Market Segment: District Energy Using Combined Heat and Power (CHP)

POWER PROFILE

Customer: HBG – Heizwerkbetriebsgesellschaft Reutlingen mbH

Location:
Reutlingen, Germany

Customer Business Issue:
Cogeneration district heating

Solution:
One Cat® G3516H natural gas generator set

Cat® Dealer:
Zeppelin Power Systems

Since installing the new Cat® G3516H engine, HBG has experienced significant efficiency improvements. The G3516H, in combination with the heat pump, increased plant efficiency to 103.7 percent.

POWER NEED

HBG – Heizwerkbetriebsgesellschaft Reutlingen mbH provides district heating for more than 4,200 residences, schools and swimming pools in the city of Reutlingen, Germany. HBG is a subsidiary of GWG – Wohnungsgesellschaft Reutlingen mbH. The city of Reutlingen holds a three-quarter interest in GWG. The remaining shares are held by GWG – Wohnungsgenossenschaft Reutlingen Gemeinnützige eG, a registered cooperative to which most of the tenants belong.

GWG was founded in 1951 to meet rapidly growing housing demand. Between 1960 and 1970, it built a completely new section of the city. GWG now owns about 7,300 residential units in Reutlingen. When the development was being built, the city decided to supply heat to the new section of the city from a central district heating plant. This has proven be a good decision.

"HBG has 22 employees and supports some 240 energy-generating systems in Reutlingen, ranging from a small district heating plant in the basement of an apartment building to a large system that supplies several thousand households," said Uwe Klingler, HBG's chief operating officer.

In 2002, the city of Reutlingen decided to make a contribution to climate protection. Reutlingen joined the Climate Alliance with the goal of reducing the city's CO_2 emissions.

"HBG then decided to modernize its main cogeneration plant located in the Orschel-Hagen section of Reutlingen. The goal was to reduce greenhouse gas emissions without increasing the costs to district heating customers," Klingler explained.

To reach this goal, HBG decided to augment the four conventional oil- and gas-fired boilers it was using to produce heat alone with a 2 MW natural gaspowered cogeneration system.

SOLUTION

As a result of a change in the German cogeneration law (Kraft-Wärme-Kopplungsgesetz, KWK) in 2002, it became possible in Germany to operate 2 MW units profitably. The electrical power generated by units of this size could now be sold to local power grid operators at a rate that included a legally guaranteed surcharge.

In 2003, Zeppelin Power Systems, Caterpillar's exclusive dealer for Germany, was awarded a contract for a 2MW cogeneration system in the Orschel-Hagel section of Reutlingen following public bidding. The company offers cogeneration equipment in the 1,000 to 2,000 kW power range, as well as a full spectrum of single-source services from system configuration to system maintenance.

The agreement provided for Zeppelin Power Systems to install a turnkey system and also handle system maintenance following startup. The heart of the cogeneration system is a Cat G3520C series natural gas generator set.

The cogeneration system was put into service in 2004 and since that time has been used to generate the power need to cover the basic load. The remaining energy demand continues to be met by the four conventional heating boilers. The Cat G3520C natural gas generator set meets the heating needs of about 2,100 households, and generates 16.5 million kilowatt hours of electricity per year. Most of that energy is fed into the local power grid and sold.

"By installing the cogeneration system, we were able to achieve a CO_2 reduction of 4,500 tons per year," reported Klingler.

Two years later the power plant's CO_2 emissions were reduced by another 700 tons. This was accomplished by installing a heat pump, which makes it possible to extract energy from the generator set's exhaust gases and radiation losses. After primary exhaust gas heat recovery, the heat pump further reduces the exhaust gas temperature from 65 °C to 35 °C and boosts overall efficiency to over 100 percent.*

"In 2011, Caterpillar was looking for a field follow partner for the new Cat G3516H generator set, which generates 2 MW in a smaller footprint. The customer service staff for HBG at Zeppelin Power Systems thought

POWER PROFILE

Customer: HBG – Heizwerkbetriebsgesellschaft Reutlingen mbH

immediately of our system in Reutlingen, since our G3520C natural gas generator set was ready for a major overhaul after 60,000 hours of flawless operation and the new unit fit perfectly into our existing infrastructure," Klingler explained.

HBG, Caterpillar and Zeppelin Power Systems agreed to replace the generator set as part of a "field follow" or product validation agreement. Within a few months Zeppelin Power Systems replaced the old unit with the new Cat G3516H, which went into operation in the summer of 2012. At the same time, an acoustic hood was installed to further reduce the system's noise level.

RESULTS

With the installation of the new Cat G3516H generator set, the overall efficiency, in combination with the heat pump, was increased to 103.7 percent.* As a result of the improved efficiency achieved by the additional technological advances in the unit, the electrical efficiency was improved from 39.4 percent to a value of 42.3 percent. Based on ambient and fuel conditions, engine and generator configuration, as well as load and power factors, Caterpillar supports electrical efficiencies on the G3516H over 44 percent.

"We were surprised how smoothly the startup went. Since going online, the system has been running reliably round-the-clock. We can see that we made the right decision and are completely satisfied with these excellent results," Klingler concluded.

Overall, natural gas consumption was cut by about 10 percent with the new generator set. In addition, the operation was protected by a full-service maintenance agreement and a guarantee of 97 percent reliability in order to eliminate all risks for the operator during the field follow program.

"We got an all-inclusive, worry-free package, and the guaranteed 97 percent operating reliability was exceeded by a long shot," Klingler stated happily.

Since the development will grow by another 200–300 units in coming years, a further expansion is planned for the power plant. "The CHP technology has proven to be effective in everyday operations, so we want to install a second CHP unit with an output of 2.5 megwatts," said Klingler, looking into the future.

Today, as in the past, service and maintenance are critical, in addition to having a top-quality generator set. "With our maintenance agreement, we know exactly what our operating costs are going to be, and we can minimize risk in the event of an outage," Klingler explained.

*Efficiency over 100 percent is based only on the lower heating value of the natural gas fuel input, which excludes latent heat of vaporization recovered in the CHP system

For more information, please visit cat.com/powergeneration

HBG, which provides district heating for more than 4,200 residences, schools and swimming pools in the city of Reutlingen, Germany, uses a cogeneration system to improve efficiency and reduce CO_2 emissions.

LEXE0584-01 January 2013