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Why plant intelligence could be next competitive edge for CBG operators

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Edifice Automationâ??s Kishor Vyas says reliable data, predictive analytics and integrated digital systems can improve digester stability, methane recovery and overall CBG plant profitability

In an exclusive **AgroSpectrum interview, Kishor Vyas, CEO, Edifice Automation Pvt Ltd**, discusses how automation, IoT and AI can help CBG plants move from operator-dependent processes towards data-driven and increasingly autonomous operations. Vyas says the first step is establishing reliable, continuous and standardised plant data, which can then be converted into actionable intelligence through analytics and AI. He identifies anaerobic digestion and gas purification as key areas where automation can deliver significant returns by improving digester stability, methane recovery and gas quality. With agricultural feedstocks remaining highly variable, Vyas argues that the future is not about replacing operators but empowering them with predictive insights and intelligent decision-support systems. He also calls for a common digital architecture for India's CBG sector, including standardised data points, instrumentation, communication protocols and performance indicators. Drawing on Edifice Automation's experience of automating more than 12 CBG plants, Vyas explains how the company's Bio Energy Intelliplant platform is helping move the industry from simply monitoring what happened to predicting what will happen and recommending the next action.

Can automation move CBG plants from operator-dependent operations to truly data-driven, autonomous facilities—and what are the biggest barriers ?

Yes, automation can move CBG plants significantly towards data-driven and increasingly autonomous operations. However, the transition is not an overnight shift from manual operations to fully autonomous plants. It is a progressive journey, beginning with reliable automation, structured data acquisition and continuous monitoring, and then moving towards analytics, artificial intelligence and autonomous decision support. At Edifice Automation, we have more than five years of experience in CBG automation and have automated over 12 CBG plants across India. Our experience shows that the first and most important step towards an intelligent plant is the availability of reliable, structured and continuous operational data. Without good-quality data, even the most advanced AI system will struggle to deliver meaningful outcomes. Once the data foundation is established, the next stage is to convert that data into actionable intelligence through analytics and AI. This enables operators to identify patterns, detect deviations and anticipate potential problems before they affect plant performance.

The biggest barriers today are feedstock variability, inconsistent instrumentation and data quality, lack of standardisation across plants and the continued dependence on operator experience. CBG plants process biological systems, and the characteristics of agricultural and organic feedstocks can change significantly. That makes complete automation more complex than in a conventional manufacturing process.

Full autonomy will take time, but autonomous decision support is already achievable. The immediate opportunity is to use automation and AI to empower operators with better information, faster alerts and predictive insights so that decisions are based on data rather than only experience.

Where does automation deliver the highest ROI in a CBG plant?

There is no single answer because the highest-return automation opportunities vary from plant to plant. However, in most CBG facilities, some of the greatest value can be generated around anaerobic digestion and gas purification. The reason is straightforward. Even relatively small improvements in digester stability, methane yield, methane recovery and gas quality can directly influence the quantity and quality of CBG produced, and therefore the plant's revenue. Automation can continuously monitor critical process parameters and help maintain the digester within its desired operating range. This can improve process stability and reduce fluctuations in gas production. Similarly, automation of gas purification can help optimise methane recovery and maintain gas quality while identifying deviations that could result in losses.

Beyond these areas, feedstock handling and energy management can provide additional efficiency gains. Monitoring the energy consumed by equipment such as compressors, pumps and other major auxiliaries can identify abnormal consumption and opportunities for optimisation.

However, the real value does not come from automating individual packages in isolation. It comes when these systems are integrated and the data from different parts of the plant is brought together. For example, understanding the relationship between feedstock characteristics, digester performance, gas production, purification efficiency and energy consumption can provide much deeper insights than monitoring each system separately. The objective should therefore be to create an integrated plant intelligence layer rather than simply automate individual pieces of equipment.

How can AI, IoT and predictive analytics help operators anticipate digester instability, methane losses and equipment failures?

The biggest shift enabled by AI and predictive analytics is moving from understanding "what happened?" to understanding "what is likely to happen next?" IoT provides the foundation by continuously capturing process parameters from the plant. These could include temperature, pressure, flow, pH, gas composition, methane concentration, energy consumption and other critical operating variables. Analytics can then establish patterns and identify deviations from normal operating behaviour. AI can go a step further by recognising relationships between multiple parameters that may not be immediately visible to an operator.

This can provide early warnings of potential digester instability, declining methane yields, abnormal energy consumption or changes in equipment performance. For example, instead of waiting for methane production to fall significantly, a predictive system can identify a combination of process changes that historically preceded a decline and alert the operator early.

The same principle can be applied to compressors, pumps and other critical equipment. Changes in vibration, energy consumption, operating pressure or other parameters can indicate developing equipment problems before an outright failure occurs. This has the potential to shift maintenance from a reactive model to a predictive one. The objective, however, is not simply to collect more data. CBG plants can generate enormous quantities of operational data, but data by itself does not create value. The real value comes from converting that data into early, actionable decisions. An intelligent system should tell the operator not only that a parameter has changed, but why that change matters, what could happen if it continues and what action should be considered.

Given the variability of agricultural and organic feedstocks, can automated control systems consistently optimise biogas yields—or will human intervention remain indispensable?

Automation can optimise the process within defined operating boundaries, but human expertise will continue to remain important. CBG plants are fundamentally different from many conventional industrial facilities because the raw material is biological and its characteristics can change considerably. The composition, moisture, organic content and other characteristics of agricultural and organic feedstocks can vary depending on the source, season, storage conditions and even individual batches.

Automated control systems can respond to these changes by continuously adjusting process parameters and maintaining the plant within defined operating limits. AI-based systems can further improve this capability by identifying patterns and recommending optimal operating conditions. However, there will always be situations where contextual judgement is required. The future, therefore, should not be viewed as “humans versus automation.” It should be about humans being empowered by automation and AI. The system should continuously monitor the plant, adapt operating parameters within approved boundaries, identify anomalies and provide recommendations. The operator should retain control over decisions that require contextual judgement or involve conditions outside the system’s defined operating envelope. This human-in-the-loop model is likely to be the most practical pathway towards increasingly autonomous CBG plants.

Over time, as more operational data becomes available and AI models become more mature, the level of autonomous decision-making can increase.

What would it take to create a common digital architecture for India’s CBG plants?

India needs a standardised digital architecture for CBG plants, beginning with common data points, instrumentation standards, communication protocols and key performance indicators. At present, plants can differ significantly in terms of equipment, automation systems, instrumentation and the way operational data is recorded. This makes it difficult to benchmark plants or develop large-scale predictive models.

A common digital architecture would allow reliable plant data to be captured in a consistent structure. Once that foundation exists, cloud-based platforms can provide real-time monitoring, multi-site benchmarking, methane-yield analysis, emissions tracking, energy-performance analysis, predictive maintenance and trend-based anomaly detection. This could be particularly valuable for companies operating multiple CBG plants because management would be able to compare plant performance across locations and identify underperforming assets much faster. At Edifice Automation, we are moving in this direction through our Bio Energy Intelliplant platform. Based on our experience of automating more than 12 CBG plants, we have developed a secure, cloud-based platform designed for multi-site monitoring, advanced analytics, predictive insights and trend-based anomaly detection. The philosophy is simple: data is the foundation; intelligence is what converts that data into better plant performance and profitability. A common digital architecture could eventually enable the CBG industry to develop industry-wide benchmarks for parameters such as methane yield, gas recovery, energy consumption, equipment availability and plant efficiency. That would represent an important step towards professionalising and standardising the operational performance of the sector.

The next generation of CBG plants will not be differentiated merely by the quality of their equipment or the capacity of their digesters. Increasingly, they will be differentiated by how intelligently they use their operational data. Automation is the first step. It creates visibility and control. The next step is plant intelligence, where data from different systems is integrated, analysed and converted into actionable insights. The ultimate objective should be to move from simply monitoring what happened to understanding why it happened, predicting what is likely to happen next and recommending what the operator should do. At Edifice Automation, our vision is to help CBG plant owners make this transition — from automation to plant intelligence.

The opportunity is significant because improving the performance of existing CBG assets can be as important as building new capacity. If digital technologies can improve digester stability, increase methane recovery, reduce energy consumption, minimise downtime and optimise maintenance, they can directly strengthen the economics of CBG projects. In an industry where feedstock costs, plant efficiency and operational reliability have a direct bearing on profitability, the ability to make faster and better decisions could become one of the most important competitive advantages for CBG operators.

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