



May 2019

Utilization of biogas CO₂ adds another level to the circular economy

After yet another summer with scarce resources of CO₂ for both food & beverage applications and for industrial usage, the CO₂ from biogas is now seriously considered a low-hanging fruit. Not all upgrading technologies are suitable for adding a CO₂ Liquefaction unit – however both amine and membrane plants are.

The content of CO₂ in the raw biogas is approx. 40-45% and without a CO₂ liquefaction unit installed, the CO₂ is vented to the atmosphere. It is not profitable in all cases though, to add a CO₂ plant, the biogas plants need to be of a certain size before it pays off, this must be evaluated case-by-case.

Biogas and Food Grade CO₂

Utilization of the CO₂ from biogas production is already known and used in the UK, mainly from membrane solutions delivered from another Pentair company; Pentair Haffmans. These plants utilize biomass from energy crops, such that the biomass composition is well known.

First plant in Denmark to recover CO₂ from anaerobic digestion is soon in operation

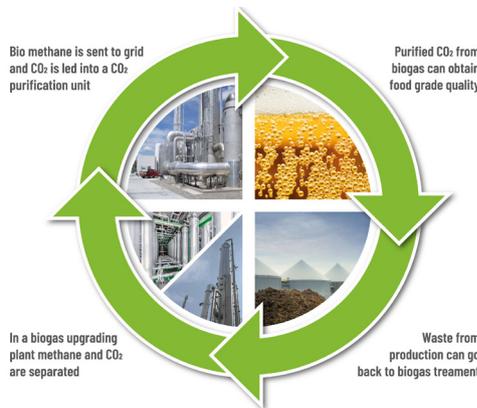
At the moment of time, the first plant in Denmark to recover CO₂ from anaerobic digestion of manure and organic industrial waste is being built by Pentair Union Engineering. The plant will be commissioned in the spring of 2019 and produce food grade CO₂. Industrial Gas Company Strandmøllen will own the plant, and recover CO₂ at Korskro, Denmark. The biogas plant is owned and operated by Nature Energy.

Biogas CO₂ complexity

There are several reasons why recovering of CO₂ from biogas is a challenge. Biogas consists predominantly of methane and CO₂ that is produced during anaerobic digestion of biomass. In addition to methane and CO₂, a variety of chemical compounds are being formed during the digestion process and since this composition is related to both biomass composition and operating conditions it is hard to predict.

Even very small variations in the gas composition may result in off spec. product quality if the plant has not been properly designed. To ensure the very best product quality, without impurities and odors, Pentair Union Engineering uses a number of proprietary technologies where the heart of the plant is a technology specially designed for the purification of CO₂ from, amongst other things, bioethanol production.

The basic working principle of the CO₂ plant is compression of the CO₂ gas in a CO₂ compressor setup to reach the desired pressure typically at 15-18 bar. After compression of the CO₂ gas, all non-condensable gases are removed by distillation. Accordingly, the plant is supplied with a combined purification and a CO₂ gas condensation system. A refrigeration unit supplies the required refrigeration capacity.



Circular Economy illustration from Korskro

Principles of biogas CO₂ plant

Coming back to the project in Denmark, this describes the principles of the CO₂ technology under construction:

The feed gas to the CO₂ liquefaction plant is coming from an amine based CO₂ extraction recovery plant. The raw gas purity leaving the amine-stripping column is about 98% CO₂, and contains impurities expected from manure digestion. Examples of these impurities are hydrocarbons, aromatics, sulfur components, alcohols etc.

Proprietary technologies implemented

As the Union Engineering CO₂ liquefaction plant needs to purify the liquid CO₂ to fulfill the ISBT quality requirements, a large number of our proprietary technologies are implemented. The overall process design of the plant is considered the most innovative and robust technology the market has seen and will set the benchmark for the future biogas plant segment.

Biogas business profitability is strongly connected to technology performance. The technology investment in biogas, biogas upgrading and eventually a CO₂ liquefaction unit is of course an important factor, in some projects actually the predominant parameter. Over time, this can appear to be an expensive influencer in case the plant availability is not optimum as uptime and efficiency are the drivers for a valuable business case.

Remote service an option

One of the tools Union Engineering is offering as a standard is the installation of an Evon Router in every upgrading plant. In case needed, remote access can be established and an eventual upgrading plant failure can be detected at an early stage and expensive unplanned stoppages can be avoided or minimized.

-/BBA