Navigating a Sea of Data

## Advanced data management for water, wind, and other renewable energy projects

Developing and implementing new renewable energy technologies requires a lot of data, but navigating an ever-growing sea of data can pose its own challenge. Pacific Northwest National Laboratory (PNNL) experts in data management are meeting that challenge head-on using advanced approaches that can transform a tsunami of data into valuable resources that support a clean energy future. Their approach to data management is powerful and flexible enough to meet the needs of multiple renewable energy applications, from advanced building operations to marine energy and wind projects.

If you deal with data, PNNL's Data Integration team can help you!

SMART SOLUTIONS FOR TIME SERIES DATA

PNNL developed a standardization pipeline specifically for time series data—Tsdat—that gives researchers and developers customized, powerful datasets right at their fingertips. Tsdat standardizes information from multiple sensors that use different measurements and makes it easy to generate real-time data visualizations—a huge time saver for users. Instead of spending time curating and standardizing data, Tsdat enables researchers, developers, and operators to quickly leverage data from multiple sources for greater insights.

Building on Tsdat, the team created a targeted data pipeline for marine energy. This pipeline can merge data from different sources–like sensors and buoys at sea–into a single, informative dashboard that can be created and optimized to meet a customer's needs. Using an open-source, pluggable framework compatible with multiple platforms, the marine energy data pipeline can be run locally or on the cloud, which makes it adaptable to projects big or small.
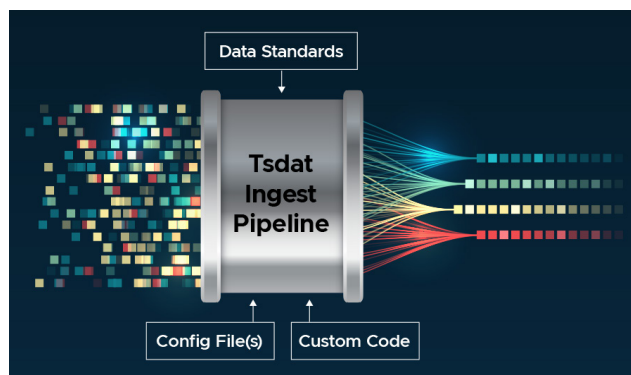
Tsdat quickly standardizes data from multiple sources, allowing researchers, developers, and device operators to spend less time curating and organizing data, and more time using it. Targeted pipelines, like the marine energy data pipeline, can extend the main Tsdat pipeline to interface with specific types of data. *(Graphic by Shannon Colson | Pacific Northwest National Laboratory)*

DATA MANAGEMENT IN ACTION

Supporting Tidal Energy
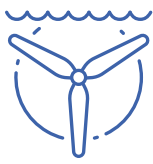
The marine energy data pipeline is helping researchers monitor the University of New Hampshire's Living Bridge project—a "smart" bridge powered by a tidal turbine. The pipeline is being set up to standardize all data gathered from bridge sensors and systems and applying quality checks and assessments to enable real time analysis for future deployments.

The pipeline was also used to streamline data from multiple devices that monitored tidal resources in Cook Inlet, Alaska—a site of interest to developers because it has some of the highest tidal energy potential in the United States.

Securing Hydropower

The Department of Energy's (DOE) Water Power Technologies Office is using digital twins (DT)—an approach that couples virtual and real-world systems—to help hydropower facilities improve their cybersecurity and operations. The Tsdat pipeline is synchronizing all DT data into a single, user-friendly dashboard that makes it easier for researchers to adjust the simulation and identify real-world improvements.

Breezing through Wind Energy
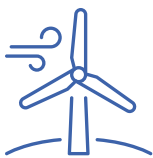
As part of DOE's Wind Energy Technologies Office Wind Data Hub, Tsdat supports several wind projects that share real-time data and visualizations of wind speed and direction from various instruments and sensors—advancing wind energy research and development. Check it out at https://a2e.energy.gov/data.
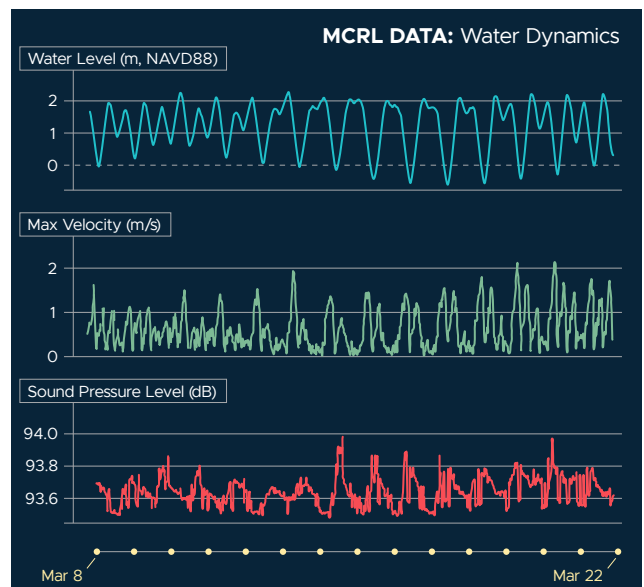
Rocking Wave Energy

The marine energy data pipeline provides data standardization for the DOE's Marine and Hydrokinetic Data Repository (MHKDR). The pipeline was used to standardize sensor data from Clallam Bay, Washington, which is used to inform testing and development of wave energy converters at the PNNL-Sequim campus.

Tsdat also supports real-time environmental monitoring data from a variety of sensors deployed in the bay at PNNL-Sequim. This provides valuable information about current meteorological and water conditions that are used in marine energy research. Check it out at https://mcrldata.pnnl.gov/.

MCRL DATA: Water Dynamics

Water Level (m, NAVD88)

Max Velocity (m/s)

Sound Pressure Level (dB)

Mar 8 — Mar 22

The MCRLdata project has environmental monitoring instruments deployed at a pier near the channel to Sequim Bay in Washington, U.S. This dashboard shows two weeks of live data from a deployed tide gauge, ADCP, and hydrophone, updated every two hours using the Tsdat pipeline.

Looking for ways to streamline your data and make it easier to use? Email the team at tsdat@pnnl.gov.

Tsdat Github repository