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Combine Environmental Stewardship and Bottom-Line Manufacturing

Wireless sensors and the network can reduce expenses

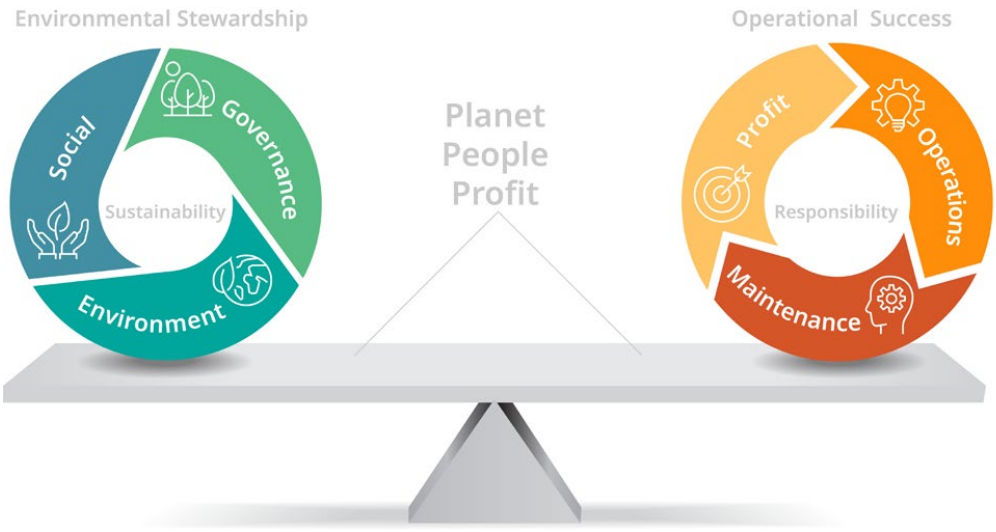
By Gerald Hardesty, Yokogawa

Environmental stewardship plays a key role in manufacturing. In fact, manufacturers integrate their productivity goals with those of quality, health, safety and environment (QHSE) and environmental social governance (ESG). Strongly affected by these concerns are facilities whose processes include water treatment. To support community and global environmental requirements, manufacturing design solutions must run parallel with sustainability actions while supporting smooth operational and maintenance savings (Figure 1).

As many manufacturing teams have discovered, meeting environmental objectives does not cause economic pain in startup, operations or maintenance. Co-innovating with manufacturers around the globe to meet environmental challenges can lead to improved environmental consciousness while enabling strong business decisions to reap profitable returns.

ADVANCES IN TECHNOLOGY STREAMLINE ENVIRONMENTAL STEWARDSHIP

Water stewardship poses nontrivial challenges for manufacturers, for example, meeting maintenance budgets while ensuring consistent water intake and achieving ideal temperatures in far-off holding ponds. Because these stewardship activities will continue to grow in importance, manufacturers must look to technology and innovative solutions that will succeed now and support them in the future.



BALANCING SUSTAINABILITY WITH PROFITS

Figure 1. Environmental stewardship does not have to come at a cost. Sustainability efforts can help to improve a company's bottom line.

Accurate temperature, pressure and vibration sensors are some of the keys to maintaining not only efficient and safe manufacturing processes but also a sustainable environment. Teams that have considered wireless devices for remote areas might have found prohibitive costs of technologies that do not conform to their practices. However, new market solutions pair high-quality sensors with open network specifications that bring IIoT affordability and enable efficiency toward digital transformation. In the end, there is no need to sacrifice either affordability or data quality.

One example is the Sushi sensor, a small, wireless pressure, vibration and temperature sensor that monitors conditions continuously and accurately over vast distances. Small sensors deliver data in tight-fitting remote situations to a hub so that teams can track trends, detect abnormal conditions early and help direct troubleshooting activities efficiently. This comprehensive condition monitoring leads to predictive maintenance and helps set maintenance priorities and reduce costs.

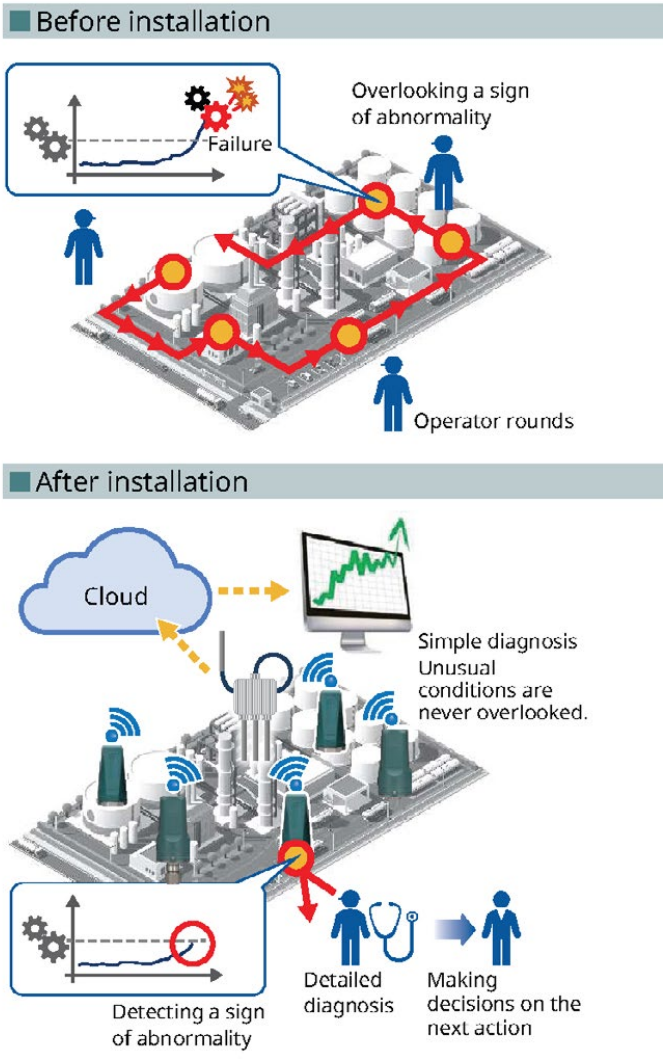
Preventive or time-based maintenance once was the preferred solution for teams to maintain equipment health. Now predictive maintenance — using data and analysis to predict when issues will arise — has been found to save maintenance resources while avoiding equipment issues. Rather than sending technicians out on a schedule to review equipment with no issues, predictive maintenance combines sensor data with machine learning and diagnostics to determine when conditions have changed and require attention.

The process is streamlined because a team member does not need to travel to the remote area to inspect conditions (Figure 2). Often, minor issues can be found and solved before they become significant, as might happen if left to a monthly schedule.

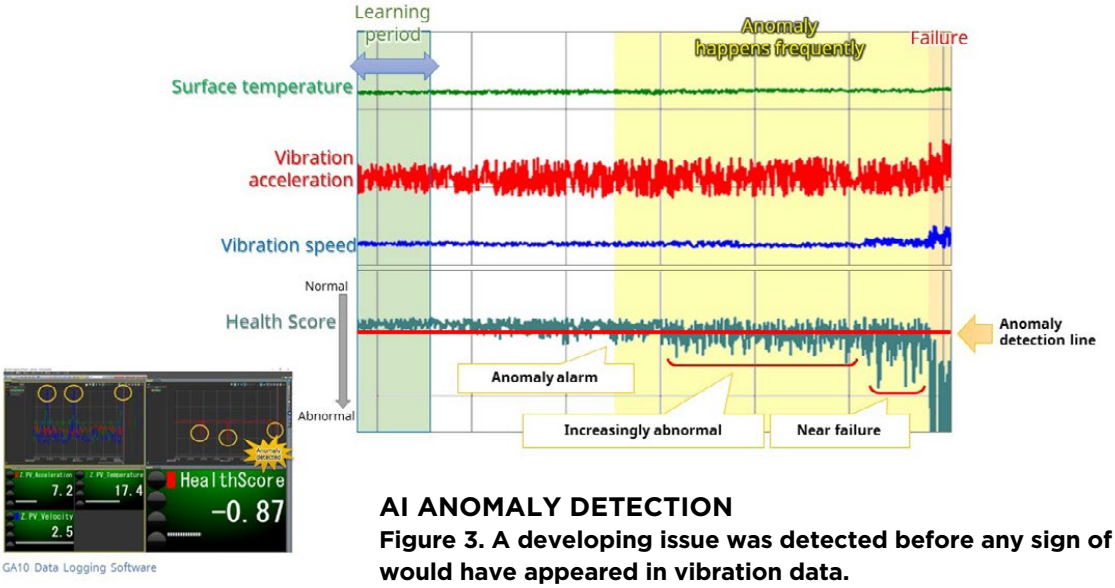
Data is communicated via the Long Range Wide Area Network (LoRaWAN), a low-power, wide-area (LPWA) networking protocol. It is ideal for conditions that require accuracy but less frequent collection rates, as seen in intake and outflow water treatment applications. LoRaWAN's bi-directional communication, end-to-end security and mobility can enable sensor deployment over six miles (10 km) from the facility.

With the focus on meeting environmental requirements, teams must store gathered data and be ready for an audit. Whether the data is analyzed and stored in the cloud, a local network or on-premise, solutions must be versatile to fit the need.

Measurement data can be sent from the Sushi sensors via a LoRaWAN gateway to Yokogawa's SMARTDAC+ GA10 data logging software, where artificial intelligence (AI) analyzes operating conditions and trends. The GA10 software alerts process management system operators to changing conditions, thus supporting predictive maintenance. In some large applications that require more analysis and storage, teams can choose a CI server in place of the SMARTDAC+.



PREDICTIVE MAINTENANCE
Figure 2. The sensor gathers data, which the data logging software analyzes. Operators are alerted to any abnormality, allowing for early intervention before serious issues arise.



AI ANOMALY DETECTION

Figure 3. A developing issue was detected before any sign of it would have appeared in vibration data.

SAVINGS DELIVERED FOR ENVIRONMENTAL SUSTAINABILITY

Many manufacturing facilities use water from external natural sources as part of their products or processes, such as a cooling tower, to remove heat from materials. Good water stewardship includes proper methods of collecting water from local resources, monitoring the quality of the water returned, eliminating negative impact on surroundings and improving the resources.

Water taken from a local source enters the facility supply pipe through a rotating filter or screen to prevent materials and wildlife from entering. Contaminants that accumulate on the filter can reduce the water throughput, jeopardize downstream operations and damage the filter.

Potentially far from the manufacturing facility, the pressure at the water intake on both sides of the filter must be measured wirelessly to monitor the flow and assure that adequate water enters the system to preserve smooth process operation. The physical distance from the facility makes connectivity a challenge for some wireless signal types and networks, so be sure to account for this when selecting a sensor.

Pumps in these applications prove vital to keeping water moving and the water treatment process operating smoothly. Excessive vibration in pumps indicates issues that can lead to pump breakdowns. Too often, equipment is either checked and monitored for vibration levels via once-daily operator rounds or not monitored at all. This lack of visibility into equipment conditions can lead to unforeseen breakdowns, downtime and costs.

However, AI combined with the right sensors can detect changes to the vibration

data before the vibration becomes a problem, as shown in Figure 3. Teams can detect potential issues and dispatch a technician before the damage becomes significant.

In addition, placing vibration sensors throughout a water treatment system means teams can improve their pump efficiency, energy usage, environmental stewardship and the team's efficiency through condition-based monitoring. Installing vibration can be easy if they are attached magnetically. Once the LoRaWAN network is established, adding additional sensors is simple and almost automatic.

Water flowing from a manufacturing process to a local river might be used to keep the process from overheating. Even though the water is clean, thermal pollution can have a devastating impact on the river ecosystem. In this situation, keeping the water in a holding pond changes the ambient temperature so slowly that the sensor does not need to send measurements every second. Some sensors can send data as often as once per minute — or less frequently to extend battery life. Many users have added a recorder to display and document how the water temperature reached a safe level.

Savings extend to a requirement for less infrastructure in the field when the sensor network's long range allows the team to forego an intermediate SCADA or backhaul network.

MOVING FORWARD TO FUTURE SUSTAINABILITY

The combination of remote sensors that are economically and quickly installed, data retrieved over a low-power network, and information that is analyzed and prepared for efficient decision-making make the goal of water sustainability more achievable.

While many sensors can provide impactful information on their own, adding the SMARTDAX+ GA10 software creates the Yokogawa IIoT Plant Asset Management Solution as the next step in providing insight and analysis for maintenance teams to make informed decisions. When sensors and LoRaWAN networks are combined with data-gathering and analysis solutions, data is efficiently stored, informed decisions are made, and costs are reduced.

As organizations complete their IIoT solutions and prepare for future sustainability challenges, open alliances — such as the nonproprietary wireless protocol LoRaWAN — encourage options for flexibility. The LoRaWAN Alliance opens up a host of interoperable tools from which users can choose. ●

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