LDĀ DESIGN

INVESTIGATING DECENTRALISED ENERGY IN BURY ST EDMUNDS

A REPORT FOR ST EDMUNDSBURY BOROUGH COUNCIL
JULY 2011

CONTENTS

Version: 1.4
Version date: 25th July 2011

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1.0 INTRODUCTION

This report presents the findings of a study carried out by *LDA Design* on behalf of St Edmundsbury Council and its partners. It provides a technical evidence base to support local authority actions and planning policies for decentralised energy. It also provides technical and financial options appraisals to help inform public and private investment in decentralised energy (heating, cooling and electricity) projects in Bury St Edmunds and their potential to be delivered to existing and planned mixed development in the town over the next 20 years.

The study does not constitute a complete technical and financial feasibility study, rather it identifies which options are worth taking to the next stage.

1.1. PROJECT OBJECTIVES

The agreement between the project partners contained within the Memorandum of Understanding (MoU) includes the strategic aim of the project:

The Parties agree to work together to investigate developing decentralised energy solutions for Bury St Edmunds (the Project). The strategic aim of the Project is to develop sustainable, affordable, low carbon energy supplies for Bury St Edmunds over the next twenty years.

This study has been commissioned by the project partners to deliver the aims and objectives of the initial phase of this project; to establish an evidence base to help inform public and private investment in decentralised energy. The study will deliver on the objectives by providing the following outputs:

- A heat and cooling map providing a spatial understanding of the current and predicted future energy demands;
- Identification and appraisal of opportunities for decentralised energy, including technology options assessment and a high-level summary of the potential costs and benefits;
- Production of a more detailed financial and technical study into the most promising opportunity, potentially making use of existing heat sources; and
- Recommendations for delivering the projects strategic objectives, practical actions for delivery and suggestions for further work.

1.2. STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 2.0 sets out the case for the low carbon economy and explains what is driving the investigation of decentralised energy, in terms of national and local policy
- Section 3.0 presents the local energy and emissions profile and provides an overview of the decentralised energy technologies which could be applied within Bury St Edmunds and how much they might be able to contribute to the emissions reduction commitments.
- Section 4.0 provides a brief overview of district heating and the different heat supply options. The potential resource and scope for application in Bury St Edmunds is explored
- Section 5.0 defines the criteria which we have used to identify potential opportunities for decentralised energy and characterises each of the options and their relative strengths
- Section 6 .0 presents the heat and cooling demand density map and the technical and financial appraisals of the opportunity areas based on initial network options
- Section 7.0 includes a more detailed financial viability assessment of the preferred option. An outline business case is developed and the potential environmental and financial benefits are considered further
- Section 8.0 contains a summary and conclusions and routes towards delivery and action based on the findings
- Section 9.0 shows how decentralised energy networks might contribute to existing Council strategies and plans and how, where strategies are not finalised, they be shaped by the study's findings
- Section 10.0 makes recommendations for how a corporate and spatial vision could reflect the findings of this study to inform future growth and action on economic development, sustainability and fuel poverty

The appendices describe our methodology and our approach to producing the heat maps and to the options appraisal.

IMAGE COURTESY OF GAVIN LOYNES CC.

2.0 DRIVERS FOR DECENTRALISED ENERGY

2.1. THE LOW CARBON ECONOMY

For many of us, the low carbon economy is a term we might have heard in the news or referred to by politicians. It may be something that we assume will happen in the future and not something to concern ourselves with while we have other pressing priorities. But all across the UK and beyond rapid progress is being made in new, low carbon, technologies and industries. The low carbon economy is already shaping the way we work, the decisions we make and the way we approach problems.

Oil drives almost every part of our economy and lives, from transport to farming. Increasing global demand pushed oil prices to unprecedented levels in summer 2008. Many economists believe this to have been a factor in the global recession. Indeed all but one of the global recessions since the 1970s has followed an increase in the price of oil. A clear trend seems to be emerging: economic growth in countries like China and India pushes oil prices up, meaning the UK pays more for its energy and fuel, leaving less disposable income. This leads to economic slowdown, recession and a slump in oil prices. As economies pick up, as we are seeing in the UK now, prices increase and the cycle starts again.

Since global demand for oil is rapidly increasing some economists conclude that boom and bust energy prices could become the norm. St Edmundsbury, like every other part of the UK, will suffer economically from this unless growth can be decoupled from the oil-based economy. The low carbon economy presents those with the foresight to do so with a new economic course to chart.

In 2010 global investment in low carbon energy, excluding nuclear was nearly £150 billion. China topped the list with over £34 billion. The UK a distant tenth, down from third in 2009, with £2 billion. However, even in the face of the worst recession in generations, new companies are emerging and existing ones evolving to take advantage of the rapid pace of change in technology and society.

It is the beginning of a process that will bring change to the very heart of our communities. Over the coming decades we will see fundamental changes to the way we generate heat and power, to our transportation systems and our homes and buildings. There will be challenges along the way, but those places that embrace the opportunities will stand to gain the most in terms of economic growth.

2.2. NATIONAL POLICY

The Government's commitment to an 80% reduction in greenhouse gas emissions by 2050 in the Climate Change Act 2008 has led to the creation of an evolving set of policies and financial incentives which are designed to encourage and facilitate the shift towards a low carbon economy. The transition will require a national roll-out of energy efficiency measures and an overhaul of our energy infrastructure in favour of a decarbonised electricity grid and decentralised networks of low and zero carbon energy technologies.

The incentive landscape for low carbon energy is complex. Policy instruments can overlap or compete, with fast changing, and sometimes uneven Government support for particular sectors or technologies. What has become clear is that decentralised energy in the right place has an important role to play. New and existing policies are incentivizing the development of district heating networks and are providing the long term investment certainty which reduces risk and attracts private finance.

The policy context for energy generation is continually evolving as our understanding of the resource improves and costs fall. The relative levels of support for renewable and low carbon technologies can change, with capital costs, installation costs, and energy prices potentially improving the commercial case over time.

2.3. LOCAL POLICY

Suffolk Strategic Partnership has set itself a demanding carbon emissions target, to reduce emissions 60% by 2025[1]. This challenge requires a steeper abatement trajectory than the national programme proposed by the Committee on Climate Change. This important commitment demonstrates the Partnership's recognition of the challenges facing local economies and the pressing need to move towards a low carbon economy.

St Edmundsbury Council are developing a suite of spatial policies in the Local Development Framework which will help them contribute to meeting the target. The adopted Core Strategy Development Plan Document identifies A Changing Climate as a key challenge to be addressed and includes a Sustainable Development policy which promotes the use of 'low carbon energy sources and decentralised energy generation'.

In April 2010 the council published and consulted on a final draft of the Development Management Submission Document provides the details of how the overarching Core Strategy policies will be implemented. It is understood that this document is under review by the Planning Authority.

The Local Development Framework, overall, provides a strong policy framework for developing new decentralised energy projects in the Borough.

A summary of some of the key drivers for decentralised energy at the national and local level are provided on the following page:

NATIONAL POLICY DRIVERS

- To ensure the UK is on target to reduce greenhouse gas emissions 80% by 2050, the Government must meet a series of legally binding carbon budgets; a cap on the total quantity of emissions in each 5 year period. The 'interim' levels of the first 4 budgets have been recommended by the Committee on Climate Change: 37 % by 2020, and 60% by 2030 relative to 1990 levels.

- The Feed-in Tariff (FiT) offers a premium payment per unit of electricity generated from renewable sources. Photovoltaics (PV), anaerobic digestion, wind, and hydro projects up to 5MW capacity can register for the FiT. Introduced in April 2010, it is paid to generators by energy supply companies and costs are recouped through a general increase in energy prices. A review of the tariff structure has reduced the rate available to large PV schemes, particularly ground mounted solar farms while increasing the tariff for anaerobic digestion.

- The Renewables Obligation (RO) requires electricity suppliers to obtain an increasing proportion of electricity from renewable sources. Renewable electricity can either be generated by the supplier or Renewables Obligation Certificates (ROCs) can be bought to meet the obligation. Generators of renewable energy will produce more ROCs than their obligation and can sell them on to recoup the additional cost of generation.

  The RO is primarily focused on electricity generation but a number of CHP systems running on either waste or biomass can claim ROCs. Certain fuels, such as energy crops, qualify for more than one ROC per MWh, to offset higher costs. The RO is likely to be replaced in the next few years (see Electricity Market Reform).

[1] CREATING THE GREENEST COUNTY: THE SUFFOLK CLIMATE ACTION PLAN, SUFFOLK STRATEGIC PARTNERSHIP

- The EU Emissions Trading Scheme (ETS) is a Europe-wide market for carbon trading between the largest emitters; those that use combustion plant with at least 20MW capacity. The ETS requires that participants hold permits for every tonne of CO_2 emitted. Some are handed out with the remainder bought on the open market. The total number of permits is reduced periodically, incentivizing energy efficiency measures as the cost of permits rises.

- The Climate Change Levy is a premium paid on the commercial and industrial supply of electricity and most fossil fuels. The levy is not usually charged on renewable electricity, providing an incentive for fuel switching by large users. CHP systems which are highly efficient and meet the Good Quality CHP (GQCHP) standards are exempt from paying the levy.

- Enhanced Capital Allowances (ECA) allows companies to write off the capital cost of CHP, biomass plant and other energy saving products against taxable profits. A business paying corporation tax at 26% will receive 26p tax relief for every £1 invested, covering capital expenditure and installation costs.

In addition to the existing incentive schemes, a number of additional schemes are due to start by 2012 which are expected to have a significant impact on the deployment of low carbon heating technologies.

- The Renewable Heat Incentive (RHI) offers a premium payment per unit of heat generated from renewable sources. It will open for non-domestic projects in July 2011, covering everything from small business and community projects up to large-scale industrial heating installations. It will support a range of technologies including solid and gaseous biomass, deep geothermal and energy from waste. CHP which burn fossil fuels, including co-firing plants will not be eligible.

  The first phase will also include Renewable Heat Premium payments for the domestic sector, to offset part of the cost of installation. The second phase will extend incentive payments to domestic installers sometime in 2012. Additional technologies may be added at this stage.

- The Carbon Reduction Commitment (CRC) will require organisations using over 6,000MWh of electricity per year to buy allowances to cover the carbon emissions associated with their energy use, starting in 2012. The price of allowances will be £12 per tonne of carbon dioxide during 2012/13, with a price set by the market in subsequent years. The design of the CRC is undergoing a wide ranging review which will simplify the scheme and reduce the burden on participants. Carbon savings cannot be claimed against the CRC while benefits are also being claimed through the Feed-in-Tariff or Renewable Heat Incentives.

- The Green Deal will offer up front funding for energy efficiency improvements in domestic and non-domestic buildings. Repayments will be taken as instalments added to the energy bills for that property. The amount repaid will be less than or equal to the expected savings on the energy bills as a result of the improvements; known as the 'Golden Rule'. This means that only improvements which can pay for themselves within an agreed period of time can be funded through the scheme. It is expected to be accompanied by a new Energy Company Obligation (ECO), replacing the CERT and CESP obligations, which will provide additional funding to top-up Green Deal finance. This will allow more expensive measures, such as solid wall insulation or low carbon energy supply, to be included in the scheme without breaking the Golden Rule.

  The details of the scheme are still under development, however the ECO may be a source of funding for district heating connections. Because of the obligations focus on fuel poor and vulnerable groups this type of funding, if made available, may be limited to housing association or fuel poor properties.

Beyond 2012 the Electricity Market Reform is intended to ensure that market will deliver the long term investment needed, particularly in renewable energy, nuclear power and carbon capture and storage, shifting the bias away from fossil fuels. The proposals are at the consultation stage and include a wide range of reforms to encourage low carbon generation and to provide a market which can cope adequately with intermittency in generation. It is to include a minimum price for carbon; augmenting the EU ETS price when it is low. The 2011 budget set the initial carbon floor price at £16 per tonne of CO_2 from 2013, rising to £30 in 2020. It also includes proposals for developing a Contract for Difference (CfD) Feed-in Tariff for large schemes where payments are made to "top up" the difference between the average market price and the tariff price. This would replace the current RO.

- The Green Investment Bank is central to the government's approach to delivering the finance needed to support the estimated £200 billion of investment in energy generation, electricity networks and gas infrastructure needed according to Ofgem. As announced in the 2011 Budget, it will begin as a £3 billion fund for investing in green projects and is expected to start lending in April 2012. It is hoped that the bank will be given the powers to borrow or raise money, issue green bonds and offer other financial products such as insurance from 2015.

- Building Regulations are also being progressively tightened, reducing the emission of new homes. While most reductions will be made through on-site measures, from 2016 developers will be able to contribute to an energy fund, which could be locally controlled, which will be used to reduce emissions elsewhere. Local Authorities may be in a position to allocate payments to eligible projects. Such 'Allowable Solutions' could therefore be put towards district heating infrastructure.

LOCAL PLANNING POLICIES

Note that these policies are included in the Development Management Document, which is understood to be under review by the Planning Authority.

- New development will be required to meet Code for Sustainable Homes level 4 and BREEAM 'Very Good'; environmental standards which encourages high energy standards and the use of low carbon energy.

- Larger developments of 10 dwellings or 1,000m^2 of non-residential floor space or more will be subject to an additional requirement to achieve a 10% reduction in regulated CO_2 emissions beyond Building Regulations Part L minimum standards which "can be achieved through "carbon compliance", i.e. a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies and directly connected heat ".

- Strategic development sites will be able to benefit from economies of scale to go beyond the 10% target. Such site specific and area targets can be set through Area Action Plans, masterplans and development briefs.

- A Supplementary Planning Document on Energy Efficiency is proposed within the Development Management Document which will include specific guidance for Consequential Improvements to Existing Dwellings. This could provide an opportunity for further establishing network connection standards and requirements for large buildings in the vicinity of existing networks to connect.

3.0

CARBON EMISSIONS AND ENERGY CONSUMPTION IN CONTEXT

3.1. CARBON EMISSIONS IN ST EDMUNDSBURY

An estimate of St Edmundsbury's energy and carbon emissions has been taken from DECC's Local and Regional CO_2 Emissions Estimates for 2005-2008 based on local gas, electricity and road transport fuel consumption estimates. Land use, land-use change and forestry are also taken into account.

DECC's High Level Energy Indicators in figure 1 show that energy consumption and carbon emissions per capita are in the upper quartile of all local authorities but have been dropping since 2006 to 11.7 tCO_2 in 2009. Nationally, emissions from buildings and industry fell by 12%% in 2009, primarily due to the recession. This is likely to have contributed to a reduction in emissions locally. As the economy improves, a rebound in output may reverse recent declines.

The above average per capita emissions are primarily due to the industrial and commercial sectors, which include a number of relatively energy intensive industries accounting for 60% of total emissions. In contrast emissions from the domestic sector are in the lower quartile, possibly pointing to higher standards of energy efficiency in existing buildings.

Suffolk's goal of achieving a 60% reduction in emissions has been set against a 2005 baseline as part of the Local Area Agreement. The Borough's per capita emissions in 2025 would therefore need to be approximately 4.5 tCO_2. This presents a significant challenge for the Borough and for its towns and villages.

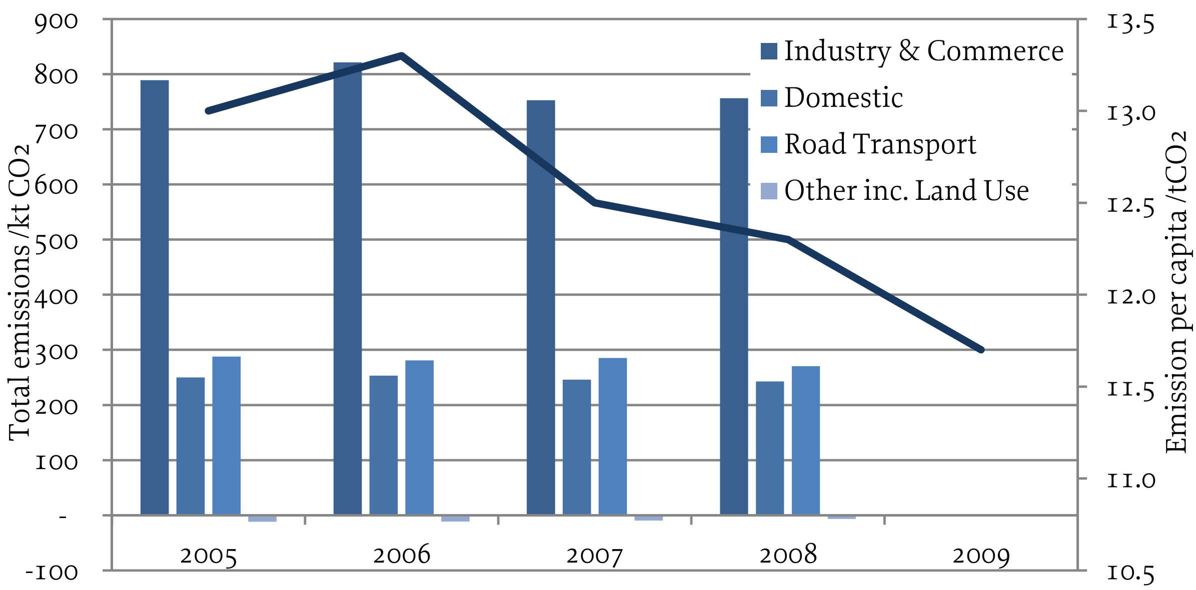
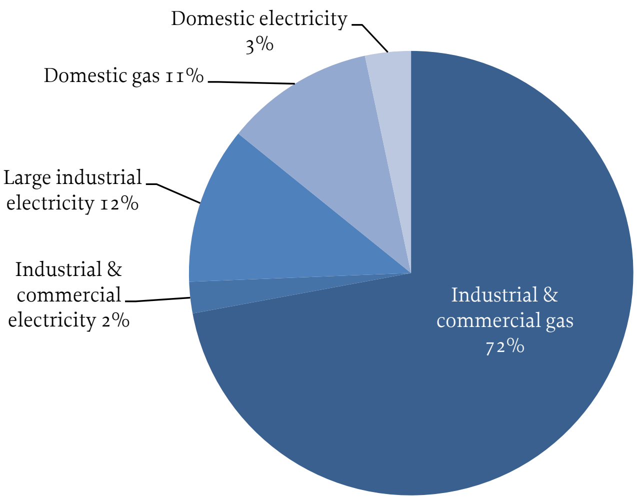


FIGURE 1: DECC'S HIGH LEVEL ENERGY INDICATORS FOR ST EDMUNDSBURY, 2009

3.2. ENERGY CONSUMPTION IN BURY ST EDMUNDS

An estimate of Bury St Edmunds' energy consumption has been taken from DECC's published electricity and gas consumption data for 2009. Energy consumption in the industrial and commercial sectors is more dominant in the Town than for the borough as a whole, accounting for over 80%. It should be noted that the Large Industrial Electricity sector in figure 2 accounts for all very large users across the whole borough and cannot be disaggregated further. Many large users, like British Sugar, are located within Bury St Edmunds but Large Industrial Electricity consumption is likely to be less than stated.



Sector	Energy consumption
Industrial & commercial gas	1,514 MWh
Industrial & commercial electricity	48 MWh
Large industrial electricity	240 MWh
Domestic gas	228 MWh
Domestic electricity	70 MWh
Total	2,100 MWh

FIGURE 2: ENERGY CONSUMPTION IN BURY ST EDMUNDS FROM DECC'S ELECTRICITY AND GAS CONSUMPTION DATA, 2009

3.3. FUTURE GROWTH IN BURY ST EDMUNDS

Bury St Edmunds is a growing town. New homes are needed, along with additional employment land and strategic infrastructure to meet the projected demand. The Bury St Edmunds Vision 2031, which will act as a masterplan for the town, provides a locally-specific spatial context to the Core Strategy. It sets out five new areas of growth (see Figure 4), which are expected to deliver 4,350 new homes and all of the new employment land needed over the plan period and beyond.

The directions of growth are:

- Fornham in North West Bury – around 900 homes
- Moreton Hall in East Bury – around 500 homes
- Westley in West Bury – around 450 homes
- North East Bury – around 1,250 homes
- South East Bury – around 1,250 homes

Despite the Building Regulations driving down the level of carbon emissions from new development, growth and an increase in population will put upward pressure on total carbon emissions. The estimated new energy demand will result in an increase in St Edmundsbury's carbon footprint of 1.2% by 2025 assuming they are built to minimum regulatory standards (see Figure 3). This does not take into account additional emissions from transport and from the potential intensification of demand for services and products, all of which have embodied emissions but which fall outside of the scope of this study.

The masterplan for Bury St Edmunds will need to reflect the commitments made through the Suffolk Strategic Partnership and will need to demonstrate what decentralised energy infrastructure can be used to reduce emissions from new development and how it will increase energy efficiency in the existing building stock and increase resilience to volatile energy prices and improved energy security.

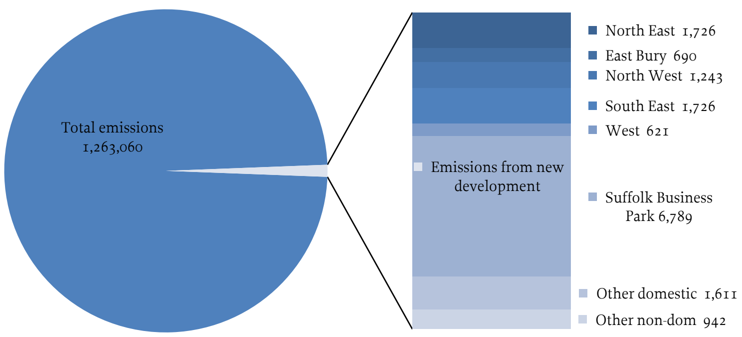


FIGURE 3: IMPACT OF NEW DEVELOPMENT ON ST EDMUNDSBURY'S CARBON EMISSIONS 2025

FIGURE 4: DIRECTIONS OF GROWTH, BURY ST EDMUNDS,
INTERPRETED FROM THE ST EDMUNDSBURY CORE STRATEGY 2010

4.0

DECENTRALISED ENERGY IN BURY ST. EDMUNDS

The power demands of buildings in the UK are predominantly met by electricity from the national grid, while heating comes from boilers located within the building using mains gas. Some heating needs are met by oil, electricity or LPG. These properties are mostly located in rural areas. Where used, cooling is usually produced in individual rooms or for a building by electric chillers.

In contrast, decentralised energy is produced closer to where it is consumed and has an increasingly important role in providing low carbon energy. Decentralised energy can comprise power generation (e.g. solar PV, wind or hydropower), heat (e.g. biomass, solar thermal or heat pumps) or a combination of both (CHP). Individual power generating technologies are often connected to the grid but do not have to be. There is no equivalent centralised grid for heat and cooling and so systems normally supply individual properties or communal systems.

4.1. REGIONAL DECENTRALISED ENERGY POTENTIAL

A regional renewable and low carbon energy capacity study has been conducted for the East of England. It provides an assessment of the renewable and low carbon energy resource potential in 2020 using DECC's Renewable and Low-carbon Energy Capacity Methodology, 2010.

Suffolk was found to have a technical potential renewable resource of 24,469 MW. This technical potential is not all likely to be developed and the capacity assessment sets out what these constraints are, including financial viability, opportunity costs and investor confidence. The opportunities and constraints were used to determine the proportion of the resource which could realistically be deployed by 2020. In Suffolk this is expected to be 557 MW; equivalent to 14% of the County's energy demands.

The regional study developed a high level estimate of the potential CHP capacity, based on the assumption that any location with a heat density above 3,000kW/km² could be served by district heating, see figure 5. The total potential capacity could be around 1,050 MW_e, approximately 4.5 times the current installed capacity. A more detailed heat map using higher resolution datasets has been developed as part of this study.

FIGURE 5: REGIONAL HEAT MAP, EAST OF ENGLAND RENEWABLE AND LOW CARBON ENERGY CAPACITY STUDY, 2011

	Thermal capacity (MW)	Thermal output (GWh)
Solar thermal	186	17
Heat pumps	309	93
Managed woodland	258	156
Energy crops & wood waste	49	27
Energy from Waste: MSW, C&IW and wet organic	400	297
Total capacity	1,202	592

SUMMARY OF 2020 THERMAL RESOURCE DEPLOYMENT FOR SUFFOLK COUNTY, EAST OF ENGLAND RENEWABLE AND LOW CARBON ENERGY CAPACITY STUDY, 2011

	Electrical capacity (MW)	Electrical output (GWh)
Wind	173	450
Solar PV	105	87
Hydro	0	0
Landfill & sewage gas	10	50
Managed woodland	5	35
Energy crops & wood waste	12	78
Energy from Waste: MSW, C&IW and wet organic	55	343
Total capacity	359	1,048

SUMMARY OF 2020 ELECTRICAL RESOURCE DEPLOYMENT FOR SUFFOLK COUNTY, EAST OF ENGLAND RENEWABLE AND LOW CARBON ENERGY CAPACITY STUDY, 2011

4.2. POTENTIAL IN BURY ST EDMUNDS

The regional capacity study does not provide results disaggregated to the town level. It is clear though that only some of the opportunities for generating renewable and low carbon energy identified for Suffolk will apply in Bury St Edmunds because of the town's character and resource opportunities and constraints.

4.2.1. WIND TURBINES

Wind energy is one of the most cost-effective renewable energy sources in the UK and is expected to make the biggest contribution to achieving our national targets for renewable energy. Large wind turbines (2.5MW) are typically over 80m tall with a rotor diameter of 100m. They are ill-suited to populated urban areas because of physical limitations and the likelihood of public and planning opposition due to visual intrusion and noise. Turbines of this size are usually located away from built up areas; with a buffer zone of 800m typical. No potential is shown in Bury St Edmunds after both 'hard' and 'soft' constraints have been applied.

Smaller turbines are subject to smaller buffer zones, around 200m for 100 kWe, and might be more suited to the town. Turbines from 6kW up to 800kW could be incorporated into a number of parts of the town where sufficient space exists. The main opportunities will be in parks, areas of open space and publicly and privately owned land. Turbulence reduces the amount of useful energy which can be extracted from the wind. Detailed appraisal will need to be undertaken by relevant project developers.

Building integrated turbines are also available at smaller sizes. The buildings themselves and other obstacles increase the level of turbulence[2]. Micro turbines are therefore not a recommended technology for Bury St Edmunds.

4.2.2. SOLAR PHOTOVOLTAICS (PV)

Solar PV has become more popular with land and building owners keen to take advantage of the Feed-in Tariff. It generates electricity and is highly flexible and can be installed on most domestic properties without requiring planning permission. Arrays can also be installed on facades and roof terraces as canopies. The Feed-in Tariff is available to all generators (householders, businesses, developers, landowners, RSLs and local authorities) and has turned PV from a niche technology into a major player.

Most installations have so far been integrated into buildings but larger ground-based arrays can be commercially attractive. A significant number of 'solar farms' have been proposed up to 5MW in size, covering many hectares. The recent review of the tariff means that from August 2011 schemes over 50kW will attract a lower tariff level. Most in the industry believe 50kW will be the maximum viable size of scheme for at least the next few years. Opportunities for such schemes exist across the town, including as canopies over car parks, on vacant land or in fields. A limiting factor will be the value of open land for other uses, including its public amenity value.

PHOTOMONTAGE OF PROPOSED SOLAR FARM, LDA DESIGN, 2011

[2] LOCATION, LOCATION, LOCATION: DOMESTIC SMALL-SCALE WIND FIELD TRIAL REPORT, ENERGY SAVING TRUST, JULY 2009

4.2.3. BIOMASS

Biomass is a versatile renewable heat and power generation resource that can be used at different scales and applications. It provides good value space and water heating with relatively short financial payback periods. Most biomass is cheaper than fossil fuels (heating oil is almost four times the price of wood chips per kilowatt hour). In some cases it can be used to replace existing fuels without changing technology. For example, you might be able to use biogas in an existing gas boiler. Biomass is also a way to use waste organic matter that would otherwise go to landfill, allowing local authorities to save money on landfill tax.

In comparison to other English regions, the East of England has low levels of managed forestry, with a significant proportion of the land used in intensive food production. The region has a limited potential biomass resource and new energy generation will be more dependent on imported feedstock.

Local biomass resources are considered more sustainable but feedstock supply chains are often national and increasingly international. Limits on the local biomass resource can be created by other power stations, such as Ely (using straw) and Thetford (using poultry litter), but can be overcome with supply from outside of the area.

The need to reduce carbon emissions and improve energy security means that a CHP powered district heating network will need to have future alternative fuels to natural gas planned in from the start. Biomass may well be one of these alternatives. However, the limited resource and growing demand might impact on security of supply in the long term.

Biomass can also be installed into individual buildings. These can be cost effective compared with some heating fuels but may compare less favourably with gas. The main limiting factors, in addition to future security of supply, will be the impact that many installations might have on air quality (a large scheme can more effectively manage emissions) and the impact of fuel deliveries on transport.

4.2.4. OTHER MICROGENERATION TECHNOLOGIES

Microgeneration technologies can be integrated within individual buildings and are often well suited to urban areas. Some residential systems do not need planning permission and have little visual impact, others are more visually intrusive. Some technologies generate heat, others power, and so consideration will need to be given to the bigger picture: for example, will a heat generating technology compete for heat demand with a district heating network. While each installation is generally small, there are many opportunities creating a significant overall potential.

The following technologies are likely to be suited to Bury St Edmunds:

SOLAR THERMAL

Solar thermal arrays are normally used to provide domestic hot water and can be installed on most homes without planning permission. Thermal arrays can serve non-domestic buildings with large hot water demands; however commercial buildings often have low demand for hot water and may not always be suited.

Alternatively, large arrays can feed into district heating networks. Examples of this exist in a number of European countries. Should a district network be developed in the town then solar thermal could offer a useful heat source in future as an alternative or supplement to gas or biomass. Council owned roof spaces, land or car parks could provide suitable locations for larger arrays.

As with other large-scale use of microgeneration technologies, inter-seasonal stores may be required in order to balance heat loads if used as part of a district heating network. Examples are starting to emerge across Europe. This is likely to be a longer-term rather than immediate requirement but presents potentially useful options for future-proofing district heating.

IMAGE OF A SOLAR THERMAL ARRAY CONNECTED TO A DISTRICT HEATING NETWORK IN MALMÖ, LDA DESIGN, 2011

SMALL HYDROPOWER

The Environment Agency have conducted a comprehensive assessment of the opportunities for small scale hydropower installations[3]. No potential sites are located in Bury St Edmunds and so the option has not been considered further.

MICRO CHP

Micro-CHP (<2kW_e) systems are being designed to serve individual buildings, avoiding the need for shared distribution infrastructure. A number of manufacturers are developing commercial units however the technology is still at the demonstration stage. Micro-CHP has been included in the Feed-in Tariff to encourage improvements in the technology but the tariff has been limited to the first 30,000 installations.

The challenge with micro-CHP will be to efficiently balance heat and power loads, particularly in smaller properties, without the need for additional energy sources. For example, while the highest demand for heat will correspond with demand for electricity (a winter evening for instance), demand for electricity will be year round while demand for heat will drop dramatically in summer months. The presence of a district heating network can help to balance these loads.

HEAT PUMPS

Heat pumps operate most efficiently in well insulated, air tight buildings. Existing buildings are often leaky which means cost and carbon savings might not be realised[4] if not accompanied by energy efficiency measures.

FIGURE 6: RENEWABLE AND LOW CARBON ENERGY CAPACITY MAP, AECOM FOR SUFFOLK COUNTY COUNCIL, APRIL 2011

4.2.5. WASTE

Suffolk County Council is the waste collection authority for Bury St Edmunds and allocates waste sites in the Minerals and Waste Development Framework. There are no existing waste installations, including landfill sites, in the town (see Figure 6). The Waste Core Strategy, including Development Management Policies , March 2011, indicates that no new strategic allocations are proposed.

Suffolk have let a long term PFI contract for an Energy from Waste plant using municipal solid waste (MSW) at Great Blakenham, 3 miles west of Ipswich. This plant is likely to make use of the available feedstock precluding use elsewhere.

Smaller scale anaerobic digestion may be forthcoming, particularly at farm scale. Outputs are normally electricity, heat, CHP and biogas. The biggest limiting factors on anaerobic digestion are:

- Movement of fuel – the economic viability is significantly affected by the distance fuel has to be transported
- Security of supply – long term contracts for fuel can be hard to obtain at a good price
- Disposal of digestate – limited by environmental regulations and space is required for spreading to land
- Outputs – electricity is the most flexible and often most useful output but will require a suitable grid connection. Heat would be compatible with a district heating network but the plant would need to be connected to a network and so may run into conflict with new and existing development.

Biogas is flexible in that it can be upgraded to biomethane and injected directly into the gas network. However, the scale of plant needed to justify the cost of injection is relatively large and would probably need to be considered as part of Waste Core Strategy.

There may be opportunities for energy from waste to contribute towards strategic infrastructure for Bury St Edmunds, particularly as the network expands and alternatives to gas CHP are sought. This should be considered first as part of a review of the Waste Core Strategy.

[3] OPPORTUNITY AND ENVIRONMENTAL SENSITIVITY MAPPING FOR HYDROPOWER IN ENGLAND AND WALES, ENVIRONMENT AGENCY, 2010

[4] GETTING WARMER: A FIELD TRIAL OF HEAT PUMPS, ENERGY SAVING TRUST, 2010

4.3. DISTRICT HEATING

The demand for heat accounts for nearly half of all UK carbon emissions making it necessary to both reduce heat demand through energy efficiency and to decarbonise the heat supply. In the right place and the right circumstances district heating and cooling can play a crucial role. Research for the Committee on Climate Change found there is significant potential for decentralised heat generation, with many of the opportunities making both environmental and business sense[5].

4.3.1. DISTRICT HEATING NETWORKS

District heating is a means of distributing heat generated in an energy centre to homes and businesses through a network of insulated pipes.

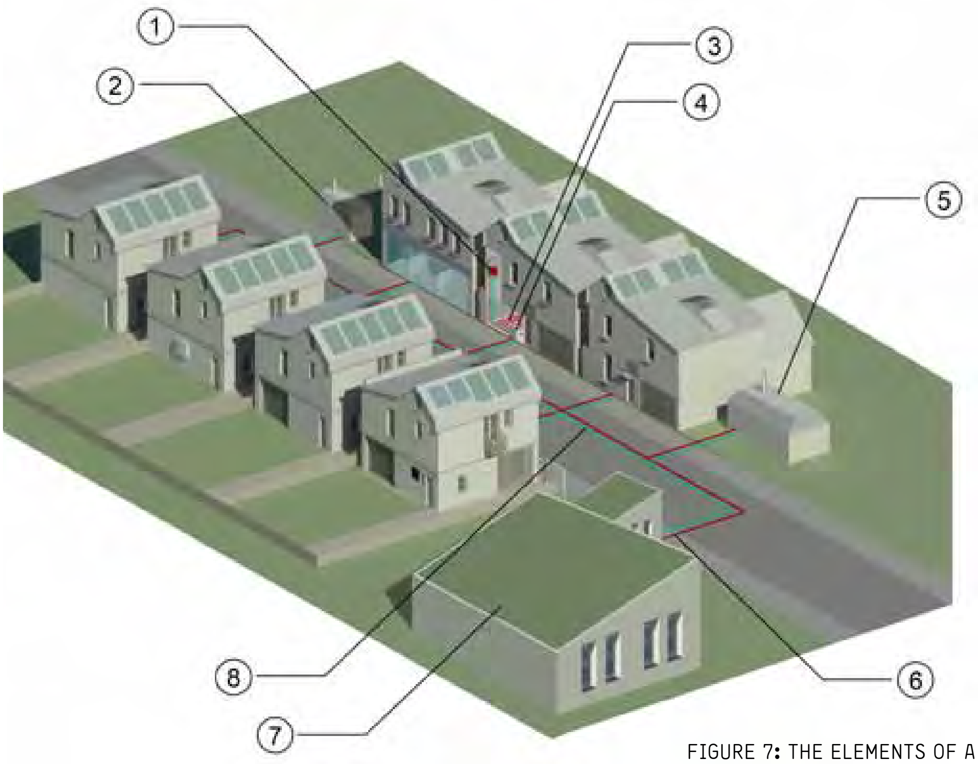
The hot water or steam is used to feed conventional building services either directly or indirectly via a heat exchanger. District heating can be used to provide space heating, hot water and cooling if the system is so designed. The cooled water is returned to the energy centre via 'return' pipes. Some industrial processes can also make use of the heat. At the boundary of each building served, a heat meter monitors consumption and is used for billing.

The diagram below shows the components of a typical district heating network:

District heating can be installed as part of a new development or retrofitted into existing communities. Networks can be expanded over time to include new loads (homes, offices, other buildings and processes). A wide variety of heat generation technologies can be used to supply district heating networks, including many renewable and low carbon technologies. The economies of scale available from the combined heat loads of the connected buildings or processes can make these technologies technically and commercially feasible. Low carbon fuels can result in significant emissions reductions when compared with traditional gas fired boilers.

Installing the heating mains can involve significant upfront investment, particularly in existing communities, which must be recouped through energy sales. A range of funding structures can be used to deliver networks, with the capital cost being met by a developer, a local authority, a third party Energy Service Company (ESCo), communities or a combination of all four. Over its lifetime district heating can provide cost savings to facilities managers through reduced maintenance costs, and in the right development it can reduce the cost of Building Regulations compliance for developers.

The potential for district heating is therefore dependent upon not only finding the right location but also in the type of heat sources used and the amount and quality of the heat being delivered. The financial case for district heating is complex. The important factors determining the viability of networks is described in section 5.



1. Hot water tank
2. Back-up boiler
3. Heating system
4. Heat exchanger
5. Energy centre
6. Hot water flow in insulated pipes
7. Anchor load (i.e. a school or hospital)
8. Low temperature return

FIGURE 7: THE ELEMENTS OF A DISTRICT HEATING NETWORK, COURTESY OF LOCAL GOVERNMENT IMPROVEMENT AND DEVELOPMENT

[5] NERA & AEA, DECARBONISING HEAT: LOW-CARBON HEAT SCENARIOS FOR THE 2020S, REPORT FOR THE COMMITTEE ON CLIMATE CHANGE, JUNE 2010

4.3.2. GAS-FIRED CHP

CHP plants generate electricity from a gas turbine, steam turbine or internal combustion engine in a similar way to conventional power stations. Instead of wasting the heat produced, it is recovered and made to do useful work; via a district heating system for instance. By combining the generation of electricity and heat, CHP makes more efficient use of its primary fuel, resulting in an energy saving of approximately 28%. In the figure 8 below the efficiency of providing energy using CHP is compared to the equivalent from the electricity grid and a heat only boiler.

The challenge of making CHP viable is finding a use for the heat produced; in industrial processes or for space heating, cooling and hot water in buildings. Because of this constraint, CHP is usually sized according to the available heat load, to ensure that a high proportion of the heat generated is used. Gas-fired CHP is flexible because of the relatively small energy centre requirements and reliance on gas which currently remains abundant.

An infrastructure study[6] for Bury St Edmunds has found that there is sufficient utilities capacity to accommodate a "large level of [development] without significant upgrades to the strategic infrastructure", suggesting that connection of new CHP capacity to the gas and electricity grids should be possible.

There are a number of CHP units already in operation in Bury St Edmunds.

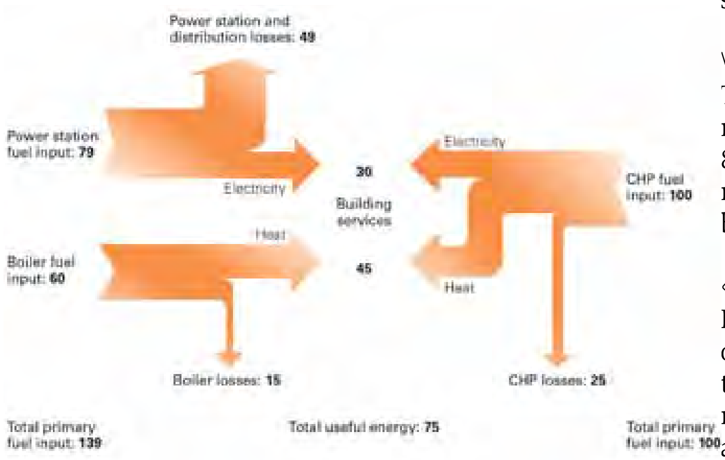


FIGURE 8: CHP SANKEY DIAGRAM, CARBON TRUST CTV044

BRITISH SUGAR

A steam cycle CHP with a waste heat boiler with the following system efficiencies assumed:
Electrical capacity: 50MWe export
Thermal input capacity: 184MWth
Electrical efficiency: 17.6%
Overall efficiency: 82.2%
Minimum available thermal capacity: 30MWth

The heat is used for processing sugar beet. The plant provides heat for processing during the 'campaign' between October and February with the 'juice run' May to August. For the rest of the year, the CHP is operated to produce electricity. The heat is rejected. Approximately 10% of the electricity is sold by private wire agreement with the remainder exported to the Grid. It is assumed that the plant operates in each mode for half the year. The plant has planned maintenance periods in April and August. These are assumed to be 10 days each but major outages are longer.

ABBEYCROFT LEISURE CENTRE

A reciprocating engine CHP with the following system efficiencies assumed:
Electrical capacity: 165kWe
Thermal capacity: 240kWth
Electrical efficiency: 36.1%
Overall efficiency: 88.6%

The leisure centre operates to meet heat demand from the centre and its swimming pool. The CHP is leased to the leisure centre but has experienced performance issues with the unit operating only periodically. The CHP is potentially oversized and could benefit from serving a larger heat load.

WEST SUFFOLK HOSPITAL

The current West Suffolk Hospital operates a reciprocating engine CHP with electrical capacity of 815kWe. Because West Suffolk Hospital is seeking a new site, it has been assumed that no network would be established around this heat source.

4.3.3. BIOMASS

Biomass is considered a low carbon fuel source because only CO_2 absorbed by the plant as it grew is emitted to the atmosphere during combustion. This CO_2 is then reabsorbed in new biomass growth. Net emissions are associated primarily with the processing and transportation of fuel. As demand for biomass increases, imported stocks are expected to become more common. The lifecycle carbon savings from some imported feedstock has been found to be higher than for fossil fuels, due in part to land use change[7]. In response, the Government is expected to publish mandatory sustainability criteria for bioenergy in summer 2011. This will require a minimum lifecycle carbon saving to be achieved for the installation to be eligible for subsidy, including the RHI and RO.

[6] NLP, INFRASTRUCTURE AND ENVIRONMENTAL CAPACITY APPRAISAL, MAY 2009

Opportunities for using biomass can be limited by logistics issues with the fuel supply. Fuel supply chains can be relatively immature and are not accessible everywhere. Delivery requires access for large vehicles and a large space for fuel storage.

Biomass can have air quality implications, depending on the type of biomass used, which will require consideration during both the design and operational phases. Dispersion modelling can be required to ensure flue gases do not affect air quality. This may place constraints about where in a development the plant can be located.

BIOMASS BOILERS

Biomass boilers are fuelled by dry biomass feedstock, commonly woodchip or wood pellets. A range of technology options have allowed systems to be designed to heat single homes or whole communities. The use of biomass boilers can be constrained by the availability of space for storing wood fuel and the logistics of regular, large fuel deliveries. As with gas-fired CHP, larger installations will require a large flue. Because environmental air pollutant levels are higher than for gas systems additional restrictions may be put in place in urban areas.

It is likely that there are a number of biomass boilers operating in individual homes or buildings, there are no known large biomass boiler installations in Bury St Edmunds.

BIOMASS CHP

Biomass CHP operates on similar principles to gas-fired CHP, with some technical differences required to accommodate each of the biomass fuel types. The choice of biomass CHP technology is made according to the types of biomass fuel that is available or on the capacity of the CHP engine required. Two main categories are:

- Solid wood biomass CHP using the Organic Rankine Cycle - systems are available at electrical capacities which range from 300kWe - 1500kWe with a typical heat to power ratio of 5:1.
- Gas engine CHP using biogases often produced from anaerobic digestion – systems typically available for electrical capacities from 1MWe upwards and have a typical heat to power ratio of 2:1.

Biogas can be generated through gasification, a thermal process which breaks down wood into a biogas consisting of carbon monoxide, hydrogen, carbon dioxide, nitrogen and a small amount of methane. Once generated the biogas can be used in a central CHP engine or boiler, or be cleaned up and injected into the gas mains, a process known as biomethane injection. Although biomethane technology is a relatively new initiative, the first phase of the Renewable Heat Incentive (RHI) will give support for grid injection and combustion of biogas for schemes under 200kWth and where the biomethane has been produced by a process other than from landfill gas. The scale of gasification plant required will depend on whether it is used in a CHP engine or injected into the gas mains.

British Sugar's steamcycle CHP is primarily gas-fired but can be co-fired with a small proportion of biogas during the campaign. The biogas is generated within the anaerobic digester which forms part of the site's wastewater treatment plant Beyond this there are no known biomass CHP installations in Bury St Edmunds.

The heat supplied via a district heating network can be produced from different types of fuel and can be generated by a number of technologies. This section explains the technology options and their primary benefits and limitations in the context of Bury St Edmunds.

It is important to note that other technology options, such as fuel cells, are expected to become more prevalent in future. However, unproven and pre-commercial technologies are not likely to be applicable during the timeframe in which this study applies and are therefore less relevant.

4.3.4. FUTURE PROOFING ENERGY SUPPLY

Fossil fuels are unlikely to be available or desirable (due to cost and emissions) in the long term. The Committee on Climate Change suggests that new power plants, including CHP, should not be fuelled by gas beyond 2020. Decentralised energy networks should therefore not be tied to using natural gas in the long term. Biomass is likely to be an important replacement fuel but competition for resources and land means that other alternatives will also be needed.

A study of future fuel supplies is beyond the scope of this study, however, a number of alternatives exist which should give confidence that district heating solution will be a robust solution long term. Accordingly, a future energy network in Bury St Edmunds *might* comprise some or all of the following heat sources:

- Waste heat from industrial processes
- CHP powered by biomass or biogas, with backup boilers supplied by biomass
- Large scale inter-seasonal thermal stores (most likely underground) to balance loads
- Heat generated from large-scale and individual building solar thermal arrays and communal heat pumps powered by renewable electricity generated within the borough. In combination with a thermal store, the intermittency of some renewable technologies could be managed

[7] THE GALLAGHER REVIEW INTO THE INDIRECT EFFECTS OF BIOFUELS PRODUCTION, RENEWABLE FUELS AGENCY, 2008

4.4. CONCLUSIONS

There is capacity and opportunity in Bury St Edmunds to deploy a range of decentralised energy technologies that can contribute to the strategic aims of the project partners, to develop affordable, low carbon and secure energy supplies. For the most part these will be delivered through private investment by individuals, businesses, communities and property developers. The Bury Vision 2031 should be clear in its support for all technologies that make a contribution to the project group's objectives.

Specifically, there is scope for microgeneration and other stand-alone energy projects. What is clear is that different renewable and low carbon technologies are suited to different types of development and will need to be deployed accordingly. The role of the Council will be to support their uptake through planning.

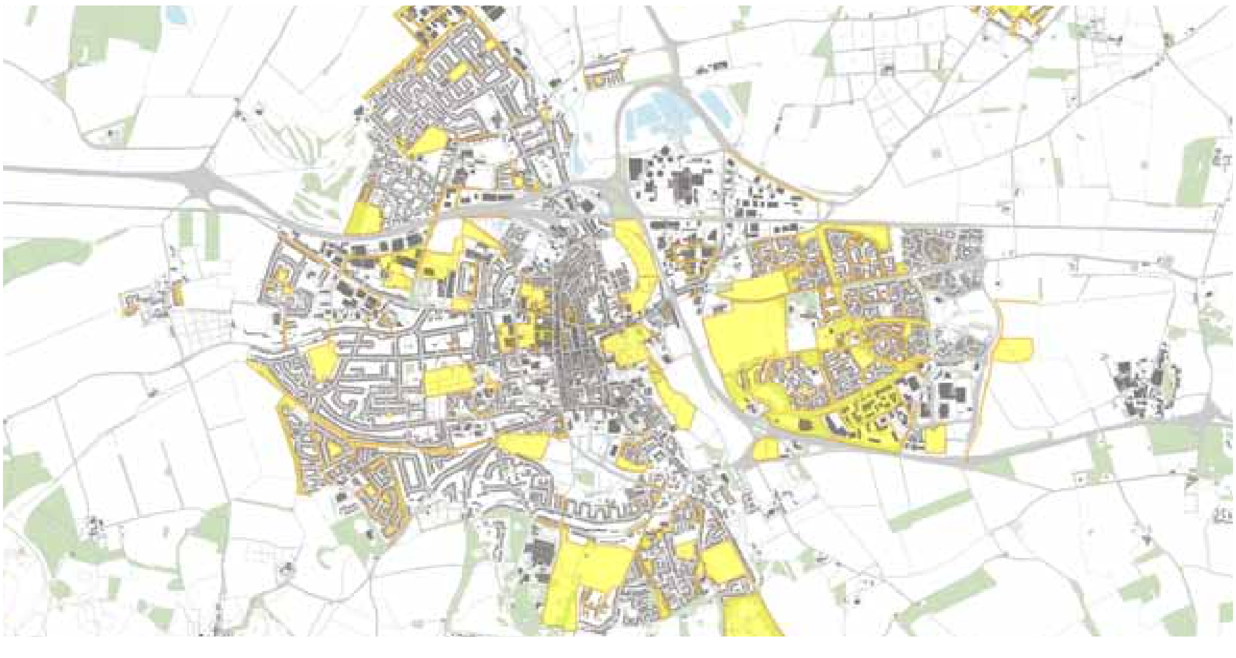
The following might be considered further as stand-alone projects:

- Small-scale wind – opportunities will be very limited within the town boundary but projects could be taken forward by landowners or by the Council on its own land. Figure 9 shows land and assets owned by the local authority, some of which might present opportunities for Council-led projects.
- Energy from waste – opportunities should be considered further as part of the next review of the Waste Core Strategy.
- Biomass – because the availability of fuel is limited biomass plant should be operated in CHP mode so that efficiency is maximised.
- Microgeneration – may play an important part in existing and new developments and should be supported where it can be shown to be more suitable than or does not conflict with a district heating solution. Ways in which the council might support microgeneration technologies are discussed in section 10.

The study also demonstrated the potential for district heating and particularly for a strategic district heating network serving existing and some new development. District heating works well in urban environments and provides infrastructure that can be used to reduce emissions in domestic, commercial and industrial buildings. The energy it generates is future proofed, ensuring continuing emissions savings in the long term.

District heating technology and the opportunities for using biomass or gas-fired CHP to supply heat appear to present a good opportunity for meeting the study objectives. This has different implications to the stand-alone and microgeneration technologies set out above in that its delivery will require more involvement from the Council and significant cooperation between stakeholders. The capital expenditure required and the potential disruption caused in construction necessitates a clear financial and technical case to be made. Therefore, the focus of the remainder of the study is on providing the first stages of the evidence needed to support the investment decisions of the project team.

FIGURE 9: MAP SHOWING LOCAL AUTHORITY OWNED LAND IN BURY ST EDMUNDS



5.0 OPTIONS IDENTIFICATION

We have conducted an initial screening of Bury St Edmunds to identify the locations which are considered to be more favourable to the establishment of district heating networks. This process has provided a shortlist of options which will be appraised in more detail in section 6.

The screening process was based on an interrogation of the heat maps we have produced, an assessment of the town's character areas and local knowledge provided through the Council and a workshop with the project partners.

Technically district heating networks in some form could be used to supply heat and hot water in each of the town's neighbourhoods. In most cases the cost of doing so would be prohibitive, with high capital cost and no return on investment generated. The options identified have been selected because they include features which reduce the capital costs and maximise the returns. Economic viability is dependent on a complex set of factors. At this screening stage, options have been identified as having higher relative potential according to a set of criteria. Consideration has been given to strategic town-wide options, those connecting a smaller number of buildings and those serving major new development.

5.1. EVALUATION CRITERIA

5.1.1. HEAT DEMAND DENSITY

District heating networks typically have a high capital cost and the distribution network is usually a large component part of this. Higher heat density means that a smaller network with shorter heat mains can supply the same amount of heat. This reduces the initial outlay and improves the commercial viability.

Cooling in buildings can be provided by central cooling plant, serving the whole building, or by local devices in specific areas, such as server rooms or south facing offices. Where the cooling demand is sufficiently large it can be produced using adsorption chillers which make use of heat provided by the network. Cooling demands act to increase the heat demand and can be considered in the same way.

High heat density occurs in dense urbanised areas where heat consumers are located close together or where small groups of large heat consumers are located in close proximity. Examples include town centres, high rise flats and industrial estates.

5.1.2. LOAD PROFILE

The aim is to have a combined load profile for the network which is high, consistent and stable throughout the year, resulting in full use of the networks production and distribution capacity.

Different types of heat consumer use different amounts and at different times of the day. A variable load profile (see Figure 10) isn't well suited to district heating, so networks serving only residential areas, where demand is low during the day when homes are empty and throughout summer when the heating is off, aren't preferred. Networks serving a mix of uses tend to be more commercially attractive.

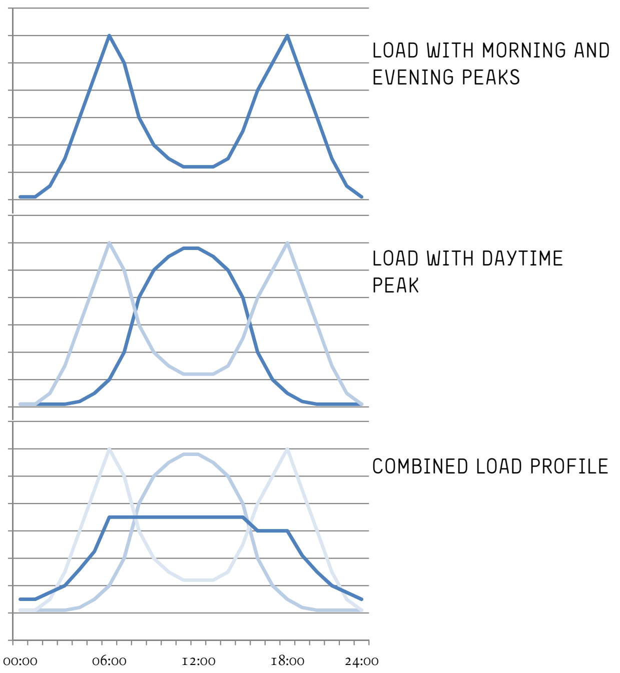


FIGURE 10: DIVERSE LOADS COMBINING TO IMPROVE THE OVERALL LOAD PROFILE

5.1.3. ANCHOR LOADS

Anchor loads are single heat consumers who have a steady heat profile throughout the day and year. Connecting to anchor loads ensures that there is a base load demand for the network to serve at all times and contributes to forming a good overall load profile. Anchor loads are often large consumers of electricity and are therefore also candidates for private wire electricity purchase agreements. Private wire contracts allow a higher price to be received for the electricity generated, while delivering lower carbon and potentially lower cost energy to the customer.

Typical anchor loads include hospitals, leisure centres and care homes.

5.1.4. PROCESS LOADS

Many industrial processes require large amounts of heat and in certain cases can play a key role in developing district heating networks.

Processes with large and continuous heat demands will make it likely that a CHP or energy from waste technology could already be in use. Where spare capacity is available, the existing plant and expertise can then help establish the network.

Where the process heat demand is met by conventional boilers or where plant space is limited, it could potentially act as an anchor load, receiving heat from another part of the network. Demands for low temperature hot water can also be served by CHP more efficiently, allowing higher electricity production (with steam cycle extraction) and lower distribution heat losses.

In all cases there will be technical and commercial restrictions to connection. The temperature and pressure must be compatible and the heat supply must be reliable ensuring security of supply for business critical processes.

5.1.5. PUBLIC SECTOR BUILDINGS

Public sector buildings can act as anchor loads for district heating networks. In addition to the relatively large heat loads of Council offices and schools, they can be useful when establishing a network.

The public sector is under pressure to reduce emissions from its estate, placing a greater emphasis on carbon abatement than in the private sector. They can therefore potentially gain more from connection to a network. They can also enter into longer term energy supply contracts, guaranteeing a customer base. This reduction in project risk improves the commercial case for energy service providers.

5.1.6. EXISTING HEAT SOURCES

Existing heat sources can reduce the cost and complexity of establishing new district heating networks.

There will be a cost involved in retrofitting existing plant for heat export but it can provide an additional revenue stream for the owner. Finding a standalone location for an energy centre can be difficult and costly. Land can be in short supply in opportunity areas, often with high value. The need for new flues and air quality implications can introduce further constraints.

Existing heat sources can often be found in anchor loads buildings, though the heat source might not have enough spare capacity to serve the network. Industrial processes can also make use of their waste heat.

5.1.7. NEW DEVELOPMENT

New developments are required through the Building Regulations to achieve high standards of energy efficiency through high performance fabric specification and increasing levels of air tightness. This acts to reduce overall heat demand. On the other hand the cost of installing district heating infrastructure in new developments is generally cheaper because it can be designed in and installed during construction.

Density of development is a key consideration in reducing the cost of infrastructure. District heating might be a favoured solution in blocks of flats whereas in many cases lower density suburban development sites might prefer a microgeneration based strategy. Microgeneration solutions can also fit more easily with phased development as the cost of installing expensive infrastructure upfront can be avoided.

5.1.8. EXISTING BUILDINGS

The increasing cost of energy and low carbon policy drivers are encouraging facilities managers to consider energy efficiency and alternative heating and cooling technologies. Heating systems in existing buildings generally have to be replaced every 15 years or so. Opportunities for connecting existing buildings to district heating networks often occur during scheduled building services maintenance and replacements. Major changes of building use or potentially of occupier can also provide opportunities to connect.

District heating can be a useful option for improving efficiency in harder to treat properties and those in conservation areas.

5.1.9. BARRIERS AND CONSTRAINTS

The presence of specific barriers or constraints to the development of district heating networks was taken into account. A wide range of physical or other constraints can have an important impact on the cost and deliverability of a proposed scheme.

Physical barriers include railway lines, rivers and major highways. These barriers introduce additional cost and complexity to the installation of heat mains. The concerns regarding continuity of service and safety of the responsible agencies can severely affect the viability of an opportunity.

Typical sub-surface constraints include existing service infrastructure pipework, sites of archaeological interest and safeguarded wayleaves. These can result in additional pipework infrastructure costs for co-ordination, survey or the need to use alternative routes.

Air Quality Management Areas (AQMA) can be established where concentrations of pollutants are found to exceed healthy levels. An AQMA requires that effort is made to reduce concentrations. This can constrain where energy centres can be located or the type of fuel used to supply heat. New installations could be required to demonstrate how their impact on local air quality is being mitigated.

Some part of a network, particularly those connecting to existing buildings, may require Compulsory Purchase Orders (CPO). This may well lead to delays in the networks development and to developments needing to connect to it.

5.2. OPTIONS IDENTIFIED

The initial investigation of Bury St Edmunds has identified 7 potential opportunities for using district heating. A brief summary of each of the options' potential benefits is provided along with an initial assessment of the buildings which the proposed network could serve and the networks' potential for expansion in the future. A map of the broad opportunity areas is included at the end of this section.

In the following diagrams:

- Energy centres and district heating mains are shown in black
- New development sites are shown in light blue and existing buildings in a darker blue dashed arrows show potential directions for future growth and interconnection with other opportunities
- Barriers to growth are show in red

5.2.1. OPPORTUNITIES NOT INCLUDED

As part of the options identification process, a number of potential opportunity areas have been deemed to be unsuitable and will not be appraised in further detail. These opportunities are:

- The current West Suffolk Hospital site includes a CHP which could possibly export heat to neighbouring buildings. Because of the hospital's desire for relocation in the long term, investment here would most likely be unviable.
- The strategic development site at South East Bury has been excluded owing to its relative isolation from other parts of Bury, there are no anchor loads, and is expected to be delivered later in the plan period. Because of the uncertainty this creates in the viability of a network and delivery options it has not been considered further.

FIGURE 11: OPTION 1 – WEST BURY

5.2.2. OPTION 1: WEST BURY

A new development led opportunity. The proposed new hospital on the strategic housing development site could support a site heating network. This could act as an anchor load facilitating expansion of the network. This expansion could allow the new build residential development to be served, and potentially existing buildings along Newmarket Road.

STRATEGIC DEVELOPMENT SITE

- West Bury is a strategic development site which is expected to include 450 homes, a local centre (shops and other convenience uses) and a 20-22 acre hospital campus to replace West Suffolk Hospital in the future. The timeframe for delivery is long term.
- The proposed hospital is anticipated to have a high heat demand and could act as an ideal anchor load to support a wider network. The hospital could also host the energy centre.
- Residential elements will be energy efficient and low density (~30dph).and are expected to be delivered prior to the hospital. Phasing means that a microgeneration strategy may be preferred by the housing developer.

FUTURE EXPANSION POTENTIAL

- The surrounding urban area is primarily low density residential and is therefore unlikely to provide the requisite heat density. The area does include some low rise flats which could increase heat density and provide opportunity for connection.
- Option 3 is located nearby to the east which is an opportunity for future expansion or interconnection.
- Railway and A14 run along northern boundary of the area, physically limiting options for expansion towards option 2.
- Interconnection with other initial opportunities is constrained by the A14 but Beeton's Way underpass could be used to create a link to option 3: Abbeycroft Leisure centre.

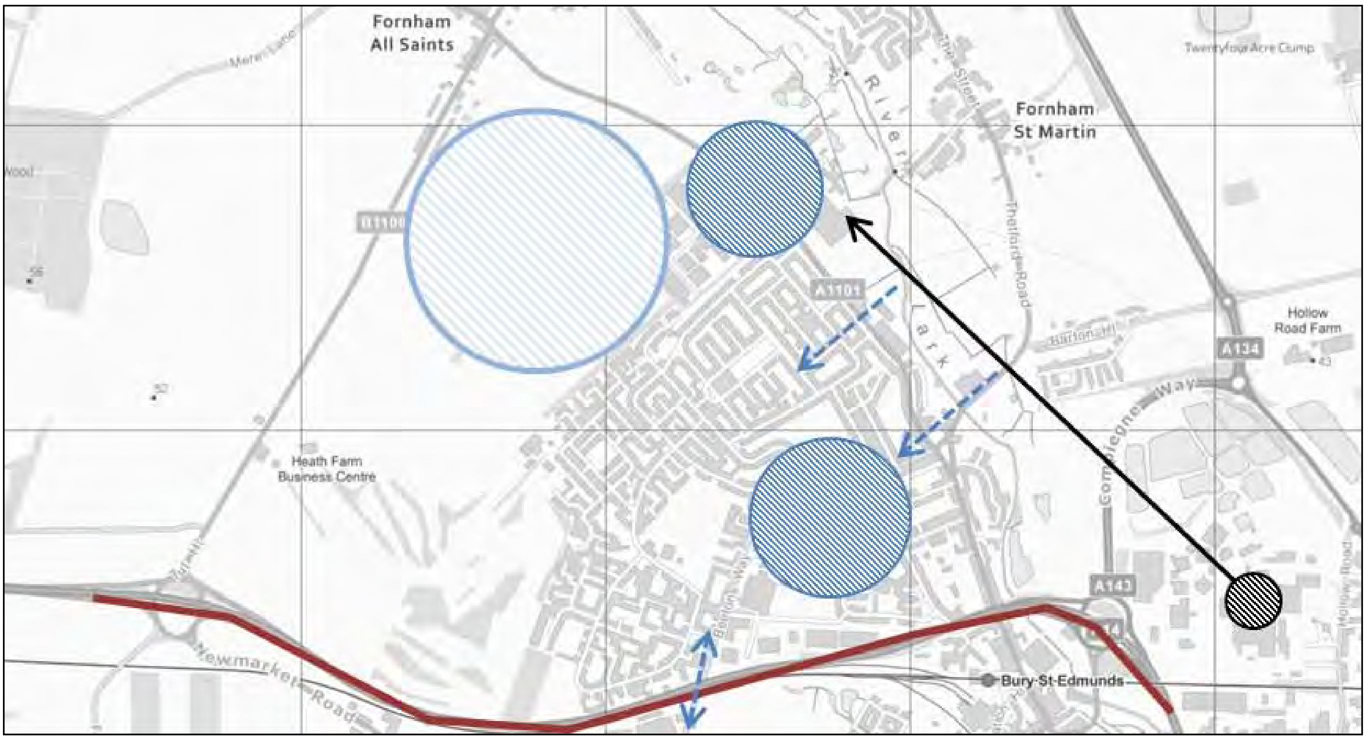


FIGURE 12: OPTION 2 – NORTH WEST BURY

5.2.3. OPTION 2: NORTH WEST BURY

There is an opportunity to make use of waste heat from the British Sugar plant. A network could serve the Northern Way industrial estate and/or the the strategic development site. The heat main could be routed across British Sugar owned land, via an underpass beneath Compiegne Way. Potential consumers include the strategic development site, Northern Way industrial estate and possibly some residential and education buildings within the adjacent neighbourhood north of the A14.

EXISTING HEAT SOURCES

- Although the British Sugar CHP plant is located at some distance from the key heat demands, the potential size of the combined loads, and the use of waste heat from the existing plant could make this option feasible.

STRATEGIC DEVELOPMENT SITE

- North West Bury is a strategic development site which is expected to include 900 homes, possibly a primary school and a local centre. Construction is currently expected within 5 years.
- Residential elements will be energy efficient and low density (~30dph). Phasing of development means that microgeneration strategy may be preferred by the housing developer unless the network connection is available prior to construction.

NORTHERN WAY INDUSTRIAL ESTATE

- Includes a range of light industrial uses which could potentially act as anchor loads. A number of businesses are large energy users, and are either CRC participants or information declarers.
- Connection to the industrial estate prior to construction of new homes at the strategic development would support extension of the network there.

PUBLIC SECTOR BUILDINGS

- Connection of Tollgate Primary, County Upper and St Benedict's Schools could facilitate network expansion into the existing residential neighbourhood. A reorganisation of the school system may lead to the construction of new school buildings, which could act as a catalyst for expansion.
- Howard Middle and the Albany Centre could act as an additional anchor for an initial network based around the strategic development site.

FUTURE EXPANSION POTENTIAL

- Surrounding urban areas primarily low density residential, but include some low rise flats. A number of these blocks and other properties are under Housing Association management.
- Interconnection with other initial opportunities is constrained by the A14 but Beeton's Way underpass could be used to create a link to option 3: Abbeycroft Leisure Centre.

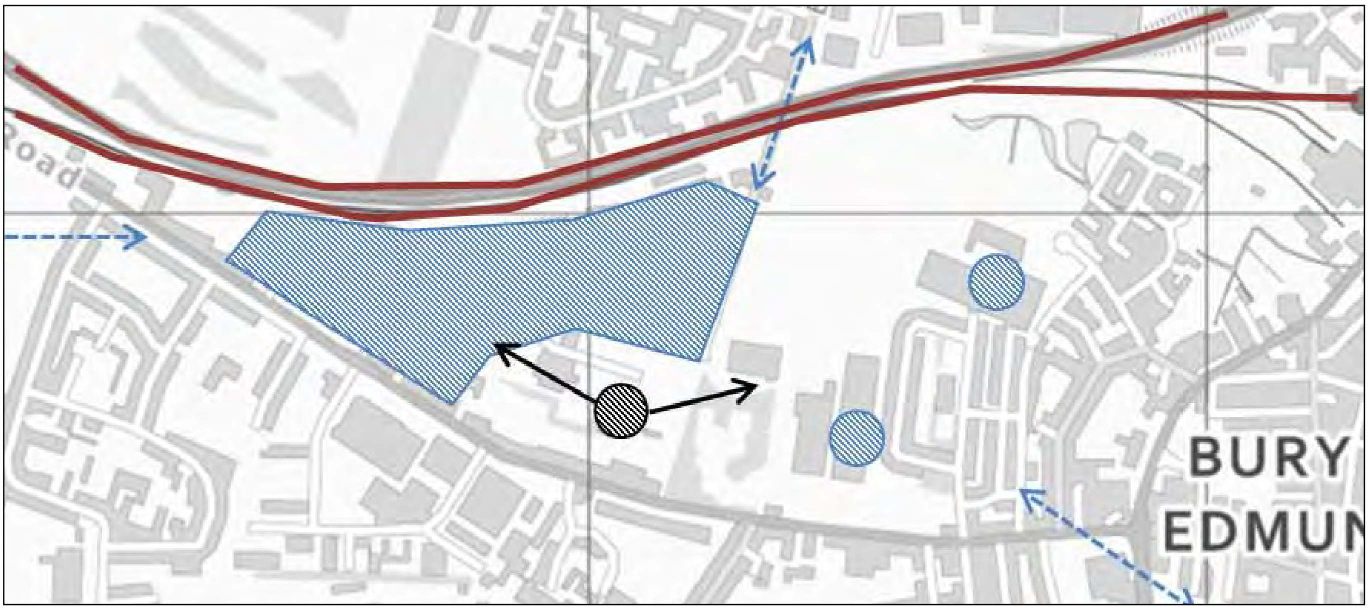


FIGURE 13: OPTION 3 – ABBEYCROFT LEISURE CENTRE

5.2.4. OPTION 3: ABBEYCROFT LEISURE CENTRE

There is an opportunity to make use of the existing CHP at Abbeycroft Leisure Centre, serving surrounding buildings. Heat density is provided by a number of large anchor loads in close proximity, including West Suffolk College, The St Edmundsbury Depot and a number of schools which are operated by the local authority or project partners. Plans to add new buildings at the College could facilitate network development.

EXISTING HEAT SOURCES

- Abbeycroft Leisure Centre has an existing CHP providing heating to the leisure complex and exporting the electricity to the national grid. There is potential opportunity to use any surplus capacity to serve neighbouring developments.

NEW DEVELOPMENT SITES

- West Suffolk College has plans to expand its estate with new buildings, extensions and refurbishment of its existing estate, including a new Further Education Building and refurbished workshops at Anglian Way.
- Site UCS065 is the Cecil & Larter tyre depot which is expected to deliver 24 homes on a brownfield site.

WESTERN WAY INDUSTRIAL ESTATE

- The estate includes a range of light industrial uses which are potential customers. A number of businesses are large energy users, including CRC participants.

PUBLIC SECTOR BUILDINGS

- The Council's depot behind West Suffolk House is used for waste management operations and services. It includes a large double height heated space with 3 loading bays.
- King Edward Upper School, 1400 pupils and St Edmundsbury CEVAP School, 200 pupils are located in close proximity to each other.
- The new Council offices at West Suffolk House are heated by ground source heat pumps. This system is newly installed and is incompatible with connection to a district heating network in the near future.

FUTURE EXPANSION POTENTIAL

- Interconnection with other initial opportunities is constrained by the A14 but Beeton's Way underpass could be used to link to the North West Bury opportunity area.
- The western extent of the area has potential to interconnect with the West Bury option. This would be dependent upon where the proposed hospital is located and whether that network serves the strategic development site at West Bury.
- The central Bury opportunity area is separated from the eastern extent by a low density residential neighbourhood. Residential neighbourhood around the schools to the east characterised by detached houses and short terraces and is therefore unlikely to provide sufficient heat density.

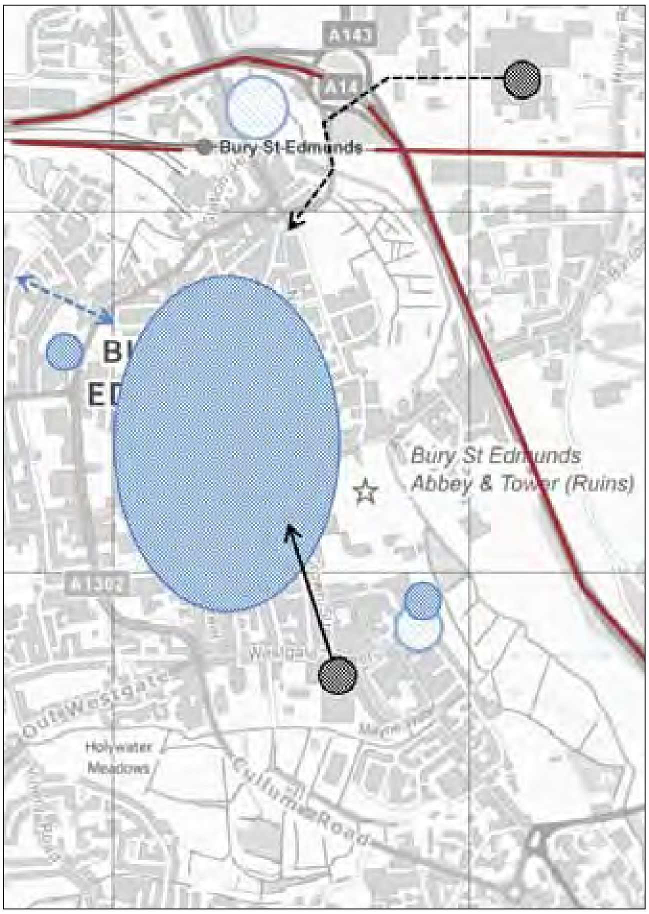


FIGURE 14: OPTION 4 - CENTRAL BURY

5.2.5. OPTION 4: CENTRAL BURY

There is an opportunity to serve the town centre, which has a high density of commercial buildings. The combined heating and cooling demands are expected to be high but the potential is limited by a number of constraints; there is little new development to catalyse network growth; finding a site for the energy centre, or centres, may be difficult; and extending a heat main under the A14 to the British Sugar factory may not be feasible and establishing the network would involve a large number of separate agents complicating co-ordination and delivery.

EXISTING HEAT SOURCES

- The British Sugar CHP plant is located on the far side of the A14 and the railway line. Although sufficient heat load is expected to be present in Central Bury, an initial network may not be able to make use of the waste heat source prior to an initial network cluster being formed. This might require an energy centre to be located within the area.

NEW DEVELOPMENT SITES

- Station Hill (site LP8) is a strategic development site which is expected to deliver ~300 homes in the long term. Delivery is not expected in the near future because of the need to find replacement sidings outside of the town before the land can be released.
- A number of smaller development sites have been identified by the Council including Nelson road car park; the Telephone exchange, Whiting Street and Thingoe House.

PUBLIC SECTOR BUILDINGS

- The town centre includes a wide range of public sector buildings, including Shire Hall courts, Seargeants Walk library, Parkway fire station, Connexions careers office and shopping and entertainment centres.
- Guildhall Feoffment CP School has approximately 220 primary pupils and St Louis Catholic Middle School has around 600.

EXISTING BUILDINGS

- A number of apartment buildings operated by Housing Associations are located in Central Bury including Forum Court of Flagship Housing and Parkway House of Suffolk Housing Society.
- Greene King's Westgate Brewery is expected to have a high heat demand from the brewing process and may be able to host an energy centre.

FUTURE EXPANSION POTENTIAL

- The number of buildings which would connect to the network initially would most likely be small. The number of individual heat loads suggests that continuing organic growth would be possible.
- Interconnection with other initial opportunities is constrained by the A14 and the railway line except for the option 3: Abbeycroft Leisure Centre option which is separated by a low density residential neighbourhood.
- To the south and west are predominantly residential neighbourhoods which contain schools, areas of affordable housing and small development sites and are therefore mostly unsuitable for connection.

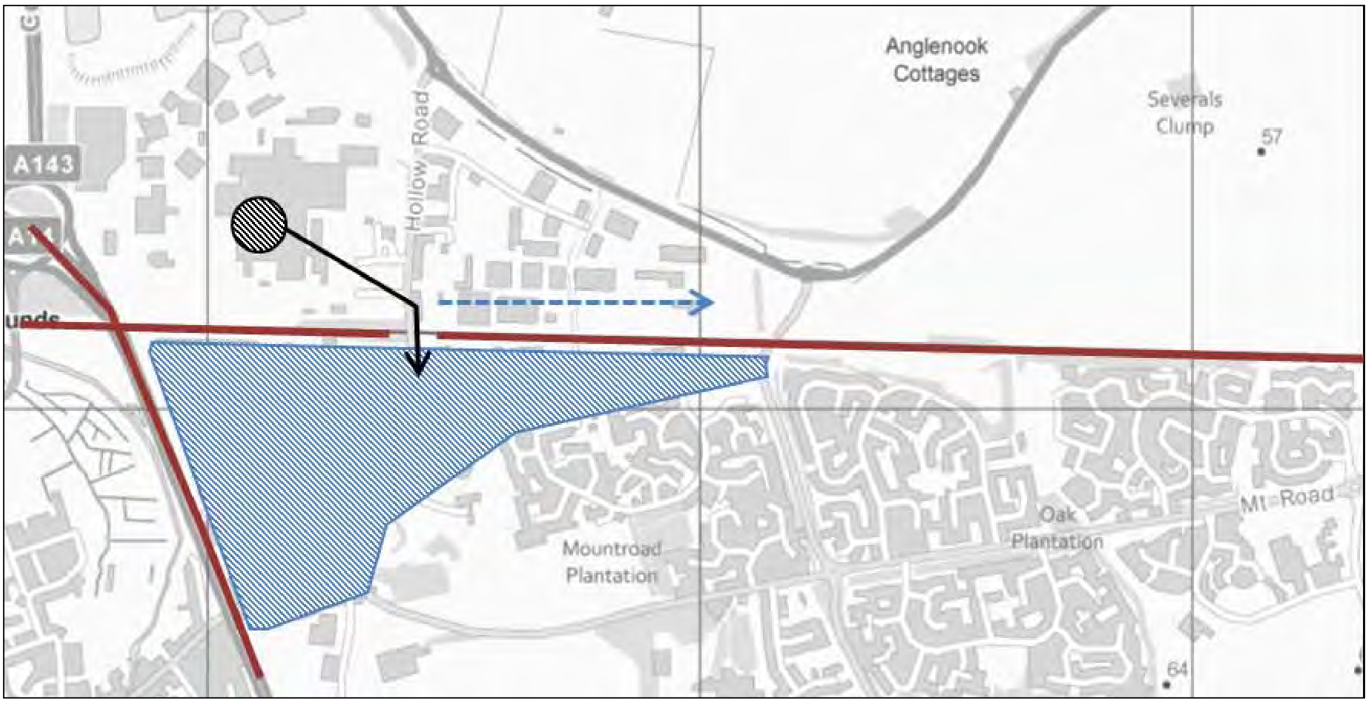


FIGURE 15: OPTION 5 – EASTERN WAY INDUSTRIAL ESTATE

5.2.6. OPTION 5: EASTERN WAY INDUSTRIAL ESTATE

There is an opportunity to make use of waste heat from the British Sugar plant to serve large heat consumers on the Eastern Way industrial estate. Potential consumers include ABN (British Sugar's sister company; animal feed and nutrition), Boortmalt and other industrial buildings to the south of the railway line. British Sugar has existing relationships with some of these businesses which could facilitate network connection and the contractual process. Eastern parts of the industrial estate are not fully occupied at present and include businesses which are not anticipated to have significant heat demand.

EXISTING HEAT SOURCES

- The British Sugar CHP plant is located on the Eastern Way industrial estate in close proximity to potential heat loads.

EASTERN WAY INDUSTRIAL ESTATE

- Businesses on the estate include ABN, Boortmalt malting company and other industrial processing. Connection to these loads would require finding a suitable pipework route which crosses the railway line.
- The estate to the east of British Sugar is not fully occupied and includes light engineering and manufacturing which is not expected to be suitable for connection.

PUBLIC SECTOR BUILDINGS

- An Adult Training Centre is located on Hollow Road, Davers Court residential care home has 34 single rooms and Priory Special School on Mount Road are all located on the far side of the railway line from British Sugar.

FUTURE EXPANSION POTENTIAL

- Interconnection with other initial opportunities is constrained by the A14, which because of its size may have additional restrictions on road works.
- Surrounding areas are agricultural or low density residential and are therefore unlikely to be suitable for expansion in the foreseeable future.

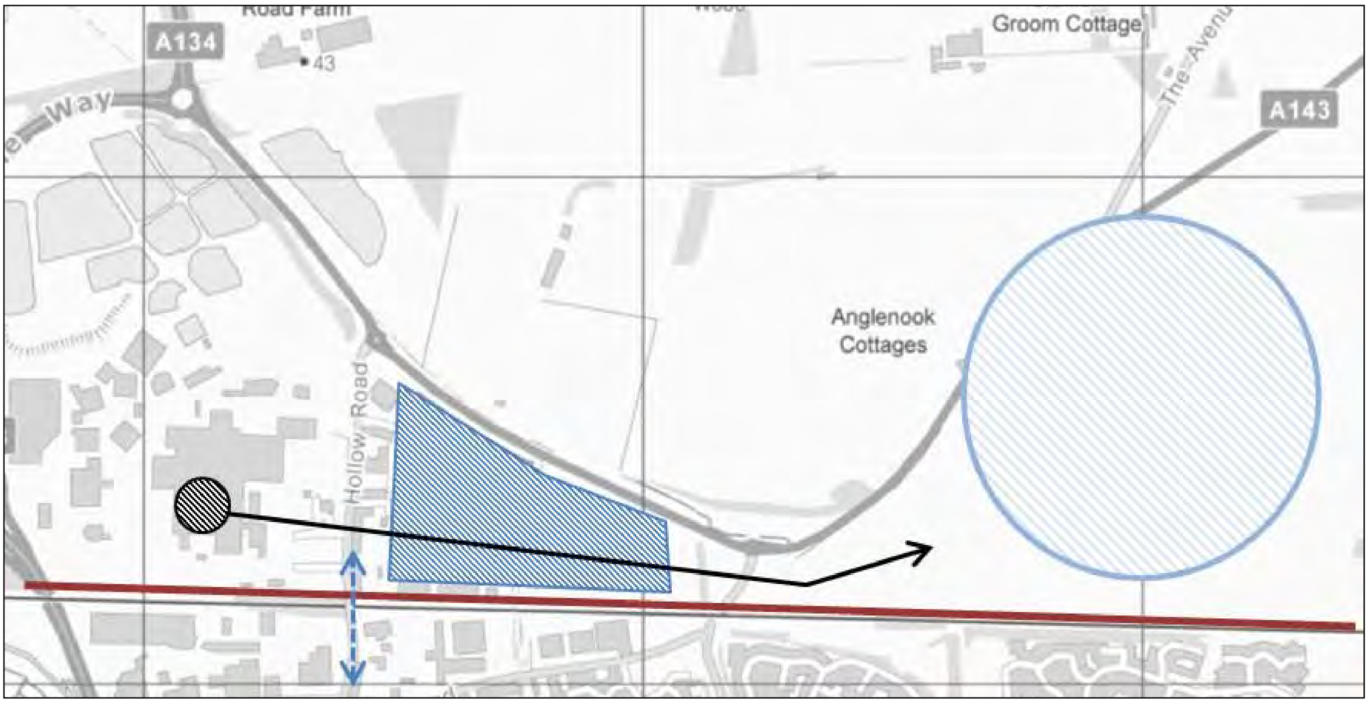


FIGURE 16: OPTION 6 - NORTH EAST BURY

5.2.7 OPTION 6: NORTH EAST BURY

A new development led opportunity. North East Bury, to the east of the British Sugar site is a strategic development site which is expected to deliver 1250 new homes, a primary school and local centre with a small supermarket. Although the density of development is expected to be low at ~30dph the developments location creates an opportunity to make use of British Sugar's waste heat. There is potential for it to be delivered alongside option 5: Eastern Way, which would provide a larger overall network heat demand.

EXISTING HEAT SOURCES

- The British Sugar CHP plant is located to the east of the strategic development site. The potential mains pipework route would not need to traverse either the railway line or Compiegne Way. However, it would cross existing development before going into open land, which we understand is in single ownership.

STRATEGIC DEVELOPMENT SITE

- North East Bury is a strategic development site which is expected to include 1250 homes, possibly a primary school and a local centre. The local centre may provide a small anchor but uncertain at this stage.
- Residential elements will be energy efficient and low density (~30dph). Delivery is expected in 10-20 years. The phasing of development means that microgeneration strategy may be preferred by housing developer unless the network connection is available prior to construction.

FUTURE EXPANSION POTENTIAL

- The surrounding area is primarily agricultural. Moreton Hall to the south is a recent low density residential development and is unlikely to provide suitable heat loads.
- The opportunity area could be served from British Sugar via option 5: Eastern Way. Interconnection with other initial opportunities is constrained by the railway line but the northern extent of option 7: Suffolk Business Park could be linked.

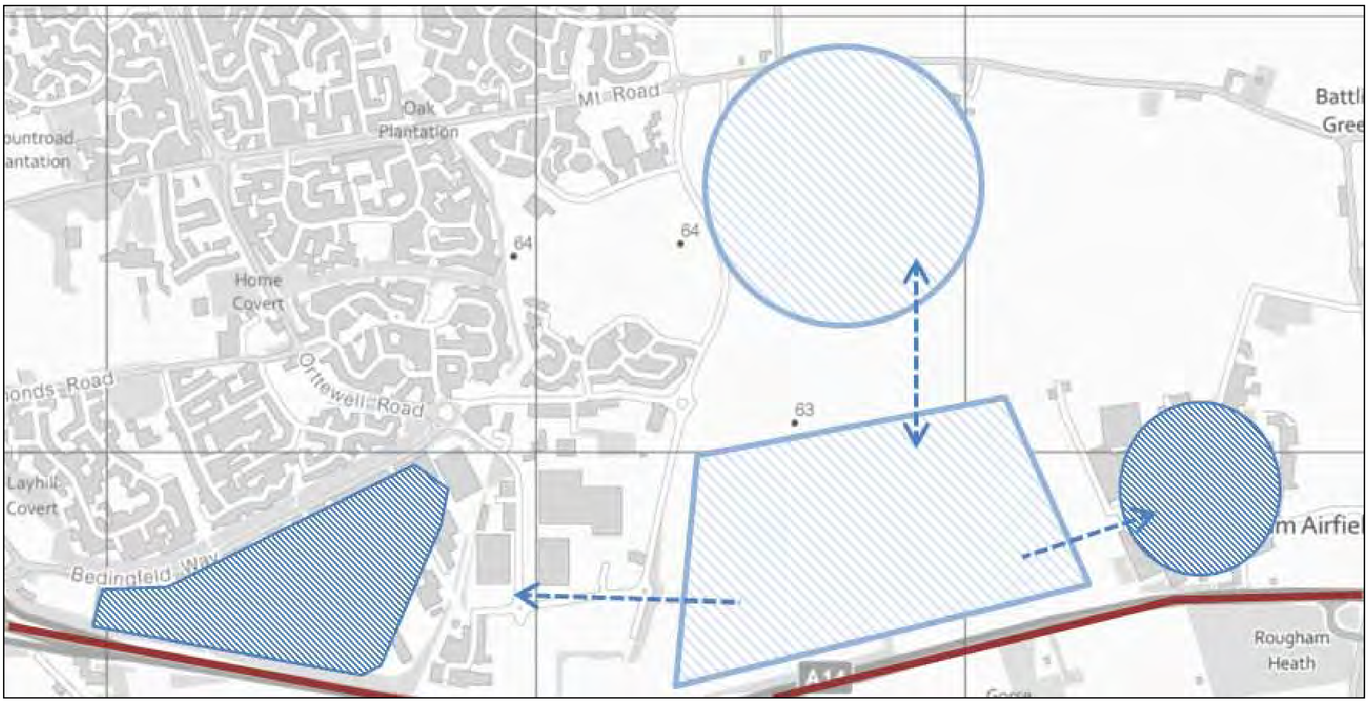


FIGURE 17: OPTION 7 – SUFFOLK BUSINESS PARK

5.2.8. OPTION 7: SUFFOLK BUSINESS PARK

There is an opportunity to develop a network to serve the allocated strategic employment site. The business park will come forward over the next 20 years. Sites of this scale tend to be developed in phases which can complicate the process of establishing a network. It also makes the future heating and cooling demand difficult to estimate. The energy centre could be located in or alongside an anchor load building, brought forward in the early phases. The 60ha site is bounded to the east and west by existing industrial areas and to the north by a future development site for a new Bury Town football stadium and East Bury, a strategic residential development site.

STRATEGIC DEVELOPMENT

- East Bury is expected to deliver 500 homes and could include a new upper school adjacent to Moreton Hall. Residential elements will be energy efficient and low density (~30dph). Phasing of development means that microgeneration strategy may be preferred by the housing developer unless the network connection is available prior to construction or they are required to install a network through planning.
- Proposals for a new stadium for Bury Town to be located on local authority owned land south of East Bury, which could include conference facilities etc.
- Suffolk Business Park is a strategic employment land site which is expected to provide sufficient B1 and B8 land to meet local needs throughout the core strategy plan period and beyond. Development will therefore occur over a 20+ year timeframe.

EXISTING BUILDINGS

- Existing Suffolk Business Park estate to the west of the strategic employment site includes large warehousing, supermarket and car showrooms typical of out of town retail parks. Parts of the Park are owned by the Council.
- Rougham industrial estate to the east of the strategic employment site comprises mixed industrial uses.

FUTURE EXPANSION POTENTIAL

- The surrounding area is primarily agricultural. Moreton Hall to the south is a recent low density residential development and is unlikely to provide suitable heat loads.
- The opportunity area could be served from British Sugar via option 5: Eastern Way. Interconnection with other initial opportunities is constrained by the railway line but the northern extent of option 7: Suffolk Business Park could be linked.

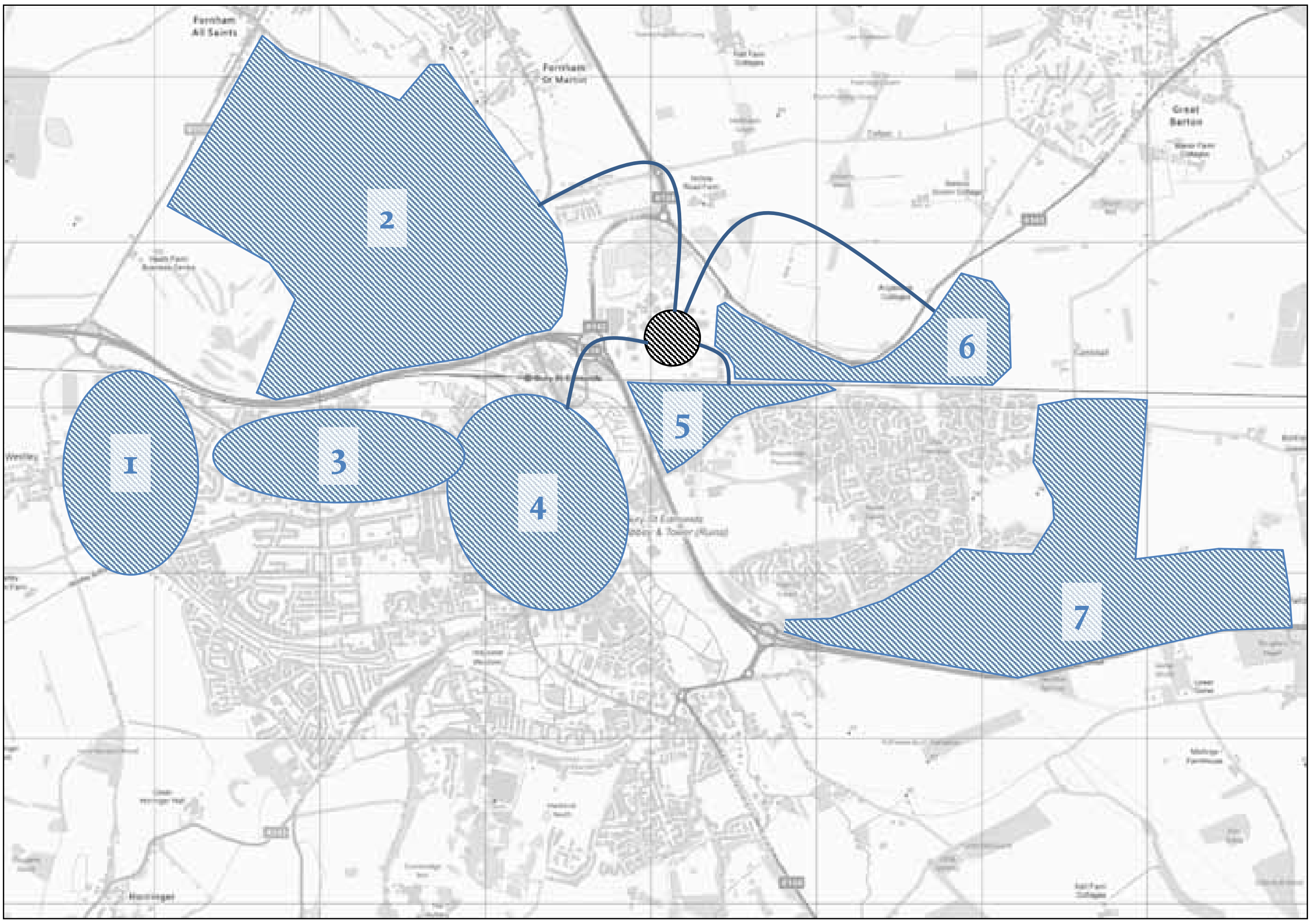


FIGURE 18: OPTION 7 - MAP SHOWING OPTIONS IDENTIFIED FOR FURTHER APPRAISAL AND THE BRITISH SUGAR SITE

Figure 18 presents the options identified for further appraisal which are:

1. West Bury
2. North West Bury
3. Abbeycroft Leisure Centre
4. Central Bury
5. Eastern Way
6. North East Bury
7. Suffolk Business Park

6.0 OPTIONS APPRAISAL

The data sheets below present a preliminary technical and financial appraisal for each of the options identified in section 5. The appraisals will be used to recommend a number of options for further study and a preferred option to be developed in more detail in section 7.

To appraise the opportunities identified in more detail, combinations of energy plant and heating networks have been proposed. The performance of this indicative network arrangement is then used to conduct a financial viability assessment for each of the options.

6.1. HEAT AND COOLING MAPS

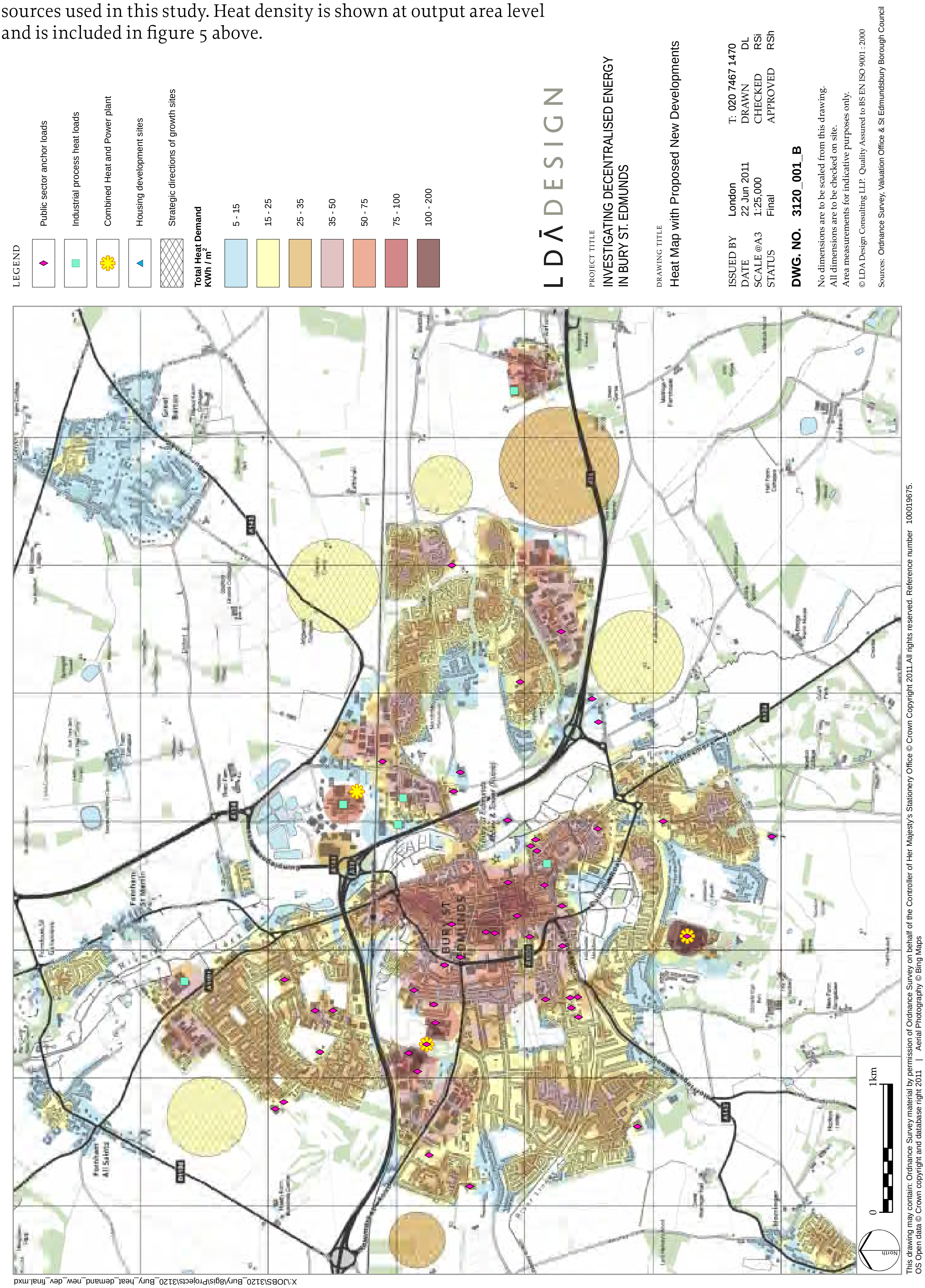
Heat and cooling maps provide a spatial picture of the distribution and density of energy demands from commercial and residential space heating and hot water and cooling respectively. The maps present the demand density as a contour map showing relative density of demand; the averaged demand per square meter can be determined using the colour scale (presented in kilowatt hours, kWh). The darker the colour the higher the predicted energy demand density.

Heat and cooling maps are useful for identifying where district heating and/or cooling networks might be suitable. Anchor loads, new development sites and other information useful in assessing the potential for district heating are also included.

The contour maps are produced following modelling of the heat and cooling demand at each residential and commercial building, using a combination of data sources linked to the National Land and Property Gazetteer address database. The methodology used in developing the maps is included in the appendix.

6.1.1. RELATIONSHIP TO THE REGIONAL HEAT MAP

A regional heat map has been produced as part of the East of England Capacity study. Because of the larger search area the DECC methodology takes a different approach and does not take advantage of all the data sources used in this study. Heat density is shown at output area level and is included in figure 5 above.



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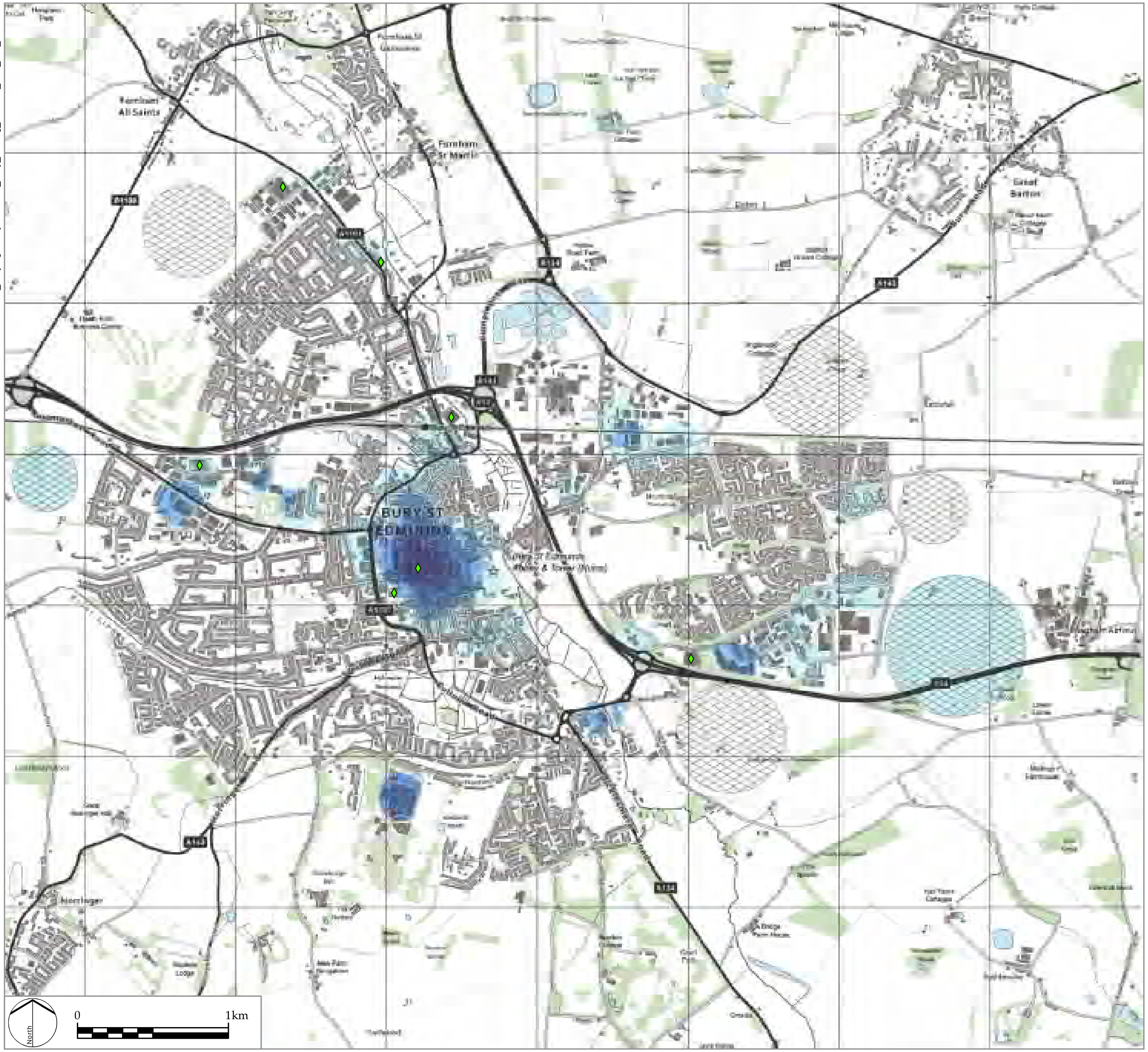


LEGEND

- Refrigeration loads
- Strategic directions of growth sites

Total cooling demand KWh / m²

- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 +

L D Ā DESIGN

PROJECT TITLE

INVESTIGATING DECENTRALISED ENERGY
IN BURY ST. EDMUNDS

DRAWING TITLE

Cooling Map with Proposed New Developments

ISSUED BY	London	T:	020 7467 1470
DATE	22 June 2011	DRAWN	DL
SCALE @A3	1:25,000	CHECKED	RSi
STATUS	Final	APPROVED	RSh

DWG. NO. 3120_002_B

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Sources: Ordnance Survey, Valuation Office & St Edmundsbury Borough Council

6.2. OPTIONS APPRAISAL METHODOLOGY

6.2.1. ENERGY PLANT SIZING

Energy plant sizing is conducted on a modelled network demand profile which reflects changes in demand throughout the day and year. The costs and benefits of different technology options can then be measured.

6.2.2. DEMAND PROFILES

Hourly heat load profiles for the networks have been developed based on generic daily load profiles for a range of building types. Daily profiles are then modulated according to historic monthly degree day profiles for East Anglia to produce annual profiles. High level assumptions for the proportion of total heat demand which is providing domestic hot water (DHW) have been made for each of the generic building types.

Cooling demand profiles are based on CIBSE monthly solar cooling profiles. Mechanical cooling is assumed to operate throughout the day and only during a cooling season from April to October.

6.2.3. PLANT SIZING STRATEGY

The primary energy plant serving district heating schemes are usually sized to meet the base load heat demand because this is usually the limiting factor. Any excess electricity produced can be exported to the grid. For each option the following technologies are sized:

- gas-fired CHP
- biomass CHP
- biomass boilers

In each case the plant is sized to achieve a full load equivalent running hours of around 4,500 hours as recommended by CIBSE. The remaining demand is met by high efficiency gas boilers sized to meet both stand by and peak loads.

A thermal store is installed with large heating plant to smooth out peak demands and to help them operate efficiently. Larger thermal stores can be used to balance heat demand over periods of days and weeks, increasing the proportion of heat which can be provided by the low carbon plant. Modelling has assumed a small thermal store only.

For existing heat sources alternative assumptions have been made to reflect available heat capacity, operating constraints and efficiency data. These are included in section 4.3.

6.3. FINANCIAL MODELLING

6.3.1. CAPITAL AND OPERATING COSTS

Capital costs comprise heat supply plant and heat distribution infrastructure, of which the largest proportion is normally associated with distribution. Pipework laid in soft landscaping or installed in a common trench at the same time as other infrastructure is considerably cheaper than that installed in the public highway.

It has been assumed that all capital expenditure is in year 1. In practice this is unlikely but in the absence of accurate phasing and connection data it is a baseline assumption.

District heating operating costs relate primarily to the cost of the input fuels. Other operating costs which are considered include maintenance and replacement costs and ESCo insurance costs.

Revenues comprise payments for heat made by connected buildings. This is based on a variable heat charge and a fixed monthly charge. The fixed charge is set for residential connections (£/month) and is linked to installed capacity (£/kW) for commercial connections. In scenarios using CHP, the sale of electricity via private wire agreement or through the grid provides an additional revenue stream. The advantages of establishing private wire agreements have been reduced by recent EU anti-competition rules so all sales are assumed to be to the grid.

6.3.2. COMMERCIAL SCENARIO

The commercial scenarios developed for each of the network options is taken from an ESCo or energy company perspective. An ESCo will value the available profit stream from heat sales and will invest an amount of capital based on that valuation. This valuation is unlikely, except on very large and very dense developments, to equate to the actual cost of the infrastructure, which will usually result in difference between capital costs and the ESCo capital contribution.

This capital shortfall will need to be provided from other funding sources. For new developments, the shortfall can be met by the developer as part of the site infrastructure costs. For existing buildings there will usually be a connection fee which will meet the infrastructure cost shortfall, but should be less than the cost of providing its own energy.

An ESCo will, in the normal course of events, seek a return on investment of between 12% and 14% over the 25 years investment. The graph in figure 19 presents a sample of typical IRRs at 5 year intervals which the ESCo would expect to achieve:

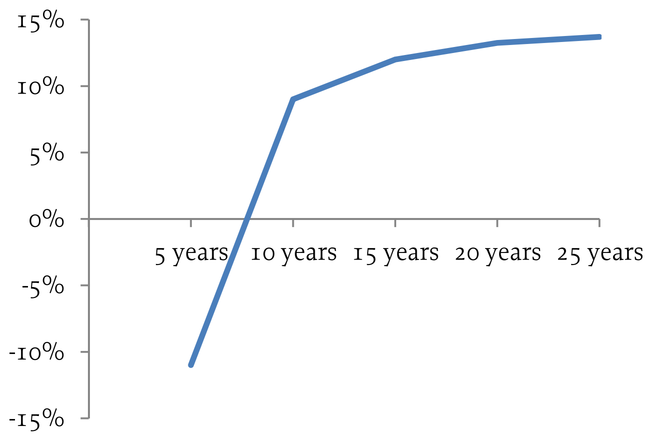


FIGURE 19: EXAMPLE IRR FOR A PROJECT THAT IS COMMERCIALLY ATTRACTIVE TO AN ESCO

The financial modelling can also be used to develop alternative funding and delivery models. The non-ESCo 25 year IRR is the rate of return for an investor taking on all of the ESCo capital costs and revenues.

Whilst we are using the term 'non-ESCo' it could be the ESCo that invests or alternatively the local authority, developer or any other investor. In this report the non-ESCo 25 year IRR is used a comparator to illustrate the extent, or otherwise, of the viability of each option in the absence of external investment.

6.4. LIMITATIONS OF THE METHODOLOGY

The maps are produced using a combination of measured and modelled data from sources with differing degrees of accuracy. The actual demand for heat can therefore differ significantly and can be skewed by large single loads. Heat maps are only indicative of likely heat demand and are therefore well suited to high level feasibility studies such as this.

For some network opportunities, particularly where it is predicated upon new non-domestic development, the level of uncertainty in the heat demand is greater. This applies particularly to options relating to the relocation of West Suffolk Hospital and Suffolk Business Park.

The cooling maps assume that all buildings in a sector which typically require cooling are making use of mechanical cooling systems. In reality many will rely on passive cooling or would use mechanical cooling in part of the building. Others buildings of these types would have no cooling at all.

Heat density is not the only metric for assessing the potential for district heating, with other factors discussed in section 5 such as the diversity of heat load and catalysts for delivery. The heat maps should therefore be read in conjunction with this report and can be used as a basis for further study using more accurate data sources.

The choice of heat supply plant has been made based on generic load profiles and modelled system operation. Where a large number of similar heat loads are connected it can be expected that their combined profile will resemble that modelled more closely. For smaller schemes the variance can be expected to be larger.

The pipework layouts presented are purely indicative and take no account of subsurface obstacles or permissions. Detailed surveys and negotiations with relevant parties would be needed to define a viable route.

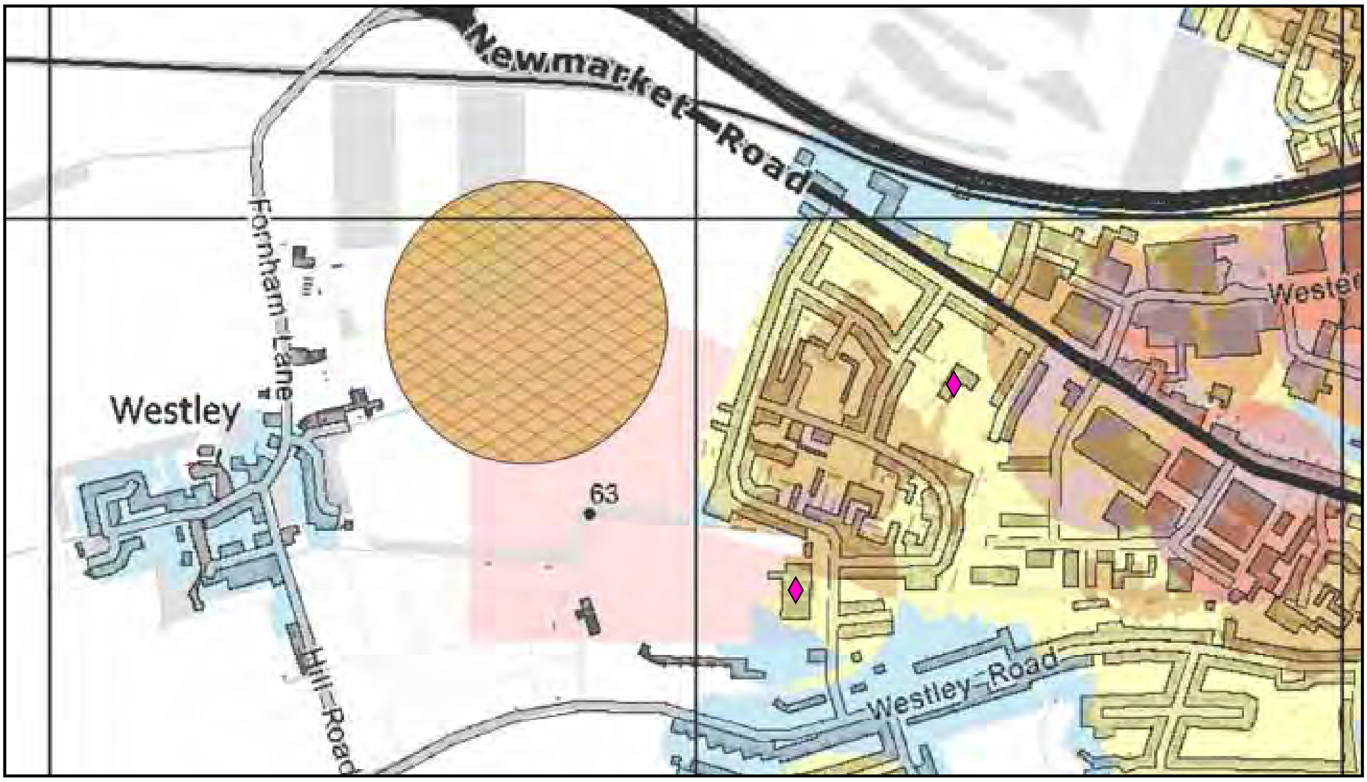
The models are critically sensitive to a number of the inputs and assumptions. These are discussed in more detail in section 7.3 on page 61.

6.5. PROJECT DATA SHEETS

The data sheet for each option includes the following:

- An extract from the heat map showing the areas heat density with key statistics including the total load for all buildings within the boundary, including new development.
- An initial network option is then proposed. A description is included and any key assumptions used in modelling and risks associated with it are made clear. The financial and technical assessment methodology is included in Appendix A.
- A schematic map of the network shows the energy centre location, buildings which we have assumed connect initially and a possible pipework route. The address and estimated heat demand of each is included in the table.
- The daily demand profile for each network option can be used to assess how diverse the loads are. A flatter load, or one with a consistent base load will allow larger low carbon plant to be used resulting in greater carbon savings.
- For each suitable fuel source an indicative capital cost of the network is provided along with the likely contribution an ESCo would be willing to make to that in return for the revenues and the IRR for a fully funded network without ESCo involvement.
- For each suitable fuel source the annual gross revenue is also shown alongside the potential carbon savings.

HEAT MAP EXCERPT



New (existing) residential	450 (0) dwellings	Area	30 ha
New (existing) non-domestic	74,650 (6,018) m²	Total heat demand	10554 MWh

INITIAL NETWORK OPTION

The initial network option modelled includes connection of all new development loads (1&2) and the school (3) to an energy centre delivered with the new hospital.

Delivery of the energy centre with new buildings allows for a range of fuel options to be explored. The size of the anchor load suggests that biomass CHP might also be viable.

CHP electricity generation would serve hospital demand, supporting the commercial case.

KEY ASSUMPTIONS

New West Suffolk Hospital campus heat demand estimated using existing site data with energy efficiency. Floor area 62,000m², metered demand 15,001,200kWh in 07/08 with an assumed 54% demand reduction to take account of higher energy efficiency standards.

Relative locations of the hospital site and the housing site have been assumed arbitrarily.

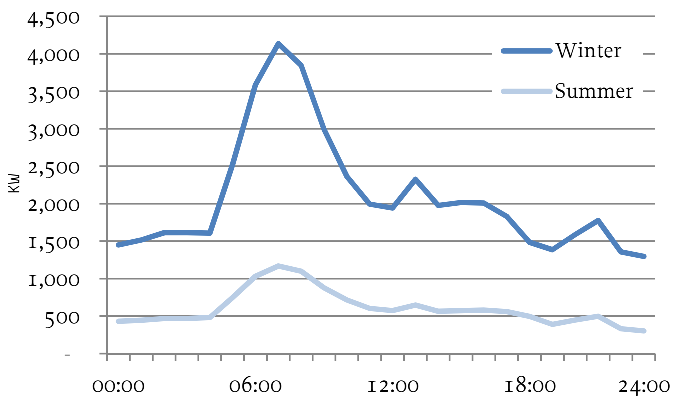
West Bury strategic housing development is assumed to include 450 new homes, a small local centre and a new 12,000m² upper school.

RISKS AND CONSTRAINTS

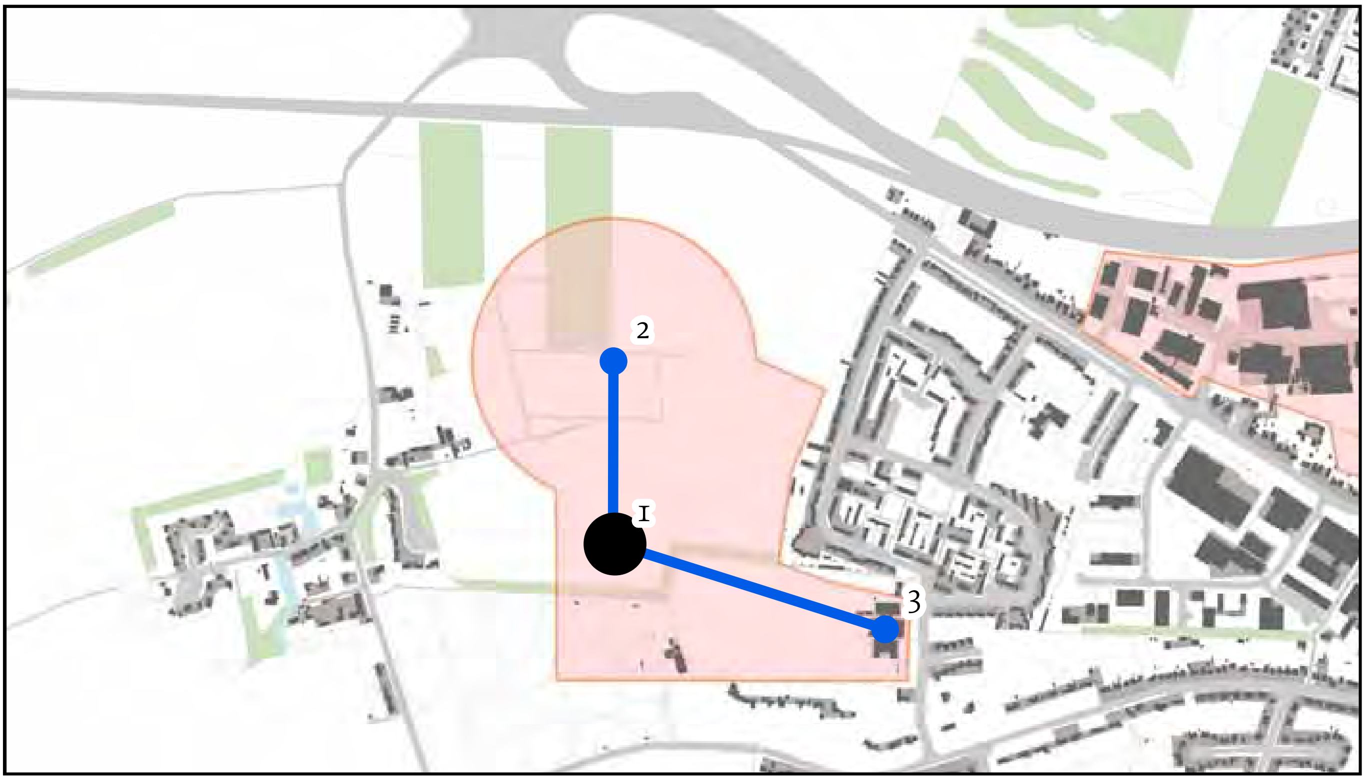
Key limitation on delivery is phasing of development. Housing would need to be delivered alongside or after hospital to help with network viability.

A concept statement has not been developed for the strategic site yet. This creates additional uncertainty in assessing the network costs and the length of mains heating pipework required.

Developers may install alternative heat or power systems which are incompatible with a strategic heat network.



INITIAL NETWORK DAILY DEMAND PROFILE



INITIAL NETWORK OPTION

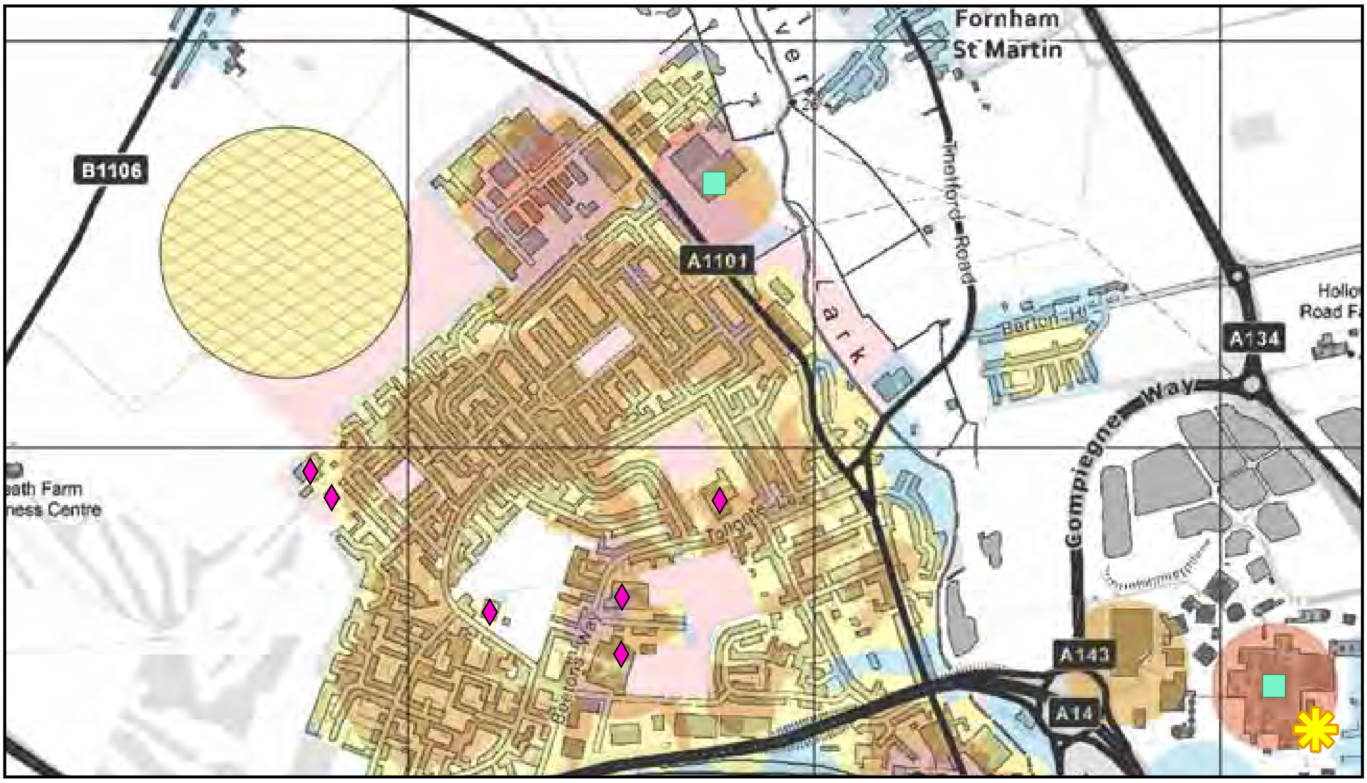
Network heat demand	11,606 MWh	Network peak	4.02 MW
		Mains pipework	720 m

Ref.	Heat Load Name	Demand
1	West Suffolk Hospital: new campus	6,967 MWh
2	Strategic development site: 450 new homes	3,278 MWh
3	Westley Middle School	360 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
Gas-fired CHP	£1.93m	1.36%	£850k	1439 tCO_2
Biomass	£1.74m	21.46% (inc. RHI)	£2.25m	2028 tCO_2
Biomass CHP	£6.36 m	-	£1.3m	5531 tCO_2

OPTION 2 NORTH WEST BURY

HEAT MAP EXCERPT



New (existing) residential	900 (1743) dwellings	Area	163 ha
New (existing) non-domestic	7,150 (142,000) m²	Total heat demand	42514 MWh

INITIAL NETWORK OPTION

The initial network option modelled includes connection to the strategic development site (1), loads on the Northern Way industrial estate and in the existing neighbourhood which are above 200MWh per annum.

Heat would be supplied by the existing gas-fired CHP at British Sugar delivered via a heating main using the existing underpass beneath Compiegne Way. Existing CHP plant at British Sugar reduces extra over cost of establishing the heat supply. Existing private wire agreements for the electricity generated will support commercial case.

ALTERNATIVE NETWORK OPTION

Alternative network configurations and connection scenarios are explored in section 7.0.

KEY ASSUMPTIONS

North West Bury strategic housing development is assumed to include 900 new homes, a local centre and a new 6,000m² primary school.

Process loads at the Northern Way have not been included in the initial network option because it is unknown whether the technical and commercial requirements of Premier Foods or other processing/manufacturing could be met.

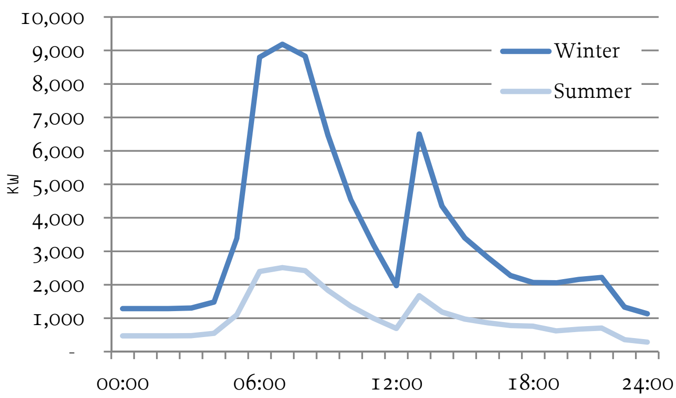
RISKS AND CONSTRAINTS

The network would need to reach the strategic site in time to serve initial phases construction.

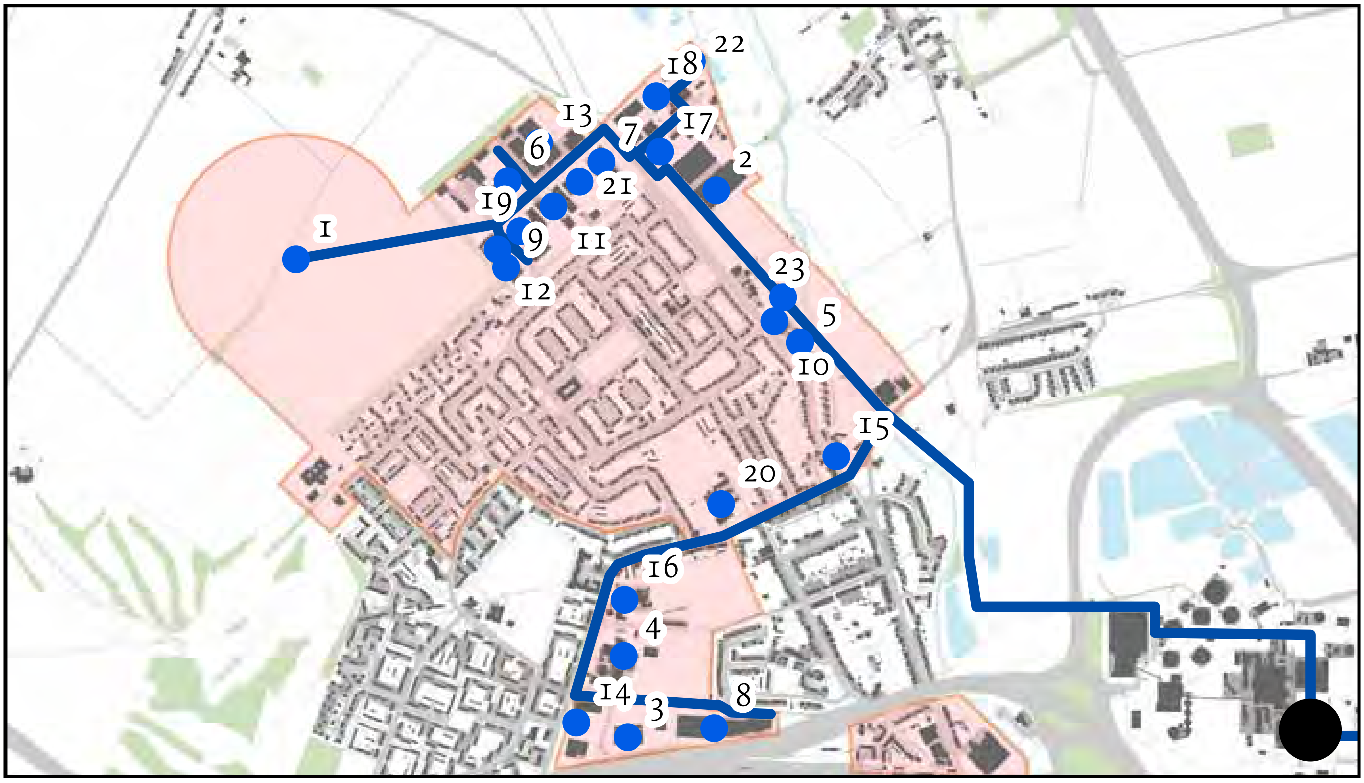
A concept statement has not been developed for the strategic site yet. This creates additional uncertainty in assessing the network costs and the length of mains heating pipework required.

The suggested network route would require wayleave agreements to be made and could result in an alternative network route being preferable.

Developers may install alternative heat or power systems which are incompatible with a strategic heat network.



INITIAL NETWORK DAILY DEMAND PROFILE



INITIAL NETWORK OPTION

Network heat demand	19,360 MWh	Network peak	9.19 MW
		Mains pipework	5564 m

Ref.	Heat Load Name	Demand	Ref.	Heat Load Name	Demand
1	Strategic development site: 900 new homes	4512 MWh	13	Cold storage Northern Way IP32 6NL	393 MWh
2	Factory Mildenhall Road IP32 6EN	2537 MWh	14	Storage Beetons Way IP32 6TD	390 MWh
3	West Suffolk College Anglian Lane IP32 6RA	905 MWh	15	Hotel Fornham Road IP32 6EH	360 MWh
4	County Upper School Beetons Way	860 MWh	16	St Benedict's Catholic School	357 MWh
5	Supermarket Mildenhall Road IP32 6EN	826 MWh	17	Car Sales Lamdin Road IP32 6NU	331 MWh
6	Unit 16 Northern Way IP32 6NL	809 MWh	18	Workshop Lamdin Road IP32 6NU	322 MWh
7	Office Northern Way IP32 6NH	694 MWh	19	Workshop Northern Way IP32 6NL	317 MWh
8	Units A3-6 Anglian Lane IP32 6SR	585 MWh	20	Tollgate Primary School	295 MWh
9	Workshop Northern Way IP32 6NN	520 MWh	21	Storage 35 Northern Way IP32 6NH	272 MWh
10	Retail Mildenhall Road IP32 6EN	458 MWh	22	Workshop Lamdin Road IP32 6NU	233 MWh
11	32 Northern Way IP32 6NL	426 MWh			
12	Workshop Northern Way IP32 6NW	415 MWh			

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
British Sugar CHP	£4.72m	21.5%	£5.6m	2,371 tCO_2

OPTION 3 ABBEYCROFT LEISURE CENTRE

HEAT MAP EXCERPT

New (existing) residential	0 (86) dwellings	Area	47 ha
New (existing) non-domestic	3,500 (125,000) m²	Total heat demand	23061 MWh

INITIAL NETWORK OPTION

The initial network option modelled includes connection of West Suffolk College (1), King Edwards VI Upper School (4) and loads above 200 MWh on the Western Way industrial estate to Abbeycroft Leisure Centre (2).

The existing energy centre in the Leisure Centre would be used, with plant replaced to accommodate the increased load. The plant replacement would potentially allow for a range of fuel options to be explored. The size of the anchor load suggests that biomass CHP will be a viable option.

CHP electricity generation would serve Leisure Centre demand with potential private wire agreements to West Suffolk House or other nearby Council buildings.

ALTERNATIVE NETWORK OPTION

An alternative initial network option overleaf connects Abbeycroft Leisure Centre (1) with St Edmundsbury Depot (2) making use of the existing CHP plant. This could significantly reduce the capital cost and complexity of developing a network here.

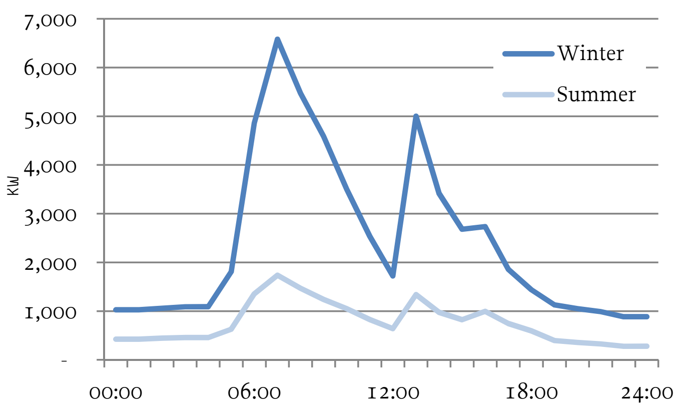
KEY ASSUMPTIONS

It has been assumed that the proposed Further Education building at West Suffolk College will be built prior to the network and will therefore not connect to an initial network.

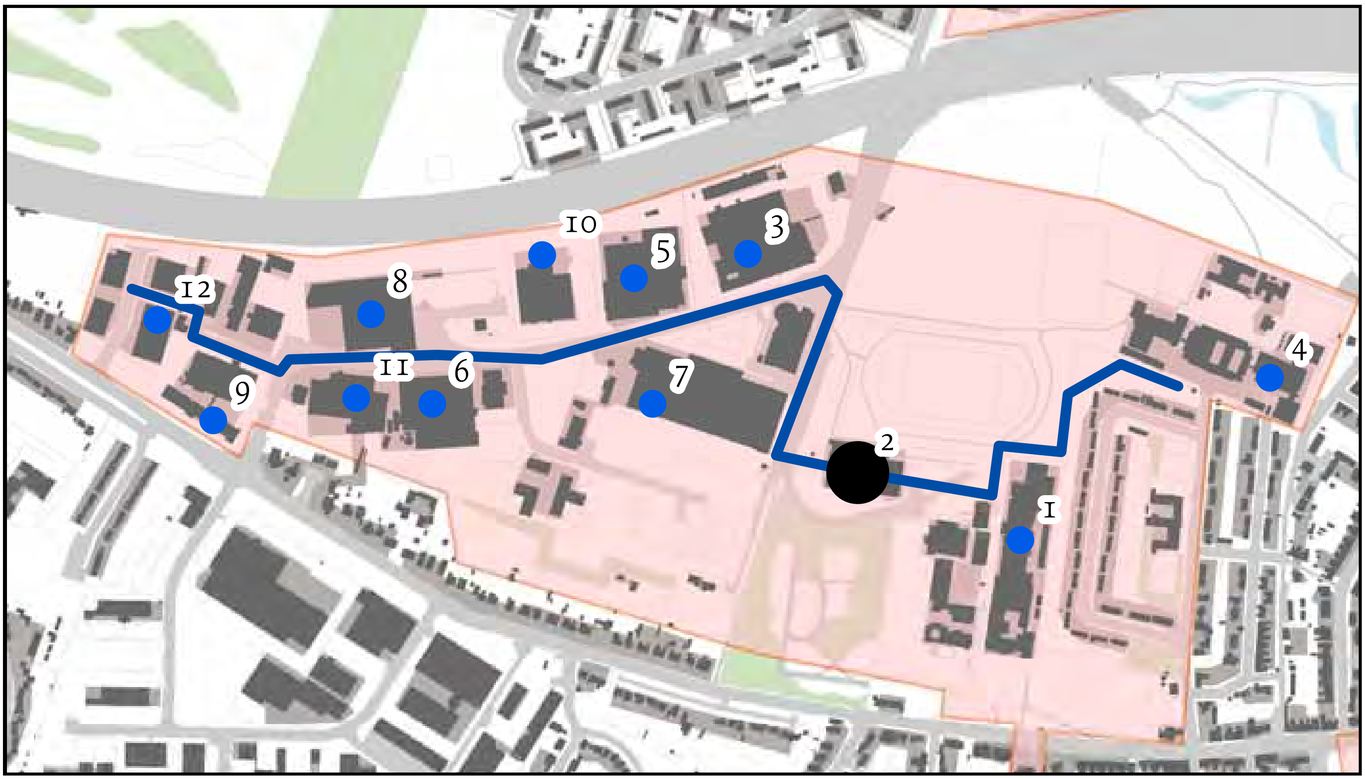
The NHS logistics building is understood to be primarily unheated and has therefore not been included because the benchmark for warehouses is expected to overestimate demand.

RISKS AND CONSTRAINTS

The lease agreement between the CHP operator and the Leisure Centre would need to be renegotiated.



INITIAL NETWORK DAILY DEMAND PROFILE

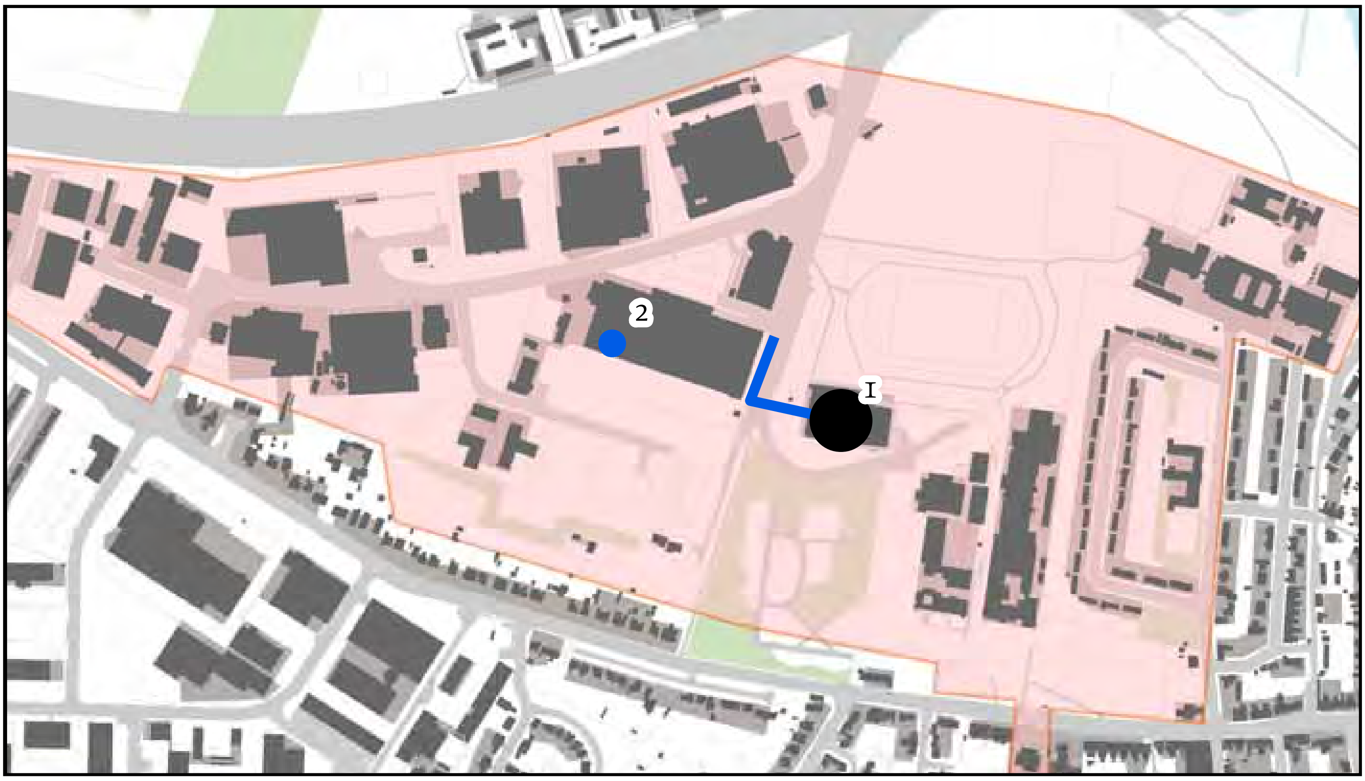


INITIAL NETWORK OPTION

Network heat demand	13,771 MWh	Network peak	6.44 MW
		Mains pipework	1500 m

Ref.	Heat Load Name	Demand
1	West Suffolk Collge	2679 MWh
2	Abbeycroft Leisure Centre	1963 MWh
3	Workshop Western Way IP33 3TB	1439 MWh
4	King Edward VI Upper School	1333 MWh
5	Workshop Western Way IP33 3SZ	1122 MWh
6	Haldo House IP33 3SP	852 MWh
7	St Edmundsbury Depot	625 MWh
8	Supermarket Western Way IP33 3SP	596 MWh
9	Storage Newmarket Road IP33 3SR	586 MWh
10	Gym Western Way IP33 3SP	585 MWh
11	Vicon House IP33 3SP	523 MWh
12	Storage Cavendish Road IP33 3TE	222 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
Gas fired CHP	£3.32m	-	£310k	1380 tCO_2
Biomass	£2.89m	0.48% (inc. RHI)	£1.1m	2052 tCO_2
Biomass CHP	£7.07m	-	£440k	5334 tCO_2



ALTERNATIVE NETWORK OPTION

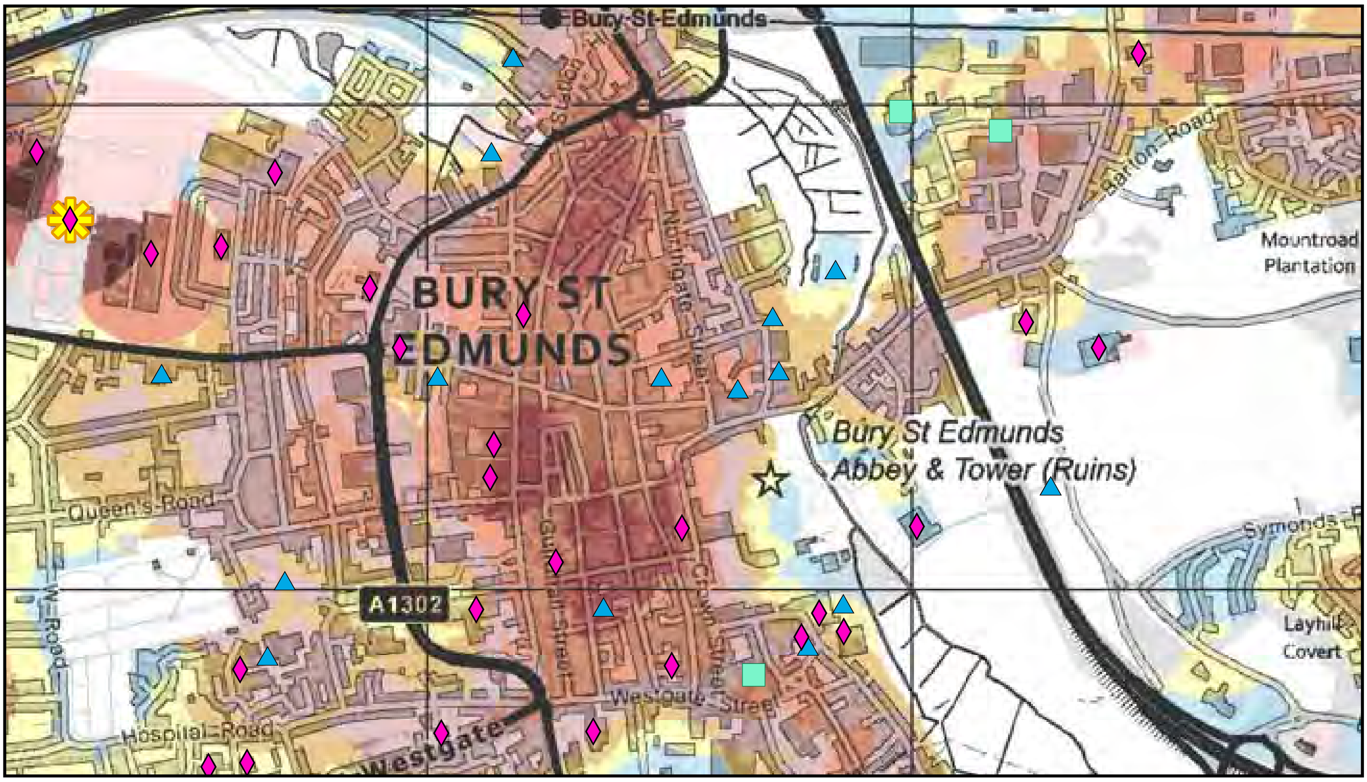
Network heat demand	2,846 MWh	Network peak	0.85 MW
		Mains pipework	150 m

Ref.	Heat Load Name	Demand
1	Abbeycroft Leisure Centre	1963 MWh
2	St Edmundsbury Depot	625 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
Existing CHP	£186k	5.8%	£154k	292 tCO_2

OPTION 4 CENTRAL BURY

HEAT MAP EXCERPT



New (existing) residential	733 (2625) dwellings	Area	105 ha
New (existing) non-domestic	0 (314,000) m²	Total heat demand	62280 MWh

INITIAL NETWORK OPTION

The initial network option modelled includes connection of large commercial loads (2-4), Shire Hall Courts (1), Parkway Fire Station (7) new development sites (8-9, 17-18) and other loads above 200MWh located along the network route to Greene King's Westgate Brewery (5).

The energy centre would be located at the brewery. Given the likely limits to available space and the number of receptors sensitive to air pollution in Central Bury biomass fuels have been considered unsuitable.

CHP electricity generation would serve Greene King's estate with the remainder sold via private wire agreements or exported to the Grid.

Expansion into the northern parts of the area could be catalysed in future when development sites LP8 Station Hill and LP9 Tayfen Road are brought forward.

KEY ASSUMPTIONS

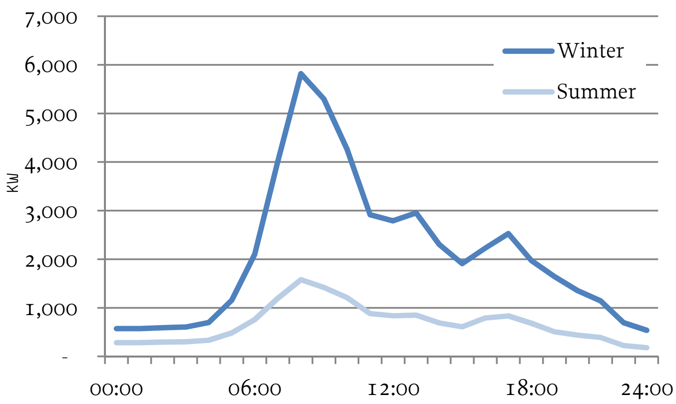
Process loads at the Westgate Brewery have not been included in the initial network option because it is unknown whether the technical and commercial requirements could be met. It is understood that process heat demands are being met by a >20MW$_e$ gas engine. This load alone could potentially be served by a CHP located on site or alternatively could connect to a network.

RISKS AND CONSTRAINTS

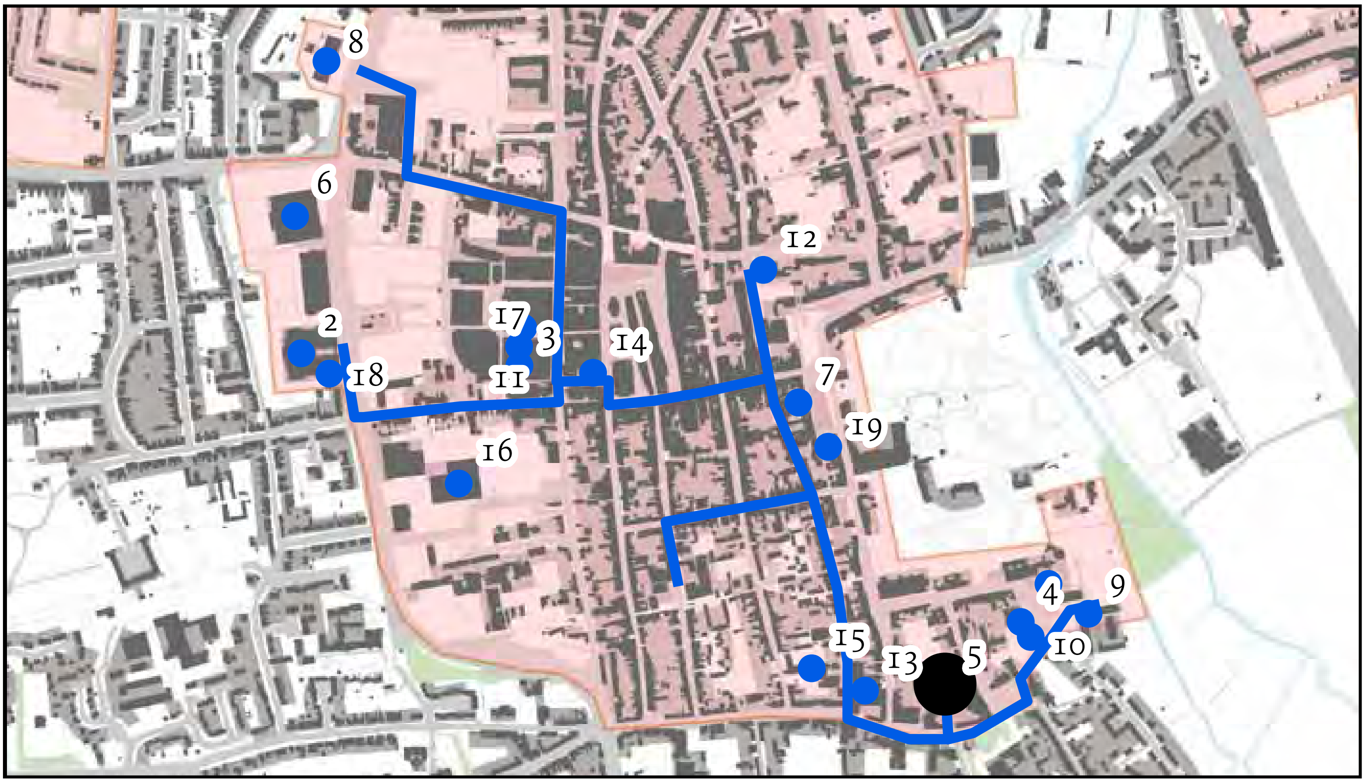
This network option would be a challenge to deliver due to the large number of private interests which would need to be co-ordinated and negotiated with. The initial network may need to be preceded by a smaller network followed by organic growth.

The potential for incorporating larger plant or CHP may be limited by the existing buildings and processes at the Westgate Brewery. Further research into the potential for hosting an energy centre would need to be conducted.

Installation of network heat mains in Central Bury would be restricted by archaeological and conservation concerns. An alternative network route may therefore be necessary changing the relative cost of connecting loads.



INITIAL NETWORK DAILY DEMAND PROFILE



INITIAL NETWORK OPTION

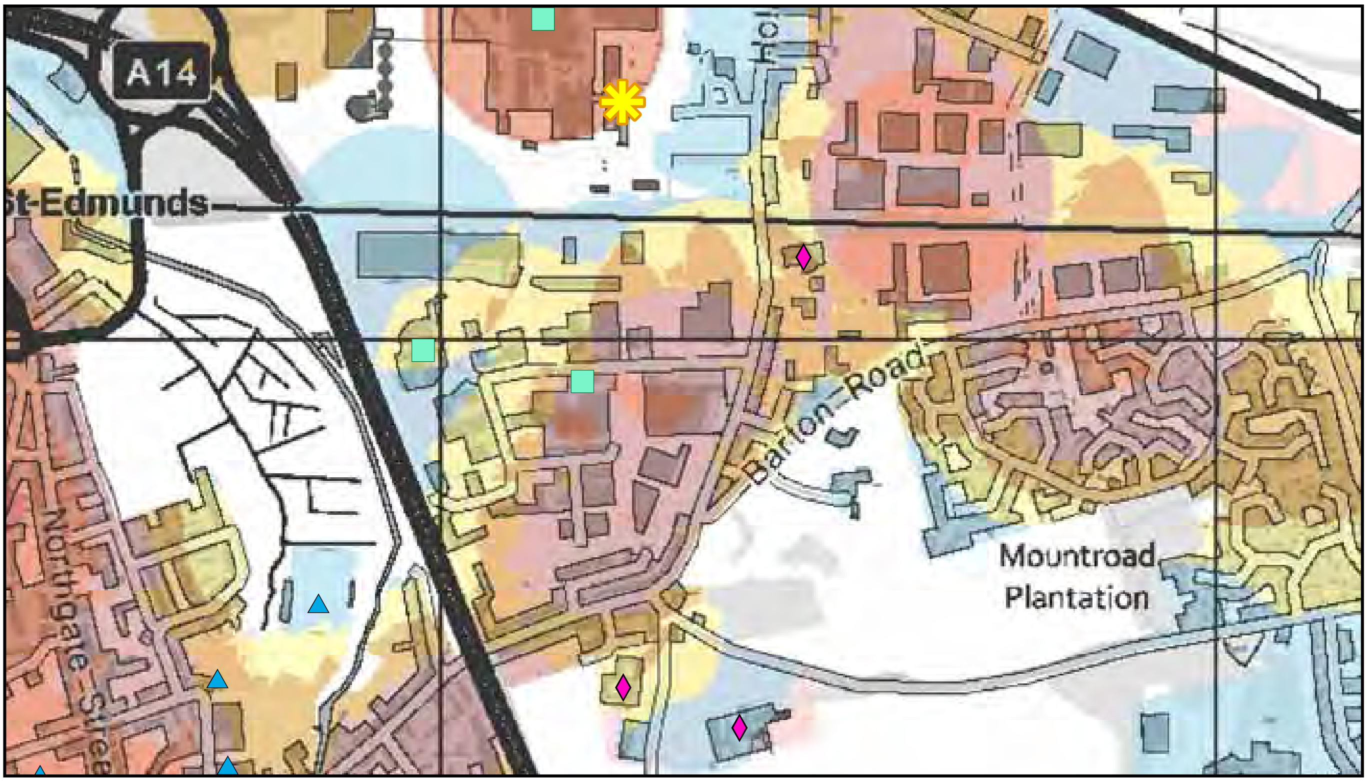
Network heat demand	11,980 MWh	Network peak	5.70 MW
		Mains pipework	2446 m

Ref.	Heat Load Name	Demand
1	Shire Hall	1407 MWh
2	Cinema Parkway North IP33 3BA	1100 MWh
3	The Arc	1056 MWh
4	Suffolk County Council	921 MWh
5	Greene King Brewery	782 MWh
6	43 - 48 Risbygate Street IP33 3AA	686 MWh
7	Hotel Angel Hill IP33 1LT	651 MWh
8	Parkway Fire Station	572 MWh
9	Suffolk Constabulary	487 MWh
10	New development: SH02 - Shire Hall	485 MWh
11	10 Gosnold Street IP33 3FB	447 MWh
12	Blomfield House Health Centre IP33 1HE	428 MWh
13	Westgate Brewery	323 MWh
14	Restaurant 3 Cornhill IP33 1BE	296 MWh
15	Guildhall Feoffment CP School	291 MWh
16	Waitrose Robert Boby Way IP33 3DH	265 MWh
17	5 Gosnold Street IP33 3FB	239 MWh
18	1 Parkway North IP33 3BA	234 MWh
19	The Atheneaum	229 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
Gas fired CHP	£4.16m	-	£1.55m	1452 tCO_2

OPTION 5 EASTERN WAY

HEAT MAP EXCERPT



New (existing) residential	0 (224) dwellings	Area	36 ha
New (existing) non-domestic	0 (93,000) m²	Total heat demand	13468 MWh

INITIAL NETWORK OPTION

The initial network option modelled connects heat loads on the Eastern Way industrial estate which are south of the railway line. Loads include Davers Court residential home (5), Priory Special School (8) and the Adult Education Centre (10) and a number of workshop and warehouse loads above 200 MWh per annum.

Heat would be supplied by the existing gas-fired CHP at British Sugar delivered via a heating main using the existing road bridge on Hollow Road. Existing CHP plant at British Sugar reduces extra over cost of establishing the heat supply. Existing private wire agreements for the electricity generated will support the commercial case.

KEY ASSUMPTIONS

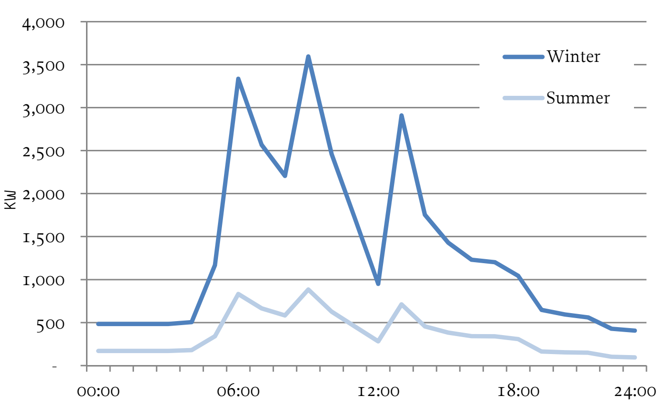
Process loads at the Boortmalt malting plant, ABN or Silverspoon have not been included in the initial network option because it is unknown whether the technical and commercial requirements could be met.

Kilning requires 620-670kWh of gas per tonne of malt, primarily for drying the barley at 40-50°C. The plant is operated 24 hours and could be a consumer of 11MW of low temperature hot water from British Sugar and could be served with minimal impact on the steam cycle efficiency. The other process loads could be of a similar magnitude but share the same uncertainties.

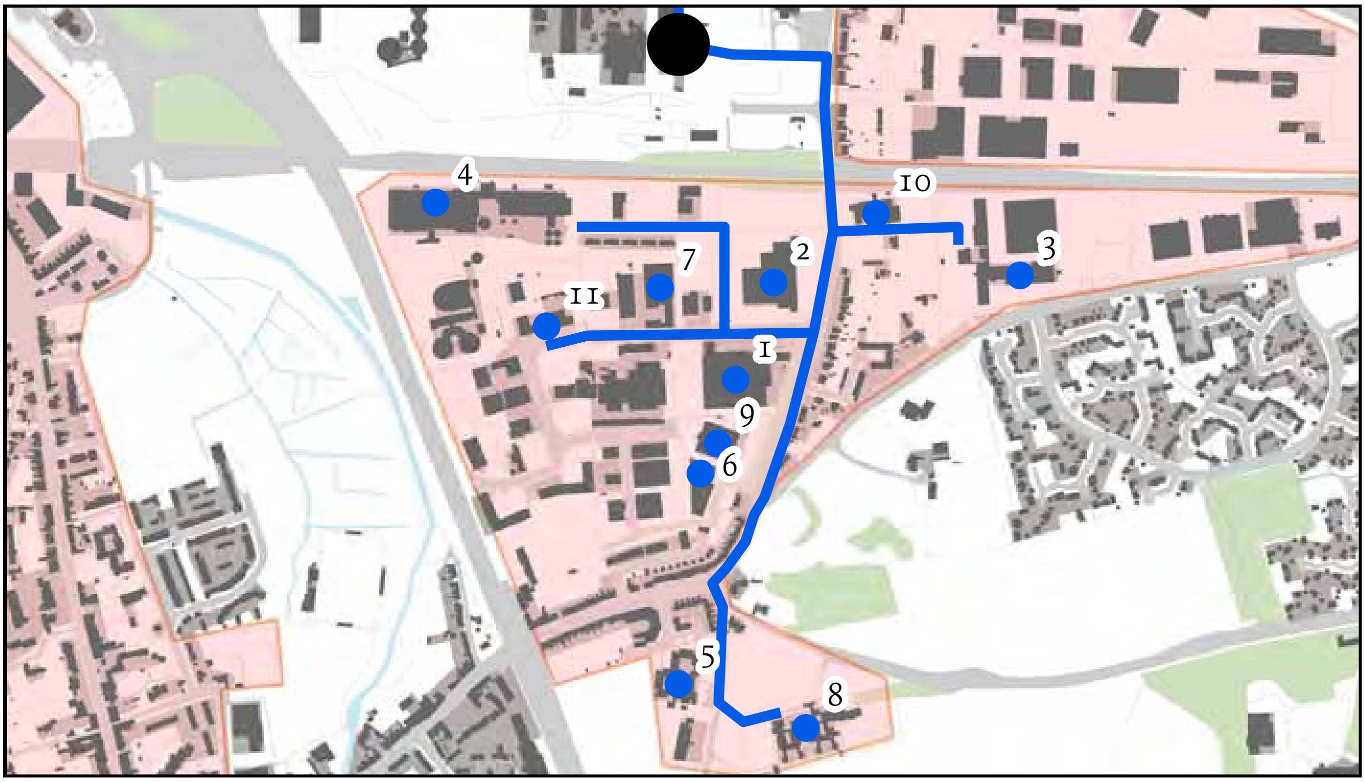
RISKS AND CONSTRAINTS

This network option would be a challenge to deliver due to the number of private interests which would need to be co-ordinated and negotiated with. The initial network may need to be preceded by a smaller number of connections followed by organic growth

Supplying heat from British Sugar relies upon there being capacity for installing infrastructure on the Hollow Road Bridge and on gaining permission from Network Rail and the Department for Transport.



INITIAL NETWORK DAILY DEMAND PROFILE



INITIAL NETWORK OPTION

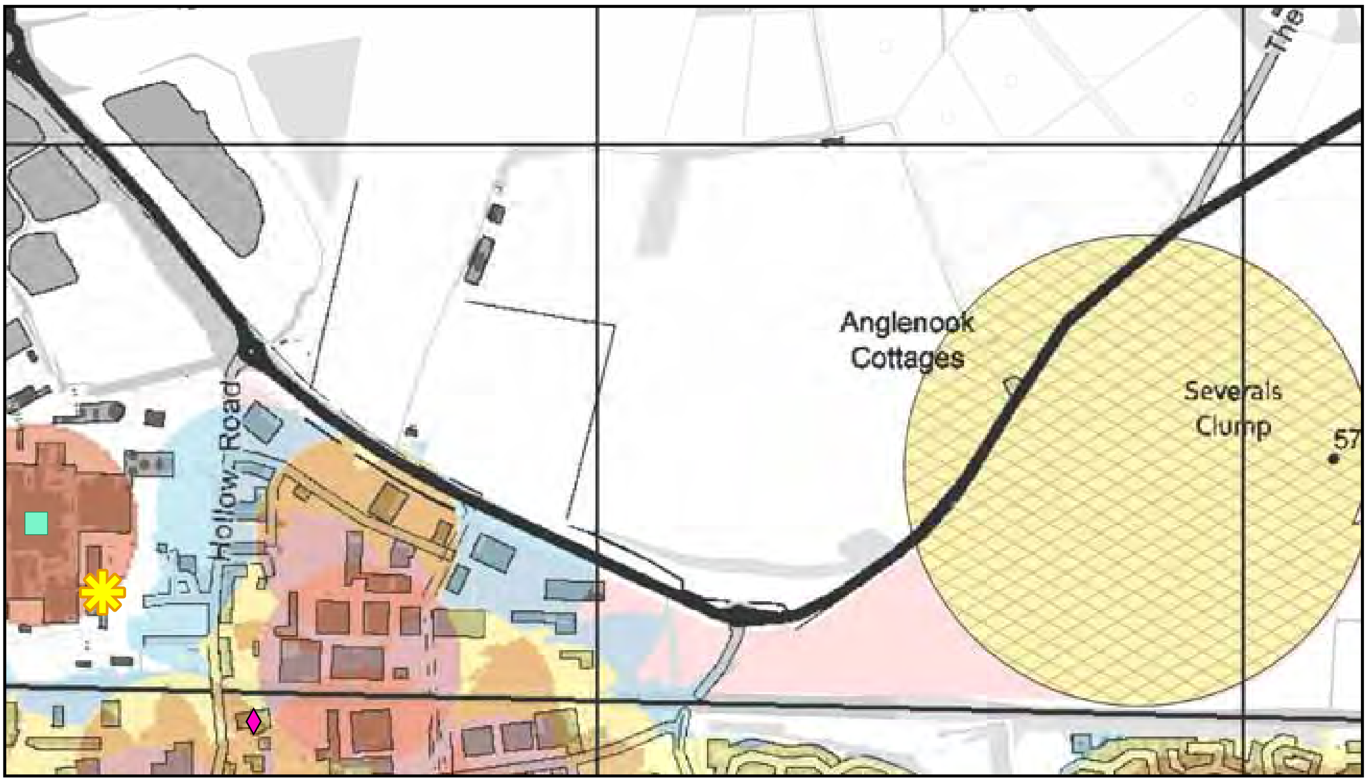
Network heat demand	6,582 MWh	Network peak	3.22 MW
		Mains pipework	1840 m

Ref.	Heat Load Name	Demand
1	Ibson House IP32 7AB	886 MWh
2	1 Eastern Way IP32 7AB	885 MWh
3	Offices Barton Road IP32 7BG	859 MWh
4	Factory 24/25 Eastern Way IP32 7AD	817 MWh
5	Davers Court care home	522 MWh
6	Office 69 Eastern Way IP32 7AB	461 MWh
7	4 Eastern Way IP32 7AB	391 MWh
8	Priory Special School	374 MWh
9	70 Eastern Way IP32 7AB	313 MWh
10	Adult Training Centre	249 MWh
11	7 Eastern Way IP32 7AB	229 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
British Sugar CHP	£1.96m	6.35%	£1.5m	1259 tCO2

OPTION 6 NORTH EAST BURY

HEAT MAP EXCERPT



New (existing) residential	1250 (0) dwellings	Area	68 ha
New (existing) non-domestic	8450 (110,000) m²	Total heat demand	17754 MWh

INITIAL NETWORK OPTION

The initial network option modelled connects the strategic development site (1) and loads above 200MWh per annum (2-9) on the parts of the Eastern Way industrial estate that can be served without crossing the railway line.

Heat would be supplied by the existing gas-fired CHP at British Sugar delivered via a heating main running along roads or soft verges where possible. Using existing CHP plant at British Sugar reduces extra over cost of establishing the heat supply. Existing private wire agreements for the electricity generated will support commercial case.

ALTERNATIVE NETWORK OPTION

An alternative initial network option overleaf connects all loads in the Eastern Way industrial estate, from this option and option 5: Eastern Way. It does not include the strategic development site. The overall length of distribution pipework is reduced and all of the heat demand is due to existing loads. This alternative option allows us to assess whether a network can be developed here independent of the new development which is likely to be low density.

KEY ASSUMPTIONS

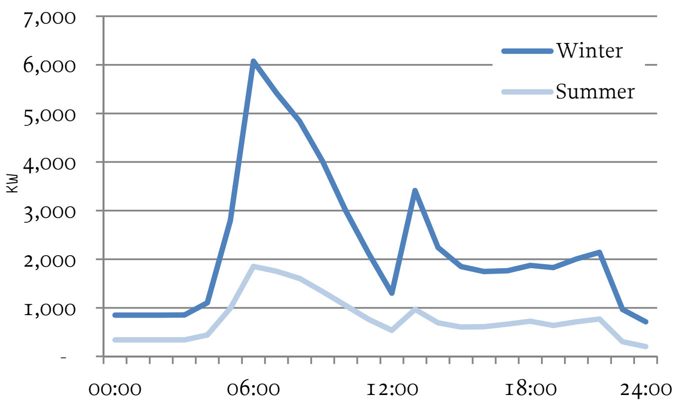
North East Bury strategic housing development is assumed to include 1250 homes, a local centre with a 1,300m² food store and a 6,000 m² primary school.

RISKS AND CONSTRAINTS

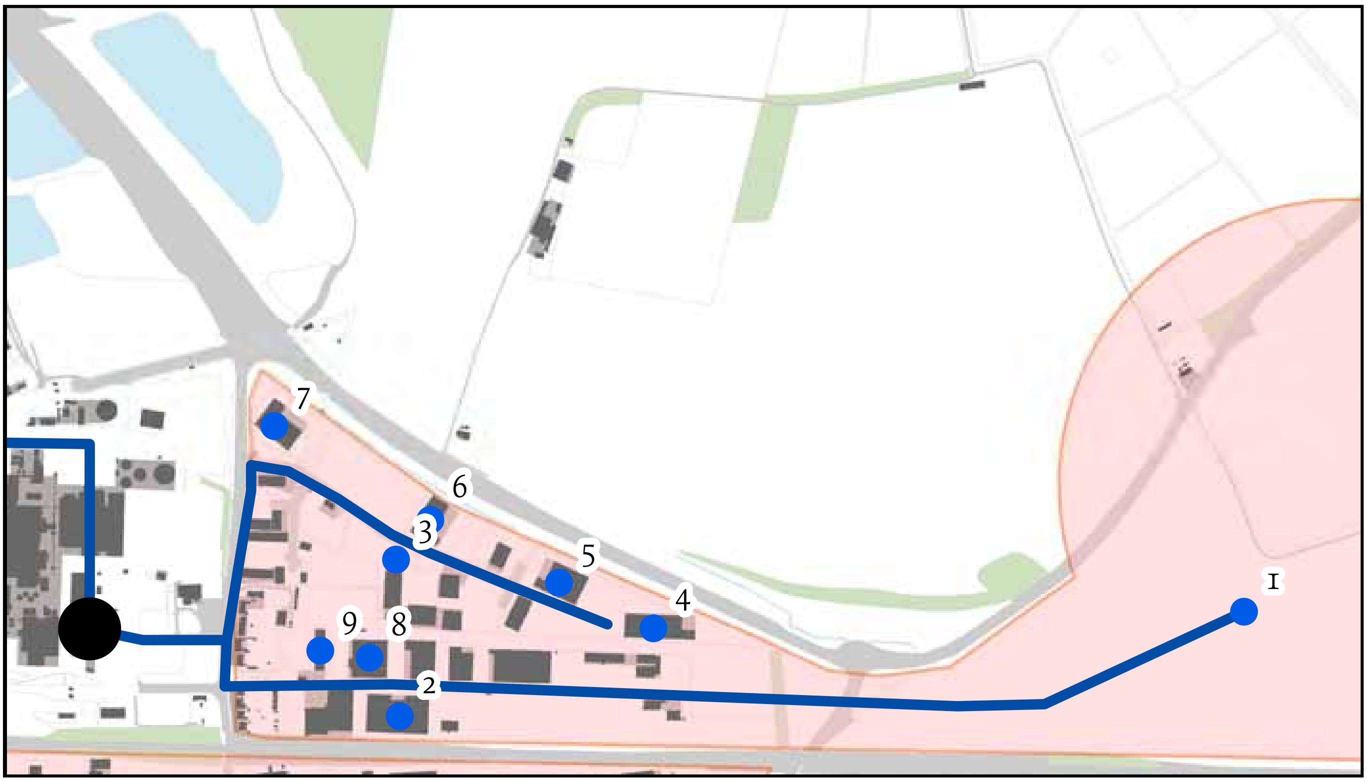
The network would need to reach the strategic site in time to serve the initial phases of construction.

A concept statement has not been developed for the strategic site yet. This creates additional uncertainty in assessing the network costs and the length of mains heating pipework required.

Developers may install alternative heat or power systems which are incompatible with a strategic heat network.



INITIAL NETWORK DAILY DEMAND PROFILE

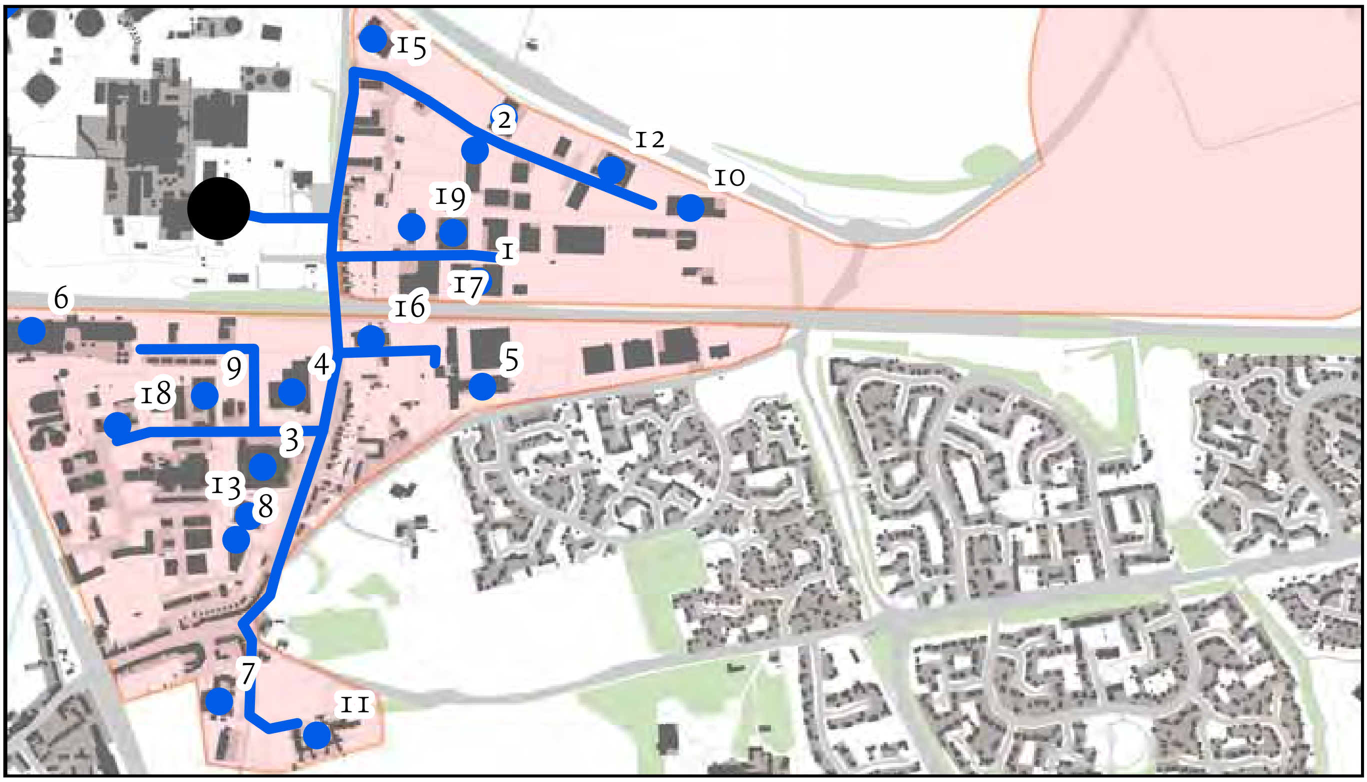


INITIAL NETWORK OPTION

Network heat demand	13,166 MWh	Network peak	6.07 MW
		Mains pipework	2300 m

Ref.	Heat Load Name	Demand
1	Strategic development site: 1250 new homes	6267 MWh
2	Manufacturing Hollow Road IP32 7AP	1884 MWh
3	Storage Chapel Pond Hill	1506 MWh
4	Workshop Chapel Pond Hill IP32 1EZ	379 MWh
5	Workshop Chapel Pond Hill IP32 7HT	319 MWh
6	Workshop Chapel Pond Hill IP32 7HT	306 MWh
7	Warehouse Chapel Pond Hill IP32 7HT	256 MWh
8	Warehouse Hollow Road	236 MWh
9	Abbotsgate House IP32 7AP	215 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
British Sugar CHP	£2.09m	106%	£5.8m	2512 tCO2



ALTERNATIVE NETWORK OPTION

Network heat demand	12,192 MWh	Network peak	6.40 MW
		Mains pipework	3296 m

Ref.	Heat Load Name	Demand	Ref.	Heat Load Name	Demand
1	Manufacturing Hollow Road IP32 7AP	1884 MWh	11	Priory Special School	374 MWh
2	Storage Chapel Pond Hill	1506 MWh	12	Workshop Chapel Pond Hill IP32 7HT	319 MWh
3	Ibson House IP32 7AB	886 MWh	13	70 Eastern Way IP32 7AB	313 MWh
4	1 Eastern Way IP32 7AB	885 MWh	14	Workshop Chapel Pond Hill IP32 7HT	306 MWh
5	Offices Barton Road IP32 7BG	859 MWh	15	Warehouse Chapel Pond Hill IP32 7HT	256 MWh
6	Factory 24/25 Eastern Way IP32 7AD	817 MWh	16	Adult Training Centre	249 MWh
7	Davers Court care home	522 MWh	17	Warehouse Hollow Road	236 MWh
8	Office 69 Eastern Way IP32 7AB	461 MWh	18	7 Eastern Way IP32 7AB	229 MWh
9	4 Eastern Way IP32 7AB	391 MWh	19	Abbotsgate House IP32 7AP	215 MWh
10	Workshop Chapel Pond Hill IP32 1EZ	379 MWh			

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
British Sugar CHP	£3.5m	10.28%	£3.25m	2,332 tCO_2

OPTION 7 SUFFOLK BUSINESS PARK

HEAT MAP EXCERPT

New (existing) residential	500 (20) dwellings	Area	210 ha
New (existing) non-domestic	206,000 (236,000) m²	Total heat demand	58,159 MWh

INITIAL NETWORK OPTION

The initial network option modelled connects the strategic employment site (1), the strategic residential site (2) and the proposed Bury Town stadium (3) with existing loads above 200MWh per annum on the existing Suffolk Business Park and Rougham industrial estate.

Delivery of the energy centre with new commercial buildings allows for a range of fuel options to be explored. Despite phasing constraints, the overall size of the connected loads suggests that biomass CHP will also be viable.

KEY ASSUMPTIONS

The heat demand from Suffolk Business Park has been estimated using a development plot ratio of 3,000 m² per hectare. The use types have been assumed to 50% B1 and 50% B8.

East Bury strategic housing development is assumed to include 500 homes and a 12,000m² upper school.

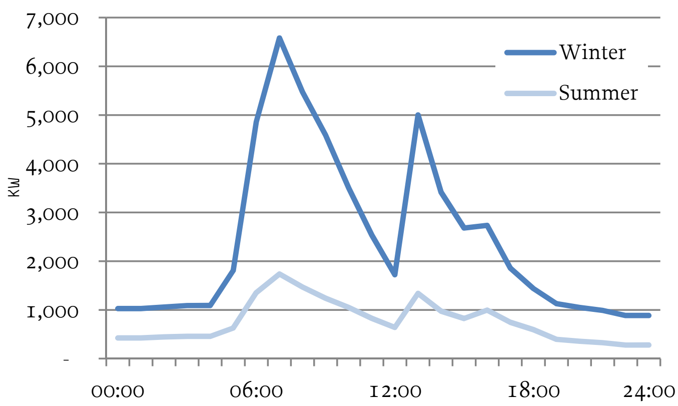
The stadium's heat demand is assumed to derive from the conference facilities only. A floor area of 1,000m² has been assumed.

Process loads at the BOCM Paul plant have not been included in the initial network option because it is unknown whether the technical and commercial requirements could be met.

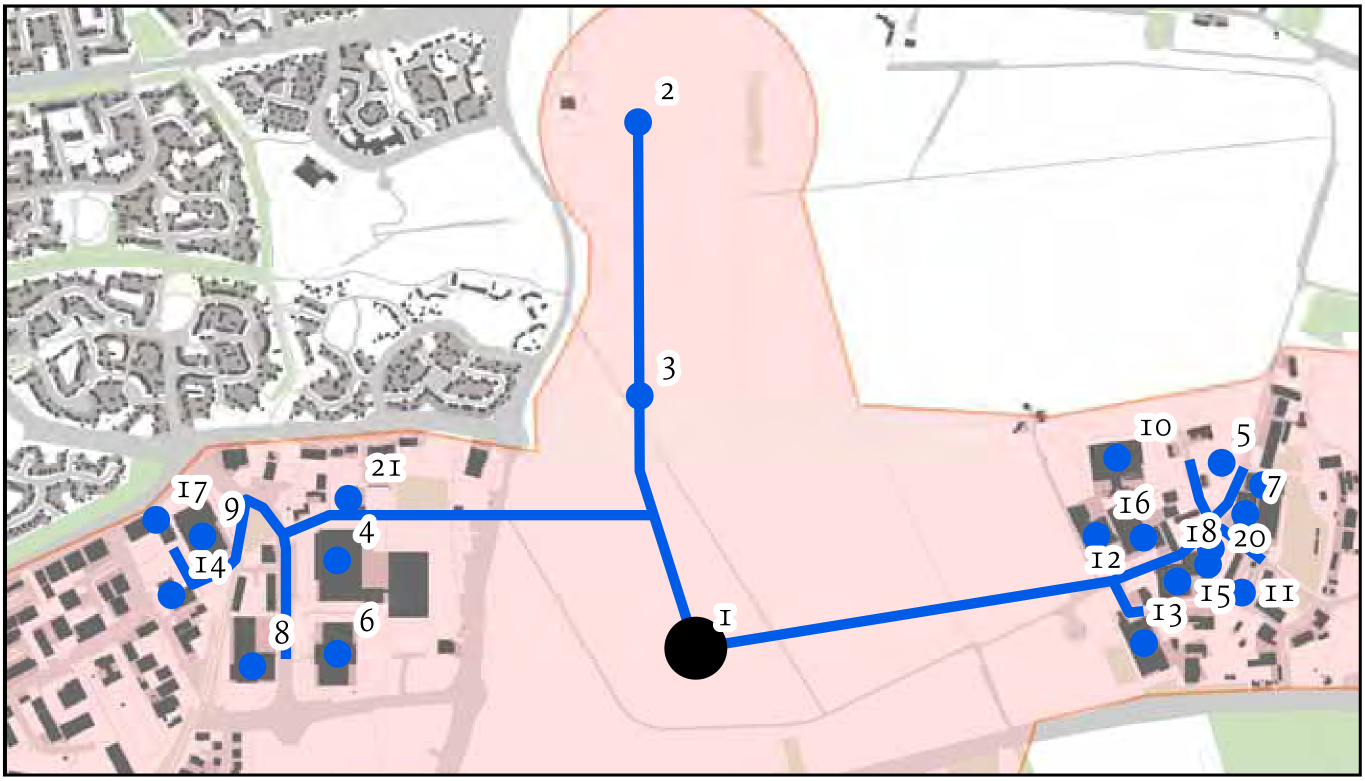
RISKS AND CONSTRAINTS

Concept statements have not been developed for the strategic sites yet. This creates additional uncertainty in assessing the network costs and the length of mains heating pipework required.

The long term phasing of delivery of the Suffolk Business Park will make it more difficult to ensure network delivery is viable. Delivery of the energy centre alongside a large anchor load or in conjunction with expansion into existing commercial buildings may be required.



INITIAL NETWORK DAILY DEMAND PROFILE



INITIAL NETWORK OPTION

Network heat demand	45,970 MWh	Network peak	23.03 MW
		Mains pipework	3425 m

Ref.	Heat Load Name	Demand	Ref.	Heat Load Name	Demand
1	Suffolk Business Park	9931 MWh	11	Workshop IP30 9ND	743 MWh
2	Strategic development site: 500 new homes	2507 MWh	12	Warehouse Perkins Road IP30 9ND	687 MWh
3	Stadium: conference only (1000sqm)	109 MWh	13	Warehouse Maxwell Road IP30 9ND	612 MWh
4	Workshop Kempson Way IP32 7AR	3121 MWh	14	Warehouse Easlea Road IP32 7BY	559 MWh
5	Warehouse Fred Castle Way IP30 9ND	2058 MWh	15	Warehouse Maxwell Road IP30 9ND	539 MWh
6	Workshop Kempson Way IP32 7AR	1065 MWh	16	Perkins Road IP30 9ND	459 MWh
7	Warehouse Fred Castle Way IP30 9ND	1050 MWh	17	Large retail IP32 7BY	421 MWh
8	Warehouse Kempson Way IP32 7GJ	1032 MWh	18	Workshops Maxwell Road IP30 9ND	300 MWh
9	Bottling plant, IP32 7BT	901 MWh	19	Unit B Woodlands Road IP30 9ND	298 MWh
10	Manufacturing Fred Castle Way IP30 9NH	799 MWh	20	Unit C Maxwell Road IP30 9DN	263 MWh
			21	Mail Delivery Office	209 MWh

	Total capital cost	non-ESCo 25 year IRR	ESCo capital contribution	Carbon savings
Gas fired CHP	£6.96m	-1.36%	£3.8m	4807 tCO_2
Biomass	£7.81m	2.37%	£4.7m (inc RHI)	6177 tCO_2
Biomass CHP	£20.64m	-	£8m	16501 tCO_2

7.0

DETAILED ASSESSMENT OF OPTION 2: NORTH WEST BURY

For the preferred network option in North West Bury we have conducted a more detailed assessment of the opportunity, including technical feasibility and financial viability assessments. A number of different network scenarios are tested, to develop a better idea of the optimum network extent.

The preferred network option connects Northern Way and the existing neighbourhood to British Sugar. The commercial case is not reliant on connection to the new development whose phasing and delivery is unknown and liable to change.

7.1. NETWORK DEVELOPMENT

The initial development of district heating networks is often based on connection of a large anchor load which is located near to the source of heat. This creates a stable commercial position from which the network can grow. Initially focussing on a single or small group of large loads can be a practical measure which reduces the complexity of contractual arrangements and construction, and therefore the level of project risk. Once the first customers are being served other large loads can then be targeted to grow the network.

While this process of organic growth helps ensure that the level of network investment matches the demand being served, some forward planning must be made. The network route should take into consideration loads which could be connected in future. This can require primary heating mains to be oversized to meet current and anticipated future demand, potentially avoiding the additional expense of replacing or installing parallel heat mains at a later date.

The loads in North West Bury connected to British Sugar, as shown in figure 12 within the options appraisal, can be divided into 3 broad network zones. These could be developed all together, or in phases.

- Northern Way industrial estate: connection to 16 existing large energy users
- strategic development site: connection to 900 homes and the local centre
- existing neighbourhood: connection of 6 existing large energy users

FIGURE 20: THE 3 NETWORK ZONES POTENTIALLY BEING SERVED BY BRITISH SUGAR

The heat demand profiles and characteristics of each of the three network zones are considered below:

NORTHERN WAY INDUSTRIAL ESTATE

Heat demand	9,134 MWh
Peak heating demand	5.38 MW
Potential carbon savings	1,232 tCO_2 pa

STRATEGIC DEVELOPMENT SITE

Heat demand	5,080 MWh
Peak heating demand	2.33 MW
Potential carbon savings	681 tCO_2 pa

EXISTING NEIGHBOURHOOD

Heat demand	3,391 MWh
Peak heating demand	2.67 MW
Potential carbon savings	457 tCO_2 pa

TOTAL

Heat demand	17,605 MWh
Peak heating demand	9.19 MW
Potential carbon savings	2,370 tCO_2 pa

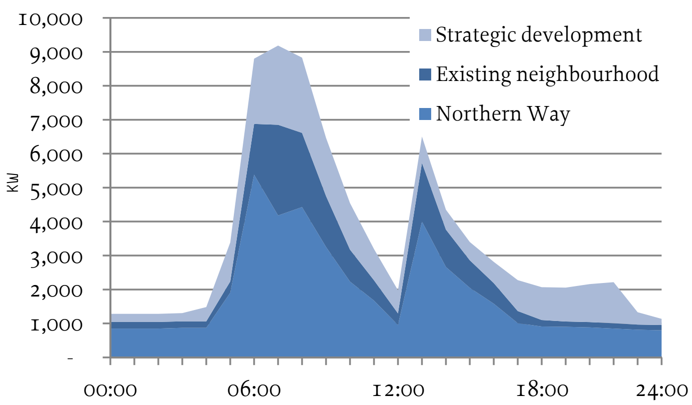


FIGURE 21: CONTRIBUTIONS FROM THE 3 NETWORK AREAS TO THE OVERALL LOAD PROFILE

7.2. OPTIMISING THE EXTENT OF THE NETWORK

Buildings in all three of the zones were assumed to be connected in the initial network option. Here we assess the impact of this assumption on commercial viability, and whether by changing the extent of the network we can improve the initial business case. We have therefore tested the attractiveness of 4 initial connection scenarios to an ESCo, which are:

1. A connection to Northern Way only
2. A connection to Northern Way and the strategic development site
3. A connection to Northern Way and the existing neighbourhood
4. A connection to all 3 zones

The financial viability of each of the 4 options is considered below using the same methodology as in the options appraisal:

SCENARIO 1: NORTHERN WAY ONLY

Total capital cost	£2.73m
ESCo capital contribution	£2.4m
Annual gross revenue	£753k
Project IRR (w/o ESCo contribution)	9.7%

SCENARIO 2: NORTHERN WAY AND STRATEGIC DEVELOPMENT SITE

Total capital cost	£3.01m
ESCo capital contribution	£4.3m
Annual gross revenue	£1.26m
Project IRR (w/o ESCo contribution)	31.8%

SCENARIO 3: NORTHERN WAY AND THE EXISTING NEIGHBOURHOOD

Total capital cost	£4.56m
ESCo capital contribution	£3.9m
Annual gross revenue	£1.08m
Project IRR (w/o ESCo contribution)	7.3%

SCENARIO 4: ALL 3 ZONES

Total capital cost	£4.72m
ESCo capital contribution	£5.6m
Annual gross revenue	£1.6m
Project IRR (w/o ESCo contribution)	21.5%

The modelled connection scenarios demonstrate that scenario 1: Northern Way only, has a positive IRR of 9.7% but would require an additional £330k to make the project commercially attractive for a fully private ESCo model. This initial section could therefore be developed independently, without reliance on further expansion to demonstrate its business case.

Extension of the network to the new development site in scenario 2 improves the IRR to 31.8%, beyond the threshold for full ESCo ownership. This does not include the additional costs to the developer of on-site infrastructure or the potential cost of delays due to CPO, all of which could be significant. Infrastructure costs are dependent on the site's layout and phasing and would need to be assessed against other energy strategy options.

An alternative extension of the network in to the existing neighbourhood has a positive, but reduced IRR of 7.3%. A larger amount of bridge funding is also required, approximately £1.56m. However, all of the proposed connections in scenario 3 are to existing buildings. The commercial case is not reliant on connection to the new development whose phasing and delivery is unknown and liable to change. This reduces the level of project risk.

7.3. SENSITIVITY OF THE MODEL

When reviewing the commercial model relating to the various connection options for British Sugar it is important to take the following points into account:

- The viability of the British Sugar connection is determined in large part by the wholesale tariff of the heat - small fluctuations in this tariff make significant differences in the model
- The wholesale heat price will be a factor of the additional capital costs incurred by British Sugar in delivering the heat. We do not have this data at present and have therefore assumed a wholesale tariff of 1.5p/kWh. An alternative price of 3p/kWh has been tested for with results shown in the adjacent table. Viability is sensitive to the price of British Sugar's heat.
- The level of service and reliability British Sugar are able to agree will also have a dramatic impact on the financial model as it will determine the amount of back up plant the ESCo has to acquire and operate.
- It is likely that British Sugar will be able to generate and sell additional electricity as a result of a connection to the heat network. This possibility has not been taken into account in the modelling as it is not anticipated that the ESCo will benefit from this. However, it will need to be taken into account when assessing the wholesale tariff.

Sensitivity analysis of each of the 4 options showing the impact of using an alternative wholesale heat price of 3p/kWh on financial viability:

SCENARIO 1: NORTHERN WAY ONLY

ESCo capital contribution	£1m
Project IRR (w/o ESCo contribution)	-1.1%

SCENARIO 2: NORTHERN WAY AND STRATEGIC DEVELOPMENT SITE

ESCo capital contribution	£3.2m
Project IRR (w/o ESCo contribution)	16.2%

SCENARIO 3: NORTHERN WAY AND THE EXISTING NEIGHBOURHOOD

ESCo capital contribution	£3m
Project IRR (w/o ESCo contribution)	-1.5%

SCENARIO 4: ALL 3 ZONES

ESCo capital contribution	£4.3m
Project IRR (w/o ESCo contribution)	10.3%

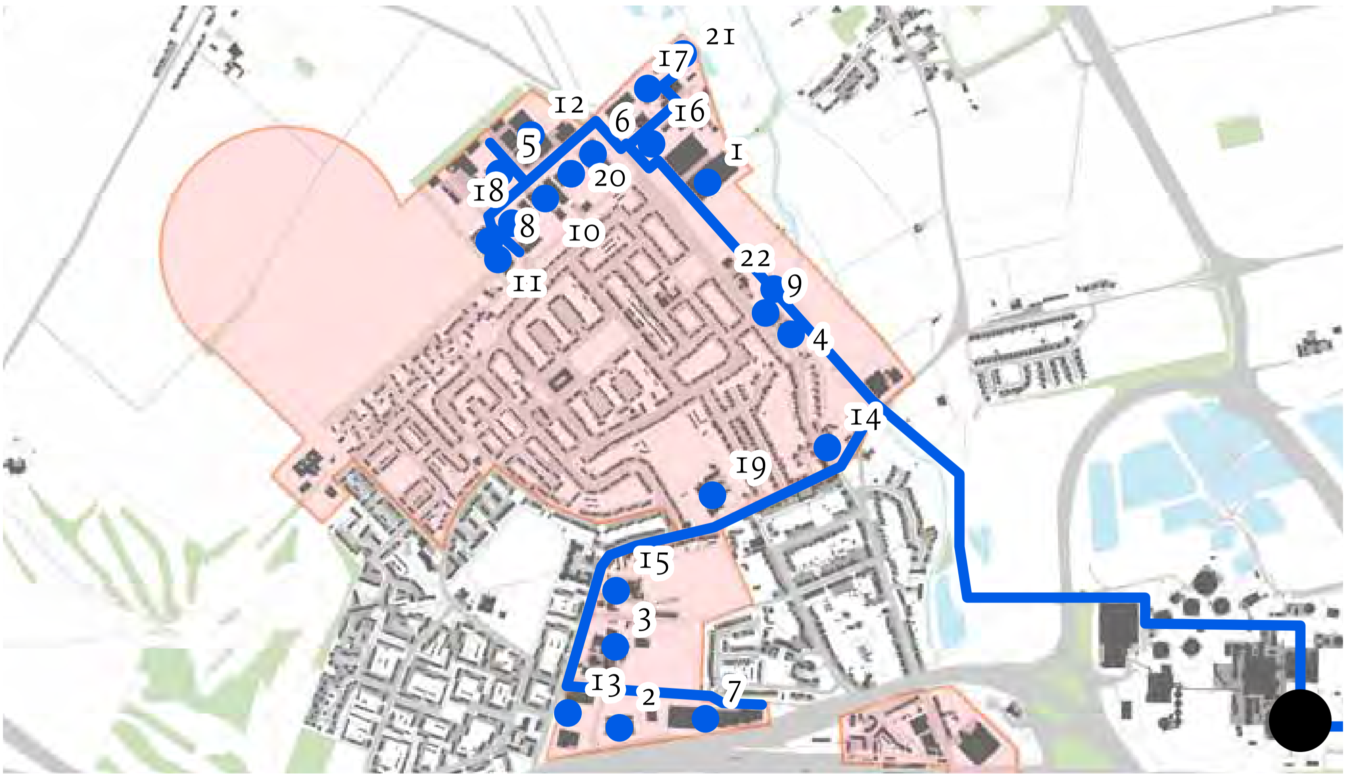


FIGURE 22: NETWORK MAP OF THE RECOMMENDED OPTION FOR NORTH WEST BURY

7.4. PREFERRED OPTION TECHNICAL SUMMARY

Scenario 3 is the preferred network option, connecting buildings at Northern Way and in the existing neighbourhood to British Sugar. A first phase connects British Sugar to the Northern Way industrial estate. A second phase connects the existing buildings in the existing neighbourhood. Each of these phases has been shown to commercially viable individually, reducing the level of investment risk. Delivery of this option is detailed below in section 7.5 and in the conclusions in section 8.

Connection to the strategic development site looks financially attractive but comes with many uncertainties and potentially high costs to the developer. While it remains an option it is not included in the preferred scenario.

Opposite are the modelling outputs for the recommended network option which can be used as a basis for more detailed feasibility studies towards delivery.

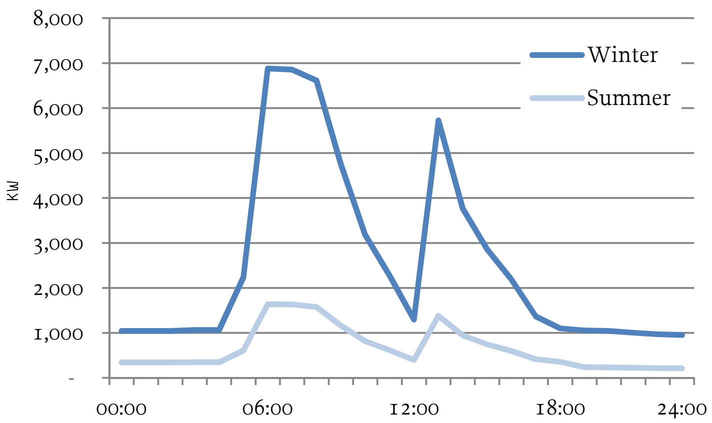


FIGURE 23: DAILY DEMAND PROFILE

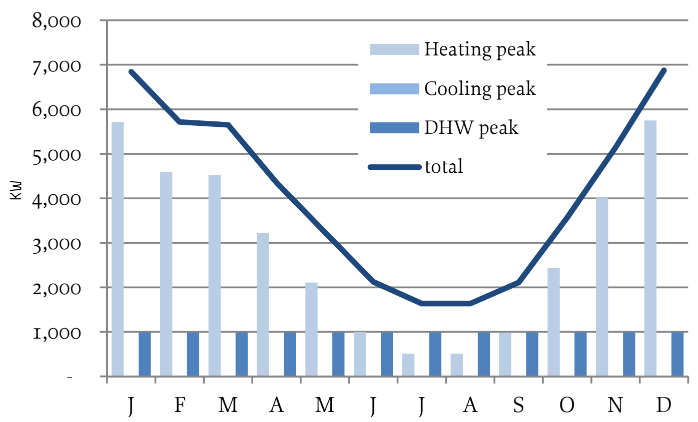


FIGURE 24: MONTHLY DEMAND PROFILE

COMMERCIAL SCENARIO RESULTS

Total capital cost	£4.56m
ESCo capital contribution	£3.9m
Annual gross revenue	£1.08m
Project IRR (w/o ESCo contribution)	7.3%

NETWORK HEAT DEMANDS

Space heat demand	9,394 MWh
Hot water demand	3,131 MWh
Total heat demand (inc. losses)	13,772 MWh
Space heating peak demand	5.7 MW
Hot water peak demand	0.99 MW
Total peak demand (inc. losses)	6.88 MW

BRITISH SUGAR CHP PLANT DATA

Addn. fuel consumption	10,182 MWh
Addn. electricity generation	1,788 MWh
Heat demand met by CHP	95%

BACK UP BOILER PLANT

Capacity required	4.4 MW
Boiler fuel consumption	628 MWh
Heat demand met by boiler	5%

CARBON EMISSIONS

CHP and boiler emissions	2,140 tCO_2 pa
Avoided electricity emissions	946 tCO_2 pa
Reference emissions	2,884 tCO_2 pa
Emissions reduction	1,689 tCO_2 pa

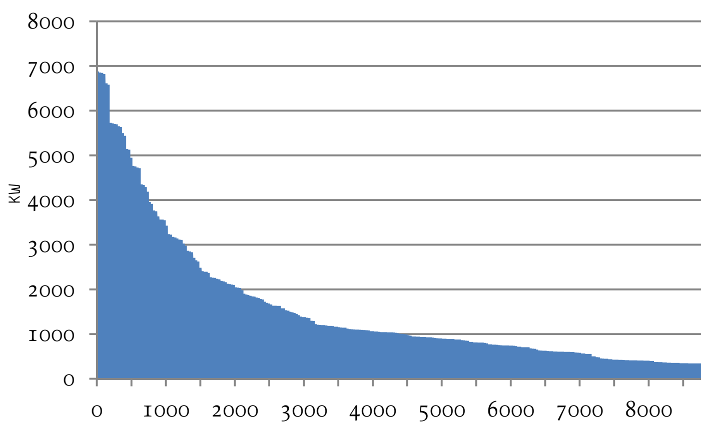


FIGURE 25: ANNUAL LOAD DURATION CURVE

7.5. DELIVERING DECENTRALISED ENERGY PROJECTS

Decentralised energy projects frequently involve several partners, collaborators and stakeholders. These multi-layered interests can add significant complexity to the commercial and contractual arrangements. Some of the specific partners needed to take the options forward are suggested in section 8.

Typically the core stakeholders are as follows:

- The procurer of the decentralised energy system – this may be a property developer, landlord, local authority or even an anchor customer. The motivations of the procurer will depend on their goals and objectives. A developer procuring a decentralised energy system for a single development will inevitably seek to limit the extent of the network to serve their development only. In this way they will deliver the required benefits and at the same time control the level of capital expenditure. On the other hand a local authority seeking to procure a strategic network, or a part thereof, will seek to procure as broad a network as possible within their business model and budget constraints.
- The ESCo or energy company – details on the type and nature of ESCo are set out below.
- The consumer of the service – this will most likely include domestic and non-domestic customers.

However, there may also be a raft of other stakeholders. For example public bodies issuing licences, permission, wayleaves, and so on; insurers; funders (debt and equity); other landowners; utility companies; fuel suppliers; and contractor.

In addition, one must consider the process for procuring an ESCo and whether that process is governed by public procurement rules.

7.6. WHAT IS AN ESCO?

This is the name commonly used to refer to special purpose vehicles or wholly owned subsidiaries set up to deliver heat and electricity across private and public networks, usually via CHP schemes, either within discrete and contained developments or across wider areas (strategic networks).

A well-known example would be the Southampton Geothermal Heating Company run by Cofely District Energy under contract with Southampton City Council.

The European Joint Research Centre distinguishes an ESCo from traditional Energy Service Providers by referring to their delivery of the following:

- ESCo guarantee the energy savings and/or the provision of the same level of energy service at a lower cost by implementing an energy efficiency project.
- ESCo accept some degree of risk for the achievement of improved energy efficiency in a user's facility and have their payment for the services delivered based (either in whole or at least in part) on the achievement of those energy efficiency improvements.
- Broadly, there are three principle ESCo business models. For the purpose of this report these are identified as follows:
  - Traditional ESCo: developer or local authority receives substantial capital contribution from the ESCo provider
  - Shared Ownership ESCo: a 50/50 joint venture across costs and revenues between the ESCo and the developer or local authority
  - Management Deal: developer or local authority funded with the ESCo providing infrastructure management

There is a fourth 'Hybrid' option which takes the best of the Shared Ownership and Management Models to deliver: shared ownership in proportion to the financial and commercial contribution; revenue share in the same proportion; energy centre fit out and distribution networks fully or part funded by partner; and grid reinforcement costs financed by partner and/or ESCo.

It is important that the procuring body, and other partnering stakeholders, are able to clearly articulate their preferred level of involvement and risk prior to embarking on an energy partner procurement exercise. This need not be communicated to bidders as to do so will force them to comply with a business model that may not suit them resulting in fewer bids. However it is essential in order to evaluate the offers received and make decisions on the preferred models.

7.6.1. TRADITIONAL ESCO

The focus is on the supply of heat and electricity. The Energy Services Partner looks to do the following:

- Owns the ESCo (can offer limited profit share).
- Funds plant and equipment in the energy centre.
- Takes ownership of the distribution infrastructure including all the maintenance and costs associated with the plant and network for between 25 and 45 years.
- Takes all revenues from the sale of heat, electricity and cooling.
- Takes liability for all environmental performance targets in relation to energy generation.
- Guarantees reduced energy bills for end users – normally up to 10%. This will help to deliver the 'affordability' objective set by the project partners.

In this model the role of the procurer would be to: fund the construction of energy centre; fund all the distribution infrastructure; agree to compel connection to the heat network for all new buildings and facilitate the connection of existing buildings where possible; if appropriate, require all buildings/tenants to contract with the ESCo as electricity provider at the commencement of their tenure. (NB – occupiers can choose to move to a new provider at anytime thereafter, subject to providing 28 days notice.)

7.6.2. SHARED OWNERSHIP ESCO

The focus is on the supply of heat and electricity. The Energy Services Partner looks to do the following:

- Create an ESCo but offer the developer or local authority a significant share in the ownership.
- Establish an Energy Supply Agreement between the Developer/local authority and energy partner.
- The partner will offer a capital contribution to overall project based on £/residence or commercial connection.
- The ESCo will take a lease of the energy centre building at a peppercorn rate.
- The ESCo will take on management responsibility for the plant and distribution infrastructure post build.
- The ESCo will be responsible for all the maintenance and costs associated with plant and network for 45 years+.
- The ESCo takes all revenues from the sale of heat, electricity and cooling (where appropriate).
- The ESCo takes liability for all environmental performance targets in relations to energy generation.

In this model the role of the procurer would be to: fund the construction of energy centre; fund all the distribution infrastructure; agree to compel connection to the heat network for all new buildings and facilitate the connection of existing buildings where possible; and if appropriate, require all buildings/tenants to contract with the ESCo as electricity provider at the commencement of their tenure. (NB – occupiers can choose to move to a new provider at any time thereafter, subject to providing 28 days notice.)

The procurer will expect to receive a profit share commensurate with their holding in the ESCo and will own title in all plant and infrastructure.

7.6.3. MANAGEMENT DEAL

This structure is more popular when the entire gamut of utility infrastructure and services is included, however, it can also work for an ESCo only arrangement.

The Energy Services Partner looks to do the following:

- Make a capital contribution based on the 'Asset value' of each infrastructure asset.
- Manage the ESCo under contract from the procurer.
- Take a minority (10%) stake in the ESCo.
- Bulk sell electricity to single supplier at a preferential rate.
- Own or lease the heat distribution infrastructure.
- Where possible operate an Independent Distribution Network Operator License (IDNO) for electricity.
- Where possible operate an inset agreement for water and waste water.
- Charge a 'standing charge' to each residential customer connected to the networks.
- Through the ESCo contract take liability for running the plant, equipment and networks.

The procurer will expect to do the following: own 90% of the ESCo and benefit from the ESCo profits; have a tradable asset – the ESCo; take long term interest in the energy provision to the development; carry some of the ESCo risk; fund the entire plant and infrastructure CAPEX; and benefit in any future increase in ESCO profits through network expansion etc.

7.6.4. THE FINANCIAL ASPECTS OF EACH MODEL

- Traditional ESCo – in this model the energy partner will look to secure the revenue streams associated with the sale of services (heat, cooling and electricity) and the levying of a standing charge on each property. This represents secure revenue regardless of usage. (NB – this does not affect adversely the occupier's overall energy bill). A traditional ESCo will not normally look to obtain an IDNO license and will not therefore be able to benefit from Distribution Use of Services (DUOS) charges to any significant degree. Capital will be raised against the service and standing charge revenue streams.
- Shared Ownership ESCo – the financial aspects are the same as for the traditional ESCo. However, the sharing of profits will be determined by the shareholder agreement between the parties.
- Management Deal – the revenue streams are the same as above in respect of the ESCo with profits being apportioned in accordance with the shareholder agreement: in this model 90% to the procurer and 10% to the energy partner. Where regulated utilities are involved e.g. IDNO networks for electricity and inset agreements for water, the revenues belong to the partner as the perpetual owner of those networks.

7.7. CAPITAL AND OPERATIONAL COSTS

District energy capital expenditure is primarily made up of the: energy centre building; plant and equipment; heat distribution network; and electricity distribution (where appropriate).
How these costs are apportioned between the various stakeholders will very much depend on the model being adopted. Key points to consider are:

- What is to be designed and built?
- How will it link with existing infrastructure?
- Who will design and build it?
- Who will operate and maintain it?
- Where will the finance come from and what proportion will be equity and debt?

For the Bury St. Edmunds heat network to be proved viable, whichever options from this report are pursued, the question of who pays for what will be of paramount concern to every stakeholder.

The level of investment each stakeholder makes will inevitably drive the level of ownership they receive, the level of risk they take and the level of returns they receive.

7.8. INCOME

The key questions are where does it come from, how much and who benefits from it. Income from a decentralised energy scheme will usually fall into the following categories:

- Heat/cooling revenue, comprised of a variable element, based on the actual amount of heat used and a standing charge payable on a monthly or quarterly basis
- Revenue is also generated from electricity sales on schemes making use of CHP. This electricity can be sold on site to occupiers or via a bulk contract to the grid. The sale of electricity to on site occupiers via a private wire, whilst once a mainstay of an ESCo proposition, is less popular now due to competition rules and an improvement in the price obtainable via bulk contracts to the grid. However, there is still a demand for single private wire contracts to commercial occupiers if this can be achieved. The sale of CHP electricity to the grid makes commercial sense. A single contract reduces costs and the demand is predictable. In addition, the ESCo avoids the need to manage the customer's demand for grid back-up.

7.8.1. HEAT TARIFFS

A primary concern for any organization procuring energy services is the level of tariffs and how they are controlled.

For regulated utility services this is managed by the regulators however unlike other utilities the production, distribution and sale of heat is unregulated.

In most ESCo contracts the control of the heat price is entirely governed by the various contracts in place between the parties. The most important one as far as the consumer is concerned is the heat supply contract. This document will set out the process for managing and regulating the heat price throughout the term of the contract.

ESCo heat tariffs are normally made up of fixed charges and variable charges and whilst there may be small differences between commercial property and residential the principles are the same.

7.8.2. FIXED CHARGES

The fixed charges are a set amount charged on each property payable monthly quarterly or annually. These amounts are index linked to the Retail Price Index (RPI) and are contracted with the occupiers through the Heat Supply Agreement (HSA).

Residential fixed charges are based on an amount agreed with the procurer at the outset of the ESCo agreement. The numbers below are an average based on our knowledge of the market

Property Size (beds)	Fixed Charge (£/yr)
2	£300
3	£310
4	£315
5	£320

Commercial fixed charges are usually calculated based on an agreed amount of heat generation capacity (kW) in the energy centre.

The range of charges can vary but a normal charge would be around £35/kW/year.

7.8.3. VARIABLE CHARGES

The variable heat charge levied by an ESCo on the actual amount of heat consumed is usually calculated by reference to an algorithm based on the energy centre input fuel prices. This is often known as the 'Maximum Heat Price Formula'.

An example of a Maximum Heat Price Formula taken from numerous projects completed by Inventa Partner over the last 12 months is shown below:

Maximum Heat Price (p/kWh) =

$$(1.5 * G) + (0.6 * B) - (0.5 * E) + 2$$

Where:

- G = Wholesale Gas Offer Price (Index – ICIS/HEREN)
- B = delivered biomass price for wood pellet (p/kWh) as provided by E.ON at the time of price review
- E = wholesale annual electricity bid price (ICIS Heren)

7.8.4. DELIVERING AFFORDABLE ENERGY

When selling a building heated by district heating it is important to be able to demonstrate that the consumer is getting good value for money. This does not necessarily mean cheaper energy but it should not mean more expensive energy.

ESCos achieve this by making a comparison with the heating bills for a traditional building and a more energy efficient Code for Sustainable Homes (CSH) or BREEAM equivalent. Today this is likely to be a standard property built to Part L 2006 standards.

An example of such a comparison, as used by Eon on a number of schemes over the last 12 month, is set out below:

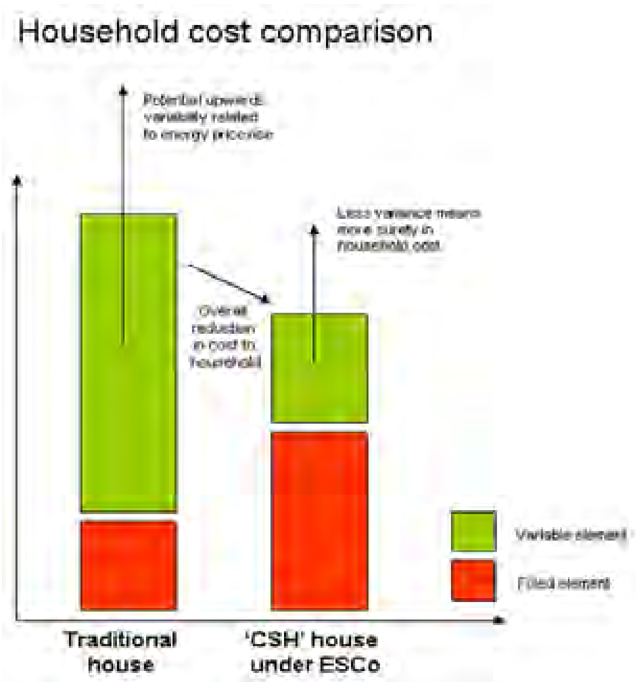


FIGURE 26: HOUSEHOLD ENERGY COST COMPARISON, COURTESY OF EON ENERGY UK

7.9. DRIVERS FOR DELIVERY

From a financial point of view the principal objective will depend very much on the wishes of the parties providing the majority of the capital. Most ESCo use a target Internal Rate of Return to judge how viable a project is. This rate of return will be calculated on the level of revenues against costs and will identify the amount of capital an ESCo will be willing to invest in a project based on either an assumed level of design and build or where available on actual plans. The level of ESCo investment is rarely based on actual capital spending as it is rare that an ESCo can show viability when all of its associated capital costs are factored in to the business model. This, like many forms of infrastructure spending, is because large elements of the capital cost can be allocated elsewhere and will derive their returns from elsewhere.

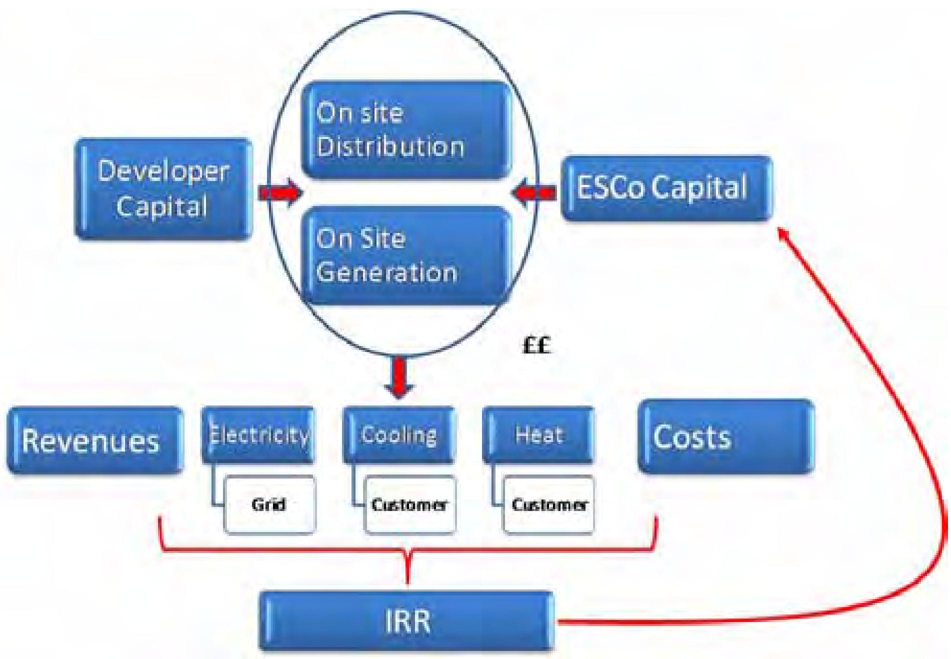
One can use the example of a road network to illustrate this point. On a new development, roads themselves derive no revenue but no one would argue that they have no value. The building of a road network on a development site creates value on the site and is an integral part of a developer's cost plan. If we assume a developer is compelled to provide a district energy network in order to meet building regulations and planning conditions, then the provision of that infrastructure creates value. The value created may not be enough to justify the cost, hence, the developer might look to other sources of finance (e.g. energy companies or contributions from an Allowable Solution[8] or the Community Infrastructure Levy) or alternative technology solutions. However, assuming a decentralised energy network is viable then a proportion of the capital cost will sit with the developer.

For district heating networks serving existing premises the capital shortfall between what the energy company will invest and what it actually costs needs to be met by the provision of connection fees charged to the existing buildings. The principal is to keep those connection fees equal to or below the alternative costs to the buildings of proving their own plant and infrastructure.

There are instances, on large diverse projects, where, following full build out, an ESCo can make very significant levels of profit. In these cases it is important that other stakeholders negotiate 'overage' opportunities allowing them to share in those benefits.

The commercial ESCo model is illustrated in the diagram below. The principals are the same for the other ESCo models:

FIGURE 27: EXAMPLE OF A COMMERCIAL ESCO MODEL



[8] THE PROPOSED DEFINITION FOR ZERO CARBON HOMES INCLUDES FOR ALLOWABLE SOLUTIONS, WHICH ARE CARBON OFFSETS THAT CAN BE USED TO REACH THE TARGET AFTER ON-SITE ENERGY EFFICIENCY AND RENEWABLE ENERGY HAVE BEEN USED

7.10. KEY ISSUES FOR STAKEHOLDERS

The issues described below will differ in importance according to the type and extent of network being considered. For example, a strategic network will require greater involvement from the local authority then for one serving a strategic development site only.

7.10.1. THE ESCO

Assuming the ESCo has a stake beyond simply operating and maintaining under a contract then the following must be considered:

- Who the early customers are – these will need to demand a significant enough initial load to justify the upfront expenditure.
- Who the future customers are.
- What services are being sold (e.g. heat, cooling, electricity) and to whom.
- How the tariffs are set and controlled (See below).
- What fiscal incentives exist and who benefits.

7.10.2. LAND PROVISION

The provision of land for an ESCo is invariably one of the most difficult issues. For several of the Bury options this is dealt with through the connection to British Sugar making an additional energy centre unnecessary. However for options where a British Sugar connection is unrealistic land must be found to site the energy centre.

The land owner may have a variety of roles. Often the provision of its own land or assets represents a useful way for a local authority to kick start a network and acquire a valuable stake, particularly in the current economic climate where the availability of public sector capital is very limited.

Of key importance when considering land for an energy centre are:

- The amount of land required and its opportunity cost.
- How the land will be valued.
- What rights over the land will be granted to the ESCo.
- What the impact is of Landlord and Tenant Act. Note that the UK-Green Building Council is developing a standardised legal framework for network infrastructure which may be able to mitigate these risks.

7.10.3. THE COUNCIL

The role of a local authority in delivering district energy schemes depends very much on the following:

- The strength of the planning policies compelling connection to a heat network (see Section 10).
- The level of public land ownership.
- The availability of capital.
- The heat demands in the relevant areas.
- The number of public sector buildings available to connect.
- The number of suitable new developments in the area.
- The density of both existing development and new development.

St Edmundsbury Council has an additional factor in the form of the existing electrical generation at British Sugar.

The ability of the Council and project partners to deliver its viability objective will very much depend on the assets the Council can bring to the decentralised energy network.

7.11. ESCO OWNERSHIP

The ownership of the ESCo is critical to its value. ESCo can be established as Special Purpose Vehicles (SPVs) with multiple ownerships or as subsidiaries to larger companies. Equally they can be owned by the developer, landlord or local authority. There are also many examples overseas of community owned ESCo.

The overriding principles are that 'you get out what you put in' and that your level of risk and responsibility will be directly related to your level of ownership. A variety of models exist in the UK but increasingly we are seeing the large energy companies moving away from SPVs, favouring instead the lower cost approach of absorbing the ESCo into the broader structure of the unregulated parts of their business. This can make sense to other stakeholders providing their own positions and roles are adequately protected by contracts.

For St EdmundsburyBorough Council it will be important to identify what the Council considers to be an acceptable level of risk prior to identifying how to become directly involved. These decisions will most likely be based around the following:

- Is there available capital for direct investment?
- Is additional land required and if so is the Council able to make it available?
- Will the council be a customer of the energy services provided?
- How does the council intend to evolve its use of planning?
- How will the new developments be treated with regards to district energy versus building integrated solutions (see Section 10)?

Of course other stakeholders will also have to consider similar questions with regards to their level of risk/ involvement.

7.12. CONTRACTS

The number of contracts required for a typical decentralised energy scheme can be daunting. However, the importance of the contractual relationship between the parties and the ESCo customers cannot be over stated.

We have set out below an example of the contracts required as an illustration of this. Please note this represents one possible contractual scenario. In this instance it assumes a single land owner and the desire of that land owner to retain ownership of the infrastructure in the long term and lease it to an ESCo.

Whilst numerous deal structures might be possible in Bury St Edmunds it is most likely that the nature of the contracts will be driven by the principle funder. The customer side supply contracts will be common to all models. Contractually the right to own and operate the ESCo usually works in two ways. Either the ESCo owns and operates the energy centre, plant and distribution infrastructure or it leases one or all.

However, in district energy scenarios where there is a capital cost shortfall it may be possible to split the ownership of the generation and distribution in order to direct public sector funds towards the network elements. This could result in the owner of the distribution network charging the owner of the energy centre a Use of System Charge (UoSC) for every kWh of heat that passes through the pipes. Whilst this is the standard modus operandi for electricity networks it has yet to be successfully employed in the UK. We are however aware of several local authorities who are considering this option as a means of recovering potential investment capital.

7.13. PROJECT DEVELOPMENT AGREEMENT

This is the main agreement between the developer and the ESCo. Under this agreement the developer appoints the ESCo for a fixed term and places performance obligations on the ESCo. For example: to take possession of the decentralised energy scheme; to operate it; and to provide heat and cooling to customers.

The Project Development Agreement will contain schedules dealing with the following:

- Development plans.
- Energy centre equipment list.
- Handover criteria.
- Commissioning plan.
- Guaranteed standards of supply.
- Customer welcome pack.
- Requirements of the energy system.
- Performance criteria.
- Maintenance plan.
- ESCo requested modifications.
- Obligations for heat and supply prior to first handover.
- Energy centre lease and deed of grant of easements.
- Equipment lease.
- Customer heat and power supply agreements.

This list does not include additional utility contracts for the supply of utilities to the ESCo and the export of electricity.

8.0 CONCLUSIONS

8.1. APPRAISAL SUMMARY

The options appraisal considered the potential for district heating in the identified opportunity areas by testing one or more possible initial network configurations. Subsequent modelling of the technical, environmental and financial aspects has enabled us to draw high-level conclusions which can be used to direct further study towards the most viable and deliverable opportunities.

The strategic aims of the project partners are to develop a viable decentralised energy network that offers affordable, low carbon and secure energy supplies for Bury St Edmunds. The following indicators will be used to assess the options against the objectives:

AFFORDABLE

The affordability of heat for consumers will be a major determinant of whether or not new customers connect. Customers will want assurances that prices will remain affordable relative to the main alternatives in the long run. Therefore, getting the pricing structure right is critical.

LOW CARBON

All of the network options modelled will deliver some carbon savings. The scale of savings will depend on the size of the heat loads served and the choice of heat supply. Longer term, consideration will also need to be given to the extent to which carbon savings can be further improved, for example by replacing gas CHP with biomass and other alternatives. This will require a better understanding of low carbon energy options across the borough.

SECURE

Energy security can be improved through resource efficiency, diversification of fuel sources and the use of renewable supplies. CHP increases the efficiency of primary energy use by generating both heat and electricity. Injecting heat from British Sugar's CHP into a network would make more use of some waste heat further improving resource efficiency. Biomass provides some opportunity to diversify away from gas into renewables produced in the UK.

Next steps for delivering the opportunities are recommended, the key partners who would need to be involved are identified, including the role the Council might play in the process.

RECOMMENDATIONS

The following general conclusions and recommendations have been drawn from the analysis:

- A number of the possible networks options could achieve a commercially attractive IRR. These are discussed in detail below.
- There are good opportunities to develop strategic district heating networks connecting new and existing development in Bury St Edmunds. These will need to be developed incrementally over time as a series of networks that could eventually join up. Each of the options entails varying degrees of complexity and risk.
- Developing a strategic network will require that the Council has some involvement in delivery and is willing to take on an enabling role. The following should be prioritised for further feasibility work: North West Bury; Abbeycroft Leisure Centre; and North East Bury with Eastern Way. These should be followed by the remaining options (details of which are set out below).
- The nature of the proposed strategic new development means that in many cases district heating may not be the energy strategy of choice. While new development could contribute useful loads, the analysis has shown that options can remain commercially attractive without connection to new development. This will help to reduce some of the future uncertainties for development of a strategic network.
- The individual networks can make a modest but important contribution to reducing emissions. The strategic network offers the potential for more significant emissions reductions.

8.2. NORTH WEST BURY

	Project IRR	Carbon savings
British Sugar CHP – scenario 2: Northern Way and existing neighbourhood	7.3%	1689 tCO_2

The large heat loads available at Northern Way, the new strategic development site and in the existing neighbourhood make a connection to British Sugar financially attractive. North West Bury is the option we consider to have the most potential to make a significant impact on delivering the strategic aims of the project and was subject to a more detailed assessment in section 7 where options for delivery were suggested.

The recommended initial network option, connecting buildings at Northern Way and in the existing neighbourhood to British Sugar, has a positive IRR of 7.3%, saving 1689 tCO_2 per annum, equivalent to 0.13% of the borough's emissions. The strategic housing development is likely to be relatively low density and connection to a network may be a more expensive route for developers to meet carbon compliance, which could have an impact on the site's viability.

A first phase could connect British Sugar to the Northern Way industrial estate. Later phases could connect the existing properties in the existing neighbourhood and the strategic development site, should this prove viable. Phasing and liaison with the developer (Countryside) will be key to realising the full potential of this option.

A partnership between the Council and British Sugar might be appropriate for the first phase, with Countryside or a third party ESCo potentially joining for later phases.

8.3. ABBEYCROFT LEISURE CENTRE

	Project IRR	Carbon savings
Gas-fired CHP	-	1380 tCO_2
Biomass	0.48% (inc RHI)	2052 tCO_2
Biomass CHP	-	5334 tCO_2
Depot only	5.8%	292 tCO_2

The leisure centre is an ideal anchor load for a district heating network. An opportunity exists to develop a strategic network in three stages:

- A potentially straightforward option exists that uses the existing leisure centre's CHP plant to serve the neighbouring depot only. This option has a positive IRR of 5.8%, saving a relatively modest 292 tCO_2 per annum.
- It might then be possible to use the existing plant space in the leisure centre to host larger plant, connected to a larger group of buildings in the area, such as West Suffolk College and County Upper School. This option has a low or negative IRR but results in larger savings of 1380-5334 tCO_2 per annum depending on the fuel source. This is equivalent to 0.11-0.42% of the borough's carbon emissions. This option would require funding from an alternative source which could include local authority capital, CIL, allowable solutions, borrowing or others described in section 10.
- Eventually a strategic connection from Abbeycroft Leisure Centre to buildings or an existing network in North West Bury might be possible.

Delivery of the connection to the depot would be simplified by the Council's existing stake in the Leisure Trust and the small scale of the network. Because the existing CHP plant has spare capacity, re-negotiation of terms with the current CHP leaseholder Cogenco might not be necessary. The option could be delivered and operated by the Council independently. Understanding the feasibility of this option should be a priority for the Council. As part of this process an early dialogue with Cogenco should be pursued.

The Council will need to take a lead in taking this option forward. Key partners will be the Leisure Trust and Cogenco.

8.4. NORTH EAST BURY AND EASTERN WAY

	Project IRR	Carbon savings
British Sugar CHP – Eastern Way industrial estate	10.28%	2332 tCO_2

North East Bury and Eastern Way have been considered individually and together in the options appraisal. The network options developed would be served by the existing CHP at British Sugar.

The recommended initial network would connect large loads on the Eastern Way industrial estate. If possible, this would include buildings on both sides of the railway line, subject to consultation with Network Rail. This option has IRR of 10.28%, saving 2332 tCO_2 per annum, equivalent to 0.18% of the borough's emissions.

A later phase could extend the network to the strategic development site, should this prove viable. Phasing and liaison with the developer (Berkeley Strategic) will be central to realising the full potential of this option. Again, this does not include the additional costs to the developer of on-site infrastructure. This cost is dependent on the site's layout and phasing and would need to be assessed against other energy strategy options.

Further investigation is warranted by the potential for additional revenue streams from serving process loads at Eastern Way. The Council should make efforts to raise awareness of the potential financial case of network connection and should attempt to create dialogue between large users of processing heat and British Sugar where technical and commercial issues can be discussed.

The Council will need to lead delivery in partnership with British Sugar, the developer of the strategic site (Berkeley Strategic), residents and tenants of Eastern Way industrial estate (particularly Boortmalt and ABN), and landowners along potential pipework routes.

8.5. WEST BURY

	Project IRR	Carbon savings
Gas-fired CHP	1.36%	1439 tCO_2
Biomass	21.46% inc. RHI	2028 tCO_2
Biomass CHP	-	5531 tCO_2

A new medical campus to replace West Suffolk Hospital could be delivered with a campus-wide district heating network. Were this delivered prior to the neighbouring housing development, it could form the basis of a wider strategic network. This option could benefit greatly from the RHI where biomass fuels are used. This option has a positive IRR of 21.46%, saving 2028 tCO_2 per annum, equivalent to 0.16% of the borough's carbon emissions. Again, this does not include the additional costs to the developer of on-site infrastructure. This cost is dependent on the site's layout and phasing and would need to be assessed against other energy strategy options.

Although a heating network could well be included as part of the hospital development, creation of a network connecting to the housing site is likely to require the delivery of the hospital first. The Council should consider co-ordinating the phasing of development and should foster a dialogue between the NHS Trust and the housing developer (Bellway Homes). The strategic housing development is likely to be relatively low density and connection to a network may be a more expensive route to meeting regulatory and planning compliance, which could have an impact on the site's viability.

Key partners for network delivery are: West Suffolk Hospital NHS Trust; the developer of the strategic housing site, Bellway Homes; and the academy partnership which governs Westley Middle School.

8.6. CENTRAL BURY

	Project IRR	Carbon savings
Gas-fired CHP	-	1452 tCO_2

The network option developed for Central Bury is considered more difficult to deliver due to the complexity of establishing a network in an existing urban area where the cost of disruption, conservation and archaeology would be add to the cost of installing the network. Because of potential air quality concerns only a gas-fired CHP option has been considered. It has a negative IRR and would result in savings of 1452 tCO_2 per annum, equivalent to 0.11% of the borough's emissions. This option would require funding from an alternative source which could include local authority capital, CIL, allowable solutions, borrowing or others described in section 10.

The network model made the assumption that the energy centre would be located at Greene King's Westgate Brewery. Due to uncertainty in the technical requirements of their process heat demands, it was not included in the model. Based on the available data, the brewing process alone could potentially be served by CHP. Were this to be carried forward, a further search for nearby loads to connect would be warranted.

Over 80% of the energy consumed in Bury St Edmunds is for industrial purposes. A CHP serving Greene King or a strategic network in Central Bury could be an effective means of reducing emissions from this sector. The Council should engage with Greene King to publicise the findings of this report and should explore the potential of developing a wider network.

8.7. SUFFOLK BUSINESS PARK

	Project IRR	Carbon savings
Gas-fired CHP	-	4807 tCO_2
Biomass	2.37% inc. RHI	6177 tCO_2
Biomass CHP	-	16501 tCO_2

The network option developed for the Suffolk Business Park is considered more difficult to deliver due to the issues surrounding phasing and uncertainty over the heat demands of future development. This option has a low or negative IRR but results in modelled savings of 4807-16501 tCO_2 per annum depending on the fuel source. This is equivalent to 0.38-1.29% of the borough's carbon emissions. This option would require funding from an alternative source which could include local authority capital, CIL, allowable solutions, borrowing or others described in section 10.

A masterplan for Suffolk Business Park was not available to support this assessment. This had led to additional uncertainty in developing a network option and its financial costs. Delivery is expected to be phased over many years, adding further complexity to the assessment of its potential.

However, delivery of the energy centre alongside a large anchor load or in conjunction with expansion into existing commercial buildings could make a smaller network viable. The potential for district heating should be re-examined following further development of outline plans and a greater understanding of the rate of deliver and their location in relation to existing heat loads.

The carbon savings that each initial network option can contribute towards meeting the commitments made through the Suffolk Strategic Partnership are relatively small but together the networks represent a more strategic opportunity which has the potential to drive further carbon savings through new connections, expansion and the use of low carbon fuels.

The map on the following page presents the district heating network opportunity areas plan.

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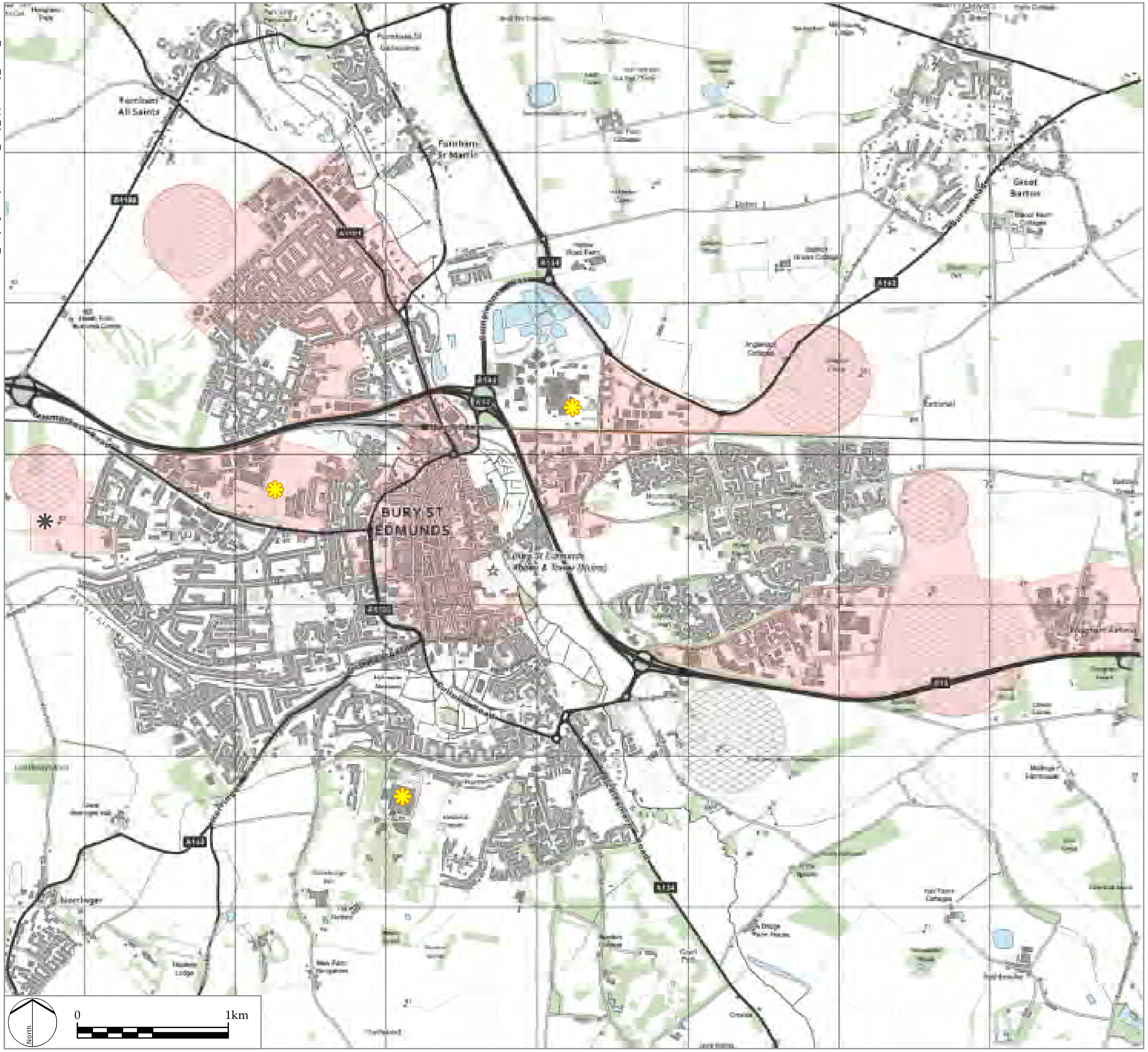

LEGEND

- Strategic directions of growth sites
- District heating network opportunity areas
- Existing Combined Heat and Power plant
- Potential future heat source

LDĀ DESIGN

PROJECT TITLE

INVESTIGATING DECENTRALISED ENERGY IN BURY ST. EDMUNDS

DRAWING TITLE

Map of network opportunity areas assessed in the options appraisal

ISSUED BY	London	T: 020 7467 1470	
DATE	22 Jun 2011	DRAWN	DL
SCALE @A3	1:25,000	CHECKED	RSi
STATUS	Final	APPROVED	RSh

DWG. NO. 3120_003_B

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Sources: Ordnance Survey, Valuation Office, St Edmundsbury Borough Council

8.8. NEXT STEPS

The Council is recommended to undertake the following actions based on the findings of this study:

- Early commitment by the Council to developing a strategic network and the role it will take in making it happen.
- Early agreement by the Council as to which parts of the network should be prioritised based on the recommendations above.
- The commitment should be reflected in the Bury Vision 2031 and other strategies, based on recommendations in Sections 9 and 10.
- Detailed technical and financial feasibility studies of the early phase options, involving appropriate partners, using this study as the starting point.
- The Council should liaise with businesses and buildings with potential to be connected and should consider inviting representatives from important heat and process loads to join as project partners. Developers of the strategic housing sites should be included.
- The Council should develop an understanding of what assets and land could be provided to support delivery of a network, by hosting an energy centre or distribution pipework for example.
- Detailed business modelling to determine the most appropriate management structure, based on preliminary analysis in Section 7. The Council and its partners will need to be able to clearly articulate their preferred level of involvement and risk prior to embarking on an energy partner procurement exercise.
- Explore wider opportunities for energy efficiency, energy supply and carbon reductions to inform a Bury or St Edmundsbury wide carbon reduction strategy.
- Explore development of a low carbon fund or similar delivery model to deliver the town's energy vision and deliver the network. This should include consideration of the relationship with CIL, Allowable Solutions, New Homes Bonus, prudential borrowing and other investing and funding options.

9.0

REFLECTING THE NETWORK IN STRATEGIES FOR BURY ST EDMUNDS

The borough and sub-region have, or are in the process of, developing a range of strategies covering economic, environmental, community and spatial issues. The study has a number of conclusions that may support the Council in its delivery of these strategies and, where strategies are not finalised, be shaped by the study's findings. The relationships explored below can also be used as part of justification for Council involvement in the delivery of a strategic network or networks.

9.1. CORPORATE PLAN 2010-2011

The borough's Corporate Plan for 2010-2011 identifies amongst its four priorities: securing a sustainable and attractive environment; and creating a prosperous local economy. In addition, the plan's housing aims for "all new homes are built to a high standard of design with sustainability features", the Clean and Green commitment to take "appropriate action to mitigate for and adapt to climate change "and "promote sustainable and carbon neutral development", and the sustainable environment goals of St Edmundsbury being a place where:

- Communities work together to conserve resources and make their settlements sustainable
- Is an international leader in resource efficiency
- Communities and businesses have benefitted from adopting a low carbon approach to energy
- The principles of sustainable design, location and construction are commonplace in all new developments
- The effects of climate change have been mitigated and adapted for

Low carbon energy will need to form a core part of the borough's economic future. Not all energy types will be suitable or viable. However, it is clear from this study that district heating can make a useful contribution in delivering these priorities.

By focussing on implementing the recommendations, St Edmundsbury Borough Council can support the Corporate Plan's goals and commitments for Bury St Edmunds.

9.2. ST EDMUNDSBURY ECONOMIC ASSESSMENT AND ACTION PLAN 2010-2015

The economic assessment and action plan has a strong focus on place and considers both St Edmundsbury as a whole and the individual town and rural centres. "This action plan therefore looks for growth that is economically resilient and environmentally sustainable". The conclusions of this study can help the Council deliver the objectives, particularly to "reduce industrial carbon emissions", including those of some of the project partners. Future iterations of the Action Plan should include a clear commitment to the development of a strategic network, in appropriate areas.

9.3. A REVIEW OF ST EDMUNDSBURY BOROUGH COUNCIL'S RESPONSE TO CLIMATE CHANGE AND ENERGY DEPENDENCY (2007)

The conclusions of this study can support the delivery of several points of the action plan developed as part of the review. Commentary on how this study can support the review's implementation is set out below:

- The development of an "invest to save" approach to the use of fuels in Council controlled buildings – exploring the viability of investing in strategic district heating would play an important part in delivering this recommendation.
- The adoption of a minimum renewable energy requirement for all non-domestic developments – a target for renewable and low carbon energy could be used to support the expansion of a network into new development. The requirements for community grant applications for development or refurbishment of facilities to incorporate best practice energy efficiency and renewable energy generation – a strategic district heating network would offer a useful way to achieve these requirements.

The study should be used to deliver the actions of the Review of St Edmundsbury Borough Councils Response to Climate Change and Energy Dependency where appropriate, through support for strategic district heating networks.

9.4. OUR SUSTAINABILITY POLICY (2008)

The study conclusions can support the delivery of the key objectives to reduce natural resource use, the borough's energy demands and tackle the effects of climate change. Making use of district heating networks to change the way energy services are supplied to existing buildings and new development will positively contribute to delivering the objectives of the sustainability policy.

9.5. WESTERN SUFFOLK COMMUNITY STRATEGY

The Community Strategy developed by the Western Suffolk Local Strategic Partnership has eight strategic priorities. The conclusions of this study can support the Partnership's delivery of several of these priorities, specifically ensuring that development of the built environment is sustainable and supports the establishment of sustainable communities. The development of a district heating network within the town and possible strategic extensions to new development, where appropriate, can support the Council in delivering these priorities.

9.6. SUFFOLK'S STRATEGIC OBJECTIVES

Suffolk's strategic objectives (formerly Local Area Agreements) reflect the issues and priority areas of the county. The study's recommendations can help in the delivery of several of these objectives. Particularly, the development of infrastructure to support growth, the development of skills and education in the area and to support to ambition that Suffolk be the 'Greenest County' and be "the county with the greatest reduction" in CO_2 emissions.

9.7. THE SUFFOLK CLIMATE ACTION PLAN

The action plan produced for the Suffolk Strategic Partnership (of which St Edmundsbury Council is a member) by the Suffolk Climate Change Partnership includes several actions whose delivery can be supported by the recommendations of this study:

- Measures to decarbonise energy supplies by developing more efficient energy generation and distribution.
- Provide a learning example of sustainable communities and resource efficiency measures.
- Develop the local low carbon economy.
- Identify, promote and establish grant-aid opportunities for resource efficiency actions.
- Create business learning initiatives and enable businesses to be sustainable in the County's changing climate.
- Promote the development of sustainable communities.
- Renewable and low carbon energy supply in new development.

10.0 SPATIAL PLANNING

10.1. A LOW CARBON ENERGY VISION

It is recommended that the town develop a corporate and spatial vision that reflects the findings of this study and uses them to inform future growth and action on economic development, sustainability and fuel poverty. The following sets out the component parts of what the vision should contain:

- The Bury St Edmunds vision is to develop a strategic decentralised energy network to supply new and existing domestic and non-domestic users in suitable parts of the town, utilising waste heat from industrial processes where possible, low carbon heat generated combined heat and power supplying district heating and cooling, and other low carbon energy generated from microgeneration and stand-alone technologies. This commitment would be justified by the evidence base prepared by *LDA Design* on behalf of the Council and its project partners (Investigating Decentralised Energy in Bury St Edmunds).
- The aim of developing the networks is to develop sustainable, affordable, low carbon energy supplies for Bury St Edmunds over the next twenty years. The strategic objectives fall into four areas:

  - Financial viability – the network should be viable taking account of all factors.
  - CO_2 emissions reduction – through the 2008 Climate Change Act, the UK Government is committed to reducing greenhouse gas emissions by 80% on 1990 levels by 2050. Suffolk, through the Creating the Greenest County programme, is aiming to achieve a 60% CO_2 reduction by 2025.
  - Affordability – the upfront capital costs of some low- or zero-carbon energy systems can be higher than for traditional energy. In contrast, fossil fuel-based energy prices have and are predicted to continue rising. Nationally several million households have moved into fuel poverty in the last year as a consequence of fuel price rises as well as other economic factors.
  - Security of supply – growing demand and dwindling supplies mean prices will become more volatile, which could adversely affect supply.

- Further work should be carried out by the Council and its partners in order to confirm the final choice and configuration of networks. However, it is anticipated that the decentralised network would start from a small number of networks, initially in the most viable parts of the town (From British Sugar to Northern Way and Eastern Way industrial estates and from Abbeycroft Leisure Centre to St Edmundsbury Depot) but with an ambition to expand and interconnect over time.
- The network or networks would also aim to support property developers in delivering their regulatory and planning CO_2 reduction requirements. Subject to an assessment of feasibility and viability, developers would be expected to consider connecting to a network and contributing to its expansion either financially or through physical expansion.

The Council should recognise that it has an important role to play in driving development of the network. Accordingly the following recommendations have been made:

- Priorities for the development of the network should be set out in the Bury Vision 2031, St Edmundsbury Council's Corporate Plan and other strategies.
- Financing options have been discussed in the evidence base and should be explored further for individual parts of the network.
- The role of the Council and the likely governance arrangements have been described in the evidence base and should be explored in more depth.

Decentralised energy can play a key part in Bury's transformation to a low carbon economy. Not only would this bring about new and a potentially more secure energy supply and reduced emissions it also opens up opportunities for creating jobs. The rapid growth in solar is having a huge impact in some parts of the country as new supply and installation companies establish themselves. This trend is set to continue.

The creation of a strategic decentralised energy network that utilises a range of interconnected technologies and which supports the development of low energy development can potentially bring a number of benefits to Bury:

- Skills and training to service new businesses and industries. Many of the skill sets required will be present in more traditional industries: engineering for installation and maintenance; or accountancy and legal skills needed for the development process. There would be an important role for the college in identifying the skills most needed in the town and what particular niches the town might be able to find for itself in such a fast moving sector. The Council's role would be to liaise with the colleges as development of the network progresses.
- Education of school children using the town as a case study. The schools would have an important role here, particularly where real projects begin to appear. The Council would have an important role to play in fostering this.

The most important first steps will be for the Council to turn the vision of a network into real projects and to involve the college and schools in the next stages of the developing a network.

10.2. THE BURY VISION 2031

The Bury Vision 2031 will have a critical part to play in the development of low carbon energy and particularly district heating networks. It provides a spatial reflection of the low carbon energy vision. It is recommended that it include a statement that development of a strategic district heating and/or cooling network is a spatial objective for the town.

The Council needs to clearly recognise its role in supporting or taking the opportunities from a concept to reality. It is useful to think about three types of opportunity in Bury:

- Private energy opportunities – these opportunities or parts of the district heating network will be entirely within the boundary of an existing building or development. This includes the British Sugar plant and land and any existing development where a technology or heat or cooling network could be installed. In terms of district heating it will include a heat source and demand and be capable of operating independently of any strategic network. Project developers are likely to include building owners or occupiers, private ESCo or other third parties.
- Planning will have a limited role except where changes to a building are significant enough to warrant a planning application. Connection to a network is likely to happen because it presents the cheapest, easiest or most secure energy option for the building or development.
- New development integrated energy opportunities – this will comprise energy strategies prepared by developers to comply with Building Regulations or policy in the Core Strategy. Planning policy in the Bury Vision 2031 could play a key role.
- Strategic energy opportunities – strategic energy opportunities will be a component part of a district heating network (be that distribution pipework, heat source or other energy supply). It will link private and development integrated systems to form a strategic network. This part of the network would need to be led by the local authority but may be a partnership with the private sector or community.

10.3. PROPOSED BURY VISION 2031 POLICY

The following planning policies and supporting text are recommended to support implementation of the town's decentralised energy opportunities.

> ### PROPOSED MASTERPLAN POLICY 1 – ON-SITE LOW CARBON ENERGY TARGET
>
> Opportunities for large-scale low carbon energy generation are limited in Bury St Edmunds. In order to deliver energy generation and CO_2 reductions, and maximise the economic, social and environmental benefits that this will bring, the Council expects new development to play its part. Accordingly, developments in 'district heating network opportunity areas' and developments over 10 dwellings will be required to emit a maximum of 6 kilograms of CO_2 per square meter per year ($kgCO_{2(eq)}$ m^2/year), where feasible and viable.

JUSTIFICATION

The challenge of delivering the energy vision's goal of increasing low carbon energy generation and reducing CO_2 emissions, and the economic, social and environmental benefits that this will bring, in a town where the opportunities for large scale low carbon energy generation are constrained is significant. The setting of a planning target that is more stringent than the building regulations on large sites is justified by the particular challenges and characteristics of the borough and its ambition. It also reflects the conclusion in the Development Management Preferred Options Document that in large strategic housing sites economies of scale can be achieved that would mean the 10% target (Policy SD7) should be exceeded.

The justification for the recommended on-site low carbon energy target is drawn from the evidence prepared as part of the 'Investigating Decentralised Energy in Bury St Edmunds' study and the recent work by the Zero Carbon Hub (Carbon Compliance: Setting an appropriate limit for zero carbon new homes - Findings and Recommendations, February 2011). It considers two aspects: technical feasibility; and financial viability.

This study shows that Bury St Edmunds has a range of opportunities, particularly for small scale technologies, but that the total potential is relatively constrained: the principal opportunities are for development integrated microgeneration and district heating. The need to deliver the vision's goal of increasing low carbon energy generation and reducing CO_2 emissions, requires the town to maximise delivery of energy efficiency and low carbon energy generation. This will not happen without a contribution from new development.

Zero Carbon Hub modelling shows the marginal additional cost of moving the Carbon Compliance limit (which would also apply to a planning target) by 1 kg can be relatively small: between £80 and £175 per dwelling using 2016 projected costs. Modelling is based on photovoltaic and, at 2010 prices, the costs range between £280 and £610. It is useful to note that the price of photovoltaic panels is anticipated to reduce significantly year on year and there are already developers able to install them at prices modelled for 2016. This is likely to have a positive impact on viability.

The target proposed here seeks to reflect an appropriate balance between the economic, social and environmental imperative of higher standards and the commercial realities of property developers.

The performance of different building types are different and this affects the viability or otherwise of a target. For example, it will be easier to achieve higher standards in larger, low rise properties. The target of 6 kilograms of CO_2 per square meter per year will only apply, therefore, in 'district heating network opportunity areas' and in developments over 10 dwellings or non-residential developments over 1,000m^2. This is broadly equivalent to the 70% reduction in emissions over a 2006 building regulations compliant home originally recommended as part of a zero carbon home. It is recognised that this will in some cases remain a challenging target, particularly for certain building types, and so it will be acceptable to average compliance across all buildings in a development.

By mirroring the Building Regulations compliance regime, demonstrating compliance with the planning target would simply be a case of presenting the information prepared for building control and showing how the additional savings will be achieved. Applicants should use open book accounting to enable the planning authority to determine viability.

It is recommended that the Council prepare further guidance to support developers in complying with this proposed policy.

PROPOSED MASTERPLAN POLICY 2 – DISTRICT HEATING NETWORK OPPORTUNITY AREAS

It is recommended that new development in a 'district heating network opportunity area' should, where feasible and financially viable, contribute to the establishment of a strategic district heating network(s) in suitable locations. Accordingly:

1. Development of all sizes should seek to make use of available heat, biomass and waste heat.
2. Strategic development sites should consider installing a district heating network to serve the site unless it can be shown not to be feasible or viable. The network should connect to or be compatible with connection to a strategic network at a future date.
3. Other new developments should connect to any available district heating networks unless it can be shown not to be feasible or viable. Where a district heating network does not yet exist, applicants should demonstrate that the heating and cooling equipment installed does not conflict with future connection to a strategic network.
4. New development should be designed to maximise the opportunities to accommodate a district heating solution, considering density, mix of use, layout and phasing.
5. Where investment or development is being undertaken into or adjacent to an anchor load identified in the heat map, full consideration should be given to the potential contribution that the building can have within a district heating network.

JUSTIFICATION

The purpose of the 'district heating network opportunity area' is to prioritise district heating in areas where the potential is greatest and to take advantage of available waste heat. This would help enable appropriate new development to contribute to the creation of a strategic network. It does not seek to require district heating in unsuitable locations or where it would significantly impact on development viability.

It is recommended that the Council aim to develop strategic area wide networks in locations identified in the map on page 75 as part of its strategy to reduce CO_2 emissions, deliver affordable heating and cooling and secure energy supplies. The Council should recognise that achieving this ambition cannot happen through planning alone. The aim of this policy is to help ensure that new development makes an appropriate contribution. Therefore, the design and layout of site-wide networks should be such as to enable future expansion into surrounding communities.

Where appropriate, applicants may be required to provide land, buildings and/or equipment for an energy centre to serve existing or new development. This would be an important part of ensuring that space and land is available for future energy centres as the network expands. More detailed feasibility studies should identify what land should be made available, where CPOs are likely to be needed and when.

The viability of district heating schemes is heavily influenced by a development's density, mix of use, layout and phasing. The cost of district heating pipes is high and so the layout of a development should seek to minimise the length of pipe needed. An on-site network should consider how it can be connected to a strategic network in future.

In developing the evidence base detail on phasing, layout and density of new development was not known and so it has not been possible to provide anything more than crude costs and returns on investment. Therefore, policy should be applied flexibly to take account of the fact that new development may not be suitable for district heating at this time by virtue of its density and phasing. In such cases a microgeneration solution might be more appropriate.

The Council is recommended to define the 'district heating network opportunity areas' on a map to be included with the Bury Vision 2031. This should reflect the areas shown in the opportunity areas map on page 75. The Council should also prepare further guidance to support developers in complying with this policy.

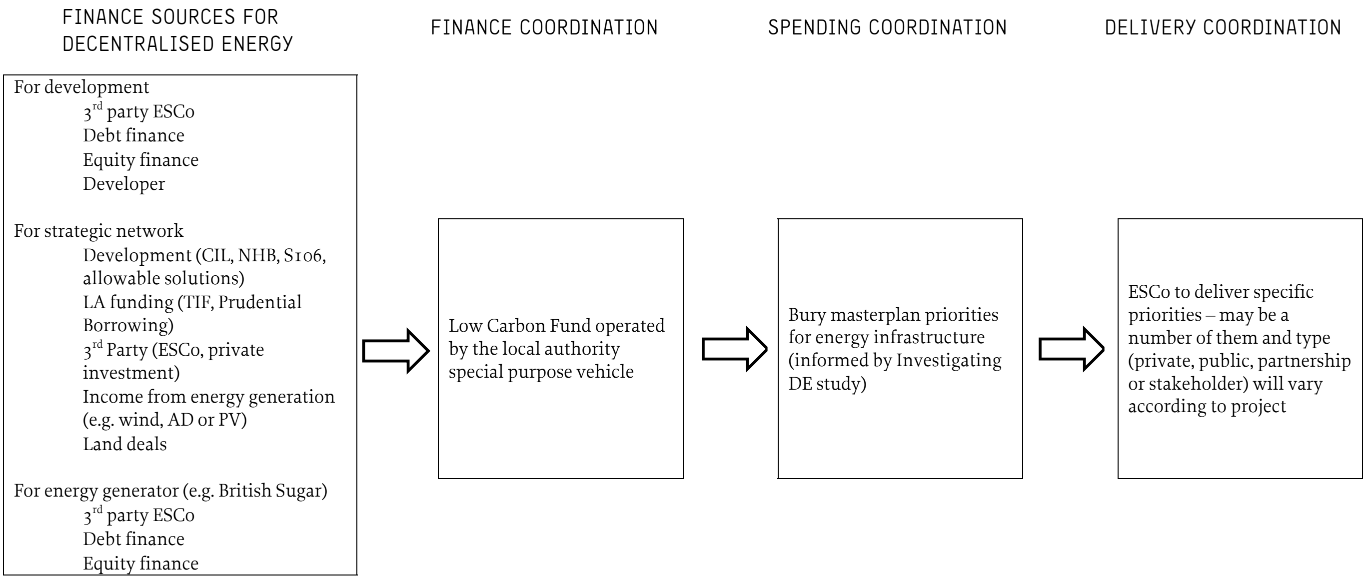

FIGURE 28: FINANCE AND GOVERNANCE ARRANGEMENTS FOR DELIVERY OF STRATEGIC ENERGY NETWORKS IN BURY ST EDMUNDS

10.4. PHYSICAL SUPPORT FOR A STRATEGIC NETWORK THROUGH PLANNING

Developing a strategic network would be a staged process over many years. The speed, extent and route would be influenced by the level, extent and nature of Bury's overall growth. Much of this cannot be known at this point in time. This would make obtaining detailed planning permission for the strategic network difficult and there is a danger that many variations to an application would need to be made, leading to delay and additional cost. The London Development Agency (now part of the Greater London Authority) concluded that designating a Local Development Order (LDO) for the proposed strategic scheme in East London would reduce planning risk. The other advantage would be to provide certainty of intent to future developers in preparing their energy strategies.

It is recommended that St Edmundsbury Council consider designating an LDO across the 'district heating network opportunity area'.

10.5. FINANCIAL SUPPORT THROUGH PLANNING

The priorities and charging schedule for the Community Infrastructure Levy (CIL) would need to factor in how it can be used to support development of strategic district heating networks. It is recognised that there will be other competing demands on CIL money. Therefore, other funding options should also be considered (Some of these are set out in Figure 28).

One such option will be Allowable Solutions, which will form part of a Building Regulations compliant zero carbon home from 2016. The zero carbon homes policy will have an impact on a majority of the strategic development sites. Although the details have yet to be confirmed, the Council may be able to coordinate the spending of Allowable Solutions locally, possibly through a locally controlled fund. This would be a useful mechanism for the council to deliver strategic energy and climate change projects and objectives.

The Bury Vision 2031 should consider how money is to be spent through preparation of a carbon reduction strategy. The recommendations in this study could be used to inform this, however, it may also wish to consider other energy supply opportunities, energy efficiency and emissions from transport and other economic activities.

A low carbon fund might also enable the Council to pool funds from other sources, including public sector borrowing (e.g. prudential borrowing, revolving funds or Tax Increment Financing) and private investment, including from the project partners. Further work should be undertaken to establish the most suitable form of delivery model.

The following suggests policy that could be included in the Bury Vision 2031.

PROPOSED MASTERPLAN POLICY 3 – COMMUNITY INFRASTRUCTURE LEVY AND ALLOWABLE SOLUTIONS

Money raised through the CIL and, in future, from Allowable Solutions (levied as part of the Building Regulations) to contribute towards the development of the strategic district heating networks identified in the 'Investigating Decentralised Energy in Bury St Edmunds' study. It may also be spent on other CO_2 reduction priorities identified by the Council in the future.

JUSTIFICATION

The Council has an ambition of facilitating the development of a strategic district heating network in the town. The 'Investigating Decentralised Energy in Bury St Edmunds' study has identified a series of potentially viable options that collectively would help to achieve this ambition. The evidence base identifies where contributions from an ESCo would be needed in order to give an attractive internal rate of return. It is recommended that the Council use some of the money raised through the CIL and future revenues from Allowable Solutions to make contribute towards key parts of the network when the success of the project is dependent upon Council involvement.

It is recommended that the Council establishes a Low Carbon Fund as a vehicle for managing and allocating the payments. This may take the form of an ESCo. The ESCo options are described in some detail in the 'Investigating Decentralised Energy in Bury St Edmunds' study but further work would need to be undertaken to confirm which is the most appropriate.

APPENDIX A: TECHNICAL METHODOLOGY

The methodology described below has been used for producing the heat maps, the technical and financial analysis of the proposed decentralised energy networks presented in the body of the report.

URBAN CHARACTER MAPS

Early stage analysis of opportunity areas was conducted using a town character map. The neighbourhoods were broadly characterised as residential/commercial/industrial using satellite imagery with further details of the urban character, including housing density, tenure and age derived from street level views. The character maps have also included density and phasing date for the strategic development sites.

HEAT AND COOLING MAPS

Heat maps provide a spatial picture of the distribution and density of heat demands from space heating and hot water. The maps present heat demand density as a contour map showing relative density of demand according to a colour scale. The contour map is produced through interpolation of the heat demand at single points, representing buildings. The outline broadly corresponds to the urban boundary.

DATA GATHERING

Data has primarily been gathered through liaison with the Council's GIS team and through publicly available sources. Additional data has been provided by a number of the project partners. Supporting information which has informed the options identification and appraisal process has been developed through a mix of desk based review, face-to-face discussion and interviews. We have sought the involvement of the project partner group where necessary.

EXISTING RESIDENTIAL BUILDINGS

Heat demands for existing residential buildings have been established using DECC's estimated gas consumption data which provides average consumption per property at LLSOA level. LLSOAs have a minimum population of 1,000 equating to around 400 households. Heat demand data is derived from this and linked to the National Land and Property Gazetteer.

EXISTING COMMERCIAL BUILDINGS

Heat demands for existing commercial buildings have been estimated using the commercial floorspace database provided by the Valuation Office Agency. Industry benchmark data is used to calculate heat demand which is then linked to the National Land and Property Gazetteer.

The heat demand of significant existing buildings which could act as anchor loads will be explored in more detail. Metered energy consumption data has been requested for public sector and other buildings. Where suitable these have been included as point loads on the map, sized to represent their relative heat demand.

NEW DEVELOPMENT DEMAND

Heat demands for new developments have been modelled using the Strategic Housing Land Availability Assessment 2009/10 (January 2010) and further information provided by the Council's planning officers and the developer partners. A number of assumptions have been used to estimate future heat demand using the limited information currently available.

Residential energy demands are based on the proposed Zero Carbon Hub[9] standards for 2016 and an assumed plot ratio and non-domestic benchmarks for new commercial development. The heat demand figures reflect current expectations of development scale and *LDA Design* experience of housing mix and other uses,

[9] ZERO CARBON HUB, CARBON COMPLIANCE: SETTING AN APPROPRIATE LIMIT FOR ZERO CARBON NEW HOMES – FINDINGS AND RECOMMENDATIONS, FEBRUARY 2011

which may change with market conditions in future. The heating loads for workshops and warehouses have been estimated using benchmarks. Where the spaces in the buildings identified are unheated the overall demand may have been overestimated.

The location and site area of strategic development sites around Bury St Edmunds have not been established. For the purposes of this study a central point for each site has been assumed based on the broad directions of growth published by the Council[10].

COOLING DEMAND

Cooling demands for new and existing buildings have been estimated using published benchmarks. The cooling demands in certain building types have been assumed to be met by natural means. The demands presented are therefore only for suitable building types as defined by CIBSE.

EXISTING HEAT SOURCES

We have identified existing heat sources which could supply district heat networks. Information on the sites has been derived from a number of sources including EU ETS, CHPQA and CRC registers. Supporting information has been provided by planning officers and facilities managers.

CLUSTER BOUNDARIES

Using the heating and cooling maps, we will identify clusters of existing buildings and new development which could present a sufficient basis for establishment of a heat network. The cluster boundaries will be indicative, reflecting the information which is informing this study. Opportunities found outside the boundary should certainly not be excluded from further consideration.

The methodology described below has been used for producing the financial models presented in this report

FINANCIAL MODELLING

All financial assessments in this report are developed through a DCF process enabling us to calculate the present value of future revenue and cost streams. The valuations are calculated in the first instance without regards to the actual capital costs. This enables us to assess an adoption value for the networks.

The DCF model is shown below for illustration purposes only:

NW Bury - all CHP & Electrical	25 Yr Projection			
		2012	2013	2014
		1	2	3
Revenues	**Totals**			
DIRECT REVENUE				
Heating - Standing Charges	9,955,545	230,400	235,930	241,592
Heating - Variable Charges	9,982,011	231,012	236,557	242,234
Total Residential	19,937,556	461,412	472,486	483,826
Heating - capacity charge	17,608,895	407,521	417,301	427,316
Heating - variable charges	29,562,257	684,156	700,576	717,389
Connection fees	1,023,350	1,023,350		
Total Commercial	48,194,502	2,115,026	1,117,877	1,144,706
Total direct revenue	68,132,058	2,576,438	1,590,363	1,628,532
Total Revenue	68,132,058	2,576,438	1,590,363	1,628,532
Costs	**Totals**			
Fuel Costs - Biomass		-	-	-
Total Biomass Costs		-	-	-
Direct Heat Purchase costs		(285,461)	(292,313)	(299,328)
Fuel Costs - Gas				
CHP		-	-	-
Boiler		(26,019)	(26,643)	(27,283)
Total Gas fuel costs	-13,459,020	(311,480)	(318,956)	(326,611)
Gross Margin	54,673,038	2,264,958	1,271,407	1,301,921
Operation, Maintenance costs & Replacement				
Staff		(108,646)	(111,254)	(113,924)
Maintenance/replacement		(410,965)	(420,829)	(430,928)
Total O&M & replacement costs	-22,452,336	(519,612)	(532,082)	(544,852)
Central costs				
Insurance		(38,647)	(23,855)	(24,428)
ESCo running costs				
Total central costs	-1,021,981	(38,647)	(23,855)	(24,428)
Total Opex costs	-24,431,364	(869,739)	(874,894)	(895,891)
EBITDA	31,198,721	1,706,700	715,469	732,640

(Earning before Interest Tax Depreciation and Amortisation)				
CapEx	**Totals**			
Capital Expenditure	-5,600,000	-5,600,000	0	0
Total Capex	-5,600,000	-5,600,000	0	0
Running Total		-5,600,000	-5,600,000	-5,600,000
Cashflow forecast				
Annual Cashflow		-3,023,562	1,590,363	1,628,532
Present Value Factor	6.0%	1.000	0.943	0.890
Discounted Cashflow		-3,023,562	1,500,342	1,449,387
Cumulative Discounted Cashflow		-£3,023,562	-£1,523,219	-£73,832
Net Before Tax Cashflow		(3,893,300)	715,469	732,640
NPV Before Tax Cashflow		-£3,672,925	£636,765	£615,139
Discount Rate	6.0%			
Total NPV of Cashflows	8,192,736			
IRR after:				
5 Years	-15.04%			
10 Years	7.07%			
15 Years	11.66%			
20 Years	13.07%			
25 Years	13.58%			

FIGURE 29: FINANCE AND GOVERNANCE ARRANGEMENTS FOR DELIVERY OF STRATEGIC ENERGY NETWORKS IN BURY ST EDMUNDS

[10] ST EDMUNDSBURY COUNCIL, BURY ST EDMUNDS VISION 2031 CONSULTATION, 2011

FINANCIAL ASSUMPTIONS

At this stage all numbers are provisional and should not be relied upon for investment purposes. The valuations are by necessity based on a series of assumptions. The principal assumptions are listed below:

- We have assumed an ESCo will require a 25 year Internal Rate of Return (IRR) of between 13% and 16% over a 25 year period
- Discount rate of 6%
- Inflation is applied to all inputs at a rate of 2.5%
- Domestic Standing Charge: £250/customer p.a.)
- Commercial capacity charge: £35/kw/yr
- Residential Variable Heat charge: 5.5p/kWh
- Commercial Variable Heat charge: 4.5p/kWh
- Electricity Export price 5.0p/kWh
- ROC price 4.3p/kWh
- Connection fees £90/kW
- Direct heat purchases from British Sugar: 1.5p and 3.0p/kWh
- Gas Purchases: 2.8p/kWh
- Biomass Purchases: 2.8p/kWh
- Regulatory prices index: 2.50%
- Capital inflation index: 2.50%
- Plant and network capital costs data from The potential and Costs of District Heating Networks, Poyry/AECOM, April 2009
- Other primary assumptions are based upon Inventa Partners project database

APPENDIX B: FUNDING SOURCES

Name	JESSICA
Administrator	Regional/City Governments
Description	JESSICA is a joint initiative of the European Commission in co-operation with the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). It is aimed at promoting sustainable urban development and regeneration. EU countries can choose to invest some of their EU structural fund allocations in revolving funds to help recycle financial resources to accelerate investment in Europe's urban areas. Grants from the European Regional Development Fund (ERDF) are transferred to Urban Development Funds (UDFs) which invest them in public-private partnerships or other projects included in an integrated plan for sustainable urban development. These investments can take the form of equity, loans and/or guarantees. The fund extends the benefit of EU support in the regions by reinvesting the returns from investments in new urban development projects, thereby creating a sustainable, revolving investment fund. Alternatively, managing authorities can decide to channel funds to UDFs using Holding Funds (HFs) which are set up to invest in several UDFs. This is not compulsory, but does offer the advantage of enabling managing authorities to delegate some of the tasks required to implement JESSICA to expert professionals. **JESSICA funds can be used for:** •urban infrastructure – including transport, water/waste water, energy •heritage or cultural sites – for tourism or other sustainable uses •redevelopment of derelict or contaminated land – including site clearance and decontamination •creation of new commercial floor space for SMEs, IT and/or R&D sectors •university buildings – medical, biotech and other specialised facilities •energy efficiency improvements
Further information	http://ec.europa.eu/regional_policy/thefunds/instruments/jessica_en.cfm#2

Name	**European Local Energy Assistance (ELENA)**
Administrator	European Investment Bank (EIB)
Description	To facilitate investments in sustainable energy at the local level, the European Commission and the European Investment Bank have established the ELENA technical assistance facility (European Local ENergy Assistance), financed through the Intelligent Energy-Europe programme.
Eligibility	Local and regional authorities or other public bodies or a grouping of such bodies from countries eligible under the Intelligent Energy Europe Programme
Funding available	ELENA support covers a share of the cost for technical support that is necessary to prepare, implement and finance the investment programme, such as feasibility and market studies, structuring of programmes, business plans, energy audits, preparation for tendering procedures - in short, everything necessary to make cities' and regions' sustainable energy projects ready for EIB funding.
Deadline	Ongoing
Further information	http://www.eib.org/products/technical_assistance/elena/index.htm

Name	**The Green Deal**
Administrator	Finance from private providers, repayments managed by energy suppliers
Description	The Green Deal, the Government's flagship scheme for giving buildings energy-saving improvements, will include microgeneration technologies like heat pumps and solar power. The principle of the Green Deal is being called The Golden Rule, under which expected savings from measures will repay the costs over 20-25 years. Consumers will get BSI quality assurance from a Green Deal Code of Practice which will cover providers and installers, and a Green Deal advice line will be set up.
Eligibility	To gain Green Deal Finance measures must be: • Green Deal Measures must meet high-level eligibility criteria in secondary legislation. The detailed eligibility criteria will be consulted on in autumn 2011. The criteria will enable a broad range of measures to attract Green Deal Finance. • This will be based on a physical assessment of the particular property and an understanding of what measures have already been installed. The Green Deal Assessor will make a recommendation on which measures should be installed. • The Green Deal Provider will then make a finance offer based on an assessment of the estimated energy savings that will result from the measures, if installed (generated in the assessment) and their likely costs for the installation work (including finance costs). This requires the measure to meet the Golden Rule in the property.
Funding available	"As long as the likely savings from a package of measures are more than the costs, the project will be financed. There is no cap" said a DECC spokeswoman
Timeframe	From Autumn 2012
Further information	http://www.decc.gov.uk/en/content/cms/tackling/green_deal/green_deal.aspx

Name	The Green Investment Bank
Administrator	TBC
Description	£1bn seed funding has been announced in the 2010 spending review will be provided to help establish the Green Investment Bank. Although the structure this will take is still being determined capital from the private sector will contribute to the funds if the bank as well. The bank is likely to provide a source of capital funding for sustainable energy projects, either through loans, equity co-investment, or first loss debt and insurance products for low carbon technologies and infrastructures,
Eligibility	Details still to emerge, although likely that potential investments must meet the goals of the Climate Change Act
Funding available	Still to be finalised but it is expected that from 2014 the bank will be available to borrowers, who are likely to be local authorities, local banking intermediaries, energy utilities, energy service companies, or public or private corporate investors.
Deadline	Expected to be available from April 2012
Further information	http://www.decc.gov.uk/en/content/cms/news/wigley_report/wigley_report.aspx

Name	European Investment Bank (EIB)
Administrator	The EIB's Board of Governors is composed of the Finance Ministers of the27 Member States.
Description	The European Investment Bank (EIB) is the European Union's financing institution. Its shareholders are the 27 Member States of the Union, which have jointly subscribed its capital. The EIB, the largest international non-sovereign lender and borrower, raises the resources it needs to finance its lending activities by borrowing on the capital markets, mainly through public bond issues. Its AAA credit rating enables it to obtain the best terms on the market. As a not-for-profit institution, the EIB passes on this advantage in the terms it offers to the beneficiaries of its loans in both the public and private sectors. The EIB's role is to provide long-term finance in support of investment projects.
Eligibility	To be eligible projects must contribute to EU economic policy objectives. For further information please see the Topics pages.
Funding available	EIB offers support to projects through a variety of ways including microfinance, loans, venture capital (through the European Investment Fund) and providing technical assistance.
Deadline	Ongoing
Further information	http://www.eib.org/index.htm

Name	Public Sector Advice Services
Administrator	Carbon Trust
Description	The Carbon Trust offers grants and loans to public sector organisations to for energy advice and feasibility studies, including its Local Authorities Carbon Management Programme.
Eligibility	Any public sector organisation, support level varies depending upon which region the organisation is located in and the scale of the organisation.
Funding available	Grants and loans for direct services provided by the Carbon Trust or accredited providers for energy advice and feasibility studies and consultancy for energy projects to new buildings (Design Advice and Strategic Design Advice)
Deadline	Ongoing
Further information	http://www.carbontrust.co.uk/cut-carbon-reduce-costs/public-sector/Pages/default.aspx

Name	**Enhanced Capital Allowance Scheme**
Administrator	HMRC
Description	Enhanced Capital Allowances (ECAs) enable a business to claim 100% first-year capital allowances on their spending on qualifying plant and machinery. There are three schemes for ECAs: • Energy-saving plant and machinery • Low carbon dioxide emission cars and natural gas and hydrogen refuelling infrastructure • Water conservation plant and machinery Businesses can write off the whole of the capital cost of their investment in these technologies against their taxable profits of the period during which they make the investment. This can deliver a helpful cash flow boost and a shortened payback period
Eligibility	Enhanced Capital Allowances (ECAs) can only be claimed on energy-saving products that meet the relevant criteria for their particular technology group – as detailed on the Energy Technology Criteria List (ETCL). (updated each month)
Funding available	100% first-year capital allowance against the taxable profits of the year of investment
Deadline	End of tax year
Further information	http://www.eca.gov.uk/

Name	**Renewables & Carbon Reduction Finance**
Administrator	The Co-operative Bank
Description	The Co-operative Bank announced plans in October 2007 to invest a further £400m into renewable energy and carbon reduction projects.
Eligibility	UK-based projects which meet the banks criteria
Funding available	•up to £25m debt size with 5-20 year terms
Deadline	N/A
Further information	http://www.co-operativebank.co.uk/servlet/Satellite/1197273362930,CFSweb/Page/Corporate-SocialBanking?WT.svl=nav3

Name	Intelligent Energy Europe
Administrator	EU
Description	The Intelligent Energy Europe (IEE) programme seeks to address the legislative, behavioural and market-based barriers to the spread of energy efficiency practices and use of renewable energy sources. This includes looking at ways to boost investment in successfully demonstrated technologies, improve sustainability policy in cities and regions, and encourage energy efficiency through education and capacity building.
	ALTENER: New and renewable energy resources (€16m) The Renewable Energy Directive commits the EU to generating 20% of total energy consumption from renewable energy sources by 2020. Projects under this priority should support this goal by building on existing EU policies on the production and market uptake of renewable energy. The three key actions are: increasing the share of renewable electricity; promoting renewable energy for heating and cooling systems; and promoting the increased production and use of bioenergy. Projects to increase the share of renewable energy could introduce new management systems for electricity grids and storage, promote renewable energy to the general public, or look at ways to remove legislative obstacles to renewables use. Projects focusing on renewable heating and cooling systems could support their integration into building developments, or examine ways to convert district heating and cooling networks to run from renewable energy sources. Projects on bioenergy support increased production and usage of solid biomass, liquid biofuels and biogas
Eligibility	IEE is open to legal entities from all 27 EU Member States, as well as Norway, Iceland, Liechtenstein and Croatia
Funding available	There are no minimum or maximum boundaries for project budgets, although most total between €500,000 and €2.5m The co-financing rate is 75%. Projects under Action 4 of the Integrated Initiatives can receive co-financing of up to 90%.
Deadline	The deadline for the current call is 12 May 2011, except for Action 4 of the Integrated Initiatives, which has a deadline of 15 June 2011.
Further information	http://ec.europa.eu/energy/intelligent/call_for_proposals/index_en.htm http://www.londoncouncils.glegroup.co.uk/fundingprogramme.php?id=103

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