CHP Ready Assessment

Selby Energy Recovery Plant

Energy Ventures No1 Ltd

14th August 2025

Project No.: SOL_24_P076_PCM

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Document Details	
Document Title	CHP Ready Assessment
Document Subtitle	Selby Energy Recovery Plant
Project No.	SOL_24_P076_PCM
Date	14th August 2025
Version	QMS_7.5.38_TEM – Template – Report Long Form – New Style (Perm) v5
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Client Name	Energy Ventures No1 Ltd

Document History				
Version	Comments	Date	Author Initials	Reviewer Initials
I1	First Issue to the Environment Agency	14/08/2025	CH	SR

Signature Page

14th August 2025

CHP Ready Assessment

Selby Energy Recovery Plant

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Acronyms and Abbreviations

Name	Description
CHP	Combined Heat and Power
RDF	Refuse Derived Fuels
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 on the behalf of Energy Ventures No.1 Ltd (the 'Applicant' or the 'Operator') by Sol Environment Ltd for the proposed operation of an energy recovery plant located at Aviation Road, Sherburn in Elmet, Leeds, LS25 6NF (Grid Reference: SE 51183 33256).

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.

The proposed development is an energy recovery facility which has been designed to recover energy from Refuse Derived Fuel (RDF) and mixed municipal waste feedstocks using combustion, specifically for the production of electricity. The facility will produce a high temperature flue gas which is then used to raise steam and generate electricity, through steam cycle turbine generation.

The facility is designed to combust pre-prepared waste feedstocks for produce heat to raise steam in a conventional tube boiler for subsequent utilisation in a steam turbine for the production of renewable electrical with a gross electrical output of 25MWe.

The plant has been designed to produce a gross electrical generation of 25MWe. Approximately 13MWe will be exported to the National Grid, 3MWe will be used by the plant as parasitic load and 2MWe will be exported to the neighbouring and co-located Kingspan facility via private connection. The remaining 6MWe will be available for a future hydrogen plant, which will be addressed via a separate permit application. There will also be 3MWth available for export to the neighbouring Kingspan facility.

The Installation has been designed to process a maximum of 240,000 tonnes per annum of pre-prepared RDF and mixed municipal waste feedstocks.

Energy Ventures already have an agreement in place with the co-located Kingspan facility to receive electricity and heat from the proposed development. However, this report identifies other 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

The proposed facility will utilise a conventional moving grate combustion system to recover energy from refuse-derived fuel (RDF) and mixed municipal waste. The facility is designed to combust pre-prepared waste feedstocks for produce heat to raise steam in a conventional tube boiler for subsequent utilisation in a steam turbine for the production of renewable electrical with a gross electrical output of 25MWe.

RDF fuel will be delivered directly to the Fuel Reception Hall, either in baled or loose form. Walking floor HGV's will reverse into the unloading lane and unload directly into the reception bunker, during which a visual inspection will take place. Additionally, baled RDF may be delivered to site and stored externally in the baled waste storage area in order for the plant to carry on operating during extended public and national holiday periods. A bunker crane will be utilised to move, mix and feed the feedstock into the feeding hopper, which subsequently automatically calls for more RDF when required.

The site will have a single incineration and combustion line comprising a reciprocating grate. RDF will be fed to the grate from the feed hopper. Primary combustion air is fed under the grate and secondary combustion air fed above the grate to ensure complete combustion. The reciprocating bars spread the RDF and cause it to travel down the grate at a controlled rate to ensure complete combustion.

Heat is recovered from the hot flue gases produced in the combustion chamber via a steam boiler, producing 111 tonnes per hour of superheated steam at 44 bar pressure at 400^{o}C.

The superheated steam then passes to a single condensing steam turbine-generator to generate gross electrical generation of 25MWe.

Flue gas cleaning and pollution control consists of Selective Non-Catalytic Reduction (SNCR) through urea injection, a dry scrubbing system incorporating sodium bicarbonate injection for acid gas neutralisation, activated carbon powder injection for absorption and removal of heavy metals, dioxins, VOCs and other harmful substances and a fabric filter for particulates removal.

Bottom ash (IBA) from the end of the grate is quenched and conveyed to a bunker storage area where it is mixed with boiler ash prior to export offsite for recovery. APC residue is exported for disposal as hazardous waste.

3. HEAT DEMAND INVESTIGATION

The plant has been designed with the ability to export heat. Energy Ventures have an agreement in place with the co-located Kingspan facility to receive electricity (2MWe) and heat (3MWth) from the proposed development. All other electricity not used by the plant will be exported to the National Grid and utilised by the proposed neighbouring hydrogen plant. Any remaining 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.

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	17	0.06%
Commercial Offices	232	0.83%
Domestic	8,716	31.35%
Education	0	0%
Government Buildings	0	0%
Hotels	0	0.07%
Large Industrial	10,787	38.81%

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

Health	0	0%
Other	0	0%
Small Industrial	7,538	27.12%
Prisons	0	0%
Retail	74	0.27%
Sport and Leisure	0	0%
Warehouses	414	1.49%
District Heating	0	0%
Total Heat Load in Area	**27,798**	**100%**

The primary sector for heat demand within 10km radius of the site is large industrial use, requiring 10,787 MWh and making up 38.81% of the total share, the second highest demand is from domestic household use, requiring 8,716 MWh (31.35% 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 in the future.

3.2 Large Heat Consumers

There are no Large Industrial 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 a maximum export capacity of approximately 3 MWth. All other heat is required by the plant.

Therefore, it is possible for the development to supply some of the available heat to the identified large industrial / domestic 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	Est Heat Demand (MWh/yr)	Est Average Heat Demand (MW)
Kingspan Insulation	North – approximately 15m	2587.31	0.29
Sherburn Enterprise Park	All directions – adjacent to the site	72341.83	8.25
Residential properties of Sherburn in Elmet	West – approx. 612m	115,060.92	13.13
Sherburn High School	South West – approx. 1,899m	2,914.12	0.33
Athelstan Community Primary School	South West – approx.. 1,682m	1,128.39	0.12
Sherburn Hungate Community Primary School	North West – approx. 1,622m	918.39	0.1
Residential properties of Little Fenton	West – approx. 1.3km	10,324.38	1.17
Residential properties of South Milford	North – approx. 1.3km	13,451.23	1.53
British Gypsum	East – approximately 1.85km	6,706.37	0.76

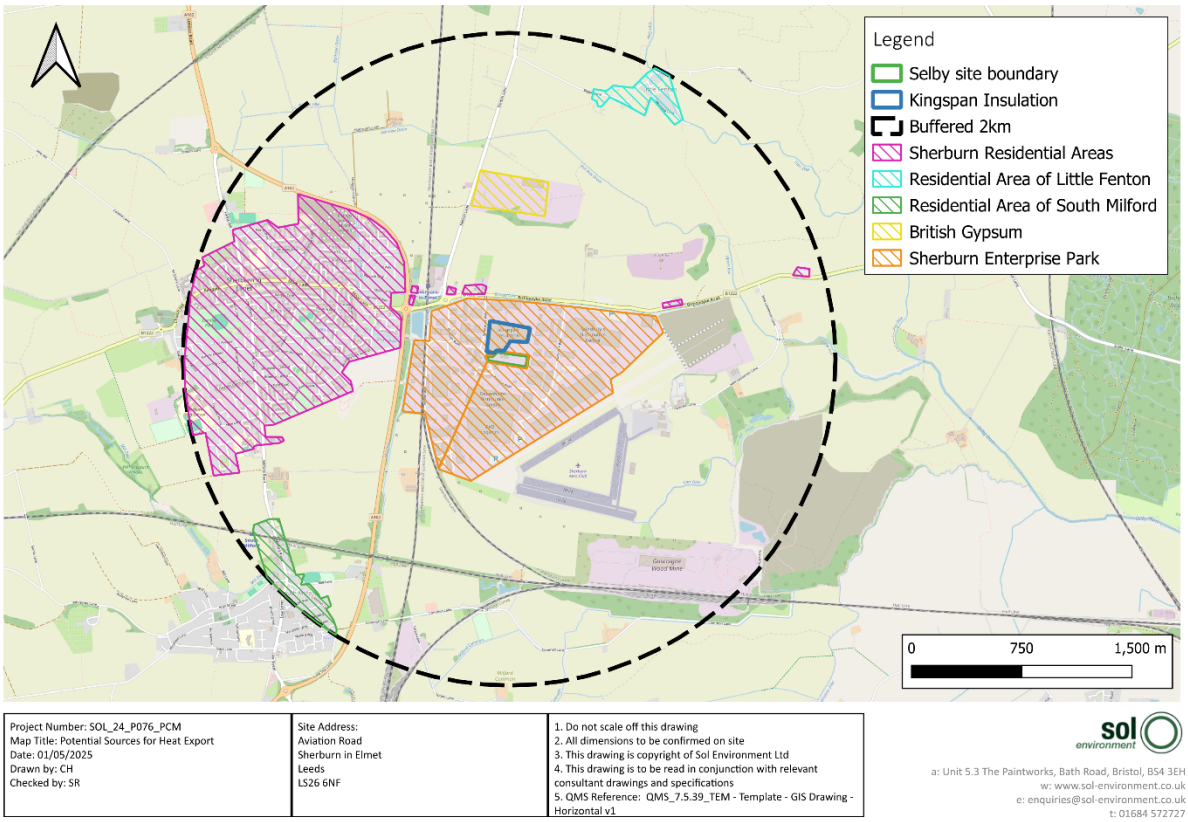

Figure 3.1 – Potential Sources for Potential Heat Export within a 2km radius from Site

3.5 Feasibility of Export

The site is located on Aviation road within the centre of the Sherburn Enterprise Park. The surrounding industrial units provide a feasible and economically viable opportunity to develop a heat distribution network to serve potential surrounding consumer sites.

As previously mentioned, the site have an agreement in place with the co-located Kingspan facility to receive electricity (2MWe) and heat (3MWth) from the proposed development. The design of the private wire is currently being determined and will be shared with the Environment Agency once available.

For the feasibility of additional future export, the reported heat use for the surrounding land use is considered to be quite high and 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 Sherburn 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.

Another primary heat demand of the area is residential areas of Sherburn in Elmet, Little Fenton and South Milford, all of which lie within a 2km 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 Kingspan which is already agreed and in the design stage. Any future 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.

The study has concluded that the nearest viable heat connection is considered to be Kingspan which is already agreed and in the design stage. Any future 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 or by Kingspan, 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 agreement with Kingspan and the lack of any further viable heat users at this time, a formal cost benefit analysis is not required and has not been considered further.

APPENDIX A HEAT AND ENERGY MASS BALANCE

Balance of Plant - PCML Kingspan

Choose Column for Balance of

- Kolom C
- Kolom D
- Kolom E
- Kolom F
- Kolom G
- Kolom H
- Kolom I
- Kolom J

Biomass Boiler in		
Fuel input	31,255	kg/h
LHV	11	MJ/kg
Energy	95.5	MWth
Efficiency	*84.3%*	

Flue gas boiler out		
T	190	°C
flow	218,782	kg/h
	173,636	mn3/h
Energy	11.4	MWth

Live Steam boiler out		
T	400.0	°C
p	44	bara
flow	110.93	t/h
Enthalpy	3,207	kJ/kgK
Energy	98.8	MWth

Steam Ejector		
Flow	1.11	t/h
Blowdown and Sootblowing		
Flow	0.83	t/h

Live Steam Turbine in		
T	395.0	°C
p	42	bara
flow	108.79	t/h
Enthalpy	3199	kJ/kg
Energy	96.7	MWth

Boiler

Turbine

GEN

Gross Power Production	**25,000**	kWe
Parasitic Load	3,000	kWe
Kingspan Private Wire (up to)	3,000	kWe
Hydrogen plant	6,000	kWe
Step up Transformer Loss	195	kWe
Net power out	**12,805**	kWe

Boiler Feedwater In		
T	140.5	°C
p	55	bara
flow	110.93	t/h
Enthalpy	595	kJ/kg
Energy	18.3	MWth

Feedwater preheater 1

FWPH1 In		
T	140.5	°C
p	54	bara
flow	110.93	t/h
Enthalpy	595	kJ/kg
Energy	18.3	MWth

Condensate FW PH 1		
T	150.0	°C
p	10	bara
flow	0.00	t/h
Enthalpy	633	kJ/kg
Energy	0.0	MWth

Turbine Bleed 1		
T	224.4	°C
p	10	bara
flow	4.56	t/h
Enthalpy	2886	kJ/kg
Energy	3.7	MWth

Turbine Outlet		
T	40.3	°C
p	0.075	bara
flow	86.09	t/h
Enthalpy	2225	kJ/kg
Energy	53.2	MWth

FW Pump In		
T	138.5	°C
p	3.5	bara
flow	110.93	t/h
Enthalpy	583	kJ/kg
Energy	18.0	MWth

Turbine Bleed 2		
T	145.3	°C
p	4.19	bara
flow	8.58	ton/h
Enthalpy	2737	kJ/kg
Energy	6.5	MWth

Turbine Bleed 3		
T	98.56	°C
p	0.96	bara
flow	9.56	t/h
Enthalpy	2523	kJ/kg
Energy	6.7	MWth

Steam Ejector		
Flow	1.11	t/h

Deaerator

T 138.50 °C

p 3.50 bara

Condensate preheater

ACC

Deaerator condensate flow		
T	95.7	°C
p	7	bara
flow	96.8	t/h
Enthalpy	401	kJ/kg
Energy	10.78	MWth

ACC Energy Removal	**49.2**	MWth

Make-up Water		
T	15.0	°C
p	4	bara
flow	1.0	t/h
Enthalpy	63	kJ/kg
Energy	0.02	MWth

3rd Party Steam Supply		
T	218	°C
p	10	bara
flow	4.56	t/h
Enthalpy	2872	kJ/kg
Energy	3.6	MWth

Energy supplied to 3rd Party	3.0	MWth

3rd Party Condensate Return		
T	120	°C
p	4	bara
flow	4.56	t/h
Enthalpy	504	kJ/kg
Energy	0.64	MWth

Case 6.6 -11MJ/kg LHV + 3MW heat offtake

Project	Kingspan	
Date	########	
Rev	6.6	*Matching LLT Boiler and Siemens Turbine, updated power distribu*
Author	MGR	

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