FIRST PROJECT PROGRESS REPORT (PPR)  |  JUNE 2016

Commercial BioSNG Demonstration Plant
Gas Network Innovation Competition
NGGD (National Grid Gas Distribution)
The commercial BioSNG demonstration project will build and operate a commercial facility that will process 10,000 tonnes per annum of refuse derived fuel and waste wood to produce 22GWh per annum of grid quality natural gas. This will catalyse the construction of a pipeline of larger scale facilities. The approach has the potential to produce 100TWh of BioSNG at a cost that matches fossil gas.

£46 billion
potential energy system savings by 2050

482 million
tonnes CO2eq GHG savings by 2050

INTRODUCTION

PROVING THE COMMERCIAL VIABILITY OF PRODUCTION OF GREEN GAS FROM WASTE

BioSNG (bio-substitute natural gas) is an energy vector which can deliver cost effective, low carbon heat and transport fuel using the existing gas network. This project will demonstrate, under commercial conditions, the conversion of waste through to delivery of green gas using thermal gasification and methanation. The gas be sold via the gas grid and will provide a national reference plant addressing commercial, legal and funding barriers. As such this Project will facilitate investment in full scale operational plants, with the potential to increase the availability of green gas in the UK by 100TWh.

The funding and strategic backing for the project comes from the project partners together with Ofgem’s Network Innovation Competition and the Department for Transport’s Advanced Biofuels Competition.

In 2013, the Project Partners successfully applied for £1.9m of NIC funding to construct a BioSNG Demonstration Plant (the “Pilot Plant Project”). That project is proceeding well and is in its operational testing phase. The objective of the Pilot Plant Project was to prove the technical and economic feasibility of thermal gasification of waste to renewable gas.

This project is focussed on commercialisation of the technology. Funders, waste suppliers and gas off-takers will only support deployment of large scale plants if the technology is demonstrated at intermediate scale on a continuous basis. The experiences of other waste to energy technologies such as those developed by Enerkem and Nexterra show that a facility of the scale proposed in this Project has enabled the development of fully commercial, large scale plants.

This project will deliver a demonstration plant at a scale of around 20–25GWh/a which is an essential intermediate step in the commercialisation of the technology. The successful completion of the project will give stakeholders the confidence to construct larger scale facilities leading to a rapid growth in BioSNG production.

Analysis of sustainable UK feedstocks by the Committee for Climate Change and the Department for Energy and Climate Change shows that BioSNG has the potential to produce 100TWh of low carbon gas. This would play an important role in decarbonising the gas grid and help the UK achieve its climate change goals.
EXECUTIVE SUMMARY

During the period the project has proceeded in accordance with the project plan. Total expenditure to date is £1.3m and the total forecast cost of the project is £23.1m, in line with the original budget.

The plant remains on track to enter operation at the start of 2018. The key risks to on time delivery are reaching commercial agreements with key suppliers and in obtaining consent from the landlord to start civil works in the third quarter of 2016.

Good progress has been made in securing consents for the project. Planning permission has been granted and the Environment Agency has confirmed that the Environmental Permit has been duly made. Application has been made to the landlord requesting consent for building work and this is expected to be secured the third quarter of 2016. A draft commercial agreement is in place with the fuel off-taker and supply of feedstock has been agreed with a local waste company.

The design is progressing well with the basis of design, process flow diagrams, piping and instrumentation diagrams, 3D layouts and equipment specifications all completed. This has allowed package enquiries to be prepared for all major equipment and these will be issued to the supply chain. Initial hazardous operation studies have been completed.

Internal and external risk review meetings have been held and, after mitigation, all risks are considered acceptable. The key risks are producing a gas that is suitable for methanation, refractory wear in the plasma converter and securing consents. Plans are in place to address each of these.

The focus in the coming months will be on selecting suppliers for all packages and placing orders for long lead time packages. Detailed design work will continue and the intent is to start civil work September 2016.
The project remains on programme and will deliver the objectives set out in the Project Direction.

ACHIEVEMENTS
The project remains on scope to deliver all its objectives, as outlined in the Project Direction. The focus to date has been on securing consents, completing the initial design and securing commitments for feedstock supply and gas off-take.

The main achievements during the period are:

- Layouts, process flow diagrams and mass and energy balances issued.
- End of waste for product gas granted.
- Planning permission submitted and granted.
- Environmental permit accepted as duly made by Environment Agency.
- Hazop studies 1 and 2 completed.
- Product off-take contract agreed in principal with Howard Tenens.
- Grid Entry GQ8 risk assessment undertaken.
- Utility requirements finalised – no additional capacity required.
- P&ID’s, layout drawings and equipment specifications issued.
- Detailed project plan agreed.
- Procurement plan complete.

PROJECT BUDGET
Committed project expenditure is £0.5m lower than the budget. This is due to the phasing of equipment expenditure and will reverse in the next 6 months.

RISK
Development projects inherently carry a degree of risk. However, our risk management approach is designed to identify potential risks at an early stage and then determine the most appropriate way of mitigating them. The risk mitigation management system that has been set-up supports the achievement of all of the key aims of the project as set-out in the original Project Direction.

NEXT STEPS
The following activities will take place in the coming months:

- Agreement of gas off-take agreement with Howard Tenens.
- Permit issued by Environment Agency.
- Test syngas produced from Swindon waste to check it meets methanation specifications.
- Order long lead time packages.
- Continue procurement of all other packages.
- Produce long lead time cost plan.
BUSINESS CASE UPDATE

The purpose of this project is to facilitate deployment of commercial scale plants which are capable of delivering renewable gas into the market place.

The commercial plant performance and costs have been assessed, based on the latest technical and engineering design data developed, operating on a residual waste feedstock. The capital costs comprise the owner’s costs, the cost of the plant and equipment, the construction and commissioning management and the expected costs of the contractor’s guarantees and profit. The operational costs are based on the maintenance, staff, utilities & consumables as well as disposal costs. Feedstock gate fees are based on latest market data and expected calorific values.

The reference plants are based on a first of a kind ‘single line’ and a mature nth of a kind facility assumed to be a double scale system. These produce 315 and 665GWh/a of green gas respectively. Recent analysis of the greenhouse gas emissions, in line with DECC’s approach in its RHI consultation indicate a saving of 346kgCO2eq/MWh for such a facility. The commercial parameters are summarised below:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>315GWh/a</td>
<td>66MWh</td>
<td>138tka</td>
<td>42MWh</td>
<td>£108m</td>
<td>£10.2m/a</td>
<td>£10.2m/a</td>
<td>£0.50/MWh</td>
</tr>
<tr>
<td>665GWh/a</td>
<td>132MWh</td>
<td>289tka</td>
<td>84MWh</td>
<td>£151m</td>
<td>£16.5m/a</td>
<td>£21.7m/a</td>
<td>£0.21/MWh</td>
</tr>
</tbody>
</table>

The following chart shows how the levelised cost is expected to transition due to specific cost reductions as facilities are deployed. These include capital cost savings from reduced EPC risk premiums, increased plant availability, reduced hurdle rate requirements and increases in scale.

In order for the project to transition to first of a kind projects and ultimately to produce gas at parity with fossil fuel there is an important role for renewable tariffs.

Significant input has been made by the project team into the recent RHI consultation, demonstrating the role of BioSNG in delivering cost effective, non-disruptive low carbon heat to consumers. BioSNG is currently supported within the biomethane tariff which provides a commercialisation route. However, the degression of this tariff as the now mature AD technology delivers grid connected biomethane plants, means that there is a risk that by the time the first large scale BioSNG plant comes on stream that the tariff will not be sufficient to support projects. A strong case has been made that the biomethane tariff should reflect the differences in maturities in the thermal and biological technologies.

Separately forthcoming changes to the Renewable Transport Fuels Obligation may provide an alternative support regime to enable early deployment with a planned Development Fuels Sub-target which is intended to provide enhanced support for more emergent technologies. This will be subject to a consultation in the Summer; the team is fully engaged with DIT in this regard, as well as seeking to enable delivery of gas as a transport fuel across the gas network.
The project is well on schedule for delivery, with the progress on the programme to date is summarised in the following table.

<table>
<thead>
<tr>
<th>Progress on deliverables</th>
<th>Actual %</th>
<th>Planned %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project total</td>
<td>27.5%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Consents</td>
<td>85%</td>
<td>90%</td>
</tr>
<tr>
<td>Design</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Contracting</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Equipment manufacture</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Construction</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Commissioning</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

There are two items on the critical path. Long lead time packages and landlord consent.

The lead times of all major packages have now been discussed with suppliers and lead times are well understood. The gasifier, plasma converter and methanation equipment are all packages with long lead times and orders will need to be placed in the third quarter of 2016 in order to remain on schedule. Contractual discussions are ongoing with suppliers of each of these packages and it should be possible to place orders in line with the programme.

Consent from the landlord is required to commence civil works. Consent will be required in the coming months to avoid any delays. Information on planned works has been sent to the landlord and discussions held with the landlord’s agent. It is expected that consent will be obtained on time.

GRANTING OF STATUTORY CONSENTS AND APPROVALS

- End of waste application submitted and approved.
- Local Development Order (planning) submitted at and approved.
- Environmental permit application submitted and accepted as duly made.
- Landlords consent submitted and discussions held with agent.
- Decision taken to defer effluent discharge consent and instead tanker waste water off site at start of operation.
- Lawyers appointed relating to lease of adjacent strip of land and lease agreed in principle.
- Basis of design document complete.
- Detailed assessment of feedstock complete and feedstock specification defined for process design.
- Specification of product gas agreed with Howard Tenens.
- GQB Grid Entry Risk assessment undertaken.
- Risk register prepared and regularly reviewed.
- Mass and energy balance complete.
- P & ID’s for entire facility complete.
- Single line diagrams issued.
- 3D model complete.
- Specifications for major equipment complete.
- Hazard review meeting 1 and 2 held and reports accepted.

PROCUREMENT

- Contracts signed with Otto Simon for Design and Construction Management.
- Progressive Energy Ltd appointed as design consultant.
- Terms agreed with Tetronics with initial design and procurement of gasification system.
- Contract signed with Amec Foster Wheeler for design of methanation equipment and for transfer of technology.
- Supplier selection for oxygen and propane gas services undertaken and agreed.
- Based on detailed design work, intensive discussions underway with suppliers of all major packages and majority of minor packages.
- Formal tender documents complete and ready for issue.
- Supply chain engagement and competitive tendering required to deliver within budget.
Committed project expenditure is £0.5m lower than the budget. This is due to the phasing of equipment expenditure and will reverse in the next 6 months. Progress against budget is summarised in the following table.

**PROJECT'S FINANCIAL PERFORMANCE TABLE**

<table>
<thead>
<tr>
<th></th>
<th>Project to Date</th>
<th>Overall Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual</td>
<td>Budget</td>
</tr>
<tr>
<td>Packages</td>
<td>£286</td>
<td>£652</td>
</tr>
<tr>
<td>Design and delivery</td>
<td>£809</td>
<td>£918</td>
</tr>
<tr>
<td>Other</td>
<td>£247</td>
<td>£319</td>
</tr>
<tr>
<td></td>
<td>£1,343</td>
<td>£1,889</td>
</tr>
</tbody>
</table>

Package costs to date are £0.4m lower than the budget because orders for equipment will be placed slightly later than planned. This will not affect the timescales for equipment delivery because supplier lead times are shorter than expected.

‘Design and delivery’ costs are £0.1m lower than budget and ‘Other’ costs are £0.1m lower than budget because of the phasing of design work. This difference will reverse over the next six months.

The remaining budget of £23.1m is considered adequate to meet the remaining costs of the project.

Bank statements have been provided to Ofgem. Due to the confidential nature of the project bank statements, they have not been included in this report.
SUCCESSFUL DELIVERY
REWARD CRITERIA (SDRC)

During this phase, SDRC 9.1 was completed in accordance with the project plan as follows:

- Planning permission has been granted by Swindon Borough Council through the issue of a Certificate of Lawful development. This was in response to the submission of a detailed package of information on the project and followed consultation with local residents and other stakeholders.
- An application for an environmental permit has been duly made. This involved engagement with the Environment Agency and detailed discussions on the fire precautions required for handling waste and the monitoring requirements for a gasification facility. The permit is expected to be issued at the end of June 2016.
- Discussions have been held with Thames Water on the discharge of effluent from the facility. It has been agreed that initially effluent will be tankered off site. Once significant quantities of effluent are available for analysis after the plant commences operation, discussion on treating it and discharging it to the drain will continue.
- The project collaboration agreement has been signed.
- Otto Simon has been appointed construction manager and their contract has been executed.
- Ongoing discussions are being held with Public Power Solution who have agreed in principle to supply waste for the facility. They have provided a letter of support and agreed to start formal contract negotiations in the first quarter of 2017.
- Wales & West have committed to provide a grid connection in the Collaboration Agreement and discussions have commenced on provision of the connection. Capacity has been confirmed and a GQ8 assessment was held in the period and the report on the assessment has not raised any gas quality issues relating to the connection.
- Discussions have been held with SSE on a electricity connection and Thames Water on the water connection. In both cases the current connections are sufficient to meet the needs of the facility and no further action is necessary.

Good progress has also been made on the detailed design and safety review and SDRC 9.2 has also been completed ahead of schedule. The following documents have been issued by the Construction Manager and approved by the project partners:

- Process flow diagrams.
- Mass and energy balances.
- Plant layouts.
- Process and instrumentation diagrams.
- Control philosophy and electrical system specifications.
- Major equipment data sheets.
- Project management manuals.
- Hazops 1 and 2.

Hazops will continue to take place throughout the project as the plant is constructed and other documents will also be updated to reflect changes that take place.

Other SDRCs remain on track for completion in line with the project plan.
LEARNING OUTCOMES

The key learning outcomes over this period have been:

ENGAGEMENT WITH STAKEHOLDERS & STRATEGIC ALIGNMENT

Delivery of this project could be narrowly focused on the technical and project delivery activities necessary to build the facility. However the strategic context for deployment is vital to deliver the outcomes this project seeks to unlock. The Project team has been heavily involved in engagement with key stakeholders, particularly in government in order to communicate the benefits of gas as a vector for low carbon heat. Consumers need a low carbon solution which is non-disruptive and low cost. Ensuring that the right framework is in place by the time the first large scale commercial projects expect to reach financial investment decisions is vital.

RISK MANAGEMENT

The project is run using the risk register as important management tool. A number of key risks have already been fully addressed (such as ensuring that the gas reaches end of waste acceptance) and a range of other risks have been successfully mitigated. By identifying the most likely and most significant impact risks the team is able to stay focused on addressing issues before they have deleterious effects on the project.

WELL STRUCTURED PROJECT MANAGEMENT

This is a complex project which is being delivered a short timeframe to a tight budget. In order to maintain programme delivery, a well structured project team is required with clear roles and responsibilities. The project team has the range of expertise necessary for to execute the programme and the interfaces and flow of information is well managed. A strong third party engineering contractor with oversight over the whole project provides the rigour required for procurement, construction and installation.

INTELLECTUAL PROPERTY RIGHTS (IPR)

No registerable IPR has arisen during the period.
Development projects inherently carry a degree of risk. However, our risk management approach is designed to identify potential risks at an early stage and then determine the most appropriate way of mitigating them. The risk mitigation management system that has been set-up supports the project achieving all of its key aims as set-out in the original Project Direction.

Internal and external risk review meetings have been held. Some key risks have already been fully mitigated, for example securing planning consent for construction and securing End of Waste status for the produced gas. The key identified ongoing project risks are:

- Overcoming technical issues to produce a gas that is suitable for methanation may cause delays. This is being mitigated by testing of the syngas at the pilot plant produced from an RDF sourced from Public Power Solutions, who will supply RDF for the demonstration facility, and engagement with the methanation technology supplier.
- Technical risks associated with wear of refractory in the plasma converter which may lead to increased maintenance costs and reduced fuel production. The design is based on experience from the pilot plant and similar Tetronic’s Plasma converter systems, appropriate cooling design and consideration of a sparing strategy.
- Delivery risks associated with securing operational consents and permission from Landlord which could cause project delays. Managed by early submission of information and engagement and use of professional advisory services.
- Variation in feedstock composition. Addressed by an ongoing monitoring regime of feedstock and the use of waste wood blending as required.
- Budget risk. This is a complex facility so requires close management of costs. This is managed by early engagement with the supply chain, value engineering processes and competitive tendering to ensure value for money.
- Programme risk. This is an aggressive schedule with a large number of complex contracts to be delivered. Addressed by strong management structure with clear roles and responsibilities, regular project meetings and an agreed procurement plan.

Use of the gas grid for distribution of biomethane offers an opportunity to the project to reduce costs and increase the attractiveness of its product. Project partners will continue to engage with the DfT to encourage the use of the grid for gas distribution.

This report has been prepared in accordance with the Gas Network Innovation Competition Governance Document published by Ofgem. The project has been subject to review and challenge by the National Grid Gas Distribution Project Manager and signed off by Lorna Millington, NGGD Network Design Manager, who is Project Sponsor for this NIC project.

Lorna Millington has confirmed that the processes in place and steps taken to prepare this Project Progress Report are sufficiently robust, and that the information provided is accurate and complete.
NATIONAL GRID GAS DISTRIBUTION connects people to the energy they use and delivers it safely, reliably and affordably to around 11 million customers in Britain. Each year we replace around 1,000 miles of gas mains and we connect 20,000 new customers to the network. We also run the UK’s gas emergency service, responding to calls on our 0800 111 999 number 24 hours a day.

ADVANCED PLASMA POWER (APP) is a world leader in advanced waste to energy and fuels technology. APP is revolutionising the way in which we treat waste sustainably by maximising the value derived from it as a source of materials and energy while minimising its impact on the environment.

PROGRESSIVE ENERGY is an established independent UK clean energy company focusing on project development and implementation. It comprises a team of highly experienced energy professionals providing the skill sets necessary to undertake all aspects of the development and implementation of energy projects.

CNG Services provides consultancy and project management services in relation to the use of natural gas as a vehicle fuel. CSL is independent from equipment suppliers and provides an ‘owner’s engineer’ service including design, project specification and management. CSL owns and operates the UK’s largest CNG filling station which has the capacity to fill more than 300 dual-fuel vehicles per day.

Wales & West Utilities is part of the CKI group and provides the safe and secure transportation of gas across its distribution network to more than 2.5m customers. The company is committed to the protection and enhancement of the environment and is always seeking new ways to minimise the environmental impact of its activities, as well as providing excellent value to its customers.

FOR MORE INFO ON GOGREENGAS AND THE PROJECT PARTNERS PLEASE VISIT: WWW.GOGREENGAS.COM