

Environmental Monitoring, Regulatory Needs & Scientific Capabilities:

A Facilitated Discussion between Scientists, Regulators and Industry

Andrea Copping

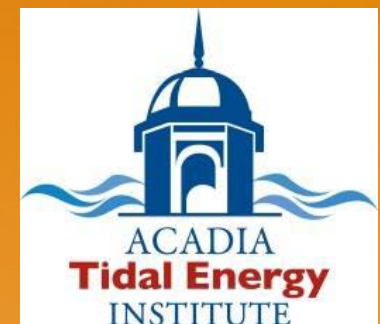
*Pacific Northwest National Laboratory
Sequim and Seattle Washington, USA*

Anna Redden

Acadia University and FORCE



Environmental Effects of
Marine Energy Development
around the World



Workshop
November 1st 2014

11/20/2014



Environmental Effects of Marine Energy

- ▶ Drivers of marine energy development are clear:
 - Need for reliable low carbon energy sources, mitigate climate change
 - Renewable energy standards in many nations, regions
 - Secure energy generated locally

BUT

- ▶ Stakeholders have concerns about potential impacts
- ▶ Regulatory/consenting processes are not well established

DRIVEN BY:

- ▶ New, largely unknown technologies with unknown potential for harm
- ▶ New use of ocean space, many other users
- ▶ Insufficient knowledge of ocean environment in high energy areas
- ▶ Concerns about marine species already under stress



Annex IV – A Concept in Sharing Information and Analyses Internationally

► Phase 1: 2010 – 2012

- OES ExCo approved Annex IV *Phase 1* in 2009
- Proposed by US; US Dept of Energy as Operating Agent
- Other US federal partners: BOEM, FERC, NOAA
- Seven Annex IV nations: US, New Zealand, Canada, Denmark, Spain, Ireland and South Korea
- Focus on information gathering, developing data platform, analysis of key interactions



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OCEAN ENERGY

WAVES, TIDAL & CURRENTS, SALINITY, THERMAL

SEARCH OES

OK

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.

Did you know...

Annex IV – A Concept in Sharing Information and Analyses Internationally

- ▶ Phase 2: 2013 – 2016
- ▶ Approved by OES Ex Co in 2013
- ▶ Twelve member nations: US, New Zealand, Canada, Spain, Ireland, Portugal, UK, Japan, China, Norway, Sweden, South Africa.
- ▶ Emphasis continues on information gathering, sharing, analysis
- ▶ Also creating a commons, gathering place



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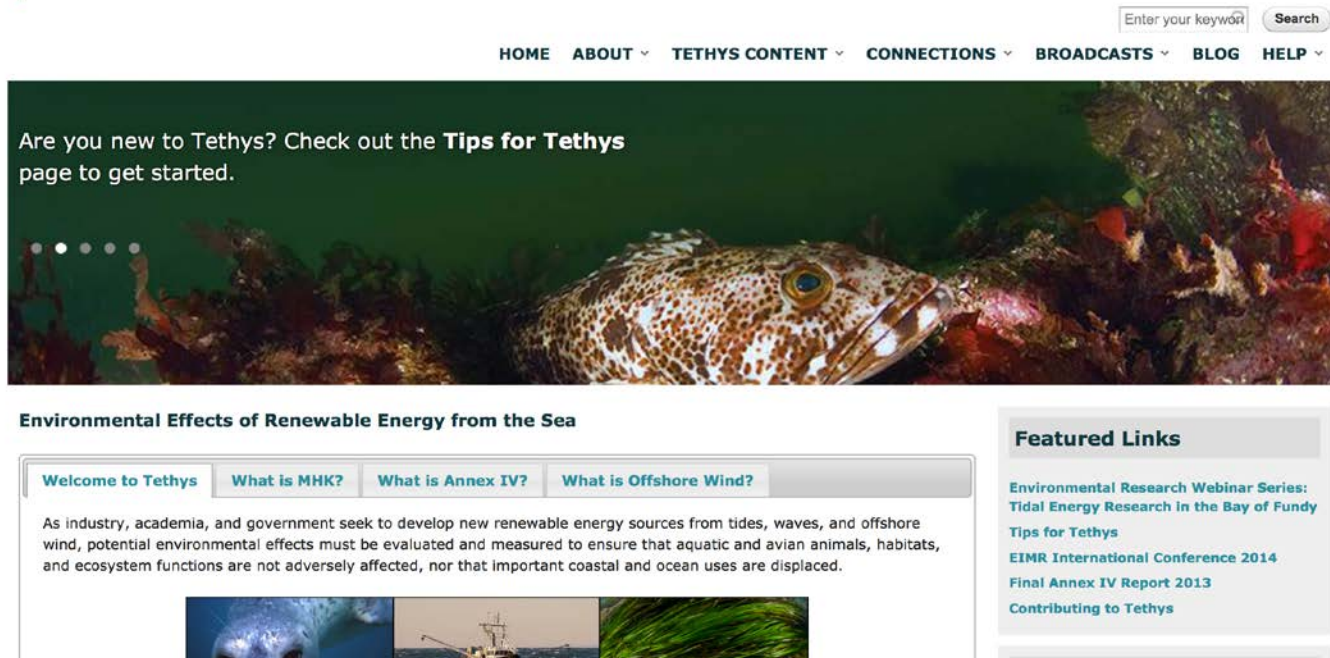
AS THE AUTHORITATIVE INTERNATIONAL VOICE ON OCEAN ENERGY WE COLLABORATE INTERNATIONALLY TO ACCELERATE THE VIABILITY, UPTAKE AND ACCEPTANCE OF OCEAN ENERGY SYSTEMS IN AN ENVIRONMENTALLY ACCEPTABLE MANNER.

Did you know...

You can find information

Developing and Sharing Information: Annex IV case studies, workshops, webinars, expert forums, *Tethys*

- ▶ Annex IV report: case studies of key interactions
- ▶ Series of workshops, building towards scientific understanding
- ▶ Webinars on environmental effects
- ▶ Experts forums on specific scientific questions
- ▶ All hosted on Tethys (Tethys.pnnl.gov)



The screenshot shows the Tethys website homepage. At the top, there is a navigation menu with links for HOME, ABOUT, TETHYS CONTENT, CONNECTIONS, BROADCASTS, BLOG, and HELP. A search bar is located to the right of the menu. Below the navigation is a large banner image of a fish underwater. The text on the banner reads: "Are you new to Tethys? Check out the **Tips for Tethys** page to get started." Below the banner is a section titled "Environmental Effects of Renewable Energy from the Sea" with sub-links: "Welcome to Tethys", "What is MHK?", "What is Annex IV?", and "What is Offshore Wind?". The main text in this section states: "As industry, academia, and government seek to develop new renewable energy sources from tides, waves, and offshore wind, potential environmental effects must be evaluated and measured to ensure that aquatic and avian animals, habitats, and ecosystem functions are not adversely affected, nor that important coastal and ocean uses are displaced." To the right of this section is a "Featured Links" box containing links to: "Environmental Research Webinar Series: Tidal Energy Research in the Bay of Fundy", "Tips for Tethys", "EIMR International Conference 2014", "Final Annex IV Report 2013", and "Contributing to Tethys". At the bottom left, there is a date "November 20, 2013" and a row of three small images: a blue abstract image, a ship at sea, and green grass.

Three Case Studies:

- ▶ Interaction of animals with tidal blades
 - ▶ Effects of underwater noise from wave and tidal devices
 - ▶ Changes to physical systems from energy removal
-
- ▶ An update planned for 2016 “State of the Science” report



Environmental Effects of Marine Energy Development
around the World
Annex IV Final Report

January 2013

A report prepared by Pacific Northwest National Laboratory for the U.S. Department of Energy under contract number DE-AC05-04OR21400. The U.S. Department of Energy and Pacific Northwest National Laboratory are not responsible for the accuracy or completeness of the information provided in this report.

Workshops

Date	Workshop	Location
2007	Ecological Effects of Wave Energy Development in the Pacific Northwest	Newport OR, US
2010	Environmental Effects of Tidal Energy Development: Proceedings of a Scientific Workshop	Seattle WA, US
2013	Instrumentation for Monitoring around Marine Renewable Energy Converters: Workshop Final Report	Seattle WA, US
2014	Best Practices for Monitoring Environmental Effects of Marine Energy Devices	Stornoway, UK
2010	Annex IV program planning	Dublin IE
2013	Annex IV review and planning phase 2	Dublin IE

Webinars, expert forums

Webinar	Date	Description
Annex IV Environmental Webinar #3: Tidal Energy Research in the Bay of Fundy	October 27, 2014	This webinar highlights the work being done by four scientists who focus their research on better understanding the tidal energy resource and potential in the Bay of Fundy, and how tidal energy developments there may affect the surrounding marine environment.
Annex IV Environmental Webinar #2: Interactions of Marine Mammals and Birds Around Marine Energy Devices	May 19, 2014	Presenters discussed several approaches to understand the interactions between marine mammals and diving seabirds around wave and tidal energy devices.
Annex IV Environmental Webinar #1: Instrumentation Workshop	Jan 23, 2014	An instrumentation workshop was held in June of 2013 to discuss the current state of the science for environmental monitoring around MHK devices.
DOE MHK Webinar #5: The Annex IV Project	Apr 03, 2012	International data sharing efforts for potential environmental effects of marine renewable energy to understand effects, minimize the potential for redundancy of efforts, and increase the efficiency of the permitting and consenting process.
DOE MHK Webinar #4: Acoustic Impacts	Dec 14, 2011	Anthropogenic noise production in the marine environment is a known stressor to many different aquatic species.
DOE MHK Webinar #3: Monitoring Technologies and Strategies	Sep 14, 2011	Focus on developing methodologies for monitoring MHK devices post-deployment, including monitoring framework development and the use of passive and active acoustics to monitor aquatic animal behavior around MHK devices.
DOE MHK Webinar #2: Aquatic Animal Interaction with Marine and Hydrokinetic Devices	Aug 29, 2011	Discussing the probability and extent of damage occurring as a result of interaction between aquatic animals and MHK devices.
DOE MHK Webinar #1: Environmental Data Management, Cumulative Impacts and Risk Assessment	Jul 27, 2011	Showcasing methods for dissemination of valuable environmental data.

Home > Knowledge Base

Knowledge Base

The Knowledge Base compiles relevant documents, Annex IV metadata forms, and U.S. permitting sites into one table. Columns may be sorted alphabetically by clicking on the headers, while results can be narrowed by keyword searches and by selecting values in the boxes to the right. Learn more about the filtering [here](#). More entries will load as you scroll down.

Tethys Map Viewer

[Clear All Filters](#)

Title	Author*	Date**	Type of Content	Technology Type	Stressor	Receptor	Collection
Renewable energy developments in an uncertain world: The case of offshore wind and birds in the UK	Madden, E., et. al.	January 2015	Journal Article	Offshore Wind	N/A	Birds	Tethys
Impact of Tidal-Stream Arrays in Relation to the Natural Variability of Sedimentary Processes	Robins, P., Neill, S., Lewis, M.	December 2014	Journal Article	Tidal	Energy Removal	Nearfield Habitat	Tethys
Greenhouse Gas Emissions from Electricity Generated by Offshore Wind Farms	Reiners, B., Ozdink, B., Kaltschmitt, M.	December 2014	Journal Article	Offshore Wind	N/A	Ecosystem	Tethys
Investigating the Co-Existence of Fisheries and Offshore Renewable Energy in the UK: Identification of a Mitigation Agenda for Fishing Effort Displacement	de Groot, J., et. al.	December 2014	Journal Article	MHK, Offshore Wind	Static Device	Fish	Tethys
An Economic and Environmental Assessment of Transporting Bulk Energy from a Grazing Ocean Thermal Energy Conversion Facility	Gilmore, E., Blohm, A., Sinsabaugh, S.	November 2014	Journal Article	OTEC	N/A	Farfield Environment	Tethys
Simulating Blade-Strike on Fish Passing Through Marine Hydrokinetic Turbines	Romero-Gomez, P., Richmond, M.	November 2014	Journal Article	In-Stream, Tidal	Dynamic Device	Fish	Tethys
Is EIA Part of the Wind Power Planning Problem?	Smart, D., Stojanovic, T., Warren, C.	November 2014	Journal Article	Offshore Wind	N/A	N/A	Tethys
Assessing the Influence of Inflow Turbulence on Noise and Performance of a Tidal Turbine using Large Eddy Simulations	Lloyd, T., Turmock, S., Humphrey, V.	November 2014	Journal Article	Tidal	Noise	N/A	Tethys
Using Medaka Embryos as a Model System to Study Biological Effects of the Electromagnetic Fields on Development and Behavior	Lee, W., Yang, K.	October 2014	Journal Article	N/A	EMF	Fish	Tethys
Insights from archaeological analysis and interpretation of marine data sets to inform marine cultural heritage management and planning of wave and tidal energy development for Orkney Waters and the Pentland Firth, NE Scotland	Pollard, E., et. al.	October 2014	Journal Article	MHK	N/A	Socio-economics	Tethys
Records of Trace Metals in Sediments from the Oregon Shelf and Slope: Investigating the Occurrence of Hypoxia Over the Past Several Thousand	Erhardt, A., et. al.	September 2014	Journal Article	N/A	Chemical Leaching	N/A	Tethys

Current search

Search found 1588 items

Text Search

Tethys Text Search finds items containing the exact words entered, in any order. Phrases can be searched using quotations.



Home > Tethys Content > Map Viewer

Map Viewer

The Map Viewer compiles documents, U.S. permitting sites, and international Annex IV project sites and research studies that are associated with a geographic location (but not all Tethys content is geotagged). This view allows panning and zooming, while results can be narrowed by keyword searches and by selecting values in the boxes to the right. Learn more about the filtering [here](#). Clicking on a bubble will open a dialogue box with more information that links to the document page.

Tethys Knowledge Base


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Current search

Search found 432 items

Text Search

Tethys Text Search finds items containing the exact words entered, in any order. Phrases can be searched using quotations.

Legend

- Documents (314)
- Project Site Annex IV (80)
- Research Study Annex IV (131)
- Permitting Site FERC (7)

Closely-packed items are clustered together. Clicking on the cluster allows you to navigate individual items. You may zoom in to make smaller clusters.

Technology Type

- Tidal (149)
- Offshore Wind (135)
- Wave (106)
- MHK (23)
- In-Stream (14)
- OTEC (4)
- Ocean Current (2)

Country

- United Kingdom (128)
- United States of America (111)
- Denmark (52)
- Canada (20)
- Sweden (17)
- The Netherlands (10)
- Germany (9)
- Norway (9)
- Norway (9)

What do we want to achieve today?

- ▶ Opportunity to establish a dialogue between regulators and scientists/developers
- ▶ Morning is to summarize what the science is telling us
- ▶ Rest of day is to determine what is needed for regulators to feel confident in permitting

- ▶ Many of the questions we will pose today were generated by the regulatory community
- ▶ The questions are a guide for discussion, not prescriptive
- ▶ As new ideas, issues, come up, we can pursue them.

- ▶ Purpose is to start the dialogue, get everyone on the same page
- ▶ Consider ways to continue this dialogue if it is useful

Ground Rules

- ▶ Other than the presentations, let's keep it informal.
- ▶ However, we have very limited time, so all appropriate manners are needed to keep us on track.
- ▶ Speak up, participate, let the group know what you are thinking.
- ▶ Get to know the people at your table and around the room.
- ▶ Andrea and Anna will facilitate; don't make us work too hard!

- ▶ No comments will be specifically attributed to an individual
- ▶ Recordings are being made of the presentations, and maybe some of the discussion.