



Combined heat and power using natural gas

HEAT AND POWER FOR GERMAN MALT PRODUCER DURST MALZ

Who Durst Malz malt producer
What Type GC 357 N5 CHP plants for the generation of heat to dry malt and electric power to feed into the company's own grid
Where Gernsheim, Germany

A malt house has an extremely high demand for energy – both electrical and thermal. For this reason, the German malt producer, Durst Malz, has been operating two combined heat and power (CHP) plants from Rolls-Royce at its location in Gernsheim since July 2011 that can do both simultaneously. The GC 357 N5 CHP plants deliver around one megawatt of heat, which is used to dry the malt. The approximately 700 kilowatts of electrical energy, which the plants generate in addition to the thermal energy, are fed into the company's own grid, resulting in an overall efficiency level of almost 90 per cent. Two identical plants have also been installed at the Durst Malz location in Bruchsal-Heidelsheim.

Gernsheim, Germany. Durst Malz, founded in 1824, has evolved over a period of almost two centuries from a family-run business into a major malt producer for the brewing industry. Since October 2011, the company has been a member of the French malt producer Groupe Soufflet, the world's second largest malt producer. The head offices of Durst Malz are located in Bruchsal-Heidelsheim and the company has two other locations in Castrop-Rauxel and Gernsheim.

Durst Malz produces around 200,000 tons of malt annually, 86,000 tons of which are produced in Gernsheim am Rhein. Malt, which, in accordance with the German purity law of 1516, in addition to hops, water and yeast, was the fourth ingredient required to make beer, is obtained from grain, primarily barley, and is the main component used in the production of beer that determines the taste. "Here in Gernsheim, we only use barley," reveals plant manager and graduate brewmaster, Berthold Klee. Customers include many major German breweries, but the company also exports to Japan, Namibia, South Africa, Guatemala and the USA.

How malt is obtained from barley

The raw material arrives by truck, rail and barge – Gernsheim has its own barge berthing facilities – close to the malting plant. Before it is stored in the 50-metre high round silos, the incoming barley is examined by the company's own laboratories for grain size and determines the water and protein content. The key factor, however, is the germination capacity of the seed, since germination is the step in the process that will ultimately determine whether the barley can be used for brewing purposes. During the germination process, enzymes are formed that enable the starch present in the barley to be transformed during the actual brewing process into maltose. By adding yeast in the fermentation process that follows, the maltose is fermented into alcohol. "Although the original grain contains enzymes, there are not enough of them to convert the starch into sugar," explains Klee.

The barley is now transferred by belt conveyors from the silos into one of the three germination towers, which have a diameter around four times greater than the round silos. The germination tower is the core element of the malt house, because this is where the barley is turned into malt. The process begins at the top of the tower and ends on the ground floor. The so-called germination chambers, consisting of large round areas each covered with 250 tons of barley, are found on the upper floors. The ceiling is covered with drops of water, the humidity of the air is high. It is like being in a steam bath. Before the

barley can germinate here, it is first steeped in water in large vats. With a water content of 45 per cent, it is then transferred to the so-called germination chamber and is allowed to germinate there for a period of six days. To ensure uniform germination, it is constantly moistened, aerated and turned. "Basically, we do nothing different from someone who places seeds in a saucer on the window sill, adds water, and lets them germinate until they are ready to be mixed into a salad to improve the taste," says Klee. "The only difference is that we end the germination process after six days and the seeds are then dried a couple of floors down," adds Konrad Lord, the production manager.

Drying – CHP territory

The atmosphere on the third and first floors is more like being in a scented sauna: aromatic malt aroma, plus a cosy temperature of 65 degrees Celsius (149 °F). Four load ventilators blow 450,000 cubic metres of air an hour into the so-called kilns to dry the malt to raise the temperature to 85 degrees Celsius (185 °F). The humidity level subsequently drops from 45 to just 4 per cent. Covered with drying malt, the floor of the kiln appears to be coated in caramel. This is where the two natural gas-fired CHP plants of Rolls-Royce are used. "We need an enormous amount of heat for the drying process," explains Klee. A hot water boiler delivers up to six megawatts of thermal energy. Relief is provided by the two MTU GC 357 N5 CHP plants, which generate around one megawatt of thermal energy. To operate as energy efficiently as possible, the malt house also uses "waste products" to heat up the air, such as the waste heat from the CHP plants or the heat dissipated during the drying process. The latter is initially used to heat up the fresh air for the drying kilns via a heat exchanger before the CHP plants are added when the temperature has risen to 60 degrees Celsius (140 °F). When the temperature reaches 85 degrees Celsius (185 °F), the maximum temperature reached in the drying process, the energy is supplied from the hot water boiler. The approximately 700 kilowatts of electrical energy produced by the plants in addition to the thermal energy are fed into the company's own grid. The plants operate with



The two type GC 357 N5 CHP plants equipped with MTU Series 400 engines deliver around one megawatt of thermal and approx 700 kilowatts of electrical energy. (Picture: Marcel Mayer)



The germinated barley is now allowed to dry again in so-called drying kilns at temperatures of up to 85 degrees Celsius (185 °F). Part of the heat is supplied by the two natural gas-fired CHP plants of Rolls-Royce. (Picture: Marcel Mayer)

an overall efficiency of almost 90 per cent. “A malt house needs a lot of energy, which is why it is the ideal place for CHP plants,” says the plant manager. In addition to the 800 cubic metres of water required daily – by way of comparison: a four-person family uses around 150 cubic metres a year – the malt house consumes four to five million kilowatt hours of gas and 800,000 to 900,000 kilowatt hours of electric power a month. “And we benefit of course from the public funding of the CHP plants as a result of the Combined Heat and Power Generation Act.”

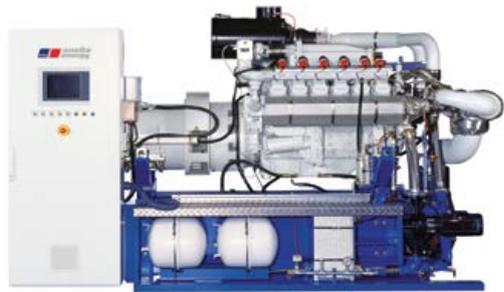
Continuous operation of CHP plants

Since the plants were installed in the basement of a germination tower in July 2011, they have been running virtually non-stop for around 23 hours a day. They are only switched off when the malt is exchanged in the kiln. “Our aim is to generate between 180,000 and 200,000 kilowatt hours a month with each unit.” How did Durst Malz hear about Rolls-Royce? “Through the building technology company Helmut Herbert GmbH, who had already installed the hot water boiler. Herbert has already been working closely with Rolls-Royce for many years,” the plant manager explains. “We knew that Herbert has powerful and reliable partners, which is why we decided to go to another manufacturer in Augsburg to replace the previous cogeneration plants we had – and are completely satisfied with the result.” Rolls-Royce supplied the main component, the CHP modules and the associated switchgear. “The modules consist of MTU gas

- 1 The barley is also given a visual quality inspection. (Picture: Marcel Mayer)
- 2 The barley then transferred to the so-called germination or malting chambers, where it is allowed to germinate for a period of six days. To ensure uniform germination, it is constantly moistened, aerated and turned. Pictured: production manager Konrad Lord taking a sample. (Pictures: Marcel Mayer)
- 3 In the company’s own laboratories – here we see laboratory assistant Barbara Secker – the incoming barley is examined for grain size, water and protein content. Only when the barley complies with the quality standards specified by Durst Malz is it then stored in the 50-meter high silos. (Picture: Marcel Mayer)



engine, generator, waste heat exchanger, exhaust silencer, module control system and power control cabinet. All these components are mounted on a base frame, complete with piping and cabling.” elucidates Peter Grüner, Head of Sales Germany Gas Power Systems at Rolls-Royce. “As our client, Herbert then installed the plants at Durst Malz, complete with all auxiliary equipment – this included the ventilation system, flue gas system, lubricating oil system, the connection to the natural gas supply, plus the heating and electrical installation. We then called in our specialists from Augsburg to carry out the commissioning of the CHP plant.” Following commissioning and start-up, service technicians from Rolls-Royce look after the plant and are responsible for such things as routine maintenance of the CHP units.



The two type GC 357 N5 CHP plants equipped with MTU Series 400 engines deliver around one megawatt of thermal and approx. 700 kilowatts of electrical energy. (Picture: Marcel Mayer)

Enough malt for 70 Munich Oktoberfests

The malt house has a throughput of 8,000 to 9,000 tons of barley each month, with production running non-stop 365 days a year, summer and winter. “During the summer months, we deliver more, simply because people are more thirsty then.” Whether months prior to the Oktoberfest are the high time of the season? “No,” says Klee with a mischievous smile. It may be a really big party in Munich, but the malt production for the Oktoberfest is only a very small part of the summer production. By comparison: at the Munich Oktoberfest in 2011, visitors consumed some 7.5 million litres of beer. Every year at the Gernsheim location, Durst Malz produces malt for around 538 million litres – enough malt for over 70 Munich Oktoberfest a year!

“A malt house needs a lot of energy, which is why it is the ideal place for CHP plants,”

Berthold Klee

Plant manager and graduate brewmaster

1 Ship unloading

The raw material arrives by truck, rail and barge – Gernsheim has its own barge berthing facilities – close to the malting plant. Via a belt conveyor, a huge vacuum unloader transports 60 to 80 tons of barley an hour into one of the round storage silos. (Picture: Marcel Mayer)

2 In conversation

Peter Grüner, Head of Sales Germany Gas Power Systems at Rolls-Royce, in conversation with Berthold Klee, plant manager at the Durst Malz Gernsheim location. (Pictures: Marcel Mayer)

3 Soft tub

The barley is first steeped in water in large vats until it has a water content of 45 percent. (Picture: Marcel Mayer)

