City Centre Action Plan

Low Carbon Energy Background Paper

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SOUTHAMPTON CITY COUNCIL

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This background document accompanies the Submission Document and outlines some background in relation to Energy within the section on *A Greener Centre*. This document is not on deposit for consultation and is background evidence.

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City Centre Action Plan – Background Document on Renewable and Low Carbon Energy Supply in the City Centre

1. Context…

1.1 The climate change

1.1.1 Tackling climate change by reducing greenhouse gas emissions has become a major global priority. There is now a strong consensus amongst scientists that greenhouse gas emissions caused by human activities are causing the climate to change at an unprecedented scale and speed. As a result the UK (and particularly the South East) will increasingly become a climate of extremes and the impact of weather events will be more pronounced representing a systemic threat to our security and prosperity.

1.1.2 There will be more intense and frequent episodes of extreme weather such as storms and floods. While the causes of these extremes may or may not be attributable to climate change, the effect is that climate change will make events like these increasingly severe and frequent. This will bring with it disruption and damage. Summers in Southampton will become hotter and drier with sustained periods of heat. This will be amplified by the Urban Heat Island (UHI) affect and the rise in temperature will bring health risks to the elderly, young and the vulnerable. The longer growing period associated with a mild winter could increase landscape maintenance costs, the increased use of air conditioning will put pressure on power demand and there is the potential for an increase in parasites and infestations. Rainfall will no longer be consistent and prolonged dry periods will put additional strain on water supply. With less rainfall in summer, droughts will be the trend. When the rain does come we will see flash floods as drainage systems will not be able to cope; there will be more disruption and damage to our transport network and water rationing and hose pipe bans will need to be enforced. The inconsistency in rainfall will leave us short in summer and inundated in winter.

1.1.3 Adapting to these impacts will be vital, as will a concerted effort to alleviate the damage we cause. It is therefore critical that future economic growth, the delivery of which remains of vital importance, is decoupled from the consumption of fossil fuels and their inevitable CO_2 emissions as we move to new models in energy generation and consumption.

1.1.4 Heating buildings makes up approx 40% of energy consumption and heating water a further 13% - accounting for 47% of UK carbon emissions. Low Carbon Heating Systems therefore represent a significant opportunity to reduce the country's emissions and district heating is one of the main approaches able to deliver low carbon heating on a large scale. The UK government and the EU commission support the development of district heating and Combined Heat and Power (CHP) systems – as set out in the UK Heat Strategy, the UK Energy White Paper 'Meeting the Energy Challenge' and the UK Low Carbon Transition Plan. This support is articulated locally through the Southampton Low Carbon City Strategy and the draft Sustainable Energy Action Plan.

1.2 The energy challenge

1.2.1 Energy consumption has increased exponentially over the last 200 years with the vast majority of this energy sourced from non-renewable, carbon intensive fossil fuels. Today, virtually all our electricity is produced at large, fossil fuel-powered plants belching smoke, with energy lost in transmission from those plants to our homes. There is an urgent need to transform this energy system and a number of factors are coming together to drive forward changes in how we use and supply our energy. There are rising concerns about energy security, long-term increases in fossil fuel prices, and a growing awareness that global fossil fuel resources are finite.

1.2.2 A secure, affordable supply of energy is critical to the smooth functioning and competitiveness of the economy, and is closely correlated with economic output. Economic pressures mean that people and organisations are more aware than ever of the costs of energy. A reliance on fossil fuels, together with supply side conditions in energy markets, leads to fluctuations in energy prices that can be damaging to the economic performance of an area. Furthermore, energy price volatility and issues in supply are forecast to worsen in future years.

1.2.3 Energy is a vital component of everyday life for Southampton residents. Southampton residents use energy to heat their homes, cook their food, power their televisions and travel to work, school, leisure and retail. Yet already for too many people in Southampton, winter fuel bills are unaffordable with residents finding it difficult to afford energy to meet their basic needs for heating, lighting and cooking with many more likely to follow. Yet most Southampton homes could save hundreds of pounds off their fuel bills through simple measures, such as introducing insulation and double glazing to homes, and thereby reduce the amount that a household spends on energy - money that can be put to more productive use elsewhere in the economy. As above, future rises in the price of fossil fuels associated with rising global demand, diminishing supplies and financial incentives for cleaner energy means that moves towards renewable and low carbon sources of energy can reduce future fuel poverty. It will therefore be essential that Southampton takes greater control of its energy system and looks to generate more of its own energy in a competitive, secure and clean way to ensure prosperity for many.

2. Local strategies and approaches

2.1.1 In response to the challenges outlined above, Southampton City Council adopted its Low Carbon City Strategy (LCCS) in July 2011, building upon the previous Air Quality and Climate Change Strategy (2004). The LCCS sets the context for activity in Southampton and acts as an invitation to public and private sector organisations to work in partnership to develop and deliver a city-scale energy programme. It sets out carbon reduction targets for the city as a whole and for the council's estate, functions and activity up to 2020. The strategy also establishes a number of headline priorities which are deemed necessary in order to achieve the targets that have been set. One of the eight key priorities is to source and use energy in a sustainable way through demand side management, investment in low carbon and renewable technologies and through efficient design and a diverse low-carbon energy

supply mix. This priority is underpinned by the commitment to explore further opportunities for local energy production and distribution building on the city's 25 year association with Cofely DE. The document states that the council will maintain and develop local low carbon and sustainable energy networks, expand the existing District Energy Scheme in partnership with Cofely DE and seek opportunities for new sustainable energy networks in the city.

2.1.2 This strategy is supplemented by the emerging Sustainable Energy Action Plan (SEAP) for Southampton. The SEAP sets out the emissions baseline Southampton is working to and presents the key actions that the council, along with potential partners, will look to invest time and resources in, in order to create jobs, economic growth and reduce CO_2. These are identified as enabling actions, demand actions, supply actions and transport actions. The plan identifies how actions could be implemented, who the key actors are, and the timescales for delivery and quantifies the impact each action will have. The SEAP will be put forward for adoption in October 2013.

2.2 Energy hierarchy

2.2.1 The SEAP develops a structured approach to address energy demand given the significant environmental and economic benefits changes to our energy system can bring. The energy hierarchy is in place in order to maximise the pace of delivery and to ensure 'quick wins' are capitalised upon:

Priority 1: Energy conservation. Change wasteful behaviour to reduce demand.
Priority 2: Energy efficiency. Use technology to reduce demand and eliminate waste.
Priority 3: Reduce the use of high carbon fuels.
Priority 4: Exploit renewable, sustainable resources.
Priority 5: Exploit non-sustainable resources using low-carbon technologies.

3. Justification for the policy

3.1 What is District Heating?

3.1.1 District Energy systems produce Low Carbon energy from a central energy centre with steam or water distributed via insulated underground pipe work, often laid with a cooling and electricity network, to provide heat to communities for heating buildings and hot water. As a result, buildings served by a district energy system do not require their own boilers or chillers. District heating is commonly used in other countries (for example 60% of Denmark's buildings use district heating) but currently it supplies less than 1% of buildings in the UK. The Sustainable Development Commission have stated that district heating – whether using heat from a CHP or thermal only plant – is the most efficient way to heat closely grouped buildings using fuel and makes the conversion from fossil heating to renewable heating much simpler. The UK Heat Strategy highlights its necessity in order to achieve the UK's interim and long term heat targets. District Energy is often coupled with Combined Heat and Power (CHP) plant and is widely recognised as a sustainable, cost-effective solution to the provision of heating, cooling and power which scores highly in BREEAM environmental assessments and facilitates compliance with Building Regulations Part L requirements.

3.1.2 A district heating network is a key element of enabling infrastructure that will allow a broader range of low carbon heat sources to be harnessed. For example, waste heat from industrial processes (such as distilleries and breweries) can be used to heat homes and businesses (as well creating additional income for the businesses supplying heat). Schemes may also incorporate other low and zero carbon technologies such as fuel cells, biomass, solar thermal, heat pumps, and high-efficiency gas-fired boilers and in Southampton's case, deep geothermal energy. Geothermal energy schemes make use of heat energy that is stored deep underground. This energy is extracted by pumping hot water to the surface where its heat is captured via heat exchangers. Heat pumps used to cool offices and data centres can also supply significant amounts of heat to district heating systems.

3.1.3 The main obstacles to the implementation of district heating systems in the UK are:

- Large initial capital investment (to install the heat pipe network)
- Lack of information available to assess opportunities
- Lack of knowledge of district heating in the UK
- Lack of a regulatory regime for heating in the UK
- Customer demand risk (i.e. customers could theoretically choose to leave the district heating system at short notice, although this is countered in Southampton's case through long-term, 10-year supply agreements signed on connection to the city centre scheme)
- Competition from natural gas (which has provided a clean and, until recently, relatively low cost fuel in the UK since the 1970s)
- Inertia caused by the existence of other energy delivery networks, existing market structures, and the commercial interests of large energy companies
- Local and central government apparently unwilling or unable to co-ordinate investment and operation of local energy systems.

3.1.4 Southampton's approach has been designed to overcome these barriers by:

- In partnership with Cofely District Energy the areas with the highest density of heat demand have been identified and mapped across the city;
- Through the Joint Cooperation Agreement between Cofely District Energy and Southampton City Council there is a legal and cooperative basis to promote the scheme and facilitate engagement with key potential customers and the energy provider;
- This framework also provides the certainty and commitment needed and coupled with the regulatory regime promoted through planning policy helps to reduce the risk for customers and suppliers and delivers the long term demand needed to make the scheme viable
- Through the development of the Council's medium to long term strategic energy planning (its SEAP) the scheme can be linked with major investment projects;
- Strategic and ongoing political commitment to the scheme to raise the necessary finance and facilitate the delivery of shared underlying infrastructure (service pipe work)

3.2 What is Combined Heat and Power?

3.2.1 Combined Heat and Power (CHP) plant produces heat and electrical power. CHP can be powered by a range of fuels, including fossil fuels, biomass, biogas or waste. CHP systems deliver an overall efficiency (around 85%) far greater than conventional power stations (typically 35% to 50% efficient) by capturing waste heat from electricity generation and using it for other purposes (such as heating buildings). Both CHP and conventional power stations incur additional energy losses in the delivery of energy to the customer through energy distribution systems. In efficient district heating systems in Scandinavia the energy losses from district heating networks lie between 6 and 9%.

3.2.2 For much of the year the heat output is used for heating and hot water in the buildings served by the District Energy scheme, while the power meets their electrical requirements. In summer, when heating requirements are lower, the surplus heat may be used to drive an absorption chiller to generate chilled water for cooling in these buildings. The provision of high-efficiency air conditioning and comfort cooling alongside heat and electrical power generation is known as tri-generation and it delivers significant energy savings compared to conventional methods of providing heating, cooling and power.

3.3 What is the Southampton District Energy Scheme?

3.3.1 The tri-generation Southampton District Energy Scheme (SDES) has been delivering supplies of heat, chilled water and electrical power to customers across the city centre for the past 25 years. The scheme encompasses over 45 energy users in the public and private sectors including the BBC TV studios, the Royal South Hants Hospital, the Solent University, West Quay Shopping Centre, the Civic Centre, a number of residential sites and the Grand De Vere Hotel. It is operated by Cofely District Energy working in partnership with the City Council under the name of Southampton Geothermal Heating Company Ltd.

3.3.2 Cofely District Energy is a specialist company of Cofely and is the UK's largest district energy company, providing district energy solutions to users in public, commercial, industrial and residential sectors.

3.3.3 The Southampton Scheme utilises heat from large scale combined heat and power plant (CHP), supplemented by geothermal energy and conventional boilers along with cooling provided by absorption chillers. The heated water is distributed via insulated pipe work to individual buildings and as a result, buildings served by the district energy system do not require their own boilers or chillers.

3.4 What are the benefits…

3.4.1 The majority of the UK's electricity is supplied by large-scale power stations that reject up to 60% of their fuels' energy as waste heat. If this waste heat was to be captured, it could meet the UK's entire heating and hot water energy needs. Whilst improving the sustainability of large scale power stations is vital, there is an increasing need to focus on the role that smaller scale decentralised energy generation could play. Renewable forms of energy are receiving growing public backing and large-scale deployment of these,

together with city, town and neighbourhood-scale CHP with district heating networks, could make a significant contribution to cuts in CO_2 emissions. The City Centre scheme already saves over 10,000 tCO_2 per annum.

3.4.2 The Southampton scheme was developed on a low temperature, low pressure basis to reduce heat losses and maximise the life of the network. The network is operated using a flow temperature of approximately 80^{o}C and a return of 50^{o}C, with distribution pressures of approximately 5 Bar. This enables direct connections into most buildings, removing the need for heat exchangers, further reducing capital costs and energy losses.

… of expansion?

3.4.3 Despite the incremental improvements in the energy efficiency of buildings within Southampton, forecast future economic and population growth for the city will tend to increase demand for energy. This growth can be balanced against the efficiency savings delivered through the expansion of district heating. In addition to efficiency savings, CHP-led district heating provides resilience and security of supply to existing and prospective occupiers in the city. This in turn will supplement the other geographical and economic benefits offered by the city that will help to draw in future investment. District heating can also act as an enabler for development by providing the pre-serviced means of achieving BREEAM targets as well as reduced costs for customers.

3.4.4 A larger district heating system is technically more resilient (as different parts of the system back each other up); performs more efficiently (as having a wider range of customers creates a more even demand profile); operates at lower financial risk (as the system is not overly reliant on any individual customer), and offers greater opportunities for further expansion. The increased financial viability of the city centre scheme, brought about through expansion and the diversity of demand, will allow the system to service a larger amount of residential areas within the city centre over time enabling a larger number of Southampton's residents to benefit from district heating in the future. This fits the priorities established in the energy hierarchy outlined in the draft SEAP as highlighted in paragraph 2.2.1 above.

… to customers?

3.4.5 Due to its greater efficiency CHP systems can deliver heat at prices below that of gas – and still be financially viable. CHP therefore offers an opportunity to help tackle fuel poverty. The financial and carbon savings would be much greater for the estimated 40% of council-owned households in Southampton heated by electricity. Typically these properties are two to three times as expensive to heat, and have twice the carbon emissions of gas heated properties. Ironically many electrically heated properties are occupied by those on the lowest incomes.

3.4.6 District heating has a high initial capital cost but the heat produced can be sold slightly below the equivalent price of gas – and still offer investors a good rate of return on capital. This is due to the high efficiency of CHP and regulatory incentives for CHP/ district heating systems. The city centre scheme operates on the basis that heat prices are indexed to the price of gas – so that heat prices to consumers are set with the aim of ensuring that they are below the equivalent price of gas. Cofely District Energy seek to provide a

10% saving to customers compared to the lifecycle costs of alternative gas-based heating arrangements. This does, however, require a long-term commitment by customers to have their heat supplied via district heating.

3.4.7 There is currently no regulatory system in the UK for heat. This is because there is no effective heat market in the UK. The markets are instead in the fuels used to produce heat – gas, electricity, oil, and coal. The gas and electricity markets are regulated to ensure fair and open competition between suppliers; allow customers choice; and ensure that customers do not face undue charges for the development and operation of shared underlying infrastructure (such as transmission and distribution systems).

3.4.8 This risk is mitigated by the public/private sector partnership which is in place with the Council acting as an arbiter to make sure that there is a consistently fair pricing and billing structure in place.

… to us as a city?

3.4.9 Securing investment in resilient energy infrastructure and a more sustainable energy system offers multiple benefits across all sectors of business and our communities by:

- Improving health and equality and addressing fuel poverty through energy efficiency and by delivering renewable and decentralised energy.
- Creating job opportunities and business growth by matching technological solutions that are currently available, such as decentralised energy, with project opportunities.
- Providing a focus for growth and development of knowledge and skills.
- Increasing inward investment and developing the low carbon economy supply chain.
- Reducing energy costs through improvements in energy efficiency.
- Cheaper energy for public-owned assets.
- De-carbonising our energy generation infrastructure, housing stock and transport infrastructure.
- Making a substantial contribution to CO_2 reduction commitments and improving public sector low carbon and climate change performance.
- Increasing the resilience and capacity of energy infrastructure.

3.5 Details of work on the network since 2010

3.5.1 Since 2010 the following connections have been made to the city centre district heating network:

- Capita Southern Regional Headquarters at One Guildhall Square
- BBC studios
- Southampton Police Divisional Headquarters
- Antelope House
- Skandia House
- Premier Inn
- Mayflower Gantry Residential Development

3.5.2 Pipe work has been laid beyond the Mayflower Gantry Residential Development towards Central Station to ‘pre-service’ future development in this part of the city.

3.6 Future expansion

3.6.1 Proposals within the draft SEAP outline the expansion of new district heating networks in five key areas of the city, alongside the expansion of the existing city centre scheme to service major development sites. The five proposed district heating areas have been identified based on three main criteria:

- The presence of large commercial and public sector organisations that can act as anchor customers (i.e. schools and/or leisure centres etc)
- A high density of carbon emissions linked to heating
- And/or the presence of major new investment or the council's 'Estates Regeneration' initiative.

3.6.2 These areas therefore offer financial stability for investors, the opportunity to embed DH at lower cost, as well as targeting the areas where DH could achieve the largest carbon emission reductions. High level feasibility assessments have been conducted for each of these areas – identifying the major energy consumers, quantifying the amounts of energy consumed, identifying potential sources of waste heat, and examining infrastructural issues and providing estimates of costs and benefits.

3.6.3 The development of CHP/ DH in Southampton needs to be assisted by a supportive planning and public policy regime that continues to require new developments to connect to an available CHP/DH system, or prepare for connection to a planned district heating system – unless a lower carbon energy system is available.