Superior Energy Performance® U.S. DEPARTMENT OF ENERGY

Case Study: Nissan Leverages Enterprise-wide Approach

Superior Energy Performance® Accelerator

Nissan Saves $9.4 Million by Implementing Enterprise-wide ISO 50001 and SEP

Nissan Motor Co., a Fortune 100 multinational automobile manufacturer, has certified all three of its U.S. plants to Superior Energy Performance® (SEP) under the Department of Energy's (DOE) Better Buildings initiative, saving close to 1,600 billion Btu of primary energy and $9.4 million in energy costs annually. Data from the two most recently certified sites show that about two-thirds of the energy savings were achieved with no capital investment, as SEP and the underlying ISO 50001 energy management system emphasize improvements through operational and behavioral changes.

Nissan's path to these savings began in 2012, when the company's Smyrna, Tennessee plant achieved SEP certification, which includes a certified ISO 50001 energy management system (EnMS). Nissan then employed the new, enterprise-wide approach to SEP certification at its plants in Decherd, TN, and Canton, MS. The Smyrna site was chosen to be the "Central Office" location of Nissan's enterprise-wide EnMS and achieved its SEP recertification in 2015.

Nissan's enterprise-wide approach to implementing the ISO 50001 EnMS and SEP saved Nissan about $19,000 per site compared to what it expects it would have spent had it adopted a site-by-site approach, and required as little as 0.4 annual full-time equivalent in internal labor. Nissan credits its success to streamlining implementation by using a "Central Office" and a "sampling" approach to the ISO 50001 audits. Additional benefits were achieved by leveraging EnMS procedures used at the Smyrna site and sharing common processes from the company's existing ISO 14001 Environmental Management System.

Headquartered in Tennessee, Nissan North America has three manufacturing and assembly facilities in the U.S., employing 12,000 people.

(Photo: Nissan Car Production Line, provided by Nissan)

Enterprise-wide Approach – Key Take Aways	
Energy and Cost Savings	Saved close to 1,600 billion Btu of energy and $9.4 million in energy costs annually by implementing ISO 50001 and SEP Enterprise-wide.
Implementation Cost Reduction	Reduced implementation costs by $19,000 per site and spent as little as 0.4 annual full time equivalent in labor to implement ISO 50001 and SEP at each site.
Analysis Tools	Using DOE's EnPI tool with submetered data provided insights for improving energy performance.

The enterprise-wide approach significantly reduced audit time and the staff resources required at our plants, so we were able to move a lot faster and cost-effectively on the ISO 50001 and SEP implementation. With the central office maintaining the EnMS, our plants can now concentrate on energy savings.

—Chris Goddard
Nissan Environmental and Energy Engineering Manager

What is ISO 50001?

ISO 50001:2011 – Energy Management Systems, is an international standard that provides a framework for the implementation of an energy management system (EnMS) for the purpose of continuously improving energy performance.

What is SEP?

DOE's Superior Energy Performance® (SEP) program drives systematic improvements in energy performance across the manufacturing and commercial buildings sectors in the U.S. Facilities certified to SEP have an ISO 50001-certified energy management system in place and demonstrate third-party verified improvement in energy performance.

What is SEP Enterprise-wide?

The SEP enterprise-wide approach enables multiple sites to share a common ISO 50001 EnMS managed by a "Central Office," though each site must still improve their energy performance and obtain third-party certification to SEP individually. This approach promotes consistency, leverages resources, and accelerates system adoption. A growing number of companies are taking up this approach to streamline EnMS implementation, make the process more cost effective, and further increase savings.

What is the SEP Enterprise-wide Accelerator?

DOE launched the Better Buildings SEP Enterprise-wide Accelerator (EWA) to test the hypothesis that ISO 50001 and SEP could be implemented at multiple sites and coordinated through a Central Office to reduce the overall implementation costs and labor per site—compared to the conventional, single-site approach. The Accelerator successfully showed that the enterprise-wide approach reduces the costs of SEP implementation.

Business Drivers for Adopting SEP Enterprise-Wide

External and internal drivers behind Nissan's pursuit of best practices in energy management include consumer expectations, brand strengthening, corporate environmental goals, and cost savings throughout the supply chain. Nissan's Green Program has reduced CO_2 emissions by 27% per vehicle across all manufacturing facilities in 2016 (against a 2005 baseline). In addition, the company reports its environmental and energy performance to external recognition programs, such as DOE's Better Plants Challenge and the Environmental Protection Agency's ENERGY STAR.

In 2006, the company formed a Nissan North America (NNA) Energy Team to achieve corporate energy reduction goals in the United States. This cross-functional team is led and supported at the executive level by Nissan's Sr. Vice President and Director/Plant Manager. The team has representatives from across all management levels and most departments, including finance, production, maintenance, legal counsel, facilities engineering, corporate communications, purchasing, environment, and contract services.

ISO 50001 and SEP drove deeper energy reductions at Nissan while the third-party verification built greater confidence in the resulting savings. By providing standard methods for auditing, project tracking, and measuring energy performance, the SEP Enterprise-wide approach (SEP Enterprise-wide) helps companies cost-effectively deploy an ISO 50001 EnMS and SEP across multiple sites in a compressed timeframe. Nissan's use of SEP Enterprise-wide was further supported by the success of SEP at its plant in Smyrna.

Results

Implementation costs, labor, and energy cost savings achieved by the three Nissan sites certified and recertified through SEP Enterprise-wide are summarized in Table 1.

Energy and Cost Savings

The three Nissan enterprise-wide SEP sites together saved a total of approximately 1,600 billion Btu in primary energy and $9.4M in energy costs annually.[1] Capital and operational project

[1] Based on 2015 U.S. industrial average rate for electricity (6.89 cents per kWh), natural gas ($3.91 per Mcf) and coal ($65.4 per short ton).

Table 1: Nissan SEP Enterprise-wide Sites Summary

Site Name	SEP Implementation Cost ($)[1]	SEP Implementation Labor (FTE-yr.)[2]	Operational Energy Savings in Total (%)	Annual Energy Cost Savings ($)[3]	Performance Improvement (%)[4]
Canton, MS	$42,000	0.4	68%	$3,777,000	20.9%
Decherd, TN	$56,000	0.3	66%	$802,000	8.0%
Smyrna, TN (Re-certification)[5]	N/A	N/A	N/A	$4,841,000	17.7%

[1] SEP implementation costs (rounded to the nearest thousand dollars) include non-requisite metering equipment investment for the Decherd site.
[2] SEP implementation labor includes both site and central office staff time. Site labor which would have been spent on energy management under business-as-usual operation during the implementation period was subtracted to represent the additional labor for implementing ISO 50001 and SEP.
[3] Annual energy cost savings (rounded to the nearest thousand dollars) are based on SEP certified energy performance improvement, which includes results from both capital and operational projects.
[4] SEP certified energy performance improvement was achieved in 3 years (including the reporting period) for all sites.
[5] The re-certified Smyrna site was not examined for implementation cost and labor or energy project details. The reported annual energy cost savings and energy performance improvement only consider the re-certification period under the Enterprise-wide approach.

data was collected for the two newly-certified sites for analysis. Results of analysis show that operational changes implemented at these two sites accounted for 67%, or $3.1M, of the energy

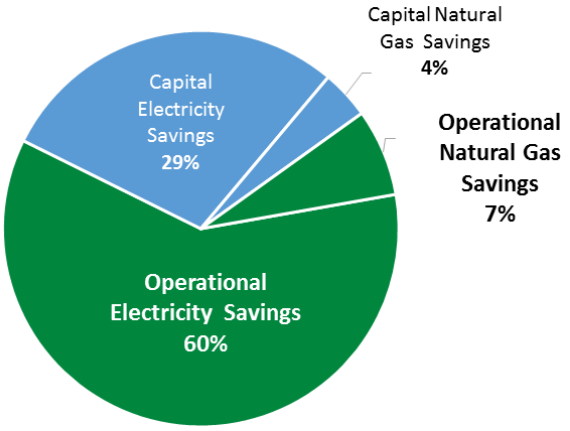

Figure 1: Nissan SEP Enterprise-wide Energy Savings Breakdown (Canton and Decherd)

cost savings. A breakdown of the total energy saved at these two sites is shown in Figure 1. Note that the SEP-certified energy savings are not entirely attributable to the implementation of ISO 50001 and SEP but also include results from the company's existing energy management.

However, ISO 50001 and SEP generally drive deeper energy savings as supported by existing publications.[2]

Implementation Cost

The implementation costs at the Canton and Decherd Nissan sites under the SEP Enterprise-wide approach was on average about $49,000 per site. Key components of these costs include metering equipment, third-party certification, and external consultants, as shown in Figure 2. The Decherd site made a $30,000 investment in metering equipment, which is not a requirement of the SEP program. This additional cost was partially offset by Decherd's lower cost for third-party verification (explained under "Cost Reduction").

The internal labor required to implement SEP Enterprise-wide was approximately 0.4 annual full-time equivalent staff member (FTE-yr), deployed over a period of 5-8 months for each facility. About 0.2 FTE-yr was attributed to the site staff and 0.2 FTE-yr to the Central Office staff. Labor estimates do not include staff time spent on implementing specific energy-saving action plans. Site labor, which would have been spent on energy

[2] Therkelsen, Peter, et al. "Development of an Enhanced Payback Function for the Superior Energy Performance® Program." *ACEEE Summer Study on Energy Efficiency in Industry, Buffalo, NY* (2015).

management under business-as-usual operations during the implementation period, was subtracted to represent the additional labor needed to implement ISO 50001 and SEP.

Cost Reduction

The costs to implement ISO 50001 and SEP under the enterprise-wide approach was on average $19,000 less per site than the single-site implementation approach, as reported by the sites

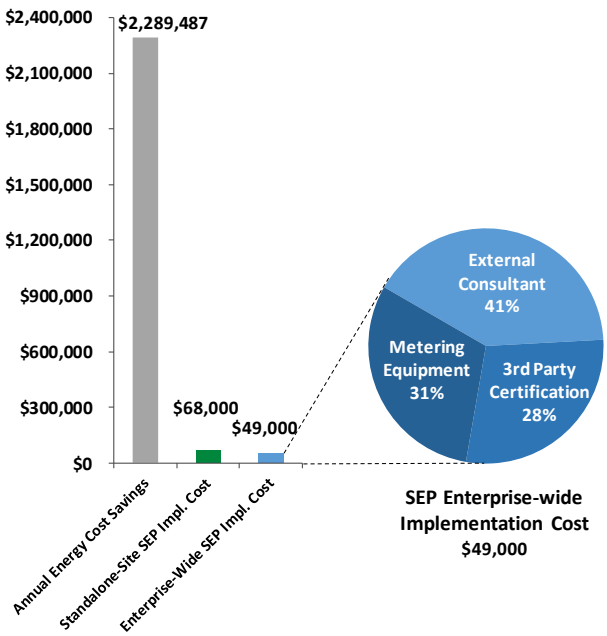

Figure 2: Nissan SEP Enterprise-wide Costs and Benefits (Canton and Decherd)

(see Figure 2). By leveraging the EnMS procedures (integrated with ISO 140001) developed at the Smyrna pilot, and building internal capacity and expertise, Nissan reduced the need for external consultants by about $9,000 per site. This includes $4,000 savings on EnMS trainings as compared to the Smyrna pilot through sharing the training costs between the Canton and Decherd sites. An additional $5,000 was saved through reduced documentation assistance. The company also reduced third-party certification costs through certifying multiple-sites and by using "sampling" for its ISO 50001 EnMS audits. This takes advantage of a provision that allows third-party auditors to verify ISO 50001 energy management systems at a subset of multiple sites (see ISO 50003 for details). As a result, the audit of the Decherd site was significantly shorter and simpler, and saved $20,000 because its EnMS did not require ISO 50001 verification. However, Decherd's energy performance did undergo verification for SEP certification.

Implementation Strategies

"Central Office" and Site Responsibilities

Nissan used its first ISO 50001 and SEP-certified site in Smyrna as the Central Office for its enterprise-wide EnMS. Nissan's Central Office consists of six staff members (Figure 3), including a Director/Plant Manager (the Management Representative), an Environmental and Energy Engineering Manager (who manages ISO

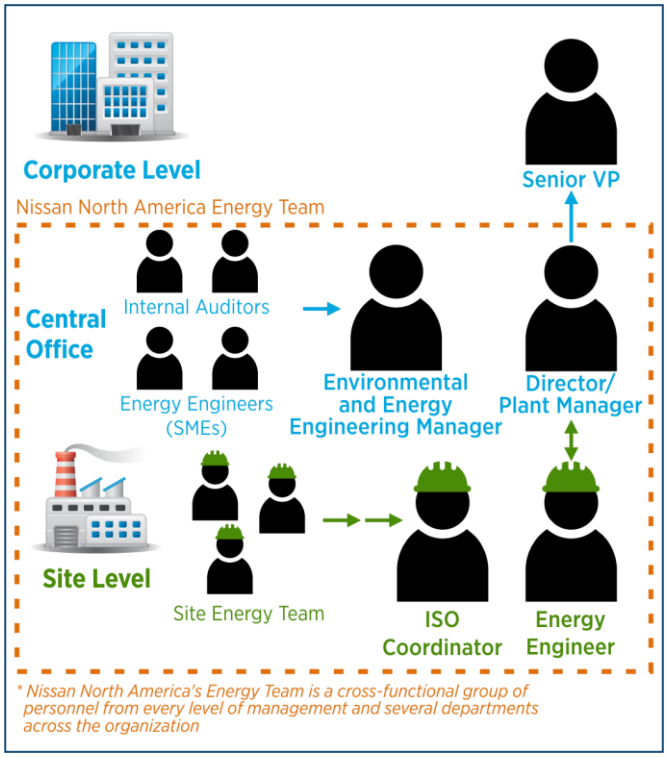

Figure 3: Nissan Enterprise-wide SEP Management Structure

50001/SEP Enterprise-wide implementation), two Senior Energy Engineers (EnMS/SEP Subject Matter Experts, or SMEs), and two internal auditors. The Central Office reports to Nissan's Sr. Vice President, who also leads the NNA Energy

Team. Their key activities during implementation included planning, training and internal audits.

At the site level, ISO 50001 and SEP Enterprise-wide implementation is led by the site Energy Engineer and the site ISO 14001 system coordinator (hereinafter "ISO Coordinator"). These two individuals performed the majority of the SEP implementation tasks with help from other site energy team members. The Central Office provided coaching and examples for performing certain tasks including site-level energy planning (energy data analysis, identifying Significant Energy Uses, setting objectives and targets, and creating action plans), using DOE's Energy Performance Indicator (EnPI) tool, and establishing a measurement plan. Internal audits were conducted jointly between the Central Office and the site energy teams and assisted by external consultants from the Georgia Institute of Technology (Georgia Tech).

EnMS Functions of Nissan Central Office

1. Planning, Audits
2. Develop EnMS Procedures
3. Technical Support, Guidance

EnMS Functions of Nissan Sites

1. Implement EnMS Procedures
2. Energy Review & Planning
3. Action Plans, Energy Perf.

The existing NNA Energy Team consists of the Central Office staff, the site energy teams, and additional stakeholders. They meet once a year to review the prior year's energy performance of the manufacturing sites and plans for improvement for the coming year. The meeting covers expectations for capital projects, changes in operations, possible baseline adjustments, introduction of new products, new on-site suppliers and other opportunities or barriers that affect achieving the energy reduction goals.

EnMS Procedures and Integration with Existing Management Systems

The EnMS procedures developed for the Smyrna site were slightly modified before adopting for the enterprise-wide EnMS. They cover how the company plans to meet the requirements of the ISO 50001 standard. The sites developed customized standard operating procedures (SOPs). The site Energy Engineer and ISO Coordinator led this effort and provided training to their site personnel to ensure the new SOPs are followed. The Central Office oversaw the effort to ensure the site SOPs are in compliance with the corporate EnMS procedures.

Another key strategy was integrating the enterprise-wide EnMS with the existing ISO 14001 environmental management systems (EMS). The Nissan staff leveraged existing processes and infrastructure (e.g. database systems) when developing the EnMS procedures. For example, the enterprise-wide EnMS shares common processes with ISO 14001 EMS in the areas of policy, legal requirements, competency and training, communication, management review, internal audits, and corrective/preventive actions. The integration of the two systems is included in the corporate EnMS procedures and site SOPs.

Competency and Trainings

Nissan understands that an effective EnMS relies on competent staff. To bolster competency, Nissan acquired a new Senior Energy Engineer at the Central Office with substantial experience in implementing ISO 50001 and SEP under the enterprise-wide approach. Nissan also brought in experts from Georgia Tech to provide EnMS training for the Central Office and site energy teams. This combined expertise enabled Nissan to move quickly with EnMS implementation and significantly reduced the required labor.

The competency and training extended to staff responsible for procurement and design. Nissan's engineers are made aware of the energy impacts of new process and equipment through an online learning course on energy life cycle calculations. Additionally, the NNA Energy Team members approve procurements over a predetermined spending threshold that impact energy use.

Insights from Metering and Analytical Tools

The Nissan sites have extensive sub-metering in place. The sites use software tools to analyze performance of submetered electricity, as well as hourly use of other utilities, such as natural gas, compressed air, chilled water, and hot water. This resulting level of granular, sub-metered data enabled the company to define energy performance metrics, identify opportunities, and quantify results from specific energy actions.

Nissan staff found the DOE's EnPI tool valuable. The Central Office trained the sites to use the tool to establish plant-wide energy profiles, and to analyze and track ongoing energy performance. Sites expanded use of the EnPI tool to also analyze and track energy performance at the shop and process levels to reveal additional energy performance improvement opportunities.

ISO 50001 and SEP complemented our longstanding energy management activities—including the Nissan Green Program and ENERGY STAR—and achieve even greater energy performance improvement. Having a structured and well-documented program that is not reliant on an individual has enabled us to sustain energy reductions over time.

—Brett Rasmussen
Sr. Energy Engineer, Nissan Canton, TN

Lessons Learned

NNA implemented enterprise-wide ISO 50001 and SEP as a key strategy in meeting its energy and environmental goals. Corporate leadership and strong collaboration at all levels led to the following lessons learned:

- Merging energy and environmental policies and procedures simplified implementation.
- DOE's EnPI tool was deemed invaluable and used extensively throughout the company.
- Third-party verification of energy performance improvements gave added credibility to energy and environmental claims, such as those contained in Nissan's Corporate Sustainability report.

Next Steps

By taking advantage of SEP Enterprise-wide, Nissan is on track to achieve continuous, verified improvements in energy performance. Key elements in place to ensure future energy savings include the following:

- An efficient, centralized EnMS that meets robust SEP/ISO 50001 standards.
- Clear procedures and tools for detailed energy monitoring.
- An aware and engaged staff to identify new opportunities for energy savings.

Nissan is now exploring potential expansion of SEP Enterprise-wide to sites in Mexico.

Nissan North America Energy Team

(Photo: provided by Nissan)