

AI-Powered Smart Building Energy Optimization

Powered by IoT, Machine Learning and Generative AI on AWS

Delivered by Batif Services Private Limited

• PUBLIC CASE STUDY

Batif Services Private Limited (AWS Partner) | Smart Building Energy Optimization | AWS AI Competency Application - Customer Reference

CLIENT	INDUSTRY	MARKET SEGMENT	CASE STUDY TYPE
Bagmane Group	Commercial Real Estate / Business Parks and Facilities	Enterprise (B2B)	Public

The Opportunity

Bagmane Group set out to build an AI-powered smart-building energy optimization platform for its commercial business parks. The platform would collect energy and building telemetry, predict consumption, identify abnormal energy usage, and deliver AI-driven recommendations that improve energy efficiency while maintaining occupant comfort across large, multi-tenant properties. The ambition was not simply to report on energy after the fact, but to give facility teams a forward-looking, explainable view of how each building behaves - and what to do next.

Because the properties host many enterprise tenants with differing operating hours and comfort expectations, the platform had to reconcile portfolio-wide efficiency goals with the day-to-day realities of individual buildings. That meant handling high-frequency telemetry, learning normal behaviour per building and per equipment class, and turning complex signals into guidance a facility manager could act on immediately.

Why It Mattered

Large commercial business parks run many energy-intensive systems - HVAC, lighting, pumps, cooling equipment and common-area infrastructure - each with its own consumption profile. As the portfolio grew, the gap between the data available and the insight teams could actually use widened. The pain points were clear and compounding:

- Limited insight into consumption patterns across buildings, floors, tenants and equipment types.
- Abnormal usage and equipment inefficiency often went unnoticed until it showed up on utility bills.
- Peak-demand periods were hard to anticipate, limiting proactive load management and demand response.
- Telemetry from smart meters, sensors and facility systems was fragmented and not analytics-ready.
- Manual review of consumption data was slow and did not scale as the portfolio expanded.
- Diagnosing the root cause of an anomaly required cross-referencing multiple systems by hand.
- Sustainability and ESG reporting depended on data that was scattered and inconsistently structured.

Left unaddressed, avoidable energy consumption, higher operating cost and weaker sustainability reporting would only grow as the portfolio expanded. Bagmane Group needed a single, intelligent layer that could sit across every building, learn how each one behaves, and convert raw telemetry into timely, trustworthy action.

How Batif Solved It on AWS

Batif Services Private Limited designed and delivered a serverless-first energy optimization platform on AWS. Telemetry from smart meters, building sensors and facility systems is collected through AWS IoT Core, then stored and processed using AWS data services. Amazon SageMaker powers energy forecasting and anomaly detection, while Amazon Bedrock turns the results into clear, natural-language analysis and recommendations that non-specialists can act on.

AWS Lambda and Amazon EventBridge drive alerts and automated workflows, and facility managers act on the insights through dashboards and targeted notifications - a closed loop from raw telemetry to operational action. The design deliberately separates ingestion, analytics and insight so each layer can evolve independently: new buildings can be onboarded without reworking the models, and models can be retrained without disrupting data collection.

The platform was built to be cost-aware from day one. Serverless components scale to zero when idle, time-series data is retained in a purpose-built store, and foundation-model calls are reserved for the moments where natural-language reasoning adds real value - keeping the running cost proportional to actual activity across the portfolio.

Solution Blueprint

Architecture Flow

Smart Meters / IoT Sensors -> AWS IoT Core -> Data Storage & Processing -> Amazon SageMaker (Forecasting / Anomaly Detection) -> Amazon Bedrock -> AI Recommendations -> Facility Management Dashboard / Alerts

Collect - ingest telemetry reliably at scale

- Smart meters, building sensors and facility systems stream telemetry into AWS IoT Core over secure, authenticated device connections.
- Time-series data lands in Amazon Timestream for fast querying; raw and processed data is retained in Amazon S3 as the long-term data lake.
- Ingestion is decoupled from analytics so new sites and device types can be added without downtime.

Predict - forecast demand and detect anomalies

- Amazon SageMaker models forecast energy consumption and predict peak-demand periods across buildings and time windows.
- Anomaly-detection models flag abnormal usage against learned baselines maintained per building and per equipment type.
- AWS Lambda orchestrates feature preparation, scheduled inference and model output routing under least-privilege roles.
- Model outputs are stored alongside the telemetry so every recommendation can be traced back to the data that produced it.

Act - explain, alert and optimize

- Amazon Bedrock converts forecasts and anomalies into plain-language explanations and prioritized optimization recommendations.
- Amazon EventBridge and AWS Lambda trigger alerts and automated workflows the moment thresholds are breached.
- Amazon SNS delivers notifications to the right facility teams, and Amazon QuickSight dashboards surface trends, anomalies and savings opportunities.
- Recommendations are framed as decision-support, leaving the facility team in control of any operational change.

Intelligence at Work

The platform combines predictive machine learning with generative AI to move facility teams from reactive monitoring to proactive optimization. Predictive models establish what is normal and what is coming; generative AI explains what it means and what to do. Core capabilities include:

- Energy consumption forecasting across buildings, floors and time periods.
- Abnormal-consumption detection against baselines learned per building and equipment class.
- Peak-demand prediction to support proactive load management and demand response.
- Building and equipment usage analysis that isolates the largest efficiency opportunities.
- Natural-language explanation of energy anomalies, written for facility teams rather than data scientists.
- AI-generated, prioritized energy optimization recommendations with the reasoning behind each one.
- Follow-up questioning, so a manager can ask why an anomaly occurred and get a grounded answer.

Model choice: Anthropic Claude 5.0 Sonnet on Amazon Bedrock was selected for the recommendation layer for its clear, grounded, action-oriented output and strong instruction adherence; Amazon Titan Text and Meta Llama 3 were also evaluated on cost, explanation quality and consistency. Using Amazon Bedrock keeps model choice flexible, so the platform can adopt newer models as they become available without re-architecting.

Example AI Insight

"Energy consumption increased significantly compared with the normal pattern. The primary contributor is higher HVAC usage during after-hours. The system recommends reviewing HVAC scheduling for the affected building and operating period."

The AWS Toolkit

AWS Service	Purpose
AWS IoT Core	Secure, scalable ingestion of telemetry from smart meters, sensors and facility systems with per-device identity.
Amazon S3	Central data lake for raw and processed telemetry feeding the analytics and reporting pipeline.
Amazon Timestream	Purpose-built time-series store for high-volume energy telemetry and fast trend queries.
Amazon SageMaker	Training and hosting of forecasting, peak-demand and anomaly-detection models.
Amazon Bedrock	Foundation model layer for natural-language anomaly explanation and optimization recommendations.
AWS Lambda	Serverless orchestration for ingestion, inference and response workflows under least privilege.
Amazon EventBridge	Event-driven triggering of alerts and automated facility workflows on threshold breaches.
Amazon SNS	Delivery of alerts and notifications to the relevant facility management teams.
Amazon QuickSight	Interactive dashboards for consumption trends, anomalies and optimization insight.
Amazon CloudWatch	Observability across ingestion, model inference and workflow health.
AWS IAM & AWS KMS	Least-privilege access control and customer-managed encryption keys for data at rest.

Engineered for Trust

Security and Governance

- Backend Lambda and data services run inside a dedicated VPC with private subnets; device connectivity is controlled through AWS IoT Core with per-device certificates.
- Data at rest is encrypted with AWS KMS keys across S3 and Timestream; data in transit uses TLS 1.2 or higher, including device-to-cloud telemetry.
- AWS IAM enforces least privilege for every service interaction, so each component can access only what it needs.
- AWS CloudTrail records API activity including Bedrock invocations, and CloudWatch captures operational metadata for traceability.

Responsible AI

- Recommendations are grounded in actual telemetry, forecasts and detected anomalies - not assumptions or invented figures.
- The platform explains why an anomaly was flagged and what evidence supports each recommendation, in language facility teams understand.
- Facility managers stay in control: the platform is decision-support, not an autonomous controller of building systems.
- Optimization guidance is balanced against occupant-comfort constraints, so efficiency gains never come at the expense of the tenant experience.

Batif's Delivery Role

Batif Services Private Limited acted as the end-to-end design and delivery partner, owning the engagement from discovery through to operations and handover:

- Discovery workshops to map building systems, consumption drivers, comfort constraints and facility workflows.
- AWS IoT and AI platform architecture and implementation across ingestion, analytics and insight.
- Building telemetry integration across smart meters, sensors and facility systems, including edge handling.
- ML and generative AI development for forecasting, anomaly detection and grounded recommendations.
- Dashboards, alerting and automated facility workflows tailored to how teams actually operate.
- Security and governance including VPC design, IAM policies, KMS encryption and audit logging.
- Cost optimization through serverless design and disciplined use of foundation-model calls.
- Deployment, AWS operations, runbook creation and knowledge transfer to the Bagmane Group team.

Value Delivered

- Improved, near real-time visibility into energy consumption across the entire portfolio.
- Earlier detection of abnormal usage and equipment inefficiency, before it reaches the utility bill.
- Data-driven facility-management decisions backed by clear, explainable AI recommendations.
- Reduced avoidable energy consumption and lower operating cost through timely intervention.
- Stronger sustainability and ESG reporting from reliable, centralized, consistently structured data.
- Faster root-cause diagnosis, with anomalies explained rather than merely flagged.
- A scalable smart-building analytics foundation ready to extend to new sites and use cases.

Built to Scale

- Highly available: IoT Core, Lambda, S3, Timestream, SageMaker endpoints and Bedrock span multiple Availability Zones.
- Auto-scaling: serverless components absorb telemetry and inference spikes during peak-demand periods without manual intervention.
- Serverless-first: no self-managed infrastructure, reducing operational overhead and freeing the team to focus on outcomes.
- Portfolio-ready: new buildings and device types onboard through the same pipeline, so the platform grows with the estate.
- Cost-efficient at scale: pay-per-use services and scale-to-zero keep spend aligned to real activity.