DEPARTMENT OF ENERGY & CLIMATE CHANGE

Biomethane into the Gas Network: A Guide for Producers

December 2009

Introduction

The present Guidance Note was foreshadowed in the Government's Renewable Energy Strategy, as well as in last year's Renewable Energy Strategy Consultation Document:

> "Given the potential for biomethane identified by other EU Member States, we are proposing to work with Gas Transporters (including National Grid and the Gas Distribution Networks) and Ofgem to make a more detailed assessment of the legal, technical and regulatory requirements for flowing biomethane directly into the gas pipe-line system. We will make this document publicly available as a guide for interested parties." [- para. 7.6.14]

It accordingly outlines the main legal, technical and regulatory requirements specific to the gas market in Great Britain. It does *not* aim to be comprehensive. It *does* aim to give a broad account of those relevant aspects of Great Britain's gas market, so that producers of biogas, who may not have considered injecting it into the gas grid, are better able to make an informed choice between the various marketing options.

This Guidance Note does not address generic regulatory issues, not specific to the GB gas market. Thus it does not address planning or environmental controls.

The Guidance Note was prepared by DECC, with the assistance of a Working Group comprising representatives from industry, renewables trade associations, the Health and Safety Executive, and Ofgem. The Department of Energy & Climate Change is grateful to all those who participated. In particular, it is pleased to acknowledge the role of the Energy Networks Association in hosting the meetings of the Working Group, and in helping to co-ordinate the drafting process.

Prospective producers of biogas/biomethane are strongly advised to seek further information and advice from the relevant Gas Distribution Network, and from professional advisers such as legal and technical engineering advisers. Whilst every care has been taken in the preparation of this Guidance Note, the Department of Energy & Climate Change cannot accept responsibility for any errors that remain.

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Section 1: Biomethane into the gas network – The policy background

1.1 Under the European Union's Renewable Energy Directive,[1] the UK is committed to meeting a target of 15% of our energy from renewables by 2020. This will require an almost 7-fold increase in the use of renewable energy. We set out how we can do this, earlier this year, in our Renewable Energy Strategy ("RES").[2] Doing so will help to develop a more diverse, low carbon energy mix; so helping the UK to meet its binding carbon budgets and to ensure security of supply, and providing new, green jobs and investment opportunities in the UK.

1.2 This will require changes in both power and heat generation. By 2020, 12% of our heat could be provided by renewable sources. Biogas – gas manufactured from organic matter, as opposed to the natural gas which is produced from geological strata underground – potentially has a significant role in contributing to our renewables target, and towards our longer term goals.

1.3 There have been a number of studies on the potential of biomethane in Britain. These have indicated a wide band of potentials for energy production, depending on the end use of the resources and the conversion technologies involved.[3]

1.4 Of the potential 100TWhs of energy from biomass available in the UK, approximately 10-20TWhs could be from biogas produced by anaerobic digestion.[4] When the process of gasification has been proven commercially, Synthesis Gas, or Syngas, will also be able to make a significant contribution.

1.5 One way of using biogas and syngas is to inject it, as biomethane, into the gas grid – into the pipe-line networks that supply our homes and businesses. The Renewable Energy Strategy also considered that biomethane injection might contribute towards meeting our 2020 renewable energy targets.[5]

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[1] Directive 2009/28/EC; for a link, see DECC's Renewable Energy Strategy web-site – details at Section 9 below.

[2] See:
http://decc.gov.uk/Media/viewfile.ashx?FilePath=What%20we%20do\UK%20energy%20supply\Energy%20mix\Renewable%20energy\Renewable%20Energy%20Strategy\1_20090715120226_e_@@_TheUKRenewableEnergyStrategy2009.pdf&filetype=4

3 Assessments of the potential for biomethane in the UK include studies:
by *Enviros* for DECC, on "Barriers to renewable heat" (2008) (see part 2b on biogas options):
http://decc.gov.uk/en/content/cms/consultations/cons_res/rescon_support/rescon_support.aspx;
by *Ernst and Young* for National Grid:
http://www.nationalgrid.com/NR/rdonlyres/9122AEBA-5E50-43CA-81E5-8FD98C2CA4EC/32182/renewablegasWPfinal1.pdf;
and by *NERA/AEA*, on "The UK Supply Curve for Renewable Heat" (2009):
http://decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/policy/renewable_heat/incentive/supply_curve/supply_curve.aspx.

4 See: "UK Biomass Strategy" (Defra/DTI/DfT, 2007)

[5] See: "The UK Renewable Energy Strategy" (DECC, 2009). Analysis for the Strategy considered the least-cost pathway to meet the UK's renewable energy targets, given constraints in each technology and sector, and wider policy goals. Commercial developers may decide to bring forward more biomethane, as their assessment of the costs, barriers and potentials may differ.

1.6 Biomethane can also be used in other ways, that would not require a connection to the gas network; for example, for combined heat and power generation, or as a transport fuel. Use of biomethane for these purposes is not covered by this Guidance Note.

1.7 Biodegradable wastes currently going to landfill, along with manures, slurries and sewage sludge, provide a significant source of feedstock for biomethane production. Diversion of waste that would otherwise end up in landfill has the additional benefit of reducing methane emissions from landfill. It is important to ensure that biogas production delivers real greenhouse gas savings, and does so sustainably. Government is addressing the sustainability of biomass used for heat and power, as part of the Renewable Energy Strategy.

Section 2: Biogas & Biomethane – Technical introduction

i. What are biogas and bio-SNG?

2.1 "Biogas" is a term used to refer to a combustible gas created by anaerobic digestion (see below) of organic material, and composed of approximately 60% methane (CH4), 40% carbon dioxide (CO2), and other trace levels of contaminants.

2.2 "Bio-SNG" is a term used to refer to a combustible gas that has been created by the thermochemical process of gasification (see below) of organic material. It is composed predominantly of methane, hydrogen, carbon monoxide, and carbon dioxide.

2.3 Biogas, or bio-SNG, can be extracted from a variety of organic materials (also known as "biomass"), including the biodegradable fraction of domestic and commercial wastes (including food waste, paper, card and wood), agricultural waste, sewage sludge and energy crops. Anaerobic digestion tends to be better suited to "wetter" resources and gasifcation to "drier" ones.

ii. What is biomethane?

2.4 "Biomethane" (or "renewable gas") is a term used to describe a gas mixture that is predominantly methane (>97%) and is sourced from organic material (biomass). This gas has similar thermal characteristics to natural gas. Subject to meeting the gas quality requirements discussed in Section 5, biomethane is considered as pipeline quality gas and can be injected into the natural gas network and used in existing gas appliances.

2.5 Biomethane can be produced by processing biogas or bioSNG, and is described further in the next two sections.

iii. Biogas production from Anaerobic Digestion

2.6 Anaerobic digestion is a natural biological process carried out by bacteria, in a humid environment in the absence of air, in which organic material is broken down into a stable fertiliser and useful biogas. Placing wet organic material in an airtight container can create this environment. These containers are known as Anaerobic Digesters (AD), and the biogas they generate can easily be captured. Biogas is also produced at landfill sites ("landfill gas") and sewage treatment works ("sewage gas").

2.7 There are two basic forms of anaerobic digestion:

- the *mesophilic* process involves the digester being heated to 25-38°C; the feedstock residence time is typically 14-30 days;
- the *thermophilic* process involves the digester being heated to 50-60°C; the residence time is typically 12-14 days.

2.8 Thermophilic digestion systems, compared with mesophilic systems, offer potentially higher methane yields and faster throughput, but they tend to require more expensive technology, greater energy input and a higher degree of operation and monitoring.

2.9 To convert the biogas to biomethane the main requirement is to remove the majority of the carbon dioxide, as well as some of the trace impurities. There are a number of commercial technologies to perform this "clean up", including water scrubbing, selexol absorption, cryogenic separation, membrane separation, and pressure swing adsorption processes.

iv. Bio-SNG production from Gasification

2.10 Biomass gasification is a process that converts solid biomass into a combustible gas (bio-SNG). This is a thermochemical process, meaning that the biomass is heated to a high temperature and the resulting gases undergo chemical reactions to form a synthesis gas (bio-SNG). Bio-SNG predominantly comprises hydrogen (H_2), carbon monoxide (CO), methane (CH_4) and carbon dioxide (CO_2). The exact composition of the bio-SNG will depend on the technology and material being gasified. There are several gasification process designs, including fixed bed, fluidised bed, multi-stage, indirect and plasma technology.[6] Gasification allows for recovery of gas from organic materials that cannot be readily processed by anaerobic digestion.

2.11 Some plants use a pyrolysis process rather than full gasification. Pyrolysis is one of the main stages of biomass gasification. It occurs when the volatile components of the biomass are vaporised through the addition of heat to form bio-SNG. The process can be stopped here; or, for full gasification, further heat and potentially steam are added, resulting in the biomass being further broken down to produce greater volumes of gas.

2.12 To generate biomethane the bio-SNG needs to be cleaned, filtered and processed further, using advanced catalytic and chemical processing techniques; these will ultimately combine the hydrogen and carbon monoxide in the gas to form methane. This process is called "methanation", and it can produce pipeline quality biomethane once the metering requirements have been met.

2.13 Because of the higher capital and operating costs (arising from these gas cleaning requirements), gasification is more suited to larger scale processes. Some gasification technologies, such as indirect gasification, are better suited to the methanation process than others based on the composition of the synthesis gas they produce (high levels of hydrogen and methane) and the production of a nitrogen-free product gas.

2.14 A schematic of how this process works is shown below in Figure 1.

[6] See: NNFCC Project 09-008, "Review of Technologies for Gasification of Biomass and Wastes": http://www.nnfcc.co.uk/metadot/index.pl?id=9348;isa=DBRow;op=show;dbview_id=2457.

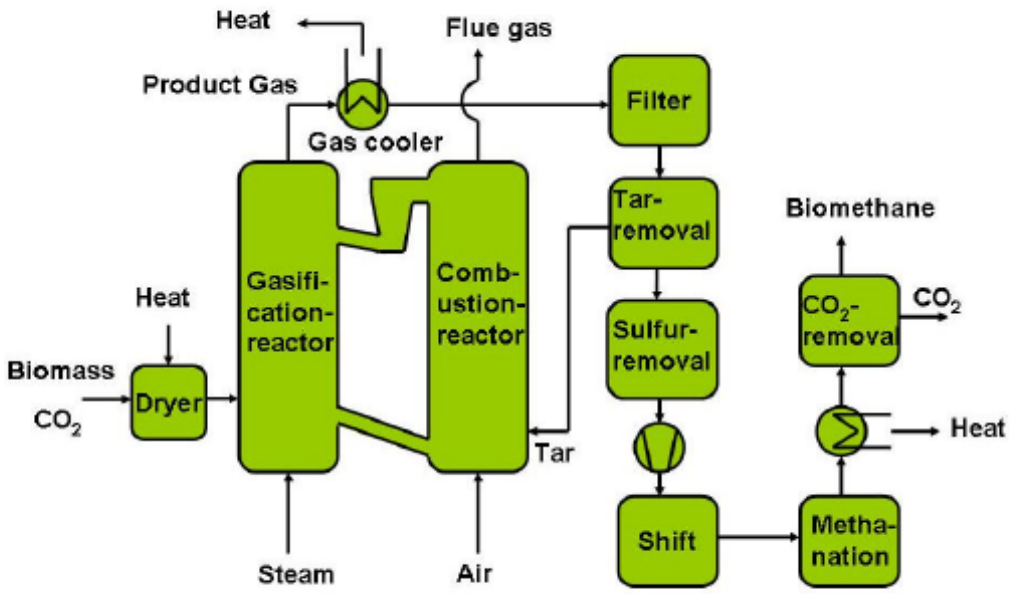

Figure 1: Schematic layout of biomass combustion and methanation to produce biomethane

v. Economies of scale

2.15 The capital-intensive nature of the processes to manufacture biomethane brings scope for economies of scale. Potential biomethane producers may wish to explore the opportunity to achieve economies of scale. This might be done, for example, by establishing central manufacturing / upgrading plants, which would collect feedstock or non-upgraded biogas from a wide catchment area.

Section 3: Why Grid injection?

3.1 Biogas or bio-SNG does not have to be injected (after upgrading) into the gas network. It can instead be utilised on-site, in combined heat and power (CHP) units, or upgraded to biomethane and used directly as a vehicle fuel or for the generation of power.

3.2 Clean-up of biogas to allow injection of biomethane into the gas network requires investment in appropriate plant and its operation. The case for making this investment needs to be assessed by developers, on a project-by-project basis, against the benefits that biomethane injection brings.

3.3 These benefits can include:

- *more efficient use of the gas*: Using the gas on-site for electricity-only applications (e.g. where there is no local demand for the heat) would harness only 30-35% of the energy in the gas. Using the gas in an efficient modern domestic boiler, having transported it through the gas pipe-line system, could use more than 90% of the energy in the gas;

- *delivery of renewable heat*: Biomethane injection enables renewable heat to be delivered directly into the gas grid, which transports gas to over 80% of homes in Great Britain ("GB");

- *greater competition for renewable gas*: The injection of biomethane into the gas grid gives the biogas producer access to a much larger market of potential buyers than if the biogas were to be sold and used locally.

3.4 From the perspective of the biogas producer, injecting the gas (as biomethane) into the gas grid can therefore give access to a higher price than available locally. Depending on commercial factors, including the associated costs, this may mean a higher net price (i.e. net of the associated additional costs).

3.5 The next section outlines the role of the different participants in our gas market arrangements, as a preliminary to the following sections setting out how a potential biomethane producer would go about seeking a connection to the gas pipe-line network.

Section 4: Who's who in the GB gas market?

4.1 The gas market in Great Britain has different functions for:

- *Government* – which makes the primary legislation and sets the strategic direction for energy policy. For example, the licensing regime outlined below is enshrined in the Gas Act 1986 (as amended), which is the responsibility of the Department of Energy and Climate Change;

- *the regulators* – for example, Ofgem (the economic regulator for the gas market) and the Health and Safety Executive (HSE) (with oversight of gas health and safety laws);

- *the market participants* – for example, holders of licences under the Gas Act 1986 (as amended).

4.2 **Ofgem (The Office of Gas and Electricity Markets)**: This is the organisation that supports the Gas and Electricity Markets Authority, which is responsible for economic regulation of the energy (gas and electricity) markets. Ofgem's principal objective is to protect the interests of consumers, present and future, wherever appropriate by promoting effective competition. Ofgem is required to carry out its functions in the manner which it considers best calculated to contribute to the achievement of sustainable development and to secure a diverse and viable long-term energy supply.[7]

4.3 **Health and Safety Executive**: The HSE is responsible for protecting against the risks to health or safety arising out of work activities. It does this through the administration and enforcement of relevant health and safety legislation.

4.4 *Whereas Ofgem and HSE are governmental bodies, those below are participants in the gas market. They are commercial organisations, subject to regulation by Ofgem and/or the HSE*.

4.5 **Producers**: These produce the gas that subsequently enters the system. Most large producers are exploiting gas in geological strata offshore – they need a Petroleum Production licence from DECC, because the hydrocarbon mineral rights are vested in the Crown, but they do not need a licence from Ofgem. In the case of biogas/biomethane, the issue of hydrocarbon mineral rights does not arise. So a biogas/biomethane producer will not require a licence from DECC or Ofgem to *produce* gas.

4.6 **Gas Transporters (GTs)**: These provide the pipelines through which gas is transported across the country to end-users; this is a licensed activity, and it is regulated by Ofgem. There are various kinds of Gas Transporter:

- *National Grid Gas plc* has a licence, as Transmission System Operator (TSO), to own and operate the high pressure National Transmission System (NTS). As well as

[7] For Ofgem's duties, see Gas Act 1986 (as amended), section 4AA.

developing and maintaining the NTS, it is responsible for the energy balancing of gas entering and leaving Great Britain's onshore gas pipe-line system or network;

- the *Gas Distribution Networks (DNs)* transport gas from the NTS and distribute it to end consumers and to Independent Gas Transporters (see below). The DNs' pipe-lines operate at different levels, or tiers, of pressure. There are 8 licensed DNs, owned and operated by 4 different organisations – National Grid Gas Distribution, Northern Gas Networks, Scotia Gas Networks, and Wales & West Utilities;

- there are also smaller, independent companies known as *Independent Gas Transporters (iGTs)*. These typically install and operate their own pipeline systems on new housing and commercial developments, downstream of a DN's network. Details of iGTs can be found on Ofgem's website at:

  www.ofgem.gov.uk/Networks/GasDistr/IGTReg/Pages/IGTReg.aspx

4.7 **Shippers**: These make arrangements with Gas Transporters to convey their gas through GT pipe-lines; this is a licensed activity, regulated by Ofgem. More broadly, Shippers contract with producers to bring gas into the gas transportation system, and they are in effect the wholesale merchants for Suppliers (below), who have the contractual relationship with gas consumers. Shippers share a common (and therefore non-discriminatory) contractual relationship with the GTs, to allow them to use the GTs' pipelines to transport gas; the terms of this relationship are set out in a Uniform Network Code (UNC), a common set of rules for the transportation and trading of gas which underpins the effective operation of GB's competitive gas market.

4.8 **Suppliers**: These sell gas to both domestic and non-domestic gas consumers; supply is a licensed activity, regulated by Ofgem. There is no contractual relationship between the Supplier and the GT; to ensure that a Supplier has gas to meet the demand of its customers, it needs to have arrangements in place with a Shipper to provide the gas required. The supply and shipping of gas are often carried out by the same entity.

4.9 Under our gas market legislation, a party making commercial arrangements with a gas transporter to allow biomethane to enter the gas pipe-line network must be a licensed Shipper. However, under the legislative framework for the GB gas market, *a legal person may not hold both a Gas Transporter licence and a Shipper (or Supply) licence*.

4.10 The following web-site:

www.ofgem.gov.uk/Licensing/Work/Documents1/LicAppGuidance011008.pdf

provides information about Ofgem's procedures for issuing licences.

4.11 In line with the Government's commitment in the Renewable Energy Strategy, it intends (subject to consultation and consideration of European Union requirements) to provide, in 2011, an exemption from the requirement for a Gas Transporter's licence for biomethane plant and associated pipe-line needed to convey gas into an existing GT pipe-line. DECC expects to consult on this in 2010 (see Section 7 below).

Section 5: How does a biomethane producer connect to the gas network?

5.1 This section assumes that you are proposing to become a biomethane (and not simply a biogas) producer, because a basic requirement for access to the gas network is that biogas is up-graded to biomethane.[8] It also assumes that you are within reasonable distance of GB's gas pipe-line network.[9] An early step should be to contact the local Gas Distribution Network (DN) company. A map showing the 8 DNs' areas, with contact details, is in section 6. But, first, some knowledge of the basic requirements for connection is needed.

i. Physical requirements

5.2 A network connection will be required. When first contacting the DN you will need to have the following information:

- proposed location of the biomethane production facility;
- anticipated volumes and profile (i.e. constant or variable hourly flows);
- anticipated gas composition;
- target connection date.

5.3 The DN will be able to guide you through the steps needed to obtain a physical connection to its network.

5.4 The provision of connection services – for example, to connect your biomethane plant to the existing pipe-line network – is a paid-for, competitive activity. A licensed Gas Transporter, or one of the registered Utility Infrastructure Providers (UIPs),[10] could offer this service. You will need to choose a service provider, and to enter into an appropriate arrangement for the work to be done.

5.5 Charges will reflect the specific type and location of the connection. If the pipeline nearest to your biomethane plant is not large enough to take the anticipated volume of gas, additional pipework may be needed. Network reinforcement may be needed if there is insufficient capacity at the point of connection. You would be responsible for the cost of any such works. The ability of a network to accept gas will depend on the usage and availability of gas in the area.

5.6 Under the present licensing regime, the connecting pipework has to be owned and operated by a licensed GT. Therefore, and unless you (as a biomethane producer) become a licensed GT for this purpose, until any exemption is made you would need to agree with an existing licensed GT for it to adopt the connection pipework. The GT will be able to explain this process.

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[8] The requirements for up-grading biogas to biomethane are outlined later in this section.

[9] An indicative map of "off-gas areas" in England can be found in "The UK Renewable Energy Strategy 2009", at Figure 4.2; see Section 9, below, for the web reference.

[10] A list of registered UIPs can be found on Lloyds Register: http://www.lloydsregister.co.uk/girs.html.

5.7 Connections to the network can be complex, and may require a significant lead time, particularly if network reinforcement and/or easements are required. It is therefore advisable to contact the DN as early as possible in the planning/evaluation process. This will help everyone involved to understand feasibility, whether reinforcements are needed, and likely costs.

ii. Contractual Arrangements

5.8 In addition to arrangements for the physical connection, a *Network Entry Agreement* will be required with the GT. You should also ensure that appropriate arrangements are in place to comply with *licensing requirements*.

5.9 *Network Entry Agreement (NEA)*: A Network Entry Agreement sets out the technical and operational conditions for the connection, and is required under the Uniform Network Code (UNC). The NEA is an agreement between (in this case) you as the biomethane producer and the GT, and it defines how the network entry facility will operate. It is normally developed in parallel with the connection process (see above), to ensure that all parties involved understand the requirements.

5.10 The typical NEA will specify:

- the point of entry (marked on a diagram);
- the plant and equipment, and its ownership;
- responsibilities for maintenance and operational control of equipment;
- gas quality specification;
- measurement arrangements;
- on-going charges;
- Local Operating Procedures (LOPs).

5.11 The LOPs are day-to-day procedures, and cover such items as:

- notification of intended gas flows;
- confirmation of actual gas flows;
- site security;
- management of flow rates, pressures and gas quality;
- emergency arrangements;
- maintenance arrangements.

5.12 The operating costs of providing other services such as gas quality monitoring, metering and telemetry, and any other non-transportation services, will normally be recovered through a bilateral agreement.

5.13 *Licensing arrangements (Shipper and Gas Transporter requirements)*: As outlined above, only a licensed Gas Shipper may make arrangements with a GT for gas to enter the network; and (until any exemption is created through legislation) only a licensed Gas Transporter may convey gas into a pipe-line of a Gas Transporter. Meanwhile the European Union's "3rd Package"[11] will require the unbundling, or legal separation, of gas

[11] Directive 2009/73/EC.

production from gas transportation; when the Directive is implemented into GB law, this may prevent a biomethane producer from holding a GT licence.

5.14 Biomethane producers will need to ensure that they have arrangements in place which comply with current and future legal requirements (including the existing prohibition on holding both a GT licence and a Gas Shipper licence). The arrangements should have the following features:

- the conveyance of biomethane into the gas network is carried out by a licensed GT;
- a licensed Gas Shipper contracts with the licensed Gas Transporter(s) for conveyance of the biomethane.

iii. What Gas Quality do I have to meet?

5.15 All gas conveyed into a Gas Transporter pipe-line must comply with gas quality requirements set out in the *Gas Safety (Management) Regulations 1996* (GS(M)R).[12] It must also meet any additional gas quality requirements specified in the relevant *Network Entry Agreement* (NEA).

5.16 *Gas Safety (Management) Regulations 1996*: A partial summary of the key gas quality requirements from Schedule 3 of the GS(M)R is shown below.

Content or characteristic	**Value**
Hydrogen Sulphide (H2S)	Less than or equal to 5 mg/m3;
Total Sulphur (including H2S)	Less than or equal to 50 mg/m3;
Hydrogen (H2)	Less than or equal to 0.1% (molar);
Oxygen (O2)	Less than or equal to 0.2% (molar);
Impurities and water and hydrocarbon dewpoints	The gas shall not contain solids or liquids that may interfere with the integrity or operation of the network or appliances
Wobbe Number (WN) (Calorific Value divided by the square root of the relative density)	Between 47.20 and 51.41 MJ/m3
Odour	Gas below 7 bar will have a stenching agent added to give a distinctive odour

5.17 The *NEA* requirements may include additional limits, including: Calorific Value, Temperature, Organo Halides, Radioactivity, and inerts like carbon dioxide. Indicative values for the NEA requirements can be found on the website of the relevant DN (in the section on its Long Term Development Plan).[13]

[12] http://www.opsi.gov.uk/si/si1996/Uksi_19960551_en_1.htm

[13] http://www.nationalgrid.com/uk/Gas/TYS/LTDP/index.htm (National Grid), http://www.northerngasnetworks.co.uk/documents/1225469171.pdf (Northern Gas Networks), http://www.scotiagasnetworks.co.uk/index2.aspx?rightColHeader=8&rightColContent=15&rightColFooter=237&hideRightCol=1&id=54(Scotia Gas Networks) and http://www.wwutilities.co.uk/long-term-development-statement.asp?GroupKeyPos=01,06,07 (Wales and West)

5.18 Commercially available clean-up technologies can deliver biomethane that will meet these standards.

5.19 If you believe that you may be unable to meet the indicative NEA requirements, you could explore with the DN if it may be possible to relax a particular limit at a specific location; or you could consider whether there could be scope to "blend" the gas to meet the specification.[14] If it appears that you would ultimately be unable to meet the GS(M)R requirements, then the discussion should be between the DN and the Health & Safety Executive; but there can be no guarantee that the specification under the GS(M)R, or elements of it, could be relaxed.

iv. What about the Waste Framework Directive?

5.20 Biomethane produced from the treatment of waste can only be injected into the gas network with the permission of whoever is responsible for the network – for example, the DN. The question whether injection into the network may require the gas to be cleaned up and treated to an appropriate agreed standard is a matter for them. There may also be regulatory implications arising from the fact that this biomethane is produced from waste. This issue is currently being considered with the competent authorities responsible for implementing the EU Waste Framework Directive,[15] namely the Environment Agency and Scottish Environment Protection Agency.

v. What equipment shall I need?

5.21 The exact equipment requirements will vary from site to site, depending on whether biogas or bio-SNG is used to make the biomethane, the clean up technologies, and any site-specific requirements.

5.22 Most biomethane injection facilities would be likely to need the following equipment:

- *Biogas/Bio-SNG production and clean-up facilities*: the biogas or bio-SNG will require some clean-up and refinement to enable it to meet the gas quality requirements above;

- *Enrichment equipment*: This is likely to be required to increase the energy content (Calorific Value) of the gas to a level similar to that of the gas already in the network,[16] to ensure consumers are billed fairly for the volume of gas they use. Biomethane can be enriched by blending it with a gas with a higher energy content than natural gas (e.g. propane);

- *Gas Quality Monitoring Equipment*: This is required to measure the energy content of the gas, and demonstrate to the GT and HSE that the biomethane is compliant with

[14] See "Enrichment equipment", below.
[15] Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste.
[16] The energy content of gas in the GB gas pipe-line system is generally between 39 and 40MJ/m3.

the gas quality requirements. On sites designated as "directed" by Ofgem, the equipment to measure the energy content of the gas has to be approved by Ofgem;[17]

- *Metering Equipment*: This is needed to measure the volume of gas injected into the gas network. On sites designated as "directed" by Ofgem it is likely that Ofgem would require fiscal standard metering. This means that metering must be accurate to within ±1 % on volume measurement, and ±1.1 % on energy measurement;

- *Odorisation Equipment*: Odorisation is required at gas pressures below 7 barg. There will be an ongoing cost for odorisation plant, and for the odorisation process as the biomethane enters the gas network. This is imperative for public safety, as it is odorisation that gives the gas its characteristic smell, which can be widely recognized in the event of an escape. This characteristic is achieved by using odorant (80% tertiarybutyl mercaptan, 20% dimethyl sulphide). The dosing rate is usually 6 mg/m3, ±2 mg/m3, depending on the DN's requirements;

- *Pressure control equipment*: Depending on the pressure of the gas network at the injection point, it is likely that the biomethane pressure will need either to be increased, using compressor equipment, or reduced, using a pressure reduction valve (also known as a regulator), to enable safe injection into the gas network. In some parts of the network there may be significant swings in gas pressure during the day. The local DN should be able to advise on the potential pressure requirements at the injection point;

- *Automatic Valve*: An automatic valve or slam shut is required to stop the injection of biomethane if it is not of appropriate quality, and also to prevent the over-pressurisation of the gas network. The DN may require a remote operation capability, to maintain the safe operation of the network;

- *Telecommunications Equipment*: This is required to send data from the injection facility, for billing and operational reasons.

5.23 It may be helpful to discuss with the host GT – that is, the licensed Gas Transporter to whose pipe-line you would connect – whether it could provide any equipment required on a commercial basis. Information about equipment can also be found on the Renewable Energy Association's website; details are in Section 9, below, on "Further information".

[17] On Ofgem "directed" sites, fiscal measurement of calorific value for billing purposes must be carried out using Ofgem approved apparatus. Currently the only apparatus approved for this purpose is the Daniels Model 500 Danalyzer gas chromatograph.

Section 6: How to contact a Gas Distribution Network

6.1 In the first instance a prospective biomethane producer should contact the local Gas Distribution Network. If the proposed biomethane plant could be suitable for an NTS or iGT connection, the DN will advise accordingly. If the volumes of gas would be very large, that could point to a connection to the NTS; whereas if the volumes are small, and a suitable pipe-line is close, that could point to a connection to an iGT network.

6.2 This map shows the areas covered by the 8 Gas Distribution Networks in Great Britain. Their contact details are set out below

GDN Contact Details:

National Grid:
www.nationalgrid.com/uk/gas

Connections Manager
Network Strategy
National Grid
Block 4
Brick Kiln Street
Hinckley
Leics. LE10 0NA

Northern Gas Networks:
www.northerngasnetworks.co.uk

Scotia Gas Networks:
www.scotiagasnetworks.co.uk
Network Capacity Manager
Telephone: 01293 818255

Wales & West Utilities:
www.wwutilities.co.uk
Head of Regulation
Telephone: 02920 278836

Section 7: The longer term

7.1 A number of issues have been identified for further consideration, with a view to making it easier, both commercially and operationally, to inject biomethane into the gas network.

i. Licence Exemptions

7.2 Under the Gas Act 1986, it is a criminal offence to convey gas into the pipe-line of a licensed Gas Transporter ("GT"), or to premises, without a GT licence or an exemption from the requirement to hold a GT licence. Exemptions are created under Statutory Instruments, subject to Parliamentary procedure, following consultation.

7.3 The Department of Energy & Climate Change recognises that there are good reasons for enabling biomethane plant and associated pipe-line to be exempt from the requirement for a GT licence. It expects to consider this as part of a forthcoming exercise, to address a number of existing exemptions which would otherwise lapse on 1 March 2011. The Department expects to issue a consultation document during 2010, taking into account the requirements of the European Union's "3rd Package".

7.4 The "3rd Package"[18] will require the unbundling, or legal separation, of gas production from gas transportation. DECC expects to consult in due course on the implementation arrangements. When the Directive is implemented into GB law, this may prevent a biomethane producer from holding a GT licence.

7.5 Any future exemption from the requirement for a GT Licence, which must be consistent with the 3rd Package, would be unlikely to affect the need for a licensed Gas Shipper to contract with the GT.

ii. Renewable Heat Incentive

7.6 The Government intends to provide financial support for renewable heat under a new "Renewable Heat Incentive" (RHI). It intends to consult on the arrangements in January, including how biomethane injection into the gas grid could be supported. It expects to introduce the RHI by April 2011. The Renewable Energy Strategy confirmed that all biomethane[19] projects that come forward between 15 July 2009 and the start date of the RHI, and that meet the relevant criteria, may be eligible for support under the RHI.

iii. Gas Quality

7.7 The Health & Safety Executive sets gas quality limits in Gas Safety (Management) Regulations (GS(M)R), and oversees the safety framework, principally through monitoring compliance with gas network operators' GS(M)R safety cases. HSE is an

[18] See Section 5, above.
[19] As defined in the Energy Act 2008; see section 100.

enabling regulator, but it is bound by legal restrictions of GS(M)R. The safety of gas consumers is paramount.

7.8 Biomethane for injection into GB's gas network – i.e., into the National Transmission System and the Distribution Networks – must satisfy the requirements of the GS(M)R) on gas quality (Schedule 3 of GS(M)R) at the entry point, or be granted an exemption under GS(M)R Regulation 11. The parameters in Schedule 3 ensure the safety and integrity of the pipelines conveying the gas, the downstream pipe work within premises, and the safe operation of gas appliances and plant.

7.9 Before providing an exemption HSE must be satisfied that the health and safety of persons likely to be affected by the exemption would not be prejudiced in consequence of it. Such a demonstration would be expected to include provision of suitable and sufficient evidence for concluding there are no significant safety implications from a failure to comply with any matters specified in Schedule 3 of GS(M)R, including any impurities likely to be present in the biomethane as well as the substances named in the Schedule. The assessment should also demonstrate that adequate consideration has been given to the long term effects to all potential consumers as a result of the failure to comply with the requirements of Schedule 3.

7.10 The facility of granting exemptions to duty holders from health and safety regulations is to deal with unintended consequences of the law that otherwise have no adverse consequences for health and safety. Few exemptions are granted, and only where an operator has been able to convincingly establish that there are *no* adverse health and safety consequences for any users or consumers.

7.11 Sound evidence would need to be available that introducing biomethane into the National Gas Distribution System would have no adverse safety implications, before any case for relaxing certain of the parameters in GS(M)R could be made.

7.12 In the event that GS(M)R requirements cannot be satisfied by biogas purification alone, it may possible to achieve point of entry requirements by other additional means, such as pre-injection mixing with sufficient distribution network gas. HSE strongly advises prospective developers to discuss these issues with the relevant Gas Distribution Network at the earliest opportunity.

iv. Other gas market issues

7.13 The governance arrangements for the gas market largely centre around the Unified Network Code. The arrangements cover a wide range of issues, including, for example, the interaction between requirements in respect of calorific value and metering. In addition Ofgem has certain powers to make regulations on technical issues. Prospective biomethane producers, through their representative bodies, would be well advised to engage with these arrangements, to ensure that they clearly understand the various requirements, and to ensure that their voice is heard when modifications to the UNC, and other governance requirements, are under consideration.

Section 8: Glossary

Anaerobic Digestion	A natural biological process carried out by bacteria in the absence of air, by which organic material is broken down into a digestate (forming a stable fertiliser) and biogas
Barg	“bar gauge” pressure – a measure of pressure above atmospheric pressure (which is around 1 bar)
Biogas	A combustible gas created by anaerobic digestion of organic material and composed of approximately 60% methane, 40% carbon dioxide and some trace elements
Biomass	Organic material of recent biological origin including the biodegradable fraction of domestic and commercial wastes, agricultural waste, sewage sludge, wood and energy crops
Biomethane	A a gas mixture that is predominantly methane (>97%) and is sourced from organic material (bio-mass)
Bio-SNG	Gas produced from a thermal treatment process
Calorific Value	The amount of heat released during the combustion of a specified amount of gas, measured in units of energy per unit of gas
Combined Heat & Power (CHP)	The use of a heat engine or a power station to generate simultaneously both electricity and useful heat
Distribution Networks	One of the 8 regional gas distribution networks in Great Britain. These consist of low pressure pipe-lines which offtake gas from the high-pressure, long-distance National Transmission System, and convey it to the end-consumer or to the pipes of an “iGT” [see below]
Gasification	A process in which dry biomass (e.g. wood) is thermally decomposed at temperatures of around 850°C to produce what is known as synthesis gas
Gas Safety (Management) Regulations (GS(M)R)	The Gas Safety (Management) Regulations 1996 (SI 1996 No.551) deal with the management of the safe flow of gas through Great Britain’s natural gas networks. The key objective is to ensure safety, by ensuring security of supply (especially to domestic consumers), and by ensuring the safety standards of emergency services provided by the gas industry
iGT	An independent Gas Transporter – i.e., a licensed Gas Transporter other than National Grid Gas and the operators of the 8 Gas Distribution Networks
Mesophilic Digestion	The biological process that occurs when an Anaerobic Digester is heated to 25-35°C
National Transmission System	The high pressure, long-distance part of National Grid’s transmission system for gas, consisting of more than 6,600

	kilometres of steel pipeline operating at pressures up to 85 bar
Network Entry Agreement	Sets out the technical and operational conditions for a connection and is required by the Uniform Network Code (UNC)
Synthesis Gas (Syngas)	A gas mixture that contains varying amounts of carbon monoxide and hydrogen
Thermophilic Digestion	The biological process that occurs when an Anaerobic Digester is heated to 50-60°C
Uniform Network Code (UNC)	A common set of rules for the transportation and trading of gas, which underpins the effective operation of Great Britain's competitive gas market

Section 9: Further information

Government:

Department of Energy & Climate Change – www.decc.gov.uk/

DECC's Renewable Energy Strategy (including *The UK Renewable Energy Strategy 2009*) – http://decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx

Department for Environment, Food and Rural Affairs – www.defra.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/

Trade associations:

Association of Electricity Producers – www.aepuk.com/

Association of Independent Gas Transporters - www.aigt.org.uk/

Association for Organics Recycling - www.organics-recycling.org.uk/

Energy Networks Association – www.energynetworks.org/

Environmental Services Association - www.esauk.org/

Renewable Energy Association – www.r-e-a.net/

Some specific web-sites:

DECC/Defra Information Portal on AD (hosted and maintained by NNFCC) – gateway to information about AD, including links to tools, information and guidance: www.biogas-info.co.uk/

Defra – information on policy to promote anaerobic digestion, anaerobic digestion task group, financial and market support, AD demonstration programme: www.defra.gov.uk/environment/waste/ad/

Business Link – advice on use of AD: www.businesslink.gov.uk/bdotg/action/detail?type=RESOURCES&itemId=1081290675

"WRAP – technical information on AD, discussion forum, AD demonstration programme: http://www.wrap.org.uk/recycling_industry/information_by_material/organics/anaerobic_digestion.html"