Case Study: Rainbarrow Farm Expansion Project

World Biogas Association

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SGN Commercial Services

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Introduction

- SGN Commercial Services are part of the SGN group who own and operate the gas distribution networks in Scotland and the south of England.
- SGN Commercial Services are a leading player in the UK biomethane sector. We pioneered the UK's first grid entry projects at Didcot, Rainbarrow Farm and the first hub injection facility at Portsdown Hill in Portsmouth.
- Rainbarrow Farm, operated by JV Energen was the first biomethane-to-grid commercial facility and has been successfully operating ever since, making it the longest serving plant in the UK.
- We have enjoyed a close working relationship with JVE and are proud to have supported the venture from the beginning.

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Overview

Last year JV Energen began a series of major developments at their biomethane to grid plant at Rainbarrow Farm in Poundbury, Dorset to increase production and reduce carbon impact.

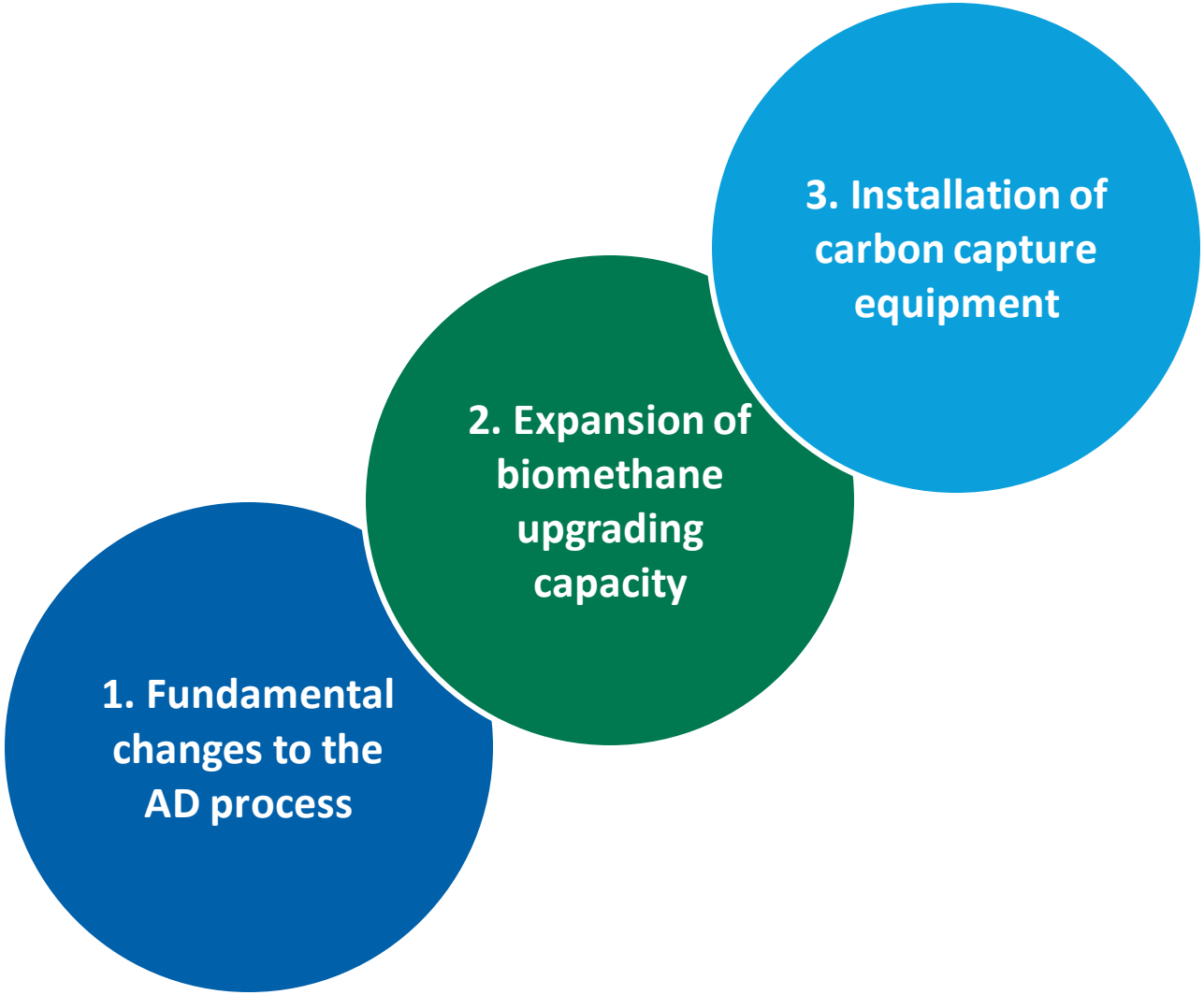
JVE's objective was to make best use of their existing biogas infrastructure by optimising their existing assets.

SGN Commercial Services' Green Gas Solutions team were engaged to coordinate, design and manage the biomethane site capacity expansion project.

Key challenges

- To optimise the plant utilising the existing footprint
- To maintain production throughout construction

Key project deliverables



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1. Changes to AD process

JVE used their considerable experience, gained over many years of biogas production to make the fundamental change in anaerobic digestion (AD) process from mesophilic to thermophilic.

How was this achieved?

- Tank conversion – converting the 2nd AD tank to a post digester tank
- Feedstock change – maize increased from 65 to 95 tonnes (rye remains at 35 tonnes)
- Increased heating capacity – additional heating required for the thermophilic process has meant that JVE had to bolster their heating capacity
- Mixing – due to the increase in dry matter the mixers were changed from the propeller type to a paddle type in the post digester
- Separation capacity – doubling of separation capacity to control dry matter efficiently.
- Increased throughput – from 100 tonnes to 130 tonnes per day

Results?

- Increased volume of biogas production
- 3 to 5% increase in gas yield per tonne

2. Expansion of biomethane upgrading capacity

The SGNCS's Green Gas Solutions team were tasked with:

- Delivering a 50% increase in biogas upgrading capacity
- Designing a fully flexible and redundant system
- Installation and commissioning of an additional fully independent biogas upgrader
- Ensure the original and new equipment are fully integrated
- Maintaining high plant availability
- Oversee and coordinate all site activity safely

Original	New	Combined
Raw biogas 900m³/hr	Raw biogas 400m³/hr	Raw biogas 1300m³/hr
Biomethane to grid 450m³/hr	Biomethane to grid 200m³/hr	Biomethane to grid 650m³/hr

2. Key elements of biomethane capacity upgrade

- Extensive multi discipline design – to ensure full integration between existing systems and new equipment
- Pre-treatment – installation of additional capability
- Second biogas upgrader – fully integrated to operate in harmony with original membrane plant
- New flare – to manage total biogas production
- Pipework modifications – to incorporate increased flows and feed to CO2 plant
- Power and instrumentation – uprated to accommodate additional demand and signals
- Additional power – a new generator was installed to cope with increased power demands across the whole site
- Enrichment – additional propane management to optimise usage
- Installation of an innovative stream selection unit

3. Installation of carbon capture plant

JVE's new CO2 plant was installed to capture and recover CO2 emissions from both membrane upgraders.

CO2 equipment details

- Tanks – two CO2 tanks, each with 50 tonnes capacity
- Quality – on-line monitoring and certification equipment installed to provide assurance
- Capacity – the plant is capable of capturing 1 tonne (1000 kg) per hour

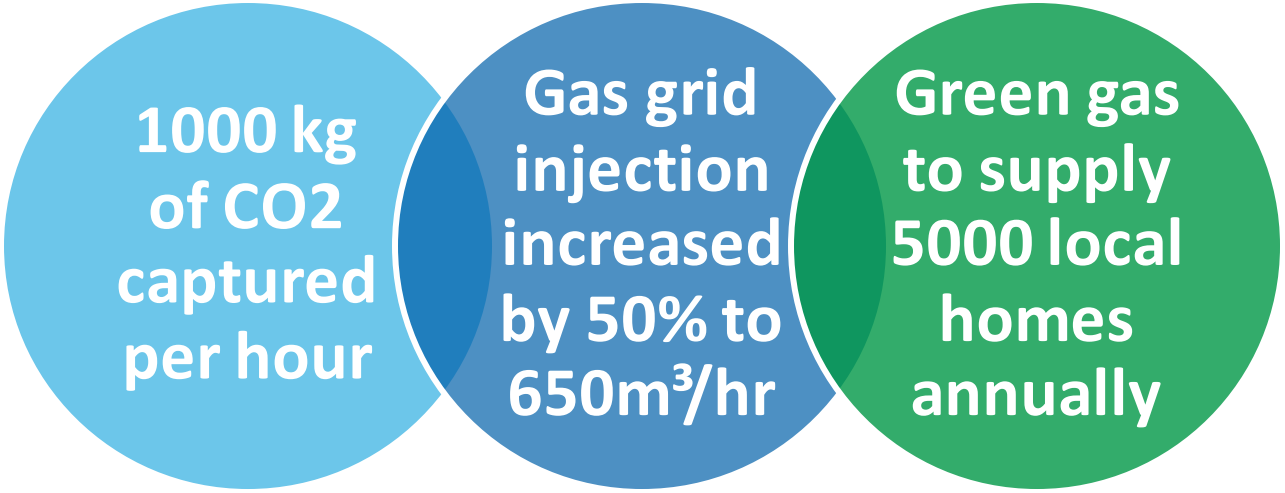
Trading in CO2

JVE has launched it's own trading company, 'Biocarbonics' to manage the trade in food grade CO2.

Current status

Tanks have been commissioned, however production has been halted by Coronavirus lockdown measures.

Environmental benefits



Innovation

SGNCS designed and installed an innovative stream selection unit:

- The unit was installed upstream of the grid entry unit (GEU) and safely blends the biomethane flows from the two independent upgraders.
- It works by continuously monitoring composition for compliance. In the event of excursion, the diversion system diverts the fault stream over to the reject gas unit.
- The fast acting operation of the stream selection unit avoids any needless closure of the GEU's remote operated valve (ROV) and associated downtime.

Gas upgrading site

Stream selection unit

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Overcoming challenges

Building on the existing footprint

Keeping people safe is ours and JVE's prime objective. Key to achieving this was to design out risk at the planning stage.

Construction on an operational site with a limited footprint required us to develop a bespoke build programme to avoid conflict and unsafe situations. Work activities were often broken down into smaller packages to enable this.

SGNCS also implemented a permit-to-work system to control all activities within the gas upgrading site.

Maximising production

Keeping biogas production going and minimising downtime was a key objective.

This was achieved by coordinating all maintenance scheduled during construction phases.

This was made a little easier as SGNCS provide the maintenance of upgrading and gas entry equipment on behalf of JVE.

Next steps

Following the Government's advice we suspended activity on site in March, which prevented us from completing the modification of the 'grid entry unit' and full commissioning of the CO2 capture plant.

However we are already injecting increased flows to grid of 525m³ per hour.

As soon as it is safe to do so, engineers will return and complete the works.

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Highlights

1. Changes to AD process result in increased production and gas yield per tonne
2. Biomethane injection capacity increased by 50%
3. Carbon capture plant installed
4. Production maintained throughout construction phases
5. Innovative and resilient design provides high availability

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Thank you

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