

The Hydrogen Economy: You Can't Manage What You Can't Monitor



By Dennis Reid, H2scan Corp.

Hydrogen is entering a new phase and is now set to play a crucial clean energy role in the world's energy supply and help address the climate crisis by moving us away from fossil fuels. But there are some serious issues to address.

The axiom often attributed to Peter Drucker, "You can't manage what you can't measure," applies to the fast-growing hydrogen economy as well. But I'd swap out the word "measure" for the broader term "monitor," meaning to detect (sense), measure, record, analyze, and then use that data to both take immediate action when necessary and predict future trends. These necessary actions might range from sounding an alarm to activating a fan to turning off a piece of equipment or turning the dials to make finite adjustments.

This article will explore some of the many uses of hydrogen, both as a clean energy fuel (as most think of it) and as a byproduct of various industrial processes, where it can indicate leaks or safety issues as well as help assess real-time equipment health and process efficiency.

I'll also discuss key hydrogen applications that require real-time monitoring, and how this has been facilitated by the development of miniaturized, solid-state, self-calibrating sensors on a chip. (Full disclosure:

My company produces real-time solutions in hydrogen monitoring, and other companies produce hydrogen-sensing products as well, including Draeger, Honeywell, MSA, Qualitrol and RKI.) These new forms of monitoring allow for more extensive hydrogen use since they solve for past safety limitations like hydrogen's volatility in certain concentrations. "Real-time" is a key term in this discussion, meaning continuous, 24/7 and basically instantaneous. How might your company, and our shared interest in the environment, benefit from the expanded and safer use of hydrogen?

Past Monitoring Challenges

Prior to these newer monitoring solutions, hydrogen was measured using in-line measurements analyzed by a Thermal Conductivity Device (TCD). This costly technology has many limitations when trying to measure hydrogen in complex gas streams. False readings in multi-gas streams and needing a reference gas also frustrate operators.

Another older technology is Gas Chromatography (GC), which is off-line, sample-based, slow, expensive, complex, has to be calibrated daily and only takes about eight samples a day. Periodically taking samples doesn't allow for timely changes and can lead to disaster.

Why Monitor Hydrogen?

According to the Department of Energy, hydrogen is actually “safer to handle and use than the fuels commonly used today. For example, hydrogen is non-toxic. In addition, because hydrogen is much lighter than air, it dissipates rapidly when it is released, allowing for relatively rapid dispersal of the fuel in case of a leak.” However, this does not mean hydrogen is risk-free to produce, transport and/or utilize. It is a potentially dangerous, volatile and highly flammable, even explosive, fuel in certain concentrations. Plus, in many applications, the mere existence of hydrogen as a byproduct can be a red flag that needs immediate attention.

For example, increased hydrogen levels in an electrical transformer might indicate that a potential fault is occurring, or that a potentially catastrophic, asset-threatening event is imminent unless actions are taken. Real-time monitoring that is accurate, tolerant of other gasses and affordable for all points of exposure can help avoid most major events. Below are five hydrogen applications and why real-time monitoring in varying environments (air, oxygen-free, oil, gas or even multi-gas) is the solution:

- **Electrolyzers and fuel cells:** Whether generating hydrogen with an electrolyzer or using it in a fuel cell to generate electricity to power a vehicle, forklift or power plant, real-time monitoring improves safety (e.g., leak detection) and offers improved management of production, transport and utilization processes.
- **Energy grid reliability and planning:** Grid transformers (some of which cost millions) can start creating fault conditions due to moisture, arcing or high temperature that causes the oil to break down, thus producing hydrogen as a byproduct. Real-time monitoring of these critical energy assets reduces system downtime and costly interruptions, allowing operators to make better operational decisions and take timely action to prevent catastrophic failures.
- **Mixed-gas pipelines:** Today there is a tremendous effort being undertaken to safely transport hydrogen through existing natural gas pipelines, which will save tremendous costs. Hundreds of trials are currently happening around Europe and elsewhere to make this commercially viable. Hydrogen sensors will play a crucial role in safety and protecting the pipeline by notifying the operators when leaks occur. Other forms of transporting hydrogen (e.g., by trucks or ships) also require real-time monitoring for safety.
- **Refineries and the petro-chemical industry:** Real-time monitoring of hydrogen levels as both a “catalyst” (to stimulate chemical reactions) and as a process byproduct are critical. Monitoring addresses both safety needs and real-time equipment health, which can extend asset life. Refineries, chemical plants, industrial gas manufacturing and other similar locations need monitoring for both process adjustments and maintenance.
- **Battery room backup safety:** Hydrogen is produced as a byproduct during over-charging of lead-acid batteries and, if not monitored closely, can lead to fire or explosions. Real-time monitoring improves safety and reduces HVAC costs and major maintenance in various facilities that use battery backups (e.g., refineries, cell towers and data centers).

The Bottom Line

Miniaturized, self-calibrating sensors have made it possible to have a monitor inside literally every hydrogen-related piece of equipment, running 24/7. Real-time management and monitoring is an effective and predictive solution in making hydrogen no riskier than the fuels we use today—less so, in many situations. Plus, hydrogen monitoring can be a lifesaver, providing real-time assessments of various dangerous situations that need human or automated actions to correct.

Check out [H2Scan](#) Corporation



Dennis Reid

Founder and Former CEO of [H2Scan](#) Corporation in Valencia, CA.
20+ year veteran in hydrogen-related industries, worldwide