Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

Case Study: Cummins Navigates SEP M&V Process

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Cummins Identifies a Sensible Variable to Track Diesel Consumption

"Superior Energy Performance®…is really about making your energy use visible…" So says Mark VanDam, facilities engineer at Cummins Rocky Mount Engine Plant (RMEP), about his company's success in making the diesel fuel consumption visible. Although diesel energy consumption is significant at RMEP, no traditional variables such as production throughput or weather could be used to predict diesel consumption, which tied the hands of the energy team. While implementing an energy management system in conformance with the ISO 50001 international standard and measuring & verifying the energy performance improvement as part of the US Department of Energy's (DOE's) Superior Energy Performance® (SEP®) program, the facility identified a creative solution to the prediction conundrum.

Energy use throughout the Rocky Mount Engine Plant can be monitored and measured from the building management system control room.

(Photo: provided by Cummins)

Case Study Summary	
Industry	Diesel Engines & Components
Facility location	Whitakers, NC
Energy performance improvement	12.6% over 2 years
Annual energy cost savings	$716,000
SEP certification level	Gold
Measurement & verification (M&V) challenge	Diesel energy consumption could not be properly predicted using common variables.
M&V solution	RMEP identified a single, time-based variable—the "test hour"—to predict diesel consumption for two different engine-testing processes.

Overview

Cummins RMEP manufactures diesel engines and machine components at its 1.2-million-square-foot facility in Whitakers near Rocky Mount, North Carolina. Everything built at the facility is pre-ordered, meaning nothing is batch-built and production can change rapidly, depending on demand.

Cummins chose RMEP to pilot ISO 50001 and the SEP program because the facility accounted for 10% of the company's total energy usage, which presented a great opportunity to save. The RMEP facility saved over 27 billion Btu of primary energy and improved its energy performance by 12.6% over two years from February 2011 through January 2013. It was certified to ISO 50001 and SEP at the Gold level in October 2013.

At RMEP, electricity makes up 86% of the total energy consumption, with diesel and natural gas each contributing another 7%. During ISO 50001 and SEP implementation, RMEP undertook multiple operational changes and capital investments to improve energy performance. For example, staff replaced blow-off nozzles with engineered nozzles, making more efficient use of compressed air to blow away dust and chips during milling/drilling/honing in the manufacturing process. Staff also repaired compressed air leaks and upgraded the lighting systems.

M&V Challenge

The SEP M&V protocol requires that facilities include all energy sources that together account

for at least 95% of the energy in-flow that crosses the facility boundary. Therefore, RMEP needed to account for all three of its energy sources—electricity, natural gas, and diesel—in its SEP M&V models. The team was able to model the electricity and natural gas consumption with traditional production and weather variables. However, the modeling of diesel consumption presented a challenge.

Solution: Defining A New Variable

To solve the problem, the team first looked into how diesel is consumed at the facility. It is used for two testing purposes: (1) for production validation tests, which involve two-minute routine tests that are conducted on all manufactured engines, and (2) for conducting a wide range of tests for performance, emissions, endurance, and other factors within RMEP's Product Engineering Test Operations Lab. These two types of tests are different, and neither of these diesel uses could be predicted using weather or traditional production variables. In order to successfully model the diesel consumption, RMEP was challenged to develop a new normalization variable.

When the RMEP team members were investigating how to normalize the two different diesel-consuming test procedures, they noticed that both tests had a time component. The production validation test has a specific number of minutes per test, and the Product Engineering Test Operations Lab records "shaft hours" for its tests. Working with a team of expert energy modelers from the Georgia Institute of Technology, the team developed a creative variable, the "test hours," which measures the diesel-consuming time in both testing procedures. This new variable predicted diesel energy usage reasonably well in the regression model. Figure 1 shows the correlation between the diesel consumption and the "test hours."

Next Steps

Although the "test hours" variable was successfully used for RMEP's SEP certification, the facility believes that the model used for predicting diesel

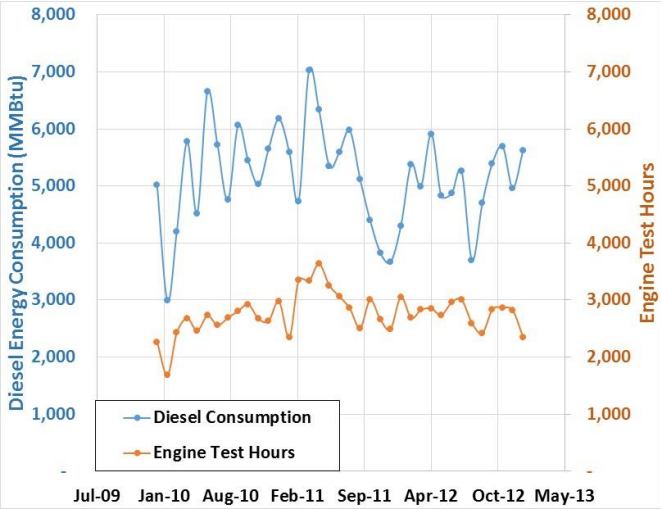

Figure 1: Time Series Plot of Diesel Consumption and Engine Test Hours during SEP Baseline and Achievement Periods

energy usage can be made more accurate when additional data become available. This is because, although all production validation tests last two minutes, each test uses varying amounts of diesel fuel, depending on the size of the engine at test. The facility has been installing diesel fuel flow meters in both testing areas to evaluate fuel rates against production rates and engine size mix. The RMEP team hopes that the new metered data can provide insights leading to a more accurate model.

RMEP is currently expanding its production and developing solutions to maintain its ISO 50001 and SEP certifications by continually improving its energy performance.

One of RMEP's six centrifugal air compressors, which together meet the compressed air demand in the plant. The six air compressors were identified as one of the plant's significant energy uses (SEUs).

(Photo: provided by Cummins)