



ACEP

Alaska Center for Energy and Power

Fostering development of innovative solutions to Alaska's energy challenges.

Project Snapshot:

Yakutat Wave Energy – Resource Assessment

ACEP's Alaska Hydrokinetic Energy Research Center (AHERC) is working with stakeholders to assess the wave energy and environmental considerations near Yakutat, Alaska.

Project Need

Yakutat is a remote community located on the "Lost Coast," along the northeastern Gulf of Alaska. Currently, it generates 100 percent of its power from diesel fuel that must be barged in, which results in a high cost of electricity that averages \$.60 per kilowatt hour. To meet energy needs, the City and Borough of Yakutat and tribal leaders have been proactive in identifying other options that are less expensive and more sustainable, including wave energy. Because the majority of wave energy devices are still in the development or prototype stages and since the energy potential of specific locations in the region is not well understood, assessments of available wave energy and environmental factors are necessary to determine if the community would like to move forward with this emerging technology.

Project Description

The first step in this assessment is to determine Yakutat's wave energy resource. To do this, ACEP, funded by the City and Borough of Yakutat, will deploy a bottom-mounted mooring offshore of Yakutat to measure key parameters relevant to the placement of an array of wave energy devices called Wave Energy Converter (WEC) power generation units.

An Acoustic Doppler Current Profiler (ADCP) will record surface wave statistics such as wave height, time between wave crests, direction, and speed. Another sensor measuring conductivity, temperature, and depth (CTD) will be co-located on the mooring and will provide data necessary for quality control of the ADCP information. The CTD observations will provide information about the environmental conditions that accompany different wave and current patterns and inform concurrent studies of area marine mammal populations and fisheries.

Schematic of the mooring deployed off of Cannon Beach, Yakutat, Alaska. The orange float contains an upward-facing acoustic Doppler current profiler that measures waves at the surface as well as sub-surface ocean currents. A CTD is mounted on the side of the float. Below the float is the yellow acoustic release. Below that is the mooring weight which prevents the mooring from being moved by wave or current action. The Yakutat wave mooring was deployed in ~38 m of water, 3 km from the Yakutat coast. The float sits ~3 meters off of the bottom and ~35 meters below the surface. Figure courtesy of J. Kasper, UAF



Alaska Center for Energy and Power

acep.uaf.edu • 907-474-5402

UAF is an AA/EO employer and educational institution.





Data gathered during Phase I will inform Phase II of the project — a modeling effort funded by the Alaska Energy Authority (AEA) to support the installation and operation of the WEC units. To pinpoint the best location and configuration for an array of multiple WECs, ACEP researchers will use the in situ wave data collected during Phase I to calculate nearshore wave statistics for the year-long period of measurement. As part of the modeling effort, information from the single measurement location will be extrapolated to water depths shallower than the mooring, taking into account non-linear wave effects. The goal of Phase II is to optimize power generation while taking other factors like ocean currents, sediment, marine mammal, fisheries, transmission costs, and other users into account. The modeling results will also contribute to Resolute Marine Inc.'s "wave-to-wire" control system for the WEC array.

AEA funding will also support the development of wave climatology for the greater Yakutat area as a key component in properly sizing the array. Additionally, the project funding will be used to establish the wave-to-wire model necessary to ensure the successful integration of the time-varying wave resources into Yakutat's existing small, isolated diesel power-based grid. The wave-to-wire model will provide advanced notice to the local utility, Yakutat Power, of the expected wave energy.

While this project is solely focused on the Yakutat area, researchers anticipate this study will establish methods and protocols that can be employed in future wave energy site resource assessments around Alaska.



Mooring top float with ADCP visible in the center of the float. The float is tethered to an 800-pound weight (a train wheel) that sits on the seafloor. A small "acoustic release" (the yellow cylinder to the right of the float) between the float and the weight allows for the retrieval of the float when the mooring is recovered for data download. The train wheel remains on the seafloor. This arrangement allows the sensitive instrumentation to remain far removed from the surface where large breaking waves could cause damage and at the same time keeps the instruments above the seafloor, where constantly moving waves of sand would likely bury anything located there. Photo courtesy of J. Kasper, UAF

Project Funding Partners

City and Borough of Yakutat
Alaska Energy Authority

Project Research Partners

Resolute Marine
U.S. Army Corps of Engineers
State of Alaska, Department of Geological and Geophysical Surveys