REFERENCE	DTI Technology Road-map – Wave Energy
Title:	DTI Technology Road-map – Wave Energy
Date:	2002
Author:	DTI & Ove Arup
Funded by:	UK Department of Trade & Industry (DTI)
Hard copy reference:	ETSU V/06/00187//REP; DTI Pub/URN 01/799 (for Ove Arup report)
URL:	http://www.berr.gov.uk/files/file15410.pdf (DTI Report) http://www.berr.gov.uk/files/file17767.pdf (Ove Arup Report)
Date accessed:	January 2007
Web Format:	pdf
IEA topics covered	IEA Ocean Energy Task II
Geographical focus:	UK
Brief Abstract:	The DTI Technology Route Map was developed in conjuction with a review of wave energy technology undertaken by Ove-Arup. The DTI document identifies the current status of the technology in the UK and worldwide. A number of R&D issues are highlighted in the document, but no detail is provided on the actual research required to tackle the challenges listed. The document stresses the need to provide a low risk and more economic path for the development of technology from model tank tests towards meaningful scale prototypes. From the Ove-Arup report it was concluded that there are no technical barrriers to the implementation of wave energy devices, and that there is an opportunity for technology transfer from the offshore industry. Marine renewable devices have to be developed within much tighter financial margins than offshore oil and gas infrastructure, and hence the cost of suitable offshore technology needs to be reduced if this transfer is to take place. A technology roadmap of activities with proposed target dates is tabulated, based on the findings of the Ove-Arup report. This roadmap is generic in nature to take into account the differences between devices, and it is designed to assist the DTI in the management of its own R&D funding programme. Activities are divided according to whether the device is a well established concept currently being supported under the DTI programme or a new concept. Some established concepts have fulfilled the target activities and more or less within the time-scale defined. It is not clear how many new concepts have met targets, because very little information on new devices being developed is available in the public domain, and it is a continuous process.

OUTPUTS	
Short Report?	YES
Major report?	YES (Ove Arup Report)
Visualisations?	YES
Information held on dedicated software?	NO

- which package?	

ARCHITECTURE	
Timescales used:	Short term 2002-04 Medium term 2004-06 Long term up to 2010
Trends and drivers?	YES
- list	• Availability of a vast marine energy resource around UK • CO2 free generation • significant contributor to UK electricity generation, providing greater supply diversity. • Strengthening UK industrial competitiveness by providing a domestic industry. • significant export potential. • Isolated off-grid applications, as well as grid-connected power plants • Offshore renewables offers UK offshore industry an opportunity to diversify / exploit existing skills and experience.
Enablers?	YES (referred to as UK industry strengths)
- list	- UK R&D experience in the development and evaluation of wave energy conversion devices - strong offshore and marine engineering capabilities, turbine manufacturing, and civil and hydraulic engineering industries.
Performance measures/targets?	YES
- list areas	Table I Established concepts

Activity	*Target Date*
Reduce risk and uncertainty of key components.	End 2002
1/10th scale (or larger) prototype testing in real, meaningful sea environments	End 2002
Evaluate potential of concepts for further development	End 2003
Develop ½ or 1/3rd scale prototypes based on evaluation above and test in an offshore environment. Include Electrical aspects and evaluate the long term performance.	End 2004
Further develop projects on components where innovation is	End 2004

	required. | Report on performance of prototypes & prospects for commercial development. | End 2010 Table II New Concepts *Activity* | *Target Date* Complete initial feasibility studies and design evaluations. | 2003 Further evaluation at 1/50 to 1/20 scale, with more detailed design engineering and cost studies. | 2004 Take forward attractive concepts to typically 1/10th scale tests in a realistic sea environment. | 2006
Mapping of RD&D activities?	YES
Critical assessment of capabilities?	YES (in Ove Arup Report)

PROCESS	
Methods used:	
- Desk study?	
- Consultation	YES
- Interviews?	YES
- Facilitated workshop(s)	YES
- Working groups/task force	YES
- Integrated Process	YES
Stakeholders engaged:	
– University based researchers	YES
– Other public sector researchers	NO
– Business – technology	YES
– Business – other	YES
– Government - energy	YES
– Government – SET	YES
– Government - other	YES
– NGOs	NO
No of people engaged:	c.30 attendees at a workshop
Budget (if known):	No known
Commitment to re-visit?	no

ACTIONS IDENTIFIED	
List of actions?	YES
Actions listed according to timescale?	YES – see Performance Measures & Targets above
Actions prioritised?	YES
Sequencing/dependencies identified?	Limited
Responsibility for actions identified?	NO
Types of actions identified:	No actions are listed, but recommendations are

	made – see below in Other types of action.
- Basic research?	
- list areas	
- Applied research?	
- list areas	
- Development & demonstration	see Performance Measures & Targets above
- list areas?	
- Other types of action?	There are a large number of specific recommendations in the Ove Arup report (below).
- list other types	• Promote co-ordination within the industry • References of previous technical work on Wave Energy to be compiled. • Costing Database and Industry Guidelines for Construction, Installation, Operation • and Maintenance activities of future WECs, (also relevant to offshore wind). • Contacts List of interested parties; WEC design teams, operators, verification bodies, contractors, suppliers, technologists in WEC development or in related technologies. • Reliability Database References; sources of information for construction materials and equipment. • Offshore Industry guidelines on the use of appropriate structural design codes and verification. • Offshore Industry guidelines for construction and marine operations planning. • Operator and Design feedback from the recently developed West of Shetlands Fields would be beneficial; i.e. BP Foinaven and Schiehallion. • Oil and Gas Operator's Metocean data for identification of tow and installation weather windows. • Grid company information on the best locations to connect WECs to the electrical grid. • Offshore oil and gas industry inspection and monitoring procedures for remote facilities. • Use of synthetic ropes and taut moorings. • Proprietary systems to reconfigure or download different control schemes (strategies). • Self diagnostics and auto testing control schemes. • The use of proprietary systems to optimise control strategies. • SCADA and communications systems. • A study to identify the potential locations for

	a prototype test facility for connection to the electrical grid. Input will be required from WEC teams and grid companies. • A study to identify the capacity of the grid at specific locations identified above. • Investigation into the potential for fault detection and effective intervention strategies in grids. • Testing and development of power conditioning modules for use in WEC systems. • A series of mooring studies relevant to the different types of WECs. • Generic mooring detail studies; long term fatigue issues of lines and connection points, standard connector designs for the quick release and re-attachment of mooring systems and subsea cables. • A series of turbine trials undertaken in one facility to test the various turbines and their efficiency. • Enhanced modelling techniques for systems involving multiple devices. • Research into real time forecasting of detailed wave time behaviour. • Development of hydraulic systems based on water or other environmentally acceptable fluids. • A standardised, flexible electrical connector. • Research and development to continue to drive down the costs of cable and connector fabrication and cable laying. • Development of hydraulic machines (motors with low part load losses, high torque pumps). • Storage of energy. • Build investor confidence by proving the technology • The Offshore Wind and Wave Energy Industries should work together