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Make Real-Time Monitoring Standard

It takes a simple sensor to save power systems from massive failure.

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Across the world, power grids are under mounting pressure from aging equipment, rising demand, and the push toward electrification.

Transformers, too often taken for granted as the essential lynchpin of today's technologically interdependent world, are carrying heavier loads for longer periods, often with minimal oversight.

Transformers are essential for powering virtually everything electrical, but many are now decades old and struggling to keep up. As electricity demand rises faster than infrastructure upgrades, the risk of failure is growing.

When dealing with such critical infrastructure, it can be dangerous to wait for something to go wrong before taking action. But all too often, investment in maintenance comes only after a fault has already caused major damage, leading to blackouts, financial loss, and public safety risks.

A fire near Heathrow Airport earlier last year showed just how devastating a single transformer failure can be. The incident triggered a massive blackout, grounding more than 1,300 flights and cutting power to over 66,000 homes. Losses were estimated at more than £100 million.

Later investigations suggested that early signs of insulation failure had been detected years before, but nothing was done to remedy the fault. What could have been a routine fix turned into a national crisis.

Heathrow was not an isolated event. The UK recorded eight transformer fires in just 10 weeks during a period last year. Similar problems have been reported in North America and Asia, where transformers installed in the 1960s and 1970s are still in use.

Nearly 40% of Britain's transmission equipment predates 1975, and more than half of USA transformers are over 40 years old. Replacements are slow and expensive. In the USA, the wait for a new transformer can stretch up to four years.

This mismatch between aging assets and limited supply is creating a dangerous vulnerability. The UK's National Energy Systems Operator expects electricity use to rise by 30% by 2035, driven by electric vehicles, data centres, and the electrification of industry.

Similar patterns are emerging everywhere. The challenge is that utilities cannot simply replace every aging transformer, they must find smarter ways to protect and extend their life.

Monitoring Matters

One of the most effective transformer fleet-wide solutions is hydrogen monitoring. When components in the main tank begin to deteriorate, hydrogen gas is one of the first warning signs. It forms when abnormal heating occurs, typical of insulation breakdown or acting events inside the transformer. In the past, operators would send oil samples to labs once a year (sometimes less frequently) to assess the hydrocarbon gas levels. But this method leaves long gaps between manual sampling, allowing incipient faults to grow unnoticed.

Modern hydrogen sensors have changed that. These small, affordable devices can be attached directly to transformers to provide continuous, real-time monitoring. They send alerts the moment hydrogen levels begin to rise, giving operators valuable time to act before a minor issue turns into a major failure. Costing only a few thousand dollars, each sensor can save millions by avoiding premature transformer failures or even blackouts.

Real-time hydrogen monitoring also turns maintenance from reactive to proactive. Instead of rushing to fix problems after a failure, utilities can plan repairs or replacements in advance. This not only cuts costs but also improves worker safety and keeps critical services, like hospitals, airports, and data centres, running without interruption. Extending transformer life by even 10 to 20% can make a major difference, especially when new units can take years to arrive.

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Studies also show that predictive maintenance enabled by continuous monitoring can reduce maintenance costs by up to 25%. Each avoided outage saves millions in lost revenue and prevents damage to a utility's reputation. Some still worry that installing sensors adds complexity or cost, but in practice, the opposite is true. These devices detect hydrogen in very small amounts, just parts per million, providing early and accurate warnings. Installation takes only a few hours and does not require shutting down the transformer. The data can be viewed remotely, allowing for automatic alerts and quick analysis. Many utilities recover the cost of investment within a few years (sometimes less).

The Heathrow fire highlighted not only technical issues but also communication gaps.

Maintenance teams had warning data, but it was fragmented and delayed. Real time hydrogen monitoring removes that blind spot. It provides transparency, ensuring that warnings are seen and acted upon immediately. For regulators, this visibility strengthens oversight and helps ensure accountability.

In developing regions such as Africa, South Asia, and Latin America, the case for adopting hydrogen monitoring is even stronger. Many of these countries face rapid growth in electricity demand but limited budgets for infrastructure upgrades.

For them, installing sensors can extend the lifespan of existing transformers and prevent costly outages. It is an affordable way to build resilience without waiting for large scale modernisation programmes.

The Role of Monitoring

Hydrogen monitoring also plays a key role in supporting renewable energy integration. As grids absorb more solar and wind power, they become more complex and variable.

Transformers must adapt to fluctuating loads, which increase stress and the risk of failure. By giving operators continuous insight into asset health, hydrogen monitoring helps maintain stability and supports the global shift to cleaner energy.

Ultimately, a small sensor can make a big difference, making incidents entirely preventable. The technology exists: it is reliable, affordable, and ready to deploy.

The question is no longer "Should utility install single gas monitors?" but "How soon can they get started?" What is needed now is urgency and commitment from utilities, policymakers, and regulators to make real-time monitoring a standard part of power grid management.