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Annex IV and Tethys:

International Environmental Data Sharing Initiative

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Annex IV & Tethys: Project Overview

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This Project:

Development of the marine renewables industry is being slowed due to concern about potential environmental effects. Annex IV and *Tethys* collects and shares information to analyze these effects and understand risks to the environment, leading to proportional monitoring and mitigation approaches that will facilitate permitting. This work is carried out under the International Energy Agency – Ocean Energy Systems (IEA-OES).

The Challenge:

Marine renewables are new users of ocean space, and, while learning has been fast, there are still many gaps in knowledge of potential effects.

Who Benefits:

Determining risks from devices and arrays, and sharing that information broadly, can assist regulators and developers to reduce monitoring and mitigation requirements, and decrease time and cost to deployment.

Project Partners:

Annex IV countries (13), U.S. federal agencies (DOE, Bureau of Ocean Energy Management [BOEM], National Oceanic and Atmospheric Administration [NOAA], Aquatera Limited

Program Strategic Priorities

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Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- Conduct R&D for Innovative MHK components
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- **Support research focused on retiring or mitigating environmental risks and reducing costs**
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- **Exchange of data information and expertise**

Project Strategic Alignment

Deployment Barriers

Support research focused on retiring or mitigating environmental risks and reducing costs

Target: Annex IV/Tethys addresses and retires perceived risks of marine renewable energy (MRE) development.

Impact: Retiring risks will accelerate permitting timelines for device deployment by simplifying baseline data collection and post-installation monitoring.

Endpoint: Understanding of risks that have been conveyed to regulators, and information applied to deployments in the United States and abroad.

Crosscutting Approaches

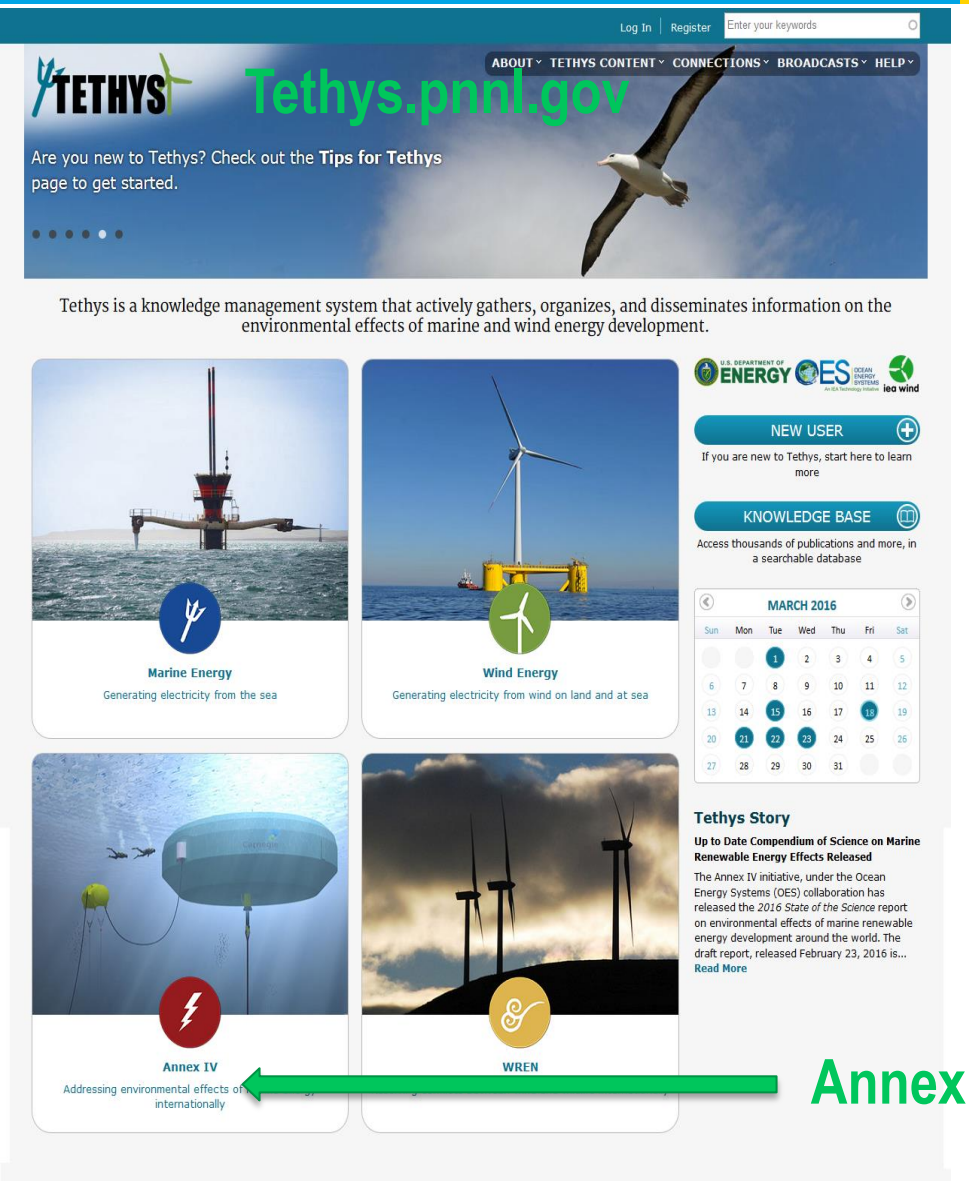
Exchange of data information and expertise

Target: Annex IV/Tethys collects and disseminates all available environmental information on effects of MRE development.

Impact: Sharing information will ensure all stakeholders have best available science for decision-making and developing proportional monitoring and mitigation strategies.

Endpoint: Shared information leading to informed permitting that accelerates deployments in the United States and abroad.

Technical Approach



- Annex IV Phase 2 - FY14-FY16
- Participation of 13 OES nations
- Annex IV collects, curates, archives:
  - Scientific literature, reports, etc. for KB and MV
  - 3450 entries/ 1700 specific to MRE
  - Metadata on projects and research studies
  - Webinars, expert forums
  - Workshops, conference tracks
  - Interactive calendar
  - Tethys Blast
  - Tethys Stories
- State of the Science report culmination of Phase 2
- Tethys developed and maintained at PNNL

Technical Approach

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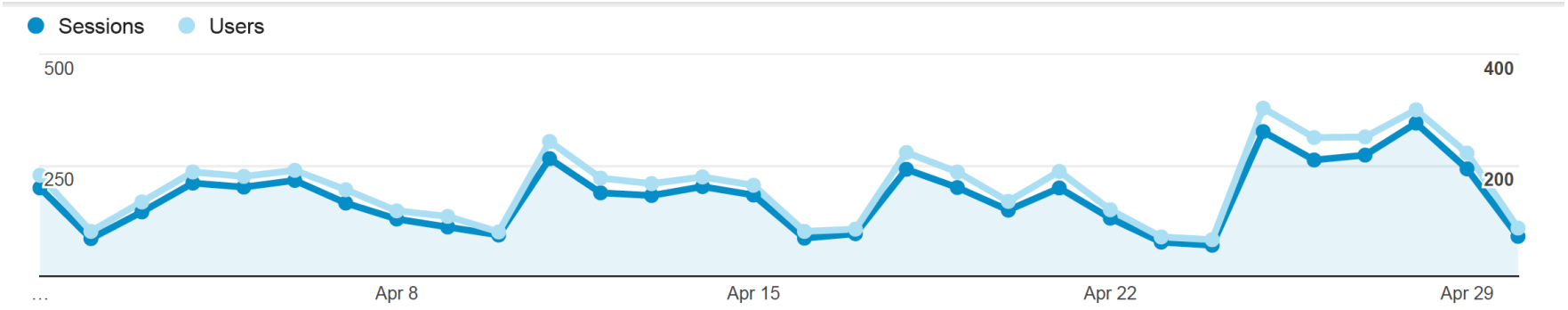
Tethys Stats from FY14 – FY16:

- Content has grown from 946 to 3,275 documents (x 3.5)
- 400,000 pageviews from 100,000 visitors
- Accessed from196 countries
- Hosted 12 webinars, four Expert Forums
- 63 Tethys Blasts to ~1,400 people
- Organized six international workshops
- Enhanced cyber security
- Faster load times

- Modern web design
- 12,000 pages on site
- Peak daily access = 324 (4/2015)
- Peak page view = 1415 (4/2015)
- 500 registered users
- 221 followers on Twitter, 138 on Facebook
- Multiple Google Analytics tracked



Accomplishments and Progress

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Annex IV and *Tethys* activities roll up to provide:

– **Comprehensive access to information** on environmental effects

– **Access and interactions with key researchers, regulators, developers**;

–Culmination in the 2016 State of the Science report

Impact of State of Science:

- In addition to the report

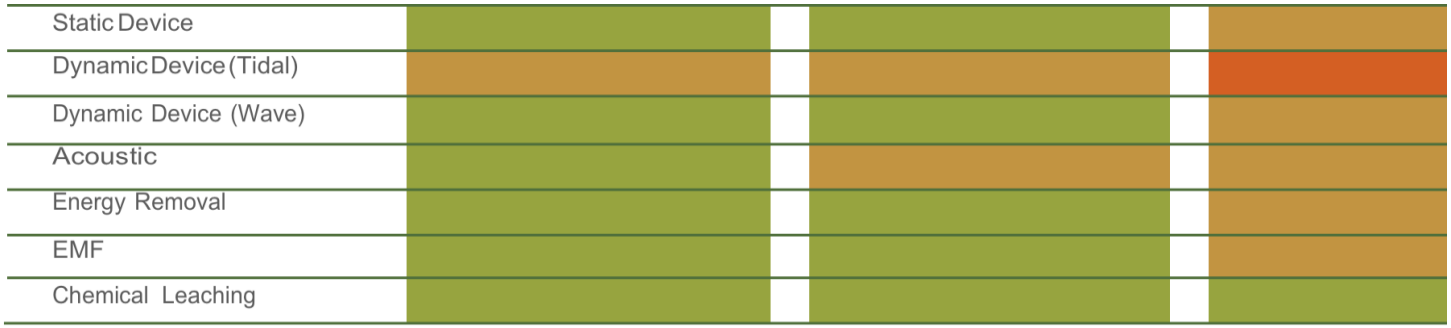
- Stand alone (eight pages) **Executive Summary**, in two languages.

- **short science summaries** (two pages) of key stressors

- **Briefings, webinars, conference presentations**

-Downloaded more than **3,400** times

Summary Risk Table of MRE stressors from SoS



Project Plan & Schedule

Significant Dates and Schedule	Explanation
Project Initiation Date	January 2010 – Phase 1 Annex IV
Project Completion Date	May 2020 – end of Phase 3
Slipped milestones/schedule	No significant milestones missed; overall schedule not affected.

Go/No-Go Decisions

Year	FY14	FY15	FY16
Go/No-Go decision point	None	Decision whether to request 3rd phase of Annex IV	Decision to co-host workshop on collision risk in association with International Conference on Ocean Energy.
Outcome	-	Decision to go forward. Request for Phase 3 granted by OES.	Decision to go forward. Workshop held and report prepared.

Project Budget

Budget History					
FY2014		FY2015		FY2016	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$475K	$100K	$500K	$132K	$820K	$100K

- No significant variances from planned budget
- Project budget expended (except 25% carryover to FY17)
- Each Annex IV country contributes time and expenses equal to €8000 (total €96,000 = ~$100K)
- OES provided €30,000 to assist with State of Science report during FY15

Research Integration & Collaboration

Annex IV, carried out under Ocean Energy Systems:

Project Partners	Role in Project
DOE Water Power Technologies Office and federal partners (BOEM and NOAA)	Planning and oversight of Annex IV. DOE acts as Operating Agent.
Phase 2 Annex IV country partners: Canada, China, Ireland, Japan, New Zealand, Nigeria, Norway, Portugal, South Africa, Spain, Sweden, United Kingdom, and United States.	Planning and implementation of all aspects of Annex IV
Aquatera Limited	Subcontractor helping with data gathering, organizing and collecting metadata, collaboration with workshops, conferences, webinars
Offshore Renewables Joint Industry Group	Collaboration on research agenda, connections to European marine renewables activities.

Research Integration & Collaboration

Publications and Presentations

Publication or Presentation	Impact and Distribution
2016 State of Science report, executive summary (in 7 languages), short science summaries, briefings, presentations at conferences	Widely distributed in hard copy and electronically. Downloads = 3,415
84 project metadata forms, 58 research metadata forms	Up to date information on projects that have been deployed, studies underway
Three peer-reviewed papers	
Four quarterly webinars per year Range of environmental topics from international speakers	Live attendance per webinar = 53–134 Online views = 375–1,400
Four Expert Forums in FY14–FY16: Collision risk, effects of turbines on larvae, analyzing acoustic data in high-energy environments.	Informed respective research agendas. Downloads = 80–165
Four workshops in FY14–FY16: Monitoring around devices, regulatory needs, action plan for collision risk	Informed research agendas, bridged gap with regulatory needs. Downloads = 83–542
Developed environmental track at European Wave and Tidal Energy Conference (EWTEC) 2015	Environmental focus at EWTEC from one session (EWTEC 2013) to six sessions.

Next Steps and Future Research

FY17/Current research:

Phase 3 of Annex IV continues, with increased emphasis on:

- Retiring collision risk
- Outreach to regulators
- Engagement in workshops on mitigation measures efficacy around turbines, and transferability of data set to new locations
- Environmental tracks at METS, EWTEC

Proposed future research:

Annex IV continues through 2020