



West of Shetland Renewable Power Workshop – Power to Offshore Oil and Gas Developments 23rd March 2021

Chatham House Rule: i.e., Everything can be freely discussed, after event, but not attributed to any individual/organisation

“House rules”: Please have video off and stay on mute unless talking

Questions: Please submit questions via chat forum during workshop in following format: (limited time during presentations)

Example: **QUESTION: CAT1/CAT2/CAT3 - Question text.....**
(OGA) Intended question target **(your organisation)**

CAT 1 – TECHNICAL

CAT 2 – COMMERCIAL / ECONOMICS

CAT 3 – REGULATORY

- OGA facilitator will collate questions during workshop
- Q/A session to be held in Open Discussion (15:50 – 16:20).
- Will spend 10 minutes on each category.
- OGA facilitator will read and target questions accordingly.
- Responders - max of 90 second answers please (if necessary, take offline)
- OGA will collate list of all questions posed throughout workshop, to allow for follow up post meeting.

(These submission details are repeated at start of workshop chat forum)

Participant organisations

- Aker Offshore Wind
- Atkins
- BEIS
- BP
- Cerulean Wind
- Chevron
- Chrysaor
- Copenhagen Offshore Partners
- Crown Estate Scotland
- EDP Renewables
- EnQuest
- Equinor
- Floating Power Plant
- Flotation Energy
- Highlands and Islands Enterprise
- Marine Power Systems
- Marine Scotland
- Moray West (Engie connection)
- National Grid
- NSMP
- OFGEM
- Oil & Gas Authority
- Oil & Gas UK
- ORE Catapult
- Orsted
- Project Orion
- RDS Energy
- Red Rock Power
- Renewable UK
- RIDG Power
- RWE
- Saipem
- SBM Offshore
- Scottish Enterprise
- Scottish Power
- Scottish Renewables



Oil & Gas Authority

- Seawind Technology
- Shell
- Shetland Island Council
- Siccar Point Energy
- SSE
- Strathclyde University
- Suncor
- TechnipFMC
- The Oil & Gas Technology Centre(OGTC)
- Wood Group

Workshop Agenda

14.00 – 14.05	Welcome Scott Robertson, OGA Operations Director
14:05 – 14:15	Introductions, Agenda, Objectives Tim McNiff OGA
14:15 – 14.45	UK Net Zero and Regulation in Offshore Power Distribution Carlo Procaccini - OGA, George Cobb - Ofgem, Colin Maciver - Crown Estate Scotland,
14.45 – 15.05	Project Orion: Electrification Workgroup Liselle Foote-Lezama, bp
15:05 – 15.50	Cross Sector Opportunities, Oil & Gas Greenfield Projects and Power Update from Onshore Terminal Neil Hardie Siccar Point Energy, Stephen Grant Equinor, Liselle Foote Lezama, bp, Craig Lennox EnQuest
15:50 – 16.20	Open Discussion All, Facilitated by OGA
16.20 – 16:30	Summary and Way Forward Brenda Wyllie OGA NNS & WOS Area Manager

With focus on the WoS Greenfield Oil and Gas developments currently being progressed:-

- To share learnings from the Regulators work on Energy transition and to outline the approach of regulators in offshore/onshore wind for potential power supply to oil and gas developments
- To brief regulators on the key objectives of the ORION WoS Electrification work group and to discuss specific issues for renewable power provision to WOS oil and gas developments
- To offer an opportunity for onshore and offshore renewable power suppliers to initiate a collaborative effort to identify solutions, share potential solutions and approaches to provide renewable power to WoS oil and gas facilities with the aim of substantially reducing CO2 emissions.



UK Net Zero and Offshore Power Regulations

Carlo Procaccini, OGA

George Cobb, Ofgem

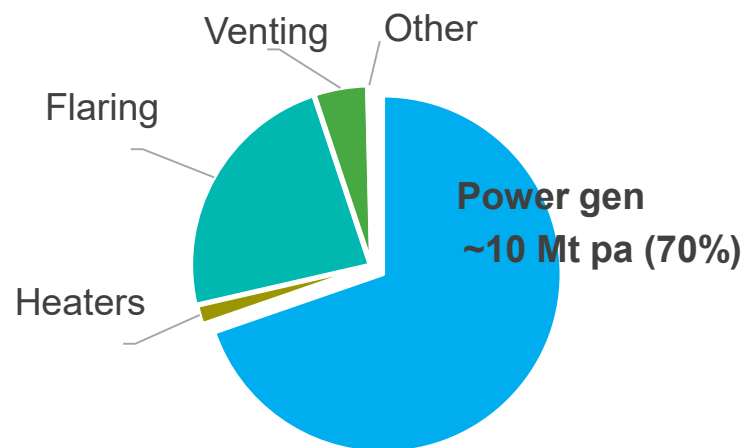
Colin Maciver, Crown Estate Scotland

GHG emissions from offshore O&G operations



Oil & Gas Authority

UKCS GHG emissions (~14MtCO₂e pa)



- ▶ Offshore emissions **large on overall UK scale:**
 - ▶ 16% of total UK energy supply sector¹
 - ▶ Equivalent to 126% of Scotland's onshore industrial emissions²
- ▶ Reducing GHG emissions key priority the O&G industry, as addressed by the new *OGA Strategy*
- ▶ **Critical to abate power gen emissions (70% of total)**

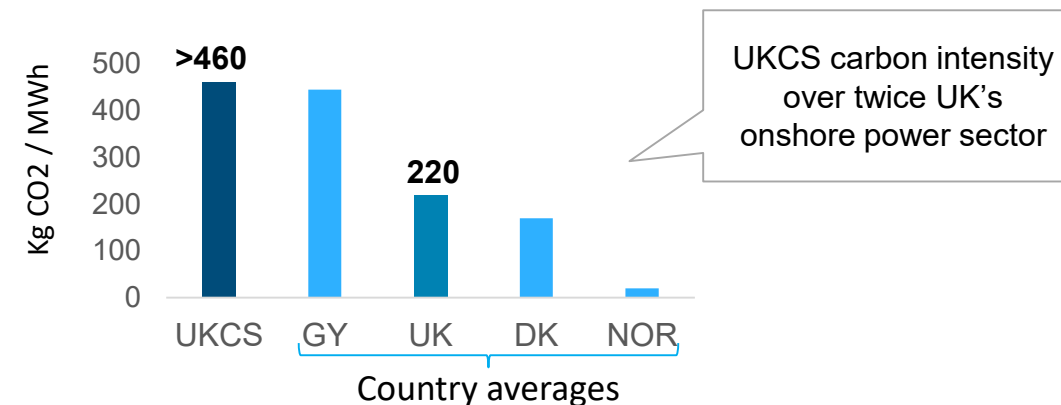
1) BEIS statistics

2) SEPA reports

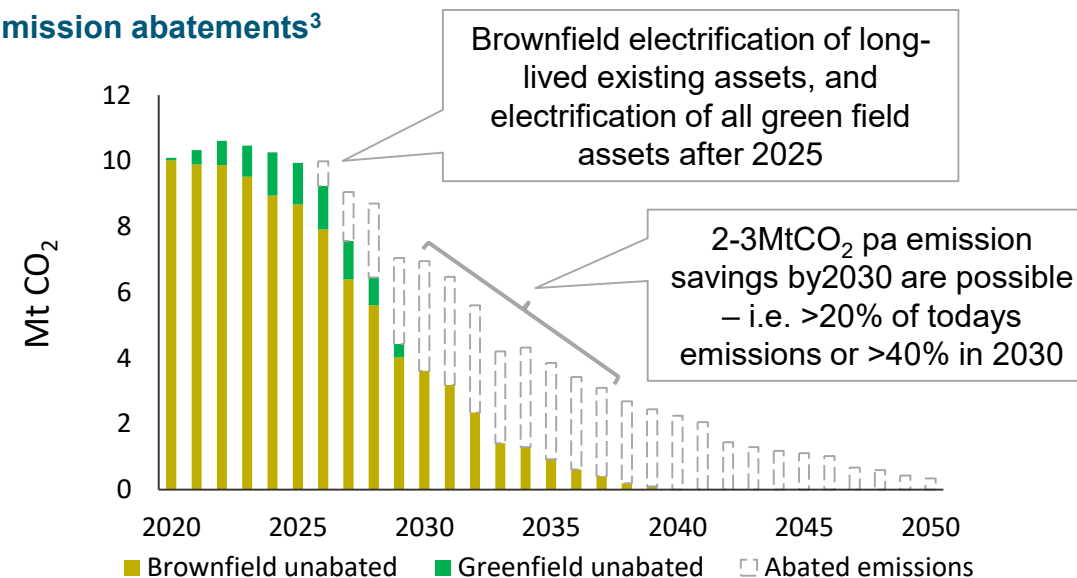
3) Energy Integration Project - scenarios

O&G power generation emissions (~10MtCO₂ pa)

Emission intensity (power generation)



Power emission abatements³

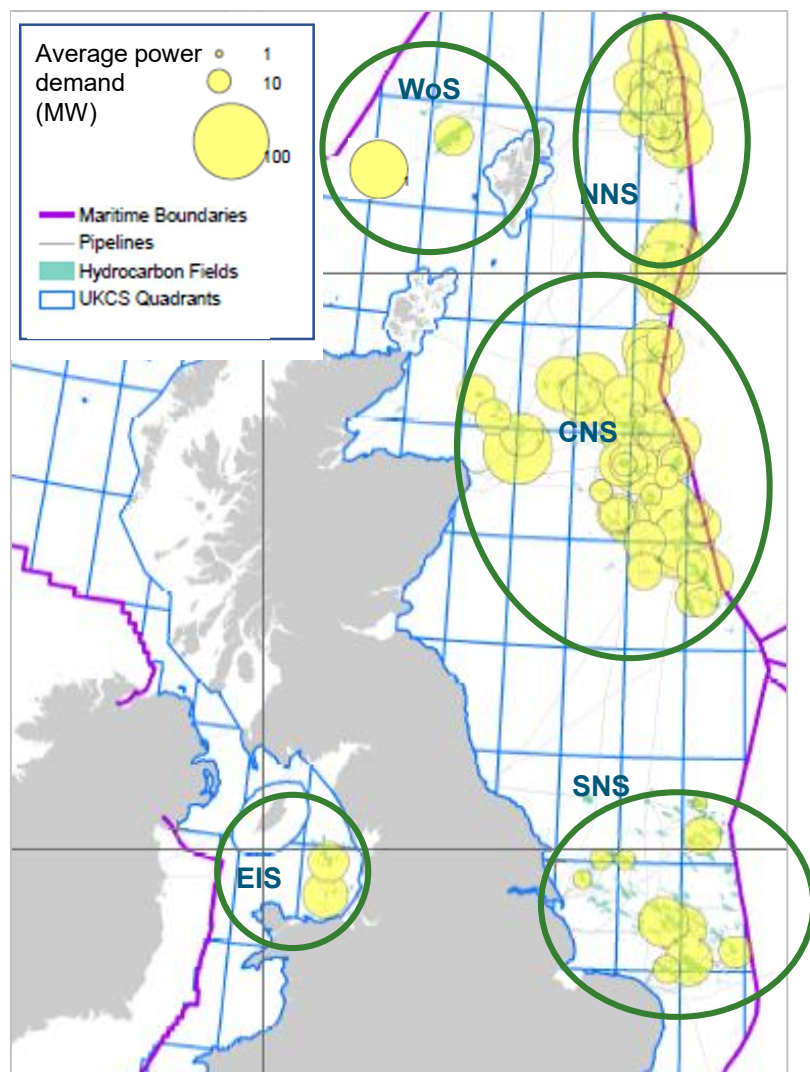


Offshore power generation by O&G sector



Oil & Gas Authority

2018 O&G power demand distribution



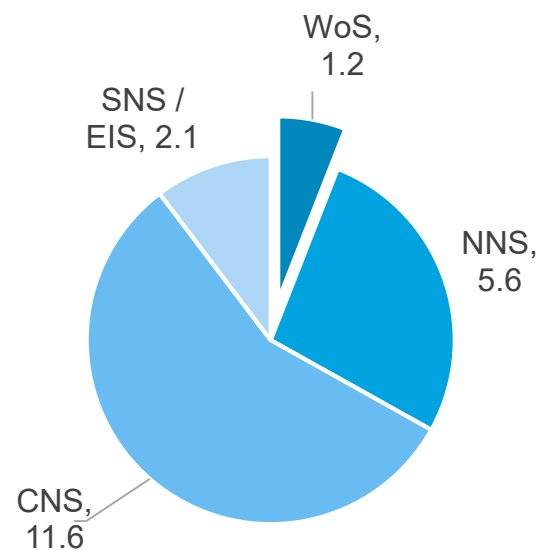
WoS: West of Shetland; NNS: Northern North Sea; CNS: Central North Sea; SNS: Southern North Sea; EIS: East Irish Sea

Power generation by UKCS area (2018 vs 2030)

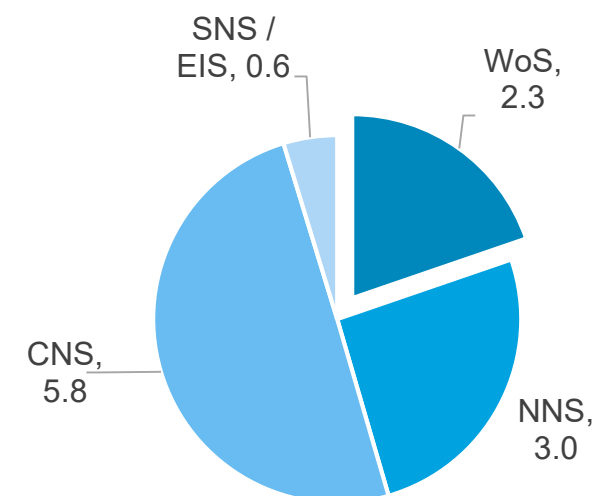
2018: 21 TWh generated on O&G installations in 2018 -- gas/diesel turbines and engines

2030: 12 TWh by 2030 (43% decline) due to asset decommissioning, partially offset by new projects (e.g. **WoS growth**)

2018 estimate: 21 TWh / y



2030 forecast: 12 TWh / y



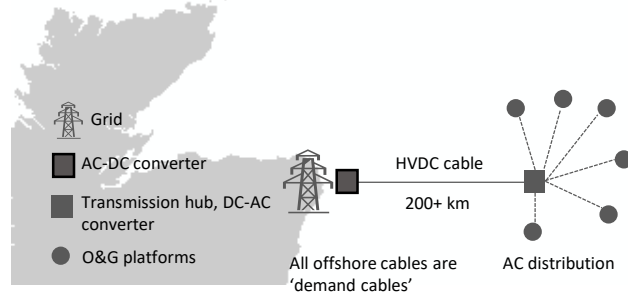
Sources: Power estimates based on 2018 O&G installation emission data (BEIS EEMS) typical emission intensities and uptime for the generation equipment employed. Timelines of asset cessation of production and new developments from OGA UKCS Survey. See Energy Integration Project Phase 2 publications

Electrification options

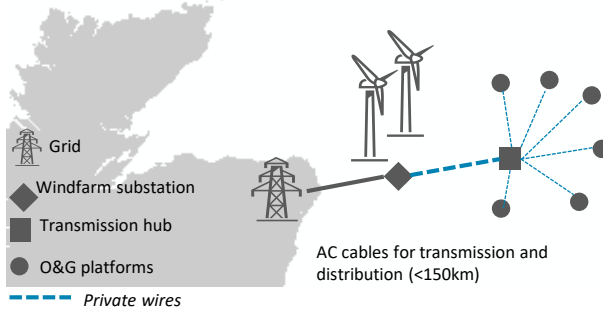


Oil & Gas Authority

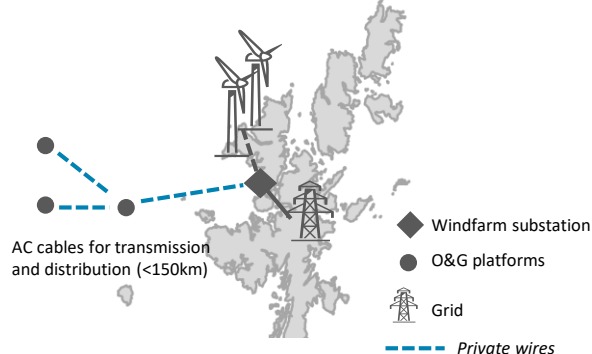
A. Power from onshore grid



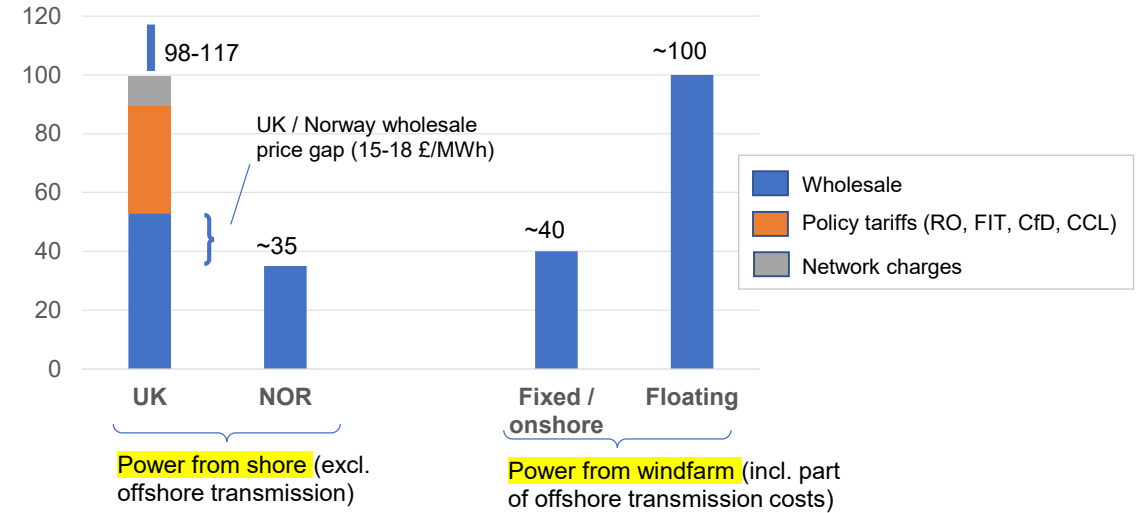
B. Power from offshore windfarms



C. Power from onshore windfarms



Economic drivers 1 – Electricity price



Economic drivers 2 – Project Capex

Power from shore

- HVDC transmission cable and hub: **~£800m-1bn**
- Distribution **£55m/platform**

Power from windfarm

- AC private wire: **£200-300m**
- Distribution: **£55m / platform**

Brownfield modifications

- Platform electrical equipment: **£15m / pl.**
- Modifications: **£136m / pl.**

Greenfield synergies

- Avoided power gen package & equipment: **£70m /pl. savings**

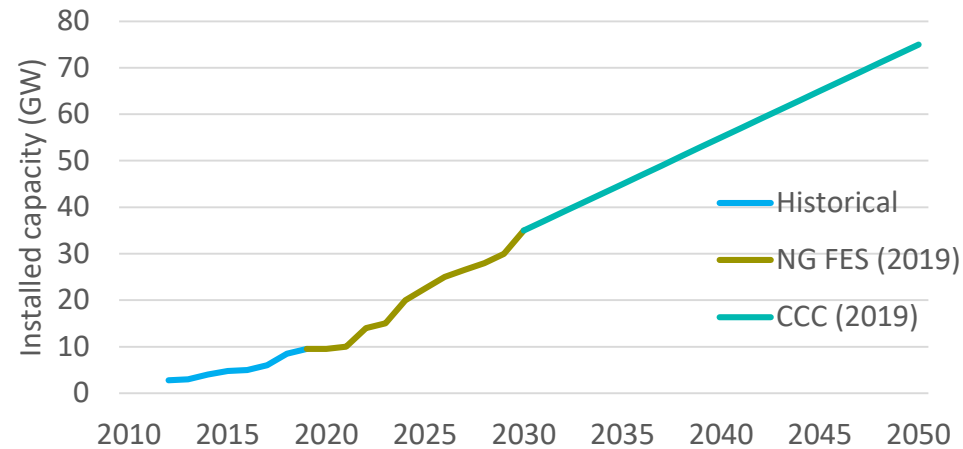
Sources: EIP Phase 2 analysis; UK shore prices reflect network charges of NE Scotland; Offshore windpower price avg. of latest CfD (in 2012 money); Floating wind cost from the 2020 OREC report [Link](#)

Synergies with Windpower expansion



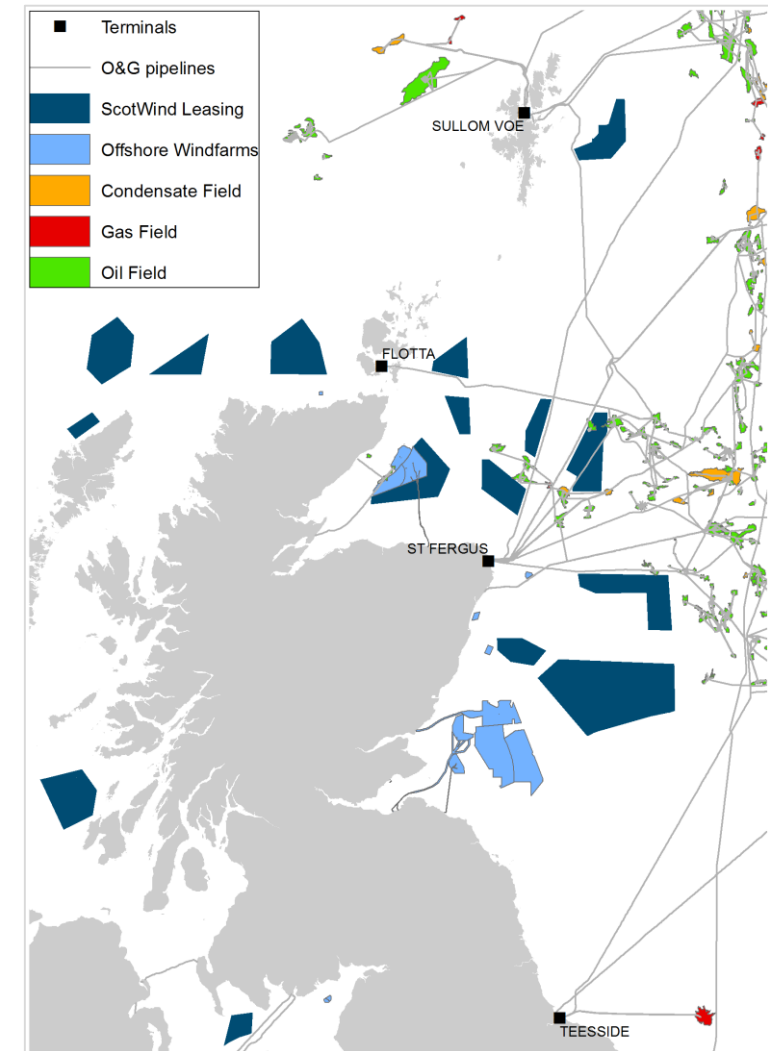
Oil & Gas Authority

UK offshore Windpower capacity (scenarios)



- ▶ ~10GW capacity installed since the 2000s, 25GW project pipeline (sanctioned, consented or early planning)
- ▶ CES ScotWind Leasing, ~10GW, ongoing
- ▶ TCE Leasing Round 4 (England & Wales) ~8.5GW, ongoing
- ▶ Government target of 40 GW capacity by 2030, with 1GW of floating wind, and 75 GW capacity by 2050 to support 'net zero' (CCC)
- ▶ Expansion in Scottish Waters near O&G operations
- ▶ **Synergies between the two sectors:** balancing supply/demand, reducing strain on onshore grid, and sharing infrastructure capex

Expansion in Scottish waters



CES data and OGA Digital Platform

Regulatory coordination



Oil & Gas Authority

Themes

Project consenting

- **O&G installations:** net zero considerations are integral part of OGA's licence stewardship and project consenting¹
- **Windfarm leasing, planning and consenting:** CES and Marine Scotland strategic planning for Windpower projects to decarbonise O&G installations
- **OGA, CES and MS** working together towards **consenting timelines** which support cross-sector projects

Infrastructure access

Offshore cables

- **Ofgem:** OFTO frameworks, consideration for demand cables, and private wires

Grid connection

- **Ofgem:** considering O&G synergies to reduce grid demand and support offshore grid and bootstrapping
- **BEIS, Ofgem:** Offshore Transmission Network Review

Electricity pricing

- **BEIS** considering O&G installations applying for **Energy Intensive Industry** status tariff exemptions
- **BEIS, Ofgem:** confirming the application of Power Purchase Agreements with renewables CfDs (e.g. for windfarms also supplying O&G installations)
- **BEIS: North Sea Transition Deal** with the O&G industry; covers also emission reduction and electrification; negotiations ongoing

Key stakeholders & their remit

- **Crown Estate Scotland:** process for windfarm lease offer and award
- **Marine Scotland** (Scottish Government): qualification of areas for windfarm application, and consenting process for marine license
- **Ofgem:** onshore/offshore transmission network strategy and investment
- **National Grid ESO:** network access capacity at chosen locations
- **BEIS:** electricity tariffs, windpower support, O&G sector deal
- **OGA:** emission performance of O&G sector, areas' energy plans, O&G development stewardship and consenting, coordination with other regulators



1) OGA Strategy: projects need to demonstrate balance of maximising value of economically recoverable petroleum and take appropriate steps to assist the Secretary of State in meeting the 'net zero' target



George Cobb

Senior Manager – Ofgem OFTO Team

Offshore wind power expansion in Scottish waters

Colin Maciver

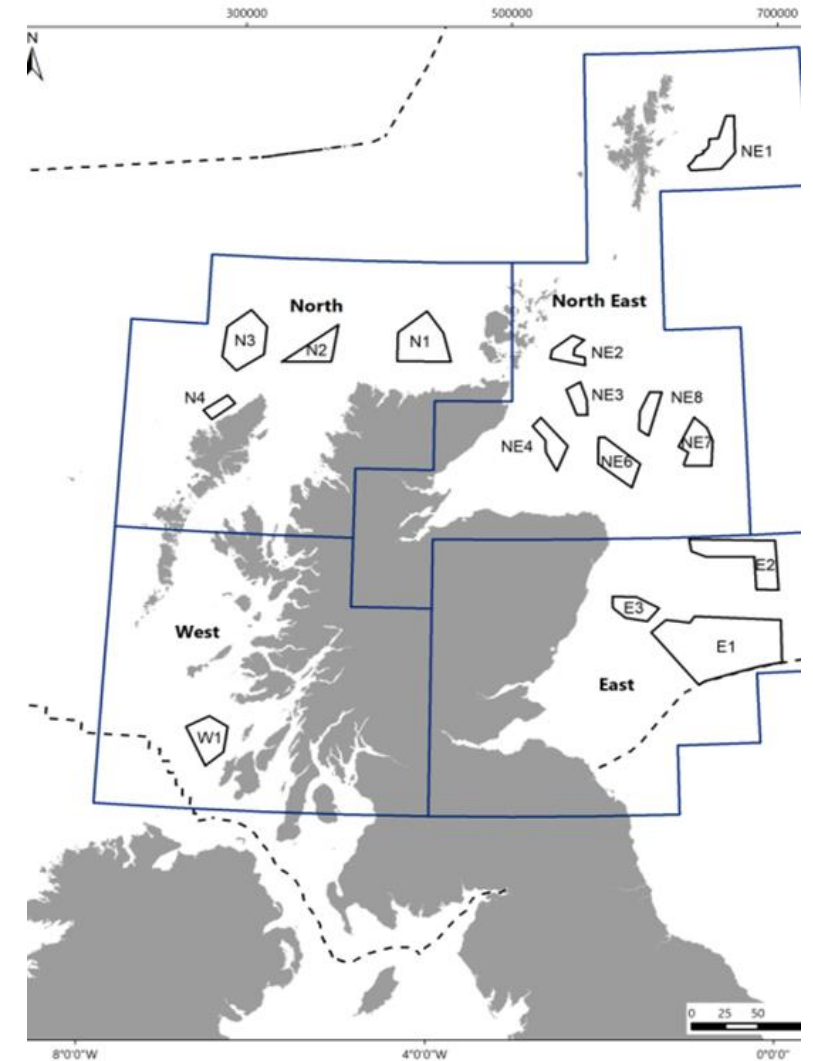
Development Manager – Crown Estate Scotland



Marine Scotland: Sectoral Marine Plan

- Defines the areas available for ScotWind Leasing
- Adopted by Scottish Ministers in October 2020
- Final SWL arrangements align with the adopted plan.
- The SMP indicates an intention to explore the demand for future leasing round to enable innovative projects and projects aimed at the decarbonisation of the oil and gas sector in Scotland.

Plan Option Areas
October 2020



ScotWind Leasing

- Target outcomes:
 - Maximise contribution to Scotland's Net Zero ambition
 - Helping power energy transition for Scotland's economy
- Objectives:
 - Certainty and clarity to attract international interest
 - Be transparent, open and fair
 - Stimulate competition and innovation
 - Early engagement with stakeholders
- Award up to 8,600km² of seabed in plan areas = up to 10GW of operational projects





Floating Wind

- Current UK market success can provide ideal conditions for floating wind.
- Major expansion of renewable power generation is required to reach recommended emissions target for the UK.
 - *“Consistently strong deployment of low-carbon generation will be needed in order to quadruple low-carbon supply by 2050 (e.g. including at least 75 GW of offshore wind).”* Committee on Climate Change, 2019
- Access to sites with consistent, high-speed wind resource in deep-water will support this necessary expansion.



Floating Wind

- Policy objectives to develop and support commercialisation and deliverability
- Cost reduction and commercial scale deployment.
- Environmental impacts related to floating WTGs are common but:
 - Certain environmental impacts are reduced when development is further from the coast.
 - Loose or catenary mooring and anchoring systems could impact other users



Route to Market

- Projects need to secure a CfD from UK Government.
- The CfD provides a price guarantee for electricity and is often supplemented by other arrangements (such as PPAs).
- Alternative off-takers may allow project timescales to be disconnected from the CfD award process.

A photograph of an offshore oil platform with a yellow jacket structure in the foreground, and a large wind turbine in the background on the sea under a blue sky.

Energy Integration

- Opportunity to best utilise the wind resource around Scotland.
- Demand from both Green and Brownfield installations for innovative solutions to reduce emissions from production.
- EI market could increase project volume and pipeline which would enhance the supply chain opportunity, particularly for deeper water technology and innovation required for 'Power to X'.



Energy Integration

- Looking forward to continuing to engage with industry and government to understand ambitions.
- Targeted seabed leasing for O&G electrification which reflects the scale and nature of demand
- CCS, cables, and pipelines and further work in Hydrogen.

A person wearing a high-visibility yellow-green safety vest with reflective silver stripes. The vest has the 'orion' logo and 'Clean Energy Project' text on the upper left. The person is holding a white hard hat with the 'orion' logo and 'Clean Energy Project' text. The background is a blurred industrial scene with smokestacks and a bright light source, possibly the sun, creating a hazy atmosphere.

orion | Clean
Energy
Project

ORION : WOS

Electrification Workgroup

Agenda

- ORION 5 mins
- WOS Electrification 10 mins
- Questions via Meeting Chat

Work Package 1 ORION & NE Techno-Economic Study

Work Package 2 Funding & Business Plan

Work Package 3 Project Technical Assurance & Guidance

Work package 4
Offshore Wind

Work package 5
Hydrogen

Work Package 6
Electrification

Work Package 7
Power Grid Study

Regional Evaluation

Natural Gas
Supply

Facility
Design
& Reuse

Storage &
Export

EOS Offshore

Full System Analysis

Wind & Tidal
Supply

CCS

Clean
Fuels

WOS Offshore

Spatial Planning



- **Objective:** To promote, support and facilitate offshore electrification of new oil & gas developments and existing producing assets in the WOS basin utilizing wind power from onshore Shetland and possibly offshore where technically feasible.
- This will be achieved by integration of stakeholders and execution of work which is of common purpose in developing electrification project.
- The electrification group is not the execution vehicle for electrification projects.

Electrification work scope

- Model future Shetland network capability and 'whole system' supply/ demand scenarios
- Understand the impact of the reliability of the supply and back up arrangements to the transmission link
- Support the development of a WOS electrification area plan, where technically feasible, for both undeveloped and producing assets
- Review recommendations arising from WOS Operator Group which is subject to separate governance and funding with linkage to ORION through ORION Electrification workgroup and ultimately Steerco
- In support of WOS Area Electrification plan development, identify potential areas for collaborative technology development and routes to external technical funding support

Electrification key interfaces

Commitment and financial contribution of Electrification workgroup members to:

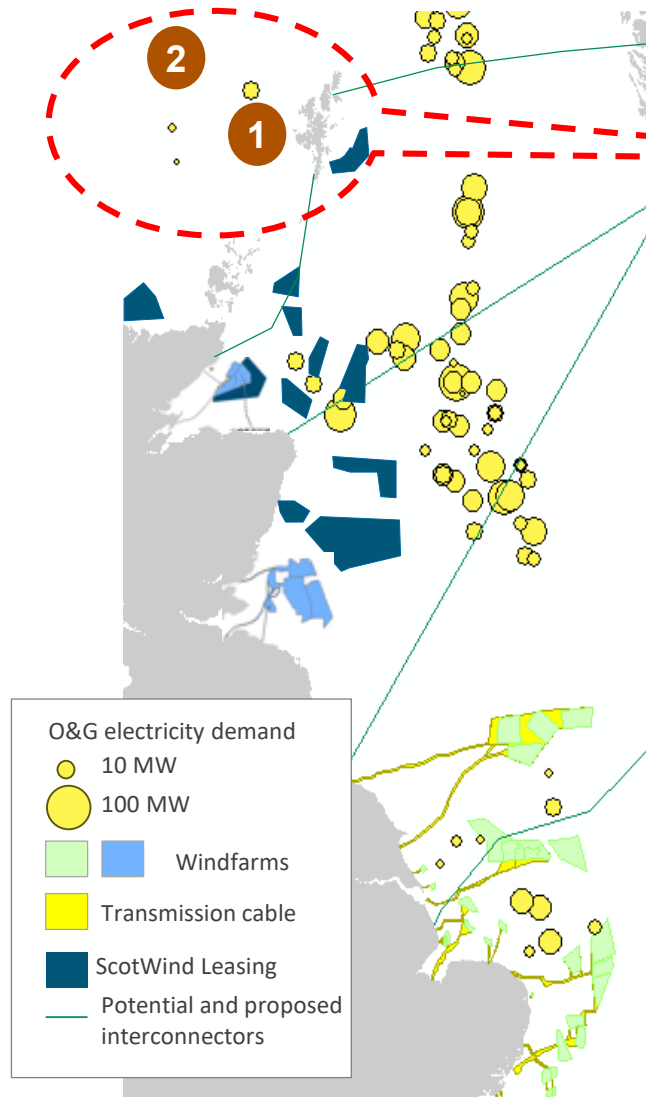
- Work Package 1 ORION & NE Techno-Economic Study
 - A 3-month study of two regions: ORION Energy Hub (Shetland) and Aberdeen, Aberdeenshire & the North East
 - The intent is to create the case for investment in various energy hub projects in these regions in support of the energy transition
- Work Package 7 Power Grid Study
 - A Strathclyde University-led study of the onshore power grid and future potential requirements
 - The intent to evaluate renewable energy opportunities and how power could be transmitted, stored & used by both local and regional customers

Opportunity examples

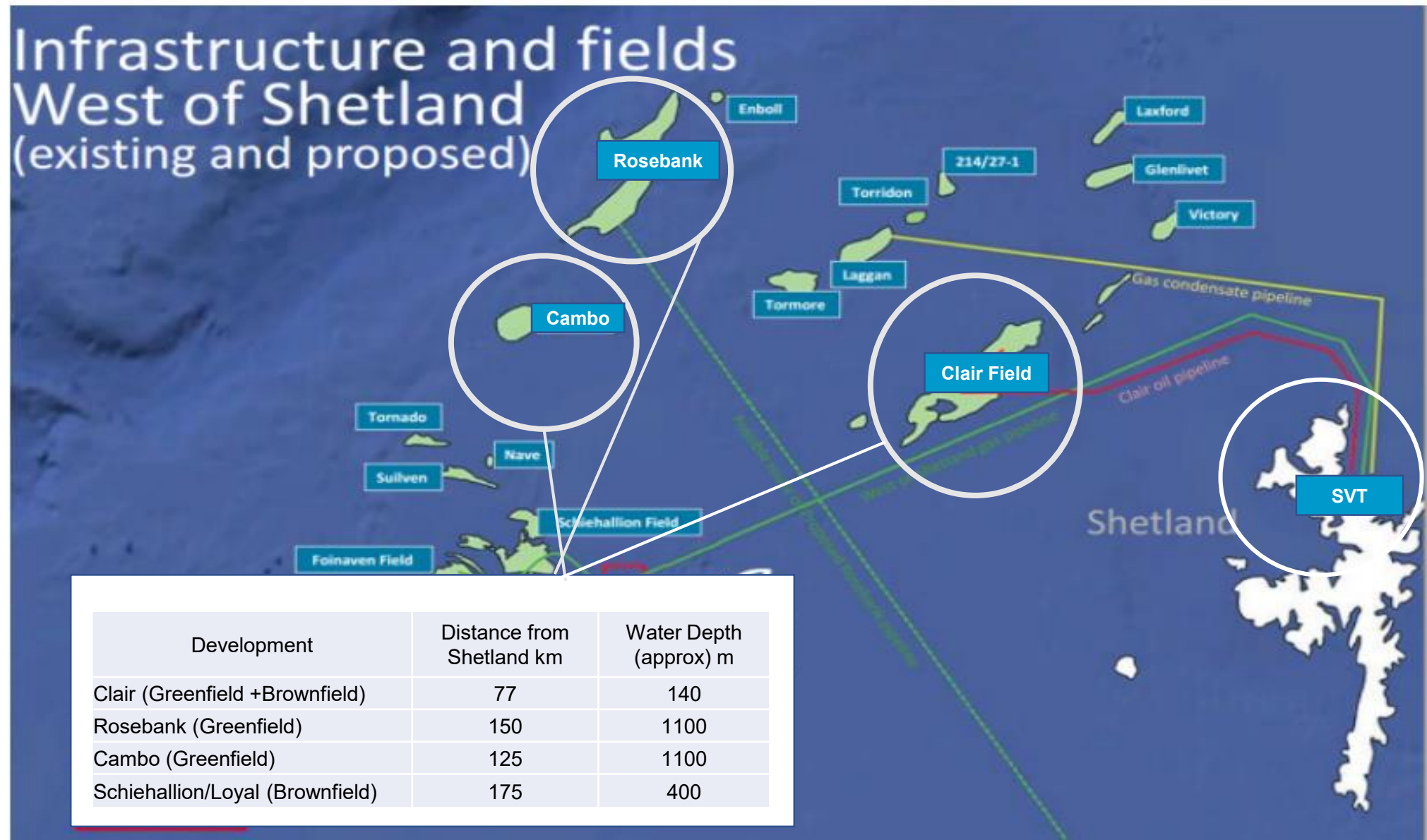
- 1 Shetland wind power supply and transmission link with the mainland enables electrification of greenfield projects West of Shetland
- 2 Could West of Shetland assets at a greater distance from Shetland Islands potentially benefit from floating wind developments?

Potential synergies

- ▶ Electrification of new build O&G assets would support savings on equipment capex without need for brownfield modifications.
- ▶ O&G access to electricity directly from offshore windfarms could offer an early commercial opportunity for wind developers to expand from
- ▶ Sharing of investment in transmission infrastructure between O&G and renewables (and potentially also with interconnector projects)



CES and TCE data and OGA Digital Platform





SICCAR POINT ENERGY

Cambo – Development Overview
March 2021

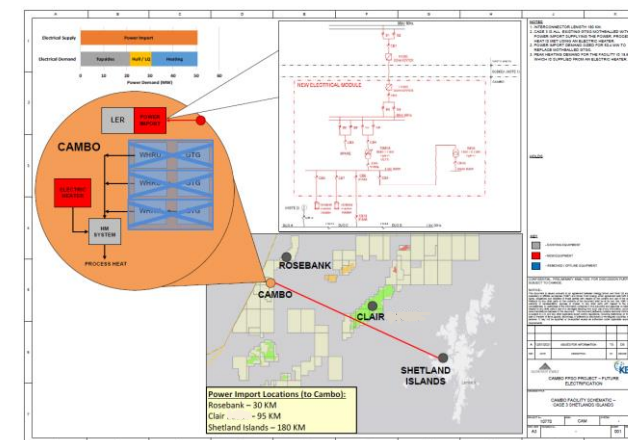
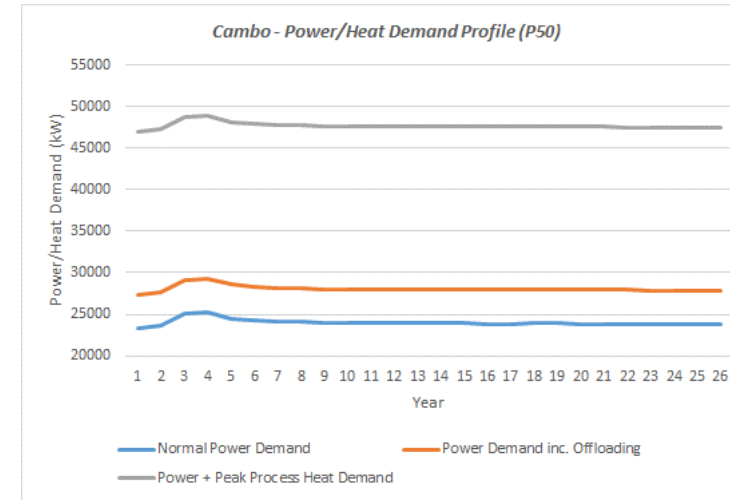
Cambo Field Development Plan

Power/heat demand summary

Power/Heat Concept

- Peak power and heat loads circa **30MW** and **20MW** respectively; main power generation and primary HV distribution - 11kV/60Hz
- Current design basis and power/heat generation philosophy:-
 - Conventional gas turbines (with Dry Low Emissions combustion technology) and exhaust gas waste heat recovery.
- Current costs/economics of direct power from shore on a stand-alone basis do not support electrification of Cambo from the outset.
 - Some technology readiness challenges to electrification also remain given the Cambo water depth and local environment.
- Ongoing work includes assessment of options and preinvestment requirements to facilitate future electrification of Cambo (to meet either part or full power/heat demand) and reduce GHG emissions
 - The Cambo cylindrical-hull FPSO concept is a significant enabler to future brownfield modifications.
- SPE are also engaging with other West of Shetland Operators/stakeholders on potential electrification collaboration opportunities
 - Options include shared grid-connected or on/offshore wind-integrated schemes.

Power/Heat Demand Profile



Clair potential future development options

WOS Field	End of production life	Operator	Power Est. (MW)	Development status	Owners
Clair development Options	>2050	BP	0-100	Possible mid 2020's start	BP (45.10% operator), Shell (27.97%), Chevron (19.42%), Chrysaor (7.50%)

- The **Greater Clair strategy refresh** along with **further regulatory clarity** will provide the case for electrification of future development options and potentially existing assets
- Preliminary technical and commercial feasibility studies have been undertaken for **Standalone electrification**
- West of Shetland operators are entering discussions around the potential for infrastructure sharing in support of **Hub electrification**

Licence

- Equinor (Operator): 40%
- Suncor: 40%
- Siccar Point Energy: 20%

Description of asset

- 130 km west of Shetland
- 1,100m water depth, harsh environment
- ~300 mm bbl total expected recoverable oil
- Good reservoir, 36.5 API Crude

Project objectives

Maximize value creation while not compromising on SSU and integrity through:

- Zero harm to people and environment
- Optimize field value through strong focus on concept development supporting Equinor and UK ambitions for carbon neutral operations
- Deliver on prevailing licence conditions with high quality and ensure first oil in line with project schedule

Low Carbon

- Work to identify and evaluate options for low carbon solutions
- Electrification – powering from shore - has been identified as a potential method
- Many technical and schedule challenges and risks

Development concepts

- Subsea wells (slanted and horizontal) tied back to an FPSO
- Drainage strategy: voidage replacement by water injection
- Gas export to West of Shetland Pipeline System (WOSPS)
- Oil export via tanker offload
- Alternative production facility concepts under consideration
- Alternatives allow flexibility to adapt to various strategy preferences: From early low cost to timely low-carbon developments

Timeline

FID

- Concept dependent: 2022 →

First Oil

- Concept dependent

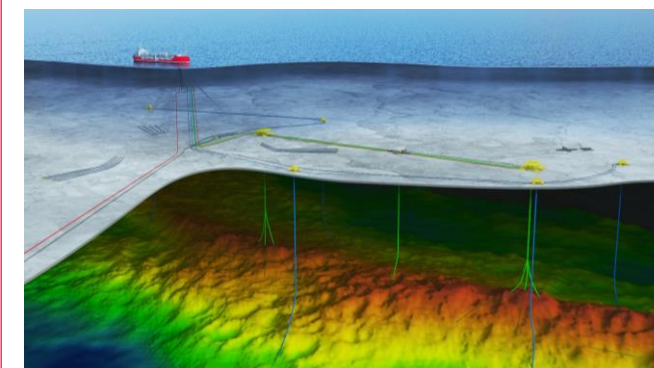
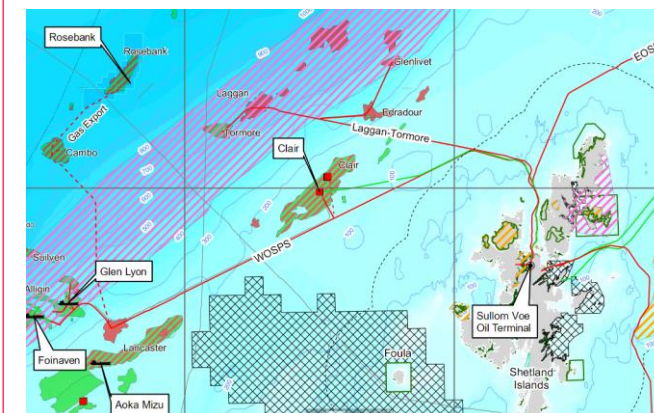
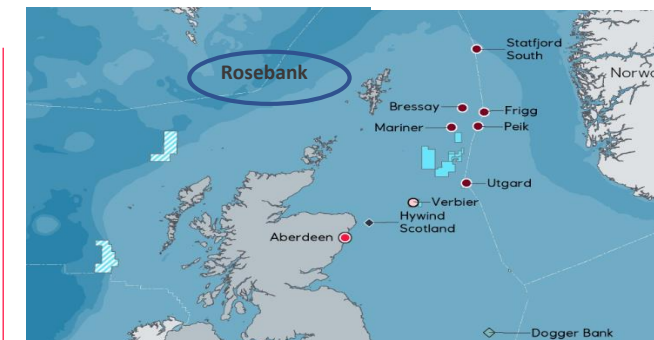
Power Demand

Peak power consumption

- Concept dependent: 40 - 60 MW

Peak heat demand

- Concept dependent: 20 – 30 MW





Sullom Voe Terminal

Craig Lennox

Midstream Director
EnQuest



Midstream Directorate

Sullom Voe Terminal ~ power provision to date

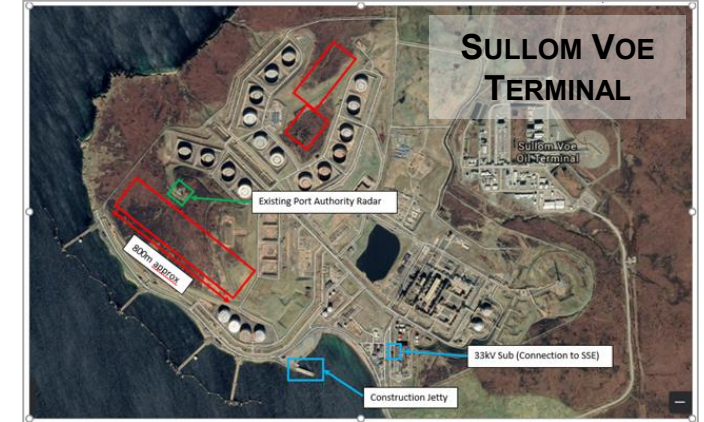
~ provenance

Terminal Services

- one of the largest oil terminals in Europe ~ c.1,000 acres industrial facility located at north-end of Shetland Main Island
- built 1975-81 with 1.6 mmbbls/d Crude Oil throughput design capacity for an initial life expectancy of 30 years
- today, c.150 kbbbls/d pipeline receipts from Ninian & Brent hubs, Shetland Gas Plant & Clair plus the processing & export of West of Shetland (WoS) gas

Power Provision

- original five Frame-5 Gas Turbines (GT) each had 24.35MW maximum output and exclusively fuelled from SVT harvested East Of Shetland (EoS) gas
- now four operational GT units configured 'two operating out of four' (2004) basis using a combination of EoS and WoS gas for fuel
- ENGIE currently contracted to operate the Power Station to satisfy the terminal requirements (av.12MW) and export surplus power to the Shetland grid (av.7MW)
- SVT power station currently operating under a SEPA Approved Derogation until 2025



Midstream Directorate

Sullom Voe Terminal ~ power provision in the future

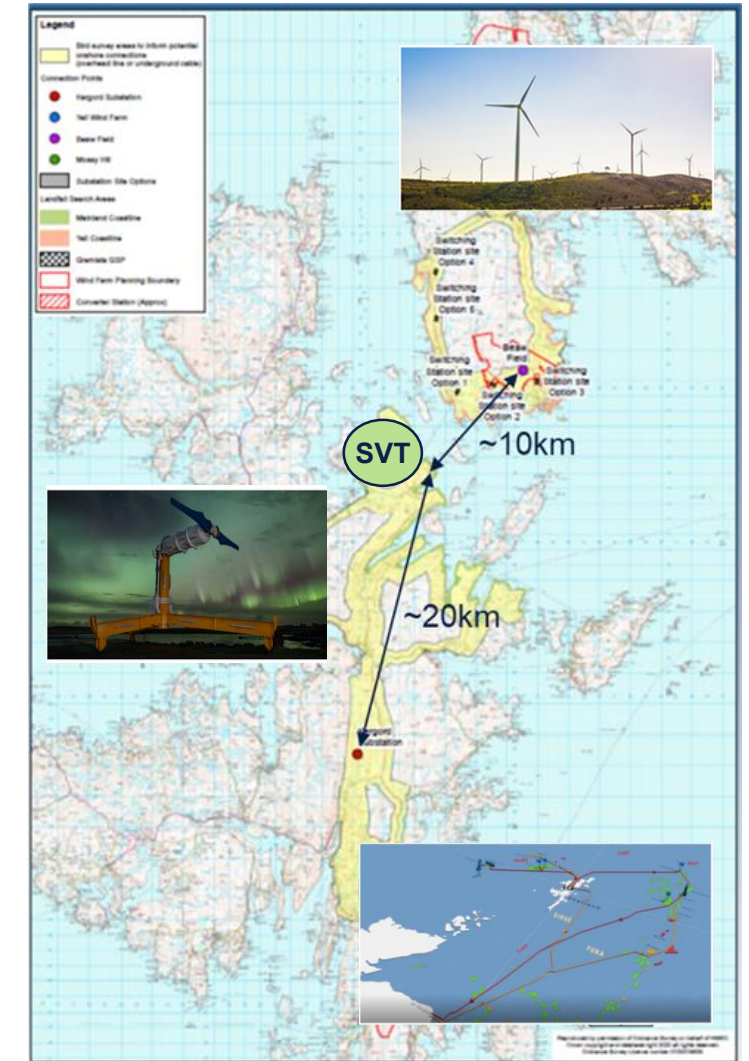
~ strategic considerations

Forecasted demands ... lower for longer

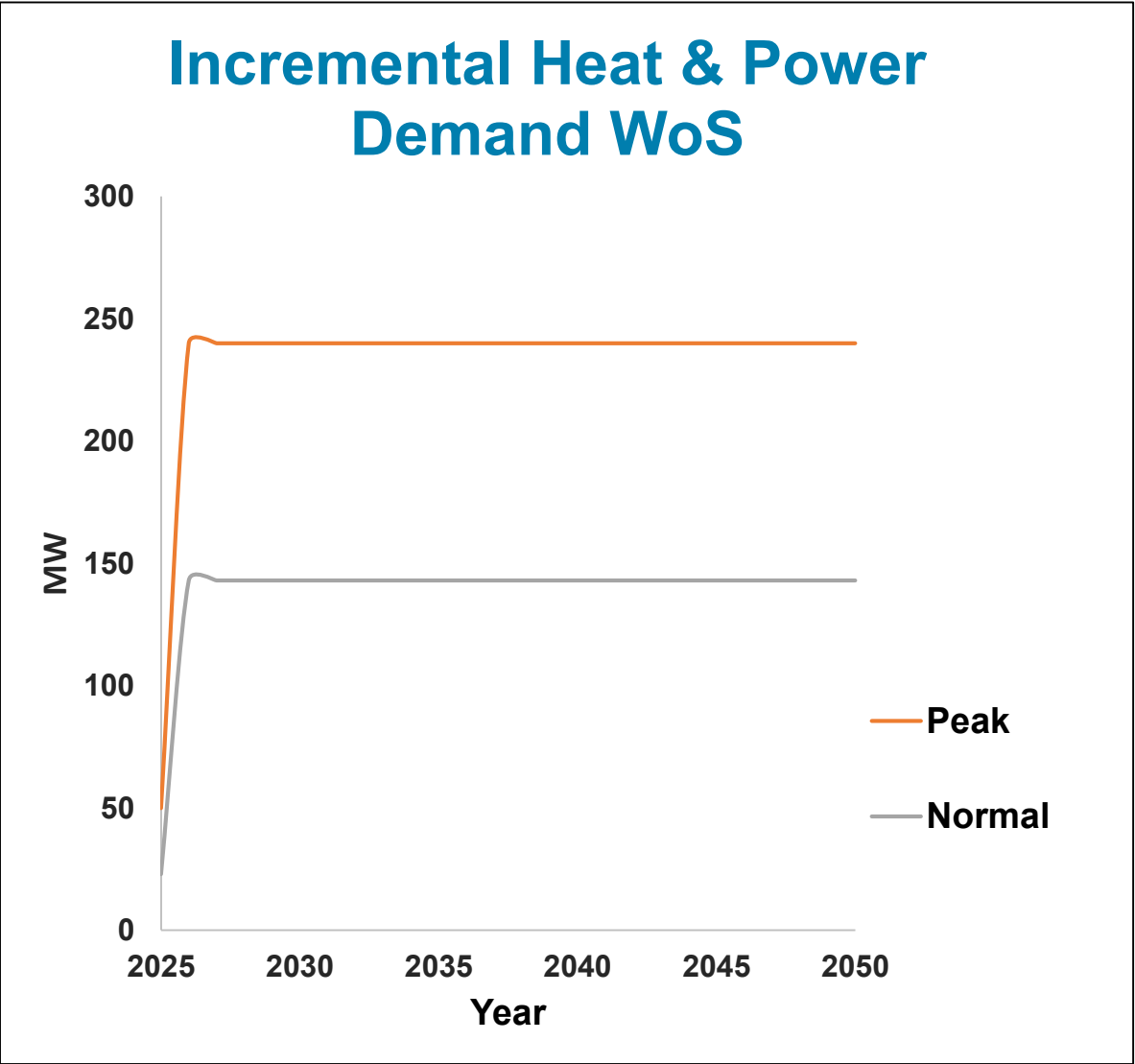
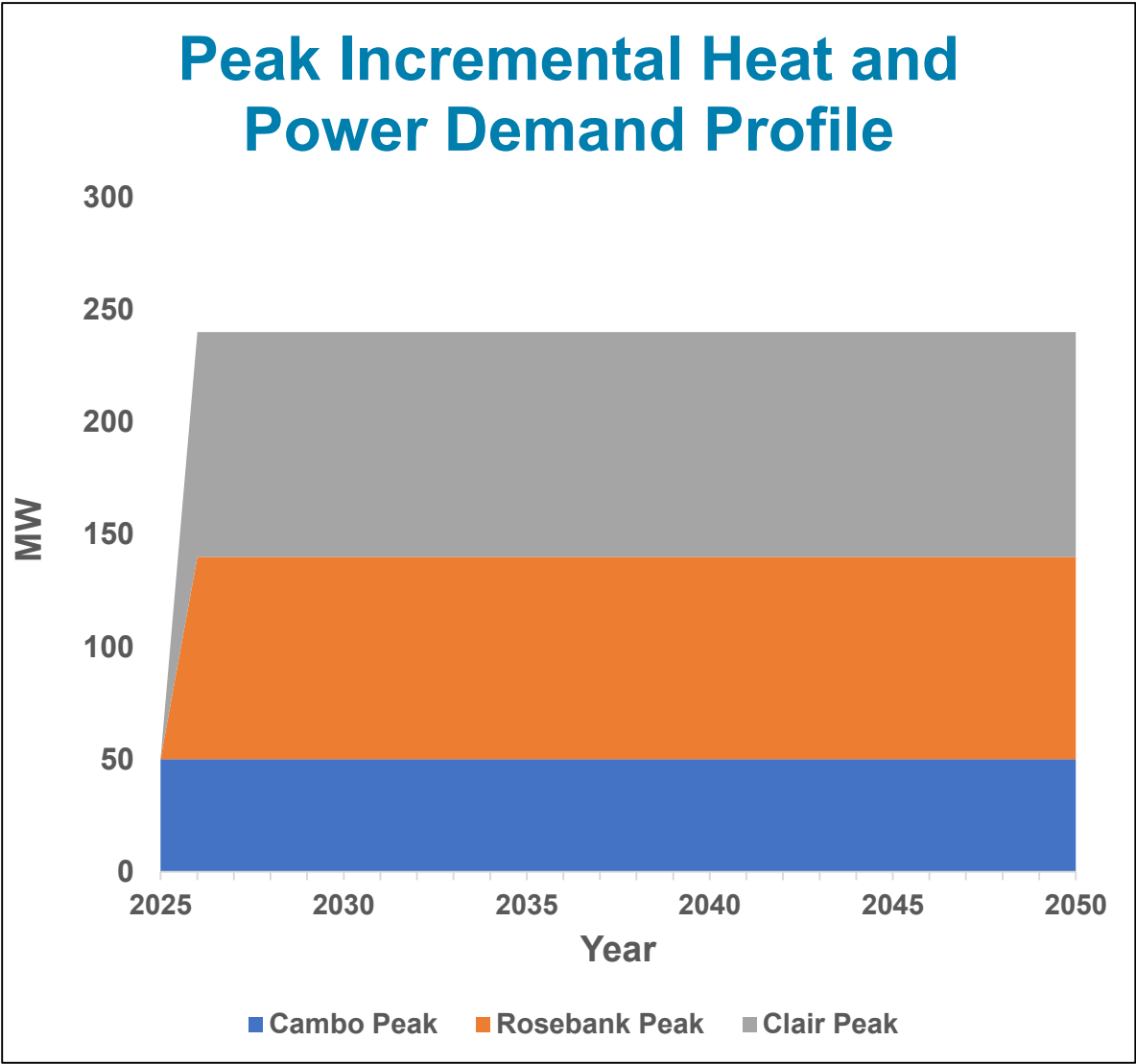
- East Of Shetland Crude Oil SVT receipts est. Cessation Of Production 2035
- Clair JV currently negotiating extension of SVT services to 2050+
- WoS gas 'sweetening' negotiating extension of SVT services to 2035
- NSMP negotiating SVT services (incl. power provision) to 2035
- SSE Power Purchase Agreement negotiating extension until 2023+

Work in progress

- **What** ~ implement a cost conscious energy solution which meets the power demand loads of SVT (2025+) and availability whilst recognising the net-zero energy transition
- **Why** ~ maintain regulatory compliance, enabling extension of terminal life and maximize economic recovery of offshore Oil & Gas assets
- **Status** ~ project in appraise and investigating a wide range of technical and commercial solutions with various 3rd party participation
- **Focus** ~ to deliver a reliable environmentally sustainable power solution for the terminal users but open to investigating / receiving proposals for symbiotic benefits with others



Offshore Power Demand Summary



Common themes - Pre-Workshop 1 to 1s

Technical	Commercial/Economic	Regulatory
Potential for power from shore or floating wind but uncertainty from WOS environment and water depth	Power import pricing currently high vs generation by GTs - investment ESG driven	OGA strategy mandates Net Zero consideration in new devpt. concepts
Technology for offshore wind exists and being deployed (Hywind, Tampen) – application in WOS?	Commercial immaturity, uncertainty on pricing, tariffs, exemptions, charges	Collaboration essential (O&G licensees, Regulators, Power providers)
Reliability /Interruption of supply – how to provide back up (grid, H2)?	High capex for options and O&G business case	Unclear Regulatory landscape (licensing & consenting process, planning permissions, timing for floating wind)
Offshore wind technology developing - Spar, semi sub, built in electrolyzers, 14-15 MW turbines - opportunity for early demo WOS ?	Early route to market for floating wind projects co-located with O&G ?	Impact of uncertainty on O&G schedules
	Fiscal levers and sector deal	Many stakeholders and interfaces
	Situation will mature so potential for pre-investment for retro-fit	

Common themes from Open Discussion

Technical	Commercial/Economic	Regulatory
	High capex for electrification of O&G platforms but potential reduction in OPEX, potential future CO2 penalties and opportunity cost of gas for platform GT's, provide a solid business case for electrification of platforms nearer Shetland.	OGA, CES and MS working together on consenting timelines which support cross sector projects" - What exactly is being done (and by whom)?
	Any consideration given to the commercial model for power form offshore energy? FPP develop a floating wind system and with TechnipFMC are integrating hydrogen energy storage, but discussions so far don't reach a consensus on owning the asset(s) or a pure power purchase model.	Intent and timing re leasing areas WOS for offshore wind development & CES view on whether Out of Round leasing might occur? Is there intent to link a leasing round to electrification of O&G assets ?
	Offshore wind can achieve 15 year CfD contracts. To make financing offshore electrification work would operators enter into 15 - 20 year supply contracts?	Any consideration being given to off-grid power hubs for the WoS platforms?
	What is the current process related to grid charges? O&G assets located North of Scotland present significant risk of high grid charges for the offshore wind developers	Can the planned onshore wind on Shetland be utilised for Power from Shore when the bulk of it may be contracted to the 600MW Shetland link inter-connector?
	As we try to also grow renewables in the basin, cost-effective O&G decarbonization is very important. Are opportunities for more affordable electricity pricing being matured?	OPRED will have a role in providing environmental clearance relating to electrification (i.e. relating to power cable connecting offshore installations).
	Could you say more about what's happening regarding the potential for Energy Intensive Industry exemption for O&G?	The WOS developments seem to have a potential issue with electrification in initial design given project timings with retrofit being a possible solution. How will OGA approach approval process given these factors.
	The long project lifetimes of the fields discussed really helps justify the CAPEX investment of renewables, so a good opportunity here	

END OF DOCUMENT