

Ocean Energy Systems Implementing Agreement: A New Collaborative Activity on Environmental Issues

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Abstract

The International Energy Agency's Ocean Energy Systems Implementing Agreement (OES-IA) is a working group of sixteen IEA member countries and the European Commission, which share a common interest in advancing ocean energy worldwide. Members of the OES-IA have been sharing efforts in 3 key areas:

- I) Review, Exchange and Dissemination of Information on Ocean Energy Systems,
- II) Development of Recommended Practices for Testing and Evaluating Ocean Energy Systems, and
- III) Integration of Ocean Energy Plants into Distribution and Transmission Electrical Grids.

In April 2009 the OES-IA launched a new collaborative task “*Assessment of Environmental Effects and Monitoring Efforts for Ocean Wave, Tidal, and Current Energy Systems*”.

This paper will present the various work programmes and publications of the OES-IA, present the current status of Ocean Energy technologies and barriers to technology penetration, thus contextualizing the relevance of the new task on Environmental Issues under the OES-IA work program.

Keywords: IEA, Implementing Agreements, Environmental Impacts, Marine Energy Converters

1 Introduction

The IEA Ocean Energy Systems Implementing Agreement (OES-IA) is one of 42 collaborative R & D work programmes or “*Implementing Agreements*” established within the IEA. The governments of Denmark, Portugal and the United Kingdom established the OES-IA in 2001 and presently OES-IA has seventeen members (16 countries and the European Commission. The representative members of the Executive Committee of the OES-IA see their Vision as:

“To realise, by 2020, the use of cost-competitive, environmentally sound ocean energy on a sustainable basis to provide a significant contribution to meeting future energy demands.”

The Executive Committee believes its Mission is:

“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.”

To accomplish its Mission, the Executive Committee has identified the following five-part strategy:

- i. To actively encourage and support the development of networks of participants involved in R, D & D, prototype testing and deployment, policy development, and

deployment, and facilitate networking opportunities.

- ii. To become a trusted source of objective information and be effective in disseminating such information to ocean energy stakeholders, policymakers and the public.
- iii. To promote and facilitate collaborative research, development, and demonstration to identify and address barriers to, and opportunities for, the development and deployment of ocean energy technologies
- iv. To promote policies and procedures consistent with sustainable development.
- v. To promote the harmonization of standards, methodologies, terminologies, and procedures where such harmonization will facilitate the development of ocean energy.

Implementing Agreements have a standard legal structure defining the commitments and rights of Contracting Parties. Contracting Parties undertake Tasks identified in “Annexes” to the Implementing Agreement. Contracting Parties designate one Operating Agent for each Task who is responsible for management of the collaboration. IA member Governments may participate themselves or designate another organisation in their country to represent them on the Annex. Industry bodies or other associations may participate as Sponsors with the approval of the IA Executive Committee.

2 Benefits

General benefits of international collaboration and cooperative activities under the OES-IA are the following:

- Shared costs and pooled technical resources
- Information sharing and networking
- Avoided duplication of effort and repetition of errors
- Harmonised technical standards
- A network of researchers
- Stronger national R&D capabilities
- Easier technical consensus
- Access to the information databases provided by the Members
- Linking research, industry and policy
- Accelerated research, development and demonstration
- Increased focus on deployment and diffusion
- Strengthened national R,D&D capabilities

Through their regular meetings, each member provides a well established platform where high-profile ocean energy issues can be addressed by experts and officials close to government policy making in each member country.

3 Membership

The seventeen members of the OES-IA, ordered by date of membership of the Agreement, are: Portugal, Denmark, UK, Japan, Ireland, the EC, Canada, the USA, Belgium, Germany, Norway, Mexico, Spain, Italy, New Zealand, Sweden and Australia. Several other countries having been invited to join: Brazil, Chile, France, India, The Netherlands, South Africa and Russia. The contracting parties to the Implementing Agreement are presented in Table 1 with continued growth since 2001 (Fig. 1).

Country	Contracting party
Portugal	INETI/LNEG
Denmark	Ministry of Transport and Energy, Danish Energy Authority
UK	Department of Energy and Climate Change (DECC)
Japan	Saga University
Ireland	Sustainable Energy Ireland (SEI)
EC	Commission of European Communities
Canada	Powertech Labs Inc.
USA	United States Department of Energy (DOE)
Belgium	Federal Public Service Economy
Germany	The Government of the Federal Republic of Germany
Norway	The Research Council of Norway
Mexico	The Government of Mexico
Spain	TECNALIA
Italy	Gestore Servizi Elettrici (GSE)
New Zealand	Aotearoa Wave and Tidal Energy Association (AWATEA)
Sweden	Swedish Energy Agency
Australia	Oceanlinx

Table 1: OES-IA Membership (as of April 2009)

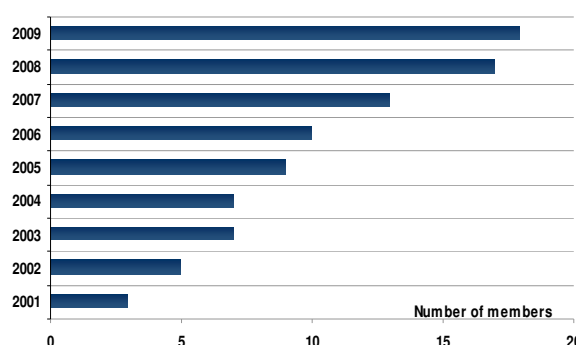


Figure 1: OES-IA Membership Growth

The OES-IA is keen to encourage increasing involvement by inviting key representatives from countries with interests in ocean energy exist to attend its Executive Committee meetings as Observers. This dialogue provides new information to existing members and enables the participation of potential new members of the OES-IA.

4 Collaborative Activities

The Executive Committee of the OES-IA and its members undertake a number of work programmes. Currently there are four collaborative tasks or “Annexes” to the Implementing Agreement (Table 2):

Annex I	Review, Exchange and Dissemination of Information on Ocean Energy Systems
OA:	INETI/LNEG – PORTUGAL
Duration:	From 2001 (indefinitely)
Annex II	Development of Recommended Practices for Testing and Evaluating Ocean Energy Systems
OA:	Ramboll - DENMARK
Duration:	2002-2003; 1 st Ext 2004-2006; 2 nd Ext 2007-2009
Annex III	Integration of Ocean Energy Plants into Distribution and Transmission Electrical Grids
OA:	Powertech Labs - CANADA
Duration:	2007 - 2009
Annex IV	Assessment of Environmental Effects and Monitoring Efforts for Ocean Wave, Tidal, and Current Energy Systems
OA:	US Department of Energy - USA
Duration:	2009 - 2011

OA: Operating Agent

Table 2: Actual OES-IA Work Programme

Annex I - Dissemination

Annex I – the “*Review, Exchange and Dissemination of Information on Ocean Energy Systems*” is a mandatory Annex: all countries joining the IA contribute through in-kind contributions to this task. The OES-IA dedicates a strong effort to exchange of information between participants. This is done through twice-yearly Executive Committee meetings. The information exchanged - on national ocean energy policies, R & D activities and demonstration projects - is further compiled and published in the Annual Report. In the recent 2008 Annual Report [1], specific commissioned papers – status reports on specific ocean energy topics - have been included for the first time, a practice, which will continue in future years.

The latest Annex I publication is a report prepared by Powertech Labs Inc. (Canada):

“Ocean Energy: Global Technology Developmental Status”: the report analyses the current development status of tidal barrages, tidal current, ocean wave, OTEC and salinity gradient technologies. Further, the report describes initiatives on ocean energy undertaken by various entities and discusses various projects in operation with emphasis on several specific systems being developed.

An OES-IA newsletter, containing contribution from members, is prepared each six months and provides information on ocean energy activities, political initiatives and device demonstrations worldwide. Although some reports are confidential to OES-IA members, most documents are eventually made

publicly available through the OES-IA website (www.iea-oceans.org).

A major new task under Annex I was completed with the development of a new DVD on ocean energy. The DVD includes interviews with recognised international experts, the perspectives of some of the OES-IA members on ocean energy and examples of ocean energy technologies. The DVD has been distributed to member countries and key personnel outside the Executive Committee since March 2009.

The Executive Committee also combines its meetings with workshops and/or conferences, at which OES-IA delegates are invited to present national policy and activities on ocean energy.

Annex II – Guidelines for Testing

When first established, the Annex II work, now completed, was devoted to scale testing. The present work programme - “*Development of Recommended Practices for Testing and Evaluating Ocean Energy Systems*” focuses on open-sea testing of prototypes, developing guidelines for performance measurement and testing procedures. Eleven countries are participating in the extension of this task: Belgium, Canada, Denmark, Ireland, Mexico, Norway, Portugal, Spain, UK, USA and Australia. A final report is being by the Operation Agent for publication in late 2009. Collaborative work is undertaken on a shared cost basis and each participant also contributes with in-kind support.

Annex III – Grid Integration

Annex III was commissioned in 2007. Collaborative work under this Annex – “*Integration of Ocean Energy Plants into Distribution and Transmission Electrical Grids*” - has been focussed on three main topics:

- 1) Identification of issues and opportunities,
- 2) Dynamic characterisation of conversion devices and
- 3) Case studies involving electrical system modelling.

The Executive Committee member countries participating in the Annex are Canada, Ireland, United Kingdom, Spain and New Zealand. Again collaborative work is undertaken on a shared cost based with additional in-kind support from each participant.

The following two reports were prepared in 2008-09 and are available on the OES-IA website:

Report No 3.1.1, “Potential opportunities and differences associated with integration of ocean wave and marine current energy plants, in comparison to wind energy”: The document presents characteristics of some wave and tidal current energy conversion processes and identifies areas where the ocean energy technologies bear unique advantages in comparison to wind energy technologies. The report also discusses how the experience gained from the wind energy industry

could be used to mitigate any future grid integration challenges associated with a large-scale implementation of ocean energy technologies.

Report No. 3.1.2, “Key features and identification of improvement needs to the existing relevant interconnection guidelines for facilitating integration of ocean energy pilot projects”: The report presents a review of some relevant interconnection guidelines and identifies key components of a generic guideline. Considering the early deployment stage of ocean energy technologies, the report discusses how a flexible interconnection guideline could be developed to accelerate the deployment.

Annex IV – Environmental Issues

This new Annex is described in Section 6.

External Collaborative Efforts

In addition to its own collaborative activities, the OES-IA Executive Committee collaborates and makes input to several IEA initiatives. These include:

- 1) Input to two specific books in support to the G8 Plan of Action, published in 2008 by the IEA prior to the G8 meeting in Japan: “*Empowering Variable Renewables: Options for Flexible Electricity Systems*” and “*Energy Technology Perspectives – Strategies and Scenarios for 2030 and 2050*” (<http://www.iea.org/g8>).
- 2) Collaboration with the IEA’s Networks of Expertise in Energy Technology (NEET) events, stimulated by the request of the G8 and the IEA Governing Board, to facilitate co-operation between the international business community and developing countries.
- 3) OES-IA also collaborates with the IEA Renewable Energy Technology Deployment Implementing Agreement (RETD-IA) on deployment of offshore technologies.

5 The Need for Collaborative Action on Environmental Issues

Difficulties caused by lack of knowledge and experience of the potential impacts of marine energy projects may hinder future deployment projects or the diverse range of marine energy technologies (Fig. 2).

Environmental issues need to be described and accounted in new deployment projects, even though there may have been relatively few deployments in each country. Environmental monitoring of effects has been sporadic and limited. As a result being able to describe, quantify, limit, mitigate or eliminate environmental effects may become a potential barrier to future deployments. Collaboration between OES-IA members can and will significantly improve the understanding of the topic. Shared experience of environmental impacts and their management may be

the most effective way to inform developers, regulatory authorities, lobby groups and concerned citizens. The OES-IA Executive Committee believes that an international and concerted approach will be the most effective way to tackle this comprehensive issue.

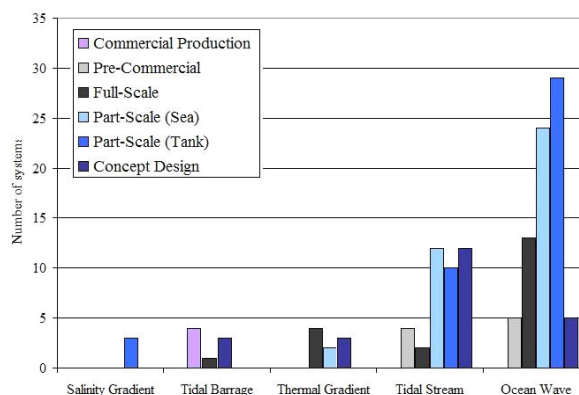


Figure 2: Ocean energy technologies at different stages of development (source: [2])

A recent publication by the EC-funded WAVEPLAM project [3] mentions that “*Environmental impacts are often perceived as a major non-technical barrier to RE technologies. Main reason is however certainly not the potential impacts compared to the existing alternatives, but rather the fact that licensing procedures require by default an environmental statement or impact assessment, which can turn out one of the major hurdles for large-scale RE penetration in general, and to wave energy in particular.*”

The EquiMar project - *Equitable Testing and Evaluation of Marine Energy Extraction Devices in terms of Performance, Cost and Environmental Impact* (2008-2010) is a collaborative research and development project involving a consortium of 23 partners (<http://www.equimar.org>). This project, funded by the European Commission, has a work program dedicated to developing common approaches to environmental impact assessments.

In 2006 the OES-IA commissioned a report (available on its website) by AEA Technologies [4], which contained a review of current developments and supporting policies for ocean energy in several countries. Specific barriers to progress in ocean energy were identified. The report identified the lack of understanding and uncertainty of environment impacts of marine energy converters as a key non-technical barrier, and highlighted the need of collaborative research and dissemination of results from demonstration projects, as essential to gain more knowledge. The other barriers identified in the report were:

- i) insufficient demonstration prototypes deployed in the marine environment to prove that technologies work as predicted,
- ii) grid connection and consenting arrangements,

- iii) lack of agreed development, testing and evaluation guidelines for ocean energy systems.

The IEA publication “*Deploying Renewables: Principles for Effective Policies*” [5] examines data and information relating to renewable energy markets and policies over the period 2000-2005. Among its recommendations relating to policies supporting RET deployment, the IEA report states that “*to remove and overcome non-economic barriers as a first priority to improve policy and market functioning*”.

The OES-IA Executive Committee recognised the importance of thorough environmental impact assessments to facilitate general acceptance of ocean energy. In 2007 the Executive Committee organised a workshop on “*Environmental issues and Ocean Energy Systems*” which was held in Messina, Italy on 18 October 2007. Ten invited experts from eight countries (Canada, Denmark, Germany, Norway, Portugal, Sweden, the USA and UK) shared information on new ocean technologies, testing facilities, results of research into environmental impacts, risk analysis and decision making, and lessons learned from demonstrations of ocean energy devices. A report on this workshop has been published and is available on the OES-IA website.

6 Annex IV - Environmental Issues

Following this successful workshop a work programme on environmental impacts was developed by the US and Canadian representatives on the Executive Committee, which was proposed by the US member and adopted at the October 2008 Executive Committee meeting (held at the 2nd International Conference on Ocean Energy, in Brest, France).

Annex IV - “*Assessment of Environmental Effects and Monitoring Efforts for Ocean Wave, Tidal, and Current Energy Systems*” - was commissioned and announced at the 2nd Global Marine Renewable Energy Conference in Washington, DC, on 15-16 April 2009. As of May, 2009, committed parties include the US, Canada, Spain, Ireland and New Zealand, and Sweden and Norway have indicated their intent to participate.

The US Department of Energy serves as operating agent for the annex, with much of the US in-kind contribution coming from the Federal Energy Regulatory Commission (FERC) and the Minerals Management Service (MMS). The Annex is designed to facilitate efficient government oversight of the development of ocean energy systems by expanding baseline knowledge of the environmental effects of ocean wave, tidal, and current energy development on the marine environment. Before analysis begins, Annex members will determine which impacts should be included to ensure that efforts are focused on priority information needs.

The first year of work will focus on developing a comprehensive, user-friendly database of currently available information on environmental impacts, monitoring strategies, and mitigation methods and prioritizing information gaps. The second year will involve expanding the database through the acquisition

of new information from ongoing case studies around the world. For critical information gaps lacking relevant case study data, literature on analogues to ocean energy devices will be explored (e.g., knowledge of monitoring navigation buoys might be applied to wave energy conversion buoys). The final year will concentrate on finalizing the database, analyzing the information gathered, and producing a report communicating resulting lessons.”

The Annex will culminate in an accessible and searchable database, an expert’s workshop, and a comprehensive summary report that will be published by the OES-IA. The report will present all relevant information gathered, provide critical analysis on monitoring efforts and mitigation, and provide guidance to international ocean energy stakeholders including policymakers, developers, regulators, agencies, academic institutions, and research organizations. Greater understanding of the environmental effects and monitoring methods related to ocean energy will foster public acceptance and help to advance ocean energy technology. It is envisioned that the final database will continue to be updated beyond by an outside source after the scope of this work program is completed.

7 Future Activities

The OES-IA Executive Committee is collaborating with the authors of a new IEA brochure “*Renewable Energy Essentials*”, which will contain a summary on ocean energy, including the status of the industry, costs, outlook, technology status and development, environmental impacts and other key points. The Executive Committee is also collaborating with the IEA authors of the 2009 edition of “*Energy Technologies at the Cutting Edge*”.

The OES-IA has also established formal liaisons with the International Electrotechnical Commission’s TC 114, established to develop standards (electrical, performance and environmental) for marine energy converters and, as noted above, with EquiMar and Waveplam.

8 Concluding Remarks

The strength of the Ocean Energy Systems Implementing Agreement is that it combines the work and experience of many governments and nations, including all the countries, where marine energy technologies and projects are being actively developed. Because the representatives of member governments on the Executive Committee include government departments, national energy agencies, device and project developers, research institutions, universities and national trade associations, the widest ranges of interests, objectives and concerns can be shared.

The OES-IA Executive Committee dedicates its work to current issues in ocean energy, seeking to identify, address and eliminate barriers to accelerate uptake of marine energy as a viable, competitive renewable and sustainable energy source.

The Executive Committee also seeks to publish as much information as possible to inform the wide range of stakeholders with interests in ocean energy. This is achieved by workshops and contributions to conferences and seminars. The following sources of information about the OES-IA and its work programmes are:

- i. OES-IA website (www.iea-oceans.org), which contains electronic copies of most of the following:
- ii. 6-monthly OES-IA newsletter
- iii. OES-IA Annual Report with invited specialist articles and national activity summaries.
- iv. Reports commissioned by OES-IA on specific topics
- v. Reports completed by the Annex Operating Agents
- vi. A poster and DVD, a trailer for which can be viewed on the website.

The OES-IA Executive Committee is dedicated to collaborative work to address critical issues to the uptake of ocean energy. It extends invitations to governments with interests in the potential for marine energy deployments.

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