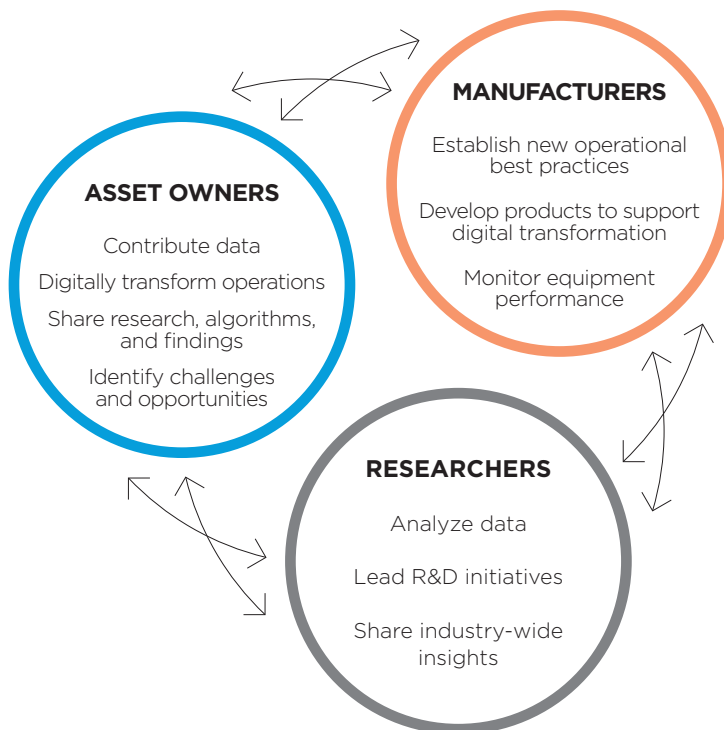




THE POWER OF INDUSTRIAL DATA

INDUSTRY CHANGES & DIGITAL TRANSFORMATION

The energy market and landscape is evolving rapidly. With the rise of low and carbon neutral energy sources, there is more pressure on the hydropower industry to change how it utilizes its assets. In order to remain competitive, hydropower asset owners are finding ways to reduce operational costs while improving reliability, availability, and quality. As compared to wind and solar, hydropower offers the benefit of service as renewable storage. This capability will require hydropower to become an on-demand resources drastically changing today's more predictable operations.



As with other industries, digital transformation is the best means to addressing hydropower's changes and challenges. By leveraging the data the industry has already collected, manufacturers can create the next generation of equipment and sensors. Operators can predict and avoid outages using deep and machine learning. Researchers can predict how changes to operational strategies will impact equipment, the environment, and the industry as a whole.

WHAT IS THE HRI?

The Hydropower Research Institute (HRI) is a data-driven collaborative formed by and designed for industry leaders to drive the digital transformation of hydropower. The HRI's goal is to benefit all participants—asset owners, manufacturers, and researchers—by:



STREAMLINING how data is classified within a hydropower plant, amongst manufacturers and different types of units. HRI staff work with every contributor to ensure data is classified consistently using our standardize classification system. HRI data can be easily compared across plants, regions, and continents.



ENHANCING the data set by ingesting data on a regular and ongoing basis. The current dataset dates back to 2002, and is dynamic and expanding with every new contributor and upload. The dataset is assessed for quality upon ingestion and regularly thereafter.



CONNECTING the asset owners, equipment and sensor manufacturers, and researchers to share, discuss, and discover. The HRI facilitates communicating challenges, collaborating on solutions, and driving change in the industry.

By aggregating data across the industry, the HRI enables manufacturers to monitor the operations of all of their equipment in a consistent and comparable format. Assess how your installed equipment is used to optimize future equipment based on available criteria and feedback from current and future customers. Direct access to current and future customers with incites in to their specific needs based on their operations.

The HRI will aggregate and standardize hydropower operational data, enabling manufacturers to:

- ▶ **MONITOR AND SERVICE EXISTING EQUIPMENT**
- ▶ **HELP SHAPE THE DIGITAL TRANSFORMATION OF THE INDUSTRY**
- ▶ **OPTIMIZE FUTURE PRODUCT OFFERINGS**
- ▶ **CONNECT WITH CURRENT AND FUTURE CUSTOMERS**

MANUFACTURERS, THE HRI, AND INDUSTRIAL DATA

The hydropower industry is facing unprecedented changes with competition from other renewables and the requirement to operate equipment in new ways. In order to succeed, asset owners are digitally transforming their operations and require digitally enabled equipment. The HRI offers the best combination of data, insight, and connection with industry leaders. Data from across the industry and around

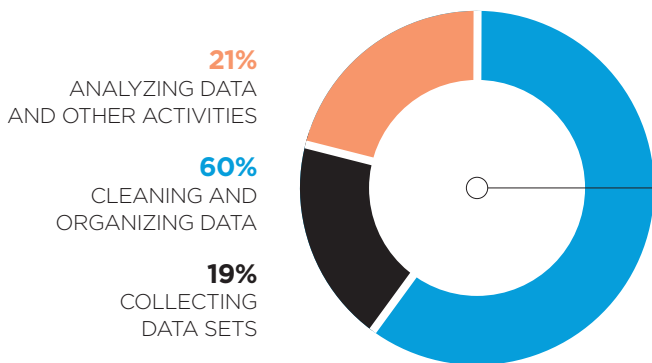
the globe is collected, providing manufacturers a single source of data on the operations of their equipment. Regardless of the systems used, manufacturers will get comparable data in an easy-to-use format to feed models and algorithms. This, in turn, allows you to optimize future products and learn how to better service existing equipment especially as operational practices change in the coming years. Research using HRI data will identify key relationships that need to be monitored for predictive maintenance, which can be integrated in future product offerings. The HRI also provides direct access to asset owners, who are eager to provide insight as to how to best serve them, and researchers who are looking at the latest and greatest analyses from the hydropower industry.

According to NewVantage Venture Partners, **Big Data** is delivering the most value to enterprises by **decreasing expenses** (49.2%) and creating new avenues for **innovation and disruption** (44.3%)

SOURCE: NEWVANTAGE VENTURE PARTNERS,
BIG DATA EXECUTIVE SURVEY 2017

HIGH QUALITY DATA

Before a dataset can be analyzed, it must be standardized so that it is comparable across different variables and sources. The Hydropower Research Institute does this work for you. With input from each contributor, the HRI identifies the origin of tags within the hydropower plant, translates tags one-by-one, and ensures that all tags are appropriately mapped to the standardized, hydropower-specific classification system. This system includes the specific component, detailed location information, and the specifics of the measurements, such as units and material. This allows HRI users to analyze precisely what interests them.



THE 80/20 RULE

Data scientists spend 60% of their time on cleaning and organizing data. Collecting data sets comes second at 19% of their time, meaning **data scientists spend around 80% of their time on preparing and managing data** for analysis. And over three-fourths of data scientists view data preparation as the least enjoyable part of their work.

SOURCE: FORBES.COM, CROWDFLOWER SURVEY 2016

The HRI recognizes that data quality is the difference between a valuable data set and useless information. We are committed to reviewing all aggregated for quality to ensure data integrity and comparability. All data ingested passes through our quality assurance process. This process starts during data discovery, during which the HRI communicates directly with the contributing asset owner. At any point, if data is deemed “bad” or not understood by the HRI, it will not be visible to HRI participants or included on reports. Data in the platform is regularly tested for numeric quality, and any questionable data is flagged for review. The QA and mapping processes allow HRI participants to create reports that are delivered quickly and securely in a consistent format without worrying about the quality of the data.

HOW DO I SIGN UP OR LEARN MORE?

If you are interested in becoming a participant in the HRI call us at **509-866-4475** or email **Join@HRIData.org** to have someone contact you.