The biogas plant was built on the farm, named Kögelhof, in 2004. The Müller family who owns the farm continued with dairy farming for another 4 years before switching completely to biogas production in 2008.

Natural energy sources

The Kögelhof smallholding is situated in the Ravensburg district. It is a family-owned farm and has been dedicated to producing biogas that can be converted into energy since 2004.

Farmer Hermann Müller grows the required feedstock himself on 180 ha of arable land. The energy produced is sufficient to supply not only the farm itself but also another 1,400 households with electricity. The waste heat is used to heat the local school building.

Sustainable energy and heat for the neighbourhood

Hermann Müller compares the functionality of a biogas plant with the way a cow's stomach works, and he should know. After all, dairy cattle were once reared on the Kögelhof.

"Like the agitators in the fermenter, the muscles of a cow move the organic matter. It is decomposed by microorganisms in the warm, airtight environment and biogas is developed."

In the Kögelhof plant, five engines which generate electricity with the help of a coupled generator – up to 4.5 million kilowatt hours per year – are run by the biogas. This power is fed into the electricity grid and can cover the energy requirements of around 1,400 households.

efficiently used

The resulting waste heat is also used in a targeted manner: The local utility company has laid a 1.4-kilometre district heating pipeline to the school centre. Both the building and the swimming hall are now heated in a biologically sustainable way, leading to an annual heating oil saving of 80,000 litres. An adjacent new development area will also be heated with biogas in the future.

Since the energy production at the Kögelhof farm is demand-driven, more is produced in winter than in summer.

"This inevitably increases the biomass throughput, which has not always allowed the full energy potential to be exploited so far," says **Hermann Müller**. "With high production volumes, there is always a certain amount of residual energy in the end product of the biomass, the so-called fermentation substrate. For this reason, we were looking for a solution to produce really sustainably and get almost the entire energy from the biomass."

Hermann Müller has found the right solution with the company Weber Entec.

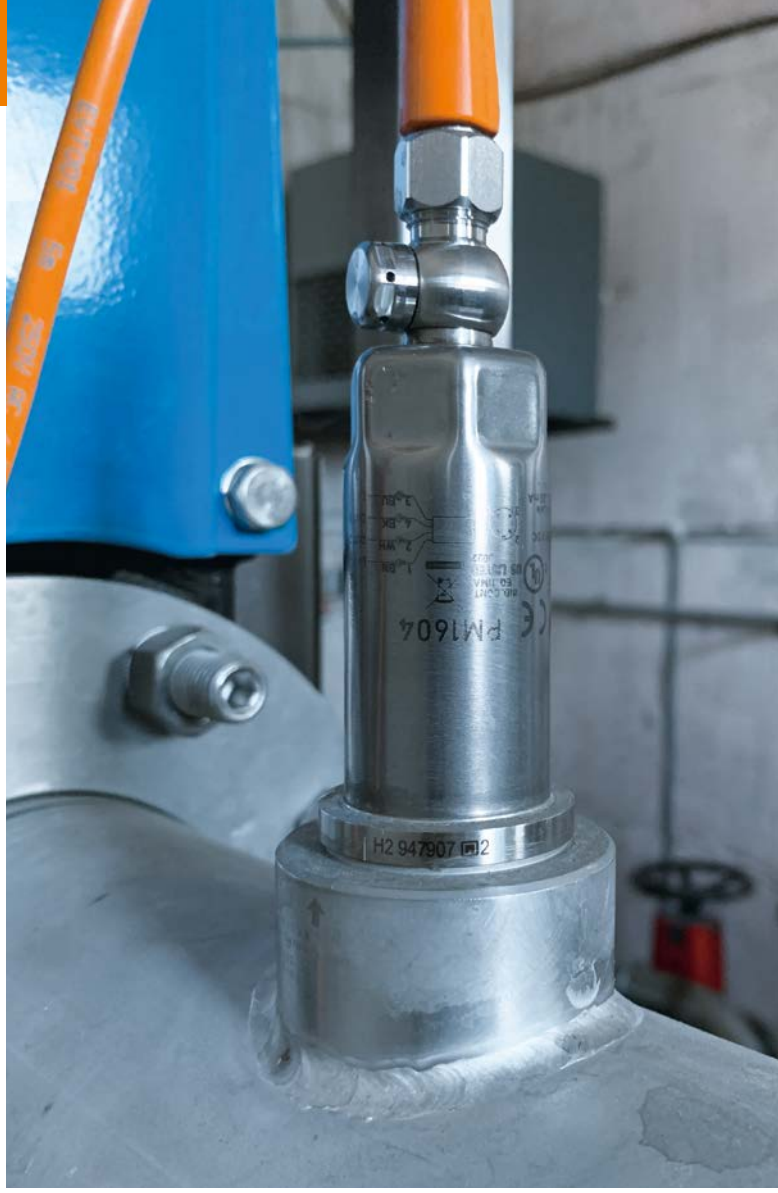
Ultrasonic disintegration

Weber Entec specialises in plant construction for ultrasonic-based applications in the field of environmental technology, in particular disintegration – the ultrasonic treatment of biogenic substances.

This process increases the surface area of the fermentation substrate – in technical jargon, this process is called digestion. The increase in surface area accelerates the organic decomposition process and increases the energy yield.

In ultrasonic disintegration, the electrical vibrations produced by a generator are transformed by a converter into mechanical vibrations (sound transducer). These vibrations are transmitted into the surrounding medium via a so-called sonotrode. Here, they alternately cause high overpressures and underpressures in rhythm with the ultrasonic frequency, depending on whether the transducer is expanding or contracting. During the negative pressure phase, microscopic vapour bubbles form

In the ultrasonic disintegration plant, biomass is processed for maximum energy yield.



The ifm pressure sensor PM1604 with its robust ceramic-capacitive pressure measuring cell is ideal for monitoring the pump.

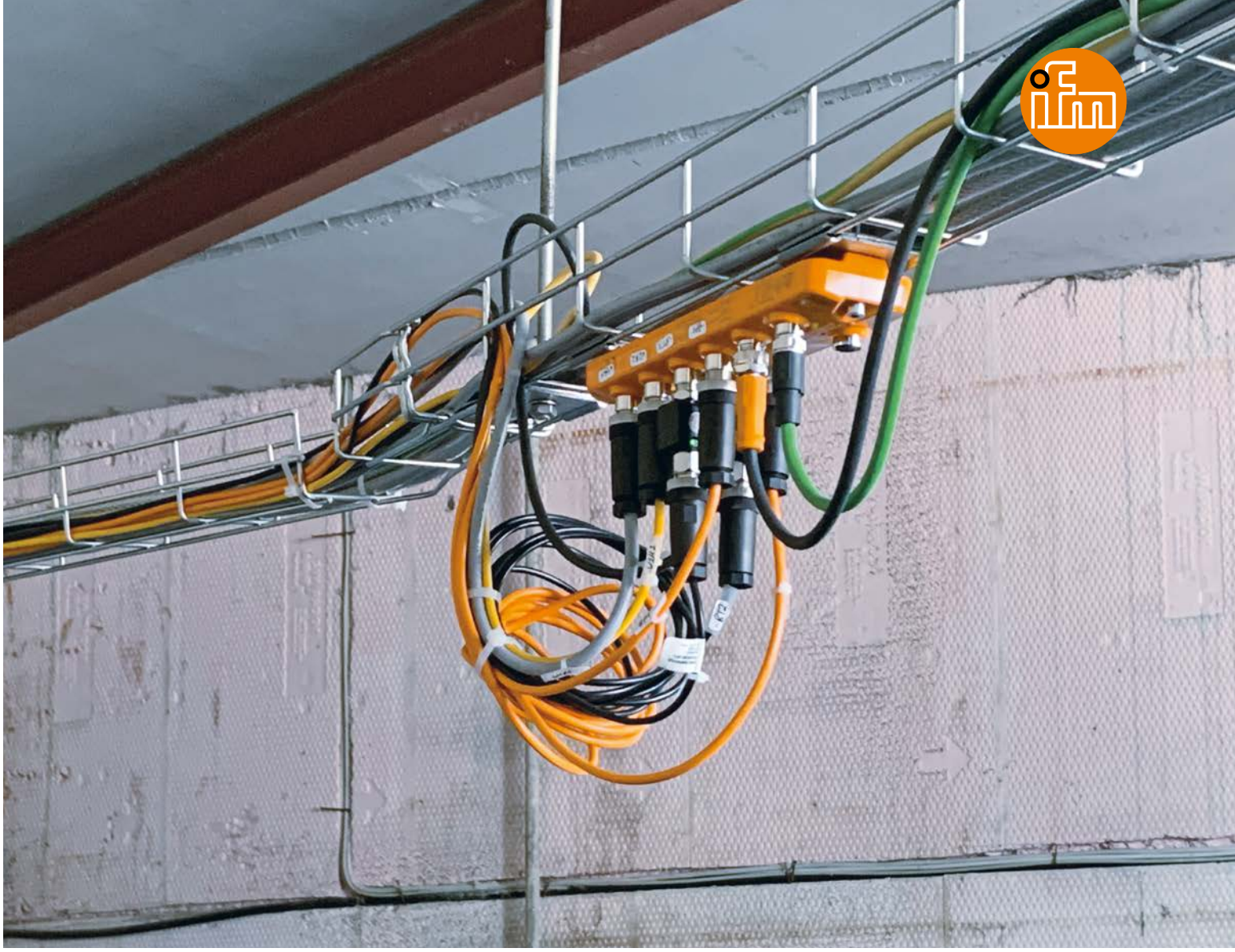
> *The sensors are very precise and reliable. IO-Link in particular has enabled us to improve our controller significantly.*

in the sonicated liquid and implode in the subsequent positive pressure phase. This process is called cavitation. The implosions release high pressures and temperatures, further propagating the disintegration process in the biomass.

Pressure monitoring at the pump

Weber Entec relies on sensors and IO-Link masters from ifm to monitor the disintegration in this plant. For example, at the pump on the main fermenter, where the fermentation substrate is pumped into the ultrasonic system and back again. The sensors monitor the pump by measuring the pressure on the suction and discharge side. They also protect the ultrasonic generation and control the flow when the line pressure loss is too high.

The flush pressure sensor PM1604 is very well suited for this application thanks to its robust ceramic-capacitive pressure measuring cell. The measuring cell is resistant to particles in the medium, while the flush process connection prevents deposits on the measuring cell.



Several IO-Link sensors and actuators can be connected to the IO-Link master. The latter also serves as a gateway and communicates with the plant controller via PROFINET.

Added value thanks to IO-Link

The sensors are connected to the controller via IO-Link. In concrete terms, this means: The sensors communicate with the IO-Link master via IO-Link. Several sensors can be connected to the latter which bundles the signals and communicates with the controller via field bus, in this case Profinet. The wiring complexity is, therefore, considerably reduced.

This communication path, which is digitalised from end to end, allows more than just the loss-free transmission of the measured value. It is for example possible to use IO-Link for reading minimum and maximum values from the sensor, which provide information about possible critical short-term pressure peaks. The status of the sensor can be checked via diagnostic data at any time. All this data on top of the mere measured value helps to avoid unplanned failures of the system.

The parameters of the PM1604 are also set via IO-Link. The measuring range, for example, can be freely scaled within limits and optimally adapted to the application.

Christian Eichhorst, Managing Director of Weber Entec GmbH & Co. KG summarises it as follows: "The sensors are very precise and reliable. IO-Link in particular has enabled us to improve our controller significantly. IO-Link offers very great advantages such as reduced wiring complexity or the direct reading of various parameters, e.g. the peak pressure."

Bottom line

Efficient use of resources – this maxim applies to both the energetic utilisation of biomass and the sensor technology used, which outputs more than just measured values thanks to IO-Link. This provides maximum transparency in process monitoring and ensures an efficient and trouble-free operation of the biogas plant.