Isle Of Wight Council

Renewable Energy Isle of Wight

Isle Of Wight Heat Mapping

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1 EXECUTIVE SUMMARY

District heating systems can significantly contribute towards the Island's targets to achieve the lowest carbon footprint in England. Provision of this heat by renewable or other low carbon fuels will result in a sustainable reduction in carbon emissions. The availability of a suitable source of heat will assist in obtaining high ratings under the Code for Sustainable Homes (CSH).

The Isle of Wight Council is considering using the planning process to encourage the installation of district heating systems in new developments. These systems will then act as seeds allowing expansion and retrofitting of district heating to neighbouring existing domestic and commercial / industrial users.

Heat maps of the Island have been produced to identify those areas having the highest heat demand density, both currently and as predicted if potential development in the Medina Valley, Ryde and The Bay are realised. As would be expected the areas having highest heat demand density are currently within urban areas.

District heating can be relatively easily implemented in new development sites where the necessary infrastructure can be installed from the outset. The Council is in a strong position to influence this by making it a planning condition for developments above a threshold value to include community district heating systems. It is suggested that this threshold should be 250 dwellings or equivalent floor area. There are mechanisms, such as Section 106 Agreements, available to Planners to assist in implementing these provisions.

The ability of these new developments to provide seeds for the growth of extended District Heating networks should be actively considered at the planning stage. Developments of appropriate size which are located in or near to areas of high existing heat demand density should be targeted and prioritised.

Where practical, district heating networks installed as part of new developments should be encouraged to connect to suitable anchor loads located within a reasonable distance of the development. This benefits the network by increasing demand, allowing economies of scale, and provides a spine from which further expansion of the network into already developed areas can take place.

There are a limited number of public and privately managed buildings with significant heat demands. These could form the anchor loads for local community heating schemes or act as hubs for small scale local networks.

There may also be a good economic and environmental case for conversion of some public buildings, such as the larger high schools, to use renewable fuels for heating. This case is further improved if they could also supply local heat networks.

There are a variety of technologies for provision of low carbon heat. These can qualify for incentive payments as part of the Central Government Renewables Obligation depending on the technology used and the details of the scheme.

2 INTRODUCTION

Under Central Government policy [1,2] the Isle of Wight Council has a responsibility to ensure that any development on the Island is carried out in ways that protect and enhance the physical environment and optimise resource and energy use.

Central Government has declared targets of reducing the UK's carbon emission to 80% of the year 1990 levels by 2050 and for 20% of the UK's energy to be supplied from renewable sources by 2020.

The Council is actively committed to a sustainable energy policy under which measures are being taken to reduce the Island's carbon footprint, including promotion of energy efficiency and the substitution of fossil fuels by low carbon alternatives.

Through the Eco Island initiative the Island Strategic Partnership (ISP) is promoting measures to sustainably reduce emissions of carbon dioxide while improving the quality of life on the Island. As part of this initiative the Island Strategic Partnership has declared an ambition for the Island to have the smallest carbon footprint in England by 2020.

The Council's view is that this plan should include a positive approach to harnessing the generating potential from renewable energy sources in an environmentally acceptable way.

Using proprietary "VantagePoint" software the IoW Council has modelled a number of proposed means of achieving the necessary reductions. This has shown that significant savings in emissions can be made by increasing the use of District Heating (DH) systems in both existing stock and new developments, particularly where these can be supplied from low carbon heat sources.

The UK government recognises the contribution district heating and CHP technologies can make to CO_2 reductions. Its approach is set out in the Household Energy Management Strategy (HEMs) supporting paper 'An Enabling Framework for District Heating and Cooling'.

Details of the measures outlined in the HEMs supporting district heating and CHP include:

- Establishing a Heat Market Forum
- Creating a National Heat Map
- Setting up an online Community Energy Information Hub
- Inclusion of an incentive for district heating in the forthcoming Renewable Heat Incentive
- Considering a commitment that public sector properties connect to heat networks

The use of district heating allows the installation of centralised energy supply facilities having a capacity greater than any one of the individual users. This increases the range of technologies that can be used to provide the heat energy, making some of the relatively high capital cost renewable technologies more viable. An energy centre located near to a supply of waste heat from another process can recover this energy and distribute it to users using the DH network.

[1] Planning Policy Statement 1: Delivering Sustainable Development - Department for Communities and Local Government

[2] PPS: planning for a low carbon future in a changing climate: consultation - Department for Communities and Local Government

District heating systems have been in use in the UK since the 1950's when a scheme was installed to heat buildings in Pimlico, London using waste heat from Battersea power station. However, mainly due to the low commercial value historically given to heat in the UK, the use of these schemes has been very limited. In contrast, the use of district heating is well developed in Europe, particularly some Scandinavian countries where it is the dominant source of domestic heating.

Increasing fuel costs and pressure to reduce carbon emissions have renewed interest in DH schemes in the UK. There is a major installation is in Southampton. This currently comprises a network of around 11km of pipes distributing heat to domestic and commercial users. A number of heat sources are employed using different technologies. These heat sources are distributed around the network such that users are generally located within approximately 1 km of an energy centre. The Southampton district energy network cost in the region of £7m to develop and delivers 40GWh of heat, 22GWh of electricity and 8GWh of cooling on an annual basis. Further expansion of the system is planned.

Significant barriers to the installation of a district heating system are the practicality and cost of the heat distribution system linking a centralised energy plant with the heat consumers. This is particularly relevant for retrofit installations into existing developments. However if the energy centre and basic network infrastructure is provided as part of a neighbouring new development extension into the already developed areas becomes easier and more economically attractive.

The Code for Sustainable Homes considers connection to a district heating system as an allowable means of achieving CO_2 emission reduction from a property, thereby increasing its rating. To achieve the maximum rating of level 6, "zero carbon", all of the energy consumed, including heat used for space and water heating, must come from renewable sources. The possibility of connection to a DH network supplied from a renewable energy source will assist in meeting this objective and act as a powerful driver for the expansion of heat networks.

Grontmij were commissioned to produce heat maps of the Island. The main aims of this being:

- To identify those areas with an existing high heat demand density where the installation of a district heating system would be most economically viable.
- To examine how Council planning policy could be used to encourage installation and expansion of district heating systems.

The heat demands from existing buildings were also considered as these could potentially provide hubs or anchor loads for local heating networks.

3 ISLAND HEAT MAPPING

3.1 Background

By plotting heat consumption data onto suitable GIS maps it is possible to identify geographical areas having high concentrations of heat consumers. These areas have increased potential for district heating as the infrastructure costs per connected load are reduced.

The Island is divided for statistical purposes into 18 Middle Layer Super Output Areas (MSOAs) each of which is subdivided to give a total of 89 Lower Layer Super Output Areas (LSOAs). The LSOAs are designated to give a mean population per area of 1500. Consequently the geographical area of each LSOA in an area of high population density is small while low, rural, population densities result in large geographical areas.

3.1.1 Domestic Heat Demand

The UK Government Department of Energy and Climate Change (DECC) publish data for the annual domestic gas consumption for each LSOA.[3]
The 2008 data was used for the mapping as being the most recent complete set.

Domestic petroleum and solid fuel consumption for 2008 is only available on a MSOA level for the Island. Therefore domestic heating provided from oil or solid fuel was allowed for by distributing the available published DECC data for these fuels for the whole Island in proportion to the geographical area of each LSOA. This approach allocates the highest proportion of the non gas usage to the areas having lowest population density, i.e. those most likely to be off the gas grid.

The DECC figures are published as total annual fuel energy supplied in KWh. In order to convert these to a heat demand a conversion efficiency of 70% was applied. This is intended to allow for boiler inefficiencies, system losses and fuel used for purposes other than heating.

To reflect the density of the heat demand in each LSOA the demand figures were divided by the geographical area of the appropriate LSOA in km^2. The resulting figures were then mapped. For convenience the maps were plotted using units of MWh/km^2 per year.

3.1.2 Industrial & Commercial Heat Demand

Figures for non domestic gas consumption are published only at MSOA level[4].

In order to estimate the non domestic consumption at the LSOA level the ratios between domestic and non domestic consumption for each MSOA were calculated. To check the validity of the data this was done for both 2006 and 2007 data sets. The ratios for both years were found to be broadly similar. A mean of the two year's ratios was then applied to the given domestic consumption for each LSOA within the relevant MSOA to give a figure for the non domestic gas. This does assume that domestic and non domestic consumers within any given MSOA are evenly distributed across its LSOAs but the errors resulting from this are likely to be small.

[3] http://www.decc.gov.uk/en/content/cms/statistics/regional/mlsoa_llsoa/llsoa_2008/llsoa_2008.aspx
[4] http://www.decc.gov.uk/en/content/cms/statistics/regional/mlsoa_llsoa/mlsoa_llsoa.aspx

A copy of the Defra NI 185 reporting spreadsheet for the year 2008 was provided by the Council. This detailed the Council owned or managed properties giving the postal address and the total annual energy consumption for each property in KWh. This list identified a number of properties, mainly larger schools, heated by fuel oil whose heat demands would not have been picked up in the DECC data. The demand from these properties was added into the appropriate LSOA.

For the purposes of this report the buildings have been separated into two sub groups; one containing the schools and Isle of Wight College, the other being the remaining public buildings including St Mary's Hospital, the prisons and the fire and police stations.

Energy use data for St Mary's Hospital for the year 2008/2009 was provided by the IoW NHS. This was again in the form of total annual consumption of electricity and fossil fuel.

The Hospital currently operates a package Combined Heat and Power (CHP) unit providing around 5% of the site heat demand with the balance of the heat requirement coming from conventional fossil fuel fired boilers.

The Isle of Wight College is heated by a combination of heating oil and natural gas. Some of the gas supplied to the college is utilised for other purposes in workshops, labs and kitchens.

Publicly managed buildings such as toilets and car parks having effectively no heating demand were not mapped.

One of the limitations of mapping heat demand by LSOA is that where a large point user is located in an LSOA of otherwise low population density the calculated heat demand per unit area is low. The high demand then becomes lost in the background of the map. One case in particular is the Island Prisons. The three prisons on the Island are currently heated by gas fired decentralised boiler plant with around twelve heating boilers on each of the sites. The total annual gas consumption is 18,7 GWh; made up of 7,315 MWh from Parkhurst, 6,500 MWh from Albany and 4,850 MWh from Camphill. However as the prisons are the only significant consumers located in their LSOAs the resulting demand per unit area puts these areas at the bottom end of the mapped demand range.

It is therefore important to identify the locations of concentrated high demands, particularly where these are close to LSOAs having a high demand density. Planning policy needs to consider the proximity of high demand areas to any new developments rather than be restricted by LSOA or individual development boundaries.

The locations of individual large consumers have been shown on the maps to illustrate where these fall within LSOAs. The presence of large consumers close to regions of high domestic demand increases the viability of any DH scheme by providing potential anchor loads.

3.1.3 Existing Privately Managed Buildings

Information on the size and location of privately owned and managed buildings was not obtainable from the Council in the time available for preparation of this report.

At this stage therefore it was necessary to identify the buildings from other sources and estimate their likely heat loads using typical benchmark figures.

A review of the Valuation Office Agency 2010 Rating List[5] for non domestic properties on the Island identified fourteen properties having a floor area greater than nominally 5000m^2. These were retail outlets, large industrial buildings, one office building and an entertainment complex.

Energy consumptions for these buildings were estimated from the floor areas using published CIBSE benchmark figures for the type of building[6]

Although these estimates have to be treated with some care they should give a reasonable indication of the order of magnitude of the heat demands.

3.1.4 Potential New Developments

Details of sites identified for potential development following the Island Strategic Housing Land Availability Assessment (SHLAA) were obtained from the Council.

This identified three areas of the Island: The Bay, Ryde and the Medina Valley where there were sites having potential for development for either housing or employment.

Where zoned for housing development the number of housing units planned for each site was pre defined.

Data for sites zoned for employment was given in the form of a total site area.

The potential heat consumption data for these planned developments was estimated based on the following assumptions:

1. The planned housing will be a mixture of low cost and family buildings. The average floor area of a dwelling house will be 75m^2.
2. New housing will be built to best practice building regulations having a target annual heat usage of 100 kWh/m^2/yr floor area.
3. Employment development will be a mix of warehousing / light industrial and offices. After allowing for access, parking and amenity space the floor area of built employment developments will be 40% of the total development land area.
4. The average heating demand for employment development will be 90 kWh/m^2/yr floor area. This represents an approximately 10% improvement in the Good Practice figures given in CIBSE Guide F 2004 to allow for improved future building standards.

3.2 Characterisation of Heat Demand Data

The base data provided total annual heating demands for each individual LSOA or property without identifying how the load varied through the period.

3.2.1 Seasonal Variations

Estimates of the maximum and minimum heat demands were made using published degree day data for the Island.

[5] www.voa.gov.uk
[6] CIBSE Guide F: Energy efficiency in buildings 2004 Table 20.1 Typical Practice

To match the published DECC and NI 185 data supplied by the Council climatic conditions for 2008 were used for characterisation.

The reported degree days for the year are shown in Figure 1 together with the calculated annual mean value. From this data it was estimated that the peak demand would be of the order of 1.8 times the mean demand with the minimum 0.2 times the mean. These boundaries are shown on the graph for illustration.

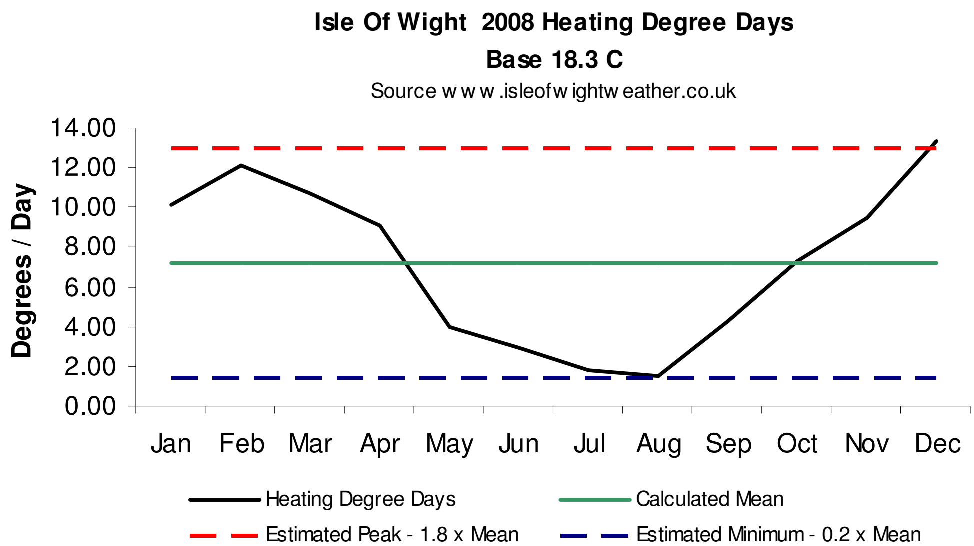


Figure 1 – 2008 Degree Days

3.2.2 Daily Variations

No information was provided on the daily operating hours of individual heating systems.

To obtain realistic figures for the likely levels of instantaneous energy demands it was necessary to estimate the annual operating hours for the heating systems. These hours vary between building types based on their hours of occupation.

The hours assumed for the various building types are summarised in Table 3.1. The total heat demand for each property was divided by these annual heating hours to give the mean heat demand in KW.

The seasonal factors as calculated above were then applied to give estimated peak and minimum instantaneous demands for each building or development.

Building / Use	Heating Hours Per Annum
St Mary's Hospital	8736
Care Home	6552
Newport Fire Station	6570
Prisons	8736
Newport Police Station	4368
Ryde Police Station	3224
Major Retail (Supermarket etc)	8736
Existing Industrial	4160
Cinema Complex	3650
Isle of Wight College	3060
School	2600
New Development Housing	2600
New Development Employment	4160
Other	2600

Table 3.1 – Estimated Annual Heating Hours By Building / Use

3.3 Heat Mapping Results

3.3.1 Heat Mapping By Area

The overall heat demand maps of the Island by LSOA are shown in appendices 1 to 7.

These illustrate the annual demand for the domestic sector (Appendix 1), the commercial and industrial sector (Appendix 2), and the potential new developments (Appendix 3). The total existing demand from all sectors is mapped in Appendix 4 and the total including potential new developments in Appendix 5.

The map of existing total demand, part reproduced in Figure 2 shows that the areas of existing high demand density are, as would be expected, in the urban areas of Newport, Cowes, Ryde and The Bay. This does not include any anticipated future demands arising from potential new developments.

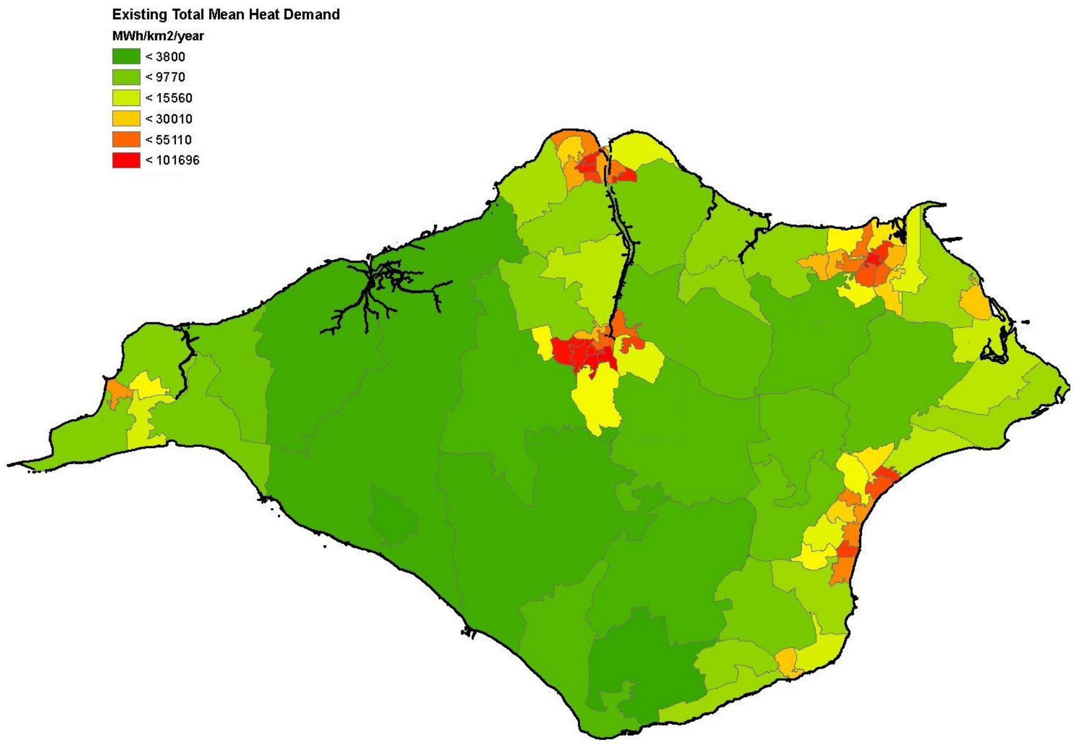


Figure 2 Existing Total Mean Annual Heat Demand by LSOA

Other areas of the Island generally show relatively low demand densities although there is some distortion due to the presence of high point demands, e.g. the prisons. To illustrate this, the point locations of the buildings identified as having a mean heat demand of greater than 200 KW are superimposed on the map shown in detail in Appendix 6 and part reproduced in Figure 3 below.

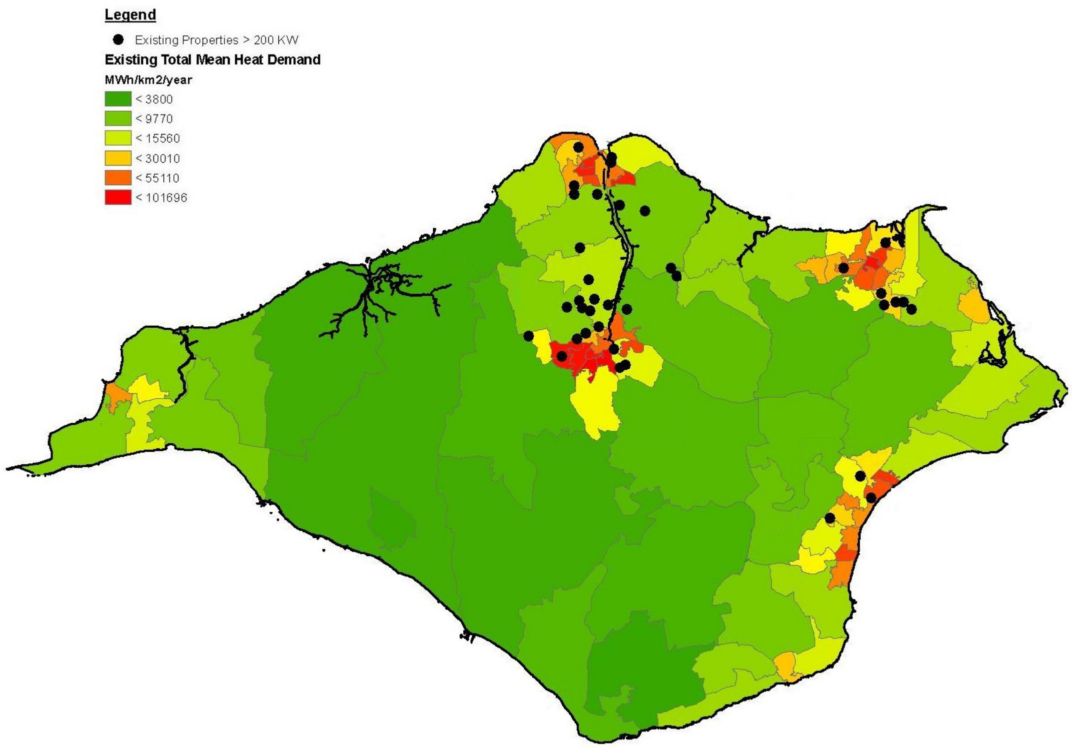


Figure 3 Location Of Existing Potential Anchor Loads

These point locations represent existing potential anchors for district heating systems.

The greatest potential for the installation of DH systems is in the new developments, where the necessary infrastructure can be installed from the outset. The sites identified by the Strategic Housing Land Availability Assessment as being potentially suitable for development are identified on the map included as Appendix 7 and partially reproduced in Figure 4. All of the potential new developments identified within the Medina Valley, Ryde and the Bay areas have been plotted. For the purposes of Figure 4 the anticipated heat demand for the development has also been added to the appropriate LSOA heat demand. In all cases the geometric centre of the development has been indicated. The resolution of the mapping may have resulted in overlapping of some closely spaced development sites.

Although not all of the potential development sites will be realised, comparison between figures 2 and 4 shows that there is no significant distortion of the heat demand pattern, from either housing or employment, if the development takes place, in that no new areas of high demand will be created remote from existing users.

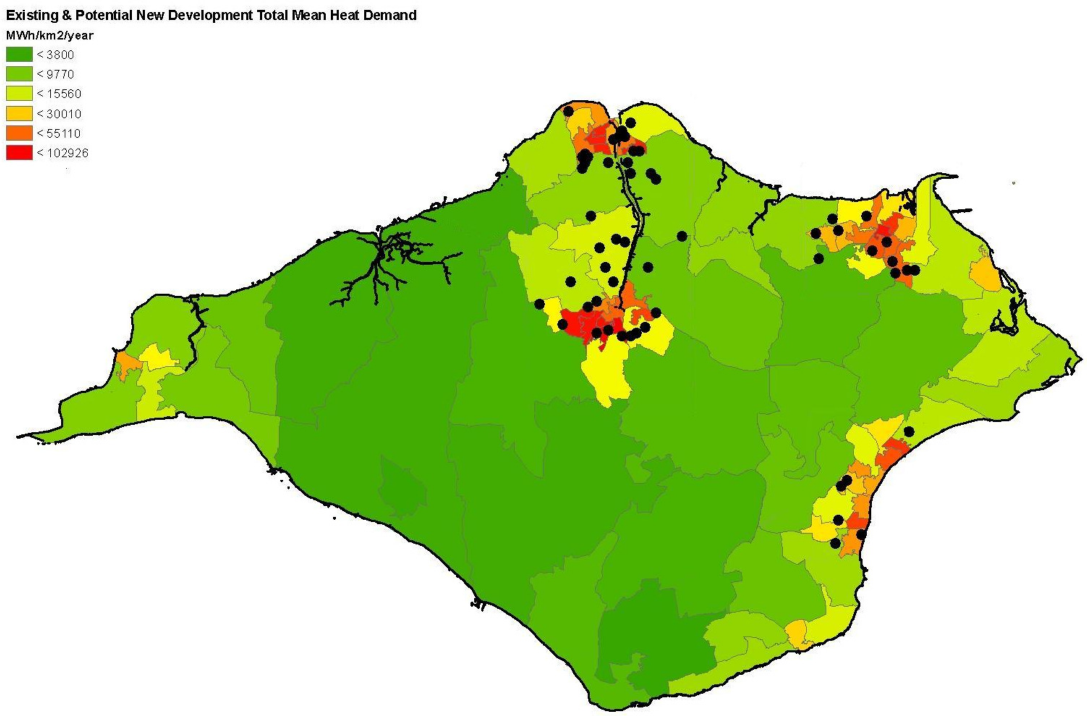


Figure 4 Location Of Potential New Development Sites

Figure 4 also illustrates that there are areas, particularly in Newport, Cowes and Ryde where the potential development areas are close together or are located close to areas having a high demand density. This gives the opportunity for individual small scale DH schemes in the developments to be connected to each other or to be extended into the existing areas as the overall development progresses. This could result in organic growth of the DH system in these areas.

3.3.2 Commercial & Industrial Heat Demand Data

The data collected for the individual buildings is summarised in Appendices 8 to 11. The data tables show the estimated maximum and minimum demands for each property based on the characterisations outlined above.

The location of the individual properties and their heat demands are mapped in Appendix 12. This also shows the potential new developments as point locations with the estimated heat demands for each development. The potential new developments alone are mapped in a similar manner as Appendix 13. In some cases it may be possible to locate energy centres at or near to an existing anchor load which would then feed local heating networks. In the case of new development the development itself could contain the energy centre which would supply its own network and potentially those of adjoining housing stock or anchor loads.

The various consumers are banded according to their heat demand as high (in excess of 500 KW instantaneous demand), medium (200 KW to 500 KW) and low (less than 200 KW).

Although they would benefit from connection to district heating if it were available, properties in the low demand band are unlikely to be significant incentives in themselves for construction or extension of a DH system specifically to serve that property. Properties in the medium and high bandings could potentially provide anchor loads for DH systems. The higher demand properties could also be suitable locations for energy centres providing heat for their own use and local heating networks. They may also be candidates in themselves for conversion to renewable fuels.

3.3.3 Distribution of Heat Consumers

The distribution of properties according to their instantaneous mean heat demand is shown in Figure 5. The heat demand is calculated from the total oil and gas fuel usage published for each property in the Defra NI 185 reporting spreadsheet for the year 2008.

As can be seen the majority of the consumers have a heat demand lower than 200 KW.

Figure 6 shows the breakdown of properties in the mid range of demand between 200 and 500 KW. There is a breakpoint in the proposed scale of Renewable Heat Incentive tariffs at < 500 KW which will improve the economics of smaller scale systems. However schemes of this size will not benefit from the economies of scale of larger systems and may still be commercially unattractive without additional incentives.
This range includes the high schools at Carisbrook, Ryde and Cowes.

Figure 7 shows the distribution of the larger consumers, having a mean heat demand of greater than 500 KW. In producing this it has been assumed that new developments will incorporate district heating systems for both housing and employment areas, consequently the demands shown are the demands from the energy centres supplying heat to the DH networks. From this it can be seen that the majority of the significant users will be in the new developments.

There are nine existing properties falling into the medium demand range and nine existing properties falling into the high demand range. These are broken down in figures 6 and 7 respectively. Of these the largest concentration of demand is the prison complex with high individual demands at the College and the High Schools at Medina and Sandown.

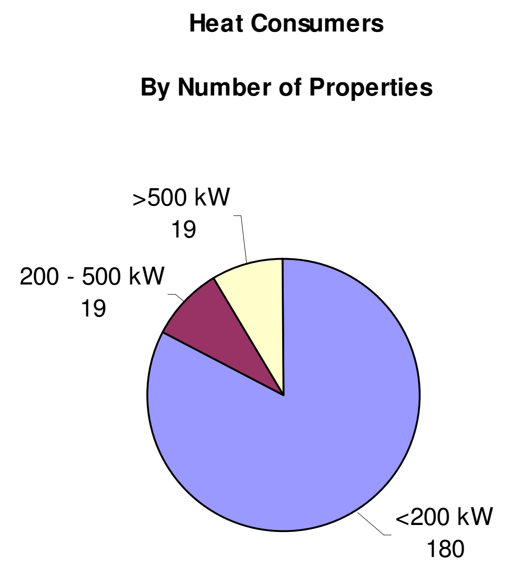


Figure 5 – Distribution of Heat Consumers by Number of Properties & Mean Demand

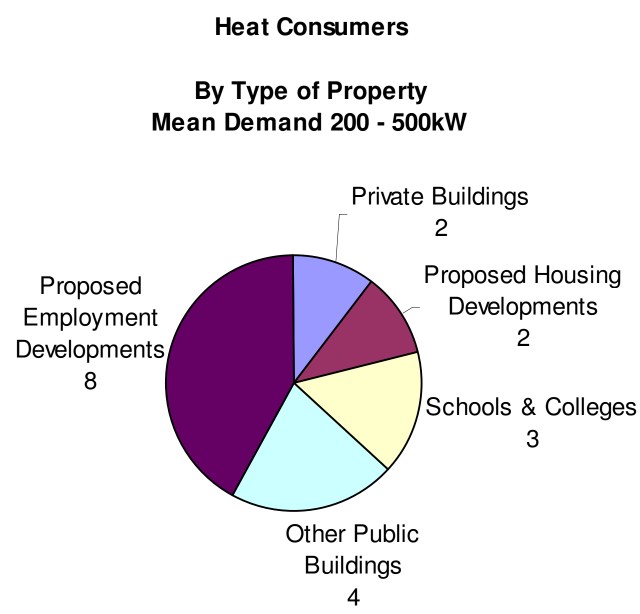


Figure 6 – Distribution of Medium Heat Consumers by Type of Properties

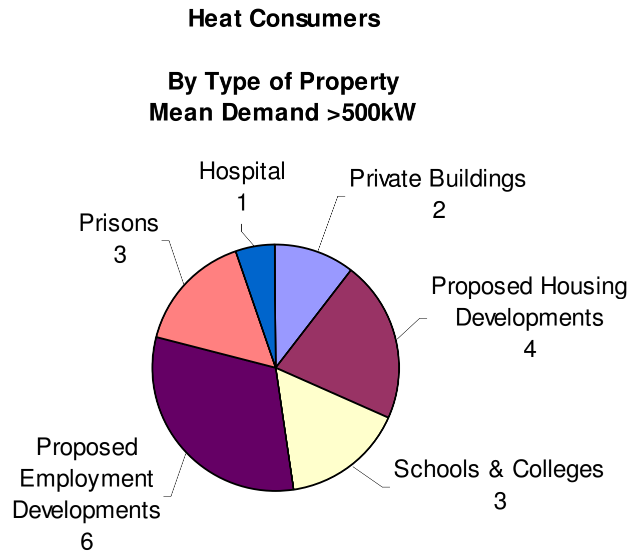


Figure 7 – Distribution of Large Heat Consumers by Type of Properties

4 EXISTING HEAT SUPPLY PLANTS ON THE ISLAND

Information supplied by the Council identified the following existing and proposed heat supply plants on the Island.

4.1 Cowes Power Station

This is an open cycle gas turbine station rated at 140 MW(e).

This could potentially be a source of heat, however it is currently only used to support the grid at times of high demand and runs intermittently as required, totalling around 100 hours per year. Under this operating pattern it cannot provide a reliable source of heat to a district heating network.

4.2 Forest Road Gasification Plant

This is a waste to energy plant employing an advanced gasification process. The plant is owned and operated by a private entity, Energos.

Energos have been approached regarding possible use of waste heat from the plant for District Heating.

Energos have advised that they would plan to operate for around 7500 hours per year and when the plant is at full output around 8000 KW of low grade heat is rejected to atmosphere. They have indicated interest in supplying heat if a suitable customer could be found. However in practice this may be difficult as the heat is rejected at a lower temperature than would normally be returned from district heating applications. Increasing its temperature by supplementary heating would not be energy efficient in comparison to a conventional closed loop heating system.

The existing plant treats municipal waste. Energos have commented that there may also be sufficient commercial waste available to justify the construction of a second plant which could be designed from the outset to supply heat at a temperature more suitable for district heating.

The existing site is located some 2.5 Km from the prison complex which could give a significant and continuous heat load if a suitable heat source could be provided. The cost of transmission of the heat over this distance is likely to be around £1.5 million, excluding local heat distribution systems at the end users. Income from heat sales and other incentives could make this attractive.

4.3 Wight Salads CHP Plant

Wight Salads operate a CHP scheme, using multiple natural gas fuelled engines, at their Arreton Valley site.

A total of 9 engines are installed each having an electrical output of 2 MW. Waste heat from the engines, together with carbon dioxide in the exhaust gas is supplied to the greenhouses to boost production.

It is unlikely that significant surplus heat would currently be available from this site.

The location of the site and nature of the business makes it unlikely that there would be significant future residential development in the vicinity. However should the existing scheme be extended or there be additional commercial / industrial development in close proximity it is it is possible that there may be scope for implementation of district heating and incorporation of some of the generating plant into an energy centre.

4.4 Pan Estate

The Pan Estate near Newport is currently under development. A biomass fired district heating scheme will be incorporated to provide heat to the estate.

Currently the heating system is being rated for the demands of the proposed housing, however the development is located near to the existing residential areas, such as Barton. Progressive extension of the DH network into these areas would therefore be practical. It may also be possible to extends westwards into Newport itself, although this would require more extensive infrastructure, including crossing the Medina.

4.5 Stag Lane Biomass Plant

Possible options under consideration for remediation of the Stag Lane refuse disposal site include the construction of a biomass burning power station.

If this development proceeds this would be an ideal source of heat for a District Heating system.

The site is located some 2 Km north of Newport in what is currently a relatively unpopulated area. However there is potentially a large housing development (LDF103) and an employment area (LDF404) planned for construction near to the site. The biomass plant could provide the heat into DH systems covering these developments. The network within LDF103 could be ultimately be extended further south to cover consumers in the north of Newport.

The amount of heat available and the temperature at which it could be supplied are not as yet defined.

5 EXISTING DISTRICT HEATING NETWORKS

The council have advised that there are currently no functional district heating systems within its estate. The existing network on the hospital site is currently being decommissioned.

This study has identified a small district heating system at the Isle of Wight College. This is an oil fired system supplying approximately half of the buildings on campus. The remaining buildings are heated by stand alone gas boilers or to a lesser extent, electric heating.

The new development at the Pan Estate will have a District Heating network installed as part of the construction.

6 TECHNOLOGIES FOR PROVISION OF LOW CARBON HEAT

6.1 Traditional Heat Generation

Heat energy for use in buildings is traditionally produced by burning fossil fuels in boilers generating either low pressure steam or hot water. Older oil fired boilers can have efficiencies, defined as the amount of useful heat produced from the boiler divided by the fuel energy supplied, of as low as 70%. Modern condensing gas fired boilers have higher efficiencies, typically up to 90%. (HHV Basis)

Combustion of natural gas in a heating boiler produces around 25% less carbon dioxide per unit energy released than oil.

6.2 Combined Heat and Power

An alternative means of heat production is to generate the heat as a by product of another process.

Combined Heat and Power (CHP) systems combine electrical generation with heat production. The electrical generation can be by a prime mover, such as a reciprocating engine or gas turbine, or by an expansion turbine using steam or an organic fluid as the driving medium.

Generation of electricity from a prime mover is relatively inefficient. Depending on the technology used between 60 and 80% of the energy supplied is lost, the majority in the form of waste heat. This heat can be recovered and used to supply a district heating system.

CHP systems can use a variety of fuels, including renewables. However the cost and complexity of the equipment required increases if the fuel moves away from natural gas or oil.

Figure 7 Package Gas Engine CHP Unit

The most common type of CHP system at the building scale is based on a reciprocating engine, usually fuelled by natural gas. If no heat is recovered from the engine its efficiency, in terms of electrical energy produced divided by fuel energy used, is of the order of 30 - 40%. However with heat recovery the overall energy efficiency as a CHP scheme can be increased to in excess of 80%.

CHP systems are at their most efficient when they can run for extended periods at near full electrical output with all of the waste heat being used. If the balance changes such that the heat demand falls below the amount of waste heat available either the generator is turned down or, more commonly, excess waste heat is dumped to atmosphere. This greatly reduces the overall efficiency.

To promote the use of efficient CHP schemes Central Government has implemented a certification scheme based on the ratio of electrical power produced to the heat recovered and used. Systems having performance above a defined threshold qualify as “Good Quality CHP”. This allows the plant operator to claim Climate Change Levy Exemption Certificates (LECs) which can be traded to increase the value of the electricity generated.

For a typical package CHP unit the useful heat to power ratio is between 1.3 and 1.5, i.e. for every KWh of electricity generated 1.3 to 1.5 KWh of recoverable heat is produced.

Generation of electricity from small scale fossil fuel fired CHP will generally only be economic if it replaces electrical energy used on a site or local network. The costs of generation from fossil fuels at this scale are such that it would normally be uneconomic to export back to the National Grid system.

There are a number of package natural gas fired CHP units commercially available with electrical outputs ranging from 30 KW to over 1 MW.

The ideal application therefore for a package CHP plant would be one in which the minimum electrical load is above 30 KW and the heating demand is always greater or equal to 1.5 times this .

It is normal to provide conventionally fired auxiliary boilers to provide top up heat and to provide back up should the CHP plant not be available.

6.3 Renewable Fuels

Currently renewable fuels produced from organic sources provide the greatest opportunity for reduction in carbon dioxide emissions from heating applications.

Although carbon dioxide is produced by the combustion of these fuels an approximately equal amount will have been extracted from the atmosphere during the growing process. Consequently these fuels are considered carbon neutral.

In practice carbon dioxide is generated during fuel harvesting, preparation and transport. However this is relatively small compared to that produced by the production and combustion of an equal quantity of fossil fuel.

Central Government policy is currently to promote the use of renewable fuels using a variety of incentive payments. A system which provides useful heat from a renewable fuel source will qualify for payments under the Renewable Heat Incentive (RHI) for each unit of heat supplied. The system can be a direct fired heat producer or a CHP plant. The RHI incentives per unit of useful heat produced are the same in each case. For a CHP plant the heat generated and used for electricity generation does not qualify for RHI incentives but any “waste” heat , for example that which would normally be rejected in a condenser, that is recovered and reused will qualify.

The RHI is currently planned to come into effect in April 2011 and is currently in a consultation process. It is proposed to band energy schemes according to their output with the payments being dependant on the size of the installation. As an example the current proposed bandings and the associated incentive payments for solid biomass fuelled schemes are shown in Table 6.1. The tariff levels for other sources of renewable heat vary by size and technology. These payments, which are in addition to the price for which the heat can be sold to consumers, are intended to encourage the use of renewable energy sources.

Size Of Solid Biomass Fired Scheme	RHI Payment per KWh (t)
Small Installations – Up To 45 KW (t)	9 p
Medium Installations – 45 KW (t) to 500 KW (t)	3.5 - 6.5 p
Large Installations - Greater Than 500 KW (t)	1.6 – 2.5 p

Table 6.1 – Proposed RHI payment levels for solid biomass fired heating schemes [7]

Under the proposed RHI payment bandings there may be some benefit in sizing plants just below the 500 KW threshold. This also allows the heat output to be determined by calculation rather than metering giving a more accurate prediction of the income from the RHI.

Larger individual users such as hospitals and prisons could also reduce carbon output by converting to renewable fuels. Although the value of the RHI in terms of £ / kWh is lower for systems greater than 500kWth output, the boilers are likely to operate with high capacity factors (number of hours boiler operates annually divided by number of hours in a year). The resulting RHI payment is therefore likely to be high with the effect of reducing the payback of such systems significantly.

Heating systems using renewable fuels are generally better suited to continuous operation, increasing both efficiency and reliability. Consequently buildings having continuous occupancy are often ideal sites for conversion to renewable fuel. This is however subject to detailed feasibility studies being undertaken. Also, given that hospitals and prisons are essentially independent organisations each will have their own priorities and criteria for investment.

6.3.1 Solid Biofuels

The use of solid renewable fuels, or biomass, as a source of heat is well proven.

Historically the most commonly used biomass fuel is wood, obtained from forestry or as a by-product of manufacturing processes. More recently there has been increasing interest in the use of crops specifically grown for use as fuel. These include willow produced through Short Rotation Coppicing (SRC) and Miscanthus, a tall woody grass. Measures are in place to encourage U.K. farmers to grow energy crops on land that would otherwise be set aside.

Biomass heating using wood has good potential for carbon reduction. For each 100 KWh of heating oil replaced by wood chip there is a carbon saving of approximately 25 kg.

Biomass fuels are generally supplied as chips or pellets. The pelletized form has a higher energy density than raw chips but higher cost due to the processing involved.

The market for these fuels is well developed with prices for both chipped and pelletised wood fuels, per unit energy content, currently below those of gas or oil.

[7] Renewable Heat Incentive - Consultation on the proposed RHI financial support scheme, DECC February 2010

Biomass boiler systems are physically larger and more expensive than fossil fuelled boilers having the same output. In addition the relatively low energy density of the fuel means that large on site storage volumes are required.

Delivery of the fuel is usually by road with the high volumes of fuel required resulting in large numbers of lorry movements with consequent costs and potential traffic issues in urban environments.

Wood fired boilers are available with heat outputs ranging from around 40 KW to over 5000 KW. Up to about 1000 KW they can be supplied as containerised units, avoiding the need for a purpose built boiler house.

Figure 8 Containerised Biomass Boiler

6.3.2 Liquid Biofuels

Currently there are two main classes of liquid biofuels; biodiesel which is produced from organic oils such as rapeseed or palm oil and bioethanol which is produced by fermentation of natural sugars from beet, cane or cereal crops.

Some work is currently underway in the UK and Europe on production of liquid biofuel by pyrolysis of wood or other organic matter. This is still in the development stage and plants are not as yet commercially available.

There is a limited supply of liquid biofuels produced as by-products from other processes, examples include tallow from animal rendering and recovered vegetable oil from food preparation. These are currently classified as wastes and their use as fuel requires compliance with the European Waste Incineration Directive (WID). Compliance with this directive increases the complexity and costs of the combustion and emission control equipment to the extent that it is only viable at relatively large scale.

Liquid biofuels are being developed principally to displace fossil oils in transportation applications. The costs of production of liquid biofuel, and the fact that it is likely to command a premium over current road fuels, are likely to make them uneconomic for use in stationary applications.

6.3.3 Gaseous Biofuels

There are two main processes for production of gaseous biofuels or biogas; thermal treatment and digestion.

Generally the gas produced is not of sufficient quality to allow it to be fed into the existing natural gas distribution system and therefore has to be used near to the point of production. Work is ongoing on developing a cost effective method of upgrading produced gas to pipeline standards but this is not as yet fully proven in the UK.

6.3.3.1 Thermal Treatment

Solid biomass can be thermally treated using a gasification or pyrolysis process to produce a fuel gas which can be used as a substitute for natural gas for boilers and prime mover applications.

Small scale pyrolysis plants are becoming commercially available in the UK. However, due to the relatively high cost of these plants, they are generally incorporated into combined heat and power systems rather than pure heating applications.

6.3.3.2 Digestion

Biogas can be produced by biological degradation of organic materials in the absence of oxygen.

This occurs naturally on landfill sites where the decomposition of the organic fraction of the waste produces a mixture of methane and carbon dioxide. This can be trapped, collected and burnt in suitable gas engines to produce electricity. In addition to the electrical power produced, combustion of landfill gas reduces the emission of methane, itself a significant greenhouse gas, into the atmosphere.

Landfill gas is generally not a viable source for district heat production as the rate of production over time cannot be reliably predicted. Also the landfills are by necessity remote from consumers making infrastructure costs prohibitive.

The degradation process can be carried out in a controlled manner in purpose built Anaerobic Digestion (AD) plant. These consist of large sealed vessels containing a slurry of organic material. The vessels are seeded with suitable bacteria and maintained at the optimum conditions for the digestion process to take place. This process produces a biogas consisting of typically 60% methane and 40% carbon dioxide. This gas can then be used as fuel for boilers or prime movers.

The feedstock to the digesters can be a mixture of liquid and solid organic materials. Typically these could include agricultural wastes, food wastes and animal by products.

As this is a continuous process the gas production is relatively predictable and reliable enabling plants to be sized for long term operation. However the digester plants have to be located near to the point of use of the fuel; making this technology unsuitable for use in the built environment.

There may however be good potential for substitution of natural gas by digester gas in rural areas where there is a significant heat demand, particularly in existing gas fired CHP systems.

6.3.4 Biofuel Fired CHP

The various types of biofuels can be used in combined heat and power plants. These plants combine the advantages of the nett low carbon emission of biomass fuel and high thermal efficiency of CHP.

Power generation from biofuels qualifies for Renewable Obligation Certificates (ROCs) for each MW of electricity generated. The ROCs have a value which can be traded, significantly increasing the value of the electricity produced. The financial incentives provided by ROCs are designed to offset the higher capital and operating costs of biomass fired plant compared to conventional fossil fuel.

The number of ROCs awarded to a generating plant depends on the process being used. Well proven technologies qualify at a low rate, typically 0.25 ROCs/MW(e) for landfill gas, while higher risk technologies such as gasification receive 2 ROCs/MW(e). This banding of technologies is designed to incentivise development of new processes.

Heat supplied from biofuel fired CHP plants will also qualifies for payments under the RHI and if the CHP scheme meets the necessary quality threshold the electricity generated also qualifies for Climate Change Levy Exemption Certificates (LECs) which can be traded in a similar way to ROCs. All of these add to the economic viability of a plant.

The capital cost of the technology, particularly the advanced technologies such as gasification, tends to encourage the construction of relatively large plants. If designed to do so from the outset these could provide heat to DH systems. Typically, at the lower end of the range a small scale CHP plant producing 2 MW of electricity could produce sufficient waste heat to supply in excess of 1000 dwellings.

6.4 Waste to Energy

Heat for district heating can also be produced from waste incineration. The revised ROC banding system introduced in 2009 allows operators of conventional mass burn incineration plant to claim ROCs on electricity generated provided they also supply sufficient heat to a CHP system to be accredited as Good Quality CHP.

Waste disposal using advanced processes, such as gasification, attracts double ROCs on the electricity generated even if there is no heat usage.

Specifically the ROC incentives include the incineration of Municipal Solid Waste (MSW). There is therefore an incentive for operators of conventional incineration plants to look for district heating loads. Installations of this type, providing district heating, are in operation in the UK in cities such as Sheffield.

There is likely to be some public opposition to construction of a MSW incineration or other treatment plant near to a residential development due to perceived environmental issues. There will be a balance between the location of the plant and its ability to provide a heat source. It is likely that this will favour larger plants, or those on existing waste treatment sites, where the costs of piping the heat to the users becomes less significant in the overall project costs.

6.5 Geothermal Energy

If geological conditions are suitable heat can be extracted from the earth as a flow of hot water. A system of this type is operating in Southampton where a borehole drilled some 1.8 Km below the city produces a stream of water at around 76 ^{o}C which is used to provide heat to the district heating network.

Heat mining of this type has a high initial capital cost but the energy subsequently supplied is effectively at zero cost and zero carbon. The finished well has a small visual impact, making it suitable for urban environments.

7 OVERVIEW OF DISTRICT HEATING SYSTEMS

A district heating system basically comprises a heat production facility, a distribution network and consumers.

7.1 Heat Production Plants

The heat can be produced by a number of means, including the technologies outlined in section 6 above. However where the heat production is a by product of another process, such as incineration or power generation, the available heat may not be able to follow daily or seasonal variations in heat demand.

These variations can be taken up by traditional fossil fuelled boilers used to provided top up and standby capacity either alone or in conjunction with heat accumulators.

Heat accumulators are essentially large hot water storage tanks. During periods of low heat demand excess heat from the production plant is used to raise the temperature of the stored water to a figure above that normally provided to the DH loop. The accumulator can be used to provide heat during periods of low demand, thus avoiding the need to run boilers at inefficient low loads, or to assist the boilers in meeting peak or transient heat demands.

The volume of water required and hence the physical size of the accumulator is dependant on the size of the heating system and the variations between the heating plant output and the peak network heating demands.

Accumulators for large DH systems can be physically very large. They are usually built as tall cylinders for process reasons and to minimise the plot area required.

Figure 9 Typical Accumulator Installation

7.2 Distribution Network

Heat distribution networks are commonly categorised into three types:

- Local networks comprising, usually buried, pipework providing hot water flow and return connections to individual buildings.
- District networks connecting a number of local networks or providing dedicated supplies to individual large users.
- Transmission networks linking the district networks to heat production plants located remote from the consumers. To minimise the size of the pipework required these networks often operate at higher temperatures than the district and local sub networks.

The network pipework needs to be insulated to reduce heat losses. This has led to the development of a range of pre insulated pipes designed to minimise installation costs.

The most commonly used pipes comprise a steel inner with bonded external insulation and outer moisture seal. These pipes are typically supplied in individual straight lengths of up to 16m and joined by welding.

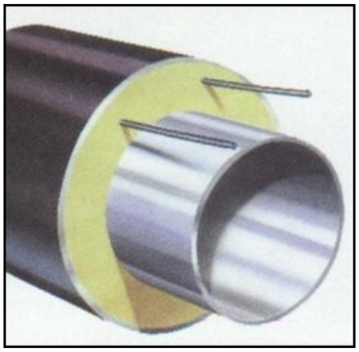


Figure 10 Pre Insulated Steel pipe

Steel pipes are susceptible to corrosion if the chemistry of the heating water is not carefully controlled or the outer membrane is damaged.
Conductivity probes are normally installed in the insulation layer to detect leakage.

These pipes are suitable for water temperatures in excess of 100°C but are expensive to install, mainly due to the joining process required.

Figure 11 Twin Core Preinsulated Pipe

Pipes can be single or twin core.
Twin core pipes combine both flow and return lines in a single casing. This reduces installation time and costs. This type of pipework is generally used for transmission or district networks where there are few off take requirements.

A more recent innovation are flexible pipes manufactured from polyethylene. These are supplied in lengths of up to 100m, significantly reducing joining costs. There is also no risk of corrosion.

Figure 12 Single Core Flexible Pipe

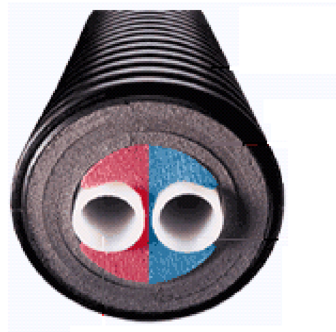


Figure 13 Twin Core Flexible Pipe

The operating temperature for this type of pipework is limited to around 90°C which tends to limit their application to local and district networks.
Heating pipes are generally buried around 1m underground in trenches backfilled with sand.

7.2.1 Consumers

The consumer installations and the heat utilisation are fundamental to the efficiency of the district heating system. The most crucial element is to obtain the maximum cooling of the heating water through the user's system.

Consumer connection can be direct, i.e. the DH water is circulated around the client heating system, or indirect where a plate heat exchanger is used to separate the DH water supply and the consumer system. The indirect system is more costly but does eliminate potential problems with cross contamination and any incompatibility between the operating pressures and temperatures of the supply and the consumer's systems.

At the domestic level direct connection is more common. The actual connection is through a relatively compact system designed to mimic a conventional heating boiler.

Heat metering and automatic controls can be incorporated into prefabricated modules for installation in individual dwellings.

Domestic hot water can be generated from the DH water using a plate heat exchanger.

Figure 14 Typical Domestic DH Connection

8 COSTS OF DH SYSTEMS

The costs of implementing a DH system will depend on the method of heat production, the extent of the network and the type and density of the individual consumers.

Figures published by DECC [8] in 2009 indicate that the costs of connection to a DH scheme in an existing development, including distribution pipework and infrastructure at the local network level, vary from around £11,000 per connection in areas comprising low density semi detached housing to under £5,000 for high density housing such as flats.

Figures published by the south West Regional Development Agency for the Littlecombe biomass fired community DH scheme indicate a network infrastructure and connection capital cost of around £7,200 per connection. [9]

The costs of heat production and transmission networks will vary widely between developments. As a guide the cost per linear metre of installing a DH network comprising 100mm flow and return lines was estimated at 2009 price levels as around £450 / m for non paved areas rising to £700 / m for paved areas. These costs cover the pipework only and exclude the costs of the heat production plants, pumping stations or connections to individual consumers.

In some cases the costs of providing DH using small distributed heat production plants to supply heat at the local or district scale will be lower than those associated with large heat production plants requiring extensive transmission networks to bring the heat to the end users.

[8] The potential and costs of district heating networks - a report to DECC by Pöyry Energy Consulting and Faber Maunsell
[9] www.regensw.co.uk/downloads/RegenSW_242.pdf

9 IMPLEMENTATION OF DISTRICT HEATING ON THE ISLAND

The heat mapping has identified areas in Newport, Ryde, Cowes and The Bay where there are existing areas of concentrated domestic heat demand (Appendix 1).

9.1 Potential CO2 & Gas Consumption Savings

The effect of connection of the domestic consumers in the five LSOAs having the highest heat demand density is illustrated in
Table **9.1**. The savings in CO_2 and gas consumption achieved by connecting properties to a heating network will depend on the number of properties connecting to the network. This itself will be influenced by the practicality of connection and the perceived benefits to the property owner. For illustration the figures for gas consumption and CO_2 reduction shown in the table are based on an uptake of the DH system of 50% of the households. Determination of the actual potential uptake level in each area would require further study. The reductions increase in direct proportion to the uptake level.

A full list of LSOAs with their associated mean heat demand densities appears as Appendix 14

LLSOA Code	IOW 001B	IOW 002C	IOW 003B	IOW 009D	IOW 007B
Location	Cowes	Cowes	East Cowes	Newport	Ryde
LSOA Area Hectares	19	21	27	14	20
Number of dwellings[10]	560	533	655	618	768
Existing domestic heat demand density (All Fuels) $MWh/km^2/year$	32,258	28,618	24,010	32,672	29,874
Gas consumption reductions with 50% of existing domestic connected to DH MWh/yr	4,346	4,257	4,585	3,243	4,234
Percentage reduction of total Island domestic gas consumption[11]	0.56%	0.55%	0.59%	0.42%	0.54%
CO_2 emission reductions with 50% of existing domestic connected to DH tonnes/yr[12]	895	877	944	668	872
Percentage reduction of total Island domestic gas CO_2 emissions[13]	0.56%	0.55%	0.59%	0.42%	0.54%

Table 9.1: Potential gas consumption and CO_2 emission reductions for existing domestic building stock connected to renewable energy DH

As LSOA sizes are based on population the area of the LSOA is a direct indicator of population, and hence dwelling density. Given the extent of the network required, as a first estimate the cost per connection of provision of DH infrastructure within an LSOA should be roughly proportional to its size.

LSOA IOW009D is the smallest by area on the Island and contains a relatively high proportion of terraced and flat type housing. This explains the apparently low gas consumption figures. The other LSOAs probably represent a more typical mix of types of accommodation. All of these give broadly similar gas and CO_2 savings.

The distribution of potential savings in domestic gas consumption and CO_2 emission by connection to DH networks is illustrated in figure 15. The X axis data is the LSOA ranked in descending order of heat demand density. The Y axis shows the cumulative saving of emissions compared to that which could theoretically be achieved by connecting all domestic property on the Island. The essentially linear relationship indicates that there is no clearly defined cut off demand density below which the savings start to diminish.

[10] 2001 Census Data
[11] Based on a total Island domestic gas consumption in 2008 of 778,605, MWh
[12] Based on SAP revised emission figures for the National Calculation Methodologies (0.206kgs of CO_2 per kWh for mains gas
[13] Based on total 2008 CO_2 emissions on the Isle of Wight attributed to domestic gas consumption of 162,263 tonnes

One of the major factors in a decision to implement DH in a particular location will be the system cost. Figure 16 shows the distribution of domestic heat demand density by LSOA. Assuming, as a first estimate, that the costs of provision of a DH network are inversely proportional to the demand density there appear to be potential economic breakpoints at demand densities of below 25,000 MWh /km^2 year and again at below 15,000 MWh /km^2 year.

Determination of the practicality and actual cost of providing DH to any given LSOA would require further work, however taking these two breakpoints as initial figures the LSOAs falling into each band and the aggregate savings in domestic gas consumption and CO_2 emission resulting from connection are shown in table 9.2. Again these figures are calculated on a notional 50% uptake. The savings will be proportional to the actual uptake achieved.

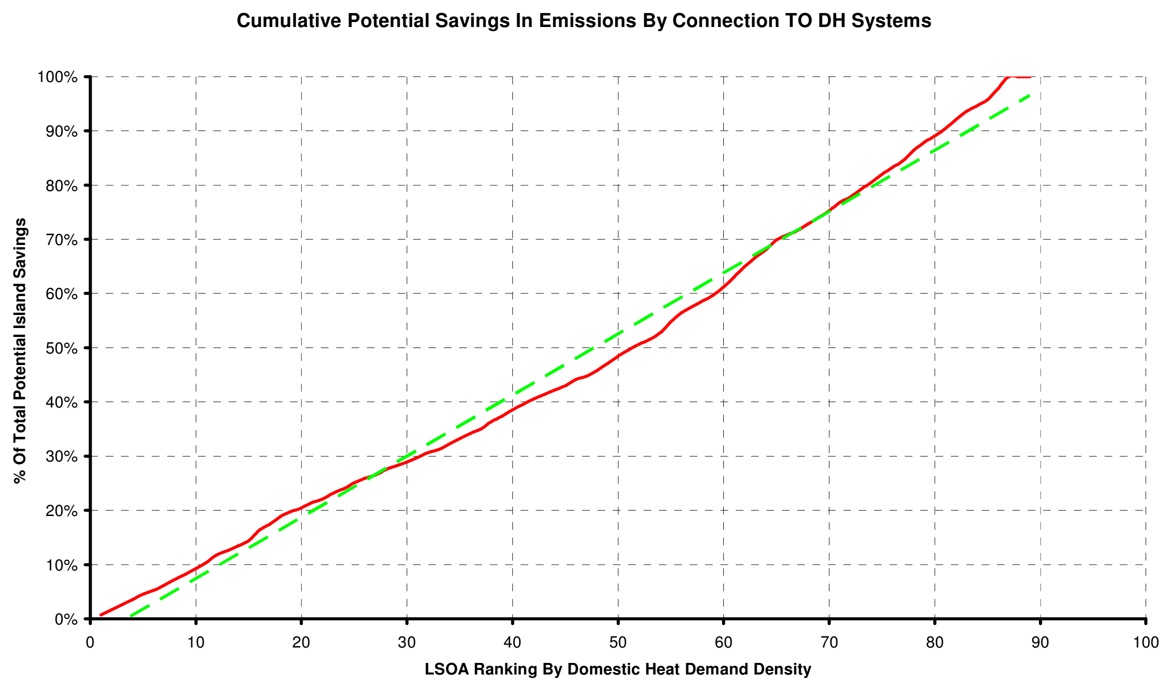


Figure 15 Potential Savings From DH Connection

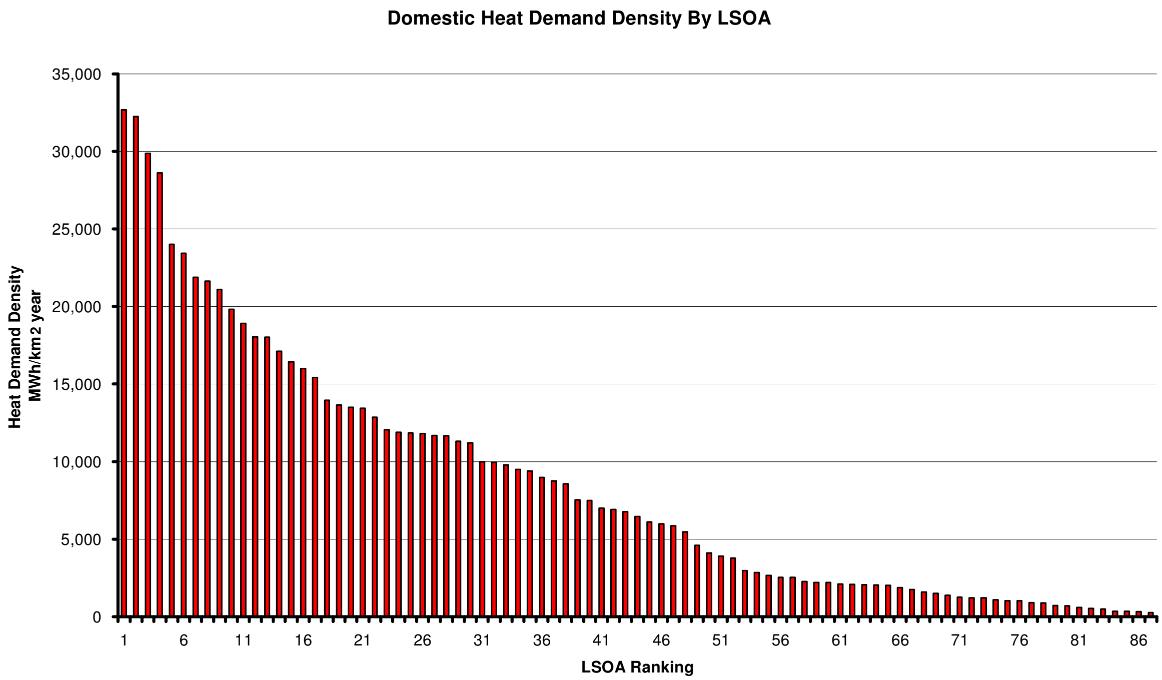


Figure 16 Domestic Demand Density by LSOA

LSOA Code	LSOA Ref	Mean domestic heat demand density (All Fuels) MWh/km2/year	Gas consumption reductions with 50% of existing domestic connected to DH MWh/yr	CO_2 emission reductions with 50% of existing domestic connected to DH Tonnes/yr
E01017328	Isle of Wight 009D	32,672	3,243	668
E01017303	Isle of Wight 001B	32,258	4,356	897
E01017340	Isle of Wight 007B	29,874	4,234	872
E01017304	Isle of Wight 002C	28,618	4,257	877
		SUB TOTAL	**16,090**	**3,315**
E01017308	Isle of Wight 003B	24,004	4,585	944
E01017306	Isle of Wight 001D	23,414	2,981	614
E01017335	Isle of Wight 004A	21,886	4,331	892
E01017327	Isle of Wight 011F	21,635	4,892	1,008
E01017348	Isle of Wight 014C	21,085	4,469	921
E01017356	Isle of Wight 016C	19,823	4,618	951
E01017342	Isle of Wight 006E	18,912	5,204	1,072
E01017349	Isle of Wight 014D	18,036	6,359	1,310
E01017322	Isle of Wight 011E	18,015	3,430	707
E01017309	Isle of Wight 001E	17,106	3,857	795
E01017326	Isle of Wight 009C	16,430	4,397	906
E01017300	Isle of Wight 001A	15,989	8,779	1,808
E01017337	Isle of Wight 004C	15,410	4,879	1,005
		TOTAL	**78,869**	**16,247**

Table 9.2 Potential Savings In Domestic Gas Consumption & Emission By Connection Of Highest Heat Demand Density LSOAs To District Heating

The equivalent CO2 and gas consumption savings figures inclusive of commercial and industrial demands are shown in table 9.3. Predicted savings by connection to district heating in these areas may be more difficult to realise as the effect of uptake of individual large properties will be very significant. Large commercial or industrial users, particularly those having multiple sites, will each have their own priorities and criteria for investment and energy policy and may be reluctant to risk compromising these. Proposals for heating schemes in these areas will need to be analysed on a case by case basis and the likely uptake clearly defined at the evaluation and design stages.

LLSOA Code	IOW 011F	IOW 011E	IOW 011A	IOW 007B	IOW 009D
Location	Newport	Newport	Newport	Ryde	Newport
LSOA Area Hectares	32	27	47	20	14
Total existing heat demand density (All Fuels) MWh/km^2/year	101,695	84,535	55,112	53,263	45,851
Gas consumption reductions with 50% of existing gas users connected to DH MWh/yr	23,190	16,258	18,422	7,575	4,561
Percentage reduction of total Island gas consumption[14]	2.00%	1.40%	1.59%	0.65%	0.39%
CO_2 emission reductions with 50% of existing gas users connected to DH tonnes/yr[15]	4,777	3,349	3,795	1,560	940
Percentage reduction of total Island gas CO_2 emissions[16]	2.00%	1.40%	1.59%	0.65%	0.39%

Table 9.3 Potential Savings In Gas Consumption & Emission By Connection Of Highest Heat Demand Density LSOAs To District Heating – Including Commercial & Industrial Users

9.2 Planning Considerations

The key economic factors in implementing district heating within existing areas are likely to be the cost of providing the distribution networks and the ability to provide a stable customer base.

The Council has the ability, through its planning policies, to encourage and, in some instances, require the installation of district heating systems. A combination of strong local leadership, a partnership-based approach to delivery, and community buy-in will be critical to any potential scheme's success.

[14] Based on a total Island gas consumption in 2008 of 1,159,126 MWh
[15] Based on SAP revised emission figures for the National Calculation Methodologies (0.206kgs of CO_2 per kWh for mains gas
[16] Based on total 2008 CO_2 emissions on the Isle of Wight attributed to gas consumption of 238,778 tonnes

If appropriately sized and located new developments are required to incorporate district heating schemes by planning policy, these can act as seeds which can then be expanded into existing developments in neighbouring areas. This is particularly relevant where the new developments are in, or near to, areas having high concentrations of heat demand.

The potential for a new development to become a seed for future expansion of the DH network should be considered at the planning stage and, where appropriate, additional requirements should be placed on the designers of the DH infrastructure to provide capacity and connections for future expansion. Where development sites are located near to each other the practicalities of linking their individual DH networks should be considered at the outset .

It is highly unlikely that all of the potential developments will be carried out. Where there are a number of development sites under consideration those located in areas where they could economically provide extended DH systems should be targeted and prioritised.

Connection of an anchor load to the DH system installed as part of a new development will benefit the system by providing larger, and possibly more stable, heat demand. A secondary benefit of these connections would be that the pipework connecting the development to the anchor load will itself become a means of feeding expansions of the network. This could extend the viability of providing heat to areas of lower demand density as a proportion of the infrastructure costs will be borne by the anchor load connection.

The economics of each case would need to be individually assessed but based on the Southampton model it may be reasonable to consider connection to an anchor load located within approximately 1km of a proposed development site. As network sizes increase they will become more attractive to Private Sector investors such as Energy Service Companies (ESCOs).

When planning the energy centres for the new developments consideration will need to be given to their size and visual impact. The plants will occupy valuable land area and may require high chimneys to ensure adequate dispersion of combustion products, particularly from biofuels.

There may however be some opportunities to locate the energy centres remote from the developments, for example near to their anchor loads.

There would be additional benefits from converting anchor loads from fossil to renewable fuels. If, for example, the five large High Schools on the Island were converted from natural gas heating to wood fuel the total annual carbon saving would be of the order of 1,100 tonnes.

The larger privately owned buildings are likely to have existing energy supply agreements and be connected to existing gas and power infrastructure. The capital costs of installing and converting to a centralised energy supply system would probably outweigh any benefit in lower unit energy costs and reduced carbon emissions. It would also take the occupiers out of the competitive supply market place so there would need to be a greater benefit than marginally lower energy costs, particularly in the case of group owned properties such as supermarkets as these customers will already be seeking ways to offset their corporate climate reduction commitments and may identify greater potential in sites other than those on the Island. As a consequence it may be more difficult to persuade these consumers of the benefits of conversion, particularly if there are significant connection costs involved.

This situation may be eased as networks expand and connection distances and costs are reduced.

This is however subject to age and condition of existing plant and it should be recommended that all options are investigated as and when heating plant replacement is required or as a condition of any further site expansion or major refurbishment.

9.3 Thresholds for Implementation of DH Schemes

In order to encourage the implementation of DH systems the Council is exploring whether it is viable to make it a requirement for developments over a threshold size to actively consider the implementation of appropriate schemes as part of the planning process.

It is possible that developers could be required to incorporate suitable heating schemes unless they can provide satisfactory evidence, on a case by case basis, to justify exemption.

9.3.1 Residential Developments

Discussions with the Council's Planning Services indicate that a possible minimum size of new allocated developments is around 100 dwellings with a maximum of up to 1400 on any one site.

As outlined in 3.1.4 above the estimated annual heat demand for new build dwellings is 7,500 Kwh. Using a 2600 hour heating period this equates to a mean demand per dwelling of 2.9 KW(t) with seasonal variations on this. Published data for existing DH projects gives typical demand figures of between 2 and 4 KW(t) per household, confirming the basis of these estimates.

In order to maximise the uptake of DH schemes it is suggested that the threshold residential development size requiring its implementation is set as low as economically practical.

A development of 250 dwellings would have a mean heating demand of somewhere around 1 MW. This is a sensible, practical size for either conventional boilers burning gas or biomass, and for CHP. The need to provide standby capacity and to cater for seasonal load variations would probably mean that energy centres would contain multiple small boilers. This remains economically practical at this size.

Costs of installing the local network and infrastructure for a DH system feeding 250 dwellings would be somewhere between £2 and £2.5 million depending on the property mix. It may be possible to offset some of the developer's costs in this regard through suitable Section 106 Agreements.

Rather than base the threshold simply on the number of properties there would be a benefit in employing a dual criterion based on both the number of dwellings and the developed floor area. This would then include sites with fewer larger properties and prevent developers manipulating the property mix to get below the threshold level.

9.3.2 Commercial & Industrial Developments

Defining a suitable threshold for implementation of DH in commercial and industrial developments is more difficult given the variety of building sizes, possible uses and heat demands that could occur.

Where proposed developments consist of multiple buildings on single site similar requirements for active consideration of an integrated site heating system should be applied. This should include an assessment of the overall energy requirements of the development as a whole and any possibilities for minimising these, for example by using waste heat from one building to heat another on the site.

On sites where the intention is to construct a single building with scope for future expansion the heating system should have provision for later extension to service any future developments.

10 CONCLUSIONS & RECOMENDATIONS

- The heat maps have identified the major consumers of heat on the Island. There are no obvious areas where the installation of a large scale district heating system into existing developments is likely to be cost effective as a stand alone project. Provision of district heat to these areas should preferably be by extension of networks installed as part of new developments.

- The planned new developments, particularly large housing developments, are good candidates in themselves for district heating and can provide seed networks for extension into neighbouring areas. The planning policy should include requirements for developers to include community heating infrastructure in new housing developments by incorporation of a statement of the form:

  "Proposals for developments containing in excess of 250 housing units or having an aggregate domestic living area of greater than 18,000 m2 shall be expected to install community district heating systems using low carbon heat sources. The application shall contain an assessment of the carbon emissions from the proposed development together with details of the proposals to minimize this."

- New Commercial and Industrial developments comprising more than one building should be required to install heat supply and distribution networks with the Council empowered to grant case by case exemptions on receipt of appropriate evidence.

- The larger schools and college could provide economically viable opportunities for carbon reduction by installation of wood chip fired boiler plant. These could also potentially become hubs for small scale district heating installations. Some of these could attract private investment.

- Larger consumers such as the Hospital and Prisons could also reduce carbon production by conversion to renewable fuels but the Council is likely to be limited in its ability to influence this decision.

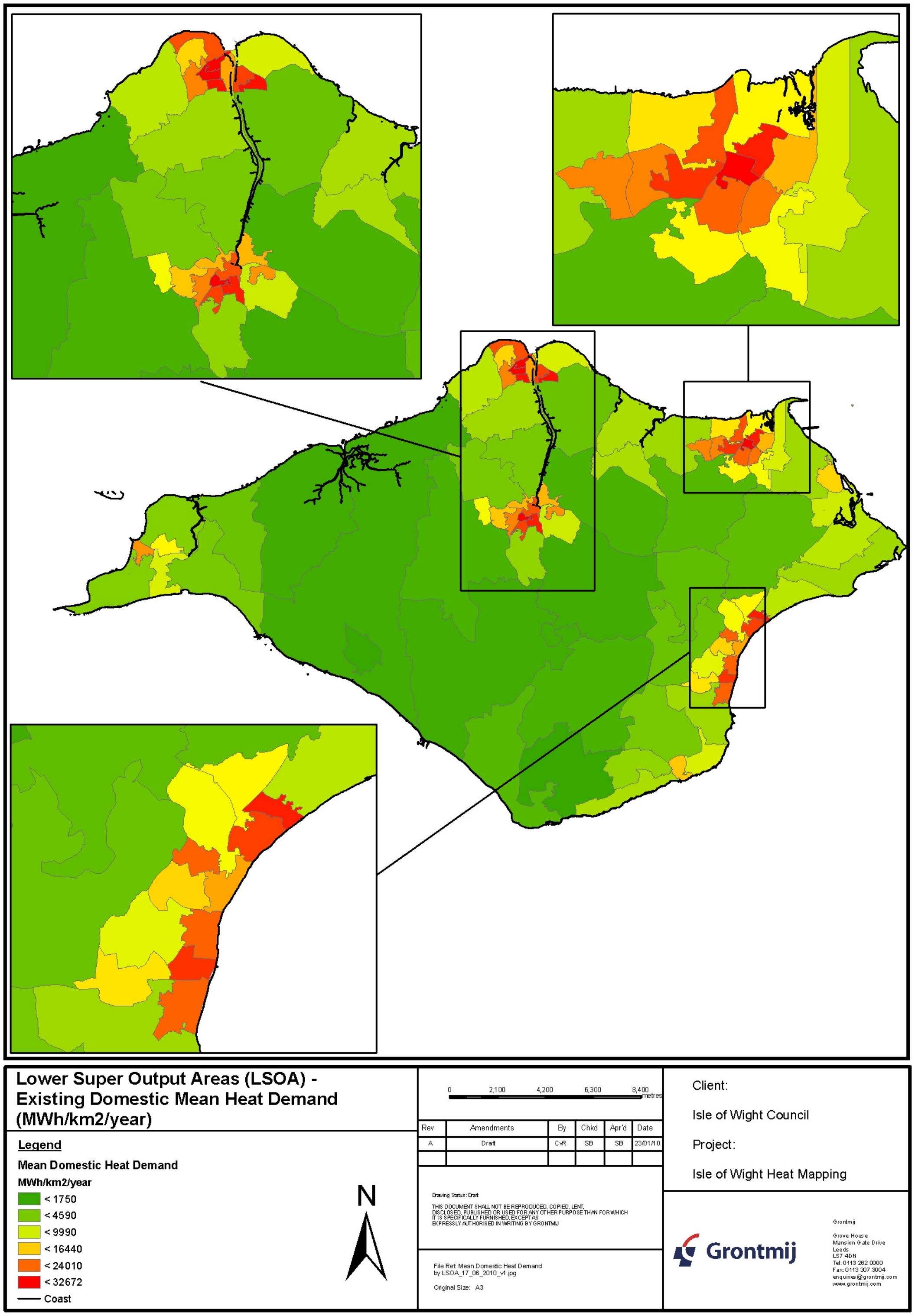
11 LIST OF APPENDICES

General Note On Heat Maps

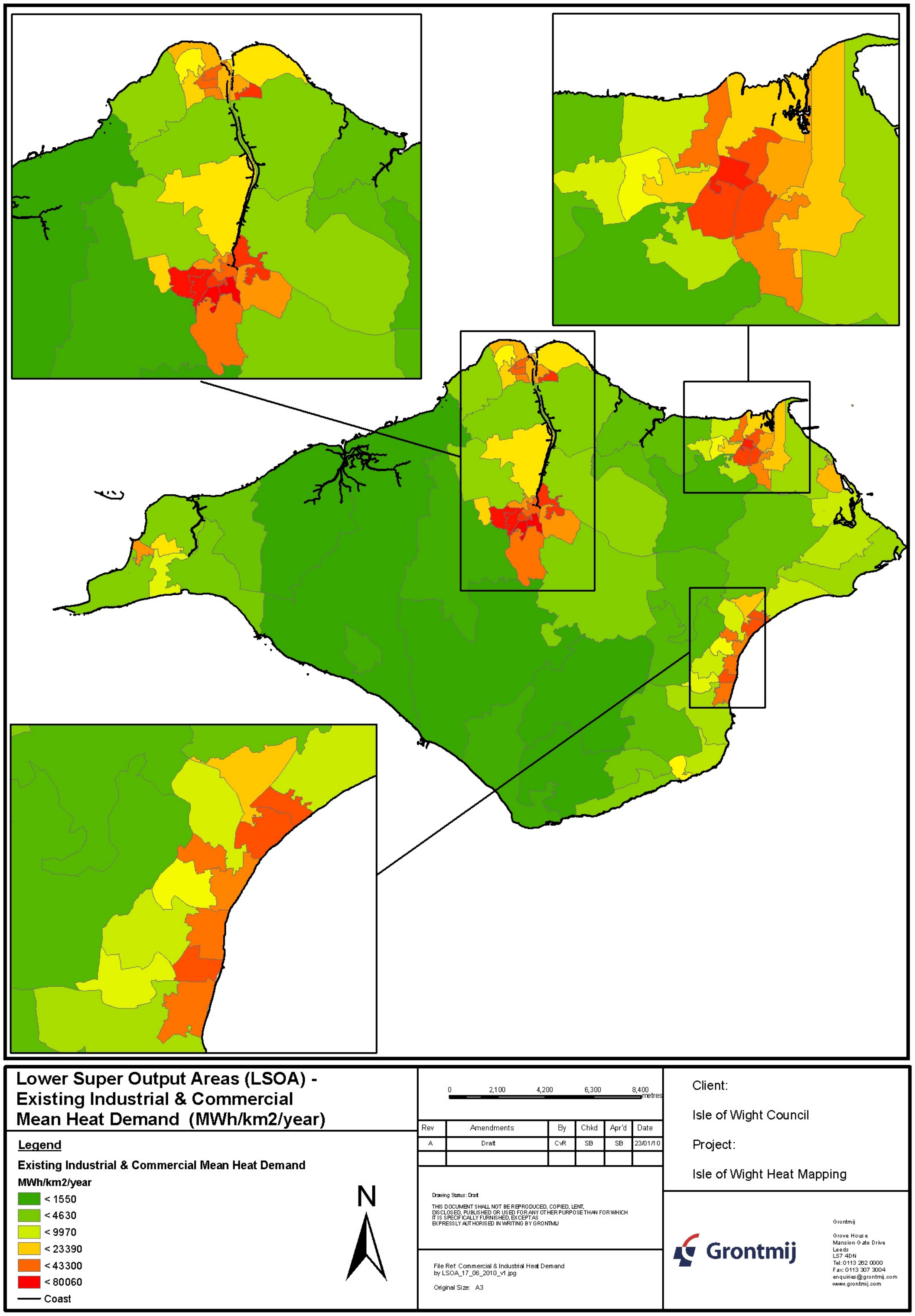
The maps have been drawn using a progressive colour scale with dark green representing zero demand and red representing the maximum demand for the data set. There are 32 colour bands evenly spread within each scale. A representative legend is given on each map to illustrate discrete values within the scale. Other than illustration these bands have no significance.

Due to the large variation between the data sets it is not practical to plot all maps to the same data scale, doing so would lose the resolution on the potential new development and industrial and commercial maps as all of the plotted data would be at the bottom of the scale.

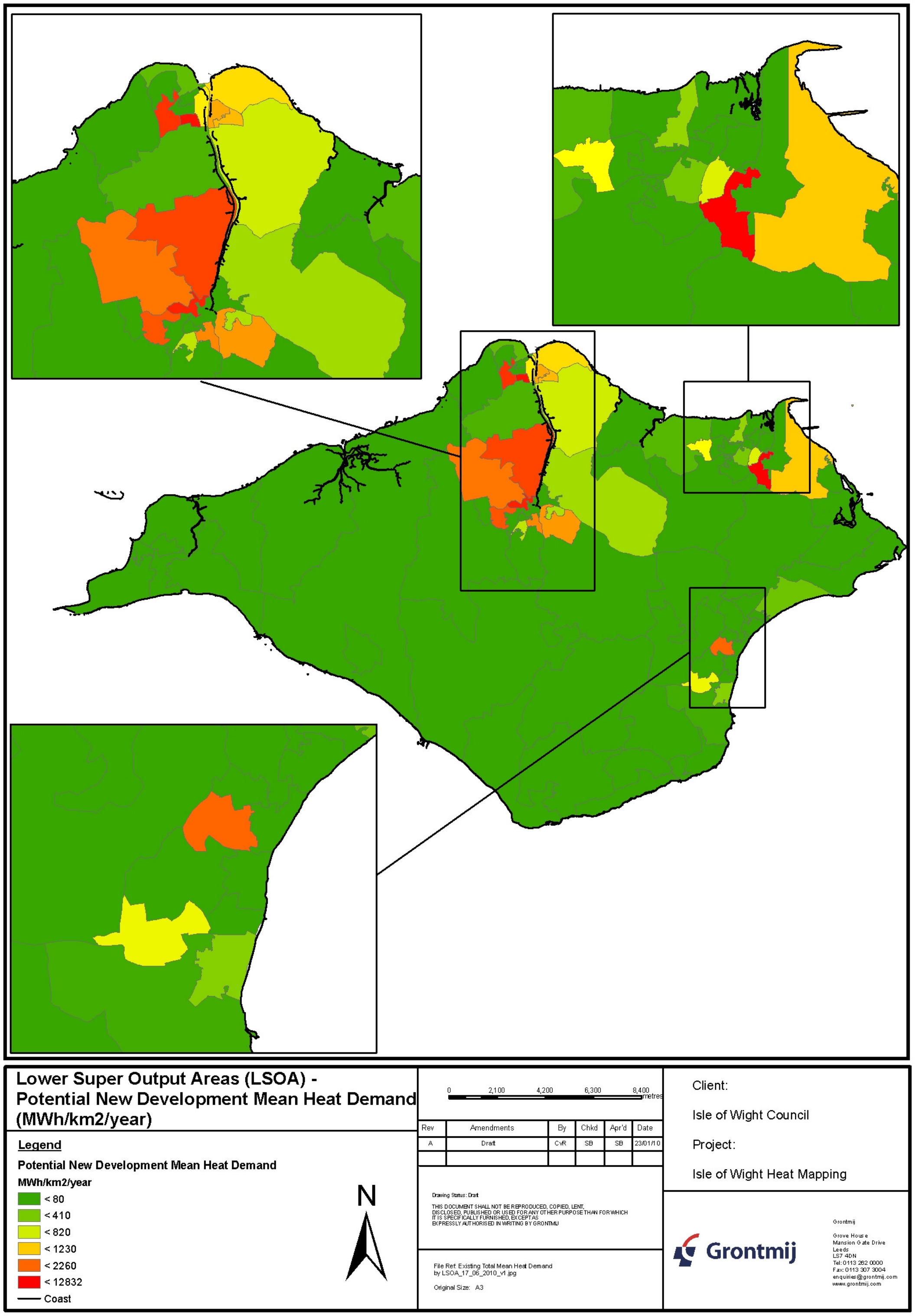
APPENDIX 1 – HEAT MAP - EXISTING DOMESTIC MEAN HEAT DEMAND



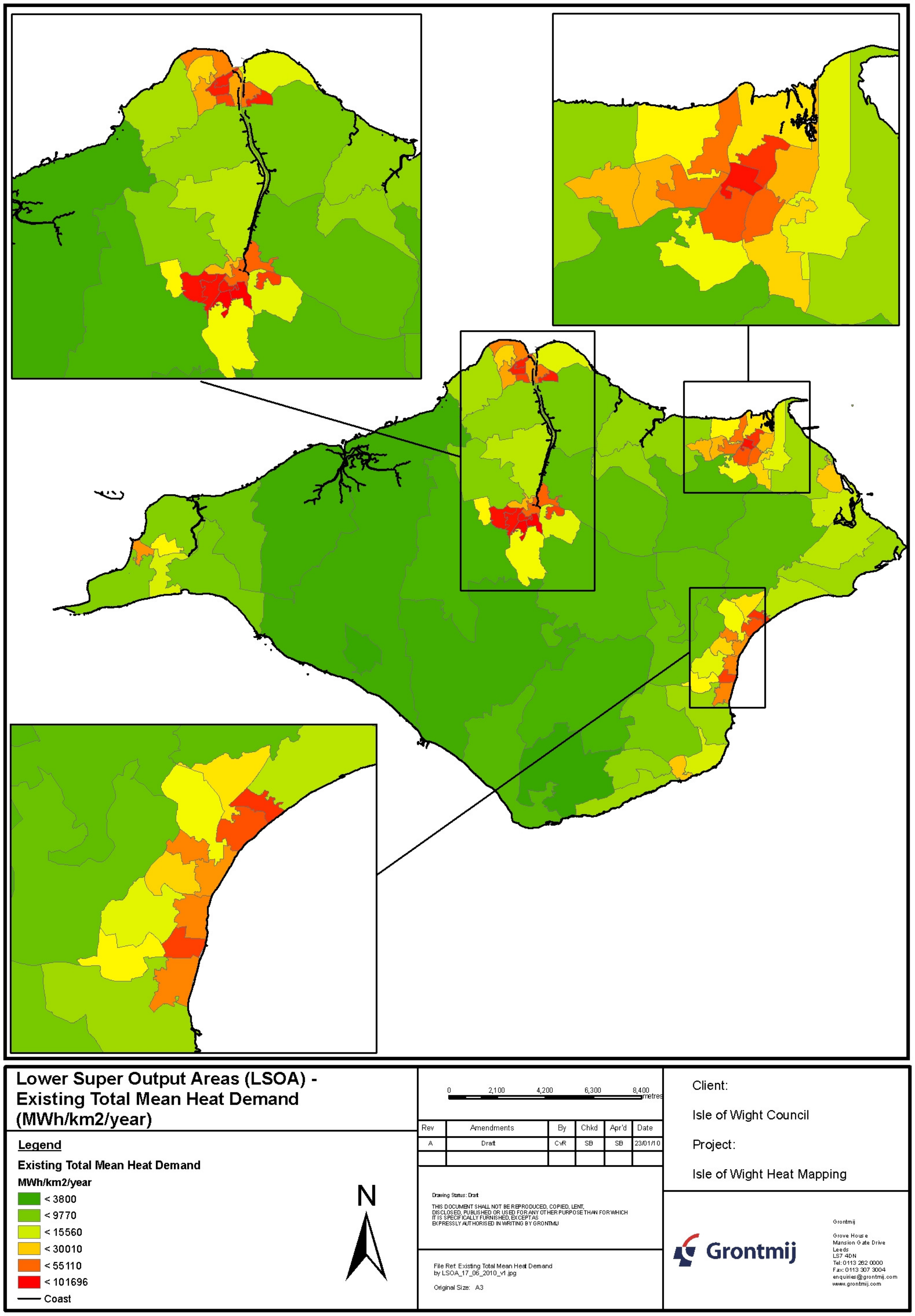
APPENDIX 2 – HEAT MAP - EXISTING INDUSTRIAL & COMMERCIAL MEAN HEAT DEMAND



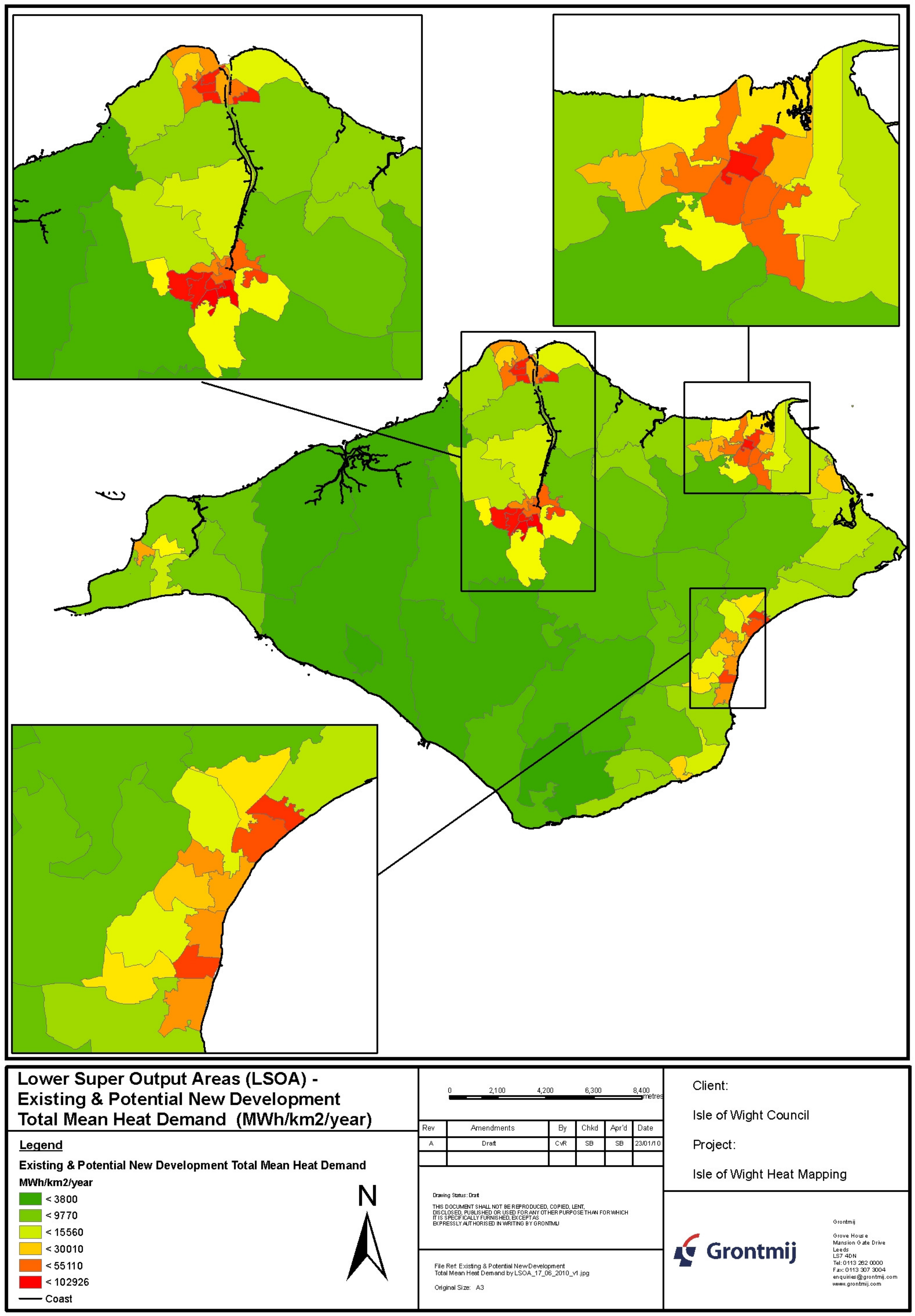
APPENDIX 3 – HEAT MAP - POTENTIAL NEW DEVELOPMENT HEAT DEMAND



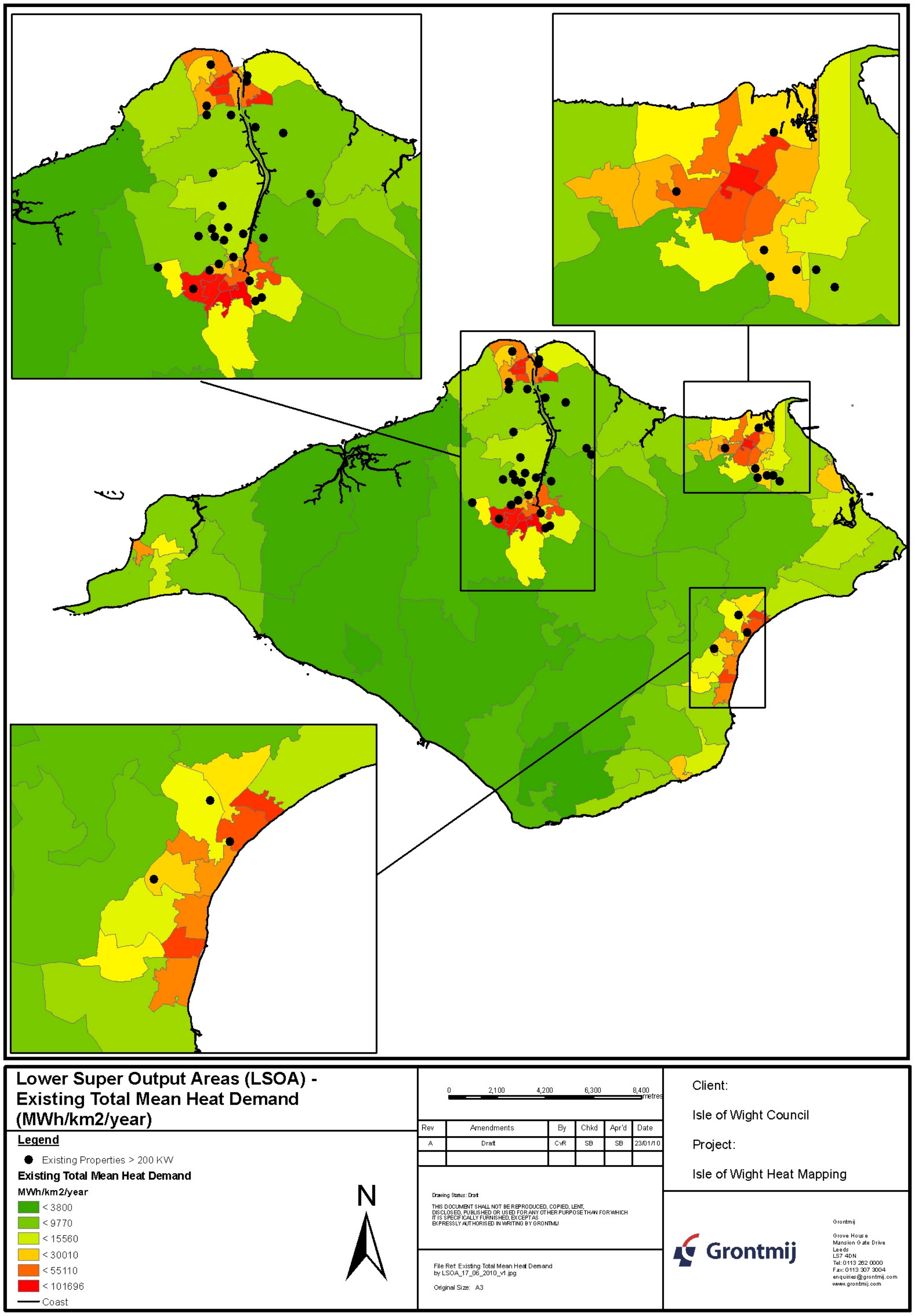
APPENDIX 4 – HEAT MAP – EXISTING DEMAND FROM ALL SOURCES



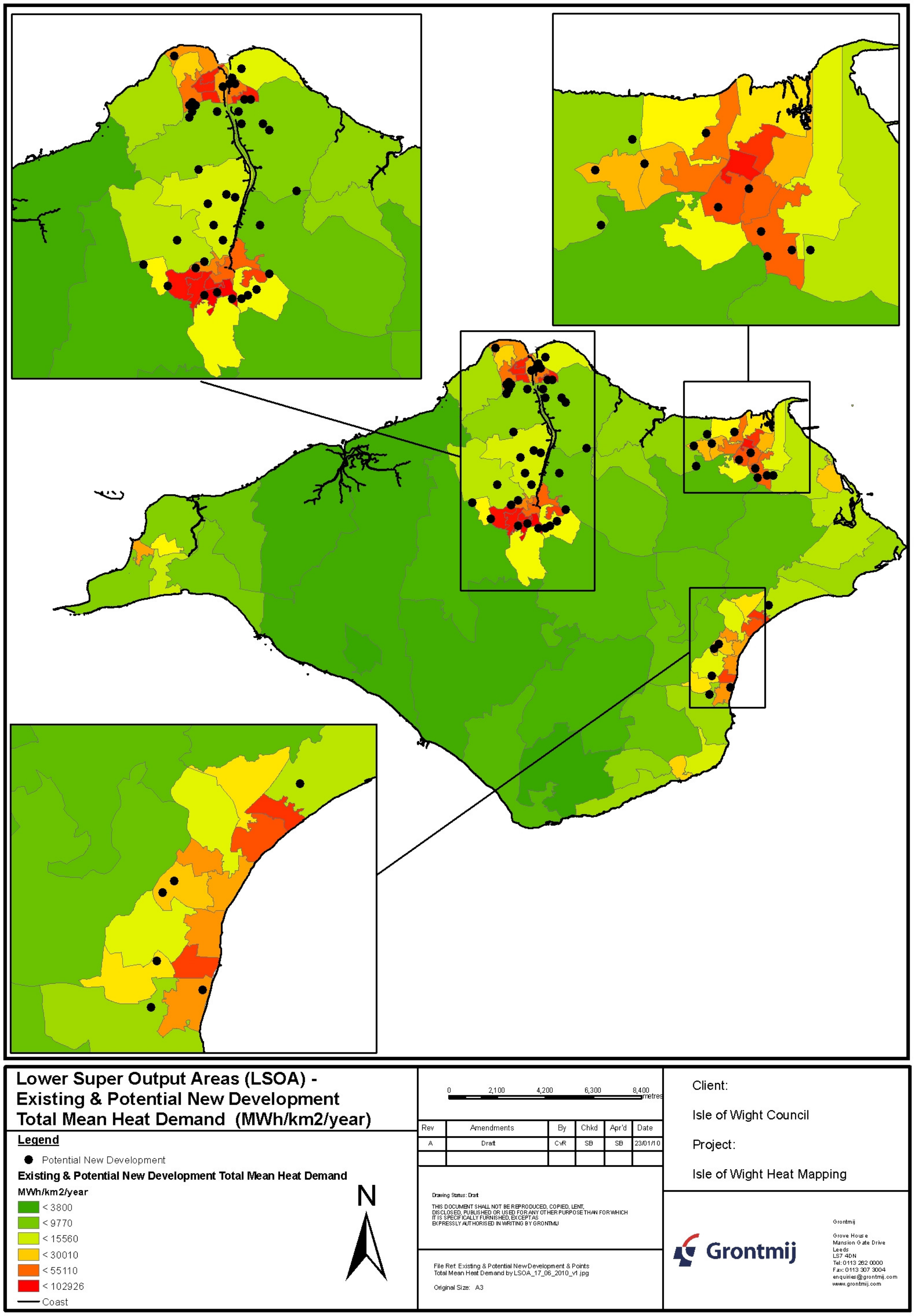
APPENDIX 5 – HEAT MAP – TOTAL HEAT DEMAND INCLUDING POTENTIAL FUTURE DEVELOPMENTS



APPENDIX 6 –LOCATION OF EXISTING BUILDINGS WITH HIGH HEAT DEMAND



APPENDIX 7 –LOCATION OF POTENTIAL NEW DEVELOPMENTS



APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
All Saints CE Primary School	School Green Road, Freshwater, PO40 9AX	Education (Schools)	1,708	2,600	91,074	63	35	7	17
Arreton St George's CE Primary School	Main Road, Arreton, Newport, PO30 3AD	Education (Schools)	571	2,600	76,875	53	30	6	17
Barton Primary School and Early Years Centre	Green Street, Newport, PO30 2AN	Education (Schools)	1,577	2,600	268,701	186	103	21	30
Bembridge CE Primary School	Steyne Road, Bembridge, PO35 5UH	Education (Schools)	1,089	2,600	155,830	108	60	12	12
Binstead Primary School	Hazelmere Avenue, Binstead, Ryde, PO33 3SA	Education (Schools)	1,476	2,600	31,490	22	12	2	19
Bishop Lovett CE Middle School	Appley Road, Ryde, PO33 1NE	Education (Schools)	3,091	2,600	318,231	220	122	24	53
Brading CE Primary School	West Street, Brading, Sandown, PO36 0DS	Education (Schools)	950	2,600	91,035	63	35	7	12

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Brighstone CE Primary School	New Road, Brighstone, Newport, PO30 4BB	Education (Schools)	917	2,600	67,418	47	26	5	28
Broadlea Primary School	Berry Hill, Lake, Sandown, PO36 9LH	Education (Schools)	1,507	2,600	206,893	143	80	16	29
Carisbrooke CE Primary School	Wellington Road, Carisbrooke, Newport, PO30 5QT	Education (Schools)	1,657	2,600	187,730	130	72	14	27
Carisbrooke High School	Mountbatten Drive, Carisbrooke, Newport, PO30 5QU	Education (Schools)	13,576	2,600	835,346	578	321	64	361
Chale CE Primary School	Church Place, Chale, Ventnor, PO38 2HA	Education (Schools)	565	2,600	37,692	26	14	3	6
Chillerton & Rookley Primary School	Main Road, Chillerton, Newport, PO30 3EP	Education (Schools)	474	2,600	53,350	37	21	4	10

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Christ the King College Lower	Trinity Middle School, Wellington Road, Newport, PO30 5QY	Education (Schools)	2,402	2,600	203,519	141	78	16	25
Christ the King College Upper	Archbishop King RC Middle, Wellington Road, Newport, PO30 5QT	Education (Schools)	2,627	2,600	219,941	152	85	17	59
Cowes High School	Crossfield Avenue, Cowes, PO31 8HB	Education (Schools)	11,525	2,600	1,235,170	855	475	95	37
Cowes Primary School	Edinburgh Close, Cowes, PO31 8HF	Education (Schools)	1,399	2,600	145,760	101	56	11	228
Dover Park Primary School	Dover Street, Ryde, PO33 2BJ	Education (Schools)	1,965	2,600	137,935	95	53	11	26
Downside Middle School Furrlongs Campus	Downside Middle School, Furrlongs, Newport, PO30 2AX	Education (Schools)	2,589	2,600	185,583	128	71	14	52

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Downside Middle School Kitbridge Campus	Kitbridge Middle School, Forest Road, Newport, PO30 5SH	Education (Schools)	2,975	2,600	243,294	168	94	19	50
East Cowes Primary School	Grange Road, East Cowes, PO32 6EA	Education (Schools)	1,557	2,600	168,916	117	65	13	24
Forelands Middle School	Walls Road, Bembridge, PO35 5RH	Education (Schools)	1,966	2,600	193,169	134	74	15	32
Gatten and Lake Primary School	Howard Road, Shanklin, PO37 6HD	Education (Schools)	1,461	2,600	150,167	104	58	12	16
Godshill Primary School	School Road, Godshill, Ventnor, PO38 3HJ	Education (Schools)	782	2,600	61,136	42	24	5	16
Greenmount Primary School	Green Street, Ryde, PO33 2QE	Education (Schools)	832	2,600	41,031	28	16	3	11
Gurnard Primary School	Hilton Road, Gurnard, Cowes, PO31 8JB	Education (Schools)	1,234	2,600	79,693	55	31	6	15

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Haylands Primary School	Playstreet Lane, Haylands, Ryde, PO33 3LJ	Education (Schools)	1,764	2,600	120,880	84	46	9	39
Holy Cross Catholic Primary School	Milfield Avenue, East Cowes, PO32 6AS	Education (Schools)	839	2,600	54,924	38	21	4	8
Hunnyhill Primary School	Albany Road, Newport, PO30 5HZ	Education (Schools)	1,448	2,600	79,609	55	31	6	28
Lake Middle School	Newport Road, Lake, Sandown, PO36 9PE	Education (Schools)	3,985	2,600	385,750	267	148	30	58
Love Lane Primary School	Love Lane, Cowes, PO31 7ET	Education (Schools)	1,512	2,600	134,523	93	52	10	33
Mayfield CE Middle School	St Vincent`s Road, Ryde, PO33 3PT	Education (Schools)	2,479	2,600	158,476	110	61	12	36
Medina High School	Fairlee Road, Newport, PO30 2DX	Education (Schools)	9,567	2,600	1,815,192	1,257	698	140	394
Medina House School	School Lane, Newport, PO30 2HS	Education (Schools)	1,939	2,600	173,389	120	67	13	38

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Nettlestone Primary School	Nettlestone Green, Nettlestone, Seaview, PO34 5DY	Education (Schools)	1,012	2,600	140,263	97	54	11	18
Newchurch Primary School	School Close, Newchurch, Sandown, PO36 0NL	Education (Schools)	1,344	2,600	125,514	87	48	10	27
Newport CE Primary School	Hazel Close, Newport, PO30 5GD	Education (Schools)	1,511	2,600	146,527	101	56	11	22
Nine Acres Primary School	South View, Newport, PO30 1QP	Education (Schools)	1,852	2,600	89,342	62	34	7	43
Niton Primary School	School Lane, Niton, Ventnor, PO38 2BP	Education (Schools)	880	2,600	40,258	28	15	3	21
Nodehill Middle School	Upper St James Street, Newport, PO30 1LJ	Education (Schools)	4,798	2,600	475,130	329	183	37	67
Northwood Primary School	Wyatts Lane, Northwood, Cowes, PO31 8PU	Education (Schools)	1,251	2,600	16,839	12	6	1	27

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Oakfield CE Primary School	Great Preston Road, Ryde, PO33 1DR	Education (Schools)	1,086	2,600	94,942	66	37	7	11
Osborne Middle School	Beatrice Avenue, East Cowes, PO32 6PA	Education (Schools)	2,542	2,600	139,587	97	54	11	36
Ryde High School	Pell Lane, Ryde, PO33 3LN	Education (Schools)	10,751	2,600	968,274	670	372	74	189
Sandham Middle School	Perowne Way, Sandown, PO36 9JU	Education (Schools)	3,863	2,600	137,603	95	53	11	50
Sandown CE Primary School	Grove Road, Sandown, PO36 9BQ	Education (Schools)	1,634	2,600	107,842	75	41	8	34
Sandown High School	The Fairway, Sandown, PO36 9JH	Education (Schools)	14,020	2,600	1,441,257	998	554	111	289
Shalfleet CE Primary School	Station Road, Shalfleet, Newport, PO30 4NN	Education (Schools)	852	2,600	36,539	25	14	3	25
Shanklin CE Primary School	Albert Road, Shanklin, PO37 7LY	Education (Schools)	1,560	2,600	120,602	83	46	9	17

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Solent Middle School	Baring Road, Cowes, PO31 8DS	Education (Schools)	2,603	2,600	209,572	145	81	16	52
Somerton Middle School	Love Lane, Cowes, PO31 7ES	Education (Schools)	2,413	2,600	136,304	94	52	10	18
St Boniface CE Primary School	Leeson Road, Ventnor, PO38 1PR	Education (Schools)	972	2,600	60,134	42	23	5	19
St Georges School	Watergate Road, Newport, PO30 1XW	Education (Schools)	3,156	2,600	227,051	157	87	17	77
St Helens Primary School	Broomlands Close, St Helens, Ryde, PO33 1XH	Education (Schools)	521	2,600	61,235	42	24	5	7
St John`s CE Primary School	Carter Street, Sandown, PO36 8BL	Education (Schools)	863	2,600	39,855	28	15	3	17
St Margaret`s Primary School	Newport Road, Ventnor, PO38 1BG	Education (Schools)	1,118	2,600	63,525	44	24	5	19
St Mary`s Catholic Primary School	Ampthill Road, Ryde, PO33 1LJ	Education (Schools)	973	2,600	33,083	23	13	3	8

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
St Saviour`s Catholic Primary School	Summers Lane, Totland, PO39 0HQ	Education (Schools)	875	2,600	146,951	102	57	11	15
St Thomas of Canterbury Catholic Primary School	High Street, Newport, PO30 1NR	Education (Schools)	844	2,600	89,547	62	34	7	13
St Wilfrid`s Catholic Primary School	Trinity Road, Ventnor, PO38 1NL	Education (Schools)	748	2,600	42,725	30	16	3	22
Summerfields Primary School	Atkinson Drive, Newport, PO30 2LJ	Education (Schools)	1,176	2,600	93,820	65	36	7	21
Swanmore Middle School	Bettesworth Road, Ryde, PO33 3HA	Education (Schools)	2,505	2,600	190,173	132	73	15	33
The Isle of Wight College	Medina Way, Newport, PO30 5TA	Education (Further & Higher)	19,000	3,060	1,831,288	1,077	598	120	535
Ventnor Middle School	Newport Road, Ventnor, PO38 1BQ	Education (Schools)	4,636	2,600	466,262	323	179	36	66
West Wight Middle School	Queens Road, Freshwater, PO40 9ET	Education (Schools)	2,818	2,600	294,916	204	113	23	33

APPENDIX 8 BASE DATA LOCAL AUTHORITY SCHOOLS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Weston Community Primary School	Weston Road, Totland, PO39 0HA	Education (Schools)	779	2,600	9,589	7	4	1	45
Whippingham Primary School	Whippingham Road, Whippingham, East Cowes, PO32 6LP	Education (Schools)	1,032	2,600	110,946	77	43	9	18
Wootton Primary School	Church Road, Wootton, Ryde, PO33 4PT	Education (Schools)	1,057	2,600	41,306	29	16	3	22
Wroxall Primary School	Station Road, Wroxall, Ventnor, PO38 3DP	Education (Schools)	880	2,600	52,300	36	20	4	1
Yarmouth CE Primary School	Mill Road, Yarmouth, PO41 0RA	Education (Schools)	670	2,600	49,048	34	19	4	10

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Arreton Branstone Farm Study Centre	Main Road, Branstone, Sandown, PO36 0LT	Community Asset		2,600	13,532	9	5	1	7
Bembridge Fire Station	Walls Road, Bembridge, PO35 5RH	Public Building	173	2,600	7,189	5	3	1	2
Bembridge Library	Church Road, Bembridge, PO35 5NA	Public Building	316	2,600	33,294	23	13	3	9
Brading Youth Centre	High Street, Brading, Sandown, PO36 0DH	Local Authority	226	2,600	26,123	18	10	2	2
Clatterford Tuition Centre	Watergate Road, Newport, PO30 1XW	Office		2,600	54,804	38	21	4	0
Cowes 4 & 5 Mariners Way	Mariners Way, Somerton, Cowes, PO31 8PD	Local Authority		2,600	64,558	45	25	5	0
Cowes Fire Station	Victoria Road, Cowes, PO31 7JJ	Public Building	259	2,600	46,365	32	18	4	3
Cowes Floating Bridge Office	Bridge Road, Cowes, PO31 7XB	Office		2,600	360,981	250	139	28	4

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Cowes Library	12- 14 Beckford Road, Cowes, PO31 7SG	Public Building	385	2,600	28,257	20	11	2	9
Cowes Northwood House Registrar Accommodation	Ward Avenue, Cowes, PO31 7NN	Office	2,329	2,600	251,507	174	97	19	62
Cowes Police Station	Birmingham Road, Cowes, PO31 7BH	Public Building	548	2,600	35,202	24	14	3	31
Cowes Youth Centre	99 Arctic Road, Cowes, PO31 7PG	Local Authority	667	2,600	66,457	46	26	5	5
East Cowes Fire Station	York Avenue, East Cowes, PO32 6RT	Public Building	254	2,600	43,756	30	17	3	5
East Cowes Group Home Main Building	76 Greenlands Road, East Cowes, PO32 6HT	Local Authority		2,600	1,142	1	0	0	0
East Cowes The York Centre Library	11 York Avenue, East Cowes, PO32 6QY	Public Building	357	2,600	56,573	39	22	4	0
Freshwater Fire Station	Tennyson Road, Freshwater, PO40 9AG	Public Building	221	2,600	14,335	10	6	1	8
Freshwater Library	41 School Green Road, Freshwater, PO40 9AP	Public Building	144	2,600	16,406	11	6	1	4

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Freshwater The Gouldings	St Andrews Way, Freshwater, PO40 9NH	Local Authority	1,553	6,570	602,350	165	92	18	18
Newport Langley Court	Langley Court, Newport, PO30 1LA	Public Building	207	2,600	10,570	7	4	1	15
Newport 114 Pyle Street	Connections, 114 Pyle Street, Newport, PO30 1XA	Local Authority		2,600	27,915	19	11	2	5
Newport 19 Barry Way (ICES)	Newport Business Park, Newport, PO30 5GY	Office	458	2,600	26,955	19	10	2	7
Newport 2 Langley Court	IT Offices, 2 Langley Court, Newport, PO30 1LA	Office	275	2,600	7,830	5	3	1	19
Newport 29 High Street Careers/Youth	Youth Office, 29 High Street, Newport, PO30 1SS	Local Authority	382	2,600	47,441	33	18	4	12
Newport 5 Langley Court	5 Langley Court, Newport, PO30 1LA	Office	76	2,600	4,564	3	2	0	3
Newport 62 Crocker Street	Youth Offending Team, 62 Crocker Street, Newport, PO30 5DA	Office	213	2,600	34,681	24	13	3	6

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Newport Archaeological Centre	61 Clatterford Road, Newport, PO30 1NZ	Public Building	208	2,600	13,013	9	5	1	3
Newport Beaulieu House Respite Care Home	Fairlee Road, Newport, PO30 2DX	Local Authority		2,600	126,837	88	49	10	22
Newport Bugle House	118 High Street, Newport, PO30 1SS	Office	723	2,600	26,300	18	10	2	41
Newport Charter House	14 St Thomas`s Square, Newport, PO30 1SL	Office	292	2,600	13,243	9	5	1	4
Newport Community Services HQ	17 Fairlee Road, Newport, PO30 2EA	Office	536	2,600	52,553	36	20	4	16
Newport County Hall and Car Park	High Street, Newport, PO30 1UD	Office	5,214	2,600	478,521	331	184	37	446
Newport County Records Office	26 Hillside, Newport, PO30 2EB	Office	662	2,600	15,343	11	6	1	5
Newport Enterprise House	St Cross Business Park, Newport, PO30 5WB	Office	989	2,600	93,699	65	36	7	50
Newport Fire Station	South Street, Newport, PO30 1JQ	Public Building	1,593	6,570	246,565	68	38	8	22

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Newport Housing Services	7 High Street, Newport, PO30 1SS	Office	271	2,600	23,190	16	9	2	14
Newport Lord Louis Library	13 Orchard Street, Newport, PO30 1LL	Public Building	1,164	2,600	67,479	47	26	5	47
Newport Maurick Farm	Pan Lane, Newport, PO30 2QD	Sports and Recreation		2,600	855	1	0	0	0
Newport Medina Leisure Centre	Fairlee Road, Newport, PO30 2DX	Sports and Recreation	4,389	2,600	934,893	647	360	72	118
Newport Police Station	High Street, Newport, PO30 1SZ	Public Building	1,387	4,368	111,977	46	26	5	58
Newport St Nicholas 58 St Johns Road	58 St Johns Road, Newport, PO30 1LT	Office	860	2,600	145,928	101	56	11	19
Newport Thompson House	Sandy Lane, Newport, PO30 3NA	Local Authority		2,600	176,353	122	68	14	52
Newport Westminster House	Westminster Lane, Newport, PO30 5DP	Local Authority	368	6,552	97,094	27	15	3	6

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Newport Wise 1 Workshop	24 Daish Way, Dodnor Industrial Estate, Newport, PO30 5XB	Local Authority		2,600	59,444	41	23	5	3
Newport Vehicle Workshops	Newport Business Park, Daish Way Newport PO30 5GY	Public Building	635	2,600	16,115	11	6	1	2
Newport Youth Centre Former Gymnasium	118 St James Street, Newport, PO30 5HE	Local Authority	584	2,600	14,918	10	6	1	39
Ryde Adelaide Club	The Adelaide Club, Adelaide Place, Ryde, PO33 3DQ	Local Authority	1,382	2,600	105,801	73	41	8	130
Ryde Fire Station	Nicholson Road, Ryde, PO33 1BE	Public Building	1,103	2,600	218,233	151	84	17	14
Ryde Library	101 George Street, Ryde, PO33 2JE	Public Building	679	2,600	92,646	64	36	7	16
Ryde Police Station	Station Street, Ryde, PO33 2QH	Public Building	825	3,224	101,681	57	32	6	26

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Ryde St Johns Annex	St Johns Road, Ryde, PO33 2RL	Local Authority	500	2,600	35,967	25	14	3	2
Ryde Town Hall	Lind Street, Ryde, PO33 2NQ	Office		2,600	160,693	111	62	12	81
Ryde Waterside Pool	Esplanade, Ryde, PO33 1JA	Sports and Recreation	975	2,600	586,953	406	226	45	228
Ryde Youth Centre	97 High Street, Ryde, PO33 3SZ	Local Authority	672	2,600	72,264	50	28	6	3
Sandown Browns Pitch & Putt	Culver Parade, Sandown, PO36 8QA	Sports and Recreation	539	2,600	14,732	10	6	1	27
Sandown Fire Station	East Yar Road, Sandown, PO36 9AX	Public Building	302	2,600	71,076	49	27	5	9
Sandown Library	119 High Street, Sandown, PO36 8AF	Public Building	420	2,600	41,352	29	16	3	7
Sandown The Heights Leisure Centre	The Broadway, Sandown, PO36 9ET	Sports and Recreation	2,133	2,600	869,478	602	334	67	228
Sandown Youth Centre	Grafton Sreet, Sandown, PO36 8JJ	Local Authority	798	2,600	101,834	71	39	8	12
Shanklin Fire Station	101 Landguard Road, Shanklin, PO37 7HT	Public Building	297	2,600	125,522	87	48	10	3

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Shanklin Library	Victoria Avenue, Shanklin, PO37 6PG	Public Building	181	2,600	14,108	10	5	1	3
Shanklin Police Station	Landguard Road, Shanklin, PO37 7HT	Public Building	731	3,224	84,582	47	26	5	24
Shanklin SOCO	Regent Street, Shanklin, PO37 7AP	Public Building	115	2,600	18,162	13	7	1	4
Shorwell Youth Centre	Fine Lane, Shorwell, Newport, PO30 3JY	Local Authority	176	2,600	19,798	14	8	2	8
St Mary's Hospital	St Mary's Hospital, Newport, PO30 5TG	Hospital		8,736	11,425,163	2,354	1,308	262	608
The Crematorium	Station Lane, Whippingham, East Cowes, PO32 6NJ	Public Building		2,600	1,113,444	771	428	86	23
Ventnor Botanic Gardens Visitors Centre	Undercliff Drive, Ventnor, PO38 1UF	Sports and Recreation		2,600	333,345	231	128	26	116
Ventnor Childrens Centre Ventnor	Albert Street, Ventnor,	Local Authority		2,600	36,237	25	14	3	0
Ventnor Fire Station	South Street, Ventnor, PO38 1NG	Public Building	192	2,600	62,831	43	24	5	2

APPENDIX 9 BASE DATA LOCAL AUTHORITY & OTHER PUBLIC BUILDINGS

Property	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Ventnor Library	High Street, Ventnor, PO38 1LZ	Public Building	303	2,600	40,585	28	16	3	5
Ventnor Police Station	Hambrough Road, Ventnor, PO38 1SG	Public Building	203	2,600	11,193	8	4	1	3
Ventnor VES	Hambrough Road, Ventnor, PO38 1SG	Public Building	98	2,600	13,936	10	5	1	0
Ventnor Youth Centre	Victoria Street, Ventnor, PO38 1ES	Local Authority	534	2,600	23,908	17	9	2	8
Wootton Youth Centre	Red Road, Wootton, Ryde, PO33 4HX	Local Authority	289	2,600	18,449	13	7	1	2
Yarmouth Fire Station	Station Road, Yarmouth, PO41 0QT	Public Building	234	2,600	41,309	29	16	3	2
Yarmouth Youth Centre	Station Road, Yarmouth, PO41 0QT	Local Authority	196	2,600	23,692	16	9	2	1

APPENDIX 10 BASE DATA PRIVATELY OWNED PROPERTY

Property[17]	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
43-51 Pyle Street	43-51 Pyle Street, Newport, PO30 1XB	Retail	5,581	8,736	1,019,649	210	117	23	655
A J Wells & Sons	Bishops Way, Newport, PO30 5WS	Industrial Building	8,248	4,160	617,775	267	149	30	0
Broadlands House	Staplers Road, Newport, PO30 2BZ	Office	3,011	2,600	375,171	260	144	29	262
Cineworld	Coppins Bridge, Newport, PO30 2TA	Entertainment	5,850	3,650	2,538,900	1,252	696	139	256
Gkn Westland Aerospace Ltd	Castle Street, East Cowes, PO32 6RH	Industrial Building	36,323	4,160	2,720,593	1,177	654	131	0
Marks & Spencer	Litten Park, Church Litten, Newport, PO30 1XL	Retail	5,630	8,736	1,028,601	212	118	24	661
Matalan	Furrlongs, Newport, PO30 2AB	Retail	4,127	8,736	312,001	64	36	7	136
Morrisons	South Street, Newport , PO30 1JQ	Retail	5,006	8,736	914,596	188	105	21	588

[17] Energy consumptions for these buildings were estimated from the floor areas using published CIBSE benchmark figures for the type of building

APPENDIX 10 BASE DATA PRIVATELY OWNED PROPERTY

Property[17]	Address	Building Type	Gross Internal Area m2	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
Morrisons	Newport Road, Sandown, PO36 9PA	Retail	3,408	8,736	622,642	128	71	14	400
Newport B & Q	Dodnor Lane, Newport, PO30 5TE	Retail	11,908	8,736	1,600,435	330	183	37	218
Ryde Tesco	Brading Road, Ryde, PO33 1QS	Retail	9,840	8,736	1,797,768	370	206	41	1,156
S P Systems Ltd	St Cross Business Park, Monks Brook, Newport, PO30 5WU	Industrial Building	12,506	4,160	936,699	405	225	45	0
Sainsburys	Foxes Road, Newport , PO30 5ZB	Retail	4,858	8,736	887,557	183	102	20	571
Shanklin Theatre	Prospect Road, Shanklin, PO37 6AJ	Entertainment	1,712	2,600	199,745	138	77	15	24
Trucast Ltd	Marlborough Road, Ryde, PO33 1AD	Industrial Building	9,045	4,160	677,471	293	163	33	0

APPENDIX 11 BASE DATA POTENTIAL NEW DEVELOPMENT

Development Site	Development Type	Grid Reference	Site Area ha	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
The Bay									
LDF229	Housing	SZ579831	3.9	2,600	677,250	469	260	52	248
LDF269	Housing	SZ586814	0.6	2,600	105,000	73	40	8	38
SE186	Housing	SZ577811	0.94	2,600	162,750	113	63	13	60
LDF035	Employment	SZ603850	1.58	4,160	398,160	172	96	19	137
E5 (17)/ LDF104	Employment	SZ581833	1.87	4,160	471,240	204	113	23	162
E5 (20)	Employment	SZ578819	1.87	4,160	471,240	204	113	23	162
Medina									
* LDF103	Housing	SZ494915	50.3	2,600	6,069,000	4,202	2,334	467	2,223
* LDF331	Housing	SZ499953	5.8	2,600	257,250	178	99	20	94
LDF338	Housing	SZ484903	0.95	2,600	131,250	91	50	10	48
LDF348	Housing	SZ481888	1.98	2,600	346,500	240	133	27	127
* LDF391	Housing	SZ493896	17.12	2,600	2,394,000	1,657	921	184	877
LDF395	Housing	SZ490894	6.55	2,600	1,144,500	792	440	88	419
LDF469	Housing	SZ502956	13.21	2,600	1,386,000	960	533	107	508
C13	Housing	SZ505959	0.79	2,600	136,500	95	53	11	50
C22	Housing	SZ503954	0.57	2,600	99,750	69	38	8	37
C25	Housing	SZ501954	4.55	2,600	199,500	138	77	15	73
C30	Housing	SZ508949	0.56	2,600	99,750	69	38	8	37
C31	Housing	SZ506949	0.69	2,600	120,750	84	46	9	44
C150	Housing	SZ483963	0.54	2,600	94,500	65	36	7	35
N11	Housing	SZ502884	0.54	2,600	94,500	65	36	7	35
N16	Housing	SZ497886	1.73	2,600	299,250	207	115	23	110
N66	Housing	SZ514892	1.02	2,600	178,500	124	69	14	65
N191	Housing	SZ493885	0.64	2,600	110,250	76	42	8	40
H3 (13)	Housing	SZ510887	18.98	2,600	110,251	76	42	8	40
LDF114	Employment	SZ489945	7.06	4,160	1,779,120	770	428	86	611
LDF115	Employment	SZ488943	1.08	4,160	272,160	118	65	13	93
LDF227	Employment	SZ504945	1.08	4,160	272,160	118	65	13	93

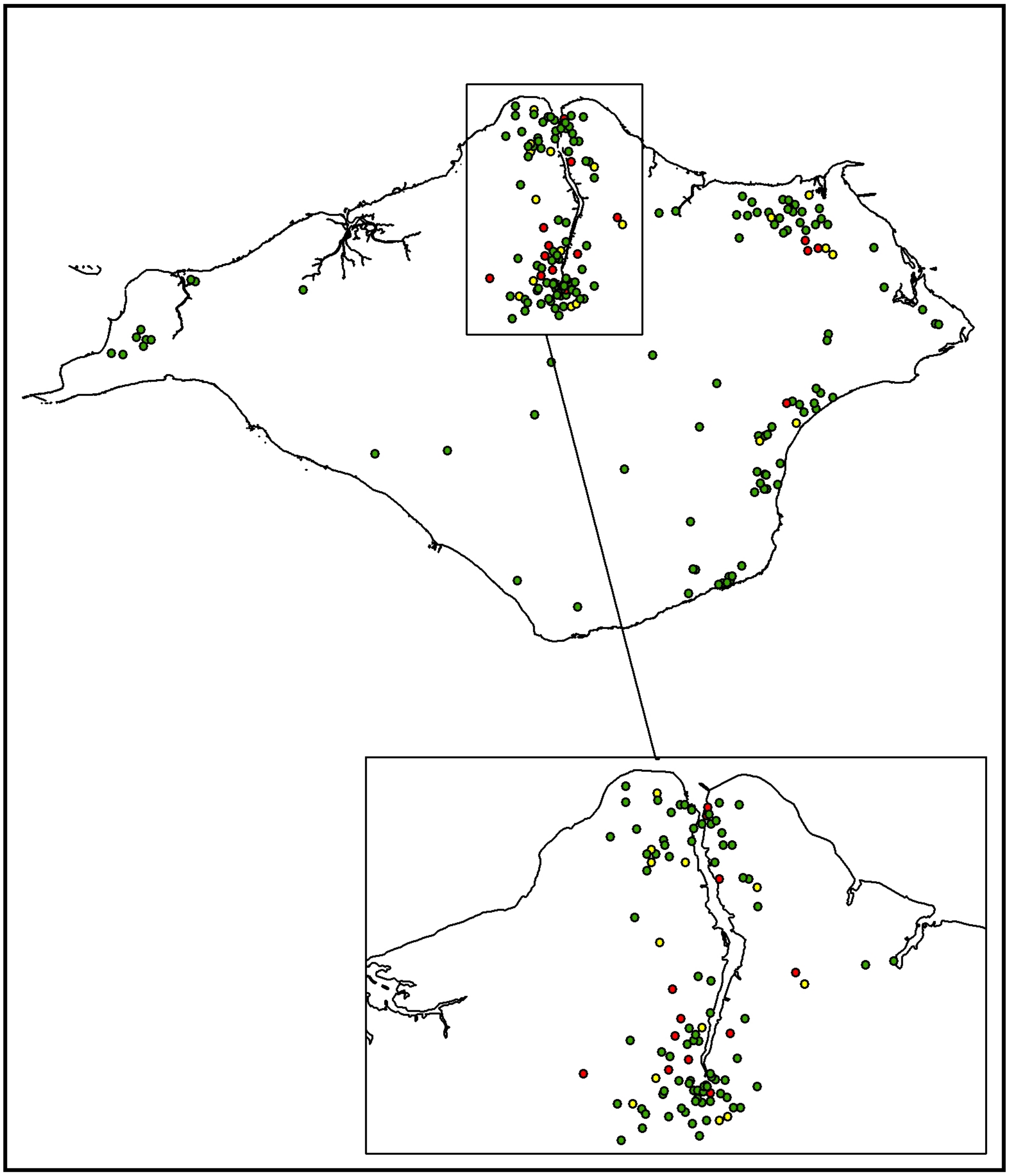
APPENDIX 11 BASE DATA POTENTIAL NEW DEVELOPMENT

Development Site	Development Type	Grid Reference	Site Area ha	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
LDF250	Employment	SZ505884	4.75	4,160	1,197,000	518	288	58	411
LDF252	Employment	SZ512941	2.34	4,160	589,680	255	142	28	203
LDF352	Employment	SZ511908	3.22	4,160	811,440	351	195	39	279
LDF404	Employment	SZ503917	1.12	4,160	282,240	122	68	14	97
LDF454	Employment	SZ490947	2.64	4,160	665,280	288	160	32	228
LDF458 (part of site area of LDF103)	Employment	SZ496908	14.69	4,160	3,701,880	1,602	890	178	1,271
LDF465	Employment	SZ523919	10.36	4,160	2,610,720	1,130	628	126	897
LDF466	Employment	SZ491926	5.96	4,160	1,501,920	650	361	72	516
LDF467	Employment	SZ497945	7.1	4,160	1,789,200	774	430	86	614
LDF474	Employment	SZ473895	42.5	4,160	10,710,000	4,634	2,575	515	3,678
E5 (3)	Employment	SZ499903	1.73	4,160	435,960	189	105	21	150
E5 (4)	Employment	SZ507885	3.33	4,160	839,160	363	202	40	288
E5 (6)/ LDF318	Employment	SZ500918	1.87	4,160	471,240	204	113	23	162
E5 (8)/ LDF447 (part of site area)	Employment	SZ489948	4.42	4,160	1,113,840	482	268	54	383
E5 (9)	Employment	SZ488947	0.58	4,160	146,160	63	35	7	50
E5 (12)/ LDF448	Employment	SZ514939	3.98	4,160	1,002,960	434	241	48	344
E5 (13)	Employment	SZ505941	12.88	4,160	3,245,760	1,404	780	156	1,115
Ryde									
LDF008	Housing	SZ570920	0.59	2,600	84,000	58	32	6	31
LDF054	Housing	SZ598906	39	2,600	6,825,000	4,725	2,625	525	2,500
* LDF398	Housing	SZ571911	4.02	2,600	336,000	233	129	26	123
LDF433	Housing	SZ578921	1.58	2,600	278,250	193	107	21	102
LDF461	Housing	SZ576925	0.63	2,600	89,250	62	34	7	33
NE79	Housing	SZ588926	0.72	2,600	99,750	69	38	8	37
H3 (34)	Housing	SZ595917	0.35	2,600	178,500	124	69	14	65
H3 (38)	Housing	SZ590914	0.77	2,600	68,250	47	26	5	25

APPENDIX 11 BASE DATA POTENTIAL NEW DEVELOPMENT

Development Site	Development Type	Grid Reference	Site Area ha	Annual Heating Hours	Total Heat Demand kWh	Peak Heat Demand kW	Mean Heat Demand kW	Minimum Heat Demand kW	Mean Electricity Demand kW
LDF255	Employment	SZ597910	14.67	4,160	3,696,840	1,600	889	178	1,270
LDF464 (part of site area of LDF054)	Employment	SZ602907	9.97	4,160	2,512,440	1,087	604	121	863
E5 (14)	Employment	SZ605907	7	4,160	1,764,000	763	424	85	606

APPENDIX 12 LOCATION OF INDIVIDUAL BUILDINGS WITH HEAT DEMANDS



All Properties - Mean Heat Demand

Legend

All Properties

Mean Heat Demand

- **Under 200 KW**
- **200 KW – 500 KW**
- **Over 500 KW**

N

0 2,000 4,000 6,000 8,000 metres

Rev	Amendments	By	Chkd	Apr'd	Date
A	Draft	CvR	SB	SB	23/01/10

Drawing Status: Draft

File Ref: Schools & Non-Schools on Isle of Wight_v1
Original Size: A3

Client:

Isle of Wight Council

Project:

Isle of Wight Heat Mapping

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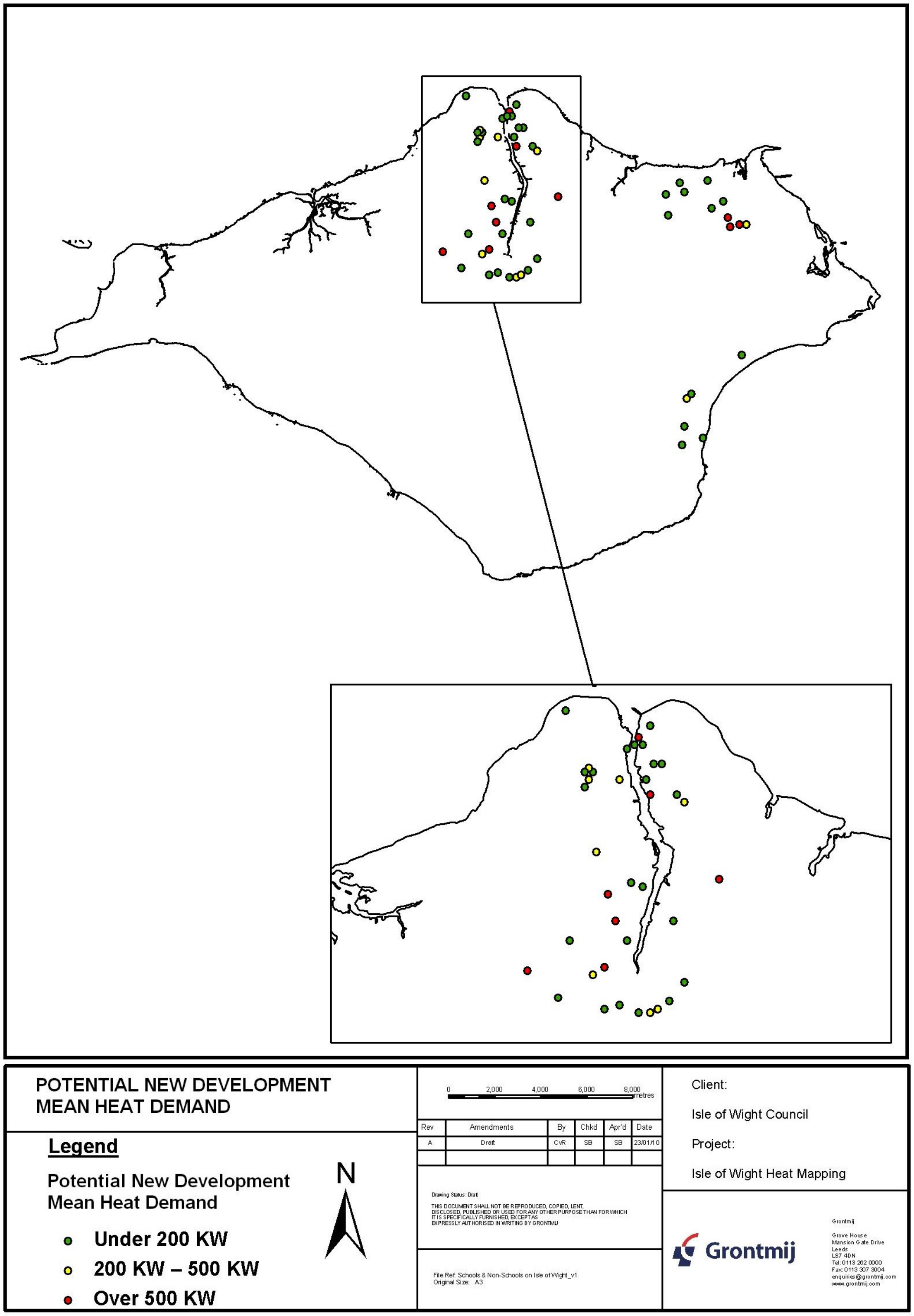
APPENDIX 13 LOCATION OF POTENTIAL NEW DEVELOPMENTS WITH HEAT DEMANDS



APPENDIX 14 FULL LIST OF LSOAs WITH ASSOCIATED HEAT DEMAND DENSITIES

LLSOA	Existing domestic heat demand density (All Fuels) MWh/km2/year	Existing commercial & industrial heat demand density MWh/km2/year	Total existing heat demand density MWh/km2/year	Potential new development heat demand MWh/km2/year	Total heat demand including potential future development MWh/km2/year
Isle of Wight 011F	21,641	80,055	101,696	1,230	102,926
Isle of Wight 011E	18,021	66,515	84,536	408	84,945
Isle of Wight 011A	11,814	43,299	55,113	-	55,113
Isle of Wight 007B	29,874	23,390	53,264	-	53,264
Isle of Wight 011B	9,497	35,075	44,573	2,130	46,703
Isle of Wight 009D	32,672	13,179	45,852	-	45,852
Isle of Wight 001B	32,258	6,380	38,637	-	38,637
Isle of Wight 001D	23,420	4,619	28,039	9,940	37,979
Isle of Wight 003B	24,010	12,264	36,274	817	37,091
Isle of Wight 002C	28,618	6,003	34,621	-	34,621
Isle of Wight 014C	21,091	8,913	30,005	-	30,005
Isle of Wight 004A	21,892	7,471	29,364	-	29,364
Isle of Wight 016C	19,830	7,771	27,601	-	27,601
Isle of Wight 008D	11,676	15,119	26,795	356	27,151
Isle of Wight 014D	18,043	7,610	25,653	-	25,653
Isle of Wight 007A	13,447	10,803	24,250	148	24,399
Isle of Wight 007C	6,102	4,628	10,730	12,832	23,562
Isle of Wight 007E	12,866	9,966	22,832	558	23,390
Isle of Wight 009C	16,436	6,582	23,018	-	23,018
Isle of Wight 008B	9,945	12,831	22,775	-	22,775
Isle of Wight 001E	17,112	3,362	20,474	935	21,409
Isle of Wight 006E	18,918	2,478	21,396	-	21,396
Isle of Wight 004C	15,416	5,237	20,653	222	20,875
Isle of Wight 002B	12,055	2,499	14,554	6,279	20,833
Isle of Wight 009B	9,780	3,877	13,658	6,650	20,308
Isle of Wight 016F	13,957	5,442	19,398	167	19,565
Isle of Wight 001A	15,995	3,139	19,135	121	19,256
Isle of Wight 016D	13,657	5,323	18,979	-	18,979
Isle of Wight 016A	13,485	5,255	18,740	-	18,740
Isle of Wight 016B	11,207	4,351	15,559	-	15,559
Isle of Wight 012G	11,668	3,668	15,336	-	15,336
Isle of Wight 001C	11,311	3,087	14,398	627	15,025
Isle of Wight 005B	11,845	1,062	12,907	625	13,532
Isle of Wight 006D	11,889	1,545	13,434	-	13,434
Isle of Wight 004D	9,988	3,364	13,352	-	13,352
Isle of Wight 015B	8,758	1,525	10,283	1,914	12,197
Isle of Wight 010E	8,561	3,033	11,594	-	11,594
Isle of Wight 018A	9,389	1,847	11,236	-	11,236
Isle of Wight 002A	8,985	1,850	10,835	-	10,835
Isle of Wight 014E	6,914	2,854	9,768	-	9,768
Isle of Wight 015E	7,539	1,307	8,846	561	9,407

APPENDIX 14 FULL LIST OF LSOAs WITH ASSOCIATED HEAT DEMAND DENSITIES

LLSOA	Existing domestic heat demand density (All Fuels) MWh/km2/year	Existing commercial & industrial heat demand density MWh/km2/year	Total existing heat demand density MWh/km2/year	Potential new development heat demand MWh/km2/year	Total heat demand including potential future development MWh/km2/year
Isle of Wight 004B	7,006	2,335	9,342	-	9,342
Isle of Wight 012D	6,769	2,096	8,865	-	8,865
Isle of Wight 006C	7,495	963	8,458	-	8,458
Isle of Wight 009A	5,862	2,285	8,147	-	8,147
Isle of Wight 008C	2,969	3,610	6,579	1,153	7,733
Isle of Wight 011D	1,749	5,695	7,443	-	7,443
Isle of Wight 006A	6,460	825	7,286	-	7,286
Isle of Wight 015A	5,997	1,031	7,027	-	7,027
Isle of Wight 003A	4,114	2,000	6,114	725	6,839
Isle of Wight 007D	3,898	2,888	6,786	-	6,786
Isle of Wight 015F	5,476	938	6,414	-	6,414
Isle of Wight 008E	1,220	2,111	3,331	2,262	5,593
Isle of Wight 018B	4,592	879	5,470	-	5,470
Isle of Wight 012A	3,774	1,173	4,948	-	4,948
Isle of Wight 010C	2,846	950	3,796	-	3,796
Isle of Wight 014B	2,547	987	3,534	142	3,676
Isle of Wight 009E	1,373	461	1,835	1,834	3,669
Isle of Wight 010A	2,659	898	3,557	-	3,557
Isle of Wight 010D	2,100	678	2,778	752	3,530
Isle of Wight 002D	2,550	489	3,040	-	3,040
Isle of Wight 016E	2,043	716	2,759	37	2,796
Isle of Wight 010B	2,092	676	2,768	-	2,768
Isle of Wight 018C	2,278	412	2,689	-	2,689
Isle of Wight 002E	2,009	375	2,383	47	2,430
Isle of Wight 005D	2,205	174	2,379	-	2,379
Isle of Wight 005C	2,205	174	2,378	-	2,378
Isle of Wight 005A	2,069	162	2,230	82	2,312
Isle of Wight 018D	1,877	331	2,208	-	2,208
Isle of Wight 012F	1,575	429	2,004	-	2,004
Isle of Wight 003C	1,027	419	1,447	530	1,976
Isle of Wight 012C	1,498	404	1,903	-	1,903
Isle of Wight 012B	1,262	329	1,591	-	1,591
Isle of Wight 018E	1,215	197	1,412	-	1,412
Isle of Wight 008A	592	468	1,059	231	1,290
Isle of Wight 012E	1,026	253	1,279	-	1,279
Isle of Wight 015D	1,087	152	1,240	-	1,240
Isle of Wight 014A	873	272	1,145	-	1,145
Isle of Wight 015C	912	121	1,032	-	1,032
Isle of Wight 006B	732	66	797	-	797
Isle of Wight 011C	345	400	745	-	745
Isle of Wight 013C	542	36	579	-	579

APPENDIX 14 FULL LIST OF LSOAs WITH ASSOCIATED HEAT DEMAND DENSITIES

LLSOA	Existing domestic heat demand density (All Fuels) MWh/km2/year	Existing commercial & industrial heat demand density MWh/km2/year	Total existing heat demand density MWh/km2/year	Potential new development heat demand MWh/km2/year	Total heat demand including potential future development MWh/km2/year
Isle of Wight 017A	316	11	327	-	327
Isle of Wight 013A	269	2	271	-	271
Isle of Wight 017C	238	31	269	-	269
Isle of Wight 017D	238	16	253	-	253
Isle of Wight 013D	238	6	244	-	244
Isle of Wight 013B	Data Unavailable	31	31	-	31
Isle of Wight 017B	Data Unavailable	4	4	-	4