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For more information about the OES-IA please visit the website [www.iea-oceans.org](http://www.iea-oceans.org)



## Introduction

Delegates from 10 of the 19 member countries of the *IEA Implementing Agreement on Ocean Energy Systems* participated in the 20th Executive Committee Meeting, in Washington, DC, USA (26–27 April 2011). This meeting was organised jointly with the 4th Annual Global Marine Renewable Energy Conference in Washington, DC (28–29 April 2011) in the same venue, the Almas Temple.

Following a proposal from the OES-IA Executive Committee, a panel session “OES-IA Country Reports” was included in the first day of the Conference. In this session, nine member countries presented their country reports, in terms of Research and Development (R&D), Government policies, devices deployments and projects. This bulletin highlights the 2011 achievements on these three topics presented in that session.

Annex I of the OES-IA work program is the central information collation and dissemination Annex on the technical, economic, environmental and social aspects of ocean energy systems. It also contributes to the definition of future priorities for the Implementing Agreement as a whole.

## CHINA

*Dengwen Xia, National Ocean Technology Center*

Since 2008, the State Oceanic Administration (SOA), has been responsible for the overall coordination of ocean affairs in China, including management of funding programmes and formulation of policies for marine energy. Following the amendment of the Renewable Energy Law, in December 2009, the State Oceanic Administration has drawn up an ocean energy development plan and incentive policies for promoting the utilisation of marine energy. In 2010, **SOA initiated a special funding programme to accelerate the utilisation and commercialisation of ocean energy with a level of funding of US\$ 43 million per year.**

China has a long tradition of ocean energy R&D. In the years 70–80s, three tidal barrages were built, in Jiangxia (3.9 MW), Haishan (250 kW) and Baishakou (640 kW).

### Member countries

2001	Denmark Portugal United Kingdom
2002	Ireland Japan
2003	Canada
2005	USA
2006	Belgium
2007	Germany Mexico Norway
2008	Spain Italy New Zealand Sweden
2009	Australia
2010	Korea South Africa
2011	China

### MISSION

To facilitate and co-ordinate ocean energy research, development and demonstration through international co-operation and information exchange, leading to the deployment and commercialisation of sustainable, efficient, reliable, cost-competitive and environmentally sound ocean energy technologies.

Different wave energy systems were investigated and a few onshore devices were built (3–100 kW). In 1998, a 70 kW “Wanxiang-I” floating tidal current turbine was built, which was replaced in 2002 by a 40 kW “Wanxiang-II” bottom-mounted turbine. Within the special funding programme, several R&D projects are in progress, from small-scale laboratory testing to small-scale sea trials. A few technology demonstration projects have been initiated, including:

- The development of an offshore pilot zone and testing site for wave and tidal current projects;
- A 10 MW tidal power plant feasibility study, engineering and design project.
- Two hybrid power demonstration systems in Dagan Island using different sources of renewable energy, including wave energy technologies.
- A 1 MW tidal current power plant demonstration project in Guishan Channel of Daishan, with the ‘OpenHydro’ turbine.

## Australia

*Tom Denniss, Oceanlinx*

In Australia numerous grant schemes are in operation for the development and deployment of renewable energy. These grant programmes are all associated with Government institutions set up to address climate change. Among these is the Australian Centre for Renewable Energy (ACRE), which is overseeing the A\$435 million Renewable Energy Demonstration Program (REDP). More recently, ACRE has indicated the likely establishment of a A\$100 million venture fund for emerging renewable energy. Ocean energy was specifically stipulated as one of the target industries for this fund.

The **Australian Government's REDP fund** awarded OPT a A\$66.5 million grant for a 19 MW wave energy project in Portland, Victoria. The project is to be developed in conjunction with the large Australian construction company, Leighton Holdings.

**Oceanlinx** supplied electricity to the local grid via its third demonstration unit in Port Kembla. Oceanlinx has now finalized the full-scale commercial projects of both its shallow and deep water oscillating water column (OWC) designs. These latest versions of the Oceanlinx technology have been named greenWAVE and blueWAVE, respectively.

**BioPower Systems** is currently dry-testing its power conversion modules at a factory facility in Sydney. The first ocean deployment of a bioWAVE device is currently planned to occur near Port Fairy, Victoria.

**Carnegie Corporation (CETO)** continues to develop its 5 MW project off Garden Island, near Perth in Western Australia. The project is partially funded by a A\$12.5 million grant from the Western Australian Government.

Other companies developing technologies in Australia include Wave Rider Energy Pty Ltd, Perpetuwave, Elemental Energy Technologies, Advanced Wave Power, Cetus Energy, Sundermann Water Power and Protean Energy.

## New Zealand

*John Huckerby, AWATEA*

The new Government released a New Zealand Energy Strategy (NZES) for consultation in early April 2011. Among new governmental initiatives are the launch of the National Policy Statement on Renewable Electricity Generation and the creation of an Environmental Protection Agency within Ministry for the Environment.

Applications to the 4th (and final) round of the **Marine Energy Deployment Fund (MEDF)** closed in late November 2010 and awards are expected to be announced in May-June 2011.

The Government continues to fund three R&D projects, two of which are undertaken by the National Institute of Water and Atmospheric Research (NIWA). A third R&D project is the development and construction of a floating wave energy system, the **Wave Energy Technology-New Zealand (WET-NZ)**. A ½-scale prototype is presently under construction in Christchurch (Lyttelton port). This technology has been tested with a ¼-scale device since 2006. In September 2010 the WET-NZ consortium was awarded US\$1.8 million to deploy another ½-scale device offshore the Oregon coast.

In May 2009, a new project was announced by **Chathan Islands Marine Energy Ltd** for construction of an onshore wave energy plant of the oscillating water column type on the main Chatham Island (800 km east of NZ). In July 2010, the company granted NZ\$ 2.16 million in the 3rd round of MEDF funding. Resource consent has already been granted.

In March 2011 **Crest Energy Limited** was granted consents to construct a marine tidal turbine power station in the mouth of the Kaipara Harbour in Northland, northern New Zealand, after 5 years duration of the permitting process.

Other companies developing or promoting wave and tidal projects in New Zealand include Tidal Power New Zealand, Tidal Flow Seamills and Tangaroa Energy.

From left to right: WET-NZ concept, ¼-scale prototype testing and ½-scale prototype under construction (New Zealand)



## Germany

*Jochen Bard, Fraunhofer IWES*

The ocean energy resource: the tidal range at the German coast is 2.2m (Borkum) up to 3.7m (Wilhelmshaven); the average wave energy resource is 10–20 kW/m (North Sea) and 5–10 kW/m (Baltic Sea); mean fresh water discharge to the North Sea is 1331 m<sup>3</sup>/s and to the Baltic Sea 117 m<sup>3</sup>/s, which represents a global potential for osmotic energy of 13 TWh. Total resources are in the range of 2% of electrical consumption. Therefore it is not among the priorities for energy policy in Germany.

Despite the small ocean energy resource, the actual German involvement into ocean energy projects is high: around 10 R&D institutions are involved in wave, tidal current and osmosis power projects in the framework of mainly European research projects. Further, around 20 companies are involved in system and component development and supply to different technologies, mainly in Europe.

**There is actually political interest to fund companies/institutes involved into international projects and to support development of sustainable energy technologies.** In this field, there is a fast-growing industrial sector and a high general public interest and media coverage in Germany.

**Voith Hydro Ocean Current Technologies**, a joint venture between Voith Hydro and RWE Innogy are progressing with the development of the tidal current concept named Voith HyTide. A 1/3 scale prototype (photo) is planned for installation in South Korea, by early spring 2011. The company is also progressing with the development and manufacturing of a full scale 1 MW prototype planned to be installed at the European Marine Energy Centre (EMEC) for testing with funding from the UK Marine Renewables Proving Fund (MRPF).



*Voith HyTide  
tidal current turbine  
(1/3-scale prototype)*

## Ireland

*Eoin Sweeney, SEAI*

On 6 May 2011 public consultation concluded on the draft **Offshore Renewable Energy Development Plan (OREDPP)** and Strategic Environmental Assessment, which describes the policy context for development of offshore wind, wave and tidal stream energy in Irish waters up to 2030.

The resource off the Irish coast was assessed for tidal energy (1.5–3.0 GW), wave energy at water depths between 0–100 m (12.5–13.6 GW), wave energy for water depths between 100–200 m (15 –17.5 GW), and for floating wind (25–27 GW).

Four test sites are in place or are being developed:

- Mayo Wave Test Site full-scale grid-connected (AMETS)
- Galway Bay site ¼ scale non-grid connected
- Strangford QUB tidal test facility
- Cork ocean energy test tank facility

An **Irish industry initiative** has proposed four coastal areas as “Development Zones” for marine energy development over the next decade, which will allow for a ‘joined-up’ approach to planning, grid, infrastructure and services issues.

**WestWave** is a collaborative project led by ESB International Limited to develop a 5 MW wave energy project off the west coast of Ireland by 2015. The project will be mainly financed by ESBI with significant financial support provided by EU NER300 funding. The technology partners, to date, are Aquamarine Power Limited, Pelamis Wave Power Limited, Ocean Energy Limited and Wavebob Limited.

The report “**Economic Study for Ocean Energy Development in Ireland**” released in July 2010 highlights that an appropriate level of investment in the ocean energy sector in Ireland could provide long-term sustainable growth and wealth creation. A new study is in preparation to identify key ports in Ireland for marine renewable development and shipping opportunities.



4<sup>th</sup> International Conference  
on Ocean Energy

17 – 19 October 2012, Dublin, Ireland

The Sustainable Energy Authority of Ireland (SEAI) is hosting this important conference in Dublin. It is a global marine energy event focused on the industrial development of renewable marine energy held every two years: [http://www.seai.ie/ICOE\\_2012](http://www.seai.ie/ICOE_2012)



## United Kingdom

*Henry Jeffrey, University of Edinburgh*

The new **UK Marine Energy Programme** held its first board meeting on 31 January 2011. Three working groups were set up to address future support needed for small scale arrays and early commercial deployment, planning and consenting issues and knowledge sharing through a Marine Intelligence Network.

Following the October 2010 Spending Review, the UK Government announced an investment of over £200 million in energy technologies, of which £60 million has been earmarked for offshore wind manufacturing infrastructure at port locations. Wave & tidal technologies are being considered as part of the evaluation process for the remainder funding. Public consultation of new banding proposals for the Renewables Obligation (RO) of all renewable technologies is planned for the summer of 2011.

**Wave Hub** is now open for business. The project holds a 25-year lease with necessary consents and permits for up to 20 MW of devices installed. At the European Marine Energy Centre (EMEC), subsea cables have been laid for the 3 additional berths. The new 3 MW Marine Drive Test "Nautilus" stand for NaREC is currently under construction.

Based on the findings of the **Severn Tidal Power Feasibility Study**, the Government decided that at the present stage it was not a strategic option, but recognised that factors, which will determine the feasibility of this power scheme, could change over time. Peel Holdings and the NWDA are financing a £3million, two-year feasibility study into tidal power options in the Mersey (200–700 MW). The final report was due to be published at the end of April, outlining their preferred option.

In Scotland, the Crown Estate has announced the names of the successful bidders for the **first commercial wave and tidal leasing round**, for eleven sites in Pentland Firth and Orkney waters. 1 GW for tidal and 600 MW for wave was proposed by developers for 2020.

The Crown Estate has designed a new approach to leasing for **Saltire Prize projects**. Companies will be invited to apply for projects of up to 30 MW installed capacity. The first application was opened on 11 October 2010 and a series of more five-month application windows are planned.

In Northern Irish waters, the Crown Estate launched a 'design discussion' in April 2011 to help shape the leasing and development process for commercial projects, which is planned to start later this year.

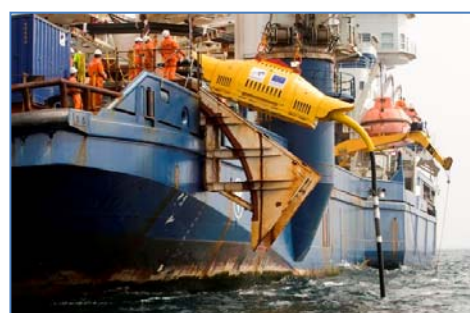
The Scottish fund called *Wave and Tidal Energy Research, Development and Demonstration Support (WATERS)* granted £13million to five marine energy projects: RWE npower, Aquamarine, Open Hydro, AWS Ocean Energy and Ocean Flow Energy.

In Wales the Welsh Marine Renewable Energy Strategic Framework (**MRESF**), was recently launched which aims to understand the marine resource in Wales.

**Scotrenuable** deployed their 250 kW device at EMEC at the end of March 2011. **Tidal Energy Ltd** were granted consent to install a 1.2 MW device in Ramsey Sound off the coast of Pembrokeshire. **Scottish Power** will deploy a second Pelamis P2 device at EMEC and collaborate with EON. **Aquamarine** plans to deploy their Oyster 2 this summer at EMEC.



*Scotrenuable  
250kW device,  
EMEC*



*Installation  
of the  
Wavehub,  
Cornwall*



**5 - 9 September 2011**

**University of Southampton, UK**

The European Wave and Tidal Energy Conference series (EWTEC) provides a global focus for all activities in wave and tidal energy conversion technology, research, development and demonstration.

**More information at: [www.ewtec.org](http://www.ewtec.org)**

## Spain

*José Luis Villate, Tecnalía*

A revision of the Spanish legal framework for ocean energy projects, concerning feed-in tariffs and specific support for demonstration projects, would be necessary to facilitate the achievements of 2020 targets (100 MW of installed ocean power). These targets have been recently confirmed by a draft of the Spanish Renewable Energy Plan 2011–2020.

In Spain, a detailed wave atlas resource for all Spanish coasts (**ENOLA**) has been released. This project was conducted by the Hydraulic Institute of Cantabria, with funding from the Spanish Energy Agency, IDAE.

One of the most important R&D initiatives in Spain, the **PSE-MAR project**, running for 5 years, was concluded in 2010. The total budget was €25 million, dedicated to the development of three wave energy technologies: PIPO, HIDROFLOT and the TECNALIA system. **OceanLider**, led by Iberdrola, is a second important R&D project which has been running since 2009 for a period of 3 years. It is a €30 million project with €15 million of public funding.

Within the **Santoña Wave Energy Project** promoted by Iberdrola, OPT has been developing an innovative Underwater Substation Pod™ (USP) for transmitting offshore power and data to onshore electric utility grids.

The **Mutriku oscillating water column (OWC)** plant of 16 OWC chambers, 18.5 kW each, was damaged in 2009 and repaired in 2010. The Voith Hydro Wavegen turbines were installed in 2011 and grid connection was announced for May 2011.

A small-scale prototype developed by PIPO Systems, the **WELCOME project**, is planned to be installed on Canary Islands, Spain. This system will be tested in the new facility 'PLOCAN' for oceanic research, created as a consortium of the Spanish Ministry of Education and Science and the Canary Islands Government.

The **Biscay Marine Energy Platform (bimep)**, a testing infrastructure for floating wave energy converters, is in progress. The estimated budget for this project is ca. €20 million. It is an area of 5.2 km<sup>2</sup> in 50–90 m water depth, with an overall capacity of 20 MW and 4 berths. An oceanographic buoy has been installed since February 2009 and the subsea cables will be installed in 2012.

In October 2010, Bilbao hosted ICOE 2011, the third International Conference on Ocean Energy organized by EVE & Tecnalía, which attracted around 1,000 participants, with 51% of industrial sector.

## Portugal

*Ana Brito e Melo, Wave Energy Centre*

On 20 October 2010 the contract of the **Wave Energy Pilot Zone** concession by the Portuguese Government was signed with the Portuguese National Grid (REN). REN established a fully owned subsidiary, ENONDAS, which is currently developing regulations, initiating the site survey and the engineering tasks. The Pilot Zone offers a total area of 320 km<sup>2</sup>, in water depths between 30 to 90 m.

Further, in October 2010 a market study for launching an **offshore energy test centre in Portugal** was commissioned by EnergyIN – *Energy Competitiveness Pole* in Portugal.

The public discussion of the **Maritime Spatial Plan (POEM)** was concluded in February 2011. The aim of this plan is to provide guidance for decisions relating to the concerned marine area. All activities and potential uses in the Portuguese maritime space were mapped.

In February 2011 the Government announced the preparation of an administrative simplification process to facilitate the approval of projects in the sea – the 'Simplex' programme, which is now open for discussion until 14 June 2011.

**Pico plant**, the 400 kW oscillating water column (OWC) in Azores has achieved important milestones: in early 2010 autonomous operation of the plant was achieved and by the end of 2010 the plant achieved 45 MWh and 1425 hours of operation.

**A new air-turbine** (Self-Rectifying Movable Guide Vane Axial-Flow Impulse Turbine) designed by IST-Instituto Superior Técnico was built by the Portuguese company Kymaner and installed in the Irish OWC floating device – Oebuoy – being tested in Galway Bay, Ireland.

The Finish company AW-Energy is pursuing the development of a **300 kW WaveRoller** demonstrator expected to be installed in the summer of 2011, offshore Peniche.

**WindFloat Prototype** is a floating platform with a Vestas V80–2.0 MW wind turbine, to be installed in 2011, in 40–50 m water depth. The system will be tested in Agucadoura – an EDP grid connected site – for a 12 month period, with focus on performance validation and turbine integration. The project is led by the consortium Principle Power, Energias de Portugal (EDP), InovCapital and A. Silva Matos.

**21st Executive Committee Meeting of the OES-IA**

13 – 14 September 2011  
Madeira Island, Portugal

## Canada

*Melanie Nadeau, Natural Resources Canada*

Two important governmental initiatives were launched in Canada last year, in April 2010:

- Nova Scotia's Renewable Electricity Plan
- British Columbia Clean Energy Act

Under these legislations, **feed-in tariff programmes are being developed** to foster the development of emerging technologies in renewable energy. In 2011, Nova Scotia issued draft feed-in tariffs for tidal power development.

The **Marine Renewable Energy Technology Roadmap**, currently being developed by Natural Resources Canada in close collaboration with the industry, is expected to be completed in August 2011.

The Fundy Ocean Research Center for Energy (**FORCE**) is Canada's leading research centre for in-stream tidal energy, located in the Bay of Fundy, Nova Scotia. FORCE is a non-profit institute, supported by both public and private funding, including the Governments of Canada and Nova Scotia and Encana Corporation. Common infrastructure will be completed in 2011. The following partnerships have plans for testing in FORCE: NS Power/OpenHydro, Alstom Hydro/Clean Current, Minas Basin/MCT and OpenHydro Atlantis/Lockheed Martin/Irving.

Other two **marine current developers active in Canada** are Mavi Innovations Inc which has completed ¼-scale testing at the National Research Centre, and New Energy Corp with projects planned for Canoe Pass, British Columbia and Grand Passage, Nova Scotia.

Companies developing **river in-stream technologies** in Canada include New Energy Corp, Sabella Énergie Inc, Clean Current, RSW-RER, Instream Energy and Verdant Power.

Among several **wave energy activities** ongoing in Canada are the development of SyncWave project, laboratory testing of SurfPower system, WET EnGen™ testing at Sandy Cove, Nova Scotia and the testing of the Wave-Power Pumping Buoy system developed by the College of the North Atlantic for testing in Lord's Cove (Canadian province of Newfoundland and Labrador).

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## United States of America

*Michael C. Reed, U.S. Department of Energy*

Since 2010 a new National Ocean Policy and Framework for Coastal and Marine Spatial Planning has been in place. Relevant industry support mechanisms have been launched, one of which is the **Technology Readiness Advancement Initiative** for wave and tidal energy. A \$37 million budget was allocated for funding 27 projects. Among those at a more advanced stage of development, is the deployment and test of two 1 MW 10-meter OpenHydro tidal turbines (Snohomish PUD), the commercial-scale array of five grid-connected tidal turbines by the Ocean Renewable Power Company and the OPT's 150 kW PowerBuoy for a 2 years test.

Another U.S. funding scheme in place is the combined programme Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR). **SBIR/STTR is the largest source of early stage technology financing in the U.S.** Seven R&D projects are active in USA, benefiting from this type of funding scheme. The new selected projects will be announced soon, expected to be initiated in June 2011.

Several demonstration projects are being developed during 2011, including:

- **Free Flow Power** to be deployed in the Mississippi River (LA)
- **Columbia Power Technologies** wave energy converter deployed in February 2011 in Puget Sound, WA
- **Verdant Power turbine** to be deployed in the East River, NY
- **Ocean Renewable Power Company** tidal turbine to be deployed in Maine's Western Passage
- **Ocean Power Technologies** 150 kW wave energy converter to be deployed in Reedsport, OR.

*Free Flow Power*



*Columbia Power Technologies*

