

MedImmune Improves Energy Performance 8.5% to Achieve Quick Payback

By implementing a facility-wide energy management system (EnMS), MedImmune, the global biologics research and development arm of AstraZeneca, improved the energy performance of its Gaithersburg, Maryland, facility by 8.5% and reduced its annual energy bill by over \$400,000. To maximize system effectiveness and achieve continuous improvement, facility staff worked with the Advanced Manufacturing Office in the U.S. Department of Energy (DOE) to implement the EnMS under the Superior Energy Performance® (SEP™) program.

Business Benefits Achieved

Implementing the EnMS in compliance with SEP—a measurement and verification program built upon the ISO 50001 standard—yielded operational (low-cost and no-cost) improvements that save the facility 32 billion Btu (34,000 GJ) and (USD) \$247,000 annually. The facility invested \$139,000 (including internal staff time) to implement the EnMS, resulting in a seven-month payback on the marginal investment. This SEP payback is based solely on *operational* energy cost savings attributable to the EnMS. Energy performance improvements at the Gaithersburg facility were verified by a third party to establish MedImmune as an SEP Silver Certified Partner.

MedImmune's participation in the SEP program demonstrates that large biopharmaceutical facilities containing research and development (R&D)-based laboratory equipment and a relatively small production plant can achieve significant benefits by implementing an EnMS. Most other SEP-certified facilities have extensive manufacturing operations that consume the majority of their energy. The MedImmune



To better manage facility-wide energy consumption, MedImmune implemented an energy management system in conformance with ISO 50001 and became the first biopharmaceutical company to receive Superior Energy Performance certification. Photo: MedImmune

Project Summary

Industry	Pharmaceuticals Testing/Manufacturing
Facility location	Gaithersburg, Maryland, USA
SEP certification level	Silver
Energy management system standard	ISO 50001
Energy performance improvement	8.5% over 3 years
Operations-based energy cost savings	\$247,000/year
Cost to implement (including internal staff time)	\$139,000
Payback period	7 months

“SEP’s verification process brought credibility to the savings and helped secure funding for energy projects.”

– Wilbur Williams, Commissioning & Qualification Expert,
Americas Region of AstraZeneca
(Former Energy Manager, MedImmune R&D Center)

facility's energy resources are now proactively managed using a rigorous business system to sustain the energy savings and continuously strengthen the facility's energy performance.

Business Case for Energy Management

MedImmune implemented an EnMS to earn certification to SEP and ISO 50001 while simultaneously achieving a mix of environmental, corporate, and cost objectives.

Environmental Stewardship

A key reason MedImmune joined the SEP program was to reinforce the company as an industry leader in environmental stewardship. MedImmune succeeded in becoming the first manufacturer in the biopharmaceuticals industry to be certified to an energy management standard. In recognition of this achievement, DOE features MedImmune and other SEP-certified companies on the [SEP website](#) and in SEP newsletters, press releases, and other publications (such as this case study).

Corporate Goals

MedImmune implemented the EnMS to support a variety of corporate objectives. The Gaithersburg facility identified SEP as a cost-effective way to support the carbon reduction goals of its parent company, AstraZeneca, which shrank its operational greenhouse gas footprint

Keys to MedImmune's Success

- ▶ Obtained full buy-in by company leadership at the beginning of the SEP implementation process
- ▶ Engaged and trained all plant staff from the start - so they would know what to expect from the EnMS
- ▶ Apprised all staff of their integral role in making the EnMS a success; clearly outlining expectations
- ▶ Collected sub-metered data to better understand how much energy is consumed, how it is used, and where opportunities exist for improvement.



The energy team at the Gaithersburg facility (pictured above) work to continuously improve energy performance. Photo: MedImmune

by 20% between 2010 and 2015. AstraZeneca is listed on the Dow Jones World Sustainability Index and is committed to maintaining their leadership standing.

MedImmune joined the U.S. Department of Energy's Better Plants program back in 2010, pledging to reduce its manufacturing energy intensity by at least 25% by 2020. SEP certification helped verify and promote the facility's subsequent performance gains.

Reducing Energy Costs

Energy costs also motivated MedImmune to join the SEP program. Cutting annual operating costs by \$247,000 ultimately improves the facility's market competitiveness.

Facility Profile

MedImmune is the global biologics research and development arm of AstraZeneca, a global, innovation-driven biopharmaceutical business that focuses on the discovery, development and commercialization of small molecule and biologic prescription medicines. MedImmune is pioneering innovative research and exploring novel pathways across key therapeutic areas, including respiratory, inflammation and autoimmunity; cardiovascular and metabolic disease; oncology; neuroscience; and infection and vaccines. MedImmune's SEP boundary contains R&D laboratory space, commercial space, and small-scale manufacturing operations to produce vaccines for clinical trials. The

facility's most energy-intensive units are its steam and boiler systems, which provide space heating and manufacturing support functions, such as water filtration, pre-heater temperature control, domestic heating, and hot water heating. Analysis identified the boiler system as the facility's most significant energy use (SEU).

EnMS Development and Implementation Managing Energy Prior to SEP

Prior to 2010, the facility managed energy as part of broader efforts to control operating costs. Performance improvements were largely outsourced to engineering or design firms.

The facility became directly involved in managing energy when the company joined the DOE Better Plants program in 2010. MedImmune was then invited to participate in DOE's Northeast pilot demonstration of SEP in December of 2012, which provided the opportunity to implement an ISO 50001-conformant EnMS and verify savings. Using SEP, the MedImmune facility now proactively tracks and manages its energy use.

Obtaining Management Commitment

The MedImmune energy team presented the pros and cons of participating in the SEP program to company leadership. The leadership team readily understood the value of reducing facility energy costs and demonstrating environmental responsibility and leadership.

Planning for EnMS Development

Once the energy team received the green light from leadership, it began reaching out to employees across the facility. The team took a holistic approach, making all staff fully aware of the EnMS effort and the value of broad employee participation. The team worked to keep all staff up to date on the process and rationale for key decisions, such as identification of the SEU and improvement opportunities.

All facility staff received computer-based training on the EnMS. The energy team also worked closely with facility staff as they performed their jobs, obtaining insights on opportunities for

improvement and instilling a sense of accountability. The team further engaged the staff by organizing "energy savings scavenger hunts," which reinforced the staff's role in saving energy.

Implementing the EnMS

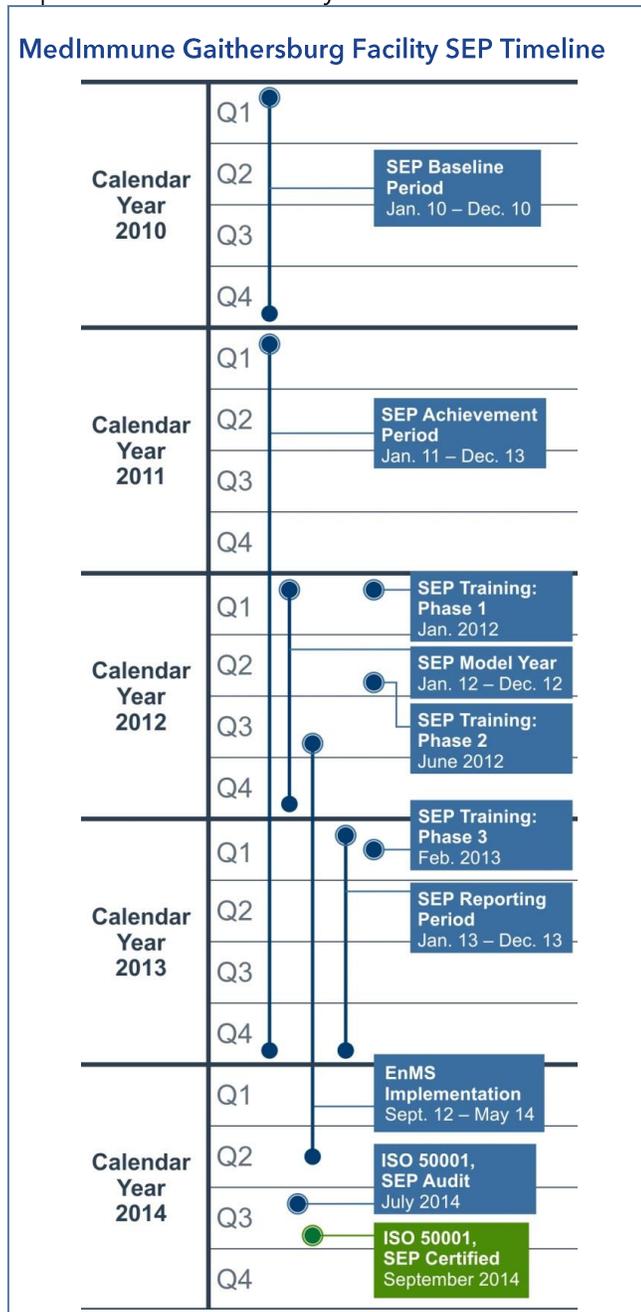
The energy team identified the SEU, collected detailed energy data, and evaluated that data to establish a baseline reflecting normal energy consumption. This baselining process provided the team with a better understanding of current facility practices—preparing them to analyze and improve the most energy-intensive processes in the facility. After completing the energy review and baseline, the maintenance team was engaged to assemble a new and expanded energy team—as defined by the ISO 50001 standard. The new team, with representation across diverse departments, then commenced collecting the data required for input to SEP's comprehensive [Energy Performance Indicator](#) (EnPI) tool. This tool ultimately helped verify the facility's 8.5% energy performance improvement (see EnPI tool section below).

"SEP helped us document and prioritize energy-saving opportunities, streamlining the process for launching new projects."

– Wilbur Williams, Commissioning & Qualification Expert,
Americas Region of AstraZeneca
(Former Energy Manager, MedImmune)

EnMS Rollout

Facility staff implemented the EnMS between September 2012 and May 2014.



Achieving ISO 50001 and SEP Certification Sub-Metering

Prior to SEP participation, the Gaithersburg facility monitored a subset of facility equipment and systems through its building automation system. Some of the instruments could not be

calibrated, so reported data units were inconsistent, impeding direct comparison of energy consumption across the facility. To meet the energy tracking requirements of SEP, MedImmune spent \$6,000 on new metering equipment that can be properly calibrated—ensuring consistent data units. The facility now has a constant stream of reliable data stored in its building management system.

Energy Savings Assessments

The energy team performed several energy assessments prior to implementing the EnMS. The EnMS helped to more accurately and easily document savings from those earlier projects, reinforcing the credibility of reported savings. Facility staff created a database of prospective projects and developed a ranking system based on project importance, cost, potential impacts, etc. Facility management now uses this system to support project selection for funding—helping streamline the process to launch new projects. In the process of identifying SEUs through the EnMS, the energy team discovered that the entire boiler system (seven boilers) was operating above capacity and probably using more natural gas than necessary. As a result, the energy team shut down two of the boilers for a year to evaluate their necessity. By the end of this evaluation period, it was determined that the facility could operate under normal conditions without those two boilers, and they were decommissioned—freeing up space for other equipment. See “Boiler Operation Optimization” in the Sampling of Projects Implemented table (on page 5) for details.

Non-Energy-Related Benefits

Some projects realized benefits beyond energy savings. For example, retrofitting the lighting system to accept longer-lasting LEDs instead of MR16 bulbs enabled MedImmune to also reduce maintenance—saving both time and associated labor costs.

Sampling of Projects Implemented at MedImmune's Gaithersburg Facility

Project Description	Project Type	Annual Source Energy Savings (MMBtu)	Annual Energy Cost Savings (\$)
LEED Design Elements	Capital	45,305	\$1,043,000
Boiler Operation Optimization	Operational	14,059	\$194,000
Interior Lighting Retrofit (LED)	Capital	4,451	\$156,500
Drive Belt Replacement Strategy	Operational	1,290	\$45,300
Highbay Lighting Retrofit	Capital	710	\$25,000
Compressor Sequencer Install	Capital	519	\$18,200
Vivarium Lighting Controls	Capital	339	\$11,900

EnPI Tool

As mentioned above, DOE provides an EnPI tool to assist plants in accurately measuring and verifying plant-wide energy improvements in compliance with the SEP [Measurement and Verification Protocol](#). This tool facilitates energy performance tracking and regression analysis to enhance staff understanding of plant energy consumption trends. Effective use of this tool requires (a) a thorough knowledge of the factors that affect a facility's energy performance, e.g., production and weather data, and (b) the ability to use statistical techniques to analyze and normalize data.

MedImmune's use of the EnPI tool enabled facility staff to establish a normalized baseline of energy consumption, track annual progress in energy performance, and identify indicators that account for variations in performance due to weather, production, and other factors.

"The EnPI tool gave us the energy data credibility that we were looking for."

– Wilbur Williams, Commissioning & Qualification Expert,
Americas Region of AstraZeneca
(Former Energy Manager, MedImmune)

Energy Management Software

An energy management software tool called "Enerit" provides a helpful user interface for the ISO 50001-conformant EnMS. It helps staff visualize the flow of electricity and natural gas throughout the facility by way of a Sankey diagram—in which the width of the energy flow lines are proportional to energy volumes. This tool was instrumental in identifying the boiler system as a significant user of natural gas and an appropriate focal point for improvement. Overall, the software facilitated a more intuitive understanding of the facility's energy profile.

Internal and Third-Party Audits and Certification

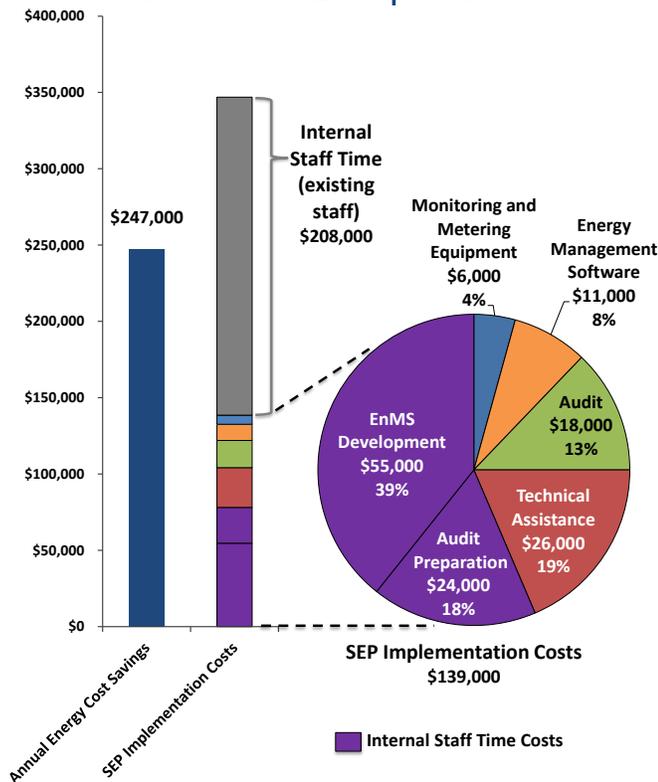
MedImmune hired [Advanced Waste Management Systems Inc.](#), an SEP verification body accredited by the [American National Standards Institute](#) (ANSI), to verify the facility's conformance with the ISO 50001 standard and achievement of SEP energy savings targets. MedImmune's energy team successfully prepared for both its Stage I ISO 50001/SEP "readiness review" audit and Stage II onsite ISO 50001/SEP audit.

Evaluating the Costs and Benefits of Implementing SEP

A detailed follow-up analysis quantified the costs and benefits associated with earning certification for SEP and ISO 50001 at the Gaithersburg facility. As shown in the pie chart (on page 6), the analysis considers program implementation costs in six categories:

- Internal staff time spent developing the EnMS
- Internal staff time spent preparing for the SEP/ISO 50001 audits
- External technical assistance
- Monitoring and metering equipment
- Energy management software (not an SEP requirement)
- Third-party audit

Costs and Benefits of SEP Implementation



In estimating the cost of internal staff time, this analysis considers only the time of staff not previously engaged in energy management activities. The time expended by facility staff already engaged in energy management is considered a sunk cost and therefore not included in the payback calculation (see table at right). At the Gaithersburg facility, almost three-quarters (\$208,000) of the total \$287,000 spent on internal staff time to implement the EnMS involved existing staff already engaged in energy management activities.

To isolate the impacts of energy efficiency measures, energy consumption levels during the baseline period (January 2010–December 2010) and reporting period (January 2013–December 2013) were normalized to reflect actual production, weather conditions, and operations during the model year (see timeline on page 4).

COST-BENEFIT ANALYSIS: Costs, Savings, & Payback

Total Cost for Implementing SEP	\$139,000
Net Internal Staff Time ^a	\$79,000
<i>EnMS Development and SEP Data Collection</i>	\$263,000
<i>SEP/ISO 50001 Audit Preparation</i>	\$24,000
<i>Existing Internal Staff Time^b</i>	-\$208,000
External Technical Assistance	\$26,000
EnMS Monitoring and Metering Equipment	\$6,000
Energy Management System Software	\$11,000
SEP/ISO 50001 Audit (3 rd party auditor)	\$18,000
Total Annual Energy Savings (Attributable to SEP)	\$420,000
Annual Operational Improvement Energy Savings (Attributable to SEP)	\$247,000
Annual Capital Project Energy Savings (Attributable to SEP)	\$172,000
SEP Marginal Payback^c	7 months

^a The value of all staff labor expended to implement the EnMS less the labor time already dedicated to facility energy management.

^b The time expended by facility staff already engaged in energy management is considered a sunk cost and therefore not included in the payback calculation.

^c SEP marginal payback is based on operational energy cost savings attributable to the SEP program.

“Our SEP certification drives us to ensure our EnMS is best in class, with measurable and verifiable results.”

– Andrea Nance, Manager of Environmental Sustainability, MedImmune,

Barriers

Adding a New Building to the EnMS

As shown in the timeline (page 4), calendar year 2010 was selected as the SEP baseline. In mid-2011, the Gaithersburg facility integrated an additional 224,000-square-foot building (with additional production and lab space) into its EnMS and SEP boundary—which initially encompassed only 571,000 square feet. This addition significantly increased the equipment and energy consumption within the SEP boundary in the midst of the SEP Achievement period.

Instead of resetting the baseline to a year following the addition of this facility, and delaying SEP certification, the energy team underwent a non-routine adjustment—defined as a one-time adjustment to otherwise constant conditions or static factors within a defined boundary—to reflect changes between the baseline and reporting period. This adjustment enabled the team to estimate baseline energy consumption and relevant variables (e.g., heating degree days) for the new facility as if it had been operational in 2010. The adjustment enabled an “apples-to-apples” comparison between the baseline and reporting period year, even though a large building was added to the scope. This adjustment was verified by the Performance Verifier.

The energy team found it challenging to calculate the amount of natural gas consumed by this new facility as it lacked natural gas sub-meters. The team came up with an engineering estimate of natural gas consumption by calculating the difference between average utility usage data from the two years before and two years after launch of the new building. This adjustment aligned with SEP requirements and was verified by the Performance Verifier.

Management Changeover

Company leadership changed twice while the energy team was trying to make the case for EnMS implementation and certification to ISO 50001 and SEP. As a result, SEP had to be

approved more than once. All of the managers deemed the project worthwhile, testifying to the EnMS’s resilience to leadership changeover.

Lessons Learned

Data Collection is Key

The energy team learned that energy data must be collected thoroughly and with a consistent methodology to effectively improve understanding of how much energy is consumed, why it is consumed, and where opportunities exist to improve performance.

Sub-metering required in new design criteria

After rising to the challenge of calculating natural gas consumption in the new building, MedImmune began requiring that sub-metering be included in all new buildings. The company is now constructing two buildings, and both support energy efficiency as a result of this new design criterion.

Sustainability Awards and Certifications

The new 224,000-square-foot building (see Barriers section above) was designed for certification to LEED—a green building program that considers energy efficiency among the qualifying metrics. The new building features energy-efficient elements such as an improved thermal envelope, high-efficiency window glazing, reduced-power-density lighting, daylighting controls, occupancy sensors, and demand controlled ventilation (see “LEED Design Elements” in table on page 5). The SEP process and use of the EnPI tool enabled the energy team to quantify and verify the energy savings projected by the lead architect of the building. These calculations helped MedImmune validate the extra cost of building a LEED-certified building. All new construction projects at MedImmune are now required to earn LEED certification at the Silver level or higher.

In addition to LEED and SEP, MedImmune received certification as a Montgomery County, Maryland Green Business and a member of the Maryland Green Business Registry. MedImmune

was also awarded AstraZeneca's 2014 Global SHE (Safety, Health, and Environment) Excellence Award for its commitment to managing environmental impacts and promoting the safety, health, and well-being of all employees. MedImmune's SEP certification was a factor in the facility's selection for both of these recognition programs.

Moving Forward

To further strengthen corporate sustainability, AstraZeneca plans to replicate elements of the EnMS and best practices learned in Gaithersburg at a number of other facilities within its portfolio. In addition, MedImmune plans to pursue certification to ISO 14001—an environmental management system standard—partly due to its success with ISO 50001. The facility plans to continuously improve its energy performance using the EnMS and hopes to recertify in 2017 at the SEP Silver level.

“SEP-certified facilities are frontrunners in energy management and efficiency improvement. Our SEP certification distinguishes us as part of an innovative leadership movement to improve energy productivity and achieve a sustainable, globally competitive future.”

– Andrea Nance, Manager of Environmental Sustainability,
MedImmune