



**SHAW RENEWABLES**

The bioenergy specialists

*presents*

# BIOGAS

in partnership with



**BIOCONSTRUCT**

INTELLIGENT BIOGAS PLANTS.





At Shaw Renewables we're passionate about building a business that delights its customers, values and nurtures its employees and sets new standards of excellence in the energy industry.

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The Shaw brand has been a trusted name for over 15 years

We specialise in the design, installation and maintenance of bespoke biomass and biogas solutions.

we only install tried and tested products

honesty and integrity at our core

We are members of The REA and ADBA who share our passion for promoting the use of bioenergy throughout the UK.



**SHAW RENEWABLES**  
The bioenergy specialists



# GLOSSARY of terms



**Anaerobic digestion** - A natural process where organic matter is broken down by micro-organisms in an air-tight tank, or digester.

**Biogas plant** - also known as an anaerobic digester.



**Substrate** - the material on or from which an organism lives, grows or obtains its nourishment.

**Feedstock** - also known as substrate



**Biogas** - One of the products derived from the process of anaerobic digestion. A gaseous fuel.

**Biomethane** - a gas which is injected directly into the national gas grid for use as a heating fuel. This gas differs from biogas, but can be extracted from biogas.



**Digestate** - The material remaining after the anaerobic digestion of a biodegradable feedstock.



**Methane** - a colourless, odourless flammable gas which is the main constituent of natural gas.



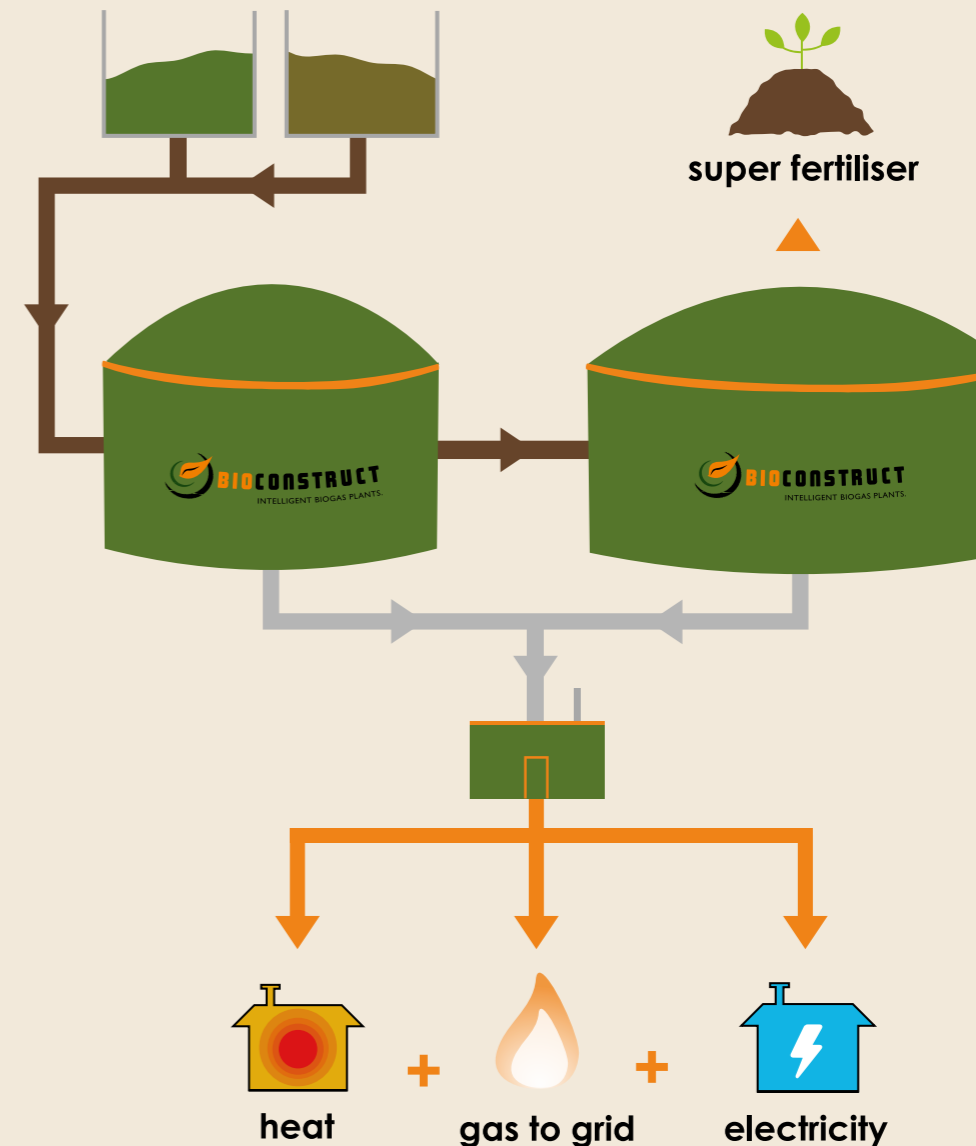
**Anaerobic** - relating to or requiring an absence of oxygen

**FIT** - Feed in Tariff

**RHI** - Renewable Heat Incentive

**REA** - Renewable Energy Association

**ADBA** - Anaerobic Digestion and Bioresources Association



**Anaerobic digestion (AD)** is a natural process where organic matter is broken down by micro-organisms, many of which are intolerant of an oxygen rich environment. This is why the process is anaerobic.

Management of the process requires a substrate - a material that the microorganisms feed and live on and an environment in which they can thrive and multiply at an accelerated rate.

The substrates are fed into "fermentation" tanks where the feedstock is continuously mixed. The fermenters are heated to provide an optimum condition for the micro-organisms to begin breaking down the matter releasing methane. The substrate remains within the fermenters long enough to allow the best yield of gas to be released (this is known as the retention time). This matter is then transferred to storage containers where any excess gases can be collected.

Biogas produced in the fermenters can be used in a few ways. The biogas can be delivered to a CHP (Combined Heat and Power) unit where moisture is removed from the gas, which is then burnt to produce electricity and heat. The moisture removed from the gas is treated and returned back to the waterways once at a suitable standard. The electricity produced is ready to be used locally and fed in to the national grid.

Biogas can also be treated further by upgrading the methane to produce biomethane - this process allows the operator to inject the gas into the national gas grid. The organic matter (now called digestate) is still rich in nitrogen and other nutrients, making the substance an ideal fertiliser.

**At the end of the process there is no waste or unusable by-product - everything has a use.**



# SUBSTRATES

Substrates are the materials on which bacteria and archaea live and grow. These two groups of microorganisms are responsible for the natural breakdown of organic matter into methane, carbon dioxide and water within an anaerobic (oxygen free) environment. The term organic matter is a banner name for a massive variety of materials, some of which are more easily converted into methane or carbon dioxide than others.

Anaerobic digestion technology is simply a means of creating an ideal environment for these microorganisms to thrive and breakdown the matter at an accelerated rate. Substrates, which are often given the name feedstock, can be materials grown or produced specifically for digestion, waste and by-products diverted from landfills or other productions or a mixture of both.

Waste or by-products are commonly used in biogas production because of its sustainability, availability and the ability to turn something that is usually disposed of into profit. Slurry and manure make excellent substrates, as they maintain their fertilising qualities during the digestion and prove popular due to the potential of turning a nuisance by-product into an income.



Energy crops specifically grown for biogas production are widely used as they provide a stable and effect substrate as well as a consistent value per acre to the grower. The sustainability of feedstock is a key factor in biogas production, as creating a good mix of varying organic matter can take time and changing one substrate for another could often slow down the process.

At the end of the process your substrate has not only produced a biogas substance which can be used as fuel, it continues to be a useful by-product itself. Now called digestate, although useless to the production of methane, it is rich in readily available nitrogen and valuable nutrients earning it the nickname "super fertiliser", which can be sold to create more profit and used on your land to increase yield and eliminate any waste from the anaerobic digestion process.

There are four main stages of the process, each stage breaks the matter into smaller and smaller parts, until the only remaining substances are methane, carbon dioxide, water and digestate, all of which have uses.

1

## Hydrolysis

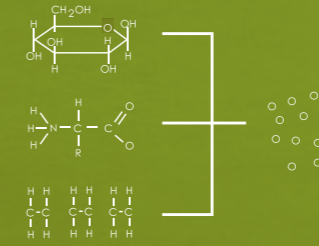
The complex organic matter, carbohydrates, fats and proteins, are broken down into simple sugars, fatty acids and amino acids.



2

## Acidogenesis

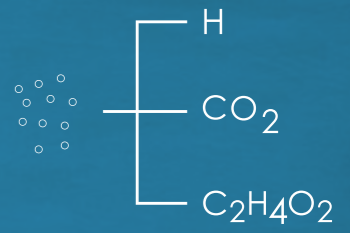
The singular sugar molecules, fatty acids and amino acids are broken down into alcohols and volatile fatty acids.



3

## Acetogenesis

The volatile fatty acids and alcohols are converted again, this time into hydrogen, carbon dioxide and acetic acid.



4

## Methanogenesis

Methanogenic archaia convert the remaining hydrogen and acetic acid into methane and more carbon dioxide.





A trusted name in Biogas across Europe, BioConstruct design bespoke plants based on your needs and substrates ensuring that your investment is a long term one.

## A unique insight

Managing 18 of their own plants gives BioConstruct a unique insight into substrates and the day-to-day managing of anaerobic digesters.

When you choose a turnkey solution from Shaw Renewables and BioConstruct you receive more than just a digestion plant, you receive over a decade of experience and expertise partnering with you to make your plant successful and profitable.



Bioconstruct have been in the renewable energy market since 2001, growing to employ over 100 experts and building a brand that is renowned for their expert advice, bespoke designs and highly profitable solutions.

The company have installed over 210 Anaerobic Digestion plants throughout Europe and are now keen to grow in the British market.

Biogas plants have often been misunderstood, miss sold and mismanaged, which is why Shaw Renewables Ltd. have partnered with BioConstruct who are passionate about the engineering and technology that goes into their installations.

## Investing over €5m in research

In 2010 BioConstruct invested €5m in a research laboratory at their headquarters in Germany. It's here that they put new technologies to the test before recommending them to customers.

Dedicated to providing the best in biogas technology, research projects are always ongoing to ensure any advice given is qualified advise.

**Robust and future proof engineering**

## Agricultural installations

We believe that our knowledge needs to extend beyond our engineering skills, and that our understanding of substrates is vital to delivering biogas plants that work for your farm.



**Vettweiss, Germany**

Installed capacity: **370kWh**

Substrate: **Maize silage and sugar beets**

Initial operation: **2011**

**The biogas is upgraded to Biomethane on site**



**Kaarsen, Germany**

Installed capacity: **3.3MW**

Substrate: **Cattle manure, cattle dung and maize silage**

Initial operation: **2005**

**This large scale plant uses 3 CHP units 2 x 1.413MW and 1 x 530kW**



**Dratum, Germany**

Installed capacity: **950kWh**

Substrate: **Energy crops, chicken and duck manure**

Initial operation: **2008**

**The initial 190kW capacity was upgraded to a total of 950kW via 3 CHP units.**



## Solutions that work for you

There's no "one-size-fits-all" solution to anaerobic digestion, which is why every plant design from Shaw Renewables and BioConstruct is bespoke and fully tailored to our customer's needs and the substrates available to them.

**Over 210 plants installed worldwide**

**A passion to be known for quality of service and customer satisfaction unites these 2 companies and makes for a great partnership.**





# RHI & FIT



## Case study

**Plant:** BioConstruct Head Quarters - Melle, Germany.

**Plant size:** currently 1.5MW

To encourage the uptake of renewable energy in homes and business across the UK, the British Government created financial incentives – the Feed in Tariff (FIT) and the Renewable Heat Incentive (RHI)



## Feed In Tariff

The Feed-in Tariff (FIT) scheme is a government programme designed to promote the uptake of a range of small-scale renewable and low-carbon electricity generation technologies.

The FIT scheme is available through licensed electricity suppliers. It requires some of them to make tariff payments on both generation and export of renewable and low carbon electricity. Generation and export tariff rates are index-linked which means that they will increase or decrease with inflation.

**The feed-in tariff is made up of two elements:**

A fixed payment from your electricity supplier for every kilowatt hour (kWh) your system generates. This is called the generation tariff.

A guaranteed price for any surplus electricity that you do not use on site, and export to the grid. This is called the export tariff and will also be paid by your electricity supplier.

**For an up to date tariff visit our website: [www.shawrenewables.co.uk](http://www.shawrenewables.co.uk)**



## RHI

The Renewable Heat Incentive (RHI) is a Government environmental programme that provides financial incentives to increase the uptake of renewable heat.

For the non-domestic sector, broadly speaking, it provides a subsidy which is payable for 20 years to eligible non-domestic renewable heat generators and producers of biogas for injection based in Great Britain.

Ofgem is responsible for implementing and administering the scheme on behalf of the Department of Energy and Climate Change (DECC).

By providing a long-term financial incentive, the objective of the non-domestic RHI is to significantly increase the proportion of heat generated from renewable sources. By driving change in a sector currently dominated by fossil fuel technologies, the RHI can help the UK meet EU targets to reduce carbon emissions and improve energy security.

**For an up to date tariff visit our website: [www.shawrenewables.co.uk](http://www.shawrenewables.co.uk)**



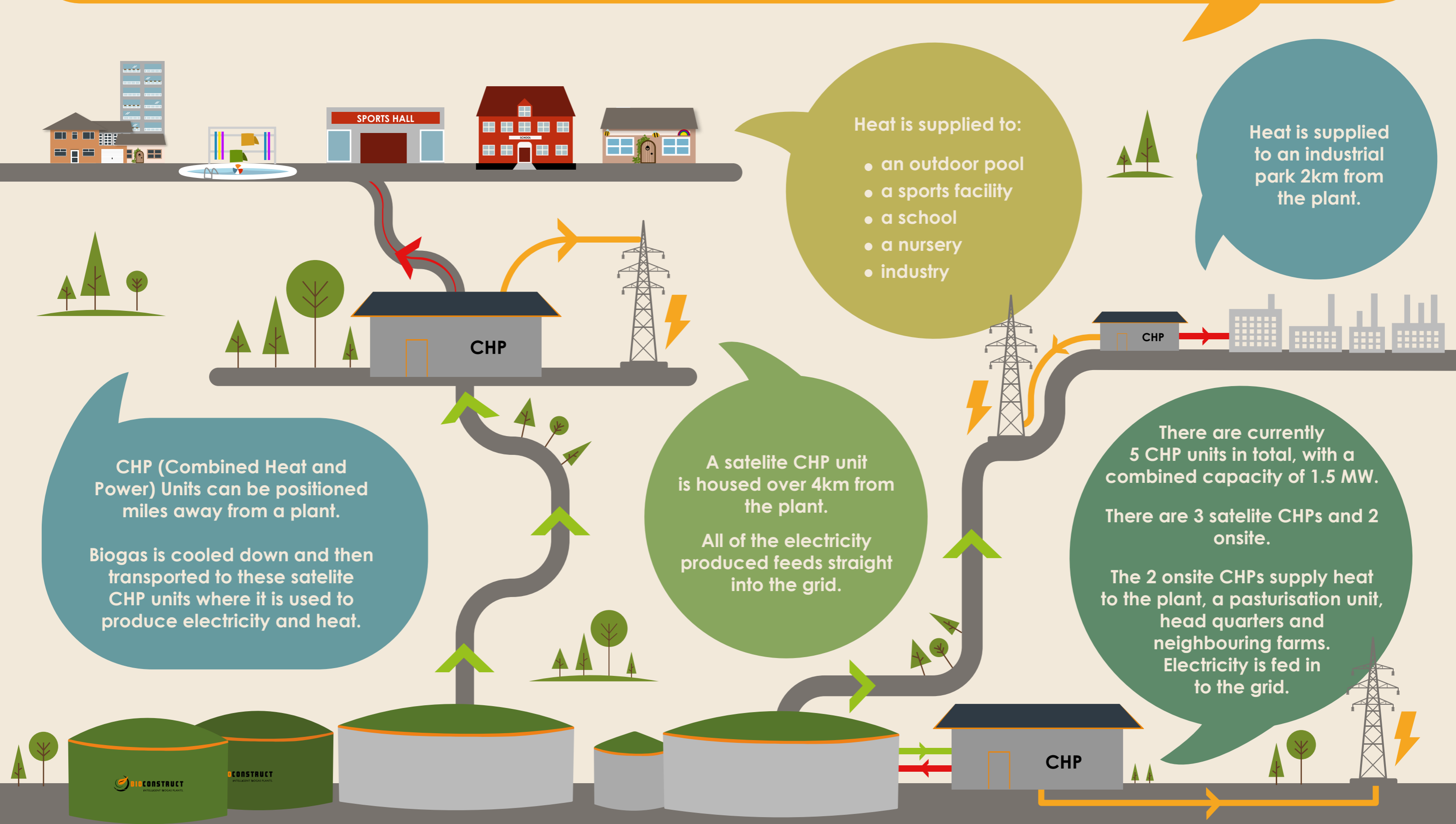
BioConstruct's Head Quarters houses office space, research facilities and a fully functioning Biogas plant.

The plant regularly undergoes development and the feedstocks vary frequently. Although the plant is used for the research and development of new methods, machinery and feedstocks the plant supplies the surrounding community with heat and feeds electricity directly into the grid.

In the UK a similar plant to this could supply electricity to homes and businesses directly from CHP Units whilst benefitting from the export tariff. As financial incentives differ in Germany, the electricity generated in this plant is sent directly to the grid to make the most of the feed in tariffs available to them.

**The following diagram illustrates the potential of a plant this size and the various applications available...**

BioConstruct's Head quarters in Melle, Germany houses their research facility and a functioning biogas plant that supplies heat and electricity to the surrounding area. Anaerobic Digestion is a process that can serve as more than just an asset to plant owners. AD can benefit communities, businesses and the local and national economy as well as the environment. This plant perfectly illustrates the potential an AD plant from Shaw Renewables and BioConstruct has.



Heat is supplied to:

- an outdoor pool
- a sports facility
- a school
- a nursery
- industry

Heat is supplied to an industrial park 2km from the plant.

CHP (Combined Heat and Power) Units can be positioned miles away from a plant.

Biogas is cooled down and then transported to these satellite CHP units where it is used to produce electricity and heat.

A satellite CHP unit is housed over 4km from the plant.

All of the electricity produced feeds straight into the grid.

There are currently 5 CHP units in total, with a combined capacity of 1.5 MW.

There are 3 satellite CHPs and 2 onsite.

The 2 onsite CHPs supply heat to the plant, a pasturisation unit, head quarters and neighbouring farms. Electricity is fed in to the grid.

Because this plant is used as part of the research process, the substrates used vary frequently.

**Brought to you by**



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