Maximizing Power Plant Performance with DVR

How Data Validation and Reconciliation (DVR) Is Revolutionizing Plant Efficiency Across the Nuclear Energy Sector

The Shift Toward Smarter Monitoring

As the power generation industry evolves, so must the methods used to monitor and optimize plant performance. In today's environment of increasing regulatory pressure, operational complexity, and demand for efficiency, traditional performance monitoring systems often fall short. Data Validation and Reconciliation (DVR) Modeling offers a modern, more accurate solution for identifying and correcting data errors that impact plant operations and business decisions. The use of DVR has now also been expanded to include nuclear uprates and power recovery, driving generation revenue increases in the millions of dollars per year.

The Problem with Traditional Methods

Plant performance has always been evaluated using measured data collected online or during routine testing or pulled from data historians. This same data is used for operational decisions and informs equipment monitoring and maintenance decisions. However, all measurement devices that feed this data are subject to potentially significant error sources. Traditional monitoring methods cannot detect or correct these biases, resulting in inaccurate assessments and potentially costly decisions. For nuclear units, these measurement errors and their associated uncertainties cause the operating limit of the plant to be impacted.

A Physics-Based Approach to Accuracy

DVR modeling addresses the issue of unreliable measurements by applying redundancy checks, uncertainty analysis, and mass and energy balance equations. The method reconciles all available data to produce a consistent and most probable "true" state of the system. Instead of relying on flawed measurements, DVR actively identifies measurement bias and corrects it.

DVR modeling has demonstrated significant benefits in a wide range of power generation settings:

- Identifies hidden bias in key operational and performance indicators such as calculated core thermal power, allowing for correction of conservative bias and generation increases (power recovery) or preventing non-conservative operation and potential regulatory issues
- Reduces uncertainty in critical calculations like core thermal power, allowing potential uprates through Measurement Uncertainty Recapture (MUR)
- Enables targeted maintenance by flagging faulty instrumentation before it impacts performance
- Assists in detecting system inefficiencies, such as cycle isolation leaks or process imbalances

Validated and Proven Results

In multiple examples across the industry, fouling of the differential pressure flow meters for measuring final feedwater flow rate has caused conservative bias in the calculation of core thermal power, causing significant generation losses. DVR has been used in numerous plants to identify and correct this measurement bias and recover lost generation.

The NRC has also approved the DVR methodology for reducing the uncertainty of the core thermal power calculation and thereby achieves uprates to the licensed power limit through the MUR process.

Nuclear utilities need accurate data to remain competitive and efficient. DVR modeling provides a powerful solution to modern challenges, delivering high-confidence performance metrics, increasing generation, and supporting better-informed decisions across the enterprise. For today's complex energy systems, DVR is not just an upgrade—it's a necessity. Learn more at ***gses.com/dvr***