

Continuous improvements yield high returns

Predictive maintenance improves profitability by more than \$1 million per year

By Roberto Anibal Gorbarán

A digital re-instrumentation and control program initiated eight years ago at the Petrobras Zarate polystyrene manufacturing plant in Argentina resulted in production gains of 3 to 5% and maintenance savings of 10 to 12% by 2008. But the benefits did not end there. A comprehensive asset management program implemented on approximately 1,000 intelligent FOUNDATION fieldbus and HART field devices has enabled continued productivity gains and greater profitability.

For example, production of high impact polystyrene has increased over the past two years from 8,000 to 8,500 kg per hour, or about 7%. Using the mid-July 2010 price for high impact polystyrene in Argentina of 37.5 to 39.9 cents per kilogram, the hourly increase of 500 kilograms was worth about \$190. With the plant operating 24/7, this amounts to about \$31,920 per week or more than \$1.5 million annually with no stoppages. These gains are attributed largely to the plant-wide implementation of Emerson's AMS Suite: Intelligent Device Manager predictive maintenance software.

This advanced application enables Petrobras Zarate personnel to communicate directly with field instruments and digital valve controllers via digital plant architecture. Diagnostic data from the intelligent devices updates a vast database containing information on every device in the plant. Since the predictive maintenance software is integrated with the digital automation system, operators and production supervisors as well as maintenance personnel are able to *look* deeply into the process and examine the condition of the instruments in a way never before possible. Pre-



dictive intelligence helps the plant perform better by reducing the time required for device commissioning and startup, speeding up routine instrument calibration, improving troubleshooting, and avoiding unscheduled downtime.

Intuitive screen graphics allow personnel to easily check on real-time alerts to determine the condition of any device and associated production equipment. Once an alert is evaluated, the useful life of that device can be predicted, and a decision can be made as to whether immediate maintenance is required or whether repair/replacement can be delayed until the next regularly scheduled production shutdown. This is the essence of predictive maintenance. The ability to make these real-time decisions on device status gives this maintenance strategy a value well beyond either preventive or reactive maintenance practices.

Challenges

Productivity in this plant, which began operation in 1986, was limited by analog instrumentation serving an old distributed control system. The need for change was recognized early by the maintenance department based on the unreliability of the process. Officials of the parent company, Petrobras Energia, headquartered in Buenos Aires, agreed up-to-date instrumentation would produce reliable data for use in an automated control system. Also needed was a system that could aid decision-makers at all levels of the organization.

A plant-wide modernization program was initiated in 2002 to take advantage of strong demand for polystyrene products throughout

South America and other world areas. Reactors in the high-impact and crystal polystyrene units were switched over to digital control in 2004. The remaining operations were transferred to the digital control system the following year. More than \$1 million was saved at that time by using a “hot cutover” technique to avoid shutting down the plant, and another \$150,000 was saved by having the entire migration performed by plant employees.

The change to digital control provided more data on each control room screen than was available previously. The staff was well trained to access and analyze this advanced diagnostics data, enabling improved product quality and faster decision-making in maintenance and operations.

Early results

Proactive maintenance measures and neural networks helped the plant achieve a 2 to 3% increase in overall reliability by 2008, while reducing maintenance costs by more than 10%. Control of production was much more efficient with reduced process variability. In addition, advanced control tools enabled operators to rapidly determine the melt flow index of a product and adjust production accordingly through data collected by their network of intelligent devices. As a result, they could confidently increase production rates for certain products.

Data from plant assets fostered better utilization of raw materials, quick correction of flow deviations, and avoidance of low quality scrap. Plant availability soared to 99%, and annual production rose by 3 to 5%. Production reached an all-time high—66,000 tons of high-impact and crystal polystyrene annually.

Progress continues

After the switch to digital control, staff members became adept at detecting and correcting production issues that could cause a unit to shut down until the problem was identified and fixed. The decision-making power of maintenance supervisors continued to grow, and more personnel—especially process engineers—became involved in fault diagnoses, further reducing plant stoppages. Specific “saves” contributed to this enviable record.

Air was discovered in a process fluid passing through a flowmeter. Using the predictive intelligence software, maintenance technicians were able to pinpoint the problem as a faulty pump seal. An emergency shutdown was avoided by arranging for a standby pump until the broken seal could be replaced.

Two control valves operating with the same P&ID were not performing properly. After digital valve controllers (DVCs) were installed on the valves, a technician was able to manipulate the proportional gain in order to improve the operation of both valves. Further, he was able to verify the improved performance through the diagnostics generated by the DVCs.

Planned turnarounds for those two control valves and many others with DVCs were delayed since the diagnostics indicated the valves were in good operating condition and did not need to be overhauled. Scheduled maintenance on many critical control valves has been extended to 2 1/2 years based on this kind of data, saving substantial costs and maximizing production.

Improved flowmeter maintenance is also saving time and money. Technicians can now check the calibration of an instrument in the field without removing it from the process. Calibration times were reduced by 60%, preventing shutdowns and reducing maintenance costs by 50%. A Wi-Fi wireless laptop is simply attached to the meter, and the calibration data is transmitted to the predictive maintenance software database for comparison with historical information on that instrument.

The plant is now installing wireless devices using the IEC 62591 (*WirelessHART*) standard, in order to monitor devices in remote and hard-to-reach locations. And the bi-oriented polystyrene manufacturing operations have also been brought under digital control.

Management anticipates continued and growing benefits for the polystyrene production operations, utilizing the digital automation platform, which was installed originally to facilitate a predictive maintenance strategy to reduce emergency maintenance and downtime.

Petrobras Zarate personnel and their peers at other Petrobras manufacturing sites across Argentina have now established an integration forum to share experiences and the advantages of operating from a smart digital platform.

ABOUT THE AUTHOR

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