



The Energy DataBus

As part of its ongoing mission to advance renewable energy and energy efficiency technologies, the National Renewable Energy Laboratory (NREL) is performing energy informatics (EI) research and development. NREL's motivation for pursuing EI stems from advances in information technologies that enable data acquisition and conversion to become actionable energy knowledge, providing new opportunities for developing future low-cost, reliable, clean energy systems.

Within its portfolio of EI projects, NREL has developed the Energy DataBus, an open-sourced software that collects massive amounts of energy-related data at second-to-second intervals; stores it in a massive, scalable database; and turns it into useful information.

With the increase in energy system instrumentation, operators know more about the real-time performance of their energy systems than ever before. However, applying this information to more efficiently operate, design, and maintain these energy systems is not easy or straightforward. Even after the data from various systems has been collected and aggregated at a single location, it may not be clear how to interpret and make decisions using this information.

That's because obtaining good-quality data is not just a matter of collecting, storing, and accessing. To be useful and informative, the data needs to be structured, cleaned, aggregated, and then visualized, allowing it to be explored in a variety of ways.



Figure 1. A screen shot of some of the high-level visualization tools for the Energy DataBus

Structured

The Energy DataBus supports multiple tools to integrate and enrich the structure of datasets. For example, disparate data sources can be processed and combined into a single high-quality dataset by uploading separate tables into the Energy DataBus, querying them with a single SQL query, pulling those apart, and reassembling them to integrate their schemas. The result is a new table created through integration of columns that are in separate databases and different schemas.

Cleaned

Datasets often include missing or false values that make the process of working with the data more complicated and can cause errors in analysis and the programs that read the data. The Energy DataBus offers a number of solutions for cleaning datasets of these issues. While there is no one type of technique or algorithm that solves all of the dataset issues, the Energy DataBus deals with missing data through either interpolation or explicitly annotating the data as non-existent. The data can be interpolated using splines or it can be predicted using correlation models with other streams of data.

Aggregated

Energy systems are being integrated to a greater degree to improve system-wide efficiency. Optimizing such a system requires that data from each component or sub-system be aggregated. However these systems usually have different metadata schemas and encode their data in different formats. To overcome these differences, the Energy DataBus employs “object relational mapping” software called PlayORM, which provides an object-oriented view of all data, easing integration between datasets. These separate systems are also often unsynchronized and collect data at different granularities. The Energy DataBus uses a mix of interpolation techniques to align and aggregate these data streams.

Visualized

Once data is structured, cleaned, and aggregated, it can be explored in numerous ways. The Energy DataBus provides flexible visualization tools that can be custom configured by decision makers. In this way, the Energy DataBus seeks to provide a general capability that can be specialized for particular sites and applications.

Free Software for Open-Source Development

The Energy DataBus uses open-source software, which not only saves the high cost of licensed software, but also gives users an opportunity to collaborate with the software developer community. Because the software is open, users can customize it to meet their specific needs and benefit from the continuous improvement by the community of users. The Energy DataBus software is now available on the open-source website GitHub.

The value of a platform like the Energy DataBus is in its adoption. The greater the adoption rate, the greater the generative value for all that use the platform. It is for this reason that NREL is releasing this software for free and helping to seed this technology in industry. Please contact us at DataBus@nrel.gov if you would like a technology demonstration or to discuss the use of the Energy DataBus for your organization. You may also visit the Energy DataBus home page at www.nrel.gov/analysis/databus/index.html.

Improving Energy Efficiency with the Energy DataBus

The groundbreaking technology that comprises the Energy DataBus allows operators to analyze energy usage and efficiency in fine detail and make meaningful and well-informed improvements to continuously improve energy efficiency.

Because the Energy DataBus is collecting information around the clock, researchers can examine energy usage from any time of any day of the week and are not limited to preset measurements. This level of granular visibility allows users to ask and answer questions that have not been addressed in the past.



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