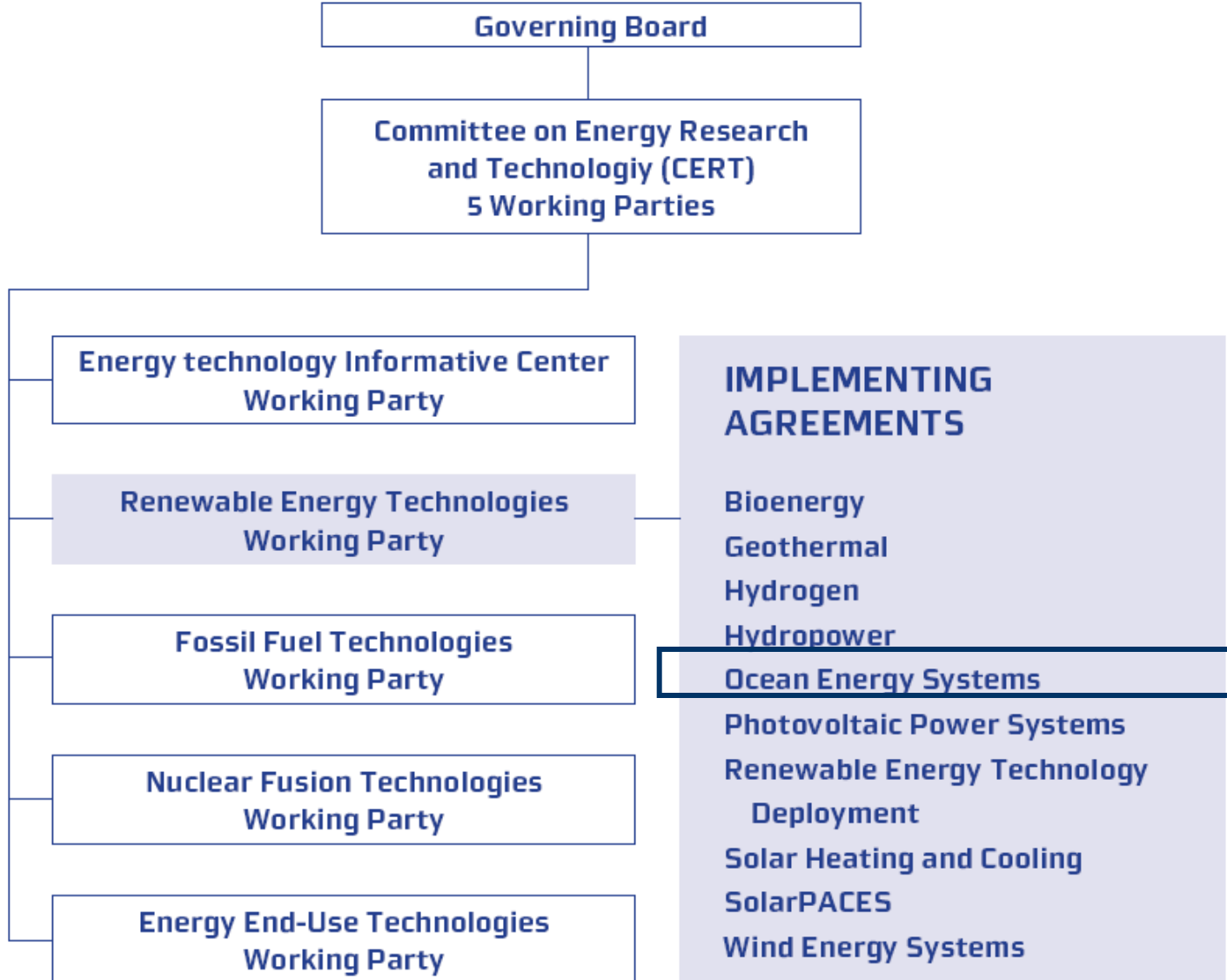


Ocean Energy Systems Implementing Agreement **An International Collaborative Programme**

IEA-OES

Jochen Bard

ISSET

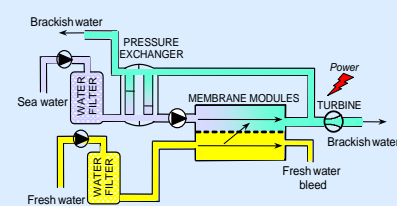
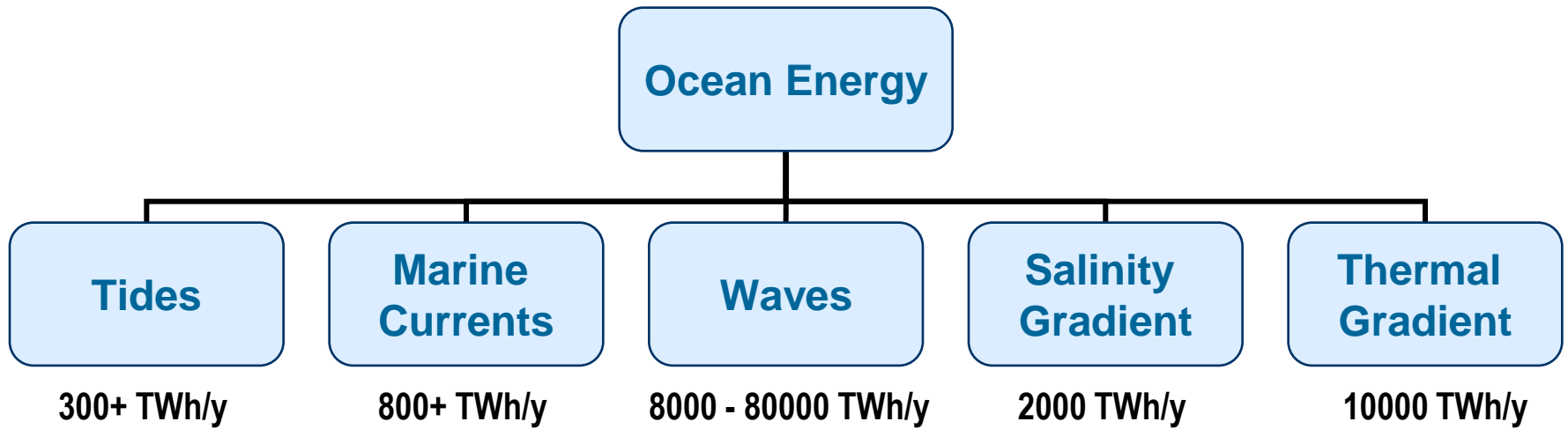


IEA-OES MISSION

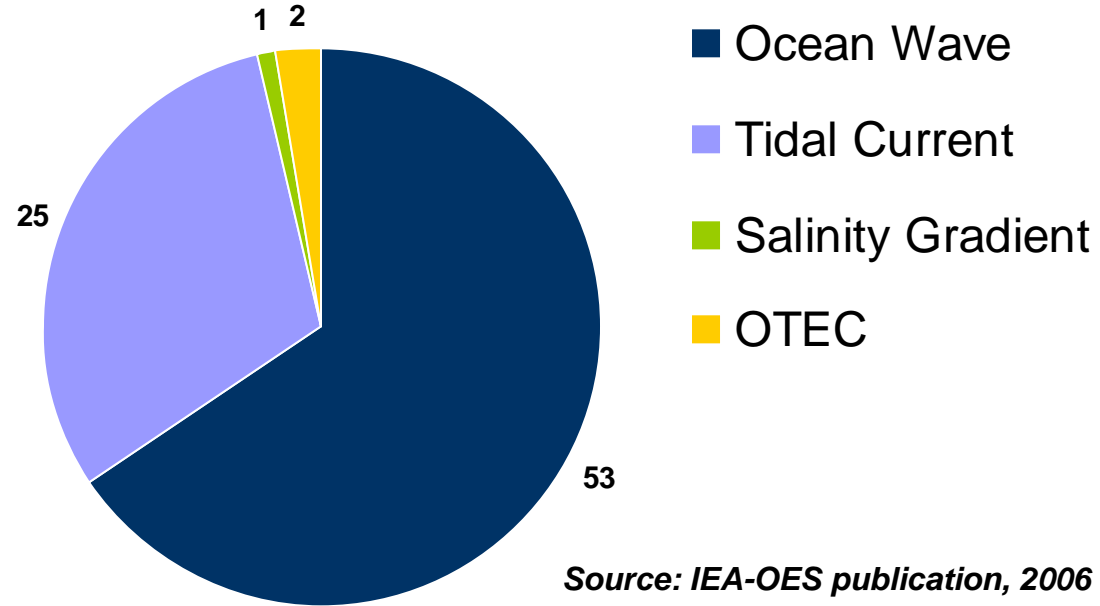
To facilitate and co-ordinate ocean energy research,
development and demonstration
through international co-operation and information exchange,
leading to the deployment and commercialisation of
sustainable, efficient, cost-competitive
and environmentally sound ocean energy technologies

5 Year Strategic Plan (2007 – 2011)

- **To actively encourage and support the development of networks of participants involved in R,D&D, prototype testing and deployment, policy development and facilitate networking opportunities.**
- **To become a trusted source of objective information and be effective in disseminating such information to ocean energy stakeholders, policymakers and the public.**
- **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**
- **To promote policies and procedures consistent with sustainable development.**
- **To promote the harmonization of standards, methodologies, terminologies, and procedures where such harmonization will facilitate the development of ocean energy.**



Status of technology development



Tidal barrages

Well developed technology, however may have significant impact on local ecosystem

Ocean waves and tidal currents technologies

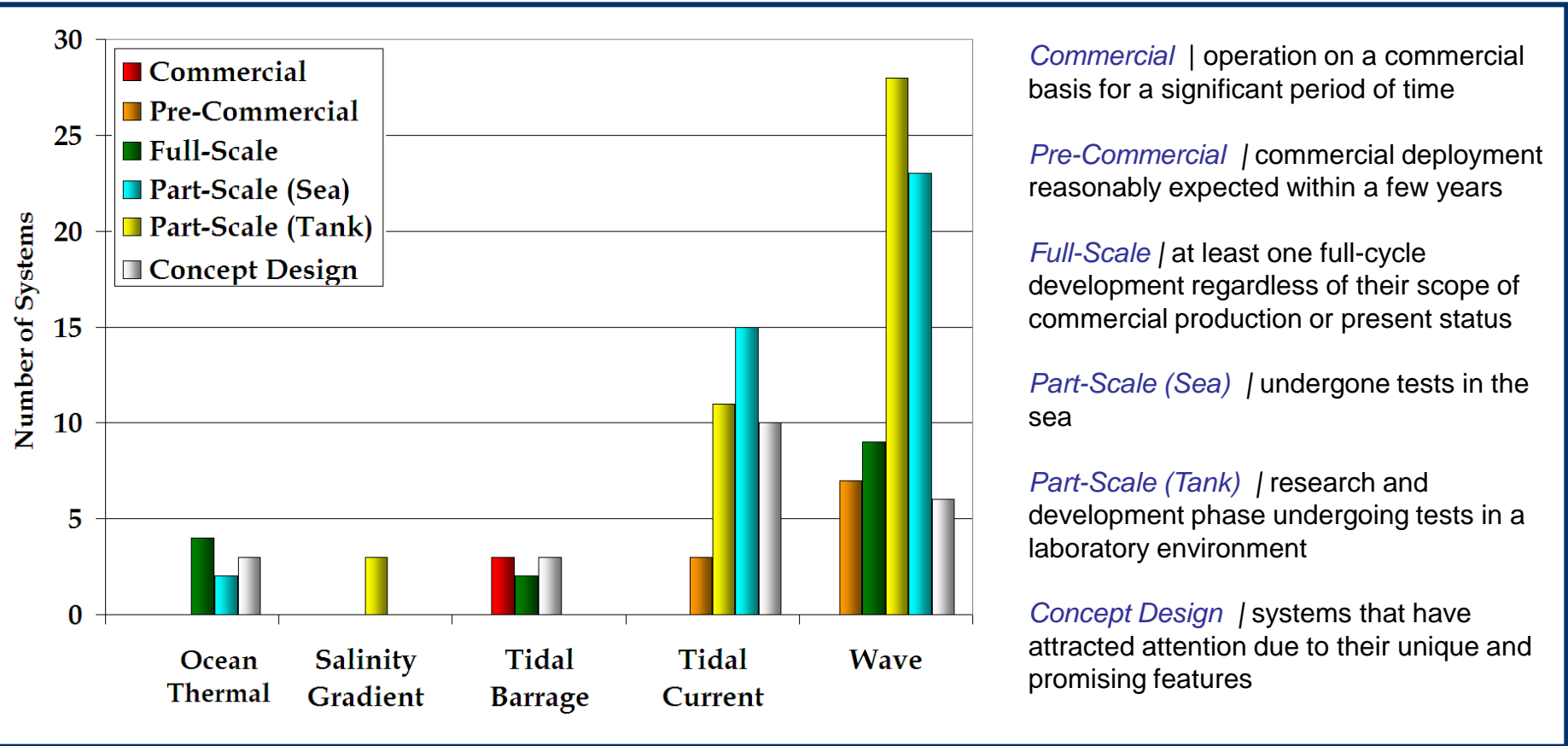
Significant number of technologies being developed worldwide: some of these technologies are at or near full-scale development and undergoing sea trials

OTEC technologies

Advanced stage of R&D

Salinity power technologies

Early stage of development



Source: IEA-OES 2007 Annual Report

Conversion technologies are at **different stage of developments**

Appropriate **government policy mechanisms** are required to bring these conversion technologies to commercial stage

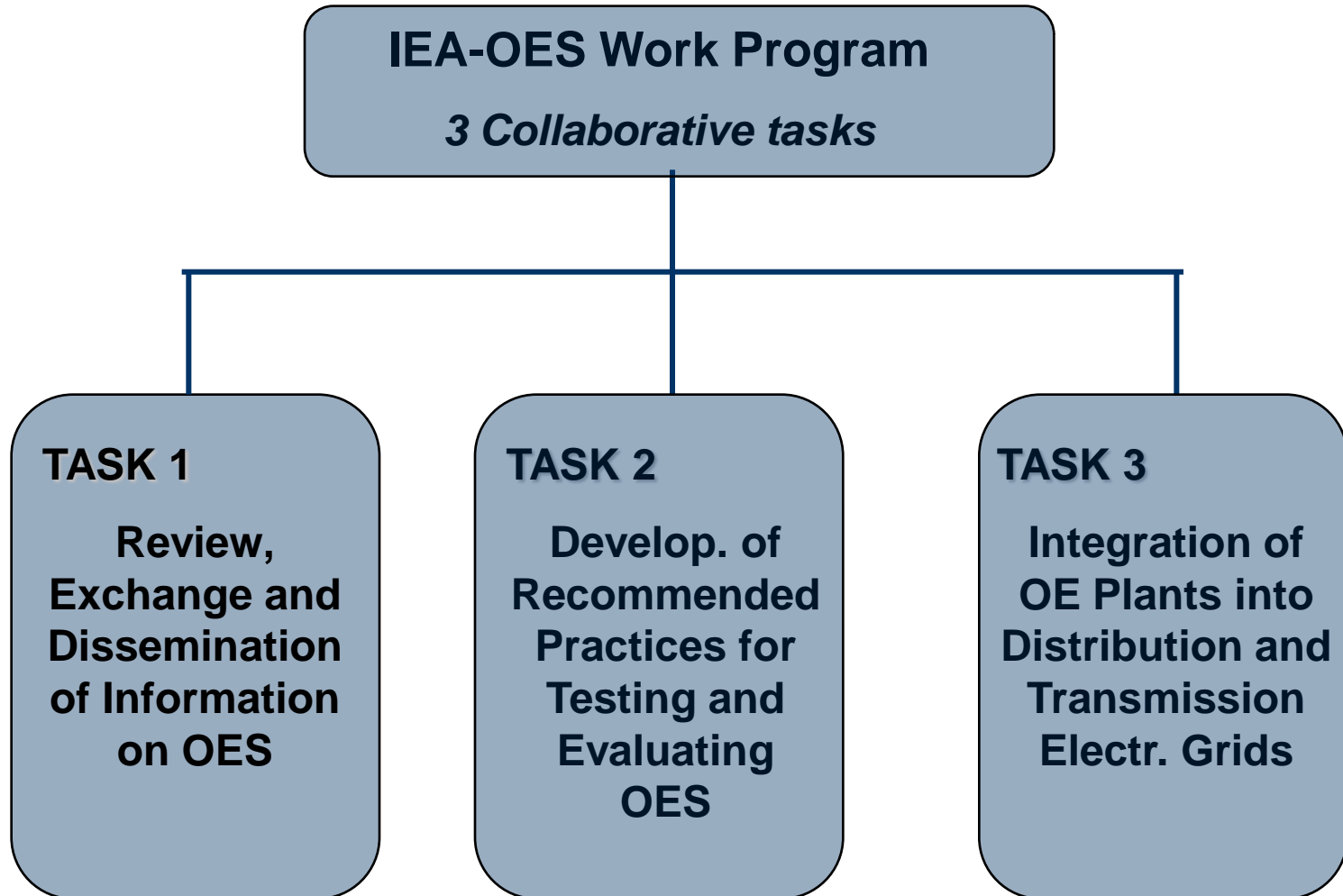
- **Insufficient number of governments** having national research & innovation, market deployment, and market-based energy policies that are open to ocean energy.
- **Lack of experience** from a larger number of full-scale sea-trials on performance & environmental impacts.
- **Lack of streamlining of licensing & permitting process** for projects.
- **Absence** of internationally recognized performance assessment **guidelines and standards**.
- **Electrical grid** connection and capacity constraint challenges.

2001 Denmark
2001 Portugal
2001 United Kingdom
2002 Ireland
2002 Japan
2003 Canada
2003 European Commission
2005 United States of America
2006 Belgium
2007 Germany
2007 Mexico
2007 Norway

2008 Spain
2008 Italy
2008 New Zealand

Prospective members:

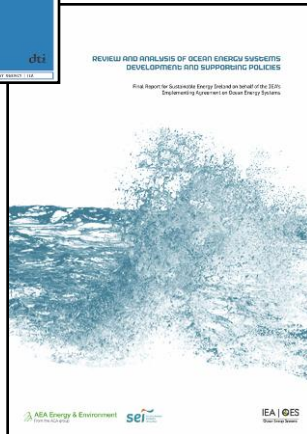
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Australia
South Africa
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Chile





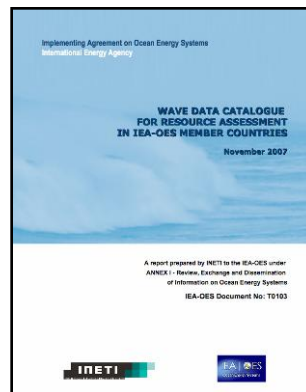
Wave an marine current energy - status and research and development priorities | 2003

This work was done to inform the IEA-OES in developing its work programme. It includes the research and development priorities in the area.



Review and analysis of Ocean Energy Systems Development and supporting Policies | 2006

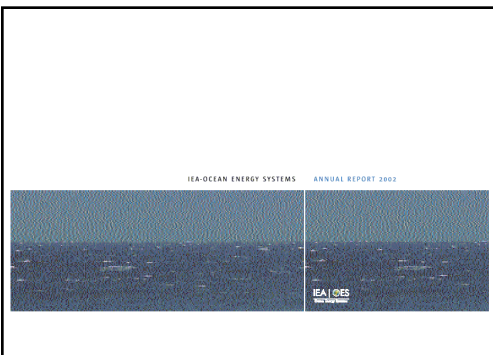
- Current status of OES R&D
- Policies and support mechanisms
- Services and facilities
- Common barriers to progress and possible solutions



Wave Data catalogue for Resource Assessment | 2007

Provides an overview of wave data appropriate for wave energy resource assessment and characterization

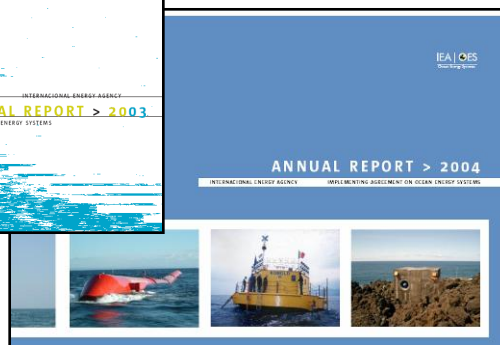
2002



2003



2004



2005



2006



2007



Newsletters

IEA | OES Ocean Energy Systems

February 2014 | ISSUE 2

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IMPLEMENTING AGREEMENT ON OCEAN ENERGY SYSTEMS | INTERNATIONAL ENERGY AGENCY

OCEAN ENERGY

Available global Ocean Energy resource in the same order of magnitude of the present electricity production worldwide.

Five basic forms of ocean energy can be harnessed to generate electricity and fresh water by various means.

GLOBAL RESOURCE

FORM OF OCEAN ENERGY	ESTIMATED GLOBAL RESOURCE* (TWh/YEAR)	PRESENT GLOBAL ELECTRICITY PRODUCTION (TWh/YEAR)
Waves	200	17,000
Tidal Ranges	100	
Salinity Gradient	100	
Temperature Gradient	100	
Current	100	

TECHNOLOGY DEVELOPMENT STATUS

Barriers & Challenges

Strategic Action of the IEA OES

MISSION OF THE IEA OES

Examples of selective conversion technologies & demonstration projects world-wide

Posters and brochures

IEA | OES Ocean Energy Systems

INTERNATIONAL ENERGY AGENCY | IMPLEMENTING AGREEMENT ON OCEAN ENERGY SYSTEMS

OCEAN ENERGY OPPORTUNITY, PRESENT STATUS AND CHALLENGES

GLOBAL RESOURCE

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Current	100	

TECHNOLOGY DEVELOPMENT STATUS

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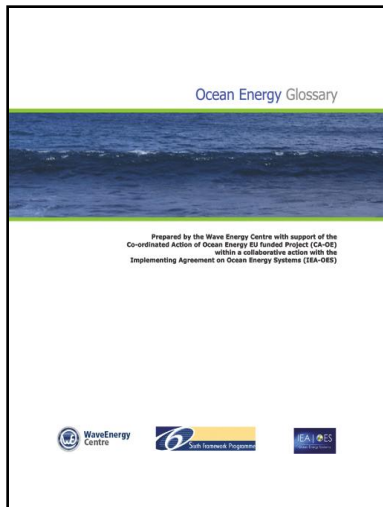
MISSION OF THE IEA OES

Examples of selective conversion technologies & demonstration projects world-wide

www.iea-oceans.org

On-line References Library
to be in place in 2008

Ocean Energy Glossary
Life document



To provide an efficient and fast reference to the ocean energy specific terms in the field of wave energy, marine current energy (tidal stream), tidal energy, OTEC and Salinity Gradient.



DVD on Ocean Energy
Started to be developed

Ocean Energy DATABASE

(available to members only)

- I) Global Ocean Power Installed Capacity
- II) Economics of the Ocean Energy
- III) Global Wave and Tidal Current Resource
- IV) RD&D Investment in Ocean Energy
- V) Ocean Energy Targets and Public Incentives

IEA-OES is collaborating with:

IEC - TC 114 : Marine Energy – Wave and Tidal Energy Converters

To develop International Standards for wave and tidal energy technology that will help establish this promising source of RE as a competitive form of electrical energy production.

IEA RETD (**Accelerating the Deployment of Offshore RE Technologies**)



IEA project "Integration of Renewables into Electricity Grids"

To provide policy and decision makers with an overview of international best practice and experience with policy frameworks for the deployment of offshore RE technologies

IEA-OES & DTI Workshop, “Ocean Energy - The IEA, UK and the EC Programs”

Bristol, UK, October 2002

IEA-OES Open Session on National activities

Lisbon, Portugal, February 2004

Workshop “Grid Integration of Ocean Energy Systems”

Copenhagen, November 2004

Expert Group Meeting “Guidelines for Testing and Performance Measurement of OES”

Amsterdam, March 2006

Workshop “Environmental Issues and Ocean Energy Systems”

Messina, Italy, October 2007

Workshop on Grid Integration of Ocean Energy Systems

4th November 2004
Danish Energy Authority
B EA OES, Akateipolis 4, 1256 Copenhagen K, Denmark

PROGRAMME

- 14:30 Open of the Workshop
Lucina Espada, Vice-Chair of the IEA-OES
Ana Estanaveiro, Workshop Chair
- 14:40 Integration of ocean power systems in the grid: the experience from other OES
Ana Estanaveiro, HFTI, Portugal
- 15:00 Overview of U.S. approach and progress concerning grid integration issues for wind energy
Stanley Green, U.S. Department of Energy, USA
- 15:20 The experience in connecting the 143 MW offshore wind farm situated at Steen Eddi, Wessen, SE
- 15:40 Workshop Impact Study
Tony Butler, Carbon T
- 16:00 Using the phasing of regulate the frequency
M. R. O'Kelly, ANZ
- 16:20 Discussion
- 17:30 Closure

Potential Environmental Impacts and Ocean Energy Devices

Expert workshop to identify environmental research needs for international collaboration

18th October 2007
Messina, Italy
Faculty of Engineering of the University of Messina

PROGRAMME

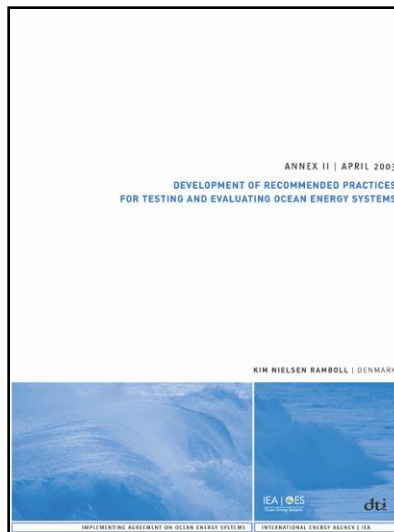
- 8:30 – 8:45 Welcome by Prof. Signorino Galvagno and Introductory roundtable
- 8:45 – 9:00 Opening remarks from IEA Chair
- 9:00 – 10:10 Parallel Between Industries
- 9:00 – 9:20 Applicable Environmental Policies
David Sobars, Germany
- 9:20 – 9:40 Lessons Learned from the Oil and Gas Industry
Robert LaBelle, USA
- 9:40 – 10:00 Ocean Renewables in Norway: The Resource and Environmental Perspectives
Lars Gilman, Norway
- 10:00 – 10:10 Discussion/Questions
- 10:10 – 10:30 Health Break
- 10:30 – 12:00 Wave and Tidal Energy Considerations – are they different?
- 10:30 – 10:50 Tidal Energy Development in Canada: Options, Opportunities and Issues
Graham Dutton, Canada
- 10:50 – 11:10 Environmental Recommendations for the Portuguese Pilot Zone
Cristina Huerta-Olivares, Portugal
- 11:10 – 11:30 UK Programme for Wave and Tidal Stream Renewable Energy
Research – John P. Hartley, UK
- 11:30 – 11:50 Colonization of Wave Power Device Foundations by Invertebrates and Fish
Oliver Langhamer, Sweden
- 11:50 – 12:00 Discussion/Questions
- 12:00 – 13:20 Lunch
- 13:20 – 14:30 Developer Experience & Strategic Environmental Considerations
- 13:20 – 13:40 Strategies for Risk Assessment
Boris Pars, USA
- 13:40 – 14:00 Environmental Considerations for Wave Dragon
Hans Christian Svendsen, Denmark
- 14:00 – 14:20 Community Involvement and Ocean Energy Deployment
Justin Klum, Oregon Wave Energy Trust, USA
- 14:20 – 14:30 Discussion/Questions
- 14:30 – 14:50 Health Break
- 14:50 – 16:30 Summarize and Prioritize Research Needs
- 16:30 – 17:00 Path Forward for IEA OES Collaboration

PART I (2002 - 2005)

Operating Agent: Ramboll, Denmark

Objective: to develop recommended practices for testing and evaluating ocean energy wave and marine current systems

➔ to improve the comparability of experimental results



Report on Development Recommended Practices for Testing and Evaluating Ocean Energy Systems | 2003

- Testing Facilities
- Testing Procedures
- Presentation of results
- Performance Assessment

PART II - REAL SCALE PHASE (2007 - 2009)

Objective:

to cover prototype testing in ocean based test sites, guidelines for performance measurements, and recommended testing procedures for the development cycle of ocean energy wave and marine current devices.

Subtasks:

- Generic & site-related Wave & Tidal Current Data
- Development and Evaluation Protocols for OES
- Guidelines for Open Sea Testing and Evaluation

Participating countries: Belgium, Canada, Denmark, Ireland, Mexico, Norway, Portugal, UK, USA, New Zealand and Spain

Operating Agent: Powertech Labs, Canada

Objective:

To conduct co-operative research into the generation, transmission and economics of integrating ocean energy into electrical grids and to provide a forum for relevant information exchange.

Subtasks:

- Identify issues and opportunities
- Describe the dynamic characteristics of ocean energy electricity generators
- Identify the near-term and longer-term practical potential of ocean power, through case studies involving the integration of ocean energy plants with distribution and transmission networks
- Coordinate activities (with other relevant IEA implementing agreements and initiatives)

Participating Countries: Canada, UK, Ireland, New Zealand and Spain

Chair

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Vice-Chair

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