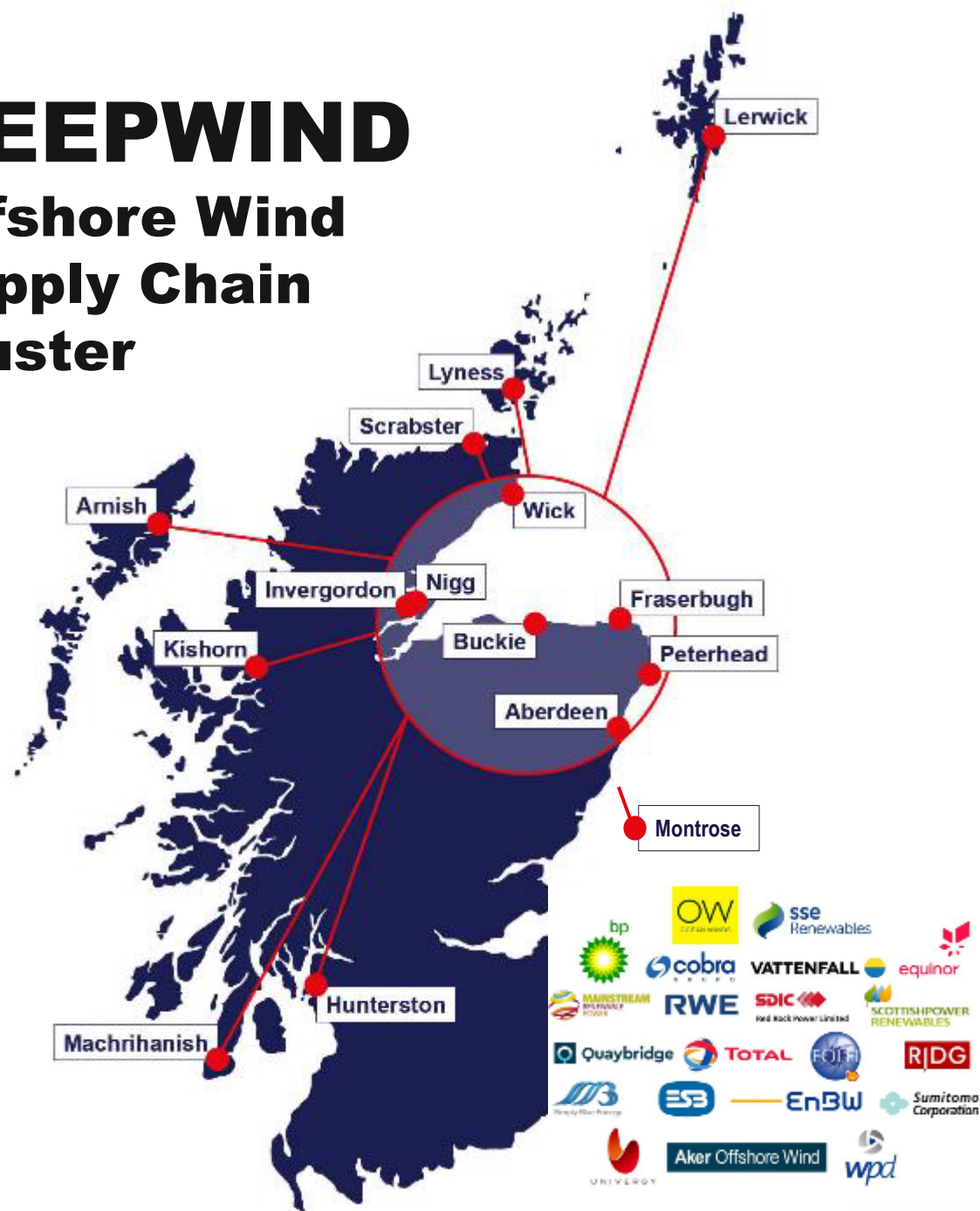
- **Floating**
- **Cables**
- **Turbines & Blades**
- **Towers**
- **Substations**
- **Mooring Solutions**
- **Substructures**



Commercial Floating Wind (GW-Scale)

DEEPWIND

Offshore Wind Supply Chain Cluster



CLUSTER

- **Hub and spoke structure**
- **Hub centred on Moray Firth and Aberdeenshire Coast projects (Place)**
- **Spokes extending to centres of offshore fabrication activity and port infrastructure in other areas of Scotland**

DeepWind Cluster

- **715 members, representing developers, supply chain companies, academia and local government.**
- **38 developers, largest group of developers in any European cluster**

INFRASTRUCTURE TECHNOLOGY DEVELOPMENT



Our Mission

We will use our unique facilities and research and engineering capabilities to bring together industry and academia and drive innovation in renewable energy.

**opportunity for
renewable energy R&D**
Levenmouth 7MW demonstration
offshore wind turbine



The Centre is a **testing facility** that hosts detailed models (and control/protection hardware) from multiple suppliers and has the **expertise (and technology infrastructure)** to undertake specialist studies; to support the deployment of HVDC projects

OFFSHORE WIND - KEY MESSAGES

- Scotland has an abundance of renewable energy potential, with 25% of Europe's wind resource crossing the seas around Scotland.
- The latest offshore wind leasing round, Scotwind, will deliver more than 28GW of offshore wind projects, 18GW of which are floating offshore wind.
- This is set to be the first floating offshore wind development on a truly commercial Scale, and Scotland has the potential to become a hub for floating offshore wind expertise.
- There is a critical role to play for Japanese companies with the right technologies to contribute to building the floating offshore wind industry in Scotland.

THINK HYDROGEN
THINK SCOTLAND



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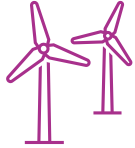


SCOTLAND A HYDROGEN NATION

- Scotland's **hydrogen economy** is the ideal home for your hydrogen investment
- **Hydrogen Nation and Exporter** - our huge renewable energy generation capacity will produce and export hydrogen at scale to the UK and Europe
- **Immediate opportunities** in both renewable and low carbon hydrogen and its supply chains
- Join us and reap the rewards of the **hydrogen revolution**



Our ambitious hydrogen production targets



A wealth of renewable energy resource



A track record of advancing new energy technologies



Supportive government policy



> 60 years of transferable experience & skills from established sectors like oil & gas



#SCOTLANDISNOW



SCOTLAND'S VALUES



**INCLUSIVE
GROWTH**



NET ZERO



FAIR WORK

SCOTLAND'S WORLD LEADING CLIMATE CHANGE TARGETS



Net zero greenhouse gas emissions by 2045



50% of Scotland's total energy demand to be supplied by renewable sources by 2030



5GW of renewable and low carbon hydrogen production by 2030



75% emissions reduction by 2030 – one of the toughest statutory emissions targets in the world



25GW of renewable and low carbon hydrogen production by 2045

Delivering our targets:

- 97.4% of Scotland's gross electricity demand generated from renewable sources in 2020
- 31.8 TWh of renewable electricity – a record year

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SCOTLAND'S OPPORTUNITIES HYDROGEN PRODUCTION

- Scotland's geographical advantage – vast wind, wave and tidal resources
- Early deployment of **large-scale hydrogen production and carbon capture utilisation and storage (CCUS)**
- One of Europe's **largest Offshore Renewable Energy Zones**
- **Enormous project pipeline** of onshore and offshore wind –
 - Total energy pipeline could exceed 50GW
 - ScotWind leasing - 28GW of new offshore wind capacity
- Huge scale-up of **electrolytic hydrogen production** required
- Scotland's green hydrogen production market estimated to be **126TWh = major hydrogen exporter** and 300,000 jobs by 2045
- Further opportunities to decarbonise **industry, transport, heat** and other sectors, and to develop **transportation and storage infrastructure**



SCOTLAND'S OPPORTUNITIES **ELECTROLYSER MANUFACTURING**

- Ideal location for electrolyser manufacturing to service Scotland's huge project pipeline and export markets
- Global leader in high value and advanced manufacturing
- Transformational investment in infrastructure, innovation and skills initiatives
- Opportunities for the integration of knowledge and skills hubs, training academies and research centres
- Range of sites suitable for large-scale manufacturing facilities
- Reduce your carbon footprint with Scotland's low carbon and green electricity

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SCOTLAND'S OPPORTUNITIES **HYDROGEN STORAGE, CONVERSION AND DISTRIBUTION**

- Opportunity for innovative technologies and equipment to store, convert and transport hydrogen
- Ideal location for Carbon Capture, Utilisation & Storage (CCUS) projects
- Proximity to offshore CO² storage resources
- Readily available natural gas supplies
- Existing oil and gas infrastructure and technical expertise
- Transferable skills from the oil and gas sector
- World-leading offshore and subsea expertise
- R&D and innovation facilities to support the development and deployment of new technologies



SCOTLAND'S OPPORTUNITIES SUSTAINABLE TRANSPORT

- Investment opportunities in **hydrogen vehicles, refuelling stations** and other **infrastructure**
- Already ahead of the game with hydrogen-powered buses, cars and refuse vehicles
- Hydrogen-powered HGVs to become prevalent
- Transport demand for hydrogen projected to increase:
 - 6TWh pa by 2035
 - 14.9TWh by 2045
 - Future markets in aviation and rail



SCOTLANDS OPPORTUNITIES END-USE APPLIANCES

- Innovative hydrogen-ready technologies required for domestic and commercial use
- Hydrogen to decarbonise Scotland's gas grid:
 - Pilot projects currently blending up to 20% hydrogen into the existing network
 - Potential to transition to 100% hydrogen in the future

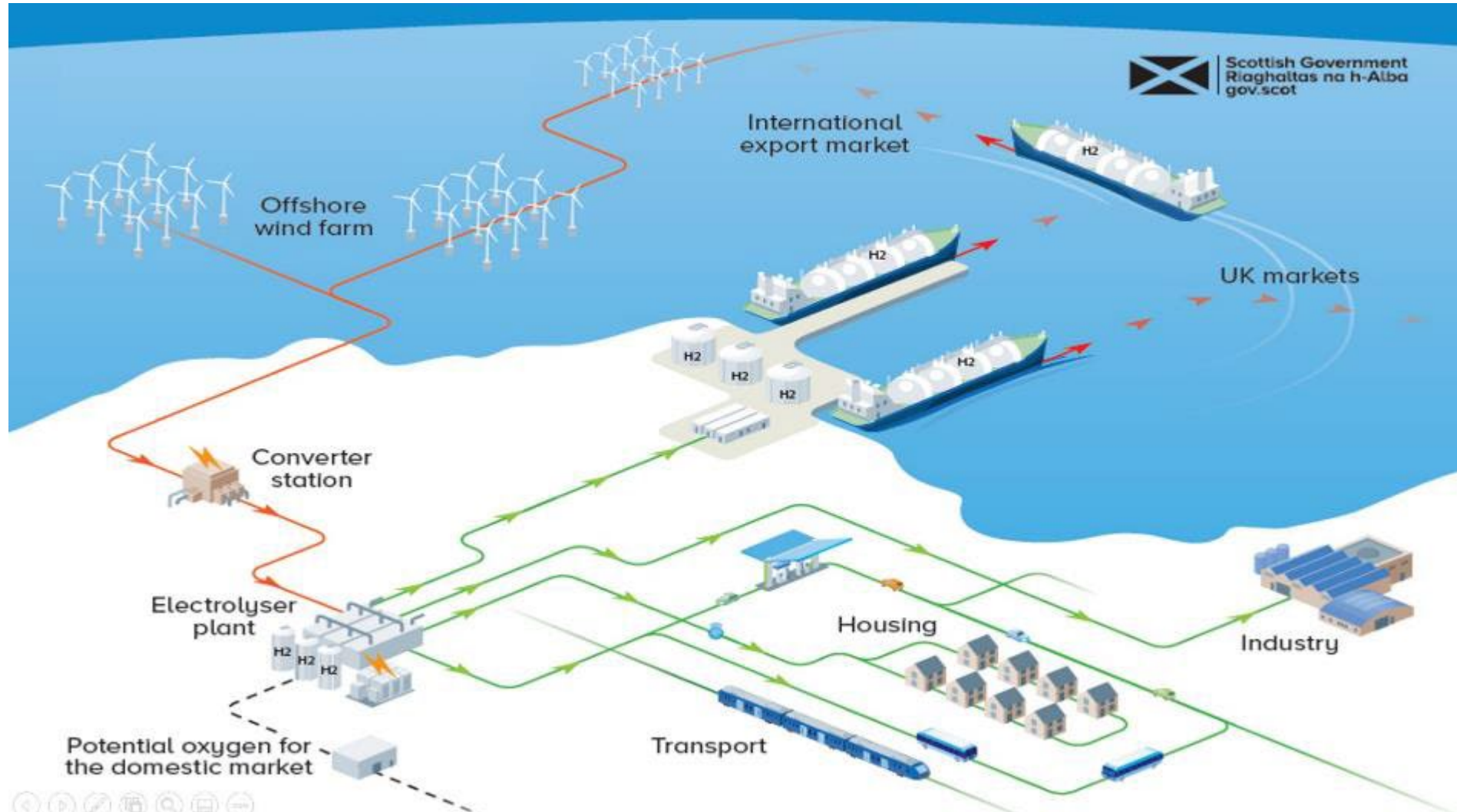
SCOTLANDS OPPORTUNITIES HYDROGEN EXPORT

- Growing global market – Scotland predicted to become a top exporter of hydrogen
- European Union target to import 10 million tonnes of renewable hydrogen by 2030
- Proximity to expected European centres of hydrogen demand – Germany, the Netherlands and Belgium
- Vast renewable resources and advanced infrastructure = low cost transportation of hydrogen by ship or pipeline

Hydrogen Policy Statement (Dec 2020)

5GW of low carbon hydrogen by 2030

Target for 11GW of offshore wind by 2030



HYDROGEN FOR SCOTLAND

REGIONAL HYDROGEN HUBS

1. ABERDEEN
2. ARGYLL & ISLANDS
3. AYRSHIRE
4. CROMARTY
5. DUMFRIES & GALLOWAY
6. DUNDEE
7. FIFE
8. GLASGOW
9. GRANGEMOUTH
10. ORKNEY
11. SCOTTISH BORDERS
12. SHETLAND
13. WESTERN ISLES



FIFE



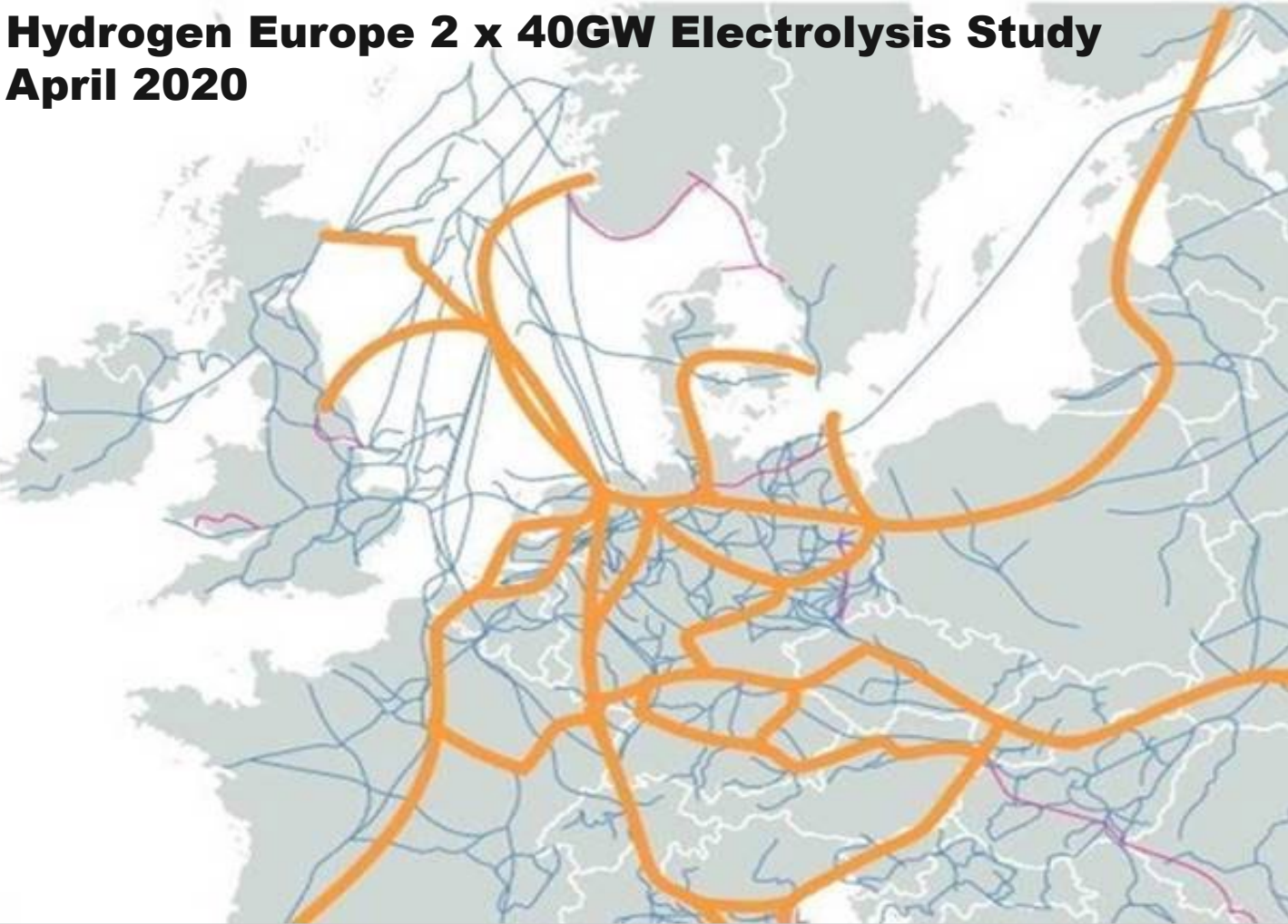
ABERDEEN



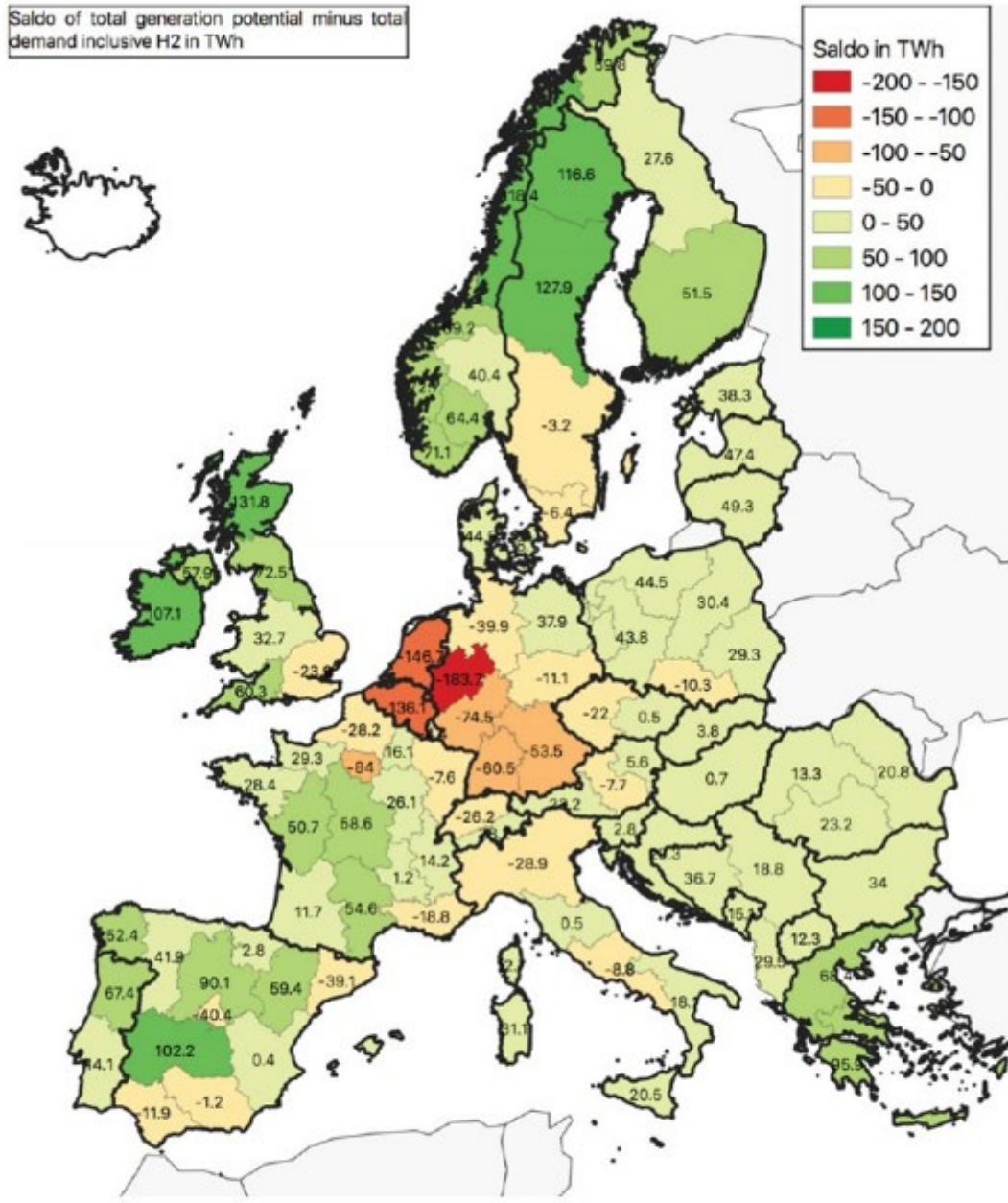
FLOTTA HYDROGEN HUB

AND FOR EUROPE

Hydrogen Europe 2 x 40GW Electrolysis Study April 2020



European Transnational Hydrogen Backbone with natural gas infrastructure (blue and red lines) and a the proposed outline for a hydrogen backbone infrastructure (orange lines).



HYDROGEN - KEY MESSAGES

- **Scotland is a net producer of renewable energy and hydrogen is key to allowing export of green energy.**
- **The Scottish government is committed to hydrogen as part of Scotland's green energy transition**
- **The next few years will be critical to decide the shape of the green hydrogen economy**
- **Scotland has an opportunity to be a front-runner in the manufacture, utilization and export of Green Hydrogen at industrial scale**
- **There is an opportunity for Japanese companies to play a part in the shaping of the future hydrogen-driven energy system**

SCOTLAND'S 32 Energy PORTS

Nigg Energy Park



Port of Cromarty Firth / Invergordon



Port of Inverness



Aberdeen Harbour



Grangemouth



Port of Rosyth



Kishorn Port & Dry Dock



Hunterston PARC





SOWEC's Strategic Investment Assessment



ScotWind & Scottish port growth

ScotWind Leasing Round

15 Sites (8-10GW) 

DeepWind ports and
harbours members 



- ScotWind projects are clustered around the east, north-east and north of Scotland
- All areas have a number of port options, particularly for supporting O&M activities
- A number of ports have or are looking to invest in capacity to support greater assembly and fabrication including
- In addition there are inward investment opportunities in these and other Scottish ports – for example:
 - Kishorn & Ardersier – focus on options for concrete floating platforms
 - Nigg, Invergordon, Hunterston & Leith – focus on floating platforms and assembly
 - Montrose – focus on chain and anchor provision
 - Arnish & Orkney – opportunities for fabrication or servicing
- There are also opportunities for inward investment at a number of Scottish ports for supply chain companies looking to serve Scottish, UK and other European markets



Forth Ports – Leith Renewables Hub

Leith Port, near Edinburgh, is owned by Forth Ports.

ENBW & BP have signed a reservation agreement to use the port for marshalling activities for its 2.9GW Morvern project.

In addition, Forth Ports is investigating use of the port for component and platform fabrication as part of a Floating Offshore Wind Hub

The Firth of Forth area is near to a number of ScotWind and earlier offshore wind projects, as well as offering access to the English offshore wind market



Above: Proposed Leith Floating Offshore Wind Hub courtesy of Forth Ports

Port Case Studies – Cromarty Firth

- Opportunity Cromarty Firth is a partnership between the ports of Nigg (in background) and Invergordon (in foreground) in North East Scotland.
- These Cromarty Firth have expertise in Oil and Gas, but are increasingly active in offshore wind work. Both ports are seeking to grow their footprint in offshore wind and are well located in closeness to a large number of ScotWind projects, particularly a number of the larger floating offshore wind projects.
- Invergordon is a Trust Port, while Nigg is owned by Global Energy Group. Both have plans for expansion to develop additional quayside and adjacent areas to support growth



TODAY'S TAKE AWAY

- Offshore wind in Scotland is an existing and future business opportunity, as well as an entry point into the UK and EU markets.
- Scotland's abundant wind resource presents a substantial commercial opportunity for companies looking to address offshore wind supply chain gaps through inward investment
- Scotland's growing production of green electricity will address the market demand for other green energy vectors at commercial scale.
- The opportunity for Japanese companies to enter the local supply chain with the technology and solutions to enable such large-scale commercialization is now.
- SDI is here to support and facilitate your journey
- Lessons learned in Scotland can contribute to Japan realizing its target of a decarbonized society by 2050.

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