Havant Heat Network Feasibility Study

Final Report

On behalf of **Havant Borough Council**

Project Ref: 39161 | Rev: 3 | Date: Apr 2017

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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
V1	21/03/17	Draft final report	DU	JR	JR
V2	7/4/17	Final report following comments from HBC	DU	JR	JR
V3	25/4/17	Correction to cashflow model	DU	JR	JR

Contents

Figures

Tables

Appendices

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Abbreviations

AQMA	Air Quality Management Areas
BEIS	Department for Business, Energy and Industrial Strategy
BGS	British Geological Survey
BMS	Building Management Systems
BSRIA	Building Services Research and Information Association
CapEx	Capital Expenditure
CHP	Combined Heat and Power
CHPQA	Combined Heat and Power Quality Assurance Programme
CIBSE	Chartered Institution of Building Services Engineers
DBEIS	Department for Business Energy and Industrial Strategy
DEC	Display Energy Certificate
DHN	District Heat Network
DPD	Detailed Project Development
EBITDA	Earnings before interest, tax, depreciation and amortization
FIT	Feed-in Tariffs
GPR	Ground-penetrating radar
GSHP	Ground source heat pumps
HBC	Havant Borough Council
HNIP	Heat Network Investment Programme
IRR	Internal Rate of Return
kW	Kilowatt
kWe	Kilowatt Electrical
kWh	Kilowatt Hour
kWth	Kilowatt Thermal
MW	Megawatt
MWe	Megawatt Electrical
MWh	Megawatt Hour
NPV	Net Present Value
O&M	Operation & Maintenance
OPEX	Operational Expenditure
PHE	Primary Heat Exchanger
PUR	Polyurethane foam
PUSH	Partnership for Urban South Hampshire
RHI	Renewable Heat Incentive
ROI	Return on Investment
SAP	Standard Assessment Procedure

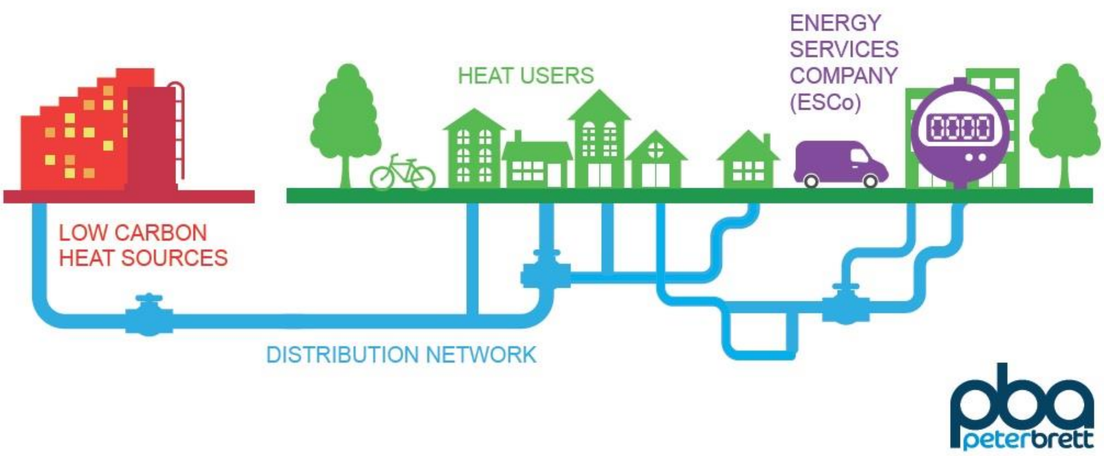
1 Executive Summary

1.1 Background

1.1.1 Havant Borough Council (HBC) is investigating ways in which low carbon energy sources can help deliver sustainable development of the town. This will align to both the Council's own policies but also the Hampshire and National policy to support low carbon transition.

1.1.2 District heating or district heat networks involves the generation or extract of low carbon heat at a central point and distribution through a highly insulated pipe network to heat users. The principal infrastructure of a heat network is presented below

District Heat Network scheme's components

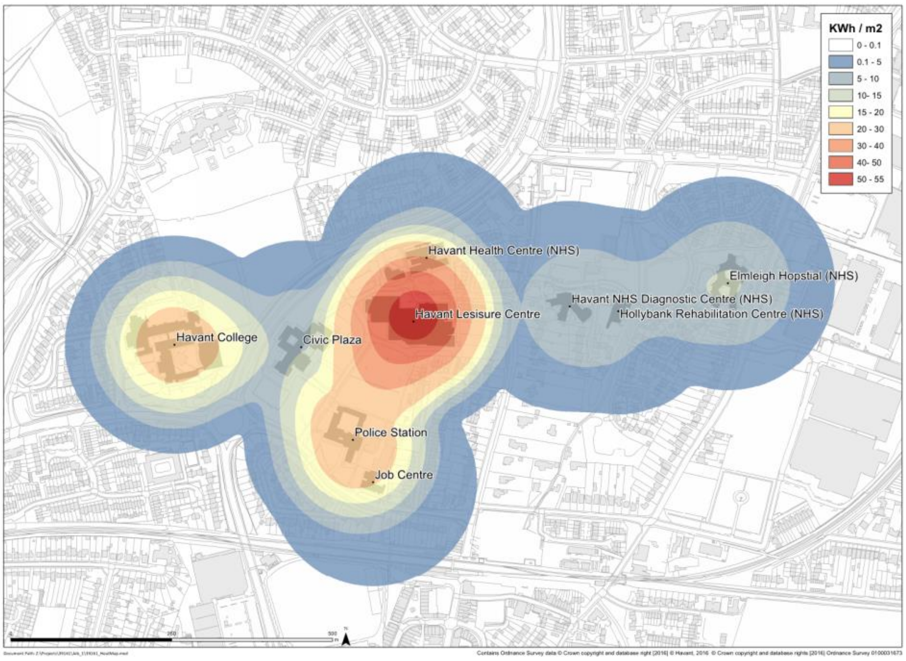


1.1.3 This Report presents the results of a Feasibility Study which assesses the options for developing a district heat network within the area known as the Havant 'Civic Campus'. The study area encompasses primarily public sector buildings north of Havant town centre with Petersfield Road to the west and New Lane to the east. The work is supported with funding from the government's Heat Network Development Unit (HNDU).

1.1.4 The primary driver agreed with HBC at the project outset was to develop the most cost effective heat network solution.

1.2 Civic Campus Heat Demand and proposed heat network solution

1.2.4 The study has assessed the heat demand of the key public sector buildings within the Civic Campus. The figure below shows the profile of heat demand across the Civic Campus with the key heat anchor demand of Havant Leisure Centre.



1.2.5 The central position of the leisure centre combined with the site's high and constant heat demand makes it the ideal location to site an energy centre to serve a Civic Campus heat network. Furthermore, the primary heating plant at the leisure centre is due for replacement in the near future so there is an opportunity to link the upgrade of the heating plant with the potential implementation of a district heating scheme in Havant Civic Campus.

1.2.6 A range of heat supply options have been assessed. The outcomes of this work focused on a 'power-led' Gas Combined Heat and Power (CHP) approach. This means the CHP has been sized to optimise local use of power generated by the CHP by matching the expected electricity generation profile with the predicted electricity demand profile of the leisure centre and Civic Plaza.

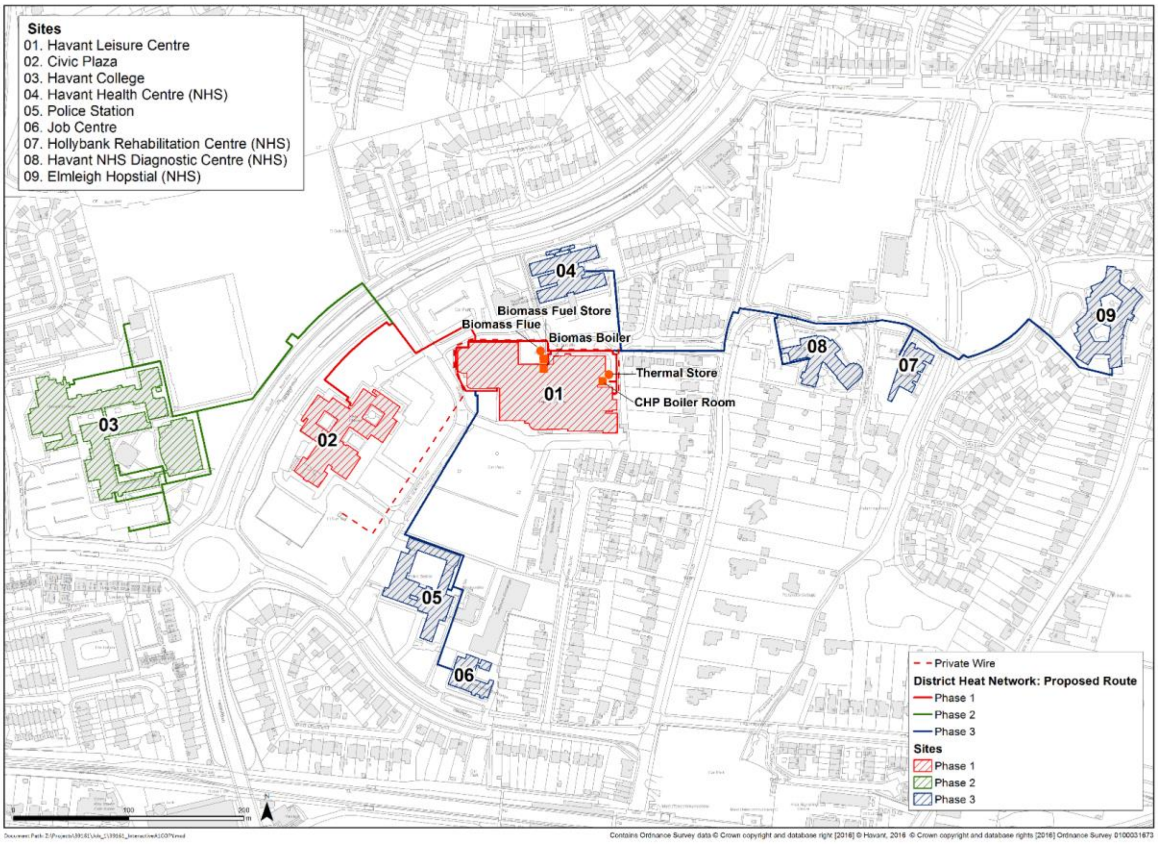
1.2.7 In order to attract potential Heat Network Investment Programme (HNIP[1]) funding, the solution should provide at least 75% of the heat via CHP or include a proportion of renewable heat technology. Therefore, the solutions explored include both CHP and a small biomass boiler located at the leisure centre or alternatively a CHP only solution with the CHP providing a greater proportion of the heat supply

1.2.8 Heat would then be distributed to other Civic Campus buildings through a network of highly insulated pipes with the power generated by the CHP used both within the leisure centre and potentially within the adjacent Civic Plaza building.

1.2.9 The scheme has assessed the technical feasibility of connection to nine Civic Campus buildings including Havant College, NHS buildings and other public sector office buildings. Site visits and plant room surveys have been undertaken to ascertain the technical feasibility of connecting to the sites whilst a preliminary route for the heat pipework has been determined and outline pipework design proposed.

1.2.10 The overall proposed scheme is shown below, based on developing a campus wide district heating network from a 'core' scheme comprising the leisure centre and Civic Plaza building.

[1] Heat Network Investment Programme – Government fund to support UK heat network development



1.3 Economic appraisal

1.3.1 A range of economic scenarios have been assessed including the economic impact of expanding a scheme from the HBC buildings to the rest of the Civic Campus. However, in agreement with HBC, the base case is focussed on a 'core' scheme comprising the Council owned buildings comprising the council offices known as the Civic Plaza and the adjacent Havant leisure centre (Phase 1).

1.3.2 One key economic assumption for the base case includes using a 'heat price' of **4.5p/kWh** which is aligned to what customers are currently paying for their heat (i.e. gas price plus allowance for boiler maintenance and replacement).

1.3.3 The table below compares the two primary heat supply options for the core scheme. A CHP and biomass solution benefits for Renewable Heat Incentive (RHI) and offers a lower carbon heat supply than the CHP alone. The financial benefit of this carbon reduction is not factored in the base model. The CHP only solution, does not offer the carbon reductions of a biomass supported solution but also avoids the additional installation and running costs associated with the supplementary biomass supply.

1.3.4 Both solutions are designed to align to the current HNIP compliance requirements. If HNIP is secured for either solution, this offers up to 30% capital funding. The impact of HNIP is also shown in the below scenarios.

	Scenario 1	Scenario 2	Scenario 3	Scenario 2a
Heating solution	165kWe CHP plus 150kW biomass	165kWe CHP	165kWe CHP plus 150kW biomass, with HNIP	165kWe CHP, with HNIP
Sites	Civic Plaza Havant Leisure Centre	Civic Plaza Havant Leisure Centre	Civic Plaza Havant Leisure Centre	Civic Plaza Havant Leisure Centre
Annual heat demand (MWh)	1929	1929	1929	1929
Project length	40	40	40	40
Heat price (p/kWh)	4.5	4.5	4.5	4.5
Project cost (Gross) inclusive of HNIP[2] where applicable	£1.16m	£1.08m	£923k	£836k
HNIP Grant	0%	0%	30%	30%
Payback (years)	32	26	21	18
Internal Rate of Return (IRR)	1.7%	3.1%	4.4%	5.9%
Net Present Value of Investment (NPV)	-£342k	-£83k	£161k	421k

1.3.5 This shows that Scenario 1, the CHP with biomass solution does not offer as attractive option as CHP alone (Scenario 2). This is because the additional benefit brought by the RHI income for biomass does outweigh the additional cost of biomass plant, fuel and maintenance. The benefit of the HNIP contribution is clear improving the business case to an IRR of 4.4% (Scenario 3).

1.3.6 The economic impact of expanding the core scheme based on the more economically attractive CHP with biomass solution to the other Civic Campus buildings is shown below, all with HNIP funding at 30%.

[2] HNIP funding can only be used to support parts of the heat network not supported by RHI. Therefore biomass plant costs excluded from HNIP reduction

	Scenario 3 Phase 1	Scenario 4 Phase 1 & 2	Scenario 5 Phase 1,2 & 3
Heating solution	165kWe CHP plus 150kW biomass	165kWe CHP plus 150kW biomass	165kWe CHP plus 150kW biomass
Sites	Civic Plaza Havant Leisure Centre	Civic Plaza Havant Leisure Centre Havant College	Civic Plaza Havant Leisure Centre Havant College Havant Health centre Police station Job centre Hollybank Rehabilitation Centre Havant NHS Diagnostic Centre Elmleigh Hospital
Annual heat demand (MWh)	1929	2744	4783
Project length	40	40	40
Heat price (p/kWh)	4.5	4.5	4.5
Project cost inclusive of HNIP (Gross)	£923k	£1.49m	£2.31m
HNIP Grant	30%	30%	30%
Payback (years)	21	38	Not Viable
Internal Rate of Return (IRR)	4.4%	0.4%	-1.8%
Net Present Value of Investment (NPV)	£161k	-£669k	-£1,740k

1.3.7 The table shows that, based on the current modelling assumptions, there does not appear to be a strong business case for expanding the network to the College or to the Phase 3 sites.

1.3.8 Sensitivity analysis has been undertaken on a range of key factors which can influence the business cases. Chief amongst these are the heat price, input fuel costs and proportion and value of electricity generated.

1.3.9 For example a heat price of 5.4p/kWh (a 20% uplift) improves the base case (Scenario 1) from 1.7% IRR to 4.4%. With HNIP this improves to an IRR of over 7%. Conversely a higher input fuel price (natural gas or biomass) will have a negative impact on the business case.

1.3.10 In addition, the value of the 'private wire' electricity sale/offset to the model is apparent. Based on the predicted demand profiles whereby the generating hours of the CHP have been optimised to align to demand the base case assumes 10% of power would be exported. However, if 25% of the generated power were to be exported this would reduce IRR from 1.7% in the base case to 0.2%.

1.3.11 The study has identified additional sites within the Civic Campus, which could be connected to a scheme thus enhancing the economic case. These include both existing sites (e.g. Trosnant School) as well as proposed developments. Notable amongst these is the proposed new health and residential care development off Lavant Drive[3]. Whilst not included in the current economic modelling, these developments have the potential to enhance the business case.

1.4 Risks & Opportunities

1.4.4 As with all investments there are a range of risks and opportunities to manage risks that will affect the outcomes of investment decisions. A number of risks are common across most heat network projects whilst others are scheme specific.

1.4.5 For the Civic Campus heat network, the primary risks identified at this stage are the lack of a strong business case, the certainty of the use of the leisure centre as the anchor load and site of primary energy plant and alignment of the heat network proposal with the wider Council strategy for the Havant Civic Campus.

1.4.6 Other local risks noted but not see as so critical include for a Havant Civic Campus scheme include:

- Lack of knowledge of district heating / skills in the Council;
- Planning – likelihood of connection of future sites;
- Heat Customers – securing the heat demand;
- A decarbonised primary heat supply; and
- Civil engineering constraints within the urban setting.

1.4.7 Further analysis of these risks and exploration of wider risks and opportunities would be required at the Outline Business Case.

1.5 Recommended next steps

1.5.1 The Council should review and reflect on the findings of this report and in particular the necessary alignment to other local agendas to facilitate the successful potential development of a Civic Campus heat network. If there is appetite to progress the scheme, a necessary first step is to apply for funding for the next stage of project development from HNDU known as Detailed Project Development (DPD) in order to procure the necessary technical support to develop the findings and recommendations of this study.

1.5.2 Given its role in the proposed scheme, it is recommended that, should a heat network scheme be brought forward the long term plans for the leisure centre are fully appraised.

1.5.3 As part of the detailed design, it is recommended that the Council explore their preferred role(s) within the network. This should include engaging with other local stakeholders who may also have roles to play in a Civic Campus scheme including Hampshire County Council, the Solent LEP and Southern Health NHS Trust.

1.5.4 A critical element of the next work phase will be continued engagement with the potential Havant Civic Campus heat network customers to ensure that the potential for heat network connection is factored into their plans. At the same time key assumptions concerning future heat/power demand and technical compatibility with existing heating customers should be explored.

[3] Known as the 'Havant Health and Welling Campus', granted planning consent in 2015 (APP/15/00303)

1.5.5 The relevant Council officers involved in the Civic Campus regeneration review have been engaged throughout the development of this study. It is recommended that the review considers the findings of this study, and in particular how a potential heat network might interface with any proposed regeneration in the Civic Campus.

1.5.6 It is recommended that this includes a risk review of the future use of existing buildings proposed for connection to a heat network and the role of local planning policy in encouraging new developments to seek to connect to a heat network. Related to the above, there is an opportunity as part of the Havant Local Plan revision, to strengthen the requirements for new developments to investigate the feasibility of connecting to a district heat network. It is recommended this is considered by the Energy Team in consultation with the Local Plan development team.

1.5.7 The proposed new health and residential care development off Lavant Drive received HBC planning consent in 2015 and is currently progressing through discharging of planning conditions. Should a heat network be brought forward within the Civic Campus, it is recommended that early engagement is made with the developers of this site to further explore the feasibility of connection to the scheme as it has the potential to enhance the business case.

1.5.8 As part of the DPD and development of the financial case, a detailed assessment of the fuel, heat and power prices should be undertaken. The modelling has shown the significant impact of fuel and heat price on the overall attractiveness of the scheme. As part of this detailed metering should be undertaken of power use at both the leisure centre and civic plaza to develop more accurate demand and supply profiles.

1.5.9 It will be important for any future scheme to consider the evolution of Building Regulations (and in particular the calculations methodologies behind these such as SAP) in the context of gas-CHP especially in the contact of new developments.

2 Introduction

2.1 Background

2.1.1 Peter Brett Associates LLP (PBA), working with Eneteq Services Ltd has been commissioned by Havant Borough Council (HBC) to undertake a feasibility study to investigate the potential for developing a district heat network in Havant.

2.1.2 A heat masterplanning exercise was undertaken in 2016 by HBC to identify areas for potential development of heat networks in Havant[4]. This highlighted an area of concentrated public buildings to the north of the Havant Town Centre, known as the 'Civic Campus' as a key opportunity area for a potential heat network (see **Figure 1.1**). The area encompasses primarily public sector buildings north of Havant town centre with Petersfield Road to the west and New Lane to the east.

2.1.3 Meanwhile east of the Civic Campus lies the 'New Lane' industrial estate known which presents a further opportunity.

2.1.4 The focus for the present study is to assess the potential for a district heat network within Havant Civic Campus. As part of the initial phase of this work, the potential for expansion of a Civic Campus scheme to both Havant Town Centre and New Lane was assessed. However, as set out in **Section 10**, for a number of reasons, these areas do not represent an immediate opportunity to the Civic Campus scheme. Therefore, in agreement with HBC, the opportunity that New Lane and Havant Town Centre offer, are not considered further within the detailed scope of this work. Recommendations for how opportunities within these areas might be progressed are included in **Section 10**.

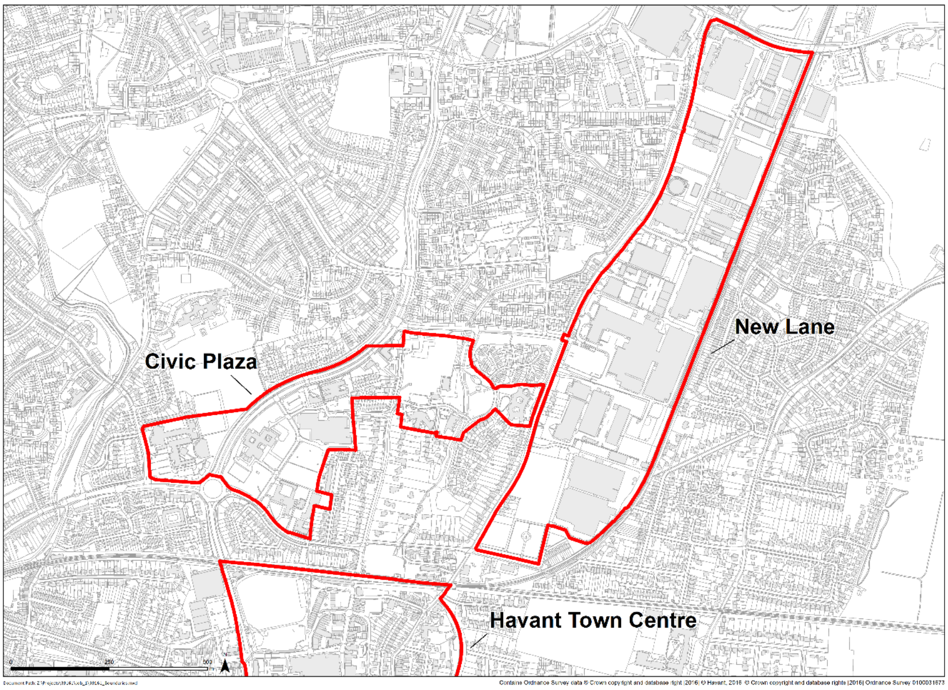


Figure 1.1 Havant heat network study areas

[4] Havant borough heat demand mapping and energy masterplanning, Havant Borough Council (2016)

2.2 Why District Heat Networks?

2.2.1 The UK national strategy for provision of heat is based on a national gas grid network, with a local distribution network connecting properties. Where properties are not on the national gas grid alternative heating fuel is used such as fuel oil, wood, coal, and electric heating.

2.2.2 Electricity is generated at power stations that are typically remote from the point of use and this can lead to inefficiencies in the form of waste heat produced in the generation process and the losses associated with electricity transmission.

2.2.3 District heating networks are associated with the generation and distribution of heat from a central point to a number of buildings or uses by using waste heat sourced from industrial processes, power generation and/or direct heat generating facilities.

2.2.4 District heat networks are essentially insulated pipes which distribute hot water from a centralised heat source to a building(s) to provide space heating and hot water. The principal infrastructure of a heat network is presented in **Figure 1.2** below.

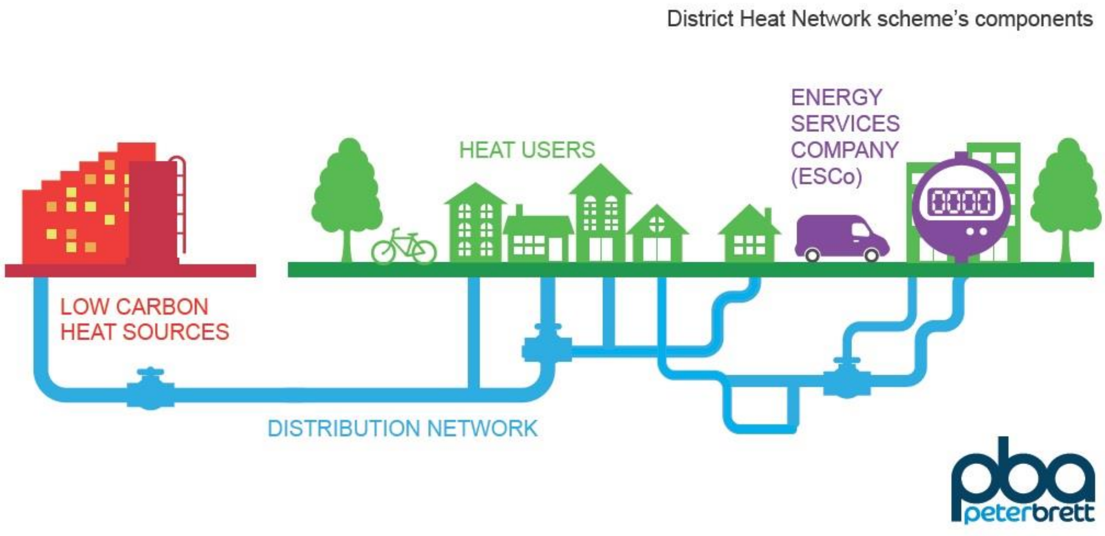


Figure 1.2 Principal infrastructure of a heat network

2.2.5 In 2013, the government published the UK's low carbon heat vision[5] and created the Heat Network Delivery Unit (HNDU) at the Department of Energy and Climate Change (DECC) now Department for Business, Energy and Industrial Strategy (DBEIS). The vision recognises that heat networks play an important role as an effective means of distributing heat energy in appropriate geographic contexts. A range of additional benefits exist with heat networks which support the expansion and implementation of new heat networks including:

- Improving the environmental performance of old building stock;
- Creating investment returns from energy consumption;
- Energy security from global geopolitical supply and pricing issues;

[5]The Future of Heating: Meeting the challenge (DECC, 2013)

- Economic growth through investing in primary infrastructure; and
- Social improvement through lower energy bills and warmer homes.

2.2.6 In 2016, government established the Heat Network Investment Programme (HNIP) which aims to provide £320m of capital support to increase the volume of heat networks being built, deliver carbon savings, and help create the conditions necessary for a self-sustaining heat network market to develop, the HNIP fund provide grant or low cost loan funding the capital costs of heat networks in the UK. The scheme is subject to key eligibility criteria.[6]

2.3 Energy Policy Context of Havant

Regional Policy

2.3.1 Havant forms part of the wider area of South Hampshire. The Partnership for Urban South Hampshire (PUSH) commissioned Arup to advice on the feasibility of an energy strategy for the sub region in 2008. The report identified significant potential for decentralised energy to assist decarbonising energy supplies in the region. The study recognised that site wide low or zero carbon infrastructures can be used to deliver low cost solutions and that "enterprise" has a critical role in bringing this together. Energy Services Companies are cited as potential solutions.

2.3.2 Future South is a partnership between the Solent Local Enterprise Partnership (LEP) Board, the Partnership for Urban South Hampshire (PUSH) and the Hampshire Chamber of Commerce. Energise Solent is its 5 year Energy Strategy. This strategy has produced a Business Case and project criteria to identify the key low carbon energy priorities and opportunities over the next five years. One of its priorities for Energise Solent is the district heat opportunity in Hampshire.[7]

Havant Vision

2.3.3 The Havant Borough Council's Corporate Strategy 2015-2020 is the overarching strategy for the borough. The 2020 vision is defined by four themes; Economy, Environment, Society and Organisation. From these themes, five priorities have been derived:

1. Financial Sustainability;
2. Economic Growth – Prosperity Havant;
3. Public Service Excellence;
4. Innovation and Creativity; and
5. Environmental Sustainability

2.3.4 This will be delivered through organisational development, developing new markets, the local economy and ensuring that the residents of Havant Borough and local businesses benefit from new development opportunities and ensuring that best practice is followed throughout the procurement process.

2.3.5 A key pillar of the Prosperity Havant initiative is the transformation of Havant town centre for which the development of decentralised heat and power is seen by HBC as potentially facilitating.

[6] https://hnip.salixfinance.co.uk/

[7] http://www.futuresouth.org/

Havant Borough Council Core Strategy March 2011

2.3.6 The Core Strategy, adopted in 2011, will cover a period up to 2026 and is the principal document setting out the broad detail and direction of development in the borough. The Core Strategy sets out a vision for Havant Borough to be cleaner, safer and more prosperous place and be recognised for its sustainable, innovative and high quality design developments and the stewardship of its natural and built environment.

2.3.7 The Core Strategy sets out a number of policies to support the deployment of decentralised energy including Policy CS14 'Efficient Use of Resources'. This states that planning permission will be granted for development that:

2.3.8 "Locally contributes to the delivery of the PUSH target of 100MW of renewable energy by 2020 for the whole of the PUSH area. Major areas of development must ensure that their on-site renewable energy production is maximised and resource efficiency is maximised."

2.3.9 The borough follows the principles of – Lean – reduce energy consumption; Clean – generate energy using low carbon technologies and Green – generate energy using renewable sources.

2.3.10 Havant's Local Plan is currently under review with a consultation on a draft plan (Havant Local Plan 2036) due to take place in Autumn 2017.[8]

Havant Energy Strategy: 2016 – 2020

2.3.11 The energy strategy for Havant Borough sets out the direction of travel to improve energy security, reduce fuel poverty and maximise economic benefits. It is based around three guiding principles:

- Energy Principle 1 'Improving Energy Efficiency' states the importance of improving energy efficiency to reduce overall energy demand. The borough will achieve this by attracting external funding to work towards a reduction of number of fuel poor homes in Havant by 10% and using the adopted local plan to deliver energy efficient buildings for the future.

- Energy Principle 2 'Increase local energy generation' states that Havant has a number of opportunities to deploy secure and local energy infrastructure across the borough and that planning will provide the basis for commercial investment in heat networks.

- Energy Principle 3 'Demonstrate Council Leadership' states that the Council will with partners to reduce energy demand within the Council's own estate and fleet.

2.3.12 Effective development of decentralised energy solution in Havant has the potential to support these principles.

Havant Civic Campus regeneration review

2.3.13 Havant Borough Council is currently undertaking a review of regeneration opportunities within the Havant Civic 'Campus' which covers a similar geographical scope to this study. This could have an impact on several of the buildings that could potentially link into a heat network. This could create an opportunity for future expansion of the network which would improve the business case. At the same time, the is a risk that regeneration proposals that do not consider the proposed heat network may undermine the business case for the heat network. Therefore it is important that relevant Council officers engaged in the regeneration review are engaged in this current feasibility study.

[8] https://www.havant.gov.uk/localplan

2.4 Report purpose and Approach

2.4.1 The purpose of this report is to present the findings of the feasibility study which has assessed the technical and economic feasibility of a district heat network in Havant. The study has focussed on the development of a heat network in the so called Civic Campus.

2.4.2 The study has also considered the high level implications of expanding and connecting a network to the adjacent areas of New Lane industrial estate to the east and Havant town centre to the south.

2.5 Report structure

2.5.1 In order to assess the various heat network options a stepped process in identifying energy demands, supply options, technology options is required. The following report has been structured in order to work through these requirements. The report structure was agreed with HBC in October 2016.

2.5.2 The structure of this report is as follows:

Section 2 Introduction This section. Provides background and sets national and local policy framework for the study;

Section 3 Energy Demand Assessment – This identifies the heat demands associated with the key sites within the Civic Campus. This is used to determine the likely routing and heat supply requirements for a potential scheme;

Section 4 Heat Supply Options – This section explores the key heat supply technology options;

Section 5 Outline Primary Heating plant design – This section assesses the presents the outline design for the primary heating plant both in terms of location, technology mix and strategy;

Section 6 Outline Energy Distribution System design - This section presents the outline network design to connect up the proposed buildings to be included in the scheme;

Section 7 Outline Economic Appraisal - This section presents the outline economic appraisal including the key parameters affecting the overall viability of the scheme;

Section 8 Risk Appraisal – Summarises the key risks with the proposed heat network at the present time;

Section 9 – Project Development and Commercialisation – Sets out the key steps for development of the projects including commercialisation options for the Council

Section 10 – New Lane and Havant Town Centre – Describes the findings of assessment of the opportunity to extend a heat network to New Lane and Havant Town Centre

Section 11 Summary and next steps – This section summarises the findings of the study and recommended next steps

3 Energy Demand Assessment

3.1 Introduction

3.1.1 Heat demand primarily defines the parameters through which a heat network can be assessed.

3.1.2 In order to determine the heat supply requirements, routing, and design for the network, it is necessary to understand the likely heat demand available within a defined geographical area. HBC has defined the study area to comprise existing buildings within the Civic Campus with potential connections to buildings within the industrial estate at New Lane and proposed regeneration sites within the town centre.

3.1.3 A suitable heat demand is one of the primary project cornerstones. The consideration of the nature of heat demand is important for a number of reasons including:

- Quality of the demand covenant which can guarantee connection in the first instance;
- The geography, size and profile of demand will influence routing; and
- Enabling an assessment of the potential revenue available from selling heat to identified customers.

3.1.4 This section presents the results of energy demand assessment associated with the buildings identified within the Civic Campus.

3.2 Study area and sites

3.2.1 The primary study area, as agreed with HBC is known as the Civic Campus and comprises 10 public and commercial buildings as shown in **Figure 3.1**.

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Figure 3.1 Site locations in study area

3.3 Site energy demand assessment

3.3.1 For each site, an Annual Heat Demand (kWh) and a Peak Heat Demand (kW) have been estimated.

3.3.2 For the majority of the sites the data has been derived from metered data. Where metered data has not been provided at this time, the following benchmarks have been used, in particular BSIRA:

- Display Energy Certificate Data;
- CIBSE Guidance (TM46);
- BSRIA Rule of Thumb (5th Edition, 2011); and
- DECC Benchmarks.

3.3.3 The following subsections describe the energy demand of each of the primary sites that offer potential connections to a heat network.

Civic Plaza

3.3.4 The Civic Plaza is predominantly office space with some conference facilities and sites on the western edge of the civic Campus within Havant. The building is comprised of three blocks, known as A, B and C.

3.3.5 Blocks A & B are heated by Gas-Fired Boilers whereas Block C is heated by an air source heat pump system. Metered data includes domestic hot water generation for Block C. It is understood that the metered data also includes space heating of core areas/circulation spaces.

3.3.6 For the Civic Plaza metered data was provided as a daily meter reading measured in cubic meters of natural gas. Consumption data was available for a 2.74-year period which included the whole of 2015. The data showed strong correlation with the Display Energy Certificate dated 11/09/2014 with a score of 59.

Floor Area	8,063 m^2
Gas Consumption Display Energy Certificate 2014	411,231 kWh
Gas Consumption Metered Date 2015	388,770 kWh
Existing Heating Plant	Gas Boilers for Heating Gas Fired Water Heaters for Domestic Hot Water Solar Thermal System
Plant Efficiency Estimate	Heating – 75% Domestic Hot Water – 85%
Annual Heat Demand Estimate	**294,000 kWh**
Peak Heat Demand Estimate	**420 kW**

3.3.7 The Annual Heat Demand is estimated by calculating the heat generated by the existing plant. The existing plant efficiencies have been estimated.

3.3.8 The Peak Heat Demand has been estimated as being 30% of the peak daily demand from metered data. This is based on our estimated daily profile for the heating/hot water demand of a typical office

3.3.9 The incoming metered gas data has been displayed graphically in **Figure 3.2**.

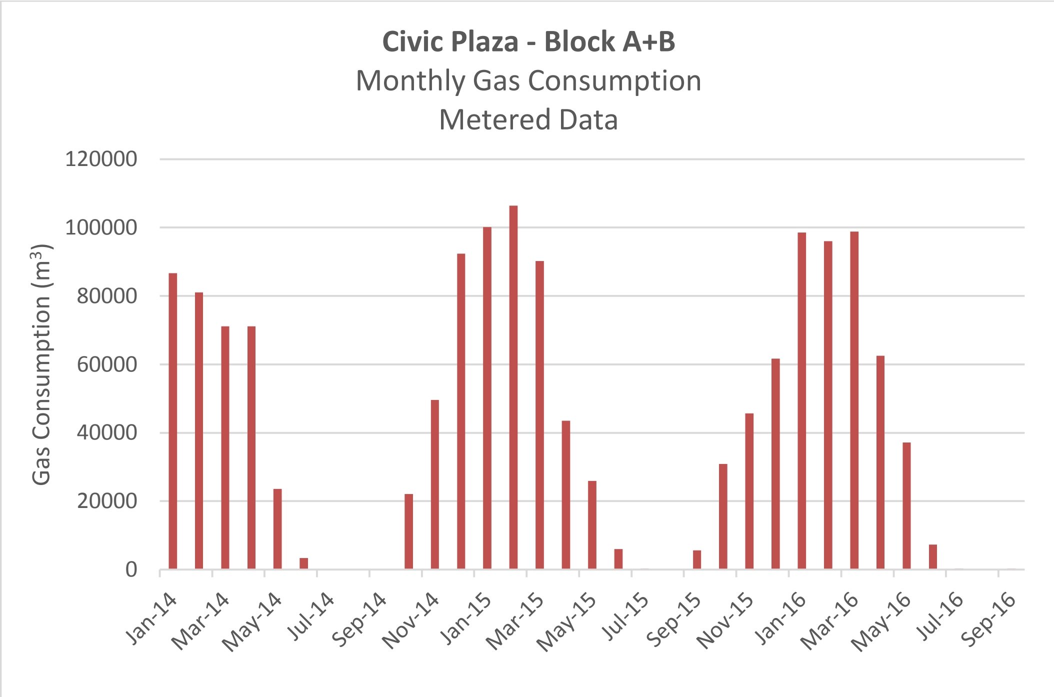

Figure 3.2 – Civic Plaza Gas Consumption

3.3.10 The metered data shows a clear correlation between weather patterns and heating demand, as expected. The domestic hot water load is low, which is as expected for a building of this nature.

3.3.11 The minimal gas demand during the summer months is due to the existing solar thermal panels installed at the Civic Plaza which are able to provide the majority of hot water demand during those months.

3.3.12 The incoming metered electrical data has been displayed graphically in **Figure 3.3**.

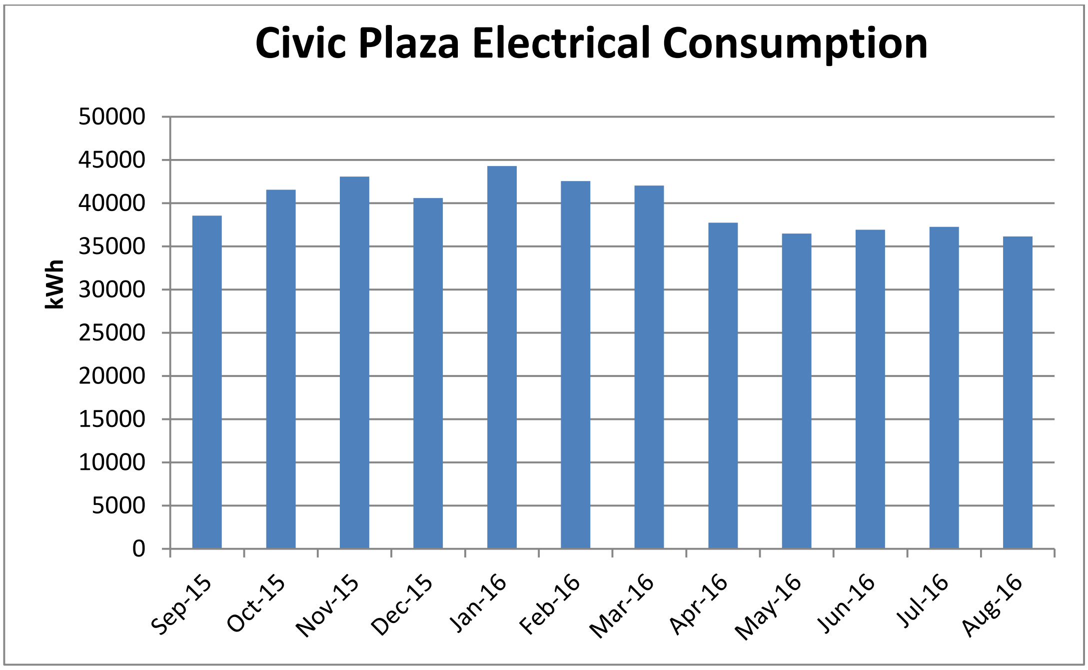

Figure 3.3 – Civic Plaza Electrical Consumption

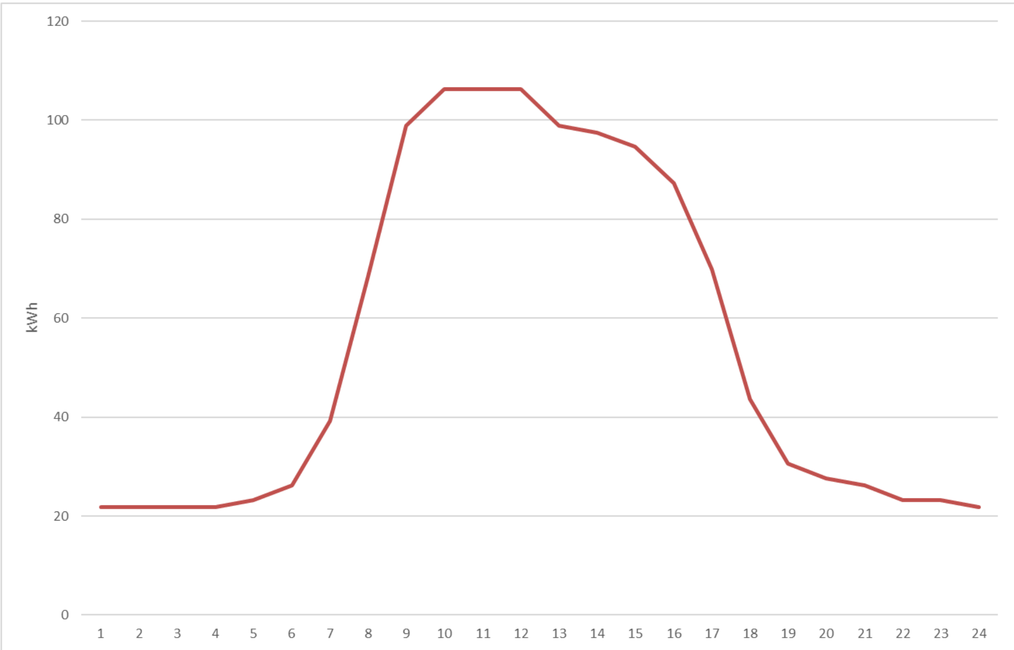

Figure 3.4 – Civic Plaza– Estimated daily electrical consumption profile (weekday)

3.3.13 **Figure 3.3** shows the typical monthly demand of between 35,000 – 45,000 kWh. An estimated Civic Plaza demand curve is shown in **Figure 3.4** based on actual annual electricity data for the Plaza which has been profiled based on typical office profile. A weekend profile is likely to be much flatter when the office is largely occupied.

Havant Leisure Centre

3.3.14 Havant Leisure Centre is owned by Havant Borough Council and managed under a long term lease by Horizon Leisure. The Leisure Centre is comprised of a swimming pool area, gym, crèche, café, sports hall and children's play centre. Changing and showering facilities are also present. The site is located at the northern end of Civic Plaza Road on the eastern side.

3.3.15 Facility Opening times: Weekdays: 6.30am-10.30pm, Weekend: 7.30am-9.30pm.

3.3.16 For the Leisure Centre metered data was provided, measured in cubic metres of natural gas, arranged to indicate monthly usage over a 3-year period.

3.3.17 Consumption data was available for a 3.25-year period which included the whole of 2015. The data showed strong correlation with the Display Energy Certificate dated 04/11/2015.

3.3.18 The Peak Heat Demand has been estimated as being 20% of the mean daily demand from the month with the greatest consumption within the metered data. This is based on our estimated heating/hot water demand daily profile.

Floor Area	7,505 m^2
Display Energy Certificate – Gas Consumption	1,823,715 kWh
Annual Gas Consumption 2015	2,041,791 kWh
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
BSRIA Benchmark Heating Demand (Doesn't include the swimming pool or DHW load)	600 kW
Swimming Pool Peak Load	250 kW
Annual Heat Demand Estimate	**1,633,000 kWh**
Peak Heat Demand Estimate	**1,800 kW**

3.3.19 The incoming metered data has been displayed graphically in **Figure 3.5**.

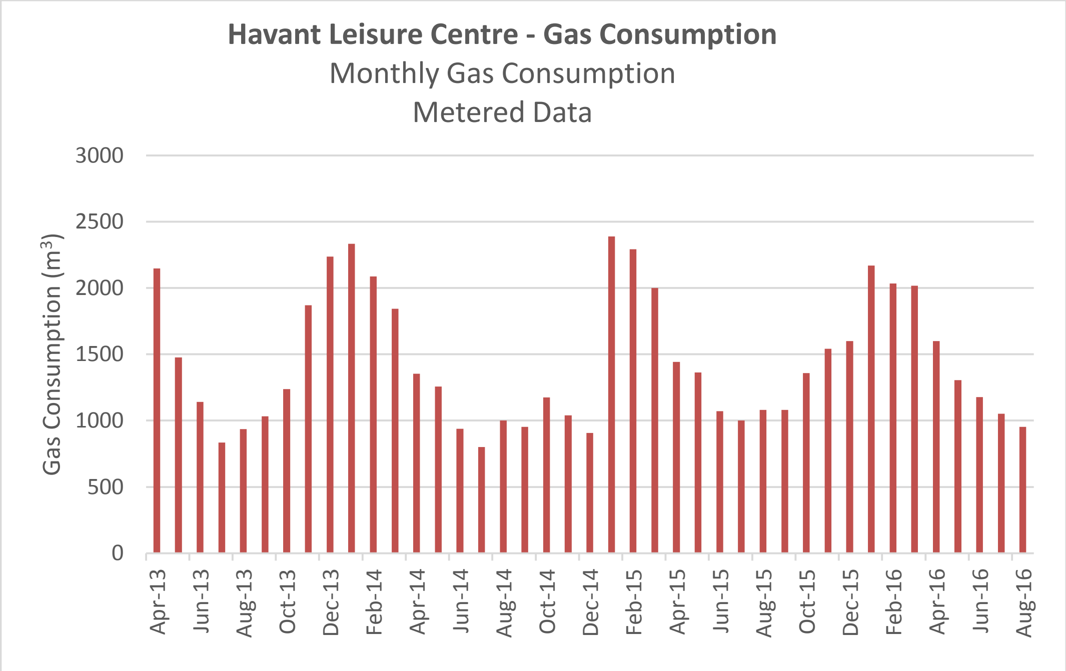

Figure 3.5 – Havant Leisure Centre Gas Consumption

3.3.20 The metered data shows a clear correlation between weather patterns and heating demand, as expected. The base load is high, which is as expected for a building of this nature as there is likely to be a large demand for domestic hot water and heating of the swimming pool.

3.3.21 Electricity demand for the leisure centre is shown in **Figure 3.6**.

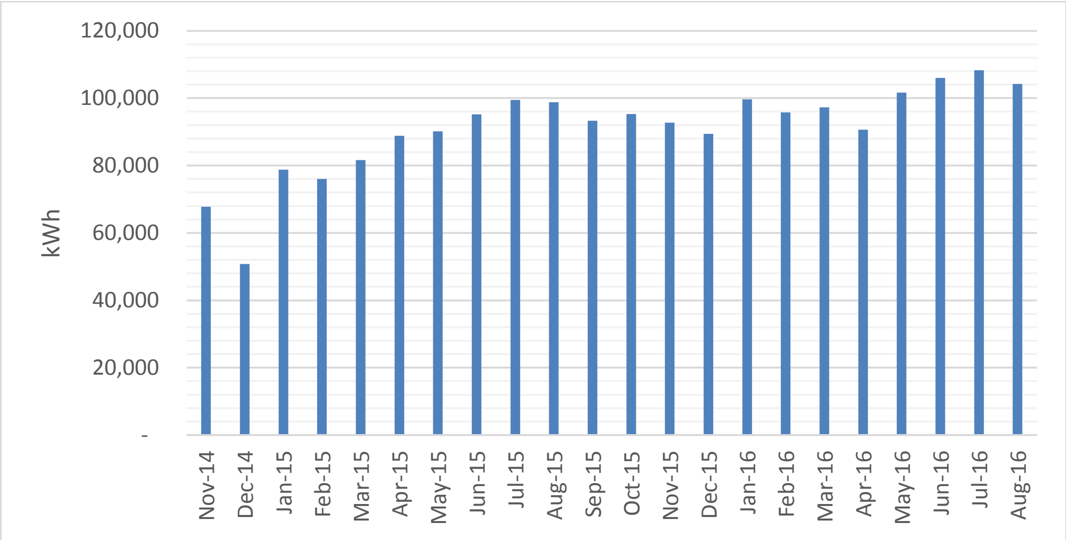

Figure 3.6 – Havant Leisure Centre Electricity Consumption

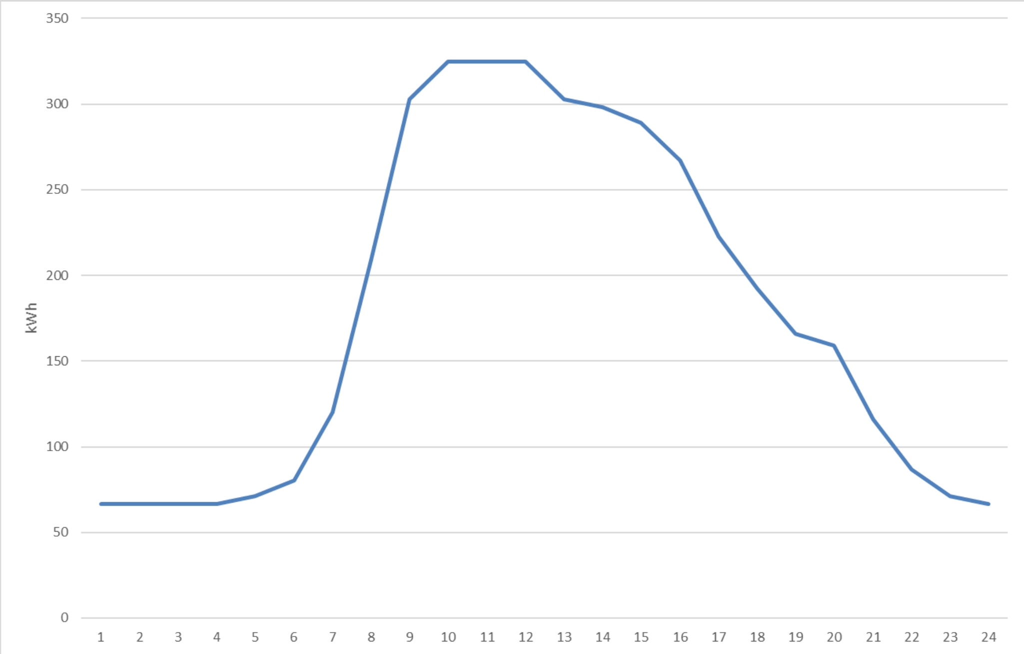

Figure 3.7 – Leisure Centre– Estimated daily electrical consumption profile

3.3.22 **Figure 3.6** shows the typical monthly demand of between 80,000 – 100,000 kWh. There appears to have been an increasing demand for electricity over time. An estimate of the Leisure Centre demand curve is shown in **Figure 3.7** based on actual annual electricity data for Havant Leisure Centre which has been profiled based on typical leisure centre demand profile. Since the leisure centre is open 7 days a week it is reasonable to assume that the demand profile would be similar for both weekends and week days.

Havant College

3.3.23 Havant College is a Sixth form college which has approximately 1,100 full time students aged 16-18 years old.

3.3.24 For Havant College, metered gas consumption data has been provided initially with units of kWh per month which has subsequently been manipulated to give units of m^3 per month.

3.3.25 A Display Energy Certificate for this building has not been provided.

3.3.26 The Peak Heat Demand has been estimated as being 30% of the mean daily demand from the month with the greatest consumption within the metered data (January 2016). This is based on our estimated heating/hot water demand daily profile.

Annual Gas Consumption	1,018,281 kWh
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
Annual Heat Demand Estimate	**815,000 kWh**
Peak Heat Demand Estimate	**1,360 kW**

3.3.27 The incoming metered data has been displayed graphically in **Figure 3.8**.

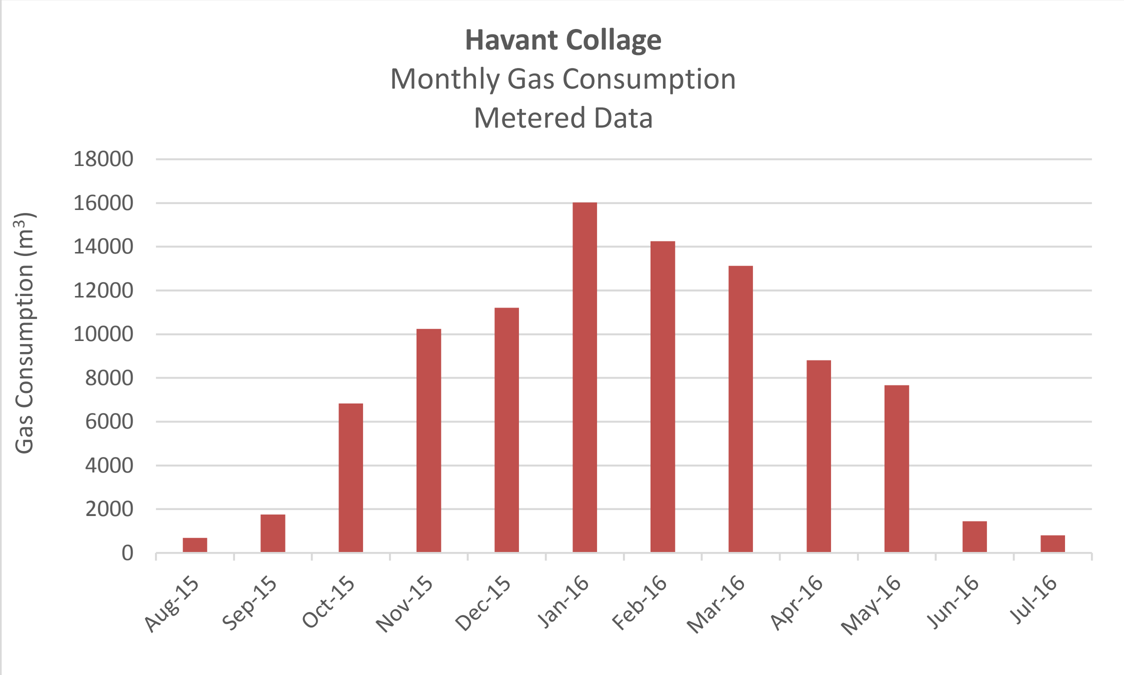

Figure 3.8 – Havant College Gas Consumption

3.3.28 The metered data shows a clear correlation between weather patterns and heating demand, as expected reflecting reduced demand for heating/hot water during the summer months when the college is less active.

Havant Health Centre

3.3.29 Havant Health Centre, also known as Homewell Practice, is a medical clinic located south of Petersfield Road and to the north of Havant Leisure Centre.

3.3.30 Facility Opening times: Weekdays: 8am-6.30pm, Weekend: Closed

3.3.31 Metered data was available in the form of monthly meter readings measured in kWh which has been manipulated to outline the monthly volume of gas consumed with units of m^3 for a 2.75-year period which included the whole of 2015. The data showed strong correlation with the Display Energy Certificate.

3.3.32 The Annual Heat Demand is estimated as shown below by calculating the heat generated by the existing plant. The annual consumption data has been taken from the mean annual consumption between 2008 and 2012 The existing plant efficiencies have been estimated.

3.3.33 The Peak Heat Demand has been estimated as being 20% of the mean daily demand from the month with the greatest consumption within the metered data for 2015. This is based on our estimated heating/hot water demand daily profile.

Floor Area	7,505 m^2
Display Energy Certificate – Gas Consumption	317,046 kWh
Annual Gas Consumption 2015	380,000 kWh
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
BSRIA Benchmark Heating Demand	230 kW
Annual Heat Demand Estimate	**300,000 kWh**
Peak Heat Demand Estimate	**280 kW**

3.3.34 The incoming metered data has been displayed graphically in **Figure 3.9**.

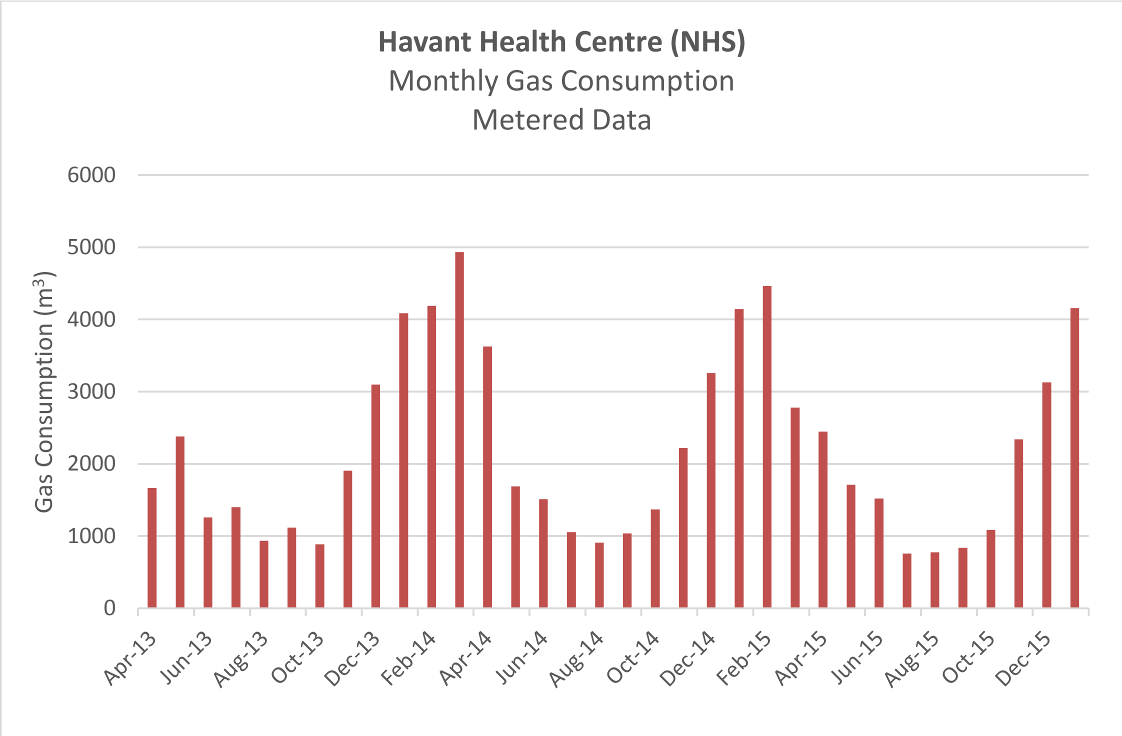

Figure 3.9 – Havant Health Centre Gas Consumption

3.3.35 The metered data shows a typical correlation between weather patterns and heating demand. The site has a relatively high base load consumption suggesting a reasonable year round demand for domestic hot water.

Police Station

3.3.36 Havant Police Station is predominantly comprised of office space located at the southern end of Civic Plaza Road on the eastern side.

3.3.37 Facility Opening times: Monday-Thursday: 8am-8pm, Friday-Sunday: Closed

3.3.38 For the Police Station no monthly metered data has been provided. Therefore, a heat profile has been generated from this heat demand estimate based on a typical profile for this type of building (**Figure 3.10**).

3.3.39 The Annual Heat Demand is estimated by the DECC Benchmarking Calculation.

3.3.40 The Peak Heat Demand has been estimated from the BSRIA Rule of Thumb for heat demand.

Floor Area	2,474 m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
BSRIA Benchmark Heating Demand	220kW
Annual Heat Demand Estimate	**938,000 kWh**
Peak Heat Demand Estimate	**220 kW**

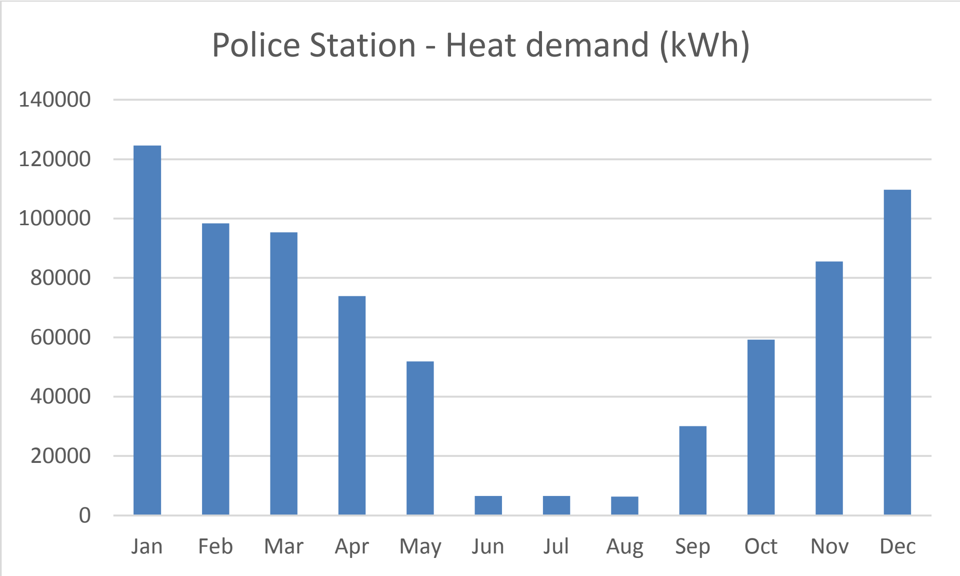

Figure 3.10 – Police Station Heat Demand profile

3.3.41 It is not expected that the police station offers a significant anchor heat demand. The limited amount of heating required in the summer months would introduce a seasonally variable heat demand on to the system that would need to be considered in the design to assess its value to the network.

Job Centre

3.3.42 The Job Centre Plus is a primarily a general office building with associated meeting rooms. It is located north of Elmleigh road adjacent to Havant Police Centre.

3.3.43 Facility Opening times: Weekdays: 9am-5pm, Weekend: Closed

3.3.44 For the Job Centre no monthly metered data has been provided. Therefore, a heat profile has been generated from this heat demand estimate based on a typical profile for this type of building. The Annual Heat Demand is estimated by the DECC Benchmarking Calculation (**Figure 3.11**).

3.3.45 The Peak Heat Demand has been estimated from the BSRIA Rule of Thumb for heat demand.

Floor Area	1620m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
BSRIA Benchmark Heating Demand	160 kW
Annual Heat Demand Estimate	**190,000 kWh**
Peak Heat Demand Estimate	**160 kW**

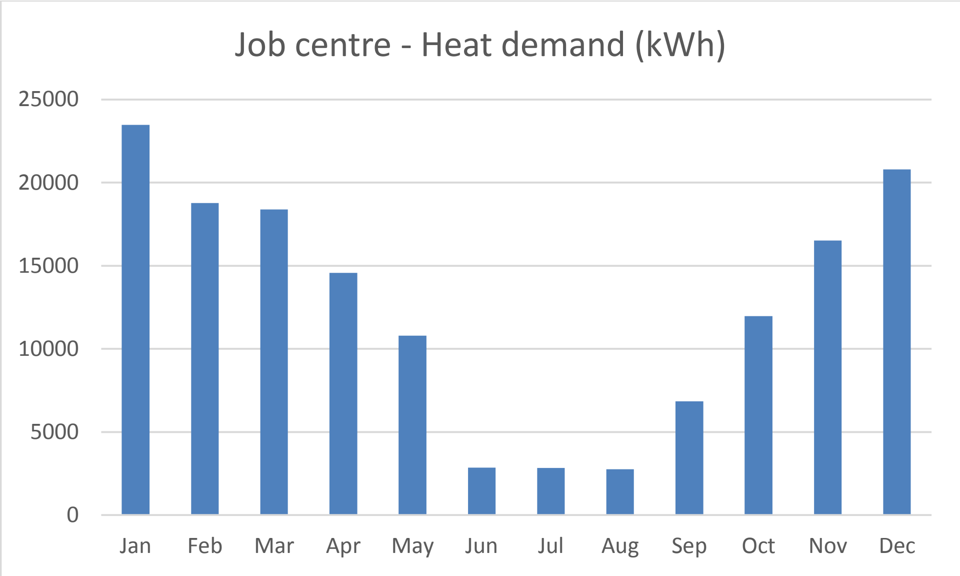

Figure 3.11 – Job Centre Heat Demand

3.3.46 Again like the police station the job centre is unlikely to offer a significant anchor demand to the network. The seasonal variation in the demand will need to be considered as part of the network design.

Methodist Church

3.3.47 Havant Methodist Church is located south of Petersfield road, adjacent to Havant Health Centre.

3.3.48 For the church metered data has been provided.

3.3.49 The Annual Heat Demand has been estimated by the determining the heat output of the plant based on assumed plant condition and the annual gas consumption.

3.3.50 The Peak Heat Demand has been estimated from the BSRIA Rule of Thumb for heat demand.

3.3.51 A Display Energy Certificate for this building has not been provided.

Floor Area (Estimated)	344 m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	85%
Annual Gas Consumption 2015	743 kWh
BSRIA Benchmark Heating Demand	30 kW
Annual Heat Demand Estimate	**594 kWh**
Peak Heat Demand Estimate	**30 kW**

3.3.52 The incoming metered data has been displayed graphically in **Figure 3.11**.

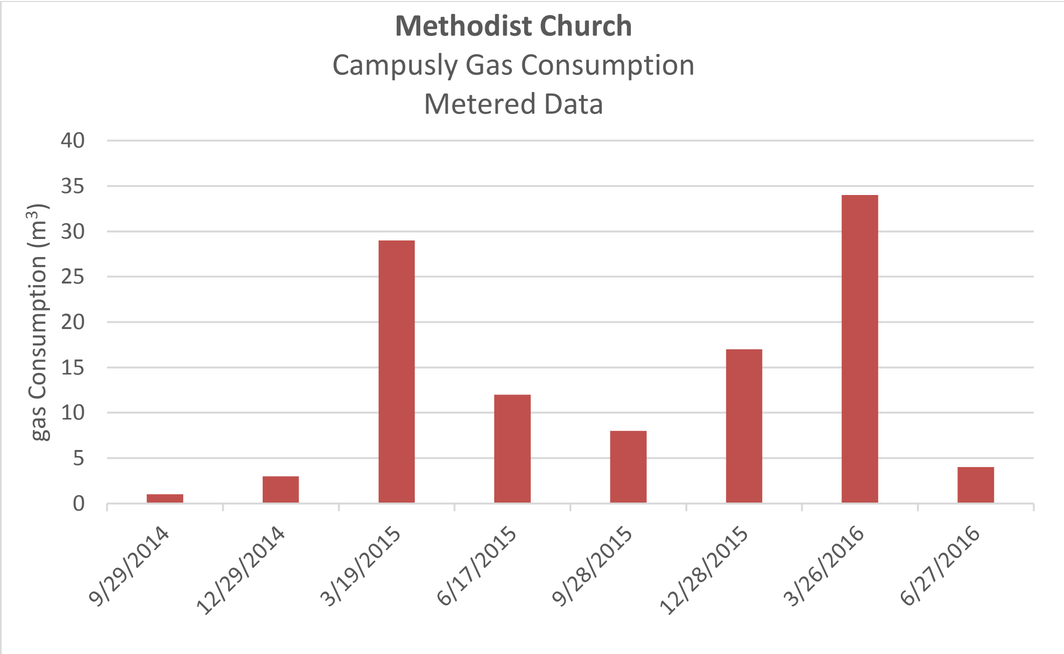

Figure 3.12 – Methodist Church Gas Consumption

3.3.53 The heat demand of the Methodist Church is very small. In the overall network demand, the value of this demand is highly unlikely to justify connection. This demand has therefore been excluded from the assessment going forward.

Hollybank Rehabilitation Centre

3.3.54 Hollybank Rehabilitation Centre, located south of Lavant Drive, provides 24-hour medical care for up to 21 patients.

3.3.55 The centre offers 24-hour care, and is in use 24 hours per day.

3.3.56 Metered data has been provided initially with units of kWh per month which has subsequently been manipulated to give units of m^3 per month.

3.3.57 The Annual Heat Demand is estimated by the determining the heat output of the plant based on the existing plant and condition and the annual gas consumption.

3.3.58 The Peak Heat Demand has been estimated as being 30% of the mean daily heat demand for the month with the greatest gas consumption in the metered data (December 2013).

Floor Area (Estimated)	1,137 m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
Annual Gas Consumption 2015	163,417 kWh
Annual Heat Demand Estimate	**130,733 kWh**
Peak Heat Demand Estimate	**230 kW**

3.3.59 The incoming gas metered data has been displayed graphically in **Figure 3.13**.

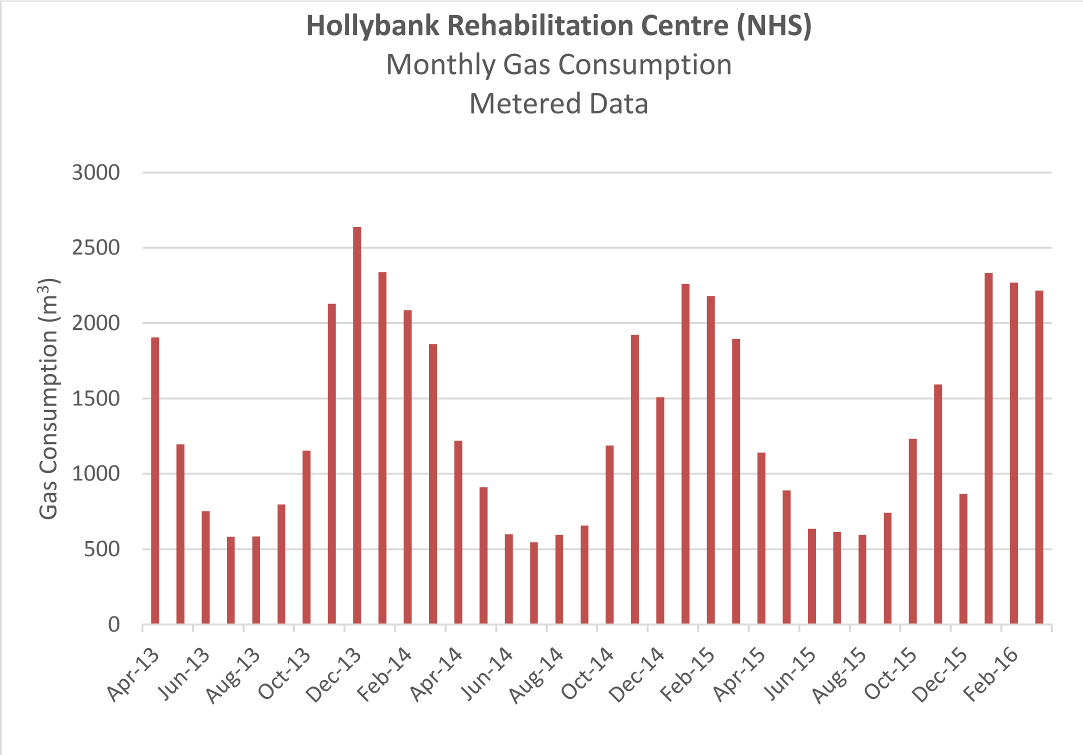

Figure 3.13 – Hollybank Rehabilitation Centre Gas Consumption

3.3.60 This demand offers a seasonal variable heat demand but has a proportionally high summer heat demand likely to be associated with the activities associated with the rehabilitation centre.

Havant Diagnostic Centre

3.3.61 Havant NHS Diagnostic Centre provides medical imaging services using equipment such as X-ray, ultrasound and echocardiograms in addition to day case surgery.

3.3.62 The Diagnostic Centre is located South of Lavant Drive, adjacent to Hollybank Rehabilitation Centre.

3.3.63 Facility Opening times: Weekdays: 8am-7pm, Saturday: 8am-12pm, Sunday: Closed

3.3.64 Metered data is provided for the Havant Diagnostic Centre.

3.3.65 The Annual Heat Demand is estimated by the determining the heat output of the plant based on the existing plant and condition and the annual gas consumption from metered data, 2014 was used.

3.3.66 The Peak Heat Demand has been estimated as being 30% of the mean daily heat demand for the month with the greatest gas consumption in the metered data (February 2014).

Floor Area (Estimated)	2,360 m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
Annual Gas Consumption 2014	250,922 kWh
BSRIA Benchmark Heating Demand	340 kW
Annual Heat Demand Estimate	**200,000 kWh**
Peak Heat Demand Estimate	**400 kW**

3.3.67 The incoming metered data has been displayed graphically in **Figure 3.14**.

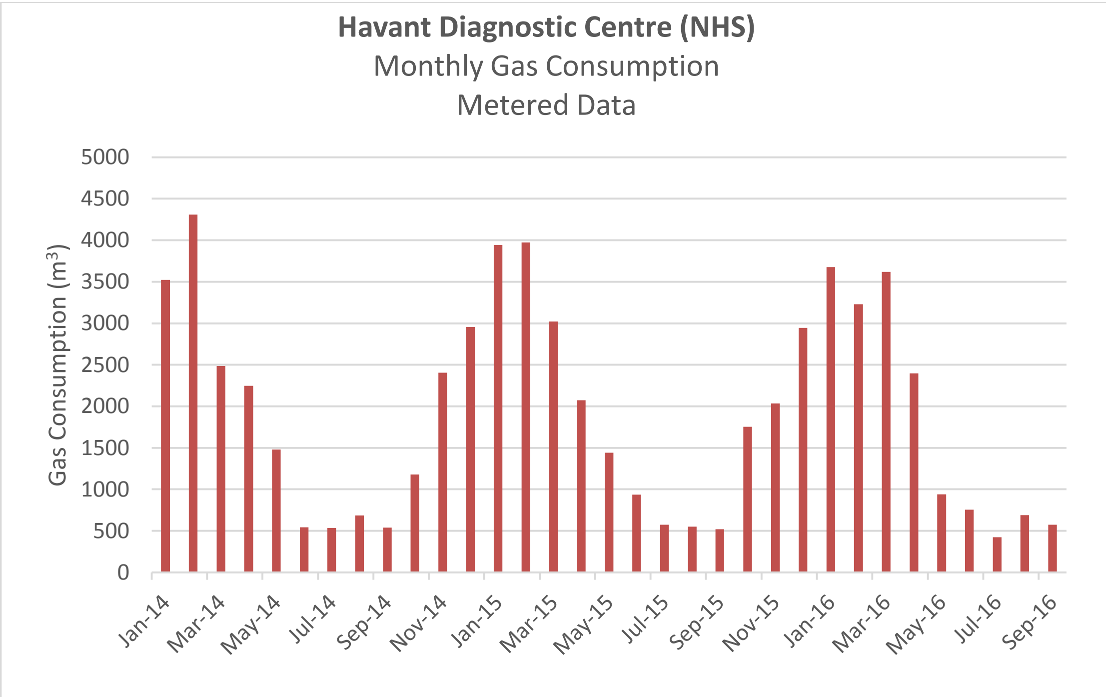

Figure 3.14 – Havant Diagnostic Centre Gas Consumption

3.3.68 The facility offers a seasonably variable heat demand. The ratio of monthly winter consumption against summer demand is considerably larger than the other potential connections such as the rehabilitation centre.

3.3.69 The operators of the site, Southern Health NHS Trust confirmed that the site is operating well under its potential capacity and therefore expand (heat) demand to increase in the future.

Elmleigh Hospital

3.3.70 Elmleigh Hospital, located west on New Lane, is an NHS facility specialising in mental health illness and offering a psychiatric intensive care unit. As an inpatient hospital, patients will be cared for over a 24-hour period.

3.3.71 For the Elmleigh Hospital metered data has been provided initially with units of kWh per month which has subsequently been manipulated to give units of m^3 per month.

3.3.72 The Annual Heat Demand is estimated by the determining the heat output of the plant based on the existing plant and condition and the annual gas consumption from metered data, 2015 was used.

3.3.73 The Peak Heat Demand has been estimated as being 30% of the mean daily heat demand for the month with the greatest gas consumption in the metered data (January 2014).

Floor Area (Estimated)	2,661 m^2
Existing Heating Plant	Gas Boilers
Plant Efficiency Estimate	80%
Annual Gas Consumption 2015	399,153 kWh
BSRIA Benchmark Heating Demand	360 kW
Annual Heat Demand Estimate	**319,322 kWh**
Peak Heat Demand Estimate	**500 kW**

3.3.74 The incoming metered data has been displayed graphically in **Figure 3.15**.

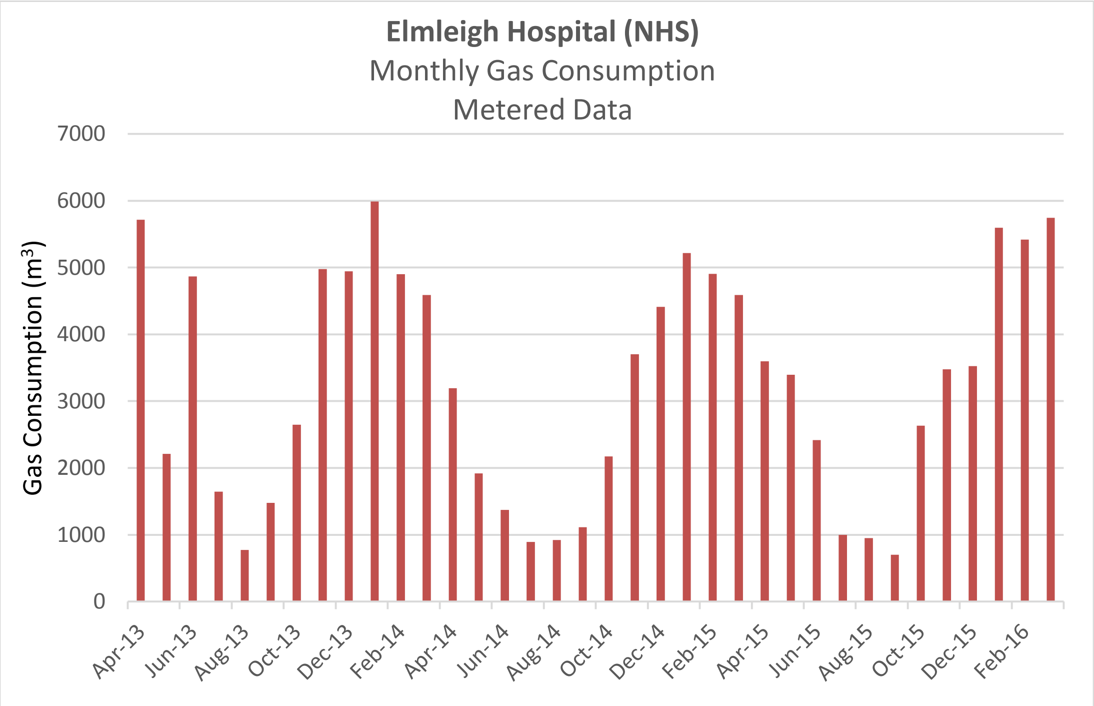

Figure 3.15 – Elmleigh Hospital Gas Consumption

3.3.75 The facility offers a seasonably variable heat demand. The ratio of monthly winter consumption against summer demand is high and as with the other seasonal variations will need to be considered further in terms of supply approach.

3.4 Combined Heat Demand

3.4.1 The below graphs show the heat demand profiles for all Civic Campus sites (excluding the Methodist Church).

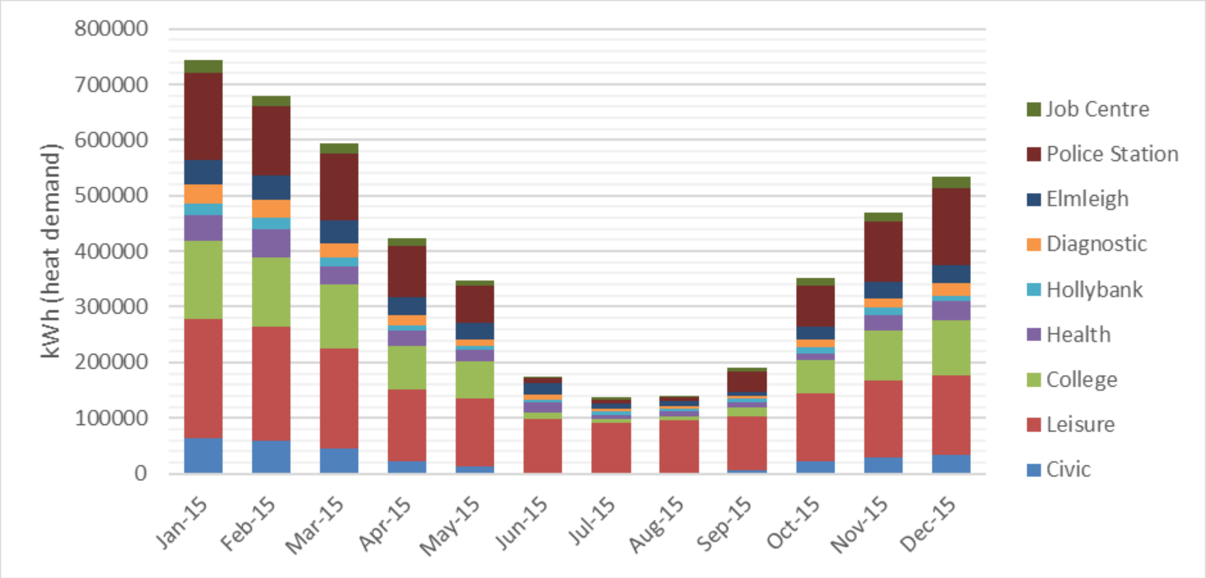

Figure 3.16 – Combined Annual Heat Profile – All Sites

3.4.2 It is clear that the Leisure Centre heat demand makes up the majority of the summer baseload and thus would serve as a suitable 'anchor' heat load for a potential network.

3.4.3 The seasonal variation in demand can often increase the capital costs and carbon efficiency of a heat network. Energy networks are designed against peak demand but network efficiencies are best achieved against baseload supply (constant demand). Further exploration is recommended to explore demand optimisation at a detailed feasibility level. This may increase the economic performance of the network.

3.4.4 Using the annual heat demands from for the sites, typical winter and summer daily heat profiles have been generated as showing in **Figures 3.17** and **3.18.**

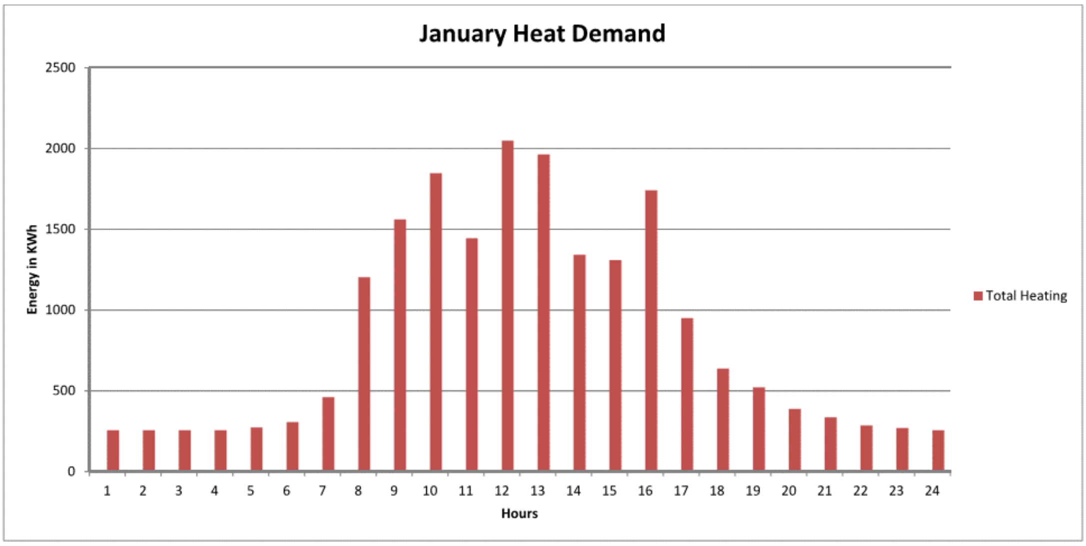

Figure 3.17 Typical winter daily heat profile for Civic Campus sites

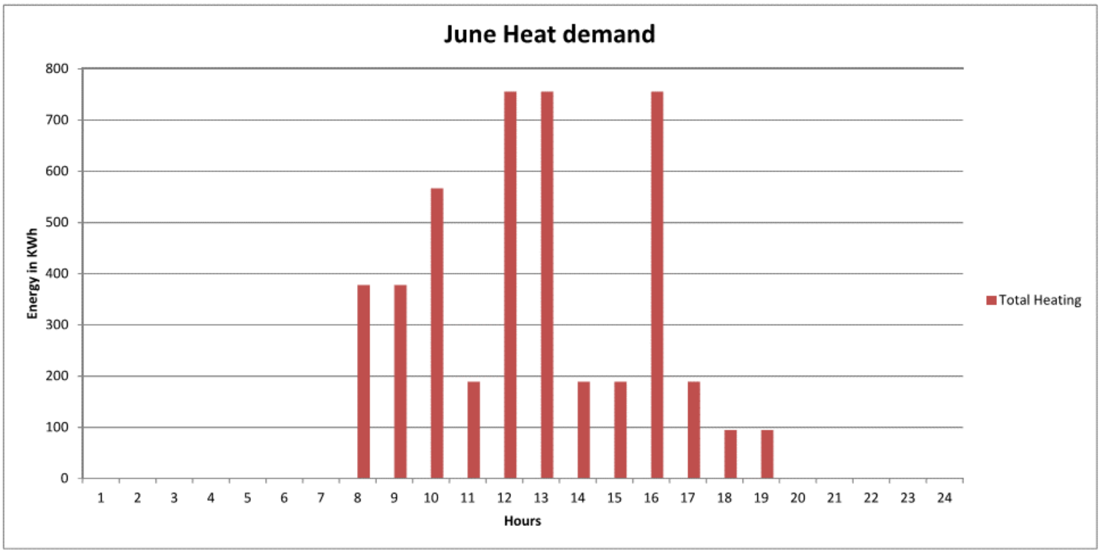

Figure 3.18 Typical summer daily heat profile for Civic Campus sites

3.5 Demand geography

3.5.1 **Figure 3.19** presents a heat demand geography for the Civic Campus sites. It confirms that the major demands are focussed around the major anchor load of Havant leisure centre.

3.5.2 Delivering heat networks is about connecting demands for heat (heat loads) with the source of heat (heat supply). In order to maximise cost effectiveness, it important to minimise the distances between connections.

3.5.3 The close proximity of the Civic Plaza to the leisure centre suggests it would offer reasonable basis for connection. Havant College to the west presents a sizable demand in its own right and the police station also appears to offer reasonable demand.

3.5.4 East of the central area are the NHS buildings along Lavant drive. These appear to offer less demand although are in close proximity to each other if a branch were to be taken along that route.

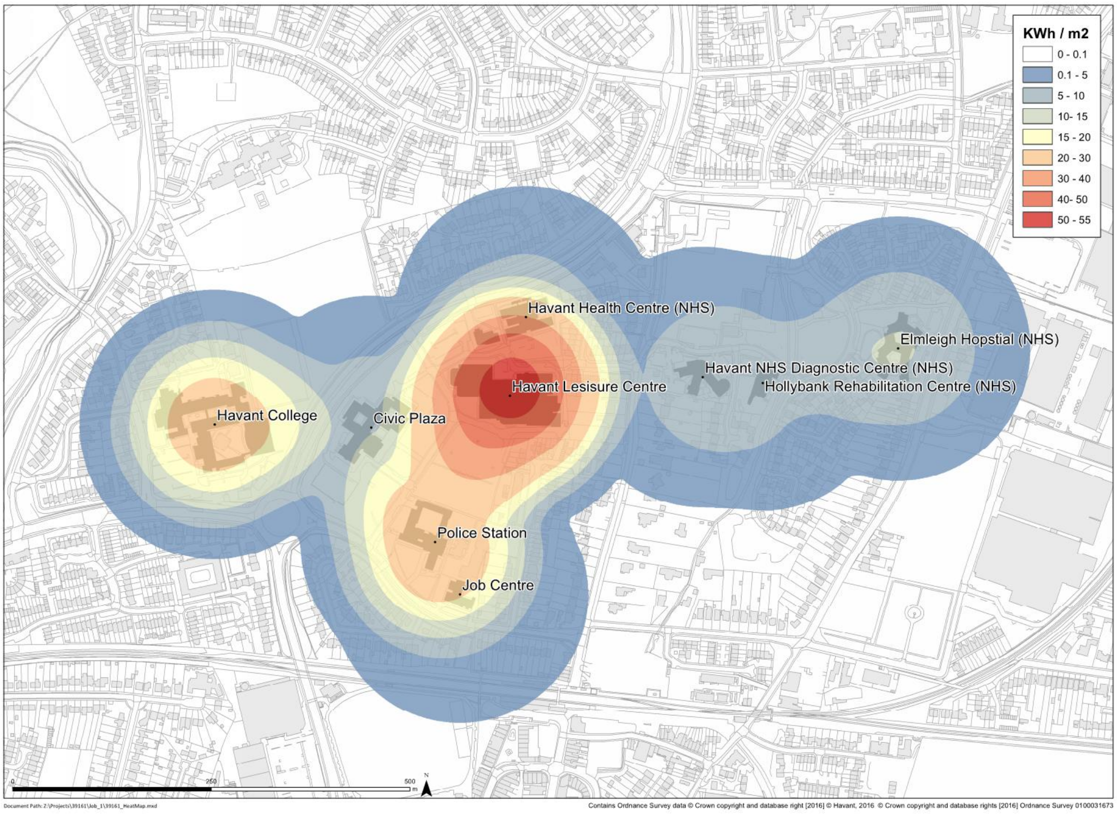

Figure 3.19 – Civic Campus Heat Demand – All Sites

3.5.5 Cooling demand has not been included as part of the current analysis. Additional demands will further enhance the investment case for a heat network but unless the heat demand is sufficient the network will not be investable.

3.5.6 The potential for cooling should be considered on a building by building basis but more suitable for new buildings with cooling demand which can therefore be designed from the outset to interface with a district heating scheme. It is recommended that cooling potential is assessed as new developments are brought forward within the Civic Campus to assess their potential compatibility with a district heat network.

3.6 Site Summary and Phasing

3.6.1 This section summarises the findings of the data collected to date to inform the scope and phasing.

3.6.2 The possible sites for connection to the heat network identified in the current scope include a range of public sector buildings. In addition, there is the potential for existing building to undergo redevelopment whilst sites have been identified for possible development or in planning.

3.6.3 This range of building types present different risk profiles from the perspective of developing potential heat network connection. Generally speaking, Council owned property provides the greatest certainty of connection. These are followed by other public sector building which, whilst connection cannot be guaranteed, the nature of the public ownership increases the likelihood of connection.

3.6.4 The highest risk sites from a potential connection and therefore demand assessment perspective are those in private ownership and those sites yet to be developed. For the purposes of heat network feasibility, the sites included may therefore categorised as shown in **Table 3.1** below.

Table 3.1 Summary of Civic Campus Sites

Connection likelihood	Description	Buildings
High (priority)	Authority owned asset providing greatest certainty of connection	Havant Council owned buildings
Medium	Whilst connection cannot be guaranteed, the nature of the public ownership increases the likelihood of connection	Typically other public sector buildings.
Low	Limited ability to influence or obligate connection	Typically the private sector sites and also yet to be developed sites

3.6.5 This categorisation will be used to assess the sites within the demand assessment and to inform the phasing of connections, prioritising local authority owned sites.

3.6.6 **Table 3.2** presents a summary of the Civic Campus sites and based on the data obtained to date a proposed phasing for connection to a district heat scheme.

Table 3.2 Summary of Civic Campus Sites

Site	Annual Heat Demand (MWh)	Proposed Connection Phase
Civic Plaza	296	1
Havant Leisure Centre	1,633	1
Havant College	815	2

Site	Annual Heat Demand (MWh)	Proposed Connection Phase
Havant Health centre (NHS)	300	3
Police station	938	3
Job centre	151	3
Hollybank Rehabilitation Centre (NHS)	131	3
Havant NHS Diagnostic Centre (NHS)	200	3
Elmleigh Hospital (NHS)	320	3
Total annual demand	**4780**	

3.6.7 Taking into account the heat demand profiles and locations of the various Civic Campus sites, the following connection phasing strategy is proposed:

Phase 1

1. Establish new primary energy generation plant at Havant Leisure centre

2. Heat connection from leisure centre to Civic Plaza

Phase 2

4. Heat connection from leisure centre to Havant College via Petersfield Road crossing.

5. Havant college may include connection to up to 4 plant rooms across the campus.

Phase 3

6. Heat connection from leisure centre to Havant health centre

7. Heat connection from leisure centre to Police Station and Job Centre

8. Heat connection from leisure centre to Hollybank Rehabilitation Centre, Havant NHS Diagnostic Centre and Elmleigh Hospital.

9. Future development sites across the Civic Campus could be connected as and when these sites are brought forward e.g. Land north of Lavant Drive (see below).

3.7 Future development – Civic Campus

3.7.1 The current demand assessment and appraisal within this report has considered the heat demand associated with existing buildings only at this stage.

3.7.2 However, it is noted from discussions with the Council that there are plans and proposals for new buildings within the Civic Campus including as part of the Havant Civic Campus regeneration review currently being undertaken by HBC.

3.7.3 New sites may include redevelopment and re-purposing of existing buildings, including potentially those included in the above demand assessment. Meanwhile there are areas of land which have been earmarked for new commercial or residential development.

3.7.4 Potential new sites within the Civic Campus include:

- Havant Health and Well-Being Campus on land north of Lavant Drive comprising 80-bed nursing home, 51 affordable extra care flats, 48 affordable and market supported living flats[9]; and

- Havant Police Station which is due for potential relocation thereby making site available for redevelopment.

3.7.5 The modelling undertaken in this section will need to be reviewed should existing sites change or new developments come forward as this will impact the business case.

3.7.6 It is important that relevant Council officers engaged in the regeneration review are engaged in the outputs of this heat network feasibility study.

3.7.7 The next section considers the potential heat supply options for Civic Campus heat network.

[9] See HBC Application APP/15/00303

4 Heat Supply Options Appraisal

4.1 Heat Supply Technologies

4.1.1 There are a number of heat generation technologies that could be considered within Havant. A summary of these options is provided below.

4.2 Natural Gas Heat and Power

4.2.1 In the UK the majority of new heat network installations are supplied through the generation of heat through burning natural gas in combined heat and power (CHP) and gas boilers.

4.2.2 CHP supplies continuous heat and it is not easily modulated. Therefore, CHP cannot supply variable heat demand without the need for additional back up heat supply (boilers, heat stores etc).

4.2.3 The combination of CHP and boilers is seen as a flexible approach to supplying heat both in terms of deployment within the urban environment and from an operation point of view. In addition, this can be supplemented with thermal storage to support the development of an efficient heat supply and maximising the use of CHP over daily energy demand profiles.

4.2.4 Limiting factors associated with gas fired CHP include air quality impacts and potentially noise, especially if it has to be located near to housing. The medium plant combustion directive due for implementation in 2017 within the UK will set stringent targets for emissions to curb air quality impacts from utility scale gas combustion (greater than 1MW thermal output).

4.2.5 At present gas-CHP is seen as providing the lowest economic cost district heat network technology and hence tends to the favoured primary heat generation technology.

4.2.6 The potential for CO_2 reductions is lower than some other technologies and it may not qualify, on its own, for some government funding schemes such as Heat Network Investment Programme (HNIP) which requires 75% of heat load met with CHP if it's the only heat generating technology used (see **Section 4.8**).

4.2.7 A further risk worth noting in terms of gas-CHP is that due to the decarbonisation of the electricity grid, the carbon 'benefit' of gas-CHP is reducing. Government has recognised this and in November 2016 Government began consultation on the Standard Assessment Procedure (SAP).[10] SAP is the calculation methodology used to assess compliance against Part L of the Building Regulations.[11]

4.2.8 The proposed reduction in the CO_2 emission factor for electricity means the carbon benefit and Part L compliance of natural gas led combined heat and power (CHP) is significantly diminished. If implemented the changes will have particular relevance to building regulation compliance for new buildings which proposed to connect to a gas-CHP led heat network. Whilst the current consultation is focussed on dwellings, it is likely that, if implemented in the domestic building regulation, it would be extended to all buildings (domestic and non-domestic).

[10] https://www.gov.uk/government/consultations/public-consultation-on-proposals-to-amend-the-standard-assessment-procedure-sap

[11] The timing of any proposed changes is not currently known

4.3 Biomass

4.3.1 Biomass is a versatile product that can be used as a fuel source for heat, power and combined heat and power (CHP) applications. The most commonly available forms of biomass on the market are wood chip and wood pellet.

4.3.2 Biomass plant can be sized to meet the heat demand of buildings connected to the heat network, and to reflect the availability of biomass in the area. If a biomass approach is adopted, space provision must be made for an energy centre. Furthermore, as a solid fuel biomass is a bulky product that requires significant storage space and supporting infrastructure (e.g. space for fuel deliveries and storage hoppers).

4.3.3 In addition, for gigawatts of heat generation the logistic movements for wood fuel are not insignificant.

4.3.4 The carbon intensity of biomass varies depending on the nature of the fuel and where the material is sourced from. If sourced locally, with minimal transport requirements, biomass can have very low carbon emissions compared with gas or electricity. However, biomass often requires transportation over significant distances (including overseas) if large supply contracts are required. The carbon intensity of biomass can still be significantly less than traditional fossil fuels (oil and gas), even including the emissions associated with intercontinental transportation.

4.3.5 Deployment of a biomass led heat supply is typically significantly more expensive than gas from both a capital and operational expenditure. Wood pellets, likely to be the fuel used in such applications due to space constraints, are currently priced at 4.4p/kWh[12]. However, incentive schemes such as the Renewable Heat Incentive (RHI) can help to offset capital costs and provide financial returns. Long-term contracts with fuel suppliers are needed to ensure security of supply and sufficient heat generation for the site.

4.3.6 In high density built-up areas, where air quality already presents an issue, the emissions from biomass plant may exceed local air quality standards. Whilst Havant does not appear to be within an AQMA, potential emissions and air quality controls will need to be investigated further during detailed design.

4.3.7 There may be the potential for a small biomass unit to provide supplementary heating as part of the Civic Campus scheme which, in further decarbonising the heat supply may support eligibility of the scheme for HNIP funding (see **Section 4.8** below). This will be considered further in the design and economic appraisal.

4.4 Solar Water Heating (or Solar Thermal)

4.4.1 Solar water heating systems could be used to offset a portion of the hot water demand in domestic properties at the proposed development. In well-designed properties, solar water heating can reduce the fuel consumption associated with hot water by 60-70%.

4.4.2 As with any solar based technology, solar water heating systems rely on solar energy and therefore the most effective heat production occurs during the daytime and sunny periods, and efficiencies are greatly reduced in winter. Therefore, their output for the whole year is relatively low.

4.4.3 Solar water heating systems generally operate most efficiently when installed on south-facing (or near-south-facing) roof spaces.

4.4.4 Use of solar water heating systems is subject to landscape/visual assessment and structural engineering calculations (especially on wide-spanning roofs).

[12] http://www.forestfuels.co.uk/about-wood-fuel/fuel-price-comparisons

4.4.5 There are examples of the use of solar thermal technology, on the continent, providing low grade heat (sub 50degC) into low temperature district heat networks.

4.5 Ground/Water Source Heat Pumps

4.5.1 Ground source heat pumps (GSHPs) draw heat energy from the ground, concentrate it and then release it into a property. Some heat pumps are able to reverse this process in summer, thereby providing cooling in buildings. A variation of the concept is the extraction of heat from significant water bodies including rivers, lakes or geological aquifers.

4.5.2 The efficiency and cost-effectiveness of GSHPs is affected by the underlying ground conditions and thermal conductivity of the geology.

4.5.3 Discussions have been held with British Geological Survey (BGS)[13] regarding the potential for geothermal heat within the Havant region in terms of the geology. From a preliminary review of the geology, BGS's view was that the area is too far east for using the Sherwood Sandstone as a hot sedimentary Aquifer (as is done in Southampton).

4.5.4 There is a considerable thickness of Lower Greensand, potentially 30-50 m thick at a depth of 400-600 m. This could be a reservoir of relatively fresh water at a mean temperature of 25 deg C. It would require a heat pump for space heating applications, but is possibly a better target than the more accessible chalk which lies at shallower depths.

4.5.5 The other possibility of a deep geothermal option at around 2km below, which could provide direct access to 55-65 deg C water for a low temp heat network.

4.5.6 Based on the geology present the cost of installing sufficient vertical heat loops to supply the required heat at low grade temperatures will be significantly higher than a gas led approach.

4.5.7 Since Havant Borough Council have stated they wish to pursue the most commercially attractive district heating scheme, GSHP will not be considered further within this feasibility study. Further detailed exploration at detailed feasibility is though recommended as combined with a renewable electricity strategy may offer a source of zero carbon energy that a gas led approach cannot provide.

4.5.8 In terms of water source heat pumps, there are no bodies of water within the project area that could offer a meaningful source of heat.

4.6 Waste heat source

4.6.1 Whilst there are no significant sources of waste heat within the Civic Campus, preliminary investigations suggest there may be potential sources within the New Land industrial estate. These will be explored further in the next phase of the study.

4.7 Suitability Summary

4.7.1 A variety of criteria can influence which heat supply technology is the most appropriate choice. The criteria that have been considered within this Options Appraisal are:

- **Technology suitability/risk** – this relates to any geo-spatial constraints and opportunities on the site that may affect suitability of a heat source;
- **Availability of financial support** – certain heat generation technologies have financial support available in the form of incentive schemes such as the renewable Heat Incentive (RHI) and Feed-in Tariffs (FIT) or the recently launched HNIP programme;

[13] Email correspondence with David Boon Engineering Geologist British Geological Survey 31 October 2016

- **Carbon benefit** – different renewable and low carbon technologies offer different carbon saving potential;
- **Heat supply resilience** – a level of risk will be associated with fuel supply and availability for the fuel type required for each heat generation technology;
- **Environmental impact** – heat supply technology may have an impact on various environmental factors including air quality, noise, and visual amenity;
- **Development risk** - there may be planning and economic constraints affecting some heat generation methods such as specific conditions the limit development of a technology type; and

4.7.2 Each heat supply option has been appraised against the above criteria which are given a Red Amber Green (RAG) status and presented in **Table 3.1.**

4.8 Heat Network Investment Programme Funding criteria

4.8.1 To support the development of the UK heat network market a £320m fund has been established by government which will provide funding for 10-30% of capital costs. The first stage of the funding programme, the HNIP pilot was launched in October 2016 with the first schemes for funding expected to be announced in early 2017.

4.8.2 Funding criteria for the full programme is still to be announced but the understanding is that it is likely to be aligned to the funding criteria for the pilot[14]. These are:

- 75% of the heat from non-renewable fuelled CHP;
- 50% of the heat from a renewable source;
- 50% of the heat from any combination of renewable/recovered heat and non-renewable fuelled CHP.

4.8.3 For the purposes of this feasibility study it has been assumed these funding criteria will apply in any future HNIP funding application.

4.8.4 It should be noted that HNIP funding can only be used to support parts of the heat network not already supported by other funding streams. In particular, where proposed district heating schemes include renewable heat technology which attracts RHI funding (e.g. biomass, GHSP), HNIP cannot be used to support the capital costs associated with the renewable heat generation plant.

[14] http://salixfinance.co.uk/system/public_files/hnip_pilot_full_applicant_guidance_2.0.pdf

Table 4.1 RAG Summary of heat supply options

	Technology Suitability/Risk	Availability of Financial Support	Carbon Benefit	Heat Supply Resilience	Environmental Impact	Development Risk
Gas-CHP	Particularly suitable for the industrial, public and commercial sectors	Financial reductions and exemptions are available for a CHP registered as 'Good Quality' with the CHPQA. Potential for HNIP if 75% supply threshold met or in tandem with renewable heat supply	CHP provides reductions in carbon emissions compared to traditional separate heat and power production.	Natural gas resources are considered to be sufficient to provide a secure supply.	Emissions can affect air quality but Havant is not an AQMA. CHP plant will emit ambient noise but should be at an acceptable level given surroundings. Plant can be located so as not to affect visual amenity.	No known planning constraints, though flue emissions will need to meet air quality requirements
Solar Thermal	Established technology - potentially suitable as supplementary heat source	Renewable Heat Incentive available to offset capital costs Supports HNIP funding	Offers kW scale carbon savings	Unable to act as primary heat source but could provide supplementary	No environmental impact	No known planning constraints. Subject to landscape/visual assessment and structural engineering calculations

	Technology Suitability/Risk	Availability of Financial Support	Carbon Benefit	Heat Supply Resilience	Environmental Impact	Development Risk
Biomass	Depending on scale may require large amounts of space required for energy centre and storage areas	Renewable Heat Incentive available to offset capital costs Supports HNIP funding	CO_2 emitted from combustion is offset by CO_2 absorbed in original growth of biomass	Security and sustainability of fuel supply chain	Emissions can affect air quality but Havant is not an AQMA Plant will emit ambient noise but should be at an acceptable level given surroundings Large energy centre and storage space could affect visual amenity	Air quality considerations
GSHP	Significantly affected by underlying ground conditions	Renewable Heat Incentive available to offset capital costs Supports HNIP funding	No on-site carbon emissions although may be carbon emissions relating to supply of electricity to pumps	Not reliant on fuel supply to site	No emissions on site affecting air quality Low levels of noise will be produced by heat pumps Majority of components are underground so out of sight	No known planning constraints but water source heat pumps require abstraction licence from Environment Agency

4.9 Summary

4.9.1 This appraisal has assessed the key heat supply options for a Civic Campus heat network scheme.

4.9.2 It finds that the most feasible technology to support a scheme would be one based on Gas-CHP. However, if HNIP funding is to be targeted the heat provision needs to by 75% from CHP. In addition, there is a potential planning/development risk of CHP heat not delivering future building regulation compliance. Therefore, it is proposed that the heat supply will need to be decarbonised further through the use of renewable heat.

4.9.3 As noted above ground source heat pumps is not considered technically feasible at the site whilst solar thermal is not able to provide the daily/annual heat supply profile suitable for the project requirements. These technologies have therefore not been taken forward in the design proposals.

4.9.4 The proposed solution will therefore consider both Gas-CHP in combination with biomass heating to deliver potential HNIP compliance as well as an option for delivering a Civic Campus heat network in the most cost effective manner. An economic comparison between Gas-CHP and Gas-CHP with biomass has been provided in **Section 6.**

5 Outline Primary Heating Plant Design

5.1 Introduction

5.1.1 The previous sections have identified the heat demand for the key buildings within the Civic Plaza and the most suitable technology to deliver an economic and low carbon heat supply to the Civic Campus area.

5.1.2 This section outlines the proposed design for a heating plant within a Civic Campus heat network.

5.2 Location

5.2.1 From the information provided and site visits undertaken to date the most appropriate option appears to locate the primary heating plant is within the Havant Leisure Centre. There are many advantages to this not least that no land purchase will be required whilst there may be opportunity to readily integrate with existing systems as one of the key demands within the network. The design is constrained to some extent by the space within the existing plant rooms.

Figure 5.1 Existing CHP and gas boiler plant within 'wet-side' leisure centre plant room

5.2.2 A contingency option would be to site new energy plant within one of the planned buildings within the area or a dedicated energy centre could be developed to service the network. However, given the central location of the leisure centre and the planned refurbishment, the proposed site for the primary heat generating plant at the leisure centre.

5.2.3 The leisure centre is owned by HBC and leased under a long term arrangement to Horizon Leisure, with the present lease running until 2042[15].

5.2.4 Two CHP units currently housed within the main 'wet-side' leisure centre plant room are disconnected. These along with the associated gas boilers are due for replacement during in the near future. HBC is reviewing a business case for replacement of the existing plant so the intention is that the findings of this study inform the business case put forward for the leisure centre.

[15] Havant Borough Council

5.2.5 The space requirements have been assessed against standard CHP plant sizing drawings dimensions for systems manufactured by ENER-G which are available from the ENERG website[16]. A marked up version of the leisure centre masterplan is provided in **Appendix A**.

5.3 Outline Plant Design

Preferred option - Gas Fired CHP, Biomass Boiler & Existing Boilers being retained for Peak Lopping & Backup

5.3.1 In line with HBC's stated objectives for a potential DHN scheme in the area, the focus in considering the design options is to maximise the potential economic benefit associated with the scheme. This includes both employing the lowest cost heat supply option whilst also ensuring the design option aligns to the potential to access available funding and incentives including HNIP.

5.3.2 The Heat Networks: Code of Practice for the UK (CP-1)[17] states that a CHP plant would typically be sized to provide between 60% and 80% of the total heat demand of a scheme with the balance from gas fired boilers. However, with a view of securing HNIP funding the inclusion of a biomass boiler will ensure that at least 50% of the annual heat demand is derived from a combination of low and renewable carbon heat source.

5.3.3 The inclusion of a thermal store into the primary network will enable the thermal generation and demand profiles to be smoothed. The biomass boiler will also connect to the thermal store via its own primary circuit thus enabling it to operate in addition to the CHP or on its own at a steady state rather than attempting to follow the demand profile which biomass boilers are not best suited.

5.3.4 The existing boiler plant and pumps etc. are to be retained or in the case of the leisure centre refurbished and/or replaced to operate as peak demand lopping/top up boilers and full load back-up should the CHP and biomass plant be disabled for maintenance etc.

5.3.5 For the preferred option, it is proposed that a natural gas fired CHP plant be installed. The current calculations are based upon an Ener-G 165 set which generates 165kWe (electrical) and 286kWth (thermal)[18]. To minimise the amount of generated electricity being spilt to grid with little or no financial return this CHP will operate at a maximum of 15-hours per day (in line with leisure centre operating hours). This has the potential for a CHP operating between 4,900 and 5,500 hours per annum[19]. In addition, it is propose that wood-pellet fired 150kWth (minimum) boiler be installed to provide additional heat during the shoulder and winter months typically October to May or 243-days per annum.

5.3.6 For the core scheme of just the Phase 1 sites comprising the leisure centre and civic plaza building, operating the CHP and biomass to the fullest extent would lead to amount of heat generated being 'dumped' (over 30%) leading to system inefficiency.

5.3.7 Refining operating hours to mitigate heat being lost in this way and aligning heat generation to heat requirements leads to a predicted heat supply profile for the preferred design option as shown in **Figure 5.**2. This is based on annual operating hours of 4,614 for the CHP and 3,478 for biomass. This equates to an average of 14 hrs a day of CHP operation.

[16] http://www.energ-group.com/combined-heat-and-power/information-centre/#

[17] Section 3.10.1 - CIBSE Heat Network Code of Practice for the UK (CP-1) 2015

[18] http://www.energ-group.com/media/373692/e165%20sales%20datasheet.pdf

[19] Depending on the availability factor i.e. range represents 90-100% availability

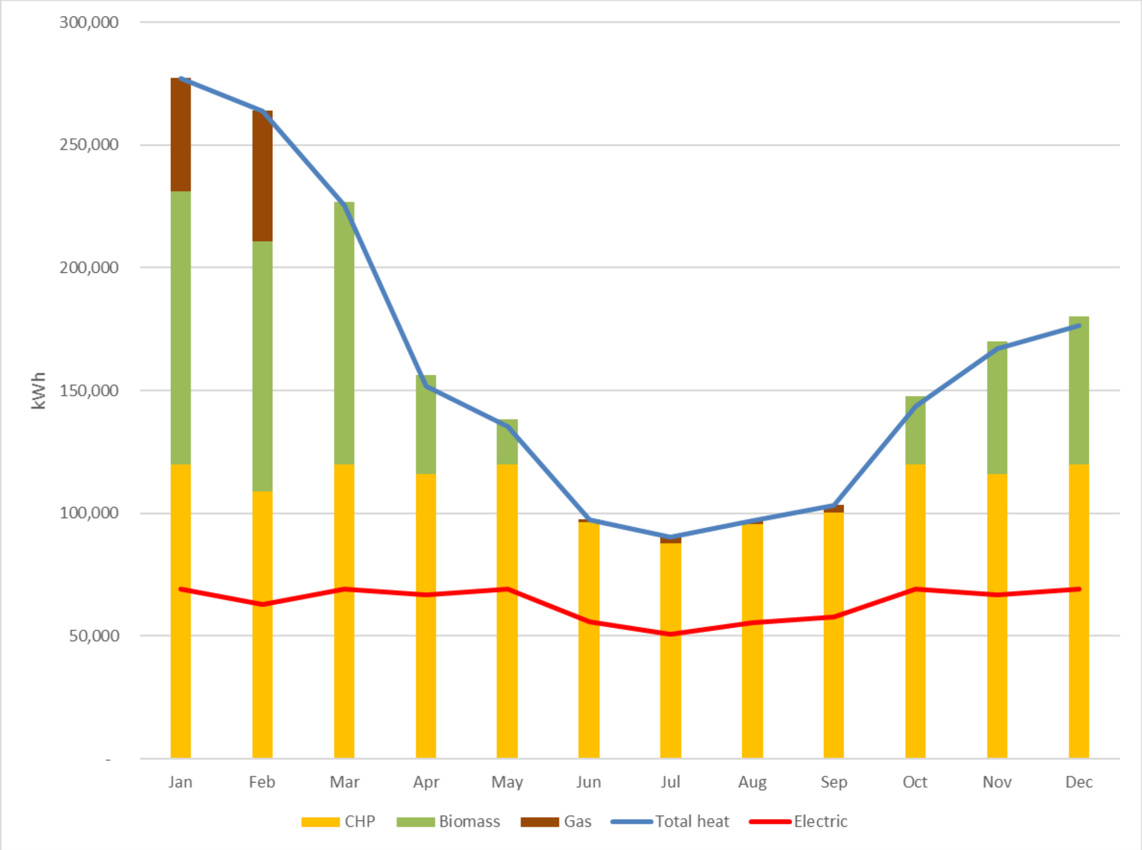

Figure 5.2 Heat supply profile for Havant Heat Network by fuel type – Phase 1 only (165kWe CHP, 150kW biomass)

5.3.8 The CHP electrical generation will be primarily used to offset electricity imported by the leisure centre and via the addition of a private wire connection the Civic Offices with any surplus generation being either spilled or sold to grid depending upon the actual quantum of generation.

5.3.9 In order to determine the likely excess of power to supply from the leisure centre to the civic plaza, a typical electricity demand profile for both sites has been compared to a 165kWe CHP operation. By adjusting the operating hours it is possible to minimise the likely spill to grid thus maximising the higher value use of the electrical generation to offset power demand within the buildings. **Figure 5.3** shows that when operating 14 hrs a day there will be minimal spill to grid. As noted above this level of generation also minimises heat dumping for the Phase 1 site demand.

5.3.10 **Appendix B** includes further analysis of power generation/export profiles.

5.3.11 It is apparent that, based on these estimated supply profiles, the majority of the power will be used within the leisure centre. The business case for the private wire connection to the Civic Plaza is considered further is **Section 5.8** whilst **Section 7** assesses the impact of varying levels amounts of electricity export. It is recommended that further analysis of the likely offset/export is undertaken at detailed design through monitoring of site power profiles.

5.3.12 As heat demand on the proposed network increased the CHP and biomass output can be increased accordingly generating higher revenues from electrical generation, RHI, in addition to the heat sales.

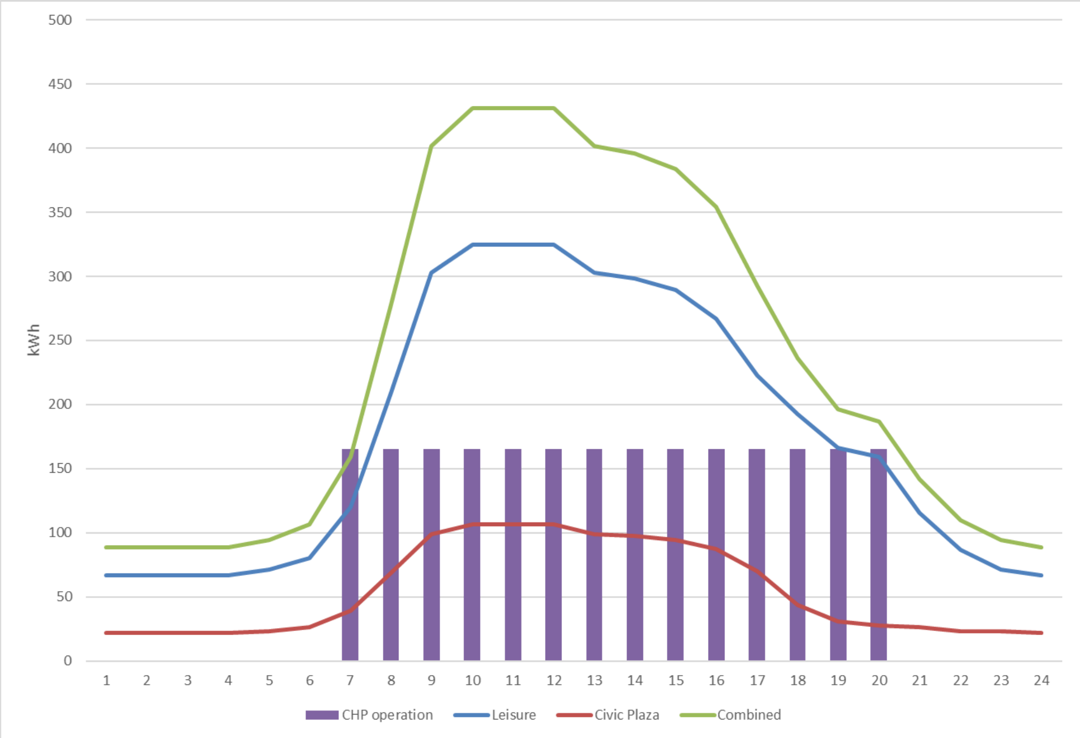

Figure 5.3 Typical daily electrical demand profiles for Civic Plaza and Leisure Centre compared to CHP electrical generation (165kWe, 14hrs)

Alternative option – Gas Fired CHP only & Existing Boilers being retained for Peak Lopping & Backup

5.3.13 This option derives 100% of the heat from gas-CHP and (existing) gas boilers with the omission of the biomass boiler. To qualify for HNIP funding the percentage of annual heat supply derived from the CHP will need to increases to 75% hence the operational hours and/or the size of the CHP will have to increase.

5.3.14 The option of increasing the operating hrs of the 165kWe CHP was first considered. This supply profile for this is shown in **Figure 5.4**

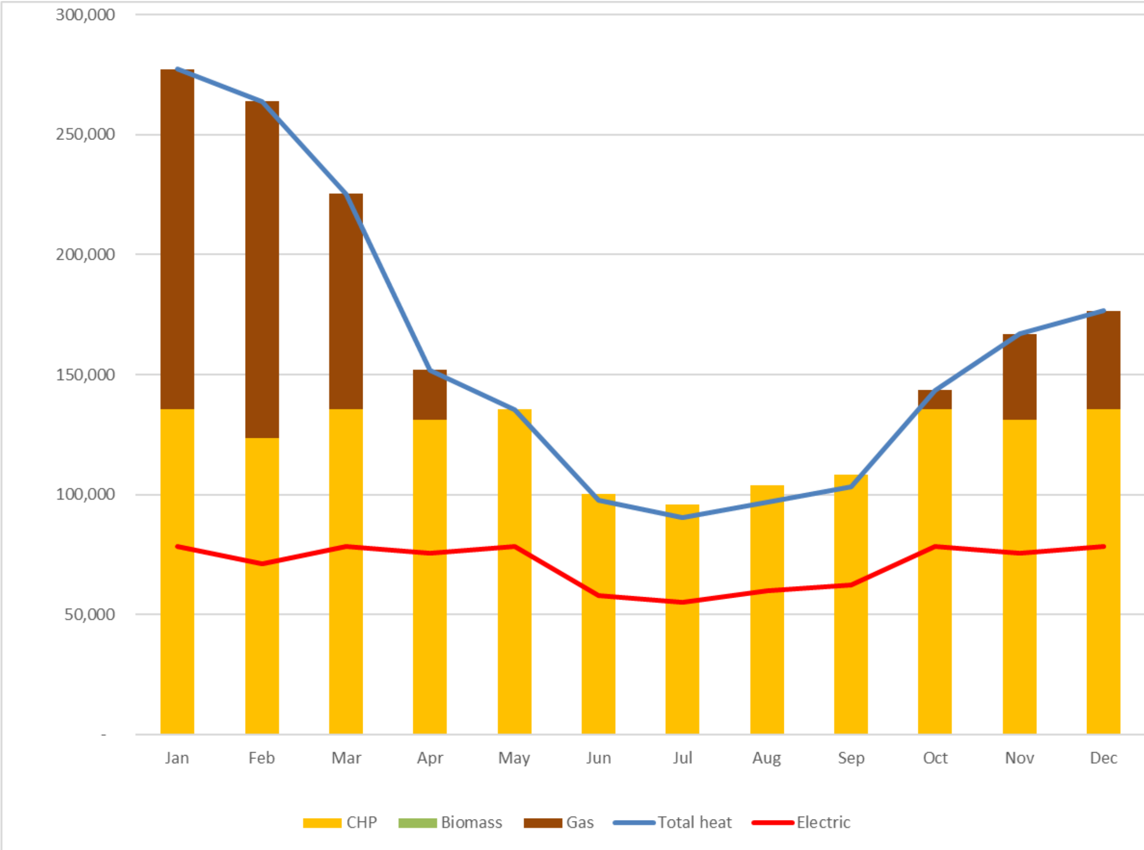

Figure 5.4 Heat supply profile for Havant Heat Network by fuel type – Phase 1 only (165kWe CHP only, 5148 hrs @ 90% availability)

5.3.15 This shows that by increasing the hours but still minimising heat dumping it is possible to meet the 75% HNIP threshold though only just. Furthermore, based on the current modelling this would mean that around 15% of the power generation would be exported to grid.

5.3.16 An alternative approach is to increase the size of the CHP. One option is a 310kWe unit which generates 310kWe (electrical) and 362kWth (thermal) the set would run for circa 4,500 hours per annum generating approximately 1,600MWth and 1,400MWe. This is shown in **Figure 5.5**.

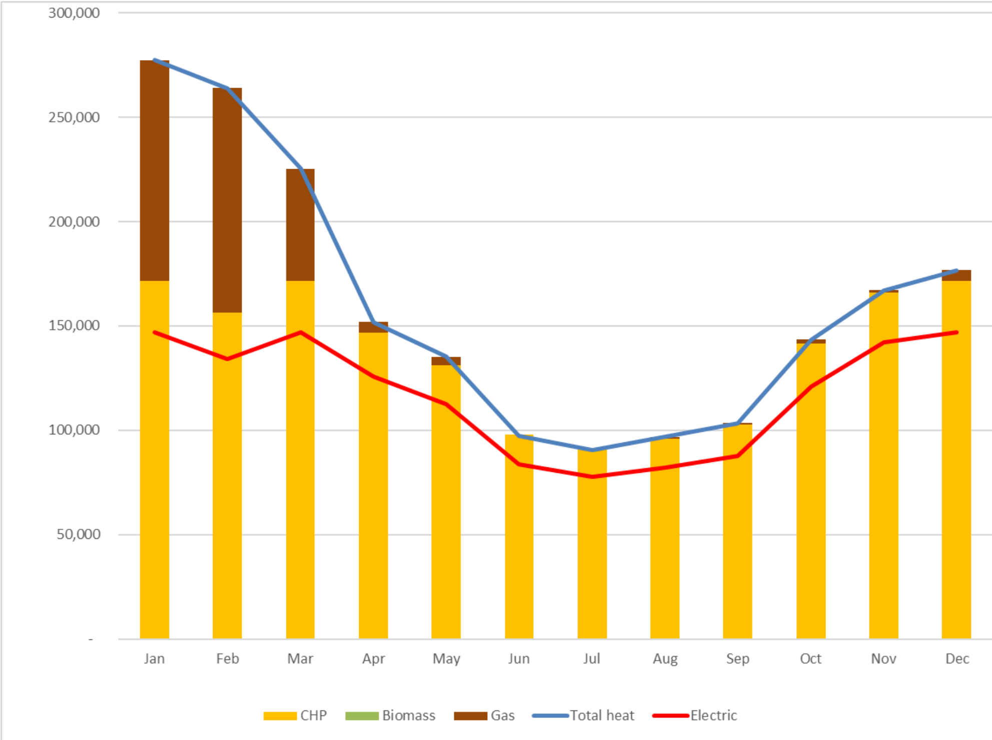

Figure 5.5 Heat supply profile for Havant Heat Network by fuel type – Phase 1 only (310kWe CHP only, 4,542 hrs @ 90% availability)

If increased to operate average 17hrs a day (5,588 hrs per year at 90% availability) this would increase the generation of electricity and therefore improve the business case but will result in 18% of heat being dumped as shown in **Figure 5.6**.

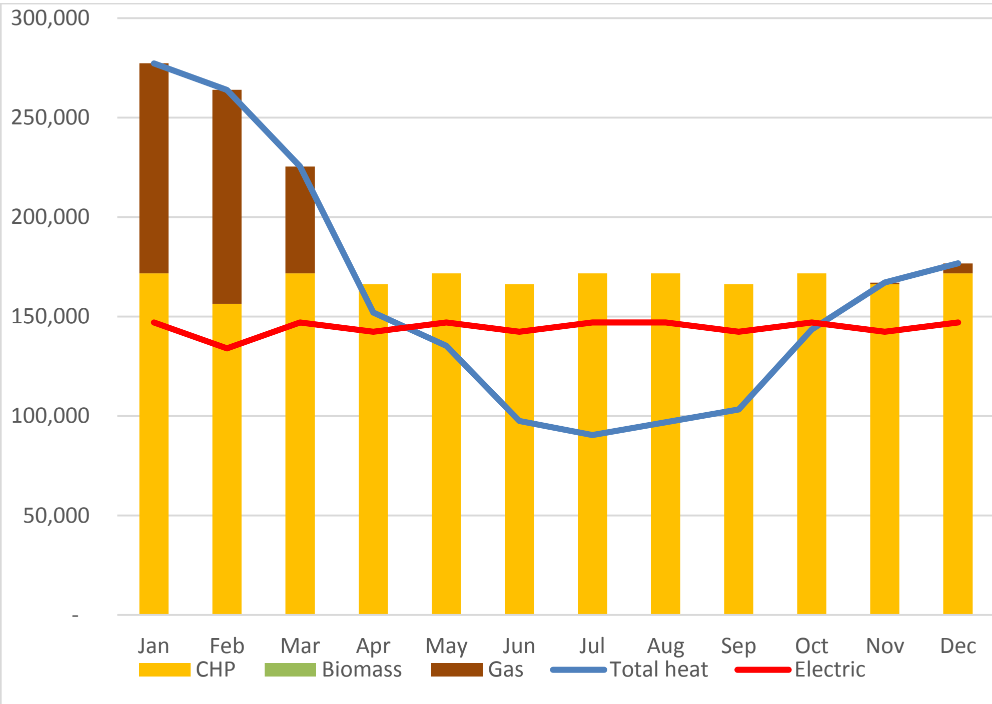

Figure 5.6 Heat supply profile for Havant Heat Network by fuel type – Phase 1 only (310kWe CHP only, 5,588 hrs @ 90% availability)

5.3.17 This option does not provide the flexibility of the preferred option as the CHP is large relative to the summer load, this is likely to result in the CHP operating with multiple starts through-out the day which is not considered good practice as it reduces life expectancy and maintenance intervals and therefore increases on-going (OPEX) costs.

5.3.18 In addition, a significant amount of electricity would be exported or spilt to grid for reduced financial benefit when compared to offsetting site power demand.

5.3.19 Lastly there are further air quality impacts to consider for larger CHP units. For example the ENER-G E310 unit has nitrous oxide (NOx) emissions of 250mg/Nm3. To reduce these further would require the incorporation of an additional pollution control device for an additional £65k.

5.3.20 Analysis shows that under the current demand assumptions, a 165kWe CHP scheme would present an optimal primary heat solution from an economic perspective. The addition of a biomass boiler allows for the potential application for HNIP funding. For the purposes of undertaking an economic appraisal in **Section 7**, we have used the design solution of a 165kWe CHP alongside a 150kW biomass boiler.

5.4 Thermal Storage

5.4.1 Incorporating thermal storage within a network can bring significant benefits, they smooth out the differences between the heat generation and consumption demand profiles; enabling the heat generating plant to run more efficiently for longer periods of time.

5.4.2 A thermal store for the proposed Civic Campus scheme, is estimated to require a volume of circa 30,000 L; however, in line with the Heat Networks: Code of Practice for the UK (CP-1)[20] consolidated hourly modelling and simulation will need to be undertaken during detail design to confirm this. It should be considered during this detail design stage as to whether to upsize the thermal store or ensure the primary network permits additional stores to be included at a later date to provide greater long-term flexibility should the generation technology or the demand profile change or the network overall demand increase.

5.4.3 We propose to locate this store externally and adjacent to the east leisure centre building where it will be screened by the building (see **Figure 5.7**). Whilst the site has been visually inspected the surface area for existing utilities a ground survey will be required to determine ground load bearing capacity and suitability.

5.4.4 The Heat Networks: Code of Practice for the UK (CP-1)[21] states that a thermal store should have a height to diameter ration of at least 2:1 however in the proposed location a ratio of 3:1 or more should be possible. This higher ratio combined with low pumping velocities and the use of baffles within the store should ensure good thermal stratification.

[20] Section CIBSE CoP Section 3.11.1

[21] CIBSE CoP Section 3.11.4

Figure 5.7 Possible location for thermal store outside existing 'wet-side' plant room

5.5 Biomass storage and logistics

5.5.1 A key consideration in the use of biomass for heating is the space for storage of the biomass fuel and the accessibility of this for delivery vehicles.

5.5.2 The proposed site for the location of the biomass store is outside and adjacent to the leisure centre's 'dry-side' plant room (see **Figure 5.8**). There is an existing walled off area which could be reconfigured as a store or alternative a dedicated storage could be sited within 1 or 2 car parking spaces.

5.5.3 The location affords excellent access for potential biomass deliveries whilst the location of the existing chimney means the required flue for the biomass boiler could potentially be accommodated within, subject to structural survey. If it proved unfeasible to house within the existing chimney a separate and dedicated flue could be installed.

Figure 5.8 Proposed location for biomass storage outside existing 'dryside' plant room. Existing chimney could be used to house biomass flue, subject to structural survey.

5.6 Operating temperatures

5.6.1 It is proposed that the primary circuit should operate with a flow temperature set point of 85⁰C or possible 90⁰C should the CHP and biomass plant permit, with the secondary network operating at 70⁰C to minimise system and network losses whilst still being a high enough temperature to meet the demands and operating conditions of the existing buildings building services.

5.6.2 As part of the detailed design development, the compatibility with the existing buildings heating infrastructure (operating temperatures) will need to be assessed in order to determine whether any modifications are required.

5.6.3 The Heat Networks: Code of Practice for the UK (CP-1)[22] states that the differential temperature; the temperature difference between the flow and return circuits should be at least 25⁰C and ideally 30⁰C greater. As such a minimum system return temperature of between 45⁰C will be required although a 40⁰C return temperature should be targeted and adopted for design purposes to minimise system thermal and pumping losses and to ensure good stratification in the thermal store is achieved.

5.6.4 An illustration of the proposed primary plant layout including operating temperatures is shown in **Figure 5.9**

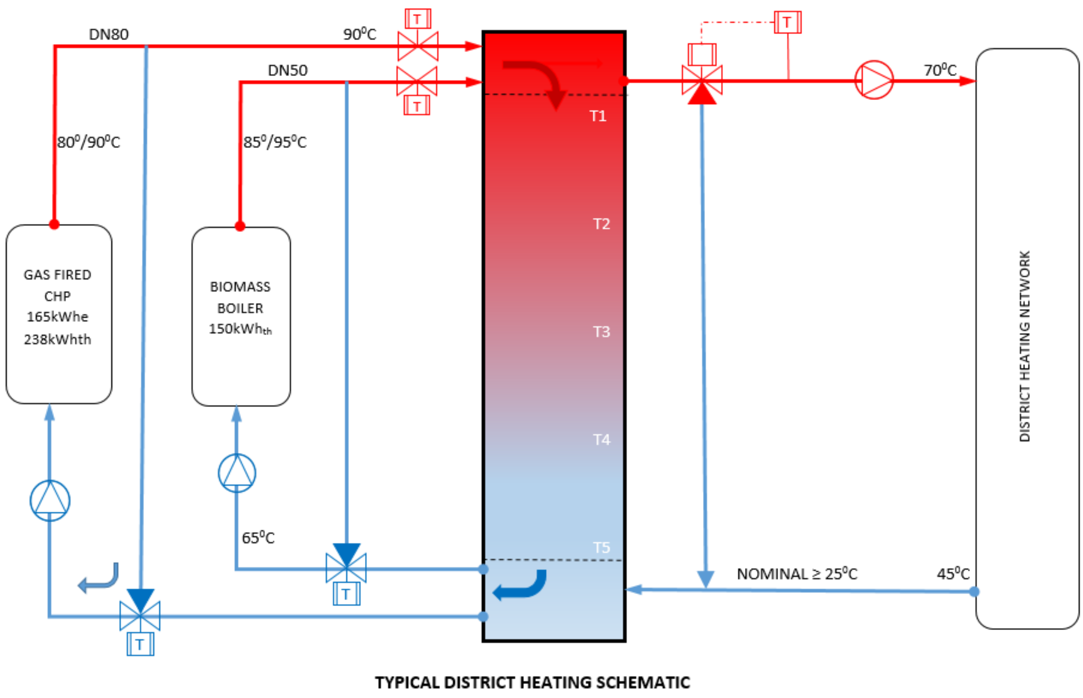

Figure 5.9 Illustrative layout of proposed Civic Campus energy centre

5.7 Primary heat exchanger

5.7.1 Each building which is proposed to connect to the network will need to accommodate a primary heat exchanger (PHE) to transfer the heat from the primary heating distribution network to the buildings heating distribution system.

5.7.2 Site visits to a number of the Civic Campus plant rooms have identified that there is, in principle, sufficient space available to accommodate the PHEs, for example see **Figure 4.9**.

[22] CIBSE CoP Section 2.4.4

Further surveys would be required at detail design in order to confirm the exact PHE location and interface with existing building heating infrastructure.

Figure 5.10 Space available to accommodate new plate heat exchanger to connect to district heat network (Havant College Sports Hall Plant Room, Havant Health Centre)

5.8 Private wire solution

5.8.1 The use of CHP as the primary heat generation technology provides the added benefit of electricity generation. This power can be used on site to offset on site power use thus saving cost on electricity purchase. Depending on the quantity and profile of power produced, there may be the potential to export 'excess' generation. Conventionally, this excess power tends to get exported or 'spilled' the grid. Depending on the quantity the grid operator may pay the generator for this though usually only 4.5p/kWh.

5.8.2 Alternatively, it is possible to export power to nearby electricity users through a so called 'private wire'. The close proximity of the Civic Plaza to the Leisure Centre present an ideal opportunity to explore this with electricity supplied by a Leisure Centre CHP feeding directly into the Plaza building electricity network thus off-setting grid electricity purchase.

5.8.3 It is estimated that a 70mm square copper/SWA cable suitable for a maximum of 50kWe/100Amp will be required to be installed between the CHP and the incoming meter room/switchboard located in front of the Civic Centre.

5.8.4 Budget costs have been included with the economic appraisal (**Section 7)** for this private wire along with sensitivity analysis of the impact of different levels of on-site power consumption of electricity generated by the CHP.

5.8.5 As noted in the electrical supply/demand curve analysis **Section 5.3**, **based on the current assumptions a 165kWe system,** only a small proportion of the power generated would be available for supply to the Civic Plaza building (with the majority used within the leisure centre). Our analysis suggests the volume exported to the Plaza annually may be around 16,500kWh.

5.8.6 At this level, an assumed electricity price at the Civic Plaza of 10p/kWh and an estimated private wire cost of £40,000, it would take around 25years to 'payback' this investment. However, with the proposed install of the heat network pipework and the additional resilience this can provide to electrical supply to the Civic Plaza. In addition, should CHP operation be increased in the future in line with heat demand growth, more power would be available for export. On this basis it would still appear to be a sensible investment.

5.8.7 A further option being explored by some smaller electricity generators (including local authorities) is the Licence Lite[23] arrangement being promoted by Ofgem. This is where power

[23] https://www.ofgem.gov.uk/licences-codes-and-standards/licences/licence-lite

generated locally is supply/sold locally, but rather than via a dedicated private wire, this solution uses the existing electricity network through a commercial arrangement with the licence district network operator (DNO). To this extent it can be considered a ‘virtual private wire’. However, since it involves payment to DHNO for use of their network, it is less financially attractive than a true private wire.

5.9 Summary

5.9.1 This section has set out the proposed design for the primary heating plant for a Civic Campus scheme.

5.9.2 The preferred option is for a gas fired CHP system sited at the Havant leisure centre with supplementary biomass heating included in order to further decarbonise the scheme and secure potential HNIP funding. The solution is supported by a thermal store which allows the heat generating plant to run more efficiently for longer periods of time. Plate heat exchangers facilitate connection of the heat network to connected buildings heat infrastructure.

5.9.3 The solution also includes for a proposed ‘private electricity supply’ from the leisure centre to CHP to the Civic Plaza electricity network in order to reduce grid electricity import costs to the Plaza.

5.9.4 The next section describes the proposed heat network routing between the primary energy plant and the proposed heat customers within the Civic Campus.

6 Energy Distribution Routing and Design

6.1 Introduction

6.1.1 Key to establishing the feasibility of a heat network within Havant is the ability to construct a primary heat distribution system from an engineering, and planning perspective. In addition, the route and design needs to consider the most cost effective route and design proposal.

6.1.2 This section outlines the approach to determining an appropriate heat distribution system that would connect the primary heating plant at Havant leisure centre to the identified sites of demand within the Civic Campus.

6.1.3 It considers potential outline design proposals in order to allow an estimate of primary pipework costs to be assessed for the economic appraisal.

6.2 Proposed distribution routing and constraints

6.2.1 The scope of the study and existing road layout dictates the primary heat network route options both within the Civic Campus and possible connection to New Lane.

6.2.2 An indicative routing was prepared for the purposes of the utility searches as shown in **Figure 6.1**. In particular, the option of taking a route directly from the Civic Campus to New Lane via Crossland Drive was explored. Records of existing utility infrastructure was then sought for these routes.

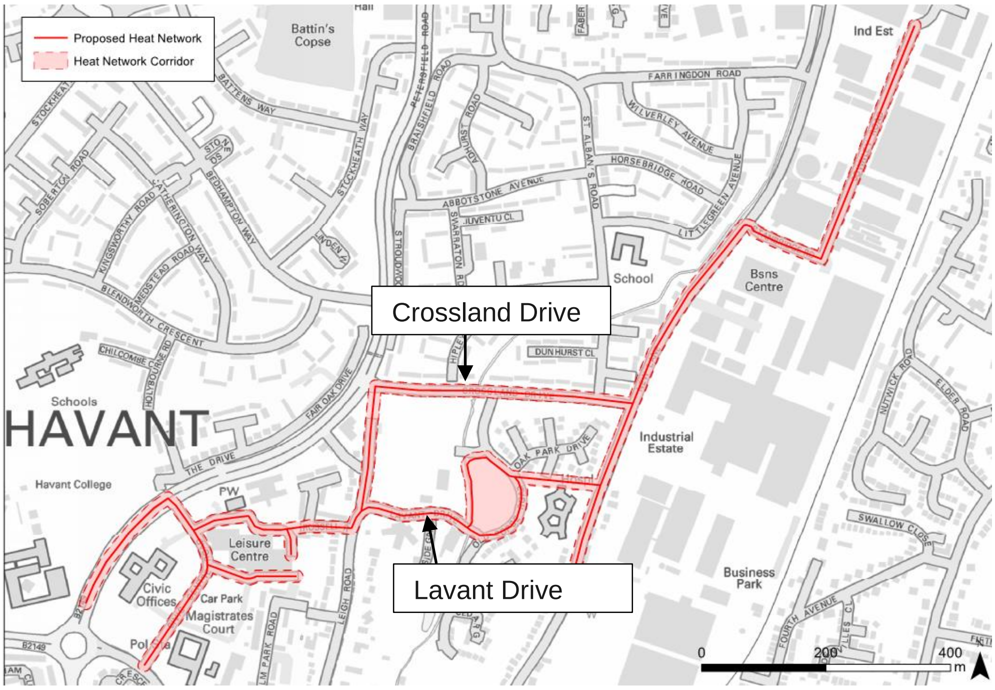

Figure 6.1 Proposed heat network routing for utility search[24]

6.2.3 The results of the utility searches are provided in **Appendix C**. This identified the main existing utility infrastructure along the proposed heat network corridor including gas, electricity, communications and water/drainage.

[24] (Contains Ordnance Survey data (c) Crown copyright and database right 2016. (c) Crown copyright and database rights 2016. Ordnance Survey 0100031673.)

6.2.4 One of the key outcomes of this were that Crossland Drive is already significantly congested with existing utility infrastructure and therefore a connection to New Lane would be best facilitated via Lavant Drive.

6.2.5 This route offers the further advantage of placing the network alongside the three NHS buildings and the potential development site north of Lavant Drive facilitating potential connection to these sites.

6.2.6 In addition to the utility searches, HBC provided details of existing land ownership as shown in **Figure 6.2**.

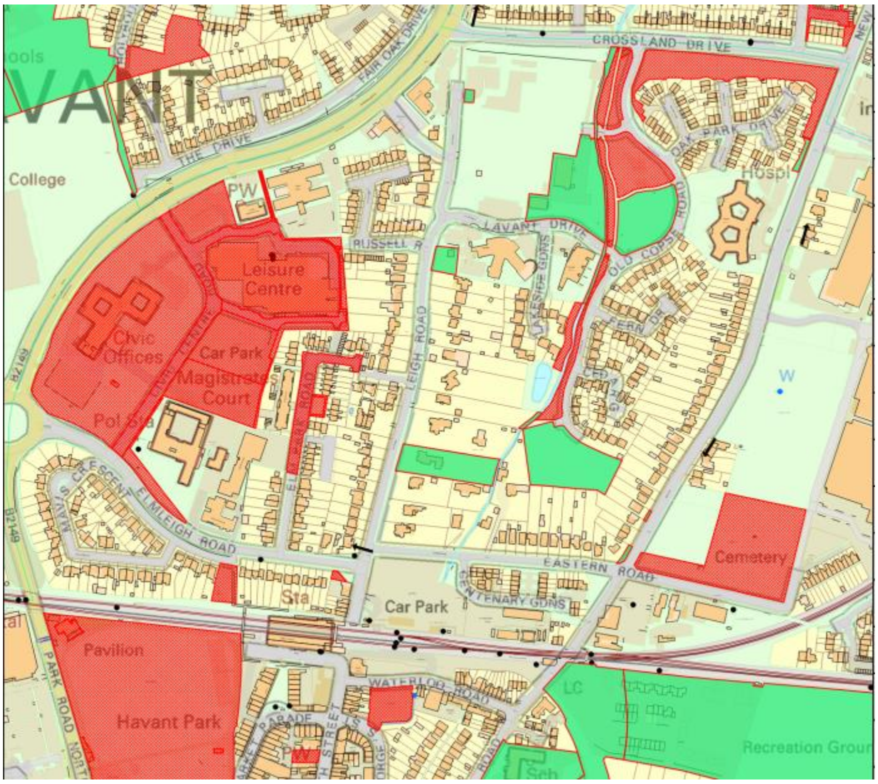

Figure 6.2 Land ownership in Civic Campus (Red = Havant Borough Council, Green = Hampshire County Council)[25]

6.2.7 This information was used to inform a primary network design which is represented in **Figure 6.3.** The outline pipe design with proposed pipe sizing is provided in **Appendix D.**

[25] Contains Ordnance Survey data (c) Crown copyright and database right 2016. (c) Crown copyright and database rights 2016. Ordnance Survey 0100031673.

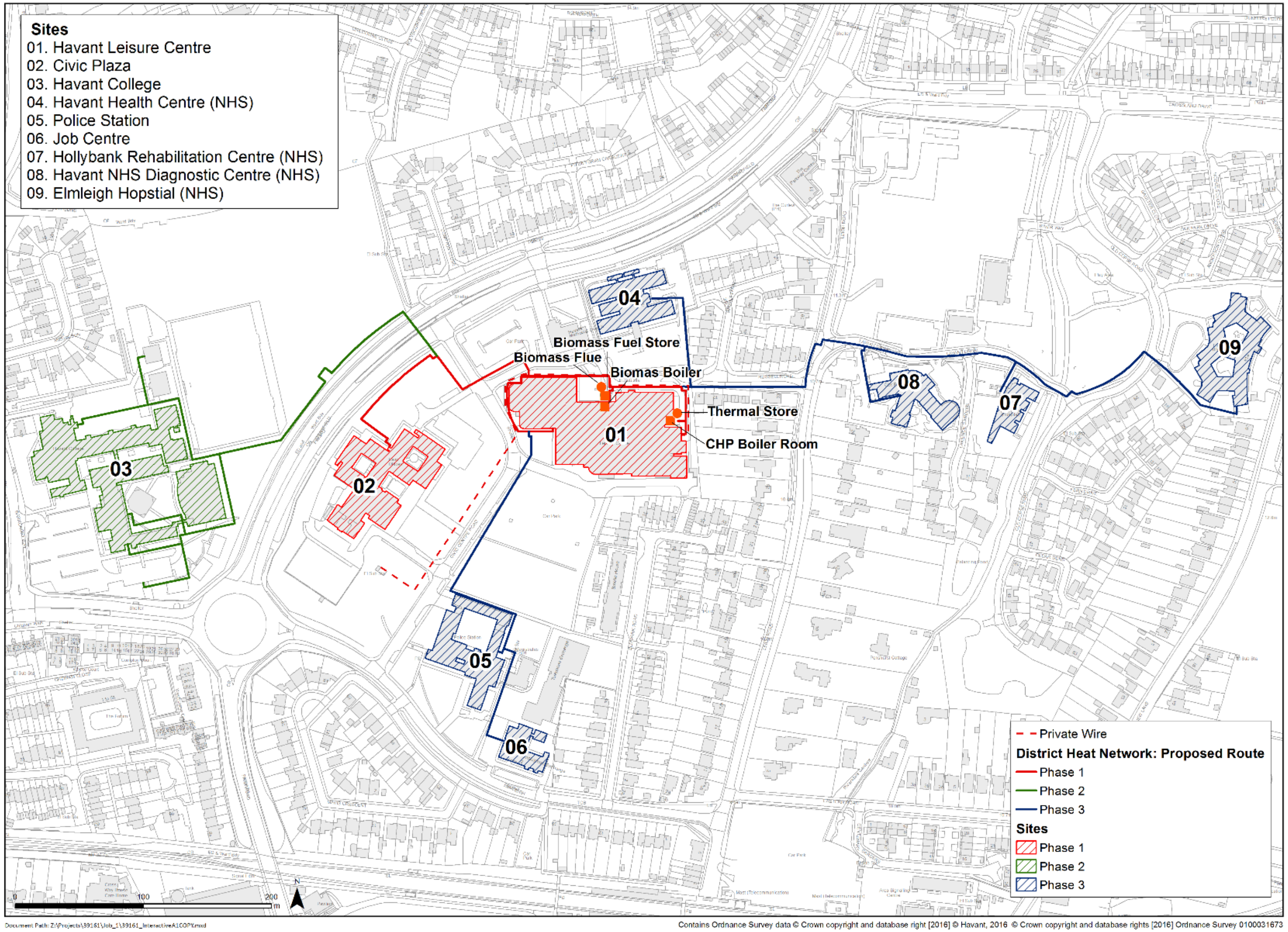

Figure 6.3 Proposed primary network design- Civic Campus (an Interactive PDF of this scheme design is shown in **Appendix E**) (Contains Ordnance Survey data (c) Crown copyright and database right 2016. (c) Crown copyright and database rights 2016. Ordnance Survey 0100031673.)

6.3 Pipe selection and heat losses

6.3.1 Preinsulated pipe consists of a carrier pipe which conveys the heated water from the point of generation to the point of use via (in most cases) a plate heat exchanger which hydraulically separates the heat network from the internal building services. This carrier pipe is encased in a larger outer pipe or casing with the void between the carrier pipe and casing being filled with an expanding PUR foam[26] during the manufacturing process. This foam cures to form a mechanical bond between the carrier pipe and the outer casing.

Figure 6.4 Image of typical pre-insulated heat pipe

6.3.2 Preinsulated pipe is manufactured with either single pipe or twin carrier pipes (one for flow and one for return) installed within a single outer casing. The twin pipe systems are more commonly utilised on new build, level ground projects as it is not as flexible to install as two single pipes in heavily congested areas. In addition, different thicknesses of insulation can be applied to the individual carrier pipes, these higher levels of insulation reduce the heat loss thus resulting in lower annual operating costs.

6.3.3 There are various standards of pipe ranging from Series-1 to Series-4 with increasing thickness of insulation being applied to the carrier pipe, this increase in insulation results in lower heat losses. The cost difference between Series 1 and 2 insulation is negligible, this increases to circa 15% material costs between Series 2 and 3 and a further 15% between Series 3 and 4, although Series 4 at the larger carrier pipe sizes is seldom used due to its overall diameter.

6.3.4 Heat loss calculations for the proposed pipework are provided in **Appendix F** for Series-2 pipework whilst estimated pipe diameters are presented within the pipework routing drawing **(Appendix D).**

6.3.5 A 15% network loss factor has been applied across all scenarios[27]. This is based on the 7% losses calculated for Series-2 pipework in **Appendix F** with a further 8% allowed for other system standing thermal losses.

6.3.6 Series-3 pipework over and above Series-2 pipework offers a nominal reduction in annual heat losses sustained by the network of 44,798kWth (13%) the increased capital cost for Series 3 over Series-2 would be circa 8%-to-10% of the mechanical install costs associated with the network or circa £25,000-to-£35,000 which equates to a 4-to-5 year payback for this additional investment. The options could be further assessed at detail design depending on final scheme scope and more detailed financial analysis.

[26] Polyurethane foam

[27] This excludes losses associated with the buildings internal pipework

6.3.7 Should Series-4 be utilised over Series-2 the reduction in nominal heat loss is 78,552kWth (23%) which would result in a payback period of approximately 7-to-8 years.

6.3.8 For the purposes of the economic modelling we have assumed Series-2 pipework.

6.4 Summary

6.4.1 This section has explored the potential to route the primary pipework for a Havant Civic Campus heat network emanating from the leisure centres to the other Civic Campus between the sites identified for possible connection to a scheme.

6.4.2 Preliminary desktop and site surveys indicate that there are no major existing constraints to the proposed route. However, a necessary activity during detailed design would be routing proving including via GPR (Radar) surveys to confirm location of existing utility infrastructure.

6.4.3 A proposed pipe design has been put forward. Again this would need to be confirmed at detailed design once final building loads and heat supply option has been confirmed.

6.4.4 Based on the proposed network design, preliminary costs have been determined which will feed into the economic appraisal in the next section.

7 Outline Economic Appraisal

7.1 Introduction

7.1.1 An economic appraisal has been undertaken of the potential economic value of delivering a heat network within Havant Civic Campus. This has focussed on the preferred primary heat option of a gas-CHP with 150kW biomass boiler as set out in **Section 5**. Additional analysis has been undertaken for a gas-CHP only approach. Solar thermal and heat pump technology were discounted within **Section 5** and therefore have not been assessed at this stage.

7.1.2 The following section sets out the method and assumptions made within the assessment and the potential economic returns that could be achieved based on a number of high level variables.

7.1.3 This is a high level economic appraisal only to inform the potential for establishing an outline business case for the delivery of a heat network in Havant based on a number of assumptions. Any decision for the investment into a heat network will require further financial assessment.

7.2 Capital cost assumptions

7.2.1 The financial viability analysis is a function of capital costs verses operational returns.

7.2.2 The primary capital costs in developing the proposed Havant Civic Campus heat network are set out in **Table 7.1**. A breakdown of the primary costs is provided in **Appendix G.**

Table 7.1 Heat network cost elements

Cost element	Estimate cost (£)	Source/comment
CHP (Ener-G 165kWe)	£164,000	Includes supply, install and commission of set, acoustic enclosure, flue etc (ENER-G)
Biomass Boiler (150kW)	£25,000	Estimate
Thermal Store	£37,500	30m^3 at £1250/m^3 (rate assumed external installation)
Biomass Fuel Store and Flue	£40,000	Estimate
Ancillary Pipework[28]	£70,000	Within leisure centre plant rooms
CHP Private Wire (Leisure centre to Civic Plaza)	£42,000	Includes cable, civils (trench share with pipe) and switchgear

[28] includes connections to existing/proposed HLC gas boiler plant, thermal store connection and pipe run to the biomass boiler

Cost element	Estimate cost (£)	Source/comment
Primary Pipework	Phase 1 £465,000 Phase 2 £454,000 Phase 3 £681,000	Powerpipe[29] material costs and Eneteq estimates of civil engineering costs based on previous projects[30]
Plate heat exchangers in connected buildings	£239,500	11No. PHEs assumed

7.2.3 An overall 10% contingency factor has been applied to the total capital costs within the cash flow model. As the business case is refined, HBC will need to determine what level of contingency they wish to apply.

7.2.4 In addition, the following uplift factors have been applied to determine a 'gross' cost[31] as agreed with DBEIS:

- Contractor engineering, procurement and OH&P32 10%
- Professional fees (Design and legal fees) 10%

7.2.5 For the purposes of the cash flow model, and as set out in **Section 6,** a **15%** primary heat network loss factor was assumed to determine what heat supply would be needed to meet the anticipated demand.

7.2.6 As described in **Section 5**, no cost provision has been made for additional back up since this is assumed to be provided the existing boiler plant within the connected buildings.

7.2.7 A summary of the other key cost assumptions used in this economic assessment is given in **Table 7.2** below.

Table 7.2 Cost assumption used in Heat Network Cash Flow Model

Cost Element	Value used in model	Assumption
Primary Fuel	2.7p/kWh	'Average' cost of gas for core Civic Campus buildings. Future projection based on DECC central price forecast
Biomass fuel	4.4p/kWh	Wood pellet (Rural Energy)
RHI	Tier 1 2.9p/kWh Tier 2 2.1p/kWh	RHI rates from 1st April 2017

[29] Based on Powerpipe Systems AB

[30] A breakdown of the primary pipe costs is provided in **Appendix H**

[31] CHP and Pipework costs quoted are inclusive of both Pre-lims and OH&P so the overall percentage uplift has been reduced accordingly

[32] Overhead and profit

Cost Element	Value used in model	Assumption
Electrical sales/off-set	11p/kWh	Current leisure centre electricity price. Future projection based on DECC central price forecast
Electrical export price (to grid)	4p/kWh	Typical industry. Future projection prorated linked to DECC central price forecast
Pumps	11p/kWh	Current leisure centre electricity price. Future projection based on DECC central price forecast
Operation & Maintenance (O&M)	3% of capex/annum	Reasonable allowance to fund maintenance staff for life of project, plant replacement and metering and billing
Administration	0.25 % of capex/annum	Reasonable allowance to fund Administration for life of project
Insurance	0.10% of capex/annum	Reasonable allowance to cover Insurance for life of project
Business rates	0.20% of capex/annum	Reasonable allowance to cover business rates
Inflation	2.5%	Government target rate. Used for non fossil fuel related inflation

7.3 Heat price

7.3.1 As with other utility charges the price paid for heat is usually made up of two elements; a variable rate per unit of consumption and a fixed rate (standing charge) to cover the non-heat supply costs associated with running the network.

7.3.2 The price of selling heat is the key variable to all heat network projects. The inconsistency in pricing across the heat network market comes from every scheme setting the price to make a fair economic return.

7.3.3 For this reason and for the base case it was decided to use the 'current' price of heat paid by potential heat customers as the model input. Engagement with potential customers within Havant Civic Campus has determined the typical 'current' heat price of around **4.5p/kWh**.[33]

7.3.4 To keep the analysis simple, a flat price of heat has been assumed (i.e. no standing charge or connection charges included) to allow for a transparent assessment of heat pricing on the economic case. The impact of a differing heat price is considered as part of the sensitivity analysis below.

7.3.5 It is recommended that the current heat price is assessed further as part of a detailed design and further commercial discussions with potential customers in order to ascertain a price of

[33] This includes the total cost of gas, an annualised costs of boiler replacement and an assumed O&M rate of 3% of the cost of the plant. This price has been checked with key stakeholders.

heat which will be low enough to attract customers but also sufficient to deliver a viable business case.

7.4 Modelled scenarios

7.4.1 In order to explore the impact of different heat supply, phasing and price on the business case, a range of scenarios were modelled. These were:

Scenario 1 - CHP and Biomass, Phase 1 sites, No HNIP

Scenario 2 - CHP only, Phase 1 sites, No HNIP

Scenario 3 - CHP and Biomass, Phase 1 sites, 30% HNIP

Scenario 4 - CHP and Biomass, Phase 1&2 sites, 30% HNIP

Scenario 5 - CHP and Biomass, All civic Campus sites, 30% HNIP

7.4.2 Cashflow models are provided for each of these scenarios in **Appendix I**. The results of this modelling is summarised below.

7.5 Scenario 1 (gas CHP with biomass boiler)

7.5.1 A 40 year cash flow model has been developed using the above assumptions and assuming just the Phase 1 sites are connected (Leisure Centre and Civic Plaza).

7.5.2 The outcome of this assessment is shown in **Table 7.3** and **Figure 7.1** below.

Table 7.3 Economic assessment of Heat network

Economic assessment parameter	Value
Project length	40
Project cost (Gross) inclusive of HNIP where applicable	£1.16m
Heat price (p/kWh)	4.5
Cumulative position	£515k
Average annual income	£13k
Year 1 income	£179k
Year 1 Expenditure	£157k
Payback (years)	32
25 year Internal Rate of Return (IRR)	-2.0%
30 year Internal Rate of Return (IRR)	-0.3%
40 year Internal Rate of Return (IRR)	1.7%
Net Present Value of Investment (NPV)	-£342k

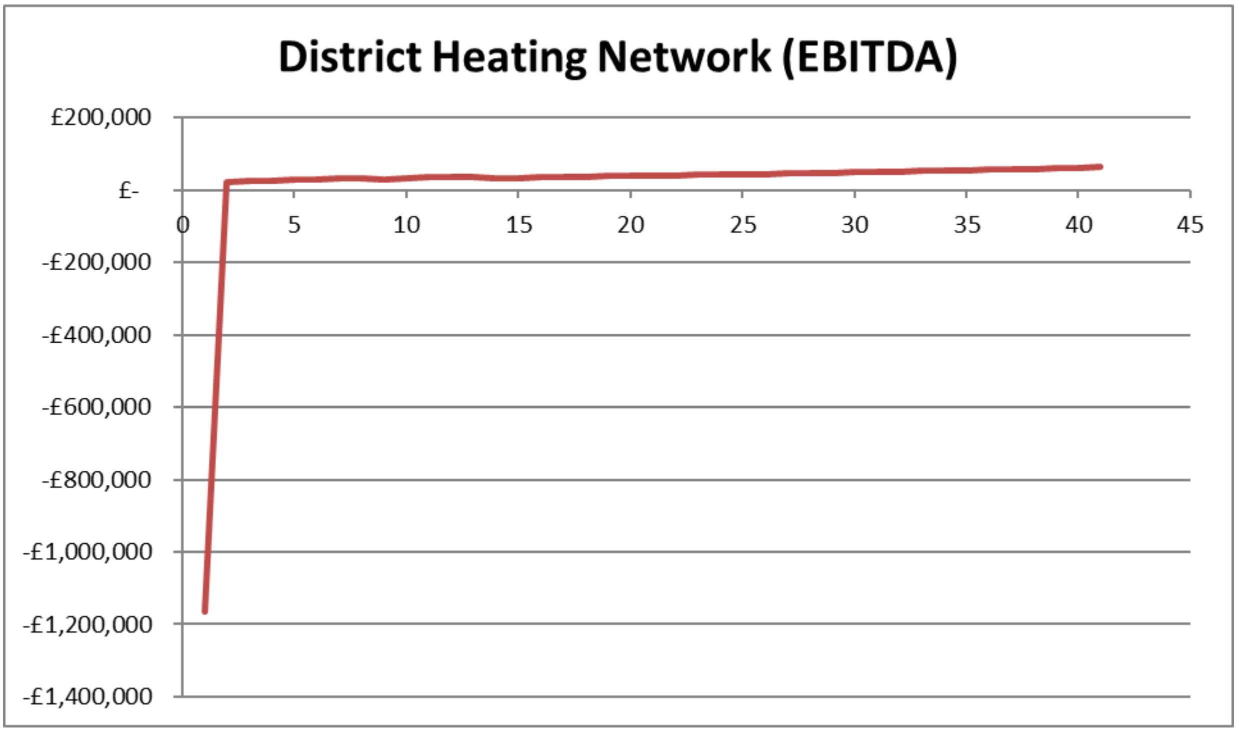

Figure 7.1 Havant Heat Network – Net Income (EBITDA)

7.5.3 The analysis shows that under the current financial assumptions, a scheme delivering heat/power to the Havant Leisure Centre and the Civic Plaza offers a potential IRR of 1.7% and a negative NPV of £342k.

7.6 Alternative Generation Optional Appraisal (gas CHP only – Scenario 2)

7.6.1 A 40 year cash flow model has been developed for the delivery of a gas CHP only approach with no biomass, again utilising existing boilers for back up and peaking supply.

7.6.2 The outcome of this assessment is shown in **Table 7.4** below.

Table 7.4 Economic assessment of Heat network (Phase 1 sites)

Economic assessment parameter	Value
Project length	40
Heat price (p/kWh)	4.5
Project cost (Gross) inclusive of HNIP where applicable	£1.08m
Cumulative position	£1.05m
Average annual income	£26k
Year 1 income	£171k
Year 1 Expenditure	£146k
Payback (years)	26
Internal Rate of Return (IRR)	3.1%
NPV	-£83k

7.6.3 This shows that Scenario 1, the CHP with biomass solution does not offer as attractive option as CHP alone (Scenario 2). This is because the additional benefit brought by the RHI income for biomass does outweigh the additional cost of biomass plant, fuel and maintenance.

7.7 Impact of HNIP funding

7.7.4 Funding may be available through DBEIS's recently launched heat network investment programme (HNIP) which provides support through a grant or long term loan. **Table 7.5** assesses the potential impact of a 30% capital contribution (grant) against the base case scenario. HNIP scenarios exclude HNIP support for biomass plant costs in line with HNIP rules.

Table 7.5 Sensitivity analysis of returns with HNIP grant

Economic assessment parameter	Base case (no HNIP funding)	30% CAPEX (Scenario 3)
Project length	40	40
Project cost (Gross) inclusive of HNIP where applicable	£1.16m	£923k
Payback (years)	32	21
Internal Rate of Return (IRR)	1.7%	4.4%
Net Present Value of Investment (NPV)	-£342k	£161k

7.7.5 As would be expected the inclusion of HNIP funding significantly improves the business case. For the remaining scenarios the Scenario 3 with HNIP is used for comparison.

7.8 Impact of network phasing (Scenario 4 & 5)

7.8.1 A heat network will be developed in phases; therefore, it is helpful to appraise the build-up of the economic case as each phase is developed. This is presented in **Table 7.6** below.

Table 7.6 Comparison of economic case for each Phase (all options with 30% HNIP)

Economic assessment parameter	Phase 1 sites only (Scenario 3)	Scenario 4: Phase 1&2 sites (includes Havant College)	Scenario 5: All sites
Project length	40	40	40
Project cost (Gross) inclusive of HNIP where applicable	£923k	£1.49m	£2.3m
Payback (years)	21	38	Not Viable
Internal Rate of Return (IRR)	4.4%	0.4%	-1.8%
Net Present Value of Investment (NPV)	£161k	-£669k	-£1,740k

7.8.2 The table shows that, based on the current modelling assumptions, there does not appear to be a strong business case for expanding the network to the College or to the Phase 3 sites.

7.9 Carbon benefit

7.9.1 The current carbon benefit associated with the scheme is related to the provision of localised heat and power through CHP with supplementary heat provided by a biomass boiler.

7.9.2 Under the current modelling, for the base case (Phase 1), the carbon savings associated with CHP with biomass compared with a gas boiler counterfactual is estimated to be 32%.

7.9.3 Over a 40 year project lifetime this equates to an estimated carbon savings of 5,525 tCO_2. The savings are calculated based on the 2016 carbon emission factors for gas and grid electricity.[34]

7.9.4 The potential value of the carbon savings depends on how carbon emissions are currently accounted for within the potential heat customers organisation. For example an organisation reporting it's carbon emissions under CRC[35] is required to pay £16 per tonne of carbon dioxide emitted annually. The potential value of this carbon over the lifetime of the scheme is £158k (allowing for CRC price inflation at 2.5%).

7.9.5 The value of this carbon savings is not included in the base model but it is recommended that this is assessed further and with each customer to determine whether this value should be incorporated.

7.10 Sensitivity analysis

7.10.1 A key factor within the model affecting the overall return is associated with the heat price paid by the end user. A heat price of **4.5p/kWh** has been assessed as the base case, which is based on the existing heat price paid by core Civic Campus customers.

7.10.2 The impact of varying the heat price on the economic model has been assessed and results of difference heat price scenarios on Scenario 3 (with 30% HNIP) are presented in **Table 7.7.**

Table 7.7 Sensitivity analysis of heat price on returns

Economic assessment parameter	4.5p/kWh (Base case) Scenario 3)	5.4p/kWh	7p/kWh
Payback (years)	21	15	10
40 year Internal Rate of Return (IRR)	4.4%	7.1%	11.1%
Net Present Value of Investment (NPV)	£161k	£701k	£1.66m

7.10.3 At 7p/kWh the scheme would offer a potential IRR of 7% and an NPV of £700k, which improves further to an IRR of 11% at 7p/kWh.

7.10.4 This highlights the significant impact the heat price has on the economic case. A critical next phase of work will be to test and assess a workable heat price with the potential customers of a Civic Campus heat network. It should be noted that for a viable commercial case, the heat price charged must be able to deliver a reasonable return on investment though subsidy of a scheme through for example HNIP funding (see **Section 7.7**) will mean the costs need not be wholly recovered through the heat charges.

[34] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2016

[35] Carbon Reduction Commitment

7.11 Electricity offset and Private wire

7.11.1 A significant influence on the model is the potential to utilise the power generated by the CHP locally to offset electricity purchase from the grid.

7.11.2 A cost allowance has been made for the cost of installing an electrical network between the leisure centre the Civic Plaza such that the power generated may be used at either building. **Table 7.8** compares the potential impact of changing the base case which assumes 90% is used locally (i.e. within the leisure centre or Civic Plaza) with differing offset amount, with the remainder of power exported to grid, for lower value.

7.11.3 It is recommended that further analysis of the likely offset/export is undertaken at detailed design through monitoring of site power profiles.

Table 7.8 Sensitivity analysis of returns with electricity export scenarios (Scenario 3)

Economic assessment parameter	Scenario 3 (90% offset / 10% export	85% offset / 15% export	75% offset / 25% export
Payback (years)	21	40	40
40 year Internal Rate of Return (IRR)	4.4%	4.0%	3.1%
Net Present Value of Investment (NPV)	£161k	£83k	-£73k

7.12 Summary

7.12.1 This high level economic appraisal has shown that based on the current demand, capital cost and heat supply assumptions and crucially using the typical ‘current’ heat price, there appears to be a viable investment opportunity in a core Havant Civic Campus heat network.

7.12.2 The analysis shows that, based on the current modelling assumptions, there does not appear to be a strong business case for expanding the network to the College or to the Phase 3 sites

7.12.3 The analysis has assessed a range of scenarios and sensitivities including the introduction of HNIP funding, a supply option excluding biomass and the impact of changing the private wire sales.

7.12.4 Alongside, a review and refinement of the demand and cost assumptions as part of detail design, it is recommended that time is spent reviewing a workable heat price with potential customers and potential investment partners.

8 Risk Appraisal

8.1 Introduction

8.1.1 This study has assessed the feasibility of developing a heat network in Havant Civic Campus.

8.1.2 Whilst the outline assessment study has shown this may be technically feasible there are a number of potential risks that are both specific to Havant and from a wider heat network investment point that will need to be addressed.

8.1.3 A risk matrix has been maintained throughout the development of this study. Where risks were identified, potential mitigation activities were proposed and discussed with HBC. As part of the outputs of this work, a review of the matrix was undertaken with HBC to provide an up to date assessment of the project risks based on the current information. A summary of the identified risks for the project is provided in **Figure 8.1** below whilst the full risk matrix and proposed mitigations is included as **Appendix J**.

8.1.4 This section reviews the key risks identified for this project based on the work completed within this study with proposed mitigation measures where applicable. The risk matrix should be treated as a 'live' document and further developed and refined as the project develops.

8.2 Key risks appraisal

8.2.1 As with all investments there are a range of risks and opportunities to manage risks that will affect the outcomes of investment decisions. A number of risks were identified within the Havant scheme but are common across many heat network projects; these include:

- Heat Customers – securing the heat demand;
- A decarbonised primary heat supply; and
- Civil engineering constraints within the urban setting.

8.2.2 These have been captured as appropriate mitigation measures proposed for the Havant network. Furthermore, since these are 'common' risks the market has developed solutions to mitigate for these whilst others will naturally be resolved as the project moves into more detailed design. The focus of this section are those risks which are considered as specific to the proposed heat network and therefore of worth particular focus to bring forward a Havant heat network.

8.2.3 For the Civic Campus heat network, the primary risks identified at this stage are the lack of a strong business case, the certainty of the use of the leisure centre as the anchor load and site of primary energy plant and alignment of the heat network proposal with the wider Council strategy for the Havant Civic Campus.

8.2.4 Other local risks noted but not see as so critical include for a Havant Civic Campus scheme include:

- Lack of knowledge of DH / skills in the Council; and
- Planning – likelihood of connection of future sites

Business case not strong enough to attract investment

8.2.5 This high level economic appraisal has shown that based on the current modelling assumptions and in particular at the 'current' heat price, there does not appear to be a strong case for investment opportunity in the Havant Civic Campus heat network without subsidy.

8.2.6 As part of the next phase of work, it is recommended that time is spent reviewing a workable heat price with potential customers and potential investment partners. This should then be further tested within the economic model along with the other sensitivities as set out within the economic appraisal.

8.2.7 In addition, the viability of the initial scheme may hinge on support from various funding streams to offset the initial cost of the heat network. The Heat Networks Investment Project (HNIP) funding could provide up to 30% subsidy for the initial investment required to set up the heat network. It forms an imperative aspect of the business case whereby the heat network may not be economically viable without the HNIP funding.

8.2.8 In addition, the economic appraisal has demonstrated that viability of the initial scheme will be further enhanced with support from Heat Networks Investment Project (HNIP) funding which could provide up to 30% subsidy for the initial investment. If taken forward the Council should consider a HNIP funding application.

8.2.9 The study has identified additional sites, within the Civic Campus which could be connected to a scheme thus enhancing the economic case. Notable amongst these opportunities is the proposed new health and residential care development off Lavant Drive. The development has received planning consent which requires commencement by December 2019. Should a heat network be brought forward within the Civic Campus, it is recommended that early engagement is made with the developers of site to further explore the feasibility of connection to the scheme.

Future use of the leisure centre

8.2.10 The current business case predicated on 'anchor' heat demand provided by Havant leisure centre as well as leisure centre proposed as the location for the primary energy plant. Clearly if the leisure centre were to be closed or re-purposed during the investment lifetime of the heat network this could have a significant impact on the business case.

8.2.11 Havant leisure centre is owned by Havant Borough Council and managed under lease by Horizon Leisure with the current lease due to run until 2042[36]. Whilst this provides some certainty over the centre's future, given its role in the proposed scheme, it is recommended that, should a heat network scheme be brought forward the long term plans for the leisure centre are fully appraised.

8.2.12 Should the leisure centre close during the investment lifetime of the heat network, then alternative options could include:

- A new centre within one of the proposed developments within the Civic Campus (e.g. Havant Health campus);
- A new stand-alone energy centre on Council owned land; or
- A combination of the above, perhaps with supplementary heat coming for a New Lane heat network should that be brought forward.

Alignment with Council strategy for Havant Civic Campus

8.2.13 Havant Borough Council is currently undertaking a review of regeneration opportunities within the Havant Civic Campus which covers a similar geographical scope to this study. This could have an impact on several of the buildings that could potentially link into a heat network. This could create an opportunity for future expansion of the network which would improve the

[36] Havant Borough Council

business case. At the same time, there is a risk that regeneration proposals that do not consider the proposed heat network may undermine the business case for the heat network.

8.2.14 The relevant Council officers involved in the Civic Campus regeneration review have been engaged throughout the development of this study. It is recommended that the review considers the findings this study, and in particular how a potential heat network might interface with any proposed regeneration in the Civic Campus. Crucially this includes a risk review of the future use of existing buildings proposed for connection to a heat network and the role of local planning policy in encouraging new developments to seek to connect to a heat network (see 'Planning' below).

Lack of expertise/resource within the Council

8.2.15 Further risks associated with the scheme include the lack of existing knowledge in the local council associated with heat networks and therefore limited expertise to take forward the business case and manage the project long term.

8.2.16 Potential mitigations to minimise this risk include outsourcing of heat network delivery and operation to third parties as other councils have chosen (see **Section 9**). This will depend on HBC's preferred role and proposed involvement in any scheme. DBEIS also provide technical support via HNDU and technical studies.

Table 8.1 Project risk matrix

Risk Identification			Risk Assessment		
Risk No.	**Risk description**	**Potential impact (including on cost and schedule)**	**Impact (low 1-high 4)**	**Likelihood (low 1-high 4)**	**Current Risk Rating**
1	Proposed plant replacement programme at Leisure centre not aligned to potential heat network programme	Significant part of potential Civic Campus heat network scheme will not be aligned to asset replacement programme which may undermine case for District Heat Network (DHN)	4	1	4
2	Unable to agree attractive yet commercially viable heat price	Unable to recover capital investment in scheme/business case weakened or attract customers to connect to the scheme	2	3	6
3	Leisure centre closure	Current business case predicated on 'anchor' heat demand provided by leisure centre as well as proposed as primary energy plant location	4	1	4

Risk Identification			Risk Assessment		
4	Commercialisation of business case	Unable to present compelling business case to potential project investor	3	3	9
5	Unable to secure Heat Network Investment Programme (HNIP) funding to support project	Will affect any business case which assumes HNIP funding	4	1	4
6	Low knowledge/awareness of DHN within Council	May lead to programme delays	2	2	4
7	HBC's review of the Havant Civic Campus regeneration opportunity	DHN strategy not aligned to long term plan for the Civic Campus area.	4	2	8
8	Thermal store	Ground conditions unable to support weight of proposed thermal store	2	2	4
9	Responsibility for maintenance of existing kit	Malfunctions of older equipment	2	1	2
10	Due to the decarbonisation of the electricity grid, the carbon 'benefit' of gas-CHP is reducing.	May affect HNIP qualification and potentially future building regulations compliance for new buildings (subject to changes in building regulations)	4	1	4
11	Limited space available at Leisure Centre (LC) for plant to service entire scheme	Will limit potential capacity of scheme to be delivered from LC.	3	1	3
12	Future use of sites may change mean they are less likely to/unwilling to connect to DHN	Will impact business case	2	4	8
13	Lack of engagement with HBC key stakeholders means fail to gain HBC stakeholder support for scheme	Fail to gain HBC approval on business case	4	1	4

Risk Identification			Risk Assessment		
14	Compatibility of existing heating systems with proposed DHN design	requirement to update existing systems up to specification adding cost to end user	2	2	4
15	Energy Data for existing buildings is not released by site operator or data quality issues	Accuracy of demand assessment may be undermined affecting robustness of design/economic appraisal	3	2	6
16	Proposed route constrained by existing utility assets	Increase costs for diversions etc	3	3	9
17	Future energy use of sites may change if sites refurbished or redeveloped	Accuracy of demand assessment affected with knock on affect on business case	2	4	8
18	Licence lite arrangement to supply 'excess' power without need for physical private wire	May not be possible and/or Licence Lite compliance costs too high to justify thus undermining CHP business case	2	3	6
19	Biomass storage/delivery	Insufficient space to accommodate required biomass delivery/storage	2	2	4
20	Leisure centre chimney	Structural integrity	3	2	6
21	System losses are greater than projected	Undermine economic case - higher heat prices required	2	2	4
22	Financial performance of plant/ system fails to meet expectation	Financial risk to the long term operator/investor	4	3	12
23	Investment shortfall / overspend	Insufficient funds to complete project	5	2	10

Risk Identification			Risk Assessment		
24	Cost basis on 'Gross' Basis with uplift applied for procurement/professional fees etc	Fail to gain HBC approval on business case due to apparent returns being longer than Council target	4	1	4
25	Security of 'waste' heat supply from New Lane	Will impact cost/design of scheme if no/unreliable heat source identified at New Lane	2	3	6
26	Connection to town centre involves rail crossing	Significant cost increase for Town Centre connection fed from Civic Campus scheme	4	2	8
27	Proposed installation of Solar PV on Leisure Centre	Will undermine business case for CHP since both optimised on basis of offsetting site power use	2	3	6

8.3 Heat customers

8.3.4 One of the primary risks concerned with the commercial development of a heat network is the establishment of a secure heat demand from potential customers.

8.3.5 The work to data has focussed on establishing the technical feasibility of connecting to the Civic Campus sites including site visits to a number of the existing plant rooms.

8.3.6 Preliminary engagement with potential Civic Campus customers suggests there is interest in possible connection to the scheme. This engagement needs to be progressed in the next phase of the study to further validate the likelihood of gaining a 'commitment to connect'. It is important that the potential heat network is integrated into the wider network to maximise profits and connectivity to the grid.

8.3.7 From experience the issues likely to be of concern to customers may include:

- Heat price – customers will expect the total cost of supplying heat to a building including to be less than the current or projected 'business as usual';
- Lack of understanding of technology and how this differs from conventional heat supply;
- Likely timings for potential heat network development and how this relates to their planned asset management programme (such within NHS operated buildings); and
- Potential timescale of heat supply contract compared with traditional supply contracts.

8.3.8 At the current stage, it is not yet known the exact heat price required to provide commercial benefits of the scheme.

8.3.9 If the heat pricing is too high, it will not form an attractive capital investment and the long term business case will be weakened due to difficulty of potential customers to be able to connect to the scheme.

8.4 Planning

8.4.1 Related to the heat customers risk item above, a further consideration is with regard the likelihood of connection of future development sites.

8.4.2 The presence of a ‘heat network policy’ will not determine whether or not a heat network gets implemented. This will instead be driven by the technical and commercial considerations which go into any development viability assessment. However, it is recognised that having a strong policy in place which obliges developers to consider connection to a heat network is an important tool in facilitating potential new sites connecting to a future heat network.

8.4.3 Of particular note are the following potential developments within the Civic Campus:

- Havant Health and Well-Being Campus on land north of Lavant Drive; and
- Havant Police Station which is due for potential relocation thereby making site available for redevelopment.

8.4.4 A key pillar of the Prosperity Havant initiative is the transformation of Havant town centre for which the development of decentralised heat and power is seen by HBC as potentially facilitating.

8.4.5 Meanwhile, the Havant Local Plan has been developed to support the development of low carbon energy infrastructure. In particular Policy CS14 states that planning permission will be granted for development that: ‘…contributes to the delivery of the PUSH target of 100MW of renewable energy by 2020 for the whole of the PUSH[37] area’.[38]

8.4.6 As part of the current review of the Havant Local Plan, the Council may wish to review this and assess whether this could be strengthened to ensure that future applications appropriately consider heat network connection in their planning proposals. Examples of wording from other authority plans are included below:

- Policy 5.6 of the London Plan 2016 requires:

Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.[39]

- Meanwhile South Gloucestershire Policy CS4 Renewable or Low Carbon District Heat Networks[40], states:

“Major development proposals [should], where practical and viable:

- *Include renewable or low carbon heating or CHP [combined heat and power] generation and distribution infrastructure on-site and demonstrate how opportunities to accommodate an energy and or district heating solution have been maximised, taking into account density, mix of uses, layout and phasing; or*

[37] Partnerships in Urban South Hampshire

[38] Havant Adopted Core Strategy (2011)

[39] London Plan 2016

[40] South Gloucestershire Core Strategy, adopted December 2013

- *Connect to an existing renewable or low carbon heat distribution network; or*

- *Provide a heat distribution network as part of the development where there are firm proposals for renewable or low carbon heat generation or CHP and distribution in the locality within a reasonable time frame; or*

- *Provide evidence that renewable and low carbon sources of heating or CHP have been fully explored and are unfeasible."*

8.5 Primary Heat supply and location

8.5.1 This project is currently based around heat supply coming from the proposed new CHP plant at Havant leisure centre. The potential carbon savings depend on the final design but will be higher for the solution which incorporates biomass. Connection to a gas CHP fuelled heat network, currently confers significant benefit in the carbon (SAP) assessment undertaken in support of building regulations compliance. However, the assessment method is currently under review and in line with the projected decarbonisation of national grid electricity the benefit is expected to reduce in future.

8.5.2 It is recommended that regulations are kept under review, especially if new buildings are planned to connect to the scheme.

8.5.3 Should the leisure centre scheme prove either economically or technically unviable, then alternative locations will be needed.

8.5.4 Primary alternatives proposed include a new energy centre in the Civic Campus to serve the sites. This could be developed as a stand-alone or perhaps more likely as part of one of the proposed new Civic Campus developments including the land of Lavant Drive.

8.5.5 These options will require more detailed investigation should the leisure centre option prove unworkable.

8.6 Network constraints

8.6.1 Routing a heat network through an existing urban infrastructure is a significant undertaking requiring substantial civil engineering works. The key constraints involved include presence of existing utility infrastructure (limiting space available to site pipework) and physical barriers to the deployment of the network.

8.6.2 The proposed routing for a Civic Campus scheme outlined in **Section 6** has been developed in light of known constraints and thus seeks to avoid major known existing utility infrastructure and minimise distances between building connections and where possible route via grass areas/verges to minimise implementation costs.

8.6.3 Based on the current information, the proposed routing does not appear to present major risks in terms of implementation there are a number of areas which will need to be carefully assessed in order to confirm the routing including:

- Crossings over Petersfield Road (B2149) and Civic Centre Road;

- Hard standing to Leisure Centre 'wet side' plant room, Havant College main plant room and Havant Health Centre;

- Presence of trees especially around the Civic Plaza and Havant College buildings; and

- Footpath between the leisure centre and Russell Road.

8.6.4 Detailed design of the network will require existing utility infrastructure to be fully assessed though the use of GPR[41] surveys and or trial pits to confirm the network route which is beyond the scope of the current study.

8.7 Stakeholder Engagement

8.7.1 Stakeholders were convened in February 2017 the discuss the findings of the work in 2 sessions, one for the Council (officers and counsellors) and another for potential heat customers. Whilst both sessions sought to brief the attendees on the proposals and seek their feedback, there was different emphasis in each session.

8.7.2 For the Council session, the aim was to understand the Council's perceived interest in the scheme, ensure it aligned to Council's existing policy and initiatives (such as the current Havant Civic Campus regeneration review) and identify any key risks and opportunities which may not have been considered.

8.7.3 For the potential customers, in addition to answering questions they might have on the proposal, it was more specifically on what their expectations and requirements would be in order to want to connect to a future scheme.

8.7.4 Overall the views from stakeholders was positive with no major barriers identified other than noting it would have to be delivered at the right price.

8.7.5 An interesting perspective from Southern NHS Trust stakeholders was that one of their key drivers was their carbon targets so the prospect of a local low carbon heat was of particular interest. The potential value of the carbon savings associated with connection of a customer to the heat network depends on how carbon emissions are currently accounted for within the potential heat customer's organisation. It is recommended the potential value of the carbon savings associated with connection of a customer to the heat network is assessed further and with each customer to determine whether this value should be incorporated in the business case.

8.8 Summary

8.8.1 The above sets the known key risk items to be considered in order to take forward the proposed Havant Civic Campus heat network.

8.8.2 In addition to the risks which are common to any heat network project, there are some key risks which are considered critical to the Havant Campus scheme. These are; the lack of a strong business case, certainty of the use of the leisure centre as the anchor load and site of primary energy plant and alignment of the heat network proposal with the wider Council strategy for the Havant Civic Campus.

8.8.3 It is recommended that, should a heat network scheme be brought forward the long term plans for the leisure centre are fully appraised. There is also a near term need to ensure any planned refurbishment of the leisure centre heating plant is done in a manner which may facilitate integration with future heat network.

8.8.4 It is recommended that the regeneration review considered the findings this study, and in particular how a potential heat network might interface with any proposed regeneration in the Civic Campus.

[41] Ground-penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface

9 Project Development and Commercialisation

9.1 Introduction

9.1.1 Moving from this present feasibility study to a fully delivered district heat network involves a number of stages. The Department for Business Energy and Industrial Strategy (DBEIS) have set out a typical heat network project development project lifecycle (**Figure 7.1**). This includes both the stages of project development supported by DBEIS Heat Network Development Unit (HNDU) as well as the subsequent stages of project commercialisation in advance of heat network delivery.

9.1.2 This section sets out the next steps for Havant Heat network project development, options for commercialising the project and an indicative programme of work from now to an operational scheme including phasing of a network.

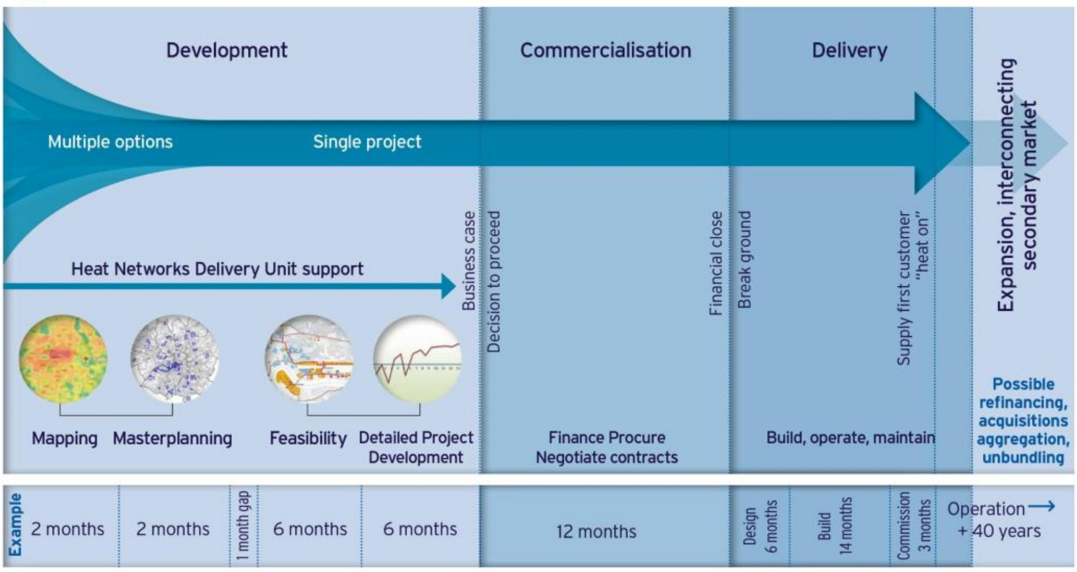

Figure 9.1 Typical heat network project development project lifecycle (DBEIS)

9.1.3 If there is appetite to progress the scheme, a necessary first step is to apply for funding for the next stage of project development from HNDU known as Detailed Project Development (DPD) in order to procure the necessary technical support to develop the findings and recommendations of this study.

9.1.4 DBEIS commissioned a study in 2016[42] which provided guidance local authorities to support their investigations and enable progression from feasibility stage through to business case delivery. This should be referred to by any Council wishing to develop a HMT Green Book compliant business case in support of HNIP funding.

9.1.5 As part of the next stage, the Council will need to explore their role in the project development and delivery. The next section explores some options in this respect.

9.2 Commercialisation: Investment and Delivery models

9.2.1 The economic assessment undertaken has demonstrated that there may be, in principle a good economic case to invest in a heat network in Havant Civic Campus. A key question

[42] DBEIS (2016) Heat Network Detailed Project Development Resource: Guidance on Strategic and Commercial Case

which emerges therefore is who pays for and operates the network. Some initial considerations for how this could work are presented below.

9.2.2 As the heat network market develops, many UK Councils are looking at commercial models to develop heat networks. One option is the establishment of a heat network 'ESCo'.

9.2.3 An Energy Services Company (ESCo) provides one or more energy related services for a project developer under a single contract or agreement.

9.2.4 The term ESCo is used interchangeably in the heat network market to define both an existing Energy Service Company, as well as a joint arrangement between a number of organisations to establish and develop a heat network (i.e. a Special Purpose Vehicle (SPV[43])).

9.2.5 There are three broad options for operating an ESCo:

a. Wholly private sector owned (100% private)

b. Wholly public sector owned (100% public)

c. Partnership including joint ventures (Joint venture)

9.2.6 Each of these options confers a different level of risk and investment opportunity as described in **Figure 9.2** below.

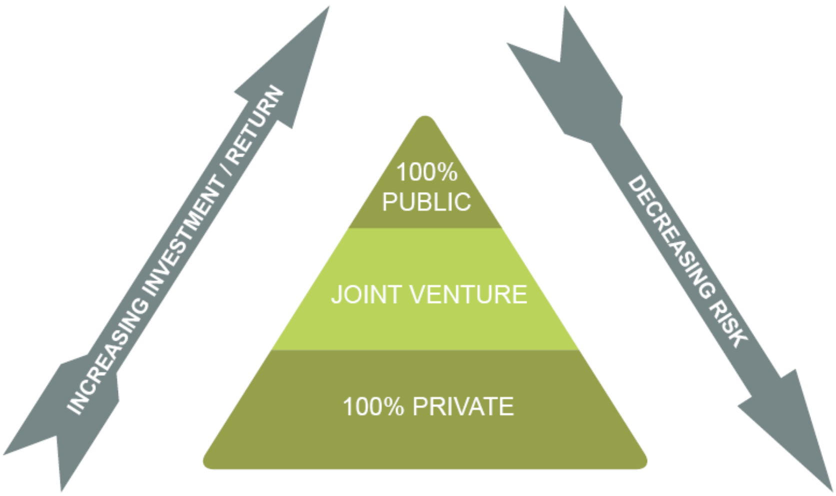

Figure 9.2 Council ESCo options - Investment/Return versus risk

9.2.7 Being in control of the of the ESCo gives a Council the ability to design the scheme to fully deliver the required aims of the project whilst also maximising the share of the financial returns that may be generated through the scheme's operation. However, this level of control requires the Council to take a large proportion of the investment and associated risks.

9.2.8 Conversely, by relinquishing control to the private sector, risk exposure will be limited but so will the ability to deliver the economic, social and environmental goals and opportunity to drive long term return from the scheme.

[43] An SPV is usually a subsidiary company with an asset/liability structure and legal status that makes its obligations secure even if the parent company goes bankrupt

9.2.9 A partnership approach can allow the risks and opportunities to be balanced between parties.

9.2.10 A variation on the model is for the authority to invest in the primary heat infrastructure (pipework) only with the network adopted by an 'ESCo' who manage and service the network under a concession agreement. The authority gets paid a 'Use of System' charge from the ESCo which refunds the upfront investment made in the pipework. This may present a lower risk option for the authority.

9.2.11 Generally speaking, the appropriateness and choice of an 'ESCo' type arrangement to deliver municipal heat networks will depend on:

- A council's appetite for risk;
- Internal resource and expertise; and,
- Access to funding/finance.

9.2.12 Many of these issues have previously been explored by other Council's in the UK including Leicester City Council, Nottingham City Council and Stoke on Trent City Council. It is recommended the Havant Borough Council explore further their preferred route to engaging with the market based on other public sector experience.

9.3 A role for Havant Borough Council

9.3.1 For a municipal district heat scheme to be successfully brought forward it is important that the local authorities roles as understood and defined. The DBEIS study (2016) looked in detail at the different roles a council can plan in scheme development which range from:

- Customer
- Governance
- Regulation
- Funding
- Asset Ownership
- Development of Property
- Land Ownership
- Landlordship
- Installation
- Operation
- Sale of Heat
- Supplier of Last Resort

9.3.2 HBC's role in setting the policy agenda is clear, but as a significant landowner and asset owner in the Civic Campus area, they have significant influence. Given the limited technical resource within the Council it is unlikely that the Council would look at act as a scheme operator. This does not preclude a less active role as partial investor. This would ensure a degree of control on the network's 3rd party development/operation such as heat pricing rules for local customers.

9.3.3 As part of the detailed design, it is recommended that the Council explore their preferred role(s) within the network. This should include engaging with other local stakeholders who may also have roles to play in a Civic Campus scheme including Hampshire County Council, the Solent LEP and Southern Health NHS Trust. The Council may also wish to engage with other local authorities who are currently involved in heat network development and operation.

9.4 Funding opportunities

9.4.1 The following list presents current routes to establish additional funding for the delivery of heat infrastructure.

- Public Works Loan Board: Borrowing by the Council from the PWLB, a body of UK Treasury, which provides loans to local authorities under the Prudential Code for Capital Finance;

- Bank debt: Potential source for ESCo or Council to access, subject to credit assessment by the bank of the borrower;

- Green Investment Bank can provide financing for heat networks;

- Salix Debt Finance is a not for profit company, funded by the DBEIS and the Welsh and Scottish Governments; and,

- Heat Network Investment programme (HNIP): set up by DBEIS in 2016, the HNIP fund provided grant or low cost loan funding the capital costs of heat networks in the UK. The scheme is subject to key eligibility criteria.

9.5 Summary

9.5.1 The above sets the steps to be considered in order to take forward the proposed Havant heat network.

9.5.2 Further assessment of the commercial case will be need in order to ensure the scheme can be delivered, this includes further sensitivity analysis of the assume costs and incomes associated with the scheme.

9.5.3 If there is appetite to progress the scheme, a necessary first step is to apply for funding for the next stage of project development from HNDU known as Detailed Project Development (DPD) in order to procure the necessary technical support to develop the findings and recommendations of this study.

9.5.4 Considerations concerning the commercial delivery model for the heat networks have been presented including typical ‘ESCo’ models. As part of the detailed design, it is recommended that HBC explore their preferred role(s) within the network. This should include engaging with other local stakeholders who may also have roles to play in a Civic Campus scheme including Hampshire County Council, the Solent LEP and Southern Health NHS Trust. The Council may also wish to engage with other local authorities who have established heat networks and/or the principles of heat networks.

10 New Lane and Havant Town Centre

10.1 Introduction

10.1.1 As part of the scope of this study PBA were asked to consider the prospect of expanding a Civic Campus heat network scheme to the nearby New Lane industrial estate. In addition, HBC wanted to understand the potential for future connection to Havant Town centre which lies to the south of the Civic Campus. This section presents an overview of these

10.2 New Lane Industrial Estate

10.2.1 The New Lane industrial estate lies east of the Havant Civic Campus and covers an area of over 30 Ha. comprising a range of commercial and industrial facilities.

10.2.2 During the initial data collection phase of the study engagement was made with a number of key sites within the New Lane. In particular, two of the sites which lie extremely close to the edge of Civic Campus, namely pharmaceuticals manufacturer Pfizer and polymer manufacturer Sumika. These sites are sited across New Lane and within 200m of Elmleigh Hospital which is part of the Civic Campus scope. Upon the recommendation of HBC contact was also made with Dunham Bush, a sheet metal fabricator which lies to the north of New Lane.

10.2.3 A visit to the Sumika site identified some potential low grade (temperature) heat sources associated with their plastic moulding process which could possibly supplement a Civic Campus network. However subsequent attempts to gather data on temperatures/operating hours from the site proved inconclusive. Furthermore, it is unlikely that this low grade heat would be of sufficient scale and consistency to prove economic.

10.2.4 The Pfizer site has significant cooling demand and could in principle present a further opportunity both a potential customer or supplier of heating/cooling and data was provided to HBC early in 2016 which suggested a gas demand of over 4 million kWh/annum and electricity of around 10 million kWh/annum. Such sizable loads are clearly of interested which masterplanning energy networks. Unfortunately, Pfizer announced in November 2016 its plans to close their New Lane distribution site in 2020[44]. It was therefore agreed with HBC, that the site was excluded from further consideration as part of this study since it could not be considered a 'secure' heat source/demand.

10.2.5 However, given its scale it is recommended that once the future use and operator of the site is known (Pfizer are due to exit the site in circa 2020), should a Civic Campus scheme come forward it would be worth exploring the prospect of connecting the site in some way to the network.

10.2.6 A further site visit took place at Dunham Bush, light manufacturing site to the north of New Lane. There appears to be a good heat demand for the site. However, there is a distanceof approx. 800m between the Dunham Bush site and a point of connection with the Civic Campus (Elmleigh Hospital). At approx. £800/m pipe install cost, plus allowing for connection costs, the capital octs of such as connection could be £750k. It is unlikely to be economic to connect the Dunham Bush site alone. However if further sites were identified between the Civic Campus (Elmleigh Hospital) and the Dunham Bush site a future connection could be justified. Alternatively, a stand along heat network could be developed within New Lane itself.

10.2.7 Possible development opportunities of note to a potential district heating scheme within New Lane include (and see **Figure 10.1**):

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44 http://www.bbc.co.uk/news/uk-england-37921236

- Former Colt site – due for demolition and housing Homes and Communities Agency. This will require substantial heat/energy provision so could form basis of scheme.

- The 'Gas holder' site which is due for demolition (APP/15/00542)

- Large commercial development site (commercial) off Downley rd

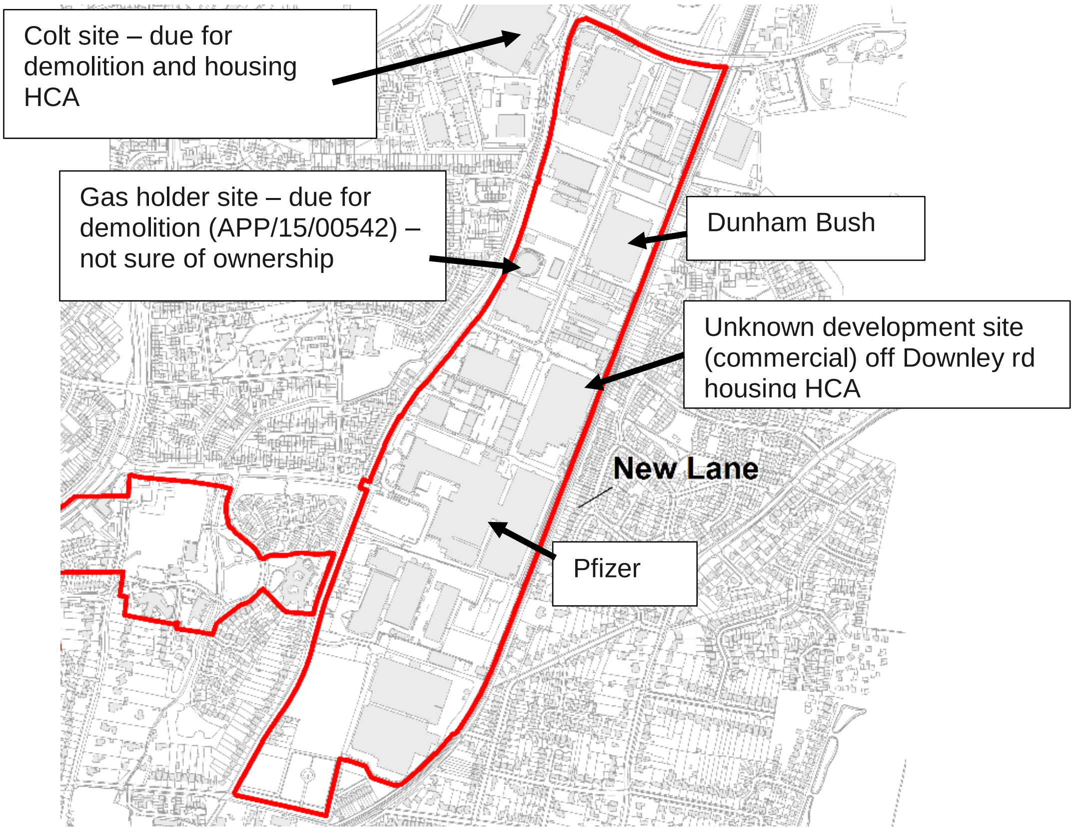

Figure 10.1 Possible opportunities of note to a potential district heating scheme within New Lane ((Contains Ordnance Survey data (c) Crown copyright and database right 2016. (c) Crown copyright and database rights 2016. Ordnance Survey 0100031673.)

10.3 Havant Town Centre

10.3.1 Havant Town centre lies approximately 0.5km from the southern edge for the Civic Campus area between which is a railway line. This presents a significant obstacle from a heat network perspective since routing over/under railways can involve significant cost increases both in terms of engagement with Network Rail as well as the engineering costs to undertake the work.

10.3.2 The disparate and mix nature of the town centre uses does not present ideal candidates for heat network connection. One site which was considered of interest was the potential development site known as 'market parade' which lies nearby the railway station on the town centre site. Plans for the site were submitted for a 136 dwelling apartment block which would have lent itself well to a possible DHN connection. However, the additional cost associated with the rail crossing is likely to make this uneconomic at this stage. Furthermore, it is understood that no decision has yet been taken on whether the development will come forward. Therefore it is not recommended to explore a Havant Town centre connection further at this stage.

10.4 Summary

10.4.1 The study has considered the high level options for expansion to both New Lane and Havant town centre. The areas present very different prospects.

10.4.2 New Lane comprises some sizable heat and power loads but none of which present an immediate economic case for connection to a Civic Campus scheme. Should the Civic Campus network be brought forward and especially if extended to the hospital sites along Lavant Drive, it would be worth re-visiting whether there may be prospects for connection to New Lane. This is especially in terms of the the closely located ‘Pfizer site’, depending on the future use of the site.

10.4.3 Irrespective of this, with the existing and planned development in New Lane and given the scale of energy demand, it may be worth exploring a New Lane scheme in its own right since there appears to be potential for connection between some of the proposed and existing sites, subject to further investigation.

10.4.4 Based on a high level appraisal, Havant town centre offers much less potential at this stage. The presence of the railway adds costs to a potential connection to the Civic Campus but irrespective, the nature of the town centre heat loads do not readily lend themselves to district heat connection being primarily small retail. The physical routing of heat pipe through the smaller streets within town centre is also likely to present a challenge to infrastructure delivery. Furthermore, with possible regeneration of the town centre the future use of buildings within the town centre is uncertain. Therefore, it is not recommended to explore a Havant Town centre connection further at this stage.

11 Summary and Recommended Next Steps

11.1 Summary

11.1.1 This report presents the findings of the feasibility study which has assessed the technical and economic feasibility of a district heat network in Havant. The study has focussed on the development of a heat network in the so called Civic Campus.

11.1.2 In summary the findings are:

- In total the Civic Campus sites assessed are collectively responsible for 4,522 MWh of annual heat demand;
- There are a range of primary heat supply options available but the most feasible technology to support a scheme would be one based on Gas-CHP. A solution has been proposed which incorporates kW scale biomass to support HNIP funding compliance;
- An outline heat distribution design has been proposed which includes connection to 9 Civic Campus sites with the primary heat generating plant sited at the Havant leisure centre;
- A high level economic appraisal has shown that under the current financial assumptions, a CHP and biomass scheme delivering heat/power to Havant Leisure Centre and the Civic Plaza offers a potential IRR of 1.7% and a negative NPV of £342k. With 30% HNIP funding, this improves to an IRR of 4.4% and an NPV value of £161k;
- Potential customers to the scheme have been engaged in the study. Sites have been surveyed for their technical feasibility to connect whilst potential customers have expressed interest in principle to connect to a future scheme, at the right price;
- The study has identified additional sites which could be connected to a scheme thus enhancing the economic case further. Notable amongst these is the consented health and residential care development off Lavant Drive[45]. Whilst not included in the current economic modelling, these developments have the potential to further enhance the business case.
- The primary risks identified at this stage associated with the Civic Campus heat network are the lack of a strong business, certainty of the use of the leisure centre as the anchor load and site of primary energy plant and alignment of the heat network proposal with the wider Council strategy for the Havant Civic Campus

11.2 Recommended next steps

11.2.1 The Council should review and reflect on the findings of this study and in particular the necessary alignment to other local agendas to facilitate the successful potential development of a Civic Campus scheme. If there is appetite to progress the scheme, a necessary first step is to apply for funding for the next stage of project development from HNDU known as Detailed Project Development (DPD) in order to procure the necessary technical support to develop the findings and recommendations of this study.

11.2.2 Given its role in the proposed scheme, it is recommended that, should a heat network scheme be brought forward the long term plans for the leisure centre are fully appraised.

11.2.3 As part of the detailed design, it is recommended that the Council explore their preferred role(s) within the network. This should include engaging with other local stakeholders who

[45] Known as the ‘Havant Health and Welling Campus’, granted planning consent in 2015 (APP/15/00303)

may also have roles to play in a Civic Campus scheme including Hampshire County Council, the Solent LEP and Southern Health NHS Trust.

11.2.4 A critical element of the next work phase will be continued engagement with the potential Havant Civic Campus heat network customers to ensure that the potential for heat network connection is factored into their plans. At the same time key assumptions concerning future heat/power demand and technical compatibility with existing heating customers should be explored.

11.2.5 The relevant Council officers involved in the Civic Campus regeneration review have been engaged throughout the development of this study. It is recommended that the review considers the findings of this study, and in particular how a potential heat network might interface with any proposed regeneration in the Civic Campus.

11.2.6 It is recommended that this includes a risk review of the future use of existing buildings proposed for connection to a heat network and the role of local planning policy in encouraging new developments to seek to connect to a heat network. Related to the above, there is an opportunity as part of the Havant Local Plan revision, to strengthen the requirements for new developments to investigate the feasibility of connecting to a district heat network. It is recommended this is considered by the Energy Team in consultation with the Local Plan development team.

11.2.7 The proposed new health and residential care development off Lavant Drive received HBC planning consent in 2015 and is currently progressing through discharging of planning conditions. Should a heat network be brought forward within the Civic Campus, it is recommended that early engagement is made with the developers of site to further explore the feasibility of connection to the scheme as it has the potential to enhance the business case.

11.2.8 As part of the DPD and development of the financial case, a detailed assessment of the fuel, heat and power prices should be undertaken. The modelling has shown the significant impact of fuel and heat price on the overall attractiveness of the scheme. As part of this detailed metering should be undertaken of power use at both the leisure centre and civic plaza to develop more accurate demand and supply profiles.

11.2.9 It will be important for any future scheme to consider the evolution of Building Regulations (and in particular the calculations methodologies behind these such as SAP) in the context of gas-CHP especially in the contact of new developments.

Appendix A Primary Energy Plant Location

Appendix B Power Generation/Export profiles

Appendix C Existing Utilities Assessment

Appendix D Outline primary pipework design

Appendix E Interactive PDF of Civic Campus DHN

Appendix F Primary Pipework Heat Loss

P038 Havant - Nominal Heat Loss Calculations

Nominal Design Data

Nominal Flow Temperature	T1	70	°C
Nominal Return Temperature	T2	40	°C
Ambient Ground Temperature	To	10	°C
Expansion of HDPE Jacket Pipe during production		1.5	%
Average Soil Coverage		0.8	m
Thermal conductivity of the soil		1.5	W/mK
Thermal conductivity of the insulation		0.026	W/mK

Powerpipe Series 2 - Single Pipe

Service Pipe		Jacket Pipe			Losses		Trench Length	Total
DN Nominal Bore mm	OD Outside Diameter mm	DY Outside Diameter mm	HDPE Wall Thickness mm	Outer Surface Temp °C	W/m	KWh/Year	(Pipe Length divided by 2) mtrs	Annual Losses KWh
DN20	26.9	110	3.0	12.59	10.11	88.6	0	-
DN25	33.7	110	3.0	13.08	11.96	104.8	95	9,957
DN32	42.4	125	3.0	13.24	13.00	113.9	110	12,524
DN40	48.3	125	3.0	13.67	14.69	128.7	110	14,156
DN50	60.3	140	3.0	13.99	16.42	143.9	370	53,234
DN65	76.1	160	3.0	14.32	18.41	161.3	340	54,829
DN80	88.9	180	3.0	14.37	19.28	168.9	200	33,771
DN100	114.3	225	3.4	14.26	20.06	175.7	430	75,555
DN125	139.7	250	3.6	14.76	23.09	202.2	255	51,571
DN150	168.3	280	3.9	15.22	26.14	229.0	130	29,771
DN200	219.1	355	4.5	15.09	27.56	241.4	0	-
DN250	273.0	450	5.2	14.55	26.84	235.1	0	-
DN300	323.9	500	5.6	15.02	30.62	268.3	0	-
DN350	355.6	560	6.0	14.63	29.48	258.2	0	-
DN400	406.4	630	6.6	14.60	30.56	267.7	0	-
DN450	457.0	630	6.6	16.16	40.42	354.1	0	-
DN500	508.0	710	7.2	15.68	39.12	342.7	0	-
DN600	610.0	800	7.9	16.63	47.35	414.8	0	-
DN700	711.0	900	8.7	17.25	95.63	837.7	0	-
DN800	813.0	1000	9.4	17.86	107.44	941.2	0	-
DN900	914.0	1100	10.2	18.42	118.74	1040.2	0	-
Calculation of heat losses according BS EN 13941						**Totals**	**2,040**	**335,367**

Appendix G Cost Breakdown

Havant Budget Costs for Options Analysis

Primary Plant								
CHP					£ 164,000	Supplied and installed		
Biomass Boiler					£ 25,000			
Biomass Flue					£ 15,000			
Fuel Store					£ 25,000			
Thermal Store c/w Onsite Insulation	£ 1,250	m3	30	m3	£ 37,500			
Ancillary Pipework					£ 70,000			
					£ 336,500			
Private Wire connection between CHP and Civic Plaza					**£ 42,175**	includes cable, civils (trench share with pipe) and switchgear		
Primary Heat Exchanges								
PHE Skids	**kWthp**							
Civic Centre	420				£ 32,500			
Havant Leisure Centre	1,835				n/a	£ 32,500	Phase 1	pipework modifications included above
Havant College - B Block	585				£ 37,500			
Havant College - Sports Hall D Block	400				£ 32,500			
Havant College - Astro Turf Changing Room	100				£ 7,500			
Havant College - Business Centre	40				£ 5,000			
Havant College - Plantroom-1	40				£ 5,000			
Havant College - Plantroom-2	40				£ 5,000	£ 92,500	Phase 2	
Havant Health Centre	230				£ 20,000			
Hollybank Rehabilitation Centre	285				£ 25,000			
Havant NHS Diagnostic Centre	400				£ 32,500			
Elmleigh Hospital	500				£ 37,000	£ 114,500	Phase 3	
Totals	**4,875**				**£ 239,500**			

Notes:
Leisure Centre boiler refurbishment/replacement costs excluded as by others, although these will need to be designed to incorporate the proposed works and to delivered in isolation.

Appendix H Primary pipework costs

Appendix I Cashflow models

Appendix J Risk Matrix