Low Carbon Gas Preheating

Project Progress Report 07

7 June 2017

Issued by email to:

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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.

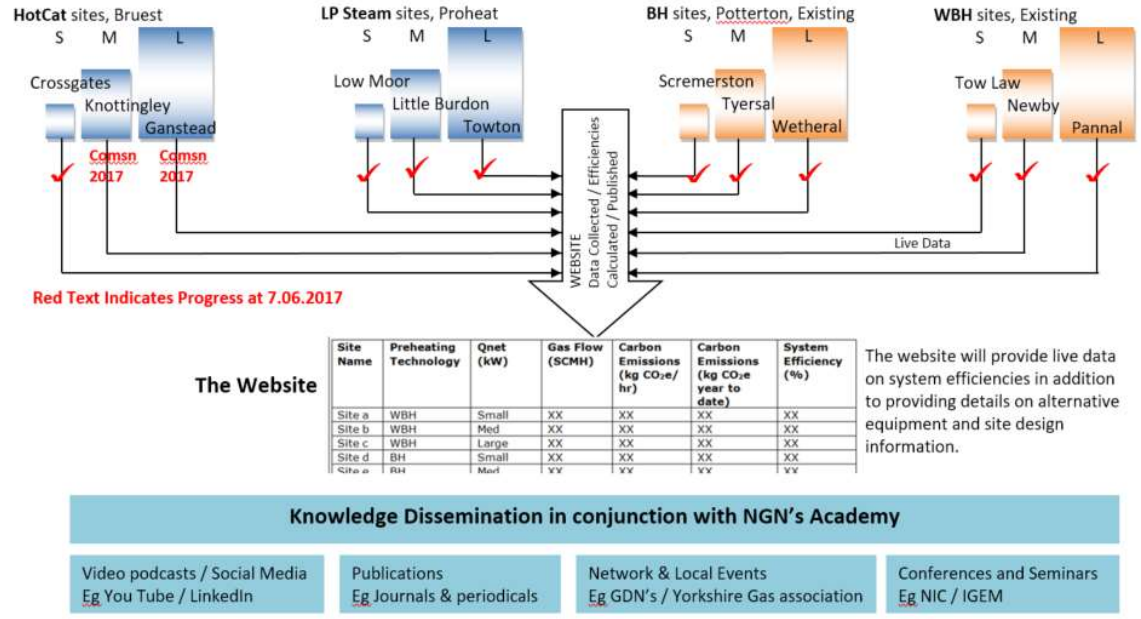


Figure 1. The LCGP Project

10 of the 12 LCGP sites are now fully commissioned, including Towton (LP Steam, Large). Of the outstanding 2 sites to be commissioned, Knottingley & Ganstead (Bruest) are anticipated to be commissioned before the start of the 2017 / 18 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. An additional full time member of NGN staff has been assigned to the LCGP project reporting to the LCGP Project Manager to resolve any remaining glitches within the data being produced.

   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

   All Proheat units have been successfully commissioned. Approval to commission the 'large' and 'medium' Hotcat technologies is still outstanding. Commissioning is expected to be completed before the start of the 2017 / 18 heating season.

4. Completion delayed by 6 months.

   As a result of the Hotcats not receiving approval to commission, and due to the glitches in the data obtained, the LCGP Project completion date shall be delayed by 6 months to June 2018. This additional time will allow data to be collected and analysed to achieve the project SDRC's from all 12 sites over the 2017 / 18 heating season.

1.2 Project Summary

During the last 6 month reporting period of the LCGP project the team have successfully commissioned the large LP Steam unit at Towton and have engaged DNV GL to determine whether the Hotcat units located at Ganstead and Knottingley can be considered to be 'safe to commission'. An additional full time member of staff has joined the LCGP team to review, ensure accuracy, and analyse all data collected from the 12 LCGP sites.

There are three 'issues' to report;

1. Hotcat Mark II commissioning approval (Knottingley and Ganstead). Remedial works were carried out to de-snag the units by an NGN sub-contractor and by Bruest in 2016. However, DNV GL have been engaged to assist NGN in confirming the units are 'safe to commission'. This piece of work needs to be completed 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 in previous reports shall be analysed and resolved by the team's new member of staff whom is dedicated to this issue.
3. Programme. The project completion date of the project has been delayed by 6 months to June 2018.

The project shall deliver the original project benefits. However, due to the time spent in resolving the above ongoing issues, the original project benefits shall be achieved 6 months later than originally anticipated.

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 data from 9 of the 12 LCGP sites. Of the 10 fully commissioned sites, data from Towton is being collected by NGN but has not yet been published to the website. 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 all 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 2 preheaters and data analysis from all 12 sites.

Commissioning of the Proheat unit at Towton is was completed by March 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. This issue is ongoing.

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. A new member of NGN staff has joined the LCGP team to review and analyse all data being collected to ensure the project SDRC's are achieved.

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 to date:

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.

Works carried out in the last 6 month period include:

- PSSR inspections of the coils were carried out in late December 2016.
- DNV GL were engaged in February 2017 to assist with an 'impasse' in agreement between NGN and Bruest.
- DNV GL issued a report in May 2017 into the impasse. The report remained largely inconclusive. The report conclusions and recommendations stated that information had 'not been forthcoming'. Work is ongoing by DNV GL to obtain further information.

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

1. Obtain G/17 Part D Electrical. Discussions between NGN / Bruest ongoing with assistance from DNV GL.
2. Obtain G/17 Part D Instrumentation. Discussions between NGN / Bruest ongoing with assistance from DNV GL.
3. Ensure Bruest comply with DNV GL report dated 12 Aug 2016, Rev 03. Grange Industries Ltd have been engaged to design additional gas sensors within the electrical rooms of the Hotcat. They will subsequently be engaged to install the sensors.

The project team are targetting the commissioning the unit prior to the start of the 2017 / 18 heating season.

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 2017 / 2018.

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 2017 / 2018.
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.
3. 14 Jan 2017. High Priority Boiler Alarm (reset required)
4. 23 Jan 2017. Heater A2 alarm (reset required)
5. 26 Jan 2017. Heater A2 alarm (Proheat attended site)

Further details of maintenance costs and alarm rectifications will be provided via the project website.

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.

Work done to obtain approval to commission these units was detailed in PPR06.

The LP Steam unit has provided preheating to the Little Burdon site since December 2016. Multiple alarms were received between January and March before Proheat attended site to tune the units.

Further faults since re-tuning was completed on 3 April 2017 included:

1. 8 April 2017. Heater A, A2 alarm. Reset required.

Further details of maintenance costs and alarm rectifications will be provided via the project website.

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 2 stage burner heads provided by Proheat at Little Burdon are not NGN's preferred type due to the incident in October 2015 (70/30 split stage 1 to stage 2). NGN's preference is to replace the 70/30 burner heads with 50 /50 burner heads and to modify / recommission the units to suit. Proheat are currently producing a quote for this upgrade. The costs will be attributed to the LCGP NIC project.

The SDRC states that 'LP Steam, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. Monitoring of the equipment began in April 2017 once commissionining was completed.

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

The Proheat units at Towton were left in automatic service following successful commissioning completion in March 2017.

Faults received since the units have operated are detailed below.

1. 7 April 2017 / 18 April 2017. T1 low alarm / Boiler A1 alarm. Proheat attended site following this.

1. 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. The SDRC states that 'LP Steam, smart metering, monitoring & telemetry equipment installed to selected sites - December 2015'. Monitoring of the equipment began in April 2017.
3. The retained water bath heaters will continue to provide emergency backup preheating to the site until the Proheat equipment is commissioned and proven to be reliable. Under normal operation the water bath heaters are left isolated.

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.

The data collected from site, the calculations performed at NGN's System Control department, and the data shared on the website, shall be checked and analysed by the LCGP new team member, Shane Muirhead.

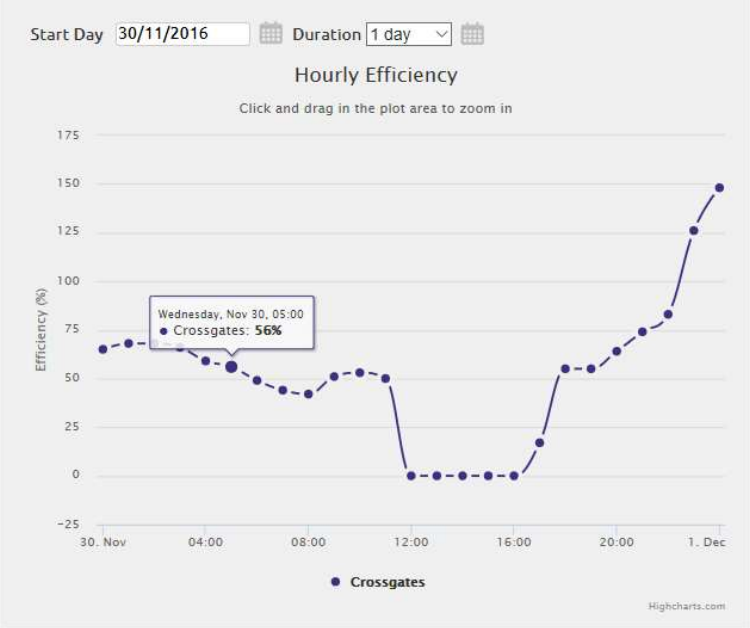


Figure 13. Website data - sample

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/

All analysis of site data reported in PPR 06 shall be further checked by Shane Muirhead to ensure the project SDRC's can be achieved prior to the production of the project close down report.

2.2.9 WP10. Project Management

Project management costs are focused on commissioning support and data analysis. The staff costs for the additional LCGP team member shall be charged to the project from 5 June 2017 until the project close down report in June 2018.

2.3 The next 6 months

Priorities over the next 6 months can be categorized into 3 main areas:

1. Commissioning – Medium Hotcat – Knottingley
2. Commissioning – Large Hotcat – Ganstead
3. 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 Data collection & Website Development

Work remaining includes;

1) Utilise all data obtained so far and ensure accuracy.
2) Analyse data obtained so far to estimate system efficiencies.

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 2017 / 18. Due to the problem with obtaining approval to commission the 2 outstanding preheaters prior to the end of the 2016 / 17 heating season an extension of time to complete this has been notified within this report, PPR 07.

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 and notes that a new LCGP team member has been employed to work to resolve these issues. 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 are also 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 internal 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 Towton site commissioning.
2. Bruest Mark II Approval to commission.
3. Website glitches – support to resolve.

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 was commissioned between January 2017 and March 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 start of winter 2017 / 18.

4.3 Website Glitches

Work was carried out prior to December 2016 to firm up the accuracy of the system efficiency calculation. Verification of this work needs to be undertaken using the data collected over the winter period 2016 / 17. This will be carried out by the new member of the LCGP team.

4.4 The next 6 months

Over the next 6 months the team will focus on;

1. Obtaining approval to commission the 2 remaining medium / large Hotcat (Bruest) 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

The medium and large LP Steam units at Little Burdon and Towton have been installed and successfully commissioned.

Update on text below from PPR04 - the remaining 2 sites to be commissioned are anticipated to be complete prior to beginning of the winter heating season of 2017 / 18. In addition to the delay in the delivery of the units (described below), the resulting delay in obtaining the approval to commission these units, due to their considerable re-design as part of this LCGP NIC project, has also contributed to the delay in achieving this SDRC in line with the originally anticipated timeline. Commissioning of these units remains 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."

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 all 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 – Further to the work prior to the PPR 06 report in December 2016, a new team member has joined the LCGP team to look specifically at the data obtained from each of the 12 sites and to verify its accuracy as well as to provide analysis including the estimation of system efficiencies.

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 resolved within the next reporting period."

7.6 Knowledge, Learning & Dissemination Strategy

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

2 of the sites (medium & large hotcat) 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

This report PPR 07 identifies the project evaluation and the detailed final report will be produced later than originally anticipated in June 2018 (detailed within the Project Direction on or before December 2017).

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 all sites.

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

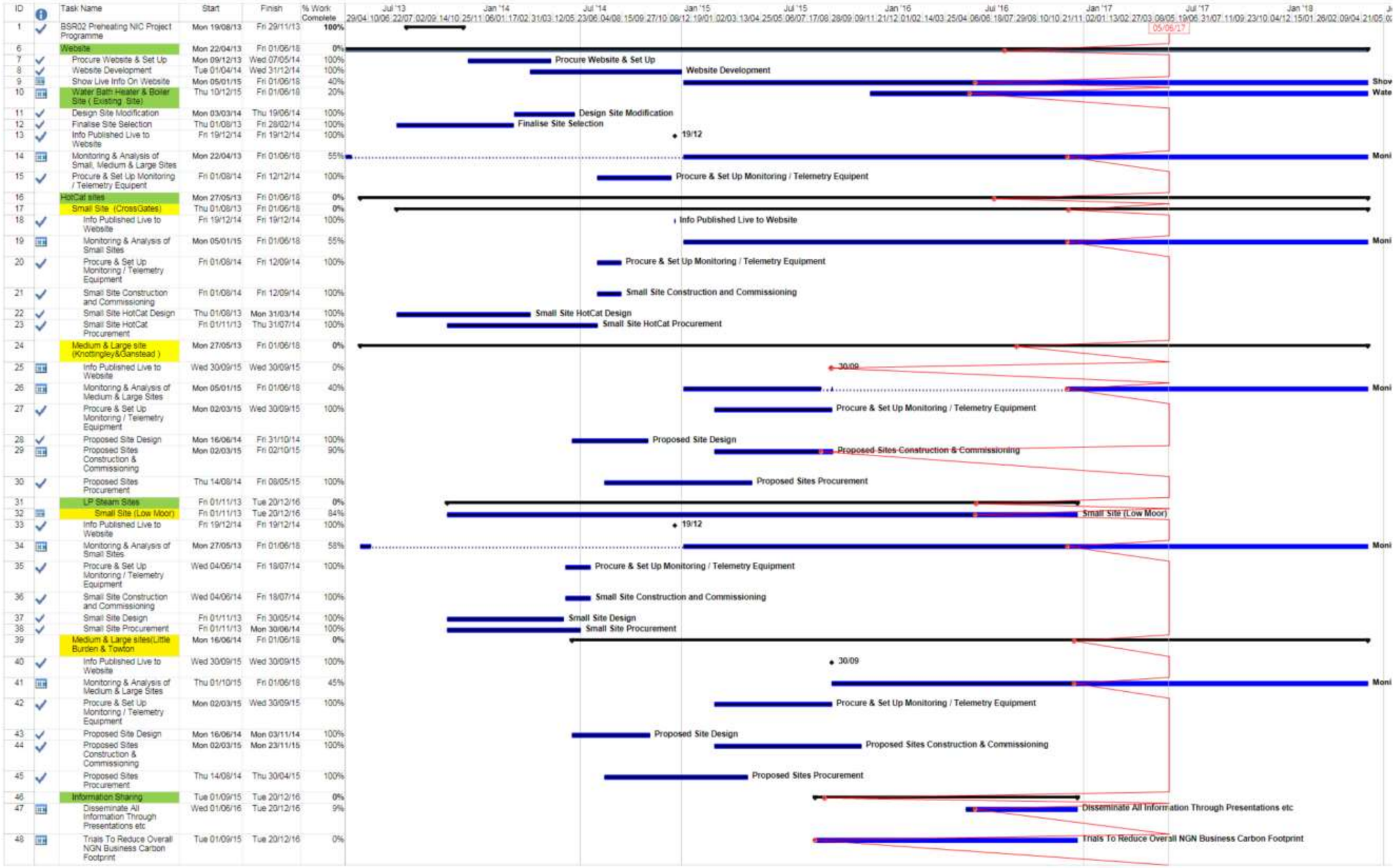
Position: Regulation Director

Signature: 

Date: 7 June 2017

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	Fri 01/06/18	0%
7	Procure Website & Set Up	Mon 09/12/13	Wed 07/05/14	100%
8	Website Development	Tue 01/04/14	Wed 31/12/14	100%
9	Show Live Info On Website	Mon 05/01/15	Fri 01/06/18	40%
10	Water Bath Heater & Boiler Site (Existing Site)	Thu 10/12/15	Fri 01/06/18	20%
11	Design Site Modification	Mon 03/03/14	Thu 19/06/14	100%
12	Finalise Site Selection	Thu 01/08/13	Fri 28/02/14	100%
13	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
14	Monitoring & Analysis of Small, Medium & Large Sites	Mon 22/04/13	Fri 01/06/18	55%
15	Procure & Set Up Monitoring / Telemetry Equipent	Fri 01/08/14	Fri 12/12/14	100%
16	HotCat sites	Mon 27/05/13	Fri 01/06/18	0%
17	Small Site (CrossGates)	Thu 01/08/13	Fri 01/06/18	0%
18	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
19	Monitoring & Analysis of Small Sites	Mon 05/01/15	Fri 01/06/18	55%
20	Procure & Set Up Monitoring / Telemetry Equipment	Fri 01/08/14	Fri 12/09/14	100%
21	Small Site Construction and Commissioning	Fri 01/08/14	Fri 12/09/14	100%
22	Small Site HotCat Design	Thu 01/08/13	Mon 31/03/14	100%
23	Small Site HotCat Procurement	Fri 01/11/13	Thu 31/07/14	100%
24	Medium & Large site (Knottingley&Garnstead)	Mon 27/05/13	Fri 01/06/18	0%
25	Info Published Live to Website	Wed 30/09/15	Wed 30/09/15	0%
26	Monitoring & Analysis of Medium & Large Sites	Mon 05/01/15	Fri 01/06/18	40%
27	Procure & Set Up Monitoring / Telemetry Equipment	Mon 02/03/15	Wed 30/09/15	100%
28	Proposed Site Design	Mon 16/06/14	Fri 31/10/14	100%
29	Proposed Sites Construction & Commissioning	Mon 02/03/15	Fri 02/10/15	90%
30	Proposed Sites Procurement	Thu 14/08/14	Fri 08/05/15	100%
31	LP Steam Sites	Fri 01/11/13	Tue 20/12/16	0%
32	Small Site (Low Moor)	Fri 01/11/13	Tue 20/12/16	84%
33	Info Published Live to Website	Fri 19/12/14	Fri 19/12/14	100%
34	Monitoring & Analysis of Small Sites	Mon 27/05/13	Fri 01/06/18	58%
35	Procure & Set Up Monitoring / Telemetry Equipment	Wed 04/06/14	Fri 18/07/14	100%
36	Small Site Construction and Commissioning	Wed 04/06/14	Fri 18/07/14	100%
37	Small Site Design	Fri 01/11/13	Fri 30/05/14	100%
38	Small Site Procurement	Fri 01/11/13	Mon 30/06/14	100%
39	Medium & Large sites(Little Burden & Towton	Mon 16/06/14	Fri 01/06/18	0%
40	Info Published Live to Website	Wed 30/09/15	Wed 30/09/15	100%
41	Monitoring & Analysis of Medium & Large Sites	Thu 01/10/15	Fri 01/06/18	45%
42	Procure & Set Up Monitoring / Telemetry Equipment	Mon 02/03/15	Wed 30/09/15	100%
43	Proposed Site Design	Mon 16/06/14	Mon 03/11/14	100%
44	Proposed Sites Construction & Commissioning	Mon 02/03/15	Mon 23/11/15	100%
45	Proposed Sites Procurement	Thu 14/08/14	Thu 30/04/15	100%
46	Information Sharing	Tue 01/09/15	Tue 20/12/16	0%
47	Disseminate All Information Through Presentations etc	Wed 01/06/16	Tue 20/12/16	9%
48	Trials To Reduce Overall NGN Business Carbon Footprint	Tue 01/09/15	Tue 20/12/16	0%



Project: BSR02 Preheating NIC Projec
Date: Mon 05/06/17

Task · Split · Milestone · Summary · Project Summary · External Tasks · External Milestone · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Progress · Deadline