nationalgrid

Advanced Plasma Power

SECOND PROJECT PROGRESS REPORT (PPR)

DEC 2014

Gas Network Innovation Competition

NGGD (National Grid Gas Distribution)
BioSNG Demonstration Plant

Partners Advanced Plasma Power, Progressive Energy, Carbotech and National Grid are at the forefront of creating and developing the technology needed to turn our everyday rubbish into a high quality energy source.

100TWh

100TWh/year potential for BioSNG

33%

Equivalent to 33% of domestic gas demand in future

1. Introduction

Developing a more sustainable way to heat our homes

BioSNG addresses the issue of decarbonising heat which, accounts for 50% of all final energy use in the UK. It also offers an alternative route for gas supply - one that is greener and affordable which could help provide us with an improved and more secure energy future.

The Gas Distribution arm of National Grid is working with specialist firms Advanced Plasma Power, Progressive Energy and Carbotech to develop new technology to convert the waste we discard daily into a valuable and long-term energy resource.

At the heart of the approach is an innovative project designed to convert waste to bio substitute natural gas (BioSNG) which can be used in the gas network.

Using BioSNG would greatly expand the supply of renewable gas over and above existing solutions such as anaerobic digestion (AD). Previously unused waste products diverted from landfill and other biomass material can act as the feedstock for gas generation via the cutting edge thermal Gasplasma® process developed by Advanced Plasma Power.

The technology will be showcased at a new demonstration process plant being built at Advanced Plasma Power's headquarters in Swindon. The test plant is designed to show the potential of BioSNG from both a technical and commercial perspective - and will move the technology from concept to reality. It will demonstrate the potential for communities to access locally generated renewable gas, using waste that would otherwise clog up valuable landfill space.

By proving that the approach works and can contribute to generating the volumes of pipeline-quality gas required to sustain the nation's energy requirements, National Grid believes that such plants can become the template for many others to serve regional needs across the country. Such a plant network could make a telling contribution to the future reliability of gas supplies at an affordable cost and with minimal environmental impact.

The approach could help solve an issue facing governments, energy suppliers, policy makers and consumer groups across the world: how to produce low carbon energy in a sustainable way through the development of advanced technology that is commercially viable, affordable, and acceptable to the energy-consuming public. It highlights National Grid's commitment to seeking economic and innovative ways to decarbonise energy, while making the best use of the existing UK gas network.

The funding and strategic backing for the project comes from Ofgem's Network Innovation Competition and the European BioEnergy Securing the Future ERANET programme.

The environmental benefits will include contributing to the acceleration of a low carbon economy, the decarbonisation of heat, and a marked reduction of waste volumes going to landfill. The economic benefits include new investment opportunities which will provide affordable energy for consumers, and the possibility of increased local control over waste processing linked to green energy generation.

2. Executive Summary

Following mobilisation in April 2014, and despite some delays with the actualisation of EU funding commitments, the project continues to proceed on schedule, with engineering and procurement as the dominant activities in this reporting period; however, it is clear that delivery lead times quoted by suppliers for some equipment items are longer than had been originally estimated. The negotiated delivery times for certain long lead items put some pressure on the milestone date for commissioning; however, the project team will expend continual effort during the fabrication period of the long lead equipment items to achieve an outcome which adheres as closely as possible to the planned schedule.

The engineering and procurement phase has demonstrated the merit of “value engineering” of process systems inasmuch as a specified technical functionality can be achieved by any number of practical designs, however, not all of them would be cost effective. This is a key learning outcome for the project and one that will be incorporated into future engineering activities, in particular the realisation of designs for a full scale facility.

Promotional activity has continued during the reporting period, with presentation on the potential of BioSNG by members of the Project Steering Committee at the Low Carbon Networks Innovation conference in Aberdeen.

Further industry presentation is planned for the 11th International Energy from Waste conference in London in February 2015 and an abstract of a paper has been accepted for presentation at the prestigious World Gas Conference in Paris in June 2015.
The project business case remains attractive subject to sustained support for renewable heat through the Renewable Heat Incentive (RHI) via the Bio-methane tariff.

With the formal sign off in the preceding period of the BESTF-ERANET funding, joint working with German partner company, Carbotech, began in earnest in September with a kick-off meeting at their works in Dusseldorf. The design duty point and performance envelope of the Carbotech gas upgrading equipment was agreed and timely schedule for delivery to the UK confirmed, currently estimated for early March 2015.

Project activity now focuses on site preparations and expediting progress on the delivery of major equipment packages, with particular emphasis on shortening delivery times wherever practicable, for example by packaging the process components into skids completed off site, and by capitalising wherever possible on shorter than planned delivery from equipment sub-suppliers.

With the bulk of the engineering work completed and the procurement of long lead items under way, the project team is now refining plans for the construction, commissioning and testing phases of the project.

3. Project Manager's Report

The prime activities over this reporting period have been the completion of the engineering and safety assessment task and the subsequent procurement exercise.

Despite facing some challenges regarding both the project schedule and capital budget, the project remains on course to achieve its primary objectives within time, budget and to the agreed process specification.

Planning consent has been granted for the site modifications proposed and it has been confirmed by the Environment Agency (EA) that due to the scale of operation, the facility is deemed to be an excluded activity, and will not require a permit to operate. The detailed design and safety assessment for the plant was signed off in July, following a detailed plant safety assessment that was overseen by the independent safety consultants, Rowan House.

The main activity over the past six months has been in the procurement of the process equipment work packages. Given the complexity of the procurement and installation phases we have actively sought ways of de-risking this phase of the project. In particular, we made a decision to incorporate a number of the main work packages including civils, utilities, and the mechanical, electrical & control installation into the "main plant items" supply (WP3) to achieve a marked reduction in the number of equipment interfaces. For each Work Package, competitive quotations were obtained from potential suppliers based on the detailed tender documentation sent. A systematic selection procedure was applied in deciding the preferred supplier. Orders have now been placed with the selected OEMs for all the main equipment work packages.

Initial quotations obtained for WP3 significantly exceeded the capital spend budget and this necessitated a detailed "value engineering" exercise being undertaken with the preferred supplier. The outcome of this work was that a significant reduction in cost, in line with the budget, was attained without causing a reduction either in the performance or functionality of the system.

The delay associated with finalising the design and cost of the work packages (especially WP3) has put some pressure on the project installation schedule. Activities have now moved toward managing the work package suppliers and, in particular, of finding ways of improving the overall project delivery times. This includes working closely with the suppliers to improve their delivery to site or arranging for them to conduct more off-site functional testing of equipment in order to reduce downstream risk of malfunction and to expedite subsequent commissioning of the facility. Site preparation work is also currently on-going in order to ensure that any equipment delivered to site is rapidly and easily installed.

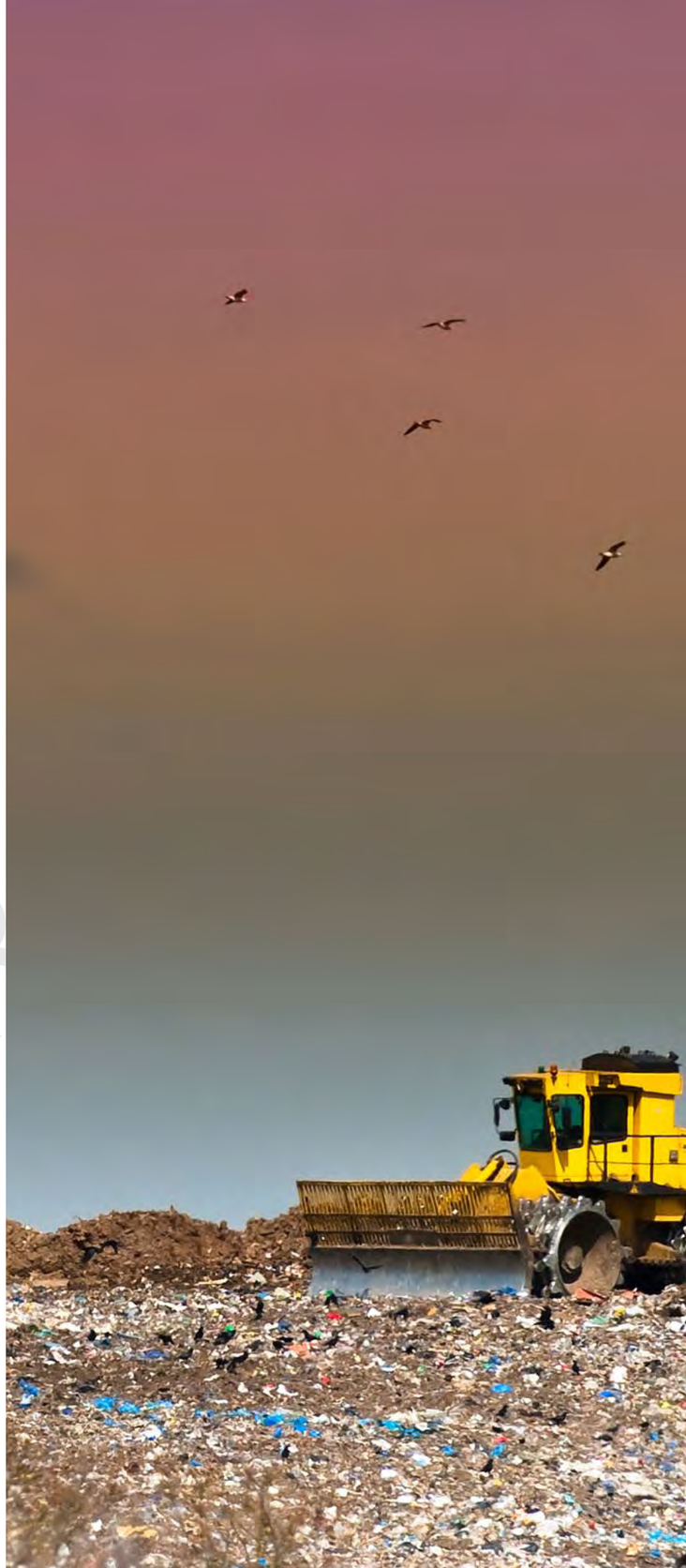
Finally, with the Original Equipment Manufacturer (OEM) engineering work and procurement of equipment being well advanced, the project team is now refining plans for the construction, commissioning and testing phases of the project.

4. Business Case Update

In their decision document on the recent consultation on the level of the Renewable Heat Incentive (RHI) biomethane to grid tariff, DECC confirmed that BioSNG would continue to be eligible for the tariff, and that they would be keeping a watching brief on future developments in the BioSNG sector.

It is important, therefore, for the project to maintain an active promotional function with a view to the continuation of a supportive policy environment for renewable gas. To this end the corporate communications teams at both National Grid and at APP are engaged with the project team to ensure that the merits of BioSNG are widely understood in order to maximize the opportunity for the BioSNG technology to emerge into an enabling commercial environment.

A key learning outcome from work undertaken already is the need for value engineering in design of the BioSNG facilities. This has proven to be essential in procurement of the demonstration facilities, but will be of even greater importance in the realization of the full-scale plant and its commercial viability. This important aspect of the business case will be a focus of Task 8.



5. Progress Against Plan - December 2014

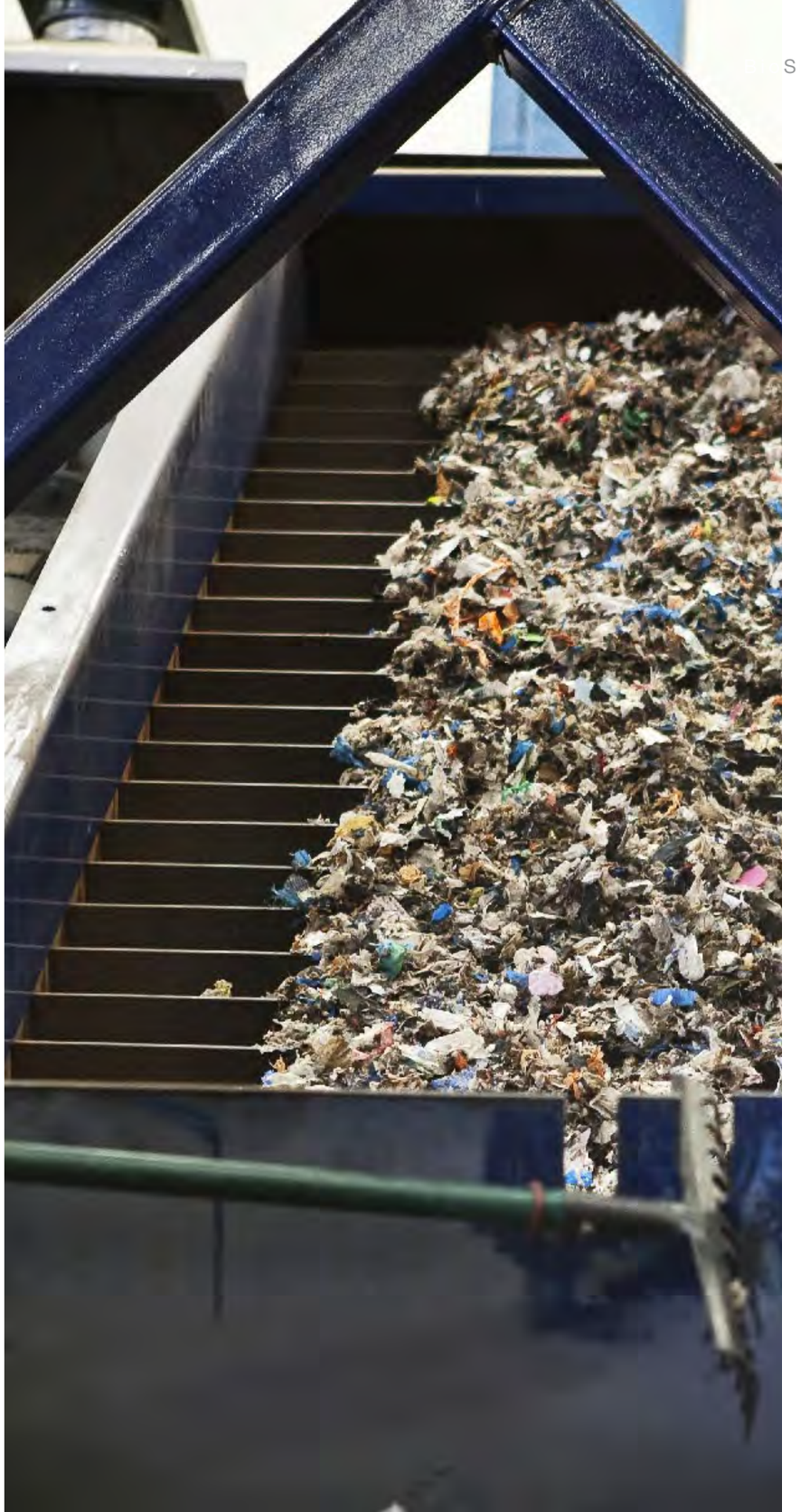
The planning consent for the changes required on site has been granted by the local authority planning body in the form of a Certificate of Lawfulness under the Local Development Order (LDO).

The landlord has also agreed to the changes proposed on site. It has been confirmed by the Environment Agency (EA) that due to the R and D scale of operation that the plant is considered as an excluded activity and will not require a permit to operate.

The detailed design and safety assessment for the plant has been completed and signed off. The plant safety study was conducted by the independent Safety Consultants, Rowan House. The scope of work included: Hazid, DSEAR and a Hazop studies to: identify specific risks, check that the materials of construction were compatible with process conditions and systematically evaluate and protect against the potential hazards and operability issues associated with the plant.

The major activity over the past six months has been in the procurement of the process equipment work packages. In order to reduce the equipment interfaces, thereby significantly de-risking the project (see also section 10), a number of the work packages (WP) including civils, utilities, and the mechanical, electrical and control installation have been subsumed under the main plant items supply (WP3).

The procurement exercise initially involved preparing tender documentation, incorporating detailed process specifications and obtaining competitive quotations from suitable suppliers. Orders have now been placed for all the main equipment work packages with the selected OEMs. The gas compressor (WP1) and the gas storage (WP2) process design drawings have been signed off and manufacturing of the compressor unit has commenced. The initial quotations obtained for the main plant items (WP3) put pressure on the capital budget and led to a value engineering exercise being conducted with the preferred supplier. A subsequent reduction in the cost, in line with permitted spend, was achieved without compromising either the functionality or the projected performance of the plant. The methane refining plant (WP4), to be provided by our project partners, Schmack Carbotech (SCT) has been fully specified and a delivery date for this equipment is in line within the required programme schedule. The order for the thermal oxidiser (WP11) has also been placed; this equipment will safely handle all the main process line emissions from the facility.



The focus has now moved towards managing the equipment suppliers to ensure that the equipment is manufactured to specification and to schedule. There is an on-going review and approval by APP for the design documentation being prepared by the suppliers. The project now entails substantially more offsite integration and so much of the commissioning of equipment will take place at factory prior to delivery at site at Swindon.

UK Heat Use

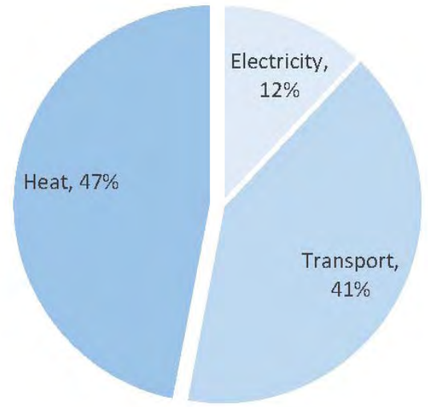


Chart above demonstrates final energy use. Heat accounts for almost 50% of final energy use.

6. Progress Against Budget

The project is forecast to be delivered within its budget but costs are being incurred later than expected. Overall expenditure in the eight months to 30 November is £696.6k which is £347.0k lower than budget. A summary of the project's financial performance is set out in the table on the following page.

Labour costs are £59.9k higher than budget. This is predominately a phasing issue as some work that was forecast to take place in 2015/16 has been pulled forward so it is likely some of the overspend will be recovered in future months.

Other costs are lower than budget at present. This is due to phasing and they are expected to return to budgeted levels. The primary cause of the phasing difference is that suppliers have agreed more generous terms than was expected in the budget. In addition, some of the underspend is due to delays in ordering equipment for the reasons set out in Section 5.

In summary, the project is expected to be delivered within budget.

PROJECT'S FINANCIAL PERFORMANCE TABLE

	Project to Date			Total		
	Actual	Budget	Variance	Actual	Budget	Variance
Labour	391,778	331,872	(59,906)	391,778	1,353,724	961,946
Equipment/Consumables	275,380	458,443	183,062	275,380	2,273,480	1,998,100
Contractors	19,693	132,356	112,663	19,693	240,677	220,984
IT	0	16,722	16,722	0	59,900	59,900
IPR Costs	0	7,111	7,111	0	32,000	32,000
Travel & Expenses	9,717	18,956	9,239	9,717	88,400	78,683
Contingency		78,103	78,103		202,409	202,409
	696,568	1,043,562	346,994	696,568	4,250,590	3,554,022

7. Bank Account

Bank statements have been provided to Ofgen. Due to the confidential nature of the project bank statements, they have not been included in this report.

8. Successful Delivery Reward Criteria (SDRC)

The second SDRC, associated with the completion of the final design and safety review, has been successfully completed on time, and was formally signed off on 24th July 2014.

The third SDRC for installation of the BioSNG equipment on site is due on the 11th April 2015. As described under Risks Section 10, the combining and simplification of the equipment work packages should allow for much of the functional testing of equipment to be carried out at the supplier's site prior to shipping to site, de-risking the overall project. The expectation is that, although this approach could lead to minor delays in the installation of equipment, it should actually expedite commissioning and should not impact the delivery of the main development aims of the project.

9. Learning Outcomes

In the period since the last report, the project effort has been focused upon engineering and procurement of the process equipment required to build the BioSNG demonstration facility. Over this period there have been four specific learning outcomes which merit recording:

1. VALUE ENGINEERING

The first learning outcome relates to value engineering. The engineering and procurement of the process plant has proved to be an iterative process in which the detailed design and specification has been refined through a value engineering exercise, occasioned by responses from tenderers. The value engineering effort has served to rationalise the detailed process design in a way that has enabled the team to control the cost of the facility without impairing its potential performance. The learning outcome here is that whilst there may be a variety of ways in which a system can be designed to perform a specified duty, they might differ significantly in cost. Systems designs should therefore be subject to a value-engineering appraisal in order to assure that the definitive design configuration represents best value for money. This is a theme that will inform all subsequent aspects of the ongoing project, especially the realisation of a design for the full-scale commercial design.

2. THE ROLE OF PRE-FABRICATION IN RISK MITIGATION

A second learning outcome from work undertaken in this reporting period are the cost, schedule and quality benefits of process system pre-fabrication in a factory environment as opposed to assembly of myriad components on site. This is not new knowledge within the process industry, but it has been a timely prompt to the project team concerning the significance of pre-fabrication in developing a commercially viable design for the full-scale facility.

3. FACE TO FACE WORKSHOPS

A third learning outcome from the work undertaken in this reporting period is the value of face to face meetings, particularly when working with international partners. Substantial progress was made with Work Package 4 through a two day technical workshop with Schmack Carbotech, the project partner that is providing the gas upgrading element of the project to meet gas grid injection specifications. This learning format provided the UK team with a much deeper understanding of the fundamental science behind the technology, and the German partners with a much better understanding of the project requirements and constraints. The investment in this workshop has also enabled progress to be maintained effectively with subsequent conference calls, building on the relationships developed.

4. IMPORTANCE OF PROJECT COMMUNICATION

Maintaining communication about the project is vital.

- Team members attended the LCNI conference in October. National Grid gave a general presentation on its vision for renewable gas, including a brief overview of the project. This was an important opportunity to engage with the community and to highlight the project and its benefits.
- A Project Communications and Marketing subgroup has been formed, including communication specialists from APP and NG, to consider carefully how the project is presented to stakeholders. This has been formed early to start to prepare materials and to plan the project Visitor Centre, such that when the initial results become available the project team has an effective framework to promote the project. This has been an important learning exercise for the technical and engineering focused team.

In summary, the key learning outcomes have been:

- The importance of well-structured value engineering in delivering commercial outcomes without compromising delivery.
- The importance of pre-fabrication of process elements to expedite onsite construction.
- The importance of collaborative, face to face workshops, particularly with international partners.
- The Importance of external communications and involvement of experts.

10. Intellectual property rights (IPR)

The IPR situation is unchanged from the last reporting period.

11. Risk Management

A comprehensive live risk register has been drawn up which allows for the regular monitoring of a range of technical commercial and project management risks, as identified by the project partners.

The approach taken, allows for potential issues to be identified and mitigated at an early stage. The risk register has been subdivided according to the main project tasks and a number of additional (internal) deliverables have been incorporated to permit a more responsive means of managing the project risks. A description of the how the risk register has been drawn-up and a copy of the full risk register (updated in the latest risk management review of 28.11.2014) is given in Appendix 1.

The main activity over the last six months has been in the procurement of the equipment for the BioSNG facility. There are a high number of interfaces between the various process units and there is, therefore, the potential for compatibility errors that may arise at the engineering design stage, leading to consequent project delays and cost overruns. This risk has been allayed by the decision to combine a number of the main work packages which has greatly reduced the number of interfaces and simplified the procurement process. An interface register has also been set up which further reduces the possibility of interface problems across battery limits.

Control of capital spend has had to be closely managed as quotes from the main process suppliers for the core methanation plant (WP3) has placed some pressure on the procurement budget. This led directly to a comprehensive value engineering exercise being undertaken with the preferred supplier of equipment, which led to a reduction of capital spend in line with the overall budget, without compromising the required functionality and projected performance of the plant.

The focus is now on managing the programme schedule to ensure that the extended timeframe experienced in finalising the scope, packaging and associated cost of the equipment supply does not materially impact the primary scientific and technical aims of the project. The combining of work packages should permit a significant part of the functional testing of equipment to be carried out at the supplier's site, prior to shipping, decreasing the risk of equipment malfunction (post shipping). This approach should also lead to an overall saving in time as this testing would normally be part of the on-site commissioning programme following installation.

Under the BESTF Eranet programme, which is part funding the BioSNG project, we have a German partner, Schmack Carbotech (SCT), providing the equipment and expertise for the BioSNG refining stage of the process. There was a delay in SCT obtaining funding for their participation which risked a delay in delivery of their equipment to site in Swindon. This risk has been downgraded to an acceptable level following a technical meeting in Germany where SCT have indicated a scope and schedule of delivery for their equipment that fall within the overall project programme. Regular fortnightly updates are being provided by SCT to keep track on progress.

12. Accuracy Assurance Statement

This will be provided by Damien Hawke, Acting Innovation Manager for NGGD

About the partner organisations

About National Grid Gas Distribution

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.

To find out more about this project and other Gas Distribution Innovation projects please contact Darren White at box.GD.Innovation@nationalgrid.com

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Visit www.nationalgridconnecting.com and join the conversation on Powering Britain's Future

The project website can be accessed at: http://www.nationalgrid.com/biosng

About Advanced Plasma Power

Advanced Plasma Power Limited (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. APP has developed the Gasplasma® process, a clean, modular and scalable advanced waste to energy and fuels technology which delivers high efficiencies whilst minimising visual and environmental impact.

The Gasplasma® process is an innovative combination of two well-established technologies – gasification and plasma treatment, both of which have decades of proven commercial operation.

To find out more about APP, please contact:

Kate Colclough at kate.colclough@app-uk.com

Visit www.advancedplasmapower.com

About Progressive Energy

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. Progressive was formed in 1998 to commercialise key energy conversion technologies developed in the CEGB including coal gasification, waste to energy, and biomass conversion. Members of the team have also been instrumental in developing best practice in waste resource utilisation through both the establishment of the UK's first commercial MBT facility, and development of energy from waste projects.

To find out more about Progressibe Energy please contact:

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