Life Is On | Schneider Electric

The Sasol Group

Industrial Power

The Sasol Group
Johannesburg, South Africa

sasol.com

Dynamic performance measurement system improves energy and electricity consumption.

Energy and electricity savings progressed and improved throughout the second and third months, saving $400,000 in the first two months.

With increased cost pressures due to a reduction in some of its commodity-based business, the Sasol Corporation required a new solution to minimize costs. Sasol introduced a new technology within the plant environment to manage its energy costs and usage due to its large impact on business performance. This **new solution must monitor energy costs and usage in real time,** allowing management, operators, and engineers to better optimize the energy within the plant, identify the amount of energy needed to meet internal requirements, and minimize its impact on the local electrical grid.

Change in steam demand shifts strategy to minimizing cost

The Sasol plant draws process water from a nearby river to produce steam in two steam stations and an automatic thermal reformer area that is used for internal and external consumer consumption. The process water is treated in one plant and mixed with condensate that is recovered from additional plants. Previously, steam demand for external customers was extremely high, especially for customers involved in coal reformation, during which maximizing output was the key to the profitability strategy. However, as the demand for coal decreased and imported natural gas increased, steam demand declined, **shifting the strategy from maximizing output to minimizing cost.** The price of steam for internal and external customers is based on an algorithm that approximates a fair market

Goals

- Monitor energy costs and usage in real time to better optimize the energy within the plant
- Identify the amount of energy needed to meet internal requirements and minimize its impact on the local electrical grid

Challenges

- Energy costs and electricity usage have a very large impact on business performance

Solutions

- Dynamic performance measures

Results

- Savings of 6% in energy and 4% in electricity costs within the first month
- Saved $400,000 within the first two months from two out of the five targeted plants and over $1 million during the course of the year
- Over 2% reduction in variable costs associated with energy feedstocks and electricity

price at current conditions. Steam stations are contractually obligated to operate with 160 tons per hour of spare steam, which is approximately equal to the steam output from one boiler. If plants cannot meet the demand for steam, they must reduce supply to the electrical generation customers who buy electricity directly from the grid. Excessive power usage from the grid can be costly.

Better informed business decisions with access to real-time critical information

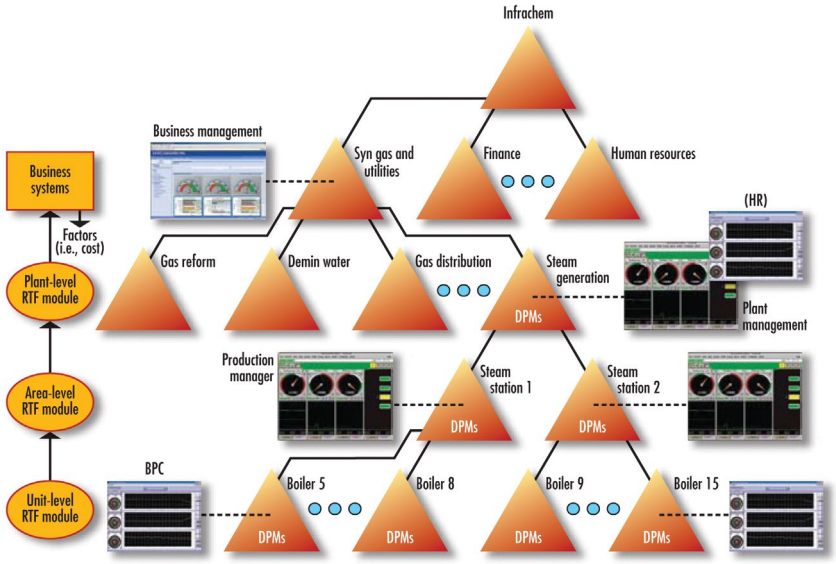
The Schneider Electric™ Business Consulting Team worked closely with Sasol personnel (from the Sasol One Site in Sasolburg, South Africa) to develop real-time dynamic performance measurements (DPM) at Steam Plants 1 and 2. To determine the underlying real-time performance measures and calculate costs and profits, DPMs and real-time financial metrics were created for each process unit and area within the two plants. Management and operator dashboards that utilize DPMs and real-time financial data were also created to provide management, operations, and engineering with **critical information in real time to enable better and more informed business decisions.**

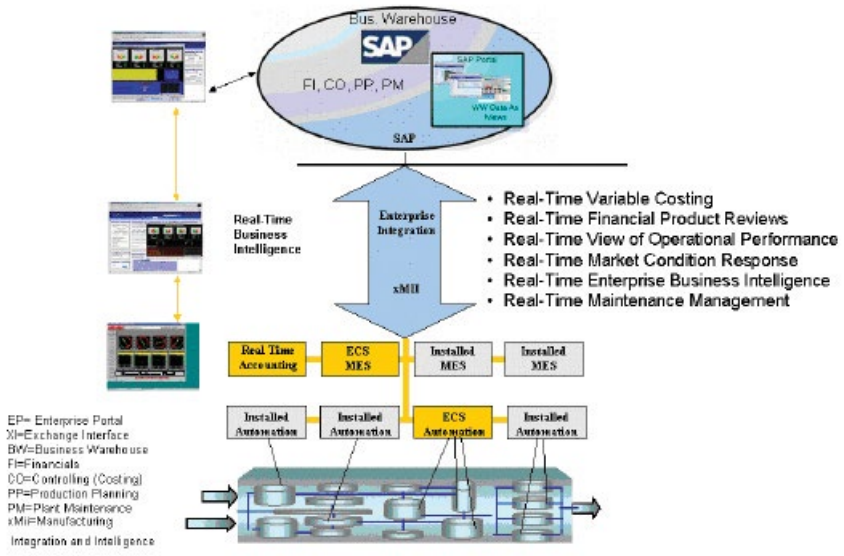
Initially, the consulting team conducted a plant operation and strategy audit. They interviewed Sasol personnel from all aspects of plant operations, starting with plant managers and continuing with operators and other pertinent personnel in the operation. Structured methodology was used to determine the correct measures of performance and break key plant performance measures into lower-level functional entities so that they could be managed effectively. The component solutions were then recombined into an overall structure.

The measured process helped to reconcile differences in how raw materials consumption was measured between the engineering and accounting staffs. The engineering production division measured coal consumption by tracking revolutions made by a wheel flow meter, while the accounting division weighed coal at the mine, as well as silo measurements, which resulted in significant weight differences. Therefore, reconciliation was required to arrive at a working solution. The process was also used to help identify a water source cost that had been incorrectly allocated.

Harnessing unused automation and IT system capacities

Sasol has made a significant investment in its automation and IT infrastructure. Each steam station has a dedicated distributed control system (DCS) for control, historization, and graphical interface. At the start of the project, each DCS was found to have some unused capacity. The unused computing capacity in each DCS provided Sasol with an opportunity to host applications beyond the basic process control, such as implementation and execution host for real-time performance measurements and business intelligence feedback.





The historian server collects critical data from each DCS and other production layer systems. Most connections between the DCS and IT layer are through bi-directional communications. Process data moves from the DCS to the historian server and is then transmitted back to the DCS for management-level reports and dashboards.

Monthly financial reports provide an overall representation of the steam generation business and the entire Infrachem Syngas steam and utilities businesses. These financial reports are generated using Hyperion Financial Management reporting capabilities that utilize key financial data from various sources. Managerial, operations, and maintenance reports utilize input from the operational data store system, SAP, and other manually entered sources to provide custom reports to meet current requirements. Production supervisors use these reports to review the production performance from the previous day.

Development of dynamic performance measurements

Modeled in the DCS, DPMs were developed for each individual boiler, steam station, and the steam generation. Three station-level DPMs were developed: steam cost, steam quality, and production rate. Each individual boiler is required to produce the lowest-cost steam at the proper pressure and temperature specifications, and maintain reliable production while managing production rates. For each boiler, the variable steam generating cost, including labor, consists of four major components: coal, electricity, fuel, and oil and water. Additionally, emissions levels were monitored and improved to enhance Sasol's environmental footprint.

Maintenance and human resources metrics

Additionally, the steam stations management rolled out a maintenance initiative that was **designed to improve the availability of key assets and avoid emergency shutdowns.** This was accomplished by improving planning, increasing predictive-reactive maintenance ratios, setting proper priorities for maintenance activities, while also reducing costs. Real-time performance measurements focused on the following within the maintenance area:

- Reactive-predictive maintenance ratio
- Boiler availability
- Emergency maintenance reaction time (the time from when a breakdown occurred to when the repair was completed and the equipment was back in operation)
- Maintenance schedule deviations (important for improving the maintenance planning process)

Implementing dynamic performance measurements

DPM algorithms, real-time financial models, and levels were implemented in the two DCSs. Using existing plant-level assets for implementation,

cost factors on the plant floor can be tracked in real time. The execution of these algorithms typically takes place in the microprocessors in the DCS. These algorithms are executed at a frequency that is in close proximity to the cycle time of the process, with the historical collection performed at a similar frequency. Unit-level metrics are then aggregated at the station and plant levels using the functionality of the historian. The totalization can be performed at various periods, including the shift, day, and month.

Real-time financial data with allocated costs are tracked using the ValuMax activity-based costing system and provide an immediate representation of product costs across the portfolio. The same real-time financial data is projected to eventually be integrated into SAP as the fidelity and applicability of the data is better understood. The figure on page 4 provides a general overview of the real-time business intelligence/finance system for Steam Stations 1 and 2. Strategic performance measurement, operational KPIs, and real-time finance models were developed and processed in the existing automation system.

Developing a baseline

Once the performance measurement models were installed, they were historicized to provide a performance profile of each unit and station. This baseline enabled an economic comparison of boilers under various conditions. Using better procedures and training, improvement initiatives, projects, and operational improvements can be financially tracked and validated. **Creating this type of baseline enables the development of data for financial and accounting validation.**

Training Sasol operators and engineers to think and act strategically is a key opportunity for improved results. Dashboards provide operations personnel with clear and simple feedback to individual impact on Sasol's business performance. Integrating this type of strategy is helping improve Sasol's business and build the knowledge and skill base of its operators and engineers. **Providing operations personnel with a tool that provides feedback as to which boiler produces the least expensive incremental steam enhances performance of each steam station.**

For example, operators can make spare and spinning steam decisions based on economic information. Spinning is the available spare steam capacity when the feed rate on an idle mill is increased. Spare steam is the amount of potential steam available by starting the third mill of a boiler running on just two mills. Operators increase steam output on an instantaneous or immediate basis according to demand changes.

Positive results

As Sasol's division continues to improve its operation and drive business value for the company, it will acquire new products and process technologies to help achieve its goals. Sasol Infrachem management views development of its employees as one of the company's most critical tasks. Government regulations and key personnel nearing retirement underscore the importance of skills and knowledge development.

The DPM methodology brings together various functional areas (such as accounting, engineering, management, operations, and maintenance) to discuss the overall business — seeing it in a holistic view. This type of **interaction creates understanding across business functions, enables proper strategic performance measures to be developed across functions,** and helps create new and valuable business processes aimed at improving the bottom line.

Real-time energy usage monitoring solution was a key tool for helping Sasol in achieving positive results on this project. Producing steam in Steam Stations 1 and 2 resulted in a 6% savings in energy and 4% savings in electricity costs within the first month (approximately $230k savings in the first month). Energy and electricity savings progressed and improved throughout the second and third months, saving $400,000 dollars in the first two months from two out of the five-targeted plants. The annualized direct benefit of this project was initially expected to be a 2% reduction in variable costs associated with energy feedstocks and electricity. **The results have far exceeded these estimates.** In collaboration with Schneider Electric,Sasol will incorporate future business information with process data and identify other areas of improvement through advanced multivariate statistical analysis, continuous improvement programs such as Six Sigma, and other business value-adding activities.

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Schneider Electric

Schneider Electric SE
70 Mechanic St.
Foxborough, MA 02035
Phone: 508-543-8750

www.schneider-electric.com

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