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ACW
AIR CARGO WEEK

August 2025

Ageing Transformers Highlight Hidden Risk

August 11, 2025

The fire that knocked out power at Heathrow Airport earlier this year served as more than a one-off disruption; it was a warning. Behind the outage lies a less visible, systemic issue plaguing airports, logistics hubs, and critical infrastructure worldwide: ageing transformers operating with little to no real-time monitoring.

The incident, which caused the cancellation of over 100 flights and disrupted cargo flows at one of the world's busiest international airports, has prompted renewed scrutiny of electrical grid reliability. But according to Dave Meyers, CEO of H2Scan, a leader in transformer gas sensing technology, Heathrow's power failure wasn't just unfortunate. It was foreseeable.

"Many transformer assets in the UK and US are over 40 or 50 years old," Meyers explained. "As these assets age, the risk of internal failure increases. If you don't have continuous monitoring, it's like flying blind."

A hidden threat to air cargo reliability

In airfreight and logistics, energy reliability is often assumed, until it vanishes. A single transformer failure can ripple through cargo operations, disrupting loading, scanning, refrigeration, security systems, and digital infrastructure. Yet the health of the transformers powering these systems is rarely scrutinised until failure occurs.

Historically, transformer monitoring has relied on periodic manual oil sampling, often every six to 48 months. These samples are analysed in a lab for dissolved gases, such as hydrogen, methane and acetylene, which signal internal faults like overheating or arcing.

> "The problem is that serious faults can develop between samples," Meyers said. "It's like checking your blood pressure once a year if you are at risk and hoping you don't get a heart attack in between."

Hydrogen, in particular, is a critical early indicator. It is the first gas released as temperatures rise inside a transformer — sometimes weeks or even months before a failure. Real-time hydrogen sensing, therefore, offers the earliest possible warning of trouble.

"Hydrogen is your first line of defence," said Meyers. "If you see it rising, you can take action before the situation becomes catastrophic."

The Heathrow fire was reportedly triggered by an undetected transformer fault at a substation serving the airport's air traffic control systems. While investigations are still ongoing, the economic impact is already clear. Industry analysts estimate the disruption cost over £100 million, or roughly £6–7 million per hour in lost passenger and cargo revenue.

"We've seen downtime costs in the range of half a million dollars an hour at other industrial sites," Meyers noted. "For a major airport, that figure is exponentially higher."

Beyond financial losses, transformer failures carry safety, environmental, and regulatory risks. Leaked oil from failed units near rivers or coastal hubs can trigger costly cleanups. Hospitals, data centres and cold-chain warehouses are similarly exposed, especially as temperatures fluctuate more widely and electrification increases demand on outdated assets.

Until recently, continuous monitoring was a luxury reserved for only the most valuable or mission-critical transformers. Multi-gas dissolved gas analysis (DGA) systems cost tens of thousands of dollars and require shutdowns for installation. That barrier is now crumbling.

"We can now install hydrogen sensors in under two hours, without taking the transformer offline," Meyers explained. "Airports or data centres can retrofit ageing units rapidly and start receiving real-time data immediately."

This cost-effective approach is gaining traction, not just among asset operators but also insurers, who increasingly offer premium reductions for monitored equipment. "Insurance companies are becoming first movers," Meyers said. "They're incentivising monitoring as a risk mitigation strategy."

International standards bodies like IEEE and CIGRÉ are also writing monitoring requirements into new guidelines, while fire safety organisations such as the NFPA are raising the profile of electrical fire prevention through better diagnostics.

Still, the shift is not universal. The utility sector remains conservative, often prioritising stability over innovation. But Meyers sees signs of transition.

"It's not realistic to retrofit every transformer in a short period," he acknowledged. "The key is to prioritise. Start with the most critical assets — those tied to passenger operations, cold-chain cargo, or air traffic systems — and build out from there."

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Use cases from the field

Meyers shared several real-world cases in which hydrogen monitoring prevented failures. In one instance, a rising trend in hydrogen levels led engineers to discover a loose connection inside a large transformer — an issue that, left undetected, would have ended in fire or outage. In another case, operators used data to identify transient spikes tied to temporary faults, avoiding costly and unnecessary interventions.

> "It's not just about detection," Meyers said. "It's about understanding the behaviour of your assets. That allows you to avoid false alarms, prioritise maintenance, and ultimately extend asset life."

AI and machine learning are beginning to play a role here too, with predictive models built from continuous sensor data, not just periodic samples. The more data is collected in real time, the more accurate future failure predictions can become.

For airports increasingly functioning as logistics hubs, with e-commerce, perishables, pharma, and electronics flowing through 24/7, the resilience of behind-the-scenes electrical infrastructure is moving up the priority list. As electrification accelerates, particularly in ground operations and cargo handling, grid stability and monitoring will become foundational to operational continuity.

"Monitoring transformers is no longer just an engineering concern," Meyers concluded. "It's a business continuity strategy, a fire safety measure, and an environmental obligation all in one."