

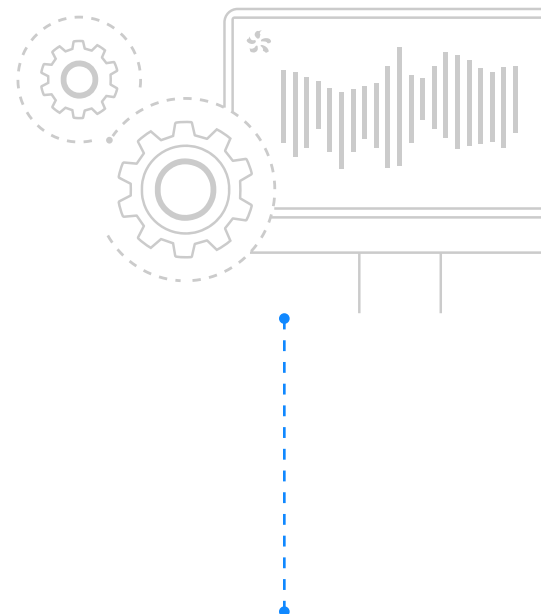
+ GUIDE

# What Is Intelligent Energy Management?

10-MINUTE READ

# Key Takeaways

- Energy management has become a strategic priority for many organizations racing to meet ambitious sustainability targets
- Energy management helps organizations balance economic, environmental, and operational factors to optimize energy consumption, reduce costs, and minimize environmental impact
- An energy management system (EMS) enables organizations to leverage data-driven insights and advanced control capabilities to identify and execute successful energy utilization strategies
- Intelligent optimization is required to handle the dynamic and uncertain environments of real-time asset operation and maximize asset performance
- When investing in an EMS, it is critical to take a long-term view to stay ahead of evolving energy needs and regulatory requirements

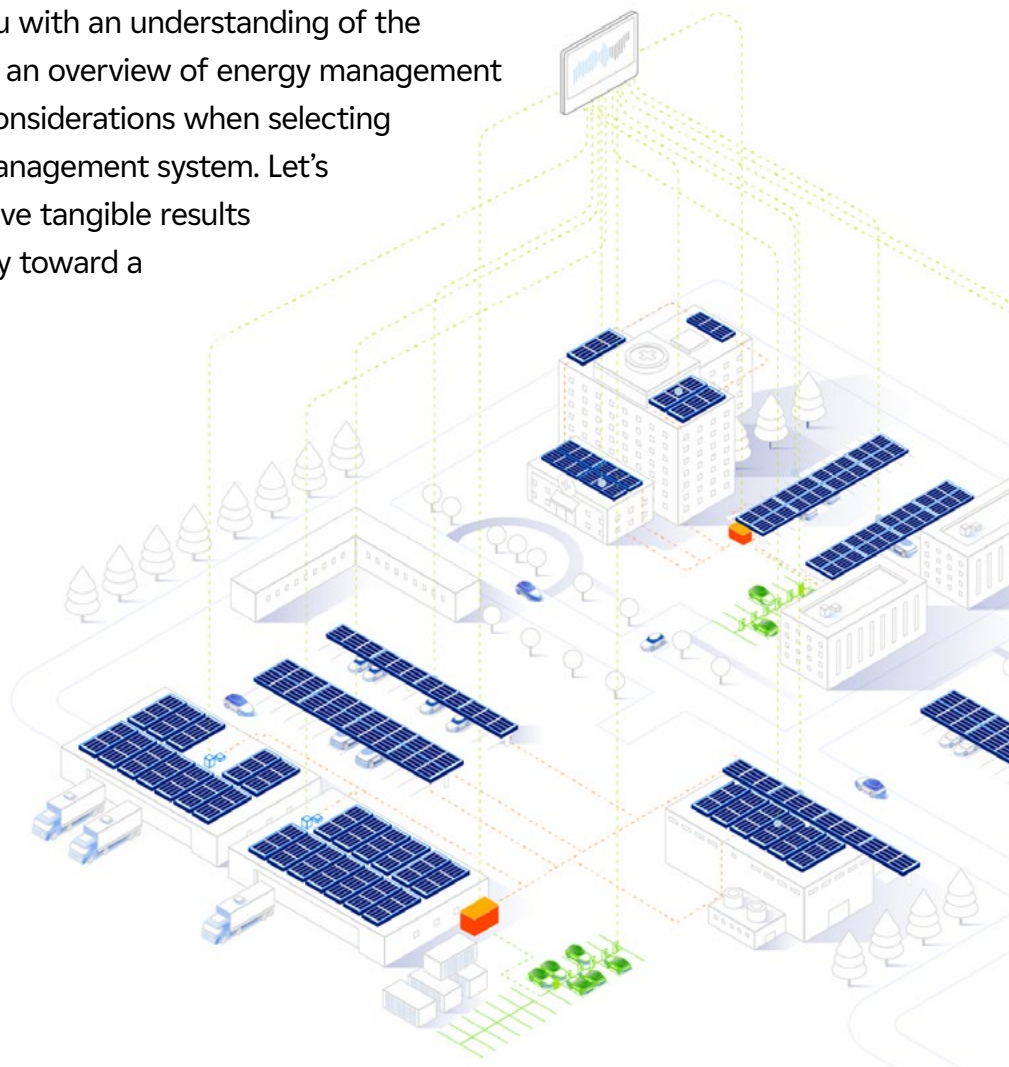


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The news is dominated by headlines about rising energy costs, increasing environmental concerns, and an overburdened power grid. **Effective energy management has become a strategic priority for organizations across all industries**, many of whom have risen to the challenge and are actively transforming their operations to meet ambitious sustainability targets.

Whether you're an operations leader, facility manager, or sustainability professional, this guide will provide you with an understanding of the fundamentals of energy management, an overview of energy management technologies on the market, and key considerations when selecting and implementing your first energy management system. Let's embark on this journey together to drive tangible results for your organization and pave the way toward a more sustainable future.



# 01 What Is Energy Management?

The goal of energy management is to optimize the use of energy resources within an organization to achieve various outcomes, including:

**Cost Reduction:** Minimize energy consumption and associated costs through efficiency improvements, optimization of energy use patterns, and energy procurement strategies.

**Environmental Sustainability:** Reduce the environmental impact of energy usage by embracing renewable energy sources, minimizing greenhouse gas emissions, and adopting sustainable practices.

**Energy Efficiency:** Enhance the efficiency of energy systems and equipment, leading to optimized energy allocation and improved operational performance and productivity.

**Operational Reliability:** Improve the reliability of critical operations by implementing measures to mitigate disruptions, address vulnerabilities, and manage the life of energy assets.

**Compliance & Risk Mitigation:** Ensure compliance with relevant regulations, standards, and industry best practices to reduce risks related to energy usage and environmental impact.

**Strategic Planning & Decision Making:** Utilize data-driven analysis and insights to support strategic planning, investment decisions, and resource allocation related to energy investments and operations.

For organizations, the overarching goal of energy management is to achieve a balance between economic, environmental, and operational considerations to optimize energy use, reduce costs, minimize environmental impact, and enhance overall organizational performance and sustainability. To achieve these goals, most organizations deploy an energy management system (EMS).

## 02 What Is an Energy Management System?

An energy management system is a comprehensive solution designed to monitor, control, and optimize energy consumption and usage within a facility, organization, or across multiple sites.

It integrates hardware, software, and analytical tools to provide real-time visibility into energy usage patterns, identify areas for improvement, and implement strategies to enhance energy efficiency and sustainability.

Core capabilities of an EMS typically include:

**Data Acquisition:** Aggregates data from various energy sources — such as electricity meters, sensors, and building management systems — to track energy consumption and generation in real-time.

**Monitoring:** Processes collected data in real-time and often visualizes it through dashboards, providing live updates on device status and surfacing issues through alerts and notifications so problems can be addressed immediately to minimize any downtime.

**Automation & Control:** Remotely controls devices for dynamic adjustments of energy usage or allocation based on demand, pricing, tariffs, or other factors. This often requires some level of automation because it is impossible to manually operate assets optimally.

**Demand Response & Load Management:** Enables organizations to participate in demand response programs and manage peak energy demand to reduce electricity costs and alleviate strain on the grid during peak periods.

**Energy Analytics & Reporting:** Analyzes energy data to identify inefficiencies, anomalies, and opportunities for improvement. Energy analyt-

ics tools may include energy benchmarking, load profiling, and predictive modeling to optimize energy usage and reduce costs.

**Compliance & Reporting:** Helps organizations comply with regulatory requirements and industry standards related to energy efficiency, greenhouse gas emissions, and sustainability. The EMS generates reports and documentation for regulatory reporting, certification programs, and sustainability initiatives.

**Distributed Energy Resource (DER) Integration:** Facilitates the integration of cleantech — such as solar generation, energy storage, and EV charging systems — into the energy management strategy. This includes monitoring energy generation, optimizing self-consumption, and managing grid exports.

An EMS empowers organizations to take a proactive approach to energy management, reduce energy costs, minimize environmental impact, and achieve their sustainability goals. By leveraging data-driven insights and advanced control capabilities, businesses can optimize their energy usage, improve operational efficiency, and enhance their competitive advantage in an increasingly energy-conscious world.

# 03 What Makes Intelligent Energy Management Different?

For an EMS to be considered intelligent, it must optimize asset operation and performance beyond what is achievable with automation. Automation and intelligence are related concepts, and the terms are sometimes used interchangeably in non-technical circles, but they have very different goals and traits.

## AUTOMATION

**Goal:** Efficiently and reliably execute pre-defined actions without the need for human intervention

**Traits:** Typically rule- or schedule-based and deterministic; requires “sensing” but not “thinking”

**Examples:** Smart home devices that turn on heating when temperature falls below 65° F; turn porch lights on at 6 p.m. and off at 6 a.m. every day

## INTELLIGENCE

**Goal:** Make decisions based on analyzing and interpreting data, context, patterns, and insights

**Traits:** Typically involves more complex processes that incorporate elements of learning, adaptation, and autonomy

**Examples:** Artificial intelligence (AI) systems that can recognize patterns in data and make predictions; machine learning (ML) algorithms that can improve performance over time by learning from historical data



For an EMS to be intelligent, its optimization engine must have the following characteristics:

- **Data Analysis & Pattern Recognition:** Processes large volumes of data to extract meaningful insights, recognize patterns, and derive actionable conclusions. This involves techniques such as data mining, statistical analysis, and pattern recognition to uncover hidden relationships and trends within the data.
- **Adaptability & Self-Learning:** Demonstrates adaptability by adjusting its behavior or performance based on changing circumstances, conditions, or feedback. It can independently learn from experience, refine its models, and improve its performance over time through continuous iteration and feedback.
- **Autonomy & Decision Making:** Possesses a degree of autonomy in decision-making, enabling it to make informed decisions or take actions based on its understanding of the situation and its objectives. This may involve automated decision-making based on predefined rules or algorithms.

These attributes make intelligent systems better suited for handling the dynamic and uncertain environments that exist in energy management. An intelligent EMS can process real-time data feeds from thousands of assets to make complex decisions, predict and forecast future trends based on historical performance, and continuously improve and adapt over time with feedback and new information.

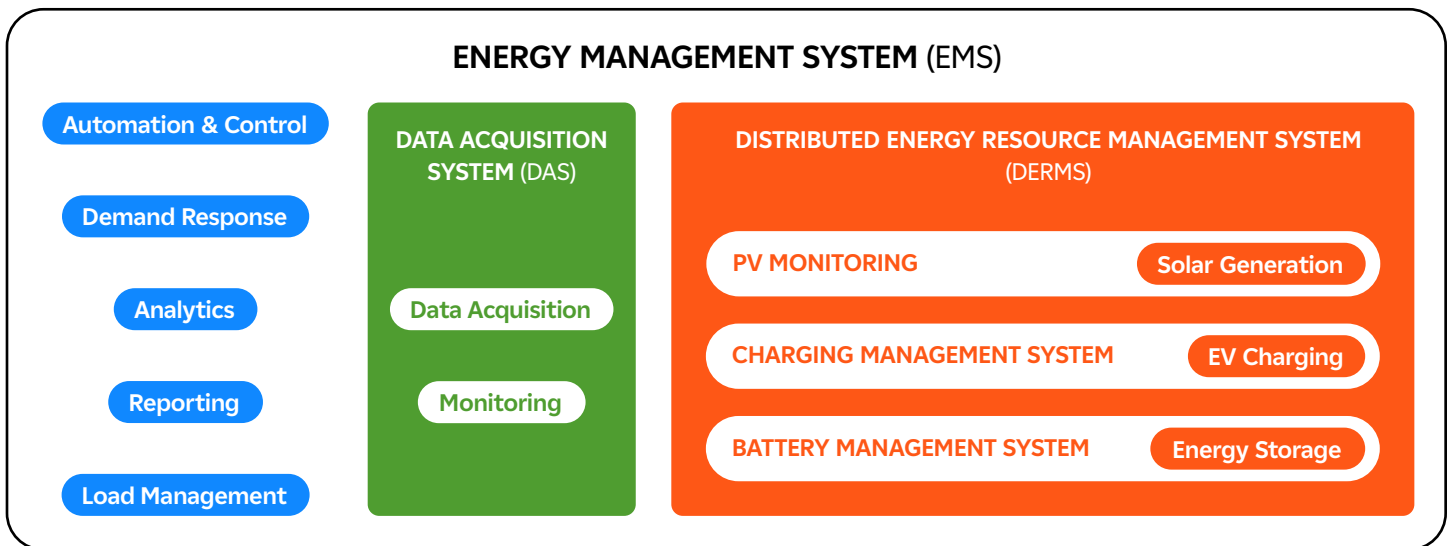
Given the absence of stringent industry definitions and regulations regarding the usage of terms such as “intelligent” or “smart,” it is imperative that buyers exercise caution when assessing solutions available on the market.

# 04 Considerations

## When Selecting an EMS

The EMS market is innovative and competitive, with numerous players and diverse offerings. Organizations have the option of choosing between single-platform solutions, which encompass all core capabilities described in the previous section, and point solutions, which focus on a narrow subset of emerging functionalities. This array of options ensures that businesses can identify and select the solution best suited to their unique requirements.

The diagram below shows how the core capabilities of an EMS are often sub-grouped and the commonly used names for these systems on the market.



Selecting the right EMS depends on many factors, including your organization's specific needs and goals, the complexity of assets or infrastructure limitations, and considerations related to cost, scalability, and interoperability.

It is important to evaluate an EMS according to the needs of your organization today, such as the number of sites or facilities and the number and types of energy assets. However, to ensure long-term success, it is critical to plan for future growth and stay ahead of evolving energy and regulatory requirements.

Here are some considerations that are essential to future-proofing and maximizing your return on assets:

## ■ Asset Co-optimization

Distributed energy resources such as solar, energy storage, and EV chargers were usually excluded from previous-generation energy management systems, and instead operated as siloed systems. As energy management practices mature, they are increasingly being integrated into unified systems so their operation can be co-optimized holistically.

This new approach usually achieves better overall outcomes on all fronts — economic, environmental, and operational. For example, customers can use solar energy for EV charging to offset electricity costs and improve sustainability. They can also maximize solar self-consumption by leveraging battery energy storage to bank solar energy and dispatch it later in the day to offset peak loads and reduce demand charges.

As your organization adds more energy asset types to its portfolio, having all assets on a single system increases the opportunities to value stack and unlocks more ways for cost savings, cost avoidance, and new revenue streams.

## ■ Scalability

Scalability is essential for ensuring your EMS can grow, adapt, and perform effectively in the face of evolving energy demands, regulatory changes, and business conditions. Consistent performance and responsiveness are critical, particularly in handling large volumes of data from real-time monitoring and control, as the number and types of energy assets increases. Cloud-based solutions typically excel at dynamically scaling resources up or down in response to fluctuating computational demands and workloads.

For sites that start with a single asset type and add other distributed energy assets later, the EMS can help coordinate how additional assets operate together over time. For instance, if the location with solar later adds energy storage and EV chargers, the EMS can assist in the co-optimization as the site expands.

## ■ Interoperability

Another important consideration is compatibility and integration with existing energy infrastructure, equipment, and systems such as metering devices,

sensors, building management systems, and fleet management systems. Choosing solutions built on open-industry standards ensures the ability to leverage a wider technology ecosystem and avoids vendor lock-in.

Occasionally, electricity tariffs, regulatory requirements, or program operations change. The EMS can dynamically update operational schedules remotely to keep the assets at optimal performance.

## ■ Data Security

Robust security features and protocols are required to protect sensitive energy data, prevent unauthorized access, and comply with relevant regulations, standards, and industry best practices. Non-compliance with regulations like General Data Protection Regulation (GDPR) or Payment Card Industry Data Security Standard (PCI DSS) can result in severe penalties, fines, legal liabilities, and reputational damage.

## ■ Deployment Options

EMS vendors provide a range of deployment options, including onsite, cloud-based, or hybrid solutions. Onsite or edge solutions excel in delivering low-latency processing and offer higher reliability since they can operate through periods of communication network interruptions, making them ideal for real-time responsiveness.

Conversely, cloud solutions offer virtually unlimited scalability and better data accessibility, enabling efficient remote administration of multiple sites and easy expansion of computing resources to accommodate high data volumes and complex processing. Some cloud-based intelligent optimization engines can leverage historical data from assets across all sites to improve the accuracy and reliability of their models. This rich and vast real-world dataset accelerates the training of learning algorithms that would otherwise take years to achieve.

Edge and cloud deployments represent complementary approaches to processing and storing data, each offering advantages and trade-offs. Depending on your specific requirements and use cases, a viable third option could be to adopt a hybrid strategy that leverages both edge and cloud computing to optimize performance, scalability, and resource utilization.

## ■ System Operation & Maintenance

Assess your in-house resources and capabilities for ongoing system operation and maintenance (O&M). The EMS should provide to facility or operations managers real-time visibility of connected assets, push notifications, and alerts with insights to improve performance. If you lack expertise or staff, consider choosing a vendor that provides these services or outsourcing O&M to a third party.

## ■ Technical Support & Services

Evaluate the level of customer support, training, documentation, and ongoing maintenance offered by the vendor to ensure successful implementation, ease of operation, and long-term partnership.

## ■ Vendor Reputation

Research the vendor's reputation, track record, and expertise in the energy management domain. Vendors with experience managing many assets generally produce better results. Request examples of customer projects that are of comparable size and in similar industries to yours so that you can evaluate whether the vendor is able to meet your specific needs.

# 05 Intelligent Energy Management: Next Steps

We hope this guide has equipped you with a basic knowledge of energy management and a preliminary framework for selecting an EMS.

The next step is to gather internal stakeholders and map out your organization's short- and long-term energy management goals, challenges, and priorities. This will help define clear requirements for initial conversations with potential vendors. A qualified vendor who has the knowledge and expertise to translate your vision into a strategic roadmap, and the practical experience to execute successfully, can be a valuable partner on your energy management journey.

**Contact us** for more information  
about intelligent energy  
management with PowerFlex.

**Get started today →**



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## About PowerFlex

PowerFlex is a clean technology solutions company making the transformation to carbon-free electrification and transportation possible. Our adaptive intelligent energy management platform, PowerFlex X™, monitors, controls, and co-optimizes clean energy assets like EV chargers, solar, energy storage, and microgrids — reducing overall energy costs through patented algorithms that maximize distributed energy resources.

PowerFlex is the third-largest installer of commercial rooftop solar and the fifth-largest network of Level 2 EV chargers in the United States. Our solar and storage projects offset 70,000 tons of CO2 each year, while our 10,000+ EV chargers were responsible for offsetting more than 19,000 tons of CO2 in 2023.

PowerFlex is backed by EDF Renewables and Manulife Investments.

Visit [powerflex.com](https://powerflex.com) for more information, and connect with us on LinkedIn, YouTube, and X.

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