

Annex IV

WHO WE ARE

Annex IV was established by the International Energy Agency Ocean Energy Systems in 2010 to examine environmental effects of marine renewable energy (MRE) development around the world. There are currently 15 Annex IV member nations, including Australia, Canada, China, Denmark, France, India, Ireland, Japan, Norway, Portugal, South Africa, Spain, Sweden, United Kingdom, and United States. Annex IV is implemented by the U.S. Department of Energy's Pacific Northwest National Laboratory, utilizing *Tethys* (<https://tethys.pnnl.gov/>) as the Annex IV coordination, collaboration, and outreach platform.

Concerns about the potential effects of MRE devices (wave and tidal) on the marine environment continue to slow siting and permitting/consenting of single devices and arrays worldwide. Annex IV is mobilizing information and the international MRE community to coordinate research that can progress the industry in an environmentally responsible manner.

WHAT WE DO

Currently in its third phase, Annex IV is working closely with MRE regulators, developers, researchers, and stakeholders to help progress the industry and expedite environmental permitting/consenting processes. Specifically, Annex IV is focusing on the ability to transfer data from already permitted/consented projects to future projects to facilitate more efficient and shorter permitting/consenting processes, as well as the collection of social and economic data to better understand impacts to surrounding communities. For both data transferability and socio-economics, Annex IV has been developing best management practices to guide these efforts.



WHAT WE KNOW

In 2016, Annex IV published the *2016 State of the Science* (<https://tethys.pnnl.gov/publications/state-of-the-science-2016>) report that summarizes the knowledge of interactions and effects of MRE devices on the marine environment, the animals that live there, and the habitats that support them. The report identified five (5) stressors that pose the most risk to environmental receptors in the marine environment, including:

- ◆ **Collision risk** for animals around tidal turbines
- ◆ Risk to marine animals from **underwater sound** generated by MRE devices
- ◆ **Effects of electromagnetic fields** on marine animals from electrical cables and MRE devices
- ◆ **Changes in physical systems**, such as energy removal and changes in flow
- ◆ **Changes in habitat caused** by MRE energy devices, such as benthic habitat changes and reefing patterns

Annex IV will be publishing an update to the *2016 State of the Science* report in 2020.



Annex IV also develops Short Science Summaries that synthesize scientific understanding about specific environmental interactions and issues. Available Short Science Summaries can be found on *Tethys* (<https://tethys.pnnl.gov/search/shortsciencesummaries>) and include:

- ◆ Collision Risk
- ◆ Underwater Noise
- ◆ Physical Systems
- ◆ Electromagnetic Fields
- ◆ Benthic Habitats and Reefing Patterns
- ◆ Entanglement with Marine Renewable Energy Mooring Lines
- ◆ Marine Spatial Planning
- ◆ Permitting/Consenting Case Studies
- ◆ Next Steps in Resolving Risk from MRE Devices

WHERE TO FIND OUT MORE

Tethys is a web-based knowledge management system used by Annex IV to collaborate with Annex IV member nations, engage with the MRE community, and facilitate the exchange of data and information on the environmental effects of MRE technologies. Information on *Tethys* is curated to promote engagement and disseminate information among the MRE community, and includes *Tethys* Blasts and *Tethys* Stories and collaborations with Annex IV such as *environmental webinars* and *expert forums*.



FOR MORE INFORMATION

Go to <http://tethys.pnnl.gov> for a robust collection of papers, reports, archived presentations, and other media about MRE development.

Contact: Andrea Copping
Pacific Northwest National Laboratory
andrea.copping@pnnl.gov
+1 206.528.3049