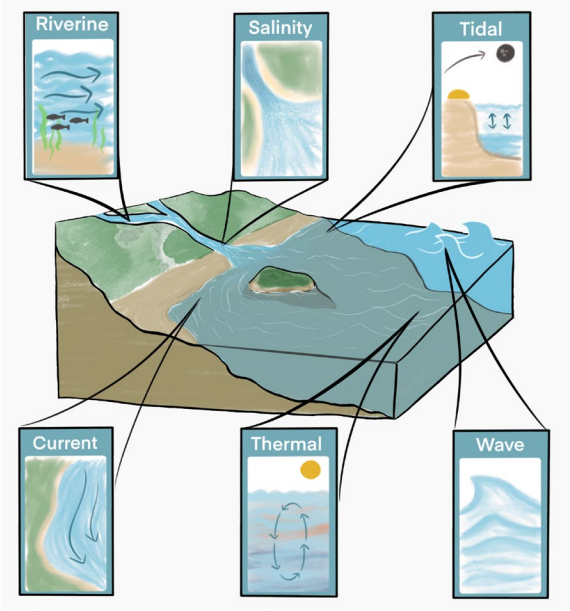
Opportunities for marine energy and shellfish farming in Alaska

Power from oceans and rivers

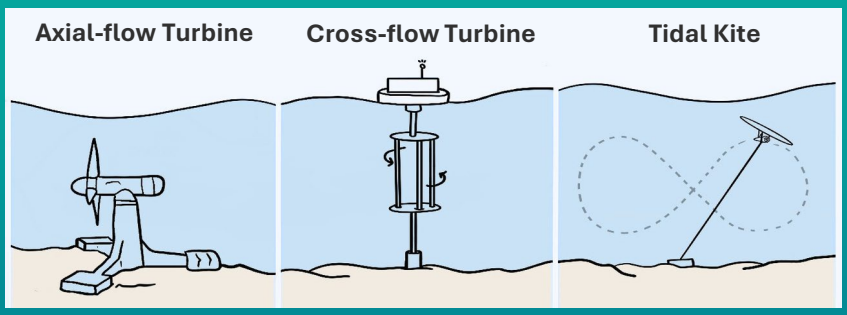
Marine energy refers to energy generated from waves, tides, currents, temperature differences, and flowing rivers. These sources of energy are found near coasts, channels, and river mouths, making them accessible to many working waterfronts and coastal communities.

What are the benefits?

Sources of marine energy follow regular, forecastable cycles, making them more reliable than other forms of renewable energy. They are typically not dependent on local weather conditions and can produce electricity at night or when other systems fail.



Locations where each type of marine energy resource can typically be found. Illustration by Candace Briggs | PNNL.



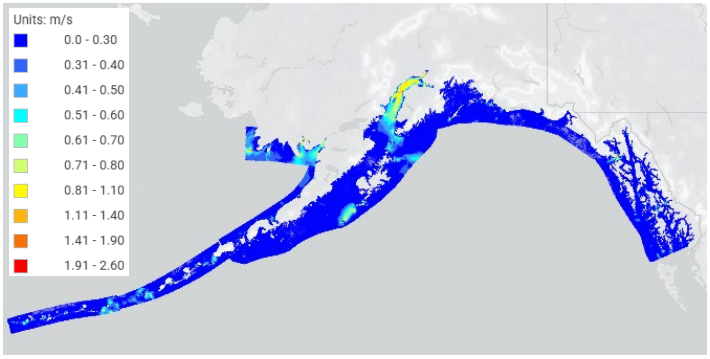
Examples of tidal energy technologies, from the Marine Energy Illustration Library. Illustrations by Cailene Gunn | PNNL.

Tidal current energy

Tidal energy generates electricity from fast-moving currents created by tidal fluctuations. The best areas for tidal energy are typically found in inlets and constricted channels. To produce power, tidal energy devices need fast moving currents with speeds usually above 1.0 m/s or 1.9 knots and often higher.

Marine energy in Alaska

With more than 46,000 miles of shoreline, Alaska holds some of the world's largest tidal energy resources, including 90% of the tidal energy available in the United States.



Modeled tidal current speeds in southern Alaska. Current speeds over 0.8 m/s are shown in yellow and warmer. From Haas et al. (2011), available in the Marine Energy Atlas.

Tidal hot spots

Shown to the left is a map of estimated tidal current speeds in Alaska. Tidal energy hot spots identified by the model are listed below.

- Cook Inlet
- Between many small islands in the Aleutian chain
- Constricted channels in Southeastern Alaska

Longlines and cages of an oyster farm in Southcentral Alaska. Photo credit: Alaska Department of Fish and Game.

Alaska's shellfish industry

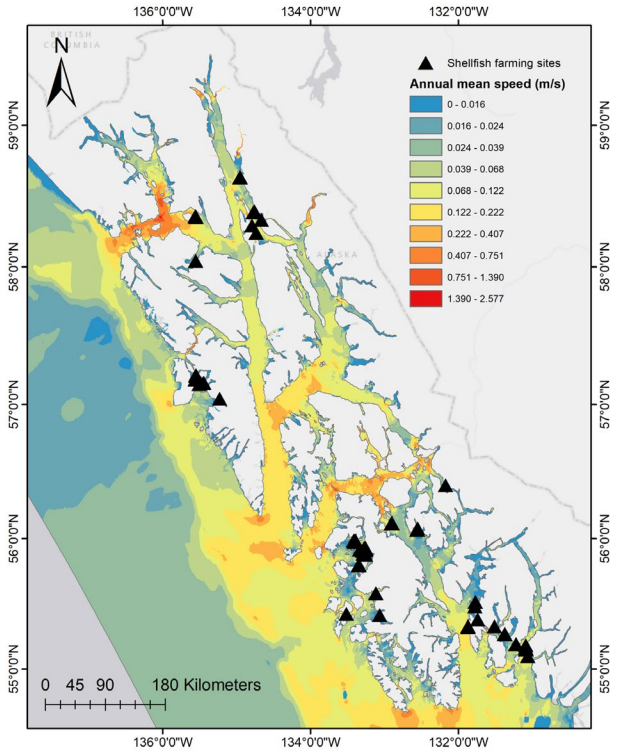
Shellfish farming is an important source of jobs and supports coastal communities in Alaska. To meet the growing demand for seafood, shellfish farming has steadily expanded, particularly in southeastern Alaska. This growth has increased the energy needs of the farms, which often rely on diesel generators to power equipment.

Powering shellfish farms with tides

In areas where shellfish farms are near abundant marine energy resources, operations could be powered using marine energy. This approach, called co-location, may help lower costs associated with diesel fuel usage, provide locally generated energy, and serve as a backup power source to keep equipment running if other systems fail.

Opportunities in Alaska

The map to the right shows a relatively high-resolution tidal current speed model for Southeast Alaska. Shellfish farm locations are depicted as triangles, highlighting opportunities for powering shellfish farms with tidal current energy.



Spatial map depicting modeled tidal current speeds and shellfish farming sites in Southeast Alaska. Shellfish site locations from Alaska Department of Fish and Game (2019), Branch et al. in prep. Tidal speed model from Brand et al. (2025).

Factors to consider for co-location

- Tidal current speed - tidal energy needs fast-flowing currents, with speeds usually above 1.0 m/s (1.9 knots) and often higher for electricity production.
- Site characteristics - factors such as water depth and seafloor type inform decisions about the best tidal energy device for each location.
- Power needs – common power needs for shellfish farms include floating upweller systems, oyster tumblers, lighting, and communication equipment. Overall power demand, equipment location and specific power requirements must be identified.

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*For more information on PNNL's work on marine energy and aquaculture, visit our website: **https://www.pnnl.gov/projects/marine-energy-aquaculture***

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