SPALDING ENERGY EXPANSION LIMITED

SPALDING ENERGY EXPANSION CHP ASSESSMENT

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LIST OF ABBREVIATIONS

°C	degrees Celsius
CCGT	combined cycle gas turbine
CHP	combined heat and power
CHPA	Combined Heat and Power Association
CO_2	carbon dioxide
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EU ETS	European Union Emissions Trading Scheme
GWe	gigawatt electrical
ha	hectares
HP	high pressure
HRSG	heat recovery steam generator
km	kilometres
LP	low pressure
MW	megawatt
MWe	megawatt electric
MWth	megawatt thermal
NHS	National Health Service
PB	Parsons Brinckerhoff
SECL	Spalding Energy Company Limited
SEE	Spalding Energy Expansion
SEEL	Spalding Energy Expansion Limited
UK	United Kingdom

EXECUTIVE SUMMARY

The proposed Spalding Energy Expansion (proposed SEE) involves the construction of a combined cycle gas turbine (CCGT) power plant that will provide up to 900 megawatts (MW) (nominal) of power generation capacity. The proposed SEE will be situated on land adjacent to the existing Spalding Power Station, an 880 MW CCGT plant in Spalding, operated by Spalding Energy Company Limited (SECL). The existing plant will, hereafter, be referred to as the existing SECL plant.

This combined heat and power (CHP) feasibility assessment has been undertaken by Parsons Brinckerhoff (PB) on behalf of Spalding Energy Expansion Limited (SEEL) for the proposed SEE only. The report has been prepared as part of a requirement by the UK Government for any proposals for new power projects to be accompanied by an assessment of the potential for CHP in the vicinity of a proposed site in accordance with the assessment methodology outlined in the Department of Trade and Industry (now Department for the Energy and Climate Change or "DECC") guidance document "Guidance on background information to accompany Notifications under Section 14(1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989 December 2006".

A structured and pro-active approach has been applied to ensure that the proposed SEE has undertaken an appropriate assessment of CHP opportunities. The report includes:

- an explanation for SEEL's choice of the proposed SEE site for the CCGT and consideration of the site for CHP based on local knowledge and experience;
- a summary of the work undertaken to identify CHP opportunities and the work done to date to explore these; and
- details of the CHP schemes being pursued.

The immediately surrounding land use to the proposed SEE is predominantly industrial, with some residential properties located further afield. The wider area is predominantly rural. The local industry is mainly light and the nearest industrial heat user per DEFRA's heat map is some 19 km away, which is deemed to be too far to be viable.

Utilising SEEL's local knowledge and relationships, two suitable users of heat from the proposed SEE have been identified. Discussions and feasibility are currently being progressed by SEEL following a technical assessment by PB.

The two options being progressed are as follows:

a. South Holland Community Hospital

   SEEL may be able to provide heat to the shortly to be completed South Holland Community Hospital, that is around 1 km away from the proposed SEE. The timing of the construction of the proposed SEE project will not support the initial supply of heat to the hospital (as the hospital will be completed prior to the proposed SEE), but a long term supply could be integrated into the design of the proposed SEE with the hospital gas fired boilers later relegated to back up duty on the commencement of a SEE CHP scheme.

   Hot water supply and return pipework would be required between the new South Holland Community Hospital and the proposed SEE if heat were to be supplied to the hospital. This pipework could be extended to cover other potential future users identified throughout two adjoining areas of commercial/industrial development when off-take opportunities that can support the required investment arise.

b. Horticultural development

A potential future opportunity exists to use both heat and carbon dioxide (CO_2) for horticultural purposes. The party has requested that it remains confidential.

The initial technical assessment indicates that provision of heat from the proposed SEE specifically designed to accommodate steam extraction would present few technical challenges. Options of waste heat are available from the proposed SEE, including waste heat from the exhaust stacks or heat extracted from the steam cycle. There are various opportunities to extract heat from the steam cycle and the connection can be optimized to suit the end user requirements.

In recognition of the CHP potential, SEEL has included CHP in the CCGT plant design to allow for a heat provision of up to 10 MWth as there is an existing potential local heat customer and as the potential exists for at least one new customer in the surrounding area. Consequently, SEEL will ensure that the proposed SEE plant design is ready to provide future heat take-off ie the proposed SEE will have a suitable connection point which is capable of being retrofitted with relevant equipment to provide heat to users. In addition, the proposed SEE site contains corridors along which suitable pipelines can be laid once commercial CHP agreements with off-takers are in place.

1. INTRODUCTION

The proposed Spalding Energy Expansion (SEE) will involve the construction of a combined cycle gas turbine (CCGT) power plant that will provide up to 900 megawatt (MW) (nominal) of power generation capacity.

This combined heat and power (CHP) feasibility assessment has been undertaken by Parsons Brinckerhoff (PB) on behalf of Spalding Energy Expansion Limited (SEEL) for the proposed SEE. The proposed SEE will be situated on land adjacent to the existing Spalding Power Station, an 860 MW CCGT plant in Spalding, operated by Spalding Energy Company Limited (SECL). This existing plant will hereafter be referred to as the existing SECL plant. This report only considers the CHP opportunities in relation to the proposed SEE.

This report has been prepared as part of a requirement by the UK Government for any proposals for new power projects to be accompanied by an assessment of the potential for CHP in the vicinity of a proposed site in accordance with the assessment methodology outlined in the Department of Trade and Industry (now Department for the Energy and Climate Change or "DECC") guidance document "Guidance on background information to accompany Notifications under Section 14(1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989 December 2006".

1.1 UK Government policy

As part of the National Energy Policy, the UK Government is committed to promoting the installation of CHP wherever economic and has set a target to achieve at least 10 GWe of installed CHP capacity by 2010. To achieve this target Government policy has been formulated to support the provision of CHP generation wherever feasible.

The Government hopes that its CHP policy will help achieve its energy policy objectives of securing supply in a diverse and sustainable manner whilst allowing power to be generated at competitive prices. The greater efficiency associated with CHP installations will also assist the Government in achieving its obligations under the European Union Emissions Trading Scheme (EU ETS) and other targets and supporting legislation.

The Government acknowledges that opportunities to exploit CHP may not always be an economic option. However, to promote the use of CHP technology it expects developers to submit information in support of notifications under Section 14(1) of the Energy Act 1976 and applications under Section 36 of the Electricity Act 1989, which demonstrates that they have seriously explored opportunities to use CHP fully, including community heating, in developing proposals for new power stations. This assessment has been undertaken for the proposed SEE.

The requirements of this assessment are outlined in the Department of Trade and Industry (now DECC) guidance document "Guidance on background information to accompany Notifications under Section 14(1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989 December 2006".

1.1.1 Guidance requirements

The guidance requires developers to explore opportunities to use CHP fully, including community heating, when developing proposals for new power stations. Any proposals submitted to the DECC are therefore expected to show that the developer has explored actively the opportunities for CHP use. Where heat opportunities have been identified as part of the studies undertaken, developers are required to show how they have dealt with these in shaping their proposals.

In addition, the guidance notes that future market conditions, outside the control of any project proponent, have the potential to give rise to variations to actual heat demand. As a result, heat

customers identified during the development of project proposals may take more or less heat than anticipated and new customers may emerge.

As such, SEEL will consider CHP in the CCGT plant design as there are potential local heat customers. SEEL will ensure that the proposed SEE plant design does not prohibit future heat take-off should any further heat customers emerge.

To show that developers have properly considered the CHP options for a site, DECC expects developers to include with their application for Section 36 consent and notification under Section 14;

- An explanation of the choice of location including the potential viability of the site for CHP;
- A report on the exploration carried out to identify and consider the economic feasibility of local heat opportunities and how to maximise the benefits from CHP;
- The results of that exploration;
- A list of organisations contacted;
- The basis for the developer's conclusion that it is not economically feasible to exploit existing regional heat markets (if this is the case);
- A description of potential future heat requirements in the area; and
- The provisions in the proposal for exploiting potential heat demand in the future.

These points have been addressed and are discussed below.

1.1.2 Potential markets

The DECC identifies a number of potential markets as being worthy of consideration in CHP assessments undertaken by developers, either singly or in combination. These include industry, commerce and public services.

The largest, most economic opportunities are expected to be found in the industrial sectors where there are often large requirements for process heat. However, opportunities are also identified in commerce (e.g. hotels, leisure centres, large corporate buildings) and public services (e.g. hospitals, universities, prisons, defence installations, administrative offices and ancillary college or hospital accommodation).

There is also potential for CHP where heat can be used in absorption chilling to deliver cooling in industry, commerce and the public sector.

1.1.3 Proposal assessment

The Government recognises that decisions on major new power station investments, including the location and anticipated load duty of the station (e.g. base load, mid-merit, peak-lopping, support to local industry, etc), will primarily be driven by the market, taking into account fiscal and other incentives now on offer for CHP.

Where the developer has identified a number of heat customers locally, DECC would wish to see clear evidence that the power station developer had discussed CHP with the owner of that heat load and, if CHP was not being progressed further, the reasons why. For example: if the heat load was already being met by another low carbon source; the owner was contracted to another source long-term; or, the customer was considered not to be commercially viable on a long-term basis.

Whilst a growing number of projects are developed as CHP from the outset, the Government recognises that it is not always feasible to identify and take advantage of local heat markets.

2. CHP ASSESSMENT

PB on behalf of SEEL has undertaken a CHP assessment to address the requirements of DECC, as detailed above, for the proposed SEE. This assessment includes investigation of the existing situation in the Spalding area, on the basis that the provision of heat becomes less viable to locations beyond this area principally as too much heat is lost in transport. As part of this assessment, SEEL has contacted the parties identified in Section 2.3 of this report (and as required by paragraph 16 of the DECC Guidance).

2.1 The Site

The proposed SEE site is located approximately 2 km to the north east of Spalding town centre, Lincolnshire at National Grid Reference TF 259 249 and covers an area of approximately 13 hectares. The immediately surrounding land use to the proposed SEE is predominantly industrial, with some residential properties located further afield. The wider area is predominantly rural.

The reasons for site selection for the proposed SEE are discussed in depth in Section 3 of the Environmental Statement for the project. These include:

- the opportunity to utilise existing infrastructure where possible, which means that items such as the workshop would not be duplicated;
- the presence of a skilled workforce at the existing SECL power station, with its established operational systems, will be available for training new employees;
- the electrical grid connection, east of Spalding, which is accessible to key areas of UK electricity demand;
- the gas supply pipeline east of Spalding is accessible and has capacity;
- there is sufficient land available for CCS and transport of CO_2 from this location appears to be feasible;
- the land use characteristics of the adjoining industrial estate and the existing SECL power station site which provide an appropriate environment for the development of the proposed SEE;
- proximity to potential heat and power off-takers; and
- SECL has a strong existing relationship with key stakeholders and the local community

The proposed SEE site is, therefore, considered to be suitable for the intended use of power generation.

The existing and potential industries in the Spalding area were assessed for their use of significant quantities of steam/heat in their processes and this is discussed further below.

On the north side of Spalding, there are three adjoining areas of commercial/industrial development. These are shown in Figure 2.1, below:

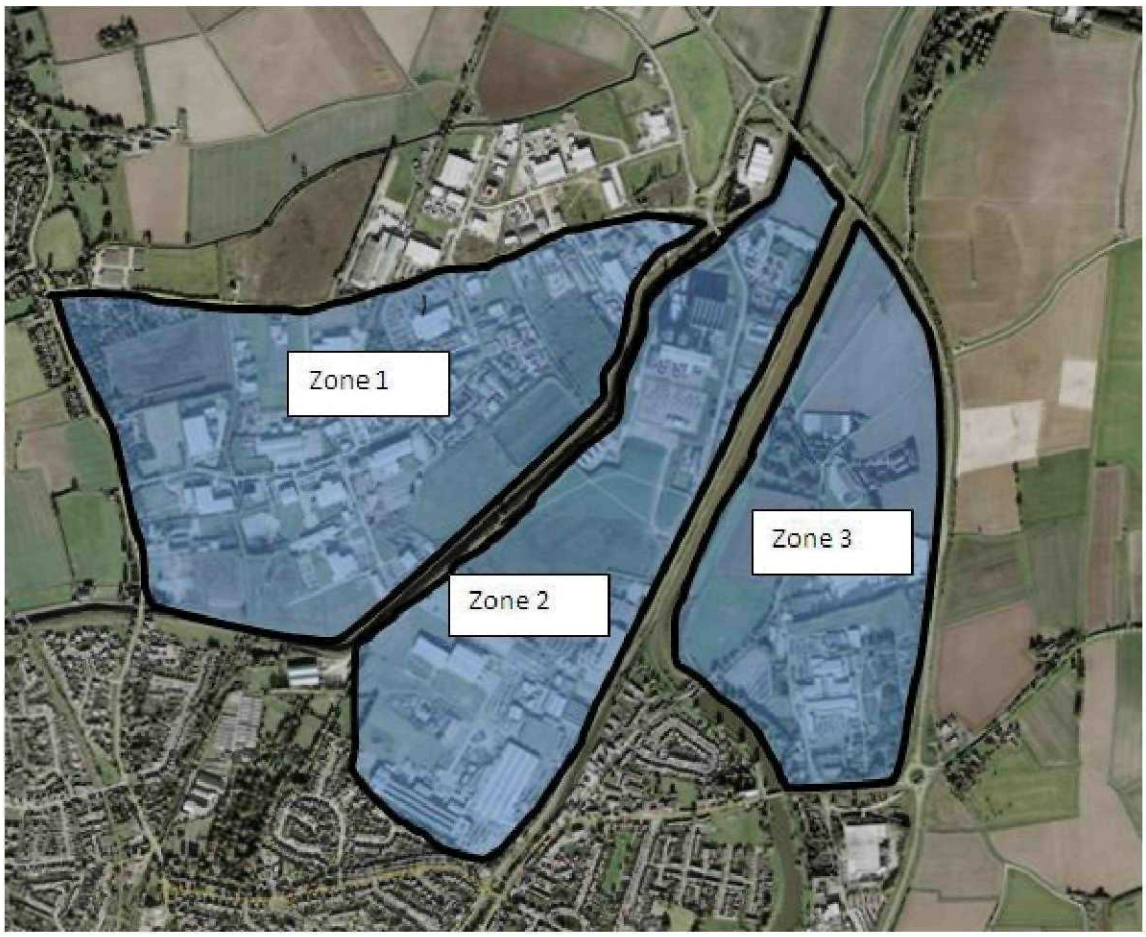


FIGURE 2.1 - COMMERCIAL/INDUSTRIAL DEVELOPMENT ZONES CLOSE TO THE SEE PROJECT

Zone 1 is bounded by Wardentree Lane to the north, Vernatt's Drain to the south and east and Spalding Road (B1356) to the west. This area comprises industrial and commercial businesses, a supermarket, a petrol station, the new South Holland Community Hospital (under construction) and vacant employment land.

Zone 2 is bounded by the A16 to the north, West Marsh Road and the River Welland to the east, Vernatt's Drain to the west and residential land to the south. This area comprises the existing SECL power station, the proposed SEE, water treatment works, food processing (production and packaging) and distribution

Zone 3 is bounded to the north and east by the A16, to the south by Holbeach Road (A151) and to the east by the River Welland. This area comprises Springfields Outlet Centre (retail), industrial and commercial businesses, agriculture, horticulture and vacant land.

Zones 1 and 2 have been identified as targets for CHP opportunities. Zone 1 would be accessible via a pipe gantry across Vernatt's Drain and Zone 2 is located adjacent to the existing site. Zone 3 has been discounted as a target for CHP opportunity as initial cost estimates indicate that the pipeline tunnelling required to overcome the physical barrier of the River Welland is likely to be prohibitive and thus providing CHP to this area would therefore be economically unfeasible.

The 3 zones could be extended at a later stage if heat users were identified. The extended areas could include the industrial estate to the North of Zone 1/ Wardentree Lane.

2.2 Consultees

In accordance with the DECC's guidance on CHP assessment, SEEL has contacted organisations identified by the DECC as being able to assist in the identification of potential CHP users. Organisations contacted as part of the assessment included:

- The Carbon Trust;
- NHS Estates/Strategic Health Authority;
- South Holland District Council;
- DECC;
- East Midlands Regional Assembly;
- Lincolnshire County Council; and
- CHP Association (CHPA).

The Department for Environment, Food and Regional Affairs (DEFRA) supports the Industrial Heat Map website (www.industrialheatmap.com) which assists power station developers and helps to fully explore opportunities to use CHP when developing proposals for new power stations.

The Industrial Heat Map website has been used to identify CHP opportunities in the East Midlands area. The location of the proposed SEE is the blue star shown on the heat map in Figure 2.2. Although there are 790 sites identified as suitable for CHP in the UK, none are in close proximity to the proposed SEE.

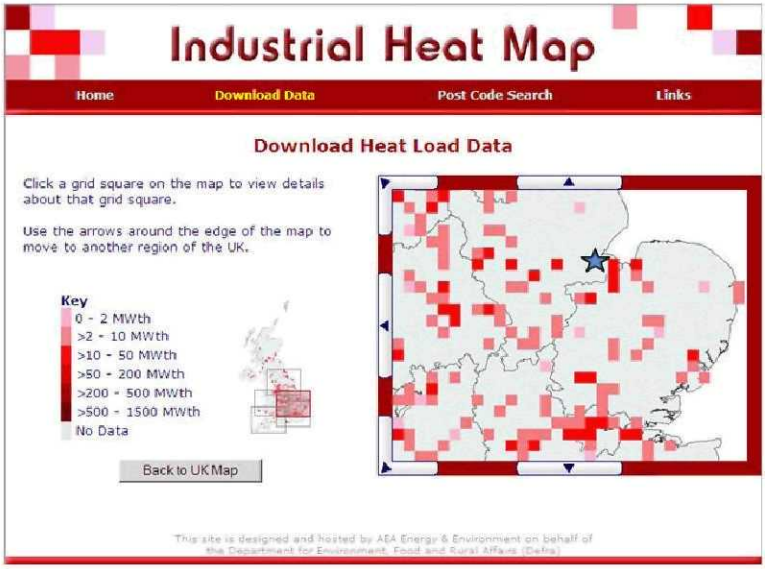


FIGURE 2.2 – EAST MIDLANDS AND EASTERN ENGLAND HEAT MAP WITH SPALDING HIGHLIGHTED

The nearest Industrial Heat User is 19 km to the east (Premier Foods located between Long Sutton and Sutton Bridge). Therefore, in order to support the development of CHP in the UK, the proposed SEE is seeking to provide an innovative local solution.

2.3 Consultee responses

Based on local knowledge, potential heat users local to the proposed SEE were contacted with the following outcomes[1]:

- Host A operates a food processing facility - this party was unable to explore the opportunity at this time;
- Host B is the provider of critical local services - this party has expressed interest and will revert once internal discussions have been completed;
- Host C operates a food processing facility - this party has not replied to our initial letters or follow up calls;
- Host D is the new South Holland Community Hospital - discussions with this party will be outlined in Section 3;
- Host E is a large multinational company with operations outside the existing district - discussions with this party will be outlined in Section 3
- Host F is involved in intensive agriculture - discussions with this potential host are on hold;
- Host G is involved in intensive agriculture - discussions with this potential host are on hold;
- InterGen is a member of the CHPA. Initial informal discussions have been held, outlining the details of the assessment and will continue as the technical and commercial aspects progress; and
- The Carbon Trust is considering providing a grant for research into a CHP scheme associated with Host E. Loughborough University has confirmed that it will be available to undertake such research. A decision will be made regarding the grant by 16 April 2009.

Given the above responses and the fact that nearest Industrial Heat User is 19 km away from the proposed SEE (see Section 2.2) it is concluded that it is not economically feasible to exploit existing regional heat markets.

2.4 Community heating

Discussions were held with South Holland District Council to identify community heating opportunities. The first of the two alternatives considered is the South Holland Community Hospital which is addressed in Section 3. The second is district heating, but due to the significant distance from local residences and the inherent low housing density in Spalding, this has been discounted at this time.

[1] Note that some parties have requested that discussions remain "Commercial in Confidence" at this time and have not been named.

3. POTENTIAL USERS

The CHP assessment has identified two potential heat users in the proposed SEE's adjoining areas of commercial/industrial development discussed in Section 2.1 that might be able to take advantage of the construction of the proposed SEE.

The potential heat users are the new South Holland Community Hospital, currently under construction around 1 km away from the proposed SEE, and Host E, situated on an adjacent site. These are discussed further in the following Sections.

3.1 South Holland Community Hospital

Following a meeting with management of the new South Holland Community Hospital in Spalding, SEEL requested PB to carry out a preliminary feasibility study into the possibility of the proposed SEE to supply heat to the proposed hospital, located around 1 km from the proposed SEE. This feasibility study will also ascertain South Holland Community Hospital's heat requirement.

The new South Holland Community Hospital is, currently, under construction and is scheduled to open during 2009. The main source of heat at the hospital will be obtained from two gas fired boilers installed during construction with provision for a third boiler should it be required in the future. Heat from the proposed SEE would not be available in time to support the programme for the new South Holland Community Hospital as the proposed SEE is targeted to be operational in Q1 2014. However, the proposed SEE could be configured with an extraction to supply the future heat demand in the form of hot water coupled into the location for the third boiler with minimum disruption to the hospital activities. Therefore, the Hospital's gas fired boilers would be used initially and then relegated to backup once the proposed SEE extraction becomes available. The gas boilers would also be required when heat is not available from the proposed SEE.

Commercial discussions are ongoing.

3.2 Host E

A further potential user has been identified, noted as Host E in the list of Consultees in Section 2.3. This relates to a future development that may require heat, electricity and CO_2. Commercial discussions are ongoing.

4. TECHNICAL AND COMMERCIAL

This Section looks at the technical and commercial aspects to consider in order to meet the CHP demands discussed in Section 3.

4.1 South Holland Community Hospital

To provide heat to the new South Holland Community Hospital it is considered that the SEE plant design would be identical to a conventional CCGT plant, except for the inclusion of the following additional items:

- Connection 'T' pieces in the high pressure (HP) steam turbine exhaust (known as the cold reheat pipework) and low pressure (LP) steam turbine inlet pipes or auxiliary steam;
- Heat recovery steam generator (HRSG) stack design and construction that would allow future retrofit of flue gas extraction equipment; and
- Control systems linked to the connections.

For the CHP scheme to be completed a hot water network would need to be installed along the same route as Vernatt's Drain from the proposed SEE to the new South Holland Community Hospital. This would consist of small diameter pipework that will be laid overground or buried. The hot water supply and return water would be a closed loop. Therefore, the water is not derived directly from the thermal plant steam/water cycle nor is it returned to the plant steam/water cycle. This is because the plant required demineralised water and the proposed SEE would not have any control of the water quality once it leaves the proposed SEE site. The heating of the hot water on site would take one of the following forms:

- Heating by use of a heat exchanger located in the stack if the correct conditions could be obtained from the stack flue gases; or
- Heating by use of a heat exchanger connected to a suitable point in the steam cycle, typically the cold reheat pipework or LP turbine crossover pipe extraction.

The hot water supply and return pipework to and from the heat exchanger and the plant boundary. The pipework could be laid across the site without affecting the main plant layout. The pipework on the proposed SEE site would be either buried or connected from the heat exchanger to the boundary by overhead pipe racks.

4.1.1 Extension for future potential users

Subject to commercial feasibility, an extension of the scheme to cover other users in Zones 1 and 2 will be considered, based on the recognition of the CHP potential associated with the existing local heat customers. SEEL has included CHP in the proposed SEE CCGT plant design allowing for the provision of up to 10 MWth of heat. It is considered that the potential exists for at least one new customer in the surrounding area.

Consequently, SEEL will ensure that the proposed SEE plant design is ready to provide future heat take-off ie the proposed SEE will have a suitable connection point which is capable of being retrofitted with relevant equipment to provide heat to users. In addition, the proposed SEE site will contain corridors along which suitable pipelines can be laid once commercial CHP agreements with off-takers are in place.

4.2 Host E

Technical and commercial discussions with Host E are ongoing at this stage.