Superior Energy Performance®
U.S. DEPARTMENT OF ENERGY

Case Study: HARBEC Navigates SEP M&V Process

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HARBEC Develops a "Total Energy" Model to Reveal Performance Improvement

Organizations that employ a combination of energy sources can sometimes encounter difficulty in identifying clear patterns in how each individual energy source correlates with production and/or other relevant variables. HARBEC overcame this problem by combining different energy sources into a single model, which allowed staff to determine the energy performance improvement at the facility.

HARBEC's energy team (next to the plant's CHP unit): from left to right, Bob Bechtold (President), Amy Bechtold (Management Representative), and Jeff Eisenhauer (Energy Manager).

(Photo: provided by HARBEC, Inc.)

Project Summary	
Industry	Plastics
Facility location	Ontario, NY
Facility size	50,000 sq. ft.
Energy performance improvement	16.5% over 3 years
Annual energy cost savings	$52,000
SEP certification level	Platinum
Measurement & verification (M&V) challenge	Energy sources cannot be modeled individually owing to CHP and renewables
M&V solution	Combine energy sources for a total energy model

Overview

HARBEC, Inc., is an injection molding company in Ontario, New York. The company sees ISO 50001 and Superior Energy Performance® (SEP®) as an opportunity to make progress toward its goal of achieving carbon neutrality. The company has improved its energy performance by as much as 16.5% over a three-year period, compared to the baseline period of November 2009–October 2010, and achieved ISO 50001 and Platinum-level SEP certification in November 2013.

During implementation of ISO 50001, HARBEC identified its natural-gas-fired combined heat and power (CHP) plant as its largest energy user and a key opportunity to improve energy performance. To control the CHP plant with greater energy efficiency, the company switched to using the facility's thermal energy demand instead of the electricity demand. As a result, HARBEC avoided significant waste of excess heat energy. Another major project was the installation of an 850 kW wind turbine in early 2013, which reduced the amount of purchased electricity.

M&V Challenge

The HARBEC team worked with experts from the Georgia Institute of Technology on the measurement & verification (M&V) aspect of ISO 50001/SEP. They followed a common procedure to first map energy consumption of all energy sources, including natural gas, purchased electricity, and wind-generated electricity (see Figure 1). The intent was to identify patterns of performance improvement. However, the presence of the CHP plant and the onsite renewable energy created complexity. The dramatic changes in consumption levels of all

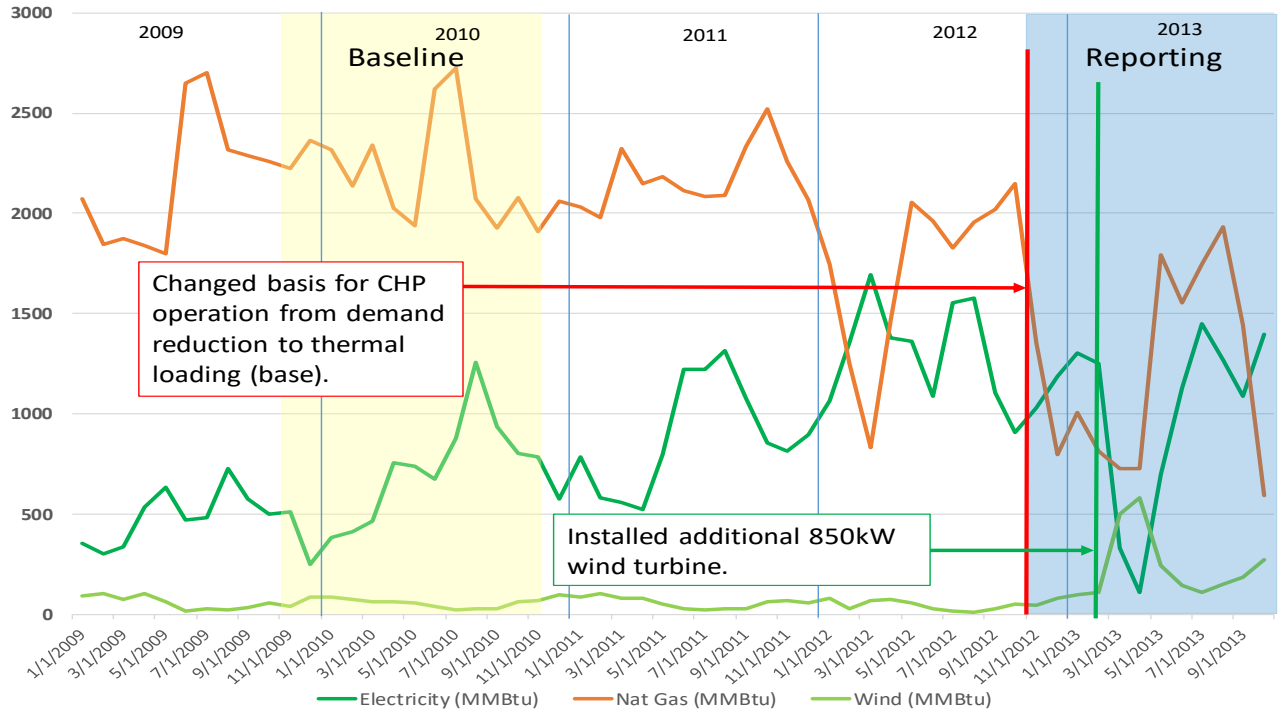

Figure 1: Primary Energy Consumption (MMBtu) by Energy Source at HARBEC (Graphic: provided by HARBEC, Inc.)

energy sources due to the change in CHP operation and the newly installed wind turbine would not support the modeling approach of tracking each energy source separately and thus yielded a number of invalid tests. In addition, with this common modeling approach, it proved difficult to identify any correlation between common variables, such as production levels and/or weather, and energy consumption.

Solution: Combine Energy Sources

CHP serves as a baseload for electricity based on the thermal energy demand at the facility. HARBEC prefers wind-generated electricity over purchased electricity to meet the remaining demand. The team opted to develop a total energy consumption model by converting the electricity from all sources into primary energy per the SEP M&V Protocol and aggregating the sources to produce a net electricity consumption value (wind-generated electricity plus purchased electricity and minus excess electricity exported back to the grid). HARBEC multiplied the grid-purchased electricity (after deducting exported electricity) by three to convert from site to primary energy, which accounts for significant thermal waste during electricity generation, as well as additional transmission and distribution losses. For onsite wind-generated electricity, the multiplier is one in absence of such thermal waste and transfer losses. Therefore, the switch to renewable energy enabled the substantial energy performance improvement at the facility.

A forecasting method was used to develop a model of total facility energy consumption (natural gas plus primary net electricity consumption). This approach yielded a reliable model that predicted the facility's total energy based on production levels and Cooling Degree Days. This model not only passed statistical validity tests, but also reflected actual plant operations: HARBEC uses CHP-derived thermal energy to generate chilled water, which serves space conditioning and injection molding process-cooling loads.

[ISO 50001/SEP] keeps us aware so that we can keep improving… If someone were to ask, Why would a small company be involved in something like this? We have to control our bottom line…and this provides positive impacts to it.

— Bob Bechtold
HARBEC President