SUSTAINABILITY

3 Ways to Leverage A.I. for Efficient Energy Management

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Energy consumption remains a critical cost center for industrial companies

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Energy consumption remains a critical cost center for industrial companies, particularly in energy-intensive sectors. Businesses must find innovative ways to control energy costs while maintaining productivity. Managing energy consumption is not only vital for reducing operational expenses but also for improving environmental sustainability and operational efficiency. The European energy system has been the most severely affected by recent fluctuations, whereas prices in the United States have shown relatively smaller variations of about 25 percent.[1] This article highlights strategic, data-driven approaches to reducing energy consumption using advanced technologies such as AI and predictive analytics.

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The Energy Challenge in Industrial Operations

Energy prices are inherently volatile, influenced by several factors such as market demand, geopolitical risks, gas import and regulatory changes.[2] For instance, businesses in Europe have experienced significant price fluctuations due to shifts in energy policy and rising global demand, making it increasingly difficult to predict long-term costs. This volatility creates unpredictability in budgeting and cost management for businesses, adding pressure on companies to manage consumption more effectively. In the US, total primary energy consumption in 2023 was approximately 27,550 billion kilowatt-hours

(kWh).[3] Beyond fluctuating prices, industrial facilities also face challenges related to outdated equipment, inefficient processes, and human error in tracking energy usage. These issues can lead to unnecessary consumption and increased costs, significantly impacting profitability over time.

Many companies struggle with identifying where energy inefficiencies exist and how to address them without disrupting their operations.[4] Additionally, many businesses lack real-time visibility into energy consumption patterns, which makes it difficult to optimize processes or predict potential spikes in energy use. As an example, a large exhibition center in Europe struggled with energy management challenges for years. With several pavilions to manage and an energy consumption bill of over Euro 2 million, the organization faced issues such as bad planning, excessive energy consumption, frequent penalties for surpassing set energy limits, and overall inefficient energy management practices. Many companies in the US are confronted with similar challenges.

It is growingly important for companies to reduce energy consumption while boosting operational efficiency. The solution lies in leveraging data and AI to gain deeper insights into energy use, predict trends, and implement targeted interventions.

Key Strategies to Reduce Energy Consumption

Through the utilization of three (3) strategic approaches, companies can leverage AI to better manage energy consumption and cost:

1. Identify and Eliminate Hidden Defects

The first step in managing energy consumption is understanding where inefficiencies lie. In many industrial operations, outdated or poorly maintained equipment consumes more energy than necessary. Identifying these inefficiencies requires a thorough analysis of

consumption data, which can be achieved using AI-powered tools.

An AI-driven approach is utilized to collect and analyze consumption data from strategically placed meters across production lines. This data enables the identification of processes or equipment that are consuming excessive energy. For instance, the application of AI can detect anomalies, such as increased power usage resulting from a deteriorating heating element, which facilitates early intervention and prevents energy waste.

Furthermore, using predictive analytics, two key solutions are provided: accurate prediction of energy consumption and early detection of equipment faults. These insights empower businesses to make informed decisions regarding the replacement of outdated equipment or the adjustment of processes to optimize energy efficiency.

2. Optimize Processes and Reduce Human Error

Manual energy tracking is prone to errors and inefficiencies. Many companies still rely on analog meters, which require manual data entry and are susceptible to inaccuracies. This human error not only leads to incorrect consumption tracking but also delays in identifying inefficiencies.

Implementing smart meters and automating data collection eliminates these challenges. Smart meters provide real-time, accurate data, enabling businesses to track consumption patterns and pinpoint inefficiencies more effectively. By analyzing this data, companies can identify energy-intensive processes and adjust them accordingly.

A European company called Vegum a.s., produces and processes technical rubber for the consumer goods, automotive, engineering and construction industry. Located in Slovakia, it serves as a prime example of a manufacturing company that optimized its operations for energy efficiency. With 30 nearly identical production lines, the company successfully reduced energy consumption during peak hours by shifting production to night shifts and

increasing the frequency of maintenance. Through the use of AI and data analysis, Vegum a.s. evaluated and selected optimal operational times which resulted in a decrease in overall energy costs and enhanced work process efficiency.

3. Avoid Over-Consumption Penalties

Many businesses incur significant costs by exceeding contracted energy limits, particularly during peak demand periods. Exceeding the 15-minute maximum energy usage can result in fines for each kilowatt over the limit, significantly increasing operational costs.

Predictive analytics can help companies anticipate these overages and take corrective actions in real time. By using AI to monitor consumption patterns, businesses can adjust production schedules or reduce energy-intensive processes during peak periods, preventing over-consumption and avoiding penalties.

This proactive approach allows companies to manage their energy consumption more effectively and minimize unnecessary costs.

Implementing a Data-Driven Energy Strategy

In order to successfully reduce energy consumption, businesses need to adopt a data-driven approach that integrates technology advancement into their operations.

The following steps outline how companies can implement such a strategy:

1. Data Collection and Analysis - The first step is to collect accurate energy consumption data using smart meters and automated systems. This data must be analyzed regularly to identify inefficiencies and trends.

2. AI Integration - Leveraging AI can enhance predictive capabilities, enabling companies to forecast consumption, detect equipment failures, and optimize processes based on real-time data.

3. Process Optimization - Once inefficiencies are identified, companies should prioritize replacing outdated equipment, upgrading energy-intensive components, and adjusting production schedules to reduce energy consumption.

4. Continuous Monitoring and Adaptation - Energy management is an ongoing process. Businesses should continuously monitor consumption data and adapt their strategies as new patterns emerge, ensuring long-term energy efficiency and cost savings.

Reducing energy consumption is a multifaceted challenge that requires a strategic approach grounded in data and technology. By identifying hidden inefficiencies, optimizing processes, and avoiding over-consumption penalties, companies can significantly reduce their energy costs while enhancing operational efficiency.
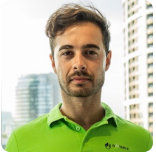
Concluding thoughts

Adopting a data-driven approach not only leads to immediate savings but also supports long-term sustainability goals. Contemporary managers should plan for and navigate energy costs challenges by utilizing AI-powered tools and data-driven insights that would empower them to make informed decisions and achieve energy efficiency targets. Through continuous monitoring, predictive analytics, and process optimization, companies can stay competitive in an increasingly energy-conscious world.

1. https://www.statista.com/topics/10726/global-electricity-prices/#topicOverview

2. https://www.sciencedirect.com/science/article/pii/S0140988324003414

3. https://www.eia.gov/

4. https://www.iea.org/reports/world-energy-investment-2023/overview-and-key-findings

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Simon Stano is an innovative entrepreneur specializing in energy management software. His company DAITABLE integrates AI to reduce energy consumption and optimize costs, minimizing environmental impact. Winner of awards including the BMW Innovation Award and Warper Startup Awards Emerging Innovator.

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