standard gas

CHP Ready Assessment

Scottow Enterprise Park

1st May 2025

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CHP Ready Assessment

Scottow Enterprise Park

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Acronyms and Abbreviations

Name	Description
CHP	Combined Heat and Power
SRF	Solid Recovered Fuels
RDF	Refuse Derived Fuels
ATT	Advanced Thermal Treatment
EA	Environment Agency
SG	Specified Generators
MCP	Medium Combustion Plant
BAT	Best Available Techniques
ELV	Emission Limit Values
IED	Industrial Emissions Directive

1. INTRODUCTION

This document has been prepared by Sol Environment Ltd on the behalf of Standard Gas SG No.1 Limited (hereafter referred to as 'Standard Gas or the 'Applicant') for the proposed operation of an synthesis fired CHP facility located at Hanger 2, Lamas Road, Badersfield, Scottow, Norfolk, NR10 5FB (National Grid Reference: TG 26104 23008).

This document supports the Environmental Permit application for the site and associated processes.

The document is a desk-based study detailing the demand and initial feasibility for exportation of heat from the proposed development.

Standard Gas's pyrolysis technology is a proven Advanced Thermal Treatment plant which thermochemically produces cracked and cleaned syngas from pre-processed non-hazardous solid wastes, principally Refuse Derived Fuel (RDF) and other similar combustible material to operate a series of gas fired CHP engines to generate power and provide heat to the wider Scottow Enterprise Park.

The Installation has been designed to process approximately 50,000 tonnes of pre-processed non-hazardous waste per annum (energy mass balance of the plant assumes an average of 6 tonnes per hour with a typical GCV of 11 – 15MJ/kg) to generate approximately 5MWe of renewable electricity and approximately 2.5MWth of heat.

The Advanced Thermal Treatment (ATT) pyrolysis process will produce a clean 'End of Waste' synthesis gas and be permitted by the Environment Agency (EA) as a Combustion Activity with the CHP engines being regulated as Medium Combustion Plant (MCP) and Specified Generators (SG) and operated in accordance with the Environmental Permitting (England and Wales) Regulations 2018 (As Amended).

The total aggregate thermal capacity of the plant is 18 – 20MWth and as such is below 20MWth and is therefore not defined as being an Article 14 facility under the EU Energy Efficiency Directive. Therefore a cost-benefit analysis in accordance with Part 2 of Annex IX is not required to be carried out . Accordingly this CHP assessment provides a BAT assessment only and does not provide a Cost Benefit Analysis.

The Plant will have the potential capacity to export up to 2.5 MWth of heat. The maximum heat capacity will be subject to the requirements of the heat consumers and confirmed during the detailed feasibility stages, should a commercially viable heat offtake be identified.

This report identifies potential commercially viable existing heat consumers as well as prospective heat consumers within a 10km study area. The design of the plant will be aligned with BAT guidance given in 'CHP Ready Guidance for Combustion and Energy from Waste Power Plants'.

1.1 Objective

The principal objectives of this CHP assessment are as follows.

- Prepare a CHP Assessment in line with the Environment Agency (EA) guidance CHP Ready Guidance for Combustion and Energy from Waste Power Plants', which will support an Environmental Permit application;
- Provide a technical description of the proposed Facility and heat export infrastructure; and
- Calculate heat demands based on identified heat consumers and assess the feasibility of connecting identified heat consumers to the network.

2. TECHNOLOGY DESCRIPTION

2.1 Plant Design and Configuration

Standard Gas have developed a facility that will produce clean gas for the purposes of generating renewable heat and power from pre-processed non-hazardous wastes. The Installation has been designed to process approximately 6 tonnes per hour of pre-prepared non-hazardous wastes, which will be thermally treated / pyrolysed at elevated temperatures to produce a cracked and clean synthetic gas that satisfies the EU Industrial Emissions Directive Article 42(1) requirements.

Accordingly, the resultant syngas will be purified to the extent that it will no longer be classed as a waste, and its combustion will result in emissions no higher than those resulting from the combustion of natural gas.

The relevant listed activity for the Installation is defined by Section 1.2 Part A(1)(f)(iv). All emissions from the combustion activities shall be in accordance with the MCP Directive, noting that Chapter IV of the Industrial Emissions Directive (IED) does not apply where Article 42 (1) is achieved – deeming syngas as no longer a waste and causing emissions no higher than combustion of natural gas.

Under Abnormal Operating Conditions it is anticipated that the Installation will be required to mirror the Emission Limit Values (ELV) prescribed by Chapter IV of the IED.

The CHP facility is an anchor development for the regeneration of the wider Scottow Enterprise Park and will be the source all of all heat and power for the proposed new developments.

All feedstock will either be delivered to site loose or in pre-prepared sealed bales. Bales will either be stored externally within a designated sealed storage area or internally within the main processing building. All loose waste will be stored internally within a dedicated bay within the main processing building. All feedstock will be inspected via a dedicated quality assurance site operative. When ready for processing, the feedstock will be loaded into a sealed and contained hopper, de-baled if required, and pre-processed via screening equipment. Once processed, the feedstock will be transferred into the primary pyrolysis retort where it undergoes thermal conversion and processed into syngas. In order to ensure that there is no secondary formation / reformation of tars and oils within the syngas, the syngas is then passed through multiple heat exchangers to elevate and thermally crack and to ensure the effective thermal decomposition of all long chain hydrocarbons. Once cracked, the syngas is quenched and rapidly cooled to remove any residual carbon and solids in the gas stream.

Any residual contamination in the syngas such as acid gases, halides and particulates are fully scrubbed from the gas using conventional ‘wet’ scrubbing abatement techniques. The elevated temperature of the gas cracking and quenching stages ensures that condensable hydrocarbons (tars and oils) do not reform in the gas and that the downstream gas cleaning system are effective in conditioning the gas.

The mineral fraction/inert material (ash, glass, stone etc) present within the waste is retained within the carbon char stream and removed from the pyrolysis system via a water cooled sealed screw conveyor and stored in a sealed container. The pyrolysis char is a high carbon, low ash material that is intended to be sold into the construction sector and used as a low carbon aggregate additive product. Any ash or particulate that may be entrained within the syngas will be removed through the syngas abatement system.

The syngas is then cooled further to below the dew point and any condensate collected. The condensate is low volume, clean and odour free. The condensate is discharged to a sealed vessel and returned into the scrubber liquor systems and reused within the process or collected and transferred offsite for offsite disposal at a suitably qualified third-party treatment process, as required. Syngas quench and scrubber liquors are all cooled using a non-contact heat exchanger connected to a evaporative cooling system and returned and recirculated through the process.

All syngas is monitored in real time using gas chromatography to ensure that the CV and gas composition are consistent with the requirements of the gas engines. The clean syngas is then combusted within the two Jenbacher type Gas Engines for the production of renewable electricity and heat.

During start-up scenarios, the pyrolysis plant is brought up to temperature using LPG auxiliary fuel supplied from an onsite tank farm. Once at temperature, the pyrolysis plant is operated using clean synthesis gas.

All electricity produced by the CHP engines is exported to local distribution network via the onsite 11kV transformer.

The Installation will have a gross electrical output of approximately 5MWe output post the parasitic load. Therefore, the facility would have the capacity to export approximately 5MWe to a local electricity distribution network.

Simultaneously, the Installation is designed with capability to export up to 2.5MWth of heat to local consumers. The maximum heat capacity will be subject to the demands of the heat consumers and confirmed during the detailed design stage.

3. HEAT DEMAND INVESTIGATION

The plant has been designed with the potential to export heat if, and when a commercially viable customer becomes available. Until then, all heat from the plant is optimised for power generation, with excess heat rejected via the evaporative cooling systems.

A Heat and Mass Balance spreadsheet can be found in Annex 1.

A review of the existing and future potential energy demands within the vicinity of the facility has been undertaken within a 10 km radius of the site. The potential heat consumers have been identified using heat mapping tools and visual inspection of maps.

The viability of connecting the proposed development with potential heat users has been considered on the basis of export capacity and distance from the site. Where present, larger heat consumers and those in close proximity to the site have been prioritised ahead of other consumers. Unfortunately, based on the initial study, no large scale users have been identified in the immediate surroundings of the site with no existing heat distribution networks known to be available or proposed.

3.1 National Heat Map

Heat consumers have been identified using publicly available data in the National Comprehensive Assessment, heat mapping tools and satellite imagery. Identified existing local heat consumers include many industrial estates located nearby surrounding the Facility.

The Department for Business, Energy and Industrial Strategy (BEIS) UK CHP Development Map [1] has been utilised to carry out a review of potential heat loads within 10km of the site.

The table below shows a breakdown of the heat demand of all sectors and building types within a 10km radius of the site.

Table 3.1 Local Heat Demand within 10km radius by Sector

Sector	Total MWh	Share
Communications and Transport	292,766	37.14%
Commercial Offices	3,252	0.41%
Domestic	460,906	58.47%
Education	5,185	0.66%
Government Buildings	365	0.05%
Hotels	2,940	0.37%
Large Industrial	0	0%

[1] https://chptools.decc.gov.uk/developmentmap

Health	692	0.09%
Other	356	0.05%
Small Industrial	16,271	2.06%
Retail	4,584	0.58%
Sport and Leisure	176	0.02%
Warehouses	713	0.09%
District Heating	0	0%
Total Heat Load in Area	**788,214**	**100%**

The primary sector for heat demand within the 10km radius of the site is domestic household use, requiring 460,906 MWt and making up 58.47% of the total share, the second highest rating is for communications and transport, needing 292,776 MWt (37.14% of the total share).

Including domestic properties within a heat network comes with challenges due to the high costs of replacing existing heating systems, the highly variable daily and seasonal nature of the heat demand and the complexities connecting a number of small heat consumers to a network. However, large new scale high density housing developments can represent a potential viable option should they be developed within a commercially viable distance to the site.

3.2 Large Heath Consumers

There are no Large Heat Loads within 10km of the site, determined through using the DBEIS UK CHP Development Map.

3.3 Feasibility of Export to Existing Residential/Domestic Consumers

The facility will have an export capacity of approximately 18 – 20MWth for CHP operation. Therefore, it is possible for the development to supply all of the available heat to the identified domestic / residential heat consumers within 10km.

However, given the high costs of replacing existing heating systems and the distance from the site creating physical constraints, the supply of all of the identified heat users is not considered a viable option.

3.4 Prospective Developments

A review of potential receptors within 2km of the site has been carried out and shown in Table 3.2 and Figure 3.1 below.

An analysis of the Local Planning Authorities Planning Portal was undertaken as part of this assessment, to identify any prospective developments that would have the potential to be a viable heat consumer. There are no prospective developments that would have the potential to be viable heat consumers in the vicinity of the site.

An estimate of the potential heat demands from the specific heat user types has been provided through the use of the Chartered Institution of Building Services Engineers (CIBSE) Guide F (Efficiency in Buildings) has been used. The heat demands for residential developments have been calculated based on a benchmark figure of 65kWh/m^2/year per property and 55kWh/m^2/year per commercial property.

The CIBSE Guide provides good practice benchmark figures based on the energy performance of existing buildings. In the CIBSE Guide, loads are expressed in terms of kWh per square metre of floor space per year of fossil fuel use and for the purpose of this assessment natural gas is typically assumed.

The annual energy demand has been estimated based on an estimate of the floor space of the developments. Converting natural gas use to actual heat loads (which can be provided by a hot water distribution system) requires an assumption of gas-fired boiler efficiency. In this study, an efficiency of 85% is assumed, based on industry norms.

Table 3.2 Potential Sources for Potential Heat Export

Receptor	Direction and Distance from site	Estimated Heat Demand (MWh/yr)	Estimated Average Heat Demand (MW)
Wider Scottow Enterprise Park	All directions – adjacent to the site	14154.68	1.62
Hautbois Hall Wedding and Events	South West – approximately 200m	128.12	0.01
HMP Bure Prison	North west – approximately 200m	2508.12	0.29
The Douglas Bader School	North West – approximately 450m	431.23	0.05
Residential properties of Badersfield	North West – approximately 500m	24549.96	2.80
Residential properties of Lamas	West – approximately 1.3km	10225.80	1.17
Oak Grove Renewable	North – approximately 1.3km	1546.35	0.18
Residential properties of Scottow	East – approximately 1.85km	5921.48	0.68
North Walsham Rugby Club	East – approximately 1.9km	20.83	0.002
Residential properties of Great Hautbois Road	South – approximately 1.9km	1055.63	0.12

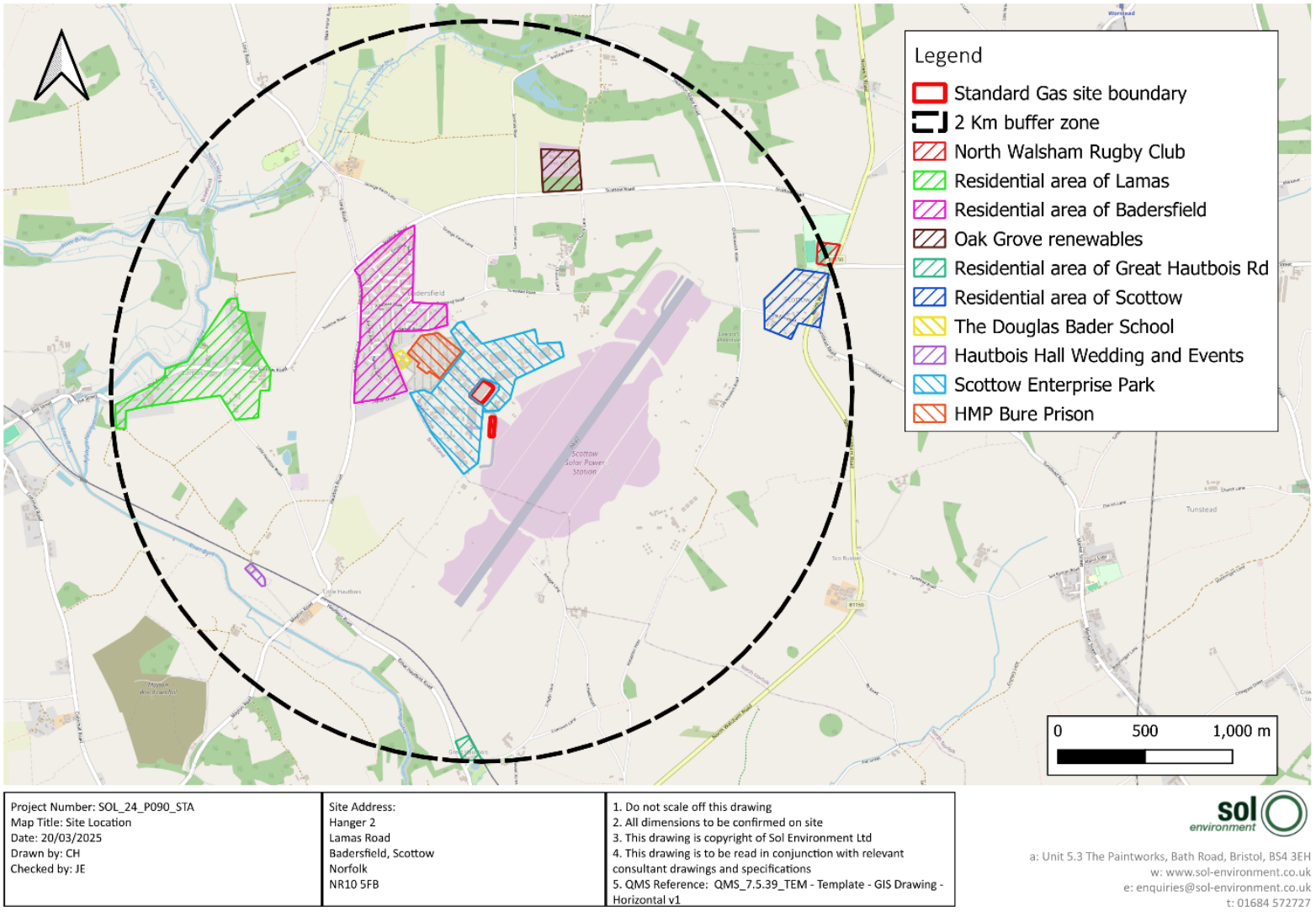

Figure 3.1 Potential sources for Potential Heat Export within a 2km radius from Site

3.5 Feasibility of Export

The Site is located within Hangar 2 of the former airfield at RAF Coltishall with a few surrounding industrial units as part of the Scottow Enterprise Park. This lends itself to having a feasible and economically viable heat distribution network developed to serve some consumer sites.

The closest potential heat user is considered to be the neighbouring businesses within the Scottow Enterprise Park.

Although the reported heat use for the surrounding businesses is considered to be quite low, the proximity to the site means that it is both technically viable and feasible to directly supply heat via a direct local connection. Given that the exact heat and energy requirements of the surrounding Scottow Enterprise Park are not known, it is proposed that further detailed technical feasibility is carried out to fully understand the viability of a direct heat supply connection.

One of the primary heat demands of the area is HMP Bire Prison which houses 650 prisoners across 7 units. Although using the CIBSE guide for Table 3.2 suggests a low heat load, it is known that prisons consume large amounts of heat and energy. Due to the proximity of the site, it would also be technically viable and feasible to directly supply heat via a direct local connection. Standard Gas will also be carrying out a detailed technical feasibility study to understand the viability of this connection.

Another primary heat demand of the area is residential areas including Badersley and Scottow, all of which lie within a 5km radius of the proposed development. Given that all housing is ‘traditionally’ using gas boilers and that no pre-existing heat distribution infrastructure is available within the area, the connection and supply of heat to this development is not considered viable.

In conclusion, the nearest viable heat connection is considered to be businesses within the wider Scottow Enterprise Park and HMP Bire Prison. These sites will be subject to further detailed technical evaluation to fully understand their heat requirement and further detailed feasibility completed.

4. CONCLUSION

An assessment of all potential domestic and commercial heat users within 10km distance from the site has been carried out using The Department for Business, Energy and Industrial Strategy (BEIS) UK CHP Development Map.

This study has concluded that the nearest viable heat connection is considered to be businesses within the wider Scottow Enterprise Park and HMP Bire Prison. These sites will be subject to further detailed technical evaluation to fully understand their heat requirement and further detailed feasibility completed.

Given that the plant has been designed as a CHP facility that is capable of supplying and exporting renewable / low carbon heat, this document will be supplemented with further studies assessing the economic business case and local market for the construction of suitable heat distribution infrastructure.

In addition, this report will be subject to ongoing review to ensure that any 'new' heat users or distribution infrastructure identified or constructed within the vicinity of the plant, will be reviewed every 4 years to identify and assess the potential commercial and technical viability for the heat export to the local area.

Due to the site being below the 20MWth threshold defined under Article 14 of the Energy Efficiency Directive, a formal cost benefit analysis is not required and has not been considered further.

APPENDIX A HEAT AND ENERGY MASS BALANCE SPREADSHEET

April 2025

STANDARD GAS SG NO.1 LIMITED

BRIEFING NOTE – HMEB Summary

SCOTTOW ENTERPRISE PARK

Parameters[1]	Value
Feed Flow (kg/hr)	6000
Dry Feed - Biogenic	40
Dry Feed - Plastic	13
Dry Feed - RDF	47
Moisture	25
Feed LHV - Wet (MJ/kg)	14.89
HHV (MJ/kg)	16.65
Ash Flow (kg/hr)	482.05
Ash Density (kg/m³)	481.00
Char Flow (kg/hr)	353.77
Char Density (kg/m³)	128.00
Char / Ash Mixture Flow (kg/hr)	835.82
Char / Ash Mixture Density (kg/m³)	221.94
Char / Ash Cooling (kW)	163.63
F2001 Heat (MW)	2.53
Electrical (MW) based on 38% Conversion - Min	6.3
Electrical (MW) based on 38% Conversion - Max	6.5
Export Mass Flow (kg/hr)	2601
Export Volume Flow (m³/hr)	2503
Export - Energy Content (MJ/m³)	24.7
Export - Total Thermal (MW)	17.2
Export - Gross Capacity (MW)	6.3
Calculated pH	6.9
pH Control - Required NaOH (kg/hr)	0.0[2]

[1] Based on 8,000 hours, 6 tonnes per hour, 48,000 tonnes per annum.
[2] Based on 25% w/w aqueous solution

H_2S Removal - Hydrogen Peroxide (l/hr)	2.7[3]
Comp Mole Frac (Oxygen)	0.03%
Comp Mole Frac (CO)	24.33%
Comp Mole Frac (CO_2)	15.07%
Comp Mole Frac (Nitrogen)	0.61%
Comp Mole Frac (Hydrogen)	17.22%
Comp Mole Frac (Methane)	21.02%
Comp Mole Frac (Acetylene)	3.44%
Comp Mole Frac (Ethylene)	7.65%
Comp Mole Frac (Ethane)	0.76%
Comp Mole Frac (Propene)	0.64%
Comp Mole Frac (Propane)	0.23%
Comp Mole Frac (n-Butane)	1.18%
Comp Mole Frac (Cyclopentane)	0.51%
Comp Mole Frac (i-Pentane)	0.02%
Comp Mole Frac (n-Pentane)	0.17%
Comp Mole Frac (Benzene)	0.06%
Comp Mole Frac (Cyclohexane)	0.17%
Comp Mole Frac (n-Hexane)	0.30%
Comp Mole Frac (n-Octane)	0.01%
Comp Mole Frac (M-PH-Ketone)	0.01%
Comp Mole Frac (H_2O)	6.40%
Comp Mole Frac (SO_2)	0.18%
Comp Mole Frac (H_2S)	0.00%

[3] Based on 35% w/w aqueous solution