NREL water power researcher Andrew Simms is part of the Modular Ocean Data Acquisition (MODAQ) systems team, which designs custom tools for marine energy developers and researchers to collect the accurate field data they need to improve these early-stage technologies
Photo by Werner Slocum, NREL

In-Water Data Acquisition Tool Supports Four Marine Energy Projects

Today, the nascent marine energy industry is putting promising prototypes in the water. These budding machines could soon produce clean energy from ocean and river waves, currents, and tides to power coastal and remote communities and the U.S. power grid.

While today's open-water trials are a critical step to learn how prototypes work in a real-world setting, collecting data in a salty, tumultuous environment is not always easy. But it can be far easier with the National Renewable Energy Laboratory's in-water data solution tool, which recently helped four marine energy projects advance towards commercial success.

NREL's Data Acquisition System

The NREL-developed Modular Ocean Data Acquisition (MODAQ) system is built from open-source hardware and software. The tool can both collect and store data and even share curated information through the cloud. Marine energy developers can work with NREL's engineers to design their own customized

MODAQ and capture high-quality field data to help monitor and improve their technology designs. For example, users could assess how much power their device produces at sea, analyze the durability of a specific device component, or even control their device from a desk halfway around the world.

MODAQ Success Stories

From 2021 to 2022, NREL designed custom MODAQ systems to support four marine energy projects, all of which were funded, in part, by the U.S. Department of Energy's Water Power Technologies Office.

University of New Hampshire Creates Tidal Energy With a Living Bridge

The University of New Hampshire's Living Bridge project is one of the country's few tidal energy test sites where researchers can study a real-world tidal turbine.

To assess the bridge's less common vertical-axis tidal turbine, the NREL team designed a custom MODAQ system to collect data on the turbine's performance. Then, in 2022, NREL researchers added sensors to measure the strain tidal forces put on the turbine's blades and how well specific adhesives and protective coatings

endure underwater. Once the device is back under the bridge, those sensors will wirelessly send data to a larger data acquisition system on a platform above the surface. This data will be added to the U.S. Department of Energy's publicly available Marine and Hydrokinetic Data Repository.

C-Power Gets the Most Complex MODAQ System Yet

In 2021, NREL researchers created a customized MODAQ system for C-Power's SeaRAY autonomous offshore power system, a wave-powered renewable energy device designed to provide energy for offshore work. The fortified MODAQ system includes a supervisory control and data acquisition system, allowing it to not only collect field data but also send that information to the cloud and connect to the web to provide C-Power with live updates on the device's performance. This MODAQ system also empowers the C-Power team to control their device from anywhere in the world.

NREL's third Modular Ocean Data Acquisition system (MODAQ 3) was designed to serve the SeaRAY autonomous offshore power system, which makes and stores clean, carbon-free energy, and also shares data with the offshore vehicles it powers. *Photo by Werner Slocum, NREL*

As of 2022, C-Power's MODAQ system is the largest, most complex system to date, able to process, clean, and display data from about 70 different sensors on the offshore energy device.

The University of Hawaii Prepares to Deploy a Wave Energy Device

At the University of Hawaii, researchers are developing a wave energy device called the Hawaii Wave Surge Energy Converter. The device uses a paddle-like design, which will sway back and forth with the waves. To help the university team analyze the effectiveness of their device, NREL designed a custom MODAQ system, which provided performance data in lab bench trials and a wave tank test. Soon, the MODAQ system will generate data on the wave energy device's first open water trial at the Makai Research Pier in Oahu, Hawaii.

Water power researchers Andrew Simms (right) and Casey Nichols have been working on a customized data acquisition system for the University of Hawaii, which the team will use to collect data on their wave energy device's first offshore trial. *Photo by Werner Slocum, NREL*

MODAQ's Broader Role in Advancing Marine Energy

The data that MODAQ and other NREL-developed data acquisition systems collect could help improve current marine energy models, like the Wave Energy Converter SIMulator, and provide marine energy developers with the high-quality data needed to hone their marine energy technology designs. Together, NREL, MODAQ, and companies, like those highlighted here, can grow marine energy into an affordable clean energy resource for communities across the United States.

More Information

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