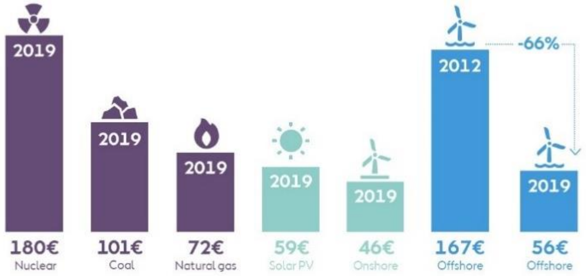
Project Neos

Electrification of oil and gas assets using renewable offshore wind energy

10/05/2022 SPE

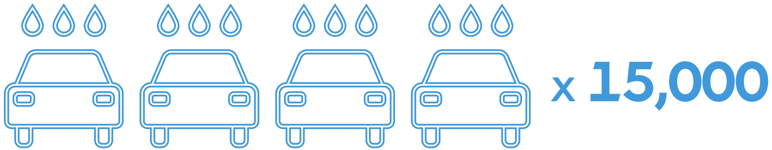


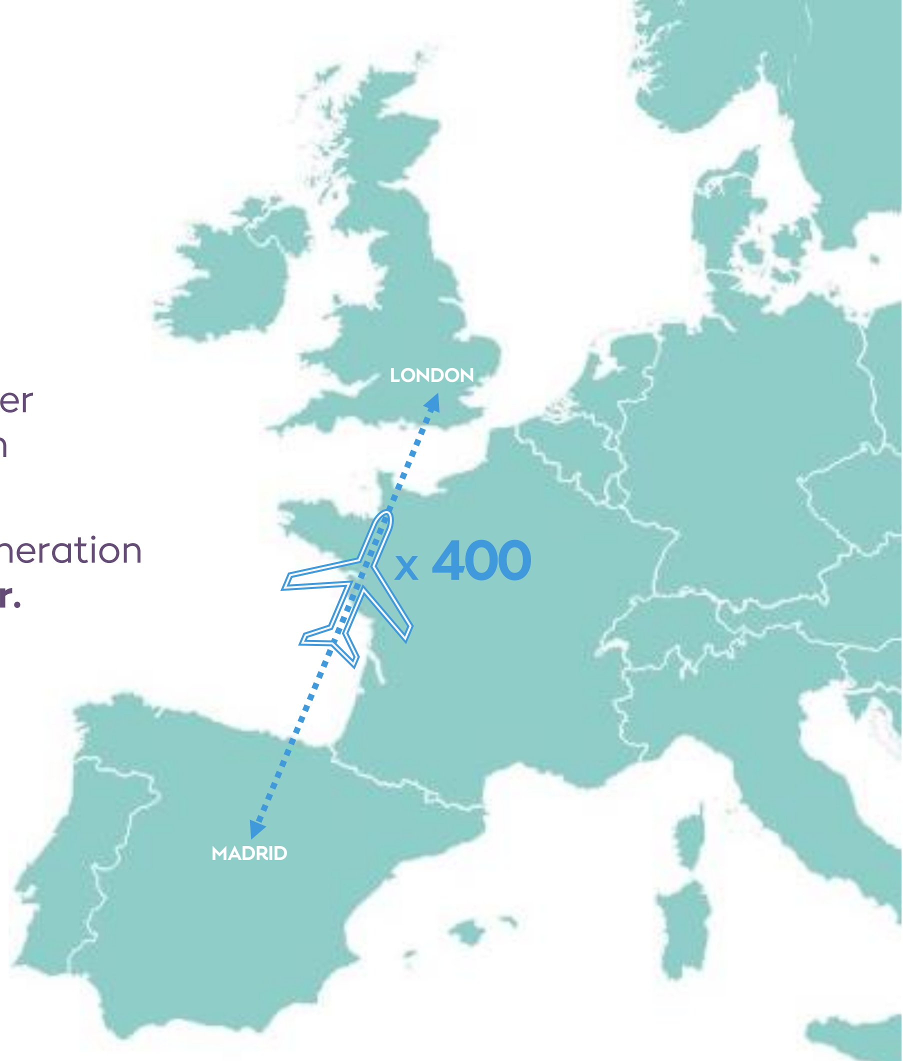
Offshore wind is the **2nd lowest cost** new-build power generation and a **neighbour to Oil & Gas** production facilities

Electrification that includes 25MW mix of power generation and compression = approx. **80,000T avoided CO_2/yr.**

Equivalent to avoiding:

- **400** return **flights** London to Madrid
- **15,000 diesel cars** on the road





Project Neos Objectives

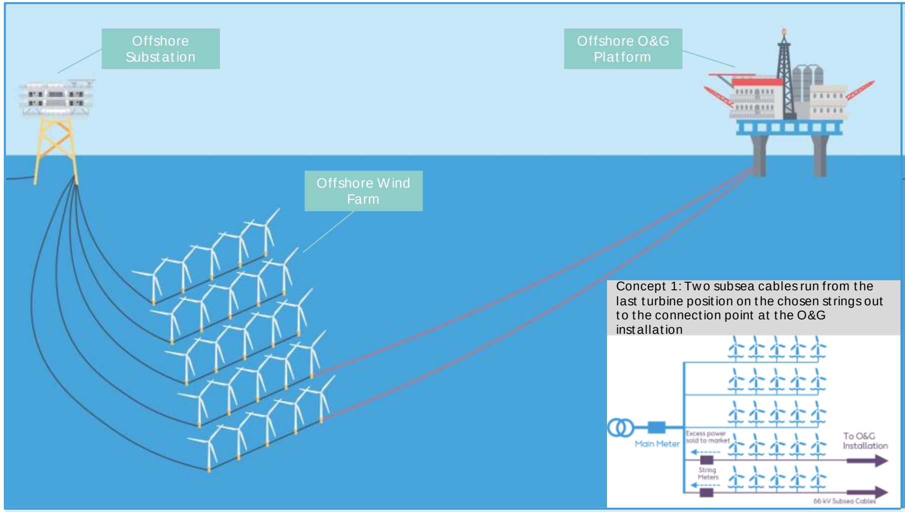
- Demonstrate feasibility of oil and gas electrification enabling and forming the conceptual basis for future electrification projects
- Inform future-proofing and build-out design for an OFW project, firstly, for oil and gas electrification followed by future new energy projects
- Validate new route to market for offshore wind other than supply to the onshore grid for future growth of wind energy sector
- Develop understanding of regulatory regime requirements and consenting pathways for integrated energy projects
- Develop approaches to coexistence, collaboration and future leasing/allocation rounds

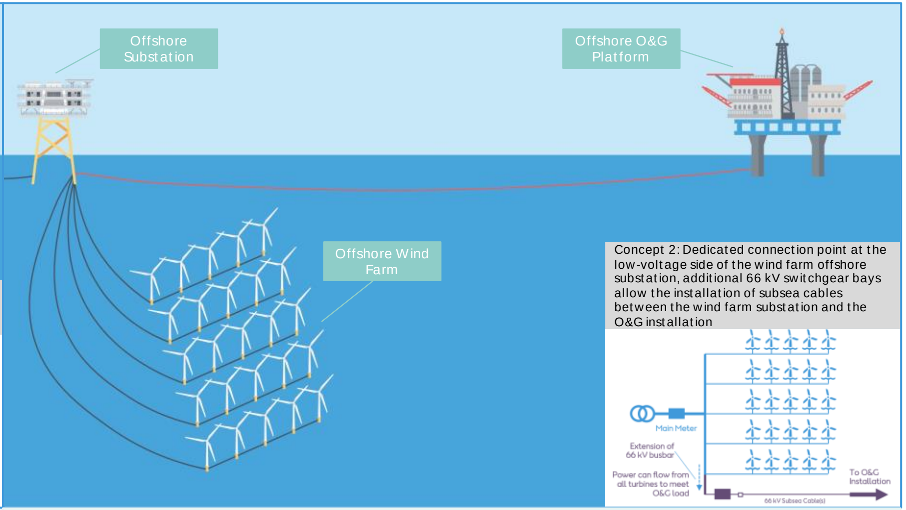
Partners

Supported By

Technical Findings

Offshore Wind Concepts

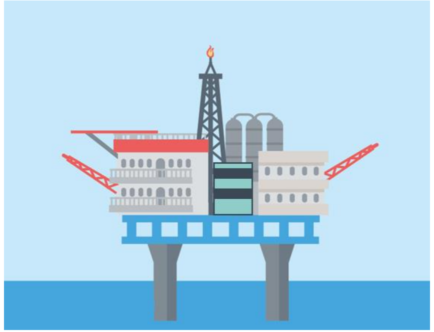




- **Direct connection** from the wind turbine array cable strings
- Two subsea cables run from the last turbine position to the connection O&G installation
- Does not impact the offshore substation so required minor changes to the OWF infrastructure
- Minimises level of anticipatory investment required and may enable this solution to be retrofitted to existing OWFs
- Restricts how many turbines can be used to deliver power, thereby limiting the achievable load factor.

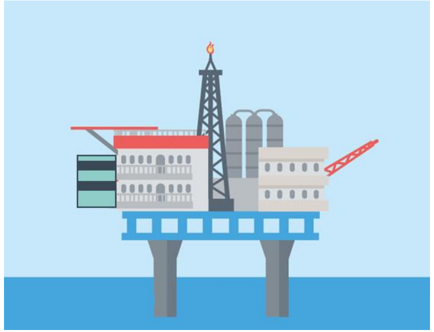
- **Dedicated connection** point at the low-voltage side of the OWF substation
- Additional 66 kV switchgear bays allow the installation of subsea cables between the OWF substation and the O&G installation
- Simplified control and metering arrangements and allows access to power for a greater number of the wind turbines connected to substation (1 power park module)
- Better suited to new-build projects

Optioneering & Layout Options



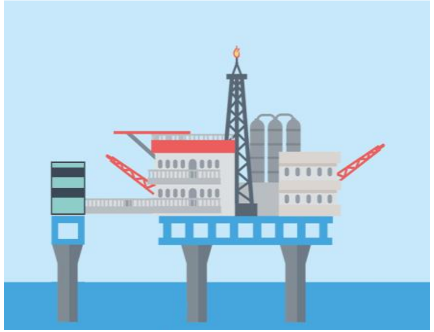
Option 1

Equipment integrated on the platform (inc. Pre-Assembled Unit (PAU) modules).



Option 2

Hang-off module from the O&G installation



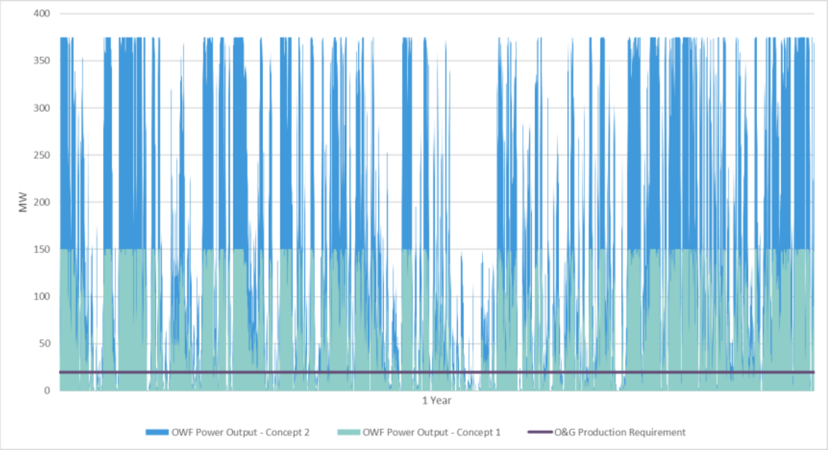
Option 3

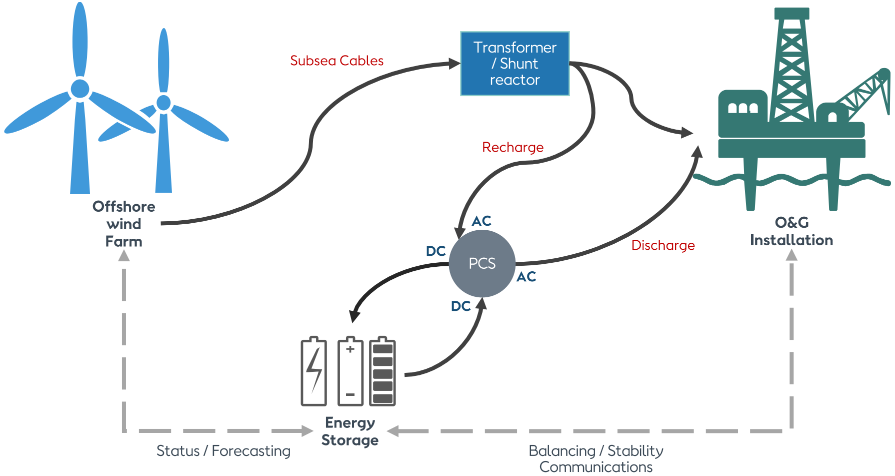
Bridge Linked Platform (BLP) adjacent to the O&G installation

Case	Description	Standard Operation	Low / No Wind Operation
Low Uptime (80 ktCO_2 reduction)	Power from the OWF	Powered by the OWF during normal operations	No platform production or power available Increased use of emergency diesel generator to provide essential power
Medium Uptime (72 ktCO_2 reduction)	Electrical supply from the OWF, and 2 x GTGs (low/no wind).	Powered by the OWF during normal operations	GTGs will be brought online as a secondary source of power GTGs do not have sufficient power to drive both compression trains (50% compression)
High Uptime (67 ktCO_2 reduction)	Electrical supply from the OWF and two GTGs, as well as retaining the existing two GTs for compression	Powered by the OWF during normal operations	Revert to original operating status; GTs and GTCs GTs fueled by produced hydrocarbons 100% redundancy achieved No change in CO2 emissions achieved during no/low wind periods.

Load Factor Analysis and Energy Management

Annual Wind Farm Production Data, 1hr Intervals





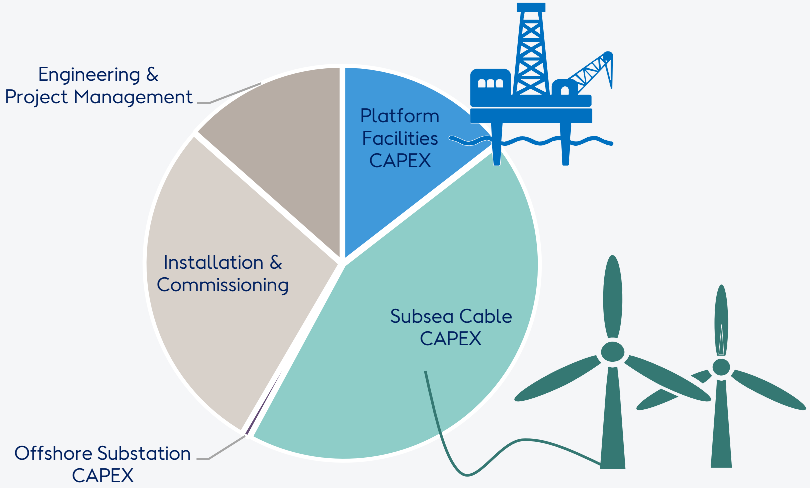
Load Factor Analysis

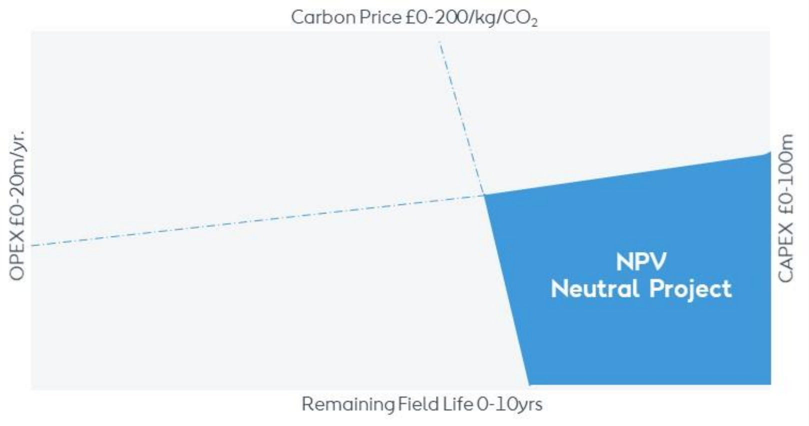
The analysis showed there were **1,088 hours (~45 days)** per year (12.4% of hours) in 84 gaps where wind generation would **not be sufficient** to meet the **demand** of the O&G platform

Possible Solution

An Offshore Microgrid comprising Offshore Wind Power, Back-Up Conventional Generation, Energy Storage and Advanced Control Systems is required to **maximise the use of renewable** generation and ensure **stable reliable E&P operations**

The Business case can be Viable in Certain Circumstances…





There is a **max CAPEX** and **max OPEX** threshold.

Projects that require **a BLP** to house additional equipment, or a **100% redundancy** (dual cable) connection >50 km or have **less than 10 yrs.** remaining field life are likely to be **unviable.**

Converting CAPEX to OPEX in the form of tariff, or structuring the **PPA pricing to reflect** expected **trends in direct OPEX** show **promising results** and should be investigated further.

Other **significant** influencing factors are **carbon price** and the robustness of carbon **price forecasting**, as well as remaining **field life**.

Higher gas prices or carbon **prices**, or opportunities for field life extension through repurposing **can drastically change** the dynamics.

Key Learnings from Collaboration

Technical Findings

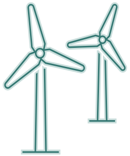
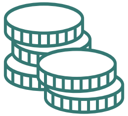
- Electrification from an OWF alone cannot provide adequate levels of reliability to sustain E&P operations
- Energy storage to 'fill the gaps' is likely not feasible due to size and cost
- Electrification supported by conventional back up generation plus energy storage is required to maintain the balance between the two facilities
- Such offshore microgrids, could provide material reductions in emissions but will require investigations into more sophisticated control systems.
- Cable costs are significant. O&G installations situated in close proximity to OWF developments will benefit from reduced CAPEX investment
- Significant cost reductions could also be made by reducing cable connections to one cable including associated equipment e.g. transformers / shunt reactors
- Existing O&G installations with motor driven compressors and pumps will be easier to electrify due to the reduced platform modification scope

Wider Industry Learnings

- Enhanced understanding of brownfield & greenfield modification options (both OWF and O&G)
- Increased collaboration and cross-industry skills development

Realising Platform Electrification

What still needs to be done:
Further Technical & Commercial Investigation

Project Specific NEOS Partners	**Further Investigation** Requires funding support, focus on developing wider industry understanding, generic solutions
 **Integration to 'in-flight' OWF project**: Investigate procurement timelines and key decision gates are aligned. **Consideration future proofing** investments to ensure procurement timelines are not prohibitive to realising platform electrification. Further development of **PPA structuring**, including single offtake solutions, mismatches in tenure versus remaining field-life, and how risks can be mitigated **Investigate grid back-feed:** and determine any technical issues or limitations, the potential regulatory challenges that may occur and the impact on electricity costs due to importing at higher priced periods and incurring Transmission Charges.	 **End to end Availability & Reliability Study:** to assess levels of back-up generation and supporting technology such as energy storage required to maintain stable operations/production (managing within hour/minute variability on load and production sides). **O&G operating procedures/processes:** Assess changes to operations that would enable electrification whilst ensuring high uptime/production, with specific reference to energy storage solutions and levels of back up generation. **Integrated solutions:** Combining the three 'NSTA decarbonisation competition' enabling projects to assess end-to-end solution opportunities.
 **Brownfield modifications:** Further assess extent, optimal design, costs, and potential downtime/risks resulting from implementing platform electrification. **Level of electrification achievable/required:** Short term vs. long-term (repurposing) including plant and processes which could be converted to electric, base power levels and redundancy needs.	 **Gap-funding solutions:** The need to find a mechanism that can provide support to investment decisions through the transition of assets to new operational activities, such as hydrogen production and CCS, with electrification as the first step.

What still needs to be done: Regulatory Clarification

Consenting	De-risking Investments
Consenting Regime: Flexibility to use the most appropriate regime for each project to expedite progress while the enduring regime is being determined. Clarity is required regarding the applicability of a **seabed lease from TCE** and timelines for connecting infrastructure should a lease be required. It is suggested that the applicability of a seabed lease should align with the consenting regime. **Need for policy support** in NPS to underpin project need-case and support decision making on major energy infrastructure.	**Clarity on future carbon pricing:** Can there be a guaranteed carbon floor price to underpin investment decisions and commercial agreements. **Anticipatory Investment recovery model**: Support from the Government Regulatory Group for Electrification (GREG) and OFGEM to enable retrofitting of brownfield projects to make minor infrastructure investment decisions, which would enable future electrification opportunities **LCCC confirmation** required agreeing formerly that Behind the (CfD) Meter supply of electricity does not conflict the principals of the CfD opportunities.

Project Neos Partners: Further Information

https://orsted.co.uk

https://www.neptuneenergy.com

https://www.goalsev.com