

## Cummins Improves Energy Performance 12.6% with SEP

Cummins Inc.—a global engine manufacturer—worked with the U.S. Department of Energy (DOE) Advanced Manufacturing Office to successfully implement an energy management system (EnMS) that meets all requirements of ISO 50001<sup>1</sup> and Superior Energy Performance<sup>®</sup> (SEP<sup>™</sup>). Cummins' implementation of the EnMS at its Rocky Mount Engine Plant (RMEP) in Rocky Mount, North Carolina, enabled a 12.6% improvement in energy performance, saving over \$700,000 a year.

### Business Benefits Achieved

Implementing the EnMS saves Cummins 99.1 billion Btu (104,600 GJ) of source energy each year and lowers the plant's energy costs by (US) \$716,000. The plant's \$248,000 investment in implementing the EnMS and securing SEP certification was paid back through cost savings in about eleven months. This SEP marginal payback is based solely on energy cost savings from *operational* improvements in energy management.

Energy savings achieved at the plant were verified by an accredited third party, earning the facility SEP certification at the Gold level. The plant's energy resources are now proactively managed via a rigorous business system to sustain those energy savings and continue strengthening plant energy performance in the years ahead.

**"SEP certification enabled us to validate energy savings with actual, verifiable numbers."**

— Alan Resnik  
Director of Facilities and  
Operations Environmental Management  
Cummins Inc.

<sup>1</sup> International Organization for Standardization Standard 50001, energy management



To achieve corporate energy reduction goals, Cummins Inc.'s natural gas and diesel engine manufacturing facility in Rocky Mount, North Carolina, implemented an energy management system that earned the plant both ISO 50001 and Gold Superior Energy Performance certifications. Photo: Cummins Sustainability Report

### Project Summary

<b>Industry</b>	Engine Manufacturing
<b>Facility location</b>	Rocky Mount, North Carolina, USA
<b>SEP certification level</b>	Gold
<b>Energy management system</b>	ISO 50001
<b>Energy performance improvement</b>	12.6% over 3 years
<b>Annual energy cost savings</b>	\$716,000
<b>Cost to implement</b>	\$248,000
<b>Payback period</b>	11 months <sup>2</sup>

### Business Case for Energy Management

Cummins corporate management chose RMEP to implement an EnMS and participate in the SEP program because that location accounted for 10% of energy use within the global company. At this level of energy usage, the plant posed

<sup>2</sup> See Evaluating the Costs and Benefits of Implementing SEP section on page 6 for more detail.

significant potential for corporate energy performance improvement.

### Corporate goals

Cummins releases an annual sustainability report that includes goals for corporate energy performance improvement and greenhouse gas (GHG) emissions reduction. The report released in May 2014 sets a goal to reduce energy use by 25% and GHG emissions by 27% by the end of 2015 (compared to a 2005 baseline and adjusted for sales). As a group, decision makers at RMEP and Cummins found SEP to be a dependable way to meet corporate energy and environmental goals.

### Benefits of SEP and Keys to Cummins' Success

SEP provides numerous advantages for all participating companies. For Cummins' RMEP, these included the following:

- ▶ Having team members with expertise in both management systems and energy systems was valuable. Possessing strong knowledge in both disciplines simplified the SEP implementation process.
- ▶ The success of prior energy projects, such as the Energy Champion program, gave management the confidence to implement ISO 50001 and SEP.
- ▶ Metering the entire plant enhances EnMS functionality and provides plant engineers with a much better idea of what is happening at the plant.
- ▶ Management is more receptive to funding future projects as a result of externally verified energy savings. That is why energy projects are still receiving funding during times of economic downturn.

### Environmental relations efforts

Implementing an EnMS to achieve verified energy savings and earn SEP certification also supports Cummins' environmental relations strategy.



From the building management system control room at the Rocky Mount Engine Plant, Cummins' Freddie Lacewell (building management system technician) can monitor energy use in any corner of the plant. Photo: Cummins Sustainability Report

Establishing and maintaining solid credentials in energy and environmental sustainability are essential to maintaining and expanding a global customer base, particularly since the company's products tend to consume significant amounts of energy. These certifications can also add value throughout the supply chain, especially if more rigorous regulations are enacted.

### Cost savings

Financial returns reinforced Cummins' interest in an EnMS. As shown in the Evaluating the Costs and Benefits of Implementing SEP section on page 6, properly operated systems reduce facility energy bills and save money. Utility bills represent a significant share of operating costs at many manufacturing facilities, and as corporations of all sizes strive to cut costs, energy efficiency offers a cost-efficient pathway to financial savings.

### Historical Approach to Energy Management

RMEP had no comprehensive system to manage energy prior to 2009. Plant officials were notified when utility rates were higher than usual; business units within the plant, however, had virtually no access to information on current energy consumption levels.

## Cummins Energy Champion Program

In 2009, Cummins initiated its Energy Champion program for training internal staff to become professionals in improving energy efficiency. The program was created after Cummins voluntarily committed (in 2006) to reduce its GHG emissions 25% by 2010 as part of the U.S. Environmental Protection Agency's Climate Leaders program. The energy professionals, or "Champions," also learned how to conduct energy efficiency assessments (energy treasure hunts), evaluate and prioritize projects, and develop site energy plans. The program helped reduce GHG emissions 28%—surpassing the initial goal. The current Cummins goal is a 27% reduction in company-wide GHG emissions by the end of 2015 (compared to a 2005 baseline, with adjustments for sales).

## Energy Savings Assessments

In 2010, as part of the DOE Save Energy Now program, Cummins participated in an energy assessment of RMEP's compressed air system. As a result of that assessment, RMEP initiated a pilot program to install engineered air nozzles and additional metering to monitor the feeder breakers on three (out of twelve) electrical substations and six compressed air drops at the plant. This successful pilot helped Cummins obtain funding to complete the metering of the remaining nine electrical substations and to install engineered nozzles on the two largest machine lines. The associated costs (and benefits) of the first three electrical substations and six compressed air drops are not considered in the cost-benefit analysis and payback calculation because they were executed prior to SEP participation.

## Facility Profile

The plant (RMEP) occupies 1.2 million square feet and employs approximately 1,800 people. In the course of manufacturing and testing engines for heavy-duty construction equipment and automobiles, the plant consumes electricity, natural gas, and diesel fuel. Engines produced at the facility meet the needs of more than 350 key

customers in automotive, marine, industrial, agricultural, and power generation industries across the globe.

RMEP is the single largest energy consumer in Cummins' global network of facilities. Within the plant, the largest energy consumer is the compressed air system, which accounts for nearly 25% of total facility energy use. The system's sophisticated controls link six air compressors to deliver adequate air flow across the plant while minimizing energy losses from blow-offs. The compressed air system is monitored by RMEP's building automation control system as part of its EnMS.

## EnMS Development and Implementation

Participation in the SEP program and EnMS development in conformance with ISO 50001 were intended to complement previous efforts to reduce the company's energy and carbon footprint.

## EnMS Training

Though Cummins had experience with other management system standards (e.g., ISO 9001 for product quality, ISO 14001 for the environment, and OSHAS<sup>3</sup> 18001 for workplace health and safety), RMEP staff were less familiar with implementing a comprehensive energy management system. To assist with EnMS implementation, the plant received DOE-sponsored training through the [Georgia Tech Energy and Sustainability Services](#) group from January 2011 to February 2012. This beneficial training enabled plant staff to better understand and use the SEP Energy Performance Indicator tool (see EnPI Tool section on page 5).

## Setting the Baseline

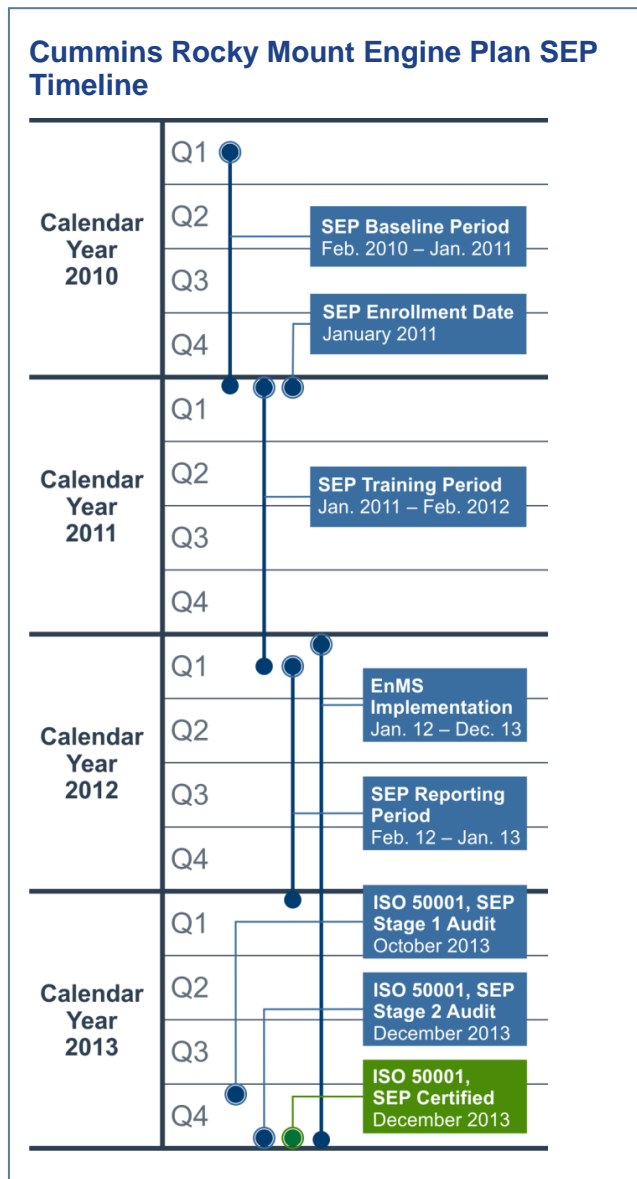
Setting a baseline is an essential step when calculating energy performance improvement. The energy team at RMEP set a baseline to represent business-as-usual energy consumption, production, heating/cooling degree days, etc. The baseline year originally ran from February

<sup>3</sup> Occupational Health and Safety Advisory Services

2010 to January 2011, as that was the year in which the Cummins executed its Energy Champion program (see Cummins Energy Champion Program section above).

### EnMS Rollout

Plant staff implemented and began executing the EnMS between January 2012 and December 2013.



### Merging Management Systems

Diverging from the path taken by many SEP pilot plants, the RMEP team decided to merge its newly developed ISO 50001 EnMS and its existing plant management systems (see Facility Profile section above) into one master management system, referred to as Safety, Environment, and Energy (SEE). SEE requires the facility to comply with all Cummins corporate standards as well as ISO and OSHAS management systems. This approach simplifies all management practices by providing one central resource for all management needs.

### Energy Team

The Cummins corporate energy team supported this EnMS effort by attending all Georgia Tech training sessions and underscoring the importance of this program to all plant staff. Management also kept the entire company informed about the plant's progress throughout EnMS implementation.

### Funding the EnMS

At Cummins, funding for large capital energy performance improvement projects competes with many other worthy projects around the company. Cummins maintains a separate capital fund to which individual facilities worldwide may submit proposals for energy-related projects. All of these projects are evaluated based on payback period, net present value, and impact on GHG reduction. The metering projects, engineered nozzles, and several other controls projects at RMEP were funded from this source, while smaller improvements were funded through local expense budgets. The EnMS helped to identify two such "smaller improvements" that entailed little or no capital, obviating a request for limited capital funds. These two projects alone (see operational projects in the table on the following page) saved the plant 1.2 million kWh, or 4.2 billion Btu, in on-site energy expenditures in the first year of implementation.



## Sampling of projects implemented at the Rocky Mount Engine Plant

Project Description	Project Type	Annual Site Energy Savings		Annual Energy Cost Savings (\$)
		kWh	MMBtu	
Replaced open blow-offs with engineered nozzles	Capital	5,300,000	18,070	\$339,000
Upgraded lighting systems	Capital	1,500,000	5,114	\$96,000
Reduced leaks in 2VH compressed air lines	Operational	567,210	1,934	\$36,000
Compressed air leak reduction project for the B Block line	Operational	668,448	2,279	\$43,000

### Raising Awareness

Cummins elevates awareness of energy efficiency efforts such as the SEP program to a global Cummins audience via its intranet site. Because Cummins appreciates the rigor of following a common process, facilities also communicate and share best practices with one another and across business units. The Energy Champions drive energy management at the facility level.

### Achieving ISO 50001 and SEP Certification

#### Sub-Metering

Prior to 2009, RMEP measured only its total energy consumption using the utility meter coming into the plant and a few old substation analog meters. However, this method of measuring energy consumption was ineffective. In alignment with SEP's rigorous measurement and verification process, the plant spent \$130,000 to purchase and install feeder breaker meters for the nine additional electrical substations. ISO 50001 and SEP implementation helped make the case for metering all major plant systems. As a result, all of the plant's feeder breakers are currently metered, enabling each business unit to receive its own energy bill. All future equipment installations must be metered and integrated into the EnMS.

**"Thanks to SEP, we were able to get corporate approval and additional funding for plant-wide metering."**

—Mark VanDam  
Facilities Engineer  
Cummins Inc.

### EnPI Tool

To assist plants in measuring and verifying plant-wide improvements, DOE offers an [Energy Performance Indicator](#) (EnPI) regression analysis tool. By providing a plant-wide energy profile, this tool helps to measure actual energy performance improvements in compliance with the SEP measurement and verification protocol. Effective use of this tool requires a thorough knowledge of the factors that affect a plant's energy performance and the ability to use statistical techniques to analyze and normalize data. RMEP's use of the EnPI tool enabled plant staff to establish a normalized baseline of energy consumption, track annual progress on energy performance improvements, and identify energy performance indicators that account for variations in energy performance due to weather, production, and other variables.

### Internal and Third-Party Audits

Cummins hired [DEKRA](#), an SEP verification body accredited by the American National Standards Institute (ANSI) and the ANSI-ASQ National Accreditation Board (ANAB), to audit the plant's conformance with ISO 50001 and its achievement of SEP energy performance improvements. The energy team was well prepared for both audits (Stage I, the SEP/ISO 50001 "readiness review" audit, and Stage II, the onsite SEP/ISO 50001 audit), in part because of the team's prior experience with other ISO management systems. The team was also familiar with the certification process, having previously performed an internal gap analysis to compare actual plant energy performance to optimal energy performance levels. This gap analysis required in-depth measurement of all energy-using systems within the plant, similar to the evaluations required for the third-party audit. The SEP/ISO 50001 readiness review audit of the plant was

completed in October 2013, and the finding of a 12.6% improvement in source energy performance (relative to the February 2010–January 2011 baseline) was ultimately verified during the Stage II audit two months later—qualifying the RMEP as a Certified SEP Gold Partner (attaining an energy performance improvement between 10% and 15%).

## Evaluating the Costs and Benefits of Implementing SEP

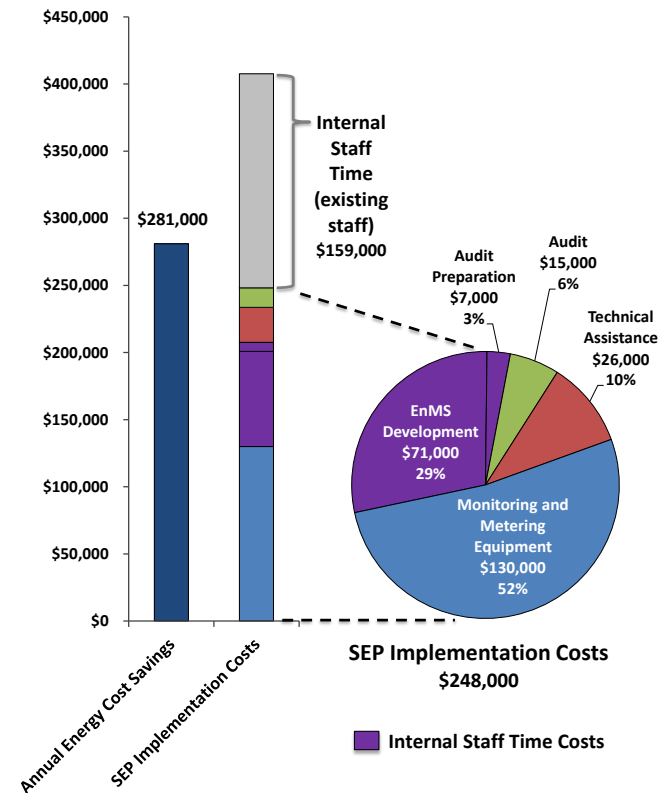
A detailed follow-up analysis quantified the costs and benefits associated with implementing SEP/ISO 50001 at the RMEP. As shown in the pie chart to the right, this analysis considers five categories of program implementation costs:

- Internal staff time spent on developing the EnMS
- Internal staff time spent preparing for the SEP/ISO 50001 audits
- Technical assistance
- Monitoring and metering equipment
- The third-party audit

In estimating the cost of internal staff time, this analysis considered only the time of staff not previously engaged in energy management activities. The time expended by plant staff already engaged in energy management is considered a sunk cost and is therefore not included in the payback calculation (see table on page 7). At RMEP, approximately two thirds (\$159,000) of the total \$237,000 worth of internal staff time spent on EnMS implementation involved existing staff already engaged in energy management activities.

To help isolate the impacts of energy efficiency measures, energy consumption during the reporting period (February 2012–January 2013) was normalized to reflect the production levels and operations in effect during the baseline period

## Costs and Benefits of SEP Implementation



(February 2010–January 2011). Energy and cost savings were then calculated using this normalized data as well as actual utility data (electricity, natural gas, and diesel fuel consumption).

The analysis shows that, at prevailing energy prices, the plant's \$248,000 investment in SEP saves the plant \$716,000 annually (after subtracting business-as-usual energy savings<sup>4</sup>)—and \$281,000 of those savings come from no-cost/low-cost operational changes. The operational savings alone paid back the investment in just eleven months, and the EnMS is expected to sustain those savings over time.

<sup>4</sup> Business-as-usual (BAU) savings are calculated as 3% of baseline year energy consumption, based on the average of BAU energy savings at nine SEP demonstration plants.

<b>COST-BENEFIT ANALYSIS: Costs, Savings, &amp; Payback</b>	
<b>Total Cost for Implementing SEP</b>	<b>\$248,000</b>
Internal Staff Time	\$237,000
<i>EnMS Development and SEP Data Collection</i>	\$230,000
<i>SEP/ISO 50001 Audit Preparation</i>	\$7,000
Existing Internal Staff Time <sup>a</sup>	-\$159,000
External Technical Assistance	\$26,000
EnMS Monitoring and Metering Equipment	\$130,000
SEP/ISO 50001 Audit (3 <sup>rd</sup> party auditor)	\$15,000
<b>Total Annual Energy Savings (Attributable to SEP)</b>	<b>\$716,000</b>
Annual Operational Improvement Energy Savings (Attributable to SEP) <sup>b</sup>	\$281,000
Annual Capital Project Energy Savings (Attributable to SEP)	\$435,000
<b>SEP Marginal Payback<sup>c</sup></b>	<b>11 months</b>
<p><sup>a</sup> The time expended by plant staff already engaged in energy management is considered a sunk cost and therefore not included in the payback calculation.</p> <p><sup>b</sup> Savings attributable to SEP subtract BAU energy savings, which are assumed to be 3% of baseline year energy consumption.</p> <p><sup>c</sup> SEP marginal payback is based on operational energy cost savings attributable to SEP and not capital projects.</p>	

## Barriers

### Metrics to Track Progress

To normalize energy consumption data using the previously mentioned EnPI tool, plant engineers are first required to identify and define the variables affecting energy consumption (production, heating and cooling degree days, etc.). The largest challenge faced by the RMEP team was determining the variable that most affects RMEP diesel fuel consumption.

The two RMEP divisions that consume diesel, the production test and product engineering laboratories, are equally heavy consumers, yet they produce very different products, making it difficult to identify a single variable representative of both divisions. A proposal to use diesel tank levels as the variable was dismissed because of its lack of precision. After multiple attempts to determine an appropriate variable, the team finally agreed upon using diesel test hours to normalize the data in a statistically accurate manner. This metric was already available and applied to both of the aforementioned RMEP divisions.

## Lessons Learned

### Energy Savings Verification

Verification and documentation of project energy savings are valuable to the facility and the company as a whole. Verification and documentation enable plant staff to reproduce and prove all savings information and calculations in a professional and credible manner. These steps are required of the RMEP energy engineer in support of the corporate sustainability plan.

### Assigning Responsibilities

Putting together a team and assigning clear individual responsibilities was also vital to successfully implementing the EnMS and earning SEP certification. Having an existing systems expert well versed in ISO 14001 and OSHAS 18001 made the documentation and administrative aspects of the management system easier and also allowed the energy engineer to focus on calculations and project identification/implementation. The systems expert's prior experience in working with auditors also expedited the audit process.

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## Moving Forward

Cummins is a Better Plants Challenge Partner<sup>5</sup> and now a Gold SEP-Certified Partner with DOE. SEP certification validates Cummins' systematic approach to reducing energy consumption and associated emissions.

RMEP staff plan to use the SEP process to help drive and track the results of all future energy improvement projects. The facility plans to recertify every three years and to eventually pursue the Mature Energy Pathway, which is an alternative SEP certification process for facilities with extensive experience in energy management.

Based on the success at RMEP, Cummins sees value in participating in the [SEP Enterprise-Wide Accelerator](#) program, which is designed to implement SEP and ISO 50001 across a business unit, multiple plants, or an entire corporation to achieve economies of scale. This approach lets facilities share best practices, better integrate ISO 50001 elements into current company practices, accelerate deployment of SEP training and tools company-wide, increase coordination of implementation activities, and help meet corporate energy goals. As Cummins implements SEP at additional facilities, staff time requirements are expected to decrease. The company is currently pursuing SEP certifications at three additional facilities: Columbus Technical Center in Indiana; Jamestown Engine Plant in Lakewood, New York; and Cummins Power Generation in Minneapolis, Minnesota.

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<sup>5</sup> SEP and Better Plants are distinct yet complementary partnership programs administered by DOE. SEP certifies individual plants for meeting the ISO 50001 standard and making verified levels of improvements in their energy performance, while Better Plants asks entire companies to commit to reducing their manufacturing energy intensity 25% or more within 10 years. These companies set ambitious goals, establish energy management plans, and report progress annually to DOE. Better Plants partners can implement SEP, whether at a single plant or across the entire enterprise, to help meet corporate energy goals. [Learn more.](#)