



# SC Johnson Waxdale Plant

## 6.4 MW CHP System

### Project Overview

In 2003, as part of SC Johnson's ongoing commitment to protect the environment, a landfill gas-fired 3.2 MW Solar Centaur 40™ combustion turbine was installed at the SC Johnson Waxdale Plant, located in Racine, Wisconsin. The landfill gas is generated at a nearby landfill site, located 2/3 of a mile from the Waxdale plant. Designed and installed by Northern Power Systems, the 3.2 MW combined heat and power (CHP) system reduces fossil fuel electrical power demand while producing 17,000 lbs/hr of 150 psi process steam through a heat recovery steam generator (HRSG).

In 2005, SC Johnson added a second 3.2 MW Solar Centaur 40™ combustion turbine, fueled primarily by natural gas. The second turbine recycles the exhaust heat from the turbine through a HRSG and produces an additional 23,000 lbs/hr of process steam.

Today, the combined 6.4 MW CHP plant provides the base load of electricity for the 2.2 million square foot manufacturing facility while providing up to 40,000 lbs/hr of high quality steam for heating and manufacturing processes. The two turbines together achieve an overall energy efficiency of more than 70% (electrical and thermal).

### Background

As waste in landfills decomposes, a gas is produced consisting of methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>) and other gases and compounds. Republic Service Kestrel Hawk landfill flared the generated gas.

As part of SC Johnson's commitment to the environment, the company became a member of the Environmental Protection Agency's (EPA) Climate Leaders Program. As a member, of this program, SC Johnson set out to reduce their greenhouse gas emissions at their U.S. facilities by 8% (absolute reduction) between the years 2000 and 2005. Being one of SC Johnson's largest plants, the Waxdale plant was a prime candidate for an energy efficiency feasibility study. Several technologies were considered for the plant's energy supply including wind and solar power, geothermal heat pumps, and landfill gas combustion for heating needs. Installing a CHP system that utilized

### Quick Facts

**LOCATION:** Racine, Wisconsin

**MARKET SECTOR:** Manufacturing

**FACILITY SIZE:** 2.2 Million Square Feet

**EQUIPMENT:**

(1) 3.2 Megawatt Landfill Gas Turbine

(1) 3.2 Megawatt Natural Gas Turbine

**FUEL:** Landfill Gas and Natural Gas

**DISTANCE FROM RENEWABLE FUEL SOURCE:**

2/3 of a Mile

**CHP GENERATING CAPACITY:** 6.4 Megawatts

**HEAT RECOVERY RATE:** 40,000 lbs/hr Steam

**HEAT RECOVERY SOURCE:** (2) Heat Recovery Steam Generators (HRSGs)

**Annual Operating Hours:** 8,760

**CHP TOTAL EFFICIENCY:** >70%

**PAYBACK:** 6 years

**BEGAN OPERATION:**

2003 (Landfill CHP System)



SC Johnson Cogeneration Facility

nearby landfill gas proved to be the best solution for the Waxdale plant, providing the greatest impact towards the overall greenhouse gas reduction goal and realizing the biggest “bang for the buck”.

Satisfied with the first turbine’s installation, operation and performance, SC Johnson decided to install a second turbine, this one primarily fueled by natural gas, to produce more on-site clean energy. The second turbine, in combination with the first turbine, has reduced the overall plant emissions annually by 52,000 tons of CO<sub>2</sub>, saving 298 railcars of coal from being burned to generate electricity in Wisconsin annually. Also due to the installation of these two turbines, SC Johnson was able to exceed their U.S. emission reduction goal by achieving an absolute reduction by 17%.

## Two Turbines Operating Together

Both the landfill gas-fired turbine and the natural gas-fired turbine run together at the same time to power the plant 24 hours a day, seven days a week. The turbines produce enough electricity to meet the manufacturing plant’s base-load needs and some peak electric demands. The amount of electricity produced is equivalent to powering 3,200 homes annually. All the electricity generated is utilized on-site by the plant except on some designated holidays, such as Christmas, when the plant is not running its usual operations. In this case the generated electricity not used by the plant is sold to the local electric utility. Since operation began in 2003, there have been no major shutdowns; only minor operating issues needed to be addressed. As a result, the system paid back in approximately 6 years and continued to be a benefit for the facility thereafter.



**SC Johnson’s Methane-fired Combustion Turbine**

PHOTO COURTESY OF SC JOHNSON

The natural gas-fired turbine can run on a mixture of landfill gas and natural gas. SC Johnson takes advantage of any excess landfill gas not used in the first turbine, which can comprise up to 5–10% of the fuel mix in the second turbine.

Each turbine has its own heat recovery system. When electricity is generated heat is produced that would normally be wasted, as it is at a typical central power plant. The turbines’ HRSGs capture the heat produced by the turbines and utilize it by making high pressure steam for space heating and for manufacturing processes. After the second turbine/HRSG installation, the Waxdale plant was able to eliminate one of their four large steam boilers.

In addition to its financial and environmental benefits, SC Johnson’s CHP system increases reliability and protects the plant’s operations. In the event that the utility experiences a power outage, the control systems will isolate the CHP system from the utility grid and the Waxdale plant will be able to keep its critical plant operations up and running avoiding downtime and lost revenue.

## For More Information

### U.S. DOE MIDWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP

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