EnFAIT

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ENFAIT
ENABLING FUTURE ARRAYS IN TIDAL

Decommissioning Report

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IDETA NOVA INNOVATION CATAPULT Offshore Renewable Energy THE UNIVERSITY OF EDINBURGH RSK wood. SKF

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1 The Project

1.1 Introduction

A Funding Grant was awarded from the European Union's Horizon 2020 research and innovation programme in January 2017 to demonstrate a grid-connected tidal energy array at a real-world tidal energy site, propelling tidal energy towards competing on a commercial basis with alternative renewable sources of energy generation – Enabling Future Arrays in Tidal (EnFAIT). This was in response to the call *LCE-15-2016: Scaling up in the ocean energy sector to arrays* to generate significant learning through demonstration of cost-effective tidal arrays.

This document is produced to capture lessons learned and outline best practices for decommissioning tidal turbines. It is to be submitted to satisfy deliverable D7.4 of the EnFAIT project and to be also made available for public dissemination.

The primary sources in this report are deliverables D7.1, D7.2 and D7.3. A stakeholder engagement overview between Nova and regulatory and environmental stakeholders was also provided and reviewed. This report is intended to inform the tidal stream energy decommissioning process generally, however given the sources are primarily Nova documentation some bias towards a twin blade turbine mounted on a gravity based tripod foundation should be accounted for.

2 Decommissioning Overview

Decommissioning is the term used to describe the removal of an object or system and it's supporting infrastructure. In the context of offshore marine energy, it is the removal of a tidal turbine and its infrastructure at the end of life of a development, clearance of the seabed, management of the waste, notification of any remains and in some instances post-decommissioning monitoring.

Decommissioning standards of offshore renewables is defined in the Energy Act 2004[1] as *the general requirement to remove relevant objects and any exceptions from this general requirement; how they are to be removed; how waste is to be dealt with; notification and marking of any remains; and monitoring, maintenance and management of the site after decommissioning.*

[1] https://www.legislation.gov.uk/ukpga/2004/20/contents

3 Lessons Learned from Nova 30

The first turbine installed by Nova was the 30 kW Nova 30 in 2014 at Bluemull Sound in the Shetland Islands. The turbine featured a nacelle, three-rotor blade and a steel, gravity-moored tripod base with concrete ballast. The Nova 30 was decommissioned in 2016 and the site returned to its original state. Nova performed an analysis of the success of this operation and compiled a lessons learned table for both deployment and decommissioning. A full description is given in deliverable D7.1 and an overview of this is compiled in Sections 3.1 to 3.3.

3.1 Turbine Design

These are items relevant at the design stage.

- Small Scale – The size of the turbine has a significant impact on the number of available installation and decommissioning vessels.
- Gravity Mooring – No piling or drilling is required, keeping the installation and lifting operations as simple as possible.
- Number of rotor blades – A decision was made to move from three blades for the Nova 30 to two blades for the Nova M100, allowing the nacelle and rotor assembly to be placed directly on the quayside or vessel deck and reducing the number of working at height and lifting operations.
- Biofouling – Lifting points should be oversized to allow for biofouling.
- Cabling Design – Designing cables so that they may be laid directly on the seabed without additional protection or ballast significantly reduces the deployment and recovery time.

3.2 Operations

These items should be considered in company operations manuals.

- Improved Planning – Building experience through ‘learning by doing’, documenting processes and further refining.
- Diving Operations – While commercial diving is safe and well controlled, the first risk control should always be elimination. The need for divers can be minimised by suitable design choices, for example, creating oversized lifting points that are suitable for remotely operated vehicles (ROV).

3.3 Post Decommissioning

These items are to be considered following the removal of equipment and associated infrastructure.

- Drop-Cam – Using a weighted camera lowered from the vessel is cheaper, safer to use and more easily controlled in a tidal stream than an ROV.
- Recycling – Where possible, unneeded components and materials post decommissioning should be repurposed, ideally by nearby communities.

4 Best Practices

The topics in this section give an overview of the decommissioning process, modelled primarily on Nova's experience and reporting.

4.1 Legislative Considerations

The primary legislation relevant to decommissioning in United Kingdom is the Energy Act 2004, and sections 105-114 require a developer to submit to the Secretary of State at the Department of Business, Energy and Industrial Strategy a draft decommissioning programme. A non-exhaustive list of legislation and guidelines to be considered is given below:

- United Nations Convention on the Law of the Sea ("UNCLOS"), 1982;
- International Maritime Organisation ("IMO") Standards;
- OSPAR Convention for the protection of the Marine Environment of the North East Atlantic;
- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended);
- The Pollution Prevention and Control (Scotland) Regulations 2012;
- The Special Waste Regulations 1996 (as amended);
- Health and Safety at Work etc. Act 1974; and
- Construction (Design and Management) ("CDM") Regulations 2015.

The decommissioning programme should be written in accordance with the legislation and guidance as applicable at the time of development.

4.2 Stakeholder Engagement

There are a broad range of stakeholders that must be considered in marine renewable energy. A scoping exercise must therefore be performed to establish relevant stakeholders and their level of involvement in the development.

An example of relevant stakeholders in the decommissioning process is given below:

- Government bodies.
- National bodies.
- Local Council.
- Local communities.
- Environmental Protection Agencies.
- Fishermen's Associations.

- National Maritime and Coastguard Agencies.
- Local Coastguard Agencies.
- Maritime Navigation Agencies.
- Shipping groups.
- Local port authorities.
- Other marine renewable developers operating in same area.

Involving stakeholders at the earliest opportunity will ensure their opinions and requirements are suitably incorporated into the development. Bringing stakeholders together for consultations will allow for a more efficient exchange of information and will encourage a more collaborative process.

4.3 Decommissioning Plan

The Decommissioning Plan is a comprehensive programme covering removal of all of the tidal energy equipment and infrastructure at the end of the life of the development. The Decommissioning Plan must be considered during all stages of the development, as incorporation of minor changes during the design stage (such as, oversized lifting eyelets for easier attachment using ROVs) may not be possible or practical to retrofit.

Nova has produced an overview of their updated decommissioning process in deliverable D7.3 which takes into consideration industry best practice, national and local regulations, port facilities, vessel technology, lessons learned as detailed in deliverable D7.1 and lessons learned from marine operations in the Shetland Tidal Array throughout the EnFAIT project. A more detailed Decommissioning Method Statement was produced in support of an application to Marine Scotland for a Marine License for decommissioning.

The Decommissioning Plan should be informed by thorough background research and information. The below list of topics should be considered:

- Equipment and infrastructure locations.
- Other infrastructure, such as subsea power and telecommunication cables.
- Prevailing weather and seasonal variation.
- Traffic survey, both AIS and non-AIS equipped vessels to be considered.
- Fishing activity.
- Nature designations.
- Seabed and site bottom surveys.

4.4 Environmental Impact Assessment

The requirement for a full EIA (Environmental Impact Assessment) will depend on the local and government legislation. It is recommended that this study is carried out for all marine decommissioning, but this might not be a requirement for relatively small-scale activities where the likely potential impact is proportionately small. The EIA will provide an assessment of the potential environmental impacts of decommissioning including effects on Marine Protected Areas (MPA) and Priority Marine Features (PMF). The document will also assess the potential effects on "Natura" sites, including Special Areas of Conservation (SAC) and Special Protection Areas (SPA).

4.5 Waste Management

Where possible, equipment and infrastructure should be transported from site and stored for refurbishment and re-use. Any material that can be recycled, should be recycled locally where possible or at the nearest available facility.

4.6 Post-Decommissioning Seabed Review

Following the removal of equipment and associated infrastructure, the seabed should be inspected using underwater video survey.

5 Summary

This report provides an overview of lessons learned from Nova's decommissioning of the Nova 30 kW turbine, the decommissioning plan for the Shetland Tidal Array, and a review of publicly available documentation on marine decommissioning more generally. Decommissioning of tidal turbines is a novel topic given that many installations have only been deployed relatively recently and are well within their design life. The guidelines and best practices will continue to evolve based on experience of future decommissioning and will therefore further drive down the levelised cost of energy for tidal turbines.

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