



# The Complete Guide to Modern BMS Systems

Our buildings are becoming digital ecosystems. Where we previously flipped switches and adjusted valves manually, most processes today are handled by automated systems that monitor, regulate, and optimize the environment around us. At the center of this development is the BMS system, also known as a Building Management System (BMS).

**zaphire**



## From Technical Control to Data-Driven Value Creation

Buildings are no longer just physical structures, they are complex digital ecosystems. A modern BMS-system acts as the brain of this ecosystem. It collects, controls, and monitors everything from heating, ventilation, and cooling to lighting, water systems, access control, and energy meters.

Traditionally, building automation systems functioned as control panels for technical operations. Today, they are decision-making tools that enable:

- Energy efficiency and CO<sub>2</sub> reduction
- Predictive maintenance
- Improved indoor climate and working conditions
- Strategic property management based on real-time data

## About Zaphire

Zaphire is a Norwegian company based in Drammen. Since 2018, we have developed modern systems for building automation and energy monitoring, with a focus on usability, security, and reliability.

Zaphire is driven by the ambition to create a top-level system built on modern IT principles and open standards. Before developing Zaphire, we observed that traditional building and energy management systems were inefficient and complex. Existing solutions appeared outdated, difficult to use, and lacked the efficiency required to meet modern demands. In 2018, we set out to solve these challenges by developing a system for building and energy automation. The result was Zaphire.

Today, Zaphire is an established market player, with solutions used by municipalities and large property managers. With Zaphire, you get a complete solution for control, monitoring, and energy tracking of buildings, with high reliability, full mobile access, and lower lifecycle costs than traditional systems.



## What is a Building Management System?

A BMS system (central operating system) is a digital control system that collects, monitors and controls technical installations in the building. The term “BMS system” is used in professional buildings such as commercial buildings, schools, hospitals, etc. Such buildings have more complex needs than private homes, and therefore require control systems that go beyond the functionality of typical smart home solutions. The BMS system handles HVAC (Heating, Ventilation, Air Conditioning), lighting control, energy monitoring, alarm and fault handling, and real-time data from sensors (e.g. temperature, humidity, CO<sub>2</sub>, occupancy, etc.).

The purpose of the system is to automate and optimize the building’s technical processes, reduce energy consumption and ensure a comfortable and safe indoor climate in a deeper way than with an IoT-based system. The difference between an IoT-based system and a BMS system mainly lies in scope, integration and intelligence.

IoT solutions often function as separate units or smart sensors. They can measure and control individual functions such as lighting, heating or temperature in a single room, but lack overall coordination and holistic control. A BMS system gathers all these functions into one common system and allows them to interact across disciplines. Where IoT devices typically react locally, a BMS system can analyze, prioritize and override automation at system level. For example, it can switch off ventilation systems in the entire building outside opening hours, adjust heating based on both outdoor temperature and occupancy, or coordinate operation between multiple buildings in a portfolio.

With the right data foundation from third parties, the BMS system can also perform automated actions based on information from access control systems, electricity prices or forecasts for energy load. This enables more precise and dynamic operation, controlled by actual needs, not fixed settings.

# How does a BMS system work

A BMS system can be divided into three levels: 1. Supervisory system, 2. Automation og 3. Sensors.

**The supervisory system** is the top level, where all underlying systems can be managed through a common user interface, also called the top system. The top system ensures monitoring, central control and coordination of the building's technical installations, and gives operational personnel full control across automation levels. Through the top system, local automation can be overridden, for example switching systems on and off, adjusting setpoints or changing operating modes, all from one unified platform.

**The automation level** constitutes the middle level and acts as the link between sensors and the supervisory system. Here you find logical controllers, often called PLCs (Programmable Logic Controllers), which interpret data from the field level and execute control tasks. This level ensures that the building's systems operate according to predefined settings established during installation.

**Sensors** represent the lowest level in the system and consist of sensors, actuators and other devices that collect and send data from the building's systems, for example heating, ventilation, air conditioning and lighting. These devices are responsible for carrying out physical operations, such as adjusting temperature, controlling lighting or opening and closing valves.

## Why is a building automation system important?

A BMS system gathers and controls all technical functions, from heating, ventilation and cooling to lighting, water, access and energy measurement. Without a well-functioning BMS system, operations lose overview, efficiency and the ability to manage the building optimally.

- **1. Efficiency and economy** - A BMS system provides real-time data on energy use, temperature and operational status. This makes it possible to detect faults, leaks and inefficient operation early, before they develop into costly problems. Properly configured control can reduce energy consumption by 10–30%, while significantly extending the lifetime of technical components.
- **2. Comfort and health** - Comfort is not just about temperature. Air quality, humidity and CO<sub>2</sub> levels affect both well-being and productivity. A BMS system automatically balances ventilation and heating based on actual use of the building.
- **3. Sustainability and environment** - Sustainable buildings require documentation of energy use and environmental impact. A BMS system delivers the data that forms the basis for ESG reporting, energy labeling and compliance with the EU taxonomy.
- **4. Predictable maintenance** - When operating data is collected and analyzed, patterns can be seen that indicate upcoming failures. A fan unit that uses more power than normal, a sensor that gives unstable values, or a filter that clogs faster than expected.
- **5. Strategic decision support** - For owners and managers, the BMS system is a source of decision data.

# Parameters for building automation

To understand how a building actually performs, technical data must be translated into measurable key figures. These parameters provide a holistic picture of energy, comfort, operation and lifetime – and make it possible to compare buildings, prioritize measures and document effect.

By tracking key indicators such as kWh per square meter, indoor climate quality (IEQ score), alarm rate, response time, repair time (MTTR) and expected lifetime of units, you gain a clear understanding of how well the building automation actually functions.

## **kWh/m<sup>2</sup> and cost per building**

Shows how much energy the building uses relative to size and cost.

## **IEQ score (Indoor Environmental Quality)**

Measures indoor climate quality based on temperature, humidity, CO<sub>2</sub> and air quality. A high IEQ score means a healthy and comfortable indoor environment.

## **Alarm rate and response time**

Indicates how many technical alarms occur and how quickly they are handled. Low alarm rate and short response time show stable, well-controlled building operation.

## **MTTR (Mean Time To Repair)**

Average time from failure occurs until it is resolved. An important measure of operational efficiency.

## **Expected lifetime of equipment**

Estimates how long technical systems will deliver satisfactory performance before replacement.

# Concrete examples of use of a BMS system

## Styring av HVAC

HVAC is often the largest energy consumer in a building, and you will therefore quickly experience significant benefits by optimizing consumption in this area. In Zaphire, multiple elements, either individually or in combination, can determine the automation that is initiated. Examples of this include data from the Meteorological Institute, sensors, and historical data. Here are concrete examples of automation you can implement in Zaphire's BMS system:

- **Automatically adjust ventilation based on occupancy:** Sensors for presence or CO<sub>2</sub> levels send data to the BMS system. When the room is empty, the airflow is reduced, and the fans switch to low mode. This results in lower energy consumption, less wear and tear, and longer fan lifespan. However, we recommend that the fans are never completely turned off, as dust and other particles can accumulate in ducts when circulation stops.
- **Disable heating/cooling based on zone temperature:** When the indoor climate is stable and the outdoor temperature is favorable, the BMS system automatically turns off the heating coil and enables "free cooling".
- **Seasonal and calendar control:** The transition between winter/summer modes can be automated based on outdoor temperature and weather forecasts or calendar.



## Control of water, heating and energy carriers

Water systems and heat exchangers are critical for comfort and energy. By controlling and analyzing these systems through a BMS system, you ensure early detection of faults. Zaphire analyzes water and temperature data to detect issues such as poorly balanced radiators, closed valves, or insufficient cooling in heat exchangers.

- **Detect leaks** – By analyzing the amount of water entering the building against the water bill, you can quickly identify errors. Zaphire supports a range of water meter providers, giving you full control over water consumption.
- **Optimize temperature based on weather and temperature** - By dynamically adjusting the temperature according to weather conditions and forecasts, the building can maintain comfort with the lowest possible energy consumption. The system increases temperature in colder weather and automatically reduces it when conditions become milder, without users noticing the change.
- **Stop circulation pumps automatically** - By monitoring temperature differences and water flow in the system, the BMS can automatically stop circulation pumps when heating demand is low, for example at night or during weekends. The pumps are restarted when load increases or when temperature levels fall below defined thresholds.
- **Optimize snow melting** - The snow melting system is automatically adjusted based on weather conditions and temperature to ensure efficient operation with the lowest possible energy use. In Zaphire, heating is only activated when conditions require it, which can be based on weather forecasts from the Meteorological Institute and/or other similar sensors. This ensures safe access and operational reliability throughout the winter, while avoiding unnecessary energy consumption.

## Access, security and operational interaction

The BMS system can be integrated with the access control system and usage patterns in the building.

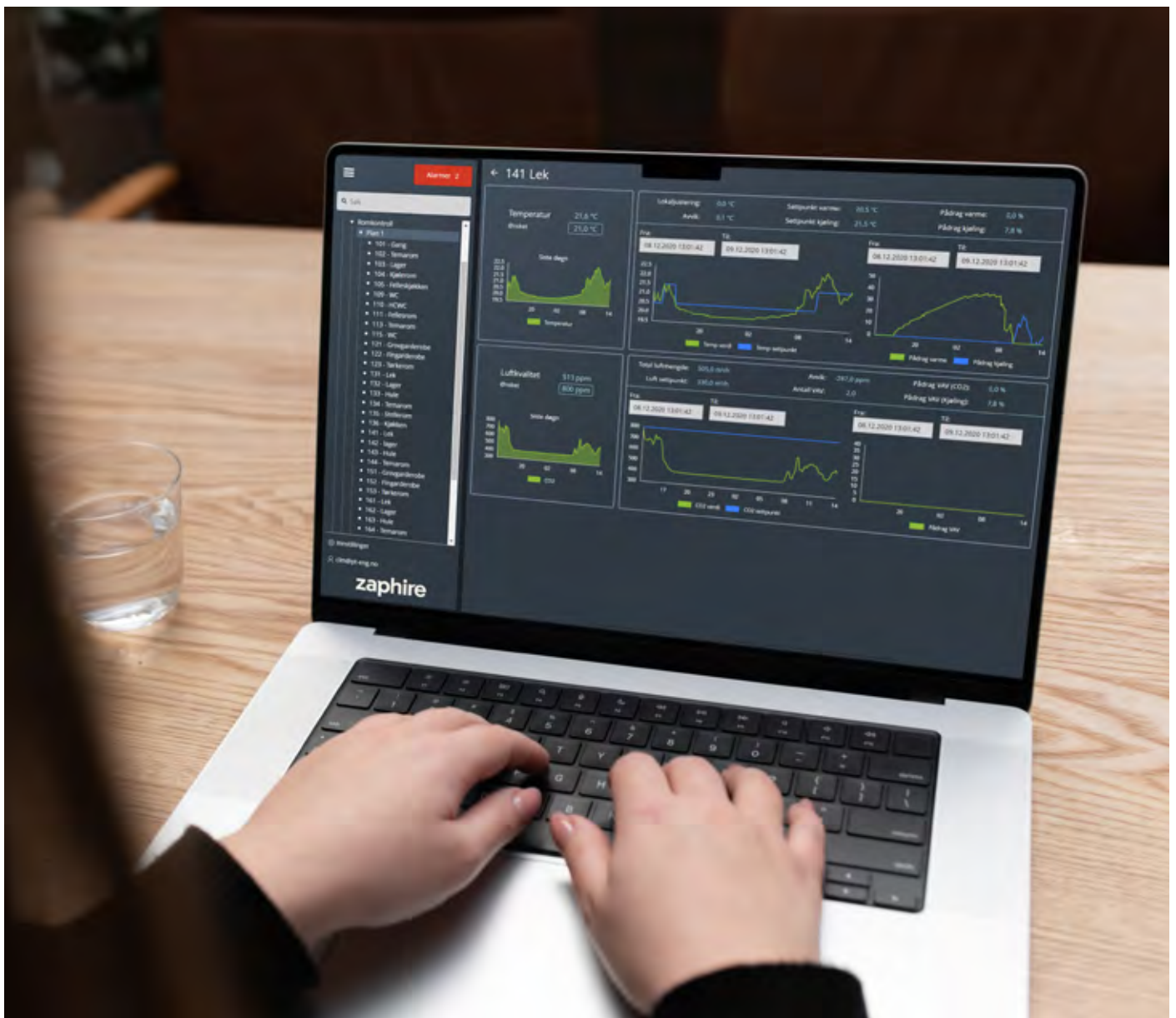
- **Automatic “sleep mode”:** When the last person logs out in the evening, the building enters a low-energy state that dims lighting, reduces ventilation and lowers heating.
- **Zone activation via meeting room booking:** When meeting rooms or floors are booked in the calendar, Zaphire’s API sends a signal to the BMS system, which increases heating and activates ventilation 30 minutes before use.
- **Zone activation via access control:** By integrating third parties that allow data to be sent to the BMS system via API, access control badges can be used to activate and deactivate heating and ventilation.

## Energy coordination and load management

By utilizing functionality from the BMS system, you can balance power consumption across multiple technical systems to reduce peak loads. This is called peak shaving and contributes to lower costs and reduced strain on the grid.

## Predictable operation and maintenance

By analyzing trends over time, the BMS system can predict faults before they occur. Deviations in temperature, pressure, or energy can be detected early, allowing maintenance to be planned before downtime occurs.



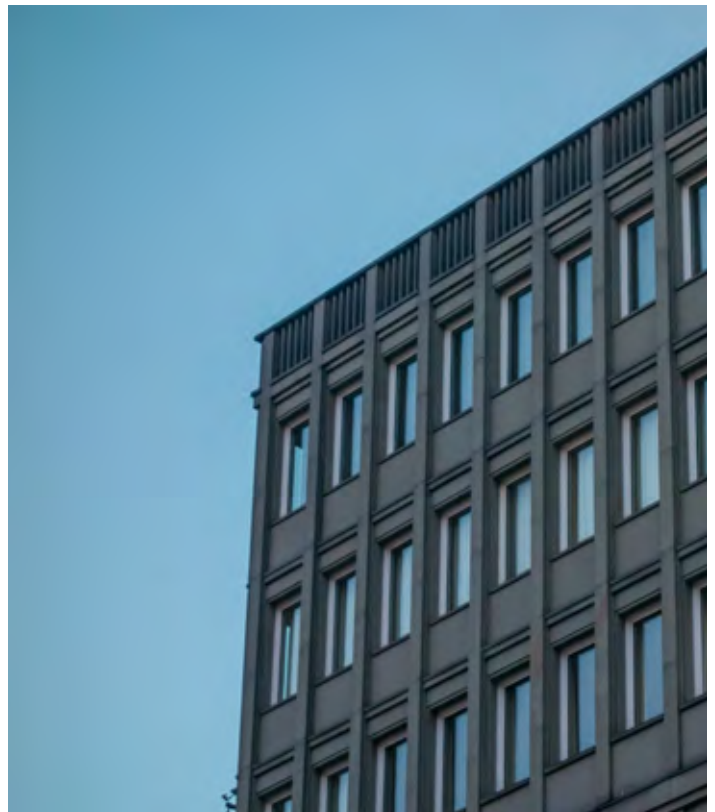


## Security in BMS systems and why it is critical

In modern buildings, the BMS system is not just a control system, it is part of the building's digital nervous system. Through the BMS, everything from ventilation and heating to access, lighting and energy is controlled. The system collects enormous amounts of real-time data and is connected to a wide range of vendors, sensors and cloud platforms. For this very reason, security in a BMS system is critical. A security breach here can give attackers access to both building systems and internal IT networks, with potentially significant financial and operational consequences.

Zaphire views security as an integrated part of the BMS architecture, not as an add-on. Traditionally, many operational systems have used VPN connections to provide vendors with remote access to the BMS. The problem is that VPN access often provides overly broad network access and is based on an outdated trust model. When one device is compromised, the attacker can move freely within the network and gain access to systems that should have been isolated. This has proven to be one of the most common causes of cyberattacks in the building sector. We see more and more vendors using this approach, but few end customers recognize the risk.

Therefore, Zaphire has chosen a different approach. Instead of VPN, we use a zero-trust model, where no devices or users are granted access without continuous authentication and authorization. Each connection is evaluated in real time, and access is limited to exactly the system, zone or data points required for the task. All communication takes place via secure application protocols such as HTTPS and WebSockets, with end-to-end encryption. This eliminates the need for open firewall ports and permanent tunnels, significantly reducing the risk of intrusion.



A key advantage of Zaphire’s solution is traceability. Every user, device and session is logged in detail. This provides full visibility into who has had access, what changes have been made, and when they occurred. This type of audit trail is essential for both security and compliance, especially in buildings with requirements for documented operations, environmental certifications or regulatory oversight. When access is also time-limited and context-based, the risk of old connections or vendor accounts remaining open is reduced.

For operations and management, this results in a significantly safer day-to-day environment. Vendor engineers still have fast and flexible access to the systems they need, but only to what is relevant for the task, and only for as long as necessary. If an account or device were to be compromised, the consequences are isolated. The attacker is not able to move laterally to other systems or spread damage across the rest of the infrastructure. In addition, IT and operations teams gain better visibility, as all connections occur through controlled and visible channels, not hidden VPN tunnels.

Zaphire follows the principle of Security by Design—where security is not something added on top of the solution, but built into the architecture from the very beginning. This includes multi-layer protection, encryption both in transit and at rest, multi-factor authentication (MFA), and continuous monitoring of system connections. We also recommend regular security audits and upgrades in line with international standards such as NIST SP 800-207 (Zero Trust Architecture), ISO 27001, and IEC 62443 for industrial control systems.

In practice, this means that Zaphire creates a BMS environment that is both flexible and secure—where the building’s technical operations can be safely managed from anywhere, without compromising the security of systems, data or people.



# Implementation model and scalability

Traditional BMS projects often have long rollout phases, complex integrations and time-consuming commissioning. Zaphire has turned this on its head. The solution is built to be fast, secure and easy to deploy, without requiring major changes to existing infrastructure.

Thanks to our modular architecture and open protocols, Zaphire's solution can actually be connected to an existing BMS system in under 20 minutes. All that is required is for an electrician to establish a physical connection to the building's BMS system (for example via BACnet, Modbus or MQTT).

The electrician is responsible for the physical connection and signal access, while Zaphire handles data collection, security, analysis and visualization. Once the signals are available, Zaphire's cloud platform connects automatically, and data collection starts immediately. This eliminates the need for VPN, heavy IT configurations or complex integration projects.

## Scalability

Once one building is connected, the solution can easily be scaled to multiple locations. Zaphire uses the same secure connection method, allowing new buildings to be activated with minimal footprint and without the need for new installations.

This makes the system ideal for portfolios that require rapid rollout, standardized data access and consistent reporting.



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**Interested in learning more?  
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