

# Benefits and Effects

**T**echnologies that harvest energy from the movement of water in oceans and large rivers are under development around the world. Marine renewable energy (MRE) devices are designed to take advantage of tidal currents, fast flowing rivers, and waves, as well as ocean currents and natural gradients of temperature and salinity in ocean waters. The potential benefits that MRE can bring to nations and stakeholders are driving research studies, development of engineering systems, and experimental deployments of wave energy converters, as well as tidal and river turbines, in coastal areas. These studies, trials, and experiments are the leading edge of the development of an international MRE industry that is adding to the renewable energy portfolio of many nations. As this development occurs, it is essential that MRE projects not harm valuable and often fragile marine populations, habitats, and systems in the oceans. The responsible development of the MRE industry is informed by science-based understanding of the potential effects of MRE installations worldwide.



## BENEFITS OF MARINE RENEWABLE ENERGY

MRE systems can provide sustainable, predictable, low-carbon energy to coastal areas and large river basins. The energy can be generated locally, providing energy security, and stability for electrical grids in remote areas, as well as supplying power to areas that rely heavily on diesel fuel. MRE devices can provide a new source of power at sea for applications that have relied on diesel, like offshore aquaculture, or on batteries, like ocean observation platforms and navigation aids. New uses like desalination to produce freshwater for remote coastal areas and islands, and providing power to isolated resorts for electric boats and dive tank refills, could all be addressed with power generated by MRE devices.

MRE development has the potential to bring employment to areas that are often far from other industries, ranging from jobs with the MRE companies, supply chain companies, environmental consultancies, as well as government regulators and advisers. Increased economic development may follow MRE development, providing social and economic advantages to communities and regions.

Like all renewable energy forms, MRE development aids in mitigating climate change by lowering greenhouse gas emissions compared to conventional power sources, and reducing the acceleration of ocean acidification, rising seawater temperatures, and rising sea levels that affect marine animals as well as coastal communities that depend on the ocean.

Wave and tidal devices can act as artificial reefs and refuges for fish and other marine organisms, sometimes providing new types of habitats. If MRE project sites are set aside for specific uses, such as prohibitions against fishing, they may act as marine protected areas, allowing fish, shellfish like crab and lobster, and other sea life to thrive, sometimes spilling over into outside areas and boosting fishing opportunities.

## POTENTIAL EFFECTS OF MARINE RENEWABLE ENERGY

In addition to the benefits of MRE development, careful study must be undertaken to understand and minimize harm to marine animals, the habitats that support them, and the oceanographic and ecosystem processes that provide them life. Only by understanding the risks from MRE can we assure that development occurs responsibly to protect valuable resources and allow them to continue to support the needs of humans in coastal communities and beyond.

The areas where MRE projects are sited are among the most energetic and least-understood areas of the oceans. These areas present challenges to observing and documenting how marine animals might interact with the devices, mooring lines, cables, and other infrastructure, or how these installations might affect seafloor or open water habitats. Based on research studies and monitoring around operating MRE devices, the greatest risk appears to be the potential for marine mammals, fish, diving seabirds, and sea turtles to be injured or killed by colliding with rotating turbine blades. Of less concern are the effects of underwater noise from MRE devices on the hearing, navigation, and communication of marine mammals and fish, as well as effects on some sensitive cartilaginous fish (like sharks and rays) and some shellfish from electromagnetic fields emitted by power cables and moving machinery. Changes in habitats, ocean water flows, wave heights, sediment transport, and ocean water quality are also under investigation, though the risks of these changes from small numbers of MRE devices appear to be low. As larger commercial MRE projects are developed in arrays, some of these potential risks will need to be revisited.

## MOVING FORWARD WITH MARINE RENEWABLE ENERGY

As MRE projects develop around the world, research and development will provide the necessary innovation, scientific understanding, and pathways for responsible commercialization that will assure a secure and sustainable energy future.

### REPORT AND MORE INFORMATION

OES-Environmental 2020 State of the Science full report and executive summary available at:  
<https://tethys.pnnl.gov/publications/state-of-the-science-2020>

### CONTACT

Andrea Copping  
Pacific Northwest National  
Laboratory  
[andrea.copping@pnnl.gov](mailto:andrea.copping@pnnl.gov)  
+1 206.528.3049

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