GE
Intelligent Platforms

Information Strategies for Manufacturing Sustainability

Balancing Environmental and Operational Metrics Can Prove That "Green Is Green"

Introduction

The growing pressure to meet environmental compliance requirements has driven manufacturers to invest heavily in "green power" solutions that conserve water and energy. In addition, the expected arrival of a U.S. carbon market and the expansion of it in the European Union have spurred a flurry of investment in corporate carbon accounting systems.

While such systems may provide a necessary reporting framework to address evolving regulations, the investment alone does not drive manufacturing sustainability. If these solutions are leveraged in isolation, manufacturers may leave a larger and more impactful opportunity behind: that is one of continuous improvement that uncovers waste and related costs, which can drive environmental and operational results.

Some companies may not realize that isolated capital investments in "green" solutions can actually disrupt stable processes that currently produce goods relatively efficiently. Concurrently, some processes can actually result in waste, whereby simply improving efficiency and yield would deliver more benefits than a major capital investment in "green power" or water conservation.

This paper discusses the importance of balancing environmental and operational performance. A combination of environmental stewardship, customer interests and the profit imperative will drive leading companies to delve deeper into the underlying forces of energy and resource consumption, which are the basis for their carbon emissions. GE Intelligent Platforms believes that an integrated approach to measuring operational and environmental performance will yield insights that can reduce cost and environmental impact at a structural level.

Better Baselines Needed for Behavioral and Capital Approaches

The compelling question many companies face is, "How do we move from measuring environmental performance to improving it?" Many of the environmental reporting and carbon accounting systems available work with extremely aggregated data from very simple sources—utility bills, for example.

Converting monthly energy consumption figures into a carbon equivalent is thus a simple matter when participating in a carbon exchange, and while this approach may explicitly quantify emissions, it doesn't uncover specific opportunities to mitigate a corporation's environmental footprint. By changing the way such systems are deployed within a firm's arsenal of management tools, they can be used to uncover resource wastage and related cost recovery opportunities.

Operational Data: A Strong Foundation for Sustainability Initiatives

Over the last two decades, manufacturers across all industries have adopted continuous improvement initiatives aimed at raising yields, making equipment more reliable, and generally reducing waste of material, labor, and capital. Thanks to the measurement systems put in place to calculate such things as machine downtime, material consumption and so on, many producers have now established a "factory data infrastructure."

Typically, these systems provide context to raw data, "tagging" equipment runtime and event data with identifying elements such as order numbers, product codes, and location data. Some of the more advanced architectures such as GE Intelligent Platforms' Proficy* Workflow and Proficy Plant Applications can easily incorporate extremely raw data, as provided by a water flow meter or energy sensor, into a contextualized form.

Extending the data collected in relation to these core equipment and product models creates a rich base of very granular data that can support several important uses:

- **Automating Common Environmental or Compliance Reporting Processes:**
  Directly measured consumption figures can be totaled or aggregated for use in generating regulatory reports, driving incentive entitlement calculations, and other cost- or compliance-focused reporting.

- **Complementing Carbon Accounting Systems & Procedures:**
  With competing standards for converting energy consumption to emissions and uncertainty as to how reporting and audit requirements will evolve, beginning with granular objective measures of energy or fuel consumption provides a base of data that can easily be repackaged as needed.

- **Adding Footprint Analysis to Continuous Improvement Efforts:**
  Trending objectively measured factors that determine carbon footprint or other environmental scores alongside common performance measures such as efficiency or quality exposes how changes in one set of measures can be used as a leading indicator of impending changes in another. Also, comparing footprint data relative to a specific product made at different times or in different locations can reveal variations that bear investigating.

Leading manufacturers in many sectors are adopting the third approach and finding significant cost savings opportunities as they gain insight into a deeper view of their operations. The key step they have taken is to ensure that the following elements are available for analysis in relation to each other:

- Production throughput
- Resource consumption (energy or fuel, water, chemicals)
- Machine runtime
- Machine downtime or idle time
- Material consumption
- Product quality (good product vs. reject/waste)

Through this type of analysis, hidden relationships that drive excessive energy or water usage can be identified and engineered out of operations. Such initiatives have yielded improvements of 20%-30% in energy consumption or other resources. Considering the upward trend in water and energy prices, there is a clear, compelling financial case to align carbon tracking and other Corporate Social Responsibility (CSR) initiatives with operational metrics and continuous improvement programs.

Simple Steps to Plug Major Water Drains

When challenged with a corporate initiative to reduce water consumption as part of a sustainability initiative, a producer of fabricated and assembled discrete goods was stuck for ideas. As part of its regulatory compliance reporting, it already measured water intake and discharge for the plant, and had been holding at a steady rate for years.

Looking for a way to motivate deeper analysis, plant leadership decided to allocate usage and discharge fees at a departmental level, and released funds to enable departmental metering. In short order, the paint operation emerged as the largest consumer of water—primarily for cleaning operations.

Confronted with directly "paying" for such a large portion of the monthly bill, the paint team analyzed its usage and found wide variations between the ways different cleaning teams worked. By identifying, and then enforcing consistent adherence to the most efficient cleaning procedures, it reduced its water usage—and the associated cost—by more than 30%!

System Considerations: Connecting Your Enterprise

When evaluating the data management and reporting to support the approach presented, it's important to realize how much existing investment can be leveraged. In most cases, a core technology project focuses on accessing existing data and delivering new formats of reporting that combine objective data from plant and ancillary assets with conversion factors, target/goal data, and cost data.

New investment often aims primarily at bridging the gap between corporate systems and the real-time applications present in the factory. Three critical needs stand out when assessing different solutions:

- Native connectivity to measurement devices or to the automation platforms that control them (such connectivity cannot compromise the normal functioning of such devices; industrially "hardened" software behaves differently than corporate middleware or reporting systems and should be used to extract and deliver data from this technology layer).
- A data mechanism that allows unstructured, time-based data to be related to contextual information such as location, product codes, etc. In the case of GE Intelligent Platforms, several solutions in its Proficy family of applications can accomplish this (see Figure 1).
- The ease with which detailed data can be aggregated and periodically transferred to corporate systems.

Brewer Meets Five-Year Energy Savings Target in Three Years

How do you reduce your electrical and gas bills when you have extremely variable recipes as far as heating and chilling are concerned? Measure energy in relation to specific production orders for specific SKUs, and then compare across all the plants that make the SKUs.

This approach allowed a major North American brewer to spot cases where energy consumption varied when all other factors were essentially equal. Measuring energy consumption next to production orders meant it could hunt for root causes through its entire efficiency management system.

Root causes for relative spikes in usage ranged from inefficient process control algorithms for heating or chilling equipment, inconsistent adherence to recipe setpoints, and even poor power management relative to down or idle times. Armed with this insight, the brewer was able to make recipes and procedures more consistent across all sites.

A baseline for its expected energy usage when running efficiently enables the brewer to evaluate capital projects for things like combined heat and power equipment or waste-to-energy solutions with a clear understanding of how much improvement such expenditures will truly yield.

Beyond Reporting – Actively Driving Improvement

Shortening the transition from "awareness" to "action" is the next step in accelerating sustainability initiatives. While historical analysis of consumption and operational data can yield ideas for process and procedural changes, it can also highlight cases for incremental opportunities that can be realized if information is made to flow faster in real time.

With energy cost structures changing to include even stronger implicit penalties for over usage (e.g., higher peak charges, better rates for smart consumption), the value of being able to affect daily decisions in a structured way is clear. Consider this energy-focused scenario:

As changeover work on a packaging line reaches completion, different machines are brought to a ready state, idling at a low rate of power consumption along the full line. Delays in releasing material from upstream processes result in an hour delay before packaging begins.

The ability to automatically notify the packaging line supervisor of the delay through the local supervisory/control application could prevent the needless idling of several assets, and their associated conveyance. Interlocking the control systems of the process area and the packaging area to expressly prevent startup of downstream operations until product is ready would provide an even stronger mechanism to reduce energy waste.

As described above, integrating automated and manual business and production processes provides a critical advantage to driving improvement. Manufacturers need to implement solutions that automate steps and help them to respond more efficiently to issues—reducing resource wastage and related costs. In addition, they can reduce variation in performance and quality for more consistent work processes.

For example, the service-oriented-architecture (SOA) that empowers solutions such as Proficy Workflow is key to deploying new logic on top of existing systems, creating composite applications that can deliver intelligent direction and enable insightful reporting. It provides a framework to not only collect data, but to apply logic to that data and to safely generate triggers or enforce logic across multiple industrial and corporate applications.

Such composite solutions enable plant and corporate staff to automatically monitor multiple systems for triggers that indicate waste reduction opportunities, and then increase the speed of response to exceptions that occur.

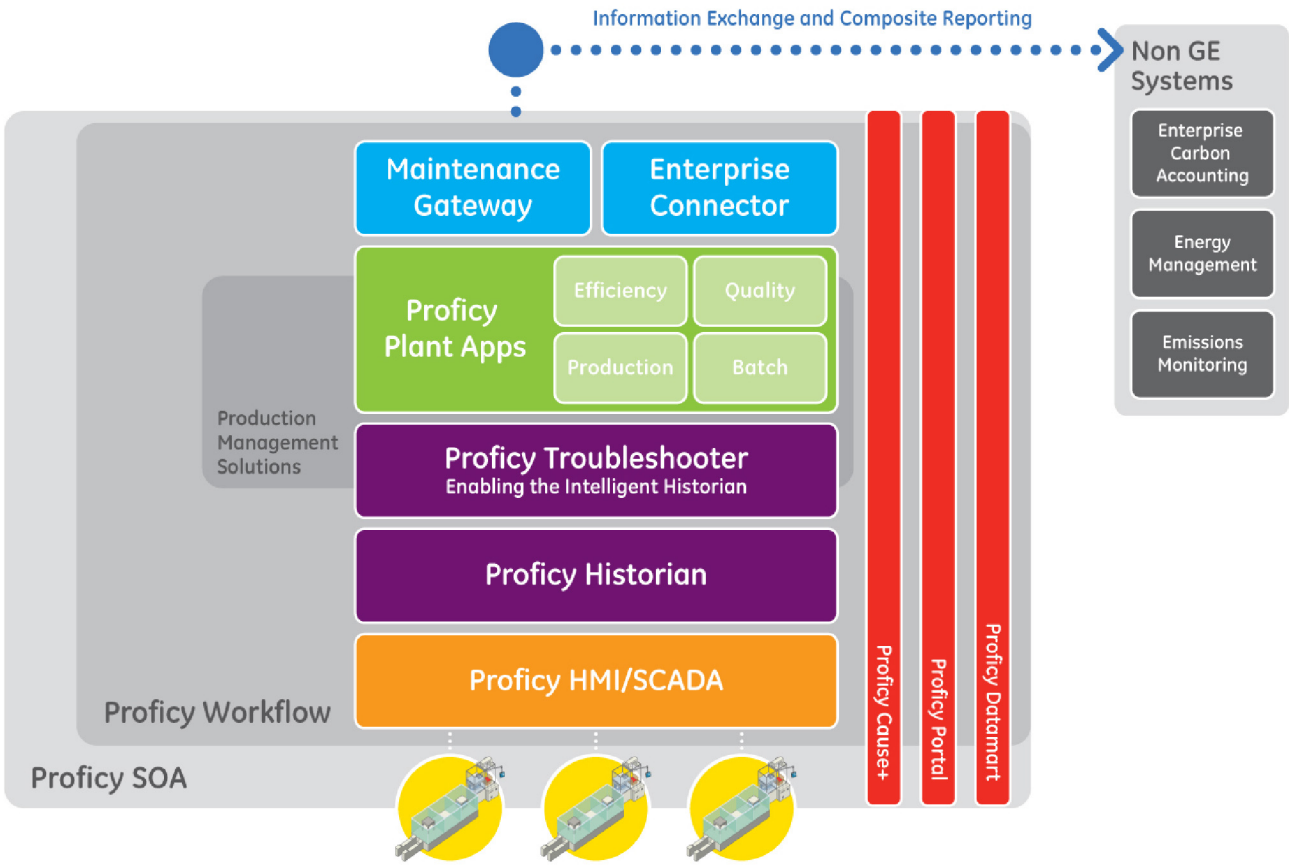

Figure 1 Architectures that include GE Intelligent Platforms' Proficy Workflow can simplify collection and redistribution of data from multiple factory sources—interconnecting people, systems, and processes to relate data to contextual information.

Conclusion

Manufacturers can greatly benefit from an integrated "big picture" view of their operations, whereby they can measure environmental factors alongside other operational metrics to gain visibility into where they may be disrupting stable processes, or conversely, where they are accepting waste simply because they do not realize it.

Sustainability initiatives that result from regulatory pressures or customer pressures should not be considered an additional cost to a corporation. Rather, a planned approach that combines measuring the underlying factors that drive environmental scores with traditional operations metrics can yield significant operational savings—proving that "Green is Green."

With an objective baseline of data in hand, manufacturers can consider structural capital changes to water or energy delivery with a clear understanding of the incremental impact they will have—delivering useful analytics and real-time actionable information to help accomplish longer-term needs.

Furthermore, continuous improvement teams equipped with detailed insight into the environmental costs of the business will be able to balance stewardship with cost and product quality as they tune recipes, processes and procedures to minimize waste in all areas—for a sustainable competitive advantage.

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