Gas NIC Final Report
BioSNG Demonstration Plant

Project Reference: NGGD GN 01

REPORT from RUNE ASSOCIATES LTD

(Confidential)

Issued by:

Rune Associates Limited
The Old Barn
Bromsash
Ross-on-Wye
HR9 7PW

Prepared for

Ofgem
9 Millbank
London
SW1P 3GE

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2. SUMMARY OF PROJECT INFORMATION

2.1. SUMMARY DETAILS

Basic Project Information	
Project name	BioSNG Demonstration Plant
Project Short Name	NGGD GN 01 BioSNG
The Funding Licensee	National Grid Gas Distribution
Total Project Cost (Cell I13[1])	£4,251k
External Funding. (Cell I25)	£2,126k
Network Licensee Compulsory Contribution. (Cell I66)	£213k
Network Licensee Extra Contribution. (Cell I37)	Nil
Gas NIC Funding Request. (Cell I85)	£1,875k
Requested threshold for the funding of cost over-runs if different to the default.	n/a
Requested protection on Direct Benefits, if different to the default.	n/a

2.2. SYNOPSIS

Synopsis of Project Submission	
Description of the problem	For gas to continue to be used for heating into the long term it will be necessary to dilute fossil gas with renewable gas to avoid breaching the UK's carbon reduction targets. However, renewable gas is currently only produced via anaerobic digestion, and there is a limit to the types of waste that can be treated in this way. i.e. primarily food/agricultural wastes and sewage, which limits the potential of renewable gas to a maximum of ~40TWh (11% of current annual domestic gas demand). Thermal gasification could treat other more abundant sources of waste (residual/black bag/commercial) and significantly increase the availability of renewable gas by ~100TWh (30% of domestic demand). This waste still has a high biogenic content (>60%) and through thermal gasification could produce bio-SNG which is pipeline ready, low carbon and cost competitive with other renewable energy sources. The end-to-end process of waste to pipeline quality gas has not been demonstrated before anywhere in the world; whilst the technology for gasification of waste is known, as is methanation, the fully integrated process has not been proven from a technical or commercial perspective. In order for projects to come to the market, demonstration of the

[1] Cell references relate to the NIC Funding request tab of the Financial workbook

	technology is required. Without proving the techno-economic feasibility through a demonstration project it is very unlikely that commercial projects would reach fruition and hence the potential benefits to the UK from increased availability of GB sourced renewable gas would not be realised.
Description of the proposed method	This project will build a demonstration gas processing plant to be connected to an existing supply of syngas (predominantly a mixture of carbon monoxide and hydrogen) from waste provided by Advanced Plasma Power's (APP's) gasifier. Once constructed, a commissioning and extensive testing programme will be undertaken. The purpose of this programme is stated to be to (a) demonstrate technically that waste-derived syngas can be converted to pipeline quality (GS(M)R compliant) gas using a design appropriate for commercial scale operation (b) optimise the process operational parameters (c) confirm the final process is commercially viable, and provide tangible demonstration to the low carbon investment community and other stakeholders.
Description of proposed Trial(s)	The steps involved are: 1. Procure and build capital equipment as specified in the detailed design. 2. Connect to APP's existing gasifier and commission the plant. 3. Undertake an extensive staged technical test programme. This will seek to understand: a. The impact of plant design and product quality of a variety of syngas compositions, feedstocks and a range of operational conditions as well as the associated carbon accounting. These early tests will underpin the commercial assumptions required to expedite the development of a full-scale facility. b. Further investigations into the technical and commercial effectiveness of the syngas cleaning, converting and upgrading techniques specified in the process design which was developed during the previous IFI-supported phase of the project, and alternatives that may be identified through the planned optimisation programme. c. Confirmation of the optimal techniques for removal of CO2 from the product stream to produce CCS-ready CO2 for transportation and sequestration. d. Investigations into control of the gas quality to ensure reliable delivery of pipeline quality gas e.g. Wobbe Index, nitrogen, hydrogen content etc. e. Refinement of the overall process control system for safe and reliable operation. 4. Based on the technical programme, refine the final design and commercial and business case for deployment of waste based Bio-SNG facilities. This includes providing key stakeholders, DECC, network and facility operators and the low carbon investment community with the tangible demonstration necessary to facilitate Bio-SNG deployment.
Intended outcomes (solutions)	Proof of the techno-economic feasibility of the waste to bio-SNG process, leading to investment in full-scale commercial bio-SNG plants. This is expected to greatly increase the availability of GB sourced renewable gas by opening up much greater quantities of biogenic feedstocks than are suitable for such conversion at present. This project will demonstrate the technology and unlock this pathway for renewable gas.

Customer impact of Project implementation.	No immediate impact.
Key strengths of the proposal	• Builds on a previous IFI project, IFI 79, which developed the process design concept, together with pre-Front End Engineering Design (FEED) and detailed design of the demonstration plant • Utilises existing waste gasification facility. • Technical expertise and commitment of project partners. • Relatively low cost (and NIC funding requested for only 45% of costs), compared to potential very large benefits. • Detailed design already completed and detailed technical test programme devised. • Comprehensive plans to showcase the project outcomes via a knowledge transfer programme. • Strong business case in relation to potential future energy system benefits for UK plc. and for gas customers.
Key weaknesses of the proposal	No significant weaknesses, although the fundamental business case could possibly be set out more clearly in relation to the energy system benefits, and the role for bio-SNG in relation to other future components of pipeline gas such as biomethane, shale gas and LNG. In addition, it is not clear what level of support there is from DECC and also from influential bodies such as The Committee on Climate Change and the Energy Technologies Institute.
Project management structure and related information.	Detailed project management structures and processes have been established; the core partners have had a collaboration agreement in place since March 2012 which provides the platform for the development. A Steering Committee has delegated authority for project delivery, with representation from each of the partners. The Project Manager (Chief Technology Officer from APP) is responsible for the day to day operations of the project, and reports to the Steering Committee. The Project Director for National Grid is accountable for the successful achievement of milestones and for allocation of stage funding under the NIC allowance.
Derogations/ Exemptions that the Project would/may require.	No derogations or exemptions are required.
Proposed Successful Delivery Reward Criteria for the Project.	Nine specific criteria are proposed: Most of the criteria definitions and timing are broadly acceptable, but some would benefit from the provision of more detail to provide evidence of completion. In addition, several criteria could be combined.
The key learning outcomes which the Project aims to deliver.	• Proving the end to end concept of taking waste and converting it to a pipeline quality GSM(R) specification gas; this includes the associated learning of what the optimal process design, performance and operating conditions are necessary to produce gas to the correct specification leading to and informing the commercial design. • Proving the development of the technical and economic performance of a commercial scale plant including innovation around:

	○ Syngas purification & polishing ○ Water gas shift and Methanator Reactors ○ Methane polishing and upgrading to Gas Quality ○ Operation of the above at the relatively moderate scales appropriate for waste-derived fuel operation (Compared with conventional fossil fuel methanation facilities) • The gas networks will learn about the expected quality and operating conditions of such a plant. • Commercial developers/local authorities/DECC will be able to understand the performance and commercial viability of such a plant across a range of operating conditions and duties which will build confidence in the process in order for commercial projects to come forward. This enables deployment of substantial quantities of renewable gas production with corresponding climate change and supply security benefits.

3. SUMMARY OF ASSESSMENT

3.1. OVERALL ASSESSMENT

Overall summary
This is a well-conceived and rigorously planned proposal, which builds on preparatory work carried out under a previous IFI project. The project is innovative in relation to technology and has the potential to make a significant impact on the carbon footprint of gas utilisation by unlocking large-scale commercial development of renewable gas, and benefits from the participation of project partners who have relevant expertise and enthusiastic commitment to the project. The project business case rests on the proposition that successful demonstration of the waste to bio-SNG pilot plant will unlock investment in many full-scale plants, with the result that much larger quantities of renewable gas will become available than could be provided by the current commercially proven route of green waste (and crops) to biomethane using anaerobic digestion. The result of this would be to enable a much larger proportion of the UK's heating requirements to continue to be provided via the existing gas infrastructure (without breaching Green House Gas (GHG) targets) rather than requiring greatly increased electrification of heating, and therefore avoiding the costs for incremental reinforcement of electricity networks, heat networks and additional low carbon generation. In addition, it would avoid some or all of the costs associated with the decommissioning of gas distribution networks that could be required in an electrification of heat scenario, and also potentially reduce the costs to consumers who might otherwise need to replace existing heating systems with systems based on electric heat pumps. The business case is well defined given the absence of immediate benefits; the scale of the potential savings in the UK energy system and for consumers (amounting to many £bn) which could be unlocked by successful demonstration of the waste to bio-SNG technology.

3.2. SUMMARY OF ASSESSMENT AGAINST INDIVIDUAL EVALUATION CRITERIA

Key to ratings		• Seems to be generally in line with the objectives and requirements of the NIC Gas evaluation criteria, • Whilst there are some areas where additional information would be useful, that provided is generally comprehensive and provides no immediate cause for concern.
		• Some indication that the project is in line with the objectives and requirements of the NIC Gas evaluation criteria. However further scrutiny is required to ensure this, • There are some gaps in the information provided, • Further assurance is needed to confirm that the project is viable and that risks are appropriately managed
		• Significantly more assurance is required that the project is in line with the objectives and requirements of the NIC Gas evaluation criteria, • There are some major gaps in the information provided, • Considerable scrutiny is needed to confirm that the project is viable and that risks are appropriately managed, • Potential major risks to the viability of the project.

Evaluation Criteria[2]	**Rating**	**Overall assessment**
Criterion A: Low carbon and benefits		The project has the potential to unlock the deployment of a technology (the manufacture of bio-SNG from waste) that could make a very significant difference to the future carbon intensity of the gas transportation system. The scale of carbon reductions that could be achieved by dilution of fossil / shale gas with zero or negative carbon bio-SNG could enable the continued use of gas for heating in larger numbers of homes and businesses without breaching the government's 2050 carbon reduction targets. Facilitation of the continued use of the gas distribution networks into the long term future would make efficient use of this resource and reduce the need for additional electricity generation and network reinforcement. It would also benefit consumers by enabling them to continue to use relatively inexpensive existing heating systems based on efficient gas boiler technology. The total long-term financial benefits could therefore amount to many £ bn.
Criterion B: Value for money		The project represents very good value for money, both in relation to the proportion of total funding requested from the NIC, and in relation to the potential large long-term benefits from the commercialisation on bio-SNG technology.

[2] Further information on evaluation criteria can be found in the Gas Network Innovation Competition Governance Document

Evaluation Criteria[2]	Rating	Overall assessment
Criterion C: Generates new knowledge		If successful, the project would uniquely demonstrate the end-to-end process of waste gasification of waste feedstock through catalytic methanation and refining to pipeline quality gas. It would inform the optimisation of the individual processes and the scaling up of the technology to a full scale plant in relation to engineering design and commercial potential.
Criterion D: Innovative and unproven business case		As the project involves the manufacture of gas (an unlicensed activity) it would not be appropriate for NGGD to undertake the project in its normal course of business. The project is a pre-commercial demonstration of a process that has not been demonstrated anywhere in the world (although it integrates existing proven technologies), and its risk profile is such that it would not readily attract pure commercial funding.
Criterion E: Involvement of other partners & external funding		Assuming that NGGD and the project partners are successful in obtaining further external funding, the NIC contribution to the project will be only 45% of the total funds required. The project partners are highly appropriate given their previous involvement, their levels of expertise in gasification technology and their willingness to commit resources to the project.
Criterion F: Relevance and timing		The project involves trialling a new technology that could have a major low carbon impact; it follows directly on from a previous IFI project (IFI79) which established the feasibility and detailed design of the proposed demonstration plant, and commencement of the project in 2014 could facilitate the commercial deployment of full-scale plant in time to have an impact on the UK's renewable energy commitments for 2020.
Criterion G: Demonstration of robust methodology		The project plan and project governance arrangements are set out at an appropriate level of detail within the proposal. The proposed trial programme is outlined at high level and in detail, and the proposed timings of each stage appear realistic. Risks and proposed mitigations are set out in a formal risk register. A project work programme has been constructed which covers the major tasks, their duration and the associated deliverables. The project methodology appears to be robust. Technical information verification has been carried out by the project partners, and by appropriate external organisations.
Criterion: Appropriateness of the SDRC definitions and timing and adequacy of links to key project milestones		The SDRC definitions and timing are broadly acceptable, but some would benefit from the provision of more detail to provide evidence of completion.

4. CRITERION A: LOW CARBON AND BENEFITS

Criteria	Rating	Overall assessment
Criterion A: Accelerates the development of a low carbon energy sector and/0r environmental benefits & has the potential to deliver net financial benefits to existing and/or future customers Credibility of the carbon, environmental and financial benefits claimed for the project.		The project has the potential to unlock the deployment of a technology (the manufacture of bio-SNG from waste) that could make a very significant difference to the future carbon intensity of the gas grid. The scale of carbon reductions that could be achieved by dilution of fossil / shale gas with zero or negative carbon bio-SNG could enable the continued use of gas for heating in larger numbers of homes and businesses without breaching the government's 2050 carbon reduction targets. Facilitation of the continued use of the gas distribution networks into the long term future would make efficient use of this resource and reduce the need for additional electricity generation and network reinforcement. It would also benefit consumers by enabling them to continue to use relatively inexpensive existing heating systems based on efficient gas boiler technology. The total long-term financial benefits could therefore amount to many £ bn.

Sub-Criteria	Assessment and material document references
* contribution to what part of the DECC Plan?	Successful demonstration of thermal gasification of waste to renewable gas could facilitate the deployment of commercial-scale bio-SNG plants which in turn would facilitate a number of key parts of the DECC Carbon Plan. Large-scale deployment of bio-SNG would enable more gas to continue to be used for heating than would otherwise be the case, by reducing carbon emissions associated with gas heating in the domestic, commercial, public and industrial sectors. Section 4.1, pp19-20
* carbon benefits claimed & assumptions	Combustion for heating of bio-SNG derived from waste has been shown by a NNFCC[3] report to provide a GHG emission reduction of either 127% or 66% (dependent upon the methodology used) compared with the combustion of natural gas. The higher percentage saving applies where account is taken of alternative disposal of the waste feedstock to landfill. Therefore if 100 TWh/a of fossil gas were replaced by bio-SNG, this would result in between 16 and 31.9 million tonnes of carbon dioxide equivalent saved per annum, dependent on the method used (between 21% and 43% of current total residential emissions (Q13) Section 2, p6, Section 4.1, p21, Section 6.2.2, p37

[3] NNFCC is a leading international consultancy with expertise on the conversion of biomass to bioenergy, biofuels and bio-based products.

Sub-Criteria	Assessment and material document references
* environmental benefits & assumptions	Associated with the carbon benefits outlined above, commercial roll-out of waste to bio-SNG plant would convert an environmental liability (landfill space and landfill emissions) to low carbon fuel. The use of waste as a fuel does not give rise to sustainability issues associated with grown biomass such as land use change / competition with food crops (although these issues would need to be addressed if grown biomass were to be used due to insufficient waste being available in the future). Section 4.1, p21
* financial benefits claimed, robustness of claims and assumptions	As this is a demonstration project, the financial benefits are associated with the large-scale commercialisation of the technology that the proposers assert will be facilitated by a successful trial. The UK energy system benefits of such a roll-out have been estimated using the RESOM model[4] which was used by DECC in producing the 2013 Heat Strategy. The benefits claimed are £1.4 bn pa saving over the base case in 2030, rising to £8.3 bn pa in 2050 due to avoided costs at other points in the energy system. The cost savings are associated with lower incremental generation capacity costs, lower costs for reinforcement of electricity networks or for building heat networks. In addition, the lower consumer appliance costs from avoidance of the need for as many expensive electric heat pumps (in 6.25 m properties) could give a total direct benefit to consumers of 25 bn. The benefits appear to have been calculated in an appropriate way, looking at the total UK energy infrastructure costs with and without commercialised bio-SNG. However, the benefits rest on the assumption that the project will stimulate significant investment in large-scale commercial plants, which in turn will depend to a large extent on the project influencing government energy policy, and in particular on the continuation of financial incentives for renewable gas derived via gasification. In addition, such benefits are necessarily long-term, inherently uncertain, and would accrue to a variety of parties (ultimately UK plc.), rather than being immediate and tangible. Nevertheless the project represents a relatively small outlay if there is even a small chance of accessing such large system benefits. Sections 3.2 and 3.3, p13 - 14 Appendix 3
* quantitative analysis provided	The project business case includes quantification of UK energy system benefits and consumer benefits following commercialisation, as outlined above. It also includes a summary of financial modelling of a full-scale production plant that was undertaken to establish that the project offers an attractive return on investment. The financial modelling demonstrates that, given favourable assumptions on waste gate fees and government subsidies for renewable gas, such full-scale plants could produce attractive returns (and "nth of a kind" plant could produce acceptable IRRs with no subsidies, given plausible increases in gas prices). The analysis provided is detailed and credible; however, it will be necessary to review the projected capital and operating costs of a full-scale prototype plant after the outcome of the demonstration. Sections 3.2, 3.3, 3.6 (pp 13-17), Appendix 3, Appendix 10

[4] Regional Energy System Optimisation Model

Sub-Criteria	Assessment and material document references
* cost, time and speed to implement	The total project cost would be £4.251 m, and the NIC funding requested is £1.875 m. The project would commence on 1st April 2014 and last for 3 years. Given the previous background work that has already been undertaken both at a conceptual level in 2010 and at a detailed process design level under IFI79 in 2012/13, the projected cost and timescale look achievable. The project partners bring a track record of commitment and engineering expertise to the project that gives confidence that the project could proceed rapidly and successfully. Section 6, 6.1, pp34 – 36 Appendices 7 and 11
* claims for potential for replication across GB	If the demonstration plant is fully successful in conclusively demonstrating the technical and economic feasibility of the process, it is suggested that between 10 and 15 trains of plant could be built by 2020, with the first commercial-scale plant being completed in 2018. Given the time required to assess the outcome of the trial, and the lack of obvious industry champions for full-scale plant, this seems rather optimistic. However, successful demonstration of the technology is clearly a prerequisite for commercialisation at larger scale, and could be significant in aligning government policy with a heat strategy including renewable gas in the longer term. Section 4.10, p28 Response to Q6
* claimed capacity released and how quickly released, if relevant	It is claimed that lower NTS Exit Capacity costs could result from commercial gasification plant being connected to the distribution systems. However, as gasification plant would not be 100% available / reliable, it is questionable whether it is correct to attribute NTS exit capacity savings which are equivalent to the total output of the plants. NGGD assumes that an individual gasification plant has 90% availability; therefore more than one plant would need to be operating in a particular GDN before NTS capacity bookings by GDNs could be reduced. This level of deployment would seem to be unlikely until well into the 2020s, by which time, as NGGD note, such future benefits would be subject to future price control settlements and so are inherently uncertain. Section 3.4, pp14-15

5. CRITERION B: VALUE FOR MONEY

Criteria	Rating	Overall assessment
Criterion B: Value for money The size of benefits and learning from the project that is applicable to the relevant network		The project represents good value for money, both in relation to the proportion of total funding requested from the NIC, and in relation to the potential very large long-term benefits from the commercialisation on bio-SNG technology.

Sub-Criteria	Assessment and material document references
* Proportion of benefits to customers (the relevant network system) as opposed to elsewhere on the supply chain	No short-term benefits to customers; however, benefits would accrue to customers in the long term if commercialisation of the bio-SNG technology is successful. In this case it is suggested that total benefits to customers of £25 bn could be realised (per heating appliance replacement cycle – e.g. over 15 years) by enabling 6.25 m more customers to continue to use gas for heating than would otherwise be the case, with the consequence that their costs to replace heating appliances would be around £4000 per household lower. It could also be argued that the projected savings of £8 bn per year in energy system costs by 2050 would ultimately feed through to consumers in the form of lower energy and network costs. Sections 3.2, 3.3, pp 13 – 14 Appendix 3
* how the project has a potential direct impact on the network	It has no direct impact on the network, as it will not be connected.
* justification that the scale & cost of the Project is appropriate in relation to the learning that is expected.	The total project cost of £4.25 m is relatively low compared to the potential UK system and consumer benefits that could result from commercialisation of the technology, as noted above. The cost is ameliorated by the use of an existing waste to syngas gasifier, and the scale of the project appears to be appropriate to be able to demonstrate and optimise the process flows and the reactors, with a view to upsizing for commercial operations. Section 4.1 (iv), p22 Sections 2.2.3 and 2.3, pp7 - 12

Sub-Criteria	Assessment and material document references
* the processes that have been employed to ensure that the Project is delivered at a market competitive cost	The project is a continuation of an existing project to design the plant, building on the outputs from IFI79. It uses an existing gasifier which is already producing syngas from waste which is of a suitable quality for upgrading to bio-SNG. The avoided cost of a dedicated gasifier is estimated to be [redacted]. The partners intend to procure the necessary capital equipment using industry best practice, with competitive tendering. In addition, the project partners will be contributing [redacted] and the partners are looking to supplement NIC funding with further external funding from an additional potential partner and from a European energy R&D programme (BESTF – ERANET) to provide the necessary additional £1.2 m non-NIC requirement. Sections 4.2 and 4.3 (vi), pp22 – 23, 4.7, 4.8, p26
* how Project Partners have been identified and selected including details of the process that has been followed and the rationale for selecting Participants and ideas for the Projects	The project partners have previously been involved in the development of the project through their participation in IFI79. The submission notes that at present only one source of high quality waste-derived syngas suitable for methanation is currently available in the UK; at Advanced Plasma Power's (APP's) demonstration facility in Swindon. APP is the Gasplasma gasification technology owner and developer of projects using this technology in the waste to energy field Progressive Energy, a specialist power generation and waste to energy project developer has been involved in the project, along with NGGD, since 2010 when they made a major contribution to the initial bio-SNG feasibility study. Both partners have specialist expertise in gasification / clean energy projects and both have agreed to make financial / in kind contributions to the bio-SNG demonstration project. Sections 4.3, 4.6, pp 22 – 23 and 25 – 26 Appendix 9
* the costs associated with protection from reliability or availability incentives and the proportion of these costs compared to the proposed benefits of the Project	Not applicable, as the demonstration project will not connect to the network.

6. CRITERION C: GENERATES NEW KNOWLEDGE

Criteria	Rating	Overall assessment
Criterion C: Generates new knowledge The potential for new learning to be generated by the project		If successful, the project would uniquely demonstrate the end-to-end process of waste gasification of waste feedstock through catalytic methanation and refining to pipeline quality gas. It would inform the optimisation of the individual processes and the scaling up of the technology to a full scale plant in relation to engineering design and commercial potential.

Sub-Criteria	Assessment and material document references
* the potential for new learning to be generated by the Project	The end-to-end process of waste gasification of waste feedstock through catalytic methanation and refining to pipeline quality gas has not been demonstrated before anywhere in the world. The only bio-SNG projects under development are from pure biomass feedstocks. Sections 2.2.2, 2.2.3, pp 7 and 9 Appendix 2
* how learning relates to the distribution system	No direct learning in relation to the distribution system, as the demonstration project will be self-contained and not connected to a distribution network. However, the achievement of pipeline quality bio-SNG is expected to provide confidence that commercial plant could be connected to the network without the need to reconfigure networks or make any other special arrangements for accommodating bio-SNG.
* applicability of learning to other network licensees	The project is not relevant to Networks' operational activities; it is a high-level enabler in relation to the continued use of gas networks into the long-term future (to 2050 and beyond), ensuring efficient use of the asset base. Section 3.4, p14
* the proposed IP management strategy and conformance with the default principles	The proposed IP management strategy conforms to the default IPR arrangements set out in the Gas NIC Governance Document. The consortium partners are already using a Research and Development (R&D) collaboration agreement which forms the on-going basis for collaboration and commercial implementation of the technology. Section 5.4, pp 32 – 33 Section 6.1.5, p36 Appendix 13
* credibility of the proposed methodology for capturing learning from the trial	Knowledge capture will be achieved by recording the results of the proposed staged technical test programme using a regular reporting structure, consistent with the experience of consortium members on previous projects supported by the Technology Strategy Board, the Energy Technology Institute and government departments such as DECC and BIS. Section 5.2, p30 Section 2.3.3, pp10 – 12

Sub-Criteria	Assessment and material document references
* quality of plans for knowledge sharing	Key learning will be captured in 6-monthly project reports, published on the project's web portal and disseminated via conferences and the ENA R&D working group. The facility will be showcased by demonstrating the complete process chain from waste input, conversion to grid quality gas and combustion in a conventional consumer appliance, and hosting 6 formal face-to-face on site dissemination events plus other specialist group visits. The plans for this area appear to be comprehensive and well thought out. Section 4.4, p24 Section 5, pp29 – 31
* how alternative IP strategy would deliver value for money to customers	In answer to a particular question, the partners confirmed that "it is a specific objective of the project Consortium Agreement that the BioSNG module could be fitted to any source of reasonable quality syngas, with technology licensing provisions to promote and enable this outcome." Answer to Q7

7. CRITERION D: INNOVATIVE AND UNPROVEN BUSINESS CASE

Criteria	Rating	Overall assessment
Criterion D: Innovative and unproven business case The extent to which projects could not be performed as part of a network licensee's normal course of business.		As the project involves the manufacture of gas (an unlicensed activity) it would not be appropriate for NGGD to undertake the project in its normal course of business. The project is a pre-commercial demonstration of a process that has not been demonstrated anywhere in the world (although it integrates existing proven technologies), and its risk profile is such that it would not readily attract pure commercial funding.

Sub-Criteria	Assessment and material document references
* The justification that the project is truly innovative: how the project is innovative and evidence that it has not been tried before	As noted above, the end-to-end process of waste gasification of waste feedstock through catalytic methanation and refining to pipeline quality gas has not been demonstrated before anywhere in the world. The only bio-SNG projects under development are from pure biomass feedstocks. Sections 2.2.2, 2.2.3, pp 7 and 9 Appendix 2
* the credibility of why the network licensee could not fund such a project through its price control allowance	The production of gas is not a licensed activity of the network licensee, so it would not be appropriate for the licensee to fund the project entirely from its price control allowance. In addition, the licensee would not derive any direct short-term benefit from the project.
* why the project can only be undertaken with the support of the NIC, including scrutiny of the claimed commercial, technical, or operational risks associated with the project	The project risks are outlined in the submission and detailed in appendix 8; however, it is not the extent or nature of the risks that make the project potentially suitable for NIC funding, rather the early pre-commercial nature of the project. In the absence of NIC it is unlikely that such a project would go ahead. The project would not be undertaken by the licensee in the course of its normal regulated activities, and would not be undertaken by other industry parties in the absence of NIC funding due to the pre-commercial nature of the project.

8. CRITERION E: INVOLVEMENT OF OTHER PARTNERS & EXTERNAL FUNDING

Criteria	Rating	Overall assessment
Criterion E: Involvement of other partners & external funding The level of external funding and appropriateness of collaborators involved in each project submission		Assuming that NGGD and the project partners are successful in obtaining further external funding, the NIC contribution to the project will be only 45% of the total funds required. The project partners are highly appropriate given their previous involvement, their levels of expertise in gasification technology and their willingness to commit resources to the project.

Sub-Criteria	Assessment and material document references
* appropriateness and affiliation of project partners	As noted above, the project partners have previously been involved in the development of the project through their participation in IFI79. The submission notes that at present only one source of high quality waste-derived syngas suitable for methanation is currently available in the UK; at Advanced Plasma Power's facility in Swindon. Progressive Energy has been involved in the project, along with NGGD, since 2010 when they made a major contribution to the initial bio-SNG feasibility study. Both partners have specialist expertise in gasification / clean energy projects and both have agreed to make financial / in kind contributions to the bio-SNG demonstration project. Sections 4.3, 4.6, pp 22 – 23 and 25 – 26 Appendix 9
* level of external funding achieved, presented on a comparable basis	As noted above, the project partners will be contributing [redacted] and, in addition to the NGGD funding of £0.213 m, the partners are looking to supplement NIC funding with further external funding from an additional potential partner and from a European energy R&D programme (BESTF – ERANET) to provide the necessary additional £1.2 m non-NIC requirement. Sections 4.7, 4.8, p26
* effectiveness of systems & processes to obtain partners and ideas	In view of the fact that the proposed demonstration project follows directly on from the design work undertaken by the partners as part of IFI79 it is considered appropriate for NGGD to continue to work in collaboration with the same partners on the next stage, for which NIC funding is requested. The proposal notes that alternative partners were investigated prior to IFI79, but none were found to be suitable. Section 4.3, p23 Section 3.6, p15

Sub-Criteria	Assessment and material document references
* robustness of contractual arrangements with partners	As noted above, the consortium partners are already using a Research and Development (R&D) collaboration agreement which forms the on-going basis for collaboration and commercial implementation of the technology. Section 5.4, pp 32 – 33 Section 6.1.5, p36 Appendix 13
* funding and benefits for each partner	APP: [redacted] in kind – labour costs Progressive Energy: [redacted] ([redacted] of their labour costs) Further funding being sought from additional project partner (up to £1m) and from a European energy R&D programme (BESTF – ERANET). Any future benefits will accrue from licensing of Background and foreground IPR, to the extent that commercial plants are developed using IPR associated with the project development. Section 4.7, 4.8, p26 Section 5.4, pp 32 – 33

9. CRITERION F: RELEVANCE AND TIMING

Criteria	Rating	Overall assessment
Criterion F: Relevance and timing		The project involves trialling a new technology that could have a major low carbon impact; it follows directly on from a previous IFI project (IFI79) which established the feasibility and detailed design of the proposed demonstration plant, and commencement of the project in 2014 could facilitate the commercial deployment of full-scale plant in time to have an impact on the UK's renewable energy commitments for 2020

Sub-Criteria	Assessment and material document references
* The significance of the project in: Overcoming current obstacles to a future low carbon economy Trialling new technologies that could have a major low carbon impact Demonstrating new system approaches that could have widespread application	One of the key Unique Selling Points of the project is its potential ability to bridge the gap between what is a theoretically attractive carbon reducing concept and the large-scale, high risk investment that would be required to put the concept into practice in a full-scale plant. Successful demonstration of this waste to energy pathway could be very significant in: • Giving commercial investors confidence to fund full-scale plant. • Creating / extending a low-carbon gas for heating option which makes continued efficient use of gas distribution assets. • Securing government support for waste to bio-SNG in future energy policy development. Section 4.10, pp 27 - 28
* why the problem is relevant and warrants funding	The funding requirement is relatively small compared to the very large potential energy system and customer benefits, and the project partners have both provided some funding themselves and sought funding from other external sources such that the NIC component is only around 45% of the total project costs. Sections 4.7 and 4.8, p 26
* how the GDN would use the method in future business planning	Not directly relevant to future Network business plans, as manufacture and supply of gas is not a licensed activity of GDNs, but will inform issues around the long term role of gas networks. Section 4.10, p28

* the appropriateness of the timing of the project	The project partners have collaborated on the bio-SNG project since March 2012 and it is well developed technically and commercially to ready to commence in a timely manner. If the project commences in 2014 and delivers first-stage results by mid-2016 as planned, this could enable investment decisions for commercial facilities to be made before the end of 2016, giving the prospect of commissioning of some full-scale plant before the end of 2020, in time to make a contribution to the UK's renewable energy obligations by that date. Section 2.3.3, p11 Section 4.10, p28 Section 6.1, p34 - 36

10. CRITERION G: DEMONSTRATION OF ROBUST METHODOLOGY

Criteria	Rating	Overall assessment
Criterion G: Demonstration of robust methodology The feasibility of the project proposals from technical, customer impact and safety perspectives		The project plan and project governance arrangements are set out at an appropriate level of detail within the proposal. The proposed trial programme is outlined at high level and in detail, and the proposed timings of each stage appear realistic. Risks and proposed mitigations are set out in a formal risk register. A project work programme has been constructed which covers the major tasks, their duration and the associated deliverables. The project methodology appears to be robust. Technical information verification has been carried out by the project partners, and by appropriate external organisations.

Sub-Criteria	Assessment and material document references
* the feasibility/quality of the project plan and programme governance, including responsibilities	The project plan and project governance arrangements are set out at an appropriate level of detail within the proposal. The proposed trial programme is outlined at high level in the section on project description (Section 2.3) and in detail in Appendix 7, and the proposed timings of each stage appear realistic. A project management system is already in place, involving a project steering committee, a project manager and a National Grid project director, as outlined in Appendix 4. Project governance appears robust, and will benefit from the previous experience of collaboration during the previous technical feasibility study represented by IFI79. Section 2.3, pp 10 – 11 Sections 6 and 6.1, pp34 – 36 Section 6.3, pp 37 - 38 Appendix 7 Appendix 4
* All risks, including customer impact, exceeding forecast costs and missing the delivery date	Risks and proposed mitigations are set out in a formal risk register (Appendix 8). In respect of safety and environmental risks, a robust HSE management system was established at the onset of the project design stage, to ensure best engineering practice at every stage of the project. Management systems have been put in place to minimise the possibility of costs exceeding the budgeted limits, and the installed capital cost of the demonstration facility was established at the detailed design stage with suppliers providing quotations against equipment design specifications (summarised in Appendix 11) Section 6.3, pp 37 – 38 Appendix 8 Appendix 11
* Whether items within the project	The process of suppliers providing quotations against equipment design specifications will help to ensure that the items within the project budget

budget appear to provide value for money	provide value for money. A project work programme has been constructed which covers the major tasks, their duration and the associated deliverables. The total manpower requirements and associated labour costs of the project have been derived from this programme on a rigorous task by task basis. The project would also benefit from use of the existing APP Gasplasma gasifier (saving around [redacted] in capital costs) and from the use of APP's existing skilled workforce. Section 6.2.1, p36 Appendix 11 Budget spreadsheet
* whether the proposed resources are sufficient to deliver the project	As noted above, the project costs and manpower requirements have been derived in a rigorous manner against a very detailed project plan, and there is no reason to believe that they will be insufficient to deliver the project.
* whether the project can be started in a timely manner	The previous feasibility and detailed design work carried out under IFI79 provides every confidence that the project can be started in a timely manner. Section 6.1, pp 34 - 36
* the robustness of the project methodology, including technical rigour and statistically robust outputs.	The project methodology appears to be robust. Technical information verification has been carried out by the project partners, and by appropriate external organisations; Otto Simon Limited in relation to process engineering aspects, and Catal Limited in relation to methanation / catalysis trials. Environmental benefit verification has been carried out by the National Non-Food Crop Centre, and commercial information verification by the project partners together with Otto Simon and Catal The project methodology has benefited from the technical expertise of both the project partners and from appropriate external experts. Section 6.4, pp38 – 40
* the appropriateness of the risk mitigation processes	As noted above, the risk mitigation process appears to be comprehensive and appropriate. Section 6.3, pp 37 – 38 Appendix 8 Appendix 11
* Clear vision for the project	The vision for the project is clear.
* Value of the project clear	The value of the project is clear.
* Impact of the project clear	The impact of the project is clear.
* Obstacles and impediments identified	These matters are addressed in the project description, at high level in the risk and contingency plan and in the project team meeting presentation.
* Project outcomes clear	The direct outcome of the project is clear.

* Means to achieve outcomes identified	The proposed methodology is generally both appropriate and credible in terms of delivery of objectives.
* Risks that may prevent outcomes identified and managed	These matters are addressed in the project description, at high level in the risk and contingency plan and in the project team meeting presentation.
* Project well planned	The information provided regarding the planning process is comprehensive and robust.
* Resources clearly identified	The proposed project team manpower, external support and financial resources are set out at high level.
* Project timeline justified	The project timeline is clearly specified in the Project Plan and Section 6 – Project Readiness.
* Technical standards clear	The submission includes appropriate references to technical standards.
* Performance requirements clear	Performance requirements are clear.
* Evidence of research of existing solutions	Significant reference is made to the existing conventional SNG plants under development elsewhere in the world, none of which is comparable to this proposal.
* Collaboration options described	Rationale for partnership arrangements and details of Partners are provided.
* Project informed by data	The Project is informed by considerable use of data.
* Clear technical governance	Technical governance is incorporated in the project management proposals.
* Clear Project Management	Project management arrangements in terms of resources and governance processes are clear.

11. SUCCESSFUL DELIVERY REWARD CRITERIA

Criteria	Rating	Assessment and material document references
Criterion: Appropriateness of the SDRC definitions and timing and adequacy of links to key project milestones		The SDRC definitions and timing are broadly acceptable, but some would benefit from the provision of more detail to provide evidence of completion.

Detailed Comments

The following criteria are proposed in the Full Submission:

1. Dissemination of knowledge via dedicated website and conference promotion:

   Dedicated website to be established to provide ongoing information on the project to external parties, and information also to be shared at industry conferences.

2. Final design, and safety review:

   It is proposed that an announcement that these two separate pieces of work have been completed should be made on the proposed bio-SNG website. In addition, the documents themselves should clearly be provided to Ofgem

3. Construction and installation:

   Again it is proposed that announcements of the completion of these phases of the project should be announced on the website, and supplemented by pictures

4. Commissioning of the plant:

   Announcement on website and evidence shown in the Visitors' Centre. It is suggested that criteria 3 and 4 should be combined because completion of commissioning represents a clear handover point that is less ambiguous than completion and installation. The report incorrectly states at this point that commissioning will be completed by the end of March 2015, whereas the Project Plan shows completion of commissioning by June 2015.

5. Test and optimisation programme:

   Successful completion of this phase of the project will be measured by the details as shown in the task 5 work package and reported in the milestone 5 report in February 2016, with highlights to be given on the website.

6. Assessment of scale up risks:

   To be included in the Final Report of the project in March 2017 following the completion of further project testing programmes. Executive Summary to be provided on website. It is not clear why this needs to be a separate criterion from 7, particularly as both will feature in the same Final Report.

7. Engineering scheme for a full scale plant:

   To be included in the Final Report of the project in March 2017 with Executive Summary to be provided on website. To incorporate the learning from the project in relation to the engineering specifications and process flows for commercial plant

8. Levelised cost of gas for a full scale plant in the UK:

   To be provided in a report in February 2017, with highlights of the results shown on website. Clearly a key output from the project as it will inform decisions regarding follow on commercial

scale projects.

9. Operating showcase – dissemination:

   It is proposed to establish a visitors' centre to demonstrate the waste to usable energy chain and to invite relevant industry parties to view the plant in operation. This is a similar criterion to 9.1, but clearly cannot begin operations until the plant is commissioned. No date is provided for the opening of the visitors' centre.

12. ADDENDUM: SYNOPSIS OF CHANGES TO THE SUBMISSION

NGGD chose not to make any changes to their original submission.