

Capabilities on project:
Energy
Environment

Section C

Estimates the level of energy demands of potential customers now and in the future

From the interim study, the Croydon town centre boundary has been agreed, which defined the scope of the decentralised energy study. This boundary embodies 4 main quadrants, as shown in Figure 1, which corresponds to key development areas:

- Wellesley Road/Park Lane
- Wandle Park
- East Croydon
- West Croydon

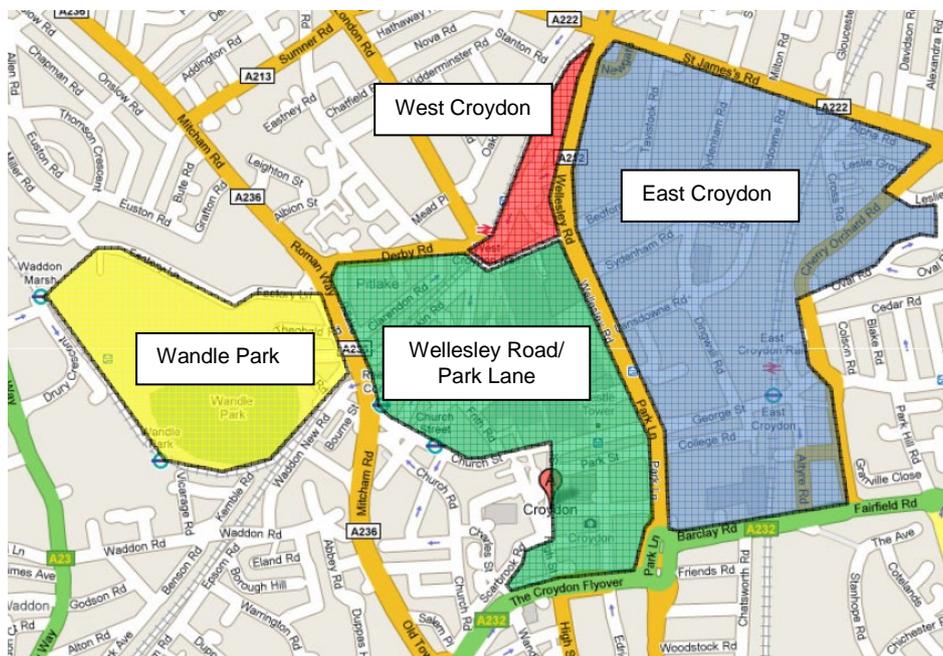


Figure 1 Town centre quadrants as defined by the council

These quadrants contain the majority of the earmarked developments to take place over the next 10 years in-line with the Urban Regeneration Vehicle and Croydon's aspiration to be 'London's Third City'.

For the final report, a total of 30 Energy Clusters have been established to provide spatial indication of the heating, cooling and electrical annual peak and energy demands in the town centre zone. These Energy Clusters are as shown in Figure 2.

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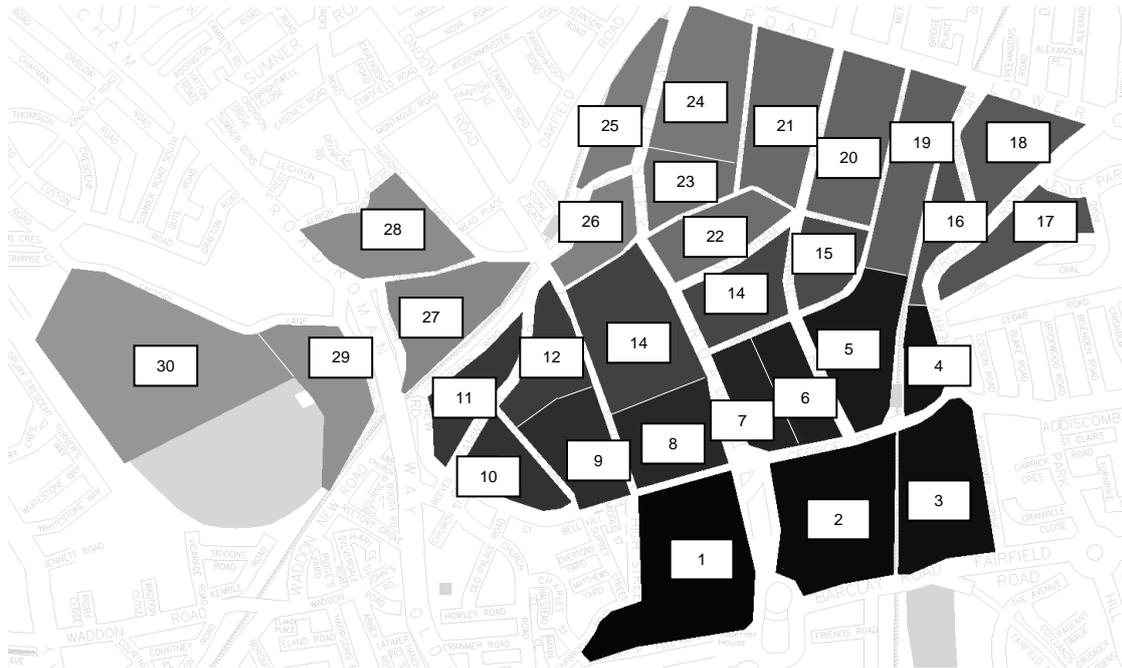


Figure 2 Map showing Energy Clusters (1 to 30) defined for the town centre area

Each Energy Clusters will indicate the sum of energy and peak demand in MWh and MW respectively of buildings identified within them as being relevant within the scope of the study. More details are available in Section B.

For the Decentralised Energy (DE) scheme to be economically viable and for it to work successfully, customers along with their respective estimate of energy demands will need to be identified. This enables the planning of the DE network routing and the prediction of the energy centre capacity to be carried out. For the purposes of this study, potential customers identified are assumed will connect to the DE scheme, to ensure that ceiling demands are at least catered for in the DE scheme capacity prediction.

The Council has listed several existing major buildings in the town centre zone, amongst which are also several major public buildings. Figure 3 highlights the location of major existing buildings and approved and pending development sites around the town centre of Croydon.

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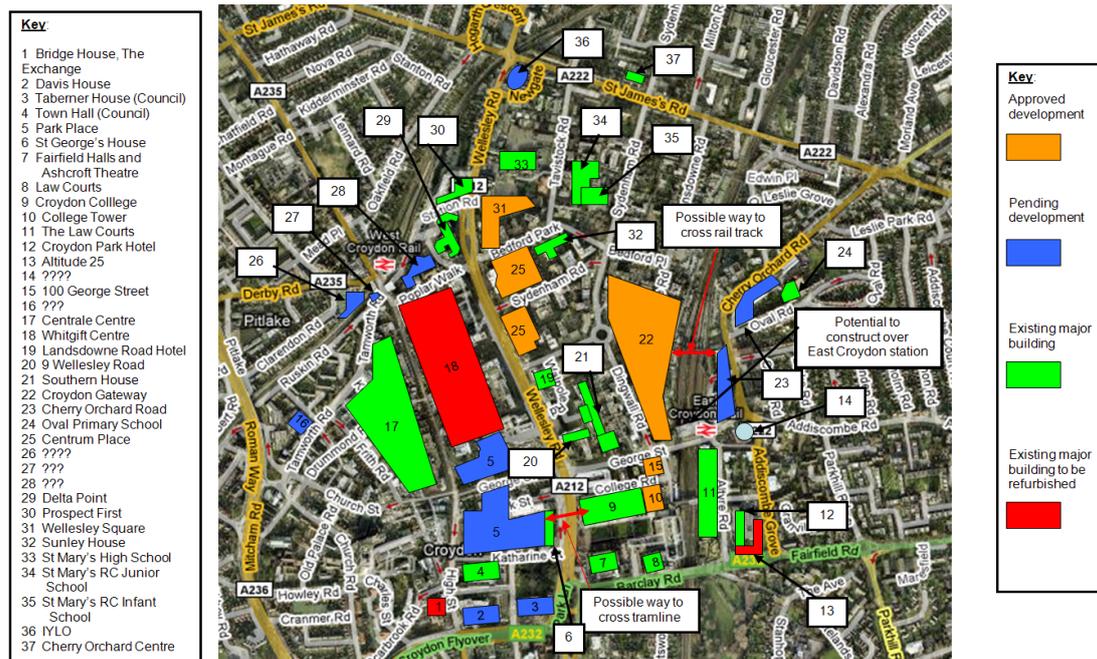


Figure 3 Map from the Council indicating the location of major existing buildings and approved and pending development sites

There are a large number of new developments to come online at different times in the Croydon town centre zone and it is crucial within the council's sustainability remit to commit these new developments to the energy scheme as well. Table 1 summarises the potential customers the study has identified to connect to the DE scheme.

Existing Buildings		Buildings to come online by 2015	
Council/Public Buildings	Cluster	Council/Public Buildings	Cluster
1 Civic centre	C001	26 Croydon College (t.b. refurbished)	C002
2 Davis House	C001	27 CURV PSDH	C001
3 Suffolk House	C002	28 Croydon learning and cultural quarter - Phase 1	C002
4 Law courts	C003		
5 East Croydon station	C004	Private Buildings	Cluster
6 Head post office	C004	29 100 George Street (Chroma with Essex House)	C002
7 Southern House	C007	30 Essex House	C002
8 Tamworth Rd Resource Centre	C011	31 College Tower	C002
9 Oval Primary & Nursery School	C017	32 Croydon Gateway (Ruskin Sq) - Phase 1	C005
10 Lunar house & Apollo house (Home Office)	C022	33 14-17 Dingwall Rd	C006
11 St Mary's High School	C024	34 Park place	C008
12 Fairfield Halls & Ashcroft Theatre (t.b. replaced by 28)	C002	35 Wellesey Square	C023
13 Taberner House (t.b. demolished & replaced by 40)	C001	36 Berkeley Homes	C024
14 The Law Courts (t.b. replaced by 39)		37 IYLO	C002
		38 29-30 Dingwall Rd	C014
Private Buildings	Cluster		
15 St George's House (also Nestle Tower)	C001	Buildings to come online beyond 2015	
16 Bridge house, The Exchange	C001	Council/Public Buildings	Cluster
17 Croydon Park Hotel	C003	39 Croydon learning and cultural quarter - Phase 2, 3 & 4	C002
18 Altitude 25	C003		
19 No. 1 Croydon	C003	Private Buildings	Cluster
20 Landsdowne Road Hotel	C007	40 Taberner House (residential)	C001
21 Centrale	C009	41 Croydon Gateway (Ruskin Sq) - Phase 2, 3 & 4	C005
22 Whitgift Centre (t.b. refurbished)	C013	42 Cherry Orchard Road	C017
23 Prospect First	C025		
24 Delta Point	C026		
25 Hancroft Road Residential	C028		

Table 1 List of buildings of potential customers to connect to the DE network

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Figure 4 shows the location of these buildings in the Croydon town centre area in their corresponding index numbers. They have been colour coded to represent the timeframe in which they could possibly connect to the DE scheme.

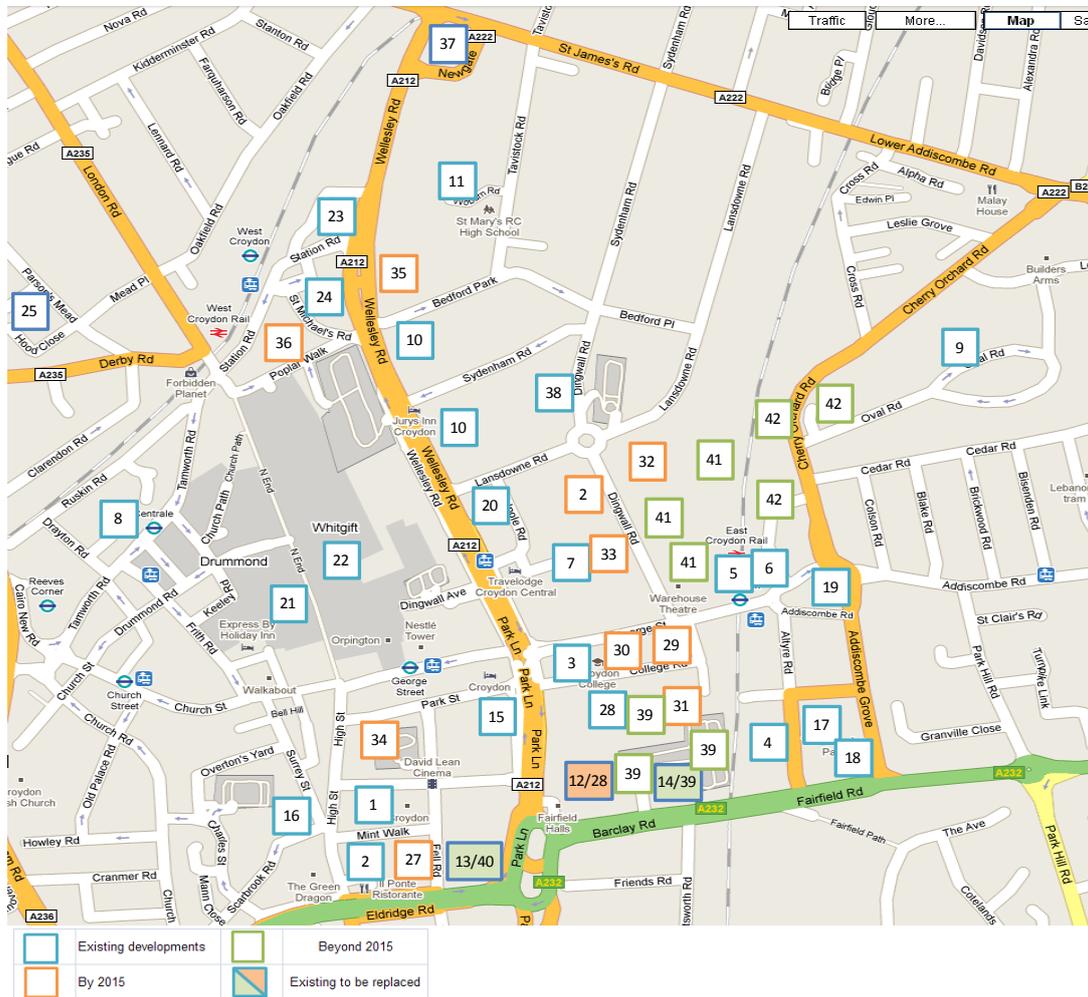


Figure 4 Locations of potential DE network customers

Having identified the potential customers that could connect to the DE scheme, the possible locations for the Energy Centres could be proposed. In the interim study, Option 3 proposed Zonal type Energy Centres as shown below in Figure 5.

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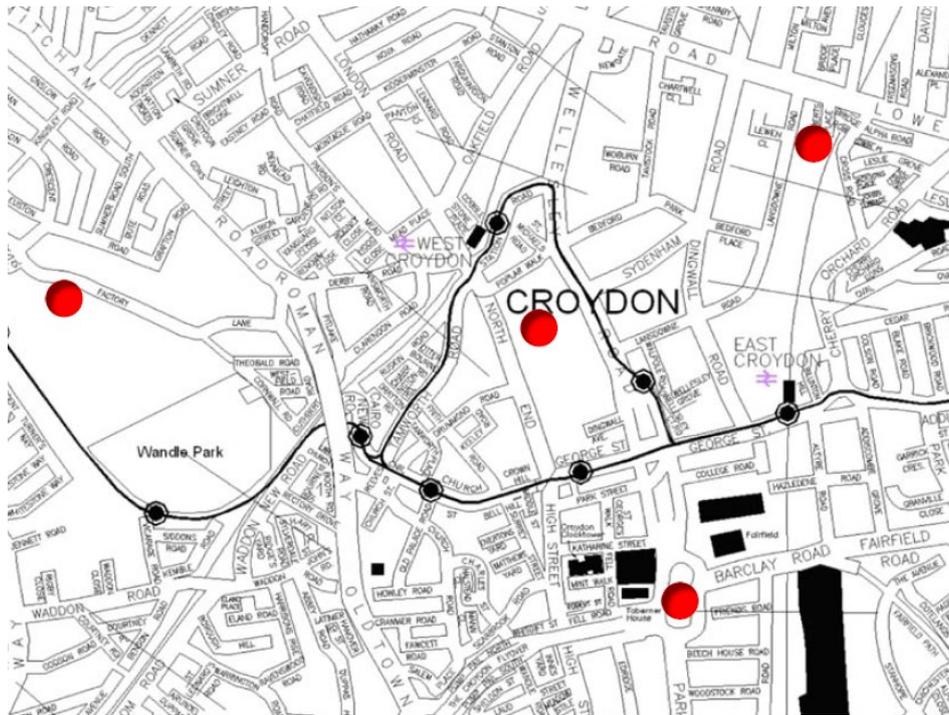


Figure 5 Zonal district Energy Centres option

This corresponds to locating the Energy Centres in the following Energy Clusters as an indicative suggestion:

- 1) Energy Centre 1 to be located in the basement of the new ‘Taberner House’ in Energy Cluster 1
- 2) Energy Centre 2 to be located somewhere along Lansdowne Road in Energy Cluster 5 or 19
- 3) Energy Centre 3 to be located somewhere in the basement car park/storage space of the Whitgift Centre in Energy Cluster 13

Each Energy Centre is designed to cater for the energy demands of several Energy Clusters as listed in Table 2 and illustrated in Figure 6. The buildings listed as potential customers are located within one of these Energy Clusters, as already listed in Table 1 and illustrated in Figure 4.

Energy Centre 1	Energy Centre 2	Energy Centre 3
Energy Cluster 1	Energy Cluster 4	Energy Cluster 7
Energy Cluster 2	Energy Cluster 5	Energy Cluster 8
Energy Cluster 3	Energy Cluster 6	Energy Cluster 9
	Energy Cluster 16	Energy Cluster 13
	Energy Cluster 17	Energy Cluster 14
		Energy Cluster 22
		Energy Cluster 23
		Energy Cluster 24
		Energy Cluster 25
		Energy Cluster 26

Table 2 List of Energy Clusters serviced by the respective Zonal Energy Centres

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Figure 6 Proposed locations of the Zonal Energy Centres and an indication of the Energy Clusters they will serve respectively

To serve these buildings, a pipe network to deliver the energy demand to the location of the buildings is needed. Figure 7 shows the primary level pipe network for each Energy Centre. These network starts from the respective Energy Centres and ends just off the site of the identified buildings. The secondary pipeline is only indicative in this study and is illustrated in Figure 7 for discussion purposes.

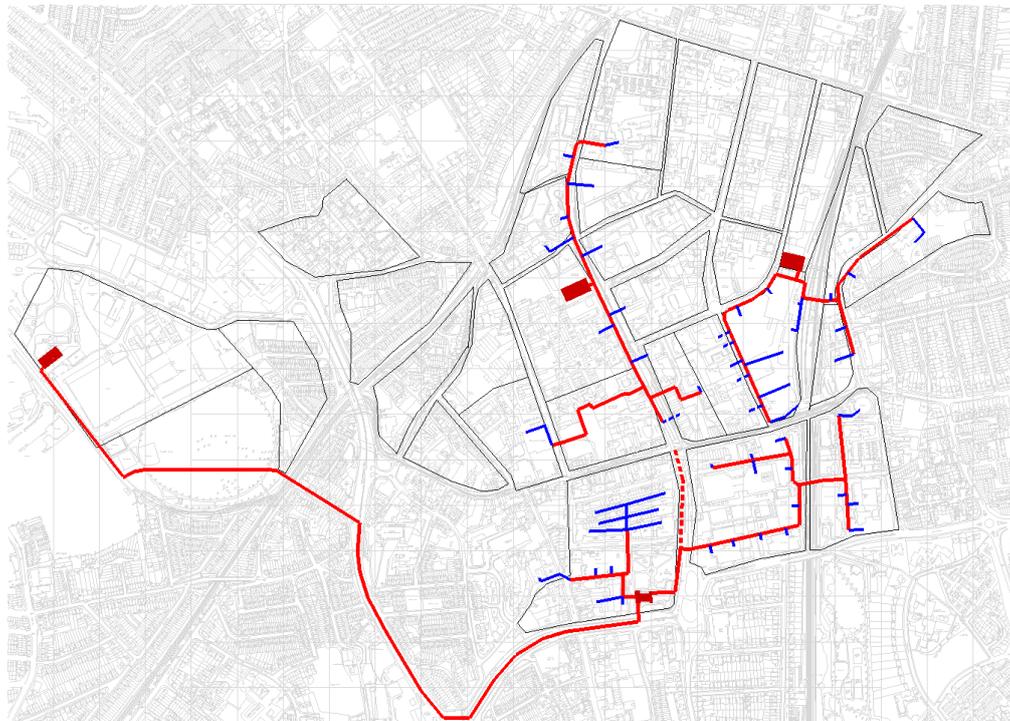


Figure 7 The routing of the primary pipelines of the DE network branching out of the respective Energy Centres. The secondary pipeline connecting the primary pipeline to the respective buildings are indicative only. The Energy Clusters are also highlighted

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Principles and Methodology

The Croydon town centre consists of a mix of building types ranging from domestic and non-domestic buildings. It was previously identified in the interim study that, in general, the town centre consists of mainly commercial buildings (shown in green) with generally residential (shown in blue) areas surrounding its fringes. Figure 8 shows an indication of the dominant building type around the town centre.

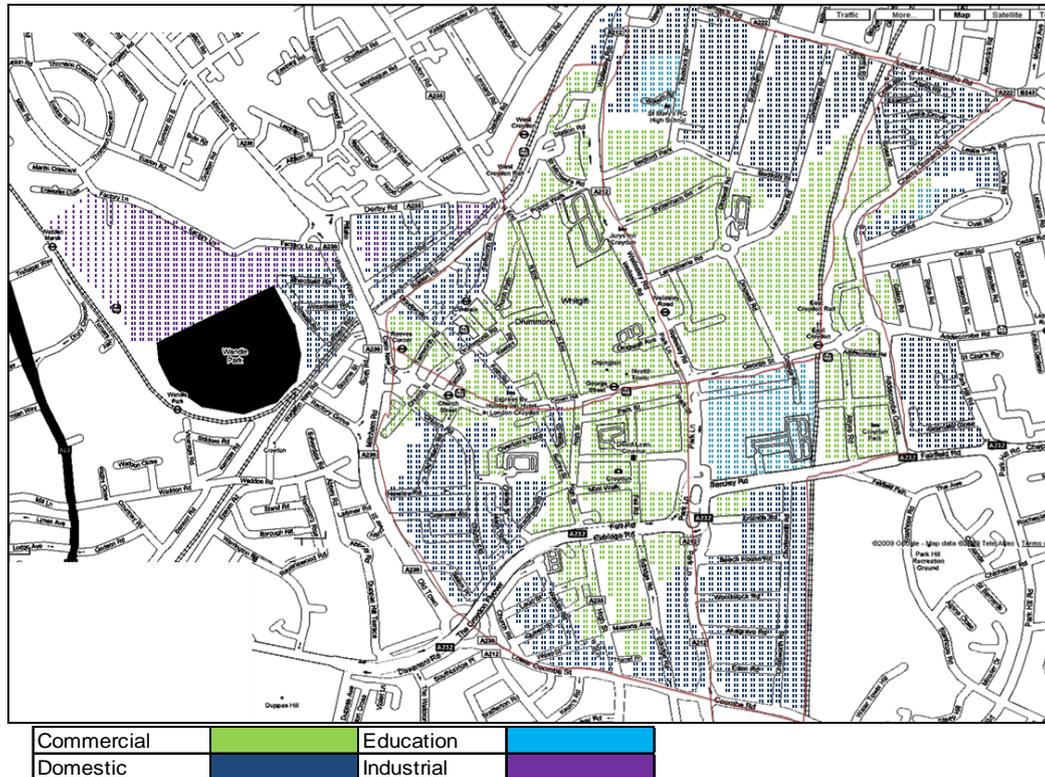


Figure 8 Map showing dominant building type clusters

In order to tailor the energy demand prediction to fit within the scope of study, the energy demand of the domestic sectors has been disregarded. The rationale behind this simplification is that it is conceded in this study that it is economically and practically not viable to connect the general existing dwellings onto the proposed DE scheme due to marketing uncertainty and risk. Generally, larger developments are considered would benefit from connecting to the DE scheme and could help make the investment into a DE scheme financially sensible.

Several sources of data have been used to estimate the heating, cooling and electrical annual energy and peak demands. These are:

- Data from the Valuation Office Agency
- Information on existing major buildings
- Information on public buildings
- Information on buildings controlled by the Council

The Valuation Office Agency (VOA) data for the Borough of Croydon has been used to help establish the present day/base case annual energy demand (in MWh) for the town centre due to commercial buildings. The VOA data contain information on the building types, locations and floor area for all existing commercial buildings in the borough. There were minute amount of inconsistencies in the VOA data, however the overall effect is considered insignificant in this study.

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The VOA data do not provide energy figures; therefore, in order to obtain an estimate of annual energy and peak demand, the VOA data would need to be linked with energy benchmark figures. For this, the CIBSE Technical Manual (TM 46): Energy Benchmarks and BSRIA Rules of Thumbs design guide have been used to formulate the energy (kWh/m²) and peak (W/m²) demand approximation for the different building types identified. The energy benchmark figures in CIBSE TM46 are derived from CIBSE Guide F: *Energy efficiency in buildings* and Energy Consumption Guide ECG19: *Energy efficiency in offices*, which are based on real energy data from samples of typical existing building stock. The TM46 energy benchmarks are provided for 29 different types of buildings as listed below in Table 3.

Building type	Building type
General office	Public buildings with light usage
High street agency	Schools and seasonal public buildings
General retail	University Campus
Large non-food shop	Clinic
Small food Store	Hospital - clinical and research
Large food store	Long term residential
Restaurant	General accommodation
Bar, pub or licensed club	Emergency services
Hotel	Laboratory or operating theatre
Cultural activities	Public waiting or circulation
Entertainment halls	Terminal
Swimming pool centre	Workshop
Fitness and health centre	Storage facility
Dry sports and leisure facility	Cold storage
Covered car park	

Table 3 List of building types covered in TM46

Typically, only electrical and fossil-thermal energy benchmarks could be obtained from the TM46. Therefore, for buildings with cooling demand, an informed approximation was made by considering the typical amount of internal and solar gains in these buildings type. Derivation of the cooling demand was also made based on the proportion of electricity consumed for lighting, equipment and fans/pumps of the cooling system. The remainder proportion will reflect the approximate electricity used by the chillers. By using nominal chiller Coefficient of Performance (CoPs) figures, the cooling energy demand could be approximated. Nominal boiler efficiencies were also assumed to obtain the heating demand from the fossil-thermal energy benchmark figures. The split between space heating and domestic hot water was based on building type and this detail could be found in Section F. The CIBSE Guide A was also used where required as reference for relevant information such as typical building internal gains. Domestic and industrial buildings have been assumed to not have any cooling demands.

The VOA data for the borough of Croydon shows that the majority proportion of the town centre consists of office and retail spaces. As other types of buildings, including domestic buildings are in small proportion, it was found that the VOA data could adequately represent the majority of the annual energy and peak demands in the town centre area. Typically in study like this, energy and peak demand figures are essentially estimations and predictions. Therefore, the figures published in the report should be viewed as an indicator of the qualitative significance of the study carried out.

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Whilst some real energy data were available, they were not used in this study as some were found to be unreliable and incomplete at times. Also, some energy data were for a particular building space and not for the whole building. For the scope of the study, the prediction of energy demand for the purpose of DE scheme consideration required whole-building figures.

The Council has identified a list of existing major buildings, with potentially high energy demands. Their energy demands have been accounted for in the VOA data energy figures.

Croydon Town Centre annual energy and peak demand estimates and predictions

The estimate of annual energy and peak demand in the town centre has been broken down into the Energy Clusters level defined earlier. *Heat maps* are used to illustrate the annual energy demand in MWh and peak demand in MW for heating, cooling and electricity of the Energy Clusters in the town centre. They are shown for four scenarios:

- 1) Present day Croydon town centre
- 2) Future Croydon town centre beyond year 2015 with business as usual and no DE scheme is implemented
- 3) Future Croydon town centre by year 2015 with DE scheme in place and the listed potential customers connect to the scheme
- 4) Future Croydon town centre beyond year 2015 with DE scheme in place and the listed potential customers connect to the scheme

The objective is to identify the spatial profile of the town centre energy demands and the potential changes in the future. This would lead to a better strategic planning and the sizing of the energy centres and the optimisation of the district energy distribution network to be implemented.

Table 4 summarises the annual heating, cooling and electricity energy and peak demands for the listed potential customers of the DE scheme.

In the *heat maps* shown in Figures 9 to 23, there are shades of blue, which indicate relatively low energy demand. This indirectly inferred that these are generally existing masses of residential areas. These are Energy Clusters that are not considered in the DE scheme. In general, all the *heat maps* demonstrated high level of demand in the core of the town centre. This is where most of the major existing buildings are located.

Furthermore, this level of demand is shown to increase significantly over the years as new developments come online in the area. Specifically, Cluster 1, 2, 4 and 5 will witness large increases in demand due to the new large developments such as Ruskin Square, Croydon Learning and Cultural Quarters, Cherry Orchard Road, Park Place and developments to replace the current Taberner House with CURV PSDH and a new residential tower.

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Potential customer identified by the client	Energy Cluster	Energy Centre	Floor area [m ²]	Energy (MWh)			Peak (MW)			Type	Note
				Heating [MWh]	Cooling [MWh]	Electricity [MWh]	Heating [kW]	Cooling [kW]	Electricity [kW]		
existing buildings to connect to DE network				55,774	30,140	39,880	43,109	64,375	28,363		
Altitude 25	3	1	24,363	1,584	-	975	1,462	-	1,218	Residential	To connect to DE scheme
Bridge house, the exchange	1	1	9,165	596	-	367	550	-	458	Residential	To connect to DE scheme
Centrale	9	3	76,180	9,713	3,809	5,333	7,618	12,189	3,809	Retail	To connect to DE scheme
Civic centre	1	1	20,440	1,395	-	409	1,840	2,044	1,226	Council	To connect to DE scheme
Croydon Park Hotel	3	1	6,878	1,702	817	722	413	1,032	206	Hotel	To connect to DE scheme
Davis House	1	1	1,178	106	96	112	82	147	71	Council	To connect to DE scheme
Delta Point	26	3	25,104	2,259	2,040	2,385	1,757	3,138	1,506	Office	To connect to DE scheme
East Croydon Station	4	2	10,800	1,210	-	432	1,080	-	432	Public	To connect to DE scheme
Fairfield Halls and Ashcroft Theatre	2	NA	10,440	713	-	209	940	1,044	626	Public building (to be demolished)	Site to be replaced by Croydon College development
George Street (Suffolk House) rent office	2	1	14,000	1,260	1,138	1,330	980	1,500	720	Office, part council rented	To connect to DE scheme
Hancroft Road (residential park)	28	NA	20,160	1,310	-	806	1,210	-	1,008	Residential	Out of range of DE scheme unless RR energy centre is feasible
Head Post Office	4	2	19,200	1,728	1,560	1,824	1,344	2,400	1,152	Public	To connect to DE scheme
Landsdowne Road Hotel	7	3	10,188	2,522	1,210	1,070	611	1,528	306	Hotel	To connect to DE scheme
Law courts	3	1	7,884	538	-	158	710	788	473	Public building	To connect to DE scheme
Lunar House & Apollo House (Home Office)	22	3	81,000	7,290	6,581	7,695	5,670	10,130	4,860	Government	To connect to DE scheme
No. 1 Croydon	3	1	21,432	1,566	563	1,238	1,355	866	1,141	Residential	To connect to DE scheme
Oval Primary & Nursery School	17	1	2,597	227	-	74	260	-	104	Council: School	To connect to DE scheme
Prospect First	25	3	26,890	2,420	2,185	2,555	1,882	3,361	1,613	Office	To connect to DE scheme
Southern House	7	3	25,245	2,272	2,051	2,398	1,767	3,156	1,515	Government	To connect to DE scheme
St George's House (also Nestle Tower)	1	1	28,128	2,532	2,285	2,672	1,969	3,516	1,688	Office	To connect to DE scheme
St Mary's High School	24	3	1,467	49	-	4	147	-	59	Council: School	To connect to DE scheme
Taberner House	1	NA	30,800	2,772	2,503	7,650	2,156	3,850	1,848	Council	To be demolished for new residential, excluded from DE scheme
Tamworth Road Resource Centre	11	NA	2,072	340	-	195	145	259	124	Council: Corporate services	Out of range, exclude from DE scheme
The Law Courts	2	NA	11,750	802	-	235	1,058	1,175	705	Public	Site to be replaced by Croydon College development
Whitgift Centre (retail extension refurb)	13	3	116,129	14,806	5,806	8,129	11,613	18,581	5,806	Retail	To connect to DE scheme
by 2015 to connect to DE network				40,475	16,740	26,570	31,574	36,691	21,245		
100 George Street (aka Chroma w EssexHouse)	2	1	24,155	2,265	1,887	2,234	1,763	3,104	1,425	Office	To connect to DE scheme
14-17 Dingwall Rd	6	2	20,000	1,800	1,625	1,900	1,400	2,500	1,200	Office	To connect to DE scheme
29-30 Dingwall Rd	14	NA	6,604	594	537	627	462	826	396	Office	Out of range, exclude from DE scheme
Berkeley Homes	26	3	24,000	1,584	-	975	1,462	-	1,218	Residential	To connect to DE scheme
College Tower	2	1	54,000	3,510	-	2,160	3,240	-	2,700	Residential	To connect to DE scheme
Croydon College (refurbished)	2	1	32,695	5,885	2,248	2,616	3,270	3,270	1,962	Education	To connect to DE scheme
Croydon Gateway (Ruskin Sq) - phase 1	5	2	26,923	2,168	1,359	1,997	1,783	2,090	1,513	Office & Residential	To connect to DE scheme
Croydon learning and cultural quarter - phase 1	2	1	51,325	5,138	3,738	4,530	4,008	6,900	2,941	Education	To connect to DE scheme
CURV PSDH	1	1	21,770	2,776	1,089	1,524	2,177	3,483	1,089	Government	To connect to DE scheme
IYLO	2	NA	11,895	773	-	476	714	-	595	Residential	Out of range, exclude from DE scheme
Park place	8	1	92,903	11,845	4,645	6,503	9,290	14,864	4,645	Retail (cancelled)	Indicative, included in DE scheme
Wellesey Square	21	3	51,035	3,505	150	2,131	3,182	480	2,552	Residential & Retail	To connect to DE scheme
beyond 2015 to connect to DE network				29,851	12,721	23,752	28,009	23,947	22,587		
Cherry Orchard Road	17	2	122,000	8,845	2,974	6,893	7,686	4,575	6,466	Office & Residential	To connect to DE scheme
Croydon Gateway (Ruskin Sq) - phase 2, 3 & 4	5	2	114,340	10,229	5,857	8,484	7,777	9,730	6,509	Office & Residential	To connect to DE scheme
Croydon learning and cultural quarter - phase 2, 3 & 4	2	1	113,199	8,775	3,890	7,143	10,698	9,641	8,072	Education	To connect to DE scheme
Taberner House (residential)	1	1	30,800	2,002	-	1,232	1,848	-	1,540	Residential	To connect to DE scheme

Table 4 List of potential customer to DE scheme and their respective annual energy and peak demands

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1) Present day Croydon town centre

For present day Croydon scenario, Figures 9, 11 and 13 show the annual heating, cooling and electricity energy demand and Figure 10, 12 and 14 show the peak demands of the Energy Clusters in the town centre.

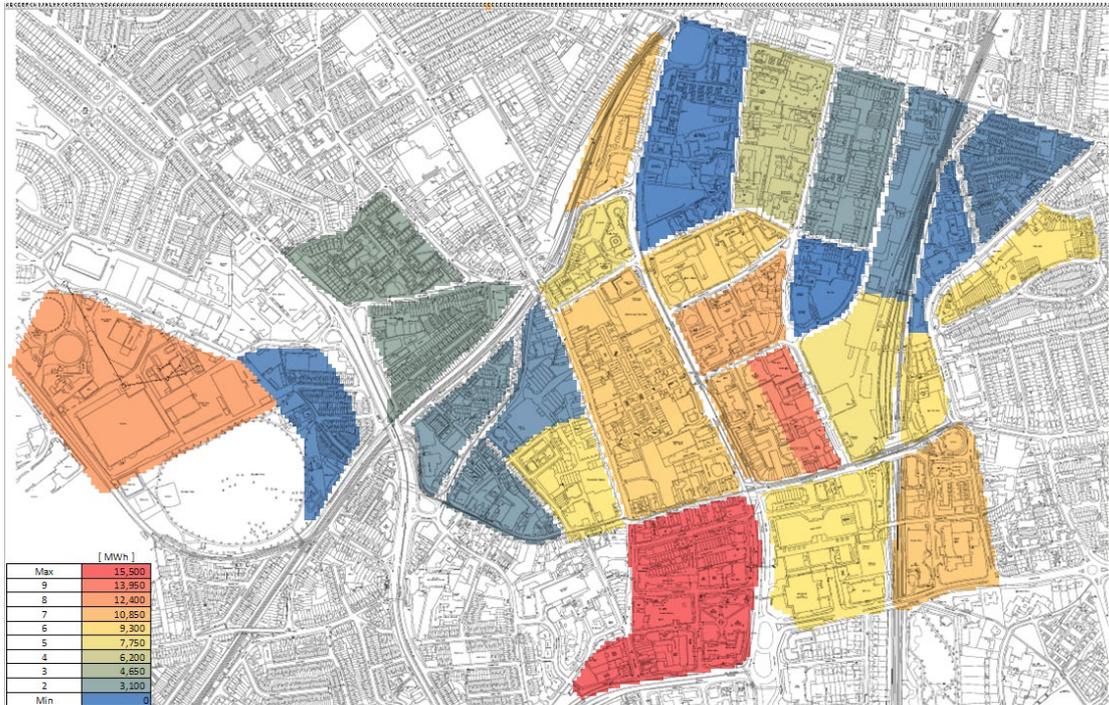


Figure 9 Present day Croydon – Heating energy demand (MWh)

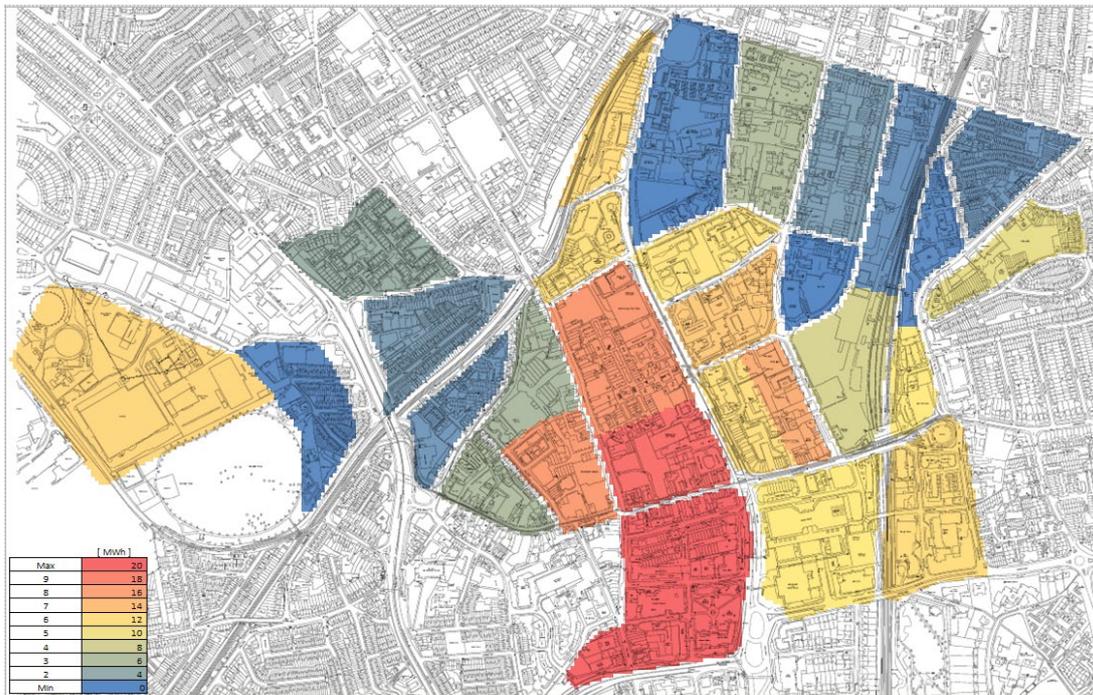


Figure 10 Present day Croydon – Heating peak demand (MW)

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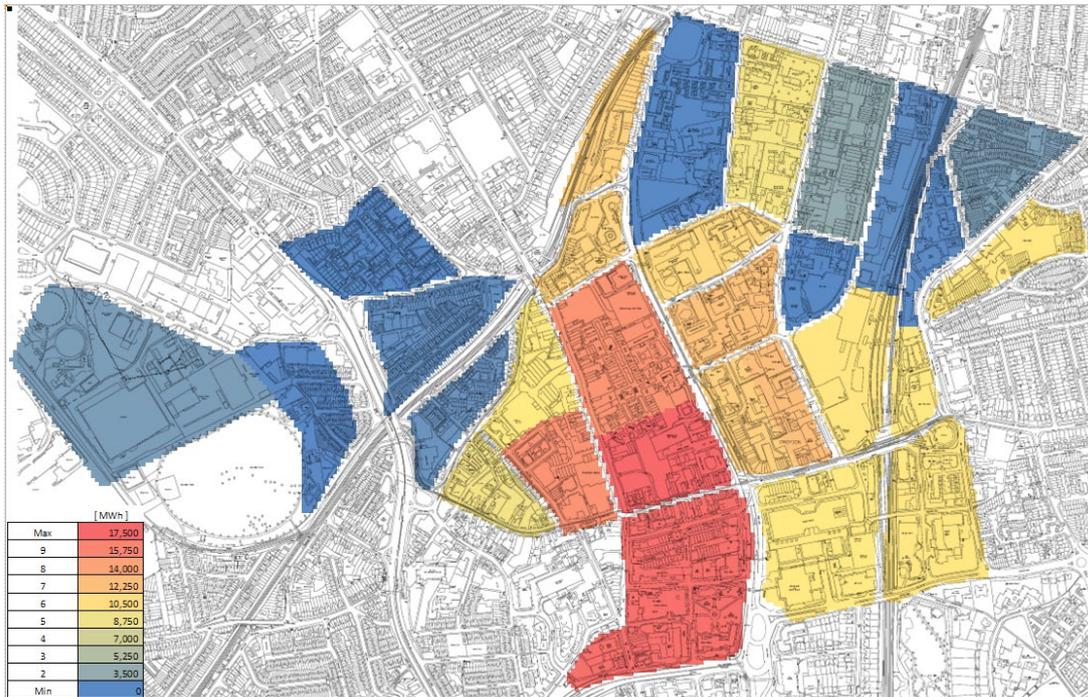


Figure 11 Present day Croydon – Cooling energy demand (MWh)

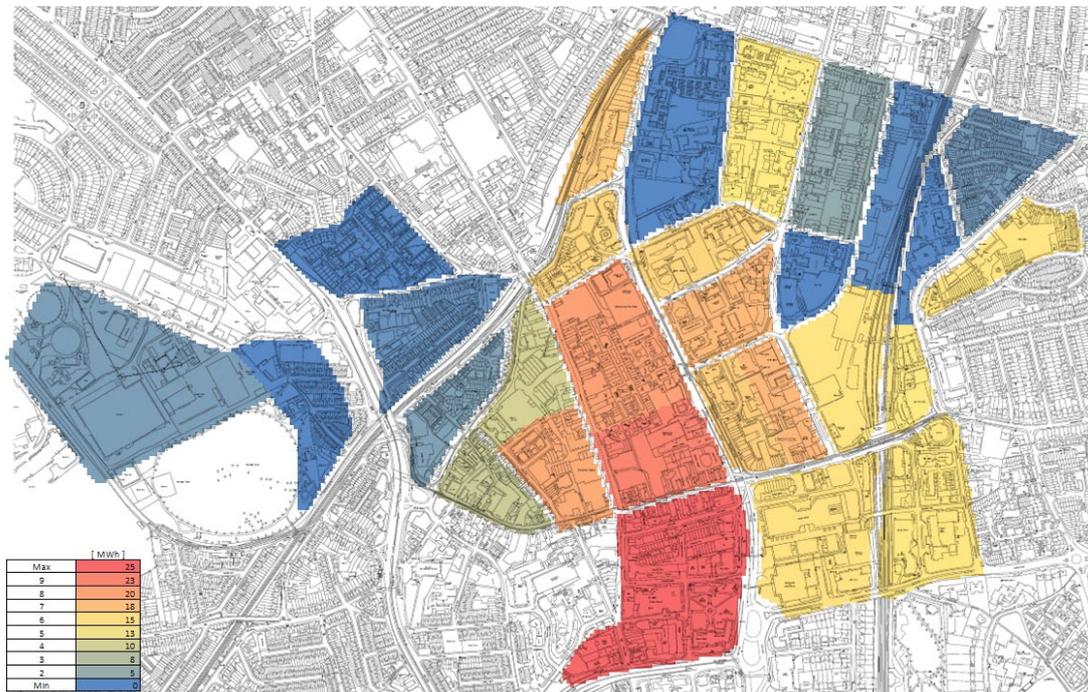


Figure 12 Present day Croydon – Cooling peak demand (MW)

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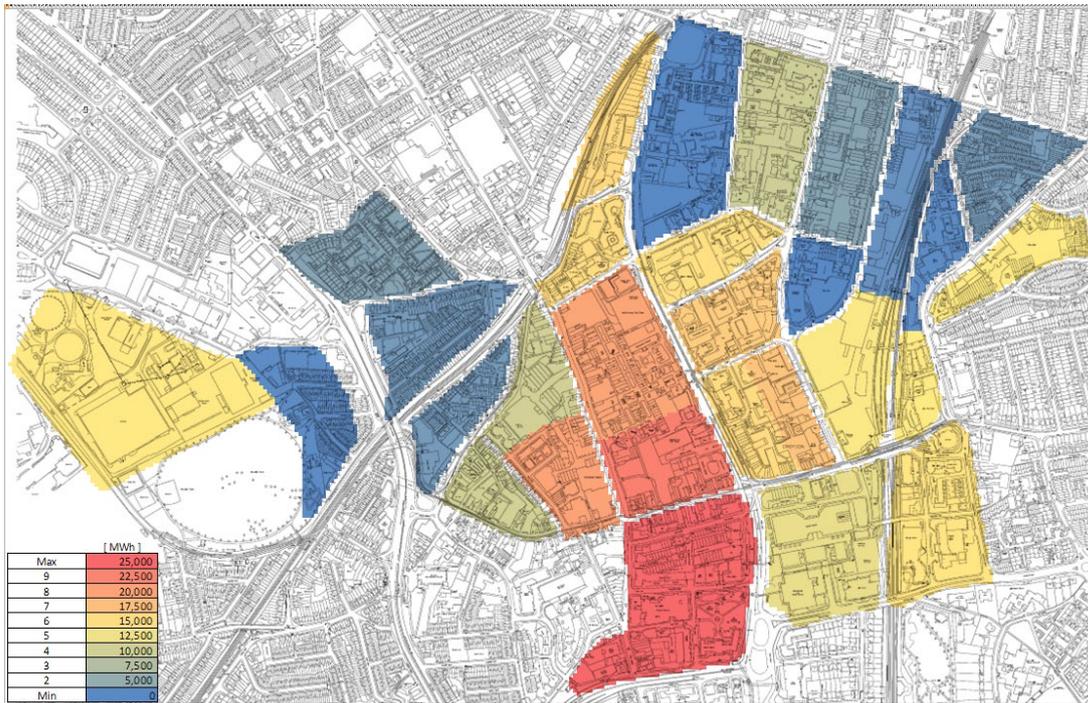


Figure 13 Present day Croydon – Electricity energy demand (MWh)

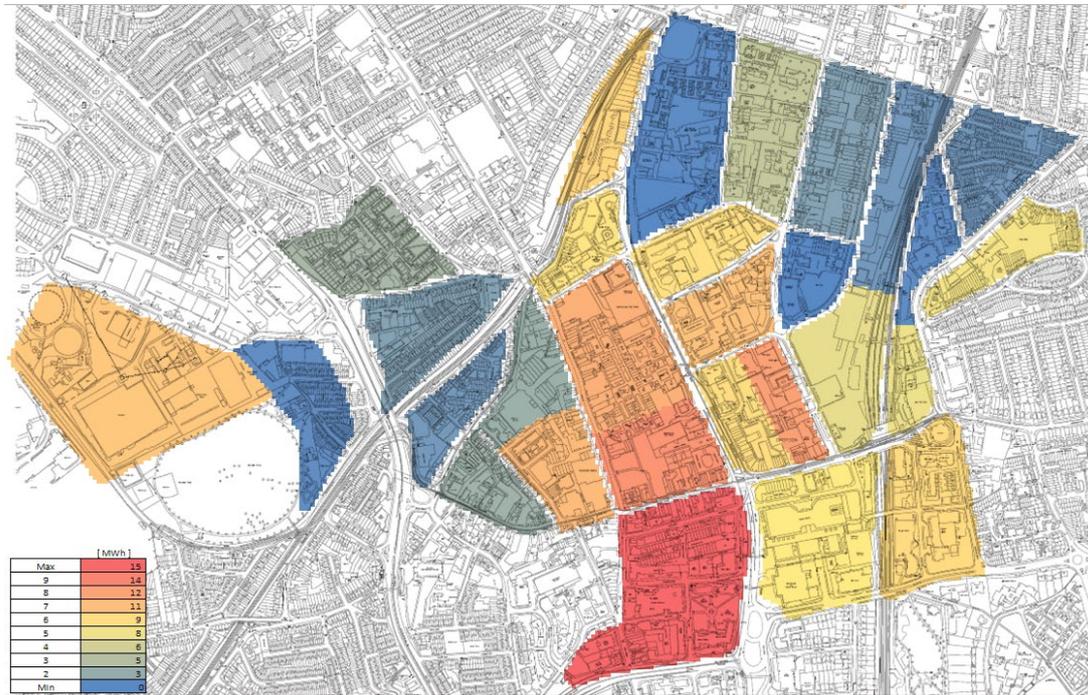


Figure 14 Present day Croydon – Electricity peak demand (MW)

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2) Future Croydon town centre beyond year 2015 with business as usual and no DE scheme is implemented

If business carries on as usual in the Croydon town centre and without the consideration of decentralising part of the town centre energy demands, new developments coming online in the coming years will lead to a significant increase in its energy demand. The *heat map* in Figure 15 demonstrates how the heating energy demand changes in the affected Energy Clusters beyond year 2015.

Please note that the scale has changed in Figure 15 compared to the common scale used in Figure 9 to 14.

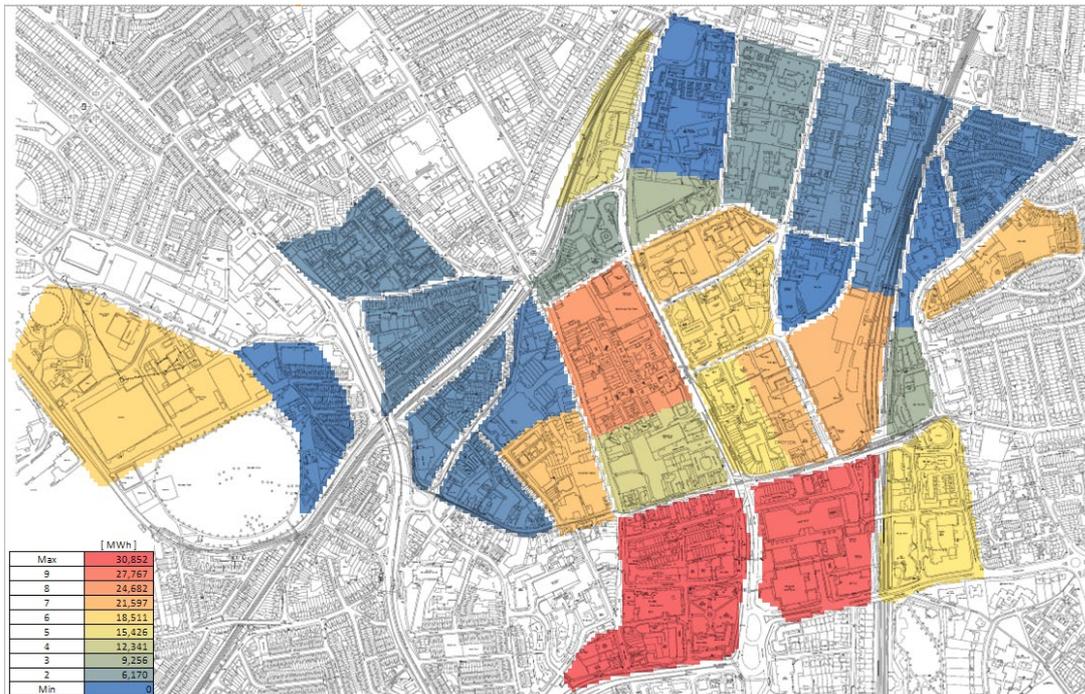


Figure 15 Business as usual beyond 2015 Croydon – Heating energy demand (MWh)

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3) Future Croydon town centre by year 2015 with DE scheme in place and the listed potential customers connect to the scheme

Figures 16 and 18 show the annual heating and cooling energy demand and Figure 17 and 19 show the peak demands of the Energy Clusters in the town centre. It can be seen that overall the town centre energy demand remains the same, although in reality, there will be some fluctuations due to minor developments and changes in the town centre not being capture in this scope of study.

What is also apparent on the *heat maps* is the immergence of concentrated energy levels where the proposed Energy Centres are located. This in effect is the energy capacity to be provided by the Energy Centre to the buildings that have connected to the DE scheme.

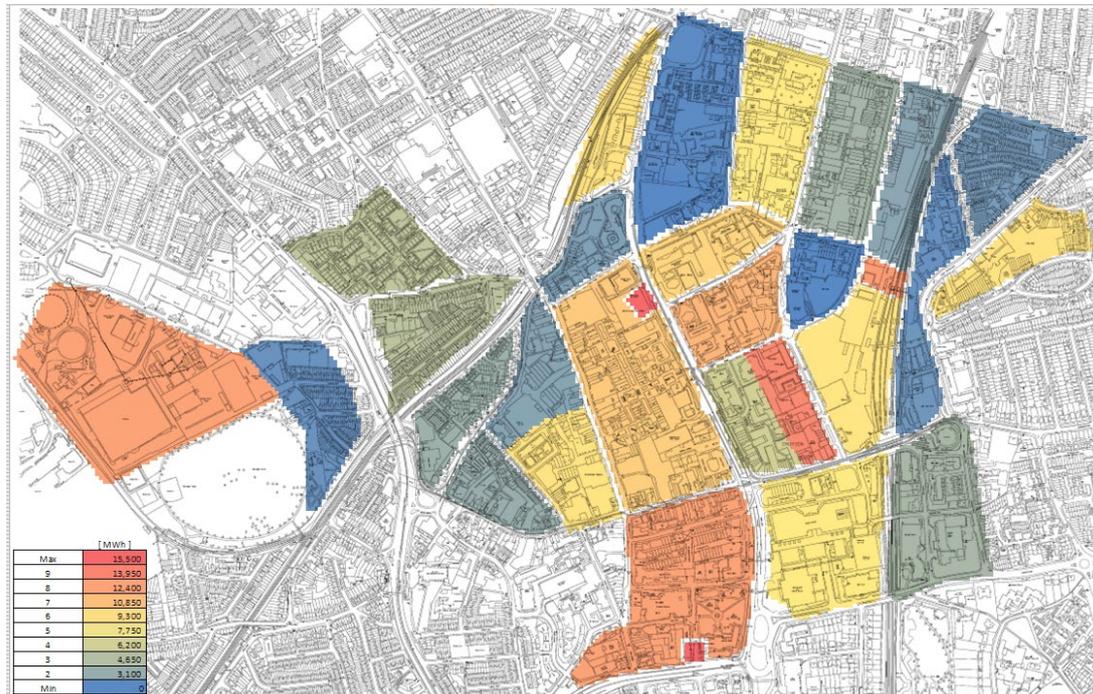


Figure 16 By 2015 Croydon – Heating energy demand (MWh) and capacity of heat energy to be supplied by Energy Centres in MWh

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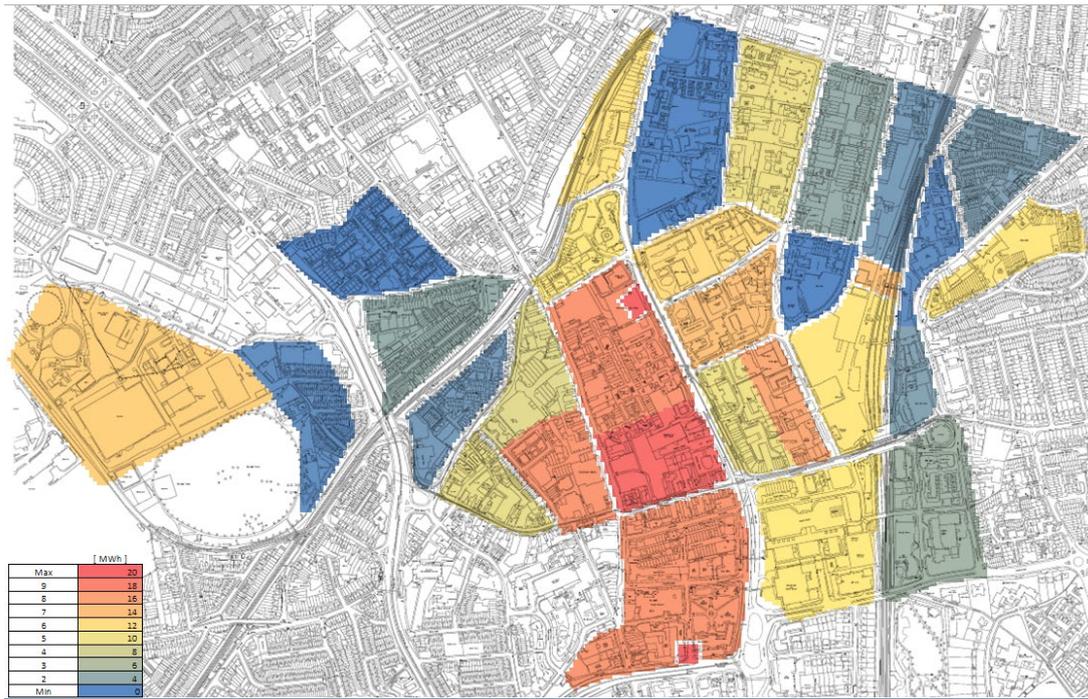


Figure 17 By 2015 Croydon – Heating peak demand (MW) and peak capacity of heat to be supplied by Energy Centres in MW

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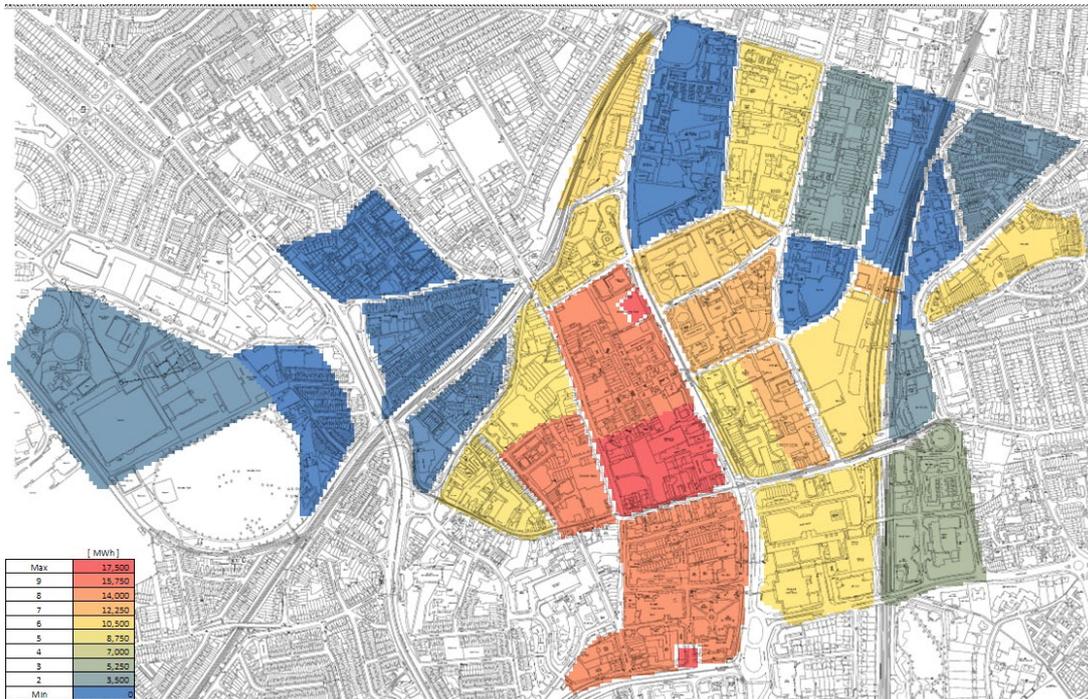


Figure 18 By 2015 Croydon – Cooling energy demand (MWh) and capacity of cooling energy to be supplied by Energy Centres in MWh

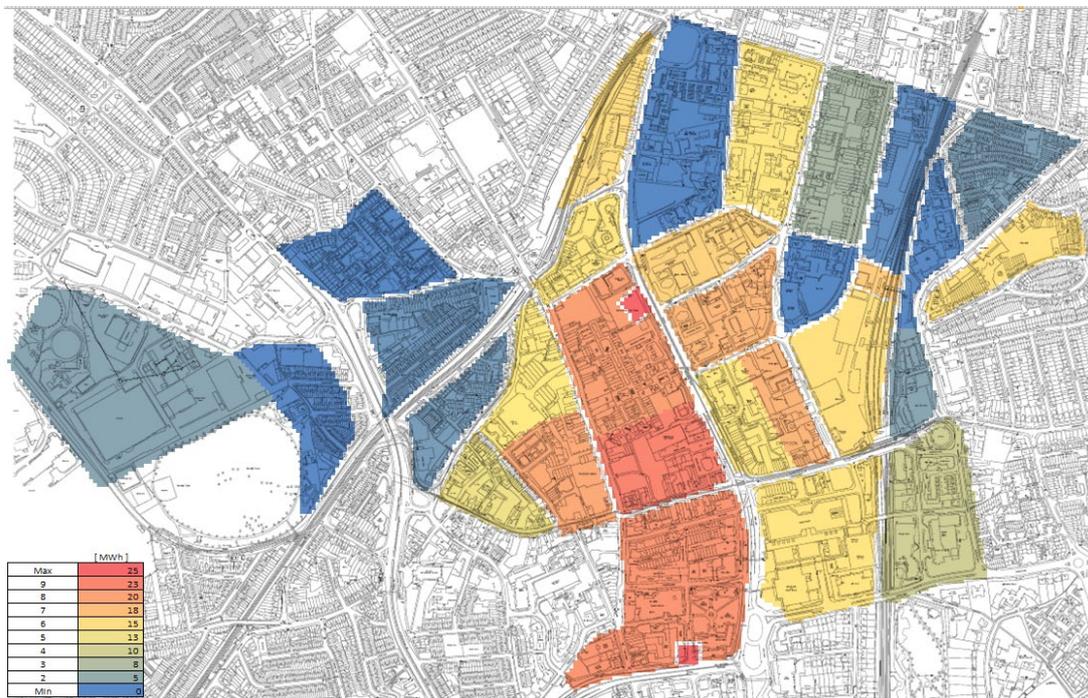


Figure 19 By 2015 Croydon – Cooling peak demand (MW) and peak capacity of cooling to be supplied by Energy Centres in MW

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4) Future Croydon town centre beyond year 2015 with DE scheme in place and the listed potential customers connect to the scheme

Beyond year 2015, more new developments come online and their energy demand are continuously offset and provided by their respective Energy Centre. This alters the landscape of the *heat maps*, however, only locally at the Energy Centres. Again, in reality, there will be some fluctuations in the energy demand in the other areas due to minor developments but this is not captured in this scope of study.

Figures 20 and 22 show the annual heating and cooling energy demand and Figure 21 and 23 show the peak demands of the Energy Clusters in the town centre.

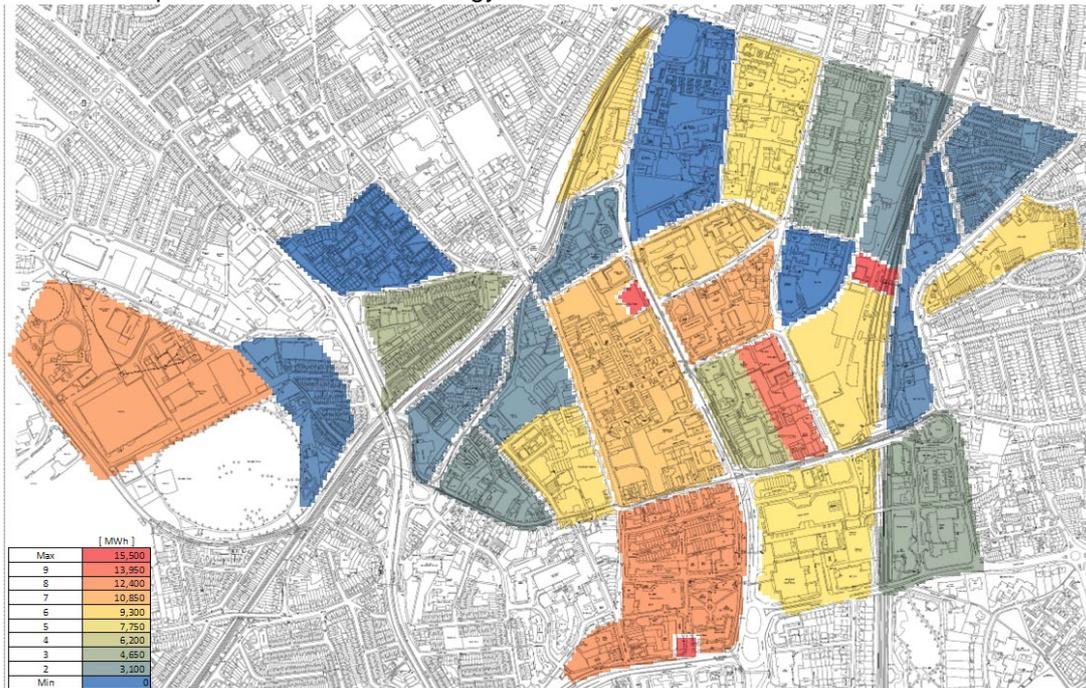


Figure 20 Beyond 2015 Croydon – Heating energy demand (MWh) and capacity of heat energy to be supplied by Energy Centres in MWh

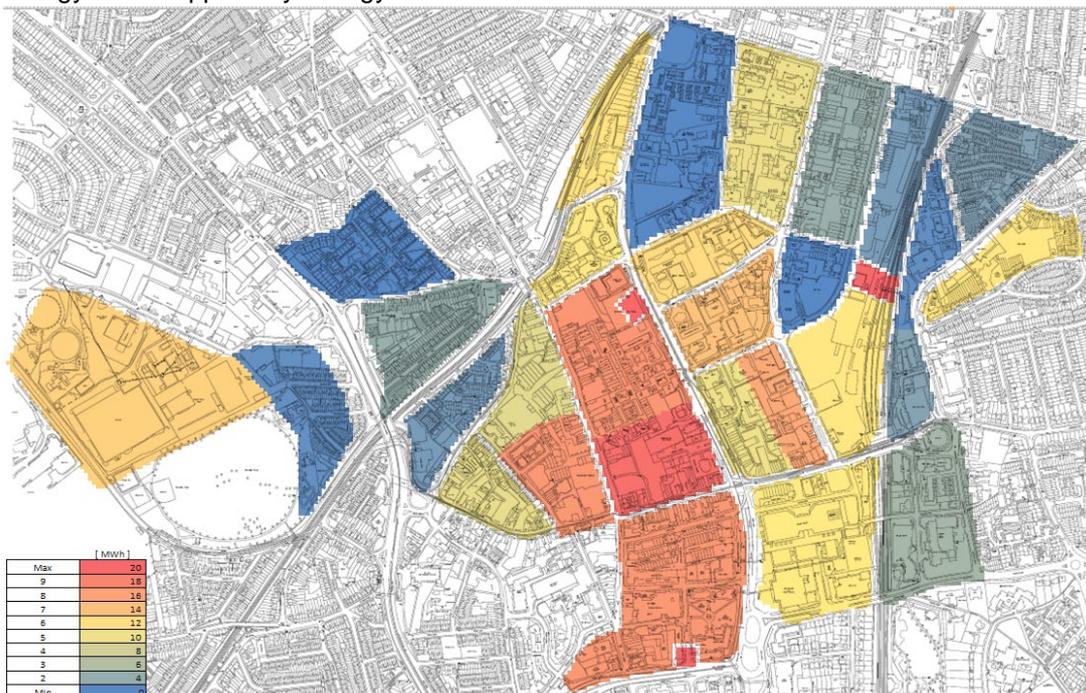


Figure 21 Beyond 2015 Croydon – Heating peak demand (MW) and peak capacity of heat to be supplied by Energy Centres in MW

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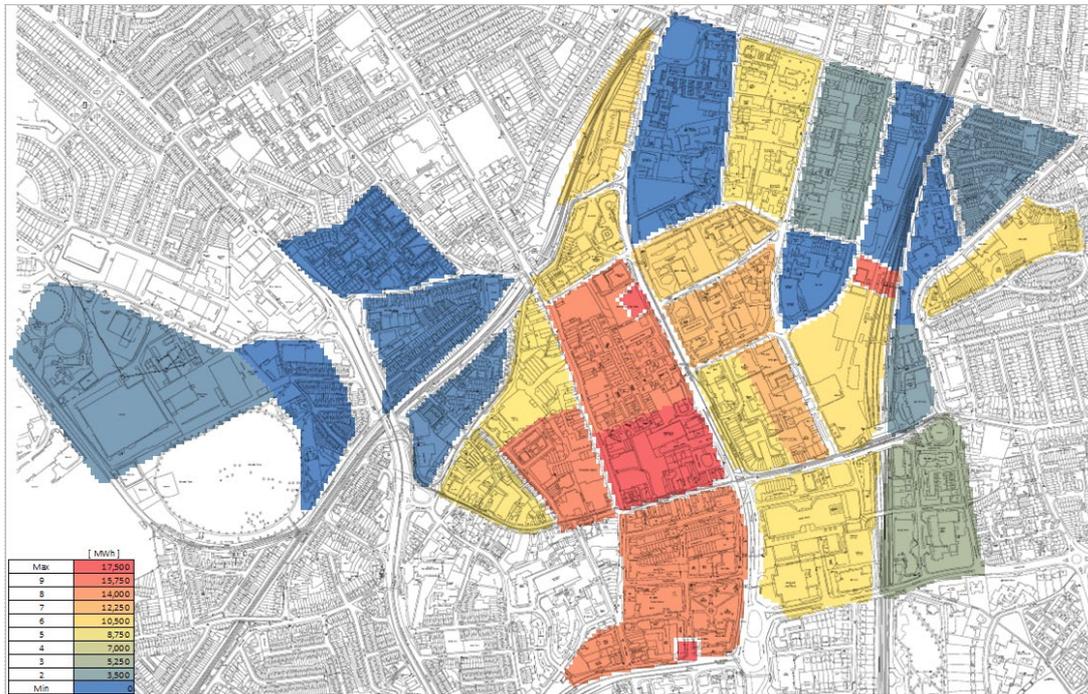


Figure 22 Beyond 2015 Croydon – Cooling energy demand (MWh) and capacity of cooling energy to be supplied by Energy Centres in MWh

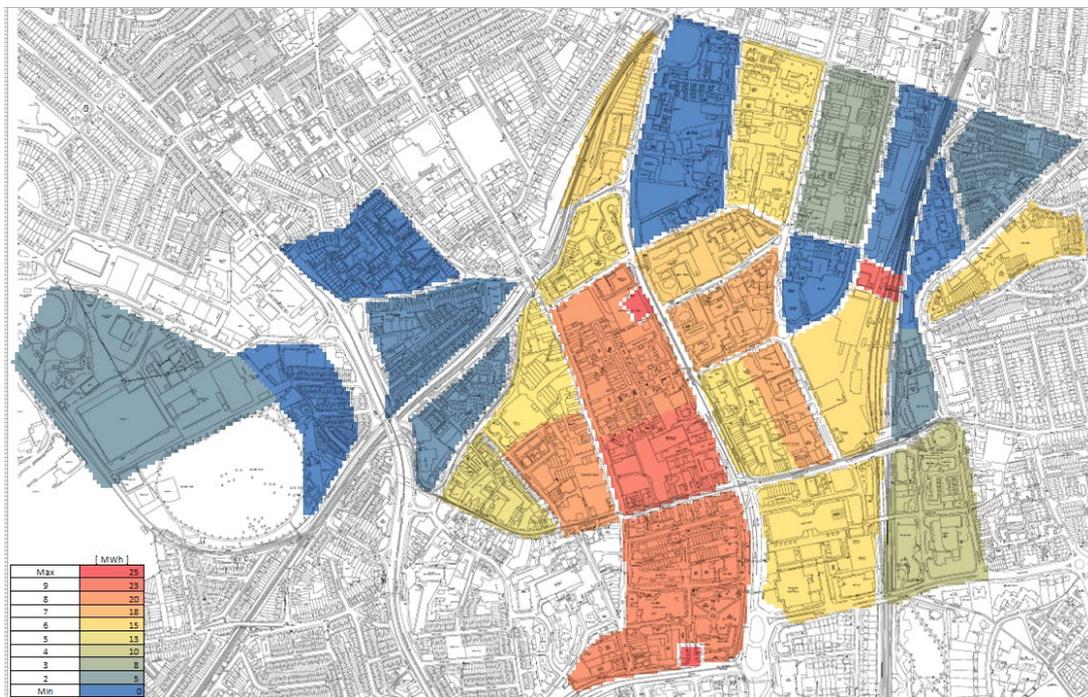


Figure 23 Beyond 2015 Croydon – Cooling peak demand (MW) and peak capacity of cooling to be supplied by Energy Centres in MW