Integrated approach to asset management

West Burton, EDF's newest CCGT plant in the UK, has taken a novel approach to guarding against unplanned outages
Credit: EDF Energy

Integrated systems protect against plant shutdowns

An integrated asset management and computerised maintenance system at the new 1300 MW West Burton combined-cycle power station is a cost-effective way to avoid unscheduled outages, writes Jason Bryant of EDF Energy.

Avoiding unexpected plant shutdowns was given high priority during planning for a new EDF Energy combined-cycle gas turbine (CCGT) plant at West Burton in the UK. At a plant like this, a full trip can cost from £500,000 to £1 million ($800,000 – $1.6 million) in the first hour – and three or four unscheduled trips per year, often unrelated to the turbines, are not uncommon.

That loss is aggravated by the hours needed to restart the plant. A trip can also take from 70 and 80 operating hours off the life of a turbine. So the planning objective was clear: reduce unscheduled downtime and eliminate catastrophic trips by focusing maintenance of assets other than turbines that commonly cause downtime. Plenty of available systems can support that strategy, but they generally produce lots of isolated, seemingly unrelated data that go unused. And we needed to gather and manage a huge amount of information from many sources and provide a single point of entry into a computerised maintenance management system (CMMS).

The solution is a complete and comprehensive asset management system with a preventive and predictive maintenance philosophy. Equipment is prioritised by its importance in keeping the plant running. Assets that could trip the plant if they fail get optimal maintenance. Conversely, assets that cannot damage operations receive only scheduled preventive maintenance.

The total integration of technologies makes this a unique, high-value system expected to deliver tangible benefits including:

- lower maintenance costs;
- greater operator efficiency with minimum errors in the collection and use of data;
- faster reaction to potential problems through diagnostic data from ancillary assets;
- less paperwork;
- complete documentation for compliance with regulatory agencies; and
- support for safe work practices.

The challenge

The brownfield West Burton plant, which has three units, each with one gas and one steam turbine, will be fully operational early in 2013. But the challenge is to keep a plant of this size and complexity running at peak efficiency with a small maintenance and control staff.

With only 50 staff across all disciplines – including operations, mechanical, electrical, control and instrumentation – the team cannot afford to repeat efforts or to send in maintenance crews without good reason. A proactive approach is also needed to maintain and fix failing assets in time to prevent loss of efficiency or, in a worst case, a plant trip. A trip of the site would expose EDF Energy – the supplier of one fifth of the UK's power and its leading source of low-carbon electricity – to the ever fluctuating energy market.

The planners envisioned an integrated technology in which each asset is carefully ranked and assigned an overall risk rating according to its impact on the environment, plant performance and health and safety.

The resulting criticality rating is used for scheduling work to avoid over-maintaining non-essential equipment while giving high-priority assets the necessary attention to prevent trips or unsafe conditions.

The solution

The asset management solution is based on Emerson's PlantWeb architecture functioning in concert with the Ovation distributed control system (DCS) and the SAP enterprise asset management system (CMMS).

Plant instrument data are collected by Emerson's AMS Suite predictive maintenance software with a connection to Beamex's CMX calibration software. We also collect plant operational data from the PI Process Workbook and Operator Rounds.

Data from these sources flows to the AMS Suite: Asset Performance Management (APM), built on Meridium's APM software. And this application serves as the point of entry into SAP, which drives our preventive/predictive maintenance strategy.

HART and WirelessHART field devices generate a vast amount of diagnostic information that, along with data from other sources, enables early detection of underperforming equipment. Deteriorating assets are recognised and reported via the integrated technologies to the CMMS, which alerts maintenance personnel and enables the work process for planning and execution.

This is the basis for the predictive maintenance that keeps essential assets performing at a high level by predicting where failures may occur and initiating timely response, taking account of condition and criticality to give a priority for repair or replacement. Four systems, one for each turbine generator units and one for the balance of plant, provide control and data acquisition for the boilers, cooling towers, ancillary systems and water treatment. As each generating module is identical, the programming for one can be used for the others, speeding up commissioning. Four DCS systems are co-joined with the integrated architecture into one control room. The Ovation system ties into the corporate SAP network through OPC integration to a PI Historian.

Making it work

The various data sources include direct access to asset health data in real time through the predictive maintenance software, online monitoring and periodic manual data collection. For example, data from handheld vibration data collectors, alignment tools and thermal imaging devices are uploaded to the predictive maintenance software for asset evaluation and processing. Output goes to AMS Suite APM and SAP for criticality assessment and subsequent defect notification when applicable.

Operator Rounds, a module of the predictive maintenance software, lets operators use handheld data collectors to take readings from plant gauges and instruments that do not feed back to the DCS. Once a round is completed, the operator docks the device and the readings automatically make their way up to AMS Suite APM, which generates a defect notification for SAP when necessary.

The Operator Rounds module perfectly serves our goal of 'one job, one stop: don't repeat, and don't write anything unless it's necessary'. Everything is automated from the moment information is recorded and entered. In many cases, assets are barcoded, so if questions arise when an operator scans an asset, he or she is automatically led through what needs to be checked.

When readings are outside tolerance levels, an alarm is raised then and there. For example, if the operator hears excessive noise or recognises that the pump is leaking, this is noted so the maintenance department will be notified

Schematic showing the integrated asset management architecture
Credit: Emerson

immediately through the regular SAP channel. Operator Rounds makes people much more efficient, eliminating handwritten sheets, which were typically filed and forgotten. Current plant operating data are now passed directly to AMS Suite APM and on to the CMMS.

Another important source of data is the CMX calibration software. Calibration routes are initiated by CMX, and all calibration information is downloaded into a handheld calibrator. Work done on any field instrument connected to the Ovation system is logged into the CMX database and can easily be accessed for regulatory documentation.

The huge amounts of data collected by these various sources eventually flow to AMS Suite APM. This application combines predictive intelligence with asset reliability information, enabling real-time analysis of asset health and availability, as well as the identification of 'bad actors': assets that require frequent maintenance. This application manages the high volumes of field-based intelligence and provides a single point of entry to SAP, which manages maintenance according to a predictive maintenance strategy for the asset.

When abnormal situations are identified, 'defect notifications' are immediately issued. The alarm is generated by AMS Suite APM but brought to the maintenance and operations groups by SAP through procedures such as work planning, scheduling, issuing work orders, accepting task completion, finance and

spare parts inventories. The combination of technologies plus the innovative integration drives the predictive maintenance philosophy.
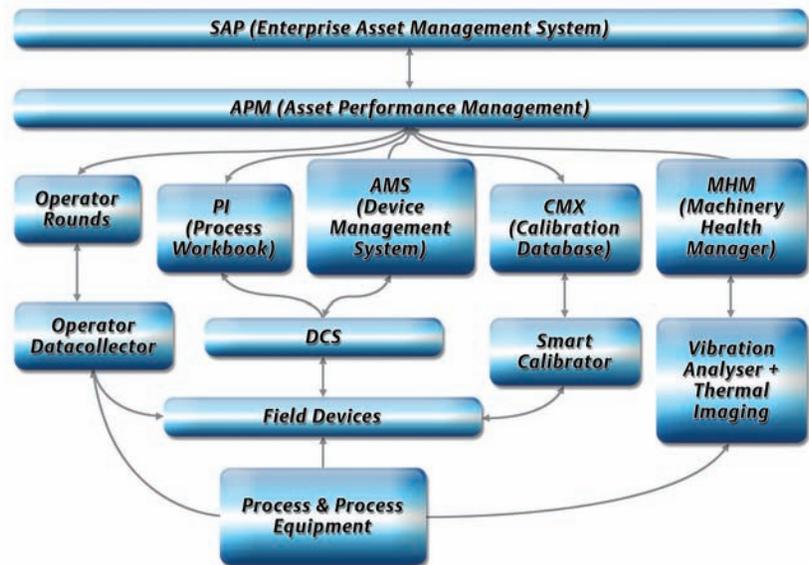
Making this unique integrated approach work required a positive partnership among the key vendors, as well as effort and teamwork between EDF Energy, Emerson, Meridium, Beamex and Logica (SAP). Issues encountered during the implementation phase were identified and overcome collectively and constructively.

Costs and benefits

The integrated asset management system at West Burton cost £750,000 ($1.2 million), not including the DCS. While this may be twice as much as a conventional approach to maintenance management, the integrated system collects a lot more information on the condition of the assets to drive predictive maintenance. Our technicians do not go out and look for something without a need being indicated. All this information is analysed and managed so that maintenance is done swiftly.

We expect this to result in high availability with lower maintenance costs. By understanding the condition of our assets and taking appropriate action to keep them in excellent condition, we should avoid unexpected trips. Preventing just one unplanned shutdown will more than justify the cost of this innovative approach to asset reliability.

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