CASE STUDY

BIOGAS UPGRADING SOLUTIONS

364 DAYS OF PREDICTABLE OPERATION AT SUSTAINABLE FUEL PLANT (SFP) GROUP

Westdorpe is a small village in the Dutch province of Zeeland, located in the South of the Netherlands. Agriculture has always been the main source of income. In 2019, a large biogas digester was constructed there to produce biogas from manure and waste byproducts.

The numbers are quite impressive: The digester consumes 180,000 tons of "waste" biomass (55% manure and 45% waste products from the food and feed industry) to produce ~ 29,000,000 Nm^3 biogas annually. The liquid output from the digester is separated (liquid/solid fraction) and both products are returned (liquids locally, solids exported) to the land as a natural fertilizer. The biogas is upgraded to deliver 18,000,000 Nm^3 of bio-methane annually, which is injected into the national grid supplying approximately 12,000 households. The system produces about 20,000 tons of liquid CO_2 each year, which is primarily sold to greenhouses as air enrichment.

SFP (Sustainable Fuel Plant) Group's mission is to accelerate the energy transition, especially in the transport sector and industry, by upscaling green gas and bio-LNG production. By extracting energy from residual flows, a circular economy is created, and a significant contribution is made to the energy transition.

In 2021, SFP took over the Aben Green Energy Westdorpe site in the Netherlands. This site initially went into operation in 2019 to fulfill the need for a larger-scale installation producing renewable gas and maximizing uptime, with Pentair initially selected as partner for the biogas upgrading and CO_2 recovery part.

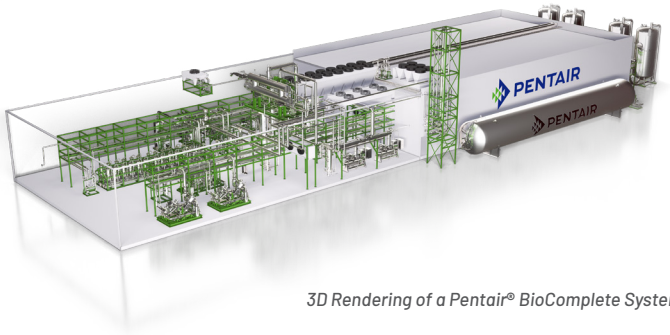
Pentair was involved in the plans for this new large scale installation from day one. The requirements were high: 364 days of operation and reliable biogas production with a comprehensive service concept to ensure plant availability.

The main economic driver for large installations is system availability, commonly referred to as uptime. The digester produces a 24/7 steady gas stream of ~3,600 Nm^3/hour and when the up-grader fails the only way to vent the biogas is flaring. In addition to its very negative impact on our environment, flaring is equal to burning "money", as the turn-over for bio-methane and CO_2 is ~45,000 € a day.

> "Pentair proved to be just the right partner for us. Our demands to the uptime were quite high, but since commissioning, the installation has been running reliably."
>
> *Bas Peters*
> *Operational Diretcor*
> *SFP Group*

To maximize revenue, the design incorporates equipment and by-pass possibilities ensuring maximum availability. The system downtime was reduced to a maximum of 1 day per year. This incorporates the rotating equipment and preventive maintenance requirements for the entire upgrading system since some parts of the installation require a shut down for maintenance purposes.

The Westdorpe installation is divided into three main areas. The pre-treatment is located outside. Here, the raw biogas is dehumidified (dried) and some impurities (such as H_2S and VOCs) are removed by activated carbon. Inside the building, there are two main processing areas separated by walls: the hazardous zone and the non-hazardous zone. In a hallway, the MCC and control system are installed.



3D Rendering of a Pentair® BioComplete System

The compression and separation of CO_2 from methane takes place in the hazardous zone. The compression, cleaning and cooling/liquefaction of the CO_2 takes place in the non-hazardous zone of the installation. This combination of membrane and the cryogenic unit provides the best solution in achieving a 100% methane yield, creating EIGA/ISBT-grade liquid CO_2 with the best running cost (lowest electrical power in this application) and the lowest Capex.

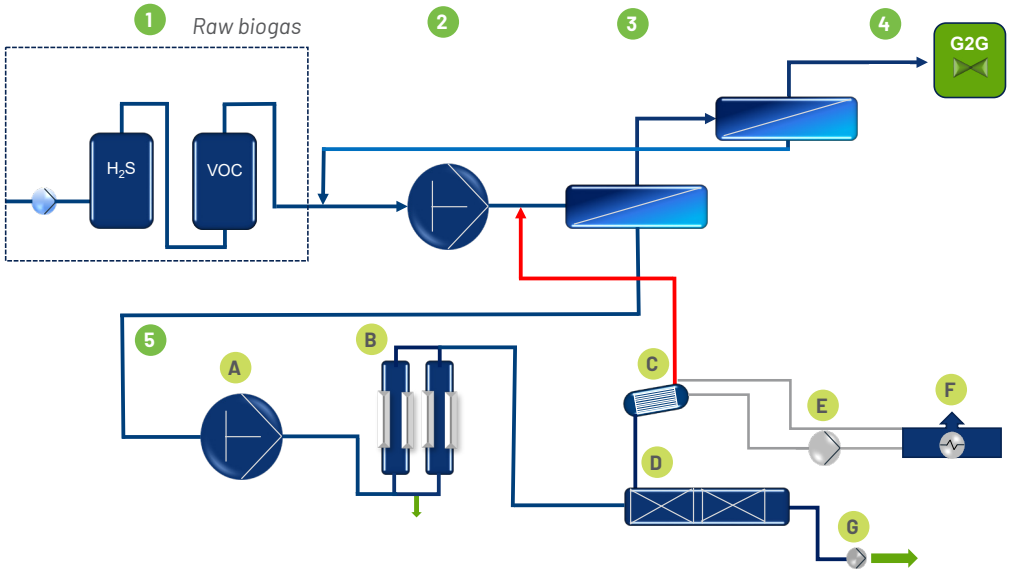
When unplanned trips cause the upgrading system to shut down production, a gas buffer equal to 1 to 2 hours production prevents immediate flaring off. This gives time for the operators and the 24/7 technical support of Pentair to diagnose, trouble-shoot and reset/restart the system. The result is a high-performance installation producing bio-methane reliably.

Based on its success, directly after acquiring the Westdorpe site in 2021, SFP Group awarded Pentair the contract for a biogas upgrading expansion to increase production capacity further.

Airial view of the Biogas Upgrading Plant of SFP Group in Westdorpe, NL

SCOPE OF SUPPLY

1. Pre-treatment biogas
2. Biogas compressor
3. 2-stage membrane unit
4. Biogas outlet gas to grid or optional CNG or Bio-LNG
5. CO_2 Recovery:
   - A CO_2 compressor
   - B Activated carbon filter/drier
   - C CO_2 condenser
   - D Stripper/re-boiler
   - E Cooling compressor
   - F Dry cooler
   - G CO_2 pump



KEY FACTS

LOCATION:
WESTDORPE,
THE NETHERLANDS

START-UP:
2019

CAPACITY:
18.000.000 m^3 OF BIOMETHANE AND 20.000 TONS OF CO_2 PER YEAR

APPLICATION:
BIOGAS UPGRADING SYSTEM TO CREATE A METHANE STREAM AND A CO_2 OFF-GAS STREAM.

FOR MORE INFORMATION:
CONTACT US OR VISIT BIOGAS.PENTAIR.COM

PENTAIR

Marinus Dammeweg 30 | 5928 PW, Venlo | The Netherlands

Snaremosevej 27 | 7000 Fredericia | Denmark

2361 Mason Ave | Daytona Beach, FI 32117 | United States