IEA Technology Collaboration Program

OCEAN ENERGY SYSTEMS

Henry Jeffrey
OES Vice Chairman

International Energy Agency

- Energy security
- Environmental protection
- Economic growth
- Engagement worldwide

- Governments and Industry benefit from sharing resources and accelerating results
- For this reason the IEA enables independent groups of experts - the IEA Technology Collaboration Programmes
- Over 40 groups working in the following areas:

Efficient end-use technologies

Renewable energies

Fossil fuel

Cross-cutting issues

iea Energy Technology Network

Main sources of ocean energy

- Tidal/Ocean Currents
- Waves
- Tidal Rise & Fall
- Thermal Gradient
- Salinity Gradient

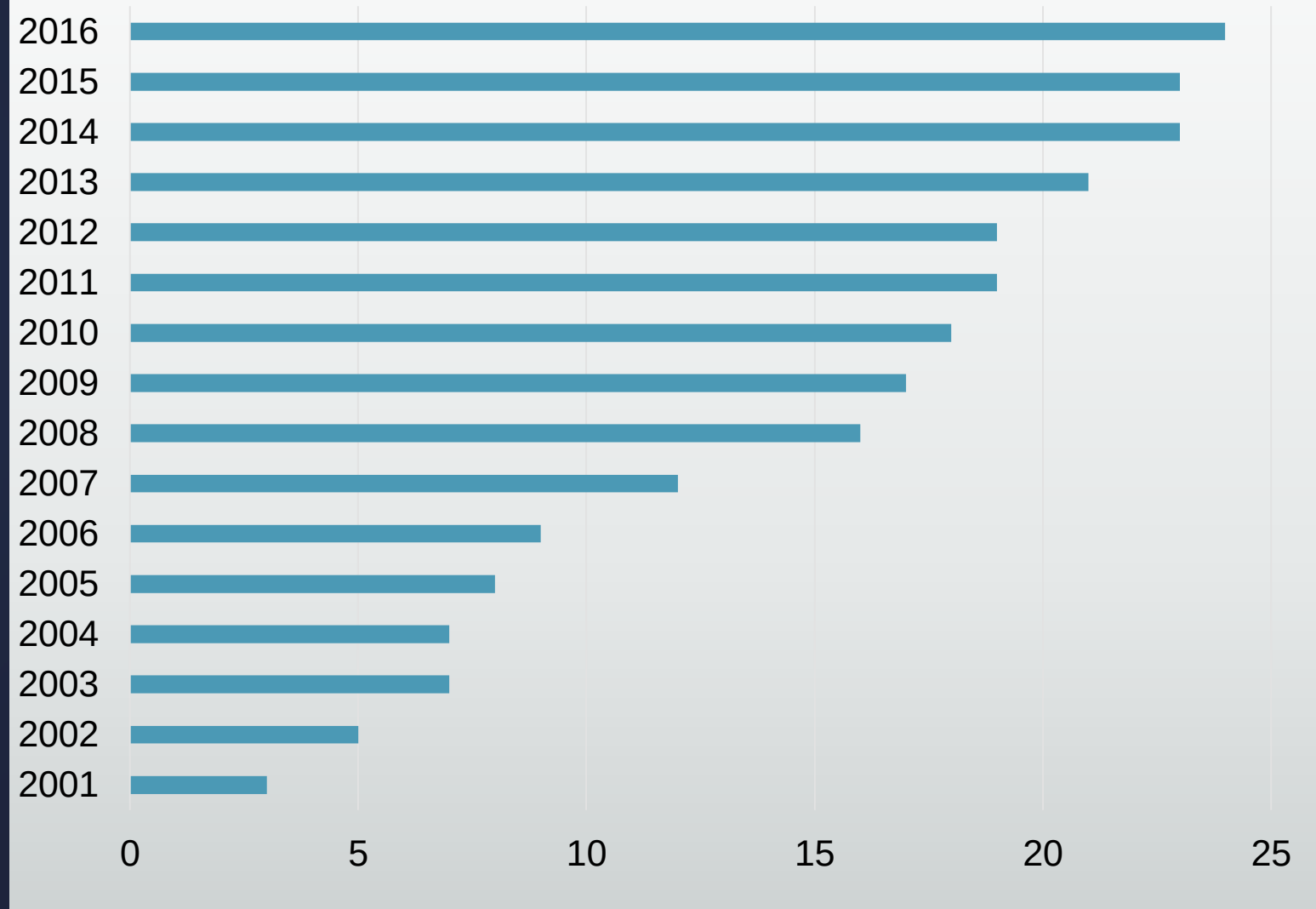
- **OES covers all forms of ocean energy, including submarine geothermal, but NOT offshore wind - seawater must be the motive power**
- **Products can include: electricity, heat, cooling, water (drinking and pressurized), biofuels, chemicals**

THE OES VISION FOR INTERNATIONAL DEPLOYMENT OF OCEAN ENERGY

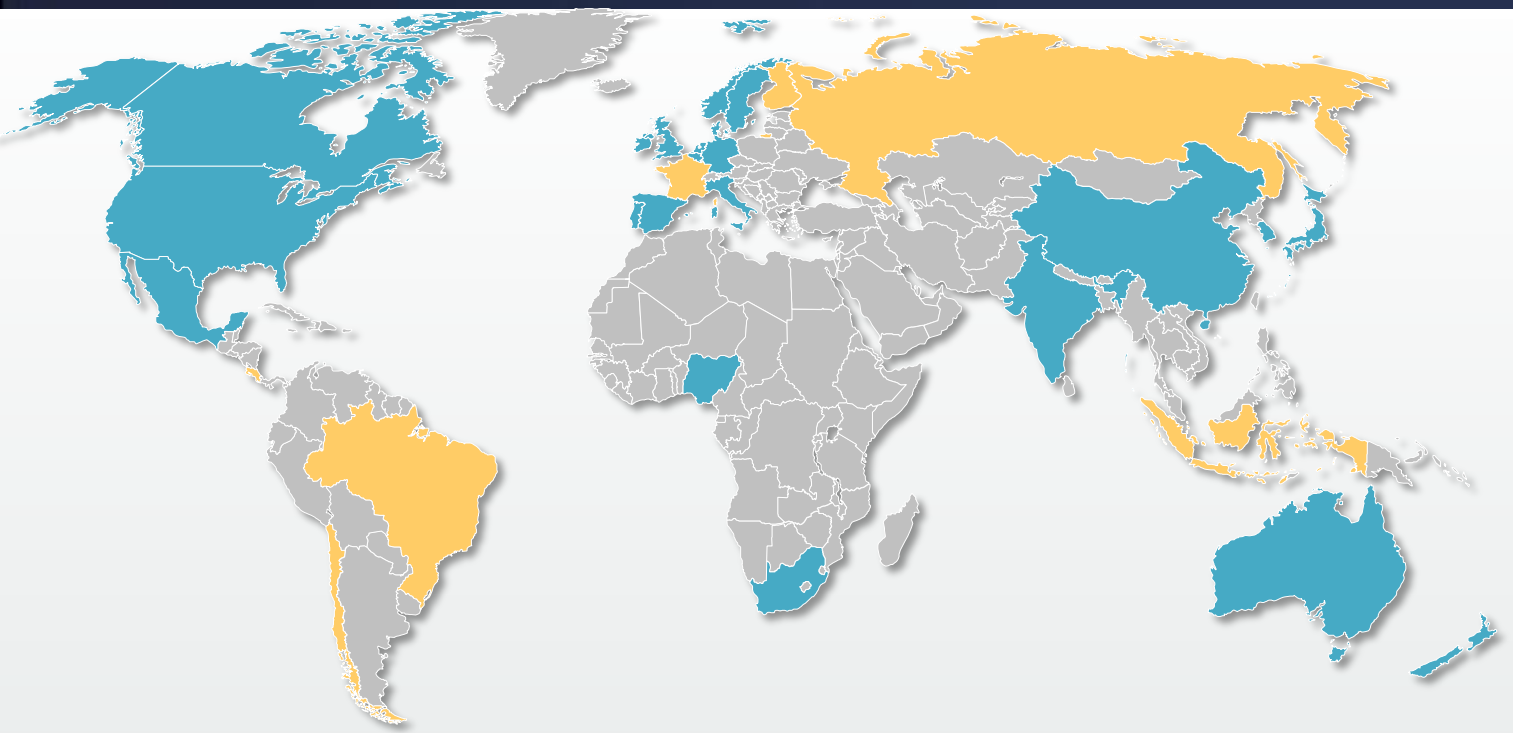
- Worldwide, there is the potential to develop 337 GW of ocean energy by 2050
- By 2050, the ocean energy deployment could create an estimated 300,000 direct jobs

Membership grow

Participation in OES builds connections between national governments and industries, creates networks of experts and expands national research capacities



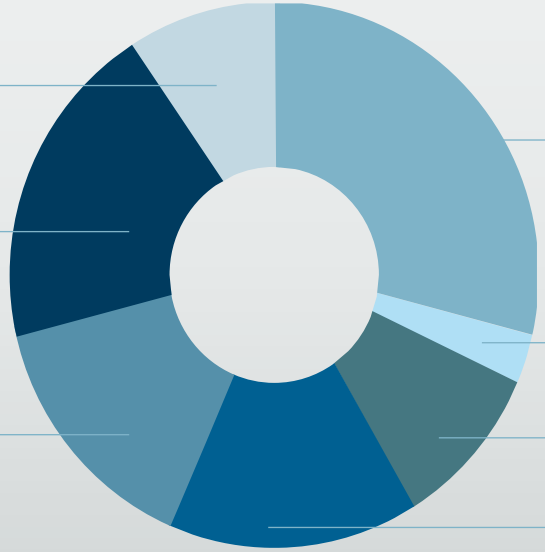
Membership diversification



Member countries (23)

Countries invited to join (9) + EC

Diversified representation of interests in the ExCo



GOVERNMENTAL AGENCIES . 3

RESEARCH ORGANIZATIONS . 6

UNIVERSITIES . 6

GOVERNMENTAL DEPARTMENTS . 9

INDUSTRY ASSOCIATIONS . 1

UTILITIES . 3

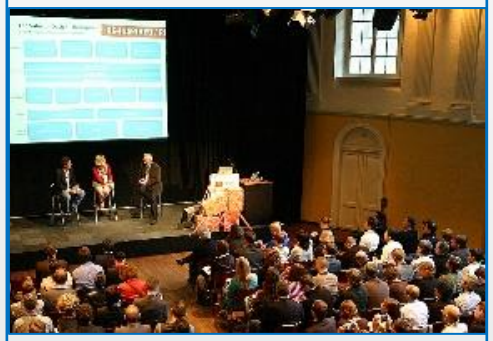
ENERGY AGENCIES . 4

The role of the OES

CONNECT

Connect organisations and individuals working in the ocean energy sector

EDUCATE



Educate people globally on the nature of ocean energy systems and the current status on development and deployment

INSPIRE

Inspire governments, corporations, agencies and individuals to become involved

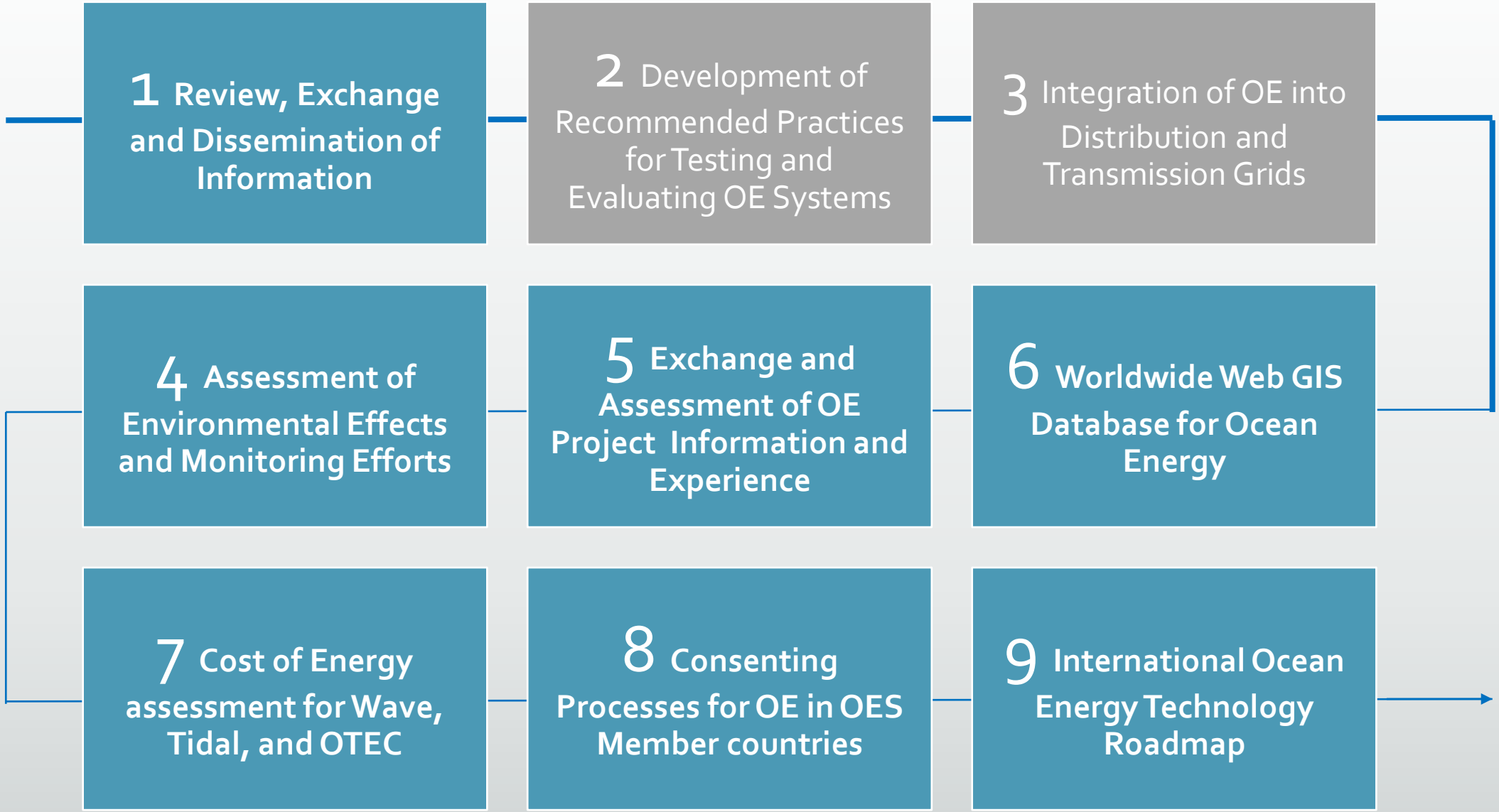
FACILITATE

Facilitate education, research, development and deployment of ocean energy systems

Challenges for the Ocean Energy Industry

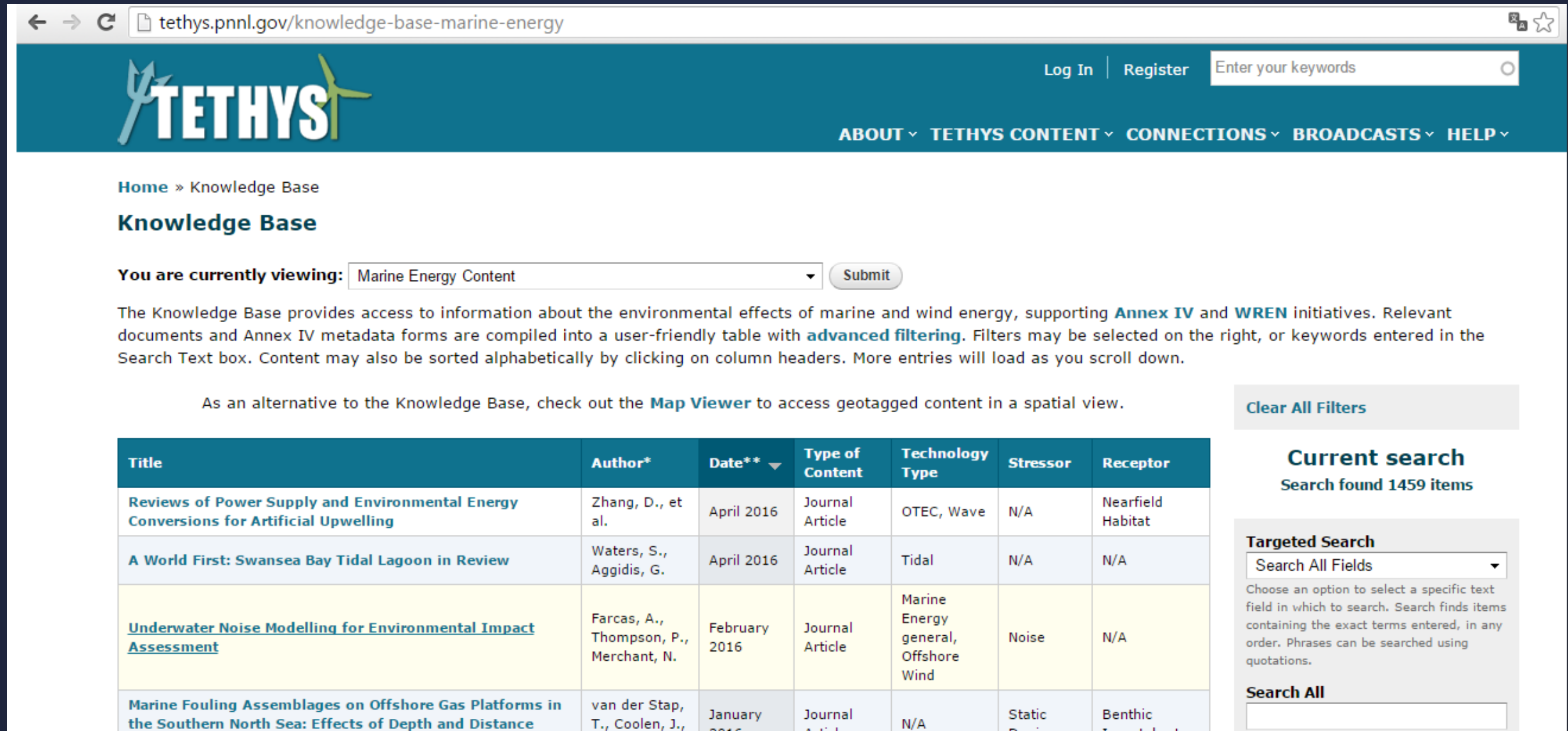
CHALLENGES	POTENTIAL SOLUTIONS AND RECOMMENDATIONS
POLICY ENVIRONMENT	• Development of an integrated policy framework with ocean energy specific regulations • International guidelines and standards • Regulatory reform and planning leading to efficient and appropriate consenting processes
INDUSTRY DEVELOPMENT	• Strategic supply chain planning, development and growth • Ocean energy infrastructure development • Technical and professional workforce training and development
MARKET DEVELOPMENT	• Development of appropriate tariff support mechanisms to provide clear market signals to the investment community. • Appropriate electricity market access and grid connection access
TECHNOLOGY DEVELOPMENT	• Prototype devices need to be very robust to withstand the marine environment • Demonstration and testing facilities • Research and innovation support and enabling technology support to facilitate cost reduction and performance improvement
ENVIRONMENTAL EFFECTS	• Establish an improved understanding of baseline environment • Strategic environmental research which is enabled by sharing of environmental data • Consider adoption of deploy and monitor schemes to facilitate sector progression • Familiarity in affected communities
PLANNING FRAMEWORK	• Marine spatial planning leading to the development of common approaches to space and resource allocation.

Work Program – ongoing tasks



Annex IV | Environmental Issues

Making existing information available and accessible



tethys.pnnl.gov/knowledge-base-marine-energy

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Knowledge Base

You are currently viewing: Marine Energy Content Submit

The Knowledge Base provides access to information about the environmental effects of marine and wind energy, supporting **Annex IV** and **WREN** initiatives. Relevant documents and Annex IV metadata forms are compiled into a user-friendly table with **advanced filtering**. Filters may be selected on the right, or keywords entered in the Search Text box. Content may also be sorted alphabetically by clicking on column headers. More entries will load as you scroll down.

As an alternative to the Knowledge Base, check out the **Map Viewer** to access geotagged content in a spatial view.

Title	Author*	Date**	Type of Content	Technology Type	Stressor	Receptor
Reviews of Power Supply and Environmental Energy Conversions for Artificial Upwelling	Zhang, D., et al.	April 2016	Journal Article	OTEC, Wave	N/A	Nearfield Habitat
A World First: Swansea Bay Tidal Lagoon in Review	Waters, S., Aggidis, G.	April 2016	Journal Article	Tidal	N/A	N/A
Underwater Noise Modelling for Environmental Impact Assessment	Farcas, A., Thompson, P., Merchant, N.	February 2016	Journal Article	Marine Energy general, Offshore Wind	Noise	N/A
Marine Fouling Assemblages on Offshore Gas Platforms in the Southern North Sea: Effects of Depth and Distance	van der Stap, T., Coolen, J.,	January	Journal	N/A	Static	Benthic

Clear All Filters

Current search

Search found 1459 items

Targeted Search

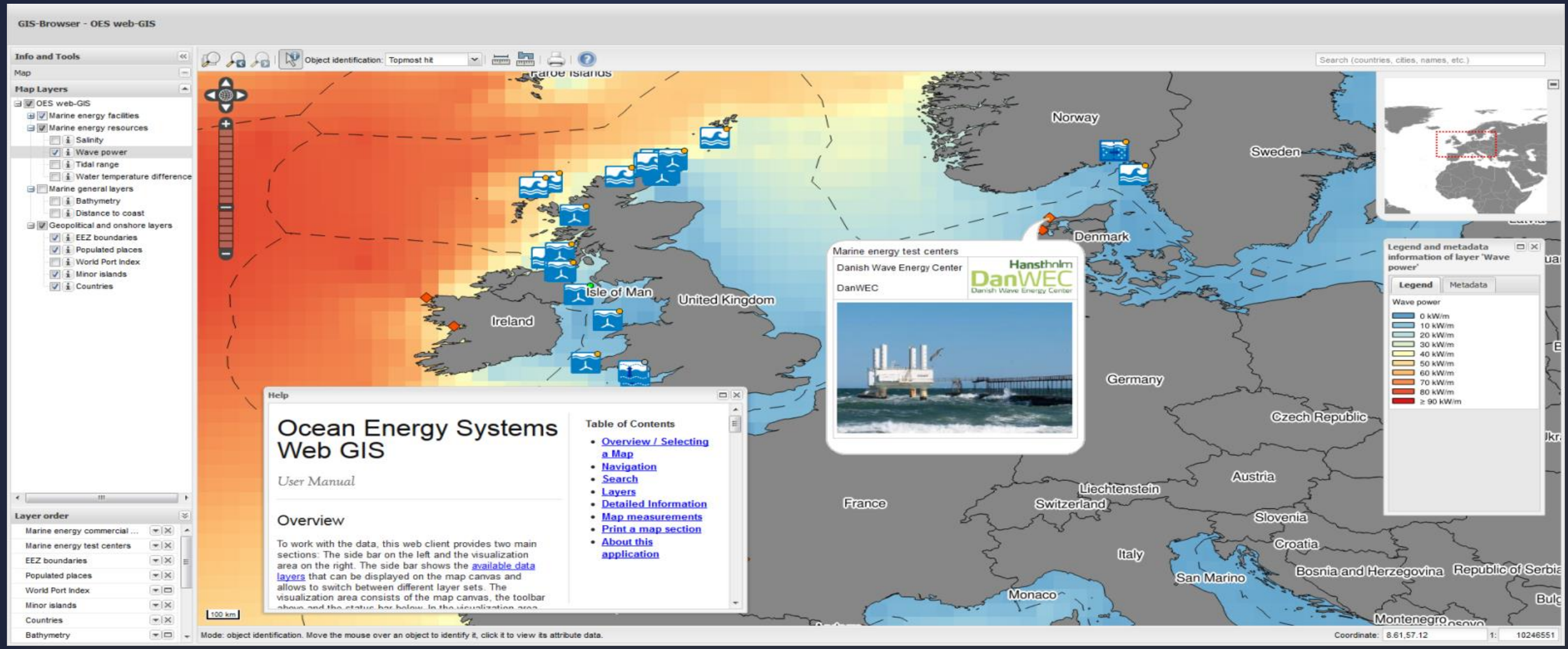
Search All Fields

Choose an option to select a specific text field in which to search. Search finds items containing the exact terms entered, in any order. Phrases can be searched using quotations.

Search All

Worlwide Web-based GIS database

Providing detailed information on ocean energy resources and related projects



Exchange and Assessment of Ocean Energy Device Project Information and Experience (Annex V)

OPERATING AGENT: **US Department of Energy**

ACHIEVEMENTS:

- **Workshop I "Open Water Testing"**
  Ireland, October 2012

- **Workshop II "Computational Modeling & Analysis"**
  UK, 25-26 Nov 2013

- **Workshop III "Designing for Reliability"**
  Portugal, 5-6 Feb 2014

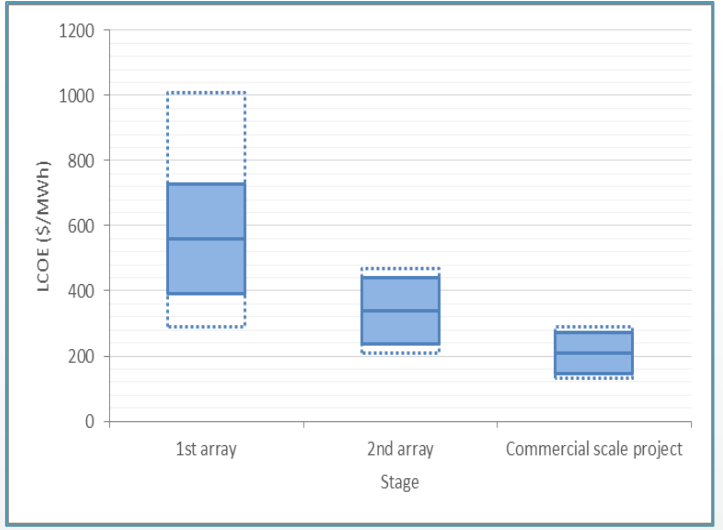
- **Workshop IV "Ocean Energy Policy"**
  Sweden, 12 May 2016

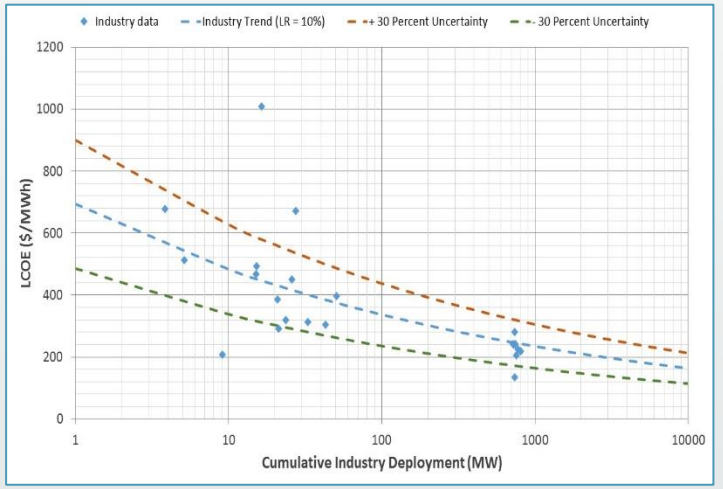
International Levelised Cost of Energy for Ocean Energy Technologies

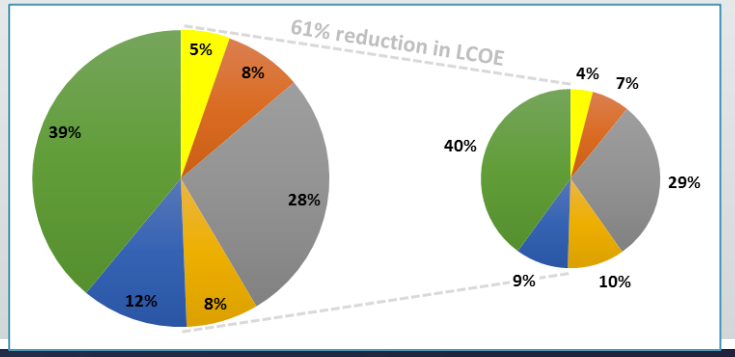
OPERATING AGENT: The University of Edinburgh (UK)

ACHIEVEMENTS:

- Thorough investigation of LCOE for **wave, tidal and OTEC** technologies; consistent methodology applied
- Cost reduction trajectories on an international level.
- Industry consultation - development of revised cost models
- High costs intrinsic to the early stage development of technology.
- Cost reduction trends: clear trajectory towards a more affordable LCOE
- Costs in the long-term are expected to decrease from the first commercial project level as experience is gained with deployment



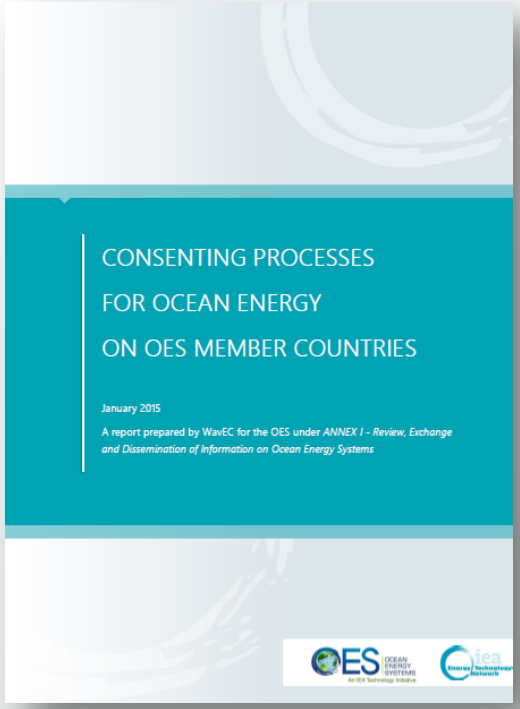




- ## Consenting Processes for Ocean Energy | 2014 -2016

Coordination: WavEC

- Legal, policy and administrative issues
- Coherent overview, highlighting areas which may require further attention



- ## International Roadmap| 2015 -2016

Coordination: University of Edinburgh

- To achieve LCOE targets within the ocean energy sector.
- Focus on two key areas: **Reliability** and **Performance Improvement**

Specific objectives:

- Identification of the key gaps hindering cost reduction
- Prioritise research and innovation activity requirements
- Engaging and mobilizing the supply chain
- Timelines and milestones to measure and track progress

OES Annual Report
Authoritative reference source

Ocean Energy Policy
Research & Development
Technology Demonstration

Special Themes:

2012 Annual Report
Development of the International Ocean Energy Industry

2013 Annual Report
Current Perspectives of Key Industrial Ocean Energy Players

2014 Annual Report
Current Perspectives of 3 Leading Project Developers

2015 Annual Report (to be release)
Interview to funding entities

Thank you

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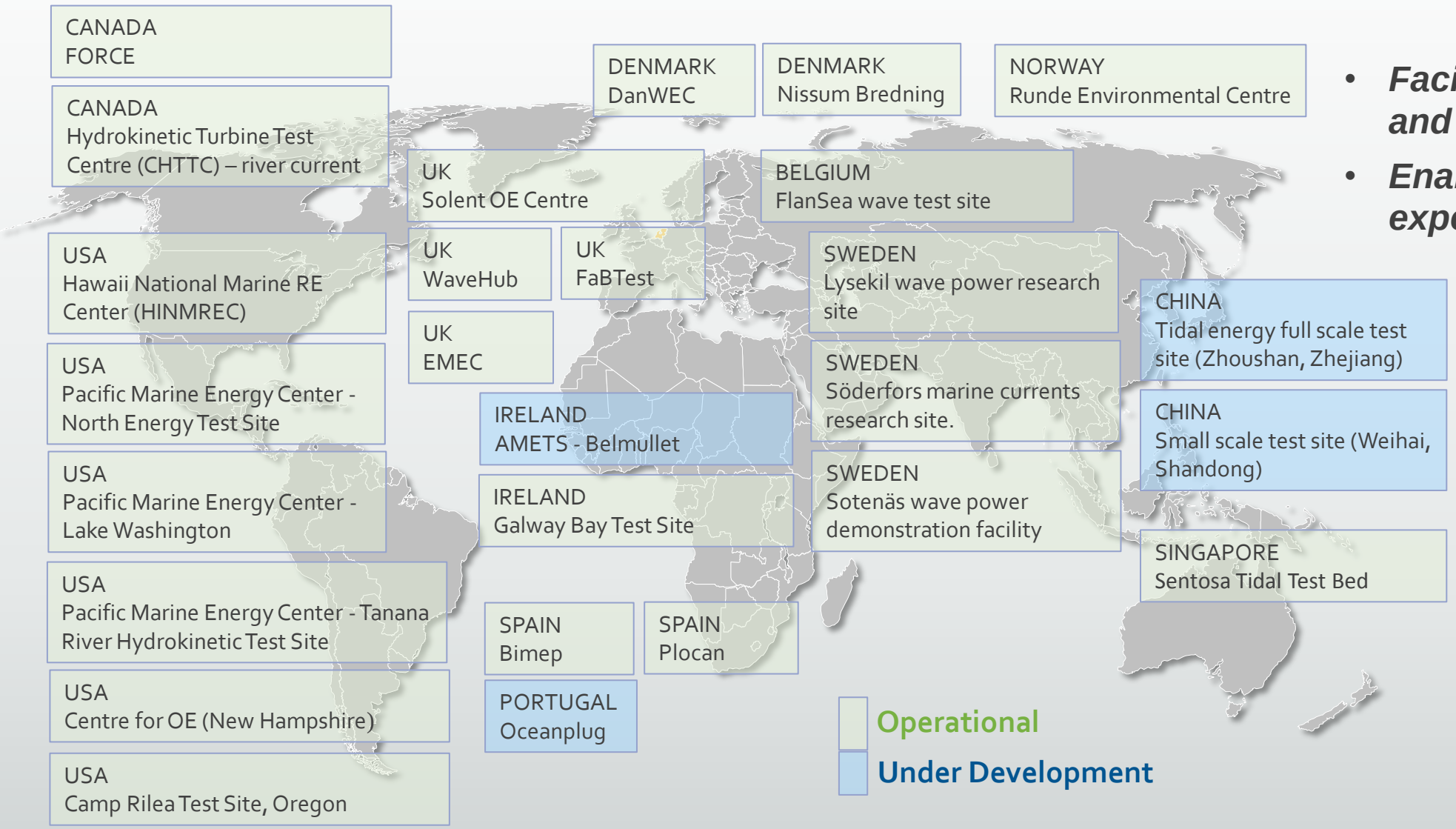
Vision

"As the authoritative international voice on ocean energy we collaborate internationally to accelerate the viability, uptake and acceptance of ocean energy systems in an environmentally acceptable manner."

Open Sea Testing Sites
Encouraging ocean energy development



- ***Facilitating administrative and legal requirements***
- ***Enabling practical O&M experience of prototypes***

Ocean Energy Policies

Countries are faced with the challenge of achieving energy security, environmental protection and economic competitiveness.

Ocean energy could contribute to these objectives in the medium to long term, provided that policies, which establish support mechanisms to stimulate market deployment and intensify R&D funding are implemented by their governments.

Activities, in these areas are growing, across the world.

	NATIONAL STRATEGY				MARKET INCENTIVES						FINANCING		
	Ocean energy targets	Roadmap for ocean energy	Detailed resource assessment	Marine Spatial Plan	Feed-in tariff	ROC	Tradable green certificates	RE portofolio standard	Open sea testing centers	Streamlined licencing regime	Fundamental R&D	Prototype testing	Testing centers
Australia			X	X						UD			
Belgium			X	X			X		X	X	X	X	
Canada	X		X	X	X				X	UD	X	X	X
China			X	X					UD		X		
Denmark									X		X		
Germany	X		X	X	X						X		
Ireland	X		X	X	X				UD	UD	X		
Italy	X				X						X		
Japan			X								X	X	
Korea	X		X				UD	X			X	X	
Mexico													
Monaco													
Norway				X			X		X		X		
New Zealand			X	X					P		X		
Nigeria		UD											
Portugal	X	UD		X					UD	UD	X		
South Africa		UD		X									
Spain	X		X						X	UD	X	X	X
Sweden				X			X		X	UD	X	X	
United Kingdom	X		X	X	UD	X			X	X	X	X	X
USA			X	X					X	UD	X	X	X

Collaboration with International organisations

ICOE 2016 INTERNATIONAL CONFERENCE ON OCEAN ENERGY	The OES is the organizer of a "poster award" and hosts a website with past conference material
IRENA International Renewable Energy Agency	IRENA workshop "Island Energy Transitions: Pathways for Accelerated Uptake of Renewables", Martinique, 22-24 June 2015
OECD	Collaboration with the OECD project "THE FUTURE OF THE OCEAN ECONOMY: Exploring the prospects for emerging ocean industries to 2030"
INORE	International Network on Offshore Renewable Energy (INORE) - association of early stage researchers. Financial sponsorship
IEC	Participation in the Technical Committee (TC) 114: Marine Energy – Wave and Tidal Energy Converters