



Combined heat and power with biogas

FROM PIG FARMER TO ENERGY PRODUCER

Who Pietro Bertesago and Giovanni Bertoni
What GR 370 B5 CHP modules with MTU Series 400 engines
Where Moscazzano and Sospiro, two villages in the northern Italian province of Cremona (near Parma)

Pietro Bertesago rears pigs for the production of Parma ham. In 2008, he was the first farmer in the northern Italian province of Cremona to install a biogas plant and two years later, he introduced a second one. Both plants are based on combined heat and power modules (CHP) from Rolls-Royce. The 12-cylinder, Series 400 engines each produce 282 kW of electrical power (kWel). The Italian government pays Bertesago 28 cents per kilowatt-hour – more than anywhere else in the world. Dairy farmer Giovanni Bertoni also has a CHP plant which feeds around 250 kWel into the public grid around the clock.

Cremona, Italy: The biogas business is booming in Italy. The country has the highest subsidy levels for biogas-based electricity production. The Italian government has undertaken to pay 28 cents per kilowatt-hour up to a maximum of 999 kWel for a period of 15 years to each eligible plant which went into operation by the end of 2012. For plants which went into operation before 2009, the maximum subsidy period is even longer – 20 years. One of those to profit from the scheme is Pietro Bertesago, a pig farmer from Moscazzano in the northern Italian province of Cremona, who installed the first biogas plant in the region in 2008. His farm, which is about an hour's drive from Parma, is home to 2,000 pigs which are being reared for Parma ham production.

“The future is in biogas, not pig farming.”

Pietro Bertesago

Pig farmer from Moscazzano

From pig farmer to energy farmer

The high feed-in tariff was not the only reason Bertesago built his biogas plant. There was also a one million euro loan for which the provincial government in Lombardy took over the interest payments in order to encourage farmers to make the investment. Bertesago used the opportunity to develop the biogas plant as a second source of income because pig farming alone was no longer a high earner. As the farmer recognized at the time: “The future is in biogas, not pig farming.” And that is how his first biogas plant started up in 2008. The plant was supplied by the Austrian company ‘Thöni Umwelttechnik’, which specializes in developing and building plants for generating electricity and heat from renewables. Together with ENplus Italia and MTU Italy, Thöni developed a biogas plant and container which met EU specifications as well as Italian regulations.

The core of the generating plant came from Germany: a type GR 370 B5 CHP module from Rolls-Royce in Augsburg. The module is based on a 12-cylinder MTU Series 400 biogas engine and the system produces a maximum of 370 kW of electricity and 241 kW of thermal energy. Bertesago feeds the electricity into the public grid and in winter, he uses the heat from the engine to heat his pigsties.

To increase his power output, two years after building the first biogas plant Bertesago added a second CHP unit, likewise based on an MTU Series 400 engine. In reduced operating mode, each of his CHP plants now produces 282 kWel to achieve the 564 kW maximum output capacity a farm of this size is allowed to feed into the grid.

Back-up pays

The farmer could also achieve the same output with one larger engine. That would mean reduced purchase and maintenance costs. But the solution with the two smaller MTU engines also has advantages – such as the reduced risk of failure. If one engine fails, the other can be operated at its maximum output of 370 kWel. That also means that none of the valuable biogas is lost because the bacteria in the fermenter continuously produce methane that cannot be allowed to escape into the atmosphere unburned because it is considerably more damaging than carbon dioxide. So, if Bertesago cannot burn his biogas in the CHP plant, he has to use a flare to burn it off. Of course, with two plants that is unlikely to happen because the probability that both of them will fail at the same time is negligible. And the two plants are only ever switched off one at a time for maintenance which comes up around eight times a year or once every one thousand hours of operation. Although the maintenance costs for two small modules are higher than for one large one, MTU Italy offers favorable package prices for multiple units so that the extra maintenance cost for two units is a maximum of 15 %. And this difference is more than made up for by continuous electricity production and feed-in at Rolls-Royce's extremely high efficiency rates. Plants based on this back-up principle also have additional financial and insurance benefits because banks and insurance companies recognize the increased security in the form of more favorable credit and premiums.

The biogas is produced just a few meters from the sties in a large fermenting tank for corn, liquid manure and glycerin. Bertesago's 2,000 pigs produce around 30 tons of liquid manure a day and this is used to produce biogas. The methane content of pig manure is significantly higher than cattle manure so that the biogas yield is also higher. Nevertheless, the energy content of the liquid manure alone is not enough for biogas production and an additional 20 tons of corn, 2 tons of glycerin and 40 tons of water are therefore fed into the



CHP plant with MTU type 12V 400 biogas engine. The compact cogeneration module from Rolls-Royce is available with 6 and 12-cylinder Series 400 biogas engines. It produces 120 to 400 kW of electric energy and 160 to max. 540 kW of thermal energy. (Photo: MTU)



With their CHP plant from Rolls-Royce, Andrea (l.) and Pietro (r.) Bertesago produce electricity which is fed into the public grid. (Photo: Rolls-Royce)

fermenting tank. Twice a day, the farmer has to fill the mixer with corn silage but the dosages and supplement rates for the other constituents are calculated automatically and are computer-controlled. In addition to looking after his pigs, Bertesago's daily routine now includes checking the temperature in the fermenter and taking engine data readings. If any irregularities occur, he can contact his customer service technician at MTU Italy who has remote access to his engine data and can adjust settings or maintenance instructions as needed.

Bertesago aims to completely pay off the loan for building the plant in ten years. His maximum feed-in rate of 564 kW for 360 days a year will produce revenues of around € 1.35 million a year. That also has to cover the cost of producing additional corn crops which he now needs not only to feed his pigs but also for biogas production.

Learning by example – Biogas plant in neighboring village

Just a few kilometers from Bertesago's farm, in the village of Sospiro, is where dairy farmer Giovanni Bertoni has his 300 year-old farm with

500 cows which produce around 10,000 liters of milk a day. Since 2010, Bertoni has also had a biogas plant with a type GR 370 B5 CHP module from Rolls-Royce.

Like Bertesago, he also began with a smaller plant and is currently feeding 250 kWel (max.) into the public grid because in Italy it is much simpler to get approval for smaller CHP plants up to this size. He uses the heat from the engine to warm the cows' drinking water in winter and the additional hot water produced is also used for cleaning the cowsheds. "I want to achieve independence with my farm and I also want to close the circle so that everything which is produced here is utilized," said Bertoni. He, too, uses the liquid manure from his animals to produce biogas – ten cubic meters of manure per day go into his fermenter. He has bought extra fields so that he can grow enough corn for biogas production and he now cultivates 125 hectares of land. And the plan is for even further increases as Bertoni wants to build an extra cowshed for another 150 cows in order to increase biogas production. "Our MTU engine can produce 370 kW and we want to use that to the full," said his son Sirio.

- 1 CHP plants can produce electric and thermal energy simultaneously. (Photo: Rolls-Royce)
- 2 Corn and liquid manure ferment in a tank to produce biogas which powers the CHP plant. (Photo: Rolls-Royce)

The Italian government pays
28
 CENTS PER kWh



Like Bertesago and Bertoni, more and more Italian farmers are deciding to move into energy production. By 2020, the Italian government wants to cover at least 17 % of the nation's energy consumption from renewable sources, and 40 % of that target amount is earmarked to come from biomass. That is why the government is offering farmers incentives in the form of attractive feed-in tariffs, tax breaks and favorable loans for biogas plant construction. Nevertheless, potential energy producers know how important reliable plant with low failure potential is for long-term success. In MTU Italy, farmers have a reliable partner on site who can provide expert advice and outstanding plant maintenance on excellent terms.

“I want to achieve independence with my farm and I also want to close the circle so that everything which is produced here is utilized.”

Giovanni Bertoni
Diary farmer



Liquid manure from pigs and cows is used to produce biogas which powers a compact cogeneration plant from Rolls-Royce. (Photo: Rolls-Royce)

Customer service for gas engines. Alessandro Maiocchi from MTU Italy provides customer support in the form of service and maintenance work and explains the special features of an MTU biogas engine. (Photos: Rolls-Royce)

