

BIOGAS SUCCESS STORIES

2020





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Key facts about biogas and biomethane



There are **18,855** biogas plants and **726** biomethane plants in Europe.



Over the past decade, the number of biomethane plants has been **doubling every 4 years**.



In 2019, Europe produced **176 TWh of biogas** and **26 TWh of biomethane**.



It is calculated our industry will be able to produce **370 TWh of biomethane by 2030** and **1,020 TWh by 2050**.



The biogas sector has the potential to reduce worldwide greenhouse gas (GHG) emissions **by 10–13%**. Relative to EU fossil fuels, biogas production can save up to 240% of GHG emissions and biomethane up to 202%.



Scaling up the production of renewable gases has the potential to create **600,000–850,000 direct jobs** and 1.1–1.5 million indirect jobs by 2050.



Renewable methane and hydrogen used throughout the energy system saves society **€217 billion** annually compared to an energy system with a minimal amount of gas.

Sources

- EBA data as of October 2020
- European Biomethane Map EBA GiE 2020
- EBA data as of October 2020
- Global Potential of Biogas – World Biogas Association, 2019
- Gas decarbonisation pathways 2020–2050, Gas for Climate 2020
- The optimal role for gas in a net zero emissions energy system, Gas for Climate 2019
- Job creation by scaling up renewable gas in Europe, Gas for Climate 2019

Biogas basics

Did you know...?



Biogas production is a microbiological fermentation process. This **natural reaction, also called anaerobic digestion (AD)**, is used in a variety of applications, including for example the fermentation of yeast to leaven bread or brew beer. The resulting product, biogas, is made up of 45–85 vol% methane and 25–50 vol% carbon dioxide.



Biogas is produced mainly from organic residues. These can be energy crops, plant by-products, animal by-products, biowaste from households or industrial & commercial organic waste. Additionally, it can be extracted from wastewater streams or landfills. Biogas production is hence an **important tool for waste recycling and recovery**.



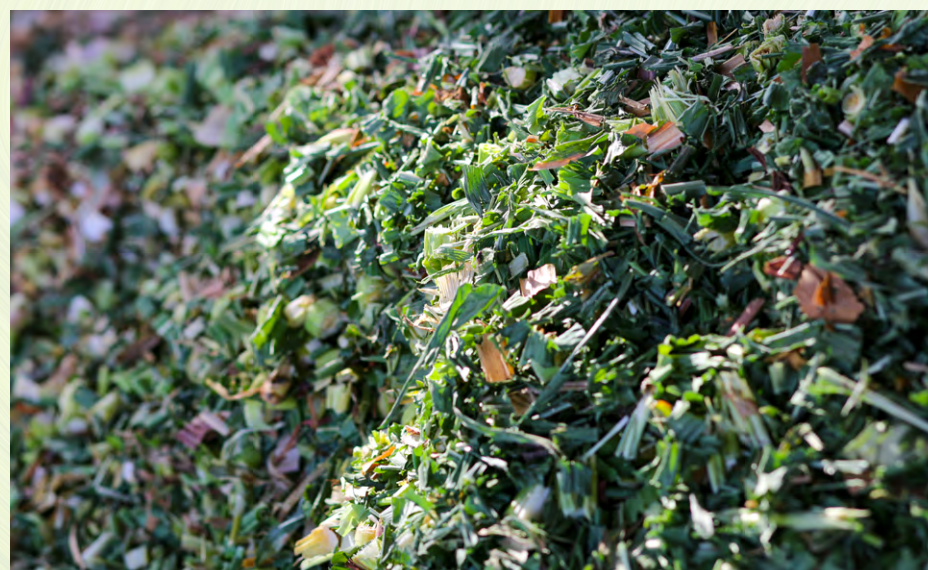
The result of this process is a **renewable gas which can provide heat and power, fuel our vehicles or be used as a raw material in the chemical industry, while protecting the environment and boosting rural development**.



When upgrading biogas, we obtain biomethane. This **purified form of biogas can be injected into the grid and used as a natural gas substitute**. It can be used for all natural gas end-user applications (cooking, heating and cooling, power, transport, etc.).



The competitive advantage of biomethane compared to other renewable sources is that **it can be deployed using the existing gas infrastructure. It can also be easily stored**, providing an alternative to intermittent generation from other sources, such as solar and wind, and ensuring security of supply. Like other renewable energy sources, **it can contribute to the reduction of CO₂ emissions from different sectors**.



A renewable source with multiple applications!

• Electricity & heat

Combined heat and power gas engines (**CHP**) are a **common valorisation route for biogas in Europe**. The idea behind CHP is that the co-generation of electrical and thermal energy is more efficient than generating them separately. CHP systems typically achieve 60% to 80% energy efficiency, compared to 50% for conventional technologies.

• Transport

In the transport sector, **biomethane is used as a biofuel in the form of a CNG substitute, called bio-CNG or bio-LNG**. Biomethane in transport is a high performer when it comes to the reduction of CO₂ emissions, especially if we consider the full the carbon footprint of the vehicles (Well-to-Wheel). Of particular significance in terms of reducing CO₂ emissions is the use of liquefied bio-methane in heavy-duty transport and in the maritime sector, where a switch to electrical power is difficult to achieve.

• Digestate

Digestate is the remaining part of the degraded biomass after biogas production: it is stable organic matter rich in various nutrients. **Digestate can be used directly as organic fertiliser or it can also be upgraded to recover high quality mineral nutrients**. The use of digestate as organic fertiliser allows the recycling of nutrients and offers a substitute for mineral fertiliser of fossil origin.

• Carbon dioxide

The purification of biogas to biomethane also generates carbon dioxide as a byproduct. The **carbon dioxide stream can be re-used** for different applications, including e-fuels production, food industry uses or maximisation of the photosynthesis potential in greenhouses.



Pathway for a negative carbon footprint

As calculated by the World Biogas Association, the biogas sector has the potential to reduce worldwide greenhouse gas (GHG) emissions by 10–13%. The biogas and biomethane industries reduce emissions in many different ways:

- **Biogas and biomethane have substantial potential to reduce emissions from agriculture and waste.** They bring manure from animal farming to the closed and controlled environment of a biogas plant. This methane is captured, optimised and utilised instead of being naturally released into the atmosphere during manure storage.
- Biogas and biomethane plants produce not only energy, but also digestate, which is formed during the process of Anaerobic Digestion (AD). **Digestate is a perfect biological and green fertilizer that can reduce the use of mineral fertilizers**, avoiding the emissions associated with their energy-intensive production.
- In addition, **the inclusion of intermediate crops as feedstocks, for example by building catch crops and cover crops into crop rotation, has a positive effect on soils.** It helps rebuild humus, essential for plant growth, and store carbon, enabling soils to serve as carbon sinks.
- **The process of upgrading biogas to biomethane further avoids emissions when using it to displace fossil fuels.** The upgrading process generates a highly concentrated CO₂-stream which has multiple applications. The CO₂ obtained can be used to produce synthetic methane based on hydrogen, feedstock for the chemical industry or e-fuels. It can also be used in industrial processes, such as the production of recently developed construction materials, achieving the permanent removal of carbon from the atmosphere.

Agro-ecology and rural development with biogas

Strengthening the link between renewable energy and agriculture is essential to create a healthier and cleaner environment and develop a more resilient, efficient and sustainable farming sector. This will enable farmers to diversify their activities by producing bio-fertilisers, protein feed, bioenergy and bio-chemicals. Moreover, giving farmers access to new sources of income has a positive impact on the development of rural areas.

The use of sequential cropping and livestock manure as feedstock for biogas production on farms has many positive effects for the environment and the preservation of biodiversity:

- **Sequential cropping can lead to negative carbon emissions** through the stimulation of natural photosynthesis and the use of carbon capture and storage (BECCS). Additional GHG emissions from chemical industries are avoided by using organic digestate to fertilise the crops, replacing mineral fertilizers.
- **Methane emissions are also avoided when livestock manure is collected to a controlled environment for biogas production.** At the same time, biogas production reduces farmers' dependence on livestock, which is an important source of GHG emissions in the agricultural sector.
- In addition to the positive impact on emissions reductions, sequential cropping done in a regime of **crop rotation helps protect biodiversity and preserve healthy soils.** Farmers rely on healthy and fertile land to grow nutritious food. The humus and carbon contents of the soil are very important indicators in assessing soil health and fertility. Building humus in soil is possible when the land is covered with plants all year long, which is the case when sequential cropping is applied in combination with the use of organic fertiliser.

Biomethane for carbon-neutral mobility

Despite all current efforts from the EU, **transport is the only sector which is not reducing its GHG emissions.** In fact, GHG emissions in the transport sector have increased year on year since 2014. Transport represents **27% of GHG emissions in Europe** according to the European Environment Agency.

Biomethane is a renewable gas that can be used as transport fuel and has the potential to achieve significant emissions reductions in this sector. **All studies on alternative fuels in the last 10 years show that biomethane can reach even carbon negative levels of CO₂ reductions** in the transport sector.

Biomethane is currently the only sustainable fuel besides green electricity which is readily available. Standard Internal gas Combustion Engines (ICE) are compatible with the use of this green gas.

This versatile sustainable fuel can be compressed to Bio-CNG or liquefied to Bio-LNG. It is already being used in light passenger vehicles as Bio-CNG, but also in heavy transport as Bio-LNG and Bio-CNG. In the maritime sector there is increasing interest in the use of biomethane as sustainable fuel. In rail transport, locomotives can replace diesel with Bio-CNG or Bio-LNG.

Acknowledging the role of biomethane in transport can greatly aid the task of decarbonizing mobility. This will support sustainable agriculture and will help mitigate the methane emissions across sectors, facilitating a robust localised production of biomethane throughout Europe.



Who is Who?

Companies and their business areas in a nutshell

Name	Active company offices or sales	Supplier of the entire biogas plants	Supplier of parts of the biogas plants	Operators of biogas and/or biomethane plants	Service provider	Project developer	Bio-methane and biogas trader	Infra-structure operator	Science & Research	Others	Page
3cea	Ireland								✓	✓	14
AB Energy SPA	Italy, UK, USA, France, Belgium, Germany, Mexico, Brasil, Serbia, Poland, Czech Republic, Romania, Bulgaria, Greece, Argentina	✓		✓	✓						14
Act Commodities B.V.	Across most Europe						✓				15
AFS Energy B.V.	Europe				✓		✓			✓	16
Agradu	The Netherlands and Belgium	✓	✓	✓			✓				16
Agraferm Technologies AG	100 references in over 20 countries worldwide	✓		✓	✓						16
Aircodiet	Denmark		✓							✓	17
Air Products PRISM Membranes	USA, Italy, Spain, UK, Czech Republic, France		✓								17
Anaergia	Worldwide	✓	✓	✓	✓						18
Aprovis Energy Systems GmbH	Europe, GUS, South and Middle America, South-East Asia		✓		✓						18
Awite Bioenergy GmbH	Germany		✓							✓	19
Azola	France (looking to develop into European countries)				✓			✓			20
Biogas Research Center	Sweden								✓		21
Biogest Energie- und Wassertechnik GmbH	UK, Italy, Romania, Serbia, the Czech Republic, France and USA	✓		✓	✓	✓					22
Biokraft AS	Norway			✓		✓	✓		✓		22
Biorefine Cluster Europe	Belgium								✓		23
Biothane	Worldwide – More than 650 references in 60 countries		✓		✓				✓		24
bmp greengas	Europe						✓				25
BTA International GmbH	Europe, North America, India, East Asia	✓	✓		✓					✓	25
BTS Biogaz	Italy, France, UK, USA, Japan, Serbia, Latin America	✓	✓	✓	✓						26
Carbotech Gas Systems GmbH	Worldwide		✓		✓					✓	27

Name	Active company offices or sales	Supplier of the entire biogas plants	Supplier of parts of the biogas plants	Operators of biogas and/or biomethane plants	Service provider	Project developer	Bio-methane and biogas trader	Infra-structure operator	Science & Research	Others	Page
China Agricultural University	China								✓		28
CO2Bioclean GmbH	–				✓						28
DBFZ Deutsches Biomasse-forschungszentrum gGmbH	Germany, Countries of the European Union, Togo, Ghana, China								✓		28
Desotec NV	Belgium, The Netherlands, Germany, France, Italy, Denmark, Finland, Sweden				✓						29
DMT Environmental Technology	The Netherlands, Germany, UK, Denmark, Switzerland, Estonia, Sweden, Norway, Spain, USA	✓	✓	✓	✓						30
DSM Bio-based Products & Services B.V	Across Europe				✓					✓	31
Ductor Oy	Sweden, Norway, Germany, Italy, Poland, UK, Spain, France, USA and Mexico	✓									32
Ecospray Technologies	Europe, USA, Malaysia, Indonesia	✓									32
Ecostrat	USA and Canada									✓	32
EIFER - Europäisches Institut für Energieforschung EDF-KIT	Germany								✓		32
Enero Furnizare SRL	Romania, Moldova					✓					33
ENGIE	Worldwide			✓		✓					33
ETW Energietechnik GmbH	Germany, France, Italy, UK, The Netherlands, Denmark, Spain, Canada		✓							✓	34
Evonik Fibres GmbH	Worldwide		✓							✓	35
Fluence Italy SRL	Italy, Spain, Ecuador, France, Brazil, Argentina, Uruguay	✓									36
Fraunhofer IWES	Germany								✓		37
FuelCell Energy	USA, South Korea, all EU States		✓								37
Future Biogas	UK			✓							37
FWE Energy Solutions GmbH	Germany					✓					38
GasUnie	The Netherlands, Germany					✓					38
Gelt International SRL	Europe				✓				✓		38
GM Green Methane	Italy	✓									39
GRDF	France							✓			40
Green Create	South Africa, Mauritius, UK, Belgium, The Netherlands	✓		✓		✓					41
Greenlane Biogas	UK, France, Italy, Germany, USA, Canada, Scandinavia, Asia		✓	✓						✓	42

Name	Active company offices or sales	Supplier of the entire biogas plants	Supplier of parts of the biogas plants	Operators of biogas and/or biomethane plants	Service provider	Project developer	Bio-methane and biogas trader	Infra-structure operator	Science & Research	Others	Page
IES Biogas SRL	Italy, France, Greece, Serbia, Croazia, China, South Korea, Indonesia, Philippines, Argentina, others	✓	✓	✓	✓	✓	✓	✓	✓		43
Inagro vzw	Belgium								✓		44
Institute for Biogas, Waste Management & Energy	Germany, Luxembourg, China, Denmark, Sweden, Norway				✓				✓	✓	44
IOGEN Corporation	Canada, USA, UK					✓	✓		✓		45
Karlsruhe Institute of Technology - KIT	Germany								✓		45
Kemira Oyj	Sweden, Denmark, France, Belgium, The Netherlands, Spain, Finland, UK, Norway, Czech Republic, Slovakia, Slovenia, Hungary, Poland and Austria									✓	46
Landwaerme GmbH	Germany, UK, The Netherlands, Switzerland, Italy, Austria, Hungary, Poland, Sweden, Spain, Denmark				✓	✓	✓				47
LIQAL B.V.	Europe		✓							✓	48
Malmberg	Sweden, Norway, Finland, Germany, UK, Denmark, Italy, China	✓	✓		✓						48
MARTIN GmbH für Umwelt- und Energietechnik	Europe except for Germany & Austria	✓	✓								49
N2 Applied	Europe and South Africa									✓	50
Nature Energy A/S	Denmark, France & UK			✓		✓	✓		✓	✓	51
Nedgia	Spain							✓		✓	52
New Energy Coalition	The Netherlands								✓	✓	53
OrangeGas	The Netherlands									✓	53
Ørsted	Denmark			✓						✓	53
Paques BV	The Netherlands									✓	54
Pastoor Consult	The Netherlands, Italy and Germany	✓				✓	✓			✓	54
Pentair	Worldwide, in particular: Europe, North and South America, Asia Pacific, Africa				✓					✓	55
Peters Agrartechnik	Belgium									✓	56
Politecnico di Torino	Italy					✓			✓		57
QED Environmental Systems	USA, UK, France and China									✓	58
Regas Srl	Italy		✓							✓	58
Renewtec – Renewable Energy Technology International AB	Sweden, Germany, Denmark, Lithuania and Poland								✓	✓	59

Name	Active company offices or sales	Supplier of the entire biogas plants	Supplier of parts of the biogas plants	Operators of biogas and/or biomethane plants	Service provider	Project developer	Bio-methane and biogas trader	Infra-structure operator	Science & Research	Others	Page
revis bioenergy GmbH	Germany	✓	✓	✓		✓					59
RI.SE	Sweden								✓		60
SAFE Spa	Italy		✓							✓	60
Schaumann BioEnergy Consult GmbH	Germany								✓	✓	61
SeekOps Inc.	USA				✓					✓	61
Shell	USA, Europe						✓			✓	62
SHV Energy	–									✓	62
streisal GmbH	Worldwide		✓								63
STX Commodities	The Netherlands									✓	64
SWEN Capital Partners	France, Italy, Belgium, Germany, The Netherlands, UK									✓	64
TAGUSGÁS - Empresa de Gás do Vale do Tejo	Portugal						✓	✓			64
Technische Universität Wien – TUWIEN	Austria								✓		65
TerraX	Italy					✓					65
TNO	Europe								✓		65
TOTAL	The Netherlands, Germany, Belgium and France			✓			✓				66
TTW legal	Poland									✓	67
UBE Europe GmbH	Worldwide		✓							✓	67
Universität für Bodenkultur Wien – BOKU	Austria								✓	✓	67
University of South Wales	UK, Worldwide								✓		68
Vaisala Oyj	Most EU countries, United States, China, Japan, Malaysia, Australia		✓							✓	69
VSL B.V.	The Netherlands									✓	69
XYLEM Water Solution AB	Worldwide		✓								70
YARA International ASA	European-wide									✓	70

The list includes EBA members up to 30 October 2020.

Success Stories

The EBA supports the role of biogas and biomethane as renewable energy, which can play a central role in the needed energy transition. We are committed to promoting the versatility of our sector by stimulating further research and development and implementation of new technologies as well as to raising awareness on socio-economic and environmental benefits.

The present booklet features some of the many success stories that are contributing to an effective energy transition in Europe. Written in collaboration with our members, these case studies show how the biogas industry is developing successful solutions to tackle challenges that we face today such as process optimisation and energy efficiency.

The EBA is representing directly and indirectly 7000 stakeholders, including national biogas associations, companies, plant operators, project developers as well as universities and research institutes from inside and outside Europe.

The biogas sector has a strong role to play in Europe to ensure sustainable energy, sustainable agriculture and waste handling. The EBA will continue to play its part, building together a climate-neutral Europe.

3cea



COMPANY INFOS

Company name: 3 Counties Energy Agency (3cea)
Phone: +353 (0)56 7790856
E-Mail: contact@3cea.ie
Website: www.3cea.ie
Active biogas activities in the following countries: Ireland



TYPE OF SERVICES

- Science & research
- Others: 3cea operates as regional energy agency in the South East region of Ireland.
- Biomethane EU project: REGENERGY

ACT Commodities B.V.



COMPANY INFOS

Company name: ACT Commodities B.V.
Phone: +31202199229
E-Mail: aloond@actcommodities.com
Website: www.actcommodities.com
Active biogas activities in the following countries: Across most of Europe



TYPE OF SERVICES

- Biomethane and biogas trader

AB Energy SPA



COMPANY INFOS

Company name: AB Energy SPA
Phone: +39 030 940 01 00
E-Mail: info@gruppoab.com
Website: www.gruppoab.com, www.bioch4nge.com
Active biogas activities in the following countries: Italy, UK, USA, France, Belgium, Germany, Mexico, Brasil, Serbia, Poland, Czech Republic, Romania, Bulgaria, Greece, Argentina



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Operators of biogas and/or biomethane plants
- Supplier of cogeneration units for biogas plants
- Supplier of biogas upgrading systems
- Service provider



First cubic metre of biomethane from agricultural feedstocks fed into the Italian gas network

Location of the project: Milan, Italy

In December 2019, AB was thrilled to celebrate the release of the first cubic metre of biomethane produced from agro-zootechnical waste in Italy. The protagonist was a company based in Milan that already produced electricity using two 999 kW biogas plants. The company decided to enhance its production using BIOCH4NGE®, the upgrading technology fully designed and built by AB. The electricity requirements for upgrading and heat for the anaerobic digestion process are met with the addition of an ECOMAX® cogeneration system, powered by methane gas from the grid or from excess biogas.

Thanks to this project, biomethane, which is a renewable source produced from agricultural origin biomass, can significantly help to reduce emissions from the agricultural sector.

Technical data

- BIOCH4NGE® 12
- Membrane-Based System
- Biogas Flow Treated: 1200 Nm³/h
- Biomethane Flow Rate: 606 Nm³/h
- CH₄ Recovery: > 99%
- Feedstocks: chopped triticale, sorghum, corn stalks, straw and manure



The BIOCH4NGE® plant installed in Milan, Italy



AFS Energy B.V.



COMPANY INFOS

Company name: AFS Energy B.V.
Phone: +31 (0)20 522 0265
E-Mail: productdevelopment@afsgroup.nl
Website: afsgroup.nl/global-broking/afs-energy/renewable-energy
Active biogas activities in the following countries: EU and UK



TYPE OF SERVICES

- **Service provider**
- **Biomethane and biogas trader**
- **Others:** Advisory & Consultancy in relation to finance and biomethane output (crossborder/GPAs)



Alternative routes-to-market for biomethane producers

Location of the project: The Netherlands

AFS Energy is part of AFS Group, a leading financial services provider based in the Amsterdam stock exchange. The Energy desk focuses on the renewable energy and environmental commodities markets across the EU and beyond. AFS Energy supports biogas producers across the EU (and the UK). Our main goal is to facilitate the energy transition by bringing together biogas producers and connecting them to the most suitable off-takers, resulting in the creation of mutual benefits for both parties. The development of new and alternative structures, such as the long term offtake of biomethane and certificates via Gas Purchase

Agreements (GPA) or the innovation of cross-border routes, provides value optimization and financial certainty for producers and allows them to focus on the production, rather than the commercialization of their product(s). In recent months we have brought together a larger multinational corporate and a newly-built biomethane plant under a corporate GPA. The GPA enables the corporate to reach their ambitious sustainability targets and take the next step towards a renewable energy supply. At the same time, the corporate provides the biomethane plant with long-term, secure and stable cash flows: the cooperation is beneficial for them both.

Agradu



COMPANY INFOS

Company name: Agradu
Phone: +31 630482423
E-Mail: info@agradu.nl
Website: www.agradu.nl
Active biogas activities in the following countries: The Netherlands, Belgium



TYPE OF SERVICES

- **Supplier of the entire biogas plants**
- **Supplier of parts of the biogas plants**
- **Operators of biogas and/or biomethane plants**
- **Biomethane and biogas trader**

Agraferm Technologies AG



COMPANY INFOS

Company name: Agraferm Technologies AG
Phone: +49 8441 8086-100
E-Mail: info@agraferm.com
Website: www.agraferm.com/en/home.html
Active biogas activities: 100 references in 20 countries



TYPE OF SERVICES

- **Supplier of biogas plants**
- **Operator of biogas/biomethane plants**
- **Service provider**

Aircodiet



COMPANY INFOS

Company name: Aircodiet
Phone: +45 7620 1530
E-Mail: rf@aircodiet.com
Website: www.aircodiet.com
Active biogas activities in the following countries: Denmark



TYPE OF SERVICES

- **Supplier of parts of the biogas plants**
- **Others:** Upgrading plant constructor

Air Products PRISM Membranes



COMPANY INFOS

Company name: Air Product PRISM Membranes
Phone: 1-314-995-3300
E-Mail: Membrane@airproducts.com
Website: www.airproducts.com
Active biogas activities in the following countries: USA, Italy, Spain, UK, Czech Republic, France



TYPE OF SERVICES

- **Supplier of parts of the biogas plants**



High methane recovery biogas plants

Location of the project: Italy

Air Products & Chemicals, Inc. and Hysytech Srl have successfully implemented a novel hybrid process for upgrading raw biogas. This innovative process combines Hysytech's water-wash technology and Air Products' PRISM® Membrane Separator technology to provide enhanced performance and economics. Air Products' unparalleled membrane process expertise, coupled with Hysytech's water-wash experience, lead to an innovative collaboration between the two companies, which ultimately combined a novel multi-stage membrane process, developed by Air Products, with Hysytech's system integration expertise. This new hybrid system, incorporating Air Products' innovative membrane process (patent pending), is capable of 99.8+% methane recovery with lower energy consumption than previous hybrid solutions. The first commercial installation was successfully commissioned by Hysytech in late September 2020 and since then has been injecting biomethane into the grid. A second commercial installation is scheduled for commissioning before the end of this year.



Prism Membranes Manufacturing Facility – Saint Louis, USA

Anaergia



COMPANY INFOS
Company name: ANAERGIA
Phone: +39 0363 1970144 (Italy)
E-Mail: info@anaergia.com; PEC: biogas@pec.it
Website: www.anaergia.com
Active biogas activities in the following countries:
 14 offices worldwide, 30 years of experience,
 1600 complete plants built worldwide, 133 patents filed

TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Service provider

Aprovis Energy Systems GmbH



COMPANY INFOS
Company name: APROVIS Energy Systems GmbH
Phone: +49 9826 65 83 – 241
E-Mail: thomas.fischer@aprovis.com
Website: www.aprovis.com
Active biogas activities in the following countries:
 Europe, GUS, South and Middle America, South-East Asia

TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Service provider

APROVIS – 20 years of biogas treatment technology

Location of the project: Weidenbach, Germany

APROVIS was set up in 2000, with a team of just three people designing and producing heat exchangers for biogas plants, principally for the German market. In response to demand from customers in the biogas sector, APROVIS developed complete biogas cooling and treatment units to ensure good quality biogas for further use, for example, in CHP units or biogas-upgrading plants for biomethane. Over the years, the APROVIS' operations have extended to the rest of Europe and further to many countries all over the

world. The first branch office of APROVIS outside Europe has now been established in Indonesia for the South East Asian market. APROVIS has its own R&D department, where work is carried out both to improve existing products, and to develop new ones. This allows APROVIS to provide state of the art products for its customers, as in the case of the complete exhaust gas system for CHP units. These and other activities have given rise to a company which, in 2020, has over 180 employees, working in areas including the commissioning, service and maintenance of APROVIS products.



Awite Bioenergy GmbH



COMPANY INFOS
Company name: Awite Bioenergie GmbH
Phone: +49 8761 72 162-0
E-Mail: info@awite.de
Website: www.awite.com

TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Gas analysis
- Automation
- Desulfurisation
- Flow measurement
- Lab facilities
- Service

Biogas upgrading plant in Bitburg

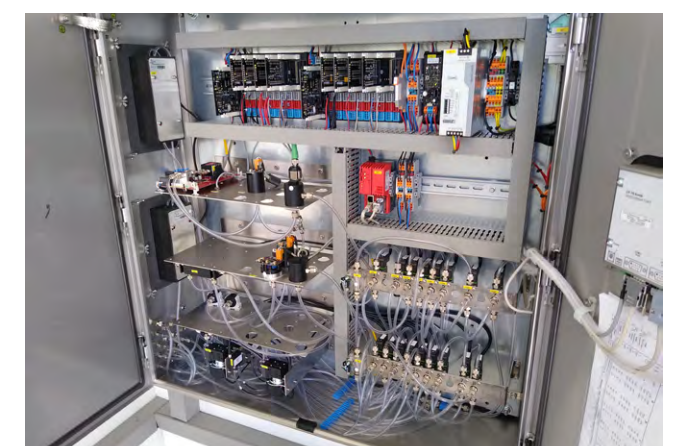
Location of the project: Bitburg (Rhineland-Palatinate), Germany

With a newly built biogas pipeline, the joint venture "Biogaspartner Bitburg" will in future combine raw biogas supplies from 48 biogas plants in the region. Biogas from the first participating facilities has been transported along the 45-kilometre-long pipeline since May 2020, arriving at a central processing plant in Bitburg. There it is refined to natural gas quality and fed into the gas grid as biomethane. Awite is supplying tailor-made gas analysis systems with measuring technology to monitor activated carbon filters

and measure thermal gas flow, as well as for and sample points at seven biogas plants. The comprehensive process control enabled by the Awite gas analysis systems ensures smooth operating procedures and helps maintain the economic efficiency of the entire plant. This project shows how developmental courage can be rewarded. The biogas partners have successfully overcome the challenges of attracting farmers or persuading landowners to allow the pipeline to cross their land, just as they have addressed the technical and regulatory complexities that presented themselves as the project advanced.



Gas analysis system AwifLEX



Azola



COMPANY INFOS

Company name: Azola

E-Mail: info@azola.fr

Website: www.azola.fr

Active biogas activities in the following countries:

France (looking to develop into European countries)



TYPE OF SERVICES

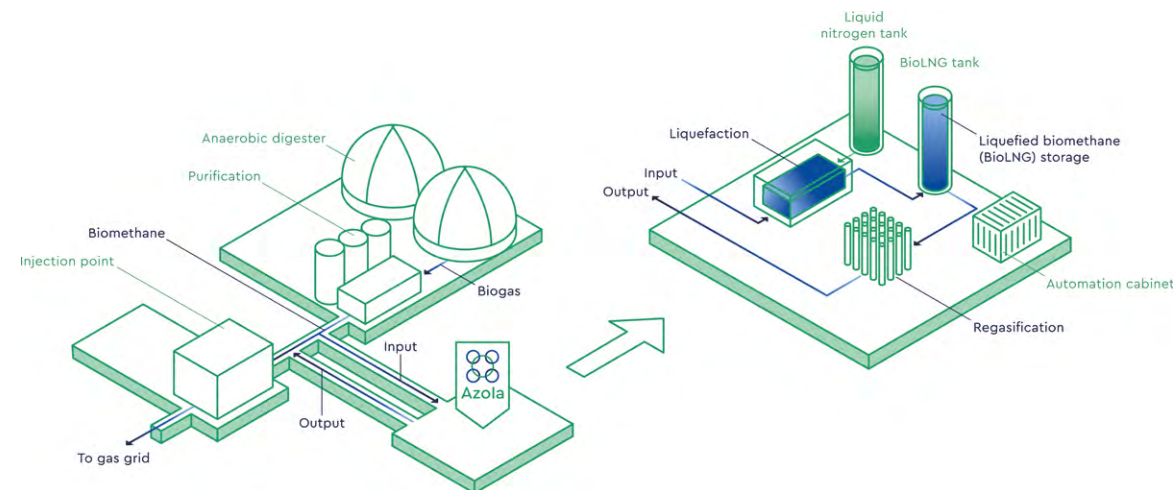
- Service provider
- Infrastructure operator



Temporary storage of biomethane in liquid form (bioLNG)

Location of the project: Epau-Bézu (Aisne Department, France)

AZOLA have developed a cryogenic solution aimed at storing biomethane on a temporary basis (Azola BIO) during periods of low demand in the gas grid. A demonstration model (scale 1:1) was successfully tested in real life conditions on an AD plant in Epau-Bézu (NE of Paris) from 2017 until 2019, following successful lab testing (2015–2016). The onsite experimental programme enabled Azola to upgrade the technology readiness level (TRL) of its Azola BIO solution from TRL 4-5 to TRL 8.



Biogas Research Center



COMPANY INFOS

Company name: Biogas Research Center

Phone: (+46) 13 28 13 06

E-Mail: angela.sanseverino@liu.se

Website: biogasresearchcenter.se

Active biogas activities in the following countries:

Sweden



TYPE OF SERVICES

- Science & Research



Biogas Research Center book “Biogas in the Sustainable Society – the Nordic Way”

Location of the project: Linköping University, Sweden

The Biogas Research Center (BRC) is a competence centre for the generation of knowledge based on the co-operation between 24 different biogas operators and 11 research groups at Linköping University and the Swedish University of Agricultural Sciences. The BRC is a triple-helix construction, funded by equal contributions from companies and regional administrations, academia, and the Swedish Energy Agency. We identified a need for a book about biogas and decided to produce one together with our BRC partners. The book

has a “bottom-up” perspective on how biogas can solve problems and create value for cities, regions and companies according to the Nordic model. In this model, sewage sludge and organic waste are the primary inputs, anaerobic digestion is the treatment form and vehicle fuel and biofertilizer are the main products. The model has global relevance and we would like to continue our efforts to spread the narrative about an amazing sustainability tool – biogas solutions. The book can be ordered via biogasresearchcenter.se/order-book-biogas-in-the-sustainable-society/?lang=en



Biogest Energie- und Wassertechnik GmbH



COMPANY INFOS

Company name: Biogest Energie - und Wassertechnik GmbH
Phone: +43 2243 20840
E-Mail: office@biogest-biogas.com
Website: www.biogest.at
Active biogas activities in the following countries: Austria, UK, Italy, Romania, Serbia, the Czech Republic, France and USA



TYPE OF SERVICES

- Supplier of the entire biogas plant
- Operators of biogas/biomethane plants
- Service provider
- Project developer
- Science & Research

Biokraft AS



COMPANY INFOS

Company name: Biokraft AS
Phone: +47 95 44 95 66 or +47 92 88 33 83
E-Mail: ml@biokraft.no or hw@biokraft.no
Website: biokraft.no
Active biogas activities in the following countries: Norway



TYPE OF SERVICES

- Operators of biogas and/or biomethane plants
- Project developer
- Biomethane and biogas trader
- Science & Research



Liquid biogas (LBG, or Bio-LNG) production and use of LBG as a heavy truck vehicle fuel and maritime ship fuel

Location of the project: Skogn, Norway

Biokraft has designed, built and, since 2018, operated the world's largest facility for integrated on-site biogas production, biogas upgrading (to biomethane) and the liquefaction of biomethane to LBG (or "Bio-LNG"). The biogas is produced from waste from industry, agriculture and aquaculture. The first stage of LBG production in terms of energy output is 125 GWh/year, although this is currently in the process of being doubled to 250 GWh/year (2021–2022). The LBG is being used as a vehicle fuel in Norway, both in busses and in heavy trucks. In 2019, Biokraft also entered into what is currently the largest LBG delivery contract in the maritime sector – supplying the cruise operator Hurtigruten with LBG for their fleet of cruise ships. Biokraft processes the bio-residue from the LBG production to make a refined bio-fertilizer, currently being supplied to farmers in the region in and around the location of the LBG plant.



Aerial photo of the LBG plant (Biokraft, Skogn)

Biorefine Cluster Europe



COMPANY INFOS

Company name: Biorefine Cluster Europe
E-Mail: info@biorefine.eu
Website: www.biorefine.eu

Active biogas activities in the following countries: Europe, collaboration EU/Asia/N-America



TYPE OF SERVICES

- Science & Research



Biorefinery of Inorganics: Recovering Mineral Nutrients from Biomass and Organic Waste

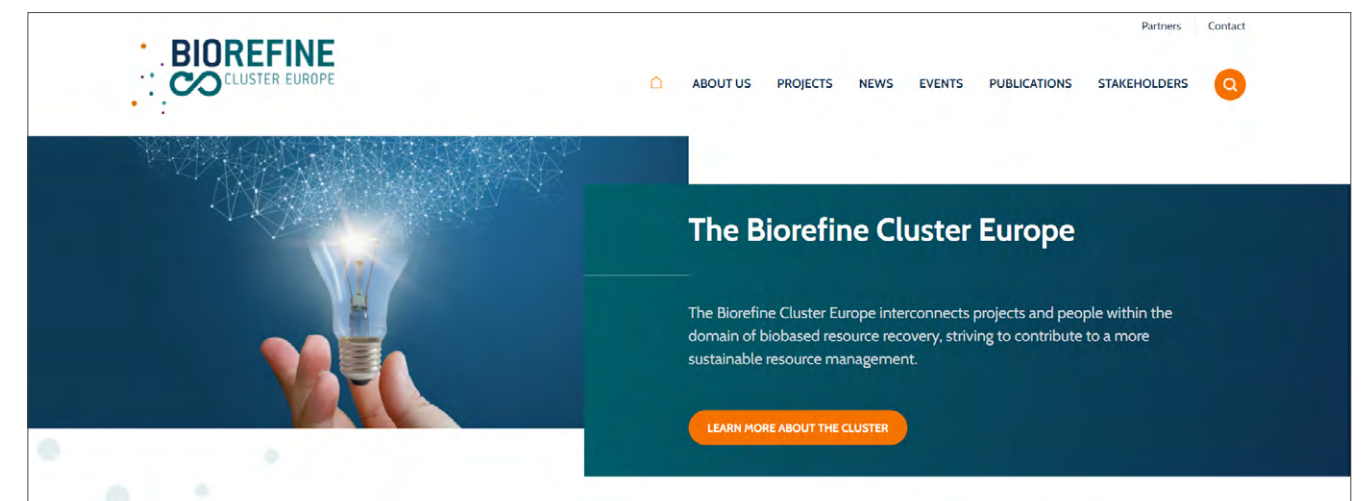
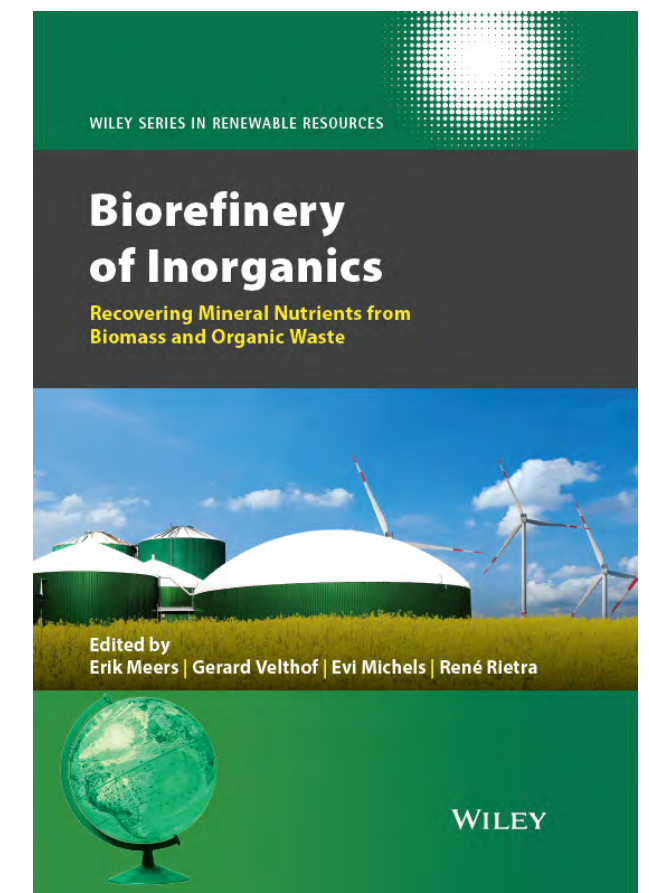
Location of the project: collaboration EU/Asia/N-America

The Biorefine Cluster Europe (BCE) is a platform for inter-connecting projects and people within the field of biobased resource recovery, striving to contribute to a more sustainable resource management in the framework of circular economy systems.

The competence focus lies within the biorefinery sector: the refinement of chemicals, materials, renewable energy and products from biobased waste streams.

A range of European research projects relating to biogas and nutrient recycling are members of the Biorefine Cluster, where they form a community of experts that interact at different levels. Currently the Biorefine Cluster Europe reaches more than 2000 people from universities and research centers.

Recently, experts from the BCE published a book titled 'Biorefinery of Inorganics: Recovering Mineral Nutrients from Biomass and Organic Waste'. This book presents a comprehensive overview of the potential for mineral recovery from waste, addressing technological issues as well as offering economic, ecological, and agronomic full-scale field assessments. It serves as a complete reference work for experts in the field and provides teaching material for future experts specialising in environmental technology sectors. Reserve your copy [here](#).



Biothane



COMPANY INFOS

Company name: Biothane
Phone: +31 642 79 49 71
E-Mail: biothane@veolia.com
Website: www.biothane.com
Active biogas activities in the following countries:
 Worldwide – More than 650 references in 60 countries



TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Service provider
- Science & Research

bmp greengas



COMPANY INFOS

Company name: bmp greengas
Phone: +49 (0)89 30 90 587-0
E-Mail: info@bmp-greengas.de
Website: www.bmp-greengas.de/en
Active biogas activities in the following countries:
 Europe



TYPE OF SERVICES

- Biomethane and biogas trader

Sludge Digestion in Reyran WWTP and injection of biomethane into the natural gas grid

Location of the project: Fréjus, France

BIOTHANE has equipped the first wastewater treatment plant in the Var department of France with a MemGas™ biogas upgrading unit in order to inject green gas into the gas grid.

The objectives are to produce 7% of the agglomeration's annual gas consumption and thus be part of a circular economy scheme, as well as producing renewable gas to supply the public Bio-CNG refuelling station located in the area.

Operational since March 2019, the plant generates an average of 105 Nm3/h of biomethane, which corresponds to the annual consumption of around 750 homes or 40 buses. This plant was recognised at the Green Awards Solution 2019.



Digester and MemGas™ installation

BTA International GmbH



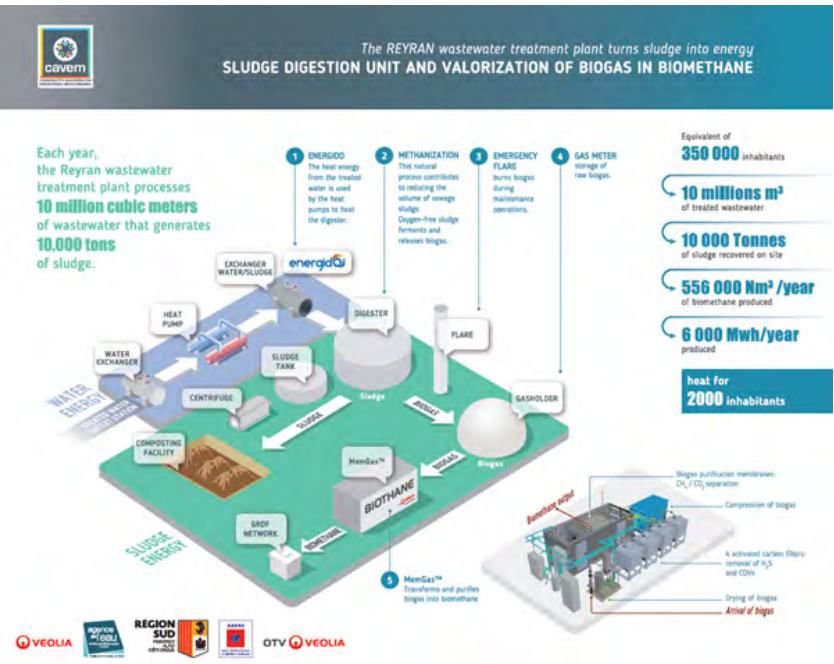
COMPANY INFOS

Company name: BTA International GmbH
Phone: +49 (0) 8441 - 8086-100
E-Mail: info@bta-international.de, s.schulte@bta-international.de
Website: www.bta-international.de
Active biogas activities in the following countries:
 Europe, North America, India, East Asia



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Service provider
- Others: Technology supplier (for Biogas plants based on BTA Process)



Overview Reyran Fréjus wastewater treatment plant



Overview MemGas™ installation



BTS Biogaz



COMPANY INFOS

Company name: BTS Biogaz
Phone: +39 0454 85 42 05
E-Mail: sales@bts-biogas.com
Website: www.bts-biogas.com
Active biogas activities in the following countries:
 Italy, France, UK, USA, Japan, Serbia, Latin America



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Service provider

Carbotech Gas Systems GmbH



COMPANY INFOS

Company name: Carbotech Gas Systems GmbH
Phone: +4920150709300
E-Mail: mail@carbotech.info
Website: www.carbotech.info
Active biogas activities in the following countries:
 worldwide



TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Service provider
- Others: Supplier of turn-key biogas upgrading plants



DEMETER ENERGIES – Twelve farms together for biogas

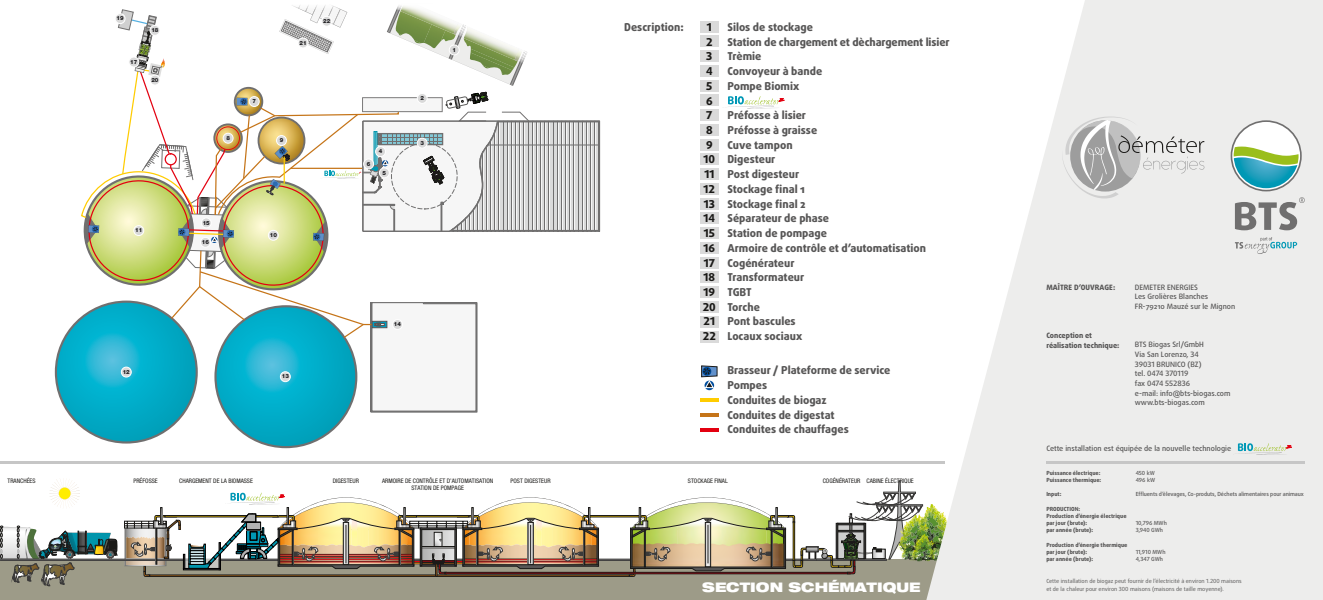
Location of the project: 79210 Mauzé-sur-le-Mignon, France

This 499 kW_e AD plant makes it possible to process the effluents from twelve farms situated less than 8 km away. The raw materials collected consist of 13,000 tonnes of manure, 5,000 tonnes of slurry and 2,000 tonnes of intermediate crops for energy recovery (CIVE), plus 600 tonnes from cereal sorting. It will also be possible, in the future, to

treat vegetable waste (grass cuttings from lawns and road-sides, as well as fruit and vegetable waste) and fats (whey, milk, oils). The thermal energy surplus of 1,500 MWh/year is channelled into a communal heating grid in Mauzé-sur-le-Mignon, enabling savings of 15 tonnes of gas to heat the local secondary school, 115,800 litres of fuel for the swimming pool and communal buildings and 135,000 litres of fuel for corn and alfalfa dryers.



INSTALLATION DE BIOGAZ 450 kW_e - DEMETER ENERGIES



Biomethane from landfill gas with high Nitrogen and VOC content

Location of the project: Madison/WI, USA

In lieu of a turn-key provider for landfill gas upgrading systems, North American customers have typically selected individual key components like VOC-, CO₂- and N₂-removal systems as well as compressors and thermal oxidizers to build a landfill gas upgrading facility. However, non-matching components and the need to integrate many different control systems, have led to owners facing significantly higher investment costs and lower performance than anticipated. Carbotech Gas Systems, together with its US partner BIO-Ferm Energy Systems, has delivered a fully integrated landfill gas upgrading system utilizing Carbotech's unique in-house adsorption technologies. It includes a single control system, while ensuring a fixed system price and offering an overall performance guarantee "flange-to-flange".

Carbotech Gas Systems has designed a fully integrated landfill gas upgrading system, consisting of biological desulfurization, biogas compression and dehydration, VOC removal, H₂S polishing, CO₂-rejection, N₂-rejection, thermal oxidizer (RTO) and biomethane compression.

The first stage CO₂-removal PSA unit was additionally designed to reject up to 14 vol.-% nitrogen. Subsequently, the second stage N₂-removal PSA unit ensures a high biomethane quality at more than 97 vol.-% CH₄ without methane losses.

A Temperature Swing Adsorption (TSA) unit was designed to eliminate VOC and siloxanes with extremely low methane losses.

The system was constructed by BIOFerm Energy Systems under Carbotech's supervision and commissioned by Carbotech.

The system started injecting biomethane into a 60 bar grid in April 2019. Due to its integrated two-stage PSA design, the system has proven to offer superior methane recovery

for a landfill gas upgrading system. The biomethane contains < 2.75 vol.-% N₂ and < 0.1 vol.-% CO₂ and O₂.

The low operating pressures of the PSA systems contribute to a low overall electrical power consumption.

Two similar plants with a capacity of 4000 Nm³/h have been put into operation in 2019 and 2020.

Process optimisation:

- Fully integrated 2-stage landfill gas upgrading system
- 2-stage PSA system for CO₂ and N₂- removal

Process efficiency:

- High methane recovery from raw gas with elevated nitrogen concentrations
- Lower electricity consumption

Economic advantages:

- Lower capital and operating expenditure
- Higher biomethane revenues



2-stage PSA landfill gas upgrading system

China Agricultural University



COMPANY INFOS

Company name: China Agricultural University
Phone: +8610-62737885
E-Mail: qiaowei@cau.edu.cn, wayqiao@sina.cn
Website: www.cau.edu.cn
Active biogas activities in the following countries:
 China



TYPE OF SERVICES

• Science & Research

CO2Bioclean GmbH



COMPANY INFOS

Company name: CO2BioClean GmbH
Phone: 00491744657708
E-Mail: Info@co2bioclean.com
Website: www.co2bioclean.com



TYPE OF SERVICES

• Service provider

DBFZ Deutsches Biomasse- forschungszentrum gGmbH



COMPANY INFOS

Company name: DBFZ – Deutsches Biomasseforschungszentrum gGmbH
Phone: Office: +49 341 2434-112
 Head of Department Biochemical conversion
 (responsible for Biogas): +49 341 2434-716
E-Mail: E-Mail Office: info@dbfz.de
 E-Mail Head of Department Biochemical conversion
 (responsible for Biogas): Peter.Kornatz@dbfz.de
Website: www.dbfz.de
Active biogas activities in the following countries:
 Germany, Countries of the European Union, Togo, Ghana,
 China



TYPE OF SERVICES

• Science & Research

Desotec NV



COMPANY INFOS

Company name: Desotec NV
Phone: +32 51 246 057
E-Mail: info@desotec.com
Website: www.desotec.com

Active biogas activities in the following countries:
 Belgium, Netherlands, Germany, France, Italy, Denmark,
 Finland, Sweden



TYPE OF SERVICES

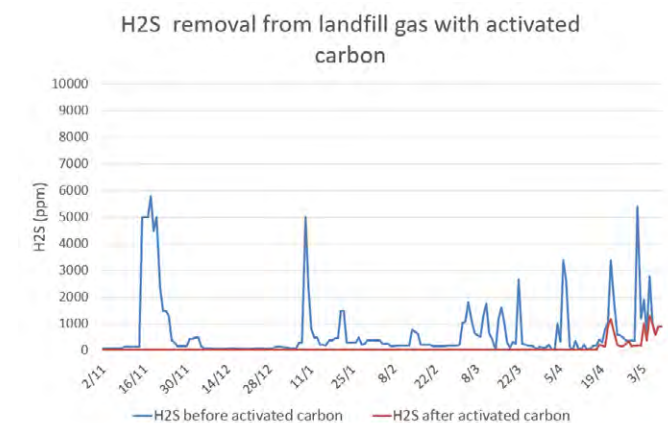
• Service provider



Activated carbon as support and back-up of a bio-scrubber for H2S removal to protect a CHP engine

Location of the project: Morbihan, France

Biogas is increasingly used to generate electricity and heat via CHP gas engines. To avoid engine damage, impurities such as H₂S and VOCs need to be removed. A landfill in Morbihan has also chosen combined heat and power to valorise their landfill gas, which has a flowrate of 650 Nm³/h and contains on average ca. 6500 ppm H₂S. A biological scrubber is in place to remove the bulk of the H₂S. However, in periods when the scrubber is undergoing maintenance or is underperforming, complimentary technology is required. Mobile activated carbon filters are therefore used to protect the gas engine at all times. The results of the different treatment steps are shown in the graphs. When saturated, the mobile filters are replaced. No handling of spent activated carbon is required by the landfill since transport and waste valorisation is completely organized by DESOTEC.



DMT Environmental Technology



COMPANY INFOS

Company name: DMT Environmental Technology

Phone: +31 513 636789

E-Mail: sales@dm-international.com

Website: www.dmt-et.com

Active biogas activities in the following countries: Netherlands, Germany, United Kingdom, Denmark, Switzerland, Estonia, Sweden, Norway, Spain, United States of America



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Service provider



Installation of DMT's biogas upgrading technology in the Luttelgeest biogas facility

Location of the project: Luttelgeest, The Netherlands

The facility in Luttelgeest started producing biogas in 2003, making it one of the pioneers of the biogas industry in the Netherlands. This state-of-the-art sustainable biogas facility was initially used to produce electricity and heat. After 10 years of profitable electricity production, it was deemed necessary to expand and implement new technology in order to remain successful. Electricity production at the facility to date has been approximately 6 million kWh per year, equivalent to the annual consumption of 1,700 households annually. To increase profits, however, DMT's biogas upgrading technology has been installed. With the expansion, it is expected that the production of renewable gas will be nearly 4 million m3 annually. This is equal to the annual consumption of approximately 2,500 households. In addition, the CO₂ that is released during the production of the renewable gas is used in a greenhouse to stimulate and boost the growth of fruit and vegetables, providing an extra component to the Luttelgeest facility's sustainability.



DSM Bio-based Products & Services B.V



COMPANY INFOS

Company name: DSM Bio-based Products & Services B.V.

Phone: +49 211 975 49 94

E-Mail: Christian.loechte@dsm.com

Website: www.dsmbiogas.com

Active biogas activities in the following countries: Across Europe in almost all countries



TYPE OF SERVICES

- Service provider
- Others: process optimization (pre-treatment, biological service, processing aids (e.g. enzymes))



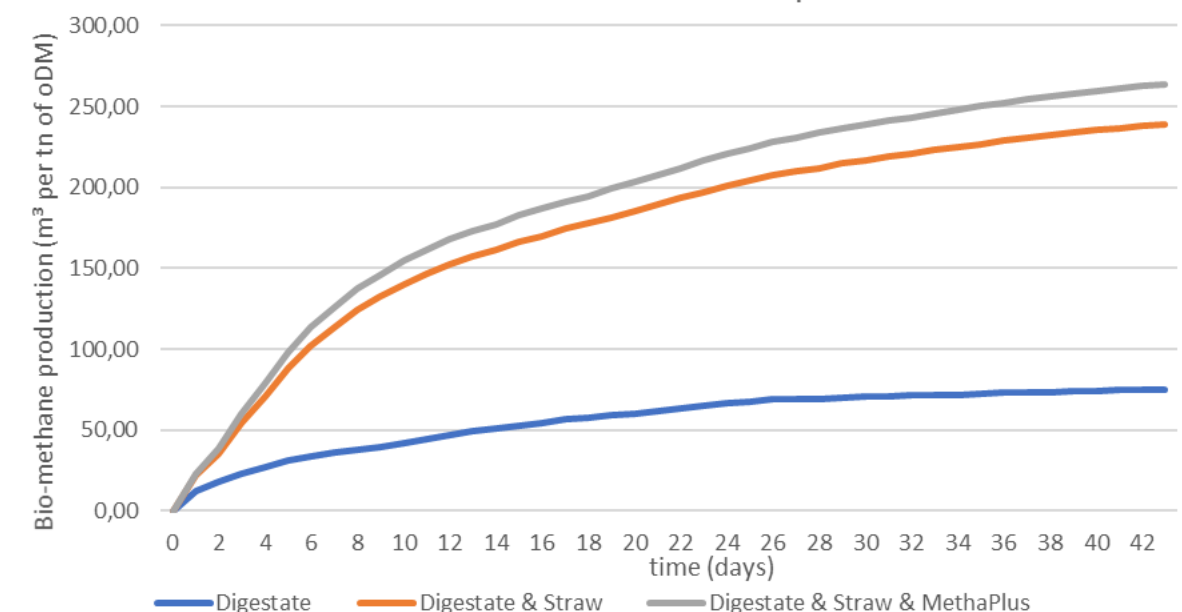
Improved methane production of pre-treated (extruded) wheat straw by hydrolytic enzyme MethaPlus® L100

Location of the project: King's Lynn/Norfolk, UK

Straw (from grain or corn) is increasingly being used as a feedstock in anaerobic digestion. Because of its fibrous structure, straw needs to be pre-treated before feeding to the digester. Pre-treatment helps biomass degradation by increasing the surface area of the biomass particles. This however also leads to higher water binding, resulting in problems with mixing and digestate pumping. Our customer also observed this issue when gradually replacing corn silage with wheat straw. In a collaborative pro-

ject, DSM and OMEX Environmental solved this by applying **MethaPlus®**, a field-proven and cost-effective enzyme preparation for solving viscosity problems biologically. Moreover, **MethaPlus®** increased bio-methane yield by 11%. This was demonstrated in AMPTS-tests using pre-treated (extruded) wheat straw as main feed mixed with digestate, both of which came from the AD plant. In conclusion, the application of **MethaPlus®** is highly recommended when pre-treated straw is fed to any biogas plant, to manage viscosity and to improve efficiency.

MethaPlus® increases bio-methane production



Bio-methane production from plant samples with and without straw and **MethaPlus®**

Ductor Oy



COMPANY INFOS

Company name: Ductor Oy
Phone: +358 10 320 6560
E-Mail: info@ductor.com
Website: www.ductor.com
Active biogas activities in the following countries:
 Sweden, Norway, Germany, Italy, Poland, U.K., Spain, France, USA, Mexico



TYPE OF SERVICES

- Supplier of the entire biogas plants

Ecospray Technologies



COMPANY INFOS

Company name: Ecospray Technologies S.r.l.
Phone: +39 0131 854611
E-Mail: info@ecospray.eu
Website: www.ecospray.eu
Active biogas activities in the following countries:
 Europe, USA, Malaysia, Indonesia



TYPE OF SERVICES

- Supplier of the entire biomethane plants (from biogas upgrading to biomethane liquefaction and bio-LNG storage)

Ecostrat



COMPANY INFOS

Company name: Ecostrat

Phone: 1-855-968-8884
Website: ecostrat.com

EIFER – Europäisches Institut für Energieforschung EDF-KIT



COMPANY INFOS

Company name: EIFER – Europäisches Institut für Energieforschung EDF-KIT
Phone: +49 (0) 721 6105 1330
E-Mail: contact@eifer.org

Website: www.eifer.kit.edu



TYPE OF SERVICES

- Science and research

ENERO FURNIZARE SRL



COMPANY INFOS

Company name: ENERO FURNIZARE SRL
Phone: +40253212181
E-Mail: office@enero-furnizare.com
Website: www.enero-furnizare.com/en

Active biogas activities in the following countries:
 Romania and Moldova



TYPE OF SERVICES

- Project developer

ENGIE



COMPANY INFOS

Company name: ENGIE BiOZ
Phone: +33 223 46 17 62
E-Mail: info.bioz@engie.com
Website: bioz-biomethane.com
Active biogas activities in the following countries: France



TYPE OF SERVICES

- Operators of biogas and/or biomethane plants
- Project developer



ENGIE BiOZ, the unit at Terres de Montaigu

Location of the project: France

ENGIE BiOZ initiates, develops, finances, builds and operates biomethane production units. With 14 plants in operation, ENGIE BiOZ reinforces ENGIE's position as the leader in renewable energies in France, with a clear target for the coming years – namely, to produce a volume of 5 TWh/year of biomethane by 2030. ENGIE BiOZ provides recognized expertise at every stage of methanation projects, from feasibility studies to implementation and exploitation. Thanks to its local presence and knowledge of the territories, ENGIE

BiOZ is active across the entire value chain, uniting all local players around adapted solutions. Developed by ENGIE BiOZ, the unit at Terres de Montaigu (France, department 85), injects biomethane into the natural gas grid, as well as generating renewable electricity for its own consumption: it is powered by its own 313 kWp solar system. In addition, the installation of pipelines transporting manure and part of the digestate limits greenhouse gas emissions linked to transport. This unit is a first step towards achieving energy self-sufficiency at a local level by mixing different renewable energies.



ETW Energietechnik GmbH



COMPANY INFOS

Company name: ETW Energietechnik GmbH

Phone: 01734186052

E-Mail: jende@etw-energie.de

Website: www.etw-energie.de

Active biogas activities in the following countries:

Germany, France, Italy, UK, Netherlands, Denmark, Spain, Canada



TYPE OF SERVICES

• **Supplier of parts of the biogas plants**

• **Others:** Supplier of CHPs and Biogas upgrading plants



Biogaspartner Bitburg Project, the centralized upgrading to biomethane of up to 1900 Nm³/h biogas from 7 decentralised biogas plants in the Eifel region in Germany.

Location of the project: Bitburg – Eifel Region, Germany

In this infrastructure project, 7 independent Biogas producers are connected through a 45 km biogas grid. Together, the 7 plants deliver 960 Nm³/h desulfurized Biogas. The ETW-SmartCycle® upgrading plant is running at 50% turn-down until the full gas supply of 1700 Nm³/h is reached. Reliability and the ability to automatically adjust capacity to varying inlet gas conditions were important criteria in choosing ETW-SmartCycle® technology for this project. This technology offers each biogas plant total flexibility in deciding whether to produce electricity in their own CHP units or biomethane in the centralized upgrading unit.



The low pressure double membrane biogas storage buffers 5.000 m³ desulfurized biogas from 7 biogas plants.



The upgrading system is designed to continuously adapt to varying volume flows, offering maximum flexibility to each of the producers.



High calorific biomethane is produced in constant quality and pressure, independent from biogas inlet variations, granting gas grid requirements.

Evonik Fibres GmbH



COMPANY INFOS

Company name: Evonik Fibres GmbH

Phone: +49 6151 18 4513

E-Mail: sepuran@evonik.com

Website: www.sepuran-green.com

Active biogas activities in the following countries:

Worldwide



TYPE OF SERVICES

• **Supplier of parts of the biomethane plants**

• **Others:** Equipment supplier, membrane manufacturer



Biomethane plants in Estonia

Location of the project: Vinni; Tartu
(end-customer: AS EG Ehitus), Estonia

EnviTec and Evonik have entered the Estonian market. Evonik, the innovation leader in membrane-based gas separation technology has provided EnviTec Biogas AG with a new generation membrane, SEPURAN® Green G5X. EnviTec's first order in the Estonian market, the building of two EnviTec gas upgrading plants, sets a new industry standard for highly efficient biogas upgrading in Estonia. The strategic cooperation between the two companies continues to grow and is expanding into new regions. The two projects reflect an important foothold in the Baltic market for EnviTec and Evonik. SEPURAN® Green G5X is emblematic of the next generation of hollow-fibre membranes, with superior properties in terms of selectivity and capacity. This enables biomethane plants to be operated with greater financial efficiency than ever before. Both Estonian gas upgrading units will be built as extensions to existing biogas facilities and will inject the Biomethane into the natural gas network.



Fluence Italy SRL



COMPANY INFOS

Company name: Fluence Italy SRL
Phone: +39 049 870 4817
E-Mail: Info.it@fluencecorp.com
Website: www.fluencecorp.com
Active biogas activities in the following countries:
 Italy, Spain, Ecuador, France, Brazil, Argentina, Uruguay



TYPE OF SERVICES

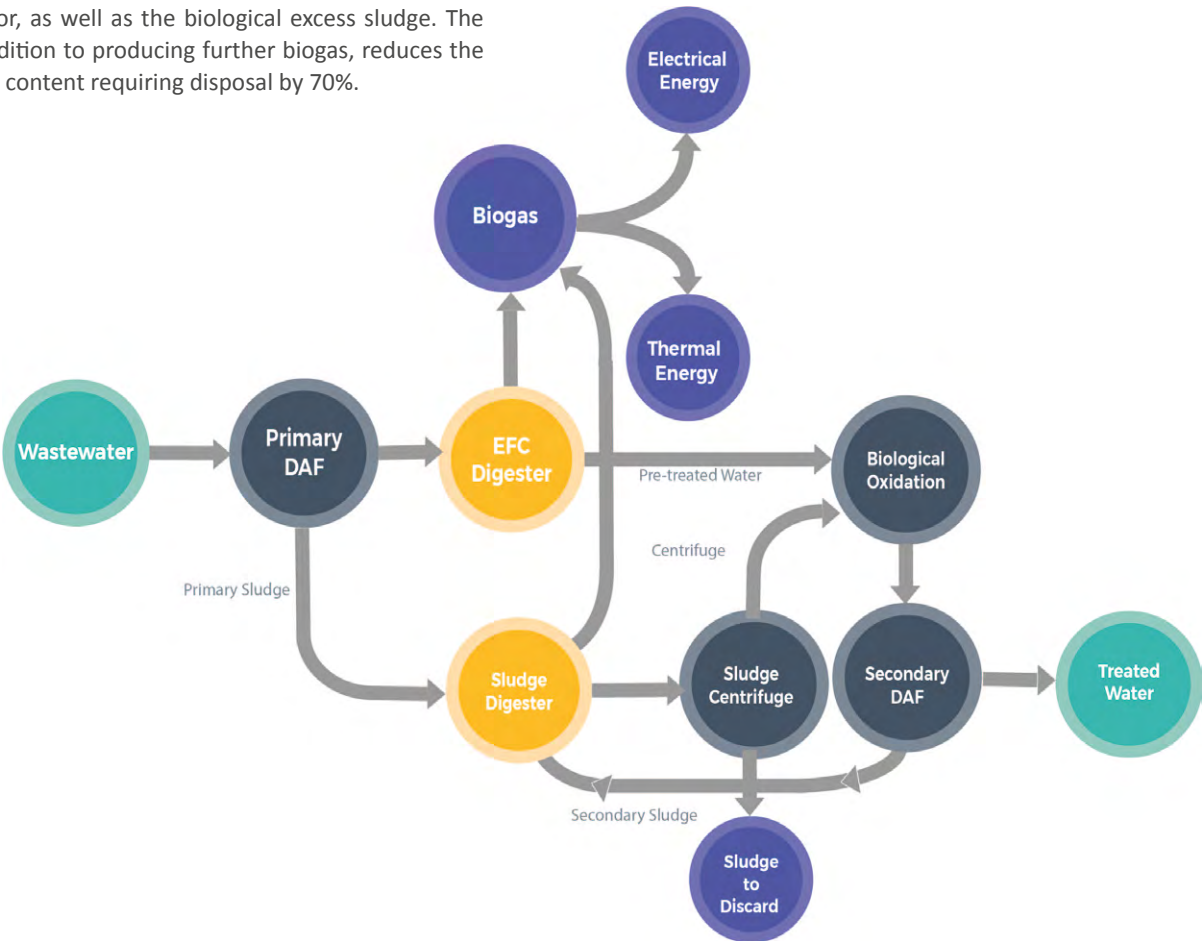
- Supplier of the entire biogas plants



Wastewater treatment with biogas production for confectionary manufacturer

Location of the project: Ossona (MI), Italy

"Dolcissimo" is a traditional Italian confectionary producer. Fluence was called to design a wastewater treatment plant that produced biogas and could cope with a high concentration of both soluble COD (essentially sugars) and fats in the wastewater. To minimize sludge production and obtain maximum biogas, both of these fractions should be digested anaerobically. Fluence designed a system that combines signature Fluence technologies. It uses both a granular sludge rapid digester (EFC), which allows for treatment of the wastewater with very short retention times (18 hours) and offers purification yields above 85%, and a classic CSTR sludge digester that treats the fat originating from the primary flotator, as well as the biological excess sludge. The latter, in addition to producing further biogas, reduces the solid sludge content requiring disposal by 70%.



Fraunhofer IWES



COMPANY INFOS

Company name: Fraunhofer IWES
Phone: +49 89 1205-0
Website: www.fraunhofer.de/en.html



TYPE OF SERVICES

- Science & research

FuelCell Energy



COMPANY INFOS

Company name: FuelCell Energy
Phone: (203) 825-6000
E-Mail: info@fce.com
Website: www.fuelcellenergy.com
Active biogas activities in the following countries:
 USA, South Korea, all EU States



TYPE OF SERVICES

- Supplier of parts of the biogas plant
- Design and manufacture CHP fuel cells that run on biogas
- Development and building biogas clean-up skids

Future Biogas



COMPANY INFOS

Company name: Future Biogas
Phone: 01483 375920
E-Mail: carole.forth@futurebiogas.com
Website: www.futurebiogas.com
Active biogas activities in the following countries: UK



TYPE OF SERVICES

- Operator of biogas/biomethane plants



Positive impact on agriculture

Location of the project: East Anglia, UK

Established in 2008, Future Biogas is one of the pioneers of AD in the UK and also the UK's largest green gas producer. Currently, the company operates 13 plants. One of its greatest successes is its championing of a regenerative farming system that works in harmony with nature to produce both renewable energy and food crops – while simultaneously boosting carbon capture, local biodiversity, soil organic matter and, consequently, soil fertility.

The company has spent over a decade optimising its cropped AD practice to make it as environmentally – and economically – viable as possible. Sensitive soil management and carbon sequestration are fundamental to this agricultural system's holistic ethos.

In practice, this means the farming partners who grow the feedstock crops for Future Biogas are encouraged to extend their crop rotations, practise minimum tillage, adopt inter-row cropping, use cultural weed control, reduce pesticide usage and replace chemical fertilisers with digestate.

FWE



COMPANY INFOS

Company name: FWE
Phone: +49 9231 50787 0
E-Mail: info@fwe.energy
Website: www.fwe.energy



TYPE OF SERVICES

- Project developer

GasUnie



COMPANY INFOS

Company name: Gasunie
Phone: +31 (0)50 521 91 11

E-Mail: info@gasunie.nl
Website: www.gasunie.nl/en

Gelt International SRL



COMPANY INFOS

Company name: Gelt International SRL
Phone: +39 051 0195372
E-Mail: c.piana@geltinternational.it
Website: www.geltinternational.it/?lang=en
Active biogas activities in the following countries: Europe



TYPE OF SERVICES

- Service provider
- Science & Research



Study of an enzyme pool for biogas plants

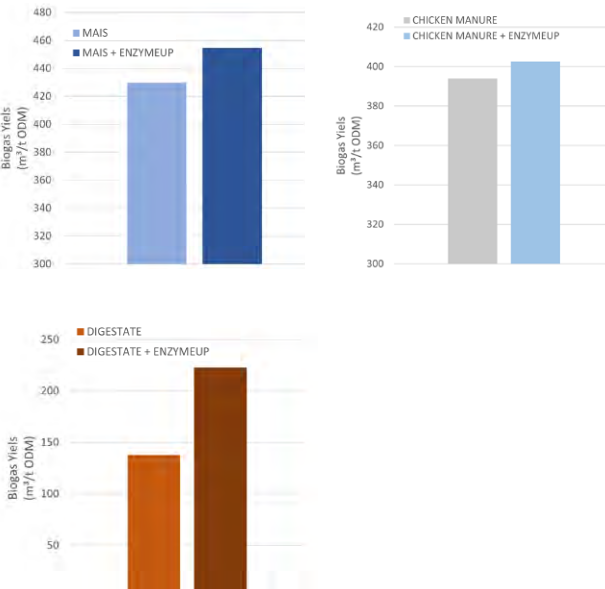
Location of the project: Italy

There is a variety of different enzyme pools on the market for biogas plants. Our aim was to formulate a product able to work with different matrices – not only focused on agricultural plants, but also suitable for wastes plants and for biomethane.

Our pool, called ENZI ME UP, includes the enzymes Alpha-amylase, Cellulase, Xylanase, Protease and Beta-glucanase. Success factors include:

- Improvement of biogas yield (see table below) in different matrices
- Optimisation of mixing and pumping time
- Reduction of auto-consumption (up to 4% in a plant of 1 MWe)

The images show the results of lab testing, but the results were also confirmed in real biogas plants.



GM Green Methane



COMPANY INFOS

Company name: GM Green Methane
Phone: +39 041 5674260
E-Mail: info@gm-greenmethane.it
Website: www.gm-greenmethane.it
Active biogas activities in the following countries: Italy



TYPE OF SERVICES

- Supplier of Biomethane Plants



Coronavirus does not stop Biomethane Revolution

Location of the project: Rome/Rovigo/Ferrara, Italy

GM-Green Methane, a company devoted to the turn-key supply of Biogas upgrading plants, enjoyed a period of intense activity in the first half of 2020, despite the severe Coronavirus restrictions imposed by the Italian Government. Between April and May 2020, Green Methane successfully completed the commissioning and start-up of three upgrading plants in Anzio, Rovigo and Ferrara, demonstrating their excellent capacity to organise and complete multiple projects, as well as their ability to stay focused on the achievement of their business targets. Two new contracts were signed for upgrading plant from OFMSW in Milan and Ancona, further strengthening the Greenmethane presence in the Biomethane field.



GRDF



COMPANY INFOS

Company name: GRDF
Phone: +33 6 37 45 59 49
E-Mail: jean-marie.gauthey@grdf.fr
Website: www.grdf.fr
Active biogas activities in the following countries: France



TYPE OF SERVICES

- Infrastructure operator

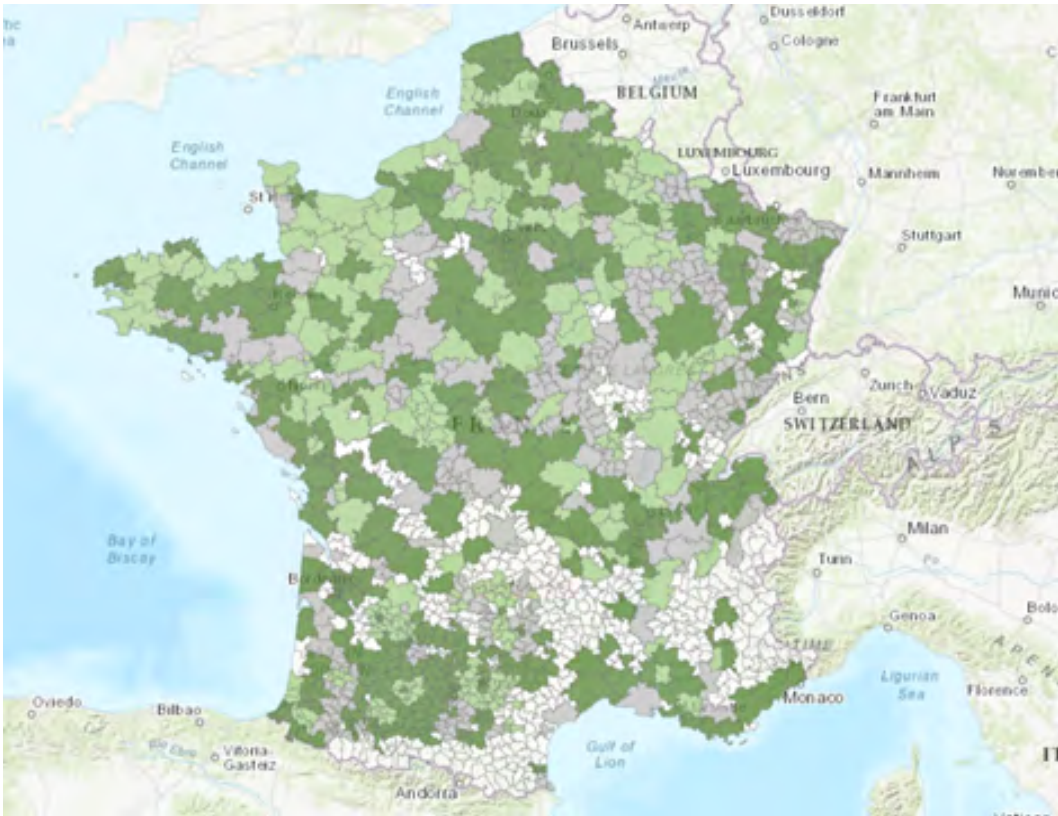


An interactive map to optimise biomethane injection into the grid

Location of the project: Digital, France

This map has been created by gas grid operators in France including GRDF. It was a legal obligation following the EGA-LIM law and the “right to inject” decree, which regulates the injection of biomethane into gas networks. To inject biomethane into gas networks, it is often necessary to carry out work to strengthen existing infrastructures. Network operators must collaborate to define the optimal connections for injection projects in an area while minimizing the

costs of adapting the networks supplying the community. The map allows you to identify favourable territories for injection projects - in particular, those in which the necessary reinforcement works may already have been carried out. This map allows biomethane project owners to evaluate their injection potential and thus optimise the localisation of their plants. For more information, please consult the online map on: projet-methanisation.grdf.fr/tester-mon-potentiel/carte-de-zonage-indicative



Green Create



COMPANY INFOS

Company name: Green Create
Phone: +31646235559
E-Mail: Tom.vanessen@green-create.com
Website: www.green-create.com
Active biogas activities in the following countries: South Africa, Mauritius, UK, Belgium, Netherlands



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Operators of biogas and/or biomethane plants
- Project developer



Producing biomethane on an industrial scale from 100% animal manure

Location of the project: Wijster, The Netherlands

Green Create specialises in the transformation of waste streams with a high nitrogen content into biomethane. Its projects, located around the globe, are funded by the Green Create W2V (waste to value) fund in cooperation with senior debt providers. In Wijster, 4.500m3/h of biogas will be produced using 100% animal effluent. Ammonia in the process is recovered and all of the solid digestate will be processed into a high value organic fertilizer.



Greenlane Biogas




COMPANY INFOS

Company name: Greenlane Biogas

Phone: +44 (0) 114 2121301

E-Mail: mark.storey@greenlanebiogas.com

Website: www.greenlanerenewables.com

Active biogas activities in the following countries: UK, France, Italy, Germany, USA, Canada, Scandinavia. Asia.


TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Others: Finance

✓ Injection into the Californian natural gas grid

Location of the project: California, USA

In early 2020, a major RNG project developer asked Greenlane for help. They had installed a membrane biogas upgrading system at their dairy manure to RNG project in California, and it was failing to meet the strict gas quality specifications of SoCalGas Rule 30. They needed a solution – and fast. Greenlane provided a replacement raw gas compressor, a chilling and dehydration system, and a PSA (Pressure Swing Adsorption) biogas upgrading system to replace the failing membranes. To get them up and running as quickly as possible, the equipment was delivered in just 12 weeks, as well as being guaranteed to fit within their existing building and footprint.

The site is already being commissioned. Not only is the system guaranteed to meet the requirements of Rule 30; it is also guaranteed to provide high methane recovery and will lower the site operating costs.

Greenlane – changing the nature of natural gas.



IES Biogas SRL




COMPANY INFOS

Company name: IES Biogas SRL

Phone: +39 0434 / 363601

E-Mail: info@iesbiogas.it

Website: www.iesbiogas.it

Active biogas activities in the following countries: Italy, France, Greece, Serbia, Croazia, China, South Korea, Indonesia, Philippines, Argentina, others


TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Service provider
- Project developer
- Biomethane and biogas trader
- Infrastructure operator
- Science & Research

✓ Bio Verola Biomethane production plant – a sustainable solution for the future of agriculture and mobility

Location of the project: Verolanuova (Brescia), Italy

IES Biogas designed and built a plant to produce 300 Sm³/h of advanced biomethane from the anaerobic digestion of 150 t/d of agricultural and zootechnical by-products and energy crops. The 2,7 million Sm³/y of biomethane produced is injected directly into the national gas grid and used in the automotive sector, allowing a saving of over 2.000 t of oil equivalent and thus avoiding the release of about 5.100 t of fossil CO₂ into the atmosphere. The digestate produced is sent to a solid-liquid separation phase. The liquid part of the digestate is treated with a biological system to reduce ammonia nitrogen, which decreases by 70%. The separated solid is aerobically stabilized to produce fertilizer, which enriches the soil with organic substance and nutrients, giving back what was taken during agricultural activities and creating a real carbon sink.



Inagro vzw



COMPANY INFOS

Company name: Inagro vzw
Phone: 003251 27 32 00
E-Mail: info@inagro.be
Website: www.inagro.be
Active biogas activities in the following countries:
 Belgium



TYPE OF SERVICES

- Science & Research



Research into small-scale anaerobic digestion

Location of the project: Rumbek-Beitem (province of West-Flanders), Belgium

INAGRO is the only research institute in Flanders that has its own biogas installation (31 kW_{el}, built in 2006) set up to facilitate practice-oriented research and demonstrations in biogas production and nutrient recovery. All the heat produced in the combined heat and power unit (CHP) is used in our greenhouse (0.4 ha) and on our on-site aquaculture fish farm.

INAGRO has been involved in several projects relating to biogas (Arbor, Pocket Power, Pocketboer 1, Pocketboer 2, Nutri2Cycle, Nitroman, Bigas-MAMBO, ...), for which the institute's small, on-site digester was an essential tool, enabling researchers to build up knowledge and expertise. INAGRO is further investing in research facilities for pretreatment and downstream techniques. One example of a success story from the last year was the successful anaerobic mono digestion of pig manure, which was achieved during work on the Pocket Power and Nutri2Cycle projects.



Institute for Biogas, Waste Management & Energy



Institute for Biogas
 Waste Management & Energy



COMPANY INFOS

Company name: Institute for Biogas, Waste Management & Energy
Phone: +49 (0)3643 – 54489 120
E-Mail: info@biogasundenergie.de
Website: www.biogasundenergie.de
Active biogas activities in the following countries:
 Germany, Luxembourg, China, Denmark, Sweden, Norway



TYPE OF SERVICES

- Service provider
- Science & Research
- Others: Consulting

Iogen Corporation



COMPANY INFOS

Company name: Iogen Corporation
Phone: 613-733-9830
E-Mail: info@iogen.ca
Website: www.iogen.ca
Active biogas activities in the following countries:
 Canada, United States, UK



TYPE OF SERVICES

- Project developer
- Biomethane and biogas trader
- Science & Research



Threemile Farm Project – injection of renewable natural gas into the gas grid

Location of the project: Boardman, Oregon, USA

The project, located near Boardman, Oregon, uses manure from 33,000 dairy cows to feed an anaerobic digester system followed by a biogas clean-up system that injects renewable natural gas (“RNG”) into the natural gas grid. The RNG is used as a transport fuel, eliminating about 130,000 tonnes of carbon dioxide emissions per year, which equates to the removal of 28,000 cars from the road. The \$55 million project began injecting RNG into the grid in July 2019.

The RNG is currently being used as transport fuel in California. Iogen provided the project with a structured RNG offtake agreement that helped maximize project returns within risk boundaries. Under a 10-year agreement, Iogen is providing an investment-grade floor price for RNG with market upside sharing, and is managing all fuel compliance activities, including generating and monetizing D3 RINs under the federal Renewable Fuel Standard and LCFS Credits under the California Low Carbon Fuel Standard program.



Oregon's only dairy manure renewable natural gas production facility – one of the largest in the US – began injecting RNG into the grid in July 2019.

Karlsruhe Institute of Technology – KIT



COMPANY INFOS

Company name: Karlsruhe Institute of Technology – KIT
Phone: +49 721 608-42960
E-Mail: reinhard.rauch@kit.edu
Website: ceb.ebi.kit.edu



TYPE OF SERVICES

- Science & Research

Active biogas activities in the following countries:
 Germany

Kemira Oyj

kemira



COMPANY INFOS

Company name: Kemira Oyj
Phone: +46 737 19 15 09
E-Mail: britt.nilsson@kemira.com
Website: www.kemira.com
Active biogas activities in the following countries:
 Sweden, Denmark, France, Belgium, Netherlands, Spain, Finland, UK, Norway, Czech Republic, Slovakia, Slovenia, Hungary, Poland and Austria



TYPE OF SERVICES

- Others: Supplier of services and products for boosting biogas production and reduction of H₂S.

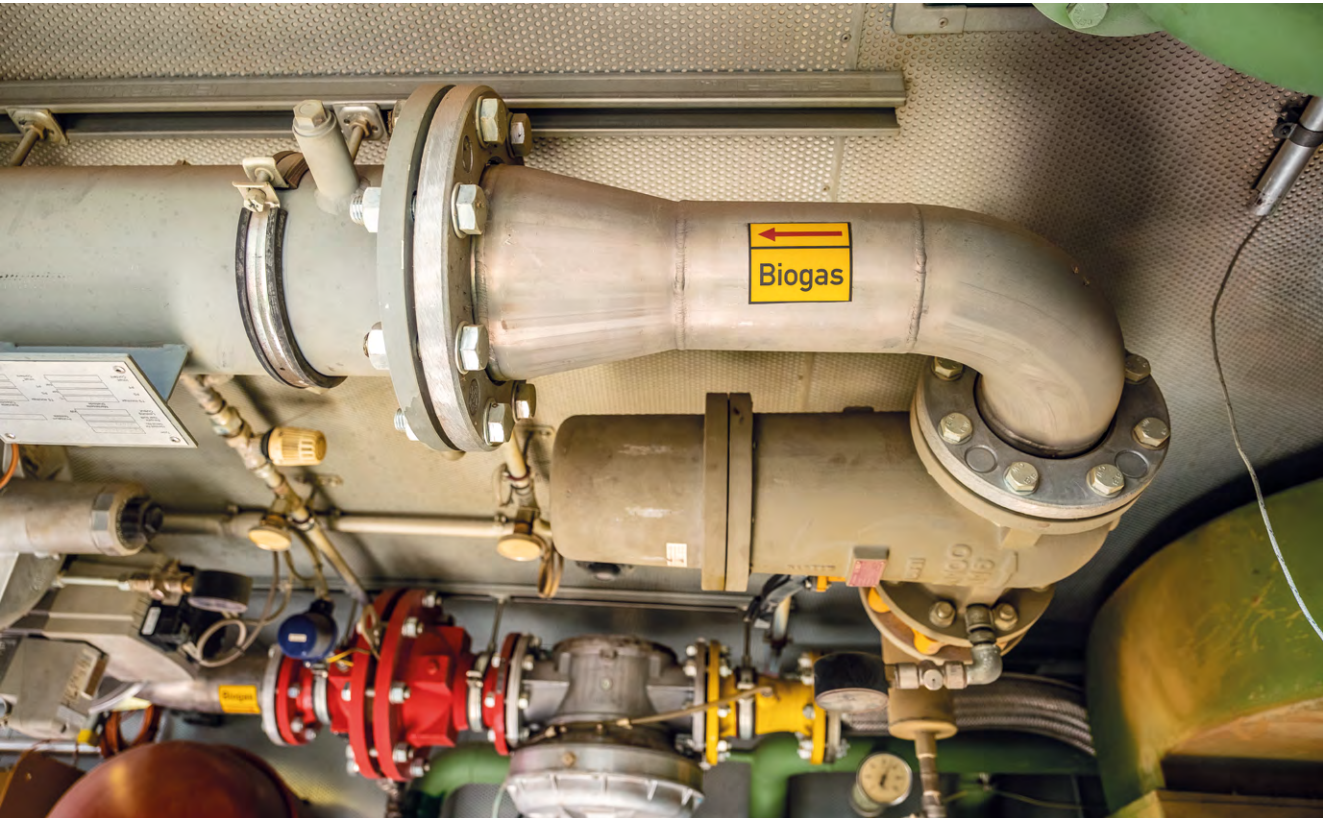


Solving instability in a biogas plant at a dairy to improve the biogas yield and performance of the whole plant

Location of the project: Umeå, Sweden

The dairy plant had high variations in the incoming flow, which caused instability, meaning the load to the anaerobic contact process had to be reduced. The anaerobic contact process was therefore unable to reach full capacity. In addition, the cost of replacing the granules that were washed out was high. To optimize all treatment steps including flotation, anaerobic process and dewatering, a thorough evaluation of the process and process data was conducted, with a view to providing a solution and offering more ap-

propriate product selections. The customer now uses Kemira BDP- 869, PAX-XL100 and Sedifloc 890C. This has resulted in improved reactor capacity, which is now remarkably stable and has a VFA (volatile fatty acid) content below the 500 ppm which is an outlet requirement. Average COD load has increased substantially, maintaining stable reactor conditions even during high peaks; biogas production has increased; flotation and dewatering have improved, with 30% less polymers; and the operation as a whole has become more efficient.



Landwärme GmbH



COMPANY INFOS

Company name: Landwärme GmbH
Phone: +49 | 89 | 24 88 200 10
E-Mail: dagmar.duering@landwaerme.de
Website: www.landwaerme.de
Active biomethane activities in the following countries:
 Germany, UK, Netherlands, Switzerland, Italy, Austria, Hungary, Poland, Sweden, Spain, Denmark



TYPE OF SERVICES

- Service provider
- Project developer
- Biomethane and biogas trader



Greening the transport sector: Closing in on 100 % biomethane at all German CNG filling stations

Location of the project: Munich, Germany

The goal Landwärme has set for itself and the CNG fuel market is no less than going completely green: 100 % biomethane at all CNG stations in Germany by the end of 2020. And they are well on their way. As of June 2020, the German CNG market has more than doubled its share of biomethane relative to 2018, rising from 30 % to an estimated 70 % by the middle of the year.

Landwärme can account for more than a third of the biomethane volume in the fuel market already, and their success and numbers are rapidly increasing. Getting there was not easy: market conditions and political frameworks have been and still are difficult. Nevertheless, as a biomethane trader, Landwärme has been an advocate for biomethane as a fuel for years, actively shaping the discourse and spreading awareness of biomethane's potential in decarbonizing the transport sector. Thanks to extensive communication and perseverance, Landwärme has been able to drive forward the shift from fossil to renewable fuels.



LIQAL B.V.



COMPANY INFOS

Company name: LIQAL B.V.
Phone: +31 (0)85 4861 000
E-Mail: info@liqal.com
Website: www.liqal.com

Active biomethane activities in the following countries:
 Europe



TYPE OF SERVICES

- Supplier of liquefaction units for biomethane

Malmberg



COMPANY INFOS

Company name: Malmberg
Phone: +46-44-780 18 00
E-Mail: info@malmberg.se
Website: www.malmberg.se

Active biomethane activities in the following countries:
 Sweden, Norway, Finland, Germany, UK, Denmark, Italy, China



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Service provider



Seaweed into green gas - Solrød Biogas, injection of biomethane into Danish gas grid

Location of the project: Copenhagen – Solrød, Denmark

The new Malmberg biogas upgrading plant in Solrød, outside Copenhagen, has the capacity to convert 2800 Nm³/h biogas into green biomethane. The plant has been in operation since October 2019, injecting the gas produced into the natural gas grid. The biomass is partly made up of seaweed from the Bay of Køge and Solrød Beach. Not only will it be turned into fossil-free energy; its removal will also improve the quality of the bathing water in the bay. The plant is the first of its kind in Denmark to produce green energy out of seaweed.

Malmberg's client for the project is Bigadan, a Danish biogas developer and operator of several biogas sites around the world.

Malmberg has delivered more than 115 biogas upgrading plants to date, in Europe and China, incorporating the reliable water wash technology Malmberg Compact™.



Martin GmbH für Umwelt- und Energietechnik



COMPANY INFOS

Company name: Martin GmbH für Umwelt- und Energietechnik
Phone: +49 89 356 17-0
E-Mail: mail@martingmbh.de
Website: www.martingmbh.de

Active biogas activities in the following countries:
 Europe except for Germany & Austria



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants



Dry anaerobic digestion in Tornesch

Location of the project: Tornesch, Germany

In Tornesch, the local waste management company, GAB Umwelt Service, operates a dry digestion plant offering a full range of waste treatment facilities. Prior to the project, organic waste treatment was managed by mechanical pre-treatment and composting. Martin GmbH was contracted as a turn-key supplier to extend the existing plant with a TTV Thoeni Plug Flow Digester unit based on the TTV Thoeni Continuous High Solids Anaerobic Digestion system. Martin completed the project on time while the existing facilities were still operating. The solids are removed to leave a liquid digestate which is then pumped to the neighbouring incineration plant (demonstrating the synergies between the two technologies), while the solid digestate is composted. The completely automated turn-key plant was integrated with the existing pre-treatment, composting and incineration plants and now produces 2.2 million m³ of biogas annually, fuelling two CHPs.

Guaranteed values (e.g. throughput, compost quality, energy consumption) were fulfilled during the performance tests.



N2 Applied

N2 — Applied



COMPANY INFOS

Company name: N2 Applied
Phone: +31 64100 1177
E-Mail: henk.aarts@n2.no
Website: www.n2applied.com
Active biogas activities in the following countries:
 Europe and South Africa



TYPE OF SERVICES

- Providing plasma treatment technology to improve digestate value by adding nitrogen from air, reducing ammonia loss and removing smell



Plasma treatment of digestate increases grass yields

Location of the project: Bingham Farm in Crumlin, Northern Ireland

Plasma treatment of digestate from a 250 kW AD plant at Bingham dairy farm in Northern Ireland has shown positive results over several years, increasing grass yield and reducing emissions and odour. The N2 unit treats the liquid fraction of the digestate, using electricity to capture nitrogen from the air. The nitrogen is absorbed into the liquid as nitrate and nitrite. This increases the nitrogen content and reduces the emissions of ammonia and residual methane during storage and field application, making more nitrogen available for the plants.

Grass growth trials were carried out by the Agri-Food and Biosciences Institute (AFBI) in 2018-2020. The treated product showed a significant increase in dry matter grass yield compared to untreated digestate. The AFBI conclusion states that “plasma treated digestate displayed great promise as a nitrogen fertiliser and provides a significant nutrient source as well as having important economic benefits long-term.”



Figure 2: Start of fertilisation with treated digestate at Bingham dairy farm, Northern Ireland.

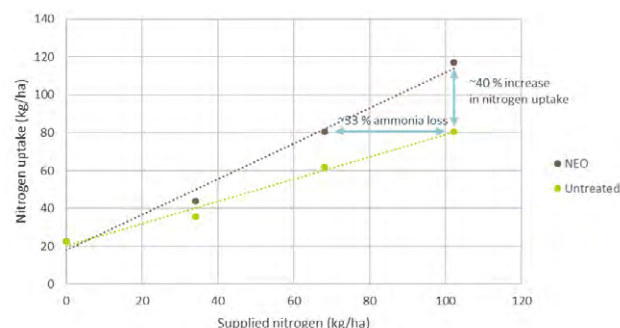


Figure 1: Differences between treated and untreated digestate N uptake on the first cut on a grass sward. The difference between the trendlines demonstrates the NH₃ lost by volatilisation from untreated digestate and the subsequent improved performance of Nitrogen Enriched Organic Fertiliser (NEO)



Figure 3: Field trial plots to evaluate the yield difference between treated and untreated digestate

Nature Energy A/S



COMPANY INFOS

Company name: Nature Energy A/S
Phone: +45 70 22 40 00
E-Mail: kontakt@natureenergy.dk
Website: natureenergy.dk/en
Active biogas activities in the following countries:
 Denmark, France & UK



TYPE OF SERVICES

- Operators of biogas and/or biomethane plants
- Project developer
- Biomethane and biogas trader
- Science & Research
- Others: Design and Construction



Nature Energy Glansager – a new large-scale Danish biogas plant

Location of the project: Glansager, Denmark

Nature Energy Glansager, located in southern Denmark, builds on Nature Energy’s successful development, design, construction and operation of 10 other biogas plants in the country. It is the 3rd generation of Nature Energy’s large-scale industrialized biogas plants.

Being able to demonstrate the ability of a large-scale, economically feasible project to secure very low odour and methane emissions is key in providing assurance that the biogas industry can play a major role in the future. Nature Energy Glansager was designed, developed and constructed by Denmark’s largest biogas operator: Nature Energy is able to draw on knowledge and experience, both of daily operations, and of the planning and execution of new projects.

Nature Energy receives farm waste products from the local farmers and delivers the digestate back to the same farmers. Low odour emission is secured by handling all biomass in closed buildings. In addition, all buildings and tanks are ventilated in such a way as to ensure that no odour escapes the biological odour treatment system.

Low methane emissions are secured by collecting methane from the digestate storage, using the most appropriate biogas upgrading technology and taking regular action to detect and rectify gas leakages.

Nature Energy’s biogas plants are fully automated. Nature Energy Glansager processes 370,000 tonnes of biomass per year and produces approx. 18 mio Nm³ methane.



Nedgia



COMPANY INFOS

Company name: Nedgia
Phone: +34 649 827 986
E-Mail: dfernandez@nedgia.es
Website: www.nedgia.es/en
Active biogas activities in the following countries:
 Spain



TYPE OF SERVICES

- Distribution System Operator



Injection and distribution of renewable gas, for the first time in Spain, into the Nedgia distribution gas grid

Location of the project: Butarque – Madrid, Spain (Euro-pean ECO-GATE Consortium)

The ECO-GATE European Consortium has initiated the injection and distribution into the NEDGIA gas grid of the renewable gas generated at the Butarque wastewater treatment plant (WWTP).

The project involves the production of biomethane, its injection into the NEDGIA gas grid and the establishment of a bio-CNG refuelling station, which is also connected to the grid. Since it is the first time renewable gas has been injected into the Spanish distribution gas grid, the project also allows the development of a system of certificates of origin for renewable gas in Spain, as is required to comply with the environmental decarbonisation objectives proposed by Europe for achievement by 2030.



Picture 2: Biomethane injected into the gas grid (painted in green)



Picture 1: Biomethane Plant in Butarque WWTP



Picture 3: Biomethane supplied in the bio-CNG refuelling station connected to the gas grid (painted in green)

New Energy Coalition



COMPANY INFOS

Company name: New Energy Coalition
Phone: +31652779011
E-Mail: l.stille@newenergycoalition.org
Website: www.newenergycoalition.org/en/
Active biogas activities in the following countries:
 Coordinator of several green gas and biogas projects in the Netherlands.



TYPE OF SERVICES

- Science & Research
- Others: Training and education of biogas professionals



New Energy Coalition and Energy Delta Institute – biogas masterclass

Location of the project: Brussels, Belgium

For the european gas sector there is only one future and that is decarbonisation. The most straightforward way to decarbonise natural gas streams is by replacing natural gas with different types of “renewable” gas, such as biogas or biomethane.

This masterclass offers a tour d’horizon of the complete biogas value chain, from biomass to biogas production, up-grading, distribution and consumption. It also looks at regulatory and public acceptance issues around renewable gas and various applications, e.g. in mobility.

The Energy Delta Institute, an energy business school under the New Energy Coalition umbrella, has organized and carried out this masterclass, in cooperation with New Energy Coalition’s partners, for the last couple of years. We have been able to train over 150 professionals from a variety of sectors, including government, not for profit, industry and energy companies; we have also helped raise awareness of the huge potential of green gas in the (future) energy mix. In this way we have made, and will continue to make, a contribution to the further expansion and uptake of biogas projects across Europe.

OrangeGas



COMPANY INFOS

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E-Mail: info@orangegas.nl
Website: orangegas.nl

Ørsted



COMPANY INFOS

Company name: Ørsted
Phone: +45 99 55 11 11
E-Mail: info@orsted.com
Website: orsted.com



TYPE OF SERVICES

- Operator of biogas/biomethane plants

Paques Europe



COMPANY INFOS

Company name: Paques Europe
Phone: +31 514 60 85 00
E-Mail: info@paques.nl
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Pastoor Consult BV



COMPANY INFOS

Company name: Pastoor Consult BV
Phone: +31(0)615066490
E-Mail: gjpastoor@pastoorconsult.nl
Website: www.pastoorconsult.nl
Active biogas activities in the following countries:
 Netherlands, Italy and Germany



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Project developer
- Biomethane and biogas trader
- Others: Specialist Energy and Feedstock



Digester optimisation by using TORWASH®

Location of the project: various locations

The research project “Digester optimisation by using TORWASH®” was initiated in May 2020 with the aim of studying the potential of applying a hydrothermal step (TORWASH®) in two digester value chains. Route 1 aims at increasing the biogas production efficiency of road-side grass. Road-side grass fed to digesters is inefficient mainly because of its fibrous nature, which limits mixing and creates floating grass layers in the digester.

The hydrothermal treatment of grass results in a solid containing fibres of a smaller particle size and a liquid fraction with dissolved organics, both of which help to increase biogas production. Route 2 aims at reducing the disposal costs of a digestate stream containing 70-80 wt% moisture. Hydrothermal treatment of the digestate and subsequent dewatering yields a solid containing 40% moisture and an organic-rich water fraction from which extra biogas can be produced.

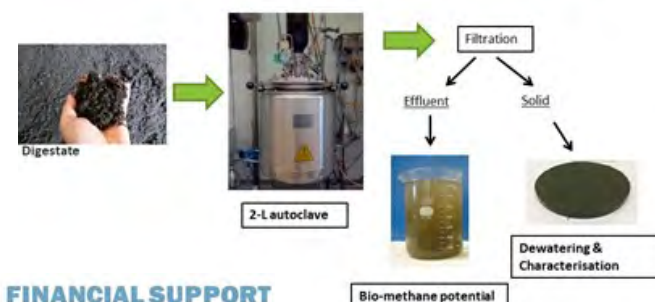
TORWASH LAB-SCALE TESTING: ROUTE 1



PROJECT CONSORTIUM



TORWASH LAB-SCALE TESTING: ROUTE 2



FINANCIAL SUPPORT

This project is financially supported by TKI-BBE



Pentair



COMPANY INFOS

Company name: Pentair
Phone: +31 77 323 2300 (Headquarters, Venlo, NL),
Phone (Sales): +39 338 672 3197 (Mr. Emanuele Zannarini, Sales Manager)
E-Mail (Sales): Emanuele.Zannarini@Pentair.com
Website: www.biogas.pentair.com

Active biogas activities in the following countries:
 Worldwide, in particular: Europe, North and South America, Asia Pacific, Africa



TYPE OF SERVICES

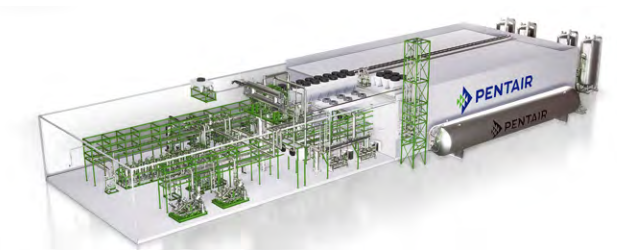
- Biogas Upgrading & CO₂ recovery system supplier (and service provider)



Large-scale biogas upgrading to biomethane and liquid CO₂ in Westdorpe

Location of the project: Westdorpe, The Netherlands

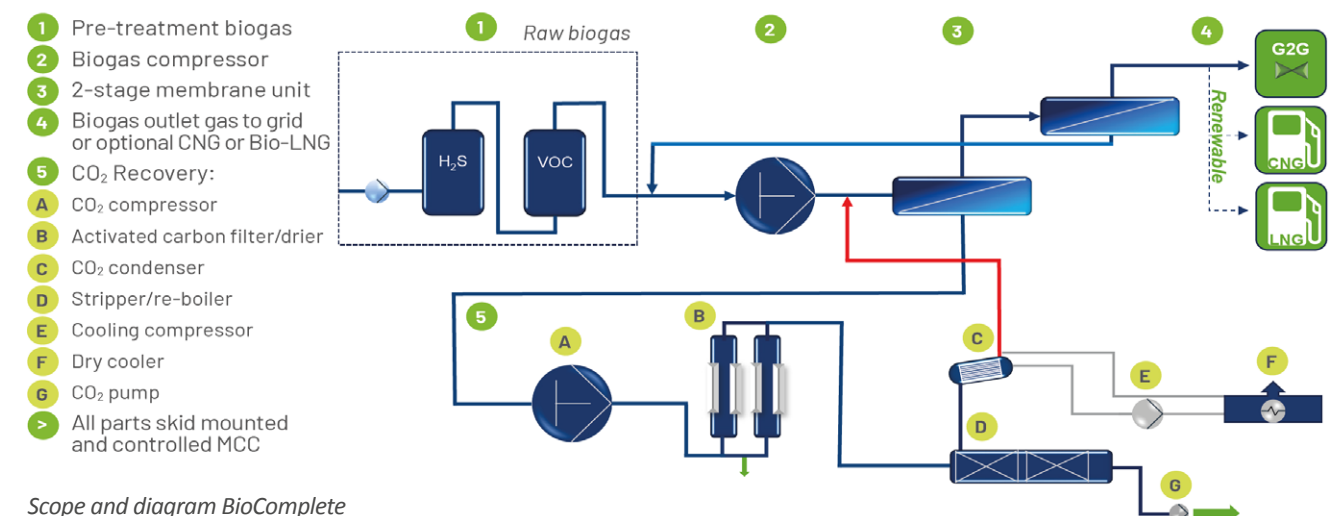
In 2019, Pentair commissioned a **BioComplete** biogas upgrading system at Aben Green Energy. The digester consumes 180,000 tons of “waste” biomass (55% manure and 45% by-products) to produce ~29,000,000 Nm³/year biogas. The biogas is upgraded to 18,000,000 Nm³/year bio-methane, which is injected into the national grid, supplying approximately 12,000 households. The second value stream, consisting of 20,000 tonnes/year of high-quality liquid CO₂, is sold mainly to greenhouses. The project specifications were ambitious: 364 days of available operation with scheduled maintenance shutdowns reduced to one day annually. The system design incorporates critical redundant and by-pass operational solutions to facilitate and support the steady, 24/7 digester gas stream of ~3,600 Nm³/h. Additionally, a gas buffer ensures that all biogas can be upgraded with minimal flaring resulting from flow variations and external process interruptions. This Pentair **BioComplete** upgrading system reduces the negative environmental effects of flaring.



BioComplete Westdorpe



Westdorpe full site aerial picture



Scope and diagram BioComplete

Peters Agrartechnik



COMPANY INFOS

Company name: Peters Agrartechnik
Phone: +32 (0)87 74 44 57
E-Mail: info@peters-mixer.be
Website: www.peters-mixer.com



Politecnico di Torino



COMPANY INFOS

Company name: Politecnico di Torino – Department of Energy
Phone: Prof. Massimo Santarelli: +39 011 090 4487
 Dr. Marta Gandiglio: +39 011 090 4560
E-Mail: denerg@pec.polito.it, massimo.santarelli@polito.it, marta.gandiglio@polito.it

Website: www.polito.it, www.denerg.polito.it, demosofc.wordpress.com
Active biogas activities in the following countries: Italy



TYPE OF SERVICES

- Project developer
- Science & Research



DEMONstration of large SOFC systems fed with biogas from WWTP (acronym DEMOSOFC)

Location of the project: Collegno (Torino, Italy)

The DEMOSOFC plant is the first industrial size biogas-fed fuel cell installation in Europe. The system is based on Solid Oxide Fuel Cell (SOFC) technology and is located in the SMAT Collegno Wastewater Treatment Plant (WWTP), close to Turin (IT).

The key advantages of fuel cell technology for biogas exploitation – compared to traditional engines – derive from the high electrical efficiency (always higher than 50%, with peaks at 55-60%, irrespective of the system size), the zero pollutants emissions to the atmosphere (< 20 mg/m³ of NO_x and SO_x, PM lower than ambient air values, measured onsite) and the possibility of power modulation without having efficiency losses.



Figure 1: DEMOSOFC plant in the Collegno WWTP

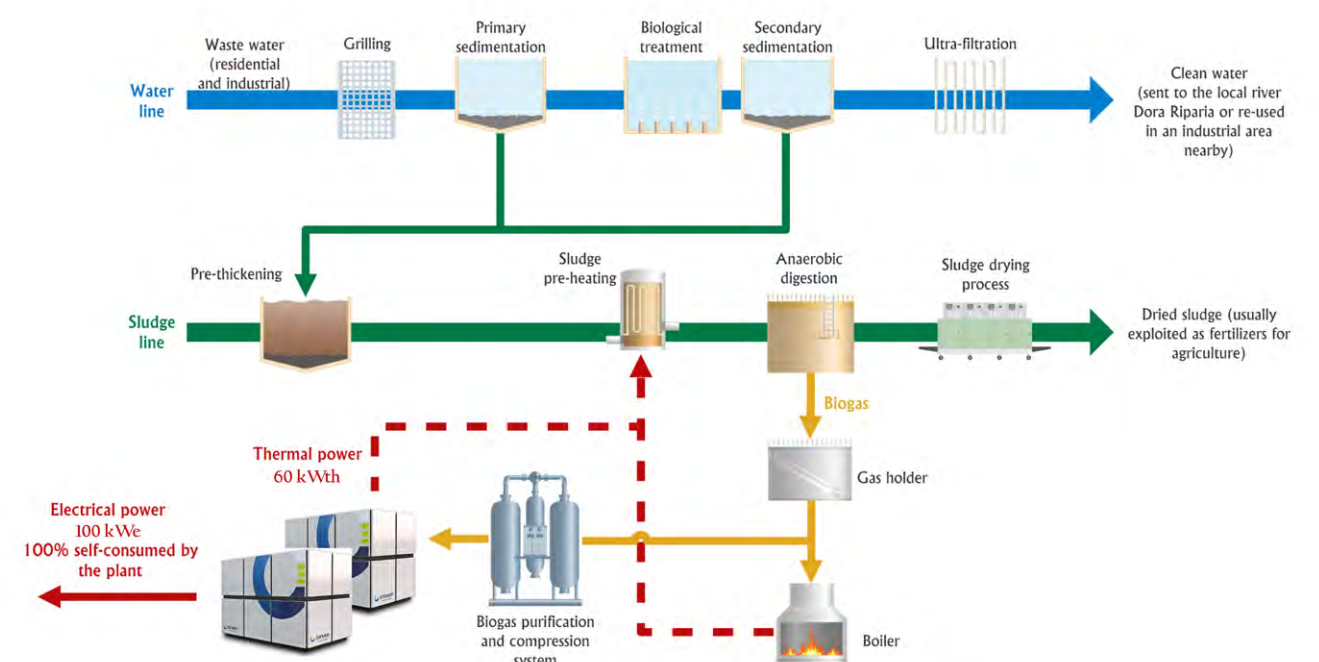


Figure 2: Layout of the DEMOSOFC plant

QED Environmental Systems



COMPANY INFOS

Company name: QED Environmental Systems
Phone: +1 (800) 624-2026
E-Mail: info@qedenv.com
Website: www.qedenv.com

Regas Srl



COMPANY INFOS

Company name: Regas Srl
Phone: (+39) 0363 277446
E-Mail: sales@regasenergy.com
Website: www.regasenergy.com
Active biogas activities in the following countries: Italy, France



TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Leading provider of metering and regulation stations to inject biomethane into the natural gas grid

Full range of solutions tailored for the biomethane industry includes:

- Quality analysis systems
- Stringent volume measurement system
- Automatic interruption and recirculation system
- Biomethane extraction plants
- Filtration stations
- Biomethane pressure reduction stations
- Odorization stations
- Data transmission and plant operation monitoring
- Service



Metering and regulation station to inject biomethane into the natural gas grid

Location of the project: Pinerolo, Turin, Italy

REGAS has been a key partner of the main utilities in the energy sector since 1998, supplying products, services and technologies dedicated to the transmission and distribution of natural gas.

Over the last few years, Regas has also developed an entire line of products for the biomethane industry. Regas recently worked on the ACEA PINEROLESE project, the first pilot project in Italy for the production of biomethane from organic waste. This project started in 2014 and is now injecting biomethane into the natural gas distribution grid.

Regas, as an EPC specialising in gas treatment systems and plants, as well as a supplier of cutting-edge technologies for gas odorisation and innovative systems for online gas analysis and real-time data management, provided a metering and regulating station for the Pinerolo project, taking care of its design, construction and installation.

At full capacity, the plant will be able to inject 800–900 cubic meters per hour of biomethane into the grid, which will then be used for various purposes, from domestic to automotive.



Renewtec – Renewable Energy Technology International AB



COMPANY INFOS

Company name: Renewable Energy Technology International AB
Phone: +46 (0)723-182 582
E-Mail: info@renewtec.se
Website: eng.renewtec.se
Active renewable energy gas activities in the following countries: Sweden, Germany, Denmark, Lithuania and Poland



TYPE OF SERVICES

- Science & Research
- Others: Conference organiser in the field of biogas, gasification and power-to-gas
www.regatec.org



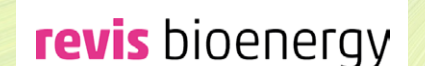
System study of lignocellulosic feedstock for biomethane production

Location of the project: Lund, Sweden (with partners from AT, CA, DE, DK and BE)

The development of indirect gasification has opened up the possibility of cost efficient bioSNG production on a small scale (5-10 MW). In the project, three different small scale bioSNG routes based on the gasification of wood chips were investigated and compared to large scale (200 MW) bioSNG facilities in terms of efficiency, primary energy needs, green-

house gas emissions and production cost. The results of the study show that the small scale bioSNG routes investigated have similar characteristics in terms of primary energy need, greenhouse gas balance and efficiency as the 200 MW facilities. The most striking result is that two of the small scale bioSNG routes (PyroCatalytic Hydrogenation and WoodRoll®) are also competitive in terms of bioSNG production cost. For more info and the full report: lignosys.renewtec.se

revis bioenergy GmbH



COMPANY INFOS

Company name: revis bioenergy GmbH
Phone: +49 251 609845-0
E-Mail: info@revis-bioenergy.de
Website: www.revis-bioenergy.de
Active biogas activities in the following countries: Germany



TYPE OF SERVICES

- Supplier of the entire biogas plants
- Supplier of parts of the biogas plants
- Operators of biogas and/or biomethane plants
- Project developer



Biogas Trebsen GmbH

Location of the project: Pauschwitz Str. 45, 04687, Saxony, Germany

Revis Bioenergy GmbH built a biogas upgrading plant producing 550 Nm³/h biomethane to feed into the grid. With this project, revis bioenergy GmbH takes the raw biogas generated from the wastewater of a paper mill and then refines it to natural gas quality with its long-proven tech-

nology. This upgrading of the biogas from the anaerobic process water treatment also allows the sustainable use of residues.

Revis bioenergy GmbH was responsible for the entire development process, from the planning to the operation of the plant.

- Construction time 6 months
- Operation of plant since September 2018

RI.SE



COMPANY INFOS

Company name: RI.SE
Phone: 010-516 50 00
E-Mail: info@ri.se
Website: www.ri.se/sv



TYPE OF SERVICES

- Science & Research

SAFE Spa



COMPANY INFOS

Company name: SAFE Spa
Phone: +390516878211
E-Mail: info@safegas.it
Website: www.safegas.it



TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Others: Supplier of Biomethane compressors



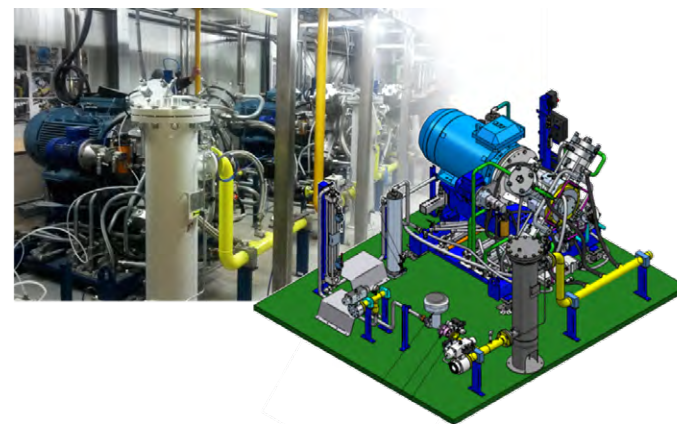
High-capacity compression station for grid injection of upgraded biomethane: from agricultural waste to the gas grid

Location of the project: Axelse Vlake, Zeeland, The Netherlands

SAFE designed and supplied Aben Green Energy with a compression station to inject up to 2300Sm³/h of agricultural biomethane into a high-pressure gas network. The compression system had to be fully integrated with the plant, ensuring high capacity and large production flexibility with the highest availability.

To meet all the requirements, the customer was continuously involved in all stages of the project. The compressor station was designed using three SAFE non-lubricated ST compressors with a max capacity of 1000Sm³/h each and 0% to 100% operability through variable speed motors and a gas recirculation line. The number of units and the compact design ensured optimized availability, footprint and service costs. The compressor station, the auxiliary systems and the control units were designed to allow complete integration in the production plan layout and station remote control system.

Thanks to the continuous customer feedback and SAFE technology, flexible and continuous operation has been ensured since the compressor's start-up in 2019.



Schaumann BioEnergy Consult GmbH



COMPANY INFOS

Company name: Schaumann BioEnergy Consult GmbH
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E-Mail: info@schaumann-bioenergy.com
Website: www.schaumann-bioenergy.com

Active biogas activities in the following countries:
 worldwide



TYPE OF SERVICES

- Science & Research
- Others: Process biological advice, process additives

SeekOps Inc.



COMPANY INFOS

Company name: SeekOps Inc.
Phone: +1 512-852-8100
E-Mail: info@seekops.com
Website: www.seekops.com
Active biogas activities in the following countries:
 United States (2 projects)



TYPE OF SERVICES

- Service provider
- Others: Biogas inspection – leak detection and quantification

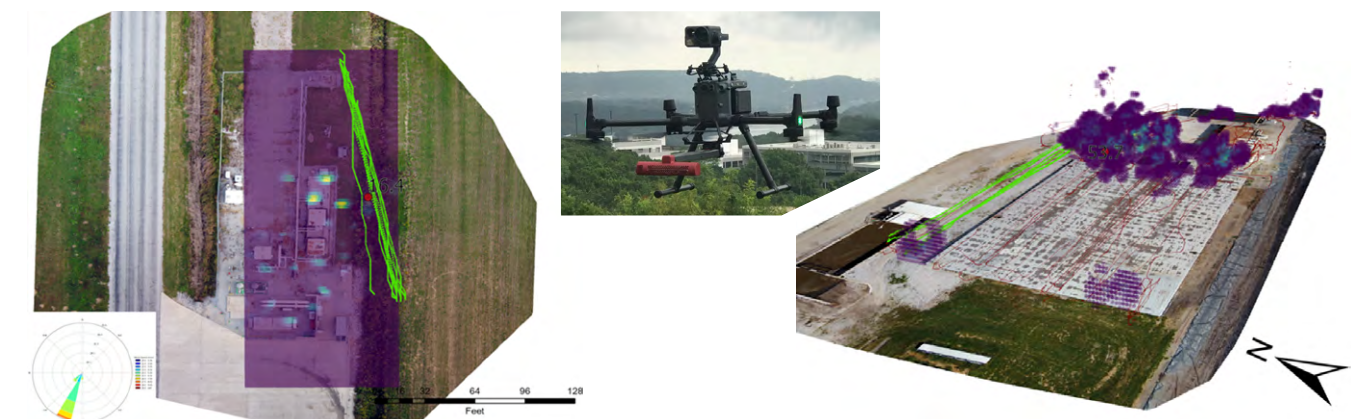


Drone-based biogas leak detection, localisation and quantification

Location of the project: Midwest, USA

SeekOps develops and deploys advanced sensor technology to detect, localise and quantify methane emissions using integrated drone-based systems. In addition to oil and gas solutions, SeekOps recently conducted inspections of dairy biogas facilities in the midwestern United States. The unique characteristics of the SeekOps solution provide efficient, sensitive leak detection and quantification across large areas to ensure the sustainability of renewable natural gas production. These first inspections were conducted in 2020

at five separate digester facilities. The results of these surveys yielded actionable data on several leaks which were immediately addressed by the operator. Furthermore, the quantitative measurements provided by SeekOps allowed effective leak grading and triage of repair activities. This successful biogas application highlights the value of efficient drone-based inspection operations, which are of real and significant benefit to asset integrity and sustainability. SeekOps will perform nine further surveys at US biogas facilities in Q4 2020.



Shell



COMPANY INFOS

Company name: Shell

Website: www.shell.com

Active biogas activities in the following countries:
US & Europe



TYPE OF SERVICES

- Biomethane and biogas trader
- Others: Investor

SHV Energy



COMPANY INFOS

Company name: Primagaz (SHV Energy)

E-Mail: www.primagaz.fr/contact

Website: www.primagaz.fr



TYPE OF SERVICES

- Biogas distributing company



Reducing emissions of a leading dermocosmetic manufacturer with bioLPG

Location of the project: La-Roche-Posay, France

La-Roche-Posay, offering innovative skincare solutions for the most fragile skin, became the first industrial site in France to use bioLPG in 2018.

BioLPG as a drop-in replacement fuel is particularly relevant for La-Roche-Posay, as the product has no impact on the performance of their manufacturing activity, and is easily incorporated into the distribution network of Primagaz France (SHV Energy). Furthermore, bioLPG is much cleaner

than fossil alternatives for heating such as heavy fuel oil and offers a real advantage in terms of CO₂ emissions.

In 2005, the La-Roche-Posay site was producing 192t CO₂ per year, which fell to zero in 2019 – with bioLPG being the last step towards carbon neutrality on the industrial site. La-Roche-Posay is committed to reducing its global carbon footprint by 60% in 2020, as part of the dedicated emission reduction program of the “L’Oreal” group. La-Roche-Posay is happy to see bioLPG aiding its contribution to this global emission reduction target.



Photograph: A bulk tank from Primagaz France at La Roche-Posay industrial site supplying bioLPG

streisal GmbH



COMPANY INFOS

Company name: streisal GmbH

Phone: +49 7522 707965 0

E-Mail: info@streisal.de

Website: www.streisal.de

Active biogas activities in the following countries:

Worldwide: Germany, Austria, Belgium, Netherlands, Italy, France, Croatia, Bosnia-Herzegovina, Serbia, Slovenia, Czech Republic, UK, Rumania, Switzerland, Slovakia, Spain, Poland, Luxembourg, Hungary, USA, Canada, China, Japan, Korea, Ukraine, Russia, Uruguay, Brazil and others



TYPE OF SERVICES

- Supplier of parts of the biogas plants:

Development, manufacturing and global marketing of innovative agitators and mixing systems for biogas plants, wastewater technology and industrial applications.

- submersible mixers from 1-18,5 kW (medium and low-speed, with propeller diameters of up to 2,8 m)
- vertical agitators
- long-axis agitators
- rod agitators



Semi-aerobic hydrolysis as a transition to flexible plant operation

Location of the project: D-17179 Lüchow Altkalen, Germany

Difficult market conditions, rising production costs, and the cut-back of guaranteed income (now only 95% of rated output) are serious threats for many German plant owners and numerous biogas plants can no longer be operated profitably. Semi-aerobic hydrolysis contributes to the economic sustainability of biogas plants by enabling the use of difficult, lower-cost substrates such as straw or dung and by generating additional revenues through more flexible and demand-oriented gas production.

After a concept study and detailed analysis of the site conditions, the existing mixing pit at the biogas plant Pommerehne was converted to perform semi-aerobic hydrolysis. A new compressed air injection system, a solid feeder, a powerful mixing system, an exhaust air filter and all the related technical components were installed and commissioned.

As a result, fibrous substrates and those containing cellulose can be transformed into a homogeneous, easily biodegradable pulp, through a highly effective biological process with alternating aerobic and anaerobic phases. By using this process, plant profitability has been significantly improved.



Hydrolysis tank with patented mixing system “streisal Hydrobull”

STX Commodities




COMPANY INFOS

Company name: STX Commodities

Phone: +31 20 5357 770

E-Mail: info@stxservices.com

Website: www.stxgroup.com/environmental-commodities

SWEN Capital Partners



COMPANY INFOS

Company name: SWEN Capital Partners

Phone: +33140681762

E-Mail: afargere@swen-cp.fr

Website: www.swen-cp.fr/en

Active biogas activities in the following countries: France, Italy, Belgium, Germany, Netherlands, United Kingdom



TYPE OF SERVICES

• Biogas infrastructure investor



SWEN Impact Fund for Transition

Location of the project: Paris, France

Convinced by the crucial role of green gases in the energy transition, SWEN Capital Partners, a major player in sustainable investments with € 5.0bn of assets under management, launched the SWEN Impact Fund for Transition in July 2019 – the first investment fund in Europe dedicated to biogas and hydrogen as renewable gas. With a current capital of € 175m, our SWEN impact fund for transition invests in renewable gas production and distribution infra-

structures within the European Economic Area, through a dedicated team of 6 people with high and complementary skills. Within its first year of operation, the Fund become an exclusive equity provider for 110 biomethane production and distribution plants in 6 European countries. Throughout the life of its investment mandate, SWIFT aims to also encourage circular economy, job creation and save CO₂ emissions. In that respect, SWEN and the EBA work hand in hand to decarbonise the European Economy through biogas, thereby powering a more sustainable future.

TAGUSGÁS – Empresa de Gás do Vale do Tejo



COMPANY INFOS

Company name: Tagusgas

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nuno.nascimento@ggnd.pt

Website: www.galp.com

Active biogas activities in the following countries:
Portugal



TYPE OF SERVICES

• Biomethane and biogas trader
• Infrastructure operator

Technische Universität Wien – TUWIEN



COMPANY INFOS

Company name: TuWien

Phone: +43-1-58801-166 00

E-Mail: mhrbek@mail.tuwien.ac.at

Website: www.vt.tuwien.ac.at//thermal_process_engineering_and_simulation/computational_fluid_dynamics/EN/



TYPE OF SERVICES

• Science & Research

Terra X



COMPANY INFOS

Company name: TerraX Srl/GmbH

Phone: +39 3403720380

E-Mail: m.niederbacher@terrax.it

Website: www.terrax.it

Active biogas activities in the following countries: Italy



TYPE OF SERVICES

• Project developer

TNO



COMPANY INFOS

Company name: TNO

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E-Mail: Marco.linders@tno.nl

Website: www.tno.nl

Active biogas activities in the following countries: Europe



TYPE OF SERVICES

• Science & Research







COMPANY INFOS
Company name: Total
Phone: +31304100800
E-Mail: info@totalgasmobility.com, gp.biogas@total.com
Website: www.total.com
Active biogas activities in the following countries:
 Netherlands, Germany, Belgium and France



TYPE OF SERVICES
 • Operators of biogas and/or biomethane plants
 • Biomethane and biogas trader






COMPANY INFOS
Company name: Tarka Trupkiewicz & Partners Law Firm LLC
Phone: +48 22 370 28 00
E-Mail: Michal.Tarka@ttw-legal.pl
Website: www.ttw-legal.pl

Active biogas activities in the following countries:
 Poland



TYPE OF SERVICES
 • Legal services & Project development





Total supplies Belgium’s first 100% bioCNG station

Location of the project: Quai des Usines, Brussels, Belgium

In 2019, Total’s worldwide competence centre for gas mobility arranged the supply for Belgium’s first bioCNG station. The Total station is located at Quai des Usines 22 in Brussels (close to the city centre and a food logistics hub). The sourcing was realized by transferring Guarantees of Origin from one of Total’s production facilities in the Netherlands to Belgium. This involved the use of the newly created Green Gas Register in Belgium and the setup of cooperation between this register and the Dutch operator Vertogas. Using this structure, Total can now green 100% of the CNG that is refueled at the Brussels station, as well as having the


opportunity to do the same for a further station based on customer demand. This is a first step towards more bioCNG being offered by Total in Belgium, and we look forward to collaborating with Belgian producers to supply locally-sourced bioCNG in the (near) future!
 On a larger scale, Total aims to become an integrated player across the entire biogas value chain. The group will focus on developing and operating facilities able to produce biomethane from industrial and agricultural organic matter, in Europe and worldwide. Total’s ambition is to produce 1.5 TWh of biomethane annually by 2025, and to provide biomethane to meet 10% of the needs of its European gas-fired power plants by 2030.





COMPANY INFOS
Company name: UBE Europe GmbH
Phone: +49 (0) 211 17883-35
E-Mail: k.wakamura@ube.com
Website: www.ube.com/contents/en/chemical/separation/index.html

Active biogas activities in the following countries:
 All over the world



TYPE OF SERVICES
 • Supplier of parts of the biogas plants
 • Others: UBE produces MEMBRANES (gas separation) for Biogas Upgrading



University of Natural Resources and Life Sciences, Vienna – BOKU



COMPANY INFOS
Company name: University of Natural Resources and Life Sciences, Vienna – BOKU
Phone: (+43-1) 47654-0
Website: www.boku.ac.at/en



TYPE OF SERVICES
 • Science & Research



University of South Wales

University of
South Wales
Prifysgol
De Cymru



COMPANY INFOS

Company name: University of South Wales

Phone: 01443 654130

E-Mail: sandra.esteves@southwales.ac.uk

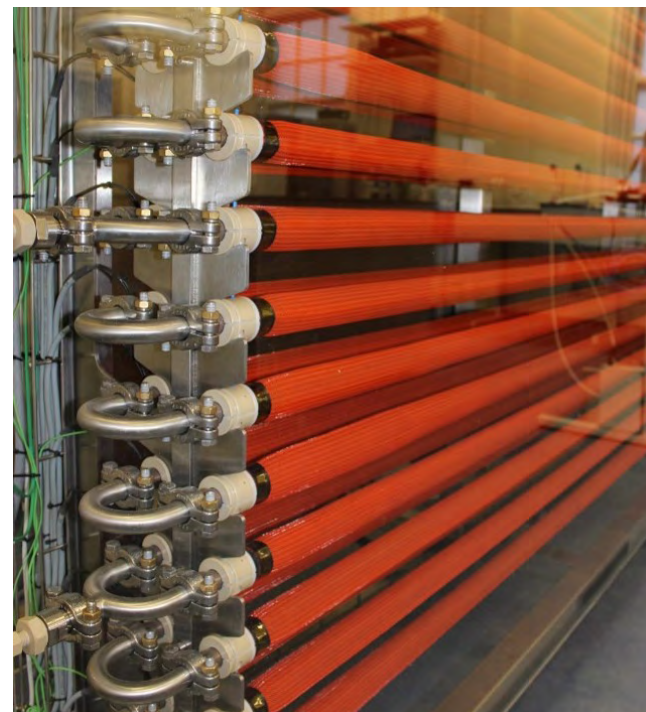
Website: www.walesadcentre.org.uk

Active biogas activities in the following countries: UK and internationally



TYPE OF SERVICES

- Science & Research



Reactor systems being investigated at the University of South Wales.

Department for
Business, Energy
& Industrial Strategy

NiTech
SOLUTIONS

bpe



Vaisala Oyj

VAISALA



COMPANY INFOS

Company name: Vaisala Oyj

Phone: +358 9 89491

E-Mail: www.vaisala.com/en/lp/contact-form

Website: www.vaisala.com

Active biogas activities in the following countries: Most EU countries, United States, China, Japan, Malaysia, Australia



TYPE OF SERVICES

- Supplier of parts of the biogas plants
- Others: Supplier of measurement instruments for biogas and biomethane plants



Landfill gas monitoring at Helsinki Region Environmental Services

Location of the project: Ämmässuo, Espoo, Finland

A wholly new type of combined methane, carbon dioxide and humidity probe, the Vaisala MGP261, was developed for the analysis of biogas and landfill gas in CHP engines and biomethane upgrading plants. The landfill gas plant required a simple direct reading instrument, operational without frequent maintenance or calibration — both of which had been recurring problems with previous instruments. Thanks to the simplicity of the design, trace heated optics and moisture repelling filter, the MGP261 was found to be

extremely resilient towards siloxanes, hydrogen sulphide and condensing moisture. Furthermore, since the MGP261 measures directly from the raw gas stream, the methane concentration measured shows the true wet basis concentration. Water vapour no longer needs to be removed from the gas before analysis. Now the operator can calculate more accurately the total volume of methane produced per hour, enabling better engine control and a more accurate inventory of methane recovered. These are both important considerations when assessing overall plant efficiency.



VSL B.V.

VSL
Dutch
Metrology
Institute



COMPANY INFOS

Company name: VSL B.V.

Phone: 015 - 269 15 00

E-Mail: info@vsl.nl

Website: www.vsl.nl

XYLEM Water Solution AB



COMPANY INFOS

Company name: XYLEM Water Solution AB
Phone: +46 8-475 60 00
E-Mail: info@xyleminc.com
Website: www.xyleminc.com
Active biogas activities in the following countries:
 Global presence



TYPE OF SERVICES

- **Supplier of parts of the biogas plants**

YARA International ASA



COMPANY INFOS

Company name: Yara International ASA
Phone: +47 45474703 (Wolfram Franke, Norway)
 +49 15114511666 (Marina Ettl, Germany)
E-Mail: Wolfram.franke@yara.com
 marina.ettl@yara.com

Website: www.yara.com
Active biogas activities in the following countries:
 Only passive (European-wide)



TYPE OF SERVICES

- **Others:** Chemical industry (fertilizer production)



Membership

Become an EBA member!
36 new members have joined our network since January 2020.

The coming year will proof to be important for our sector. The EBA has increased its activities and new members are joining. This allows for a very strong network as well as a strong position within Europe.

Discover the benefits of EBA membership:

- Support your interests at a European level, through our close collaboration with the EU institutions;
- Become a part of our extended network of experts active in the field of biogas and biomethane;
- Get involved in European projects to develop the biogas and biomethane sector and cooperate with us in removing the existing barriers for the development of renewable gas technologies;
- Join our Company Advisory Council to exchange views on market opportunities and participate in dedicated working groups to influence policy topics;
- Join our Scientific Advisory Council to extend cooperation with other members and facilitate the exchange of knowledge in biogas and biomethane research;
- Access in-depth analysis and first-hand information on the development of the biogas and biomethane sectors through our website, newsletter and social media;
- Participate as a speaker at our conferences and workshops;
- Enjoy free access to EBA reports and studies and enhance your visibility through EBA publications.



Interested in joining?
Get in touch with us: info@europeanbiogas.eu



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