ISO 50001 Energy Management System
Case Study

2021 Global - Americas

3M Company

Utilizing standardization to double the size of the ISO 50001 & SEP Enterprise

Energy as a 3M Competitive Advantage

Case Study Snapshot	
Industry	Manufacturing
Product/Service	Multiple
Location	22 in US, 5 in Canada, 1 in Mexico
Energy management system	Energy Management System (ISO 50001) and Superior Energy Performance (ANSI/MSE 50028-1)
Energy performance improvement period, in years	5 years (2016-2020)
Energy Performance Improvement (%) over improvement period	4.10%
Total energy cost savings over improvement period	$12,000,000 USD
Cost to implement EnMS	$3,620,000 USD
Total Energy Savings over improvement period	986,000 GJ
Total CO_2-e emission reduction over improvement period	845,000 Metric tons

Organization Profile & Business Case

Since 3M's founding in 1902, the company has expanded from a small-scale mining venture to an innovative global manufacturing powerhouse with over 90,000 employees operating in 70 countries. Today, more than 60,000 3M products are used in homes, businesses, schools, hospitals and other industries.

3M is both a global leader in environmental stewardship, driving energy and climate sustainability efforts through a holistic approach, ensuring every life is improved. From establishing the Corporate Energy Management Department in 1973, in addition to over 40 years of setting sustainability targets, energy has always played a big part in 3M's sustainable actions. The Energy Policy developed in 1991 incorporates energy conservation into our business practices, revised in 2020 to include design and procurement elements. As a result of this effort, operational costs continue to lower, the carbon footprint is reduced, the energy supply reliability has increased, and brand image has continued to be strengthened. Starting in 2019, 3M's sustainability goals extend to integrating a *Sustainability Value Commitment* into all new products so that customers can reduce their carbon footprint as well. In 2021, 3M announced their commitment to be carbon neutral by 2050 in further support of the Paris Climate Commitment.

ISO 50001/SEP for 3M – 3M's journey with ISO 50001 began as a pilot venture with the joint support of the US Department of Energy and Natural Resources Canada in 2011. 3M volunteered two facilities: 3M Cordova in

Illinois, US and 3M Brockville in Ontario, Canada. Growing from two sites in the pilot to now 45 sites globally that are ISO 50001 certified; 29 of which have taken the additional step to achieve SEP certification (certified by Canadian Welding Bureau/Korean Energy Agency and accredited by ANSI National Accreditation/ DQS GmbH).

In 2014, 3M developed the new company sustainability goals in accordance with the United Nations Development Goals. The 2025 Climate & Energy sustainability goals stipulate corporate energy efficiency, renewable energy, and carbon neutrality goals.

Business Benefits

With the 28 certified sites combined, 3M Americas' normalized energy performance has improved by 4.10% during the improvement period of 2016 to 2020.

After a decade of standard maintenance, the Enterprise team has had the expertise necessary to build a robust and standardized implementation plan. The team of four members consulted the existing sites to formulate a task list that encompassed all the standard requirements and its appropriate tool. This reduced the implementation timeline from 18 months for the first site down to only 3 months with only internal resources.

With the growth of adding 16 sites in 2020 alone, implementation costs were drastically reduced. From spending $63k USD on the first site, where half the cost went towards certification audits and remaining towards external staff and metering to only $3k per site.

Figure 1: 45 of 3M Global Sites are ISO 50001 certified amongst 3 Enterprise systems

Enterprise Advantage – 3M's focus is to develop a global enterprise model for 3M in the future. As of 2021, there are two ISO 50001/SEP enterprise models: 3M Americas (North, Central & South America) and 3M Germany (Figure 1). There are seventeen additional sites are to be certified by the end of 2021: 8 in US, 2 in Mexico, 4 in Brazil, 1 in Panama, and 2 in Singapore.

3M was able to expand the Enterprise quickly by leveraging our own trained internal auditors, having a dedicated central resource to assist with implementation at each site, and providing standardized tools, resources, and training material. The benefits of the enterprise-model are clear to us:

- Commitment from Senior-level Executive Management
- Centralized system for documents – Energy Policy, Energy Management System (EnMS) Procedures and Manual
- Sampled sites for conducting external audits
- Knowledge share amongst sites (reduced cost, time, and resources)
- Common energy efficiency guidelines for design and procurement, and operations

Other Benefits – The EnMS system also provides benefits that extend beyond monetary gain. As stated within 3M's Energy Policy, continuous energy performance improvement is encouraged by employees in their work and personal activities. ISO 50001 and SEP provides a structured platform to make this possible. Additionally, our customers value and commend our commitment to sustainability, improving customer satisfaction and brand image.

Plan

In early 2000, an EnMS for 3M was modelled by Georgia Institute of Technology and deployed across all 3M global sites. The model included a dedicated corporate energy team coordinating with local energy leaders at each facility. The central function provided awareness training, employee reward programs, and resources for energy-saving projects, instilling an energy-conscious culture at 3M. These existing structures became the

backbone for ISO 50001 and instituted a rigid EnMS. For the first few sites certified, third-party resources propelled the implementation process until 3M had some of the necessary tools and procedures built.

"To gain momentum towards our ISO 50001 certification, it was important to build on existing legacy systems and management processes that were already helping us consume energy efficiently."

—Andrew Hejnar, USAC Energy Manger, 3M

The Energy Review process is completed at each site and it identifies the significant energy uses at the site. Most 3M sites have electrical metering at the sub-station level as well for large natural gas consumers. Metering and monitoring systems allow sites to identify inefficient processes, and plant baseloads which then lead to recognizing operational control projects, optimization projects and equipment upgrades.

Once there are identified projects and opportunities for improvement in the energy hopper, 3M evaluates for financial and technical feasibility. Resources for implementation upon selection are allocated by local facilities. Local utilities and other incentive programs reduce the simple payback, making these projects more attractive. Should the energy-related project meet the cost-benefit requirements of the dedicated Centrally Coordinate Investment (CCI) Fund, 3M is able to provide additional support and resources to the site.

From the beginnings of energy management at 3M, three things have stayed true to help achieve the targets:

1. Metering and targeting allows energy to be visible and enables improvement activities.
2. Adopting energy-efficient technologies gives an inherent advantage in saving energy.
3. People are the catalysts to making progress in energy. Our employees who are aware of the energy use around them are motivated to act.

On average, the ISO 50001 certified sites outperform non-certified sites in energy efficiency improvements over the five-year improvement period. The realized savings and sustainability goal alignment from our ISO 50001 certified sites continue to fortify Top Management commitment for the EnMS across the organization. In 2020, 3M's VP in Enterprise Operations mandated that all sites contributing to 80% of global energy usage (Tier 1) to be certified to ISO 50001 by 2025.

Do, Check, Act

Building channels to share information and maintain consistent communication ensures that 3M achieves our corporate sustainability goals. Standardization of tools and resources sets 3M for success.

The Energy Teams – Forming a concrete structure to involve individuals from top management to operators allows 3M to easily coordinate ISO 50001 implementation. Figure 2 outlines the key cross-functional teams involved in the Enterprise. Site-level energy teams typically include an Energy Leader, Engineering/Maintenance Manager, LSS Black Belts, Environmental, Health & Safety Representatives, Operators, and Engineering/Maintenance Personnel

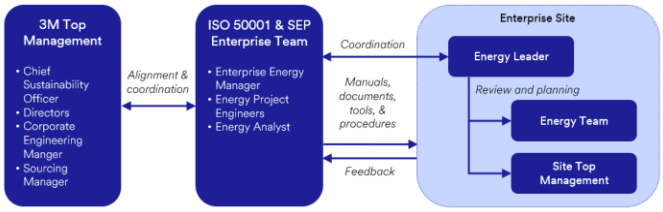

Figure 2: Hierarchical Representation of Energy Management Teams

3M reviews the Strategic Energy Management Plan annually to prioritize programs and meet global goals. Utilizing input from stakeholders, including executive management, manufacturing directors, plant managers, and operators. The goals include to continually improve results, leverage engineering expertise, drive site-level efficiency improvements, and continue top management support.

Energy Performance Derivation and Validation – 3M measures energy performance utilizing three key factors:

measured energy use normalized for weather, production, and/or occupancy; energy savings from energy projects implemented; and the effectiveness of the EnMS. These factors are included on the energy dashboard for each facility and are part of each site's management review.

The baseline year for energy modelling is 2015 with a timeframe of 1 year (the reporting period is from 2016 to 2020). Modelling software tools provide a top-down verification, while a bottom-up approach is used to tabulate savings through completion of energy actions. SEP Measurement and Verification Protocol and IPMVP international standard is used to verify energy performance. The effectiveness of the EnMS is measured by completing an EnMS scorecard at each site. The EnMS is evaluated during top management reviews, internal audits, quarterly corporate reporting, and monthly team meetings.

Projects and Actions – 3M recognizes that most of energy is used for process and space heating. Therefore, the focus for projects have been around boilers, steam systems and process equipment.

- Subscribing to steam trap monitoring services
- Li-ion batteries for material handling equipment
- Optimizing controls in manufacturing processes
- Upgrading end-of-life infrastructure to energy-efficient technologies (air compressors and HVAC)
- Installing co-generation system for heat and power
- Improving the building envelope efficiency
- DC to AC motor conversions and drive upgrades
- Lighting retrofit upgrades to metal halide and high-pressure sodium lights

Renewable Energy – Establishing sources for renewable energy including purchased power agreements and 3M owned on-site generation has been in focus for the last several years. 3M has surpassed the goal for 2020 of 25% by providing 35.4% of global electricity from renewable sources like solar and wind.

Operational Control – Documentation systems such as the Energy Corrective Action/Preventative Action (EnCAPA), the EnMS manual, SharePoint (common online platform), and Standard Operating Procedures (SOP), and associated checklists that guide our energy program with continuous improvement in mind. 3M strives to adopt engineering and administrative controls in addition to energy projects. Examples include ensuring preventative maintenance is compliant for significant energy uses and establishing 3M-wide standardized 12hr, 24hr, and 48hr shutdown checklists for trained personnel.

Communication – Sites utilize a plethora of avenues to motivate employees, increase awareness, and promote engagement. At each site, there is a variety of employee engagement activities along with an employee suggestion system integrated to the Lean Six Sigma Tier board process (Figure 3). Some activities include on-site energy bulletin boards, informational cards held within employee badges, layered process audits, poster campaigns, leak detection tags, energy treasure hunts, quarterly energy newsletters, annual Earth Day celebrations, energy fairs, and lunch-n-learn activities.

Figure 3: Sustainability/Energy Employee Suggestion Tier Tag

The Enterprise team provides energy and ISO 50001/SEP awareness training for new employees and site visitors, and refresher training is available for existing employees every two years. The Corporate Energy Team provides online webinars, quarterly newsletters, and energy dashboards to show progress towards our corporate energy goals and introduce emerging technologies to the site energy leaders. Top management provides support

through promoting different initiatives like presenting ISO 50001 certification during company-wide meetings.

Design and Procurement – Consideration for energy has been integrated in our design and procurement activities through the implementation of an internal mandatory energy manual released in January 2021. It prescribes best practices and guidelines for common workspaces, utilities and process systems found within 3M. A key element in the manual is the requirement for new equipment to have metering installed when energy consumption is expected to exceed thresholds (see Figure 4). The sourcing standard also stipulates that 3M is committed to increasing energy and resource efficiency in manufacturing and supply chain. It is also communicated to our suppliers – available for review on the 3M Supplier Direct website.

Utility	Threshold Criteria
Chilled Water	> 50 TONS
Compressed Air	> 75 SCFM
Natural Gas/ LP	400 MMBtu/hr
Electrical	35 kW
Steam	900 lbs/hr

Figure 4: Threshold requirements for energy metering

Tools & Resources – It was of benefit to leverage existing corporate tools and resources for ISO 50001 implementation. This includes the legacy of corporate leadership in sustainability, Management of Change (MOC) processes, ISO 9001 and ISO 14001 systems, and our corporate energy data and project databases. An Enterprise-wide SharePoint system was developed to house the EnMS tools & resources, providing easy access and document control. Each site utilizes the components of the system as needed to integrate with existing procedures and practices, while meeting the requirements of the standard.

The following tools and databases have been key in the development of the EnMS: Energy Review and Planning Tool (ERPT), RETScreen Expert energy modelling platform (Figure 5), Site Energy Data System, and Energy Cost Reduction Projects (ECRP).

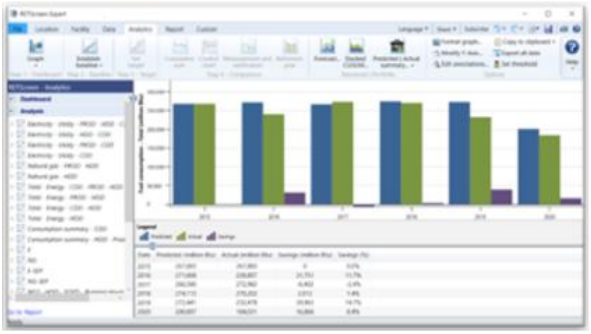

Figure 5: RETScreen Energy Modelling normalizes energy performance to variables that impact the process at a site

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Peer-to-Peer Group – As legacy sites adopted to the new IOS 50001 2018 standard and onboarding sites were lacking experience in managing the ISO 50001 EnMS, the Enterprise team decided to create a platform to connect the Enterprise site energy leaders. The Microsoft Teams room "ISO 50001/SEP Help Room" hosts a forum to discuss various topics and offers a peer-to-peer platform to exchange best practices. This also helps the Enterprise team recognize emerging gaps in the EnMS and address them through bi-weekly meetings. The Enterprise team also introduce topics of interest and new technologies to the group for early adoption.

Continual Improvement – 3M's has adopted many changes over the decade-long ISO 50001 journey to integrate the EnMS into the business practices. Some of the more recent challenges and measures include:

- **Limited priority for energy management –** monthly meetings with top management and infrastructure teams to increase energy considerations in business decisions
- **Substantial gains were difficult to maintain** – built an energy roadmap to bridge the gap between site efforts and future business planning

- **Limited by available capital** – created a dedicated corporate fund (CCI) for capital energy projects
- **Lack of metering systems and best practices** – developed an Energy Manual 81; requires metering for projects above utility consumption thresholds
- **EnMS Maturity** – provided energy training on common significant energy uses at 3M to help sites understand their systems and identify unique energy-saving opportunities
- **Approach to energy management varied by site** – invested in an Enterprise-model to allow document and tools standardization

Transparency

Our Energy Policy is proudly presented at the entrance of our buildings alongside Quality, Health and Safety, and Environmental policies. 3M's progress and success stories are published in annual sustainability reports and is represented though numerous awards and organizations:

- *RE100; CE100; Water Resilience Coalition* – corporate partner
- *Clean Energy Ministerial (CEM)* – Award of Excellence in Energy Management for Corporate (2019); National Award for Canada (2019)
- *Association of Energy Engineers (AEE)* – founding member of AEE (1977); presented at multiple conferences, reaching large audiences annually
- *Dow Jones Sustainability Index* – 3M included for 19 consecutive years
- *Carbon Disclosure Project* – ranking A- in climate change for 2016
- *DOE's Better Buildings, Better Plants* – Challenge Partner; Better Project Award Winner (3m Brookings, 2020); Low-Carbon Pilot participant
- *Pilot program for The Commission for Environmental Cooperation (CEC)* – in collaboration with Natural Resources Canada, Canada Brockville PSD, US Cottage Grove & Mexico SLP sites participated as part of Clean Energy Ministerial
- *Energy Efficiency National Partnership (EENP)* – Best Practices Award (3M Singapore Tuas, 2019)
- *International Energy Agency (IEA), Asia-Pacific Economic Cooperation (APEC) Energy Workshops, Singapore Manufacturing Federation (SMF) and Singapore National Environment Agency* – present EnMS success stories for 3M's key accounts

What We Would Have Done Differently

Things 3M would have done differently with the EnMS:

- Standardize processes and systems early on to make implementation easier and smoother
- Work towards implementing a dedicated energy/sustainability role at the high energy-intensity manufacturing sites
- Establish metering capabilities to better understand real-time site energy consumption
- Early implementation of ISO 50001 at Tier 1 sites to advance the corporate targets
- Collaborate with different internal groups such as corporate engineering, facilities, EHS etc.
- Development of an Energy Manual to include best practices and standardized company guidelines
- Explore different methods to secure funding for energy and sustainability projects

Strengthening the Enterprise system for ISO 50001 and SEP has built a strong foundation for the 3M sites to achieve their individual goals that ultimately supports the corporate energy targets. In sharing these best practices and lesson learned, 3M hopes to grow together towards a sustainable future.

The Energy Management Leadership Awards is an international competition that recognizes leading organizations for sharing high-quality, replicable descriptions of their ISO 50001 implementation and certification experiences. The Clean Energy Ministerial (CEM) began offering these Awards in 2016. For more information, please visit www.cleanenergyministerial.org/EMAwards.

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