NELES

Plant Manager's guide to profit through process control

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Instrumentation and controls typically represent 10% of the capital cost of a process plant. For process plants, this "nervous system" senses, monitors, and controls most plant activities. Yet, in a typical plant, 30% of the controls are running in manual mode, effectively negating the capital investment. The reasons are many, but the impact is felt throughout plant operations.

Resolving the most common control system performance issues most typically has the following effects:

Reduce process variability by 50%
Reduce energy consumption by 0.5% to 10%
Increase production rate by 0.5% to 10%

Often, these results can be achieved with minimal capital expense using a targeted approach to resolve instrument and valve issues, controller tuning, and control strategy changes. Typical Return on Investment for these activities is less than 12 months.

Loops in manual are a symptom of the deeper problems: instrument and valve issues, and poor controller tuning.

The path to improved performance

One hour audit. Many control system performance issues are hidden in plain sight. Generating awareness of the issue is often the first step. A simple audit of "control loops in manual" will give insight into the extent of the problem at your plant. This can be easily accomplished in one hour, through a discussion with a board operator. Typical plants will show 20-30% of controllers in manual/bypass/override. World-class plants have less than 10% in manual. Note that loops in manual are not the real issue: there are underlying reasons why the loop is not in Auto.

Estimate potential benefits. The link between poor control performance and poor process results is highly process-dependent. Consider bringing in a process control expert to assess the situation. With an understanding of process dynamics and control, a skilled engineer can estimate:

Quality losses due to high variability and poor control
Energy losses due to high variability and poor control
Chemical losses due to high variability and poor control (See example below)
Production rate losses due to high variability and poor control
Reliability losses due to instrument and valve issues

Get the tools to resolve issues. With hundreds or thousands of instruments, controls, and valves, a manual approach is not practical. Software tools monitor, diagnose, and prioritize control system issues, and can even recommend corrective actions. With this approach, plant personnel are leveraged to deliver the highest value – taking the proper corrective actions.

FIGURE 1: Controller tuning is a simple, non-invasive action that can lead to significant improvements. In this chart, the process variable (red line) is supposed to follow the green Setpoint line. With the old tuning, the control was sluggish and unresponsive. The simple tuning correction ensures that the plant is quickly performing exactly where it should be.

Integration with work flow. Simple adjustments to daily, monthly, and annual practices help to ensure the plant remains at peak performance. Without these simple adjustments, benefits will deteriorate over 12-24 months. Typically, the following activities are needed:

Project phase: 1-6 months of focused effort to resolve the majority of issues and document the financial benefits.
Daily monitoring: Integrating new diagnostics and monitoring into the daily activities of operations, maintenance, and engineering.
Monthly results: Plant-level management review of selected KPIs.
Annually: Integration of monitoring with shutdown/turnaround planning cycles.

Key metrics

To achieve and sustain results, the following Key Performance Indicators (KPIs) are recommended:

Loops in normal mode. This is a good high-level metric for control system health. When instruments, controls, and valves fail or under-perform, controls are typically put in lower modes of control. (Manual instead of auto, or auto instead of cascade)

Controllers with significant oscillation. Oscillation saps the efficiency from your plant. Imagine driving your car along a sine wave instead of in a straight line, and you get some idea of what oscillation does to plant efficiency. Worse, oscillations spread throughout the plant, spreading inefficiencies.

Losses from poor control. This metric must be custom-developed for the specifics of your plant and process. This metric compares actual production results to the theoretical best control to quantify the size of the improvement possible.

Example: Pulp Mill Saves $1 Million in Chemical Costs

Following a production upgrade at the Mondi paper plant in Syktyvkar, Russia, plant management wanted to optimize the operation for maximum benefit. Metso performed a site audit, and recommended a Control Performance Solution: A combination of software with regular monitoring and reporting services.

Working hand-in-hand with plant personnel, more than 175 individual adjustments were made to the plant. Some were as simple as changing tuning constants. Others involved repairs to instruments and valves.

Improved control resulted in a significant variability reduction for key quality parameters. More importantly, the stabilized process used far less bleaching chemicals, saving well over $1 million. The return on investment could be calculated in months, not years.

For further details on this example. Right click on photo, select open link to view video.