SHOWCASE PROJECT: BRIGGS & STRATTON: POWER REGENERATION SYSTEM

SOLUTION OVERVIEW
Engineers at Briggs & Stratton have pioneered an energy saving solution at the company’s Wauwatosa reliability lab, making it one of the most advanced in the industry. In 2011, the company implemented an innovative system that captures the energy lost during engine testing and converts it into electricity that is used to power the adjacent Briggs & Stratton plant where the engines are made. Based on the success of this project, Briggs & Stratton is considering applying this approach to other facility locations.

At Briggs & Stratton’s reliability lab, engineers screen the company’s small engine models to meet the exacting standards set for outdoor power equipment such as lawn mowers and snow blowers. As a routine procedure, each engine is evaluated for hundreds of hours to establish long-term durability and prove design safety before it reaches the consumer market. This conventional process proved to be costly, resulting in nearly $1 million per year in fuel expenses alone to test engine reliability.

Briggs & Stratton engineers uncovered an opportunity to lower their operating cost by capturing the energy output from electric generators used to test the engine line-up. In 2008, Briggs & Stratton partnered with Rockwell Automation to create a first of its kind power regeneration system that would capture the mechanical energy generated during engine testing and convert it into electricity for the plant’s consumption.

Experts from both companies identified custom requirements for the project, and ways to maximize return on investment. A major challenge was that a similar regeneration system did not yet exist, so the Briggs & Stratton-Rockwell team had to design the project essentially from a clean sheet. Due to the high costs of creating such a unique system, the team competed for state funding through Wisconsin’s Focus on Energy Program in 2008 and again in 2009. On a third attempt, they won a grant that paid for half the cost of the project, or $108,400. The investment covered equipment and material, installation, and the development of a power monitoring system.

SECTOR TYPE
Industrial

LOCATION
Wauwatosa, Wisconsin

PROJECT SIZE
46,000 Square Feet

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FINANCIAL OVERVIEW
Project Cost: $217,000

SOLUTIONS
Briggs & Stratton’s power regeneration system is capturing mechanical energy from the R&D testing of its gasoline engine line-up, which reduces the need to purchase electricity from an outside utility. Advanced control and data collection features monitor engine endurance, while the system simultaneously generates electricity.

The system consists of a group of 12 test stands of various horsepower limits. This is a subset of the 105 test stands in the reliability lab, and 312 total in the Wauwatosa plant. The test stands are equipped with alternating current (AC) electric motors operated from variable frequency drives (VFD’s) on a common 180 amp regenerative bus. The regenerative bus is bi-directional, meaning it can supply AC power to the motors and also regenerate power to the AC line. The motor and drive systems start the engines and test them at various operating conditions by varying the loads on the engine. Previously, the power generated by the motors was dissipated as heat and lost. The new regeneration system captures the power output from the rotational energy of the gasoline engines and creates electricity. All 12 AC motors and drives convert the rotational energy of the engine to electricity, which is then sent to a common direct current (DC) bus supply. The DC bus supply then converts the DC to AC, and synchronizes to the AC line, where all the power is directed back to the internal grid—reducing the need for electricity from the outside utility.

The team installed new control hardware and software that increases productivity, efficiency, and safety. An automated data acquisition system monitors engine health and diagnoses engine glitches, which eliminates human collection errors and frees technicians for other tasks. Most importantly, it improves safety by providing warning signs and automatic shutdown in the unlikely event of catastrophic engine failure. The user friendly system enables technicians to instantly determine when an engine is not operating normally or when a test is set up incorrectly. Briggs & Stratton estimates that productivity and efficiency gains associated with the data acquisition system equate to about $40,000 per year.

The power regeneration system is expected to generate 533,000 kWh annually and reduce energy costs by $48,000 a year as electricity is fed back into the plant’s internal grid. The savings equate to an almost 25% improvement in energy intensity within the Test Building, which is where the reliability lab is located. Additionally, the electricity savings are estimated to reduce the plant’s greenhouse gas emissions by 442 tons per year. This project was implemented on 12 test stands, but has the potential to expand to other test stands and laboratories for additional energy savings. The company is considering implementing the power regeneration system at another 36 test stands in the next two years. Expanding the power regeneration system to include these additional 36 test stands would save an additional $100,000 per year, with implementation costs of about $475,000, according to Briggs & Stratton.

OTHER BENEFITS
As part of this project, Briggs & Stratton implemented power monitoring for the corporation and

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added nearly 100 meters and submeters. This will form the beginning of a web-based enterprise-wide energy management system the company is developing that will rely on advanced metering.

An interactive touch screen and web-based data system enables Briggs & Stratton engineers to track and analyze energy usage and spending within a single facility or from multiple sites. The system allows energy managers to benchmark energy use, compare data trends, and prioritize energy issues.

The project has earned Briggs & Stratton multiple awards including:

- Wisconsin Manufacturing Council Innovation Award (2011)
- Alliance to Save Energy Galaxy Award (2011)
- Wisconsin Green Building Alliance Special Citation (2012)
Baseline data represents estimated energy intensity and cost metrics assuming the regeneration project was not implemented.

### Annual Energy Use
(Source EUI)

<table>
<thead>
<tr>
<th></th>
<th>Baseline()</th>
<th>Expected(2013)</th>
<th>Actual()</th>
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<tbody>
<tr>
<td><strong>Energy Use</strong></td>
<td>492 kBtu/sq ft.</td>
<td>373 kBtu/sq ft.</td>
<td>Coming soon</td>
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**Energy Savings**: 24%

### Annual Energy Cost

<table>
<thead>
<tr>
<th></th>
<th>Baseline()</th>
<th>Expected(2013)</th>
<th>Actual()</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Cost</strong></td>
<td>$196,000</td>
<td>$148,000</td>
<td>Coming soon</td>
</tr>
</tbody>
</table>

**Cost Savings**: $48,000

Headquarters building

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B&S worked with Rockwell Automation
Energy is captured and reused from test engines

Test engines generate electricity