VIEW POINT

ENERGY-SMART OPERATIONS: PRACTICAL PATHS TO SUSTAINABILITY AND OPERATIONAL VALUE

An Executive Point of View for Industrial and Energy Sector Leaders

Infosys

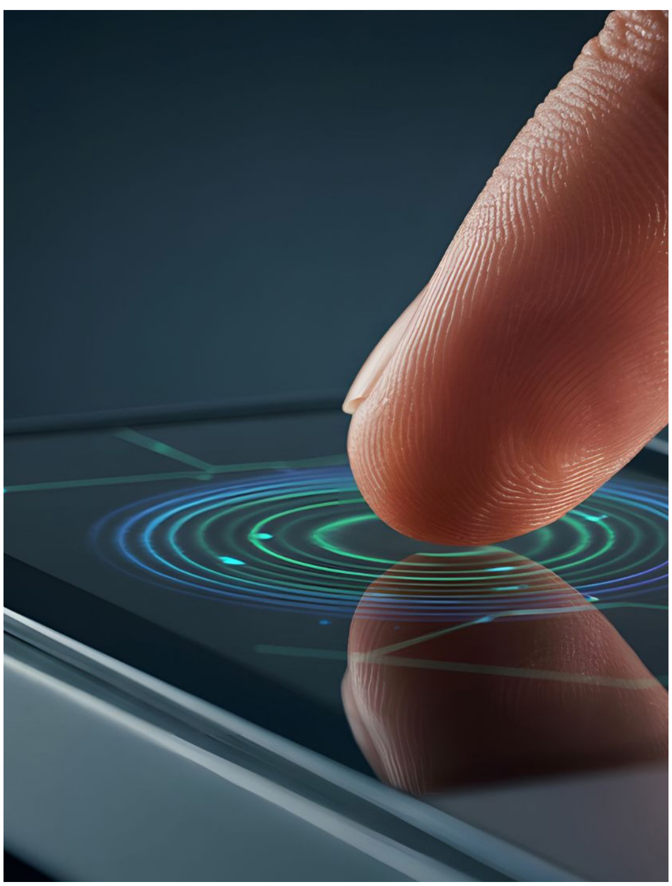
Navigate your next

Executive Summary

Industrial and energy-intensive organizations are facing sustained pressure to improve efficiency, control operating costs, respond faster to disruption, support sustainability objectives, and prepare for a future shaped by renewable energy, decentralization, and rising digital expectations. Delivering on these priorities with legacy systems and siloed data is increasingly difficult.

A practical path forward is emerging through the integration of IoT with IT and OT data — and, in 2026, through the technologies that have matured around it: Unified Namespace architectures, industrial DataOps, edge computing, and AI that has moved from pilots into production operations. The result is not just better monitoring, but a more modern operating model built on visibility, context, and actionable insight — one in which energy stops being treated as a utility line item and becomes a source of operational intelligence.

This point of view presents a practical framework based on recent industry perspectives on industrial energy management, IT/OT integration, utility monitoring, industrial data architecture, and applied AI — updated with the latest technologies and market developments through mid-2026.



Why This Matters Now

Three developments make 2026 a critical inflection point.

First, AI has moved from experimentation to execution.

Across energy systems, manufacturing, and infrastructure, organizations are embedding AI directly into day-to-day operations rather than testing it in isolation. Agentic AI is beginning to coordinate work that spans multiple systems — forecasting, scheduling, optimization — and AI-powered digital twins and predictive analytics have moved from niche applications into core operational use. Leading adopters report productivity gains of 20–30 percent, machine downtime reduced by up to half, and roughly a quarter of energy costs reclaimed.

Second, the focus is shifting from passive monitoring to active grid interaction.

With volatile energy costs and aggressive decarbonization targets, manufacturers are moving beyond monitoring consumption toward participating in the energy system: virtual power plants that aggregate distributed assets across sites, demand-side flexibility, storage orchestration, and smarter integration of on-site renewables.

Third, the reporting landscape has changed — but the data discipline has not.

The EU's Omnibus I Directive (in force since March 2026) narrowed the scope of CSRD to the largest companies, easing the burden on many. Yet third-party assurance, granular Scope 1–3 emissions data, and energy-consumption disclosures remain the standard for those in scope — and customers, lenders, and large-company value chains continue to demand credible energy data from everyone else.

For most organizations, the constraint is not ambition; it is execution. Energy data often exists, but it is disconnected from the operational context required for better decisions. The opportunity is to make energy management practical, measurable, and embedded into day-to-day operations.

External Document © 2026 Infosys Limited

Key Challenges Facing Industrial and Energy Organizations

Industrial and energy organizations commonly face the following barriers:

- Limited site-level visibility into electricity and broader utility consumption (water, air, gas, electricity, steam, and derived utilities)
- Fragmented "data spaghetti" architectures — point-to-point integrations that trap an estimated 30–40 percent of operationally critical data in silos
- Difficulty establishing consistent energy baselines and performance indicators across sites
- Utility data separated from asset, process, and production context, limiting diagnosis and action
- AI ambitions that outpace the data foundation — most industrial AI pilots stall for lack of governed, contextualized data
- Expanding connectivity (sensors, edge gateways, brokers, cloud links) that outpaces security and governance
- Manual, time-intensive sustainability reporting processes that cannot withstand assurance scrutiny

Together, these barriers limit cost reduction, sustainability performance, and the ability to capture value from AI-enabled operations.

Practical Point of View

Treat energy as operational intelligence, not a utility line item

The organizations leading the next phase of industrial transformation are those that stop treating energy as overhead and start treating it as a source of operational insight. The true value of IoT is not in connecting more devices, but in integrating operational and enterprise data in ways that improve decisions — moving beyond siloed reporting toward real-time transparency, predictive action, and more adaptive operations. Energy efficiency, cost control, resilience, and sustainability are no longer separate conversations; they are becoming parts of the same digital operating strategy.

Implication for clients: Position energy within the operations and digital agenda, with shared ownership across engineering, operations, finance, and sustainability — not as a standalone reporting stream.

Sources: *IoT, IT/OT Integration, and the New Imperative for Energy-Smart Operations (2026); Deloitte 2026 Energy Industry Outlook (December 2025)*

External Document © 2026 Infosys Limited

Measure at the machine level before pursuing optimization

Energy management begins with measurement. Monthly utility bills show totals but not where energy was used, when demand peaked, or which assets drive cost. Machine- and process-level monitoring across the WAGES utilities — water, air, gas, electricity, steam — plus derived utilities such as compressed air, treated water, and heat, reveals savings opportunities and machine-health insight at the same time: abnormal current draw can expose failing windings, poor lubrication, or voltage problems long before a breakdown. Comprehensive utility monitoring and optimization regularly reduces energy consumption by 5 to 15 percent.

Implication for clients: Metering and instrumentation are foundational investments. Prioritize high-cost, high-consumption utilities and establish baselines before attempting advanced optimization.

Sources: *Energy Management Starts with Energy Monitoring — Opto 22 (29 May 2024); Utility Consumption Monitoring for Sustainability — InTech (26 December 2023); Meet Sustainability Goals with Energy Measurement and Management (26 March 2024)*

Use standards-based indicators to turn data into management action

Measurement alone is not enough. ISO 50001 and ISO 50006 remain the practical structures for defining an energy baseline and a disciplined set of energy performance indicators — total consumption, savings versus baseline, specific energy consumption, peak demand, and equipment efficiency. A small, consistent indicator framework creates a common operating language between site teams, management, and sustainability stakeholders, and improves comparison and accountability across facilities.

Implication for clients: A small number of well-defined EnPIs, tied to a documented baseline, is more valuable than a large volume of disconnected data points.

Sources: *Utility Consumption Monitoring for Sustainability — InTech (26 December 2023); Energy Management and Sustainability in Industrial Operations digest (2026)*

Contextualize data with Industrial DataOps — and consider a Unified Namespace

Raw device data has limited value until it is connected to production context: which meter maps to which line, which line produced which batch, how scrap affects energy intensity. Industrial DataOps addresses this by breaking down silos and centralizing contextualized data from OT and IT systems.

Since the original DataOps articles were published, one architectural pattern has become dominant: the Unified Namespace (UNS). A UNS uses an MQTT broker as the central hub to which every system — PLCs, SCADA, MES, ERP, and energy meters — publishes and subscribes, organized in an ISA-95 hierarchy (enterprise / site / area / line / asset). It replaces brittle point-to-point integration with a single, governed, real-time data layer.

External Document © 2026 Infosys Limited

The results reported by the ecosystem are material: integration projects completed roughly four times faster than traditional approaches, three-year returns above 400 percent on DataOps platforms, and utility-scale deployments streaming more than a hundred billion data points per day through UNS infrastructure.

Implication for clients: Organize energy information so it ties to real assets, operating conditions, and production outcomes. Where integration debt is high, evaluate a UNS/DataOps architecture as the foundation rather than adding more point-to-point connections.

Sources: *Navigating Energy Efficiency: How Industrial DataOps Paves the Way — Rockwell Automation (05 August 2024); What Is a Unified Namespace and How Does It Work in Manufacturing? — IIoT World (updated 2026); Unified Namespace Essentials — HiveMQ (2026)*

Build on efficient, open communications from edge to cloud

Communications architecture is now a strategic concern, not a technical preference. Lightweight, event-driven protocols such as MQTT minimize data transfer, support device sleep modes, and enable edge processing through local brokers — reducing bandwidth, latency, and energy use at once. The Sparkplug B specification adds standardized payloads and report-by-exception behavior, cutting message volume by around 90 percent in typical deployments. Edge computing keeps time-critical analytics close to the process, while the cloud handles fleet-wide analysis and model training.

Implication for clients: Standardize on open, efficient data movement (MQTT/Sparkplug, OPC UA for machine semantics) and push processing to the edge where latency, resilience, or bandwidth demand it. Scalability of digital initiatives depends on it.

Sources: *MQTT: The Path to Smart Manufacturing Sustainability — HiveMQ (03 June 2024); Unified Namespace for Manufacturing: MQTT, Sparkplug B, ISA-95 — TeepTrak (May 2026); Smart Manufacturing Trends 2026 — RTInsights (April 2026)*

Apply AI where the data foundation is ready — and govern it

AI in industrial operations has crossed from pilots to production. Predictive maintenance is now a mature, widely deployed capability; AI-based demand forecasting, peak prediction, and process optimization deliver measurable energy value; and digital twins let operators test operating strategies virtually before committing physical assets. The newest wave — agentic AI that acts rather than recommends — is entering real operational environments, coordinating forecasting, scheduling, and optimization across systems.

Two lessons from the 2026 deployments stand out. First, AI succeeds where the data foundation is governed and contextualized — a Unified Namespace or equivalent is increasingly described as the prerequisite for agentic AI on operational data. Second, autonomy needs guardrails: actions that change physical behavior (setpoints, load shifting, storage dispatch) require human oversight, staged rollout, and clear accountability, exactly as in security automation.

Implication for clients: Focus AI investment on a short list of operational energy use cases with measurable value — forecasting, predictive maintenance, process optimization — and govern any AI that can act on physical processes.

Sources: *AI in 2026: 3 Trends Shaping the Year Ahead — Hanwha (2026); Industrial AI Software Options 2026 — Viewpoint Analysis (June 2026); Future of Smart Manufacturing: AI Trends 2026 (April 2026)*

Move from passive monitoring to active grid interaction

The 2026 frontier is participation, not just observation. Virtual power plants aggregate distributed energy resources — solar, batteries, wind — across multiple sites to act as a single plant, letting manufacturers monetize flexibility and sell excess energy back to the grid. Sensor-equipped renewable assets self-optimize; IoT-enabled storage manages energy locally or from central nodes; and demand-side management shifts consumption away from expensive peaks. As electricity demand grows — accelerated by electrification and AI data centers — and grid expansion becomes harder, decentralized generation and storage are becoming strategically relevant to industrial sites.

Implication for clients: Assess site electrical readiness, on-site generation, and storage options with grid interactivity in mind. Energy flexibility is becoming a revenue and resilience lever, not only a cost lever.

Sources: *Top 10 Energy Efficiency Solutions for Manufacturing 2026 — IIoT World (March 2026); IoT, IT/OT Integration, and the New Imperative for Energy-Smart Operations (2026); Deloitte 2026 Energy Industry Outlook (December 2025)*

External Document © 2026 Infosys Limited

Secure the energy-data estate as part of the strategy

Connected operations create value and exposure in equal measure. If the data flowing between sensors, brokers, and analytics platforms is intercepted or manipulated, consequences can extend beyond information loss to equipment damage, process disruption, or safety hazards. Every energy sensor, MQTT broker, edge gateway, and cloud link is simultaneously an operational asset and attack surface — and as AI agents begin to act on operational data, governing what they may read and write becomes a first-class design question. Trustworthy analytics require trustworthy data.

Implication for clients: Build security in from the start: device authentication and encrypted transport, hardened and monitored brokers, connectivity governance between OT and IT, and explicit controls over AI-agent actions on operational systems.

Sources: *IoT, IT/OT Integration, and the New Imperative for Energy-Smart Operations (2026); Securing the Unified Namespace Architecture — HiveMQ (2026)*

Build reporting capability as a data discipline — whatever the regulatory scope

The EU's Omnibus I Directive (Directive (EU) 2026/470, in force from 18 March 2026) narrowed CSRD to companies with more than 1,000 employees and over €450 million in turnover, and removed sector-specific standards. For companies still in scope, the fundamentals are unchanged: energy consumption, energy intensity, and Scope 1–3 emissions must be reported with third-party assurance — which means automated, verifiable data collection rather than year-end spreadsheet exercises. For companies now out of scope, the same energy-data discipline still pays: large customers push reporting expectations down their value chains, and the underlying data drives the 5–15 percent savings described above regardless of any disclosure obligation.

Implication for clients: Develop reporting maturity as part of digital operations — data quality, integration, governance, automation — not as an isolated compliance task. The same infrastructure serves optimization and disclosure.

Sources: *Council of the EU: Omnibus I adoption (24 February 2026); Industrial Energy Efficiency and CSRD Requirements — Caligo Industria (February 2026); Digital Technology to Decarbonize Industry (23 October 2023)*

Advance in phases — autonomy is earned, not installed

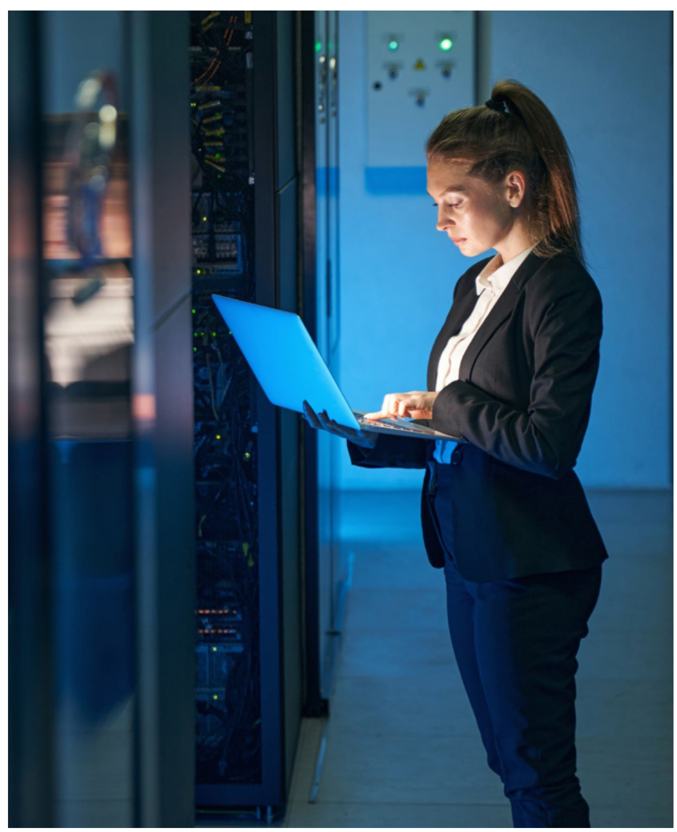
A practical roadmap still follows four stages:

1. Data gathering
2. Deep analysis
3. Predictive modeling
4. Prescriptive or automated control

This guidance has only become more relevant as agentic AI arrives. Organizations that try to skip directly to autonomous optimization struggle because the underlying data, context, and governance are not ready — the widely reported gap between the 98 percent of manufacturers exploring AI and the roughly 20 percent prepared to deploy it reflects precisely this foundation gap. Phased progression builds value incrementally, strengthens the data foundation for each next step, and reduces implementation risk by aligning investment with demonstrated benefit.

Implication for clients: Do not skip the fundamentals. Each stage should demonstrably pay for the next.

Sources: *Navigating Energy Efficiency: How Industrial DataOps Paves the Way — Rockwell Automation (05 August 2024); Future of Smart Manufacturing: AI Trends 2026 (April 2026)*



External Document © 2026 Infosys Limited

Recommended Actions

Organizations can translate this point of view into action through a focused near-term agenda:

- Form a cross-functional energy team spanning engineering, operations, finance, IT/OT, and sustainability
- Rank sites by cost exposure, carbon profile, infrastructure readiness, and data maturity
- Expand metering and utility monitoring for high-value systems; establish baselines and a core EnPI set (ISO 50001/50006)
- Assess data architecture: where point-to-point integration is the bottleneck, plan a UNS/DataOps foundation with MQTT/Sparkplug and edge processing
- Contextualize energy data with asset, process, and production information
- Select two or three AI use cases with measurable value — forecasting, predictive maintenance, process optimization — and define governance for any automated action
- Evaluate grid-interactive opportunities: demand flexibility, storage, on-site renewables, virtual power plant participation
- Embed security requirements (device identity, encrypted transport, broker hardening, AI-agent governance) into every deployment
- Automate sustainability data collection so reporting — mandatory or voluntary — draws from the same trusted pipeline as operations

Business Value Potential

A practical, integrated approach to energy-smart operations can unlock measurable business value, including:

- 5–15 percent reduction in utility consumption from comprehensive monitoring and optimization
- Reduced downtime and maintenance cost through predictive analytics — leaders report downtime cut by up to half
- Faster, cheaper systems integration — UNS/DataOps adopters report integration roughly four times faster than traditional approaches
- New revenue and resilience from grid interactivity, storage, and distributed generation
- More credible, assurance-ready sustainability data at lower reporting cost
- A governed data foundation that makes AI investment productive rather than experimental

External Document © 2026 Infosys Limited

Applying AI in Energy-Smart Operations: A Consequence-Aware Approach

Energy-smart operations require AI solutions that improve performance without disrupting critical industrial processes. AI delivers the greatest impact when it is embedded directly into existing energy-management and operations workflows. Rather than functioning as a standalone tool, AI-driven capabilities strengthen core operational functions, improve the quality of insight, and reduce the workload of engineers and energy managers — while maintaining the reliability essential in industrial environments. The framework below adapts the principles of our View Point on AI-driven OT security to the energy-smart operations context; the two disciplines share the same physics, the same telemetry, and the same rule: in a cyber-physical environment, a wrong automated action is never just a data problem.

Six AI capabilities that matter in energy-smart operations

AI brings six proven capabilities to energy-smart operations. Each delivers maximum value when embedded into the existing pillars — measurement, context, and phased optimization — rather than deployed as disconnected tooling.

- Asset Intelligence — the foundation for everything else: continuous discovery and classification of the energy estate — meters, sensors, drives, motors, pumps, compressors, storage, and distributed generation — with criticality ranked by consumption, cost, and process impact. You cannot optimize what you do not know you have.
- Assisted Analysis — the fastest return on investment: automated correlation of consumption deviations with production events, shift patterns, and price signals, building the investigative narrative for energy reviews that engineers currently assemble by hand.
- Guided Opportunity Hunting — data-driven pattern recognition and site-specific hypotheses that uncover hidden waste — idle-state consumption, compressed-air leakage, scheduling losses — across distributed sites, rather than waiting for problems to announce themselves.
- Enhanced Anomaly Detection — fuses energy signatures, process behavior, and production context to surface deviations that are meaningful in the operational world, not just statistically unusual — sharply reducing false alarms that erode operator trust.
- Cross-Domain Correlation — aligns energy, production, quality, maintenance, weather, and market-price signals into a unified timeline — essential for understanding the real drivers of cost and consumption across modern operations.
- Predictive Analytics — bridges reliability engineering and energy performance: demand and peak forecasting, and predictive maintenance that catches the worn bearing or fouled heat exchanger whose first symptom is quietly rising energy intensity.

Three design principles for AI that touches physical operations

1. **Consequence-Aware Automation.** In industrial environments, automation must understand the potential physical and operational impact of an action. Energy optimization is not exempt: a mis-triggered load shift, storage dispatch, or setpoint change can stop production or create safety risks just as surely as a mis-triggered security response. Generic automation playbooks cannot simply be lifted into the plant. Automation here must be cautious by design — supportive, but never reckless.
2. **Contextual Analytics.** Energy analytics only work well when they understand the industrial process behind the telemetry. We are not just looking at kilowatt-hours; we are looking at how machines, lines, and processes behave in their operational context. A consumption spike during a product changeover is normal; the same spike at idle is a finding. Context is what separates insight from noise.
3. **Human-Approved Control.** Actions that alter the physical environment cannot be fully automated, because of safety, product quality, and operational continuity. Human validation remains mandatory before any AI-recommended action that could change how the process runs. AI augments engineers and operators; it does not replace them. This balance is what delivers speed without compromising safety or reliability.

Sources: *https://www.infosys.com/services/cyber-security/documents/ai-driven-ot-security.pdf*

A tiered autonomy model for energy optimization

AI adoption in energy-smart operations demands a framework that explicitly defines which actions can be automated and which require human judgment. As organizations progress toward stage four of the maturity path — prescriptive and automated control — this model becomes the guardrail that keeps acceleration safe: Any action affecting physical processes remains under explicit human approval — the same safety oversight industrial environments have always required.

External Document © 2026 Infosys Limited

Tier A: Fully Automated	Tier B: Guarded Automation	Tier C: Human-Only Decision
Insight with no physical impact • Monitoring, baselining, and EnPI computation • Demand and peak forecasting • Anomaly detection and alerting • Opportunity identification and ranking • Automated reporting and documentation **Risk: Minimal — errors affect only information, not physical systems.**	**Bounded, reversible adjustments** • Shifting flexible, non-critical loads within pre-approved envelopes • Battery charge/discharge within set limits • HVAC and lighting schedule adjustments • Demand-response participation per agreed rules **Risk: Moderate — reversible, no direct impact on production.** **Control: Automated execution with operator notification and automatic rollback.**	**Any action affecting production or safety** • Process setpoint or parameter changes • Production rescheduling or line stops • Equipment shutdown or start-up • Anything touching safety systems or product quality **Risk: High — errors could cause safety incidents, production loss, or quality issues.** **Control: Explicit approval from qualified operations or engineering personnel.**

Architecture and trust: edge, center, governance

Effective AI deployment follows a hybrid architecture. The edge layer keeps baselining, anomaly detection, and Tier A/B logic at the plant, so sites retain visibility and optimization even during network disruptions. The central layer provides what no single site can see: fleet-wide analytics, model training on aggregated data, cross-site benchmarking, and unified reporting. The governance layer makes AI trustworthy — model lifecycle management, drift monitoring as processes and product mixes evolve, explainability requirements, and audit documentation aligned to frameworks such as the NIST AI Risk Management Framework.

Explainability deserves particular emphasis. Operators and engineers will not act on black-box recommendations they cannot validate. Every AI output should carry evidence-based explanations ("this line's specific energy consumption is 12 percent above baseline for this product mix and shift pattern"), confidence reporting, and recommendations labeled with their operational consequences. Trust is not a soft requirement; it is what determines whether the AI gets used at all.

Implication for clients: Adopt AI for energy with the same discipline mature organizations apply to AI in security operations: capabilities embedded in existing workflows, consequence-aware automation, tiered autonomy with humans approving anything that touches the process, and governance that keeps models explainable and accurate over time.

Sources: *AI-Driven OT Security: Building the Next-Generation OT SOC — Infosys View Point, Michel Bruggeman (2026) https://www.infosys.com/services/cyber-security/documents/ai-driven-ot-security.pdf , adapted to the energy-smart operations context; NIST AI Risk Management Framework 1.0*

External Document © 2026 Infosys Limited

Conclusion

For industrial and energy sector leaders, the path to energy sustainability is both operational and architectural. Organizations improve outcomes when they begin with site-level measurement, connect data with context through modern industrial data architecture, apply AI where the foundation is ready, participate actively in the energy system, and secure the entire estate as they build it.

What has changed in 2026 is not the direction, but the maturity of the tools: Unified Namespace architectures, production-grade industrial AI, and grid-interactive energy assets. The organizations that lead will be those that pair maturing technology with disciplined, phased execution — advancing from visibility to optimization to well-governed autonomy, one demonstrated step at a time, with consequence-aware automation and humans retaining final authority over anything that touches the physical process.

References

- **IoT, IT/OT Integration, and the New Imperative for Energy-Smart Operations** — deep-dive synthesis (2026)
- **Energy Management and Sustainability in Industrial Operations** — article digest (2026)
- **Navigating Energy Efficiency: How Industrial DataOps Paves the Way** — Rockwell Automation, 05 August 2024
- **MQTT: The Path to Smart Manufacturing Sustainability** — HiveMQ, 03 June 2024
- **Energy Management Starts with Energy Monitoring** — Opto 22, 29 May 2024
- **Utility Consumption Monitoring for Sustainability** — InTech, 26 December 2023
- **Meet Sustainability Goals with Energy Measurement and Management** — 26 March 2024
- **Top 10 Energy Efficiency Solutions for Manufacturing 2026** — IIoT World, March 2026
- **What Is a Unified Namespace and How Does It Work in Manufacturing?** — IIoT World, updated 2026
- **Unified Namespace for Manufacturing: MQTT, Sparkplug B, ISA-95** — TeepTrak, May 2026
- **Smart Manufacturing Trends 2026: AI, IoT, and Automation** — RTInsights, April 2026
- **AI in 2026: 3 Trends Shaping the Year Ahead** — Hanwha, 2026
- **Industrial AI Software Options 2026: An Independent Viewpoint** — Viewpoint Analysis, June 2026
- **Future of Smart Manufacturing: AI Trends Driving Industrial Transformation in 2026** — April 2026
- **2026 Energy Industry Outlook** — Deloitte, December 2025
- **Omnibus I Directive (EU) 2026/470 — CSRD/CSDDD simplification** — Council of the EU, February 2026
- **AI-Driven OT Security: Building the Next-Generation OT SOC** — Infosys View Point, Michel Bruggeman, 2026 (*https://www.infosys.com/services/cyber-security/documents/ai-driven-ot-security.pdf*)

About the Author

Michel Bruggeman

Principal Consultant | EMEA IoT & OT Lead

Michel Bruggeman is a distinguished cybersecurity leader with over 25 years of experience, specializing in Operational Technology (OT) security, industrial cybersecurity architecture, and cyber resilience. He has held strategic roles across the insurance, manufacturing, energy, and semiconductor sectors, focusing on ICS/OT risk assessments, secure cloud adoption, and incident response readiness. Michel is a SANS /ISA Mentor and Microsoft Certified Trainer, with deep expertise in IEC 62443, DORA, NIS2, NIST, and ISO 27001.

For more information, contact askus@infosys.com

Infosys
Navigate your next

© 2026 Infosys Limited, Bengaluru, India. All Rights Reserved. Infosys believes the information in this document is accurate as of its publication date; such information is subject to change without notice. Infosys acknowledges the proprietary rights of other companies to the trademarks, product names and such other intellectual property rights mentioned in this document. Except as expressly permitted, neither this documentation nor any part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, printing, photocopying, recording or otherwise, without the prior permission of Infosys Limited and/ or any named intellectual property rights holders under this document.