

3M Saves \$3.6 Million through Implementing SEP Enterprise-wide

The 3M Company, a multinational Fortune 100 manufacturer, achieved significant energy and cost savings by simultaneously certifying multiple sites to Superior Energy Performance® (SEP). In 2016, 3M used an enterprise-wide approach to certify six sites to SEP, a Better Buildings Initiative program which includes a certified ISO 50001 energy management system (EnMS). Their first SEP pilot site in Cordova, Illinois was among the six sites, and successfully re-certified. The six sites improved their energy performance by an average of 7.3% and collectively saved the company 636 billion Btu in primary energy and \$3.6 million (M) in energy costs. 69% of the energy cost savings at the five newly certified sites resulted from operational changes with little capital expenditure.

Following the enterprise-wide “Central Office” approach, existing 3M staff members with EnMS expertise took on much of the responsibility for setting up a shared EnMS across the sites. The Central Office staff were able to guide and streamline activities, thus lowering the level of effort at each site and helping keep all sites on schedule. As a result, the company was able to save \$23,600 and more than one full-time person equivalent on implementing ISO 50001 and SEP at each site. 3M plans to further expand certifications to ISO 50001 and SEP, adding 5-7 sites per year by 2020.

Through the enterprise-wide approach, 3M improved its competency to manage energy at the plant level and helped better engage corporate management in plant-level energy improvements.

—Steve Schultz
3M Corporate Energy Manager



Minnesota-based 3M Company combines science with 3M technology to create a steady stream of unique products for customers around the world.

(Photo: 3M Headquarters in MN, provided by 3M)

Enterprise wide Approach	Key Takeaways
Energy and Cost Savings	Saved 636 billion Btu, in energy consumption and \$3.6M in energy costs
Implementation Cost Reduction	Reduced \$23,600 in implementation costs and more than 1 FTE-yr in labor per site; condensed the implementation timeline by six months
Corporate Tools	Corporate “Review and Planning Tool” streamlined ISO 50001 and SEP implementation at sites

Business Drivers for Adopting SEP Enterprise-wide

For at least 40 years, 3M’s corporate energy department has tracked energy consumption and promoted a culture of energy awareness as part of its robust energy management program. In 2011, 3M joined the Department of Energy (DOE) Better Plants Challenge, pledging a 25% improvement in energy intensity across all of its U.S. sites over a 10-year period. 3M met this target in 2014 and followed up with an ambitious new goal to cut its energy intensity by another 30% by 2025.

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.

The company has also set a goal to keep its greenhouse gas (GHG) emissions at least 50% below its 2002 baseline through 2025—while continuing to grow its business. 3M identified the SEP enterprise-wide approach as a key strategy to meet both its energy intensity and GHG goals.

The SEP enterprise-wide approach (SEP Enterprise-wide) brings 3M's energy management

program to the next level by incorporating a consistent, data-driven system to identify large energy using systems and improvement opportunities, make changes, and measure the results. This methodology and effort to continually improve energy performance under the ISO 50001 standard, provides unique value for an energy-mature company like 3M, which has already harvested a large number of low/no-cost energy-saving opportunities.

Results

Implementation cost, labor, and energy cost savings achieved by the six individual 3M sites using the SEP enterprise-wide approach are shown in Table 1.

Energy and Cost Savings

Collectively, the six sites saved 38.3 million kWh of site electricity and 244 billion Btu of natural gas, which total to 636 billion Btu in primary energy and \$3.6M in energy costs¹. Operational changes accounted for 69%, or \$1.7M, of the energy cost savings at the five sites newly certified to SEP. A breakdown of the total energy savings is shown in Figure 1 (all components are reported in units of primary energy). Note that the SEP-certified energy savings is not entirely credited to the implementation of ISO 50001 and SEP but also includes the company's existing energy management program. However, ISO 50001 and

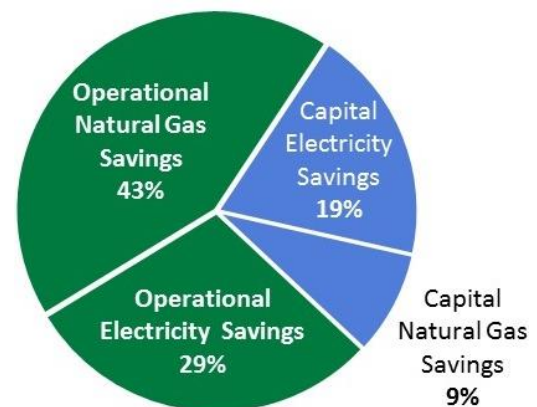


Figure 1: 3M SEP Enterprise-wide Energy Savings Breakdown (Site A through E)

¹ 2015 U.S. average industrial rate for electricity (6.89 cents per kWh) and natural gas (3.91 dollar per Mcf) are used.

Table 1: 3M 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	Perf. Improvement (%) ⁴
Manufacturing Site A	\$20,000	1.8	89%	\$473,000	11.0%
Manufacturing Site B	\$183,000	2.2	92%	\$250,000	6.9%
Manufacturing Site C	\$13,500	1.5	87%	\$580,000	5.2%
Manufacturing Site D	\$73,000	0.7	46%	\$941,000	10.0%
Manufacturing Site E	\$23,000	2.3	76%	\$154,000	5.2%
Manufacturing Site F ⁵	N/A	N/A	N/A	\$1,163,000	5.7%

¹ SEP implementation costs (rounded to the nearest thousand dollars) contained non-requisite metering equipment investment for site B and D.

² SEP implementation labor included both site and Central Office staff time. Site labor which would have been spent on energy management under business-as-usual during the implementation period was subtracted to represent the additional labor for implementing SEP.

³ Annual energy cost savings (rounded to the nearest thousand dollars) reflect SEP certified energy performance improvement, which included results from both capital and operational projects.

⁴ SEP certified energy performance improvement was achieved in 3 years (including reporting period) for all sites.

⁵ Site F is SEP re-certified and was not examined for implementation cost and labor or project details. The reported annual energy cost savings and energy performance improvement only considers the re-certification period under the Enterprise-wide approach.

SEP generally drive deeper energy savings as supported by existing publications.²

Implementation Cost

Implementing SEP Enterprise-wide at 3M cost an average of about \$63,000 per site. As shown in Figure 2, major cost components include metering equipment, third-party certification, and external consultants. Two of the five sites (B and D in Table 1) invested (\$162,000 and \$45,000, respectively) in metering equipment to facilitate ISO 50001 and SEP implementation. This helpful, but non-requisite equipment imposes a higher implementation cost.

The level of effort required by internal staff to implement the ISO 50001 EnMS and SEP was 1.7 annual full-time equivalent (FTE-yr) staff members, on average (including 1.4 FTE-yr for site staff and 0.3 FTE-yr for Central Office staff) over a period of 18 to 24 months. Staff time spent on implementing specific energy-saving action plans were excluded. Site D used less labor to implement ISO 50001 and SEP, as it already had a more mature existing energy management program in place. Site labor which would have

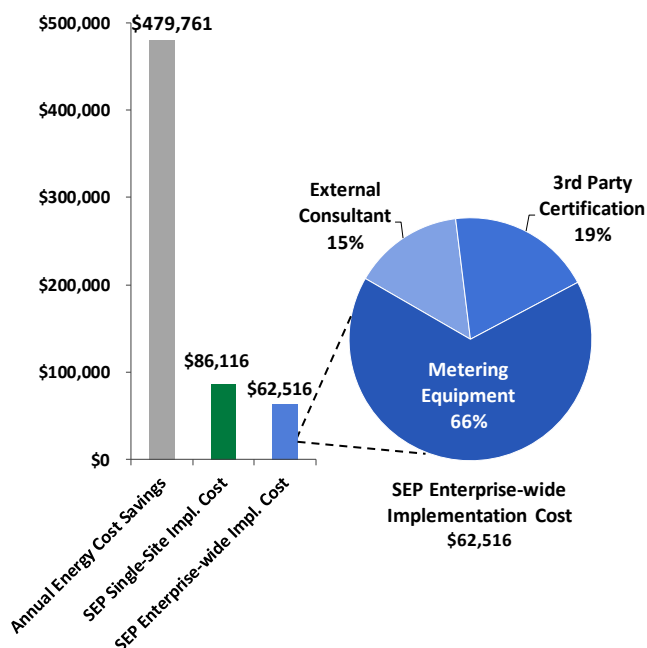


Figure 2: 3M SEP Enterprise-wide Costs and Benefits (Averaged Across Sites A through E)

been spent on energy management under business-as-usual conditions during the implementation period was subtracted to represent

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).

the additional labor for implementing ISO 50001 and SEP.

Cost Reduction

The cost to implement SEP Enterprise-wide was \$23,600 less per site than the cost to implement SEP at a single site (see Figure 2). These savings are attributable to reduced third-party certification (\$3,600) and external consultants (\$20,000) costs, as reported by the sites. Having five sites participating in the EnMS training sessions provided by an external consultant at a common location saved the company \$16,000 per site as compared to the costs for the Cordova pilot site training. Additionally, \$4,000 per site of other external consulting costs was avoided through adopting enterprise-wide approach. The sites also estimate that an average 1.3 FTE-yr in *additional* internal labor would be needed if SEP were implemented on a stand-alone basis. This represents a substantial labor cost savings. 3M attributes cost reductions to:

- Having the Central Office and multiple sites work together on the EnMS and SEP
- The overarching SEP Enterprise-wide structure, including 3M's Review and Planning (R&P) Tool and Corporate Energy Manual
- Shorter third-party audits due to universal templates and sampling for the ISO 50001 audit.

Mitigated Third-Party Certification Cost

SEP Enterprise-wide enabled 3M to lower the cost of third-party audits and certification. By sharing a common EnMS, as well as documentation and tools, two of the five sites significantly reduced their ISO 50001 audit time. The company also took advantage of a "sampling" provision, allowing third-party auditors to verify ISO 50001 at a subset of multiple sites, as defined in ISO 50003. Finally, economies of scale enabled 3M to negotiate a lower fee for its audits. In all, 3M saved \$18,000 on the initial ISO 50001/SEP certification audits, and the company projects future savings of \$56,000 on audit costs over the three-year cycle (including initial audit and two surveillance audits), compared to costs for stand-alone site audits.

Implementation Strategies

3M credits its success with the SEP enterprise-wide approach to some core strategic decisions:

- Assigning functions in a manner that promotes accountability for meeting energy goals;
- Developing and training staff on internal tools to facilitate implementation;
- Leveraging internal and external expertise to train additional staff on-the-job.

"Central Office" and Site Functions

To ensure that the sites would meet their energy performance goals, the company established a two-tier, corporate-level and site-level management structure for SEP Enterprise-wide reporting (see Figure 3).

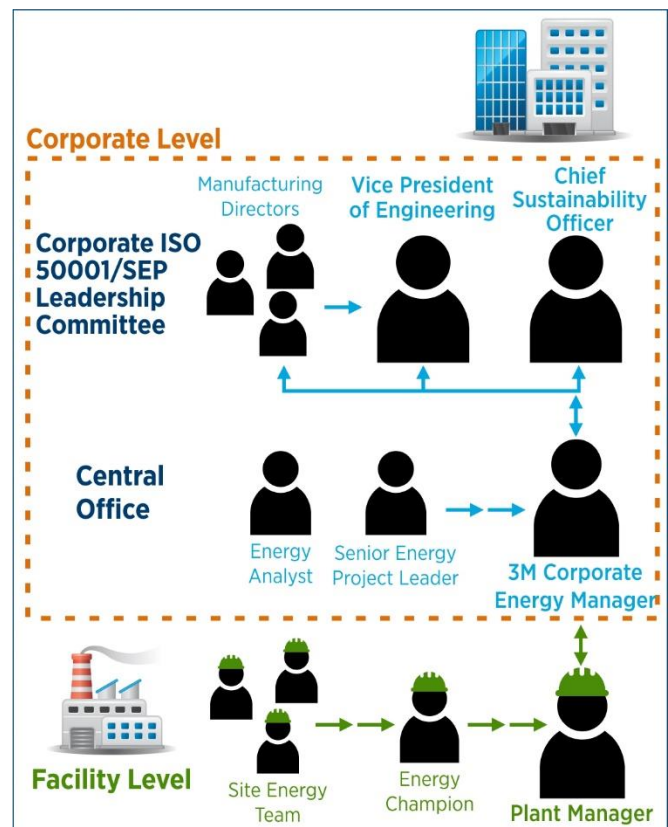


Figure 3: 3M Enterprise-wide SEP Management Structure

At the corporate level, top management is represented by the ISO 50001/SEP Leadership Committee, which includes the respective Manufacturing Director(s), VP of Engineering, and

Chief Sustainability Officer. 3M's EnMS Central Office, which includes the Corporate Energy Manager, a Senior Energy Project Leader, and an Energy Analyst, is in direct communication with each site. The site-level top management is represented by the Plant Manager, to whom the site Energy Champion reports. In this way, the ISO 50001/SEP Leadership Committee is made aware of any site not meeting its energy performance goal. This reporting structure, with representation from top management, holds sites accountable for meeting their energy targets.

SEP and ISO 50001 implementation and maintenance responsibilities are split between the Central Office and the sites as shown below:

EnMS Functions of 3M Central Office



1. Policy, Planning & Oversight
2. Owning Enterprise ISO 50001
3. Tools, Technical Support

EnMS Functions of 3M Sites



1. Complete Energy Review Tool
2. SOPs*, Training, Engagement
3. Action Plans, Perf. Review

*SOP: Standard Operating Procedures

Review and Planning (R&P) Tool

3M's Central Office provides each site with a proprietary R&P Tool, which has effectively helped streamline ISO 50001 and SEP implementation. This Microsoft Excel®-based tool contains tabs to access step-by-step guidance on energy planning and energy review-related requirements for ISO 50001 and SEP. The tool also stores site-level energy performance for use in site and corporate management reviews. Additionally, the Central Office hosted internal training and certification classes to ensure proper use of the tool. One person from each site must be certified to manage and use the R&P tool.

Corporate Implementation Toolkit

3M developed a suite of tools to facilitate the SEP enterprise-wide approach. These tools include multiple systems for tracking energy consumption and cost, energy projects, and corrective/preventive actions.

In addition to the R&P Tool, the Central Office developed a *Corporate Energy Manual*, which describes how 3M addresses the requirements of ISO 50001 and SEP and refers staff to corporate and site-level standard operating procedures (SOPs). These SOPs address different components of the ISO 50001 EnMS (e.g. internal audits) and sites are typically given flexibility to tailor SOPs to their own circumstances.

The sites also use a Central Office-developed template to organize all required inputs to and outputs from management review meetings, which are held twice a year at the site level and annually at the corporate level.

Leveraging Technical Assistance

The Central Office developed tools, trainings, and other technical assistance to effectively share its extensive ISO audit experience with the sites. The Central Office also organized DOE-sponsored ISO 50001 and SEP gap analyses and training sessions conducted by the Georgia Institute of Technology. 3M staff found it valuable to share and strategize with peers across sites during these sessions.

The Central Office also used internal audits to train site-level staff on ISO 50001 and SEP. The Georgia Tech consultants coached staff at one 3M facility as they performed internal audits at the site. Similarly, staff from 3M Canada—one of the company's earliest SEP-certified sites—conducted internal audits at the other four sites while simultaneously training select staff at those sites to become internal auditors.

Now that the framework is in place, we can implement ISO 50001/SEP at additional plants faster and with less cost.

—Steve Schultz
3M Corporate Energy Manager

Lessons Learned

As one of the first companies to use SEP Enterprise-wide, 3M explored the tasks required to implement an ISO 50001 EnMS across multiple sites and ways to appropriately engage top management at the corporate and site level. Once the R&P tool became available, the sites had detailed guidance on the implementation process.

The two-tier management review structure developed at 3M enabled each site to be accountable for its own energy performance improvement and helped engage corporate management in site-level energy performance improvement efforts. This engagement, in turn, strengthened management commitment at both levels.

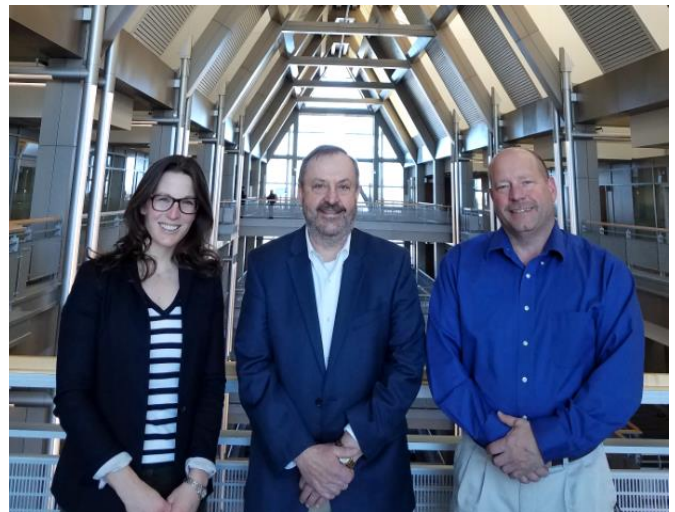
The simultaneous implementation of SEP at multiple sites and related in-person training sessions presented unique opportunities to brainstorm ideas, collaborate on issues, share best practices, and leverage resources across sites. Benchmarking across other sites yielded valuable insights, which were later formulated into implementation strategies.

Since embarking on our ISO 50001 journey in Decatur as part of 3M's enterprise-wide SEP, we have seen very significant reductions in our energy usage. In addition to the savings, the value this program brings is in the implementation of the measurement and management systems that are needed for sustainable year-on-year improvements. The enterprise-wide approach has enabled us to learn from the other participating locations of the company and to leverage best practices. Implementation does take management commitment of resources, but the payback in the end is well worth the effort.

—Robin Higgs
3M Decatur Site Manager

Next Steps

Recognizing greater improvement in energy performance at the SEP sites compared to its other sites, 3M plans to expand ISO 50001 and SEP implementation to more sites around the world. This broader implementation will support achievement of 3M's next energy efficiency goal—an additional 30% improvement by 2025. The company's recently crafted multiple-site EnMS continues to serve the certified sites and will provide a strong foundation for future sites.



3M ISO 50001 Energy Management System Central Office Team (Left to right: Chrissie Walsh, Steve Schultz, and Brian Guggisberg)

(Photo: provided by 3M)