Devonport Energy from Waste Project

Sustainable Community Energy Initiatives Scoping Report

Issued 7th September 2011

Contents

Appendices

0 Executive Summary and Conclusions

This study comprises MVV's analysis of possible District Heating (DH) and other sustainable energy improvement opportunities in the west Plymouth area surrounding the HM Naval Base and Dockyard at Devonport (the Dockyard), namely Barne Barton, Weston Mill/St Budeaux and Keyham/Devonport. These opportunities arise from MVV's proposed Energy from Waste Combined Heat and Power (EfW CHP) plant to be located in the Dockyard's North Yard, close to Blackies Wood. In developing its proposals for the EfW CHP plant MVV has already applied the principle of combined heat and power generation by connecting the plant to the Dockyard's steam network. Thus, if built, the EfW CHP plant would be operating at a very high level of energy efficiency combined with a corresponding considerable reduction in CO_2.

The heating demand of the study area has been systematically assessed by desk top analysis. Supplying further heat (ie additional to the Dockyard's demands) to supply a local district heating demand is presently limited for technical and contractual reasons. Even though the EfW CHP plant will from the outset have high energy efficiencies and heat output it is concluded that:

- A small "micro" DH scheme could be established for certain areas of Barne Barton close to the EfW CHP plant, but with capital subsidies required. Such a scheme would yield savings to consumers of at least £120 per annum
- Possibly a smaller "micro" DH scheme could be established for the sheltered housing and the primary school in the area close to the Camels Head Gate at Weston Mill, with similar benefits but with larger capital subsidies
- Photo Voltaic electricity production systems could be established for the multi-storey flats in Talbot Gardens/Savage Road in Barne Barton with possibly a capital subsidy. Such a scheme would yield savings to consumers of at least £100 per annum
- Instead of or in addition to the above additional thermal insulation could be installed to reduce heating demand at selected properties where insulation levels are low and there are no current plans to improve insulation but the extent and cost of this cannot be determined at this stage
- A further "Section 106 Energy Study" will be necessary to be carried out in 2012 to verify the initial findings of this study and to confirm the extent to which subsidies are required

- Subject to further study the implementation of the above initiatives through the establishment of one or more not for profit Energy Supply Companies (ESCos) and with a capital subsidy of £500,000 it could be feasible to establish either DH or PV systems for properties in the area of Barne Barton closest to the EfW CHP

MVV also sees potential for the creation of an expanded district heating solution in Plymouth. The EfW CHP plant could be a significant part of a possible overall DH solution with several other heat generating sources feeding into a city wide district heating network. The development of an overall, wider DH solution offers the opportunity for further structural development of Plymouth. Outside of the South West Devon Waste Partnership PFI project MVV will be willing to provide Plymouth City Council (PCC) with assistance and support in the planning and construction of a district heating network, and to take part in any future wider DH system procurement exercise.

MVV has extensive expertise in this area. It operates one of the largest district heating networks in Europe for the city of Mannheim and other affiliated regional authorities in the greater Mannheim area. MVV's municipal utility shareholdings in Kiel and Offenbach also operate district heating networks very successfully. MVV also has extensive experience in designing and planning district heating systems.

1 Introduction

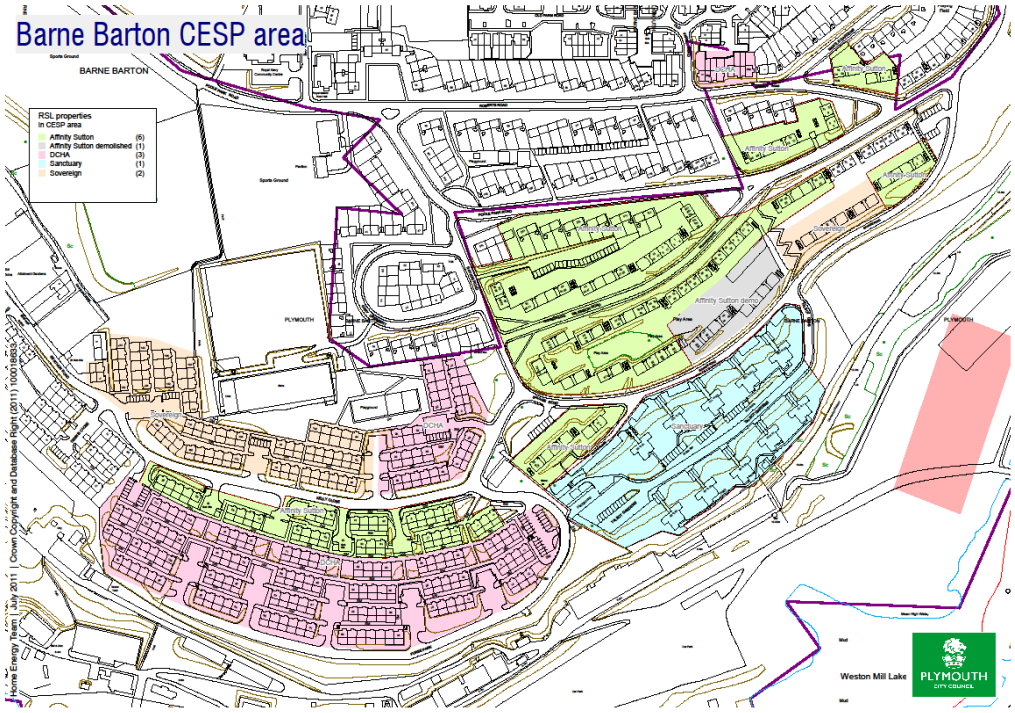
This report has been prepared by the Energy Department of MVV Umwelt GmbH (VU.E) (with the assistance of consultants and potential suppliers of equipment) to support the request for additional information made by MVV Environment Devonport Limited (MED), as part of its response to the Regulation 19 letter received from Plymouth City Council on 1st July 2011. It is intended to be a high level scoping review of the potential for various sustainable energy improvement opportunities in the vicinity of the high efficiency Energy from Waste Combined Heat and Power (EfW CHP) plant proposed by MED to PCC under a planning application ref: 11-00750-FU, to be located on Ministry of Defence (MOD) land in the North Yard of the Her Majesty's Naval Base Devonport (the Dockyard).

This report is an initial quantitative assessment intended to supplement the qualitative statements made in the planning application about DH from the EfW CHP plant, and to explore alternative ways in which the sustainable energy performance of various properties in the subject area can be improved. It has been carried out with limited information obtained from various housing associations, who are the principal owners/managers of a large number of properties in the subject area, from basic knowledge of certain planned commercial developments in the area, and on generally available information on heat demands and characteristics. Publicly available geographical data and generic heat data has been used. MVV also employed a specialist consulting firm with which it has worked extensively on DH systems in Germany, call GEF. GEF's report on the DH system design and costs is included in Appendix B.

MVV is also aware that PCC, in co-operation with four housing associations, which are principal property owners in the area, and a major energy supply company have secured UK and EU funding to develop a Community Energy Saving Programme (CESP) for the Barne Barton area (see map below). This programme has to be completed by December 2012 in order not to lose the funding. It requires all possible improvements to be made to the properties in the area at the same time in order to maximise the benefits and minimise disturbance to residents.

If MED is granted planning permission in January 2012 following a Planning Committee in December 2011 the proposed EfW CHP would not be operational before autumn 2014. MED would not be able to deliver any district heating benefits to the properties in Barne Barton by the CESP

deadline of December 2012 but as part of the Section 106 Agreement are prepared to develop proposals over the next year which deliver other carbon reductions to properties in the vicinity of the proposed plant. MED has entered into discussions with the partners in the CESP programme to ensure that the proposals which they are developing will be complementary to those in the CESP programme and not duplicate or conflict with them.



It will be necessary to carry out much more detailed analysis, which will take several months to complete, before coming to a firm conclusion on the best means of improving the sustainable energy performance of the area. This report is intended to inform such analysis and indicate how such improvement could be made, giving also an indication of the likely costs and benefits to be obtained.

MVV proposes to carry out such analysis under the auspices of a Section 106 Agreement with PCC if planning consent for the EfW CHP plant is granted. This analysis would be carried out in 2012 and reported to PCC. For the purposes of this report this is referred to as the "Section 106 Energy Study". The scope and terms of reference of the Section 106 Energy Study will need to be agreed with PCC.

2 Existing and Proposed Developments and Their Heating Requirements

Developments in Study Area

Three areas of west Plymouth were considered for this study and are shown below in red. They are generally described as Barne Barton, Weston Mill/St Budeaux and Keyham/Devonport. In addition the energy demand of future developments in the Dockyard (both South Yard and North Yard) were considered.

In each area MVV estimated the maximum potential connectable heat

demand. This was accomplished by carrying out a desktop heat demand study for each of the examined areas. To do this a survey of the existing building infrastructure had to be completed. The nature of the properties under consideration and their physical dimensional data was obtained

from open source geographical information systems (eg Google Earth and Street View) by examination of aerial (satellite) and street level images. The structural form of the buildings in Barne Barton, Weston Mill/St. Budeaux and Keyham were generally also assessed. The predominant building structures consist mainly of multi-storey dwellings, terrace houses and multi family residences. The design of the 120 flats in Talbot gardens and Savage Road of Barne Barton are a notable exception. These flats were built by the Ministry of Defence between 1966 and 1976, and are known to have poor levels of insulation. The main lease is held by Sanctuary Housing although a number of flats are sub-leased and in private hands. Each flat has its electricity supplied though a dedicated meter unit located in a central shaft which runs the entire height of the block.

For the purposes of this study MVV's experience of the supply of heat to similar building types in Germany was used to estimate the unknown factors that are needed for the calculation of the heat demand of the buildings in Plymouth. The calculation is based on the standardized calculation specification included in the European Standard EN 12831:2003.

As far as MVV is aware, generally all areas have limited potential for significant new build development. In the Weston Mill area there is a potential development of the existing fire station area into a proposed Weston Mill Shopping Centre. MVV contacted the developers of the proposed shopping centre to obtain information on likely heating demand, including the demand for air conditioning which could be met by heat supply through absorption chillers. However, no information was forthcoming and so for the time being no statements on the ability to supply this proposed development can be made.

In the Dockyard there are the known developments of the Help for Heroes and Devonport Landing Craft Co-location Project facilities in North Yard and by Princess Yachts in the South Yard.

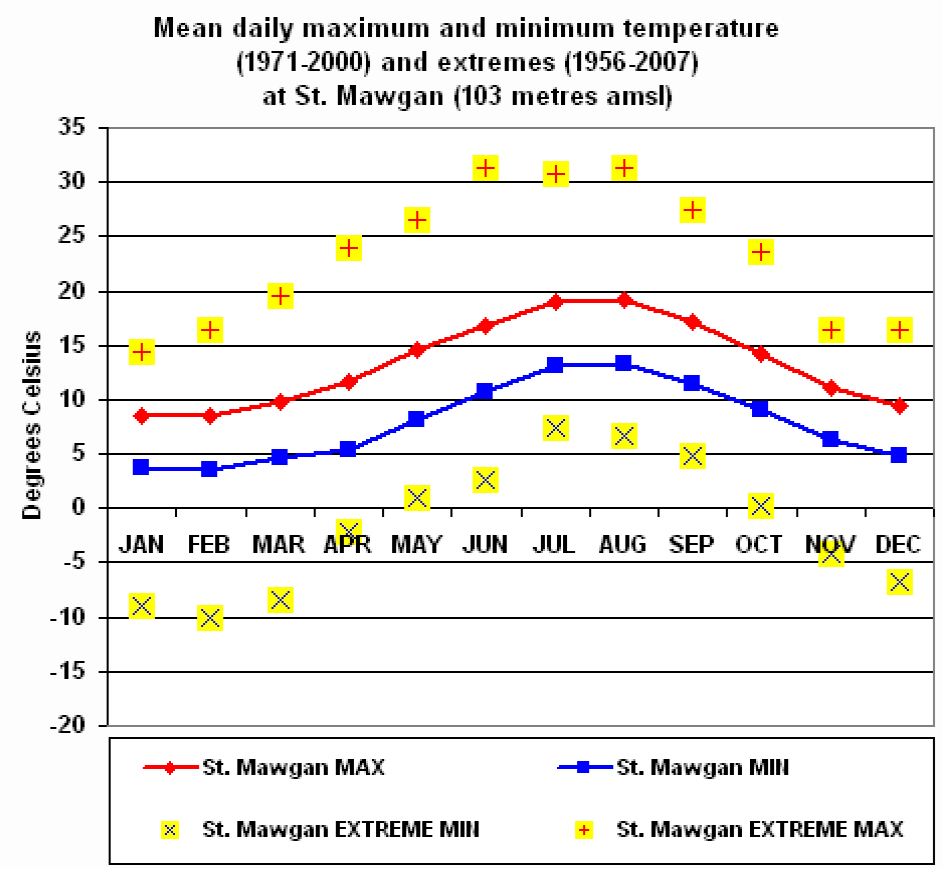
<u>Heat Demand Outside the Dockyard</u>

For this study it was assumed that the thermal insulation heat transfer coefficient is as typically found for a multi-storey dwelling with a low insulation standard. This coefficient corresponds to brick with mortar construction and can be applied to both multi family residences and the terraced houses.

To simplify the analysis when considering the layout of individual flats, each storey was analysed as if it was one single room bound only by the external walls. The average room temperature to be achieved was assumed to be 20°C and the air exchange rate was assumed to be 1.5 changes per hour. This is a typical level for housing with low insulation levels.

It is possible to generate a more precise estimate for individual buildings if the year of construction, the insulation standard and the exact heated living space of the specific area is known.

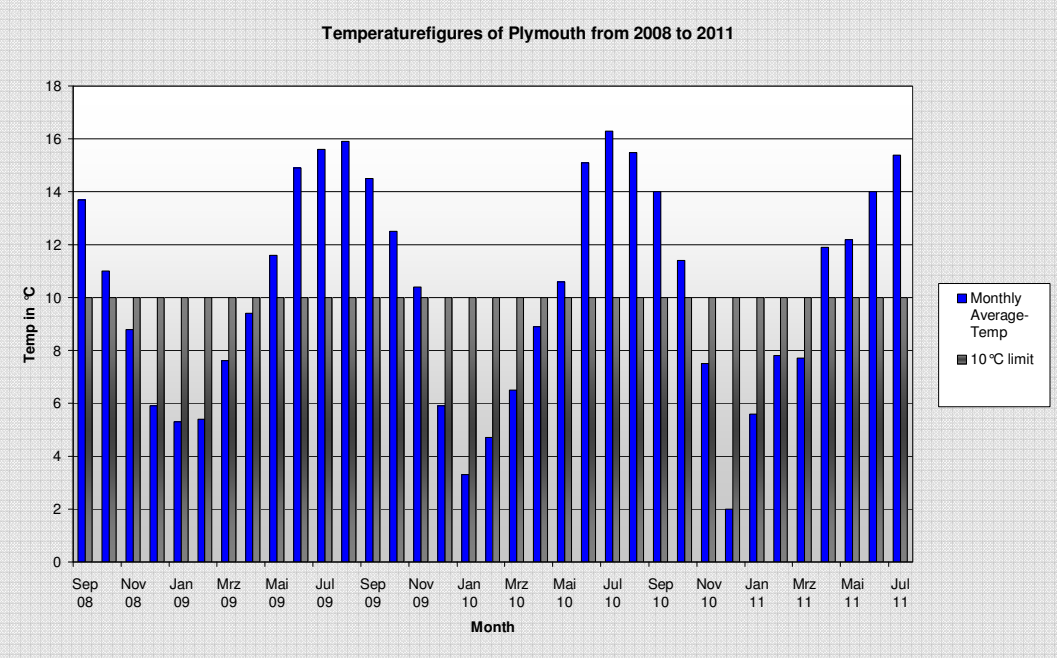
The minimum temperature used for the determination of the heat demand was taken from published data by the UK Meteorological Office, as shown on the graph below.



The maximum connected heat demand is the main factor for the design and engineering of any DH network. This is because the system has to be capable of supplying all the heat required by consumers during the worst weather conditions.

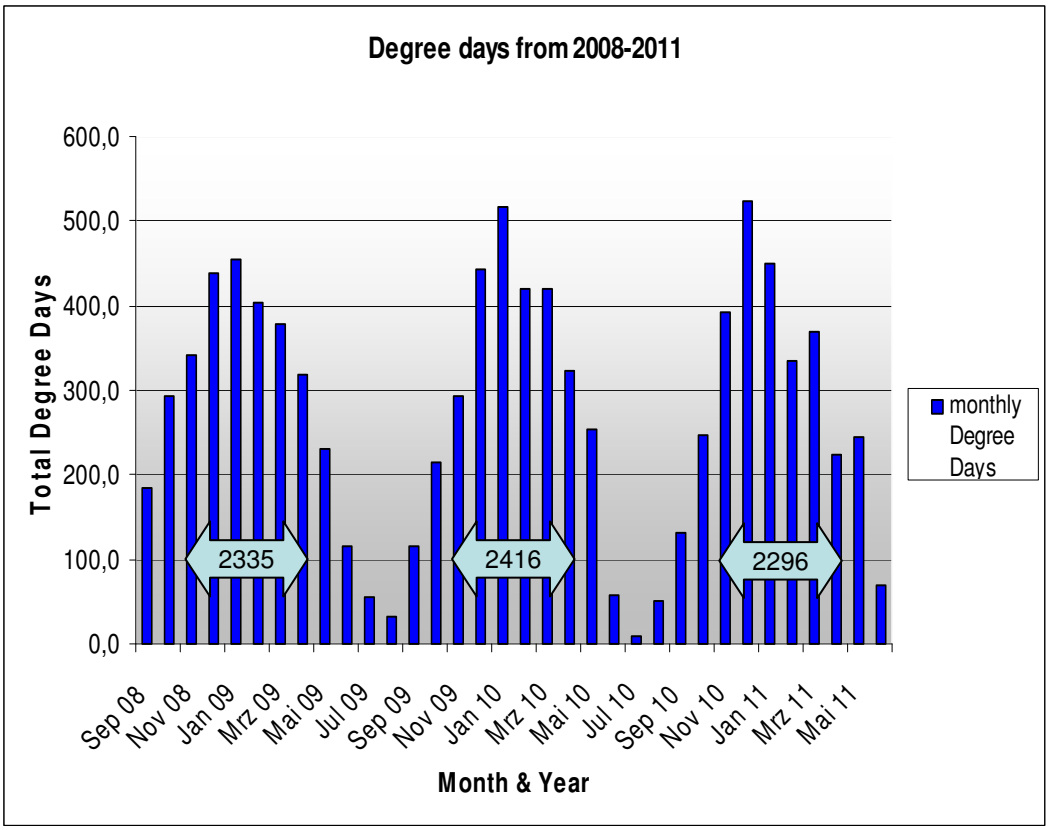
Since this consumption data is influenced by consumer behaviour the yearly temperature characteristics and the corresponding heating degree days for the last three years was assessed by an independent weather consultant. This data was used to build a more accurate picture of the real heating demand in the specific area for the existing buildings.

The graph below shows the average monthly temperatures from September 2008 to July 2011. It was assumed that the residents of the buildings will exhibit a normal economic heating behaviour, ie that heating is not required until the outside temperature reaches below 10°C. This temperature limit of 10°C was applied to the historic temperature data to establish the period when heating is necessary. This shows that according to the historic temperature data the main heating period starts November and ends at the beginning of May.



The outside temperature figures were converted into "Degree Days". They are a function of temperature and time, and have the unit Kelvin-days (K-d). This data is generated by a standardized process and give precise information on the hourly heat demand of a heated building. Degree Day figures are usually used to monitor the heating energy demand of buildings. The more heating Degree Days that appear in a heating period, the more heating is necessary. The following figure shows the trend of the degree days from 2008-2011 in Plymouth. Since it is assumed that the consumers do not use heating in the months from May to October the resulting Degree Days from these months are not included.

The average number of Degree Days in the period analysed amounts to 2350 K-d.



To obtain better quality information about the necessary modifications that need to be carried out to connect the existing housing to a DH grid a further, detailed survey of the existing heat systems in the buildings will be necessary as part of the Section 106 Energy Study. The crucial factors are the current energy sources (assumed to be gas) and the technical equipment used for the heating.

South Yard Demand

The South Yard is presently supplied by steam heat as part of the current Dockyard heating system which was developed over many years. This is a steam based system. If the EfW CHP plant proceeds the South Yard will be disconnected from the North Yard and will be supplied with steam from existing boilers in the Morice Yard. As discussed in Section 4 in the longer term the supply of heat to the South Yard would be better done via a conventional DH system rather than steam.

The Dockyard's South Yard and surrounding area are technically within reach of a DH system fed, in part, by the EfW CHP facility. However, due to the limits on available useful heat from the EfW CHP facility (see Section 4) and the need to have back up and peaking heating capacity these areas are regarded as only connectable under the auspices of the wider district energy scheme being promoted as a separate procurement activity by PCC. The areas to be developed are marked on the map below. New developments in the South Yard are still being considered and the only known significant development is that proposed by Princess Yachts. This is understood to be a new manufacturing facility that will require heat for space heating and process requirements. Outline energy details have been obtained although further information is required. It is understood that the new development will initially have its own steam boilers, to be used whilst the existing, old, MOD buildings are in use, to be replaced with dedicated hot water boilers for the new buildings to be constructed. The thermal demand of the finished Princess Yachts facility is understood to be in the order of 200 kW_{th} with a yearly load of around 600 MWh.

North Yard Demand

The EfW CHP plant will already meet the entire energy demand of the North Yard by supplying steam into the existing steam system. Future

developments in the Dockyard's North Yard, for example the Devonport Landing Craft Co-location Project and the Help for Heroes swimming pool and rehabilitation centre, are already included within the contracted maximum heat under the Energy Supply Agreement for the Dockyard, and are managed within the maximum contracted heat demand of 23.4 MW thermal.

It is expected that notwithstanding the above additional developments the main focus of the MOD will be to reduce the energy demand in the North Yard. Through MOD's facilities management and supply contractor, Devonport Royal Dockyard Limited (DRDL), there is an ongoing energy management programme at the Dockyard that is aimed at reducing its consumption of both gas and electricity. This includes the following measures which in the short term are targeted to reduce energy consumption by 8% over the next 5 years:

- Installing energy efficient lighting
- Raising awareness across the site of the impacts of energy usage through an awareness and 'switch-off' campaign
- Investing in additional energy monitoring and reporting systems
- Investing in inverter drives for motors
- Instigating a programme of voltage reduction throughout all sub-stations
- Improving compressed air system controls
- Replacing life expired distribution systems
- Improving heating controls
- Installing and upgrading steam system lagging.

Beyond these measures DRDL's strategy will be to continue to invest in energy efficiency and to raise awareness, with the long term target of maintaining a year on year reduction of between 1 and 2 % for the foreseeable future. The consumption profiles built into the Energy Supply Agreement with MVV reflect these energy management ambitions.

If the EfW CHP plant proceeds MVV would propose to monitor the energy demand of the Dockyard and report on the same to PCC. This would take the form of an annual audit of the above initiatives and any demand reductions achieved, together with a revision of any projections on further demand reductions, focussing particularly on steam. It should be noted that such information will only be made available if approval is granted by the MOD/DRDL. Furthermore, any ability to release heat for use in a DH

system will only be possible if the MOD agree to a revision of the contracts in place.

3 Existing and Proposed Heat Demand and Supply Assessment

Using data established as set out under Section 2 the current and future heating demand of the study area was assessed.

Residential Demand

The three areas of study outside of the Dockyard were sub-divided into a number of discrete areas for which the potential, likely, maximum heat demand was estimated. Altogether 16 areas were considered, labelled A to G1, G2, H to J1, J2, K to N, as shown below. It is estimated that there are totally more than 1,900 residential consumer points in the study area.

Applying the systematic analysis described in Section 2 to each area the peak and annual average heat demand for each area has been assessed. The values given imply that all houses in the respective areas are connected to the district heating system to form a supply rate of 100%. The results are set out pictorially in Appendix A, and are summarised below:

Area	Peak Demand (kW_{th})	Maximum Annual Average Demand (MWh_{th})	Approximate Number of Dwellings
A	4,200	9,140	64
B	240	504	3
C	930	1,896	10
D	1,570	3,300	17
E	690	1,465	12
F	730	1,572	19
G1	750	1,593	20
G2	990	2,098	25
H	5,890	12,900	~300
I	1,960	4,287	~110
J1	1,120	2,452	9
J2	925	1,577	12
K	2970	6,521	~100
L	18,150	39,888	~480
M	14,180	30,752	~420
N	9,350	20,353	~300
Total	64,645	140,296	~1,900

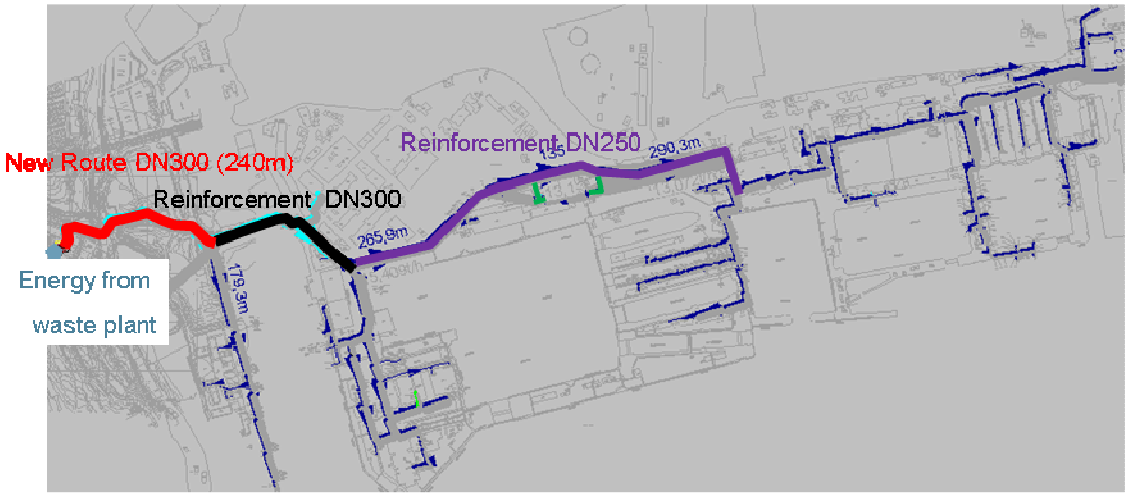
Dockyard's South Yard Demand

The current demand of the South Yard is estimated between 5 and 6 MW_{th}. Many of the older, unused buildings in South Yard are not connected to the steam system and are either not heated or connected to temporary heating sources. Future developments in South Yard include Princess Yachts. The thermal demand of the finished Princess Yachts facility is understood to be in the order of 200 kW_{th} with a yearly load of around 600 MWh. No further details were provided prior to the conclusion of this study.

Dockyard's South Yard Supply

Under the contractually agreed arrangements for the supply of steam from the EfW CHP plant, the Dockyard's South Yard steam system will be disconnected from the North Yard system, and the heat demand in South Yard will be met by the current boilers located at Morice Yard.

The Dockyard's South Yard steam system could be reconnected to the existing steam network. In order to minimise transportation losses of steam over such a large distance it would be necessary to replace the main steam transportation pipe in South Yard with its associated condensate return pipe. However, the supply of heat with process steam down to the end of the heating system at South Yard is not optimal because of high transportation losses and pressure drops even with an upgraded and optimized pipe work installation. It would be more efficient and cost effective to reinforce the (as yet) unreinforced steam pipe in the diagram below (to the south of the violet "Reinforcement DN250" pipe) and install a heat exchanger at existing Morice Yard Boiler House which is currently supplying South Yard with steam and deliver the condensed steam back to the EfW CHP plant via the condensate system of the North Yard.



It may be even more efficient and cheaper to build a large hot water pipe work system across or around the North Yard to supply the South Yard rather than to reinforce the current steam pipe work. Approximately 1050m would have to be reinforced with additionally reinforcement of the condensate system the GEF Report (see Appendix B). The GEF report also states that this pipe work has to be built as "double pipe work installation" because of the need to have a appropriate condensate return. Double pipe work in this context means that not only the steam pipe but also the condensate return needs to be reinforced. The actual condensate system will not be sufficient to transport the additional amount of condensate with the additional load of a heat exchanger for the district heat supply of South Yard. At a cost of roughly €1000/m (taken from the steam supply study as the costs for double pipe work installation) this would give an approximate cost of €1,050,000 (approximately £955,000). With these high costs it is better value for money to invest this money in the wider district

heating scheme supplying the City of Plymouth with a hot water supply sub-region in the South Yard.

Conversion of the Existing Dockyard Steam System

This system has been built up over a number of years as a medium pressure steam system with a condensate return. It runs largely over ground and requires regular maintenance to manage corrosion and leaks. It is understood that the MOD has previously considered the cost of replacing the steam system with a pressurised hot water system but with a cost of between £20 and £25 million such a replacement has not been considered further. It is considered that despite the thermal advantages this might bring the cost of replacing the steam system under the auspices of this study is not economic.

4 EfW CHP Plant District Heating Potential

Current EfW CHP Plant Design

The proposed EfW CHP plant has been designed to dispose of 245,000 tonnes per annum of household and commercial/industrial waste with maximum recovery of energy in the form of electricity and steam for supply to the Dockyard's Northyard. The maximum thermal content input to the boiler from the waste has been set at 82.1 MW_{th}. Allowing for the minimisation of natural losses the boiler can supply up to approximately 73.1 MW_{th} useful heat in the form of high pressure steam at 400 degrees Celsius and 40 bar. In theory all of this steam could be used for heating purposes, but in such a case it would not produce any electricity.

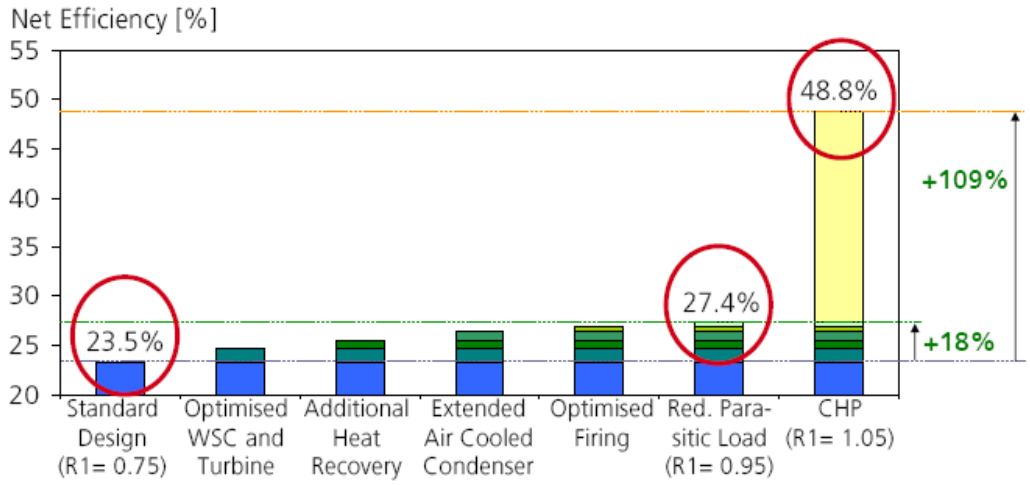
The contract with the South West Devon Waste Partnership (SWDWP) was awarded on the basis that the EfW CHP plant will supply heat and electricity to the Dockyard under the auspices of a long term contract with the MOD and DRDL. This contract is commercially confidential but obliges MVV to supply all heat (in the form of medium pressure steam) and electricity used by in the Dockyard for current operations as well as additional foreseen demands such as arising from the Help for Heroes project up to the stated limits of:

- 23.4 MW_{th} for steam
- 22.5 MW_e for electricity.

For the purposes of this study it has been assumed that in the early years the EfW CHP facility will actually supply a winter time average of 16.8 MW_{th} with up to 23.4 MW_{th} peak heat to the Dockyard to the existing heat consumers including the Fleet Accommodation Centre (FAC) at the coldest winter day. Additional new projects such as the Help for Heroes facilities are regarded as small additional loads within the current contractual limits.

The demand of the Dockyard varies over the year and in the summer is very low such that for certain periods the supply of steam will be cut off and the EfW CHP plant will operate in electricity mode only. Conventional EfW plants only produce electricity and have a net efficiency of 23-24%. Various measures can be employed to increase the net efficiency such as additional heat recovery systems. MVV's proposed EfW CHP plant includes many such features and will have an "electricity only" net efficiency of 27.4%, ie an increase in potential electricity output of 18%

when compared to conventional EfW plants. When supplying steam the average net efficiency will be 39.5% and in periods of peak steam supply, in the winter, the net efficiency will be 48.8%, ie an increase of 109% when compared to conventional EfW plants. This is illustrated in the diagram below.



MVV's EfW CHP plant design enables it not only to also produce electricity and steam for the Dockyard but also to take advantage of the Renewable Obligation scheme run by OFGEM. To obtain various fiscal benefits from this scheme it is necessary to achieve a "Quality Index" (QI) of up to 100, as set out by Good Quality CHP Scheme, whereby the energy efficiency of the project is measured according to a specified detailed formula. The proposed EfW CHP is anticipated to have a QI of approximately 105. The EfW CHP facility has already been registered under the Good Quality CHP Scheme which is operated by DECC. This is the first step towards being awarded RO Certificates (ROCs) upon which the economics of the EfW CHP facility under the terms of its contract with SWDWP have been established. The principal fiscal benefit of receiving ROCs can be met on a sliding scale basis when the QI is less than or equal to 100. Having a QI above 100 creates no additional benefits and, as designed, the EfW CHP plant will benefit from maximum ROCs. Indeed, the ability of the EfW CHP plant to still obtain ROCs with a slightly lower QI is an additional advantage.

Heat supply to the Dockyard will be through the delivery of medium pressure steam into the existing Dockyard steam system, and will be used to heat existing and foreseen additional demands in the North yard and

the FAC. Under current conditions the Dockyard's demand is not anticipated to reduce substantially due to changes in Dockyard use although there will be expected to be some year on year reductions in demand as additional (heat) energy efficiency measures are installed by or on behalf of the MOD (as discussed in Section 2). However, even with the anticipated Dockyard demand it is possible to extract additional heat supply from the EfW CHP plant without substantially reducing the electrical power output, and without significantly changing the commercially optimised position presently anticipated. Specifically such changes could be accommodated without reducing the QI to less than 100.

Should heat (or electricity) demand in the Dockyard's North Yard reduce over time, either due to reduced activity or improvements in energy efficiency, more heat (and electricity) will be available either to:

- Supply low cost heat (and electricity) to areas of the Dockyard's North Yard set aside for commercial rejuvenation (as is happening in the South Yard), or
- Supply more heat into a wider Plymouth DH scheme if developed

It should be noted that this can only be done if there are changes to the contractual arrangement with the MOD and DRDL. Subject to that, up to 40 MW_{th} of heat could be supplied, but in order to enable such additional heat to be supplied efficiently it would be necessary to increase the capacity of the steam/hot water heat exchanger and possibly replace the steam turbine due to the adjusted balance between steam and electricity. Such modifications cannot be assessed under the auspices of this study but it known that all such changes could be accommodated by the current design without introducing new buildings in the EfW CHP plant.

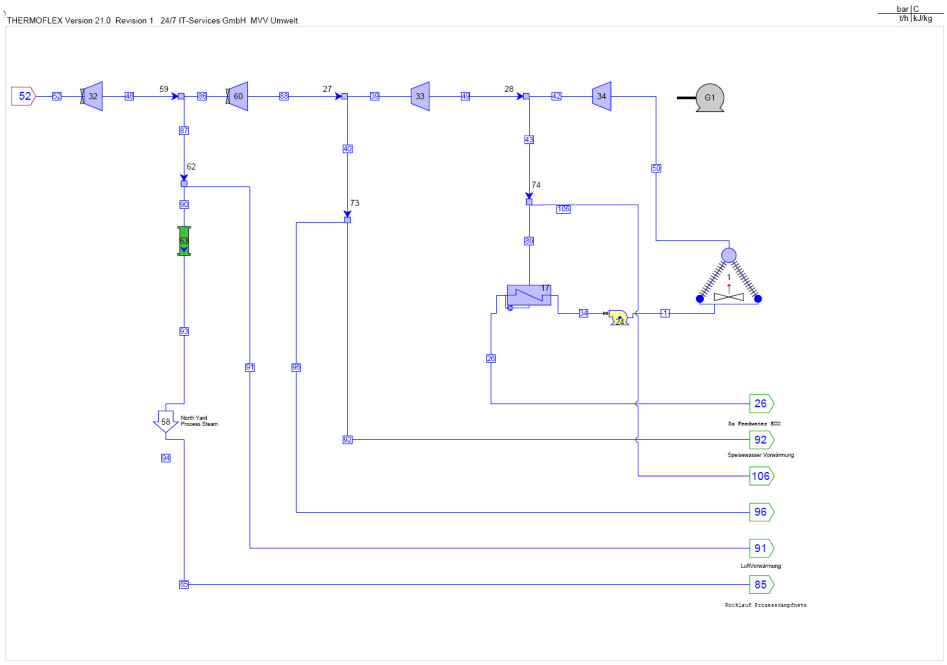
Initial Spare Heat Assessment

The initial useful free heating capacity of the EfW CHP plant has been calculated using the "Thermoflow" thermodynamic tool. This is a common standard piece of software for calculating energy balances in such projects. "Free capacity" means the heat to be delivered to third parties over and above the contracted heat demand under the Energy Supply Agreement for the Dockyard without influencing the pressure and temperature for each flow element of the water steam cycle of the plant or affecting the QI.

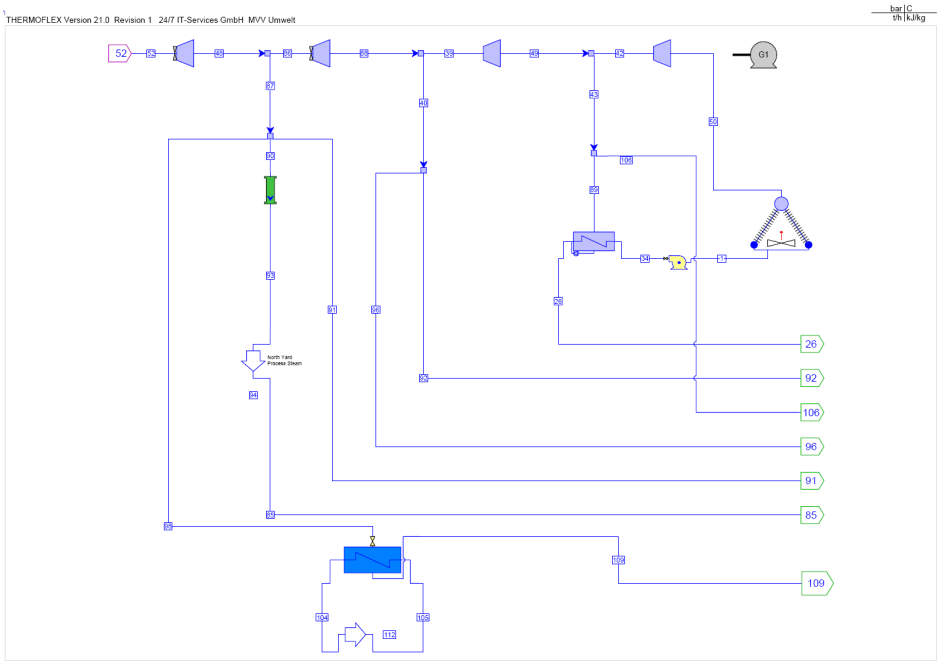
There are several technical issues to be considered when increasing the additional heat output in an already designed facility. The main equipment influenced within the CHP process is the steam turbine and the associated steam water cycle of the boiler of the EfW CHP plant. Any additional CHP heat load extracted from the steam water cycle has a back coupling effect to all other connect heat consumers. To calculate these effects MVV used the Thermoflow thermodynamic tool. This tool can also simulate major but not detailed physical effects of components used in power plant and heat processes. Additional heat can only be extracted from the turbine from the designed extractions points of the turbine with the extracted steam fed to hot water heat exchangers. Because of the nature of the CHP process additional heat will automatically lead to a loss in electricity generated. It is essential not to influence the designed steam water cycle and the corresponding pressures and temperatures at the extraction of the turbine to minimise the back coupling effects to the plant which could lead in extreme circumstances to a non functional plant.

Depending on the equipment installed the easiest and cheapest way is to use a one stage DH heat extraction condensing heat exchanger fed by the same extraction point as the process steam extraction for North Yard. This simple system could yield an additional 2.5 MW_{th} heat from the turbine. The maximum heat supply is possible by using a more efficient 3 stage DH heat extraction exchanger, pre-heating the medium temperature hot water from each of three extraction points on the turbine. The maximum additional thermal output possible, with the three stage DH heat extraction design, is 3.75MW_{th} but this value of additional heat (derived with the Thermoflow tool) will need confirmation from the supplier of the turbine.

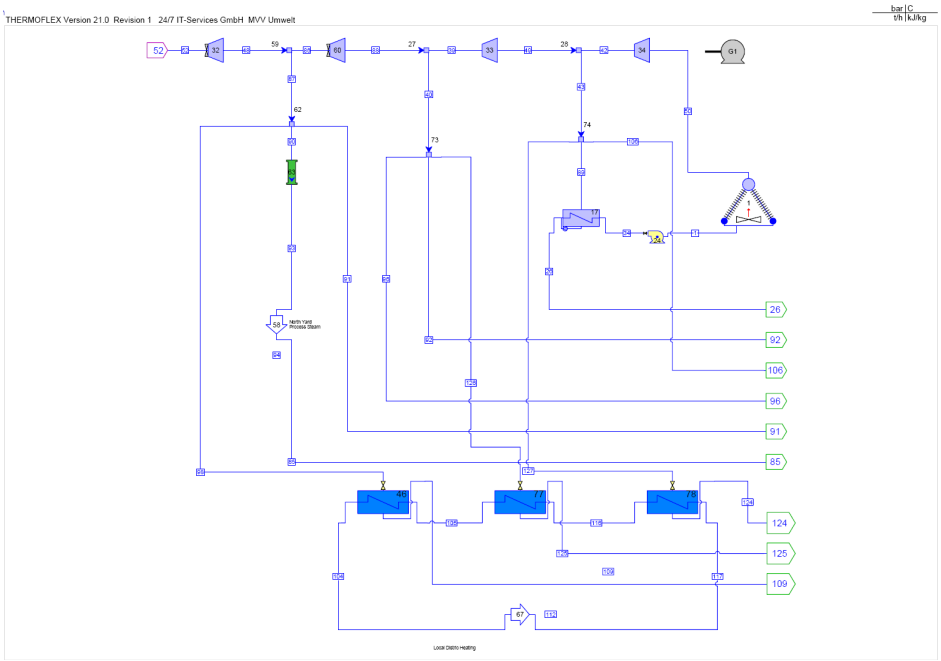
The water steam cycles for the current design situation, the single stage DH heat extraction design and the three stage DH heat extraction design are shown below.



Current design of steam water cycle with 23.4 MW thermal to North Yard



1 stage heat exchanger for additional load for district heating. Maximum additional capacity 2.5 MW thermal



3 stage heat exchanger for additional load for district heating. Maximum additional capacity 3.75 MW thermal.

In any event, as more heat is taken from the EfW CHP facility there is a reduction in the electrical power output for which there are commercial impacts. These are accounted for in the commercial analysis in Section 8. With a maximum connected heat demand of 3.75MW_{th} the total additional heat output will be 7,479 MWh_{th} per annum. This will lead to a reduction in 1,444 MWh_e electrical output per annum.

5 Short Term Technical Feasibility and Options

DH System Characteristics

DH systems are common in continental Europe although there are a few examples of systems in the UK. As such the main technology for DH is of European origin. Heat is supplied through pressurised hot water. By being pressurised the temperature of water is kept above its boiling point in the range of 120 to 130 degrees Celsius, thus enabling efficient distribution of heat over long distances.

Steam based DH systems (as established in the Dockyard) are rarely used for supplying residential and commercial properties; these would be used where there is significant industrial demand including a requirement for process steam. MVV operates a steam based system in Mannheim's industrial area but the remainder of MVV's DH systems in Germany and the Czech Republic are all pressurised hot water systems. Given this experience MVV's opinion is that the assessment of any DH system outside the Dockyard can only be based on pressurised hot water.

Pressurised hot water DH system trunk (transport) mains are large diameter pipes with a high degree of thermal insulation. A flow and a return system are required to form a closed loop which returns cooler water to the heat source for re-heating. Photographs of a typical DH system under construction are shown in Appendix C.

Typically the internal central heating system for connected properties is a wet radiator based system with a gas or oil fired boiler, operating under the natural pressure head from a tank situated at high level in the property. In a fully developed DH system the boiler is replaced by a heat exchanger which takes heat from the pressurised hot water main in the street, via a branch service. The cooler water leaving the pressurised system side of the heat exchanger is returned to the DH systems via a return branch. All pipe work is highly insulated.

In large DH systems it is essential to have a level of redundancy of heating sources such that should any one unit be out of action (eg due to maintenance) the remaining heat sources can supply heat on a continuous basis. The capacity of the heating sources has to be sufficient to cover the peak demand even when the largest single heat source is out of action.

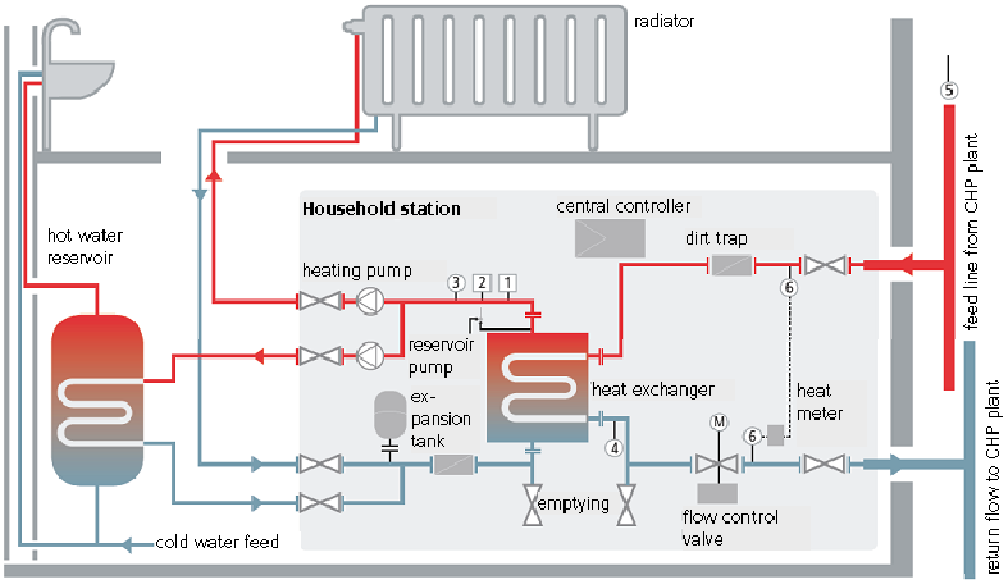
A typical property hot water central heating system connected to a DH system is shown below, together with a photograph of a typical heat exchanger unit. For the vast majority of the properties in the study area the existing heating system will enable relatively easy connection to a DH system. Each property would need to be surveyed in order to ascertain the exact space availability for the heat exchanger unit, which is typically wall mounted. The route of the flow and return branch lines from the DH system would also need to be surveyed to check for other services and any hidden obstructions.

Depending on the existing system a number of individual properties in the same block (eg the properties in Savage Road owned by Affinity Sutton and Sovereign) may be fed from a common boiler. In such cases a single heat exchanger unit could be used. If each property in a block of flats has its own boiler but lacks space to accommodate its own heat exchanger a combined heat exchanger could be used which then feed each flat with its own metered supply. The precise arrangement cannot be determined at this stage and will require a full survey.

In the case of a DH system fed by the proposed EfW CHP plant there are two issues which require specific attention:

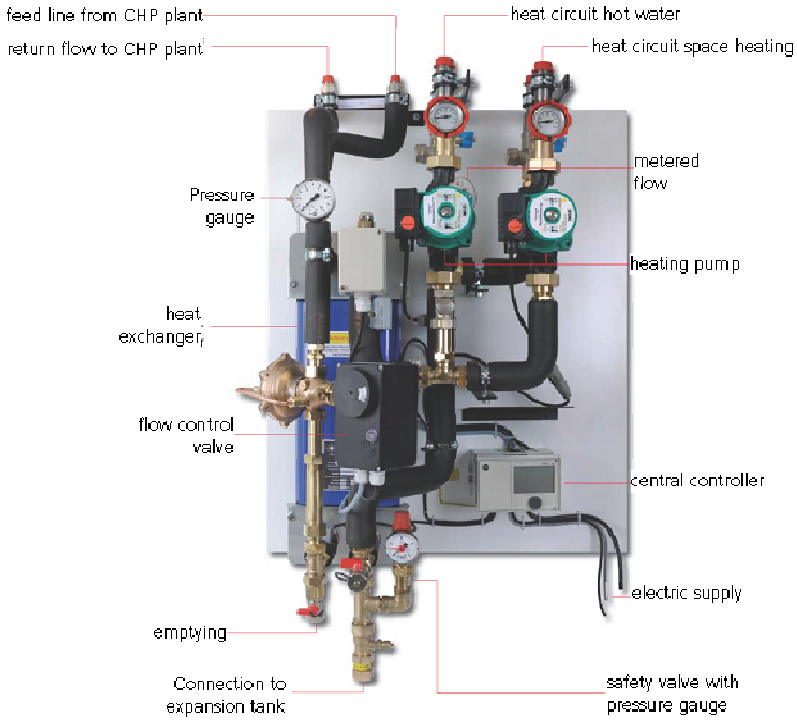
- A number of close properties do not have an existing hot water central heating system (eg the 120 flats in the ten blocks on Talbot Gardens (area C), the head lease for which is held by Sanctuary Housing)
- In the early years the EfW CHP facility would be the only heat source; there being no central standby supply of heat apart from the existing steam boilers in the Dockyard

These issues are considered further below.



1 **safety temperature probe**
2 **temperature control**
3 **feed line temperature probe**
4 **return flow temperature probe**
5 **outdoor temperature probe**
6 **temperature probe for heat meter**

Typical Schematic of Domestic System



Typical Heat Exchanger and Metering Unit

Potential DH Systems in Study Area

MVV has examined the potential for a small (micro) DH system feeding into the adjacent properties in Savage Road and Talbot Gardens, as well

as the Weston Mill Primary School on Wolseley Road, and the sheltered housing opposite the school on the other side of the St Budeaux Bypass. These areas are considered the main priority areas also because they are the nearest neighbours to the proposed EfW CHP plant; either to the plant building itself or to the traffic flows in and out of the plant.

The physical layout and sizing of the DH network necessary to feed these areas was considered. MVV employed a specialist consulting firm with which it has worked extensively on similar systems in Germany, call GEF. GEF's report on the DH system design and costs is included in Appendix B.

For design purposes the medium temperature hot water system is assumed to work with a 90°C feed temperature and ideally with a 50°C return temperature. These are common set points for such a district heating system.

If older/existing space heating systems are connected to the district heating it may happen that the return flow temperatures increase. This will then lower the supplied maximum heat to the district heating system.

For the 120 flats in Talbot Gardens/Savage Road in Area C it would be necessary to install internal wet central heating systems in each flat in order to benefit from any DH system. For assessment purposes it has been assumed that a single heat exchanger plus common standby boilers could be installed at ground floor level at each block, with independent external access. This would feed heat to each property which would be individually metered and regulated. As such the installation of a conventional hot water central heating system in each property could be very expensive, possibly requiring additional building works for the heat exchanger and boiler unit to be housed.

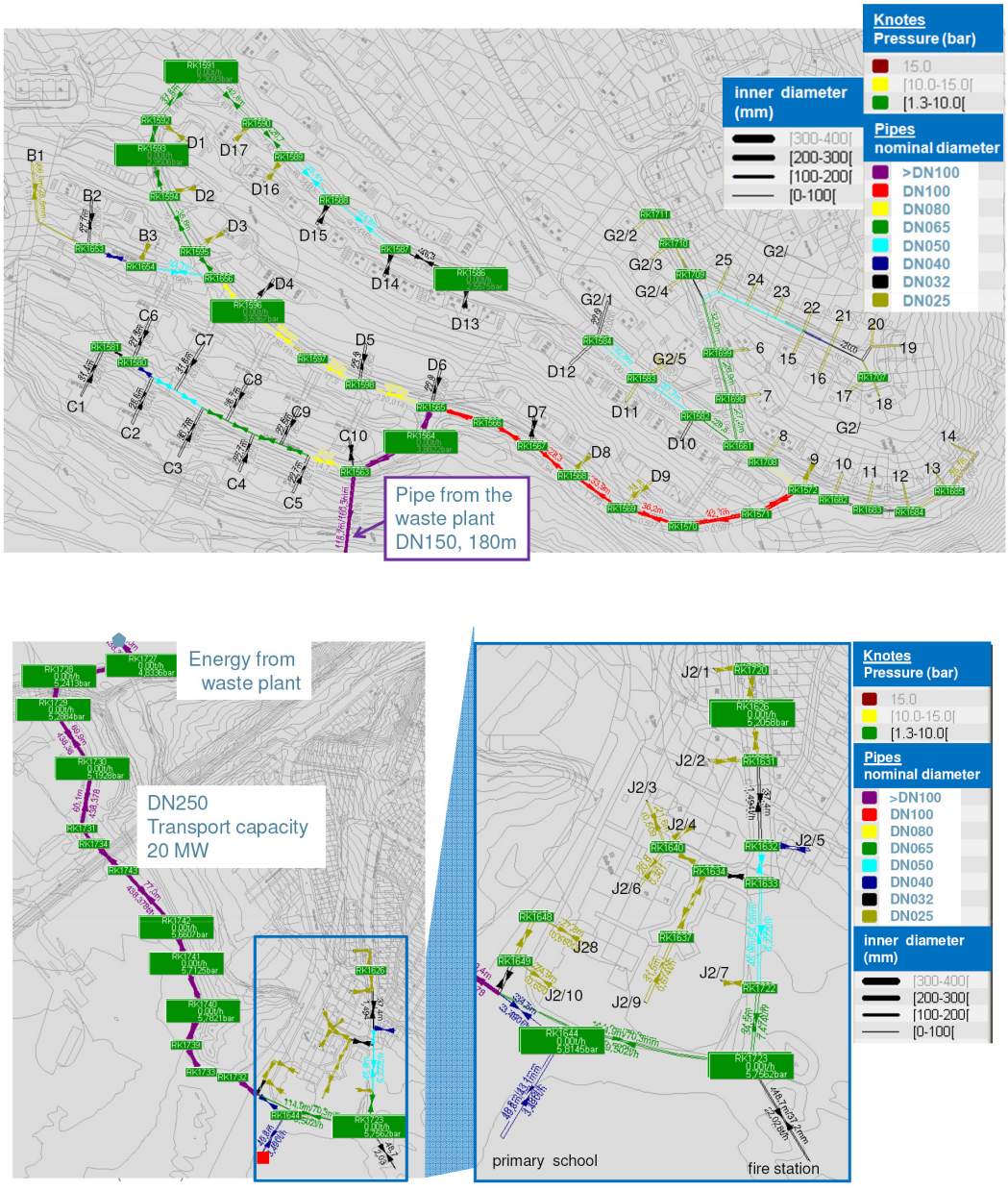
As shown in Sections 7 and 8 below, the initial analysis in this study suggests that on financial considerations alone area C would be better served with a PV system. Assuming therefore the exclusion of area C for DH analysis purposes, this study shows that the following areas could be connected technically to a micro DH scheme and supplied with their peak load heating requirements, taking account of the 3.75MW_{th} maximum free spare heat capacity available:

Area	Location Description	Peak Heat Demand (kW_{th})	Estimated Average Heat Demand (MWh_{th})	Comment
B	Between Roope Close and Kelly Close	240	500	
D	Between Savage Road and Wilkinson Road	1,570	3,300	
G2	Between Poole Park Road, Roberts Road and Mantle Gardens	990	2,100	
J2	Weston Mill School and sheltered housing	925	1,580	
Total		3,725	7,480	

As discussed in Section 8 for the purposes of cost analysis it has been assumed for each area that only 80% of the peak heat demand will be connected since it is likely that not all possible heat consumer will enter into a long term agreement with an ESCo to be supplied from district heating.

For the purposes of the remainder of this study these are collectively referred to as the Initial District Heating Schemes (IDHSs). Plans showing the principal routes along which pressurised hot water pipes could be laid for the IDHSs, subject to final survey, are shown below and included in the GEF Report in Appendix B. It needs to be stressed that all such routes

need to be thoroughly surveyed in order to confirm that the pipe work is capable of being laid along each route without undue cost to overcome existing utility and other services.



Initial Pipe Routes for the IDHS Areas

It should be noted that there will be a number of properties not in the IDHS areas which may claim to have as great a degree of impact from the proposed EfW CHP plant as those in the IDHS. Not every property claiming to be impacted can be included in the IDHS due the simple practical

limitation of available heat energy from the EfW CHP plant as set out above.

It should also be noted that the diameters for each pipe have been sized, where appropriate, to allow expansion of the system in the future. This particularly applies to the main pipe running along the proposed EfW CHP plant entrance road route which has been sized to carry the full water flow that would be required to allow the EfW CHP plant to feed an extensive, wider Plymouth DH scheme. The capacity of other pipes in the IDHS areas to enable future expansion will need to be reviewed in the Section 106 Energy Study.

Standby Heating

Back up heating sources will still be required because in the initial years, before the implementation of the wider district heating scheme, the only source of heat will be the EfW CHP plant. Back up would be required for approximately 800 hours per year. The main period when the EfW CHP plant is not producing heat will be in the summer, when residential heating demand is reduced. However, as some outages could occur in the winter period, when demand is the highest, the standby facilities have to be sized to meet the maximum demand of the IDHS areas, ie 3.7 MW_{th}.

There are three basic ways by which back up can be provided;

- A new, central, heating only, boiler located on the EfW CHP site or on nearby Ministry of Defence land
- Use the existing Babcock boilers to produce steam which would feed the EfW CHP plant's steam /hot water heat exchanger
- Maintain each current gas fired boiler to come on automatically when there is an outage (in the case of the Talbot Gardens flats these would have to be installed new)

At this stage, in order to minimise capital costs, it has been assumed that each individual consumer's boiler will be kept in place and placed on standby duty. This will require each boiler to be maintained properly so that in the event of an outage it can be relied upon to take over the heating duty. The cost of gas used in the outage period and the cost of maintaining the boiler throughout the year are not included in this analysis and will need to be considered further in the Section 106 Energy Study.

It would be preferable if the wider DH procurement process could be aligned with the proposed detailed study since many decisions made in the DH procurement will have a direct influence on the heat delivered from the EfW CHP plant.

The remaining areas of study cannot be initially supplied with heat from the EfW CHP plant in the short term as there would be no further spare heat capacity. These areas could possibly supplied from an ESCo set up under the above procurement exercise, or the heat from the EfW CHP plant could be supplied to the ESCo for such use. In either case additional heat sources would be required to supplement the EfW CHP plant and to provide back up when the former plant is under maintenance. This is discussed further in Section 5.

Alternatives to DH Systems

There are two basic alternatives to a DH system that could deliver improvements in sustainable energy performance of the study area:

- Photo Voltaic (PV) systems, or
- Improved thermal insulation with loft, wall and window insulation

Both of these options are under consideration within the CESP area noted in Section 1.

PV Systems

Notwithstanding the benefits of a DH system in terms of cost and CO_2 savings (see Sections 7 and 8) it is also possible to fit PV systems to most domestic properties. Properties would need to have a reasonable area of uncluttered roof space (ie without dormer windows) and generally be south facing with a suitable pitch. This enables the maximum exposure to direct sunlight. Domestic PV systems are becoming increasing popular with householders and the extent to which properties across the UK are fitted with PV systems is expected to increase dramatically over the next few years. This is largely driven by the Feed in Tariff system implemented in 2010 by the government and the rapidly falling capital cost of PV cells. The Feed in Tariff system pays a substantial price for power generated by PV systems regardless of whether it is exported to the grid or consumed by the householder. Payments are also made for power exported and there are savings to the householder for avoided imported power. There are also CO_2 savings to be made on any PV generated power as this

displaces power from the grid. It is therefore appropriate to test the benefits of a DH system against those potentially available for PV systems.

As a further consideration, where the current heating system is electric (typically using storage heaters with a "white meter" taking power during the night at lower tariff rates) then in order to benefit from the DH system the entire property would have to be fitted with a standard hot water central heating system. This will entail considerable extra costs and disruption to the occupiers. This applies to the 120 flats in Talbot Gardens which are known to have electric storage heating and immersion heaters as their sole source of heat.

These flats were built by the Ministry of Defence between 1966 and 1976, and are known to have poor level of insulation. The main lease is held by Sanctuary Housing although a number of flats are sub-leased in private hands. Each flat has its electricity supplied though a dedicated meter unit located in a central shaft which runs the entire height of the block.

Whilst MVV has experience of installation of PV systems in Germany, in contrast to the situation with DH systems there is a wealth of UK experience also available. MVV is working with Kier Construction who has an established PV business located at Totnes, Devon, called Kier Energy Solutions (KES). KES has examined the potential for PV cells in the subject area, looking primarily at the flats in Talbot Gardens. Their report on the technical assessment of such a scheme in Talbot Gardens is attached as Appendix D. This shows that an individual PV system for each apartment could be mounted on the roof of each block, generating almost 930 kWh of electricity each year. Of this it is estimated that 70% would be at times of high consumer demand, and so would have the effect of reducing the consumer's import of electricity. The other 30% would be at times of low consumer demand and so would be exported to the grid.

The KES assessment looks at just five of the ten blocks in area C (being those with the Talbot Gardens address) but it is equally applicable to the other five blocks which have a Savage Road address. The work to carry out such a PV development is already under consideration as part of the CESP project referred to above.

Insulation

The same blocks of flats in area C are known to have poor insulation levels and the main lessee, Sanctuary Housing, has considered the possibility of

externally cladding the buildings with a specialist, weatherproof, insulation system. The work to do this is already under consideration as part of the CESP project referred to above and subject to the successful outcome of that the insulation work is expected to go ahead before December 2012.

As far as MVV is aware, there have been no other studies to improve the thermal insulation of any of the other buildings in the study area other than conventional cavity insulation. The precise extent to which the existing building stock has such insulation already cannot be quantified at this stage and would need more detailed assessment.

Generally the installation of thermal insulation in roof spaces and lofts has a very low capital cost and achieves reasonable reductions in thermal demand. Cavity wall insulation in properties which have cavities is also relatively easy, although more expensive. Improved heat loss through windows is also possible with modern wood or uPVC double or triple glazed units. Costs can be quite high.

Generally, supported by a variety of government initiatives over the past years, a substantial proportion of the UK's older building stock has been improved with one or more of the above measures. Within the scope of this study it has not been possible to assess the extent to which existing properties could benefit from additional thermal insulation. This is something that would have to be included in the Section 106 Energy Study.

6 Longer Term DH Technical Feasibility and Options

Beyond the IDHS areas there is still the potential to supply heat through a DH system to a wider area. However, to do so will require additional heat input beyond that which is initially available from the EfW CHP plant. The capital cost of such a wider scheme will also be considerable and cannot be contemplated under the auspices of the EfW CHP contract with the SWDWP. It is understood that PCC intends to embark on a procurement exercise to select a private sector partner to create another, bigger, ESCo (BESCo) to establish such a scheme but at the time of this study only a market testing exercise had been carried out in March/April 2011.

Subject to the Section 106 Energy Study it is anticipated that a significant area of Barne Barton (areas A to G2, excluding B, C, D and G1) and Keyham (areas H to N, excluding J2) could be added to a larger DH scheme but only if additional heat input is available. Further areas could also be added including Devonport and the Dockyard's South Yard. However, until the wider DH procurement exercise is initiated by PCC the studies carried out for them by ICT Ltd in 2010 remain a valid assessment of the feasibility.

It has to be clearly understood that due to the contractual commitments applying to the EfW CHP facility that the supply of additional heat (ie beyond the 3.75MW_{th} assessed in Section 4) can only be supplied from the EfW CHP facility if there is a reduction in demand from the Dockyard. Therefore, in order to realise a wider DH scheme additional heating capacity would be required.

MVV has carried out its own initial review of the wider DH opportunities and assessed the demands and potential heat source requirements (ie those required in addition to the EfW CHP plant) and a review of that assessment is included in Appendix E. This shows that as well as the above areas of Keyham and Devonport a much wider area including the City Centre and Derriford is possible. Major trunk mains in excess of 13 km in length would be required, as well as significant branch systems of smaller diameter.

In this scenario the EfW CHP plant could, subject to agreement with MOD and DRDL, provide much more heat than the initial 3.75MW_{th} identified in Section 4. It would be necessary to reconfigure the water-steam cycle and replace the steam turbine in order to enable the delivery of more heat but MVV estimates up to 40 MW_{th} could be produced. Assuming no

reduction in the Dockyard heat demand this would allow up to 17 MW_{th} to be supplied into the wider DH system, including the IDHS demand. This assumes no reduction in the demand of the Dockyard. If the Dockyard's demand were to reduce additional heat could be supplied into the wider DH system. Such additional heat would be supplied as "base load" heat as the EfW CHP plant will act in a steady state, but the heat sent to the wider DH system would go up as the Dockyard demand went down seasonally, and vice versa.

Any additional heat supply will decrease the power production capability of the EfW CHP plant. Since the current balance of heat and power from the EfW CHP plant is optimised to the current heat and power demand of the Dockyard the changes in the design of the EfW CHP plant noted above will require additional investment. This cost will affect the current commercial arrangements potentially adversely, since the EfW CHP plant's energy is delivered directly to MOD/DRDL via private networks. A reduction in the production of electricity from the EfW CHP plant means that this electricity has to imported from grid at higher costs and therefore needs to be commercially compensated for by the revenues received from the additional heat consumers.

The wider DH scheme will require significant capital investment not only in trunk mains, connections, metering and customer service systems, but also additional heat inputs. Additional heat inputs could come from new capital projects built as part of the wider DH scheme (eg a biomass boiler) or could be purchased by the BESCo under arm's length agreements with the owner of the heating assets. Such heating assets could be the existing boilers owned by DRDL in the Dockyard's South Yard, and the boilers at Derriford Hospital owned by the Plymouth Teaching Primary Care Trust.

Indeed, heat from the EfW CHP facility would have to be supplied to the BESCo under such an arm's length contracts with MVV Environment Devonport Limited, as the EfW CHP plant owner.

7 Carbon Savings Assessment and Comparisons

The EfW CHP plant will, without any DH scheme, enable the saving of 70,000 tonnes per annum of CO_2. This figure has been previously calculated using the Environment Agency's WRATE analysis programme which is the standard tool for determining the CO_2 impacts of different waste treatment options. The figure of 70,000 tonnes per annum assumes the proportions of power and heat supplied by the EfW CHP plant under its current contractual arrangements, and takes account of the biogenic content of the waste, plus avoided landfill and transport CO_2 (and other greenhouse gases) emissions. If the proportions of power and heat supplied by the EfW CHP plant were to change (ie more heat and less power) the CO_2 savings would improve, even allowing for the fact that (as stated in Section 4) there would be less power generated by the EfW CHP plant and thus a need for more power to be taken from the grid. This grid power would result in additional CO_2 emissions elsewhere.

Thus, the construction of a DH network supplied from the EfW CHP plant will, in either case, result in lower CO_2 emissions. The heat supplied by the EfW CHP plant will displace approximately 90% of the entire heat demand of a typical household, assuming that the back up heating system remains the property's existing boiler. Thus the CO_2 savings potentially available by supplying heat from the EfW CHP plant fed DH system are a function of the domestic demand of the households in each area.

Likewise a PV scheme will generate CO_2 savings based on the amount of power generated by the PV cells, which is not related to the electricity demand of the household. Thus the CO_2 savings potentially available from PV cells are not a function of domestic demand but are principally a function of the amount of light falling on them.

The CO_2 savings that could be achieved from additional thermal insulation cannot be assessed in the timescales for this study and require significant assessment of the current housing stock, possibly involving door to door enquiries. Even though the savings in CO_2 emission will be lower than those that could be achieved with a DH system the capital cost will be significantly lower, so on a specific cost bases thermal insulation may be a better option.

CO_2 Savings Assumptions

CO_2 emissions from different fuels used to heat a typical household were taken from the following table published online at:

:http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,163182&_dad=portal&_schema=PORTAL

The table shows annual CO_2 emissions from heating a typical house (20,000 kWh/year) via a variety of heating systems, each time comparing CO_2 savings to natural gas and oil.

Fuel	Net calorific value (MJ/kg)	Carbon content (%)	Approx. life cycle CO_2 emissions (including production) See note 1		Annual total CO_2 emissions to heat a typical house (20,000 kWh/yr)		
			kg/GJ	kg/MWh	kg	kg saved compared with oil	kg saved compared with gas
Hard coal	29	75	134	484	9680	-2680	-4280
Oil	42	85	97	350	7000	0	-1600
Natural gas	38	75	75	270	5400	1600	0
LPG	46	82	90	323	6460	540	-1060
Electricity (UK grid)	-	-	150	530	10600	-3600	-5200
Electricity (large scale wood chip combustion)	-	-	16	58	1160	5840	4240
Electricity large scale wood chip gasification)	-	-	7	25	500	6500	4900
Wood chips (25% MC) Fuel only	14	37.5	2	7	140	6860	5260
Wood chips (25% MC) Including boiler	14	37.5	7	25	500	6500	4900
Wood pellets (10% MC starting from dry wood waste)	17	45	4	15	300	6700	5100
Wood pellets (10% MC) Including boiler	17	45	9	33	660	6340	4740
Grasses/straw (15% MC)	14.5	38	1.5 to 4	5.4 to 15	108 to 300	6892 to 6700	5292 to 5100

As stated in Section 4, by providing heat for district heating the EfW CHP plant will produce less power. A simulation programme called Thermoflex was used to calculate the loss of power caused by providing 20,000 kWh of district heating. Depending on the connected heat capacity of the DH system there are different factors of energy production loss.

The first factor to be applied for the additional connected heat capacity for the first 3,750 kW_{th} supplied (ie the maximum available from the EfW CHP plant under its current contractual limitations) is a specific electricity loss rate of 0.19 kW_{el}/kW_{th}. If the connected heat capacity is larger then the actual maximum contracted heat capacity of 23.4 MW_{th} there would be no more electricity production because all the heat needs to be exported directly to the district heating system without producing any electricity. This also means that the parasitic load of the plant has to imported from the grid. Therefore, under a larger thermal output, the loss of electricity production will be 25 MW_{tel} and the specific electricity loss

rate will be 0.34 kW_{el}/kW_{th}. As noted in Section 6 commercial factors would also have to be considered.

This power can no longer be generated in the EfW CHP plant and must thus be produced by other, conventional power plant connected elsewhere to the UK grid. This will result in the production of CO_2 emissions produced at those conventional power plants. DEFRA publishes on a yearly basis guidelines entitled "2011 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting". There are different GHG factors to be used depending on the consumption of energy. For example there is a distinction between direct and indirect GHG emissions. Since the figures used in this study's analysis were for heat consumption it is necessary to convert the heat demand into an equivalent natural gas consumption. From Annex 1 Table 1c of the DEFRA document a conversion factor of 0.18360 kg CO_2/kWh for natural gas on a gross calorific value basis has been used. Assuming an efficiency factor of 80% for the individual boilers in each house it is possible to calculate the natural gas consumption by dividing the heat consumption with the efficiency factor of the boiler and multiplying it with the ratio of the gross to lower calorific value.

If electricity is used for heating it is necessary to use a conversion factor (found in Annex 3 Table 3c of the DEFRA document) for grid power in 2009 of 0.52462 kg CO2 per kWh.

<u>CO_2 Savings Specific Capital Cost Comparison</u>

A full assessment of the CO_2 savings achieved area by area by the implementation of a DH system is set out in Appendix F. This shows considerable CO_2 saving potential under a wider DH scheme. The CO_2 saving for each area is compared to the capital cost of that part of the DH system, taking into account the transport trunk mains requirements. Operating costs should also be considered in due course. The total of all areas A to N examined in this study (which for the avoidance of doubt cannot all be supplied by the EfW CHP plant initially due to current contractual commitments) has a saving of almost 29,000 tonnes CO_2 per annum at a specific cost of £74.36 per tonne of CO_2 saved over 25 years. The specific costs are higher for individual areas due to the lack of economy of scale. For the IDHS areas the saving is over 1,500 tonnes CO_2 per annum at a specific cost of £74.01 per tonne of CO_2 saved over 25 years.

The energy replacement potential of a PV system is considerably lower than a DH system simply because, as stated above, the energy generated by a PV system is a function of light availability and, even under the higher light availability in the south west of the UK, a typical household PV system will not displace all grid power imported by a consumer. Taking the flats in area C as an example (since these have electric heating which could be replaced by new water central heating systems fed by the DH system) it is calculated that the respective CO_2 savings are as follows using the conversion described above:

CO_2 Savings Specific Cost from PV:

Electricity substituted	2,266 MWh over 25 years
CO_2 savings	1,188 t CO_2 over 25 years
Capital cost	520,000 £
CO_2 saving specific capital costs	437.71 £/t CO_2

CO_2 Savings Specific Cost from DH (including cost of new internal heating systems):

Electricity substituted	38,594 MWh over 25 years
CO_2 savings	20,247 t CO_2 over 25 years
Capital cost	1,554,000 £
CO_2 saving specific capital costs	76.75 £/t CO_2

Because of the need for subsidies (as explained in Section 8) these have to be considered too. The table below shows the effect the different subsidies calculated under Section 8 in terms of CO_2 savings. It should be noted that under the FIT scheme any PV system will also receive a subsidy in the form of higher electricity prices for generated power, and this has the effect of reducing the capital subsidy required for the PV system. In Section 8 this is £97,000 for Area C. The effect of the FIT over 25 years is significant; without the benefit of the FIT the PV scheme would require a subsidy of £1.475 million.

Supplied area / scheme	Subsidy required	CO_2 savings	CO_2 specific subsidy cost
Areas B, D, G2 and J2	£ 1,381,000	38,436	£ 35.93
Areas B, D, G2	£ 597,000	30,330	£ 19.68

Areas B, D, G2 and J2 without 250 mm diameter trunk main	£748,000	38,436	£19.46
Area C with PV	£97,000	1,188	£81,65
Area C with PV and Feed in Tariff	£1,475,000	1,188	£1,241.58
Area C with district heating	£1,109,000	20,247	£54.80

Thus it can be seen that for area C, the specific costs of CO_2 savings is substantially lower with a DH system, even allowing for the additional cost of replacing the internal heating systems.

For other properties in the study area, an approximate comparison of CO_2 savings between PV and DH has been made. By visual inspection these properties use gas for their heating. In addition, for such properties, which are generally houses, the available roof space may be larger and so additional PV cells could be installed, thereby increasing the amount of electricity generated and the corresponding CO_2 savings will be higher. However, the majority of properties in the study area are terraced and as such the additional suitable (ie generally south facing) roof area is not considered significant when compared to the roof area for each of the flats in area C. Indeed, for a number of properties the alignment of the roof may not be suitable for optimal PV electricity generation. Thus a specific cost of CO_2 savings can be considered comparable to the situation in area C, and a specific cost of more than £300 per tonne of CO_2 saved is considered reasonable for comparison purposes. This is therefore at least five times higher than the corresponding figures for a DH system. It should be noted that these costs are based only on capital costs and do not take account of operating costs or subsidy requirements. This will have to be further considered in the Section 106 Energy Study.

Given the lack of accurate data on thermal insulation levels it has not been possible to assess the specific costs of CO2 savings due to additional thermal insulation. This would have to be carried out under the Section 106 Energy Study.

8 Commercial Feasibility and Potential Commercial Arrangements

Economic Assessment Methodology

The implementation of a DH system in the IDHS areas, whilst technically feasible, needs to be examined from a commercial view point. This is done by calculating the internal "rate of return". This rate of return is calculated by taking the income from energy sales (at heavily discounted prices - see below), less the cost of operations (including lost electricity revenues) and maintenance, to give an "operating cash flow". This operating cash flow is compared, before the deduction of any tax, to the initial capital investment (regardless of how that investment is financed). The "rate of return" is equivalent to the interest rate that would have to be applied to a loan of the same value as the capital investment to achieve the operating cash flows. DH schemes are typically long term investments requiring some degree of government support in one way or another. This is likely to be the case of the wider Plymouth DH scheme being considered by PCC. However, for the IDHS areas considered in this report it is recognised that government financial support is unlikely to be forthcoming and as such the initial schemes need to be justified by the investor; MVV.

Since the initial schemes are being proposed on the back of the EfW CHP plant, and are seen by MVV as an opportunity to provide some benefits to those residents closer to the facility, the rate of return sought by MVV on any such investment is below that which would ordinarily apply to other DH schemes. Typically this would be in the range of 12 to 15 %, measured before the deduction of tax. Of most importance, despite the large benefits of reduced cost of heat (or electricity) to the end consumers the infrastructure of the IDHS is expected to be at no capital cost to them.

For the purposes of this study MVV has assumed a lower rate of return being required, being that simply necessary to cover the cost of finance. For the purposes of the IDHS scheme MVV believes a minimum rate of return of 9.0% is necessary. This rate is set having regard for the cost of finance available to MVV from its corporate lenders, the repayment of which is fully guaranteed by MVV. It is a fixed rate, and would not be subject to variation over the long term (see below) duration of the IDHS assets.

The rate of return of 9.0% is set assuming that inflation will be at a standard rate of 2.5% per annum. This is the figure used in PFI projects as a standard

inflation rate, although clearly, in reality, the rate of inflation will vary from year to year.

For each scheme the income, operating and capital costs have been estimated.

Income Assumptions

To calculate the IDHS income MVV has assumed certain benefits accruing to the end consumers in the form of lower energy costs. In the light of the proximity of the end consumers in the study areas it has been assumed that the total annual cost for heating from the IDHS system would be 20% below the cost under current market price conditions. The current market price has been taken as the quoted cost of gas to domestic consumers for the first quarter of 2011, increased by 15% to allow for the recently announced gas price increases (some as high as 20%). According to OFGEM in the first quarter of 2011 the gas demand of a medium sized domestic property was 16,500 kWh per year worth £608, leading to a unit gas price of £36.85/MWh (see Appendix G - OFGEM Domestic Energy Data Factsheet 96). Adding 15% to this to allow for recently announced price increases and then deducting a 20% discount gives a unit price of £33.90/MWh which has been used as the rate paid by consumers for heat.

Thus a typical consumer could see a free financial benefit or some £120 per annum. This would be achieved without any additional costs by the consumer.

It has also been assumed that, as a further benefit to consumers, the cost of such DH energy would be increased by the Retail Prices Index, rather than being pegged to gas prices, so that end consumers will enjoy the additional benefit of not being exposed to more future price increases in gas.

Despite the 20% discount over current gas prices being offered it is unlikely that all potential consumers in the IDHS areas will agree to sign to take heat from the DH system. As such MVV has assumed an 80% uptake rate and accordingly heat demand for each area has been assessed at 80% of the total estimated for each IDHS area set out in Section 3. In any event, there would need to be a minimum number of consumers (approximately 50%) initially willing to be connected to the IDHS in order for it to be viable.

Operating Cost Assumptions

Operations costs include the costs of power to pump the hot water around the DH pipe work and the costs of reading heat meters. These, together with maintenance costs are estimated at 1% of the initial capital cost per annum.

Additionally, by supplying the additional heat capacity to the IDHS areas the EfW CHP plant would produce less electricity, thereby reducing the income to MVV. This also has to be allowed for when assessing the rate of return. The loss of power output is assessed as being 0.19MWh_e of electricity per MWh_{th} of heat. The price of power lost has been assumed to be £65/MWh; this represents a reasonable forecast of future electricity income which the EfW CHP facility would achieve from grid sales.

Capital Cost Assumptions

In evaluating capital costs standard costs for DH systems in Germany have been used. It is considered that such costs in the UK will be comparable and an exchange rate of 1.1 €/£ has been adopted. Since the work would not be carried out until 2013/2014 the standard inflation rate of 2.5% has also been applied.

It has also been assumed that the ESCo would benefit from:

- Wayleaves/easement to cross highways and land belonging to housing associations and private owners being free of charge
- A concession agreement for the IDHS areas under which PCC guarantees not to allow any future DH scheme (eg arising from the wider DH procurement exercise) to connect to the concession area properties being granted free of charge

MVV has assessed the capital costs of the IDHS schemes area by area using consultants experienced in DH schemes called GEF. Capital costs are assessed in GEF's report is included in Appendix B. The capital cost has been broken down into various elements:

- Central heat exchanger to convert steam energy to pressurised hot water energy
- Trunk (transport) pipe work to transfer heat from the EfW CHP facility through the streets (generally this will be up to 150 mm diameter flow pipe with an equally sized return pipe)

- Branch connection to each consumer*
- Heat exchanger and metering unit at each consumer premises*

Items marked * are only applied to those consumers that enter into contracts to take heat from the EfW CHP facility (see below). This has been assumed as 80%. However, it is further assumed that these consumers will all sign up at the outset of the project such that all consumer connections can be constructed at the same time, thereby achieving an economy of scale to minimise capital costs.

For area J2 it would be necessary to lay a separate trunk main along the access road of the EfW CHP plant and it would make sense to size this pipe sufficient to take the potential heat that could be supplied to the wider DH scheme, as discussed in Section 6. This therefore needs to be of a larger diameter than the trunk mains supplying the three areas in Barne Barton, and a diameter of 250 mm has been calculated. This main also would be longer than the trunk mains supplying Barne Barton. This means that the economics of area J2 are unduly disadvantaged by this additional capital cost. The heat demand of area J2 is only 24% of the total which further disadvantages this area compared to the three areas in Barne Barton.

A contingency of 15% of all capital costs has been added to allow for uncertainties in the current study, in particularly the costs of overcoming various existing utility services in the ground which cannot be assessed at this stage. It will be necessary to carry out the Section 106 Energy Study to reduce this contingency.

Corporate Form

In order to differentiate between the waste management business of MED and the responsibilities of running a DH system it may be that the IDHS assets are owned by a separate IDHS ESCo company. This would be a "not for profit" company.

Each consumer would need to sign agreements with the ESCo for the initial connection and to be supplied heat exclusively from the ESCo for an agreed term, which is likely to be for at least 10 years (the Supply Term), preferably 20 years or more. However, given the proposed discounts of energy compared to gas heating it is expected that the majority of consumers would have no objections to such agreements, especially given the price protection afforded by RPI escalation. The ESCo may also

have to take responsibility for ensuring that each consumer's gas boiler is maintained safely during the Supply Term so that it will work in standby mode and come on automatically when there is an outage. The supply of gas during an outage will need to be reviewed in the Section 106 Energy Study.

DH Economic Analysis

The rate of return has been assessed for each IDHS area using an Excel spreadsheet based financial model over a 25 year operating period. This is included as Appendix H. This is used to calculate the rate of return without a capital subsidy, and, if appropriate, to calculate the capital subsidy necessary to achieve the minimum rate of return of 9.0%. It also calculates the simple pay-back period, ie the period of years in which the initial capital investment is paid back. This is an alternative simple measure to the rate of return calculation of financial viability.

Due to the small scale of the IDHS areas, and the relatively small number of consumers taking heat compared to the initial capital investment, the initial economic analysis shows that none of the IDHS areas achieve the minimum rate of return.

The capital costs, rate of return, and payback period for each IDHS area are set out below.

IDHS area	Capital Cost (£ million)	Rate of Return (%)	Pay back period (years)	Comment
B	0.135	5.9	14.5	
D	1.019	4.5	16.5	
G2	0.611	5.1	15.5	
J2	1.056	0	>>50	As noted above, area J2 suffers additional trunk main costs which reduce the economic viability
Total	2.821	2.5	20.5	

Clearly the average rate of return for all four areas of the IDHS is well below the minimum of 9.0%. This is primarily because the IDHS area capital cost is high compared to the connected heat demand. Indeed, in order to achieve the minimum level of rate of return a subsidy is required. This is assumed to be a capital subsidy, but could also be in the form of a revenue subsidy as well.

Currently the only subsidy available to DH scheme as envisaged would be under the Renewable Heat Incentive (RHI). Under the recently announced regulations for the RHI projects which are eligible for the Renewable Obligation (RO) cannot simultaneously be eligible for the RHI. The economics of the EfW CHP plant have been based on maximising the ROC income and the project has already been registered under the Good Quality CHP Scheme operated by DECC. This is the first step towards being awarded ROCs upon which the economics of the EfW CHP facility under the terms of its contract with SWDWP have been established. The subsidy available from ROCs is substantially greater (approximately five times) than that which would be available under the RHI and as such switching to receive income under the RHI instead would not serve to improve the EfW CHP plant's economic situation.

Calculation of the rate of return, as set out in Appendix H, shows that in order for the IDHS to be viable it will require a subsidy of £1.381 million to bring the rate of return to 9.0%.

Given the particularly poor economics of area J2, two sensitivities were examined:

a) Removal of area J2 from the analysis such that only areas B, D and G2 are supplied

b) Inclusion of area J2 but with the removal of the cost of the 250 mm diameter trunk main on the basis that this is part of the costs MVV would have to bear if it were to be the developer of the wider DH scheme.

The economics improve under both scenarios, requiring a lower subsidy as follows:

Scenario	Subsidy required to achieve 9.0% rate of return (£ million)
Areas B, D, G2 and J2	1.381
Areas B, D, G2	0.597
Areas B, D, G2 and J2 without 250 mm diameter trunk main	0.748

PV Economic Assessment

It has not been possible in the timeframe available to assess the economic viability of PV systems in all the areas included in this study. This can only be considered further under the Section 106 Energy Study.

Due to the particular circumstances of the 120 flats in Talbot Gardens/Savage Road (area C) a PV scheme has been assessed. The economics of the PV scheme have been assessed using technical and cost data from KES. This is included in Appendix I. This shows that an individual PV system for each apartment could be mounted on the roof of each block, generating almost 930 kWh of electricity each year. Of this it is estimated that 70% would be at times of high consumer demand, and

so would have the effect of reducing the consumer's import of electricity. The other 30% would be at times of low consumer demand and so would be exported to the grid.

Any PV investment would also be done on a "not for profit" basis, possibly by the IDHS ESCo, but possibly as a separate commercial ESCo. The ESCo would install the PV systems for each flat and pay all capital and operating costs. Residents would benefits from free electricity when the PV cells are exporting and only pay, at their normal tariff, for power imported from the grid when demand is high or PV output is low. This would tend to modify consumers' demand patterns to encourage greater use of power in the day, and less at night.

Potentially the consumer could reduce his imported power requirements by 70% of the electricity generated by the PV system. At a typical tariff of £160/MWh it is estimated that the annual benefit to consumers would be over £100 per annum. This would be achieved without any costs by the consumer.

Through smart meters installed before the connection of each system to each domestic consumer unit the total electrical generation from the PV systems can be remotely monitored. Export is either 'deemed' by the supplier in agreement with the consumer, or monitored by a further meter installed between the existing import meter and consumer unit.

With this metering information the ESCo would claim the income from the Feed In Tariff (FIT) and net exported power to provide the return on the initial investment. The rates for these are prescribed under regulation and are scheduled to be £39.60/MWh and £3.10/MWh respectively from March 2012. The consumers' arrangements with their current electricity supplier will not have to be changed as the demand for imported electricity will simply reduce. This issue will have to be explored in more detail in the Section 106 Energy Study. As with the IDHS there would need to be a minimum number of consumers agreeing to have PV systems fitted but for the same price incentive reasons it is considered that uptake would be high.

The economic viability has also been assessed using a 25 year operational life financial model in an excel spreadsheet. This is included as Appendix I. Costs are as estimated by KES although for the non-PV cell costs a contingency of 15% has been added. The economic assessment is set out below:

IDHS area	Capital Cost (£ million)	Rate of Return (%)	Pay back period (years)	Comment
C	0.519	6.8	13.5	Includes FIT subsidy benefit
Total	0.519	6.8	13.5	

The assessment shows that a subsidy of £96,833 is still required to achieve a rate of return of 9.0%. However, with the capital cost of PV systems decreasing at a significant rate every year it may well be that a PV system will prove viable on a "not for profit" basis without a subsidy. This can only be ascertained following the Section 106 Energy Study.

Area C DH Assessment

For comparison with a PV system the economics of connecting area C to the DH system have also been considered, taking into account the additional cost of fitting new, internal central heating systems into each flat. The cost of this has been assessed at €10,000 (£9,090) per flat, as set out in Appendix B. In this situation the rate of return is too low to be calculable. The subsidy required to restore the rate of return to 9.0% is £1.109 million. Thus it can be seen for area C that PV cells would be a far more effective financial investment.

Fuel Poverty

Fuel poverty can be considered with a scheme recently introduced by OFGEM called the Warm Home Discount for licensed supplier. This could be offered so that anyone who is eligible for this scheme as part of the core group would get the same benefit as if they are supplied with gas. This would mean the consumer would get an additional rebate of £120 rising to £140. Such a scheme could not be considered for consumers connected to the IDHS since they will receive a substantial heating cost benefit. The financial impact would be small since there will be not so many direct consumers.

9 Summary and Recommendations

This study shows that there are a number of ways in which the sustainable energy performance of the study area could be improved as a result of the development of MVV's proposed EfW CHP plant.

Principally this could be achieved with a micro DH system in the closer parts of Barne Barton. The area immediately opposite the Dockyard's Camels Head Gates at Weston Mill could also be developed with a micro DH scheme. In both cases a capital subsidy would be required. However, this study shows there is the potential for a reasonable micro DH system in Barne Barton that would require a capital subsidy of £500,000 and provide significant energy benefits to connected consumers of up to £120 per annum, as well as significant CO_2 savings. The total of all areas A to N examined in this study (which for the avoidance of doubt cannot all be supplied by the EfW CHP plant initially due to current contractual commitments) has a saving of almost 29,000 tonnes CO2 per annum over 25 years at a specific capital cost of £74.36 per tonne of CO_2 saved. The specific costs are higher for individual areas due to the lack of economy of scale. For the IDHS areas the saving is over 1,500 tonnes CO2 per annum over 25 years at a specific capital cost of £74.01 per tonne of CO_2 saved.

In addition, for the 120 flats in Talbot Gardens/Savage Road (area C) a PV system could also be developed that would also provide energy benefits to consumers of over £100 per annum, as well as CO2 savings. Such a PV scheme would, under current cost assumptions, also require a capital subsidy but, subject to the Section 106 Energy Study, it is consider that such a subsidy could be reduced or even eliminated as capital costs of PV systems fall.

To further assess the above MVV proposes to carry out a Section 106 Energy Study after it has been granted planning permission for its proposed EfW CHP plant. The terms of reference and scope of this study would be agreed with PCC. Although the Section 106 Energy Study will include the detailed assessment of DH, PV and thermal insulation options it is anticipated that the main outcome of that study will focus on DH options, leveraging on the availability of renewable heat from the EfW CHP plant.

This study recommends that the following steps are taken under the Section 106 Energy Study for the detailed assessment of an extensive DH network:

1. Segregation of the study region into smaller, contiguous areas

2. Categorisation of potential heat consumers and use of energy, eg
    - Space heating private
    - Space heating business
    - Hot water utilisation
    - Industrial consumers (eg laundries, etc)
    - Cooling with installation of adsorption cooling machines

3. Collection of data and assessment of current status of existing infrastructure, eg data on:

    - housing structure in the individual areas
    - building density in the individual areas
    - examining routes for district heating pipe work
    - existing type of heating (fuel and technical equipment)
    - consumption patterns
    - population density
    - meteorological conditions

4. Collection and assessment of data on energy market development, eg:

    - Energy policy framework conditions
        i. Energy targets (national)
        ii. Energy targets (regional)
        iii. Subsidy programmes (international, national, regional)
    - Energy price development

5. Collection of data on population development

6. Collection of data on structural developments, eg:

    - Urban development programmes
    - New housing developments
    - Industrial areas
    - Redevelopment areas
    - Insulation levels in properties

7. Forecasting of energy demand taking into account development scenarios with sub-division into defined territorial structure

8. Development of technical concepts taking into account development scenarios

9. Consideration of the economic viability of the technical concepts taking into account development scenarios

10. Development of detailed financing models

11. Development of ESCo financial and corporate structures

12. Development of a master plan for implementation including:

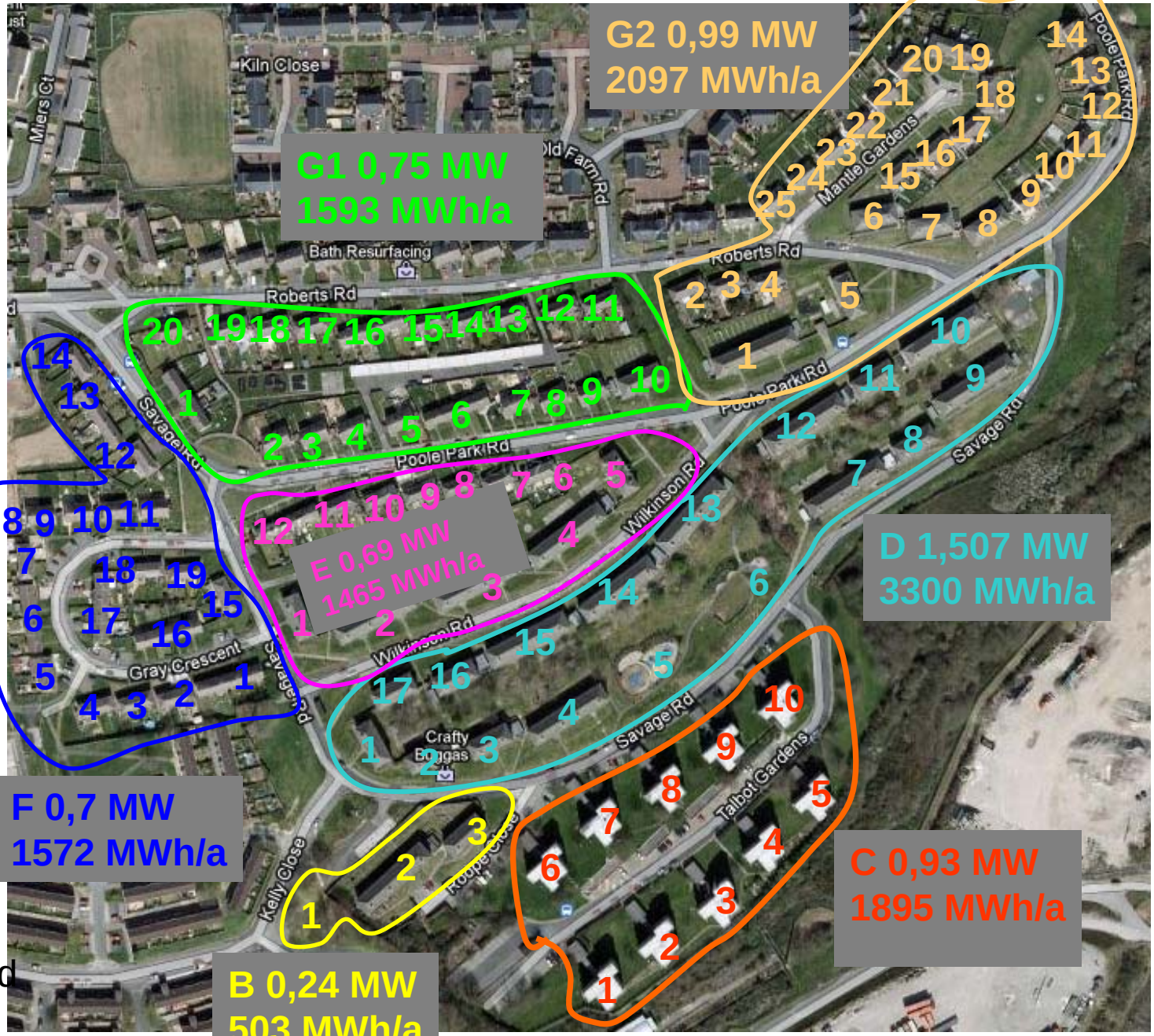
    - Definition of preferential areas
    - Subsidy requirements
    - Community relations issues
    - Definition of overall time schedule
    - Definition of the ESCo business and economic plan

Appendix A - Heat Demand Assessment


10 MWth
12,8 MWth
41,6 MWth
A
B
C
D
E
F
G1
G2
H
I
J1
J2
K
L
M
N
St Budeaux
Weston Mill
Pennycross
Beacon Park
North Prospect
Keyham
Ford
Milehouse
Hamoaze
Thanckes Lake
Morice Town
Stoke
Torpoint
Antony Rd
Ferry Rd
Ferry St
A347
A374
A3064
A386
B3396
Wolseley Rd
Albert Rd
Park Ave
Davenport Park
Victoria Park
The Pkwy


Total Area A
4,2 MW
9139,5 MWh/a
Kelly Close
Berthon Road
Wilkinson
Crescent
Furse Park
© 2011 Microsoft Corporation

2300 K*d


G2 0,99 MW
2097 MWh/a
G1 0,75 MW
1593 MWh/a
E 0,69 MW
1465 MWh/a
D 1,507 MW
3300 MWh/a
F 0,7 MW
1572 MWh/a
C 0,93 MW
1895 MWh/a
B 0,24 MW
503 MWh/a
Kiln Close
Roberts Rd
Bath Resurfacing
Poole Park Rd
Savage Rd
Wilkinson Rd
Gray Crescent
Crafty Beggas
Talbot Gardens
Kelly Close
Mantle Gardens

2300 K*d


G2
G2 0,99 MW
2098 MWh/a
Ark Royal Close
Mantle Gardens
Roberts Rd
Savage Rd
1
2
3
4
5
6
7
8
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11
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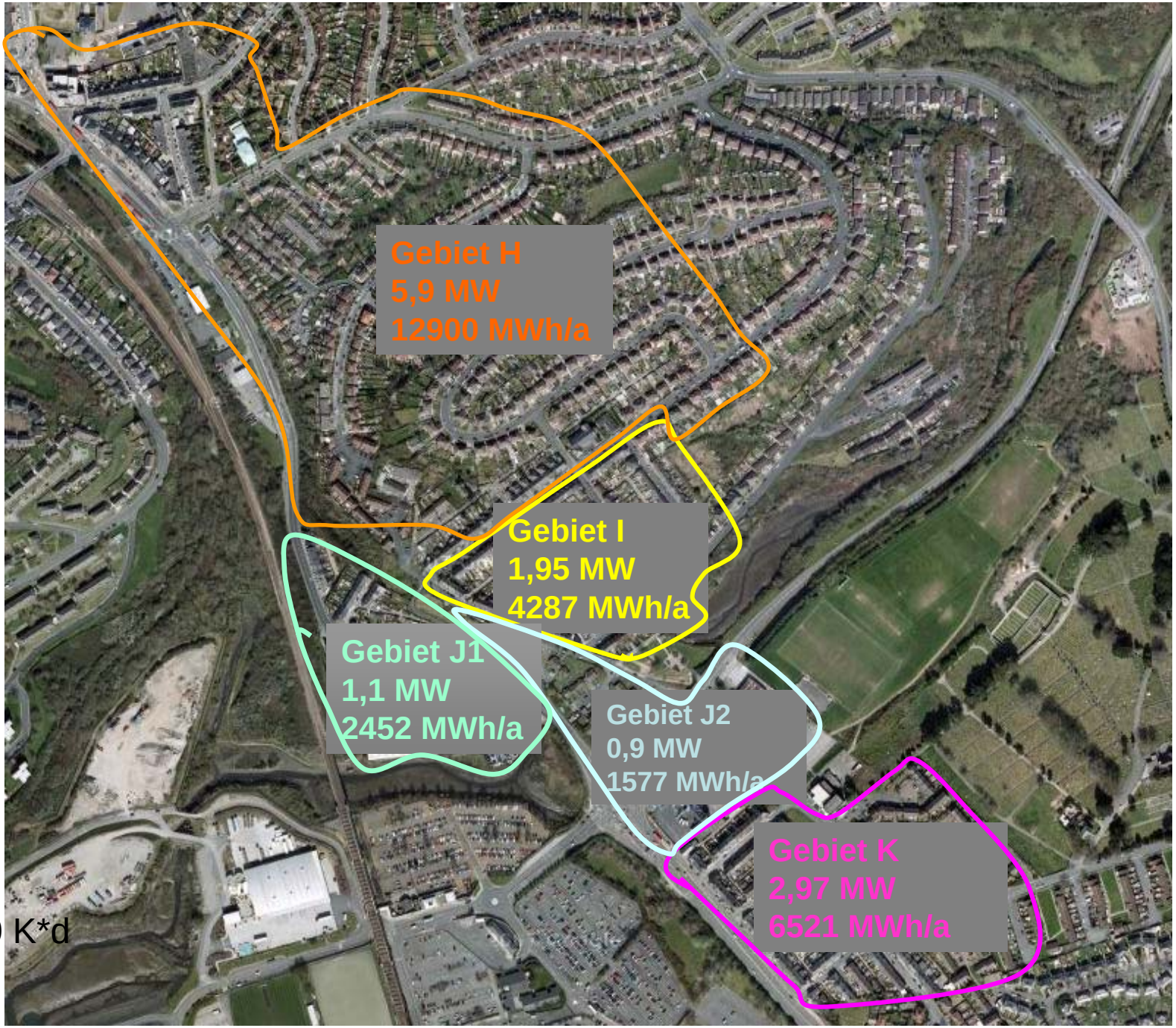
20
21
22
23
24
25

2300 K*d


Gebiet H
5,9 MW
12900 MWh/a
Gebiet I
1,95 MW
4287 MWh/a
Gebiet J1
1,1 MW
2452 MWh/a
Gebiet J2
0,9 MW
1577 MWh/a
Gebiet K
2,97 MW
6521 MWh/a

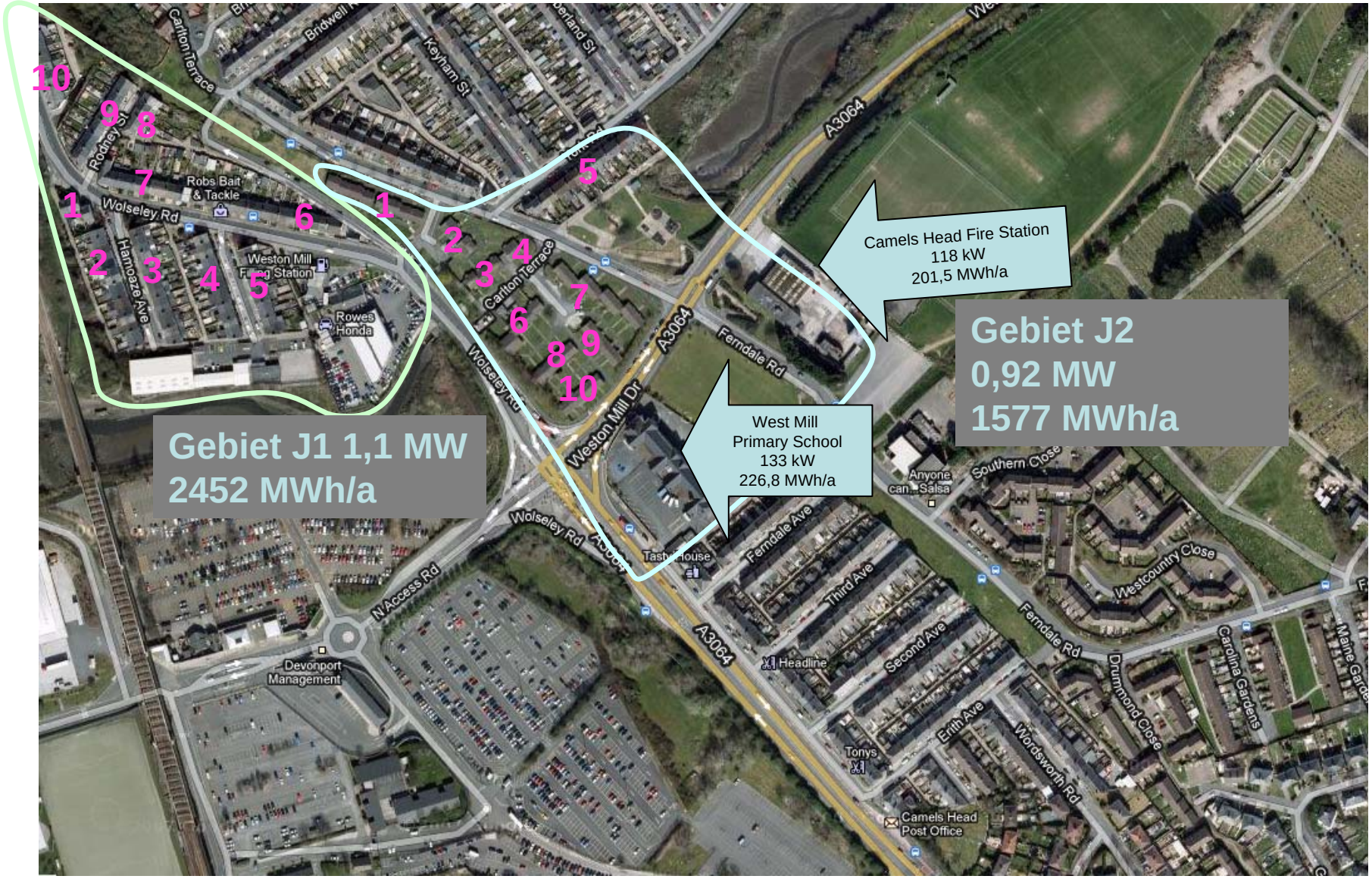
2300 K*d


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
Gebiet H
5,9 MW
12900 MWh/a

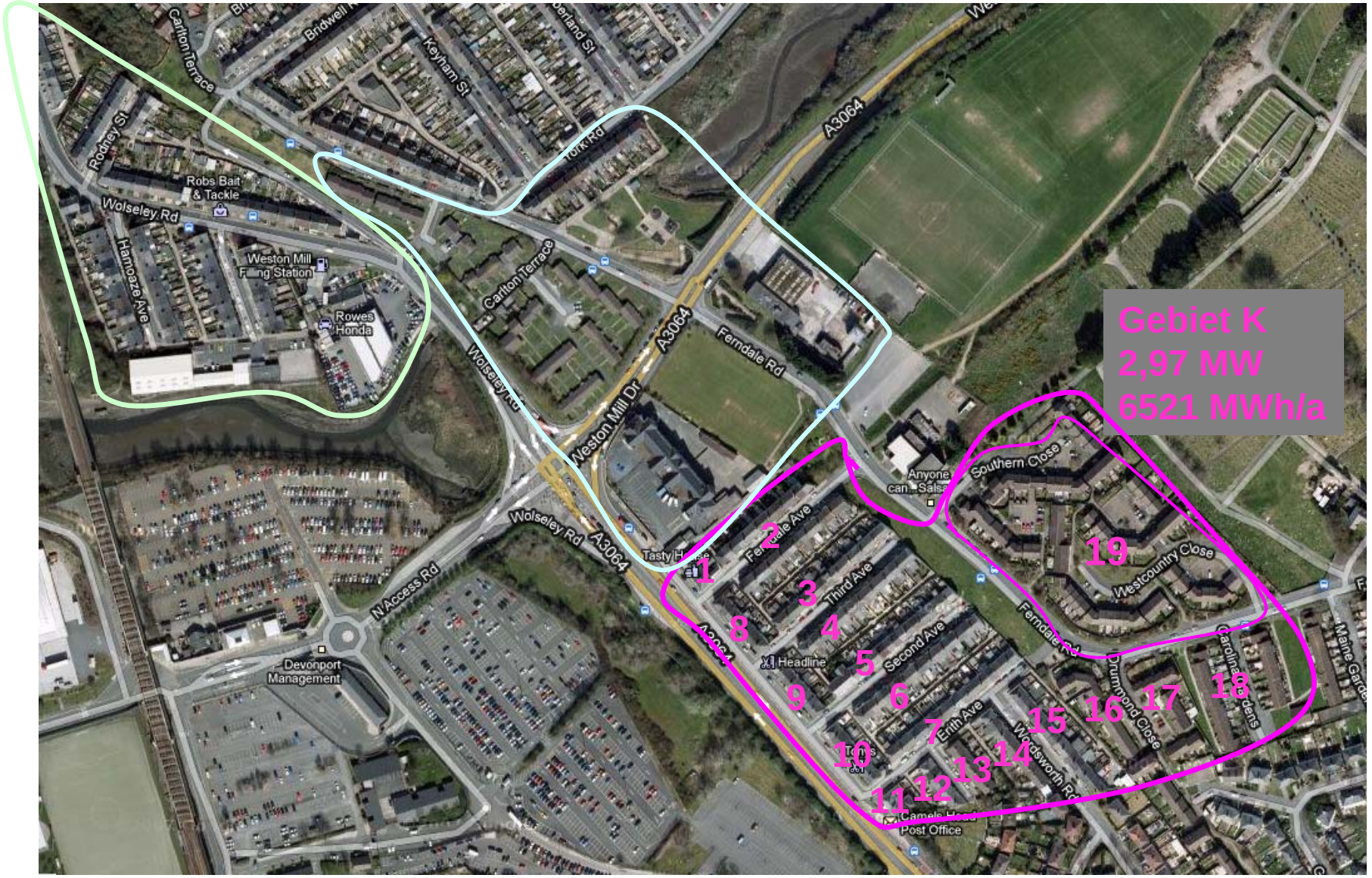
2300 K*d


Gebiet I
1,96 MW
4287 MWh/a
Carlton Terrace
Rodney St
Wolseley Rd
Robs Bait & Tackle
Wolseley Rd
Carlton Terrace
Western Mel Stores
Dance Krazy
Keyham St
Keyham St
Northumberland St
Elliot St
York Rd
1
2
3
4
5
6
7
8
9
10
11

2300 K*d


Gebiet J1 1,1 MW
2452 MWh/a
Gebiet J2
0,92 MW
1577 MWh/a
Camels Head Fire Station
118 kW
201,5 MWh/a
West Mill
Primary School
133 kW
226,8 MWh/a
Wolseley Rd
Hannaaze Ave
Robs Bait & Tackle
Weston Mill Ferry Station
Rowes Honda
Carlton Terrace
Keyham St
Rodney St
Weston Mill Dr
Ferndale Rd
A3064
N Access Rd
Devonport Management
Headline
Tonys
Camels Head Post Office
Anyone can Salsa
Southern Close
Westcountry Close
Drummond Close
Carolina Gardens
Wordsworth Rd
Erith Ave
Second Ave
Third Ave

2300 K*d


Gebiet K
2,97 MW
6521 MWh/a
Carlton Terrace
Bridwell
Keyham St
Rodney St
Robs Bait & Tackle
Wolseley Rd
Hannoaze Ave
Weston Mill F ng Station
Rowes Honda
Carlton Terrace
Wolseley Rd
A3064
Weston Mill Dr
Ferndale Rd
Anyone can Salsa
Southern Close
Westcountry Close
Third Ave
Second Ave
Erith Ave
Wordsworth Rd
Drummond Close
Carolina Gardens
Maine Garde
Headline
Tasty H
N Access Rd
Devonport Management
Post Office
1
2
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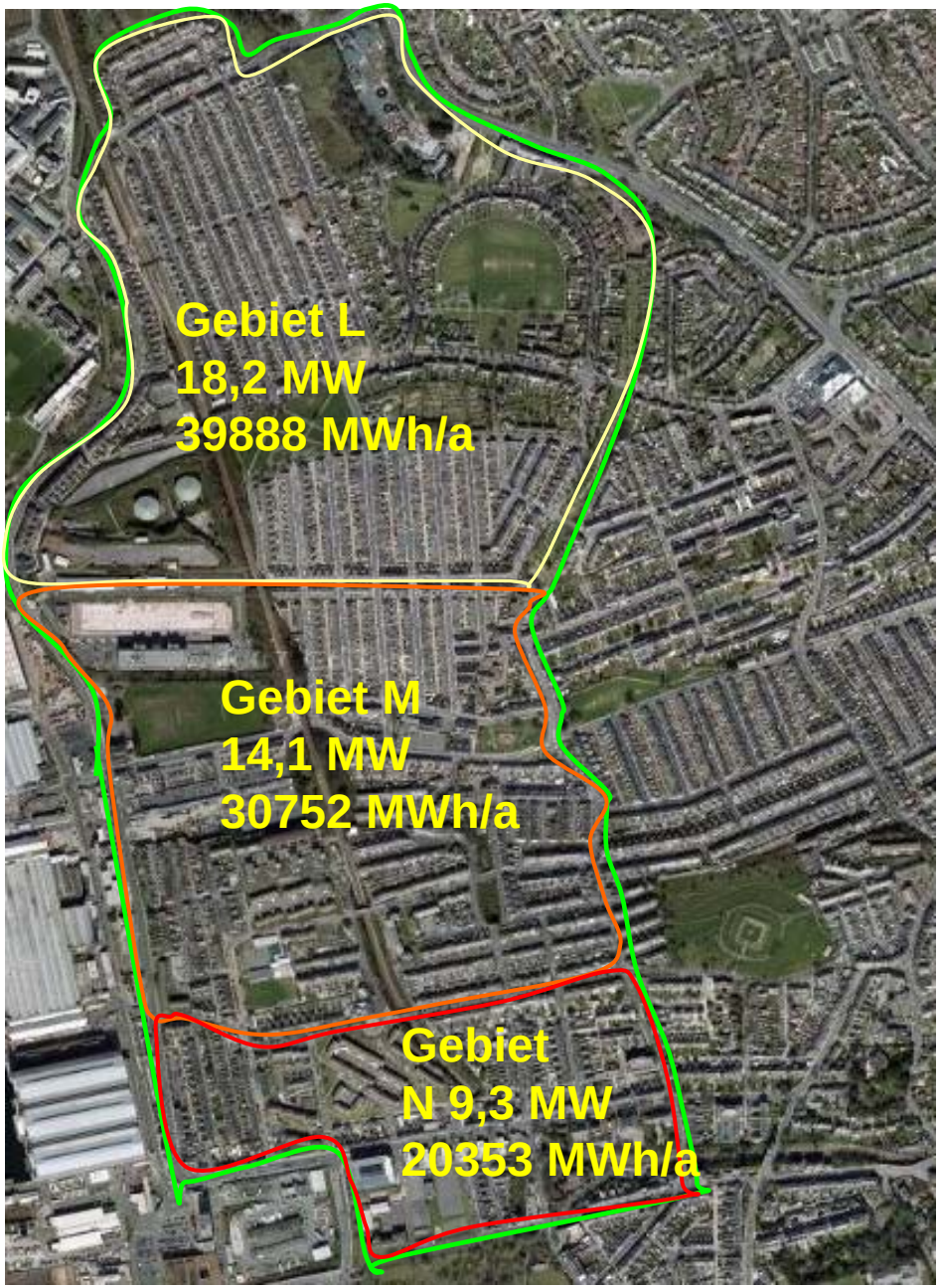
2300 K*d


Gebiet L
18,2 MW
39888 MWh/a
Gebiet M
14,1 MW
30752 MWh/a
Gebiet
N 9,3 MW
20353 MWh/a

2300 K*d


Gebiet L
18,153 MW
39888 MWh/a
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

2300 K*d


City Collage,
Ford Goschen Centre
457 kW
780,3 MWh/a
1
Gebiet M
14,2 MW
30752 MWh/a
2
Ford Collage
38 KW
65 MWh/a
4
3
6
5
Morice Town
Primary School
135 kW
230 MWh/a

2300 K*d

2300 K*d

Appendix B - GEF Report

Feasibility Study for the District Heating Supply for Barne Barton in Plymouth

Presentation

22.08.2011

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www.gef.de

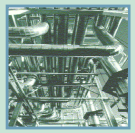
MVV Umwelt

GEF Ingenieur AG

Agenda

1. Basics and parameters
2. Pipework
3. Heat extraction
4. Compact district heating station
5. Conclusion



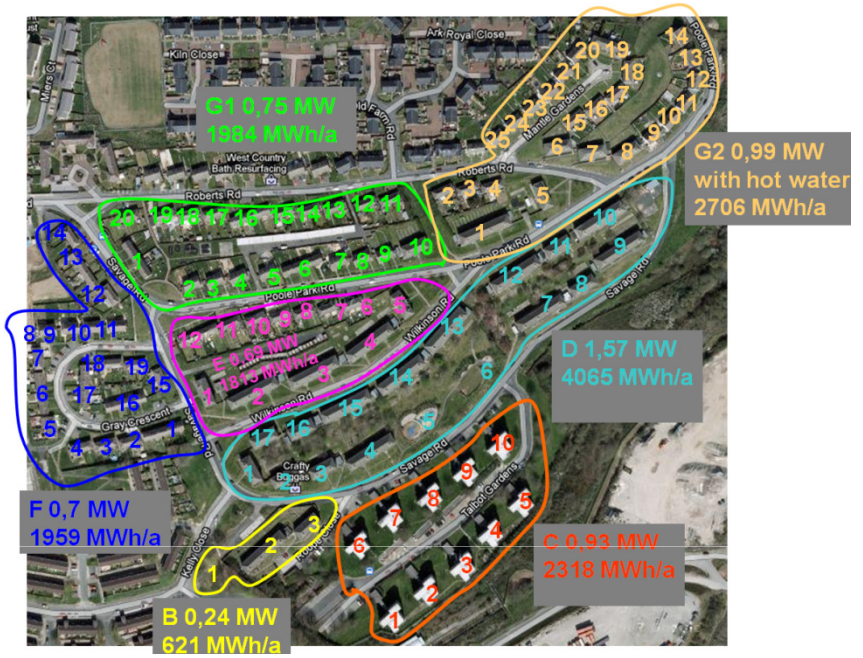
Basics and parameters

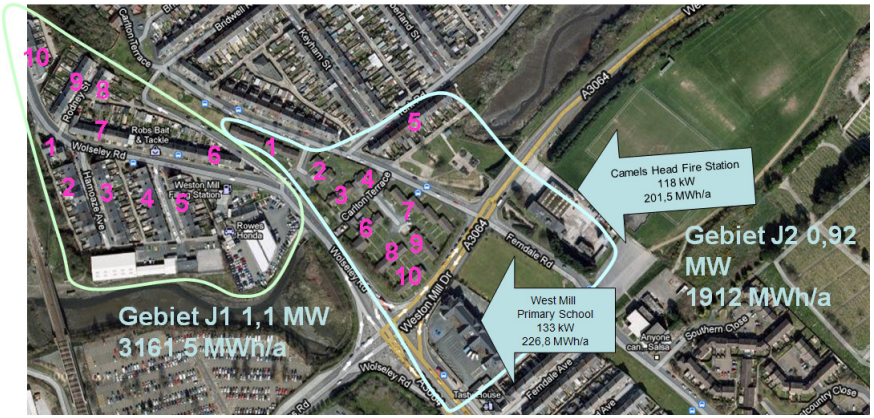
- Scope of work: Working out a feasibility study to supply the buildings in certain areas of "Barne Barton“ in Plymouth with heat from the new heat supply (Efw-Plant). The study will focus on cost and manpower requirements estimations.

- Estimates are prepared for :
  - pipework
  - heat extraction
  - compact district heating stations
  - building, heating and window restoration

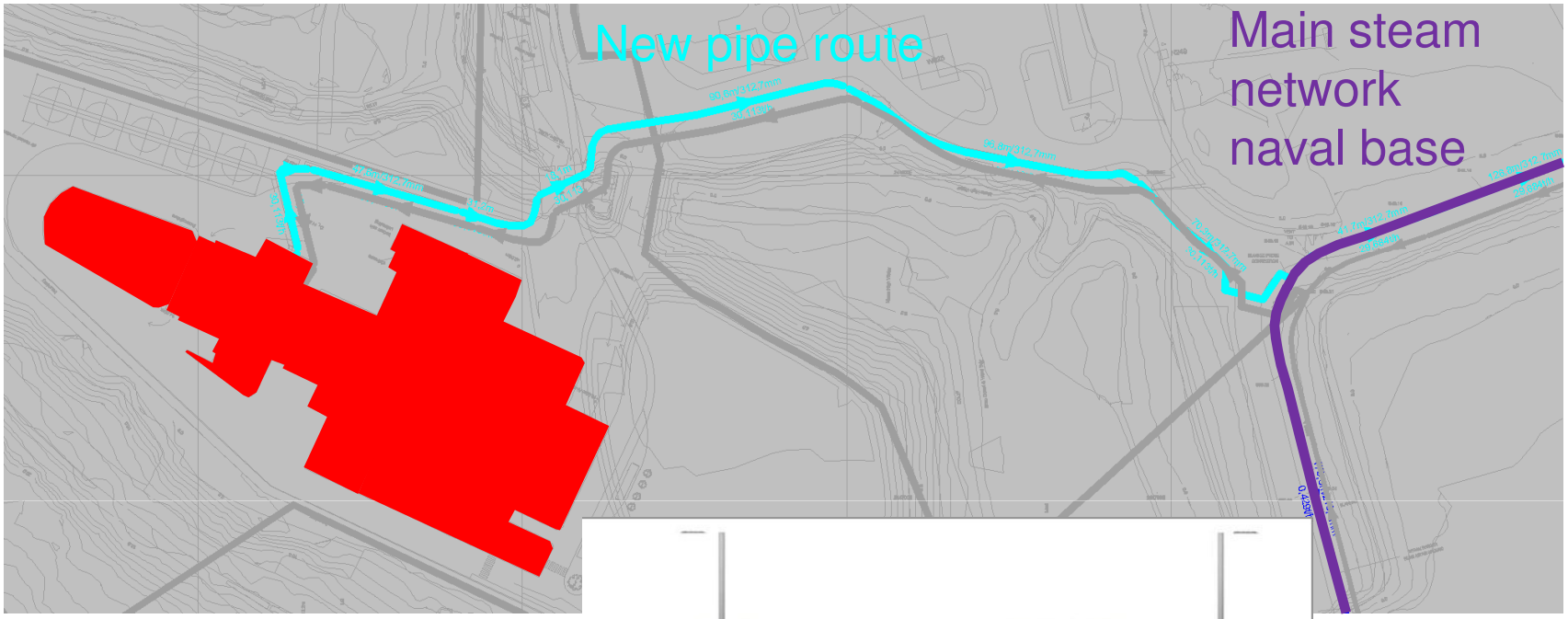
Basics and parameters

- The following buildings are part of the case study:
- Barne Barton: Area B, C, D, G2
- Area J2





New heat supply



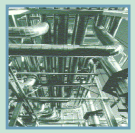
Energy from waste plant

North

Agenda

1. Basics and parameters
2. Pipework
3. Heat extraction
4. Compact district heating station
5. Conclusion

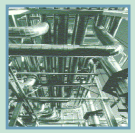


Development of the hydraulic model

- A hydraulic model of the hot water distribution system has been developed with the hydraulic software STANET Netzberechnung
- The MVV Umwelt estimated the installed building load of space heating and domestic hot water and the dimensions of the buildings.
- The MVV Umwelt sent a map of the area to GEF.
- GEF included the geodetic height taken from Google Earth into the hydraulic model.
- On the basis of the information GEF designed a possible network. The peak load case was used for dimensioning.

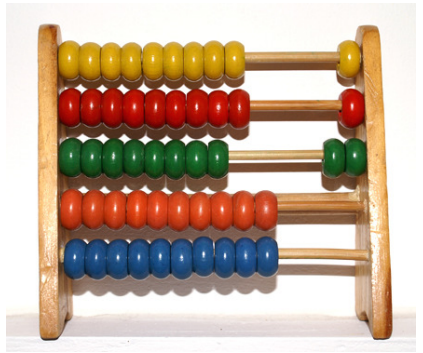


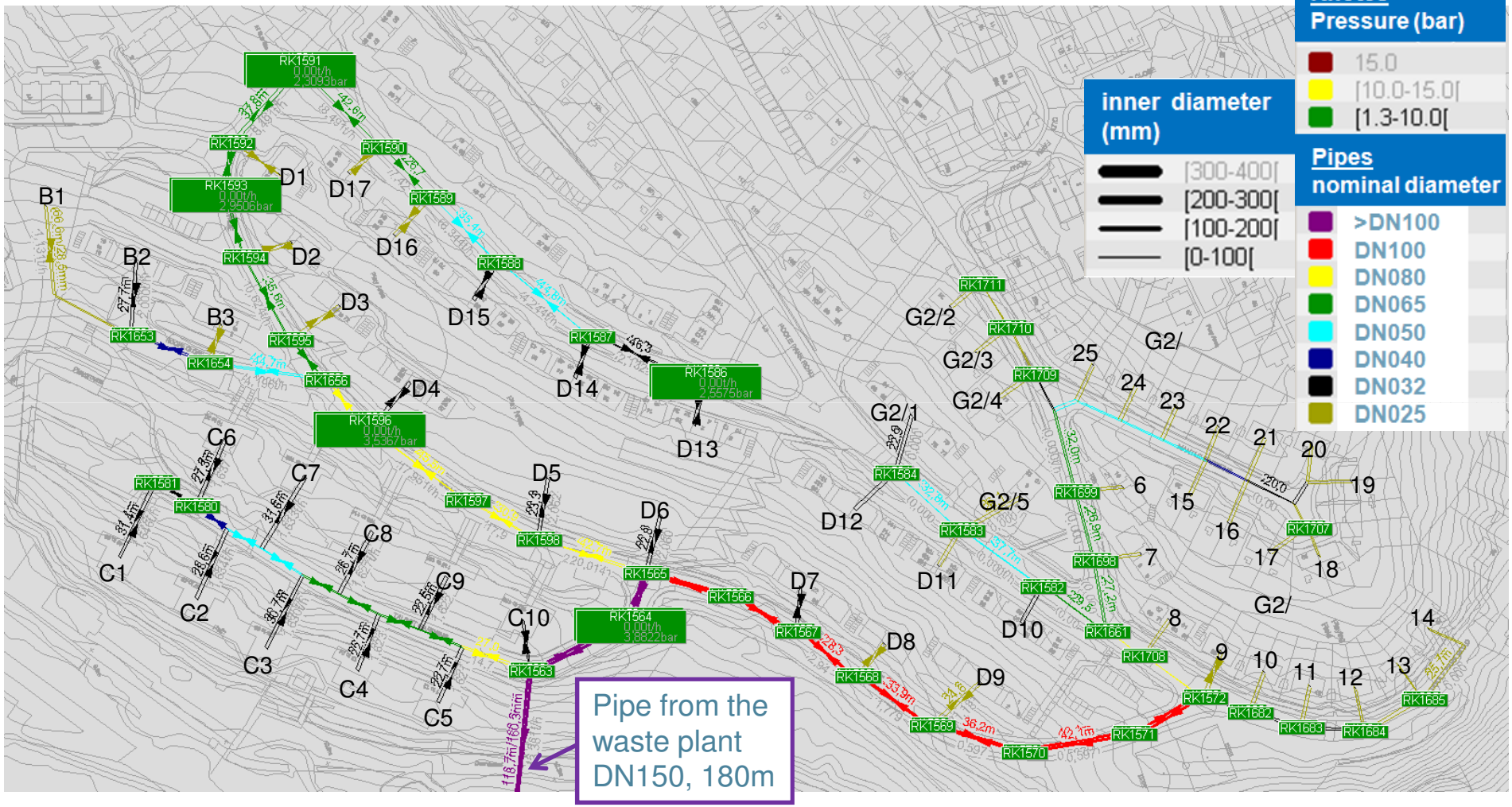
Dimensioning
Barne Barton (Plymouth)

- Results of the hydraulic simulation of the hot water distribution system (peak load case)

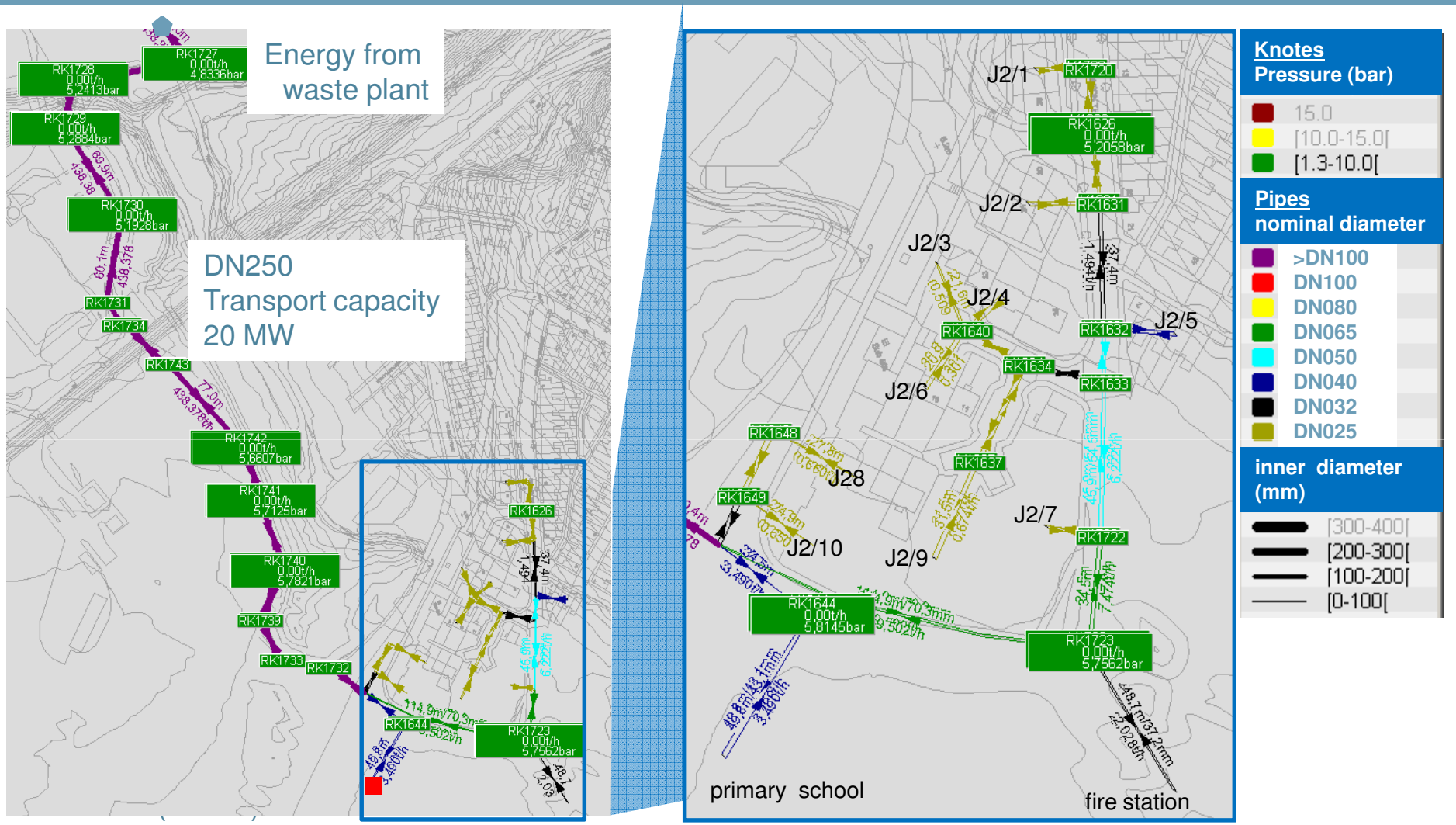
• diversity factor	85 %
• hot water feed-in	23,470 kW
• supply / return water temp.	90 °C / 50 °C
• pres. waste station supply / return	8.5 / 5 bar (abs.)
• mass flow waste station	505 t/h
• min. pressure network	1 bar
• min. differential pressure	1 bar
• max. specific pressure decrease	150 Pa/m



Dimensioning Barne Barton area B. C, D, G2 (Plymouth)



Dimensioning area J2 (Plymouth)



Estimation of the cost and the manpower requirements

- On the basis of the dimensioning (peak load case) it is possible to estimate cost.
- GEF has costing data from many district heating projects. The cost estimation is based n this data.
- GEF prefers pre-insulated bonded pipes with a steel medium pipe.
- For each area the length of the different pipe types was derived:
  - transport pipes
  - distribution pipes of each area B, C, D, G2, J2
  - building connection pipes of each area B, C, D, G2, J2
- A table with the different nominal diameters of the network pipes for the different areas was prepared.

Estimation of the cost and the necessary man-days

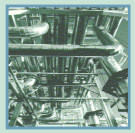
transport pipes (20 MW) unpaved

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN250	600.6	615,000 €	384,000 €	102,000 €	129,000 €	306	30
Sum	**600.6**	**615,640 €**	**384,000 €**	**102,000 €**	**129,000 €**	**306**	**30**

transport pipes (1 MW) unpaved

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN100	600.6	353,000 €	210,000 €	69,000 €	74,000 €	255	30
Sum	**600.6**	**353,350 €**	**210,000 €**	**69,000 €**	**74,000 €**	**255**	**30**



Estimation of the cost and the necessary man-days

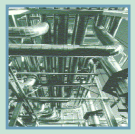
distribution pipes B

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN040	31.1	16,000 €	6,000 €	7,000 €	3,000 €	16	2
DN050	44.7	25,000 €	9,000 €	11,000 €	5,000 €	22	3
Sum	**75.8**	**41,000 €**	**15,000 €**	**18,000 €**	**8,000 €**	**38**	**5**

building connection pipes B

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	81.7	39,000 €	14,000 €	17,000 €	8,000 €	51	8
DN032	27.7	13,000 €	5,000 €	6,000 €	2,000 €	17	3
Sum	**109.4**	**52,000 €**	**19,000 €**	**23,000 €**	**10,000 €**	**68**	**11**



Estimation of the cost and the necessary man-days

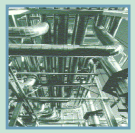
distribution pipes C

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN032	17.6	8,000 €	3,000 €	4,000 €	1,000 €	9	1
DN040	14.7	8,000 €	3,000 €	3,000 €	2,000 €	7	1
DN050	33.6	19,000 €	7,000 €	8,000 €	4,000 €	17	2
DN065	66.3	40,000 €	16,000 €	16,000 €	8,000 €	33	4
DN080	27.0	19,000 €	8,000 €	7,000 €	4,000 €	14	2
DN150	180.8	190,000 €	89,000 €	61,000 €	40,000 €	90	152
Sum	**340.0**	**284,000 €**	**126,000 €**	**99,000 €**	**59,000 €**	**170**	**162**

building connection pipes C

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN032	263.4	127,000 €	45,000 €	55,000 €	27,000 €	165	26
Sum	**263.4**	**127,000 €**	**45,000 €**	**55,000 €**	**27,000 €**	**165**	**26**



Estimation of the cost and the necessary man-days

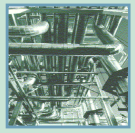
distribution pipes D

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN032	46.3	22,000 €	8,000 €	10,000 €	4,000 €	23	3
DN050	150.7	84,000 €	32,000 €	34,000 €	18,000 €	75	9
DN065	237.3	144,000 €	57,000 €	57,000 €	30,000 €	119	14
DN080	188.7	131,000 €	58,000 €	46,000 €	27,000 €	94	13
DN100	232.2	194,000 €	81,000 €	72,000 €	41,000 €	116	19
Sum	**855.2**	**575,000 €**	**236,000 €**	**219,000 €**	**120,000 €**	**427**	**58**

building connection pipes D

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	156.3	75,000 €	27,000 €	32,000 €	16,000 €	98	16
DN032	172.8	83,000 €	29,000 €	37,000 €	17,000 €	108	17
Sum	**329.1**	**158,000 €**	**56,000 €**	**69,000 €**	**33,000 €**	**206**	**33**



Estimation of the cost and the necessary man-days

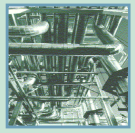
distribution pipes G2

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	101.4	49,000 €	17,000 €	22,000 €	10,000 €	51	6
DN032	107.4	52,000 €	18,000 €	23,000 €	11,000 €	54	6
DN040	17.2	9,000 €	3,000 €	4,000 €	2,000 €	9	1
DN050	62.8	35,000 €	13,000 €	15,000 €	7,000 €	31	4
DN065	86.1	52,000 €	21,000 €	20,000 €	11,000 €	43	6
Sum	**374.9**	**197,000 €**	**72,000 €**	**84,000 €**	**41,000 €**	**188**	**23**

building connection pipes G2

nominal diameter	length [m]	first cost_	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	388.5	187,000 €	66,000 €	82,000 €	39,000 €	243	39
DN032	22.9	11,000 €	4,000 €	5,000 €	2,000 €	14	2
Sum	**411.4**	**198,000 €**	**70,000 €**	**87,000 €**	**41,000 €**	**257**	**41**



Estimation of the cost and the necessary man-days

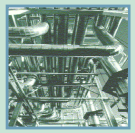
distribution pipes J2

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	140.3	67,000 €	24,000 €	29,000 €	14,000 €	70	8
DN032	76.7	37,000 €	13,000 €	16,000 €	8,000 €	38	4
DN040	34.5	18,000 €	7,000 €	7,000 €	4,000 €	17	2
DN050	62.2	35,000 €	13,000 €	14,000 €	8,000 €	31	4
DN065	149.4	91,000 €	36,000 €	36,000 €	19,000 €	75	9
Sum	**463.1**	**248,000 €**	**93,000 €**	**102,000 €**	**53,000 €**	**231**	**27**

building connection pipes J2

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]
DN025	170.4	82,000 €	29,000 €	36,000 €	17,000 €	107	17
DN032	48.7	23,000 €	8,000 €	11,000 €	4,000 €	30	5
DN040	71.4	37,000 €	14,000 €	15,000 €	8,000 €	45	7
Sum	**290.5**	**105,000 €**	**37,000 €**	**47,000 €**	**21,000 €**	**137**	**22**



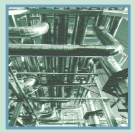
Estimation of the cost and the necessary man-days

- Finally the estimation of the whole hot water distribution system is:

nominal diameter	length [m]	first cost	pipework	under-ground con-struction	other	pipe building [man-days]	planning [man-days]	construction managemen t agent [man-days]	construction supervision orderer [man-days]
Sum transport pipes (20 MW)	600.6	615,640 €	384,000 €	102,000 €	129,000 €	306	30		
Sum distribution pipes B	75.8	41,000 €	15,000 €	18,000 €	8,000 €	38	5		
Sum building connection pipes B	109.4	52,000 €	19,000 €	23,000 €	10,000 €	68	11		
Sum distribution pipes C	340.0	284,000 €	126,000 €	99,000 €	59,000 €	170	162		
Sum building connection pipes C	263.4	127,000 €	45,000 €	55,000 €	27,000 €	165	26		
Sum distribution pipes D	855.2	575,000 €	236,000 €	219,000 €	120,000 €	427	58	240	55
Sum building connection pipes D	329.1	158,000 €	56,000 €	69,000 €	33,000 €	206	33		
Sum distribution pipes G2	374.9	197,000 €	72,000 €	84,000 €	41,000 €	188	23		
Sum building connection pipes G2	411.4	198,000 €	70,000 €	87,000 €	41,000 €	257	41		
Sum distribution pipes J2	463.1	248,000 €	93,000 €	102,000 €	53,000 €	231	27		
Sum building connection pipes J2	290.5	105,000 €	37,000 €	47,000 €	21,000 €	137	22		
Sum total	**4,113.4**	**2,600,640 €**	**1,153,000 €**	**905,000 €**	**542,000 €**	**2,193**	**438**	**240**	**55**

- The first cost of the hot water distribution system are **2.6 million €**. The annual operating costs of the system are about 15,000 €/a.
- The necessary man-days of the hot water distribution system are **2,930 man-days**.

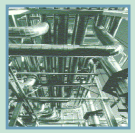


Agenda

1. Basics and parameters
2. Pipework
3. Heat extraction
4. Compact district heating station
5. Conclusion



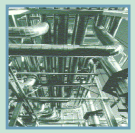
Heat extraction

- The waste plant produces steam for an existing steam system.
- Because of this it is necessary to design a heat extraction for the hot water distribution system.
- GEF has experience from many district heating projects. The estimation is based on this data.

Cost assumption heat extraction 3 MW_{th} (without building)

1) General	**40,000 €**	
Building site equipment, documentation, engineering, bringing into service		
2) Mechanical engineering	**180,000 €**	
Heat exchanger 2 x 2.5 MW		40,000 €
Hot water system (pressure threshold system, piping, fittings)		90,000 €
Pumps		30,000 €
Steel construction		20,000 €
3) Heating reserve boiler (heating oil 4.5 MW)	**180,000 €**	



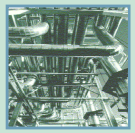



Cost assumption heat extraction 3 MW_{th} (without building)

4) Electrical, instrumentation & control	**70,000 €**	
Control box		40,000 €
Plumbing trade		20,000 €
Cabling		10,000 €
Sum Heat extraction	**470,000 €**	

In the total costs are 45,000 € for the planning, starting up, construction management agent and construction supervision orderer. This are manpower requirements of **80 man-days**.



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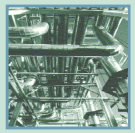


Compact district heating station

- The MVV Umwelt estimates the installed building load of space heating and domestic hot water and the dimensions of the buildings.
- The dimensioning of every compact district heating station depends on the installed building load of space heating and domestic hot water of the building.
- GEF has data from many district heating projects. The estimation is based on this data.

compact district heating station

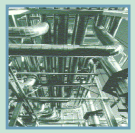
Compact district heating station

- Finally the estimation of the whole indirect compact district heating stations is:

building load of space heating and domestic hot	building	number of buildings	spec. costs compact district heating station indirect [€/unit]	spec. assembly costs [€/unit]	planning + construction management agent per station [€/unit]	first costs [€]	assembly costs [€]	planning + construction management agent [€]	spec. labour costs assembly [€/h]	spec. labour costs planning + construction management agent [€/h]	assembly [man-days]	planning + construction management agent [man-days]
unter 50	G2/05, J2/08, J2/10, J2/09, G2/04, G2/03, G2/02, G2/09, G2/10, G2/11, G2/12, G2/13, G2/14, J2/03, G2/25, G2/24, G2/23, G2/22, G2/21, G2/20, G2/15, G2/16, G2/17, G2/18, J2/06, J2/02, J2/04	27	6,000	1,200	1,000	162,000	32,400	27,000	50	80	81	42
50-75	J2/07, J2/01, D08, D09, D11, G2/08, G2/07, G2/06, B1, G2/19, B3, D01, D02, D03, D16, D17	16	8,500	1,200	1,000	136,000	19,200	16,000	50	80	48	25
75-100	C1-C10	10	10,000	1,200	1,000	100,000	12,000	10,000	50	80	30	16
100-125	D04, D05, D06, D07, D10, D12, D13, D14, D15, Camels Head Fire Station, G2/01, B2	12	11,000	1,200	1,000	132,000	14,400	12,000	50	80	36	19
150-175	J2/05	1	13,000	1,200	1,000	13,000	1,200	1,000	50	80	3	2
200-225	Primary School	1	15,000	1,200	1,000	15,000	1,200	1,000	50	80	3	2
Sum		**67**				**558,000**					**201**	**106**

- The cost of the compact district heating stations are **560,000 €**.
- The necessary manpower requirements of the compact district heating stations are **310 man-days**.



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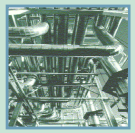
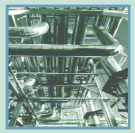


Conclusion

- The case study estimates cost and manpower requirements for certain areas of "Barne Barton“, Plymouth.

	Cost	Manpower
• Pipework	2,600,000 €	2,930 man-days
• Heat extraction	470,000 €	80 man-days
• Compact district heating station	560,000 €	310 man-days
Sum	**3,630,000 €**	**3,320 man-days**



Appendix C – DH System Photographs











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UR 8

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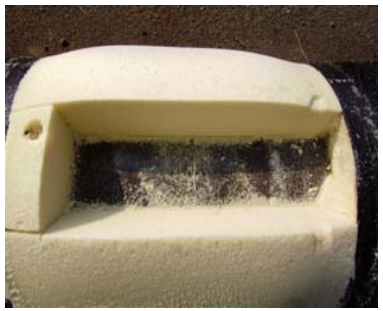


Appendix D - KES PV Assessment

TALBOT GARDENS, PLYMOUTH
Design of Photo-voltaic system Technical Description Statement

This statement prepared by Kier Energy Solutions regards the feasibility of installing Photovoltaic (PV) systems on the apartment buildings at Talbot Gardens in Plymouth, Devon[1]. The apartments at Savage Road though not directly referred to are of the same plan therefore the details below can be similarly applied.

The site

The Talbot Garden site consist of 5 block buildings each containing 12 apartments. The roof of each block is flat, split over two levels and aligned SE/SW. The roof area is estimated at 195m². Little or no parapet exists at the roof edges. Construction and access has not been confirmed. Two options for system design are possible relating to tenure and how benefit is transferred to occupants. Connection can be made to either;

1. Landlords supply - Financial benefits to occupants made by managed arrangement , or
2. Apartments – Renewable supply and financial benefits to occupants by direct connection of system to consumer unit in each apartment. The following information is based upon this option.

System description

12 systems per block (1 per apartment) required. A high efficiency Sanyo HIT-N235SE10 Module is recommended to maximise yield for the available space. It is estimated that not more than 48 x 235W modules can be accommodated on each roof totalling **11.28kWp**. This would equate to 4 Modules per apartment or **0.94kWp**. For an equal distribution of PV per apartment an equal number of modules are required.

Equipment and its location

A **0.94kWp** system would require the following equipment for each apartment;

No.	Equipment	Location
4	Sanyo HIT-N235SE10 Modules	On roof
	Flat roof mounting system on A-frame	On roof
1	Dorfmueller DMI 1200/90 Inverter	On or adjacent roof
2	DC Isolators	Adjacent Inverter
2	AC Isolator	1 at Inverter 1 at consumer unit
1	Ofgem compliant Total Generation Meter	At consumer unit
4	String Cables	From Array to inverter
1	AC cabling and containment	From Inverter to Consumer unit

Metering, Connection and cabling

Direct Connection to Apartments – System design as above. Occupiers benefit directly from PV generated supply and export. Connection has to be made into the consumer unit of each apartment. Cabling can be routed in main service riser in building but electrical works within each apartment also required with consequent disruption. Separate meters in each apartment.

Connection to Landlord Supply – Landlord benefits from generation, supply and export. Separate and managed arrangement required to transfer any benefit to occupiers. Alternative system design and equipment would be required with potentially less disruption to tenants. A single meter required on Landlords supply.

Installation

At this stage it is not possible to speculate on the type and cost of fixings to secure the arrays to the roof without knowing the construction and state of repair of the structure. Labour costs to install the frame and modules (provided a secure fixing detail is in place) and commission the arrays are approximately £2860 per block. Assuming pedestrian access is available to bring equipment to the roof area a very provisional

[1] The details described and estimates provided in this document are made by desktop survey, are not guaranteed and are subject to confirmation by detailed survey.

sum of £1000 could be included per block for edge protection to provide a safe method of working. A feasible timescale for installation of solar equipment would be within 1 week. A reasonable cost estimate for the additional AC works required is £500 per apartment but an additional sum is likely to be required for builder's works to bring cables down through the service riser to the required floor level.

Maintenance

PV systems have no moving parts and require little maintenance. Modules mounted in excess of 5 degrees pitch are self cleaning in normal environmental conditions. The manufacturer guarantees performance of this module at 80% for 25 years. The inverter carries a manufacturer's guarantee of 5 years. A provisional sum of £350 per block for an annual check is reasonable assuming that safe access to the arrays is possible. The roof appears to be flat with little or no parapet and a man safe system may be deemed necessary for unscaffolded access. This would also impact on the space available for arrays in the first instance.

Engineering Recommendation for connection

This installation falls under the engineering requirements G83/1 Stage 2 for the connection of multiple small scale embedded generators (SSEG). You are required to make an application to the Distribution Network Operator for approval to proceed with connection. The DNO will review your application, specify any conditions for your connection and notify you of their approval or otherwise.

Equipment cost

At this stage it is impossible to estimate with certainty a fixed price for the complete works in design, installation and commissioning. However the cost of equipment only (with the exclusions below) is estimated in the region of **£4000 excluding VAT per apartment**.

1. The cost of design, supply and installation of fixings to secure the array to the roof is not included.
2. No estimate has been made for the cost of scaffolding or a safe system of work including lifting equipment required for the installation works.
3. The cost of AC works from the inverter site (assuming it is on roof) to the consumer unit in each apartment is not included.
4. The cost of replacing inverters and maintaining a regime of annual system checks is not included.
5. No additional metering or monitoring equipment is included.

Economies of scale can be expected for larger equipment orders across 60 apartments. The PV industry is rapidly expanding in the UK and with competition in equipment supply further reductions in costs may arise.

Yield and $C0_2$ estimate

Array Size	= 0.94kWp
Pitch	= 30°
Orientation	= South East
Estimated annual yield	= 772.3kWh[2]

Sanyo HIT modules combine Amorphous and Mono-crystalline silicon resulting in an estimated 20% higher yield than similar sized systems using standard Mono modules therefore;

Estimated total annual yield	**= 926.76kWh**

Estimated annual income from Feed in Tariff (FiT) at current rates[3]:

Generation Tariff @ 43.3p x 926.76	= £401
Assuming 70% supply units saved @ 12p[4] x 649	= £77
30% exported @ 3.1p x 278	= £8
Estimated Total annual revenue from FiT	**= £486**
CO2 saved @ 0.529 kg per kWh	**= 0.49 tonnes**

[2] SAP2009 Methodology
[3] The UK Feed in Tariff is due to be reduced in March 2012 (<4kW = 39.6p/kWh)
[4] Customer to satisfy themselves of the value of grid supplied electricity

Appendix E - MVV Wider DH Scheme MVV Review

Plymouth District Energy Procurement Partnership

MVV Review for Soft Market Testing

4th April 2011

MVV Umwelt

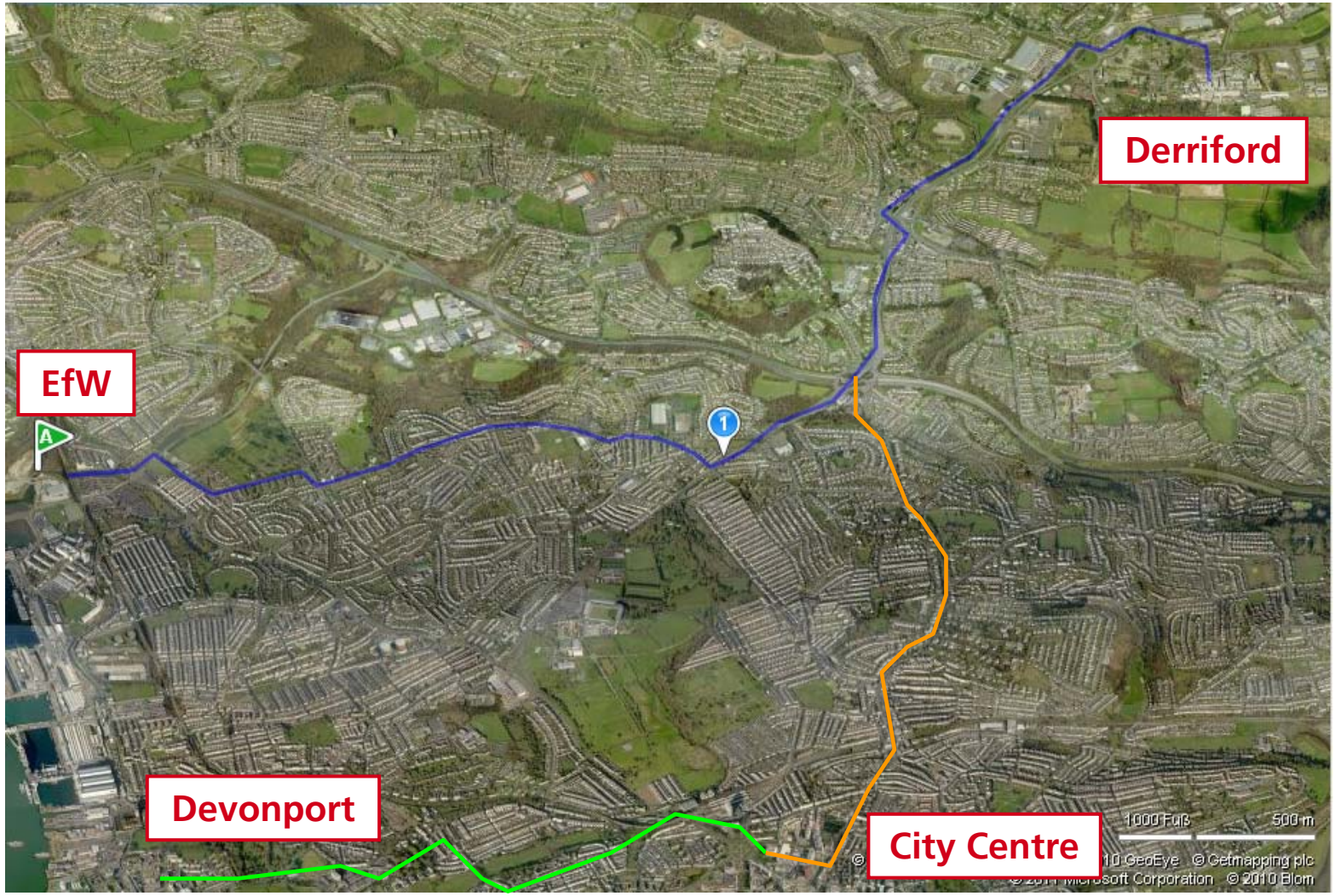
Principal locations of heat supply and demand centres

500 m

MVV Umwelt

Distances between supply and demand centres

blue=7,370m green=3,120m yellow=3,320m



MVV Umwelt

Proposal 1
distance = 13,810m

EfW plant

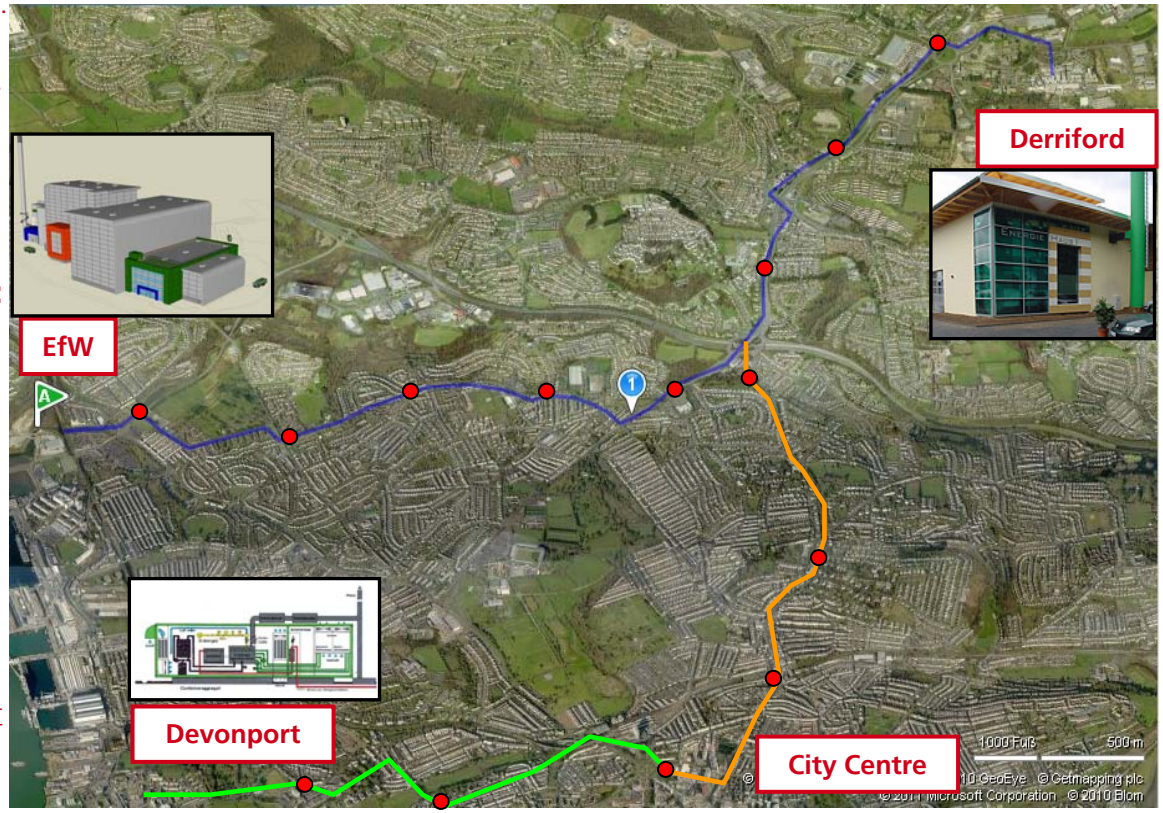
Efw plant has 80 MWth. Up to 40 MWth can be offered for heat output. 23 MWth capacity reserved for naval base. Up to 17 MWth potential for district heating subject to commercial terms.

Devonport Dockyard:

Demand = 66 GWh
Peak load = 31 MW (incl. 23 MW for naval base)

Exisiting plant:
3x8.5 MW (North Yard Backup)
3x7.5 MW (South Yard Supply)
2x5.2+1x2.5 MW (Fleet Accomodation Centre)

Proposed use in DH: South Yard boilers for peak and backup units and biomethane production



- 14 x 2 pump stations

Derriford:

Demand = 37 GWh (LT and HT)
Peak load = 17 MW

Existing plant: 4 new boiler (cost £10 million) for steam generation at 170°C

Proposed use: super heating by using biomass (wood chips)

City Centre

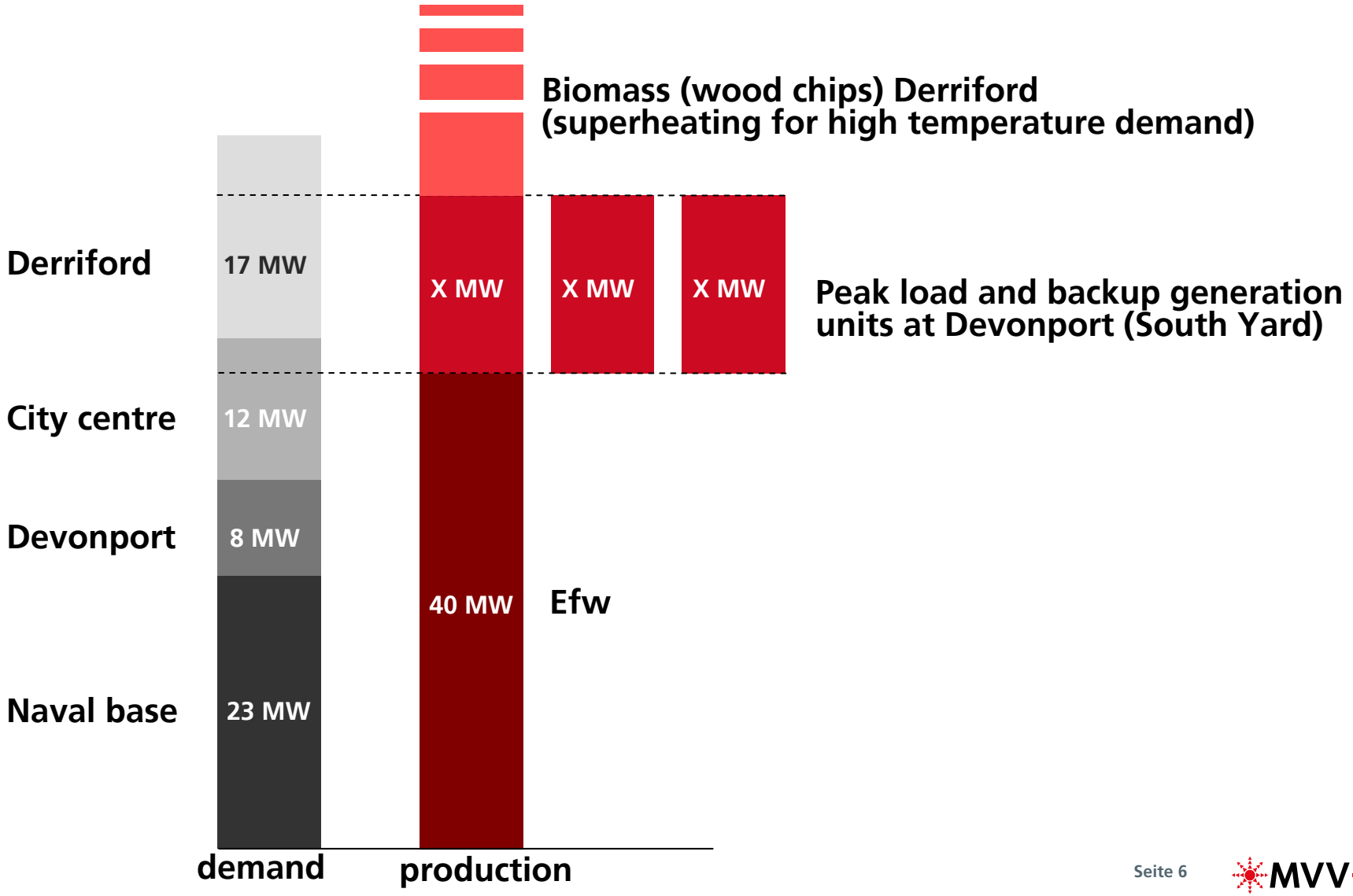
Demand = 15 GWh
Peak load = 12.4 MW

CO2 reduction (replacement of conventional heat sources)

current heat generation with:	gas	electricity
rate [%]	80	20
Demand [GWh_{th}]*	94	24
Efficiency [-]	0.77	0.4
GHG Emissions [kg/kWh]	0.18523	0.50249
GHG Emissions savings [t/a]	**22,612**	**30,150**

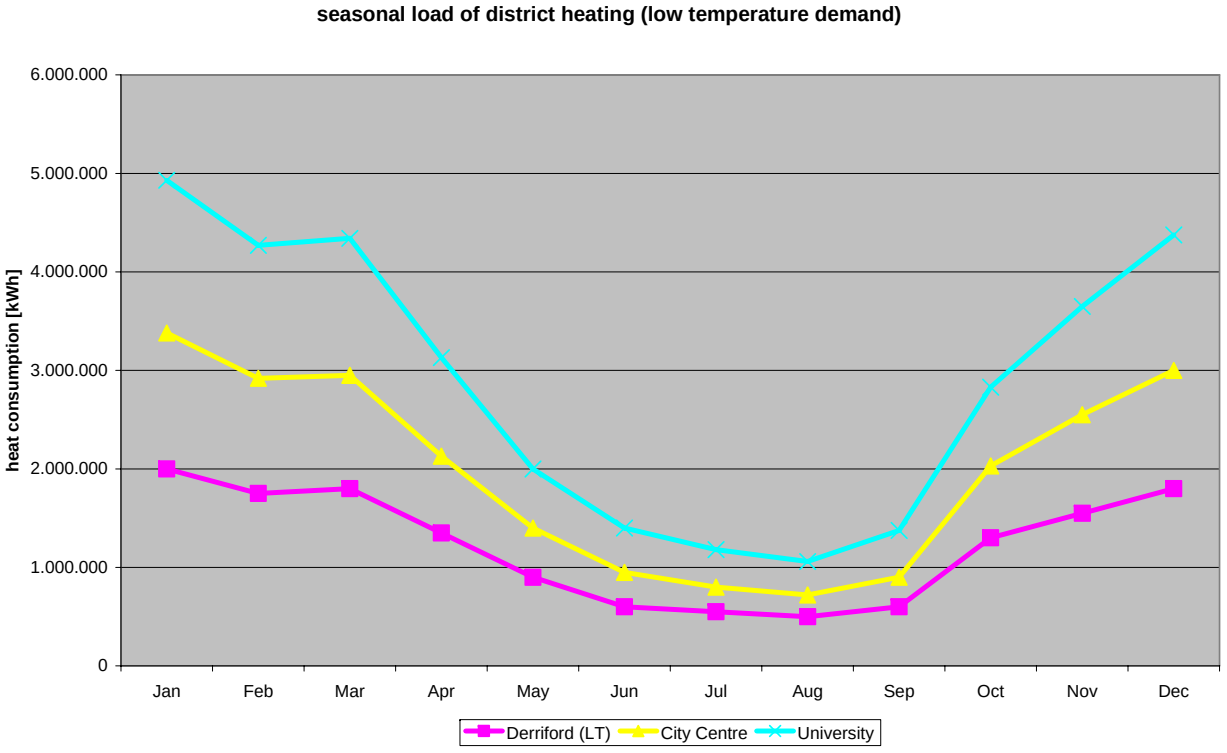
* demand: 66 GWh + 15 GWh + 37 GWh = 118 GWh_{th}

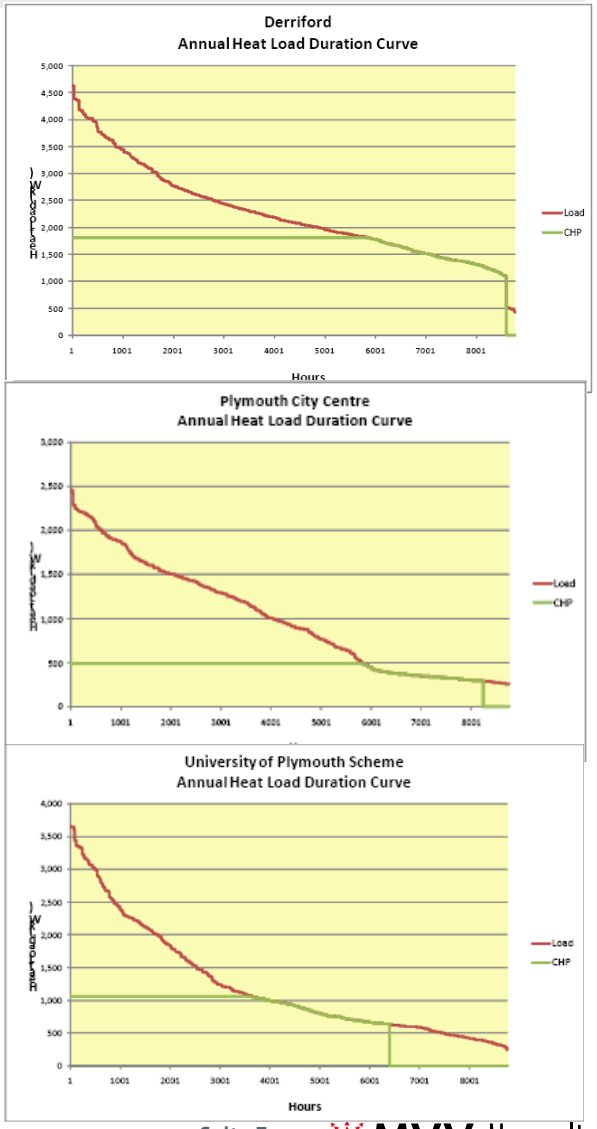
supply concept district heating
peak capacities



MVV Umwelt

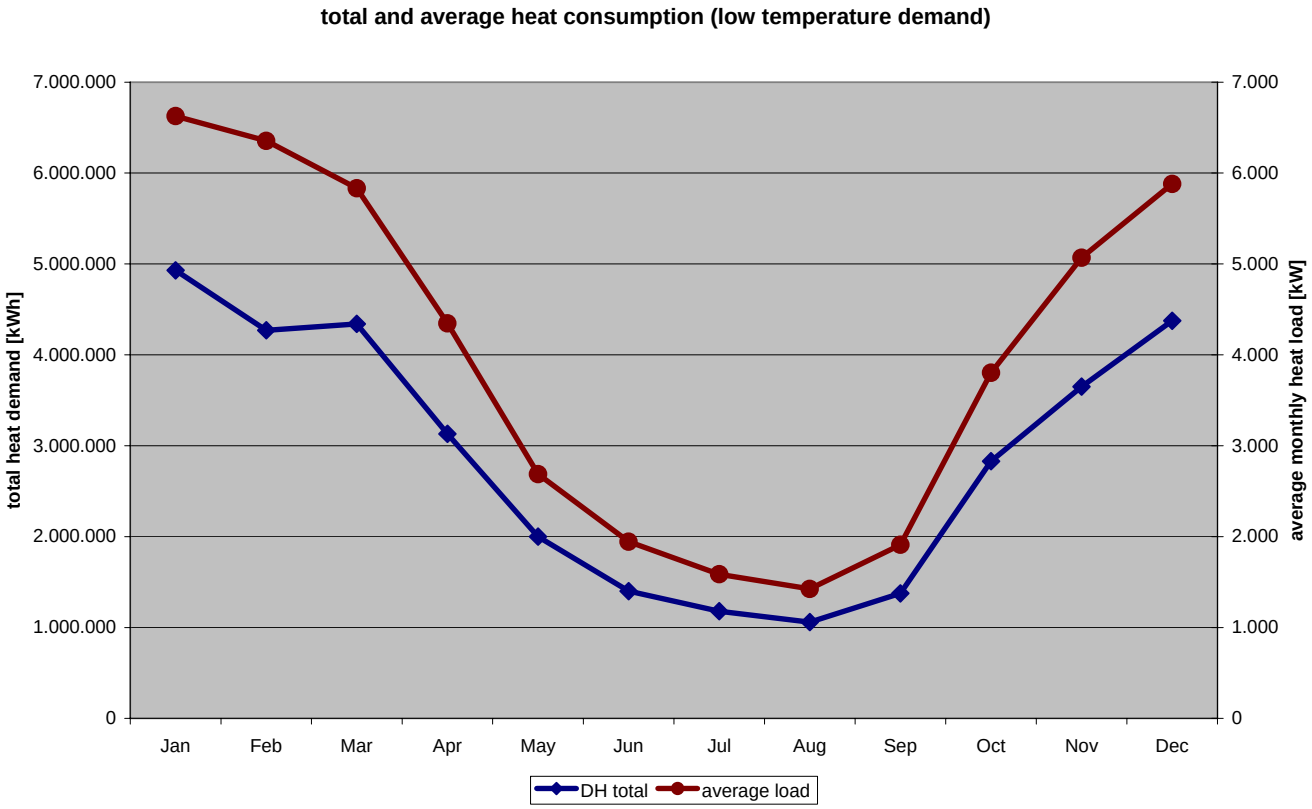
supply concept district heating
heat load and duration curves





MVV Umwelt

supply concept district heating
average heat load



Average load of district heating is within the range of EfW potential heat capacity

MVV Umwelt

Provisional costs
Proposal 1

- **Investments**

pipework:	**8.3 Mio. GBP**	(13.810m x 600GBP/m infrastructure)
peak and backup units:	**10 Mio. GBP**	
biomass (wood chips) :	**0.5 Mio. GBP**	
pumping devices & pressure control	**2.8 Mio. GBP**	(14 x 2 x 100.000 GBP)
→ **annuity =**	**2.1 Mio. GBP p.a.**	

- **Operating costs**

loss of electricity and ROC:	**3,6 Mio. GBP p.a.**	(20 MW x 26,5% x 8.000h x (48+37) GBP/MWh)
basic energy price:	**30,51 GBP/MWh**	

Thank you for your attention

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MVV Umwelt

Appendix F - CO2 specific costs

Area	supply rate	thermal peak connection	yearly heat demand	total demand project lifetime	heat source	substituted energy project lifetime	GHG factor	CO2 savings per year	CO2 savings project lifetime	capital expenditure (GEF study)	CO2 savings cost
		kW	MWh	MWh	-	MWh	g CO2 / kWh		t CO2	GBP	GBP / t CO2
A	80%	4,200	9,139.5	186,051	gas	255,820	0.18360	1,846	46,969	£2,203,455	£46.91
B	80%	240	503.9	10,258	gas	14,105	0.18360	102	2,590	£180,034	£69.51
C	80%	930	1,895.9	38,594	electric	38,594	0.52462	796	20,247	£1,448,764	£71.55
D	80%	1,570	3,299.9	67,175	gas	92,366	0.18360	666	16,958	£859,739	£50.70
E	80%	690	1,464.6	29,815	gas	40,996	0.18360	296	7,527	£327,710	£43.54
F	80%	730	1,571.6	31,993	gas	43,990	0.18360	317	8,077	£809,504	£100.22
G1	80%	750	1,592.6	32,420	gas	44,578	0.18360	322	8,185	£437,743	£53.48
G2	80%	990	2,098.0	42,709	gas	58,725	0.18360	424	10,782	£547,947	£50.82
Transport A-G								0		£190,000	
H	80%	5,890	12,899.9	262,601	gas	361,076	0.18360	2,605	66,294	£7,467,971	£112.65
I	80%	1,960	4,287.0	87,270	gas	119,996	0.18360	866	22,031	£2,476,746	£112.42
J1	80%	1,120	2,451.9	49,913	gas	68,630	0.18360	495	12,600	£388,691	£30.85
J2	80%	925	1,577.3	32,109	gas	44,150	0.18360	319	8,106	£433,958	£53.54
Transport J2								0		£353,000	
K	80%	2,970	6,521.1	132,749	gas	182,530	0.18360	1,317	33,513	£2,033,802	£60.69
L	80%	18,150	39,888.2	811,996	gas	1,116,495	0.18360	8,056	204,988	£9,454,635	£46.12
M	80%	14,180	30,751.7	626,006	gas	860,758	0.18360	6,211	158,035	£8,567,419	£54.21
N	80%	9,350	20,353.3	414,328	gas	569,701	0.18360	4,111	104,597	£6,317,180	£60.40
Transport H-N										£615,000	
EfW CHP Heat Exchanger Plant										£280,000	
EfW CHP Turbine Replacement										£9,000,000	
IDHS Barne Barton (B, D, G2)		2,800	5,901.8	120,142		165,196		1,192	30,330	£1,777,720	£58.61
IDHS Weston Mill (J2)		925	1,577.3	32,109		44,150		319	8,106	£786,958	£97.08
Total IDHS System (B, D, G2, J2)		3,725	7,479.1	152,251		209,346		1,510	38,436	£2,844,678	£74.01
Total Study Area A - N		64,645	140,296.4	2,855,987		3,912,510		28,747	731,499	£54,393,299	£74.36

CO2 correction for less electricity production											
IDHS Barne Barton (B, D, G2)		2,800	5,901.8	120,142		165,196	0.52462	-647	-16,466	£1,777,720	£128.23
IDHS Weston Mill (J2)		925	1,577.3	32,109		44,150	0.52462	-173	-4,401	£786,958	£212.39
Total IDHS System (B, D, G2, J2)		3,725	7,479.1	152,251		209,346	0.52462	-820	-20,867	£2,844,678	£161.92
Total Study Area A - N		64,645	140,296.4	2,855,987		3,912,510	0.52462	-27,587	-701,977	£54,393,299	£1,842.47

increase (+)/decrease (-) of yearly WRATE emission											
IDHS Barne Barton (B, D, G2)								545			
IDHS Weston Mill (J2)								146			
Total IDHS System (B, D, G2, J2)								690			
Total Study Area A - N								1,160			

Appendix G - OFGEM Domestic Energy Data Factsheet 96

ofgem

Promoting choice and value
for all gas and electricity customers

Typical domestic energy consumption figures

Factsheet 96 18.01.11 www.ofgem.gov.uk

Ofgem uses a typical domestic energy consumption figure when working out certain types of data and analysis. For example, average household bills. We recently revised these typical consumption figures. The new figures came into use on 17 January 2011.

What is a typical consumption figure?

It is the amount of energy that a 'typical' household, with a medium level of energy consumption, uses in a year.

We have also calculated typical low and typical high annual consumption values.[1]

What is this used for?

Ofgem uses this figure in a wide range of analysis. This includes:

- calculating the cost of an average annual energy bill
- working out the level of savings available for customers who want to switch.

Other organisations that may use our typical consumption figures include:

- media
- energy suppliers
- industry
- other bodies such as the Advertising Standards Agency
- some (but not all) switching sites.

Why has Ofgem recalculated the figure?

The typical consumption values were last reviewed in 2003 by Energywatch. We decided to revise the figures so that they better reflect current consumption levels.

	Gas	Electricity
New typical medium consumption figures	16,500 kWh	3,300 kWh
Old typical medium consumption figures	20,500 kWh	3,300 kWh

As you can see, the typical consumption figure for gas has decreased. But the figure for electricity has stayed the same.

For households on a time of use tariff, such as Economy 7, the typical medium consumption figure for electricity is 5,000 kWh, compared to the old value of 6,600 kWh.

Customers may choose to be on a time of use tariff because it fits their pattern of energy consumption. Some households on a time of use tariff may have a higher consumption of electricity than those on standard tariffs because they use electricity to heat their home or provide hot water.

[1] Typical low consumption values: Gas - 11,000 kWh, Electricity - 2,100 kWh. Typical high consumption values: Gas - 23,000 kWh, Electricity - 5,100 kWh

Why has typical gas consumption decreased?

Households may be keen to reduce their energy use, to save money on their bills or cut carbon emissions and combat climate change.

They may be doing this via increased energy efficiency measures around the home, which would reduce gas use.

For example, households could have taken up energy efficient improvements such as:

- insulation
- a more energy efficient boiler
- double glazing.

Government programmes such as the Carbon Emissions Reduction Target (CERT) have also promoted the take-up of energy saving measures.

Why has typical electricity consumption stayed the same?

There is no definitive answer for why typical electricity consumption has stayed the same. Lighting and household appliances are increasingly more energy efficient, but this may have been offset by the growing number of energy-hungry gadgets in a typical home. For example, there are more laptops, large screen televisions and other electronic appliances.

How have we calculated the new consumption figures?

The old 2003 figures were calculated based using mean consumption figures.

To calculate the new typical consumption figures, we used median historical values. Using median values allows our figure to be more representative for a greater number of consumers.

Mean: Adds together a set of figures and then divides by the number of figures in the range.

Median: Arranges a set of figures in order of size. Takes the middle figure.

As part of our assessment we reviewed consumption data and analysis from other organisations. We also looked at consumption trends over time.

Considering the information available, and taking views from stakeholders, we decided to take four years of historical data as a basis for our calculations. We used consumption data provided by the Department for Energy and Climate Change (DECC) and industry.

We consulted widely on this method. When we calculated the figures, we also consulted on whether we should adopt them as our new consumption figures.

Why doesn't Ofgem change consumption figures more regularly to give more real time information on consumption?

We use a combination of long-term typical consumption figures and current market data in our analysis.

It is essential to have a benchmark typical consumption figure so we can show how trends change.

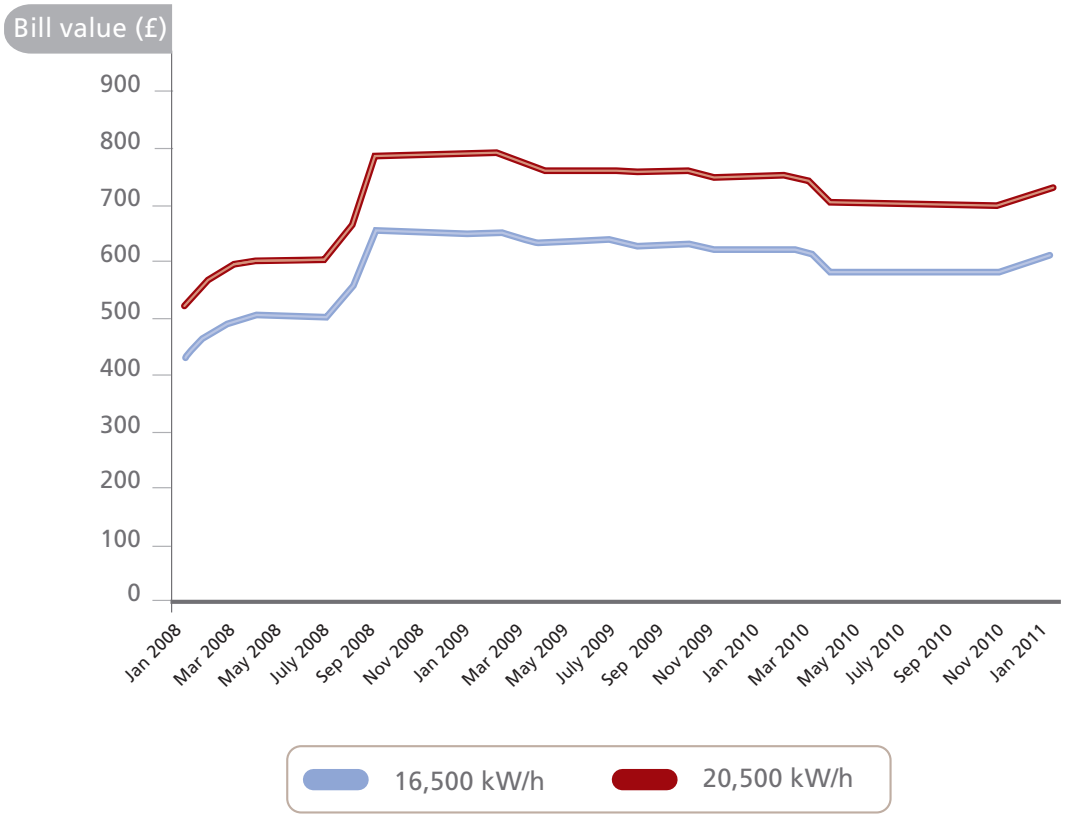
If we changed the typical consumption figures more regularly, it would be more difficult to produce a consistent picture of bill values over time. It could also be more confusing for consumers and industry if we regularly changed our benchmark figures.

In future, if we have evidence that they are no longer a fair representation of consumption, we will consider revising these figures again, as we have done now.

Graph shows the annual gas bill values for standard direct debit tariffs, averaged across all the big six suppliers and across Great Britain, from 1 January 2008 to 1 January 2011.

Red line uses the old typical medium consumption level (20,500 kWh)

Blue line uses the new typical medium consumption level (16,500 kWh)



Typical domestic energy consumption figures

How will the revised typical consumption figures affect customers?

They are just meant to represent typical consumption figures, so your household's energy consumption will not change. Your energy bills will still be based on your own consumption.

But it will mean that we change the figure given for a 'typical' or 'medium' energy bill. We use this figure in various work, including our factsheet: Household Energy Bills Explained. So if you regularly compare your gas bill with our 'medium' bills figure, then you will notice a change.

Annual bill values for standard direct debit tariffs, averaged across all big six suppliers, across Great Britain. All bill values below reflect gas and electricity prices in January 2011.

New medium gas bill – based on consumption of 16,500 kWh per year	Old medium gas bill - based on consumption of 20,500 kWh per year
£608	£729
New medium electricity bill – based on consumption of 3,300 kWh per year	**Old medium electricity bill – based on consumption of 3,300 kWh per year**
£424	£424

Not all online comparison sites use our figures. Some use their own data to calculate average bills. But if you do regularly use an online comparison site to compare prices, and that site uses our figures, then you may see some changes in the typical savings it says you can make by switching.

It is important to note that these are just meant to represent 'typical' consumption figures. In reality, there is no such thing as a typical consumer. Every household is different.

Use real information about your own energy use to shop around

Over the last few years we have made major changes to the retail energy market. We have put pressure on suppliers and introduced new rules, including improved information for consumers on their actual energy use through clearer bills and annual statements.

This way you don't have to use typical consumption figures when shopping around for a better deal.

When switching, or using an online comparison site, make sure you have your recent bill or energy statement on hand. It provides valuable information about your own energy use and the type of deal you are currently on.

This will help you make accurate comparisons with any alternative offer.

For further information please contact:

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Alison Wright, Press Officer	020 7901 7217	email alison.wright@ofgem.gov.uk

Appendix H - Initial District Heating Financial Model

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss factor EfW	**0.19**																

IDHS Summary- Areas B, D, G2 & J2

Heat Revenues

Heat Demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (t)	0	0	0	2,786	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982
Gas Cost per MWh																	
Discount Applied																	
Heat Revenues within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 0	£ 0	£ 0	£ 101,718	£ 223,853	£ 229,450	£ 235,186	£ 241,066	£ 247,092	£ 253,270	£ 259,601	£ 266,091	£ 272,744	£ 279,562	£ 286,551	£ 293,715

Capital Expenditure

Distribution Pipework	GBP	£ 0	£ 0	(£ 714,058)	(£ 306,800)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	(£ 541,769)	(£ 232,775)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	(£ 195,171)	(£ 83,857)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	GBP	£ 0	£ 0	(£ 276,201)	(£ 118,672)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	(£ 246,589)	(£ 105,949)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for IDHS Summary- Areas B, D, G2 & J2

Power Loss due to the heat demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (e)	0	0	0	557	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196
Power Revenues per MWh																	
Lost Power Revenues	GBP	£ 0	£ 0	£ 0	(£ 39,002)	(£ 85,833)	(£ 87,979)	(£ 90,179)	(£ 92,433)	(£ 94,744)	(£ 97,113)	(£ 99,540)	(£ 102,029)	(£ 104,580)	(£ 107,194)	(£ 109,874)	(£ 112,621)
Maintenance Costs of Network within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 0	£ 0	£ 0	(£ 14,153)	(£ 31,148)	(£ 31,927)	(£ 32,725)	(£ 33,543)	(£ 34,381)	(£ 35,241)	(£ 36,122)	(£ 37,025)	(£ 37,951)	(£ 38,899)	(£ 39,872)	(£ 40,869)

Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D, G2 & J2		**£ 0**	**£ 0**	**(£ 1,973,788)**	**(£ 799,491)**	**£ 106,872**	**£ 109,544**	**£ 112,283**	**£ 115,090**	**£ 117,967**	**£ 120,916**	**£ 123,939**	**£ 127,037**	**£ 130,213**	**£ 133,469**	**£ 136,805**	**£ 140,226**
IRR before Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**1.91%**																
Pay Back	**21.5 Years**																
Capital Subsidy Required from Third Party	**£ 1,380,137**	**£ 0**	**£ 0**	**£ 1,021,723**	**£ 438,991**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**
Pre Tax, Pre Finance Cashflow for IRR after Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**8.20%**	**£ 0**	**£ 0**	**(£ 952,066)**	**(£ 360,500)**	**£ 106,872**	**£ 109,544**	**£ 112,283**	**£ 115,090**	**£ 117,967**	**£ 120,916**	**£ 123,939**	**£ 127,037**	**£ 130,213**	**£ 133,469**	**£ 136,805**	**£ 140,226**
Pay Back	**11.5 Years**																

Barne Barton - Area B

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area B	503 MWh/a																
Heat Demand within Barne Barton - Area B	402 MWh/a	0	0	0	187	402	402	402	402	402	402	402	402	402	402	402	402
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 0	£ 0	£ 0	£ 6,843	£ 15,059	£ 15,436	£ 15,822	£ 16,217	£ 16,623	£ 17,038	£ 17,464	£ 17,901	£ 18,348	£ 18,807	£ 19,277	£ 19,759

Capital Expenditure

Distribution Pipework	€ 41,000	£ 0	£ 0	(£ 27,593)	(£ 11,856)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	(£ 11,213)	(£ 4,818)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	(£ 12,879)	(£ 5,534)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 41,600	£ 0	£ 0	(£ 27,997)	(£ 12,029)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	(£ 15,075)	(£ 6,477)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area B

Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	0	0	0	37	80	80	80	80	80	80	80	80	80	80	80	80
Power Revenues per MWh	£ 65.00																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth
(Base Case)

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss factor EfW	**0.19**														
IDHS Summary- Areas B, D, G2 & J2															
Heat Revenues															
Heat Demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (t)	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	152,326
Gas Cost per MWh															
Discount Applied															
Heat Revenues within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 301,058	£ 308,584	£ 316,299	£ 324,207	£ 332,312	£ 340,619	£ 349,135	£ 357,863	£ 366,810	£ 375,980	£ 385,380	£ 395,014	£ 404,890	£ 7,748,050
Capital Expenditure															
Distribution Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 1,020,859)
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 774,544)
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 279,028)
Building Connection Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 394,873)
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 352,538)
Costs of operating a District Heating System for IDHS Summary- Areas B, D, G2 & J2															
Power Loss due to the heat demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (e)	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	30,465
Power Revenues per MWh															
Lost Power Revenues	GBP	(£ 115,436)	(£ 118,322)	(£ 121,280)	(£ 124,312)	(£ 127,420)	(£ 130,606)	(£ 133,871)	(£ 137,218)	(£ 140,648)	(£ 144,164)	(£ 147,768)	(£ 151,462)	(£ 155,249)	(£ 2,970,878)
Maintenance Costs of Network within IDHS Summary- Areas B, D, G2 & J2	GBP	(£ 41,890)	(£ 42,938)	(£ 44,011)	(£ 45,111)	(£ 46,239)	(£ 47,395)	(£ 48,580)	(£ 49,795)	(£ 51,039)	(£ 52,315)	(£ 53,623)	(£ 54,964)	(£ 56,338)	(£ 1,078,094)
Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D, G2 & J2		**£ 143,731**	**£ 147,325**	**£ 151,008**	**£ 154,783**	**£ 158,652**	**£ 162,619**	**£ 166,684**	**£ 170,851**	**£ 175,123**	**£ 179,501**	**£ 183,988**	**£ 188,588**	**£ 193,303**	**£ 877,236**
IRR before Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**1.91%**														
Pay Back	**21.5 Years**														
Capital Subsidy Required from Third Party	**£ 1,380,137**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 1,460,714**
Pre Tax, Pre Finance Cashflow for		**£ 143,731**	**£ 147,325**	**£ 151,008**	**£ 154,783**	**£ 158,652**	**£ 162,619**	**£ 166,684**	**£ 170,851**	**£ 175,123**	**£ 179,501**	**£ 183,988**	**£ 188,588**	**£ 193,303**	**£ 2,337,950**
IRR after Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**8.20%**														
Pay Back	**11.5 Years**														
Barne Barton - Area B															
Heat Revenues															
Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area B	503 MWh/a														
Heat Demand within Barne Barton - Area B	402 MWh/a	402	402	402	402	402	402	402	402	402	402	402	402	402	10,247
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 20,253	£ 20,759	£ 21,278	£ 21,810	£ 22,356	£ 22,914	£ 23,487	£ 24,075	£ 24,676	£ 25,293	£ 25,926	£ 26,574	£ 27,238	£ 521,234
Capital Expenditure															
Distribution Pipework	€ 41,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 39,449)
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 16,030)
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 18,413)
Building Connection Pipework	€ 41,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 40,026)
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 21,553)
Costs of operating a District Heating System for Barne Barton - Area B															
Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	80	80	80	80	80	80	80	80	80	80	80	80	80	2,049
Power Revenues per MWh	£ 65.00														

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	2.50%																
Euro / Sterling Exchange Rate	1.10																
Base Date of Model	01/04/2011																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	13/10/2014																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	01/04/2013																
District Heating Construction End Date	31/08/2014																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 2,624)	(£ 5,774)	(£ 5,919)	(£ 6,067)	(£ 6,218)	(£ 6,374)	(£ 6,533)	(£ 6,696)	(£ 6,864)	(£ 7,035)	(£ 7,211)	(£ 7,392)	(£ 7,576)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	£ 0	£ 0	£ 0	(£ 679)	(£ 1,495)	(£ 1,533)	(£ 1,571)	(£ 1,610)	(£ 1,651)	(£ 1,692)	(£ 1,734)	(£ 1,777)	(£ 1,822)	(£ 1,867)	(£ 1,914)	(£ 1,962)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 0**	**£ 0**	**(£ 94,757)**	**(£ 37,174)**	**£ 7,790**	**£ 7,984**	**£ 8,184**	**£ 8,389**	**£ 8,598**	**£ 8,813**	**£ 9,034**	**£ 9,259**	**£ 9,491**	**£ 9,728**	**£ 9,971**	**£ 10,221**
IRR for Barne Barton - Area B	5.26%																
Pay Back	15.5 Years																

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a																
Heat Demand within Barne Barton - Area D	2,640 MWh/a	0	0	0	1,230	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 0	£ 0	£ 0	£ 44,893	£ 98,798	£ 101,268	£ 103,800	£ 106,395	£ 109,055	£ 111,781	£ 114,576	£ 117,440	£ 120,376	£ 123,386	£ 126,470	£ 129,632

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	(£ 386,978)	(£ 166,268)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	(£ 70,406)	(£ 30,251)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	(£ 80,870)	(£ 34,746)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 126,400	£ 0	£ 0	(£ 85,068)	(£ 36,550)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	(£ 89,913)	(£ 38,632)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	0.00	0.00	0.00	245.92	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 17,214)	(£ 37,883)	(£ 38,830)	(£ 39,801)	(£ 40,796)	(£ 41,816)	(£ 42,861)	(£ 43,933)	(£ 45,031)	(£ 46,157)	(£ 47,310)	(£ 48,493)	(£ 49,706)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	£ 0	£ 0	£ 0	(£ 5,114)	(£ 11,255)	(£ 11,537)	(£ 11,825)	(£ 12,121)	(£ 12,424)	(£ 12,734)	(£ 13,053)	(£ 13,379)	(£ 13,714)	(£ 14,056)	(£ 14,408)	(£ 14,768)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 0**	**£ 0**	**(£ 713,235)**	**(£ 283,881)**	**£ 49,660**	**£ 50,902**	**£ 52,174**	**£ 53,479**	**£ 54,816**	**£ 56,186**	**£ 57,591**	**£ 59,030**	**£ 60,506**	**£ 62,019**	**£ 63,569**	**£ 65,159**
IRR for Barne Barton - Area D	3.86%																
Pay Back	17.5 Years																

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a																
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	0	0	0	781	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 0	£ 0	£ 0	£ 28,528	£ 62,782	£ 64,352	£ 65,960	£ 67,609	£ 69,300	£ 71,032	£ 72,808	£ 74,628	£ 76,494	£ 78,406	£ 80,366	£ 82,375

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	(£ 132,582)	(£ 56,965)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	(£ 46,252)	(£ 19,873)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	(£ 53,126)	(£ 22,826)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 158,400	£ 0	£ 0	(£ 106,604)	(£ 45,803)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	(£ 88,837)	(£ 38,169)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area G2

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Lost Power Revenues		(£ 7,766)	(£ 7,960)	(£ 8,159)	(£ 8,363)	(£ 8,572)	(£ 8,786)	(£ 9,006)	(£ 9,231)	(£ 9,462)	(£ 9,698)	(£ 9,941)	(£ 10,189)	(£ 10,444)	(£ 199,860)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	(£ 2,011)	(£ 2,061)	(£ 2,113)	(£ 2,166)	(£ 2,220)	(£ 2,275)	(£ 2,332)	(£ 2,391)	(£ 2,450)	(£ 2,512)	(£ 2,574)	(£ 2,639)	(£ 2,705)	(£ 51,757)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 10,476**	**£ 10,738**	**£ 11,007**	**£ 11,282**	**£ 11,564**	**£ 11,853**	**£ 12,149**	**£ 12,453**	**£ 12,764**	**£ 13,083**	**£ 13,410**	**£ 13,746**	**£ 14,089**	**£ 134,147**
IRR for Barne Barton - Area B	**5.26%**														
Pay Back	**15.5 Years**														

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a														
Heat Demand within Barne Barton - Area D	2,640 MWh/a	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	67,230
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 132,873	£ 136,195	£ 139,600	£ 143,090	£ 146,667	£ 150,334	£ 154,092	£ 157,944	£ 161,893	£ 165,940	£ 170,089	£ 174,341	£ 178,699	£ 3,419,629

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 553,246)
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 100,657)
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 115,616)
Building Connection Pipework	€ 126,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 121,618)
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 128,545)

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	13,446
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 50,948)	(£ 52,222)	(£ 53,527)	(£ 54,866)	(£ 56,237)	(£ 57,643)	(£ 59,084)	(£ 60,561)	(£ 62,075)	(£ 63,627)	(£ 65,218)	(£ 66,848)	(£ 68,520)	(£ 1,311,207)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	(£ 15,137)	(£ 15,516)	(£ 15,904)	(£ 16,301)	(£ 16,709)	(£ 17,126)	(£ 17,555)	(£ 17,993)	(£ 18,443)	(£ 18,904)	(£ 19,377)	(£ 19,861)	(£ 20,358)	(£ 389,573)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 66,788**	**£ 68,457**	**£ 70,169**	**£ 71,923**	**£ 73,721**	**£ 75,564**	**£ 77,453**	**£ 79,389**	**£ 81,374**	**£ 83,408**	**£ 85,494**	**£ 87,631**	**£ 89,822**	**£ 699,167**
IRR for Barne Barton - Area D	**3.86%**														
Pay Back	**17.5 Years**														

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a														
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	42,721
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 84,435	£ 86,546	£ 88,709	£ 90,927	£ 93,200	£ 95,530	£ 97,918	£ 100,366	£ 102,876	£ 105,447	£ 108,084	£ 110,786	£ 113,555	£ 2,173,019

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 189,547)
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 66,125)
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,952)
Building Connection Pipework	€ 158,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 152,407)
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 127,006)

Costs of operating a District Heating System for Barne Barton - Area G2

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth
(Base Case)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	0.00	0.00	0.00	156.27	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 10,939)	(£ 24,073)	(£ 24,675)	(£ 25,292)	(£ 25,924)	(£ 26,572)	(£ 27,236)	(£ 27,917)	(£ 28,615)	(£ 29,330)	(£ 30,064)	(£ 30,815)	(£ 31,586)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	£ 0	£ 0	£ 0	(£ 3,065)	(£ 6,745)	(£ 6,913)	(£ 7,086)	(£ 7,263)	(£ 7,445)	(£ 7,631)	(£ 7,822)	(£ 8,017)	(£ 8,218)	(£ 8,423)	(£ 8,634)	(£ 8,850)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 0**	**£ 0**	**(£ 427,401)**	**(£ 169,112)**	**£ 31,964**	**£ 32,764**	**£ 33,583**	**£ 34,422**	**£ 35,283**	**£ 36,165**	**£ 37,069**	**£ 37,996**	**£ 38,946**	**£ 39,919**	**£ 40,917**	**£ 41,940**
IRR for Barne Barton - Area G2	**4.45%**																
Pay Back	**16.5 Years**																

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a																
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	0	0	0	588	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 0	£ 0	£ 0	£ 21,454	£ 47,214	£ 48,394	£ 49,604	£ 50,844	£ 52,115	£ 53,418	£ 54,753	£ 56,122	£ 57,525	£ 58,963	£ 60,438	£ 61,948

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	(£ 166,905)	(£ 71,712)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN250	€ 615,000	£ 0	£ 0	(£ 413,898)	(£ 177,834)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	(£ 48,296)	(£ 20,751)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 84,000	£ 0	£ 0	(£ 56,532)	(£ 24,290)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	(£ 52,764)	(£ 22,670)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	0.00	0.00	0.00	117.52	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 8,226)	(£ 18,103)	(£ 18,556)	(£ 19,020)	(£ 19,495)	(£ 19,983)	(£ 20,482)	(£ 20,994)	(£ 21,519)	(£ 22,057)	(£ 22,609)	(£ 23,174)	(£ 23,753)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	£ 0	£ 0	£ 0	(£ 5,295)	(£ 11,652)	(£ 11,944)	(£ 12,242)	(£ 12,548)	(£ 12,862)	(£ 13,184)	(£ 13,513)	(£ 13,851)	(£ 14,197)	(£ 14,552)	(£ 14,916)	(£ 15,289)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 0**	**£ 0**	**(£ 738,396)**	**(£ 309,324)**	**£ 17,458**	**£ 17,894**	**£ 18,342**	**£ 18,800**	**£ 19,270**	**£ 19,752**	**£ 20,246**	**£ 20,752**	**£ 21,271**	**£ 21,802**	**£ 22,348**	**£ 22,906**
IRR for Weston Mill Drive - Area J2	**#DIV/0!**																
Pay Back	**not achieved**																

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a																
Heat Demand within Barne Barton - Area C	1,492 MWh/a	0 MWh/a	0 MWh/a	0 MWh/a	695 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 0	£ 0	£ 0	£ 25,372	£ 55,836	£ 57,232	£ 58,663	£ 60,129	£ 61,633	£ 63,173	£ 64,753	£ 66,372	£ 68,031	£ 69,732	£ 71,475	£ 73,262

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	(£ 63,262)	(£ 27,181)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	(£ 43,449)	(£ 18,668)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	(£ 49,906)	(£ 21,443)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 101,600	£ 0	£ 0	(£ 68,377)	(£ 29,379)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	(£ 53,840)	(£ 23,133)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	8,544
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 32,375)	(£ 33,185)	(£ 34,014)	(£ 34,865)	(£ 35,736)	(£ 36,630)	(£ 37,545)	(£ 38,484)	(£ 39,446)	(£ 40,432)	(£ 41,443)	(£ 42,479)	(£ 43,541)	(£ 833,213)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	(£ 9,071)	(£ 9,298)	(£ 9,530)	(£ 9,768)	(£ 10,013)	(£ 10,263)	(£ 10,519)	(£ 10,782)	(£ 11,052)	(£ 11,328)	(£ 11,611)	(£ 11,902)	(£ 12,199)	(£ 233,449)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 42,989**	**£ 44,063**	**£ 45,165**	**£ 46,294**	**£ 47,451**	**£ 48,638**	**£ 49,854**	**£ 51,100**	**£ 52,377**	**£ 53,687**	**£ 55,029**	**£ 56,405**	**£ 57,815**	**£ 495,321**
IRR for Barne Barton - Area G2	**4.45%**														
Pay Back	**16.5 Years**														

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a														
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	32,128
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 63,497	£ 65,085	£ 66,712	£ 68,380	£ 70,089	£ 71,841	£ 73,637	£ 75,478	£ 77,365	£ 79,299	£ 81,282	£ 83,314	£ 85,397	£ 1,634,168

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 238,617)
Distribution Pipe - DN250	€ 615,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 591,732)
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 69,047)
Building Connection Pipework	€ 84,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 80,822)
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,434)

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	6,426
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 24,347)	(£ 24,956)	(£ 25,580)	(£ 26,219)	(£ 26,875)	(£ 27,546)	(£ 28,235)	(£ 28,941)	(£ 29,665)	(£ 30,406)	(£ 31,166)	(£ 31,945)	(£ 32,744)	(£ 626,598)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	(£ 15,671)	(£ 16,063)	(£ 16,465)	(£ 16,876)	(£ 17,298)	(£ 17,731)	(£ 18,174)	(£ 18,628)	(£ 19,094)	(£ 19,571)	(£ 20,060)	(£ 20,562)	(£ 21,076)	(£ 403,316)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 23,479**	**£ 24,066**	**£ 24,667**	**£ 25,284**	**£ 25,916**	**£ 26,564**	**£ 27,228**	**£ 27,909**	**£ 28,607**	**£ 29,322**	**£ 30,055**	**£ 30,806**	**£ 31,576**	**(£ 451,399)**
IRR for Weston Mill Drive - Area J2	**#DIV/0!**														
Pay Back	**not achieved**														

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a														
Heat Demand within Barne Barton - Area C	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	37,995
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 75,093	£ 76,971	£ 78,895	£ 80,867	£ 82,889	£ 84,961	£ 87,085	£ 89,262	£ 91,494	£ 93,781	£ 96,126	£ 98,529	£ 100,992	£ 1,932,609

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 90,444)
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 62,117)
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 71,349)
Building Connection Pipework	€ 101,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 97,756)
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 76,973)
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	(£ 807,606)	(£ 346,994)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Costs of operating a District Heating System for Barne Barton - Area C																	
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	0	0	0	139	298	298	298	298	298	298	298	298	298	298	298	298
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 9,728)	(£ 21,410)	(£ 21,945)	(£ 22,493)	(£ 23,056)	(£ 23,632)	(£ 24,223)	(£ 24,829)	(£ 25,449)	(£ 26,085)	(£ 26,738)	(£ 27,406)	(£ 28,091)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	£ 0	£ 0	£ 0	(£ 1,999)	(£ 4,400)	(£ 4,510)	(£ 4,623)	(£ 4,739)	(£ 4,857)	(£ 4,978)	(£ 5,103)	(£ 5,230)	(£ 5,361)	(£ 5,495)	(£ 5,633)	(£ 5,773)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 0**	**£ 0**	**(£ 1,086,441)**	**(£ 453,154)**	**£ 30,026**	**£ 30,777**	**£ 31,546**	**£ 32,335**	**£ 33,143**	**£ 33,972**	**£ 34,821**	**£ 35,692**	**£ 36,584**	**£ 37,499**	**£ 38,436**	**£ 39,397**
IRR before Capital Subsidy for Barne Barton - Area C	**#DIV/0!**																
Pay Back	**not achieved**																
Capital Subsidy Required from Third Party	**£ 1,109,251**	**£ 0**	**£ 0**	**£ 821,184**	**£ 352,828**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 0**	**£ 0**	**(£ 265,257)**	**(£ 100,326)**	**£ 30,026**	**£ 30,777**	**£ 31,546**	**£ 32,335**	**£ 33,143**	**£ 33,972**	**£ 34,821**	**£ 35,692**	**£ 36,584**	**£ 37,499**	**£ 38,436**	**£ 39,397**
IRR after Capital Subsidy for Barne Barton - Area C	**8.28%**																
Pay Back	**11.5 Years**																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 1,154,600)
Costs of operating a District Heating System for Barne Barton - Area C															
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	298	298	298	298	298	298	298	298	298	298	298	298	298	7,599
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 28,793)	(£ 29,513)	(£ 30,251)	(£ 31,007)	(£ 31,783)	(£ 32,577)	(£ 33,392)	(£ 34,226)	(£ 35,082)	(£ 35,959)	(£ 36,858)	(£ 37,780)	(£ 38,724)	(£ 741,031)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	(£ 5,918)	(£ 6,066)	(£ 6,217)	(£ 6,373)	(£ 6,532)	(£ 6,695)	(£ 6,863)	(£ 7,034)	(£ 7,210)	(£ 7,391)	(£ 7,575)	(£ 7,765)	(£ 7,959)	(£ 152,302)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 40,382**	**£ 41,392**	**£ 42,426**	**£ 43,487**	**£ 44,574**	**£ 45,689**	**£ 46,831**	**£ 48,002**	**£ 49,202**	**£ 50,432**	**£ 51,692**	**£ 52,985**	**£ 54,309**	**(£ 513,963)**
IRR before Capital Subsidy for Barne Barton - Area C	**#DIV/0!**														
Pay Back	**not achieved**														
Capital Subsidy Required from Third Party	**£ 1,109,251**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 1,174,012**
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 40,382**	**£ 41,392**	**£ 42,426**	**£ 43,487**	**£ 44,574**	**£ 45,689**	**£ 46,831**	**£ 48,002**	**£ 49,202**	**£ 50,432**	**£ 51,692**	**£ 52,985**	**£ 54,309**	**(£ 964,077)**
IRR after Capital Subsidy for Barne Barton - Area C	**8.28%**														
Pay Back	**11.5 Years**														

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss factor EfW	**0.19**																

IDHS Summary- Areas B, D & G2

Heat Revenues

Heat Demand within IDHS Summary- Areas B, D & G2	MWh/a (t)	0	0	0	2,198	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720
Gas Cost per MWh																	
Discount Applied																	
Heat Revenues within IDHS Summary- Areas B, D & G2	GBP	£ 0	£ 0	£ 0	£ 80,264	£ 176,640	£ 181,056	£ 185,582	£ 190,222	£ 194,977	£ 199,852	£ 204,848	£ 209,969	£ 215,218	£ 220,599	£ 226,114	£ 231,767

Capital Expenditure

Distribution Pipework	GBP	£ 0	£ 0	(£ 547,153)	(£ 235,088)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	(£ 127,871)	(£ 54,941)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	(£ 146,875)	(£ 63,106)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	GBP	£ 0	£ 0	(£ 219,669)	(£ 94,382)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	(£ 193,825)	(£ 83,279)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for IDHS Summary- Areas B, D & G2

Power Loss due to the heat demand within IDHS Summary- Areas B, D & G2	MWh/a (e)	0	0	0	440	944	944	944	944	944	944	944	944	944	944	944	944
Power Revenues per MWh																	
Lost Power Revenues	GBP	£ 0	£ 0	£ 0	(£ 30,776)	(£ 67,730)	(£ 69,423)	(£ 71,159)	(£ 72,938)	(£ 74,761)	(£ 76,630)	(£ 78,546)	(£ 80,510)	(£ 82,522)	(£ 84,585)	(£ 86,700)	(£ 88,868)
Maintenance Costs of Network within IDHS Summary- Areas B, D & G2	GBP	£ 0	£ 0	£ 0	(£ 8,859)	(£ 19,495)	(£ 19,983)	(£ 20,482)	(£ 20,994)	(£ 21,519)	(£ 22,057)	(£ 22,609)	(£ 23,174)	(£ 23,753)	(£ 24,347)	(£ 24,956)	(£ 25,580)
Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D & G2		**£ 0**	**£ 0**	**(£ 1,235,393)**	**(£ 490,167)**	**£ 89,414**	**£ 91,650**	**£ 93,941**	**£ 96,289**	**£ 98,697**	**£ 101,164**	**£ 103,693**	**£ 106,286**	**£ 108,943**	**£ 111,666**	**£ 114,458**	**£ 117,319**
IRR before Capital Subsidy for IDHS Summary- Areas B, D & G2	**4.18%**																
Pay Back	**16.5 Years**																
Capital Subsidy Required from Third Party	**£ 597,343**	**£ 0**	**£ 0**	**£ 442,216**	**£ 190,001**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**
Pre Tax, Pre Finance Cashflow for IRR after Capital Subsidy for IDHS Summary- Areas B, D & G2		**£ 0**	**£ 0**	**(£ 793,177)**	**(£ 300,165)**	**£ 89,414**	**£ 91,650**	**£ 93,941**	**£ 96,289**	**£ 98,697**	**£ 101,164**	**£ 103,693**	**£ 106,286**	**£ 108,943**	**£ 111,666**	**£ 114,458**	**£ 117,319**
IRR after Capital Subsidy for IDHS Summary- Areas B, D & G2	**8.24%**																
Pay Back	**11.5 Years**																

Barne Barton - Area B

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area B	503 MWh/a																
Heat Demand within Barne Barton - Area B	402 MWh/a	0	0	0	187	402	402	402	402	402	402	402	402	402	402	402	402
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 0	£ 0	£ 0	£ 6,843	£ 15,059	£ 15,436	£ 15,822	£ 16,217	£ 16,623	£ 17,038	£ 17,464	£ 17,901	£ 18,348	£ 18,807	£ 19,277	£ 19,759

Capital Expenditure

Distribution Pipework	€ 41,000	£ 0	£ 0	(£ 27,593)	(£ 11,856)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	(£ 11,213)	(£ 4,818)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	(£ 12,879)	(£ 5,534)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 41,600	£ 0	£ 0	(£ 27,997)	(£ 12,029)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	(£ 15,075)	(£ 6,477)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area B

Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	0	0	0	37	80	80	80	80	80	80	80	80	80	80	80	80
Power Revenues per MWh	£ 65.00																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss factor EfW	**0.19**														
IDHS Summary- Areas B, D & G2															
Heat Revenues															
Heat Demand within IDHS Summary- Areas B, D & G2	MWh/a (t)	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	4,720	120,198
Gas Cost per MWh															
Discount Applied															
Heat Revenues within IDHS Summary- Areas B, D & G2	GBP	£ 237,561	£ 243,500	£ 249,587	£ 255,827	£ 262,223	£ 268,778	£ 275,498	£ 282,385	£ 289,445	£ 296,681	£ 304,098	£ 311,700	£ 319,493	£ 6,113,882
Capital Expenditure															
Distribution Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 782,241)
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 182,812)
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 209,981)
Building Connection Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 314,051)
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 277,104)
Costs of operating a District Heating System for IDHS Summary- Areas B, D & G2															
Power Loss due to the heat demand within IDHS Summary- Areas B, D & G2	MWh/a (e)	944	944	944	944	944	944	944	944	944	944	944	944	944	24,040
Power Revenues per MWh															
Lost Power Revenues	GBP	(£ 91,089)	(£ 93,366)	(£ 95,701)	(£ 98,093)	(£ 100,546)	(£ 103,059)	(£ 105,636)	(£ 108,277)	(£ 110,983)	(£ 113,758)	(£ 116,602)	(£ 119,517)	(£ 122,505)	(£ 2,344,280)
Maintenance Costs of Network within IDHS Summary- Areas B, D & G2	GBP	(£ 26,219)	(£ 26,875)	(£ 27,547)	(£ 28,235)	(£ 28,941)	(£ 29,665)	(£ 30,406)	(£ 31,166)	(£ 31,946)	(£ 32,744)	(£ 33,563)	(£ 34,402)	(£ 35,262)	(£ 674,778)
Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D & G2		**£ 120,252**	**£ 123,259**	**£ 126,340**	**£ 129,499**	**£ 132,736**	**£ 136,055**	**£ 139,456**	**£ 142,942**	**£ 146,516**	**£ 150,179**	**£ 153,933**	**£ 157,782**	**£ 161,726**	**£ 1,328,635**
IRR before Capital Subsidy for IDHS Summary- Areas B, D & G2	**4.18%**														
Pay Back	**16.5 Years**														
Capital Subsidy Required from Third Party	**£ 597,343**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 632,217**
Pre Tax, Pre Finance Cashflow for		**£ 120,252**	**£ 123,259**	**£ 126,340**	**£ 129,499**	**£ 132,736**	**£ 136,055**	**£ 139,456**	**£ 142,942**	**£ 146,516**	**£ 150,179**	**£ 153,933**	**£ 157,782**	**£ 161,726**	**£ 1,960,852**
IRR after Capital Subsidy for IDHS Summary- Areas B, D & G2	**8.24%**														
Pay Back	**11.5 Years**														
Barne Barton - Area B															
Heat Revenues															
Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area B	503 MWh/a														
Heat Demand within Barne Barton - Area B	402 MWh/a	402	402	402	402	402	402	402	402	402	402	402	402	402	10,247
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 20,253	£ 20,759	£ 21,278	£ 21,810	£ 22,356	£ 22,914	£ 23,487	£ 24,075	£ 24,676	£ 25,293	£ 25,926	£ 26,574	£ 27,238	£ 521,234
Capital Expenditure															
Distribution Pipework	€ 41,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 39,449)
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 16,030)
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 18,413)
Building Connection Pipework	€ 41,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 40,026)
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 21,553)
Costs of operating a District Heating System for Barne Barton - Area B															
Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	80	80	80	80	80	80	80	80	80	80	80	80	80	2,049
Power Revenues per MWh	£ 65.00														

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	2.50%																
Euro / Sterling Exchange Rate	1.10																
Base Date of Model	01/04/2011																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	13/10/2014																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	01/04/2013																
District Heating Construction End Date	31/08/2014																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 2,624)	(£ 5,774)	(£ 5,919)	(£ 6,067)	(£ 6,218)	(£ 6,374)	(£ 6,533)	(£ 6,696)	(£ 6,864)	(£ 7,035)	(£ 7,211)	(£ 7,392)	(£ 7,576)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	£ 0	£ 0	£ 0	(£ 679)	(£ 1,495)	(£ 1,533)	(£ 1,571)	(£ 1,610)	(£ 1,651)	(£ 1,692)	(£ 1,734)	(£ 1,777)	(£ 1,822)	(£ 1,867)	(£ 1,914)	(£ 1,962)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 0**	**£ 0**	**(£ 94,757)**	**(£ 37,174)**	**£ 7,790**	**£ 7,984**	**£ 8,184**	**£ 8,389**	**£ 8,598**	**£ 8,813**	**£ 9,034**	**£ 9,259**	**£ 9,491**	**£ 9,728**	**£ 9,971**	**£ 10,221**
IRR for Barne Barton - Area B	5.26%																
Pay Back	15.5 Years																

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a																
Heat Demand within Barne Barton - Area D	2,640 MWh/a	0	0	0	1,230	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 0	£ 0	£ 0	£ 44,893	£ 98,798	£ 101,268	£ 103,800	£ 106,395	£ 109,055	£ 111,781	£ 114,576	£ 117,440	£ 120,376	£ 123,386	£ 126,470	£ 129,632

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	(£ 386,978)	(£ 166,268)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	(£ 70,406)	(£ 30,251)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	(£ 80,870)	(£ 34,746)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 126,400	£ 0	£ 0	(£ 85,068)	(£ 36,550)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	(£ 89,913)	(£ 38,632)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	0.00	0.00	0.00	245.92	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 17,214)	(£ 37,883)	(£ 38,830)	(£ 39,801)	(£ 40,796)	(£ 41,816)	(£ 42,861)	(£ 43,933)	(£ 45,031)	(£ 46,157)	(£ 47,310)	(£ 48,493)	(£ 49,706)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	£ 0	£ 0	£ 0	(£ 5,114)	(£ 11,255)	(£ 11,537)	(£ 11,825)	(£ 12,121)	(£ 12,424)	(£ 12,734)	(£ 13,053)	(£ 13,379)	(£ 13,714)	(£ 14,056)	(£ 14,408)	(£ 14,768)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 0**	**£ 0**	**(£ 713,235)**	**(£ 283,881)**	**£ 49,660**	**£ 50,902**	**£ 52,174**	**£ 53,479**	**£ 54,816**	**£ 56,186**	**£ 57,591**	**£ 59,030**	**£ 60,506**	**£ 62,019**	**£ 63,569**	**£ 65,159**
IRR for Barne Barton - Area D	3.86%																
Pay Back	17.5 Years																

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a																
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	0	0	0	781	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 0	£ 0	£ 0	£ 28,528	£ 62,782	£ 64,352	£ 65,960	£ 67,609	£ 69,300	£ 71,032	£ 72,808	£ 74,628	£ 76,494	£ 78,406	£ 80,366	£ 82,375

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	(£ 132,582)	(£ 56,965)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	(£ 46,252)	(£ 19,873)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	(£ 53,126)	(£ 22,826)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 158,400	£ 0	£ 0	(£ 106,604)	(£ 45,803)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	(£ 88,837)	(£ 38,169)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area G2

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	2.50%														
Euro / Sterling Exchange Rate	1.10														
Base Date of Model	01/04/2011														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	13/10/2014														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	01/04/2013														
District Heating Construction End Date	31/08/2014														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Lost Power Revenues		(£ 7,766)	(£ 7,960)	(£ 8,159)	(£ 8,363)	(£ 8,572)	(£ 8,786)	(£ 9,006)	(£ 9,231)	(£ 9,462)	(£ 9,698)	(£ 9,941)	(£ 10,189)	(£ 10,444)	(£ 199,860)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	(£ 2,011)	(£ 2,061)	(£ 2,113)	(£ 2,166)	(£ 2,220)	(£ 2,275)	(£ 2,332)	(£ 2,391)	(£ 2,450)	(£ 2,512)	(£ 2,574)	(£ 2,639)	(£ 2,705)	(£ 51,757)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 10,476**	**£ 10,738**	**£ 11,007**	**£ 11,282**	**£ 11,564**	**£ 11,853**	**£ 12,149**	**£ 12,453**	**£ 12,764**	**£ 13,083**	**£ 13,410**	**£ 13,746**	**£ 14,089**	**£ 134,147**
IRR for Barne Barton - Area B	**5.26%**														
Pay Back	**15.5 Years**														

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a														
Heat Demand within Barne Barton - Area D	2,640 MWh/a	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	67,230
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 132,873	£ 136,195	£ 139,600	£ 143,090	£ 146,667	£ 150,334	£ 154,092	£ 157,944	£ 161,893	£ 165,940	£ 170,089	£ 174,341	£ 178,699	£ 3,419,629

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 553,246)
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 100,657)
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 115,616)
Building Connection Pipework	€ 126,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 121,618)
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 128,545)

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	13,446
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 50,948)	(£ 52,222)	(£ 53,527)	(£ 54,866)	(£ 56,237)	(£ 57,643)	(£ 59,084)	(£ 60,561)	(£ 62,075)	(£ 63,627)	(£ 65,218)	(£ 66,848)	(£ 68,520)	(£ 1,311,207)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	(£ 15,137)	(£ 15,516)	(£ 15,904)	(£ 16,301)	(£ 16,709)	(£ 17,126)	(£ 17,555)	(£ 17,993)	(£ 18,443)	(£ 18,904)	(£ 19,377)	(£ 19,861)	(£ 20,358)	(£ 389,573)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 66,788**	**£ 68,457**	**£ 70,169**	**£ 71,923**	**£ 73,721**	**£ 75,564**	**£ 77,453**	**£ 79,389**	**£ 81,374**	**£ 83,408**	**£ 85,494**	**£ 87,631**	**£ 89,822**	**£ 699,167**
IRR for Barne Barton - Area D	**3.86%**														
Pay Back	**17.5 Years**														

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a														
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	42,721
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 84,435	£ 86,546	£ 88,709	£ 90,927	£ 93,200	£ 95,530	£ 97,918	£ 100,366	£ 102,876	£ 105,447	£ 108,084	£ 110,786	£ 113,555	£ 2,173,019

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 189,547)
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 66,125)
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,952)
Building Connection Pipework	€ 158,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 152,407)
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 127,006)

Costs of operating a District Heating System for Barne Barton - Area G2

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	0.00	0.00	0.00	156.27	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 10,939)	(£ 24,073)	(£ 24,675)	(£ 25,292)	(£ 25,924)	(£ 26,572)	(£ 27,236)	(£ 27,917)	(£ 28,615)	(£ 29,330)	(£ 30,064)	(£ 30,815)	(£ 31,586)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	£ 0	£ 0	£ 0	(£ 3,065)	(£ 6,745)	(£ 6,913)	(£ 7,086)	(£ 7,263)	(£ 7,445)	(£ 7,631)	(£ 7,822)	(£ 8,017)	(£ 8,218)	(£ 8,423)	(£ 8,634)	(£ 8,850)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 0**	**£ 0**	**(£ 427,401)**	**(£ 169,112)**	**£ 31,964**	**£ 32,764**	**£ 33,583**	**£ 34,422**	**£ 35,283**	**£ 36,165**	**£ 37,069**	**£ 37,996**	**£ 38,946**	**£ 39,919**	**£ 40,917**	**£ 41,940**
IRR for Barne Barton - Area G2	**4.45%**																
Pay Back	**16.5 Years**																

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a																
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	0	0	0	588	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 0	£ 0	£ 0	£ 21,454	£ 47,214	£ 48,394	£ 49,604	£ 50,844	£ 52,115	£ 53,418	£ 54,753	£ 56,122	£ 57,525	£ 58,963	£ 60,438	£ 61,948

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	(£ 166,905)	(£ 71,712)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN250	€ 615,000	£ 0	£ 0	(£ 413,898)	(£ 177,834)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	(£ 48,296)	(£ 20,751)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 84,000	£ 0	£ 0	(£ 56,532)	(£ 24,290)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	(£ 52,764)	(£ 22,670)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	0.00	0.00	0.00	117.52	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 8,226)	(£ 18,103)	(£ 18,556)	(£ 19,020)	(£ 19,495)	(£ 19,983)	(£ 20,482)	(£ 20,994)	(£ 21,519)	(£ 22,057)	(£ 22,609)	(£ 23,174)	(£ 23,753)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	£ 0	£ 0	£ 0	(£ 5,295)	(£ 11,652)	(£ 11,944)	(£ 12,242)	(£ 12,548)	(£ 12,862)	(£ 13,184)	(£ 13,513)	(£ 13,851)	(£ 14,197)	(£ 14,552)	(£ 14,916)	(£ 15,289)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 0**	**£ 0**	**(£ 738,396)**	**(£ 309,324)**	**£ 17,458**	**£ 17,894**	**£ 18,342**	**£ 18,800**	**£ 19,270**	**£ 19,752**	**£ 20,246**	**£ 20,752**	**£ 21,271**	**£ 21,802**	**£ 22,348**	**£ 22,906**
IRR for Weston Mill Drive - Area J2	**#DIV/0!**																
Pay Back	**not achieved**																

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a																
Heat Demand within Barne Barton - Area C	1,492 MWh/a	0 MWh/a	0 MWh/a	0 MWh/a	695 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 0	£ 0	£ 0	£ 25,372	£ 55,836	£ 57,232	£ 58,663	£ 60,129	£ 61,633	£ 63,173	£ 64,753	£ 66,372	£ 68,031	£ 69,732	£ 71,475	£ 73,262

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	(£ 63,262)	(£ 27,181)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	(£ 43,449)	(£ 18,668)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	(£ 49,906)	(£ 21,443)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 101,600	£ 0	£ 0	(£ 68,377)	(£ 29,379)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	(£ 53,840)	(£ 23,133)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	8,544
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 32,375)	(£ 33,185)	(£ 34,014)	(£ 34,865)	(£ 35,736)	(£ 36,630)	(£ 37,545)	(£ 38,484)	(£ 39,446)	(£ 40,432)	(£ 41,443)	(£ 42,479)	(£ 43,541)	(£ 833,213)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	(£ 9,071)	(£ 9,298)	(£ 9,530)	(£ 9,768)	(£ 10,013)	(£ 10,263)	(£ 10,519)	(£ 10,782)	(£ 11,052)	(£ 11,328)	(£ 11,611)	(£ 11,902)	(£ 12,199)	(£ 233,449)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 42,989**	**£ 44,063**	**£ 45,165**	**£ 46,294**	**£ 47,451**	**£ 48,638**	**£ 49,854**	**£ 51,100**	**£ 52,377**	**£ 53,687**	**£ 55,029**	**£ 56,405**	**£ 57,815**	**£ 495,321**
IRR for Barne Barton - Area G2	**4.45%**														
Pay Back	**16.5 Years**														

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a														
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	32,128
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 63,497	£ 65,085	£ 66,712	£ 68,380	£ 70,089	£ 71,841	£ 73,637	£ 75,478	£ 77,365	£ 79,299	£ 81,282	£ 83,314	£ 85,397	£ 1,634,168

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 238,617)
Distribution Pipe - DN250	€ 615,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 591,732)
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 69,047)
Building Connection Pipework	€ 84,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 80,822)
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,434)

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	6,426
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 24,347)	(£ 24,956)	(£ 25,580)	(£ 26,219)	(£ 26,875)	(£ 27,546)	(£ 28,235)	(£ 28,941)	(£ 29,665)	(£ 30,406)	(£ 31,166)	(£ 31,945)	(£ 32,744)	(£ 626,598)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	(£ 15,671)	(£ 16,063)	(£ 16,465)	(£ 16,876)	(£ 17,298)	(£ 17,731)	(£ 18,174)	(£ 18,628)	(£ 19,094)	(£ 19,571)	(£ 20,060)	(£ 20,562)	(£ 21,076)	(£ 403,316)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 23,479**	**£ 24,066**	**£ 24,667**	**£ 25,284**	**£ 25,916**	**£ 26,564**	**£ 27,228**	**£ 27,909**	**£ 28,607**	**£ 29,322**	**£ 30,055**	**£ 30,806**	**£ 31,576**	**(£ 451,399)**
IRR for Weston Mill Drive - Area J2	**#DIV/0!**														
Pay Back	**not achieved**														

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a														
Heat Demand within Barne Barton - Area C	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	37,995
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 75,093	£ 76,971	£ 78,895	£ 80,867	£ 82,889	£ 84,961	£ 87,085	£ 89,262	£ 91,494	£ 93,781	£ 96,126	£ 98,529	£ 100,992	£ 1,932,609

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 90,444)
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 62,117)
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 71,349)
Building Connection Pipework	€ 101,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 97,756)
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 76,973)
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	(£ 807,606)	(£ 346,994)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Costs of operating a District Heating System for Barne Barton - Area C																	
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	0	0	0	139	298	298	298	298	298	298	298	298	298	298	298	298
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 9,728)	(£ 21,410)	(£ 21,945)	(£ 22,493)	(£ 23,056)	(£ 23,632)	(£ 24,223)	(£ 24,829)	(£ 25,449)	(£ 26,085)	(£ 26,738)	(£ 27,406)	(£ 28,091)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	£ 0	£ 0	£ 0	(£ 1,999)	(£ 4,400)	(£ 4,510)	(£ 4,623)	(£ 4,739)	(£ 4,857)	(£ 4,978)	(£ 5,103)	(£ 5,230)	(£ 5,361)	(£ 5,495)	(£ 5,633)	(£ 5,773)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 0**	**£ 0**	**(£ 1,086,441)**	**(£ 453,154)**	**£ 30,026**	**£ 30,777**	**£ 31,546**	**£ 32,335**	**£ 33,143**	**£ 33,972**	**£ 34,821**	**£ 35,692**	**£ 36,584**	**£ 37,499**	**£ 38,436**	**£ 39,397**
IRR before Capital Subsidy for Barne Barton - Area C	**#DIV/0!**																
Pay Back	**not achieved**																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case Less Area J2)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 1,154,600)
Costs of operating a District Heating System for Barne Barton - Area C															
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	298	298	298	298	298	298	298	298	298	298	298	298	298	7,599
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 28,793)	(£ 29,513)	(£ 30,251)	(£ 31,007)	(£ 31,783)	(£ 32,577)	(£ 33,392)	(£ 34,226)	(£ 35,082)	(£ 35,959)	(£ 36,858)	(£ 37,780)	(£ 38,724)	(£ 741,031)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	(£ 5,918)	(£ 6,066)	(£ 6,217)	(£ 6,373)	(£ 6,532)	(£ 6,695)	(£ 6,863)	(£ 7,034)	(£ 7,210)	(£ 7,391)	(£ 7,575)	(£ 7,765)	(£ 7,959)	(£ 152,302)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 40,382**	**£ 41,392**	**£ 42,426**	**£ 43,487**	**£ 44,574**	**£ 45,689**	**£ 46,831**	**£ 48,002**	**£ 49,202**	**£ 50,432**	**£ 51,692**	**£ 52,985**	**£ 54,309**	**(£ 513,963)**
IRR before Capital Subsidy for Barne Barton - Area C	**#DIV/0!**														
Pay Back	**not achieved**														

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss factor EfW	**0.19**																

IDHS Summary- Areas B, D, G2 & J2

Heat Revenues

Heat Demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (t)	0	0	0	2,786	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982
Gas Cost per MWh																	
Discount Applied																	
Heat Revenues within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 0	£ 0	£ 0	£ 101,718	£ 223,853	£ 229,450	£ 235,186	£ 241,066	£ 247,092	£ 253,270	£ 259,601	£ 266,091	£ 272,744	£ 279,562	£ 286,551	£ 293,715

Capital Expenditure

Distribution Pipework	GBP	£ 0	£ 0	(£ 714,058)	(£ 306,800)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	(£ 127,871)	(£ 54,941)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	(£ 195,171)	(£ 83,857)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	GBP	£ 0	£ 0	(£ 276,201)	(£ 118,672)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	(£ 246,589)	(£ 105,949)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for IDHS Summary- Areas B, D, G2 & J2

Power Loss due to the heat demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (e)	0	0	0	557	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196
Power Revenues per MWh																	
Lost Power Revenues	GBP	£ 0	£ 0	£ 0	(£ 39,002)	(£ 85,833)	(£ 87,979)	(£ 90,179)	(£ 92,433)	(£ 94,744)	(£ 97,113)	(£ 99,540)	(£ 102,029)	(£ 104,580)	(£ 107,194)	(£ 109,874)	(£ 112,621)
Maintenance Costs of Network within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 0	£ 0	£ 0	(£ 11,185)	(£ 24,616)	(£ 25,232)	(£ 25,862)	(£ 26,509)	(£ 27,172)	(£ 27,851)	(£ 28,547)	(£ 29,261)	(£ 29,992)	(£ 30,742)	(£ 31,511)	(£ 32,299)

Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D, G2 & J2		**£ 0**	**£ 0**	**(£ 1,559,890)**	**(£ 618,689)**	**£ 113,404**	**£ 116,239**	**£ 119,145**	**£ 122,124**	**£ 125,177**	**£ 128,306**	**£ 131,514**	**£ 134,802**	**£ 138,172**	**£ 141,626**	**£ 145,166**	**£ 148,796**
IRR before Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**4.22%**																
Pay Back	**16.5 Years**																
Capital Subsidy Required from Third Party	**£ 748,291**	**£ 0**	**£ 0**	**£ 553,964**	**£ 238,015**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**
Pre Tax, Pre Finance Cashflow for IRR after Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2		**£ 0**	**£ 0**	**(£ 1,005,927)**	**(£ 380,674)**	**£ 113,404**	**£ 116,239**	**£ 119,145**	**£ 122,124**	**£ 125,177**	**£ 128,306**	**£ 131,514**	**£ 134,802**	**£ 138,172**	**£ 141,626**	**£ 145,166**	**£ 148,796**
IRR after Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**8.24%**																
Pay Back	**11.5 Years**																

Barne Barton - Area B

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area B	503 MWh/a																
Heat Demand within Barne Barton - Area B	402 MWh/a	0	0	0	187	402	402	402	402	402	402	402	402	402	402	402	402
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 0	£ 0	£ 0	£ 6,843	£ 15,059	£ 15,436	£ 15,822	£ 16,217	£ 16,623	£ 17,038	£ 17,464	£ 17,901	£ 18,348	£ 18,807	£ 19,277	£ 19,759

Capital Expenditure

Distribution Pipework	€ 41,000	£ 0	£ 0	(£ 27,593)	(£ 11,856)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	(£ 11,213)	(£ 4,818)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	(£ 12,879)	(£ 5,534)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 41,600	£ 0	£ 0	(£ 27,997)	(£ 12,029)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	(£ 15,075)	(£ 6,477)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area B

Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	0	0	0	37	80	80	80	80	80	80	80	80	80	80	80	80
Power Revenues per MWh	£ 65.00																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss factor EfW	**0.19**														
IDHS Summary- Areas B, D, G2 & J2															
Heat Revenues															
Heat Demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (t)	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	5,982	152,326
Gas Cost per MWh															
Discount Applied															
Heat Revenues within IDHS Summary- Areas B, D, G2 & J2	GBP	£ 301,058	£ 308,584	£ 316,299	£ 324,207	£ 332,312	£ 340,619	£ 349,135	£ 357,863	£ 366,810	£ 375,980	£ 385,380	£ 395,014	£ 404,890	£ 7,748,050
Capital Expenditure															
Distribution Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 1,020,859)
Proportion of Distribution Pipe - DN150 & DN250	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 182,812)
Proportion of Heat Exchange Plant	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 279,028)
Building Connection Pipework	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 394,873)
Connection costs to each building unit's heating system	GBP	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 352,538)
Costs of operating a District Heating System for IDHS Summary- Areas B, D, G2 & J2															
Power Loss due to the heat demand within IDHS Summary- Areas B, D, G2 & J2	MWh/a (e)	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	1,196	30,465
Power Revenues per MWh															
Lost Power Revenues	GBP	(£ 115,436)	(£ 118,322)	(£ 121,280)	(£ 124,312)	(£ 127,420)	(£ 130,606)	(£ 133,871)	(£ 137,218)	(£ 140,648)	(£ 144,164)	(£ 147,768)	(£ 151,462)	(£ 155,249)	(£ 2,970,878)
Maintenance Costs of Network within IDHS Summary- Areas B, D, G2 & J2	GBP	(£ 33,106)	(£ 33,934)	(£ 34,782)	(£ 35,652)	(£ 36,543)	(£ 37,457)	(£ 38,393)	(£ 39,353)	(£ 40,337)	(£ 41,345)	(£ 42,379)	(£ 43,438)	(£ 44,524)	(£ 852,021)
Pre Tax, Pre Finance Cashflow for IDHS Summary- Areas B, D, G2 & J2		**£ 152,516**	**£ 156,328**	**£ 160,237**	**£ 164,243**	**£ 168,349**	**£ 172,557**	**£ 176,871**	**£ 181,293**	**£ 185,825**	**£ 190,471**	**£ 195,233**	**£ 200,114**	**£ 205,116**	**£ 1,695,042**
IRR before Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**4.22%**														
Pay Back	**16.5 Years**														
Capital Subsidy Required from Third Party	**£ 748,291**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 791,979**
Pre Tax, Pre Finance Cashflow for		**£ 152,516**	**£ 156,328**	**£ 160,237**	**£ 164,243**	**£ 168,349**	**£ 172,557**	**£ 176,871**	**£ 181,293**	**£ 185,825**	**£ 190,471**	**£ 195,233**	**£ 200,114**	**£ 205,116**	**£ 2,487,021**
IRR after Capital Subsidy for IDHS Summary- Areas B, D, G2 & J2	**8.24%**														
Pay Back	**11.5 Years**														
Barne Barton - Area B															
Heat Revenues															
Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area B	503 MWh/a														
Heat Demand within Barne Barton - Area B	402 MWh/a	402	402	402	402	402	402	402	402	402	402	402	402	402	10,247
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area B	£ 33.90	£ 20,253	£ 20,759	£ 21,278	£ 21,810	£ 22,356	£ 22,914	£ 23,487	£ 24,075	£ 24,676	£ 25,293	£ 25,926	£ 26,574	£ 27,238	£ 521,234
Capital Expenditure															
Distribution Pipework	€ 41,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 39,449)
Proportion of Distribution Pipe - DN150	€ 16,661	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 16,030)
Proportion of Heat Exchange Plant	€ 19,137	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 18,413)
Building Connection Pipework	€ 41,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 40,026)
Connection costs to each building unit's heating system	€ 22,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 21,553)
Costs of operating a District Heating System for Barne Barton - Area B															
Power Loss due to the heat demand within Barne Barton - Area B	MWh/a (e)	80	80	80	80	80	80	80	80	80	80	80	80	80	2,049
Power Revenues per MWh	£ 65.00														

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 2,624)	(£ 5,774)	(£ 5,919)	(£ 6,067)	(£ 6,218)	(£ 6,374)	(£ 6,533)	(£ 6,696)	(£ 6,864)	(£ 7,035)	(£ 7,211)	(£ 7,392)	(£ 7,576)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	£ 0	£ 0	£ 0	(£ 679)	(£ 1,495)	(£ 1,533)	(£ 1,571)	(£ 1,610)	(£ 1,651)	(£ 1,692)	(£ 1,734)	(£ 1,777)	(£ 1,822)	(£ 1,867)	(£ 1,914)	(£ 1,962)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 0**	**£ 0**	**(£ 94,757)**	**(£ 37,174)**	**£ 7,790**	**£ 7,984**	**£ 8,184**	**£ 8,389**	**£ 8,598**	**£ 8,813**	**£ 9,034**	**£ 9,259**	**£ 9,491**	**£ 9,728**	**£ 9,971**	**£ 10,221**
IRR for Barne Barton - Area B	**5.26%**																
Pay Back	**15.5 Years**																

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a																
Heat Demand within Barne Barton - Area D	2,640 MWh/a	0	0	0	1,230	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 0	£ 0	£ 0	£ 44,893	£ 98,798	£ 101,268	£ 103,800	£ 106,395	£ 109,055	£ 111,781	£ 114,576	£ 117,440	£ 120,376	£ 123,386	£ 126,470	£ 129,632

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	(£ 386,978)	(£ 166,268)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	(£ 70,406)	(£ 30,251)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	(£ 80,870)	(£ 34,746)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 126,400	£ 0	£ 0	(£ 85,068)	(£ 36,550)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	(£ 89,913)	(£ 38,632)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	0.00	0.00	0.00	245.92	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 17,214)	(£ 37,883)	(£ 38,830)	(£ 39,801)	(£ 40,796)	(£ 41,816)	(£ 42,861)	(£ 43,933)	(£ 45,031)	(£ 46,157)	(£ 47,310)	(£ 48,493)	(£ 49,706)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	£ 0	£ 0	£ 0	(£ 5,114)	(£ 11,255)	(£ 11,537)	(£ 11,825)	(£ 12,121)	(£ 12,424)	(£ 12,734)	(£ 13,053)	(£ 13,379)	(£ 13,714)	(£ 14,056)	(£ 14,408)	(£ 14,768)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 0**	**£ 0**	**(£ 713,235)**	**(£ 283,881)**	**£ 49,660**	**£ 50,902**	**£ 52,174**	**£ 53,479**	**£ 54,816**	**£ 56,186**	**£ 57,591**	**£ 59,030**	**£ 60,506**	**£ 62,019**	**£ 63,569**	**£ 65,159**
IRR for Barne Barton - Area D	**3.86%**																
Pay Back	**17.5 Years**																

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a																
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	0	0	0	781	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 0	£ 0	£ 0	£ 28,528	£ 62,782	£ 64,352	£ 65,960	£ 67,609	£ 69,300	£ 71,032	£ 72,808	£ 74,628	£ 76,494	£ 78,406	£ 80,366	£ 82,375

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	(£ 132,582)	(£ 56,965)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	(£ 46,252)	(£ 19,873)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	(£ 53,126)	(£ 22,826)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 158,400	£ 0	£ 0	(£ 106,604)	(£ 45,803)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	(£ 88,837)	(£ 38,169)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Barne Barton - Area G2

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Lost Power Revenues		(£ 7,766)	(£ 7,960)	(£ 8,159)	(£ 8,363)	(£ 8,572)	(£ 8,786)	(£ 9,006)	(£ 9,231)	(£ 9,462)	(£ 9,698)	(£ 9,941)	(£ 10,189)	(£ 10,444)	(£ 199,860)
Maintenance Costs of Network within Barne Barton - Area B	1.00%	(£ 2,011)	(£ 2,061)	(£ 2,113)	(£ 2,166)	(£ 2,220)	(£ 2,275)	(£ 2,332)	(£ 2,391)	(£ 2,450)	(£ 2,512)	(£ 2,574)	(£ 2,639)	(£ 2,705)	(£ 51,757)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area B		**£ 10,476**	**£ 10,738**	**£ 11,007**	**£ 11,282**	**£ 11,564**	**£ 11,853**	**£ 12,149**	**£ 12,453**	**£ 12,764**	**£ 13,083**	**£ 13,410**	**£ 13,746**	**£ 14,089**	**£ 134,147**
IRR for Barne Barton - Area B	**5.26%**														
Pay Back	**15.5 Years**														

Barne Barton - Area D

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area D	3,300 MWh/a														
Heat Demand within Barne Barton - Area D	2,640 MWh/a	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	2,640	67,230
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area D	£ 33.90	£ 132,873	£ 136,195	£ 139,600	£ 143,090	£ 146,667	£ 150,334	£ 154,092	£ 157,944	£ 161,893	£ 165,940	£ 170,089	£ 174,341	£ 178,699	£ 3,419,629

Capital Expenditure

Distribution Pipework	€ 575,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 553,246)
Proportion of Distribution Pipe - DN150	€ 104,615	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 100,657)
Proportion of Heat Exchange Plant	€ 120,162	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 115,616)
Building Connection Pipework	€ 126,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 121,618)
Connection costs to each building unit's heating system	€ 133,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 128,545)

Costs of operating a District Heating System for Barne Barton - Area D

Power Loss due to the heat demand within Barne Barton - Area D	MWh/a (e)	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	528.00	13,446
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 50,948)	(£ 52,222)	(£ 53,527)	(£ 54,866)	(£ 56,237)	(£ 57,643)	(£ 59,084)	(£ 60,561)	(£ 62,075)	(£ 63,627)	(£ 65,218)	(£ 66,848)	(£ 68,520)	(£ 1,311,207)
Maintenance Costs of Network within Barne Barton - Area D	1.00%	(£ 15,137)	(£ 15,516)	(£ 15,904)	(£ 16,301)	(£ 16,709)	(£ 17,126)	(£ 17,555)	(£ 17,993)	(£ 18,443)	(£ 18,904)	(£ 19,377)	(£ 19,861)	(£ 20,358)	(£ 389,573)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area D		**£ 66,788**	**£ 68,457**	**£ 70,169**	**£ 71,923**	**£ 73,721**	**£ 75,564**	**£ 77,453**	**£ 79,389**	**£ 81,374**	**£ 83,408**	**£ 85,494**	**£ 87,631**	**£ 89,822**	**£ 699,167**
IRR for Barne Barton - Area D	**3.86%**														
Pay Back	**17.5 Years**														

Barne Barton - Area G2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area G2	2,097 MWh/a														
Heat Demand within Barne Barton - Area G2	1,678 MWh/a	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	1,678	42,721
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area G2	£ 33.90	£ 84,435	£ 86,546	£ 88,709	£ 90,927	£ 93,200	£ 95,530	£ 97,918	£ 100,366	£ 102,876	£ 105,447	£ 108,084	£ 110,786	£ 113,555	£ 2,173,019

Capital Expenditure

Distribution Pipework	€ 197,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 189,547)
Proportion of Distribution Pipe - DN150	€ 68,725	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 66,125)
Proportion of Heat Exchange Plant	€ 78,939	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,952)
Building Connection Pipework	€ 158,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 152,407)
Connection costs to each building unit's heating system	€ 132,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 127,006)

Costs of operating a District Heating System for Barne Barton - Area G2

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	0.00	0.00	0.00	156.27	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 10,939)	(£ 24,073)	(£ 24,675)	(£ 25,292)	(£ 25,924)	(£ 26,572)	(£ 27,236)	(£ 27,917)	(£ 28,615)	(£ 29,330)	(£ 30,064)	(£ 30,815)	(£ 31,586)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	£ 0	£ 0	£ 0	(£ 3,065)	(£ 6,745)	(£ 6,913)	(£ 7,086)	(£ 7,263)	(£ 7,445)	(£ 7,631)	(£ 7,822)	(£ 8,017)	(£ 8,218)	(£ 8,423)	(£ 8,634)	(£ 8,850)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 0**	**£ 0**	**(£ 427,401)**	**(£ 169,112)**	**£ 31,964**	**£ 32,764**	**£ 33,583**	**£ 34,422**	**£ 35,283**	**£ 36,165**	**£ 37,069**	**£ 37,996**	**£ 38,946**	**£ 39,919**	**£ 40,917**	**£ 41,940**
IRR for Barne Barton - Area G2	**4.45%**																
Pay Back	**16.5 Years**																

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a																
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	0	0	0	588	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 0	£ 0	£ 0	£ 21,454	£ 47,214	£ 48,394	£ 49,604	£ 50,844	£ 52,115	£ 53,418	£ 54,753	£ 56,122	£ 57,525	£ 58,963	£ 60,438	£ 61,948

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	(£ 166,905)	(£ 71,712)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN250	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	(£ 48,296)	(£ 20,751)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 84,000	£ 0	£ 0	(£ 56,532)	(£ 24,290)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	(£ 52,764)	(£ 22,670)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	0.00	0.00	0.00	117.52	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 8,226)	(£ 18,103)	(£ 18,556)	(£ 19,020)	(£ 19,495)	(£ 19,983)	(£ 20,482)	(£ 20,994)	(£ 21,519)	(£ 22,057)	(£ 22,609)	(£ 23,174)	(£ 23,753)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	£ 0	£ 0	£ 0	(£ 2,327)	(£ 5,121)	(£ 5,249)	(£ 5,380)	(£ 5,515)	(£ 5,652)	(£ 5,794)	(£ 5,939)	(£ 6,087)	(£ 6,239)	(£ 6,395)	(£ 6,555)	(£ 6,719)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 0**	**£ 0**	**(£ 324,498)**	**(£ 128,522)**	**£ 23,989**	**£ 24,589**	**£ 25,204**	**£ 25,834**	**£ 26,480**	**£ 27,142**	**£ 27,820**	**£ 28,516**	**£ 29,229**	**£ 29,960**	**£ 30,709**	**£ 31,476**
IRR for Weston Mill Drive - Area J2	**4.36%**																
Pay Back	**16.5 Years**																

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%																
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a																
Heat Demand within Barne Barton - Area C	1,492 MWh/a	0 MWh/a	0 MWh/a	0 MWh/a	695 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a
Gas Cost per MWh	£ 42.38																
Discount Applied	20.00%																
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 0	£ 0	£ 0	£ 25,372	£ 55,836	£ 57,232	£ 58,663	£ 60,129	£ 61,633	£ 63,173	£ 64,753	£ 66,372	£ 68,031	£ 69,732	£ 71,475	£ 73,262

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	(£ 63,262)	(£ 27,181)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	(£ 43,449)	(£ 18,668)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	(£ 49,906)	(£ 21,443)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Building Connection Pipework	€ 101,600	£ 0	£ 0	(£ 68,377)	(£ 29,379)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	(£ 53,840)	(£ 23,133)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Power Loss due to the heat demand within Barne Barton - Area G2	MWh/a (e)	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	335.52	8,544
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 32,375)	(£ 33,185)	(£ 34,014)	(£ 34,865)	(£ 35,736)	(£ 36,630)	(£ 37,545)	(£ 38,484)	(£ 39,446)	(£ 40,432)	(£ 41,443)	(£ 42,479)	(£ 43,541)	(£ 833,213)
Maintenance Costs of Network within Barne Barton - Area G2	1.00%	(£ 9,071)	(£ 9,298)	(£ 9,530)	(£ 9,768)	(£ 10,013)	(£ 10,263)	(£ 10,519)	(£ 10,782)	(£ 11,052)	(£ 11,328)	(£ 11,611)	(£ 11,902)	(£ 12,199)	(£ 233,449)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area G2		**£ 42,989**	**£ 44,063**	**£ 45,165**	**£ 46,294**	**£ 47,451**	**£ 48,638**	**£ 49,854**	**£ 51,100**	**£ 52,377**	**£ 53,687**	**£ 55,029**	**£ 56,405**	**£ 57,815**	**£ 495,321**
IRR for Barne Barton - Area G2	**4.45%**														
Pay Back	**16.5 Years**														

Weston Mill Drive - Area J2

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Weston Mill Drive - Area J2	1,577 MWh/a														
Heat Demand within Weston Mill Drive - Area J2	1,262 MWh/a	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	1,262	32,128
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Weston Mill Drive - Area J2	£ 33.90	£ 63,497	£ 65,085	£ 66,712	£ 68,380	£ 70,089	£ 71,841	£ 73,637	£ 75,478	£ 77,365	£ 79,299	£ 81,282	£ 83,314	£ 85,397	£ 1,634,168

Capital Expenditure

Distribution Pipework	€ 248,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 238,617)
Distribution Pipe - DN250	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Proportion of Heat Exchange Plant	€ 71,762	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 69,047)
Building Connection Pipework	€ 84,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 80,822)
Connection costs to each building unit's heating system	€ 78,400	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 75,434)

Costs of operating a District Heating System for Weston Mill Drive - Area J2

Power Loss due to the heat demand within Weston Mill Drive - Area J2	MWh/a (e)	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	252.32	6,426
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 24,347)	(£ 24,956)	(£ 25,580)	(£ 26,219)	(£ 26,875)	(£ 27,546)	(£ 28,235)	(£ 28,941)	(£ 29,665)	(£ 30,406)	(£ 31,166)	(£ 31,945)	(£ 32,744)	(£ 626,598)
Maintenance Costs of Network within Weston Mill Drive - Area J2	1.00%	(£ 6,887)	(£ 7,059)	(£ 7,236)	(£ 7,416)	(£ 7,602)	(£ 7,792)	(£ 7,987)	(£ 8,186)	(£ 8,391)	(£ 8,601)	(£ 8,816)	(£ 9,036)	(£ 9,262)	(£ 177,242)
Pre Tax, Pre Finance Cashflow for Weston Mill Drive - Area J2		**£ 32,263**	**£ 33,070**	**£ 33,897**	**£ 34,744**	**£ 35,613**	**£ 36,503**	**£ 37,415**	**£ 38,351**	**£ 39,310**	**£ 40,292**	**£ 41,300**	**£ 42,332**	**£ 43,390**	**£ 366,407**
IRR for Weston Mill Drive - Area J2	**4.36%**														
Pay Back	**16.5 Years**														

Barne Barton - Area C **not included within IDHS**

Heat Revenues

Scheme Take-Up by the Community	80.00%														
Full Heat Demand within Barne Barton - Area C	1,865 MWh/a														
Heat Demand within Barne Barton - Area C	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	1,492 MWh/a	37,995
Gas Cost per MWh	£ 42.38														
Discount Applied	20.00%														
Heat Revenues within Barne Barton - Area C	£ 33.90	£ 75,093	£ 76,971	£ 78,895	£ 80,867	£ 82,889	£ 84,961	£ 87,085	£ 89,262	£ 91,494	£ 93,781	£ 96,126	£ 98,529	£ 100,992	£ 1,932,609

Capital Expenditure

Distribution Pipework	€ 94,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 90,444)
Distribution Pipe - DN150	€ 64,560	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 62,117)
Proportion of Heat Exchange Plant	€ 74,155	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 71,349)
Building Connection Pipework	€ 101,600	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 97,756)
Connection costs to each building unit's heating system	€ 80,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 76,973)
Insulation of Outer Walls	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing	€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Retail Price Index - RPIx	**2.50%**																
Euro / Sterling Exchange Rate	**1.10**																
Base Date of Model	**01/04/2011**																
Start of Contract Year		*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year		*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor		*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live	**13/10/2014**																
Proportion of Year facility is operational		-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date	**01/04/2013**																
District Heating Construction End Date	**31/08/2014**																
District Heating Construction period		-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	(£ 807,606)	(£ 346,994)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Costs of operating a District Heating System for Barne Barton - Area C																	
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	0	0	0	139	298	298	298	298	298	298	298	298	298	298	298	298
Power Revenues per MWh	£ 65.00																
Lost Power Revenues		£ 0	£ 0	£ 0	(£ 9,728)	(£ 21,410)	(£ 21,945)	(£ 22,493)	(£ 23,056)	(£ 23,632)	(£ 24,223)	(£ 24,829)	(£ 25,449)	(£ 26,085)	(£ 26,738)	(£ 27,406)	(£ 28,091)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	£ 0	£ 0	£ 0	(£ 1,999)	(£ 4,400)	(£ 4,510)	(£ 4,623)	(£ 4,739)	(£ 4,857)	(£ 4,978)	(£ 5,103)	(£ 5,230)	(£ 5,361)	(£ 5,495)	(£ 5,633)	(£ 5,773)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 0**	**£ 0**	**(£ 1,086,441)**	**(£ 453,154)**	**£ 30,026**	**£ 30,777**	**£ 31,546**	**£ 32,335**	**£ 33,143**	**£ 33,972**	**£ 34,821**	**£ 35,692**	**£ 36,584**	**£ 37,499**	**£ 38,436**	**£ 39,397**

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

(Base Case including Area J2 but excluding 250 diameter trunk main)

Year		**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**TOTAL**
Retail Price Index - RPIx	**2.50%**														
Euro / Sterling Exchange Rate	**1.10**														
Base Date of Model	**01/04/2011**														
Start of Contract Year		*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year		*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor		*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live	**13/10/2014**														
Proportion of Year facility is operational		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date	**01/04/2013**														
District Heating Construction End Date	**31/08/2014**														
District Heating Construction period		-	-	-	-	-	-	-	-	-	-	-	-	-	
Replacement of Storage Heating Systems with new Heating system	€ 1,200,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 1,154,600)
Costs of operating a District Heating System for Barne Barton - Area C															
Power Loss due to the heat demand within Barne Barton - Area C	MWh/a (e)	298	298	298	298	298	298	298	298	298	298	298	298	298	7,599
Power Revenues per MWh	£ 65.00														
Lost Power Revenues		(£ 28,793)	(£ 29,513)	(£ 30,251)	(£ 31,007)	(£ 31,783)	(£ 32,577)	(£ 33,392)	(£ 34,226)	(£ 35,082)	(£ 35,959)	(£ 36,858)	(£ 37,780)	(£ 38,724)	(£ 741,031)
Maintenance Costs of Network within Barne Barton - Area C	1.00%	(£ 5,918)	(£ 6,066)	(£ 6,217)	(£ 6,373)	(£ 6,532)	(£ 6,695)	(£ 6,863)	(£ 7,034)	(£ 7,210)	(£ 7,391)	(£ 7,575)	(£ 7,765)	(£ 7,959)	(£ 152,302)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C		**£ 40,382**	**£ 41,392**	**£ 42,426**	**£ 43,487**	**£ 44,574**	**£ 45,689**	**£ 46,831**	**£ 48,002**	**£ 49,202**	**£ 50,432**	**£ 51,692**	**£ 52,985**	**£ 54,309**	**(£ 513,963)**

Appendix I - Initial PV Financial Model

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

Year			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Retail Price Index - RPIx		**2.50%**																
Euro / Sterling Exchange Rate		**1.10**																
Base Date of Model		**01/04/2011**																
Start of Contract Year			*01/04/2011*	*01/04/2012*	*01/04/2013*	*01/04/2014*	*01/04/2015*	*01/04/2016*	*01/04/2017*	*01/04/2018*	*01/04/2019*	*01/04/2020*	*01/04/2021*	*01/04/2022*	*01/04/2023*	*01/04/2024*	*01/04/2025*	*01/04/2026*
End of Contract Year			*31/03/2012*	*31/03/2013*	*31/03/2014*	*31/03/2015*	*31/03/2016*	*31/03/2017*	*31/03/2018*	*31/03/2019*	*31/03/2020*	*31/03/2021*	*31/03/2022*	*31/03/2023*	*31/03/2024*	*31/03/2025*	*31/03/2026*	*31/03/2027*
Inflation Factor			*1.000*	*1.025*	*1.051*	*1.077*	*1.104*	*1.131*	*1.160*	*1.189*	*1.218*	*1.249*	*1.280*	*1.312*	*1.345*	*1.379*	*1.413*	*1.448*
Date District Heating System goes live		**13/10/2014**																
Proportion of Year facility is operational			-	-	-	*0.466*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
District Heating Construction Start Date		**01/04/2013**																
District Heating Construction End Date		**31/08/2014**																
District Heating Construction period			-	-	*1.000*	*0.419*	-	-	-	-	-	-	-	-	-	-	-	-
Barne Barton - Area C																		
Heat Revenues																		
Scheme Take-Up by the Community		80.00%																
Number of Appartments within Barne Barton - Area C		96																
Estimated Annual Yield per Appartment		0.92676 MWh/a																
Total Estimated Annual Yield for Barne Barton - Area C		88.97 MWh/a	0 MWh/a	0 MWh/a	0 MWh/a	41 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a
Generation Tarrif / MWh		£ 367.00	£ 0.396															
Supply Saving	70.0%	£ 0.00	£ 0.160															
Exported to Grid	30.0%	£ 8.62	£ 0.031															
Heat Revenues within Barne Barton - Area C		£ 405.30 / MWh	£ 0	£ 0	£ 0	£ 18,086	£ 39,803	£ 40,798	£ 41,818	£ 42,863	£ 43,935	£ 45,033	£ 46,159	£ 47,313	£ 48,496	£ 49,708	£ 50,951	£ 52,224
Capital Expenditure																		
Sanyo HIT-N235SE10 Module units (£4k per appartment)		£ 384,000	£ 0	£ 0	(£ 284,277)	(£ 122,142)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Installation of units		£ 40,000	£ 0	£ 0	(£ 29,612)	(£ 12,723)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Scaffolding Costs		£ 11,500	£ 0	£ 0	(£ 8,514)	(£ 3,658)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Meter Connections Costs		£ 55,200	£ 0	£ 0	(£ 40,865)	(£ 17,558)	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Insulation of Outer Walls - included within CESP		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing - included within CESP		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of Storage Heating Systems with new Heating system		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Costs of operating a District Heating System for Barne Barton - Area C																		
Maintenance & Annual Inspection regime		£ 4,025.00	£ 0	£ 0	£ 0	(£ 2,019)	(£ 4,443)	(£ 4,554)	(£ 4,668)	(£ 4,784)	(£ 4,904)	(£ 5,027)	(£ 5,152)	(£ 5,281)	(£ 5,413)	(£ 5,549)	(£ 5,687)	(£ 5,829)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C			**£ 0**	**£ 0**	**(£ 363,268)**	**(£ 140,014)**	**£ 35,360**	**£ 36,244**	**£ 37,150**	**£ 38,079**	**£ 39,030**	**£ 40,006**	**£ 41,006**	**£ 42,032**	**£ 43,082**	**£ 44,159**	**£ 45,263**	**£ 46,395**
IRR before Capital Subsidy for Barne Barton - Area C		**6.80%**																
Pay Back		**13.5 Years**																
Capital Subsidy Required from Third Party		**£ 96,833**	**£ 0**	**£ 0**	**£ 71,686**	**£ 30,800**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C			**£ 0**	**£ 0**	**(£ 291,582)**	**(£ 109,213)**	**£ 35,360**	**£ 36,244**	**£ 37,150**	**£ 38,079**	**£ 39,030**	**£ 40,006**	**£ 41,006**	**£ 42,032**	**£ 43,082**	**£ 44,159**	**£ 45,263**	**£ 46,395**
IRR after Capital Subsidy for Barne Barton - Area C		**9.00%**																
Pay Back		**11.5 Years**																

Economic Assessment of the Initial District Heating System for Barne Barton & Weston Mill areas of Plymouth

Year			2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	TOTAL
Retail Price Index - RPIx		**2.50%**														
Euro / Sterling Exchange Rate		**1.10**														
Base Date of Model		**01/04/2011**														
Start of Contract Year			*01/04/2027*	*01/04/2028*	*01/04/2029*	*01/04/2030*	*01/04/2031*	*01/04/2032*	*01/04/2033*	*01/04/2034*	*01/04/2035*	*01/04/2036*	*01/04/2037*	*01/04/2038*	*01/04/2039*	
End of Contract Year			*31/03/2028*	*31/03/2029*	*31/03/2030*	*31/03/2031*	*31/03/2032*	*31/03/2033*	*31/03/2034*	*31/03/2035*	*31/03/2036*	*31/03/2037*	*31/03/2038*	*31/03/2039*	*31/03/2040*	
Inflation Factor			*1.485*	*1.522*	*1.560*	*1.599*	*1.639*	*1.680*	*1.722*	*1.765*	*1.809*	*1.854*	*1.900*	*1.948*	*1.996*	
Date District Heating System goes live		**13/10/2014**														
Proportion of Year facility is operational			*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
District Heating Construction Start Date		**01/04/2013**														
District Heating Construction End Date		**31/08/2014**														
District Heating Construction period			-	-	-	-	-	-	-	-	-	-	-	-	-	
Barne Barton - Area C																
Heat Revenues																
Scheme Take-Up by the Community		80.00%														
Number of Appartments within Barne Barton - Area C		96														
Estimated Annual Yield per Appartment		0.92676 MWh/a														
Total Estimated Annual Yield for Barne Barton - Area C		88.97 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	89 MWh/a	2,266
Generation Tarrif / MWh		£ 367.00	£ 0.396													
Supply Saving	70.0%	£ 0.00	£ 0.160													
Exported to Grid	30.0%	£ 8.62	£ 0.031													
Heat Revenues within Barne Barton - Area C		£ 405.30 / MWh	£ 53,530	£ 54,868	£ 56,240	£ 57,646	£ 59,087	£ 60,564	£ 62,078	£ 63,630	£ 65,221	£ 66,852	£ 68,523	£ 70,236	£ 71,992	£ 1,377,651
Capital Expenditure																
Sanyo HIT-N235SE10 Module units (£4k per appartment)		£ 384,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 406,419)
Installation of units		£ 40,000	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 42,335)
Scaffolding Costs		£ 11,500	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 12,171)
Meter Connections Costs		£ 55,200	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	(£ 58,423)
Insulation of Outer Walls - included within CESP		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of exising windows with Triple Glazing - included within CESP		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Replacement of Storage Heating Systems with new Heating system		€ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0	£ 0
Costs of operating a District Heating System for Barne Barton - Area C																
Maintenance & Annual Inspection regime		£ 4,025.00	(£ 5,975)	(£ 6,125)	(£ 6,278)	(£ 6,435)	(£ 6,595)	(£ 6,760)	(£ 6,929)	(£ 7,103)	(£ 7,280)	(£ 7,462)	(£ 7,649)	(£ 7,840)	(£ 8,036)	(£ 153,777)
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C			**£ 47,555**	**£ 48,744**	**£ 49,962**	**£ 51,211**	**£ 52,492**	**£ 53,804**	**£ 55,149**	**£ 56,528**	**£ 57,941**	**£ 59,389**	**£ 60,874**	**£ 62,396**	**£ 63,956**	**£ 704,526**
IRR before Capital Subsidy for Barne Barton - Area C		**6.80%**														
Pay Back		**13.5 Years**														
Capital Subsidy Required from Third Party		**£ 96,833**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 0**	**£ 102,486**
Pre Tax, Pre Finance Cashflow for Barne Barton - Area C			**£ 47,555**	**£ 48,744**	**£ 49,962**	**£ 51,211**	**£ 52,492**	**£ 53,804**	**£ 55,149**	**£ 56,528**	**£ 57,941**	**£ 59,389**	**£ 60,874**	**£ 62,396**	**£ 63,956**	**(£ 109,713)**
IRR after Capital Subsidy for Barne Barton - Area C		**9.00%**														
Pay Back		**11.5 Years**														