

Delving into the integration of biogas and bioethanol production in Argentina with Krieg & Fischer Ingenieure and Bioelectrica

# A match made in heaven

**R**io Cuarto biogas plant in Argentina demonstrates that biogas can successfully be included in the bioethanol value chain. Based on this project, anaerobic digestion (AD) offers a proven solution for thin stillage from corn-based ethanol production, commonly evaporated with high energy consumption.

The plant was constructed in collaboration between German engineering company Krieg & Fischer Ingenieure, which developed an anaerobic fermentation system, and Argentinean project developer Bioelectrica.

Leftover from the ethanol production, thin stillage contains all non-starch components and still has plenty of available energy potential. Most ethanol producers use the thin stillage to create animal feed ingredients, but its high water content makes the process costly, for the plant owners and the environment.

In the case of Argentinean

bioethanol producer Bio4, consumption of natural gas for the evaporation of waste from ethanol production was 581 Nm<sup>3</sup>/h. In addition to the initial idea of finding a solution for thin stillage, the construction of a biogas plant provided an opportunity to sell renewable electricity, as well as tackle the high demand for heat in the bioethanol process. Finally, the digestate from the plant could be used by corn producers and farmers who already invested in the bioethanol plant, as a high-quality natural fertiliser.

However, the design, construction, and operation of biogas plants based on thin stillage is not a simple task. In terms of AD, grain stillage differs significantly in the contents and other characteristics from other common stillages treated anaerobically (from juice, molasses, rice, fruits, potatoes, for example). Processing thin stillage as feedstock in biogas plants requires technology that can

deal with high temperature, acidity, and inhibiting components, such as high protein, high sulphur content – often unbalanced nutrients. These disadvantages must be compensated through adequate process design.

With 30 years of experience in biogas sector and the team of highly-skilled engineers working on an interdisciplinary basis, Krieg & Fischer Ingenieure's engineering team was responsible for the tailor-made engineering and the commissioning of Rio Cuarto biogas plant. The cooperation between Krieg & Fischer Ingenieure and Bioelectrica started in 2013, with the construction of the Rio Cuarto I biogas plant, using energy crops.

In 2016, the decision was made that the plant should be extended and adapted with the addition of thin stillage from bioethanol production and integrated with a bioethanol factory.

The Rio Cuarto II biogas plant was commissioned in 2017/2018. It is an industrial

biowaste plant designed to process 130,000 tonnes per annum of thin stillage from corn-based bioethanol production. The reception tank and equipment needed to be designed according to highly-corrosive conditions. A continuous stirred tank reactor system was chosen for the digestion system, as it is biologically more robust than digesters with biomass retention, even if the required tank volume is larger.

The digester tank is designed to handle a delivered amount of 14 m<sup>3</sup> of thin stillage per hour. The tank itself is a glass-coated, bolted steel structure with a volume of 8,000 m<sup>3</sup> and is equipped with one top-mounted agitator. For an optimised hydraulic retention time and getting a proper gas storage capacity, the plant has a secondary digester with a double membrane gas holder roof. The operation temperature is mesophilic.

The facility's total biogas production is 900 m<sup>3</sup>/h, powering two 1.2 MW (electric) combined heat and power (CHP) units. The electricity is fed to the public grid and the heat is used for ethanol production, substituting natural gas.

During construction, the existing plant was operational and all working procedures had to be adjusted to these conditions.

The adequate solution for the AD of thin stillage was not the only step forward for biogas and bioethanol industries made with this project. An improvement in the bioethanol production process through the recirculation of process



View of the Rio Cuarto facility



Digestion of thin stillage at the Rio Cuarto plant

water was also important. The process water from the biogas plant is partly re-circulated to the bioethanol plant and local engineers from Bioelectrica developed the technology to reuse it in the production process,

reducing the consumption of water, energy, urea, and other components. As a result, the bioethanol plant's operational costs were lowered.

The Rio Cuarto II biogas plant has been operational since 2018, proving that

the mono-fermentation of thin stillage is possible. Experience from operating the plant shows it requires a high monitoring effort. An optimum nutrition supply for the bacteria is essential to achieve stable operation. With constant monitoring of the process, regular lab tests, and support from Krieg & Fischer's engineers, the system is stable and the project has achieved its objectives.

For its outstanding work on integrating biogas and bioethanol production in Rio Cuarto, Krieg & Fischer Ingenieure was crowned the winner of the AD & Biogas World Biogas Expo Award 2020 in the Circular Economy Award category, in October 2020. According to representatives of the AD & Bioresources Association and the World Biogas Association, AD is the heart of the circular

economy and this prize is all about closing the loop and bringing an end to waste.

Following the good example set in Argentina and discovering a solution that has been proven on an industrial scale, project partners hope that more bioethanol plants will discover and utilise the great potential of biogas, helping to achieve the necessary climate goals. ●

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