SCOTTISHPOWER
RENEWABLES

ScottishPower Renewables
Proposed Orcadian Wave Project
Preliminary Decommissioning Plan

March 2012

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1.0 INTRODUCTION

Figure 1.1: Pelamis P2 under tow

ScottishPower Renewables (UK) Ltd. (SPR) currently have consent to install and operate a 750kW Pelamis P2 (Figure 1.1) wave energy converter (WEC) at the European Marine Energy Centre (EMEC) wave test site at Billia Croo, Orkney during the summer of 2011. The Pelamis is a semi-submerged wave energy converter with a simple geometry configuration based on individual cylindrical segments linked linearly by universal joints. As waves pass down the length of the machine, the induced motions of the separate segments relative to one another are resisted by hydraulic rams. The device will be moored offshore in depths of greater than 50m by a unique mooring spread which enables it to self-reference itself and maintain a directional heading perpendicular to the predominant wave direction. The Pelamis P2 will be grid connected via the EMEC sub-station via an existing cable.

SPR are required to submit for approval to the Secretary of State at the Department of Energy & Climate Change a Decommissioning Programme in accordance with the requirements of Sections 105 – 114 of the Energy Act 2004. Consultation is required on the proposed decommissioning programme with a number of DECC specified stakeholders. A final report will then be produced taking into account the responses of this consultation process.

An environmental report was produced to support the application for consent applications under Section 36 of the Electricity Act 1989, Food and Environment Protection Act 1985 (FEPA) and the Coast Protection Act 1949 (CPA) associated with the proposed works back in 2007.

Additionally, a European Protected Species (EPS) Licence was also gained in relation to the Pelamis deployment. As part of the conditions relating to the aforementioned consents an Environmental Monitoring Plan (EMP) has been produced and has been agreed with Scottish Natural Heritage (SNH) and Marine Scotland Licence Operating Team (MS-LOT).

This report summarises the requirements and outline procedures for the decommissioning of the P2 Pelamis Wave Energy Convertor (WEC). This WEC shall be deployed at the European Marine Energy Centre (EMEC) wave test site in Orkney for ScottishPower Renewables (SPR).

For the avoidance of doubt, the decommissioning of the non technology specific project infrastructure such as subsea cables and onshore infrastructure has been excluded from the scope of the report. This infrastructure is already in place and is the responsibility of EMEC and, therefore, outwith the scope of this report. EMEC will include a Decommissioning Programme for the moorings components as an Annex to their overall site infrastructure decommissioning programme.

The proposals laid out in this report are based on the experience gained by the Pelamis Wave Power (PWP) to date and on current industry best practice. The exact details of the decommissioning programme will be established through consultation with stakeholders and the Department of Energy & Climate Change (DECC) guidelines on the decommissioning of offshore renewable energy installations in accordance with the requirements of the Energy Act 2004.

1.1 COMPANY OWNERSHIP STATUS

ScottishPower Renewable Energy Limited, the parent company of ScottishPower Renewables (UK) Limited (SPR), is a wholly owned subsidiary of ScottishPower UK plc.

SPR aims to continue to expand its renewables capacity in the UK in order to help the Scottish and UK Governments to meet their 2020 electricity generation targets from renewable sources. This includes the development of some of the newer renewable technologies including wave and tidal renewables. The installation of the Pelamis P2 machine at the EMEC test berth is part of the phased development programme which SPR is undertaking to achieve its marine renewables ambitions.

1.2 PELAMIS P2 TECHNOLOGY

SPR intend to deploy the wave energy converter (WEC) known as the Pelamis P2, which has been designed and developed by Pelamis Wave Power (PWP). This technology is a semi-submerged wave energy converter with a simple geometry configuration based on individual cylindrical segments linked linearly by universal joints. As waves pass down the length of the machine, the induced motions of the separate segments relative to one another are resisted by hydraulic rams.

The Pelamis technology, which has been grid connected and tested in Orkney and Portugal, consists of main tube cylinders which are connected end to end via 'universal joints'. The end of each tube houses a power conversion "module(s)" (Figure 1.3). Each module houses an independent power generation system consisting of two separate hydraulic circuits. Located at the end of the modules are hydraulic cylinders which connect to the adjacent tube resisting wave induced joint movements.

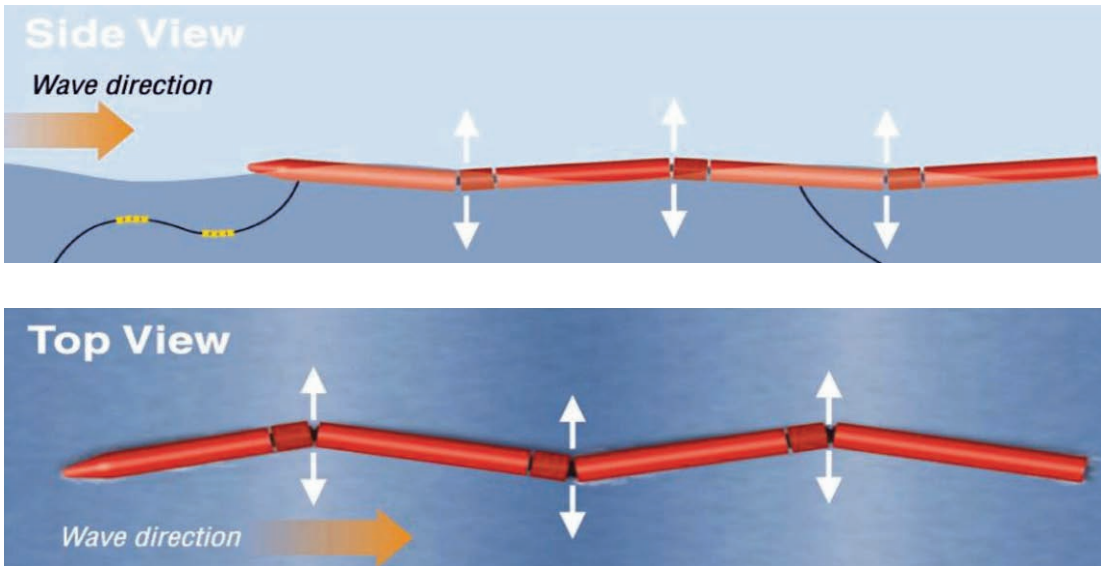


Figure 1.2: Graphical representation of the induced motion of the Pelamis P2 device.

The hydraulic rams drive pressurised fluid into power smoothing, high pressure accumulators which then direct the fluid through variable displacement motors and back to low pressure fluid reservoirs. The variable displacement motor is directly linked to an asynchronous generator producing a 3-phase voltage.

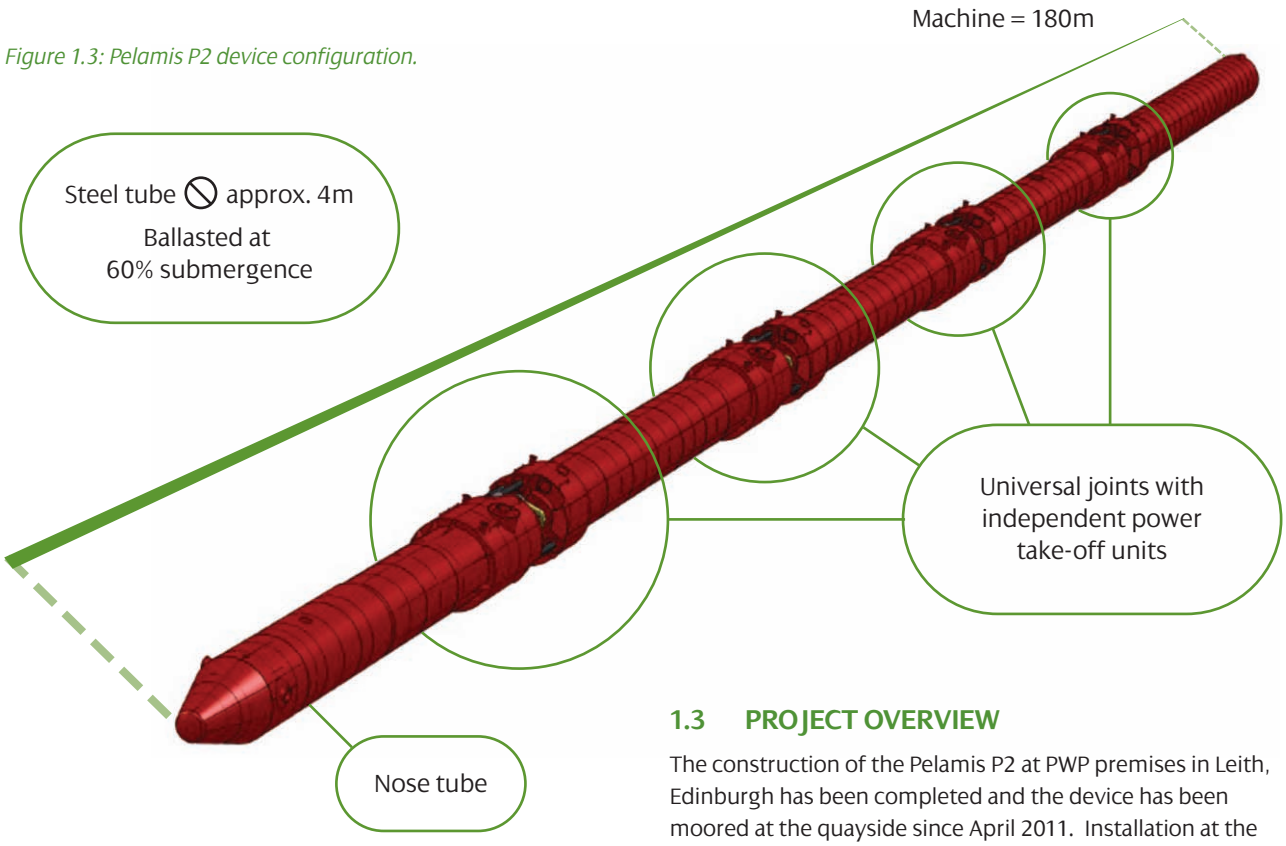
The maximum overall generating capacity of the Pelamis P2 machine is 750kW. The motor generator sets in each module feeds the produced electricity onto a 690V bus-line which runs the length of the device and feeds into a nose-mounted transformer. The transformer output is fed down to the seafloor via a flexible umbilical connector which is subsequently joined to a static high voltage cable on the sea bed taking the generated power to the shore and a suitable grid connection.

The device is moored offshore in a depth of approximately 50m by a unique mooring spread which enables it to self-reference itself and maintain a directional heading perpendicular to the predominant wave direction.

The P2 device can be completely removed from the Billia Croo site using a moderate sized vessel. The mooring system is secured to the seabed with gravity anchors so no piling operations are required, resulting in easier decommissioning/removal of this equipment.

SPR has taken a phased approach to their marine deployments aiming to de-risk the testing of the Pelamis technology by designing a staged development plan to allow learning input at each stage.

Figure 1.3: Pelamis P2 device configuration.



1.3 PROJECT OVERVIEW

The construction of the Pelamis P2 at PWP premises in Leith, Edinburgh has been completed and the device has been moored at the quayside since April 2011. Installation at the EMEC Billia Croo wave test facility is proposed for summer 2011. Once installed the device will be grid connected and will export electricity to the onsite EMEC sub-station.

The testing of the Pelamis P2 device will be undertaken in a controlled and staged manner starting in summer 2011 with an initial 2 year programme. The testing programme will focus on device performance and the development of operational procedures (e.g. installation/O&M techniques). A 5 year lease has been entered into with EMEC. The high level programme periods are:

- Q1 2010 – Q2 2011: Procurement and Build;
- Q4 2011 – Q3 2012: Proving Period; and
- Q4 2012 – Q3 2015: Operational Testing Period.

2.0 EXECUTIVE SUMMARY

ScottishPower Renewables (UK) Ltd. (SPR) currently have consent to install and operate a 750kW P2 Pelamis wave energy converter (WEC) at the European Marine Energy Centre (EMEC) wave test site at Billia Croo, Orkney. SPR are required to prepare a Decommissioning Programme under Section 105 of the Energy Act 2004 for submission to the Secretary of State. Consultation is required on the proposed decommissioning programme with a number of DECC specified stakeholders. A final report will then be produced taking into account the responses of this consultation process.

The decommissioning of the project aims to return the site, as far as is practical and desirable, to the condition it was in prior to installation. It will involve the complete removal of the Pelamis P2 machine. This will be returned to shore for re-use – potentially at another array site. All working practices will be governed by an environmental action plan and health and safety policy, in accordance with current legislation. Seabed restoration works will not be required as there will be no impact upon this environment from the P2 WEC itself.

It is expected that decommissioning will take place at the end of the project life of between 3-5 years. It may be that infrastructure components are changed/renewed within the timeframes of the complete project life, in such instances the obsolete component would be completely removed and taken back to shore for re-use, recycling or disposal and a replacement part installed. SPR will take into account the latest waste management techniques and legislation 6-months prior to the start of decommissioning activities. A schedule for the decommissioning programme will be determined closer to the end of the life of the project.

Members of the public will be able to view the Decommissioning Programme at the EMEC offices in Stromness or on the EMEC website www.emec.org.uk, and also on request from ScottishPower Renewables.

3.0 BACKGROUND INFORMATION

3.1 INSTALLATION SITE

The EMEC wave test site is located at Billia Croo, to the west of the Orkney Mainland some 2km from the town of Stromness. The location of the SPR Pelamis P2 test berth is at 58 58.922' North and 3 23.924' West. The average water depth at the berth is 50m.

The Billia Croo test facility is directly exposed to wind and sea swell from the Atlantic Ocean, although the prevailing wind direction is southwest and wave direction is from the west and northwest (Lawrence et al., 2009). Waves from other directions are also present at the test site. The largest significant wave heights are in the order of 11-12m with the maximum wave height being well above 20m (Lawrence et al., 2009).

The Orkney Islands are very exposed in nature and have a high frequency of gales (>34knots / 17ms-1) from the southwest to west, and strong winds (>18knots / 9ms-1) from the west-southwest and southeast, particularly from October to March. On the longest day, there are approximately 18 hours of daylight with no proper darkness; whilst on the shortest day there are generally only 6 hours of daylight.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Benthic Surveys

The subsea benthic sediments and communities have been investigated through a cable route survey (ICIT, 2002a) and a sublittoral survey (ICIT, 2002b), which focused on gathering baseline biological data.

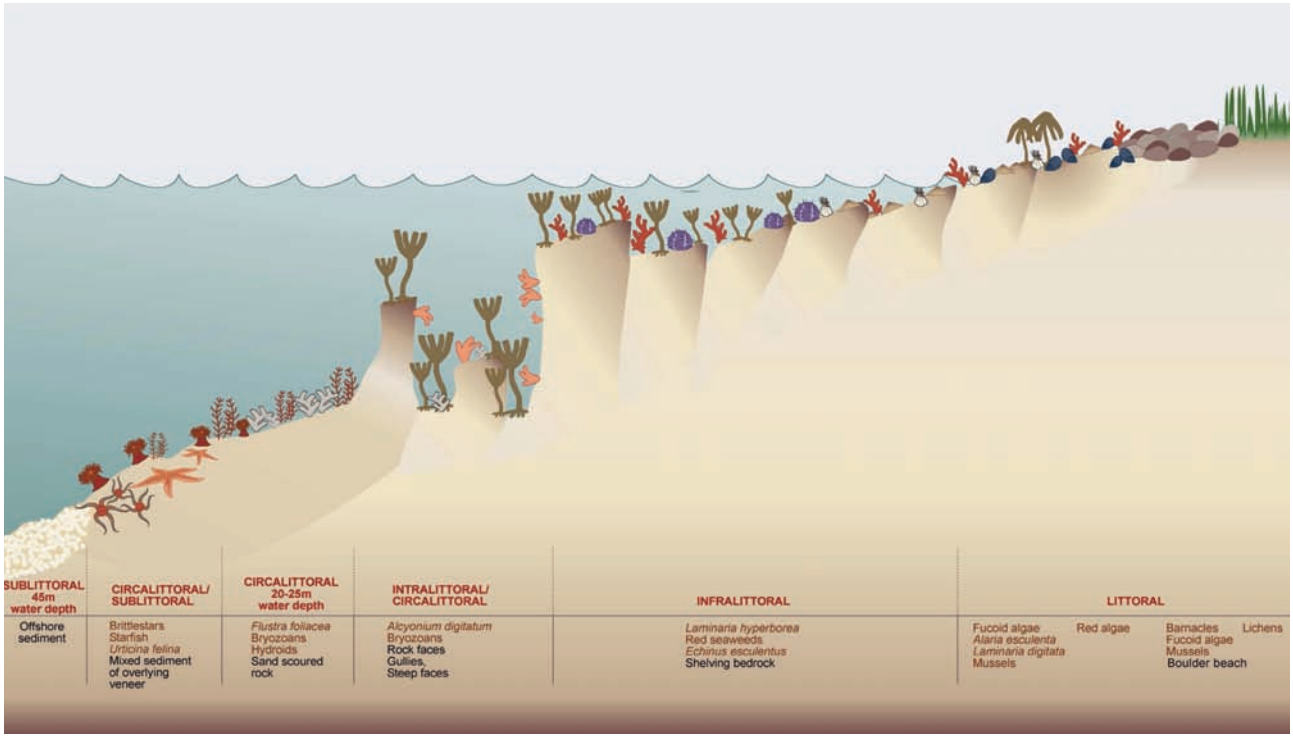
The benthic community present (see Figure 3.2) is dependent on, for instance, sediment type, water depth and hydrographic regime. There is a shift from bedrock to a broken boulder/stone seabed, to a sediment dominated seabed, as depth and distance from shore increase (ICIT, 2002a & b). Near-shore areas are dominated by dense kelp forests, which thin to kelp park in water depths of approximately 20-25m (Murray et al., 1999; ICIT, 2002a), with kelp disappearing after 32m. Fauna observed at the site is typical of hard substrata and exposed areas (e.g. Alcyonium digitatum, Echinus esculentus and Flustra foliacea). Locations within the site where broken boulder / stone substrata predominates tend to support a more diverse community consisting of F. foliacea and brittlestar biotopes.

Deeper surveys, in the range of 48-50m (where the proposed Pelamis P2 will be deployed) lay on the boundary between the predominantly boulder/stone seabed on the landward side and the sedimentary seabed on the seaward side. Analysis of core samples taken from the offshore sediment area indicates that the sediments are dominated primarily by polychaete worms followed by nematode worms, although in some samples polychaetes accounted for over 80% of sample species composition (unpublished data).

3.2.2 Birds

Although the Orkney Islands host a large number of important seabird populations there are not known to be any of national or international importance in the vicinity of the Billia Croo wave test facility. The wave test site area is locally important for certain seabirds (e.g. Guillemot, Kittiwake, Arctic Skua, Great Skua and Arctic Tern). Other bird species that are present within the Orkney archipelago are also present at the Billia Croo site in small numbers (e.g. Cormorant, Shag and Puffin). Waders are found within the intertidal zone and shallow subtidal. These include Oystercatcher, Redshank, Curlew, Turnstone, Ringed plover and Purple sandpiper. The highest numbers of seabirds in Orkney generally occur between April and September; whereas, waders and wildfowl numbers are at their greatest between August and February.

Figure 3.2: Schematic diagram illustrating community succession at the Billia Croo test area.



3.2.3 Marine Mammals

Harbour porpoise are known to be present in the area of the wave test facility at Billia Croo, with the most important time of year for them being between April and September. There are also regular sightings of Minke whale and Risso's dolphin and occasional sightings of white beaked dolphin. Records further offshore indicate that white sided dolphin, killer whale and pilot whale use the area for passage; however, there are no known resident populations in the area. Harbour seals are present within the area. Their nearest known haul-out is at Warebeth beach, where sightings of up to 50 individuals have been recorded.

3.2.4 Conservation

The area in the vicinity of Billia Croo has a number of conservation designations, noted for their local, national and international importance. The National Scenic Area (NSA), within which part of the the Billia Croo test facility sits, has been designated under Section 262c of the Town and Country Planning Act (Scotland) 1972.

Sites of Special Scientific Interest (SSSIs) are notified under the Wildlife and Countryside Act 1981. They are intended to form a national network of areas representing natural features of greatest value to wildlife and earth science conservation.

Special Areas of Conservation (SAC) is the main mechanism by which the EC Habitats Directive (European Commission (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) is implemented. Additionally, Special Protection Areas (SPAs) Birds Directive (Council Directive 79/409/EEC). Natura 2000 is the title for the network of areas designated to conserve natural habitats and species of wildlife which are rare, endangered or vulnerable in the European Community.

Under the European Habitats and Birds Directives and the transposing Conservation (Natural Habitats, & c.) Regulations 1994, as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 and The Conservation of Habitats and Species Regulations 2010, the competent authority (in this case the Scottish Government) must consider the effect of a development on European sites when considering whether to grant an application for consent.

The closest conservation site to the Billia Croo test site is Stromness Heaths and Coasts SAC and SSSI, which are approximately 1km away. Additionally, the Hoy SPA is approximately 2km to the south of the test facility.

3.3 HUMAN ENVIRONMENT

3.3.1 Fisheries

The sea area adjacent to Billia Croo is mainly utilised by trawlers in transit. The main fishing grounds to which they are travelling are further to the north and west of the test facility. Fishing along the west coast of the Orkney mainland takes place in water depths of approximately 58m (Carl Bro, 2002). Additionally, the use of mobile fishing gear is subject to a seasonal closure (May-September) to the west of Hoy and the Orkney Mainland, made under the Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 1989. The purpose of this closure is to protect fish nurseries in the area. Fisheries for lobster, edible crab, green crab and velvet crabs occur within the vicinity of the wave test centre year round (weather dependent) in 33-38m of water.

3.3.2 Other Vessel Traffic

The wave test site is not an important location for recreational angling itself, but sea angling vessels to transit the area en route to, for instance, Marwick Head. Similarly the site is not a major location for recreational diving, although Orkney Dive Boat Operators Association vessels use the area for passage to diving sites in the north. Additionally, sailing vessels are known to pass through the area on passage to and from Stromness marina.

The wave test site is located within a charted area to be avoided (ATBA). This is an area to be avoided by vessels >5,000grt with oil or other hazardous cargoes being carried in bulk. Other than the cables associated with the wave test facility, there are no pipelines or other cables charted within the Billia Croo area (Hydrography of the Navy, 1993).

3.3.3 Harbour Facilities

Lyness will be utilised for maintenance activities and temporary berthing of machines. Other harbour facilities are also likely to be utilised for the berthing of vessels (e.g. the Voe Viking [see Appendix 1] in Stromness Harbour). All activities involving harbours and / or vessel movements will be undertaken in full consultation with Orkney Islands Council Marine services Department. The timings of works will also be undertaken to avoid, wherever possible, the use of the area and facilities by the regular ferry services that operate in the area.

3.4 PROXIMITY TO OTHER DEVELOPMENTS

Of the five cabled test berths at the EMEC Billia Croo test facility only one is currently occupied. This relates to another Pelamis P2 machine that has been installed by E.ON. It is the adjacent berth to this machine at which the SPR Pelamis P2 will be installed. By the time this occurs Wello Oy should have their 'Penguin' device installed at the test facility and Aquamarine Power are also looking to install their next generation 'Oyster 2' device at the site during 2012 .

4.0 DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

4.1 GENERAL

It will be a requirement prior to any de-commissioning activities to perform an assessment to determine whether complete removal of all components is beneficial to the marine environment. If benefit is confirmed, the complete system will be removed as outlined below.

- Removal of Pelamis P2 machine from offshore site;
- Tow of Pelamis to identified de-commissioning/ holding site;

Following completion of the above activities, and those planned by EMEC with regards the electrical and mooring components, the site will be left without any components associated with the Pelamis system.

Figure 4.1: Pelamis under tow.

4.2 PELAMIS RECOVERY AND TOW

The planned removal of the Pelamis machine from the offshore site to a harbour facility is part of the normal operation and maintenance (O&M) methodology for the operation of this device. This design feature allows for the safe and speedy removal of the machine to safe haven for inspection, maintenance and/or repair. Similarly, in the event of machine decommissioning the machine would be removed as per this standard procedure, as already demonstrated in operating with such machines in Orkney and Portugal. This operation can be carried out by a tug or large multi-cat type vessel without the need for manned access to the machine are carried out remotely

Following the removal of the machine from site it will be towed to the normal O&M site and then onto the decommissioning site, the location of which to be determined nearer the time. As with the machine removal from site, any towing operation will be as per normal procedures with any specific additional requirements as a result of the proposed towing route and destination.

During this operation, appropriate navigational marking will be used to address any risks to mariners which may be posed the operation. Advice on appropriate marking will be agreed with Trinity House, Northern Lighthouse Board and the Maritime and Coastguard Agency (MCA). Towing shall be conducted in accordance with current MCA guidelines and any Marine Warranty requirements.

From arrival onsite to tow of machine commencing PWP have demonstrated this operation in 20-30 minutes. Removal of the Pelamis machines will only be carried out in suitable weather conditions with a significant wave height of less than 2.5m.

4.3 MACHINE BREAK-UP AND RECYCLING

As part of the decommissioning exercise the machine shall be removed to a suitable location (see Figure 4.2) for its dismantling, recycling and/or disposal . With the predominant construction material being steel such an activity would use the same techniques and facility as would be utilised for the breaking of ships, therefore this work shall likely be undertaken at a shore facility such as a shipyard / breakers yard harbour and/or drydock. Here the individual components can be safely disassembled and major structural components can be recovered for reuse. For an indicative list of constituent components see Table 4.1.

Figure 4.2: Pelamis Machine in Drydock – a potential location for machine break-up.

TABLE 4.1:
Likely constituent materials for the Pelamis P2 device.

MATERIAL (MACHINE)	APPROXIMATE QUANTITY PROPOSED	WASTE MANAGEMENT
Steel (various grades & alloys)	800t	Recycle or Reuse
Ballast (sand/steel)	600t	Reuse or Disposal
Copper (incl. wiring & generator windings)	<4t	Recycle or Reuse
Rubber (incl. seals)	<3t	Recycle or Disposal
Plastics (assorted components)	<1t	Recycle or Disposal
Batteries (200Ah lead-acid batteries)	x24	Recycle
Transformer fluid (Midel 7131)	<700lt	Recycle
Hydraulic fluid	<8,000lt	Recycle
External paint (EPIGRIP M922 & RESISTEX C173V2)	1400lt	Disposal
Internal paint (EPIGRIP C400V2 & RESISTEX C173V2)	150lt	Disposal
Anti-Fouling paint	Currently none	-

5.0 DESCRIPTION OF PROPOSED DECOMMISSIONING MEASURES

The Pelamis P2 device can be completely removed from the Billia Croo site using a moderate sized vessel (e.g. a multi-cat vessel such as the Voe Viking [see Appendix 1]).

All decommissioned equipment will be transported to shore; no materials will be disposed of at sea. Surveys of the systems and equipment close to the end of their life will decide to what extent components and materials can be reused. The majority of the remaining material, including the hydraulic oil, will be recycled. Disposal at a licensed facility will only be considered where no other viable option is available.

Table 4.1 indicates the main constituent materials for Pelamis P2 and the proposed waste management solutions for each one.

The port or shipyard where landing and break-up of the equipment will be decided at the time of decommissioning. However, the proximity of North Sea related support industries and facilities in the North of Scotland provides cost effective options for the disposal and breakup of this equipment.

If relevant, the position, surveyed depth and dimensions of any remains will be forwarded to the British Hydrographic Office, the Kingfisher Information Service and other relevant stakeholders in advance, in order to document and chart the remains and inform local users of the sea.

5.1 SAFETY

All decommissioning work undertaken at EMEC will be carried out under the requirements of ScottishPower Renewables Health and Safety Management System and the site operator's safety management system. A health safety and environment management plan will be produced with applicable risk assessments and safe systems of work deployed to ensure the safety of all personnel involved in the decommissioning works. This plan will be agreed by both parties before any works are undertaken.

The offshore Hazard Identification and Risk Assessment (HIRA) shall be carried out for all offshore activities. This will have been performed in order to identify any task specific hazards related to carrying out the removal works. In addition to the hazards detailed in the HIRA document, the following generic safety issues will also be addressed.

- No personnel to stand beneath suspended loads during lead-out onto the vessels.
- Ensure all lift rigging has valid certification.
- Brief all relevant personnel with the decommissioning plan and activities.
- VHF communications between deck, bridge, and trail tug to be confirmed prior to any deployment operations.
- All personnel accessing stern roller deck area to wear life preservers.
- Machinery spaces to be oxygen checked / ventilated prior to entry.

6.0 ENVIRONMENTAL IMPACT ASSESSMENT

A device specific Environmental report was undertaken in 2007 to sit beneath the umbrella Environmental Impacts Assessment (EIA) already undertaken for the EMEC Billia Croo wave test facility (Carl Bro, 2002). This supported the Section 36, CPA and FEPA licences for the installation of a Pelamis array. Since this was first submitted, and consents gained, the array has reduced in the number of devices to be installed. This currently stands at one device, with the potential for others to follow; therefore, there remains the requirement for Section 36 consent. The environmental report identified the potential impacts of the Pelamis device through the installation, operation and maintenance procedures. In addition to the identification of the potential impacts the environmental report also identified mitigation measures to reduce the effects of any potential impacts. The environmental report also contains a table of commitments made to implement these measures.

Decommissioning is essentially the reverse of the installation process; however the duration of operations are expected to be less. Any disturbance to the environment in terms of noise is, therefore, likely to be reduced in its temporal scale, although not its absolute levels. Thus, at this stage of the project programme, it is considered that the potential impacts upon the environment are covered by the original environmental report and that there are no additional potential impacts being introduced through the decommissioning procedure. As the date for decommissioning approaches the environmental report will be revisited and any additional issues will be addressed through the production of an addendum to this document.

7.0 CONSULTATIONS WITH INTERESTED PARTIES

The following list of bodies will all be contacted as part of the consultation process on the decommissioning plan for the Pelamis P2 device. This list of appropriate parties was provided by EMEC after consultation with DECC. Responses received will be included into the final decommissioning plan submitted to DECC. Additionally, the decommissioning plan will be made available for public viewing at EMEC's offices, Stromness, Orkney as well as on request from ScottishPower Renewables.

- Chamber of Shipping;
- European Marine Energy Centre (EMEC);
- Historic Scotland (HS);
- Marine Scotland: Compliance;
- Maritime and Coastguard Agency (MCA);
- Northern Lighthouse Board (NLB);
- Orkney Dive Boat Operators Association (ODBOA);
- Orkney Fisheries Association (OFA);
- Orkney Fishermen's Society (OFS);
- Orkney Islands Council (OIC);
- Orkney Islands Council Marine Services;
- Royal Society for Protection of Birds (RSPB);
- Royal Yacht Association (Scotland) (RYA);
- Scottish Environment Protection Agency (SEPA);
- Scottish Fishermen's Federation; and
- Scottish Natural Heritage (SNH).

DECC will also conduct its own consultation with statutory consultees upon receipt of the updated draft decommissioning plan from our own consultation. We will further update the draft decommissioning plan subject to further comments from statutory consultees and DECC.

8.0 COSTS AND FINANCIAL SECURITY

Information related to finance is deemed to be commercially sensitive and has not been included here. ScottishPower Renewables will provide adequate financial security in order that all obligations documented within the Decommissioning Plan can be met. These financial details relating to security will be approved by the Secretary of State at the Department of Energy and Climate Change.

9.0 SCHEDULE

Although the design life of the Pelamis P2 machine is 20 years, it is expected that decommissioning will occur in 2015, after which the decommissioned machine will be sited at a different project location for further testing/operation. Towards the end of the life of the project a detailed schedule will be produced, drawing upon experience gained from existing projects and other industry good practice. This schedule will show the planned dates (with allowance for weather conditions) that decommissioning will commence and is likely to finish.

The following are indicative of the overall timescales that are involved, although times indicated do not allow for weather window interruptions:

- 1-2 weeks - machine removal to appropriate, previously designated facility.
- 2 months - strip down and recycling/scrapping of machines.

10.0 PROJECT MANAGEMENT AND VERIFICATION

Within the detailed schedule, which will be drawn up by SPR towards the end of the life of the project, relevant verification to Government concerning progress and compliance will be provided once the final review of the decommissioning programme has been undertaken. The decommissioning works will be project managed by SPR.

11.0 SEABED CLEARANCE AND RESTORATION OF THE SITE

As there will be no impacts upon the seabed through the Pelamis P2 WEC removal it is not deemed necessary to carry out a seabed survey after the decommissioning process.

12.0 POST-DECOMMISSIONING MONITORING, MAINTENANCE AND MANAGEMENT OF THE SITE

This is not thought to be required, given the reasons in Section 11. Therefore, there are no further plans to carry out any subsequent monitoring, maintenance or management of the site.

13.0 SUPPORTING STUDIES

1. ScottishPower Renewables (2007). Environmental Report: Multiple Wave Energy Converter Project.

14.0 REFERENCES

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EMEC (2005). Environmental Impact Assessment (EIA): Guidance for Developers at the European Marine Energy Centre. Accessed at http://www.emec.org.uk/pdf/EMEC_EIA_Guidelines.pdf

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APPENDIX 1 – VOE VIKING MULTI CAT

Delta Marine Ltd Lerwick

tel: 0044 1595 694799 fax: 0044 1595 692685

" Voe Viking"

Damen Multi Cat® 2611

General

Type of vessel	: Damen Multi Cat 2611
Yard number	: 1563 – Damen Shipyards Hardinxveld
Basic functions	: Anchor handling, dredger service, supply, Towing, hose handling, survey, ship assist
Classification	: Bureau Veritas I ✠ HULL • MACH Tug : Unrestricted Navigation : Nat. Authorities : MCA workboat class 1 : 150 miles from shore

Dimensions

Length o.a.	: 26,00 m
Beam o.a.	: 11,50 m
Depth at sides	: 3,50 m
Draught aft (min)	: 2,25 m
Displacement	: 515 ton (m)

Tank capacities

Fuel oil	: 110,00 m^3
Black/grey water	: 9,20 m^3
Fresh water	: 52,00 m^3
Dirty oil	: 1,70 m^3
Ballast water	: 55,00 m^3

Performances

Bollard pull	: ± 33 tons
Speed	: ± 10,0 knots

Propulsion system

Main engines	: 3 x Cummins KTA 38M0
Total power	: 1791 bkW at 1800 rpm
Gearboxes	: 3 x Reintjes WAF 464 5,591:1
Propulsion	: 3 x fixed pitch propellers in nozzles, 1700 mm
Bowthruster	: hydraulically driven 200 kW, 360°

Auxiliary systems

Generator sets	: 2 x Cummins 6 BT 5.9-D 89 kVA each
Hydraulic power	: Cummins N14-M 400 kW
Transfer pumps	: Fuel and fresh water 50 m^3 /hr

Deck lay-out

Deck cranes	: 2 x Effer 180.000 3S, 10T at 16 m
Towing winch	: 500 m x Ø 36 mm, 30 T pull
Anchor-handling	: 100 m x Ø 56 mm, 100 T pull
Tugger winch	: 100 m x Ø 20 mm, 13 T pull
Towing hook	: 1 x Mampaey 33 T
Spud poles	: 2 x Ø 550 mm, 15 m
Bow- / Sternroller	: 150 T S.W.L. 5m, Ø 1000 mm
Capstan	: 5 tons

Accommodation

Comfortable heated and air-conditioned accommodation for 6 persons, in 3 cabins, galley, sanitary facilities, etc.
Seating for 12 day passengers

Nautical and communication equipment

Radar system	: 2 x Furuno FR 1505 MKIII
Compass	: Observator MKIV
Gyro compass	: Tokimec ESN.110 N
Echosounder	: Furuno FCV 581
D-GPS	: Furuno GP – 80
GPS	: Furuno GP - 33
GPS Chart Plotter	: Selwa Barramundi
Autopilot	: Radio Zeeland, Sea Pilot 75
Nav-tex	: Furuno NX 500
VHF	: 2 x Sailor RT 4822 / DSC
VHF H/Held	: 3 x Water proof ICOM
Inmarsat-C	: Furuno Felcom 15
SSB	: Yaesu – FRG 100
U.P.S. system	: APC 1600 W – 220V

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