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Appendix 2

Heat Mapping

The potential for future extension of a pipe work network to urban centres or planned large scale residential developments in neighbouring boroughs.

In order to start to address the potential for future expansion of the pipe work network we have carried out a high level analysis of the Croydon surrounding areas using heat mapping.

Heat mapping at its most basic is a method of graphically representing energy demand or consumption across an area. As its name suggests, the prime motivation is to understand heat distribution across the built environment. This can be heat demand, energy demand for generating heat, or excess heat production, for example from industry or power generation, or a combination of each.

Heat Mapping Methodology

There are no defined or standardised methodologies for heat maps. The method chosen for a particular study will depend on the aims and ambitions of the study, the scale of the mapping, and the availability of data for the particular area.

There are two basic methods of producing a heat map:

Bottom-up. The bottom up approach models heat production from first principles. Using information on the built environment, it is possible to create building models and simulate the heat demand. Combined with data which provides the spatial distribution of buildings, this then allows a spatial map of thermal demand to be created. This theoretical approach allows interrogation of the built form to assess the potential impact of low carbon measures on the heat demand or energy demand.

Top-down. An alternative approach to heat mapping is to take existing measured data and plot this spatially. Currently the most detailed level of utility information available for gas and electricity consumption in the UK is at the middle layer output area (each of which typically comprises circa 6000 homes). This means that data is consistent across an area but limited in resolution to the level at which information is available. At middle layer, the areas are sufficiently large to mean that there could be significant variation between areas which appear similar, for example through the inclusion of parks or high rise flats.

A combination of both approaches can be used to allow the resolution of the bottom up approach to be calibrated against known data in the top down approach.

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Heat mapping for Croydon
At the early stages of this study, there is still much information to collect relating to the built form, and current consumption. For this reason, the heat maps presented in this interim report make use of established publicly available data sets. Heat maps are presented at two levels of resolution depending on the methodology used.

Middle Layer heat mapping
The middle layer heat mapping indicates heat use across the Borough of Croydon at middle layer super output area (MLSOA) resolution. The output area system is based on census data collection and the middle layer level represents groups of output areas covering circa 6,000 dwellings. Across the Borough of Croydon, there are 44 MLSOAs.

The middle layer heat mapping uses data on gas and electricity consumption available from the Department of Energy and Climate Change (DECC). This provides gas and electricity consumption for domestic and commercial / industrial uses for each MLSOA. To produce the heat map, the gas consumption is converted to heat demand assuming 75% boiler efficiency, and added to the economy 7 electricity consumption from the domestic sector. The data is presented in units of average kW demand per km^2 per year (assuming heat supply spread over 8760 hours), a metric which essentially describes heat power demand density.

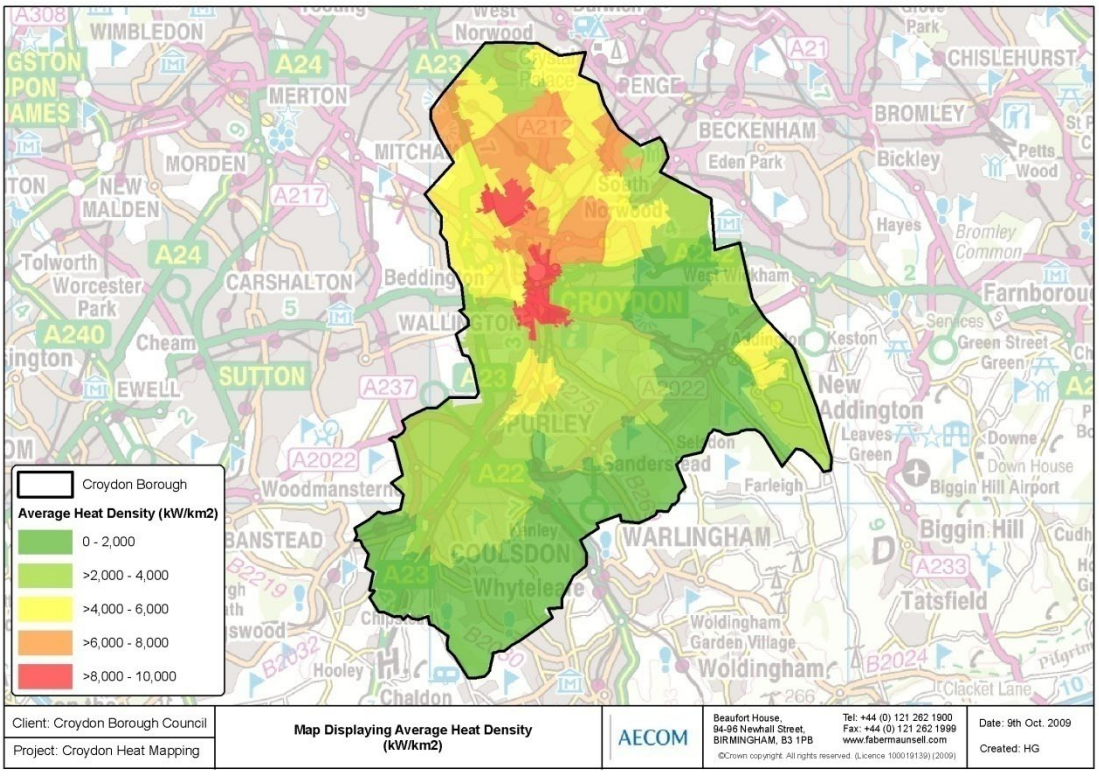

Figure 7.1: MSOA_Average Heat Density

The map clearly shows the high heat demand in the town centre with heat densities of over 8,000 kW / km^2 / yr achieved. In general, the heat density in the more urban northern half is above 4,000 kW / km^2 / yr, whilst the southern half is mostly less than 4,000 kW / km^2 / yr. From prior work by AECOM for DECC[1], it is thought that the viability level for CHP and DH in terms of heat density may lie around 3,000 kW / km^2 / yr suggesting that large parts of Croydon may be suitable for DH (it is important to recognise

[1] The Potential and Costs of District Heating Networks. AECOM and Poyry Energy Consulting. April 2009.

that this viability limit is a very crude high level test for large area studies and further detailed analysis is always required). The areas shown in red in this map have heat densities above 6,000kW/km2 where district heating will be most viable. The outputs from this map show that there are regions of Croydon which merit further analysis to assess the viability for district heating.

Output area heat mapping.
The output area (OA) is the smallest defined geographical area used in the census, representing just over 100 dwellings. The analysis used in this report breaks down the MLSOA data to output area using information from the Census 2001 on dwelling numbers and built form, and statistics on land-use available from the neighbourhood statistics website. For housing, the ratio of heat demand between flats, terraced houses, semi-detached and detached houses is used to pro-rate the MLSOA consumption data to OA level. The ratio splits in heat demand are based on SAP (Standard Assessment Procedure) energy modelling of typical UK dwellings [2].

The commercial energy consumption is pro-rated down to OA level using land use statistics which provide the area of land in each OA used by non-domestic buildings. This relatively simple method does not take into account the height of buildings (and thus total building floor area) but relies on the simplification that within a MLSOA, the non-domestic buildings are relatively uniform in height. This method will be refined in the final report to provide a more accurate assessment.

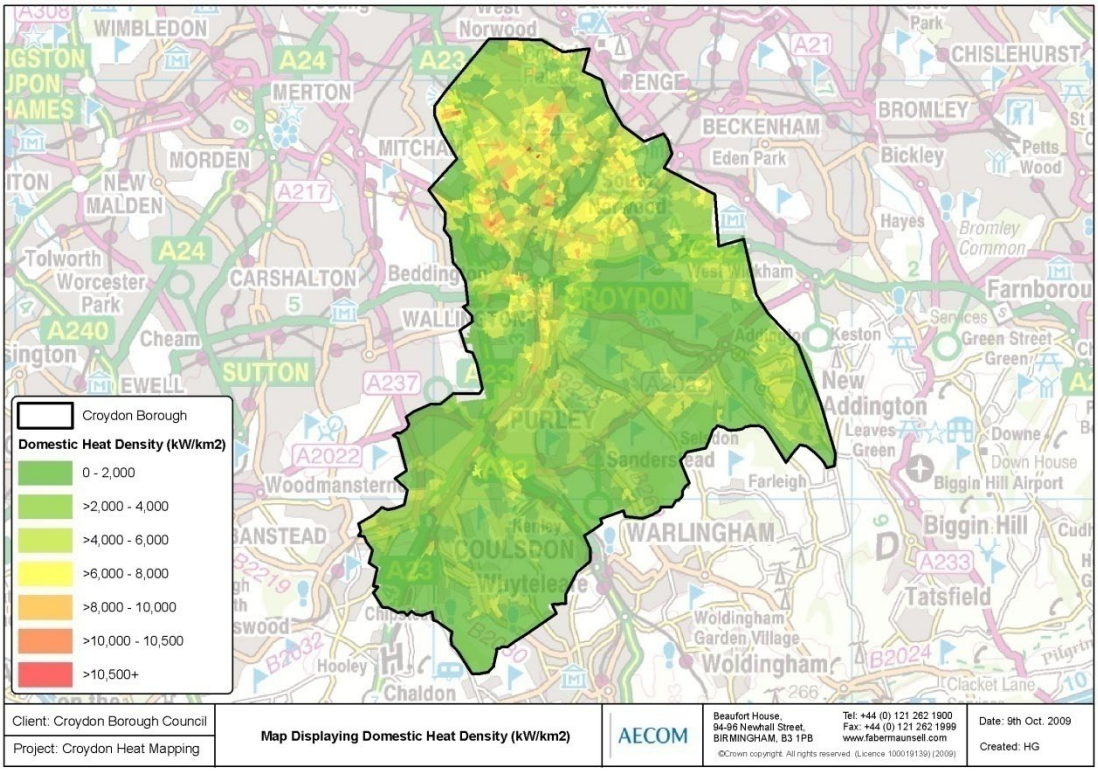

Figure 7.2: OA_Domestic Heat Density

The domestic heat density maps demonstrate that most of the borough is relatively low in domestic heat density, with higher levels achieved in the north of typically up to 8,000 kW / km^2 / yr. There are some isolated pockets of around 10,000 kW / km^2 / yr which will consist of very high density housing or flats.

[2] The definition of a “typical UK dwelling” for each form is based on extensive analysis of the English House Condition Survey.

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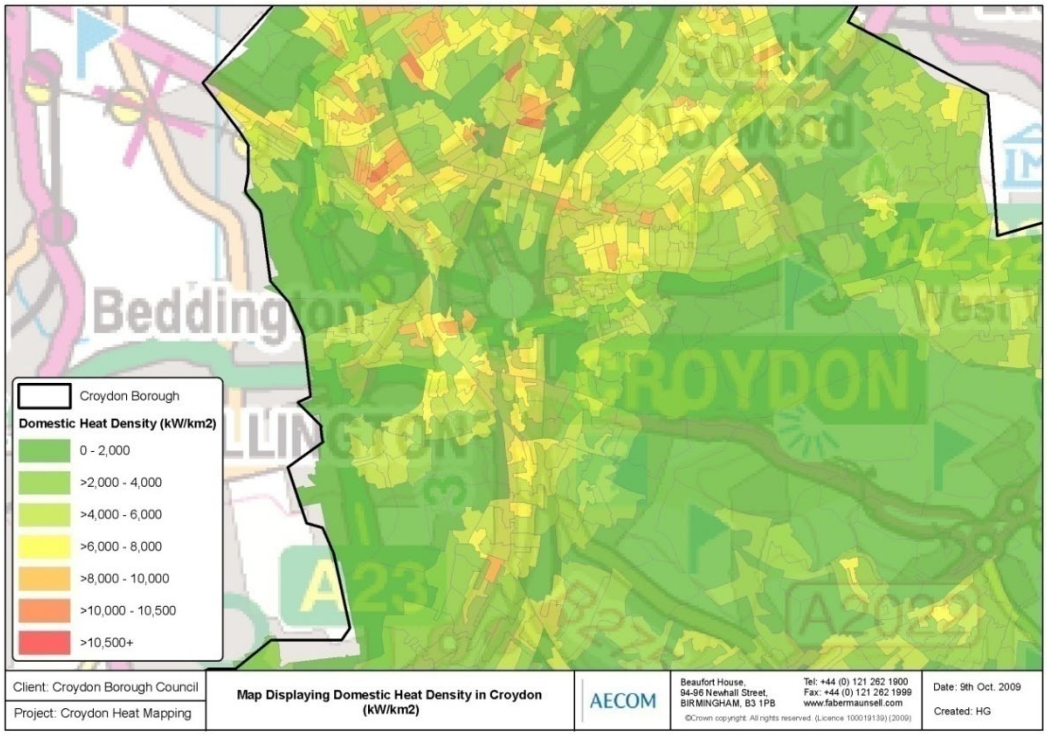

Figure 7.3: - OA_Domestic Heat Density_detail

The detail on Croydon town centre shows a large reduction in heat demand in the very town centre due to the dominance of non-domestic buildings. The impact of the commercial buildings can clearly be seen in the two maps which show the overall average heat density (including domestic). In the Croydon town centre area, the heat density is predicted to reach over 15,000 kW / km^2 / yr, almost entirely due to the commercial buildings. It is possible that the methodology is also under-predicting this density due to not accounting for building height.

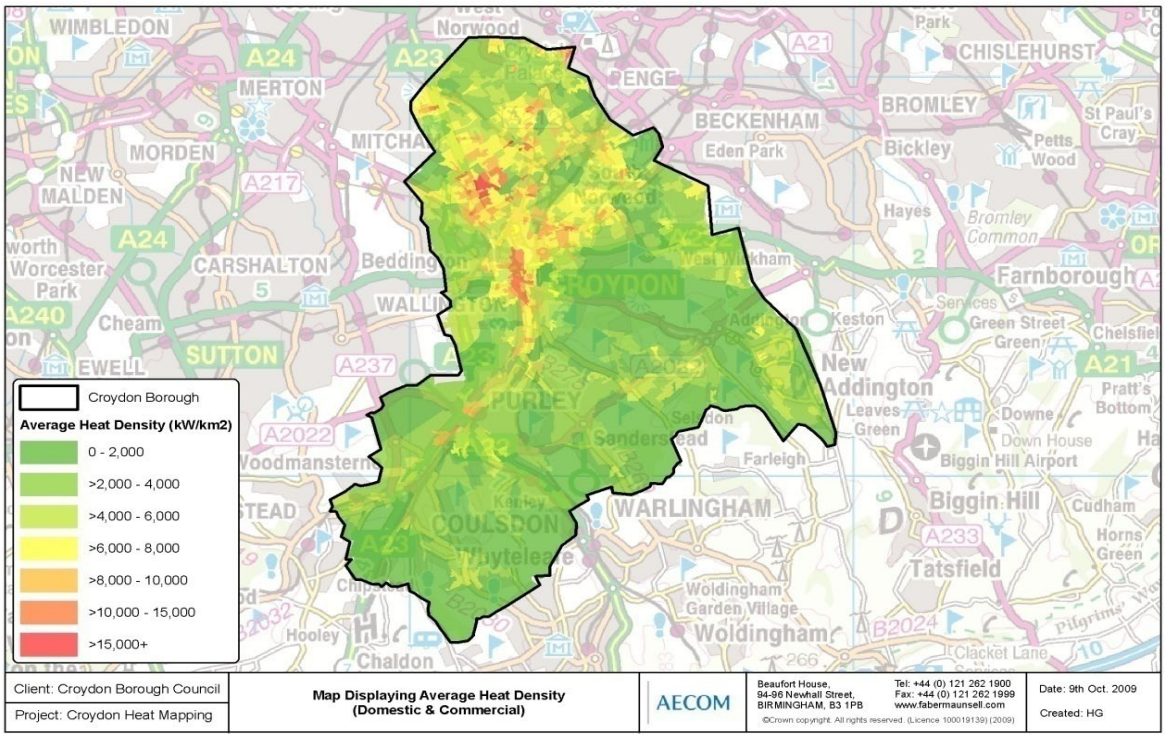

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Figure 7.4: – OA_Average Heat Density

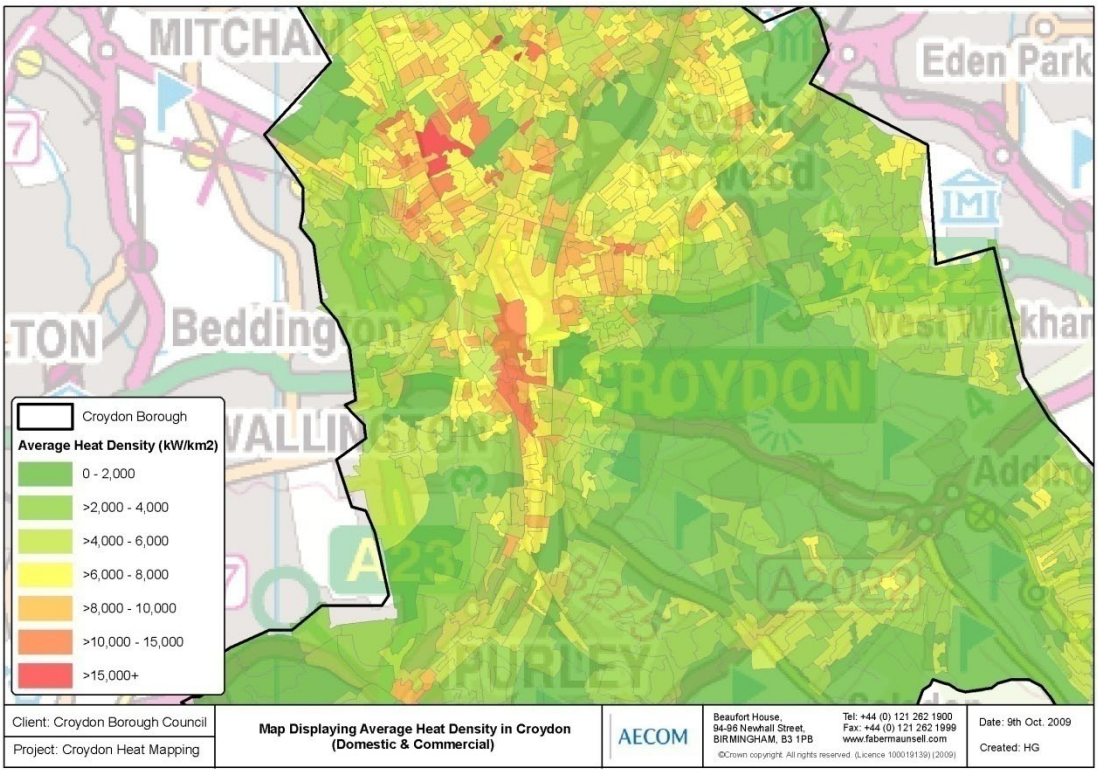

Figure 7.5: - OA_Average Heat Density_detail

The maps can be used to assess potential DH schemes, and opportunities to link additional areas. A number of factors need to be considered when examining larger scale scheme potential and a balance will need to be struck between size of load, and distance between loads. In general, the larger the distance between individual schemes, the larger the loads will need to be to justify the installation of the DH network.

The average heat density map at OA level indicates that a wider scale scheme could potentially incorporate areas in the Borough to the North West and North East of the town centre. These are located along the A222 and A23 roads. Connection to these areas would require a more detailed understanding of the heat demand in these areas.

References

Local Development Framework for Croydon – Core Strategy
http://www.croydon.gov.uk/planningandregeneration/planningpolicy/ldf/corestrategy