Future Financing Scenarios for Offshore Wind Assets

Summary Report

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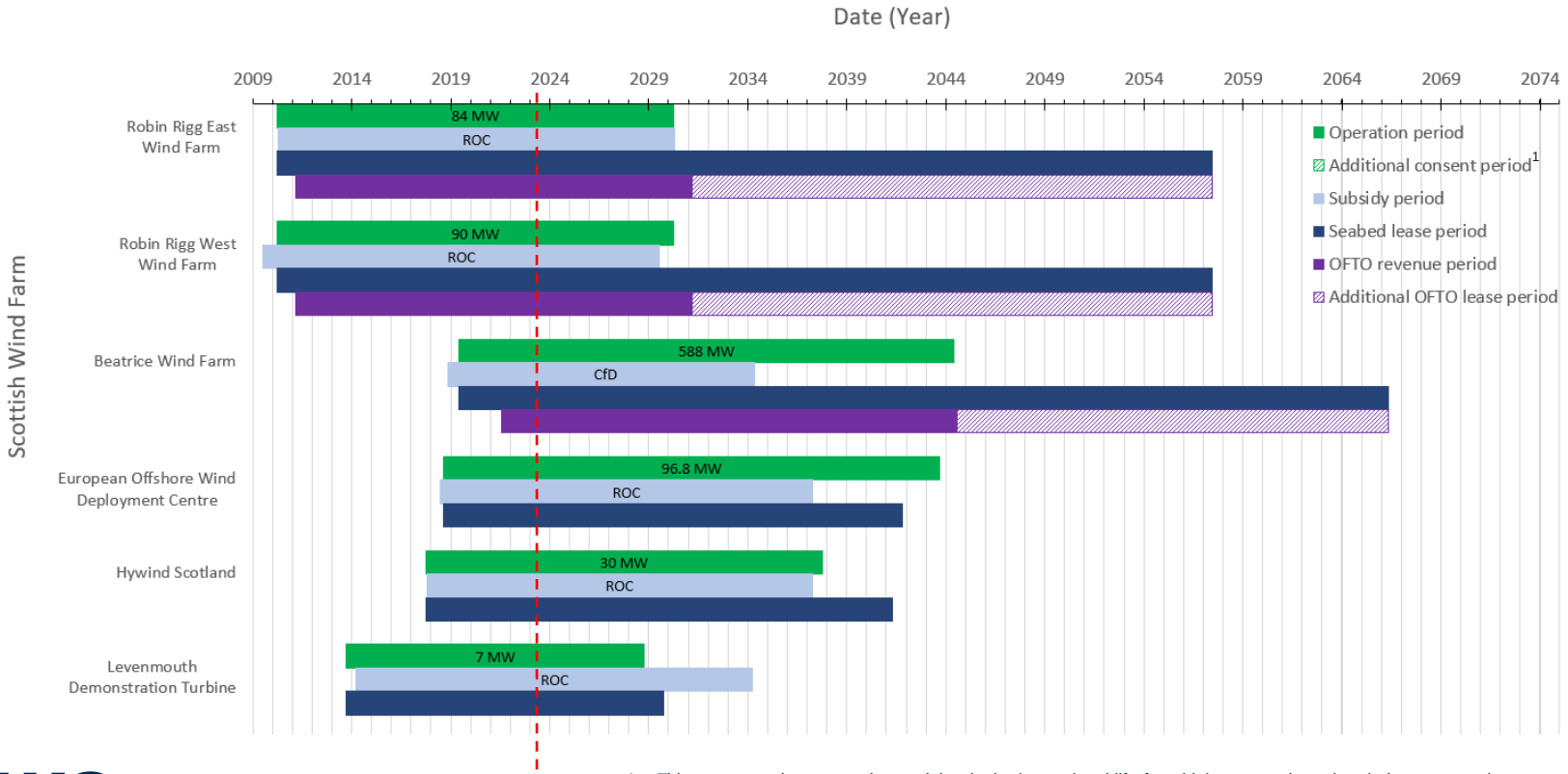
Acronyms

BEIS:	Department of Business, Energy & Industrial Strategy
Capex:	Capital Expenditure
CES:	Crown Estate Scotland
CfD:	Contract for Difference
CM:	Capacity Market
COD:	Commercial Operations Date
ComPPA:	Commercial Power Purchase Agreement
Decex:	Decommissioning Expenditure
Devex:	Development Expenditure
FC:	Financial Close
FID	Final Investment Decision
£ or GBP:	Great British Pound
GW:	Gigawatt
IRR:	Internal Rate of Return
k:	Thousand
m:	Million
MW:	Megawatt
MWh:	Megawatt Hour
NPV:	Net Present Value
OFGEM:	Office of Gas and Electricity Markets
OFTO:	Offshore Transmission Owner
Opex:	Operational Expenditure
OSW:	Offshore Wind
OWF:	Offshore Wind Farm
REGO:	Renewable Energy Guarantee of Origin
ROC:	Renewable Obligation Certificates
UK:	United Kingdom
Y or Yr:	Year

Introduction

- This assignment examines the long-term prospects for extending the life of Scottish offshore wind assets. It aims:
  - To aid the understanding of the options available to offshore wind developers and the potential revenues they can access as their assets come towards the end of their operational life;
  - To identify the relevant financing mechanisms available to support low carbon generation;
  - To assess the feasibility of these mechanisms in financing end-of-life scenarios for offshore wind farms including decommissioning, life extension, and repowering.
- Scotland's offshore wind assets comprise 1.9 GW of OSW assets in operation, 1.6 GW under construction and +25GW at various stages of development. The oldest of these assets entered operation in 2010 and will be reaching a decision on decommissioning or life extension before 2030. The following two slides present a timeline of the Scottish OSW assets currently in operation and under construction, with key dates outlined.
- These OSW assets are typically underpinned by financial support mechanisms (ROCs, CfDs) for a certain duration (usually 15 years) to facilitate the initial investment in the assets. The support mechanisms cover approximately half of the expected technical lifetime of the offshore wind farm components.
- After the expiry of the financial support mechanisms, OSW developers are typically reliant on revenues from the wholesale market, any direct contracts with customers (ComPPAs) plus relatively modest payments from participation in the UK CM and REGO.

Crown Estate Scotland Asset Timeline



1 – This corresponds to years beyond the design/operational life for which consent has already been granted. Note this is only applicable to Neart Na Gaoithe which has been granted a 50-year consent

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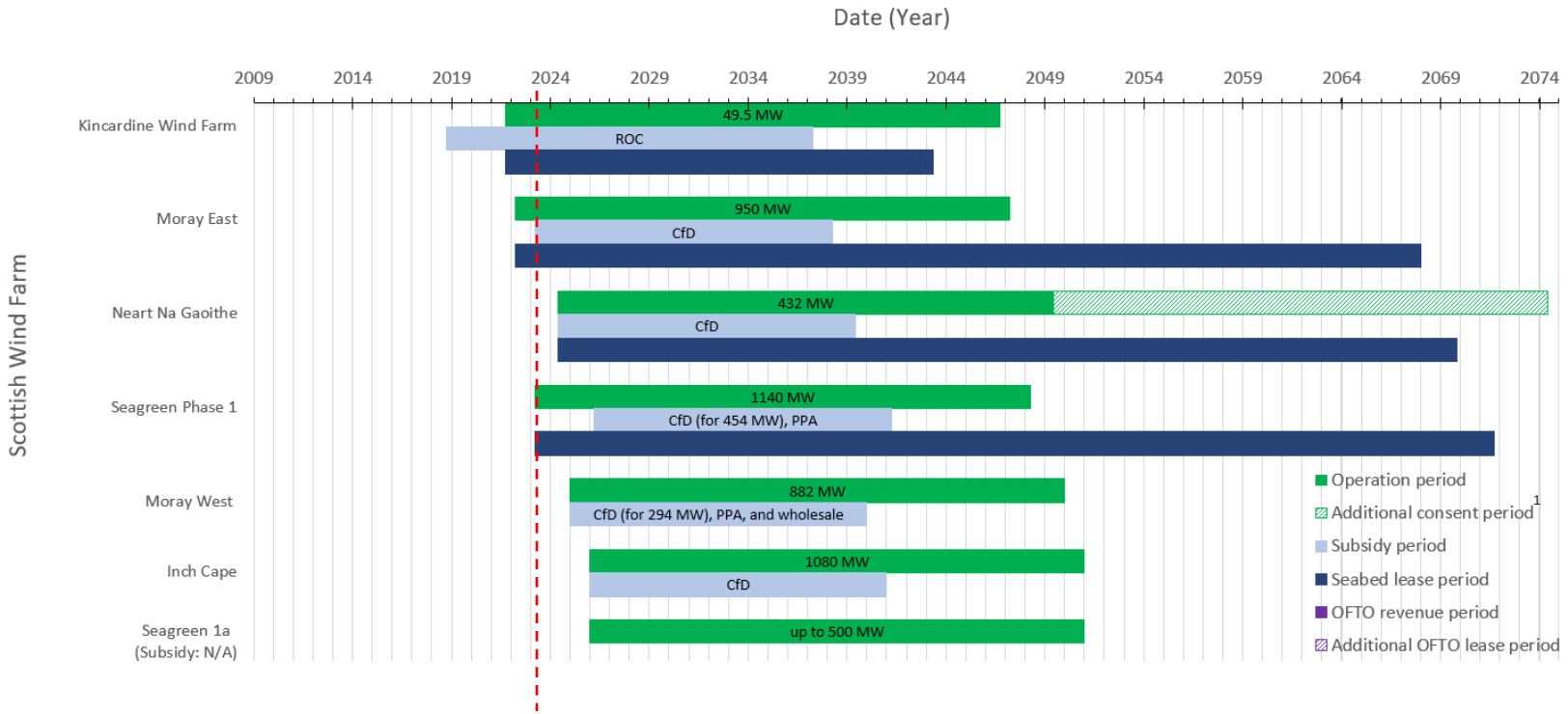

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Decommissioning and End of Asset Life Strategies

- Under the current regulatory framework, developers are obliged to submit a decommissioning plan at the time of FID and to update it periodically, notably three years before the expiry of the 25-year Section 36 Electricity Act 1989 consent period. Developers are also expected to maintain or build up financial reserves for decommissioning liabilities throughout the lifetime of the asset.
- Developers will typically examine the techno-economics of extending the asset lifetime 3-5 years before the end of the originally planned asset lifetime. At that point, developers will face the choice of decommissioning the asset, extending the asset lifetime or replacing some or all of the asset's components (i.e. partially or fully repowering the assets).
- The factors that the developers will take into consideration at that point include, *inter alia:*
  - the condition of the assets and the expected remaining lifetime;
  - the incremental operating costs required to extend the asset lifetime;
  - projected capital costs for partial and full repowering of the asset;
  - additional yield from partial and full repowering of the asset;
  - prevailing power prices at the time;
  - certainty, and expected quantum, of free cashflows from the extended project;
  - availability of financing for partial and full repowering of the assets; and
  - the risks associated with each of the choices.

Future Scenarios

To assess the relative attractiveness of the future end of life choices and the associated policy, this study has assessed future price, cost, financing and technology trends for the Scottish OSW sector.

- **Price Scenarios:** Representative price projections based on current forecasts from market advisors are employed to arrive at "consensus" low, base and high price scenarios for use in this report. Overall, wholesale prices are expected to decline from an expected low-base-high band of £42/MWh- £61/MWh - £74/MWh in 2030 to £34/MWh- £46/MWh - £59/MWh in 2059. Capture prices are forecast to decline from a low-base-high band of £36/MWh- £50/MWh- £58/MWh in 2030 to £30/MWh- £39/MWh- £51/MWh in 2059.
- **Market Development Scenarios:** Pricing scenarios are associated with different penetration rates of renewables and storage technologies. Higher price case scenarios represent a greater share of conventional fossil fuel technologies and increased fossil fuel prices as opposed to the comparable scenarios with the lower price case being more consistent with the achievement of the UK's net zero ambitions.
- **Cost and Technology Scenarios:** Current trends towards larger and more efficient turbines, increasingly efficient construction techniques and supply chain competition are expected to continue, leading to £/MW declines in the forecast period. The development of a secondary market in refurbished components is expected to grow in the forecast period. This will provide a potential source of components for repowering purposes. More efficient maintenance regimes are expected to lead to real term declines in opex/MW in the initial operating period of OSW assets. In life extension scenarios, opex is expected to increase in the period.

Future Scenarios (continued)

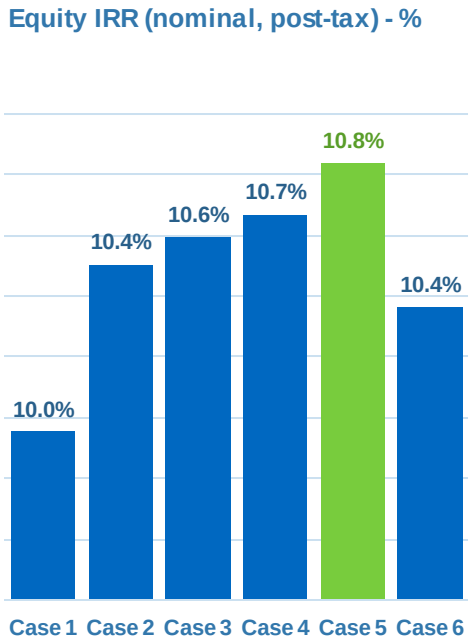
- **Financing Scenarios:** In the life extension cases, developers are expected to meet incremental costs (primarily opex) from equity. Third-party financing of future repowering expenditure is expected to be required only in the capital-intensive cases involving repowering and partial repowering of the assets. Commercial banks may have some appetite for merchant risk, but debt quantum and pricing will be greatly enhanced by bankable, long-term offtake contracts and/or by CfDs (or equivalents); technology risks associated with recycling of components for repowering will be scrutinised closely by Lenders' Technical Advisors before bankability is established.
- **Long-Term Contracting Trends:** Robust, long-term Commercial Power Purchase Agreements will facilitate the deployment of some incremental repowering capex. The bankability of ComPPAs will continue to depend upon the creditworthiness of the offtaker(s) in addition to ComPPA duration, technological and other project factors. We expect industrial offtake to become increasingly important, as green hydrogen production for domestic decarbonisation and for export markets[1].
- **Future Support Mechanisms:** The capital intensity associated with partial and full repowering of OSW assets means that it would be highly advantageous for a form of support mechanism to be available for Scottish OSW assets as they approach their initial decommissioning dates. The current preferred CfD support mechanism could be adapted & extended to cover repowering investment. This will require an amendment to the current CfD regulations – specifically regulations 14(5), 14(9) and 14(13) in the CfD (Allocation) Regulations 2014. Other existing revenue supplements (CM, REGOs) offer come cashflow support but are insufficient on their own to provide cashflow certainty.

1 – The Scottish government has conducted surveys on the potential for export of green hydrogen which conclude that two-thirds of stakeholders expect a high potential for export of green hydrogen to European markets considering the abundant endowment of off-shore wind resources for Scotland. However, the likelihood of capturing this potential is dependent on the progress of other low cost competing centres for exports markets such as North Africa.

Financial Modelling

- The Consultants modelled a representative Scottish OWF asset to illustrate the relative indicative economics of these choices:
  - Six cases were analysed with five representing variations to the base case (Case 1) with decommissioning after an operating period of 30 years. Although many wind farms have an initial design life of 25 years, 30 years was chosen as the base line because most modern wind farms are tending towards this value.
  - All cases showed adequate equity returns in the vicinity of an indicative 10% (post-tax, levered, nominal).
  - Cases 2-4 with life extensions of 5, 7 & 10 years show consistent improvement as each incremental year adds more value to the business for project's shareholders. In this case it is assumed that the developers increased opex towards the end of the asset life to facilitate the life extensions. The incremental opex is assumed to be funded internally.
  - With partial repowering in Case 5, the £1 billion capex and the additional £46m per year opex relative to Case 1 is more than offset by net cash inflows from 15 additional operating years, resulting in an IRR of 10.8%. This case is assumed to deploy refurbished components for the repowering and the repowering capex is assumed to be equity-funded.
  - In Case 6, with full repowering, however, the £1.5 billion capex for refurbishment is value dilutive despite reduction in per year incremental opex to £36m vs. £46m (Case 5). Hence, the associated 10.4% returns are only commensurate with Case 2, which represents the 5-year life extension. This case is assumed to be funded ~85:15 by debt and equity.
  - Further analysis on all cases for NPVs over the life of the project and the incremental NPV in mid-year 2053 (at the time of the institution of the decommissioning reserve) confirms the above findings.
  - Sensitivities based on low and high wholesale price cases also yield similar results, lending further support to the analysis.

Financial Modelling



	Equity IRR (nominal, post-tax) - %	Project NPV (as at FC) - £000s	NPV (@ Decommissioning reserve commencement in 2053)	NPV Discount Rate - %	Simple Payback (from COD) - Years
Case 1 Base Case	10.0%	38,197	598,400	9.0%	12.00
Case 2 Lifetime Extension 5 years	10.4%	69,542	1,090,089	9.0%	12.25
Case 3 Lifetime Extension 7 years	10.6%	76,759	1,227,538	9.0%	12.25
Case 4 Lifetime Extension 10 years	10.7%	84,938	1,398,268	9.0%	12.25
Case 5 Partial Repowering	10.8%	100,923	1,655,372	9.0%	12.25
Case 6 Full Repowering	10.4%	69,349	1,179,575	9.0%	12.25

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Conclusions

- Scotland's offshore wind assets comprise 1.9 GW of OSW assets in operation, 1.6 GW under construction and 25+ GW at various stages of development. The oldest of these assets entered operation in 2010 and will be reaching a decision on decommissioning or life extension before 2030.
- Representative economics indicate that asset life extensions - ranging from short-term extensions of 5 years with existing asset configuration to full repowering investments - have acceptable returns based on current expectations of costs and prices in the forecast period. The economic are broadly similar in the range of 10%-11%; when making the decommissioning/life extension decision, factors other than economics, including appetite for risk, access to capital and financing will be key determinants for developers.
- To maximise the longevity of the existing Scottish offshore wind assets, mobilisation of tens of billions of pounds of incremental capex will be required for partial and full repowering of the assets. This will require the pool of available capital providers to be extended beyond equity providers.
- While ComPPAs will become increasingly important in the mix of route to market options, extension of tried-and-tested support mechanisms - specifically CfDs - could also play an important role in de-risking future repowering investments and crowding in commercial banks.
- Extension of CfD mechanism to repowering investments will require an amendment to the existing regulations. Assets that have previously or currently been in receipt of CfDs, ROCs, and similar payments are currently ineligible to apply for a CfD for the purposes of repowering.

Recommendations

Revenue Mechanism	▪ The Consultant recommends that CES should engage BEIS in support of offshore wind repowering to be permitted under revised CfD legislation. The modelling and insights from this study could be highlighted as part of the current consultation underway by BEIS[1].
Bankability and Returns	▪ Where it is necessary to enhance the economics of marginal life extension/repowering projects, mechanisms to enhance equity returns for developers should be investigated[2]. These could include accelerated depreciation or enhanced capital allowances during the period of the life extension.
OFTO Licencing	▪ In life extension/repowering scenarios, at present it is unclear if OFTO assets will be retendered to a new licensee or extended under the incumbent OFTO ownership. Clarity around the process for extending or reconsenting OFTO licences should be sought from OFGEM[3].
Circular Economy Considerations	▪ Reuse, recycling and remanufacturing of components at scale could be promoted by CES and the OSW industry by recognising circular economy considerations. ▪ Third-party certification of refurbished components should be encouraged to ensure that banks are more likely to accept technology risks associated with their use in lifetime extension/repowering projects.
Supply Chain Considerations	▪ With significant OSW assets being decommissioned from 2043 onwards, managing potential supply chain constraints/bottlenecks associated with decommissioning/life extension/repowering projects will be critical. ▪ However, these risks also present economic opportunities; cross-stakeholder coordination is recommended to ensure a smooth decommissioning process and to maximise the possible economic opportunities to the Scottish supply chain.

1 – See BEIS Consultation on policy considerations for future rounds of the Contracts for Difference scheme
2 – This could be necessary, for example, in a period of protracted low wholesale prices.
3 – There is a current OFGEM consultation on these and related questions – see OFTO End of Tender Revenue Stream – 2nd Policy Development Consultation

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