



edgmethods

# Sustainability Twin

## Energy Management Reimagined

- ✓ Cost Reduction
- ✓ Regulatory Compliance
- ✓ Operational Efficiency
- ✓ Sustainability Commitment
- ✓ Risk Management

**EdgeMethods has developed a robust Industry 4.0 energy management solution, utilising advanced data technologies to enable companies to unlock energy insights at speed.**

Our solution features both Plant Digital Twins and Sustainability Digital Twins, which provide virtual representations of the physical manufacturing environment. By leveraging sophisticated mathematical calculations, we implement both virtual and physical metering solutions.

This dual approach enables precise monitoring across all areas of the manufacturing environment/process, including those previously without any metering infrastructure. The quality of energy metering allows us to fully populate the data within boundaries and enables our data scientists to supply outputs such as; energy cascade models, static/dynamic loss reports and continuous improvement opportunities.

**The focus of our solution is to significantly reduce energy consumption, boost operational efficiency and reduce GHG emissions.**

In the era of Industry 4.0, efficient energy management is critical for achieving sustainable industrial operations. Our Industry 4.0-aligned Energy Management System (EnMS) stands at the forefront of this transformation, integrating advanced digital twin technologies and virtual energy meters to provide unparalleled monitoring and optimisation of energy consumption by assets and production processes.

## 1 Digital Twin Technology

Our EnMS employs state-of-the-art digital twin technology to create accurate, digital replicas of physical assets and production processes. These digital twins enable detailed monitoring, and analysis of energy consumption patterns, allowing you to visualise and understand the energy dynamics of your entire industrial setup.

### Sustainability-Focused Digital Twin:

The sustainability-focused digital twin is specifically designed to optimise energy efficiency and reduce the carbon footprint of industrial operations. This digital twin integrates environmental impact data with energy consumption metrics, providing a comprehensive view of both operational efficiency and sustainability performance. It allows you to evaluate the impact of renewable energy integration, and assess the lifecycle carbon footprint of all assets and processes. By utilising this advanced tool, you can make informed decisions that align with both economic and environmental goals.

- **Real-Time Monitoring:** The digital twin continuously monitors energy consumption in real-time, identifying areas where energy is being wasted and suggesting adjustments to improve efficiency.
- **Predictive Analysis:** Through advanced data science capabilities, the digital twin can predict future energy usage based on current trends, enabling you to plan and implement proactive maintenance strategies to prevent energy losses and avoid downtime.
- **Optimisation Algorithms:** Integrated algorithms optimise energy use by identifying suboptimal operational parameters and processes, ensuring that energy is used efficiently across all assets.
- **Environmental Impact Assessment:** By incorporating data on emissions and resource use, the digital twin helps in assessing the environmental impact of various operations, guiding you towards more sustainable practices.

## 2 Virtual Energy Meters

Virtual energy meters are integral to our EnMS, providing precise and continuous measurement of energy consumption across various assets and processes. Unlike traditional meters, virtual energy meters offer flexibility and scalability, allowing for easy integration into your existing systems without the need for extensive hardware installations. These meters deliver real-time data on energy usage, enabling detailed tracking and analysis at a granular level, from individual machines to entire production lines.

## 3 Comprehensive Energy Monitoring:

Our system provides a holistic view of energy consumption across all facets of your industrial operations. By combining data from digital twins and virtual energy meters, the EnMS offers comprehensive monitoring capabilities that cover every aspect of energy use, from specific assets to complete production processes. This level of detail helps in identifying energy-intensive operations and highlights areas for potential savings.

## 4 Advanced Analytics and Reporting:

Leveraging big data analytics, our EnMS processes and analyses vast amounts of energy data to generate actionable insights. Advanced algorithms detect patterns and anomalies, facilitating predictive maintenance and energy optimisation. The system's intuitive dashboards and customisable reports provide clear, actionable information, empowering you to make informed decisions and drive energy efficiency initiatives.

## 5 Seamless Integration:

Designed for seamless integration with existing industrial systems, our EnMS supports various communication protocols and interfaces. This ensures that you can incorporate the system into your current infrastructure with minimal disruption, leveraging existing data sources and operational frameworks to enhance energy management.

## 6 Sustainability and Cost Savings:

By providing detailed insights into energy consumption and enabling targeted energy-saving strategies, our EnMS helps you achieve significant cost reductions and sustainability goals. The system supports compliance with regulatory standards and enhances corporate responsibility initiatives by promoting efficient energy use and reducing carbon footprints.

## Benefits

- 1 Enhanced Visibility:**  
Gain a comprehensive understanding of energy usage across assets and processes.
- 2 Optimised Performance:**  
Identify and address inefficiencies with precision, improving overall operational efficiency.
- 3 Cost Efficiency:**  
Achieve substantial cost savings through targeted energy optimisation strategies.
- 4 Sustainability:**  
Support environmental goals and regulatory compliance with improved energy management practices.



Our Industry 4.0-aligned Energy Management System harnesses the power of digital twin technologies and virtual energy meters to revolutionise the way you monitor and manage energy consumption. With real-time insights, advanced analytics, and comprehensive monitoring capabilities, our EnMS empowers you to drive efficiency, reduce costs, and achieve sustainability in your industrial operations. Embrace the future of energy management with our cutting-edge solution and transform your approach to industrial energy use.



# The Technical Part Our Energy Management Solution (EnMS)

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## Digital Twin Technology

The key to our EnMS is the 'sustainability twin'—a specialised form of digital twin technology tailored specifically for energy management. This digital twin serves as a dynamic model that replicates the physical manufacturing process, enabling

- **Dynamic Data Mapping:** All business data, from telemetry to metering, is continuously mapped and analysed, allowing for adaptive responses to operational changes.
- **Customised Machine Learning Models:** Our data scientists develop bespoke ML models that are finely tuned to the unique requirements of individual manufacturing environments, ensuring optimal energy management practices.

Businesses often have limited physical metering when it comes to energy consumption, due to the high capital cost and disruption associated with installation.

To combat this, EdgeMethods have developed virtual energy meters, utilising data analytics, algorithms & mathematical calculations to accurately deduce figures based on input variables (such as operating parameters, process data, or historical usage patterns). This allows for the creation of an EnMS with high data integrity, without the need for additional physical meters.

On the next page, we explain in more detail how we implement Virtual Meters.

## Virtual Energy Meters and Data Integrity

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## ISO 50001 Compliance

Our EnMS complies and adopts all the guiding principles outlined in ISO 50001. We supplement these standards, with the STRUCTese principles & operational insights to unlock transformational improvement opportunities aligned to energy efficiency.

**STRUCTese** takes the foundation of ISO 50001's framework and builds a more comprehensive approach. By implementing STRUCTese, our EnMS can deliver the following capabilities:

- **Comprehensive Measurement & Management:** Moving beyond traditional monitoring to provide direct measurement, tracking, and benchmarking of energy usage.
- **Energy Loss Cascade Models:** A detailed visualisation of energy flows and losses, allowing for targeted improvements and better resource allocation.
- **Real-time Energy Efficiency Monitoring:** Through continuous monitoring & optimisation in the embedded PDCA (Plan, Do, Check, Act) cycle, STRUCTese facilitates immediate adjustments.

## Integration of STRUCTese Principles

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## Structese Principles in Action:

Since the implementation of **STRUCTese** in over 150 plants, The Bayer Group has achieved remarkable milestones, including saving 1.5 million MWh of energy and cutting 428,000 metric tonnes of GHG emissions.



### Identifying Significant Energy Users (SEU) & Boundaries

**SEUs** are critical components or areas that consume substantial energy, and identifying them helps target efficiency improvements. **Boundaries** delineate the operational scope of the energy management system, either encompassing whole facilities or specific areas.

## Virtual Metering Explained

### Current Meter Mapping

This step assesses existing energy meters within the set boundaries, identifying what data is already captured and **pinpointing gaps** in data collection.

### Creating Virtual Meters to Fill Voids

Virtual meters use algorithms to estimate energy usage where physical meters are lacking, enabling comprehensive monitoring without costly installations.

### Creating a Complete Energy Consumption Model

A complete energy model is constructed using both physical and virtual meters, providing a holistic view of energy consumption within the facility.

### Energy Outputs

**Cascades:** Visual representations of energy distribution and consumption, identifying loss areas.  
**Dynamic & Static Losses:** Dynamic losses vary with production, while static losses are consistent inefficiencies.  
**Energy Types:** Tracks and analyses different types of energy.  
**Reporting Dashboards:** Visualise real-time and historical energy data, facilitating analysis and decision-making.

## Why EdgeMethods Stands Out

Our EnMS is not merely a technological product but a holistic energy management partnership. We provide:

### 1. Comprehensive Energy Mapping:

Using our energy cascade model methodology, EdgeMethods covers both dynamic and static energy losses, leaving no stone unturned when it comes to energy data.

### 2. Virtual Energy Meters:

Our virtual energy meters reduce the need for extensive physical meter installations, lowering initial capital expenditure while providing comprehensive energy insights across the entire production line.

### 3. Advanced Analytical Tools:

Our smart factory energy management solution turns complex data into actionable insights. Equipped with advanced analytics, our system allows for detailed collection, monitoring, and analysis of energy data to optimise energy consumption and identify inefficiencies.

### 4. Customisation and Scalability:

Every feature of our EnMS is tailored to fit the unique needs of your manufacturing environment, ensuring scalability and flexibility as your business grows.

### 5. Balanced Approach to KPIs:

We balance energy efficiency with other critical business KPIs like production output, quality, and operational costs, ensuring improvements don't compromise overall performance.

### 6. Continual Support and Improvement:

EdgeMethods is committed to continuous improvement, offering ongoing support and updates to ensure our system evolves with your business and the latest technological advancements.

## Let's Get Started!



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