Your energy Our network

Using our gas network for your biomethane gas

Biomethane Connection Process

V1.2 March 2025

YOUR GAS EMERGENCY AND PIPELINE SERVICE

WALES&WEST UTILITIES

Contents

Introduction

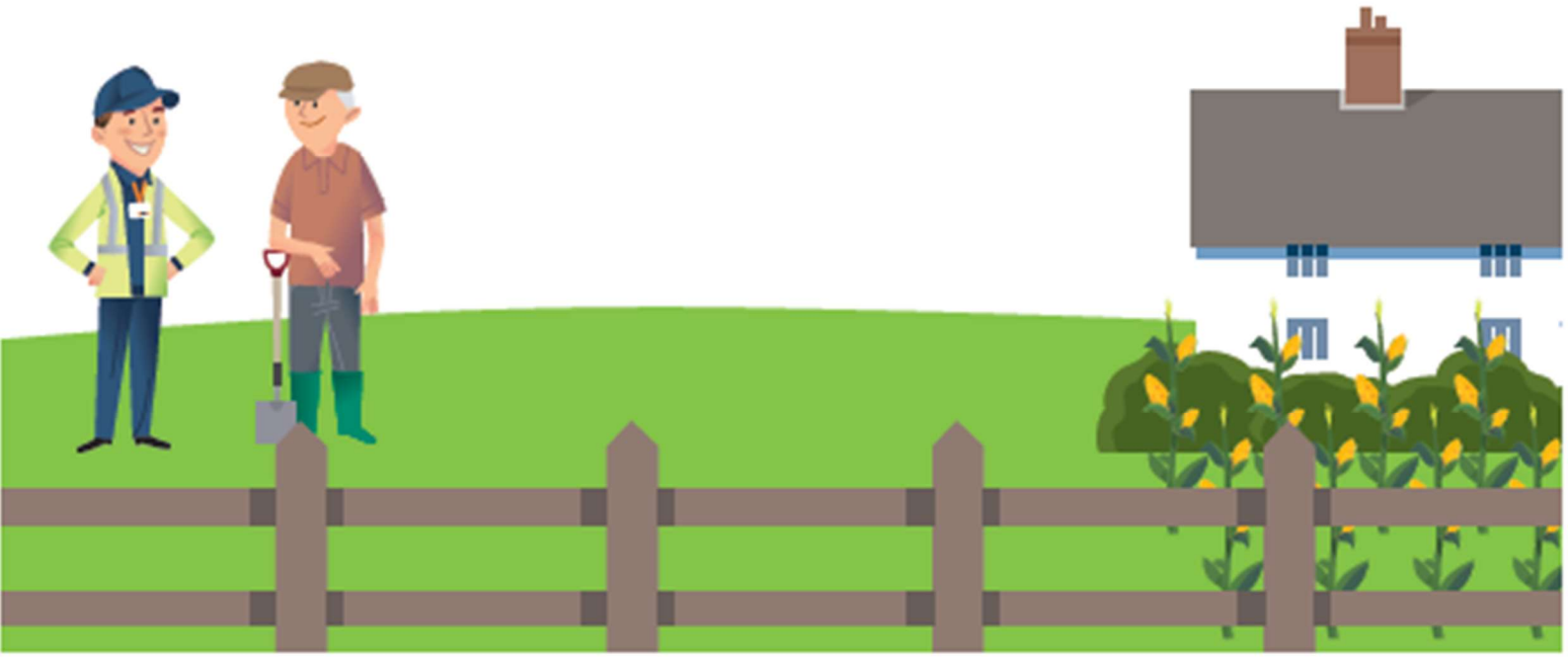
This guide has been produced as a reference document, to explain more about specific aspects of the biomethane gas to grid connection process, the procedures and technical issues involved in connecting to our network.

Through this document we will explain the key pieces of legislation, the stakeholders involved, and the equipment involved in connecting a biomethane plant to our network and an examination of the producer's role and responsibilities.

Although some of the content is unavoidably technical, care has been taken to explain concepts, procedures, and equipment in accessible language, so that this guide can be used by those with a non-engineering background.

Secured Capacity, What Next?

This section provides an overview of our biomethane connection process and some key elements to be included in your project.

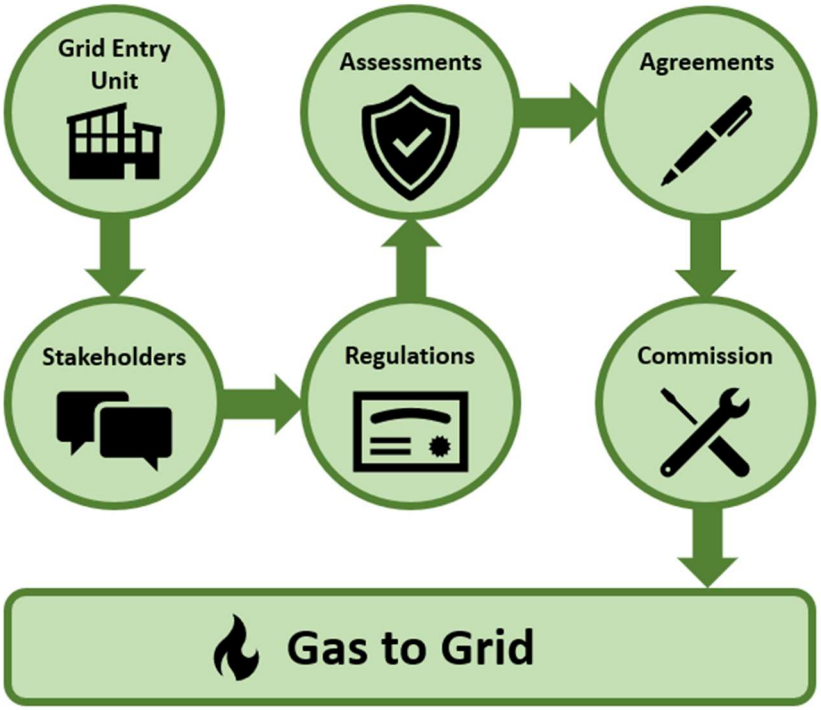


Key Elements of the Connection Process

By this point you will have secured your capacity with us, paid your deposit, and received your signed connection agreement, and so the physical construction can now get underway.

We have identified 6 areas of the connection process that are key to a successful and swift project completion. The following sections give an overview of the equipment, documentation, personnel involved, and the commissioning process.

It important to mention here that to manage a gas to grid scheme requires an experienced Project Manager, with specialist knowledge of the processes, equipment, and requirements needed for the project as a whole.



However, if you have a questions or require any further information that has not been covered here, please do not hesitate to get in touch with our biomethane team.

Wales & West Utilities, Gas Quality & Distribution Network Entry Department:

Biomethane@wwutilities.co.uk

02920 278672

Important Capacity Booking Information

To ensure you have a smooth connection process with Wales & West Utilities (WWU) it is essential to keep us fully up to date with your project, especially when you reach certain milestones along the way.

To help you manage this we will provide you with our milestone document, this gives us basic information on your development and allows us to see that progress is being made in these particular areas:

- Planning Permission Approval,
- Confirmation of finances secured,
- Evidence of site progress,
- Proof of construction contract,
- GEU builder confirmed, and order placed,
- HAZOP date confirmed,
- GQ8 assessment date confirmed,
- Planned date to start injecting biomethane.

If no progress has been demonstrated within 180 days of your booking, the capacity maybe cancelled, and your deposit returned. If you reach 180 days and wish to continue your development a continuation can be applied for to extend your booking for a further 180 days.

As your development progresses, WWU will need to inspect and witness the assessments, testing and commissioning all the necessary elements to ensure everything has been completed in accordance with our minimum functional specification, the detailed design requirements and the GL5 process for the Grid Entry Unit (GEU).

Understanding the Grid Entry Unit (GEU)

An explanation of the key pieces of equipment needed to connect a biomethane plant to our gas distribution network.

- There are a number of technical processes that the biomethane needs to go through, before it can be injected into the gas network, so that it matches the quality of the natural gas already in the grid.

The Grid Entry Unit (GEU)

The grid entry unit or GEU performs many functions to ensure your biomethane meets all the correct standards and regulations before it can enter our gas network. It monitors the quality and quantity of the biomethane prior to entry to the grid and includes the odorisation plant. There should also be a reject gas facility to return biomethane that is not compliant to the gas production facility for further improvement or flaring.

The GEU performs the following key tasks:

Pressure control: to prevent over pressurised biomethane entering the grid.

Gas analysis: measuring the constituent parts and the Calorific Value (CV) of the gas to ensure gas quality and to calculate the energy in the gas.

Flow Weighted Average Calorific Value (FWACV) functionality: the energy content of the gas being injected into the grid needs to be measured and recorded. You will also be given a target CV to reach and maintain each day.

Flow metering: measuring the quantity of biomethane that is injected for the FWACV and billing purposes.

Odorant injection: to give the biomethane the characteristic gas smell.

Temperature measurement: to ensure that the temperature of the gas is kept within specified limits.

Propanation: where there are any shortfalls in the CV of biomethane, propane can be added.

Communication telemetry/supervisory system: equipment to send all necessary data via satellite/GPRS to the gas distributor to demonstrate compliance with gas quality standards and regulations.

Reject gas pipeline: should any non-compliant gas be detected this must be diverted from entering the network.

Remote Operated Valve (ROV): this can be closed remotely by WWU if the gas produced from the facility is not compliant and fails to divert automatically.

With WWU's connection model the elements listed above will be supplied, owned, controlled, and maintained by the producer. However, the ROV and satellite/GPRS are always the property of and controlled by WWU.

Pressure Regulation and Control

The delivery of biomethane has to be at a sufficient pressure to meet requirements without exceeding the Maximum Operating Pressure (MOP) of the downstream pipeline. If necessary, the pressure of

the biomethane can be raised prior to the GEU. Pressure regulation and control needs to meet the recommendations set by the Institution of Gas Engineers and Managers (IGEM/TD/13).

Gas analysis for Compliance Monitoring

The GEU has to be capable of supplying all of the necessary information and data to assure WWU that the gas being injected into the grid is compliant with legislation.

The GEU has to measure or calculate the following determinants on the Ofgem approved Calorific Value Determination Device (CVDD) and other calibrated devices:

- Methane (CH4)
- Carbon dioxide (CO2)
- Nitrogen (N2)
- Oxygen (O2)
- Propane
- Butane
- Ethane
- Calorific Value (CV)
- Water Dew Point
- Hydrogen sulphide (H2S)
- Wobbe Index (WI)
- Relative Density (RD)
- Compression Factor (Z)
- Density

Biomethane/Biogas Samples

In addition to the GEU online gas quality monitoring, WWU will require sampling reports for the biomethane and biogas. These reports are used to demonstrate compliance for areas of gas quality that cannot be determined using an automatic process. The requirements for the information will be site specific and will be determined by the feedstock that is used to produce the biogas. For example, waste water sludge plants are likely to have siloxanes present.

Flow Weighted Average Calorific Value (FWACV) functionality

The gas sold to customers is billed using the FWACV, this is the amount of energy released by the gas when burnt. Consequently, WWU must keep a detailed account of the average calorific value of the gas being injected. The calorific value of the biomethane must be measured and recorded by instrumentation that has been accredited by Ofgem. It also has to closely match the CV of the natural gas in the local network, due to this a CV target will be provided which must be met each ‘gas day’.

The Ofgem accreditation will be confirmed in the Letter of Direction. The producer’s team must also design the wider plant installation to deliver all FWACV requirements set out in the regulations and the Letters of Direction/Approval.

Data management for FWACV and the UK-wide billing system is computed by Xoserve on behalf of all shippers, gas distributors and consumers.
This will require:

- Receipt of data (in specified electronic file format) at end of gas day (data is total energy flowing into the grid and average CV of such energy)
- Communication of data files using an ADSL link or similar
- Calculation of FWACV is to be performed by an approved methodology and approved software
- Producers should consult their Letter of Direction and The Gas (Calculation of Thermal Energy) Regulations.

To ensure the CVDD is working correctly, you will require an approved Ofgem 35-day test gas cylinder, which should be used at least once within a 35 day period. You may also require, depending on the equipment installed a certified calibration gas cylinder, which should be used daily.

Flow Metering

Metering systems need to be designed in accordance with standards set by the Institution of Gas Engineers and Managers. The producer should be aware that the metering is required to be calibrated on Natural Gas at a UKAS accredited (or equivalent) test centre and the meter will need to be periodically removed for recalibration as stated in the standards.

Odorant Injection

Typically, odorant injection systems are installed on systems larger than those to be found on a gas to grid biomethane project. However, the system needs to be designed in accordance with the principles of any typical odorant facility and must comply with the IGEM/SR/16 standard.

The instantaneous flow rate from the flow meter is used by the odorant system to control the correct odorant rate.

The rhinology test point location is to be agreed with WWU. This is a point on the export pipe (after the ROV) where monthly manual gas testing can be undertaken our trained rhinologists.

The rhinology point may or may not be within the site compound, but appropriate access will need to be considered and designed in the site plan. The location needs to be selected so that the sample is solely representative of the biomethane and not the natural gas in the pipeline. IGEM/TD/16 gives further details of the requirements regarding odorant injection.

Temperature Measurement

The outlet temperature to the GEU must be monitored to ensure it remains within the limits as stipulated in the GQ8 assessment. This is to safeguard our downstream network against excessive temperatures that may damage the integrity of PE pipelines.

Propanation

Biomethane is enriched with Liquefied Petroleum Gas (LPG), the usual material used is commercial propane. This stage is referred to as 'propanation'.

Biomethane is required to be enriched to ensure that the gas meets the required CV as determined by the FWACV (the amount of energy required in the gas). Note there can be issues with the Wobbe Index caused by heavy use of propane when pure methane is generated.

The addition of liquid propane will cool the gas after addition and gas pre-heating is normally required as part of the propanation plant. The final temperature of the biomethane is required to be within the limits set out in the Network Entry Agreement. The propane must not mask or effect the odorant being injected downstream.

Communication Telemetry/Supervisory System

The GEU telemetry/supervisory system has to supply all relevant data to the Remote Telemetry Unit (RTU) in order that it can be supplied off-site via satellite into WWU's control room with a GPRS unit acting as a secondary back-up route. A communications router will also be necessary to allow access for the Gas Quality data to be transmitted into WWU's gas quality monitoring system.

In addition to the data for gas analysis compliance monitoring, the following data is required as a minimum:

- Gas Flow
- Inlet Pressure
- Outlet Pressure
- Inlet Temperature
- Outlet Temperature
- Odorant concentration
- Odorant system alarms/monitoring
- Position of ROV
- Position of divert valve
- Metering health
- Power fail
- CVDD Fault

Reject Gas Pipeline

The GEU may determine that the biomethane produced is not of the correct quality for any of the predetermined quality settings. If this occurs the reject gas pipeline must be sized to carry the reject gas safely away from the injection pipeline. The reject gas is then conveyed back to the anaerobic digestion plant and/or flare (burnt off) so it does not enter our network.

Remote Operated Valve (ROV)

Remote Operated Valve or ROV can be operated by our control room if the gas produced by the facility is not compliant with regulations. Non-compliant gas is almost always detected (and then rejected) by the GEU, but the ROV acts as a final, emergency barrier, if required. The ROV can either be part of the GEU or situated further downstream before the connection to our network. It will be purchased and

installed as part of your development but will be adopted by WWU after commissioning and will be under our control.

A Physical Connection

The GEU will require an approved connection to our network, all connections below 7 bar can be done through a utilities infrastructure provider (UIP) which is listed in the Gas Industry Registration Scheme (GIRS). This certified contractor can lay gas pipes and connect to our network. Or you can ask us for a quotation to make the connection. However, if you intend to connect to the above 7 bar network, you will need to talk to WWU first.

Ownership

The producer will own and operate the GEU except for the ROV and the equipment used for remote communication with our Control Room which includes the satellite and any GPRS or mobile communication units and their routers.

The following diagram (Figure 1) shows the basic components which should be included in the GEU and the division of ownership between the producer and WWU.

The Remotely Operated Valve (ROV) (Figure 2), the first valve upstream of the ROV and the pipework downstream of the ROV will be adopted by WWU. WWU will also assume responsibility for the Intrinsically Safe (IS) barrier, the valve limit switches, and the cable between the IS barrier and ROV.

Responsibility for any instrument air system, external solenoids, the electrical supply and the signal/cable from the Remote Telemetry Unit (RTU) to the IS barrier will remain with the DFO.

Items shown in green will be owned and maintained by DFO. Items shown in blue will be adopted and maintained by WWU.

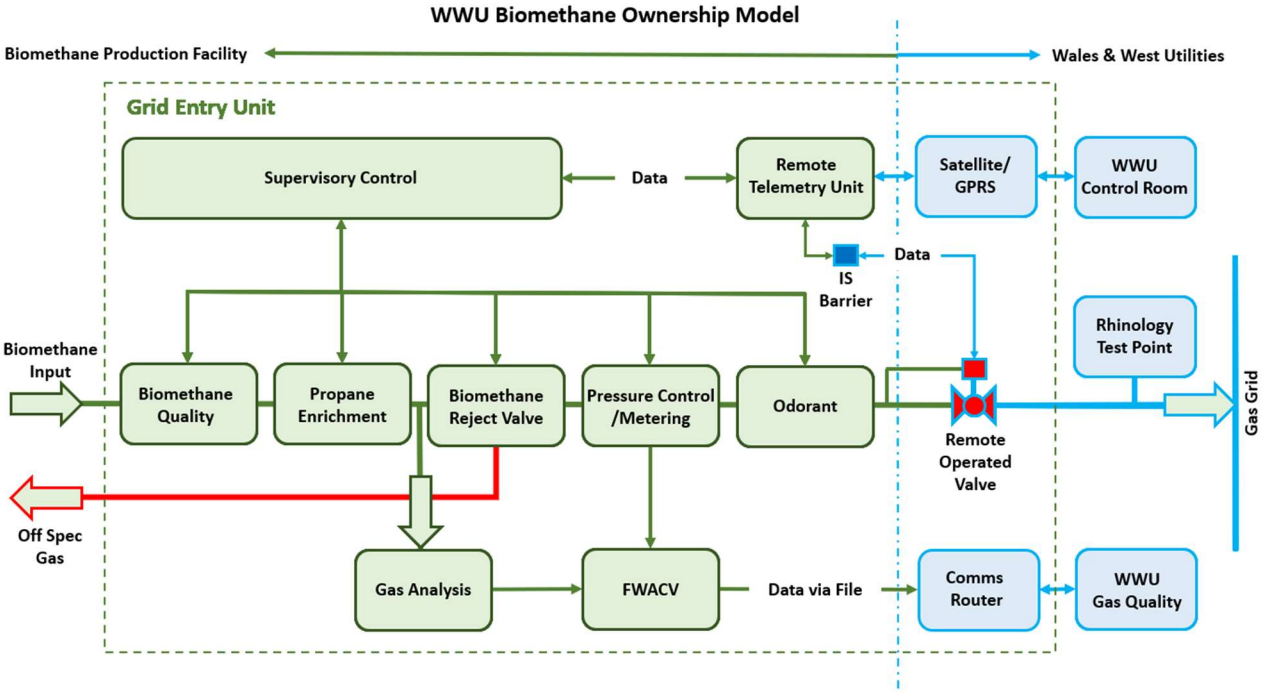


Figure 1: Grid entry unit and ownership model

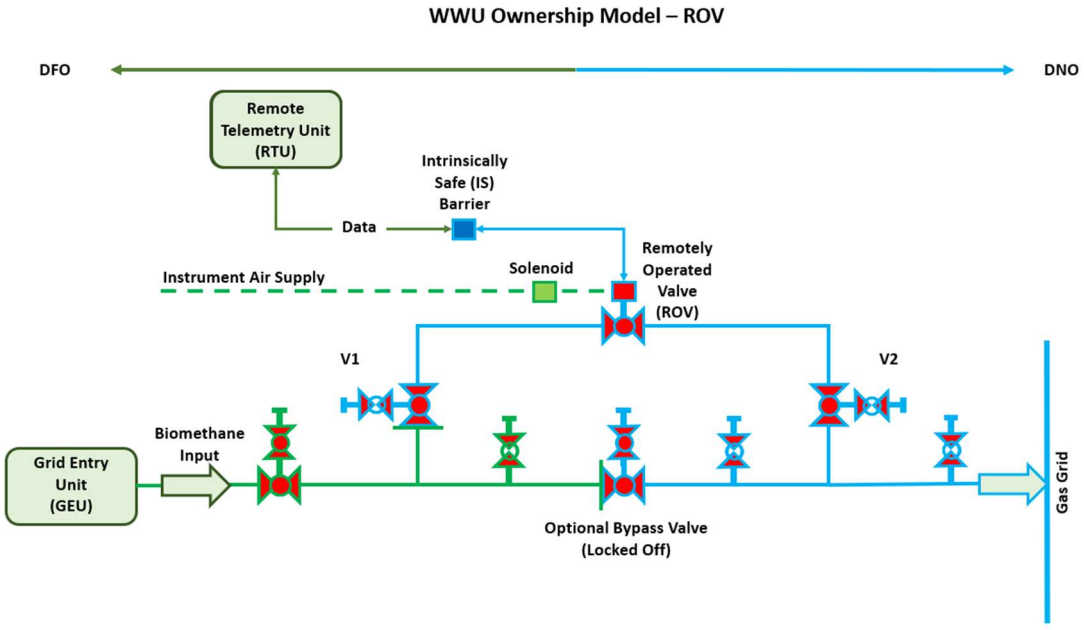
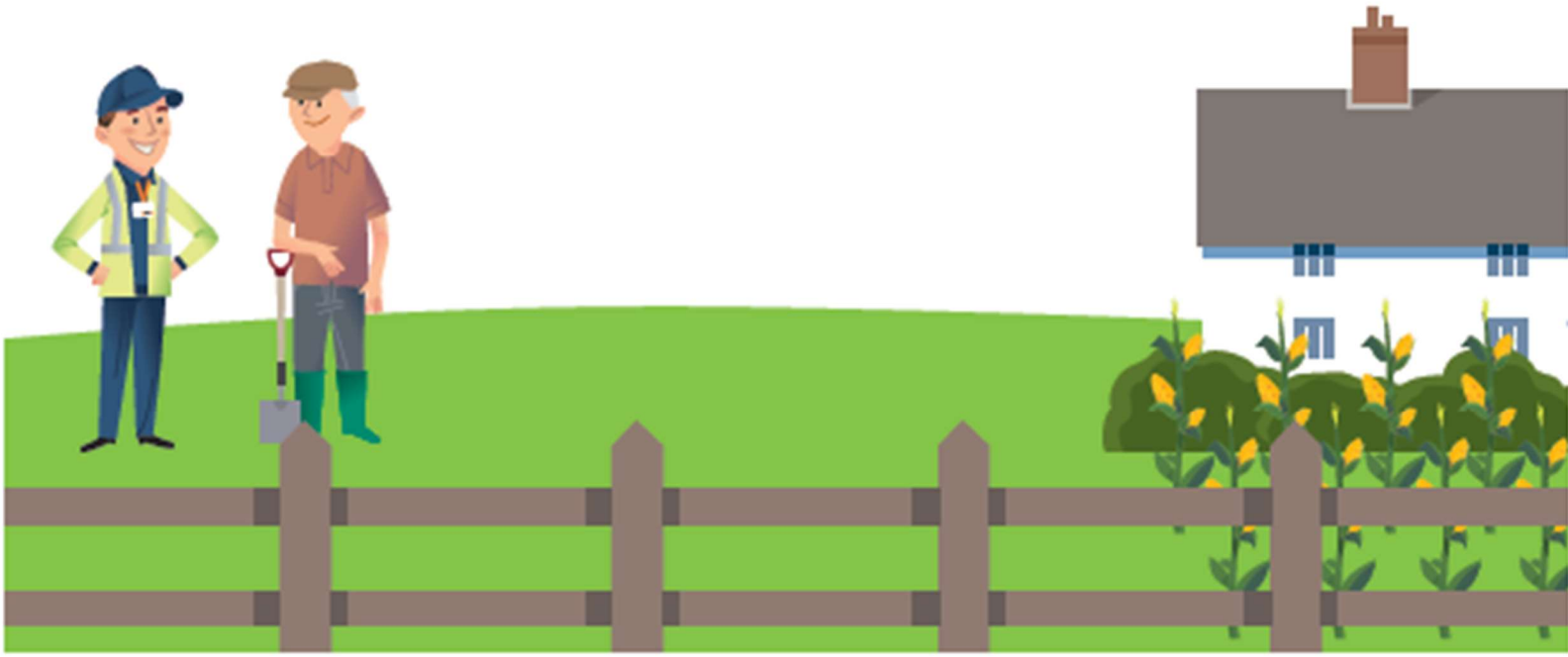


Figure 2: ROV ownership model

Project Collaborators

This section contains a brief summary of the key stakeholders involved in a typical biomethane project.



Working With Stakeholders

A wide range of third party organisations have a role in any biomethane project. It is important to have a project manager who understands the collaboration needed with these various organisations.

Shippers

A producer will need to have a commercial agreement with a gas shipper. Commercial gas shippers are often household names. They buy gas on wholesale markets and sell it to suppliers. Gas shippers pay the gas distributors to transport their gas to the end users.

Gas Distribution Networks (GDNs)

There are four main gas distributors in the UK: Northern Gas Networks, National Grid, Wales and West Utilities and SGN. Each owns and operates the gas distribution network in their area, conducting planned maintenance, improvement work, and emergency repairs.

All gas distributors have been challenged by Ofgem to reduce the carbon footprint of the UK's total gas consumption by increasing the volume of 'green gas' entering the network. In response, distributors are actively supporting biomethane projects, by collaborating closely with producers to get their gas to the grid.

Biomethane producers should approach their regional gas distributor early in the process, as they are a crucial partner.

A producer will need to have a Network Entry Agreement (NEA) with the distributor to be able to supply gas into the grid. This is a signed agreement between the producer and the distributor and covers key issues such as the quality of the gas, measuring the volume of gas injected and ongoing quality monitoring. For more information about the Network Entry Agreement.

Delivery Facility Operator (DFO)

A DFO is employed by the producer to operate and maintain the production facility in line with the Network Entry Agreement. In most cases the DFO is the producer, but in some instances the producer may decide to employ a third party organisation which specialises in this field.

Utility Infrastructure Provider (UIP)

This is a pre-accredited contractor that has been deemed fit and proper to work on the UK gas network. The producer is free to select any UIP that they choose to deliver the project, as long as they are accredited.

The Office of Gas and Electricity Markets (Ofgem)

This is a non-ministerial office that regulates the UK's gas and electricity networks. Ofgem may not have direct involvement with a biomethane plant's construction but do require prescribed pieces of information. Predominantly, they will require the manufacturer details for the Calorific Value Determination Device (CVDD), a critical piece of equipment that measures the energy content of the gas being produced. Ofgem provide assurance of the quality and accreditation of this equipment,

and only Ofgem approved equipment can be used. They may also request to see where the sampling point is located so that there is assurance about the Calorific Value measurements.

Xoserve

A third party company that provides centralised information and data services for gas transporters and shippers.

Department for Business, Energy & Industrial Strategy (BEIS)

Brings together responsibilities for business, industrial strategy, science, innovation, energy, and climate change. BEIS is a ministerial department, supported by forty-six agencies and public bodies. They also provide tariff support schemes for biomethane produced via anaerobic digestion which is injected into the gas grid.

Council Planning Department

Any scheme that requires a considerable level of industrial plant will need to obtain the relevant planning permission from the local council. A producer will need to approach their local planning department at an early stage.

Health and Safety Executive (HSE)

The Health and Safety Executive oversees the safety regulations governing construction and civil engineering schemes. It should be noted that all High Pressure (HP) main connections require six months notification to the HSE.

Environment Agency (EA)

The Environment Agency has regulatory controls around the use of digestates as a fertiliser. Further information can also be found at www.environmentagency.co.uk.

Speciality Plant Suppliers

Whilst some of the plant and equipment required to produce biomethane has been around for many years, other parts are very recent technology. To ensure that a producer gets the best advice, they should seek from an experienced Project Manager.

As the biomethane industry continues to grow, there are an increasing number of suppliers who specialise in the production of biomethane generating equipment. Suppliers will often provide a 'turn-key' solution. This means they will function as project managers, designers, and will also build the plant. Producers should ensure that their consultants and suppliers are experienced in all the legislative and the regulatory requirements.

Management of Complex Systems

This section outlines the regulations and standards that must be met when first designing and building your facility and then producing biomethane for entry into the network.

Regulations and Standards

There are a substantial number of regulations and standards that must be met when producing biomethane. Your project manager will need to be familiar with the necessary material, including:

- Acts
- Regulations and Orders
- European Legislation
- HSE Approved Codes of Practice and Guidance Notes
- Institution of Gas Engineers and Managers (IGEM) documentation
- British Standards
- Gas Industry Standards

Although not an exhaustive list, the following covers the main technical and legislative documents.

The following documents are specific to WWU, or industry standards compiled by IGEM, the Institute for Gas Engineers and Managers. You will be able to obtain full versions of the documentation from IGEM (www.igem.org.uk).

IGEM/GL/5 Edition 3 – Managing New Works, Modifications and Repairs

The GL/5 documentation covers the management of new works, modifications and repairs undertaken on the UK gas network. A producer will need to comply with this procedural document as their plant will be connecting into the gas network.

WWU/PM/GQ/8 – Management Procedure for Assessing the Requirement for Gas Quality, Calorific Value and Flow Measurement Systems

This is a gas quality workshop that forms part of the risk management strategy. The workshop should be organised by the designers appointed by the producers.

WWU/SP/ME/1 – Specification for Gas Transporter's Requirements for Gas Measurement Systems Connected to the WWU Network

This is the specification for the gas transporter's requirements for gas volume and energy measurement systems connected to the National Grid Gas Transmission and Distribution Systems. It dictates how the gas should be measured and the standard of equipment required to achieve the measurement.

WWU/PR/ME/2 – Validation of Equipment Associated with the Calculation of Mass, Volume and Energy Flow Rate of Gas

These are the procedures that will demonstrate that the instrumentation and equipment used within a facility performs to the required standards. There are five parts to this procedural document but only the first three will be relevant to a producer:

- Part 1: General Requirements

- Part 2: Generic Test Procedure
- Part 3: Flow Weighted Average Calorific Value Offtakes

IGE/TD/4 Edition 4 +A: 2013 - Polyethylene (PE) and steel gas services and service pipework

These are recommendation guidelines that cover the design, construction, inspection, testing, operation, and maintenance of gas services infrastructure.

IGEM/TD/13 Edition 2 – Pressure Regulating Installations for Natural Gas, LPG

This technical standard applies to the safe design, construction, inspection, testing, operation, and maintenance of pressure regulating installations (PRIs) in accordance with current knowledge and operational experience. The Standard reflects the need to ensure adequate reliability and continuity of supply at pressures that are safe for the downstream system and equipment.

IGEM/TD/16 Edition 2 – Biomethane injection

This standard is crucial to a producer as it covers the construction and operation of facilities that allow biomethane to be injected into the UK grid. It details the requirements for design, construction, installation, inspection, testing and operation of the GEU. It should be noted that the Biomethane Upgrading Plant is outside of this standard.

IGEM/TD/17 – Steel and Polyethylene pipelines for Biogas Distribution

This technical standard covers biogas pipelines. It will primarily be used by your chosen UIP and your installation team.

IGEM/TD/101 Edition 3 – Adoption of pipe systems by a Gas Transporter - Management of Utility Infrastructure Provider Activities

This document will cover the requirements for laying newly constructed gas mains and services and details what needs to be achieved by the UIP for the distributor to adopt the pipe systems.

Other documents include:

Uniform Network Code – UNC

This is a set of rules that allow competition within the gas network whilst ensuring consistency and assurance.

HSE's RR882 Research Report – Hazards arising from the conveyance and use of gas from Non-Conventional Sources (NCS)

This document helps the Health and Safety Executive (HSE) to undertake assessment of hazards and risks associated with the introduction of Non-Conventional Source (NCS) gas into the existing national gas pipeline network. It provides guidance, procedures, and processes to ensure compliance and the continued safe operation of the gas network.

Gas Safety (Management) Regulations 1996 – GS(M)R

This document addresses the compliance requirements on the installation, operation, and maintenance for conveying gas within the UK network.

The regulations include Generic Gas Quality in Schedule 3. This will inform a producer of the gas quality that will need to be achieved. However, minor exemptions have been negotiated from the regulations on the O2 content - the HSE has granted a class exemption to permit gases containing up to 1% mol/mol into transmission and distribution systems, up to 38 bar, provided that the gas is otherwise compliant with GS(M)R.

Gas (Calculation of Thermal Energy Regulations) 1996 (Amended in 1997 and 2002)

This regulation dictates the necessary calculations and definitions required to ensure that the Flow Weighted Average Calorific Value (FWACV) requirements are being met.

Pressure Systems Safety Regulations 2000 – PSSR

The duties imposed by PSSR relate to pressure systems for use at work and the risk to health/safety.

The aim of these Regulations is to prevent serious injury from the hazard of stored energy as a result of the failure of a pressure system or one of its component parts.

Before using any qualifying pressure equipment (new or otherwise), a written scheme of examination (WSE) must be in place, and an examination undertaken.

In general terms the user must do the following:

Provide safe and suitable equipment: for example, is the equipment suitable for its intended purpose and installed correctly and are modifications/repairs being conducted correctly?

Know the operating conditions: including the characteristics of the relevant fluid in the system and the safe operating limits of the equipment.

Fit suitable protective devices and ensure they function properly: for example, devices such as safety valves, bursting discs and electronic appliances, and ensure they are adjusted to their correct settings and in good working order at all times.

Carry out suitable maintenance: including a whole-system maintenance programme that considers factors such as age, uses and the environment in which it is operated.

Make provision for appropriate training: so that anybody who operates, installs, maintains, repairs, inspects or tests pressure equipment has the necessary skills and knowledge to carry out their job safely. Refresher training should be included.

Have the equipment examined: as required under PSSR, including production of a written scheme of examination (WSE), to be used by a competent person to carry out the examination - details in the PSSR Approved Code of Practice (L122).

Choose a competent person: ensuring they have the necessary knowledge, skills and, importantly, independence to undertake their role and responsibilities effectively.

Pipeline Safety Regulations (PSR) 1996 & Pipeline Safety (Amendment) Regulations 2003 – PSR

The PSR apply to all pipelines and require that they be designed, constructed, and operated safely. This will include examination and maintenance. The Biomethane Network Entry Facility, in addition to the rest of the production facility, has to be designed in accordance with these regulations.

The Dangerous Substances and Explosive Atmospheres Regulations 2002 – DSEAR

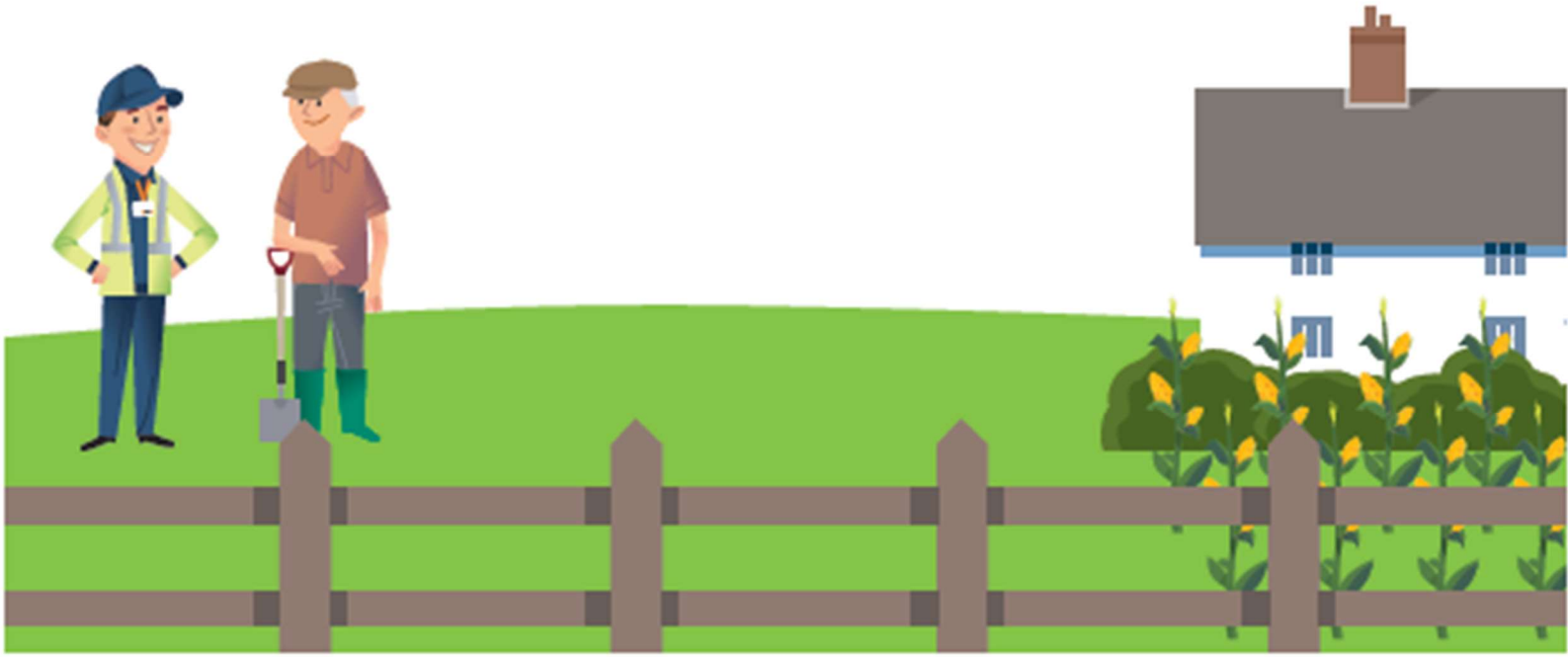
A hazardous area drawing is required to be produced under DSEAR. This may affect the location and layout of the biomethane production facility and proximity to properties and potential ignition sources. Each piece of equipment in the Hazardous Area within the GEU (such as the Pressure Reduction Module and Analyser rooms) needs to be suitable for use in the specified hazardous location.

Construction (Design and Management) Regulations 2015 – CDM

Under CDM 2015, a biomethane producer wishing to connect to the grid has to appoint a principal designer for the work. Within the scope of the work to be undertaken by the principal designer there is a requirement for the GEU and the Remote Operable Valve to be included. The producer has to ensure that the principal designer's brief includes any work associated with this equipment.

Design, Build, and Assess

This section contains, a description of the key assessments involved in connecting a biomethane plant to the grid.



Design and Safety Assessments

Whilst designing and building your plant it is important to follow the current industry Regulations and standards. To ensure this is done correctly WWU must be involved in all four of the following assessments, your project manager should be able to assist to organise these.

The Design Assessment: to be approved, your design must follow the criteria set out in IGE/GL/5 or GL5 for short and meet other the necessary industry standards.

The Gas Quality Risk Assessment: this is known as a GQ8 workshop and will help recognise any significant risk and identify solutions associated with the gas quality, calorific value, and flow measurement.

The HAZOP assessment: this is our interface hazardous and operability study known as a HAZOP and covers the grid entry unit and its connection to our network. This is to identify potential risks and their consequences which may lead to fatalities. No gas will be allowed to flow into our gas network until this study has been completed – with any recommended changes put into practice.

The Grid Entry Unit Assessment: the grid entry unit is the equipment used to evaluate and control the flow of biomethane into our network and must meet many industry standards.

These assessments are listed in order from design through to commissioning and the earlier the arrangements are made the less pressure is put on the project at the closing stages.

IGEM/GL/5 Edition 3 – Managing New Works, Modifications and Repairs

The GL5 documentation covers the management of new works, modifications and repairs undertaken on the UK gas network. As a producer you will need to comply with this procedural document as your plant will be connecting into the gas network.

The completion of all the GL5 documentation can be labour intensive and requires expert guidance. WWU will raise the GL5 on our system to start the process, however, the sign-off documentation needs to be completed by an appraiser who is instructed by the producer. This needs to be done for each element of the works (mechanical, electrical, instrumentation, etc).

Gas producers are guided towards Appendix F of the GL5 documentation as this gives a detailed breakdown of what information will be required from the Utility Infrastructure Provider (UIP)/producer to successfully conclude the GL5 documentation.

The contents of Appendix F should include:

- Drawings,
- Qualification requirements of UIP staff,
- Equipment sizing,
- Risk assessment requirements.

The roles and responsibilities that need to be filled are captured below. Some of the roles will be covered by one consultant:

Competent Design Authority	The Competent Design Authority (CDA) is a body appointed by the gas industry having responsibilities for the project design. They hold a register of design approvers and appraisers to be employed in the design acceptance process.
Commissioning Engineer	The Commissioning Engineer is an engineer within the company or within an external organisation with the relevant competencies and authority to commission and put systems into use.
Design Appraiser	The Design Appraiser is an engineer with the relevant competencies to appraise design work in a specified discipline(s). The Appraiser must be demonstrably independent of the work to be appraised. Appraisers must be nominated through the project plan or in writing to the Project Manager. Appraisers should be on a CDA Register.
Design Approver	The Design Approver is an engineer with the relevant competencies to approve a design that meets the requirements of the contract or design brief, legislation, standards and is safe. Design Approvers must be nominated through the project plan or in writing to the Project Manager. Design Approvers should be on a CDA Register.
Design Organisation	The organisation which undertakes the design stage of a project.
Installer	The person or organisation who undertakes installation, inspection, testing and commissioning activities. The Design Organisation and the Installer may be part of the same company.
Project Manager	The manager or engineer with responsibility for the management of the project. The Project Manager ensures that the project progresses through all of its stages from the initiation stage to the final commissioning stage, and that all of the relevant drawings, test results and paperwork are completed. The Project Manager or technically competent person must verify on site that the works have been carried out and are fully completed as per the approved design and compliant with all relevant Transporter Technical Documents and Specifications.
User	The User is a person representing the producer who has responsibility for the work being constructed, modified, or repaired and who grants approval for work to be undertaken.

Table 1: GL5 Roles and Responsibilities

Gas Quality GQ8 Risk Assessment

As part of the gas to grid process, you are required to conduct a risk assessment of the biomethane facility in order to understand the required measurement provisions for gas quality, calorific value, and flow measurement.

The GQ8 assessment is intended to identify potential risks and their consequences which may lead to non-compliant gas entering our network. Specifically, our requirements for:

- The content and characteristics of gas,
- Odorisation,
- Calorific value measurement,
- Volume and energy flow measurement.

This workshop is critical and will be attended by the WWU, the producer and the producer's designers. It must be conducted early in the design process so that there is clear understanding of the quality of the gas.

Further information on the GQ8 assessment can be found in our document: A Guide to GQ8 Studies for Biomethane Connections.

HAZOP Assessment

WWU has strict rules about the equipment which is to be connected to our network. To make the process easier, there will need to be a HAZOP (Hazardous and Operability) study undertaken to support the design of the GEU. This is a requirement before the design has been finalised. It may be undertaken by an independent third party and should be completed as early as possible.

HAZOP studies may be conducted on many areas of your plant and processes, however, WWU requires a functional safety assessment or HAZOP which covers the risks associated with your interface to our network.

The WWU interface HAZOP study is to be completed in support of your connection to identify potential risks and their consequences which may lead to fatalities on our network. Specifically covering plant and processes related to the GEU, the ROV and the flow of gas into our network.

The interface HAZOP does not have to be conducted independently and can be part of a larger study. However, the assessment must ensure the requirements of the appropriate industry standards are met. The most important aspect of conducting a HAZOP study is that once a potential hazard or operability problem has been identified, is the determination of appropriate remedial measures.

Further information on Hazop assessments can be found in our document: A Guide to HAZOP Studies for Biomethane Connections.

Grid Entry Unit Assessments

As we reach the end of the development and the plant has been built, it is now down to the producer to prove the systems are functional and fit for purpose. To ensure this we use commissioning tests that are executed on the GEU installation known as the Factory Acceptance Test or FAT and the Site Acceptance Test or SAT.

The FAT enables components that make up the GEU to be evaluated at source and before delivery to site. The SAT is a 'multi-layered' procedure that tests elements of the equipment after installation and demonstrates that the components interact to provide a fully functioning process.

Prior to conducting the SAT WWU require the RTU Input/Output mapping matrix. This must be provided to us in suitable time to support the creation of data transfer systems between the GEU, our Control Room and National Grid.

It is necessary to invite WWU to both the FAT and the SAT so that they can witness the necessary testing. WWU may attend the FAT but will definitely attend the SAT.

Understanding the Paperwork

This section contains an overview of key documents and approvals associated with the biomethane connection process.

Agreements and Approvals

From the outset, the contractual set-up of the producer's own organisation will need to be considered, and there are a few legal agreements that must be put in place to make sure everyone knows what is expected of them. Key agreements include:

Network Entry Agreement (NEA): WWU has a document called a network entry agreement which stipulates the conditions of entry, equipment ownership, and each parties' responsibilities. It can also contain local operating procedures that would be specific to each connection detailing things like site access and emergency arrangements.

Ofgem Letters of Direction and Approval: there are also legal agreements between us and Ofgem on behalf of the producer, known as a Letter of Direction and Letters of Approval. These are issued by Ofgem and show the operational requirements for gas quality and flow measurement equipment, what your allowed to use and how and when to use it.

Adoption Agreement: once the project has completed the construction and commissioning of their plant, some of the infrastructure will be adopted by WWU.

Shippers: in order to get paid for the gas, the producer, will need to have a commercial agreement with a gas shipper. These are companies that buy gas on wholesale markets and sell it to retail suppliers.

Network Entry Agreement (NEA)

The Network Entry Agreement (NEA) is the authorisation given by WWU to a biomethane producer to allow entry into the gas network. The agreement will detail the conditions, limitations, and rules regarding the entry.

The first step to securing an NEA is the successful completion of a GQ8 and the HAZOP assessments. WWU will then commence an internal process for obtaining a draft NEA to the producer. There are likely to be negotiations around the technical contents of the NEA and appropriate time will need to be allowed for the completion of this document.

The NEA will contain a schedule of agreements that will need to be met by the producer and transporter, which ensure that the producer's plant and equipment is fit to provide biomethane in accordance with the conditions stipulated in the NEA. This will include:

- Written Scheme of Examination
- As-built drawings, diagrams, and specifications
- Safe Operating Limits
- Maximum Operating Pressure
- Gas quality requirements including the required calorific values for the gas.

Ofgem Letters of Direction and Approval

The Letter of Direction (LoD) is issued by Ofgem for your facility is held by us. This letter will inform the producer of the 'gas-on' date and the agreements on the manner and location for determining the Calorific Value. The LoD sets out:

- The location on your site where the CV of gas is measured.
- That the CV will be determined at 5am each day (or immediately after) for the gas supplied the previous day.
- The manner in which the CV average is to be calculated.

The Letters of Approval (LoA) are also issued by Ofgem and inform the producer of the apparatus and software that shall be used in determining the Calorific Value, the operational requirements, and how each are to be configured.

A letter will be supplied for each of the following:

- The Calorific Value Determination Device (CVDD)
- The Official FWACV calculation Software

It is necessary for Ofgem Gas Examiner to inspect the GEU once it has been installed at site and is fully operational to complete a detailed examination of official CVDD sample point and the gas quality systems. If these checks are deemed satisfactory, they will apply to Ofgem to obtain the LoD to begin on the agreed 'go-live' date.

Once the LoD has been issued, you must continuously sample the gas being produced, using your approved CVDD. The CVDD, its controller and the Ofgem approved software, must be operational at all times - whether or not the site is injecting gas into our network. The only exception is for maintenance works or faults and these times must be logged for the Ofgem Gas Examiner to view.

Adoption Agreement

Once the project has completed the construction and commissioning their plant, some of the infrastructure will be adopted by WWU. The adoption will include:

- the export pipe,
- the ROV,
- and the satellite/GPRS.

If the WWU undertook the network connection works, only the Utility Infrastructure Provider (UIP) and WWU will need to sign adoption agreements for the minor items of works not done by the us.

If the UIP has done all of the network connection works, two agreements will need to be signed, one with the UIP and one with the producer.

To ensure that the adoption is processed in line with all regulatory standards the producer needs to be familiar with IGEM documentation (IGEM/TD/101 Ed 2) and WWU's own internal documentation (which is based around IGEM/TD/101 Ed 2). By following all of the necessary protocol and procedures, the producer will make the adoption process considerably easier and quicker.

If the producer has progressed the design works with a UIP, they must process all necessary documentation, including a Non-Routine Operation form (NRO), to enable the distributor to adopt the export feeder main. The documentation should include any easements.

It is essential that the producer has completed and compiled all the necessary paperwork and certification to be checked and included as part of the Gas Transporter's Validation and Adoption procedures. Particular attention should be paid to the requirements detailed for the FWACV and Letter of Direction (Ofgem), Design Pack appraisal and reviews, Material and Test Certification, Maintenance Manuals, Site Specific access, contact details, emergency plans, stakeholder management plan and any other requirement to comply with legislation and WWU requirements.

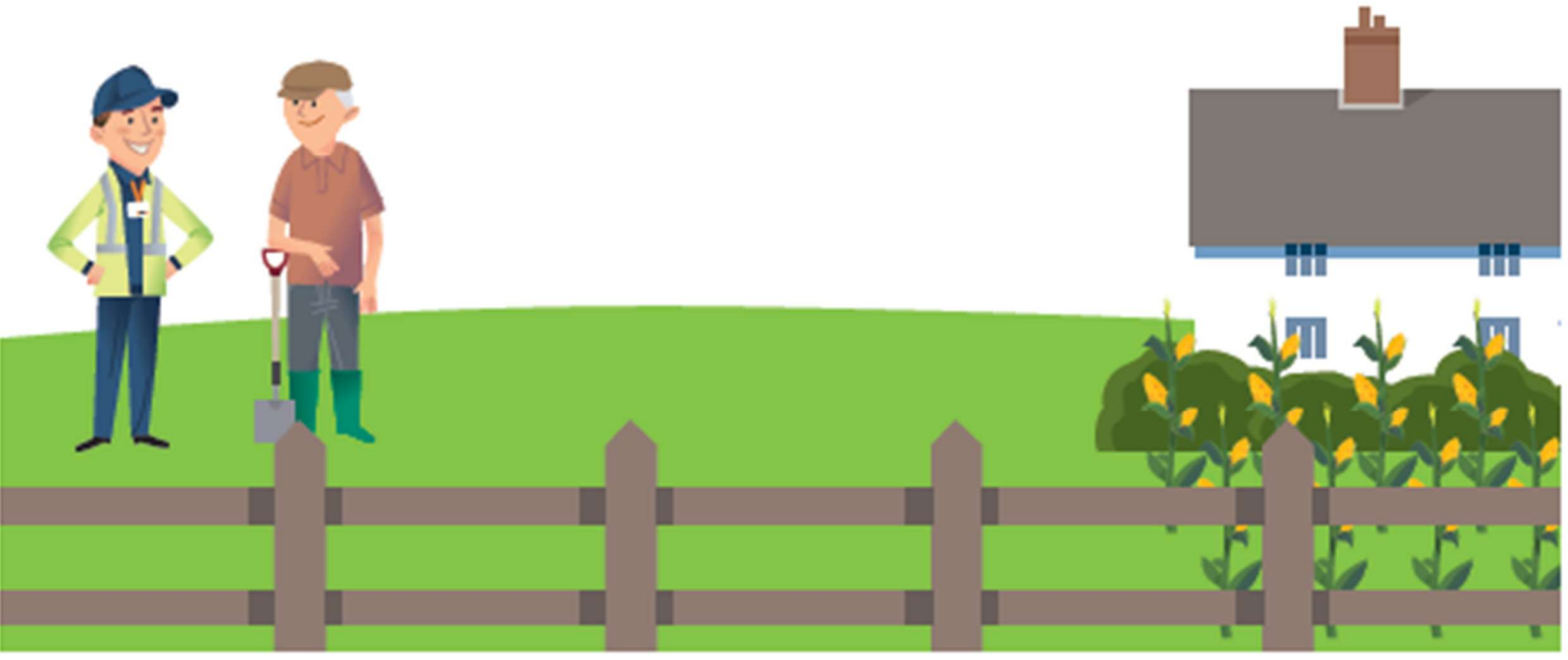
Shippers

A producer will need to have a commercial agreement with a gas shipper. Commercial gas shippers are often household names. They buy gas on wholesale markets and sell it to suppliers. Gas shippers pay the gas distributors like WWU to transport their gas to the end users.

The agreement between the producer and shipper can be negotiated but shippers are generally looking for long-term agreements. There may be maximum and minimum supply volume limits within the agreement.

Gas To Grid – the Final Stages

This section contains information about the commissioning of key pieces of equipment in your Grid Entry Unit that are integral to the safe injection of biomethane into our network.



Commissioning

The final commissioning of the GEU may be completed over a few weeks once the unit has been installed and is operational. However, there will be checks that will need to take place on the 'go-live' day to be witnessed by WWU before we will open the ROV and allow gas to flow into the network.

The commissioning of the GEU prior to the 'go-live' day will need to cover:

- Formal calibration and sign off of the fiscal metering system (ME2)
- CVDD performance evaluation (ISO 10723)
- Ofgem Gas Examiners inspection
- Telemetry end to end testing
- Biomethane/biogas samples
- Pipe connection audit (if required)
- The completion of all the SAT testing
- The completion of the GL5 process
- The producer and WWU to sign the NEA

The commissioning of the GEU on the 'go-live' day will need to cover:

- The mechanical installation and pressure settings (PSSR & IGEM/TD/13)
- Sign off the gas quality systems
- ROV Non Routine Operation (NRO)
- Odorisation and rhinology checks

Subject to all the commissioning checks listed above, WWU will then agree that gas can be exported into our network, and we will open the ROV from our control room.

All personnel conducting commissioning and the initial validation must be competent and adequately trained to do so.

Fiscal Metering ME2 Validation

The metering system will need to be validated in accordance with ME2 Part 3. ME2 is a gas distributor procedure that is used to demonstrate that instrumentation and equipment associated with measurement systems for the calculation of mass, volume or energy flowrate of gas are functioning correctly thus ensuring that the complete metering system is able to perform within the uncertainty requirements.

CVDD Performance Evaluation (ISO 10723)

The producer must arrange for a standard reference test, ISO 10723 or equivalent. This will be conducted by an independent expert accredited by Ofgem. This should be arranged immediately after

the GEU has been installed and the gas analyser or CVDD (the component that measures gas quality) is powered up and stabilised. The test can be conducted before the plant is gassed up or connected as the test is conducted using reference/calibration gases.

The Ofgem Gas Examiner will receive and review the evaluation report and associated test results and, assuming everything is in order, will issue a Letter of Direction granting the final authority required to inject gas.

Ofgem Gas Examiners Inspection

It is necessary for Ofgem Gas Examiner to inspect the GEU once it has been installed at site and is fully operational to complete a detailed examination of official CVDD sample point and the gas quality systems.

Telemetry End to End Testing

As the GEU telemetry/supervisory system has to supply all relevant data to WWU's control room it is important to test that certain spans are created, and attributes are correctly set. End to end testing is used to test the functionality and performance to simulate real user circumstances and data to replicate live settings.

Biomethane/Biogas Samples

In addition to the GEU online gas quality monitoring, WWU will require sampling reports for the biomethane and biogas. These reports are used to demonstrate compliance for areas of gas quality that cannot be determined using an automatic process. The requirements for the information will be site specific and will be determined by the feedstock that is used to produce the biogas. For example, waste water sludge plants are likely to have siloxanes present.

Pipe Connection Audit

As WWU adopts all pipe and equipment downstream of the ROV where it becomes part of our network, we have the right to audit the connection, the connection process and the UIP's competencies.

PSSR and IGEM/TD/13

An inspection of the written scheme of examination and functional checks must be witnessed to ensure pressure systems have been appropriately installed and that any protective/safety devices have been set correctly and function properly.

Gas Quality Sign off

To obtain gas quality sign off, all aspects of the gas quality and FWACV system must be checked to ensure compliance with the relevant Regulations and Ofgem approvals. Including:

FWACV Software: Only software tested and approved by Ofgem can used to calculate the FWACV. This software must be the correct version and configured as described in the Ofgem LoA's for the equipment being installed.

CVDD Daily and Ofgem 35-day Calibration: The certified composition for the approved Ofgem 35-day test gas cylinder and the certified calibration gas cylinder (if required) will need to be checked to ensure it has been correctly entered into the supervisory systems. Each cylinder should be operated on the 'go-live' day to ensure a satisfactory test result prior to gas injection.

ROV Non Routine Operation (NRO)

A written commissioning Non Routine Operation (NRO) procedure must be used for the initial opening of the ROV and any valve operations that may be involved to allow gas to flow from the GEU into the network.

Odorisation and Rhinology Checks

Once the GEU has been commissioned and biomethane has started into the network, WWU will utilise the rhinology test point to manually check that the gas being exported has been dosed with the correct levels of odorant.

Timeline

The following timeline (Table 2) gives an indication of the minimum time scales involved in the commissioning process and the sort of notice we need to provide 3rd parties to ensure everything is setup for the 'go-live' day. Not allowing us enough time to progress your connection may cause delays.

What?	Why?	When?
Telemetry input and output (IO) schedule	To identify the telemetry points needed for monitoring and control.	At least six weeks before the first gas flow.
Put together site data for billing	The main information to allow us to set up billing systems.	At least six weeks before the first gas flow.
Ask for ISO 10723 test	This tests the accuracy of the gas analyser.	At least six weeks' notice to schedule the test.
Details of Ofgem sample point to us	Photo, address and sample point.	At least four weeks before the first gas flow.
Request for Direction	Formal request to Ofgem.	At least two weeks before the first gas flow.
Ofgem gas examiner site inspection	To confirm the official Ofgem sample point meets the specification.	At least two weeks before the first gas flow.
Factory acceptance testing (FAT)	Assurance and functional testing.	Before GEU is delivered to the site.
ME2 test	Check the accuracy of the fiscal metering.	Before GEU is delivered to the site.
ISO10723 test	Tests the accuracy of the calorific-value measurement by the gas analyser.	At least 2 weeks before the first gas flow.
Network entry agreement	Legal document to set out key responsibilities.	To be completed before the first gas flow.
Issue of letter of direction	Ofgem gives permission to the site to allow the flow of gas into our network.	Must be before the first flow date but after the ISO10723 test.
Calibration tests	Compulsory 35-day and daily gas-analyser calibration tests.	First activity on the day of the first gas flow.
Site acceptance testing (SAT)	Assurance and functional testing.	To be completed before the first gas flow.

Table 2: Timeline of Key Commissioning Stages

Top Tips

To help you manage your project and avoid any pitfalls, in this section we have highlighted a variety of problem areas we have noted from previous biomethane projects.

Lessons Learnt

1. **Network Entry Agreement (NEA) timescales:** the NEA can take a long time to close out, ensure enough time is factored in for the necessary legal checks.

2. **Gas quality failure:** when there is a failure of gas quality detected by the GEU, two successful samples must be taken before gas is allowed to be injected again. Some accredited gas sampling equipment works on four minute cycles. That would mean that there would be over eight minutes of gas rejection before re-injection is permitted. An analyser on a continuous cycle may decrease the injection period.

3. **Sourcing equipment from overseas:** as the biomethane market in the UK is still in its infancy, certain products and services are regularly being imported from more established markets. Prior to placing orders and contracts it is important to ensure that all components and services meet the relevant UK standards and regulations.

4. **Impact of third party actions:** third party actions can have a significant impact on a producer's programme. Be aware that something small can have a significant impact on your project timeline so make sure you consider this at the outset of your project.

5. **Importance of applying for planning permission early:** planning permission for the biomethane facility needs to be progressed early, to ensure there are no unforeseen issues. For example, there may be planning constraints on the height of plants which could affect the scrubber in the biomethane upgrade plant.

6. **Regular meetings with the gas distributor:** there are distinct benefits to be gained from holding regular meetings for the producer and transporter. The meetings allow the coordination of tasks as well as clarity regarding roles and responsibilities and effective data sharing between the parties.

7. **Gas examiner's availability:** making early contact with the gas examiner is essential, as their availability is limited.

8. **GQ8 workshop attendees:** the WWU's gas quality representative should attend the GQ8 assessment. Ensuring the right representatives are present can be critical to the success of the scheme.

9. **Organise the HAZOP early:** the HAZOP can require a considerable amount of organising, due to the number of attendees. The arrangements for this exercise should be started as early as possible.

10. **Dual streams could be a more cost effective option:** a producer should consider redundancy/dual streams and duty/standby equipment, to provide a back-up solution in the event of equipment failure. There has been recorded instances of production/injection being compromised due to the failure of minor pieces of equipment. Low cost duty/standby equipment would overcome this and the cost of not injecting could well be higher than the cost of maintaining standby equipment. For example, deploy two odorisation pumps not one.

11. **Re-calibration of flow meter:** it is also worth remembering that the fiscal flow meter will be expected periodically to be sent to a UKAS accredited (or equivalent) test centre for re-calibration on Natural Gas in accordance with the relevant standard. This process may prevent the facility from flowing for an extended period of time , a standby/spare fiscal meter could negate this.

12. **Rhinology test location:** the location of the Rhinology point can be a contentious issue. This should be considered from an early stage.

13. **The importance of a good project manager**: to manage a gas to grid scheme requires an experienced Project Manager, with specialist knowledge.

14. **Biomethane compliance:** the effects of each stage of the gas production process, such as gas clean up and water content removal, needs to be carefully considered, so that the resulting biomethane is compliant with regulations.

15. **Digester waste :** there are considerable benefits from getting good advice on the waste stream and what quality the waste digestate will be. It is important to understand the waste product and how to get rid of the by-product early on.

16. **Impact of feedstock seasonality:** the seasonality of the feedstock will affect the digestates and can also affect the quality and quantity of gas production.

17. **CV management**: the site has to manage the target CV whilst not compromising Wobbe or other related Gas Quality values. The addition of propane can increase these gas quality values.

Notes

Please use this space to make any notes.

Useful contacts

Government

Department for Business, Energy & Industrial Strategy **www.beis.gov.uk**

Department for Environment, Food and Rural Affairs – **www.defra.gov.uk**

Department for Communities and Local Government **www.communities.gov.uk**

Health & Safety Executive **www.hse.gov.uk**

Ofgem **– www.ofgem.gov.uk**

Other useful contacts

Lloyd's Register – www.lr.org

Trade associations

Anaerobic Digestion & Bioresources Association (ADBA) – **adbioresources.org**

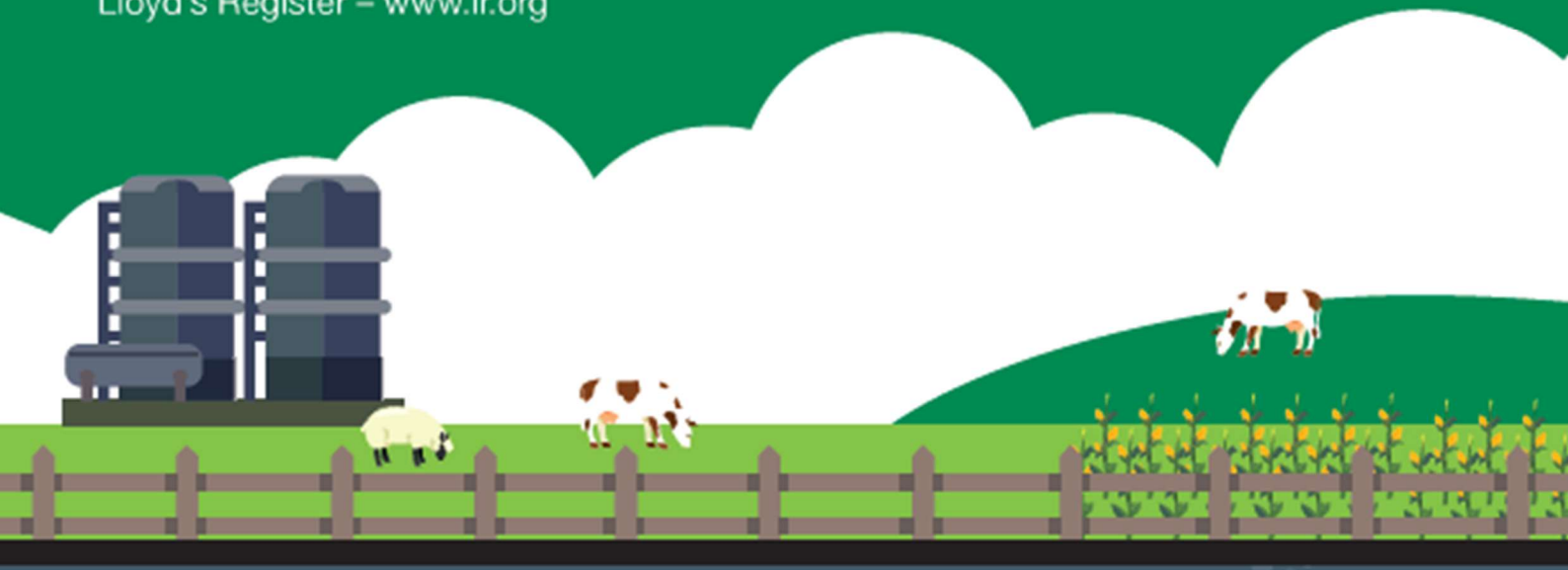
Association of Electricity Producers **www.aepuk.com**

Association of Independent Gas Transporters – **www.aigt.org.uk**

Energy Networks Association **www.energynetworks.org**

Environmental Services Association **www.esauk.org**

Renewable Energy Association **www.r-e-a.net**



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