Low Carbon Gas Preheating

Project Progress Report 06

13 December 2016

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1.0 Executive Summary

1.1 Project Snapshot

The transition to a low carbon energy sector in the UK presents Gas Distribution Networks (GDNs) with a number of challenges, including reducing the Business Carbon Footprint (BCF) of operating gas networks. The requirement for GDNs to preheat gas at pressure reduction stations (PRS) to avoid freezing the outlet pipework and ensure continuity of supply is a significant contributor to our BCF. GDN's preheating requirement is currently delivered using aging Water Bath Heaters (WBH) or more modern Boiler Package technologies (BH). However, there are several key issues that GDNs currently face when appraising investment options for preheating technology. Firstly, the whole life costs and in particular the carbon impact of currently available technologies is not understood. Secondly, there has been limited research or development in this area resulting in no financially viable alternative to existing technologies. And finally, the current shrinkage arrangements provide no incentive to target reductions in BCF associated with preheating.

The Low Carbon Gas Preheating (LCGP) seeks to address these issues directly. The project will install two 'alternative' preheating technologies across six NGN sites of differing scale - three Thermo Catalytic Systems (HotCat) and three Low Pressure Steam Systems (LP Steam). Smart metering technology will be installed on each of the six sites to provide data required to calculate and publish the system efficiency of each site and each technology. Additionally, smart metering technology will be installed separately on six sites that employ existing technologies. System efficiencies will be calculated and published for direct comparison.

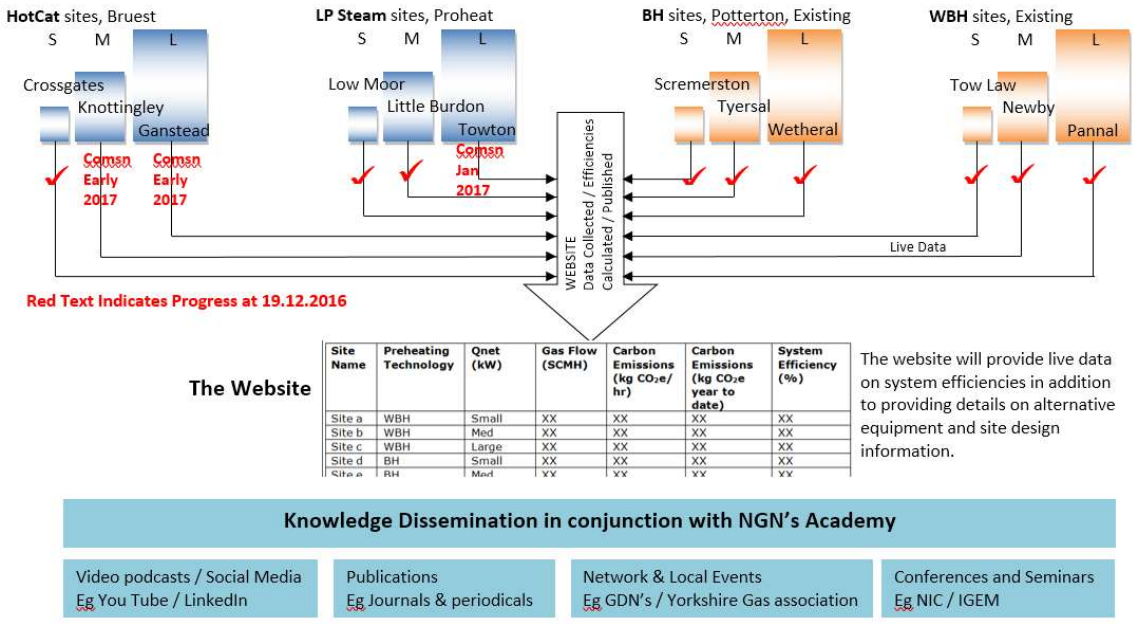


Figure 1. The LCGP Project

9 of the 12 LCGP sites are now fully commissioned, including Little Burdon (LP Steam, Medium). Of the outstanding 3 sites to be commissioned, Towton (Proheat) is anticipated to be commissioned in January 2017, Knottingley & Ganstead (Bruest) are anticipated to be commissioned before the end of the 2016 / 17 heating season.

All project costs and analysis of costs are contained within the Confidential Annex.

With reference to Figure 1, the project progress can be summarised as follows:

1. Website development / Knowledge Dissemination.

   The website remains live and publicly accessible via the NGN Website. All data is available for download to allow individuals to undertake their own data analysis should they wish to do so. Glitches have been addressed but further site specific analysis is required to further explain some results. This work can only be done once the new calculation methods have been verified by obtaining 'real life' results from the LCGP sites.

   The website can be viewed at:

   http://www.northerngasnetworks.co.uk/ngn-and-you/gearing-up-for-the-future/low-carbon-gas-preheating-lcgp-project/

2. 2015 Procurement and Construction.

   Construction of preheating on all sites is now complete.

3. 2015 Alternative Technology Equipment

   The 'medium' Proheat unit has been successfully commissioned with the 'large' Proheat units expected to be successfully commissioned in January 2017. Approval to commission the 'large' and 'medium' Hotcat technologies is still outstanding. Commissioning is expected to be completed before the 2016 / 17 heating season is over.

1.2 Project Summary

During the sixth-6 month reporting period of the LCGP project the team have successfully commissioned the medium LP Steam unit at Little Burdon and carried out successful testing of the remedial works to provide a gas tight seal between the electrical and gas sides of the Hotcat Mark II units at Ganstead and Knottingley. Bruest have attended the Ganstead and Knottingley sites to carry out de-snagging and testing with a view to obtaining permission to commission prior to the end of the 2016 / 17 heating season. Modifications have been made to the calculations for preheater efficiency which need to run when flows through sites are suitably high enough to verify that the modified calculations / software is effective.

There are two 'issues' to report;

1. Hotcat Mark II commissioning approval (Knottingley and Ganstead). Remedial works have been carried out to de-snag the units by an NGN sub-contractor and by Bruest. However, more work is to be done before the team can obtain an NGN/PM/G/17 Part D (Approval to commission), from the electrical / instrumentation / mechanical G17 Users.
2. Website data. Glitches identified have been addressed but cannot be verified until flows through site are suitably high enough to verify the work done. There remains a risk that further work will be required.

If the above two issues have been resolved prior to the end of the 2016 / 17 heating season, the project shall deliver the original project benefits. If they are not resolved in time, then an extension of time may be requested to achieve the original project benefits.

1.3 Risk Section

An updated risk register is contained within the Confidential Annex.

Details of live risks are given along with all costs to date and forecast costs to complete the LCGP project.

1.4 The Learning Section

The LCGP website is live and contains site data from 8 of the 12 LCGP sites. Little Burdon will be the 9th site to provide data. This will be made live in January 2017. Mini case studies from the small LP Steam and small hotcat sites are on the website. Further information detailing lessons learnt will be added once the large & medium alternative preheaters are commissioned, along with a report to give more detail into instrumentation used to acquire the data from each site.

2.0 Project Manager's Report

2.1 Project Overview

Remaining work on the LCGP project involves commissioning of 3 preheaters and data analysis from all 12 sites.

Commissioning of the Proheat unit at Towton is anticipated to be completed in January 2017. Approval to commission the Hotcat Units at Knottingley and Ganstead remains difficult to obtain as agreement is needed for electrical / instrumentation / mechanical and via DNV GL. However, this is still anticipated to be obtained in early 2017.

Modifications to the data calculations for the website have been made. Accuracy of the software modifications need to be verified once flows through each of the LCGP sites increase above 30% of maximum anticipated design flow rates.

2.2 Work Packages

The project has been broken down into 10 work packages. Each is detailed in this section but can be summarised as follows:

- WP01 to 06. Each of the 6 sites where alternative technology is installed
- WP07. Work carried out on the 6 sites with existing technology; 3 boiler houses / 3 water bath heater sites
- WP08. The website and information management
- WP09. Training / System Control
- WP10. Project Management

2.2.1 WP01. Hotcat Small (Crossgates)

Figure 2. Small Hotcat at Crossgates.

This site installation and commissioning was completed prior to PPR 03. Details can be found in previous PPR's and in the mini case study published on the project website.

The Hotcat has provided preheating to the Crossgates site since winter 2015 / 16 with the following faults reported:

1. Prior to June 2016: Overheating alarms. This was determined as a set up issue rather than a fault resulting in reactive maintenance costs. The outlet temperature of the hotcat was initially set to alarm over 20°C. However, in low flow conditions, when ambient temperatures were high, this limit was exceeded. The setting was increased to 40°C.
2. Prior to June 2016: PLC locked out. It was noted on site that the PLC controlling the hotcat froze up. This was resolved with assistance from Bruest. No additional parts were necessary to resolve the issue.
3. 18 September 2016. Heater A1 alarm (non-critical). Action taken involved an NGN operative attending site to reset the alarm. This closed the fault.

A 12 month maintenance service visit was carried out on 14 / 15 / 16 September 2016.

Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016 and 6 December 2016.

The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.

2.2.2 WP02. Hotcat Medium (Knottingley)

Figure 3. Medium Hotcat at Knottingley

As previously reported, Bruest have designed and built the Hotcat Mark II as a direct result of funding from the LCGP project. Approval to commission was anticipated to be obtained during summer 2016. This has not yet been achieved.

Bruest attended Knottingley and Ganstead sites during their UK visit between 18 September 2016 and 1 October 2016. Works they carried out included de-snagging and electrical testing.

Issues to be resolved prior to arranging for commissioning to commence are:

1. Obtain G/17 Part D Electrical. Discussions between NGN / Bruest ongoing.
2. Obtain G/17 Part D Instrumentation. Discussions between NGN / Bruest ongoing.
3. Ensure Bruest comply with DNV GL report dated 12 Aug 2016, Rev 03. Dispute ongoing re-Bruest letter dated 21 October 2016 (high and low level gas detection system).
4. Obtain G/17 Part D Mechanical. NGN to carry out PSSR inspection of coil in order to obtain this.

The project team are focussed on commissioning the unit prior to heating season 2016 / 17 being over (i.e. before April 2017).

The main works contractor has completed smoke testing between the gas side / electrical side as required by the DNV GL report dated 12 Aug 2016, Rev 03. Smoke test date 07.09.2016.

The SDRC states that 'HotCat, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. It was anticipated in PPR 04 that monitoring of the data would begin in early

2016. PPR05 anticipated that monitoring of the data would occur prior to winter 2016 / 17. We now believe monitoring of the data will occur during the winter 2016 / 2017.

Work to remove the exisitng preheating technology (WBH's) will only be carried out once the Bruest hotcats have proven to be reliable.

Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016 and 6 December 2016. The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.

Figure 4. Retained preheating at Knottingley providing an emergency backup only

2.2.3 WP03. Hotcat Large (Ganstead)

Issues to be resolved prior to arranging for commissioning to commence are the same as those identified earlier in WP02. Hotcat Medium (Knottingley).

Figure 5. Large Hotcat at Ganstead

1. The main works contractor has fully demobilised from site.
2. The main works contractor has completed smoke testing between the gas side / electrical side. (Smoke test date 10.10.2016 for both units).
3. The SDRC states that 'HotCat, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. It was anticipated in PPR 04 that monitoring of the data would begin in early 2016. PPR05 anticipated that monitoring of the data would occur prior to winter 2016 / 17. We now believe monitoring of the data will occur during the winter 2016 / 2017.
4. Work to remove the existing preheating technology (Boilerhouse and Heat exchanger) will only be carried out once the Bruest hotcats have proven to be reliable.
5. Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016 and 6 December 2016. The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.

Figure 6. Retained preheating at Ganstead providing an emergency backup only

2.2.4 WP04. LP Steam Small (Low Moor)

Figure 7. Small LP Steam at Low Moor

This site installation and commissioning was completed prior to PPR 03. Details can be found in previous PPR's and in the mini case study published on the project website.

The LP Steam unit has provided preheating to the Low Moor site since winter 2015 / 16. Faults received are detailed below.

1. Prior to June 2016: Numerous low temperature alarms had been reported since January 2016. Proheat advised that a software upgrade should be carried out based on learning obtained from running this unit. Also, separate instruments provide outlet temperature data to the Proheat control panel and NGN's System Control department. This issue has been resolved by NGN to reduce these faults arising.
2. 21 June 2016. High priority heater alarm. Action taken involved an NGN Maintenance Engineer (Penspen) attending site to reset the alarm. This closed the fault.

Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016. The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.

2.2.5 WP05. LP Steam Medium (Little Burdon)

Figure 8. Proheat Units during Nov / Dec 2016 commissioning

The Proheat units at Little Burdon were left in automatic service following successful commissioning completion on 9 December 2016. This successful commissioning followed remedial works resulting from the incident on 10 October 2015.

During a conference call held on Friday 9 December 2016, NGN / DNV GL / Proheat agreed to leave the units operating in automatic mode. It was agreed that 1 further inspection of the burner grates would be required on 22 December 2016 prior to the Christmas period.

NB. DNV GL were engaged to assess any safety concerns of the Proheat remedial works proposal and ongoing support for any safety concerns arising through commissioning.

Briefly summarizing the works since 10 October 2015 to date:

1. Proheat issued the final, Approved and Appraised report into the incident on 16 March 2016.
2. Macaw Engineering Limited were issued the Proheat report for review on NGN's behalf on 21 March 2016. NGN expected this work to be completed in summer 2016.
3. Macaw Engineering Limited could not complete this work.
4. DNV GL provided a quotation, dated 01 September 2016, to review the Proheat report dated 16 March 2016. DNV GL issued their report on 14 October 2016. Approval to commission the Proheat units was provided by the NGN Head of Asset Integrity on 25 October 2016.
5. DNV GL issued a report dated 14 October 2016 confirming the units could be re-commissioned safely.
6. NGN's Head of Asset Integrity confirmed the report from Proheat (checked by DNV GL) had been accepted by NGN.

7. Proheat successfully commissioned the units between Monday 7 November 2016 and Friday 9 December 2016

Other issues

Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016. The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.

The SDRC states that 'LP Steam, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. Monitoring of the equipment will begin in January 2017. As such, data will be collected during the winter 2016 / 17.

Work to remove the exisitng preheating technology (WBH) will only be carried out once the Proheat Units have proven to be reliable.

Figure 9. Retained preheating at Little Burdon providing an emergency back up only

2.2.6 WP06. LP Steam Large (Towton)

Figure 10. Large LP Steam at Towton

1. Following the incident with overheating at Little Burdon and the subsequent instruction issued 13 October 2015, Towton commissioning was put 'on hold' until this investigation was concluded.
2. Proheat proposed the use of a different burner head at Towton when compared with Little Burdon. This led to DNV GL reviewing their report issued on 14 October 2016 and reissuing a revised report dated 2 December 2016.

3. Commissioning is expected to be carried out beginning in January 2017.
4. Draft maintenance procedures were issued to assethealth@northerngas.co.uk for incorporation in the maintenance system on 25 October 2016. The final maintenance procedures for this unit are in a review procedure via NGN's Standards department.
5. The SDRC states that 'LP Steam, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. Monitoring of the equipment is likely to begin during winter 2016 / 17.
6. The retained water bath heaters will continue to provide preheating to the site until the Proheat equipment is commissioned and proven to be reliable.

Figure 11. Retained preheating at Towton providing an emergency backup only

2.2.7 WP07. Existing Technology (Boilerhouses (BH) and Water Bath Heaters (WBH))

All instrumentation is now live and reporting back to SCADA.

Preheating call out logs are being kept for each of the NIC sites. As an example of the information available, the below table shows 2016 preheating alarms from Tyersal (Boilerhouse site, Medium). Based on the reference number below, further log information can be requested from NGN's System Control department.

Alarms / call outs from all NIC sites will ultimately be priced and considered in the whole life cost analysis of each of the preheating technologies.

Tyersal - Boilerhouse

Last Log Entry	Reference	Title
01/01/2016 10:43	120724	BURSTDISC1, BOILERA1, BOILERA2, COMPUTER1 alarms
13/01/2016 07:06:33	120811	BOILERA2 alarm
14/01/2016 06:35:42	120823	Boiler A2
24/02/2016 07:26:52	121102	Multiple Boiler Alarms 24/02/16
28/02/2016 03:24:34	121111	Mutliple Boiler Alarms
18/03/2016 10:28:00	121222	Multiple Boiler Alarms
19/03/2016 09:14:57	121276	Boiler A2 Alarm 19/03
20/03/2016 11:23:56	121281	Boiler A2 20/03
24/03/2016 07:13:09	121296	BOILERA2 alarm
29/03/2016 08:47:34	121318	Boiler A1 & A2 29/03
15/04/2016 11:00:17	MGAY-A8HB6W	Bursting Disc Install 29/03
06/01/2016 14:31	121616	BOILERA1
29/06/2016 11:44:05	121801	Boiler A2

Figure 12. Preheater alarms - example table of information

2.2.8 WP08. Website

As an example of the information being calculated, the below chart, taken directly from the website, shows the preheating performance of the Hotcat at Crossgates (small site). It's clear that figures above 100% efficient need further explanation. All analysis of data obtained during winter 2016 / 17 will be carried out once preheating demands are reduced.

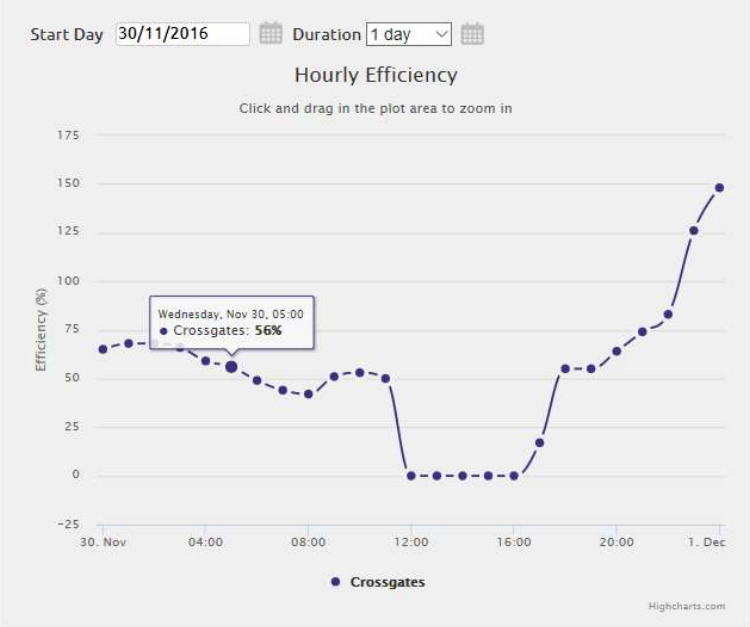


Figure 13. Website data - sample

The website can be viewed at:

http://www.northerngasnetworks.co.uk/ngn-and-you/gearing-up-for-the-future/low-carbon-gas-preheating-lcgp-project/

Further to site inspections of the instrumentation carried out prior to summer 2016, work has been done to attempt to resolve any 'glitches' within the calculations.

Issues addressed included:

1. Low flows through site are thought to affect the accuracy of the measured values as the large majority of heat reaching the gas itself is subsequently lost to atmosphere before it reaches the outlet temperature sensor. The calculation was modified to disregard any efficiency calculations where the flow rate through the site was less than 30% of the maximum site design flow rate.
2. Co-efficients used in calculating the kWh contained within $1m^3$ of gas were checked and found to be ok.
3. Anomalies were removed from the calculations by summing up 60 values per hour to give an average.

4. Calculation added to the algorithm to 'add in' assumed energy consumption should the preheater underheat the gas.
5. Recognition within the software that when Qnet is negative, the results are discarded. NB. A negative Qnet demonstrates that to hit an outlet temperature of 0degC then it would need to give up energy, not receive energy from preheating.
6. Disregard all results when inlet temperature is above 10degC.
7. Other differences which should be identified prior to drawing any conclusions include:
    a. Some sites have surface mounted temperature sensors, others have thermowells.
    b. Some sites have fiscal quality metering, others have orifice plate metering (less accurate).
8. Where hourly efficiencies are being calculated, these can show wide swings in values due to the nature of the preheater. For example, a WBH burner may fire (draw gas) for 30 minutes, but the WBH continues to provide heating to the gas stream for 4 hours. So in hour 1 the heater appears inefficient, but in hours 2, 3 and 4 the preheater appears infinitely efficient.

Knowledge Dissemination activities this period include:

- Attendance at the LCNI Conference, Manchester (NGN's stand)
- Presentation of project progress to the IGEM, North East & Yorkshire Section Event. 13 October 2016.

2.2.9 WP10. Project Management

Site supervisors and project leads are no longer charged to the LCGP project costs as all installation works are now complete.

Project management costs are focused on commissioning support and data analysis.

2.3 The next 6 months

Priorities over the next 6 months can be categorized into 4 main areas:

1. Commissioning – Medium Hotcat – Knottingley
2. Commissioning – Large Hotcat – Ganstead
3. Commissioning – Large LP Steam –Towton
4. Data collection and website development

2.3.1 Commissioning – Medium Hotcat – Knottingley.

Work remaining includes;

1) Obtaining approval to commission
2) Arranging commissioning with Bruest

2.3.2 Commissioning – Large Hotcat - Ganstead

Work remaining includes;

1) Obtaining approval to commission
2) Arranging commissioning with Bruest (work will follow commissioning at Knottingley)

2.3.3 Commissioning – Large LP Steam – Towton

Work remaining includes;

1) Arranging commissioning with Proheat
2) Ensuring commissioning is carried out with no safety risk to NGN

2.3.4 Data collection & Website Development

Work remaining includes;

1) Monitor the data and calculations when flow rates through site are suitably high.

3.0 Business Case Update

The benefits to be gained from this project have not changed since the full submission. The four key objectives will be achieved:

1. *Assess the potential for alternative technologies to meet preheating requirements across a range of heating system sizes and operating site parameters*.

All sizes of hotcat and LP Steam units shall be able to be monitored and compared over winter 2016 / 17. Should there be a problem with commissioning the 3 outstanding preheaters prior to the end of the 2016 / 17 heating season then an extension of time to complete this objective may be requested.

2. *Provide an independent and accurate model for assessing the efficiency of preheating systems across the UK based on reducing business carbon footprint (BCF) and whole life costs*.

This report acknowledges there are some issues with the data provided so far. However, the objective of the project will ultimately be achieved when accurate data is obtained from site.

3. *Increase the technological options available to gas transporters for the replacement of preheating assets and increase the supply side of this market*.

The Hotcat Mark II is available for other GDN's to purchase from Bruest, as is the Hotcat Mark I. The developments in the Proheat equipment will also be available to other GDN's to purchase.

4. *Provide quantified data on system efficiency of both alternative and existing technologies that can provide the industry with information that will allow more informed investment decisions and a more efficient operation of the network*.

We will carry out our own data analysis and share this through presentations or via the website once all 12 LCGP sites are commissioned and are reporting back to the website.

4.0 Progress Against Plan

The latest project programme is contained in Appendix A of this report.

There have been 3 main areas of work over the last 6 months. These are:

1. Proheat Approval to commission / site commissioning.
2. Bruest Mark II Approval to commission.
3. Website glitches.

4.1 Proheat approval

The Proheat units were scheduled to be commissioned by 30 September 2015 at Little Burdon and Towton. Little Burdon was successfully commissioned by Friday 9 December 2016. Towton is anticipated to be commissioned during January 2017.

4.2 Hotcat approval

The Hotcat Mark II units were also scheduled to be commissioned by 30 September 2015 at Knottingley and Ganstead. Once approval to commission is received it is anticipated that the units will be operational prior to the end of winter 2016 / 17.

4.3 Website Glitches

Work has been carried out to firm up the accuracy of the system efficiency calculation. Verification of the work needs to be undertaken during periods of high gas flow to verify the modifications to the calculations / software.

4.4 The next 6 months

Over the next 6 months the team will focus on;

1. Obtaining approval to commission the 3 remaining medium or large alternative preheating sites.
2. Data collection and website development
3. Data Analysis & Knowledge Dissemination where possible.

5.0 Progress Against Budget

The project against budget summary is contained in the confidential annex.

6.0 Bank Account

The bank account details are contained in the confidential annex.

7.0 SDRC

7.1 Preheating Site Selection

Completed.

7.2 Preheating Site & Technology Design

7.2.1 Smart Metering (Existing Technology)

Completed.

7.2.2 HotCat and LP Steam Small Site Designs

Completed.

7.2.3 HotCat & LP Steam Medium and Large Site Design

Completed.

7.3 Technology Build & Installation

Update on text below from PPR04, monitoring of the medium LP Steam unit at Little Burdon will commence January 2017. The remaining 3 sites still to be commissioned is anticipated to be ongoing prior to the end of the winter heating season of 2016 / 17. This is subject to achieving approval to commission the units. Achieving this approval is a project priority for the LCGP team.

Text from PPR 04:

"The **large and medium hotcats** have been installed in line with the SDRC as detailed earlier in this document. However, as a result of the delay in the delivery of the Hotcats, caused by encouraging Bruest to re-design them to improve their efficency, the units will not be commissioned until early 2016. Following commissioning the data produced will be sent back to NGN's SCADA system where it will be manipulated prior to being published for monitoring on the project website in terms of hourly / daily efficiency and carbon emissions. This '**monitoring**' aspect of the SDRC is later than initially planned for the hotcat. This is as a result of improving the design of the hotcats with a view to increasing the efficiency and decreasing the carbon emissions. The improved hotcat design is now available for other GDN's to benefit from should they chose to procure and install one following this project.

…….

The **large LP Steam units** have been installed in line with the SDRC as detailed earlier in this document. However, the overheating incident at Little Burdon lead to a delay in the completion of the commissioning of the medium LP Steam units, this then lead to a subsequent delay in commissioning the large LP Steam units at Towton. The team would like to stress that the medium LP Steam units at Little Burdon were the first units of this size and burner configuration to be commissioned in the UK. As with the developed Hotcat design, the subsequent remedial works which we believe will now form part of the 'standard design' of this size unit from Proheat, is a development which will hopefully be seen by NGN and other GDN's as beneficial for future Proheat orders."

7.4 Successful trialling and demonstration of alternative preheating technologies

This SDRC was largely complete prior to PPR 03.

Case studies for the large and medium sites were scheduled to be uploaded to the website in line with the SDRC by January 2016. However, these case studies will be issued following successful commissioning of each of the sites to ensure they provide as much relevant information as possible for other GDN's to use.

7.5 Successful estimation of system efficiencies of existing preheating technologies

Update on text below from PPR04; Work has been carried out over this reporting period to identify and resolve issues with the SCADA calculations. Modifications have been made to the algorithm which produces the data for export to the website. This revised data will be verified over the coming months when gas flows increase through the LCGP sites. There are 3 sites with preheaters to be commissioned.

Text from PPR 04:

"The system efficiency of the preheaters can be clearly seen on the project website. Calculations are being carried out within NGN's SCADA system as detailed in Section 2.2.8. Meetings have been held at System Control, Moorside to resolve the efficiency values which appear to be inaccurate (eg, some show 255%), whilst these meetings have resolved quite a number of issues, we cannot be sure that there are no other glitches in the calculations until there is a period of cold weather where the demand on all of the preheaters is high. All issues with data accuracy and calculation co-efficients should be eesolved within the next reporting period."

7.6 Knowledge, Learning & Dissemination Strategy

The functionality of the website was proven prior to PPR 03.

As per 7.5, 3 of the sites (medium & large hotcat and Large LP Steam) will not have data flowing back to the website in line with this SDRC (December 2015) due to issues as described in 7.3.

7.7 Project Evaluation & Final Project Report

The detailed final report is not yet due to be produced.

8.0 Learning Outcomes

Designs have been published on the project website for the Hotcat Mark II to allow other GDN's to better understand the preheater.

Mini case studies of the large and medium hotcats / LP Steam units will be published on the website after the successful completion of the commissioning of each. A mini case study for Little Burdon will be published in early 2017.

9.0 IPR

No relevant IPR's have been generated or are forecast to be generated.

10.0 Risk Management

The project risk register has been updated and is contained in the Confidential Annex.

Over the last 6 months we have obtained actual base costs for certain lines of the risk register. Base costs have been updated and the associated 'risk' values have been reduced. Analysis of the risks and opportunities is contained in the Confidential Annex.

11.0 Other

All information and progress relating to the LCGP project is contained in the sections above or in the confidential annex.

12.0 Accuracy Assurance Statement

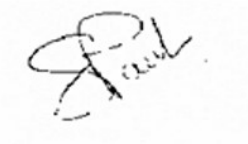
The report has been prepared in accordance with the Network Innovation Competition Guidance document published by Ofgem. Additionally, this report has been subject to review and challenge via NGN's independent Internal Audit function to provide further assurance on the accuracy and integrity of the data and information being presented.

Senior Manager Sign Off:

I can confirm that the process followed to compile and check this return is compliant with the control requirements outlined above have been completed and the information presented is robust, accurate and complete.

Name: Stephen Parker

Position: Regulation Director

Signature: 

Date: 13 December 2016

Appendix A – Programme

ID	Task Name	Start	Finish	% Work Complete
1	BSR02 Preheating NIC Project Programme	Mon 19/08/13	Fri 29/11/13	100%
6	Website	Mon 22/04/13	Tue 30/04/19	0%
7	**<New Summary Task>**	**Mon 02/12/13**	**Wed 30/04/14**	**100%**
8	Procure Website & Set Up	Mon 02/12/13	Wed 30/04/14	100%
9	Website Development	Tue 01/04/14	Wed 31/12/14	100%
10	Show Live Info On Website	Mon 05/01/15	Fri 16/12/16	0%
11	Water Bath Heater & Boiler Site (Existing Site)	Thu 10/12/15	Tue 30/04/19	0%
12	Design Site Modification	Mon 03/03/14	Thu 19/06/14	100%
13	Finalise Site Selection	Thu 01/08/13	Fri 28/02/14	100%
14	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
15	Monitoring & Analysis of Small, Medium & Large Sites	Mon 22/04/13	Mon 01/05/17	0%
16	Procure & Set Up Monitoring / Telemetry Equipent	Fri 01/08/14	Fri 12/12/14	100%
17	HotCat sites	Mon 27/05/13	Mon 01/05/17	0%
18	Small Site (CrossGates)	Thu 01/08/13	Mon 01/05/17	0%
19	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
20	Monitoring & Analysis of Small Sites	Mon 05/01/15	Mon 01/05/17	0%
21	Procure & Set Up Monitoring / Telemetry Equipment	Fri 01/08/14	Fri 12/09/14	100%
22	Small Site Construction and Commissioning	Fri 01/08/14	Fri 12/09/14	100%
23	Small Site HotCat Design	Thu 01/08/13	Mon 31/03/14	100%
24	Small Site HotCat Procurement	Fri 01/11/13	Thu 31/07/14	100%
25	Medium & Large site (Knottingley&Ganstead)	Mon 27/05/13	Mon 01/05/17	0%
26	Info Published Live to Website	Wed 30/09/15	Wed 30/09/15	0%
27	Monitoring & Analysis of Medium & Large Sites	Mon 05/01/15	Mon 01/05/17	0%
28	Procure & Set Up Monitoring / Telemetry Equipment	Mon 02/03/15	Wed 30/09/15	100%
29	Proposed Site Design	Mon 16/06/14	Fri 31/10/14	100%
30	Proposed Sites Construction & Commissioning	Mon 02/03/15	Fri 02/10/15	0%
31	Proposed Sites Procurement	Thu 14/08/14	Fri 08/05/15	100%
32	LP Steam Sites	Fri 01/11/13	Tue 20/12/16	0%
33	Small Site (Low Moor)	Fri 01/11/13	Tue 20/12/16	0%
34	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
35	Monitoring & Analysis of Small Sites	Mon 27/05/13	Mon 01/05/17	0%
36	Procure & Set Up Monitoring / Telemetry Equipment	Wed 04/06/14	Fri 18/07/14	100%
37	Small Site Construction and Commissioning	Wed 04/06/14	Fri 18/07/14	100%
38	Small Site Design	Fri 01/11/13	Fri 30/05/14	100%
39	Small Site Procurement	Fri 01/11/13	Mon 30/06/14	100%
40	Medium & Large sites(Little Burden & Towton	Mon 16/06/14	Mon 01/05/17	0%
41	Info Published Live to Website	Wed 30/09/15	Wed 30/09/15	0%
42	Monitoring & Analysis of Medium & Large Sites	Thu 01/10/15	Mon 01/05/17	0%
43	Procure & Set Up Monitoring / Telemetry Equipment	Mon 02/03/15	Wed 30/09/15	100%
44	Proposed Site Design	Mon 16/06/14	Mon 03/11/14	100%
45	Proposed Sites Construction & Commissioning	Mon 02/03/15	Mon 23/11/15	70%
46	Proposed Sites Procurement	Thu 14/08/14	Thu 30/04/15	100%
47	Information Sharing	Tue 01/09/15	Tue 20/12/16	0%
48	Disseminate All Information Through Presentations etc	Wed 01/06/16	Tue 20/12/16	0%
49	Trials To Reduce Overall NGN Business Carbon Footprint	Tue 01/09/15	Tue 20/12/16	0%