

EXECUTIVE SUMMARY

MeyGen Lessons Learnt Summary Report

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Lessons learnt from the design, installation and initial operations phases of the 6MW 4-turbine tidal array in Scotland's Pentland Firth



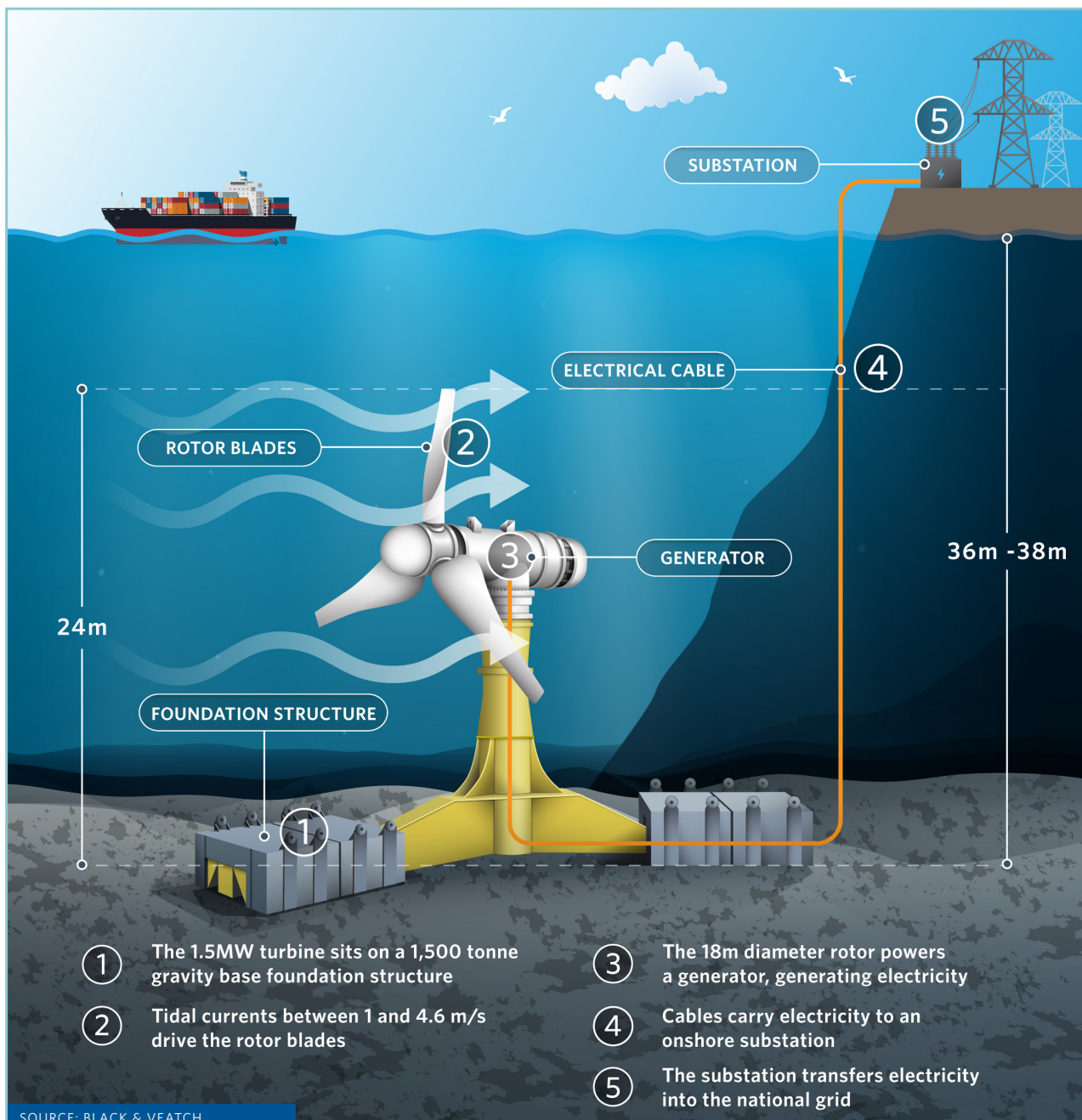
Department for
Business, Energy
& Industrial Strategy

Scottish Enterprise via the Renewable Energy Investment Fund ("REIF"),
Highlands & Islands Enterprise, The Crown Estate, and SIMEC Atlantis Energy

1. INTRODUCTION

MeyGen was awarded an Agreement for Lease for the Inner Sound tidal development site on 21st October 2010 by The Crown Estate for 398MW of installed tidal stream energy capacity. MeyGen Phase 1A is a 6MW demonstration tidal stream energy array comprised of four 1.5MW tidal turbines in the Inner Sound of Scotland's Pentland Firth. Phase 1A of the MeyGen project is partly funded through a £10million grant from the Department for Business Energy and Industrial Strategy (BEIS) under the Marine Energy Array Demonstrator (MEAD) Fund. The remainder of the funding is from SIMEC Atlantis Energy, and The Crown Estate (Scotland), Scottish Enterprise's Renewable Energy Investment Fund, and Highlands and Islands Enterprise.

The project formerly entered its 25-year operations phase in April 2018. As the first multi-MW tidal array, MeyGen Phase 1A is a trail blazer for the industry. The key lessons learnt throughout the design, construction and initial operations phases of the project, relevant to other tidal energy installations, are presented here. For a full list of lessons refer to the full report (Lessons Learnt from MeyGen Phase 1A Final Summary Report). Since the project has only been operational for 24 months, the lessons included here are drawn from the initial project phases; long-term conclusions on project performance and impact are not yet available.



2. KEY TIDAL ENERGY LESSONS LEARNT

- 1 Integration of turbine and power train suppliers:** By integrating the entire power train system with the turbine supply workpackage, correct component system integration would be ensured.
- 2 Interventions:** The majority of early stage issues that required interventions were as a result of faults in standard components, rather than novel components specific to the tidal industry.
- 3 Pitch system:** MeyGen encountered fewer technical issues with the pitch system of those turbines employing an electrical pitch system in comparison to those with a hydraulic pitch system.
- 4 Foundation type:** MeyGen Phase 1A uses gravity foundations which have three feet that each require a suitably level seabed. MeyGen has found it extremely difficult to find locations that satisfy the foundation requirements for all the feet of all the foundations. MeyGen should have given a higher weighting to this issue when deciding between the use of gravity base or monopile foundations in the early engineering stage.
- 5 Cable stability:** No suitable guidance existed for stability of cables on a fractured rock seabed under the action of significant tidal and wave loading, which meant that MeyGen had to develop a custom approach which relies on frequent cable monitoring but allowed significant cost savings. A cable stability standard drawing on MeyGen's experience is in preparation and will be published by the British Standards Institute.
- 6 Dry-mate vs wet-mate connectors:** MeyGen found that the use of dry-mate connectors significantly increased the complexity of the turbine installation and retrieval, due to the need to handle the cable tails attached to the turbine, which increased the mobilisation time required, and also required standby periods between operations. Handling cable tails on deck, which could be under tension, also significantly increased the health and safety risk compared to the use of wet-mate connectors. Dry-mate connectors also restricted the permissible current velocity for installation operations, as the vessel remained connected to the sea bed, which limited installation windows to neap tides, making it more difficult to negotiate on vessel rates due to the lack of flexibility, exacerbated if multiple turbines required installation/retrieval.

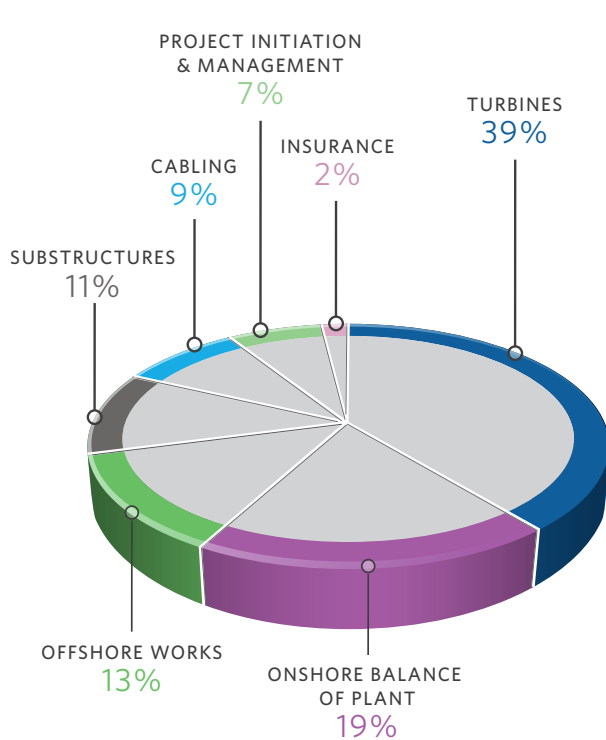


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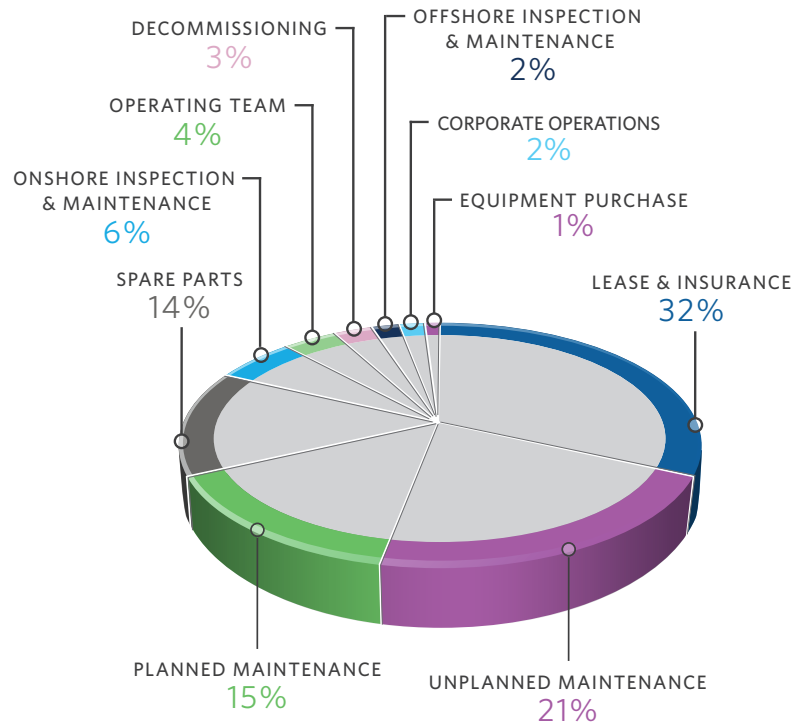


- 7 **Vessel capability:** One of the most impactful lessons learnt by MeyGen from a cost perspective is that currently available dynamic positioning vessels do not work reliably in currents stronger than 6 knots. The safe use of a Jack-Up Vessel at a high velocity tidal site was proven to be possible (this approach had previously been questioned within the industry for a number of years). MeyGen's view is that for foundation installation a Jack-Up Vessel can be cost effective; however, MeyGen would still expect to use a dynamic positioning vessel for turbine and cable installation.
- 8 **Real-time onsite Metocean data feed:** Having real-time metocean data feeds on site can be invaluable as it allows detailed operational planning.
- 9 **Marine Warranty Surveyor:** The Marine Warranty Surveyors were not initially familiar with the kind of operational procedures in often strong currents required for a tidal energy project and the successful engagement with the Marine Warranty Surveyor has been a key component to the success of MeyGen Phase 1A.
- 10 **Energy-based availability:** Most Operation & Maintenance contractors applied the same philosophy as for offshore wind in terms of attempting to maximise overall availability, but in tidal energy priority should be given to maximising availability during times of peak flow (time-based vs energy-based availability).
- 11 **Turbulence:** Turbulence variations across the site can significantly influence performance of individual turbines if they have a narrow design envelope. Having a machine that can be remotely adapted to different environmental conditions would negate the need to decide between operating a turbine at suboptimal parameters or choosing to mobilise an unplanned intervention.
- 12 **Performance estimates:** MeyGen attempted to conduct the power performance assessment according to the International Electrotechnical Commission Technical Specification (IEC TS) on Tidal Power Performance Assessment (IEC TS-62600-200), but in practice encountered a number of issues which made this difficult. In particular, the site did not meet the required sea bed slope parameters for instrument deployment, and the number of instruments stipulated by the standard was cost prohibitive.
- 13 **Health & Safety:** The onshore and offshore works had different lead parties responsible for ensuring the Construction, Design and Management (CDM) regulations were met. This introduced a lot of interface complexity which could be greatly simplified if only one party was responsible for both.
- 14 **Stakeholder engagement:** There have been no local stakeholder complaints or incidents throughout the construction and early operations phases of the project. Due to the novel nature of the project potential stakeholder impacts had been identified as a possible area of concern during the consenting process.

3. PROJECT COSTS



£51.3M CAPEX



£1.4M OPEX PER YEAR

4. POWER PERFORMANCE



6MW
Project Size

34%
Capacity Factor

25 **450GWh**
OPERATIONAL YEARS Lifetime Energy Yield Forecast

0.41
POWER COEFFICIENT

95%
AVAILABILITY

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