



The Sizewell C Project

8.15 Combined Heat and Power Feasibility Study

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Executive Summary

This Combined Heat and Power (CHP) Feasibility Study has been prepared by SZC Co. to support the Development Consent Order (DCO) application for a new nuclear power station at Sizewell, called Sizewell C.

The Overarching National Policy Statement for Energy EN-1 (NPS EN-1) (Ref. 1.1) and the National Policy Statement for Nuclear Power Generation EN-6 (NPS EN-6) (Ref. 1.2) require that any application to develop a thermal generating station must either include CHP, or contain evidence that the possibilities for CHP have been fully explored to inform the consideration of the application.

Paragraph 4.6.8 of the NPS EN-1 clarifies that if the proposal is for thermal generation without CHP, the applicant should:

- explain why CHP is not economically or practically feasible, for example if there is a more energy efficient means of satisfying a nearby domestic heat demand;
- provide details of any potential future heat requirements in the area that the station could meet; and
- detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited.

A detailed study was previously commissioned by EDF Energy to evaluate the feasibility and economic viability for inclusion of CHP at the Hinkley Point C project in Somerset. This information was submitted within the application for development consent, where it was found that CHP would be impractical and uneconomic.

This CHP Statement does not seek to replicate the detailed work undertaken for Hinkley Point C, but rather makes comparisons between the site situation at Hinkley and Sizewell to understand whether CHP would be practical and economic for inclusion at Sizewell C.

Like other nuclear power station sites, Sizewell is located in a rural location, away from centres of population. This restricts the potential for exporting waste heat into surrounding areas. The practicality of exporting heat to potential heat users around Hinkley Point C was evaluated, where a range of connection scenarios were tested to determine whether the inclusion of CHP would be a practical and viable solution. This considered connecting to potential heat users within a 15 kilometre (km) radius from the Hinkley Point C site. Similar studies have also been undertaken for other thermal generating stations, including the Wylfa Newydd New Nuclear Power Station in

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Anglesey. In each case the studies concluded that such opportunities are both impractical and uneconomic.

It is material to note that according to the UK CHP Development Map (Ref. 1.3), which maps heat demand across the UK, the heat demand identified to exist within a 15 km buffer area around Sizewell is significantly lower than Hinkley Point. Given this limited demand, similar conclusions would inevitably be found for Sizewell if undertaking a more detailed engineering feasibility study. In addition, the potential for future development in proximity to the power station is currently considered to be equally limited due to the demographic criterion, meaning that future industrial, residential or commercial developments may also be constrained to preserve the general characteristics of the area around the nuclear site throughout its lifecycle to ensure that the basis on which the site is licensed is not undermined.

It follows that the inclusion of CHP is not currently considered practical or viable for Sizewell C. This is a conclusion that is supported by paragraph 2.9.3 of EN-6, which recognises that the economic viability of CHP opportunities may be more limited for new nuclear power stations because the application of a demographic criterion for new nuclear power stations can result in stations being located away from major population centres and industrial heat demand, as is the case with Sizewell C.

However, SZC Co. will continue to explore the heat demand within the area. If SZC Co. finds that there is a heat demand in the future that can be exploited, and is satisfied that it is commercially viable and practical to retrofit the scheme to deliver a decentralised heat network, SZC Co. will take steps to retrospectively incorporate CHP at Sizewell C.

1 Purpose of this Statement

1.1 Introduction

1.1.1 Combined Heat and Power (CHP) is the generation of usable heat and electricity in a single process. A CHP generating station may either supply steam direct to customers or capture waste heat for low-pressure steam, hot water or space heating purposes after it has been used to drive electricity generating turbines.

1.1.2 The Overarching National Policy Statement for Energy EN-1 (NPS EN-1) and the National Policy Statement for Nuclear Power Generation EN-6 (NPS EN-6) require that any application to develop a thermal generating station must either include CHP, or contain evidence that the possibilities for CHP have been fully explored to inform the consideration of the application.

1.1.3 This CHP Statement draws from the in-depth findings at Hinkley Point C (Ref. 1.4) and the Wylfa Newydd Project CHP study (Ref. 1.5), and compares the findings with site condition around Sizewell to demonstrate the technical justifications required by Paragraph 4.6.8 of EN-1.

1.2 Key drivers

a) National Planning Policies

i. Overarching National Policy Statement for Energy (EN-1), July 2011

1.2.1 The Overarching National Policy Statement for Energy (EN-1) is part of a suite of NPSs issued by the Government and sets the policy for delivering major energy infrastructure. EN-1 should be read in conjunction with the National Policy Statement for Nuclear Power Generation (EN-6). Together they provide the primary basis for decisions on DCO applications for nuclear power generation with a capacity of more than 50 megawatts (MW) listed in EN-6. The suite of energy NPSs, including EN-1 and EN-6, have been approved by Parliament and were formally designated by the Secretary of State on 19th July 2011.

1.2.2 NPS EN-1 covers the need for new nationally significant energy infrastructure and assessment principles that should be applied in the decision making process.

1.2.3 Paragraph 4.6.2 “recognises that CHP is technically feasible for all types of thermal generating stations, including nuclear, energy from waste and biomass, although the majority of CHP plants in the UK are fuelled by gas”.

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- 1.2.4 Paragraph 4.6.5 states that “[t]o be economically viable as a CHP plant, a generating station needs to be located close to industrial or domestic customers with heat demands. The distance will vary according to the size of the generating station and the nature of the heat demand. For industrial purposes, customers are likely to be intensive heat users such as chemical plants, refineries or paper mills. CHP can also be used to provide lower grade heat for light industrial users such as commercial greenhouses, or more commonly for hot water and space heating, including supply through district heating networks. A 2009 report for DECC on district heating networks suggested that, for example, a district heating network using waste heat from a generating station would be cost-effective where there was a demand for 200 MWth of heat within 15 km. Additionally, the provision of CHP is most likely to be cost-effective and practical where it is included as part of the initial design and is part of a mixed-use development. For example, retrofitting a district heating network to an existing housing estate may not be efficient”.
- 1.2.5 Paragraph 4.6.6. states that “[u]nder guidelines issued by DECC (then DTI) in 2006, any application to develop a thermal generating station under Section 36 of the Electricity Act 1989 must either include CHP or contain evidence that the possibilities for CHP have been fully explored to inform the IPC’s consideration of the application. This should be through an audit trail of dialogue between the applicant and prospective customers. The same principle applies to any thermal power station which is the subject of an application for development consent under the Planning Act 2008. The IPC should have regard to DECC’s guidance, or any successor to it, when considering the CHP aspects of applications for thermal generating stations”.
- 1.2.6 Paragraph 4.6.8 of the NPS EN-1 states that the “[u]tilisation of useful heat that displaces conventional heat generation from fossil fuel sources is to be encouraged where, as will often be the case, it is more efficient than the alternative electricity/heat generation mix. To encourage proper consideration of CHP, substantial additional positive weight should therefore be given by the IPC to applications incorporating CHP. If the proposal is for thermal generation without CHP, the applicant should:
- explain why CHP is not economically or practically feasible for example if there is a more energy efficient means of satisfying a nearby domestic heat demand;
 - provide details of any potential future heat requirements in the area that the station could meet; and

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- *detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited*.
 - ii. [National Policy Statement for Nuclear Power Generation \(EN-6\), July 2011](#)
- 1.2.7 In conjunction with Part 3 of NPS EN-1, NPS EN-6 sets out the Government’s assessment of the need for new nuclear power, including the identification of Sizewell as a potentially suitable site for the deployment of a new nuclear power station before the end of 2025. It also provides the assessment principles to assess the acceptability of proposals for new nuclear power stations and gives more specific consideration to the design of the facilities.
- 1.2.8 Paragraph 2.9.2 of EN6 states that “[i]n keeping with applications for other thermal generating stations, development consent applications for nuclear power stations should demonstrate that the applicant has fully considered the opportunities for CHP”.
- 1.2.9 Paragraph 2.9.3 goes on to recognise that “*the economic viability of CHP opportunities...may be more limited for new nuclear power stations because the application of a demographic criterion for new nuclear power stations can result in stations being located away from major population centres and industrial heat demand. Future industrial, residential or commercial developments may also be constrained to preserve the general characteristics of the area around the nuclear site throughout its lifecycle to ensure that the basis on which the site is licensed is not undermined*”.
- iii. [Department of Trade and Industry 2006 CHP Guidance](#)
- 1.2.10 NPS EN-1 references guidelines (Ref. 1.6) issued by Department of Trade and Industry (now the Department for Business, Energy, and Industrial Strategy (BEIS)) for a thermal generating station under Section 36 of the Electricity Act 1989 that would require a CHP or evidence that the possibilities of CHP have been explored.
- 1.2.11 Paragraph 8 of those guidelines states that Government believes it is highly preferable, from a climate change and fuel efficiency perspective, for the waste heat from large power stations to be put to beneficial use where possible. It expects developers to explore opportunities to use CHP fully, including community heating, when developing proposals for new power stations. However, it does recognise that in some cases CHP will not always be an economic option.

1.2.12 Paragraph 11 of the guidance states that: *“Developers should provide evidence to show the steps that they have taken to assess the viability of CHP opportunities within the vicinity of their proposed location for the plant. Their application or notification should contain:*

- *an explanation of their 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; and,*
- *a list of organisations contacted.”*

1.2.13 Paragraph 12 of the guidance lists what must be included with generating station applications where CHP is not proposed:

- *“the basis for the developer’s conclusion that it is not economically feasible to exploit existing regional heat markets;*
- *a description of potential future heat requirements in the area; and*
- *the provisions in the proposed scheme for exploiting any potential heat demand in the future.”*

2 Factual Background

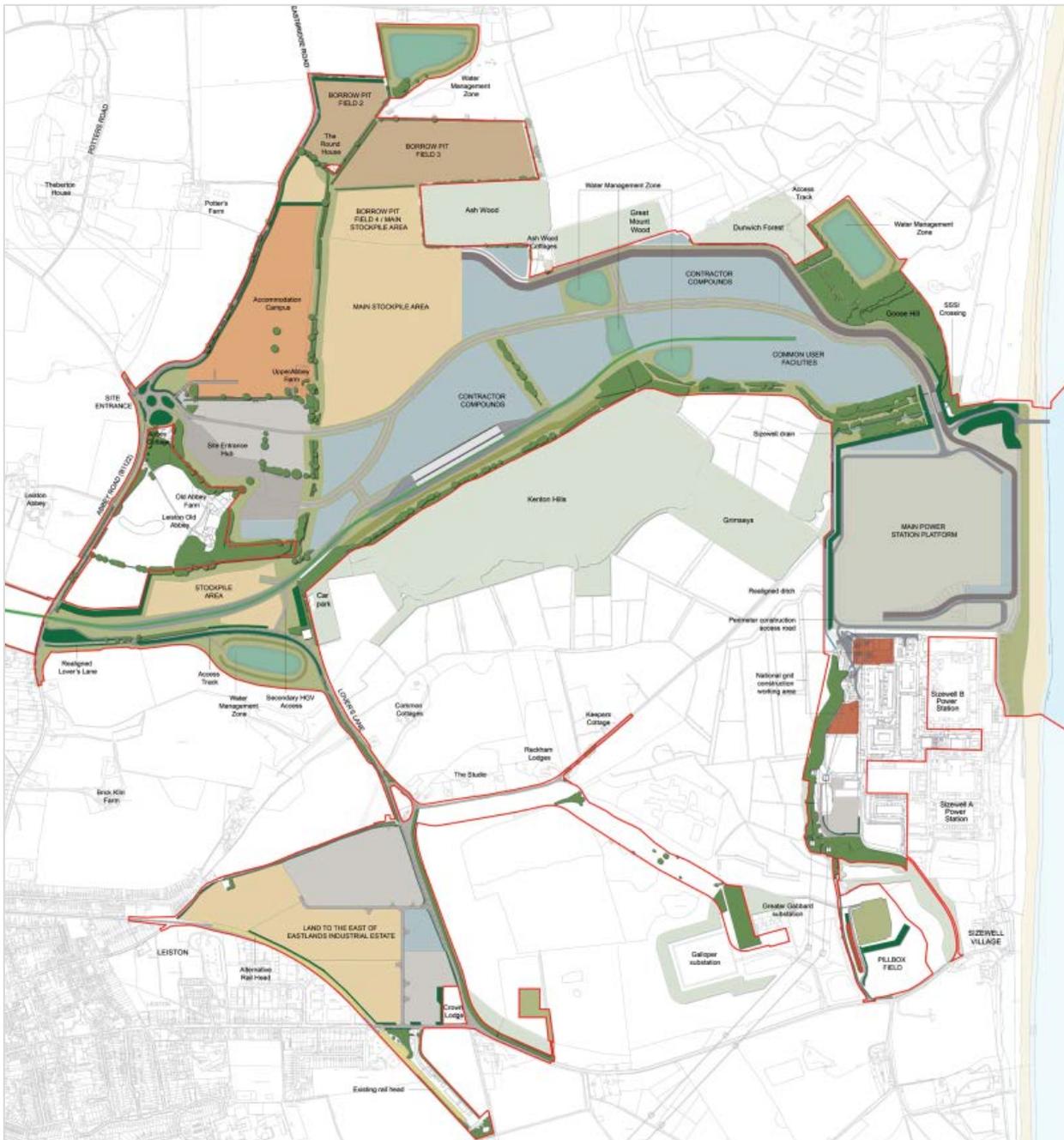
2.1 The development proposals

2.1.1 SZC Co. is proposing to build a new nuclear power station at Sizewell in East Suffolk, known as Sizewell C. Located to the north of the existing Sizewell B power station, the Sizewell C site is located on the Suffolk coast, approximately halfway between Felixstowe and Lowestoft; to the north-east of the town of Leiston.

2.1.2 The site comprises an area of flat grassland immediately north of the existing Sizewell B power station. Part of the site, in the south west corner, is occupied by existing Sizewell B infrastructure. To the north lies Dunwich forest, to the west is the Sizewell Belts Nature Reserve. To the east is the Suffolk Coast Path and the North Sea.

- 2.1.3** The proposed Sizewell C power station would comprise two UK European Pressurised Reactor (UK EPR™) units with an expected net electrical output of approximately 1,670MW per unit, giving a total site capacity of approximately 3,340MW. The design of the UK EPR™ units is based on technology used successfully and safely around the world for many years, which has been enhanced by innovations to improve performance and safety. The UK EPR™ design has passed the Generic Design Assessment (GDA) process undertaken by UK regulators (Office for Nuclear Regulation and Environment Agency), and has been licenced and permitted at Hinkley Point C. Once operational, Sizewell C would be able to generate enough electricity to supply approximately six million (or about 20%) homes in the United Kingdom (UK). The general location of the proposed Sizewell C development site is shown in **Plate 2.1**.

Plate 2.1: General site location



2.1.4 Electricity would be generated at the main development site from heat energy produced from the two UK EPR™ reactors. The heat would be used to raise steam which would then be used to power turbines to generate electricity. Electricity generated in the two turbine halls (one for each reactor) would be

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converted by transformers to high voltage (400kV), before being exported from the site. Electrical connections from Sizewell C would be made via underground cables from the site to a new National Grid 400kV sub-station which would be located adjacent to the existing Sizewell B sub-station. This would provide the connection for Sizewell C to the existing national grid high voltage transmission system.

2.1.5 A UK EPR™ reactor is capable of producing approximately 4,500MW of heat from nuclear fission which takes place in the reactor core. The UK EPR™ design is such that once the fuel is loaded in the reactor core the reactor can operate at full power continuously in a ‘fuel cycle’ of up to 18 months. Spent fuel removed from the reactor core would undergo several years of storage to cool in the pools inside the plant before transfer to the Interim Spent Fuel Store (ISFS).

2.1.6 For the UK EPR™ reactors at Sizewell C there would be three cooling systems, comprising primary, secondary and open circuit systems. The primary system, housed in the reactor building, is a closed water-filled pressurised system which enables the heat produced by the nuclear fission reaction inside the fuel assemblies in the reactor core to be extracted. The secondary system is also closed, independent of the primary system, and operates at a lower pressure. The open circuit cooling system would be independent of the primary and secondary systems and would draw water directly from the sea. It would absorb heat from the secondary system in the condensers and other parallel heat exchanger systems and, after a single passage through these systems, the now heated water would then be discharged back to the sea.

2.2 Previous CHP studies undertaken by EDF Energy Group

2.2.1 A study concerning the potential use of CHP was undertaken by Jacobs on behalf of EDF Energy group for the Hinkley Point C application for development consent. According to paragraph 4.6.5 of NPS EN1, a district heating network using waste heat from a generating station would be cost-effective where there was a demand for 200 MWth of heat within 15 km. Accordingly, the Hinkley Point C study established a search area using a 15 km radius around the Hinkley Point C development site. This search area enabled consideration of potential heat demands in two towns within proximity to the Hinkley Point C development site - Bridgwater and Burnham-on-Sea. The largest (Bridgwater) was recorded to have a population of circa 41,000 in the 2011 census.

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- 2.2.2 The heat demands within the search area were split into two groups: existing buildings and potential future developments. These were further categorised into different sub-groups, looking at housing, education, leisure, healthcare, commercial, and industrial uses. Future demands were assessed based on a range of data sources, including consultation with the local authorities and the review of material available, such as land supply reports from the local authority. From this, heat demands were estimated taking account of published benchmark data.
- 2.2.3 It would clearly be impractical and uneconomic to connect every heat demand within the 15 km search area. This would require significant investment in infrastructure to support what were often identified to be isolated developments. Accordingly, the study eliminated potential users on a case by case basis, with the aim of developing ‘clusters’ of heat users. This approach minimises infrastructure costs and distribution losses of a potential heat network. The study identified two potential ‘clusters’ for a district heating network, the first located in Bridgwater and Cannington, the second in Burnham-on-Sea and Highbridge. The latter cluster was anticipated to be less viable because of its smaller size as well as other environmental and engineering constraints.
- 2.2.4 In each case, the study considered an optimistic scenario for uptake of a future district heating network, assuming that 100% of the estimated heat demand could be met through district heating. The study also assessed more realistic scenarios, whereby only 75% connection was attained, as well as a further scenario whereby a hypothetical new settlement, incorporating 4,000 new homes, could connect to the network. A detailed economic model was developed to analyse the cost of the infrastructure required and associated paybacks for each connection scenario.
- 2.2.5 It is material to note that under all scenarios tested, the study concluded that the delivery of decentralised heating from Hinkley Point C would be uneconomic. Even if the distribution of this heat was incentivised by Government schemes; the opportunity for CHP would be incapable of delivering energy at a price that would be competitive with gas. Furthermore, the diversion of heat energy from the generation process would reduce the quantity of low carbon electricity capable of being produced by Hinkley Point C, which further limits its potential and benefits for carbon abatement.
- 2.2.6 In addition to the economic analysis, the report concluded that from a technical standpoint, the EPR™ units that will be used at Hinkley Point C and which are proposed for Sizewell C, require extremely high quality water in order to generate steam for the turbine. For this reason, any district heating

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network would have to operate as a separate system, utilising additional heat exchangers from the second circuit. Such a system would be bespoke and anticipated to be extremely costly, due to the sophisticated nature of the systems incorporating leak detection and protective devices to prevent damage due to water ingress to the turbine. Such an installation on a nuclear power station would require careful assessment of its potential impact on nuclear safety. This would include both the design and integrity of the equipment and its compatibility with the safety-significant systems with which it would interact, and also the practical means by which it would be implemented. The utilisation of CHP on the Hinkley Point C site would therefore require further testing and approvals through, for example, the GDA process.

2.3 Conclusions and key findings of the Hinkley Point C CHP assessment

2.3.1 The conclusions of the Hinkley Point C CHP report were therefore as follows:

- Operating Hinkley Point C as a combined heat and power plant is technically feasible but it is not considered commercially viable.
- The site is remote, and the distance to the nearest major heat loads in Bridgwater requires pipe routes at the limit of the 15 km range indicated by the National Policy Statement EN-1.
- The main heat loads in Bridgwater would be space heating, mainly of existing properties, both residential and commercial. The heat load profile of a district heating scheme gives very poor utilisation of the heat infrastructure.
- The heat demand is only high for around 4 months and is reduced for 4 months during summer months (winter / summer seasonal variation). This means that the cost of the system has to be borne by relatively small heat sales. The infrastructure cost is very high compared to the heat supplied.
- The project would take many years to complete and require a very large investment in administration and development costs as well as the plant. The high capital cost would then need to be financed over a very long period, at least 20-30 years. Thus there is considerable capital outlay, with no return until the project is commissioned.
- The viability of the project is critically dependent on the number of connections which will be made. This cannot be accurately predicted.

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Thus there is a substantial commercial risk which will compound the difficulty in obtaining funding.

- The cost of heat from the CHP scheme will not compete with the cost of supplying the same heat from gas. It was found that there is no economic incentive to promote the project.
- The CHP scheme has relatively poor performance in abating carbon dioxide, principally because the use of the heat would reduce the output of the nuclear power station requiring replacement of the power from fossil fuelled sources.
- Similar carbon dioxide abatement can be achieved with much smaller outlay by using alternatives such as energy efficiency measures and heat pumps etc. The alternative schemes are more practical and implementable for both new and old properties.

2.4 Other comparable studies

2.4.1 A CHP feasibility study was also conducted for the Wylfa Newydd Project by Horizon Nuclear Power. This assessment considered the potential to supply process steam to industrial concerns, and the potential to supply lower grade waste heat to a district heating network.

2.4.2 Similar to the assessment of Hinkley Point C, the use of process steam taken from the primary circuit was not considered to be feasible for the Wylfa Newydd plant for numerous reasons. The direct use of steam from the reactor was found to not be economically practical, as the reactor steam cannot be exported directly, and therefore would need to be used to evaporate water in a secondary circuit. This process would reduce the temperature of the steam, making it less viable for industrial uses. More critically, in that case it was found that the use of steam in this way would reduce the amount of usable electricity generated by the station.

2.4.3 With regards to using lower grade waste heat to supply a district heating network, a high-level assessment of the potential for CHP was conducted by mapping where the most significant heat loads exist within a 15 km radius of the proposed power station. The largest heat load was identified to be the area of Holyhead. Further assessments were then made of the heat loads in Holyhead and along a conceptual pipeline route between the station and the settlement, where costs of heat delivery and carbon abatement were calculated.

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- 2.4.4 The assessment concluded that a CHP system connected to the Wylfa Newydd Power Station is not viable. A further assessment was also made to evaluate what would be necessary to make the system viable and it was found that the reductions in capital cost or increases in heat load which would be necessary, are unachievable. Indeed, the proposal for CHP was not found to be viable by a considerable margin.
- 2.4.5 This assessment showed that the use of heat from the Wylfa Newydd Power Station in a CHP scheme is not considered to be a viable proposition. This outcome is consistent with other CHP studies and results from the remote location of the power station, meaning that the nearest significant heat load for any CHP scheme is a long distance away.
- 2.4.6 To make decentralised energy most cost effective, it is necessary to have a steady demand for heating and hot water throughout the year. Even if connection was possible, the most prevalent and available heat load found by the Wylfa study was for domestic space heating, which has very poor overall utilisation of the CHP system, because the demand is only around 30% of the maximum heat transmission. The poor utilisation means that there is a very poor return on the heating network infrastructure costs.
- 2.4.7 The original value of the energy from the nuclear power plant is quite high because the heat could be used to provide high value carbon-free electricity in the generation process. This is compounded with the fact that the costs and complexity of abstracting heat from a nuclear plant are much greater than for conventional sources of heat.
- 2.4.8 Conclusions between the study at Hinkley Point C and Horizon Nuclear Power’s assessment for Wylfa are therefore consistent.
- 2.5 **Comparison of heat loads between nuclear sites**
- 2.5.1 BEIS maintains an interactive CHP development map, enabling rapid assessments to be made of heat demand within a given area. The interactive map enables high level assessments to be undertaken of heat demands from a variety of different sectors.
- 2.5.2 Using the interactive map, a comparison has been made of the heat demands within a 15 km search buffer centred on the site locations of Hinkley Point, Wylfa and Sizewell. The assessment undertaken does not distinguish between heat clusters, but rather the total predicted heat demand existing within a 15 km search area. The findings are presented in **Table 2.1**.

Table 2.1: CHP development map heat loads

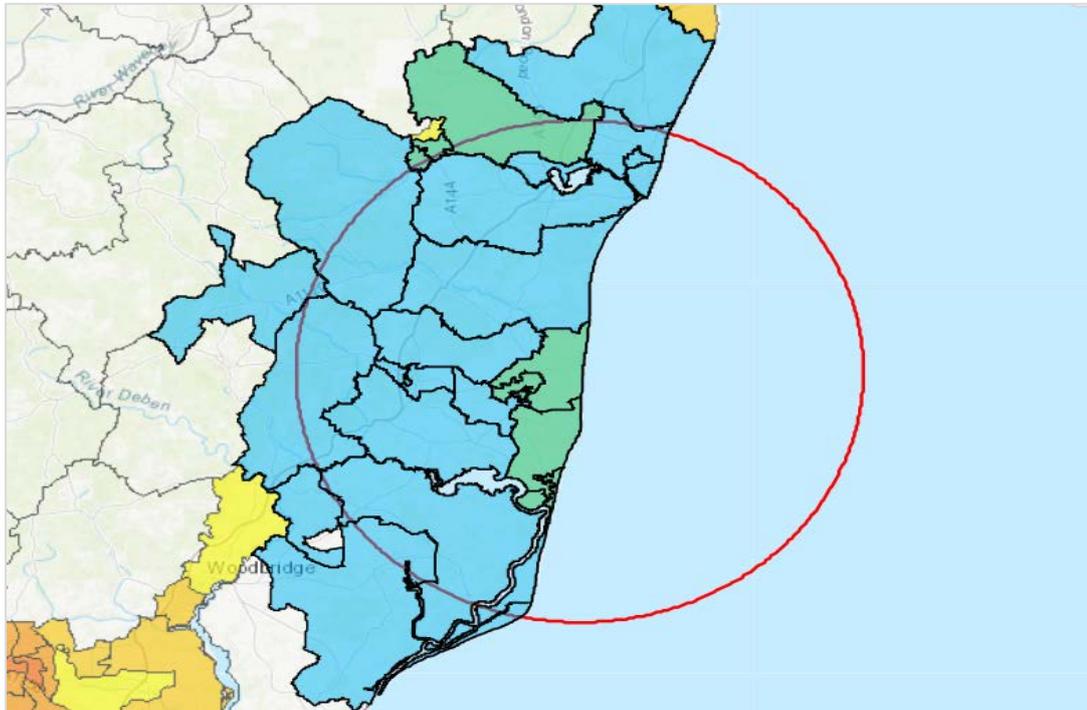
Sector	Wylfa		Hinkley Point C		Sizewell C	
	Split	MWh	Split	MWh	Split	MWh
Communications and Transport	0.01%	30	0.04%	327	0.03%	109
Commercial Offices	0.25%	621	1.76%	15,167	0.67%	2,540
Domestic	97.16%	240,939	62.65%	539,242	85.12%	321,635
Education	0.66%	1633	1.82%	15648	0.53%	2007
Government Buildings	0.22%	539	0.55%	4,741	0.17%	656
Hotels	0.38%	933	0.20%	1,759	0.66%	2495
Large Industrial	0%	0	26.90%	231,532	8.05%	30,433
Health	0.03%	65	0.83%	7105	0.09%	338
Other	0.04%	110	0.09%	737	0.20%	756
Small Industrial	1%	2,468	3.79%	32,601	3.78%	14,296
Prisons	0%	0	0%	0	0%	0
Retail	0.16%	393	1.30%	11,175	0.42%	1,592
Sport and Leisure	0.08%	206	0.03%	90	0.17%	649
Warehouses	0.02%	46	0.04%	381	0.10%	363
District Heating	0%	0	0%	0	0%	0
Total heat load in area (MWh/Annum)	247,981		860,704		377,867	

2.5.3 From the review it is apparent that the heat demand within a 15 km circular buffer of the Sizewell C main development site is marginally higher than Wylfa but significantly lower than for Hinkley Point. The lower heat demand within the local area of Sizewell is a broad indicator that the economics of delivering a decentralised energy network would be equal to or less favourable for Sizewell C than Hinkley Point C, where more detailed analysis found this to be uneconomic.

2.5.4 The comparison also identifies that 85% of the heat demand within the search area is from existing domestic properties, whereas for Hinkley Point C there is a higher proportion of industrial heat demands which are generally

more compatible with district heating solutions due to the more intensive heating demands and year-round heating demand profiles.

Plate 2.2: 15 km search area around Sizewell



2.5.5 A 15 km buffer around the Sizewell C development site includes the small towns of Leiston and Saxmundum as shown in **Plate 2.2**. However, there are no large population centres or industrial heat demands.

3 Constraints of implementing CHP for Sizewell C

3.1 Context

3.1.1 Previous studies for Hinkley Point C and Wylfa have concluded that CHP is not practical, from both a cost and technical standpoint. Similar findings can be expected for Sizewell C. This section draws from previous assessments to demonstrate that such constraints are equally relevant to Sizewell. Accordingly, CHP is not proposed for the station design.

3.1.2 Paragraph 4.6.8 of the NPS EN-1 clarifies that if the proposal is for thermal generation without CHP, the applicant should:

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- explain why CHP is not economically or practically feasible, for example if there is a more energy efficient means of satisfying a nearby domestic heat demand;
- provide details of any potential future heat requirements in the area that the station could meet; and
- detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited.

3.1.3 The following sections provide justified reasons to address paragraph 4.6.8.

3.2 Consideration of economic feasibility

3.2.1 The economic viability of implementing CHP was assessed in detail as part of the Hinkley Point C DCO application. A key conclusion of that report was that the cost of heat from the CHP would be more than the cost of supplying the same heat from existing gas systems. Whilst the report was undertaken some time ago, the general economics of the conclusions have not changed. Gas prices have remained relatively stable since the original assessment was undertaken.

3.2.2 The Hinkley Point C CHP report also identified that the viability of any decentralised energy project is critically dependent on the number of connections which will be made. The broad comparison in heat demand taken from the UK CHP development map presented in **Table 2.1** indicates that heat demand in the local area of Sizewell is predominantly residential, and significantly lower than that of Hinkley Point. The retrofit of decentralised energy into residential properties is generally complex to achieve, due to the numerous agreements to be put in place with individual homeowners.

3.2.3 Furthermore, as set out within the Hinkley Point C CHP study, there is high seasonal variation with heat demands within the residential sector. Heat demand associated with residential properties is only high for around 4 months of each year and very low during summer months, save for the requirements for domestic hot water. This means that the cost of any decentralised energy system has to be borne by relatively small heat sales, making the infrastructure cost very high compared to the heat supplied.

3.2.4 Heat demand within the immediate area around the Sizewell C development site is significantly lower than Hinkley. This can be explained by the rural nature of the site and smaller population. In 2011 (the last national census) the town of Bridgewater in Somerset had a population of circa 41,000,

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whereas the nearest town to Sizewell (Leiston) had a population of circa 5,500.

3.2.5 In addition, the ability to successfully negotiate connection costs to domestic users cannot be accurately predicted. Thus there is a potential commercial risk which could compound the difficulty in an investment decision.

3.3 Consideration of practical feasibility

3.3.1 Paragraph 4.6.8 of the NPS EN-1 clarifies that if the proposal is for thermal generation without CHP, the applicant should explain why CHP is not practically feasible, for example if there is a more energy efficient means of satisfying a nearby domestic heat demand.

3.3.2 Similar to the conclusions of both the Hinkley Point C CHP Study and that undertaken for Wylfa, the practical use of process steam for exporting to a future nearby industrial use is expected to be limited, due to the high costs of implementing such a proposal, coupled with the detrimental impacts that could be expected on the quantity of electricity generated. The Wylfa study, for example, identified that abstracting steam from the primary circuit would reduce electricity generation by 1 MWe for around every 3 MWth of heat abstracted meaning that the heat abstraction to support an industrial process would substantially reduce the power output from the plant.

3.3.3 With regard to decarbonising heat and power from the domestic sector, the UK Government is the first major economy to sign legally binding agreements to achieve net zero emissions by 2050. The Committee on Climate Change's report 'Net Zero – The UK's Contribution to stopping Global Warming' (Ref. 1.7) recognises that the decarbonisation of the grid is an essential part of the zero carbon strategy, requiring a quadrupling of the supply of low carbon energy by 2050 in order to meet a fully decarbonised electricity supply. Sizewell C will play a significant role for this, supplying over 6 million homes with virtually zero carbon electricity. However, the heat sector is also a significant consideration. The most widespread method of heating homes in the UK is currently through gas boilers, however a zero carbon energy future will not permit the widespread use of fossil fuels for heating. Decentralised energy supplied by virtually zero carbon heat does provide a potentially interesting opportunity for decarbonising local heating requirements around Sizewell.

3.3.4 The benefit of a CHP led decentralised energy network was considered from the perspective of carbon abatement by the CHP Study for Hinkley Point C. Whilst the inclusion of CHP is technically feasible for a new nuclear facility, previous assessments have found that CHP from a nuclear power station is

less effective for carbon abatement than other technologies, such as energy efficiency and heat pumps. It stands that a combination of energy efficiency through good standards of insulation, coupled with electric led efficient heating systems, such as heat pumps, will continue to be appropriate solutions to meet this future challenge.

3.4 Future heat requirements

3.4.1 Part 2 of paragraph 4.6.8 of NPS EN-1 states that if a proposal is for thermal generation without CHP, the applicant should provide details of any potential future heat requirements in the area that the station could meet.

3.4.2 An assessment has been undertaken of potential future developments within 15 km of the Sizewell C main development site. This has been based on data collected from local plan site allocations, comprising the Site Allocations and Area Specific Policies Development Plan Document - East Suffolk (Ref. 1.8) and the Waveney Local Plan (Ref. 1.9). A full list of sites identified is provided in **Appendix 8.15A**, 'Future Developments', appended to this document.

3.4.3 Within a 15 km search radius from the main development site there are 3,005 dwellings allocated with 463 hectares (ha) of employment land. These allocations are spread across 23 separate sites, with the largest (Policy WLP2.13 – North of Lowestoft Garden Village) for up to 1,300 homes and 8 ha of employment land in a mixed-use development located approximately 14 km from the main development site. Whilst this appears to offer some potential, it is relevant to note that this site is located at the upper end of the 15 km boundary stated by the NPS. Furthermore, a hypothetical commercial assessment to directly connect 4,000 new dwellings on a single site was undertaken for the CHP assessment for Hinkley Point C, where it was concluded that the total cost per MWhr was uneconomic by a significant margin, even when considering a 30-year payback period.

3.4.4 Given the fragmented nature of the sites identified in strategic land allocations, a CHP solution to deliver heat to future heat users could be expected to be uneconomic.

3.5 Future provisions

3.5.1 The final part of paragraph 4.6.8 of EN-1 requires that consideration is given to detail the provisions in the proposed scheme for ensuring any potential heat demand in the future can be exploited.

3.5.2 As identified, the review of existing heat demands from the Government's CHP map and future demands expected from land allocations is generally

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limited and found to be lower than Hinkley Point C. The limited heat demand now and in the future is unlikely to make CHP viable. Notwithstanding this, the Government has committed to decarbonisation and a large part of the UK's efforts to meet net zero will be focussed on decarbonising heat. SZC Co. wants to ensure that it can offer the greatest benefit to the local community and is a 'no regret' decision for the Government. This could provide a unique opportunity for the Government to explore developing technologies.

- 3.5.3 SZC Co. is exploring opportunities to make the best possible use of resources, including exploring innovative options for making use of waste heat for example to make hydrogen, in cryo-storage or in absorption chillers for data centres. SZC Co. is considering small engineering adjustments to ensure that relevant options remain open once the Sizewell C Project is operational. These adjustments are not included in the DCO application and would be expected to be supported by the necessary separate consents, should these options be progressed. In addition, SZC Co. will continue to explore the heat demand within the area. If SZC Co. finds that there is a heat demand in the future that can be exploited, and is satisfied that it is commercially viable and practical to retrofit the scheme to deliver a decentralised heat network, SZC Co. will take steps to retrospectively incorporate CHP at Sizewell C.

3.6 Consultation with stakeholders

- 3.6.1 Paragraph 11 of the 2006 Department of Trade and Industry guidance states that developers should provide evidence to show the steps that they have taken to assess the viability of CHP opportunities. This should include a list of organisations contacted. Due to the comparison identified above it is clear that there is no immediate or potential future heat demands in proximity to the site and therefore no formal consultation has been undertaken with local authorities or wider stakeholders on this matter.

4 Conclusions

- 4.1.1 This CHP Feasibility Study has been prepared by SZC Co. to support the DCO application for a new nuclear power station at Sizewell, called Sizewell C.
- 4.1.2 A detailed study was previously commissioned by EDF Energy to evaluate the practical feasibility and economic viability for inclusion of CHP at the Hinkley Point C project in Somerset. This study was included within the application for development consent, where it was concluded that CHP would

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be impractical and uneconomic. Similar to the findings for Hinkley Point C and indeed any thermal generating station, whilst operating Sizewell C as a CHP plant is technically feasible, various constraints exist which mean that such a solution is not practical nor currently expected to be commercially viable.

4.1.3 This CHP Feasibility Study does not seek to replicate the detailed work undertaken for Hinkley Point C, but rather makes comparisons between the site situation between Hinkley and Sizewell to justify that CHP would be neither practical nor economic. This CHP Feasibility Study draws from the in depth findings at Hinkley Point C, and other CHP assessments produced for thermal generating stations and addresses the technical justifications in NPS EN-1 paragraph 4.6.8. Key findings include:

- The Sizewell C main development site is located within a relatively remote location, over 30 km from the nearest city of Ipswich. Guidance suggests that a distance of 15 km may be viable for decentralised energy.
- The settlements that do currently exist within a 15 km radius of the site have relatively limited heat demands. The Government’s CHP heat map has identified that the surrounding heat demands are significantly lower for Sizewell than for a similar area surrounding Hinkley Point.
- According to the CHP development map, there are no large heat load sites identified within the 15 km search area. These are defined as sites with a point heat demand of greater than 5 MWth. which could act as potential anchor load for heat network development.
- The principal existing demand is from the domestic sector, which would be space heating, mainly of existing properties, both residential and commercial. These are generally expected to be individual houses, rather than larger estates and blocks of flats. The heat demand within the domestic sector is only high for around 4 months during the winter and very low for 4 months during summer months (winter / summer seasonal variation). This means that the cost of the system has to be borne by relatively small heat sales. The infrastructure cost is very high compared to the heat supplied.
- It is envisaged that any decentralised heat network supplied by Sizewell C would take many years to complete and require a very large investment in administration and development costs as well as the plant. The high capital cost would then need to be financed over a very

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long period. Thus there is considerable capital outlay, with no return until the Sizewell C Project is commissioned.

- The viability of the Sizewell C Project would be dependent on the number of connections made. As the predominant heat demand is for existing residential users, this cannot be accurately predicted. Thus there would always be a substantial commercial risk which will compound the difficulty in obtaining funding.
- As with Hinkley Point C, it would be reasonable to expect that any CHP scheme would have relatively poor performance in abating carbon dioxide, principally because the use of the heat would reduce the output of the nuclear power station requiring replacement of the power from fossil fuelled sources.

4.1.4 For the above reasons it is concluded that the inclusion of CHP is not currently considered economically or practically feasible for Sizewell C. This conclusion is consistent with NPS EN-6, which acknowledges in paragraph 2.9.3 that *“the economic viability of CHP opportunities... may be more limited for new nuclear power stations because the application of a demographic criterion for new nuclear power stations can result in stations being located away from major population centres and industrial heat demand”*.

4.1.5 However, SZC Co. will continue to explore the heat demand within the area. If SZC Co. finds that there is a heat demand in the future that can be exploited, and is satisfied that it is commercially viable and practical to retrofit the scheme to deliver a decentralised heat network, SZC Co. will take steps to retrospectively incorporate CHP at Sizewell C. To facilitate this, SZC Co. is considering small engineering adjustments to ensure that relevant options remain open once the Sizewell C Project is operational. These adjustments are not included in the DCO application and would be expected to be supported by the necessary separate consents, should these options be progressed.

References

- 1.1 Department of Energy and Climate Change, Overarching National Policy Statement for Energy (EN-1). London: The Stationery Office, July 2011.
- 1.2 Department of Energy and Climate Change, National Policy Statement for Nuclear Power Generation (EN-6). London: The Stationery Office, July 2011.
- 1.3 Department for Business, Energy & Industrial Strategy, UK CHP Development Map. Accessible at: <https://chptools.decc.gov.uk/developmentmap>
- 1.4 EDF Development Company Ltd. Potential Use of CHP at Hinkley Point C. Jacobs Engineering UK Limited. September 2010.
- 1.5 Wylfa Newydd Project. 8.28 Combined Heat and Power Feasibility Study. Pins Reference. EN010007. June 2018.
- 1.6 Department of Energy and Climate Change, 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. London: The Stationery Office, December 2006.
- 1.7 Net Zero: The UK's contribution to stopping Global Warming 2019 Report. Accessible at: <https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>
- 1.8 East Suffolk Council (2017) Site Allocations and Area Specific Policies Development Plan Document. Accessible at: <https://www.eastsuffolk.gov.uk/assets/Planning/Suffolk-Coastal-Local-Plan/Site-Allocations-and-Area-Specific-Policies/Adopted-Version-Sites-DPD-January-2017.pdf>
- 1.9 East Suffolk Council (2019) Waveney Local Plan. Accessible at: <https://www.eastsuffolk.gov.uk/assets/Your-Council/WDC-Council-Meetings/2019/March/Council-20-03-19/Item-11-APPENDIX-A-Waveney-Local-Plan.pdf>

Appendix 8.15A: Future Developments

1 Future Development Review

1.1.1 An analysis of future site allocations has been undertaken to determine the number and type of new sites allocated that could be expected to come forward. The assessment has been undertaken based on data collected by SZC Co. from the following documents:

- Site Allocations and Area Specific Policies Development Plan Document - East Suffolk (2017).
- Waveney Local Plan (2019).

1.1.2 **Table 1.1** below includes a list of sites identified in the review. The review shows that there are 3,005 dwellings and 463 ha of land designated within the plan periods.

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Table 1.1 – Site Allocations within 15 km of Sizewell C

Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	3 ha of land to the rear of Rose Hill, Saxmundham Road, Aldeburgh, is identified for a mixed development comprising a care home and open market housing for approximately 10 units	Saxmundham	Care home	10		2404
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	1.66 ha of land to the east of Aldeburgh Road, Aldringham, is identified for residential use for approximately 40 units.	Aldringham	Residential	40		2600
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.54 ha of land at Mill Road, Badingham, is identified for residential use for approximately 10 units	Badingham	Residential	10		3378
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.69 ha of land adjacent to Corner Cottages, Benhall, is identified for residential use for approximately 15 units	Benhall	Estate	15		3991
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	1.86 ha of land at The Street, Darsham, is identified for a mixed use development comprising a village hall, village green, and 20 new homes in accordance with	Darsham	Mixed	20		4776

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
	outline planning permission DC/13/2933/OUT.					
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.6 ha of land opposite Townsfield Cottages, Dennington, is identified for residential use for approximately 10 units.	Dennington	Residential	10		5548
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.56 ha of land south of Solomon's Rest, The Street, Hacheston, is identified for small scale residential use for approximately 10 units.	Hacheston	Residential	10		5889
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	1.86 ha of land south of Ambleside, Main Road Kelsale cum Carlton, is identified for residential use for approximately 30 units although a higher quantum of development may be appropriate subject to design and layout.	Kelsale cum Carlton	Residential	30		5928
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.86 ha of land north of Mill Close, Orford, is identified for residential use for approximately 10 units	Orford	Residential	10		6001

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	5.05 ha of land west of Garden Square, Rendlesham, is identified for a mixed residential development and greenspace provision for approximately 50 units.	Rendlesham	Mixed	50		6111
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	4.3 ha of land to the east of Redwald Road, Rendlesham, is identified for residential use for approximately 50 units	Rendlesham	Residential	50		6277
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	2.18 ha of land north-east of Street Farm, Saxmundham, is identified for residential use for approximately 40 units.	Saxmundham	Residential	40		6531
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.42 ha of land opposite The Sorrel Horse, The Street, Shottisham, is identified for small scale mixed use development for approximately 10 dwellings and a car park to accommodate circa 30 cars.	Shottisham	Mixed	10		6698
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.4 ha of land fronting Old Homes Road, Thorpeness, is identified for residential use for approximately 5 units.	Thorpeness	Residential	5		6801

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	2.45 ha of land south of Lower Road, Westerfield, is identified for residential use for approximately 20 units and public open space provision.	Westerfield	Residential	20		7582
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	3.65 ha of land at Old Station Works Main Road, Westerfield, is identified for a mixed employment / residential use for approximately 20 units.	Westerfield	Mixed	20		10164
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	0.7 ha of land at Street Farm, Witnesham, is identified for residential use for approximately 20 units.	Witnesham	Residential	20		11979
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	30 ha of land is identified at Ransomes, Nacton Heath for new employment provision for a mix of B1, B2 and B8 uses. Development will be subject to the preparation of development brief by the District Council.	Nacton heath	Employment		30	12275
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Land at Silverlace Green comprises some 2.24 ha of employment land. Within the site 0.98 ha of land remains vacant. The site contains	Parham	Employment		2.24	12355

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
	lawful uses within Use Classes B1 and B2.					
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	The former airfield at Parham comprises some 5.72 ha of employment land. 1.67 ha of land remains vacant. The site contains lawful uses within Use Classes B1 and B2.	Parham	Employment		5.72	13169
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	The former airfield at Debach comprises 10.89 ha of employment land. The site is fully occupied and contains lawful uses within Use Classes B1, B2 and B8.	Debach	Employment		10.89	13342
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Bentwaters Park covers an area of some 390 ha. It contains a wide range of traditional and unusual (sui generis) employment uses which make use of the great variety of building sizes and types and infrastructure available on the site. The building types are reflective of its former use as a military airfield. The Council is keen to ensure that this site remains a vibrant employment site.	Rendlesham	Employment		390	13367

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
	Accordingly, the Council will permit new employment uses where they will not breach site, environmental and highway constraints identified and conditioned in the planning permission C/10/3239 approved 11/12/2015. Outside of those limits new employment uses will be permitted where they are supported by robust evidence which confirms that their individual and cumulative impacts are acceptable. In both circumstances, proposals should conform to local and national planning policy, particularly with regard to the environmental designations on and in close proximity to the site.					
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Carlton Park comprises some 8 ha of employment land. 3 ha of land remains vacant. The site contains lawful uses within Use Classes B1, B2 and B8	Kelsale cum Carlton	Employment		8	13416

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Levington Park, is an existing low key employment site, some 3.29 ha in size	Levington	Employment		3.29	13685
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Riverside Industrial Estate comprises 2.04 ha of land with permission for a mix of B1 and B2 type uses	Wickham Market	Employment		2.04	13693
Site Allocations and Area Specific Policies Development Plan Document - East Suffolk	Two parcels of land as shown on the Policies Map are designated as public open space. This land is intended to form part of the country park (minimum of 24.5 ha total) required to be provided in association with the new Ipswich Garden Suburb the built area for which is located within the administrative boundary of Ipswich Borough Council.	Westerfield	Recreation / Green infrastructure			13743
Waveney Local Plan	WLP2.13 - Land comprising the North of Lowestoft Garden Village (approximately 71 ha) is allocated for a comprehensive mixed use development including: Approximately 1,300 new dwellings; Retirement	Lowestoft Area	Mixed	1300	8	13813

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
	community comprising a care home / nursing home and extra care and/or sheltered dwellings; 2 form entry primary school and a pre-school setting (2.2 ha); A local shopping centre comprising a convenience store, cafés, a pre-school setting, community centre and other local services; Playing field, play areas and green infrastructure; and 8 ha of employment development (falling under use classes B1, B2 and B8)					
Waveney Local Plan	WLP2.20 - Land at Gunton Park, off Old Lane, Corton (3.85 ha) as identified on the Policies Map is allocated for a residential development of approximately 65 dwellings and open space.	Lowestoft Area	Residential	65		13869
Waveney Local Plan	WLP2.14 - Land north of Union Lane, Oulton (5.70 ha) as identified on the Policies Map is allocated for a residential development of approximately 150 dwellings	Lowestoft Area	Residential	150		14196

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
Waveney Local Plan	WLP2.15 - Land between Hall Lane and Union Lane, Oulton (6.37 ha) as identified on the Policies Map is allocated for a residential development of approximately 190 dwellings.	Lowestoft Area	Residential	190		14266
Waveney Local Plan	WLP2.18 - Land at Mobbs Way, Oulton (2.80 ha) as identified on the Policies Map is allocated for employment development (falling under use classes B1, B2 and B8).	Lowestoft Area	Employment		2.8	14269
Waveney Local Plan	WLP2.16 - Land South of the Street, Carlton Colville/Gisleham (54.88 ha) as defined on the Policies Map is allocated for a comprehensive mixed use development. Pre-school, retirement, allotments, local shops	Lowestoft Area	Mixed	900		14285
Waveney Local Plan	WLP2.19 - Proposed sports and leisure. 30.23 ha. 20.75ha of sports pitches and sports facilities, 8 ha commercial development	Lowestoft Area	Sports			14737



SIZEWELL C PROJECT – COMBINED HEAT AND POWER
FEASIBILITY STUDY

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Source	Description	Location	Type of Development	Houses (dwellings)	Employment Land (ha)	Distance from Main Development Site (M)
East Suffolk emerging Local Plan	1.5 ha of land at Mow Hill, Witnesham, as shown on the Policies Map, is identified for the development of approximately 30 dwellings.	Witnesham	Residential	30		
Totals				3005	463	

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