Maximizing return on plant assets

Manufacturers in nearly every process industry face the need to improve their return on large asset investments. Effectively managing assets, however, requires a wealth of information and analysis. With data originating from a variety of devices and systems, the process plant is teeming with information. The challenge, however, is having relevant information available at the right time, in the right form, and to the right people.

Plant managers, for example, are more focused on improving overall efficiencies as opposed to employing the latest technologies. They want solutions that maximize total value to the enterprise. Operations and Engineering, on the other hand, want production to proceed smoothly with equipment running at high performance levels for optimum product quality. They abhor surprises and unscheduled downtime. Maintenance managers want knowledge of equipment conditions, calibration shifts, and performance levels to predict maintenance needs before asset failure or degraded product quality events occur. Additionally, they want to balance workloads, maintain spare parts inventory, and ensure personnel are updated on existing equipment conditions.

Aiding decision-making

Processing plants must deal with a variety of decisions to get more return from their large asset investments. While many plants focus on asset management, the largest return on investment results from those who can optimize asset performance. In this case, assets are defined as equipment, processes and people.

Studies by a leading chemical company suggest that maintenance is the single largest controllable expenditure in a plant, thereby representing a golden opportunity to increase profits. These decisions require the real-time collection and analysis of plant available

information to measure asset availability, performance, and quality. Asset optimization tools can help, for example, decide whether it's more cost effective to acquire new equipment or keep existing equipment running. They can also predict maintenance needs to help avoid unscheduled downtime, degraded quality, or unnecessary maintenance and calibration.

The best systems provide a composite view of the health and performance of an asset while maintaining all the richness of information, advantages, and capabilities of each specialized system. The user need not switch between several systems, workplaces, application environments, and navigation schemes.

In order to achieve this composite view, assets must provide comprehensive diagnostics that are readily incorporated into the system. Greater engineering expense is incurred if a tight integration between the assets and the system is not supported.

Asset monitors

Until recently, predictive maintenance strategies served only critical and expensive process equipment that required costly, specialized measurements. Today, the plant includes intelligent field devices, control systems, workstations, and network hardware—all of which contain a rich set of embedded diagnostic information. Plant asset optimization systems work in concert with asset monitors, device management systems, and computer maintenance systems. The computerized asset optimization system can collect, aggregate, analyze, and compare this information to historical data. The goal is to provide advanced warning of degrading devices and equipment, impending asset failure, and deteriorating process performance. This effort starts with the asset monitor.

Asset monitors vary in complexity. Some simply identify status changes in an intelligent device. Others identify high, low, or deviation limit conditions of the asset in the control system. More advanced asset monitors identify abnormal conditions such as a dirty pH sensor. When the asset monitor detects a prescribed condition, it issues a documented

alert. The alert contains all information necessary to describe an asset condition. Logic systems may use this information to generate a work order for maintenance purposes.

Asset monitors can exist in all parts of plant hierarchy, including IT areas, control systems, process equipment, and field instrumentation. They are often part of an asset optimization hierarchy of basic and higher levels. They identify performance events through quality checks, Boolean checks, flow delta, limit checks, and deviation checks. Communication of these events from the field will often be via standard protocols, such as HART, FOUNDATION Fieldbus, and PROFIBUS. Manufacturers are continuously extending the range of devices with integral asset monitors.

For example, asset monitors can he deployed to review the condition of motors and their associated load machines, such as pumps, compressors, and fans. These asset monitors identify abnormal or unstable equipment conditions that might stress the electrical equipment, and, over time, cause wear and failure.

The range of monitor capabilities runs from basic to advanced information. Basic monitors will track the actual motor running hours and number of starts. More advanced monitors will predict the time-to-trip function related to motor thermal overload.

In the IT area, asset monitors commonly track the operation of printers, computers, switches, and software programs. The monitors will issue alerts, for example, when IT systems are performing with low free disk space at a high CPU load, with high amounts of network traffic, or with faulty switch ports. They will assess simple and sophisticated problem conditions, permitting identification of root causes.

Asset condition reporting

The continuous improvement of plant performance requires an effective human interface to help visualize key plant information and asset performance metrics. Plant information should be readily available that describes asset performance objectives, constraints, current behavior, and relationships with other plant assets. The plant asset optimization system must organize and arrange asset information for maintenance

personnel to enhance the efficiency of their daily activities. Additional filters may refine this information for specific maintenance roles, such as the maintenance technician, maintenance engineer, and maintenance manager.

Within their workplace environment, maintenance personnel should get meaningful analysis and reporting tools needed to identify and analyze poor plant asset performers. Report screens should quickly communicate performance problems. Tools for analysis must be included to identify problem causes, locations, and the impact on overall plant performance. Helpful information to support analysis of root causes for problems includes field device diagnostics, electronic documentation, product instructions, loop diagrams, SOP documents, P&ID drawings, and information management.

Reducing time to repair

Three factors can reduce time to repair:

- Streamlined work processes (alarm ⇨ root cause analysis/detailed diagnosis ⇨ decision)
- Elimination of paperwork.
- A single electronic audit trail

Consider the example where an operator recognizes the degrading performance of a cooling tower. Traditionally, the operator receives a process alarm and reviews the process graphics and alarms to identify the problem location—for example, a cooling tower's pH level control loop. Then the operator either blindly sends a maintenance request via log entry, handwritten note, or email. Or he spends significant time searching several systems in different locations, environments, and navigation schemes to see if maintenance has been requested or scheduled.

Using a plant asset optimization system, the operator or maintenance technician receives notice of the maintenance event via the pH analyzer's asset monitor. Unlike the process alarm described earlier which identifies a control loop problem that currently could be impacting production where the fault could lie with the sensor, the analyzer, the control valve, the valve positioner, the piping, or any other loop influence, this asset alert specifies

the exact equipment at fault (in this case, the pH analyzer) and is typically issued prior to any loop problem occurrence. The alert may be delivered via mobile telephone, e-mail account, or pager. The accompanying information describes the equipment, the problem, and its probable cause. With the integration of a Computerized Maintenance Management System (CMMS), the operator or technician can quickly determine if a pH analyzer work order is necessary. If work is not currently scheduled, he can automatically initiate the work order process by electronically submitting a fault report to the CMMS. If calibration is required, the work order is automatically forwarded to an action list of an integrated device management system.

Managing calibration and configuration

Calibration management is an important facet of the plant maintenance strategy. As noted above, the integration of asset optimization with computerized maintenance and device management significantly reduces the time to repair. Similarly, integrating calibration services with a plant asset optimization system can generate appreciable savings.

In many cases, calibration is a manual operation that’s routinely scheduled. A preventive calibration practice like this often proves costly because it’s performed regardless of need. A plant asset optimization system, on the other hand, can determine the optimal calibration schedule, using historical data, fault analysis, process analysis, and a pre-determined calibration strategy. With this system, generated alerts trigger notification that a device needs calibration.

Streamlining calibration workflow improves the quality of the process and product while reducing costs. Via software connectivity and communications, a plant asset optimization system can extend the capabilities of an off-the-shelf Device Management System (DMS). The combination offers a complete management solution for managing the calibration of field devices. Precise calibration and configuration combined with secure electronic documentation optimizes the life cycle of field devices.

An asset optimization system integrated with DMS calibration provides the user with a detailed record of the maintenance action performed on virtually every field device in the plant. This solution can optionally assist in complying with 21 CFR Part 11 requirements. It can combine completely automated configuration, calibration test, and documentation procedures with electronic signatures—including signatures at the level of the handheld calibration unit. This capability ensures the validity and security of calibration and configuration procedures and results.

Summary

In short, effective management of capital assets for optimal productivity can have a significant impact on a company's balance sheet and income statement. Integrating the capabilities of asset monitors, computerized maintenance, and device management systems with an over riding plant asset optimization system generates measurable savings that pay off in smoothly running operations, improved product quality, and efficient maintenance and calibration practices. The importance of an effective capital asset optimization strategy that enables managers at all levels to make decisions accurately and confidently quickly becomes self-evident.

Production facilities employing real-time asset optimization systems use asset performance monitors to significantly improve process uptime and product quality while reducing maintenance costs. An effective performance monitoring system provides the solution for seamlessly presenting asset information, regardless of type, in the proper context to management, operations, engineering, and maintenance.

Ideally, these systems bring together—in one user interface—all the information resident in different, traditionally disparate, automation and monitoring systems. Assets may include automation equipment, plant infrastructure, plant equipment, field devices, IT assets, and production processes. This becomes possible as equipment manufacturers adopt open standards for built-in diagnostic modules, communication systems, and compatible computerized maintenance management systems (CMMS).

With this kind of integrated information at hand, plants can launch continuous improvement initiatives. Maintenance practices can evolve along the following lines:

- Reactive -- Fix on failure.
- Preventive --Maintain on a schedule.
- Predictive --Maintain when conditions detected.
- Reliability Centered--Apply the appropriate technique based upon the role of the asset, safety, and criticality.
- Proactive—Move toward cross functional teams comprised of Operations, Process and Maintenance personnel.

The optimized mix of these initiatives result in maintenance strategies to minimize unscheduled shutdowns and optimize product quality while cost effectively using the maintenance resources on hand. The upshot is a higher return on assets, ultimately leading to operational excellence.

Functions of plant asset optimization systems

- Provide a single interface for aggregating and analyzing plant-wide asset information, regardless of type.
- Put information in the proper context for operations, engineering and plant maintenance.
- Check key performance indicators and asset health.
- Automatically monitor and alarm asset conditions in real time, warning of degrading performance and impending failure.
- Facilitate fast, reliable implementation of corrective actions.
- Reduce time to repair by recommending optimized work processes.

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