Intelligent Energy Management for Multi-Unit Operations:
CASE STUDY: How One Nationwide Retail Chain Achieved Significant Energy and HVAC Repair Savings with BAYweb Cloud EMS

Effective energy management is a common challenge for large, national retailers who operate hundreds or thousands of locations across diverse regions and climate zones. This case study describes how one national retailer took control of their energy management with BAYweb and the savings and benefits they realized as a result.
Case Study Overview

Effective energy management is difficult for any business, but it is especially challenging for large retailers operating many individual stores across the country.

One large retailer chose to address this challenge head-on by partnering with BAYweb to deploy our intelligent energy management solution across more than 3,300 locations in North America.


Finding a single, cost-effective energy management solution was a difficult problem for the facilities management team of this large multi-unit retailer, who was seeking a system that could be implemented nationwide across their network of more than 3,300 retail stores.

Before contacting BAYweb, the facilities manager and his team evaluated several energy management offerings on a pilot test basis, but found that none had the features or the flexibility needed to address the company’s need to monitor HVAC performance and control each location’s energy use to achieve the significant energy savings required by the company.

EFFECTIVE ENERGY SAVINGS: Challenges and Solutions

This retailer was facing significant challenges in meeting its goal to achieve meaningful energy savings across it network of over 3,300 retail stores. BAYweb was able to address these challenges with our Cloud EMS platform and Professional model thermostats as described below:

<table>
<thead>
<tr>
<th>Challenge</th>
<th>BAYweb Solution</th>
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<tr>
<td>3,300 plus location spread over a diverse set of climate zones</td>
<td>Temperature set point profiles were established for each store location based on climate zone and space use considerations</td>
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<tr>
<td>Existing programmable thermostats were inaccurate, unconnected, and hard to use</td>
<td>Cloud EMS enabled facilities managers to easily control and monitor temperature settings for all 3,300 plus locations from any device with an internet browser</td>
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<tr>
<td>High HVAC maintenance and repair costs</td>
<td>Cloud EMS provides real-time performance measurement for every HVAC unit in every store location. Units that fall below pre-set performance benchmarks are preemptively repaired at substantially lower cost compared to letting units “run to failure”</td>
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<tr>
<td>Solutions that lacked features, capabilities, and scalability</td>
<td>BAYweb leverages a 30+ year history in power monitoring, networking and control systems to provide the tools for facility managers to gain control of energy and maintenance costs and successfully implement meaningful savings programs across an entire operation</td>
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Different Stores, Different Temperature Zones, High HVAC Maintenance Expenses a Problem for this Major Retailer

The retailer’s facilities management team was beset by numerous problems that prevented them from getting a comprehensive or accurate picture of energy use across all store locations:

- **Many locations, many temperature zones:** Widely dispersed store locations spread across a variety of weather and temperature zones meant that stores in each area had different energy monitoring and efficiency requirements. For example, reducing winter heating costs was a priority for stores in the Northeast and Midwest while optimizing savings on summer cooling and year-round HVAC maintenance costs was a priority for stores in the South and Southwest. Existing store thermostats could not be programmed to consistently accommodate these fluctuations or capture the data necessary to monitor and adjust HVAC equipment performance.

- **Current energy management solution inadequate and unworkable:** The retailer had previously implemented manually programmable thermostats in many store locations in an attempt to achieve higher energy savings and efficiency. In practice, however, store employees did not set these thermostats properly to reduce heating and cooling costs, and eventually employees in many stores neglected to set or monitor thermostats entirely. Additionally, when tested by the facilities team, many of these thermostats were found to be defective, giving inaccurate temperature readings.

- **High HVAC maintenance and repair costs:** HVAC maintenance and repair expenses were a significant and uncontrollable yearly expense for this retailer. Each year, up to 10% of the company’s HVAC units in its store network failed without warning, usually requiring a compressor replacement at a cost of $1,500-$2,000 per unit. For a national chain of 3,300 stores, a 10% failure rate meant that over 300 store HVAC units failed each year. Due to the unpredictability of these failures, the company had no choice but to allocate a sizable portion of their facilities budget to cover HVAC repairs.

- **Other systems lacked necessary features:** The facilities management team tested a number of energy management systems at pilot store locations. While some of these systems were cost-effective, they were not without significant problems: Their features were limited, they were not scalable, or they could not be managed from a central location.

Because of the variable temperature zones in its widely-dispersed store network, its significant, uncontrollable HVAC repair costs, and its inability to measure, analyze, or control each store’s energy use, this company had little effective control over its energy costs. Compounded by the prospect of rising future electricity and energy costs, the company’s facilities management team knew they needed to put a viable energy management solution in place as soon as possible.
Specifying Initial System Requirements

Faced with these challenges, the facilities team sought an energy management solution that would:

- Effectively control energy usage at each store from a central location, by controlling temperature set points and schedules for heating and cooling.
- Monitor HVAC equipment performance in real time, for every retail location, and retain this information in a centralized location to build a historical database of equipment performance and energy use for every store.
- Analyze both historical and ongoing data for every store to develop an optimized temperature setpoint profile to maximize energy savings for each store location.
- Control and significantly reduce its HVAC maintenance and repair expenses and gain greater energy efficiency from the HVAC systems in each store.

Initial System Evaluation and Pilot Test

After contacting BAYweb, the facilities management team worked with the BAYweb team to set up an initial test of the BAYweb Cloud EMS intelligent energy management system for evaluation in 83 pilot store locations across the Midwest, South, and Northeast. From the onset of their evaluation process, the facilities management team stressed the importance of establishing a viable pilot test under real-world conditions prior to a wider rollout to a larger number of stores in its network.

During the evaluation, the retailer’s facilities management team noted that the cloud-based BAYweb system did not require additional, costly network hardware, complex monitoring equipment, or the costly and complicated installation of a conventional energy management system.

**Implementation of HVAC health monitoring:** During the pilot testing period, the retailer also worked with BAYweb’s technical and engineering staff to implement and evaluate the HVAC "health monitoring" components of the BAYweb system. This part of the system consists of a network of temperature sensors installed in the supply ducts of every HVAC unit in every store. These sensors continuously monitor the supply temperature for each HVAC unit in operation and calculate a corresponding health grade accordingly, all of which can be viewed in real-time in BAYweb Cloud EMS or analyzed historically.

By continuously comparing each unit’s performance temperatures with those of all other units in the retailer’s store network, BAYweb monitoring can determine when a unit’s performance begins to degrade and requires preemptive maintenance.
Real-time monitoring of each HVAC unit in the network places an assigned condition rating or grade to each unit, based on output of sensors monitoring each unit’s performance.

HVAC units are graded A to F; “F” units are flagged for immediate pre-emptive repair to avoid letting each unit “run to failure,” thereby providing significant savings in annual repair costs.

Spotting these problems early prevents expensive HVAC equipment failure since a pre-emptive $150 service call can prevent a $2,000 compressor replacement a few months later if the unit runs completely out of coolant without warning and burns out. When multiplied over thousands of HVAC units, all of varying ages and conditions across the retailer’s store network, the yearly savings available from real-time HVAC monitoring and pre-emptive maintenance are substantial.

Pilot store tests resulted in significant savings in electricity and gas heating costs: The 83-store pilot test confirmed the basic functionality of the BAYweb system, and the initial results also verified the kilowatt-hour savings that could be achieved by more efficient measurement and control of a store’s temperature setpoints using BAYweb Cloud EMS.

On average, the 83 stores in the pilot test saved 10% on their electricity costs, and 37% on their natural gas costs, compared to other company-operated stores in these regions not operating BAYweb Cloud EMS.

Typical Store System Configuration Using BAYweb Cloud EMS

A typical configuration for a single store location consisted of one or more programmable thermostats (one for each temperature zone of the store’s HVAC system), one or more wall temperature sensors, and duct temperature sensors installed in each HVAC unit.
Each location’s thermostats, sensors, and control units were networked into BAYweb Cloud EMS, which provided the facilities management team with centralized dashboards to:

1. **Control and monitor each store’s temperature set points and schedule:**
   - Measure and monitor operating temperatures for each store location, to set thermostat temperatures and schedules remotely via BAYweb Cloud EMS.

2. **Monitor HVAC systems:** Measure and log equipment performance (“HVAC health”) based on the supply air temperature of each HVAC unit for each store location.

3. **Continuously log all temperature and HVAC run time data:** Record all temperature and sensor information to a centralized database in BAYweb Cloud EMS to build a historical database of each store’s historical energy utilization for further analysis.

Over a short period of time, as historical energy use profiles were developed for each store, the BAYweb system dashboard enabled the facilities staff to identify and optimize thermostat temperature settings for each store location and maximize energy efficiency based on each store’s indoor and outdoor temperature history, square footage, and floorspace utilization.
Pilot Store Validation and Rollout

After the initial pilot test, additional store units were incorporated into a subsequent staged rollout, requiring on-site installation of BAYweb programmable thermostats, HVAC sensors, and control modules. Over a period of 13 months, every store in the company’s retail network was integrated into the BAYweb system.

Outcome and Benefits from System Implementation

After several months of operation, the retailer’s facilities management team experienced a number of significant benefits from their implementation of the BAYweb intelligent energy management system:

- **Substantial energy savings**: The ability to carefully monitor each store’s energy use through BAYweb Cloud EMS and being able to develop thermostat temperature set points optimized for each store location, resulted in a significant reduction in kilowatt-hour use in each location, along with substantial per-store savings in natural gas heating costs across this retailer’s 3,300-plus store network;

The retailer gained a **16% savings** in energy costs for each store, resulting in an average per-store energy cost reduction of **$3,456 annually**.
• Significantly lower HVAC repair and maintenance costs: By continuously monitoring the performance of every HVAC unit in every store in its network, the company significantly reduced its annual HVAC maintenance expenses, saving approximately $1 million annually. Further, by capturing detail on all HVAC systems in the entire store network, BAYweb Cloud EMS enabled the retailer to treat its HVAC system as a "portfolio" of individual units, each with its own comprehensive record of operating performance.

This insight enabled the company to establish predictive models of average HVAC unit performance, which further enabled the company to be far more proactive in financial decisions regarding HVAC maintenance. For example, with operating performance data on all of the HVAC units across its network, the company was able to make more financially sound repair vs. replacement decisions based on each unit's five-year capitalized cost.

Additionally, real-time monitoring of HVAC units has given the company a much better foundation to verify the diagnosis of repair technicians assigned to maintain each of its units, as they now have the data to compare each unit's performance with the technician's on-site assessment, to confirm the service actually required for that unit.

KEYS TO SUCCESS: How to Implement an Effective Energy Savings Cost Reduction Program

After the successful rollout of the BAYweb Cloud EMS intelligent energy management system to its entire network of 3,300-plus stores, the retailer gained valuable insights that serve as useful guidance to other companies operating multiple retail locations who are seeking to reduce their energy and maintenance costs:

• Careful pilot testing: Key to the success of the final implementation was the early pilot test conducted at the beginning of the relationship between the retailer and BAYweb. A small number of stores were chosen for the pilot, each store representative of a larger subset of store configurations in its chain—by square footage, temperature zone location, site location (mall or detached), etc. Upon implementation, the retailer established accurate baseline energy use data for each store, compiled this data into BAYweb Cloud EMS, then used the BAYweb control system to fine tune temperature set points for each location. The energy use analysis capabilities of the BAYweb control system enabled the retailer to measure and compare actual energy savings against each store's prior baseline energy usage.

• Data-driven energy use decisions: As more stores were added to the pilot in a staged rollout, the facilities management team stressed the importance of "letting the data talk:" They used the data collected in BAYweb Cloud EMS to drive each decision on temperature set points, adjustment of energy use profiles based on seasonal changes, extreme temperature changes, and other factors affecting each store's energy utilization.
• **System flexibility:** The retailer’s facilities management team found that the flexibility of BAYweb Cloud EMS was an important feature in its large, geographically diverse network of store locations in vastly different climate zones. For example, thermostat set point control for heating was the most valuable feature for stores in colder locations in the Northeast and Midwest; for stores in the hotter South and Southwest, the retailer gained the most financial benefit from BAYweb HVAC monitoring of each location’s air conditioning units.

• **HVAC monitoring changes financial assumptions:** The ability to monitor every HVAC unit in its network to pre-emptively repair underperforming units at a fraction of the cost of letting each unit "run to failure" has given this retailer a whole new insight into its annual maintenance costs. The company no longer has to establish a large reserve for maintenance expenses in its annual budget. Instead, it can project a much lower maintenance cost estimate, now based on accurate HVAC runtime performance data collected in BAYweb Cloud EMS.

• **Installation is a significant component of the overall energy management system implementation:** According to the facilities management team, while overall costs for the BAYweb system were substantially lower than those of a conventional energy management system, installation costs were still a significant share of the company’s overall implementation cost. Here, the facilities team also stressed the value of working with an experienced energy management solution provider in selecting and managing the right installation partners for the project, to ensure cost-effective, on-time installation.

### A New Platform for Further Energy Savings Initiatives

Now that it has been successfully operating BAYweb Cloud EMS across its store network, the retailer has discovered a significant new benefit: With a system-wide capability to monitor real-time energy use for every one of its stores across its 3,300-plus store network, combined with a historical energy use database updated continuously in the BAYweb Cloud EMS, the facilities management team can now measure, evaluate, and make accurate projections on the performance of new additional energy use initiatives. Using BAYweb Cloud EMS, any new energy-saving initiative can be carefully tested and evaluated against solid, proven baseline energy use data before being rolled out to other stores in the retailer’s network.
About BAYweb

BAYweb is a division of Bay Controls, an energy solutions company that provides products and services to a broad range of industrial, commercial, and government customers.

Founded in 1983, Bay Controls has provided sophisticated energy-saving solutions to industrial customers in 70 countries. The company’s solutions deliver over 1.8 Terawatt-hours (1,800,000 megawatt-hours) of energy savings annually; nearly twice the combined output of all of the solar cells in the United States every year.

In 2009, BAYweb was launched to leverage the company’s industrial sector expertise and technology into the BAYweb line of products and the BAYweb cloud-based system. This brought light and multi-location commercial and institutional facilities a new ability to reduce their energy and operating costs.

BAYweb energy management products are in use at thousands of facilities throughout North America.