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COLINDALE
ENERGY MASTERPLAN

RAMBOLL

COLINDALE ENERGY MASTERPLAN

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EXECUTIVE SUMMARY

Objectives and Approach

The London Borough of Barnet and the Greater London Authority (GLA) have commissioned Ramboll Energy to undertake a decentralised Energy Masterplan (EMP) study to identify the opportunity for developing a decentralised energy heat network within the Colindale Regeneration Area (CRA).

The purpose of the study is to establish an EMP based on decentralised energy serving the Colindale Regeneration Area, as defined in the Colindale Area Action Plan (AAP). The EMP shall determine the extent of a decentralised energy that has the potential to supply market competitive, low carbon energy to new developments and existing properties.
The specific objectives of this study can be summarised as follows:

- Identify energy loads and determine the current and future energy demand and supply balance.
- Determine an overarching district heating (DH) network connecting to and utilising existing and future low to zero carbon energy sources supplying the identified energy loads
- Determine the environmental benefits in terms of carbon dioxide savings compared with 'business as usual'
- Identify major barriers, issues and constraints (such as crossing major rivers, rail lines, roads; public realm works, etc.) and make recommendations.
- Spatially map the DE vision.
- Establish an incremental DE delivery plan based on consecutive construction phases, clearly identifying where the scheme should be 'kick-started', whether temporary Energy Centres should be considered and taking into account the energy loads development etc.
- Identify indicative costs and revenues for the various phases and appraise financial viability of the proposed DE scheme over its whole life cycle.

Previous Work Undertaken

The London Heat Map for Barnet was completed in May 2010 where five focus areas were identified for district heating. Colindale was ranked highest in the study and it was suggested that a feasibility study was performed to develop the network.

Other Local Authority involvement in DH projects in London

There are a number of DH schemes within London where there has been a role from the public sector in enabling opportunities. Policy is continuing to develop in support of decentralised energy and public work is underway to unlock commercial opportunities for private sector involvement in the delivery of schemes.

Across London DH schemes are being planned and constructed. The successful rollout of some of these schemes will create the backbone of a pan-London DH network.[1] Public sector funding is being applied both to initiate and de-risk projects through a number of initiatives.

Summary findings

The projected long term DH network connected demand within the CRA once all development has been fully built is 41.4 GWh/a. A significant proportion of this is made up by demands from Colindale Avenue and Edgware Road.

A number of possible energy centre locations for the decentralised network have been considered. There are a number of existing and proposed CHP engine sites within the CRA. To make use of existing infrastructure as far as possible Ramboll has investigated existing sites where there is an existing energy centre along-side new demand opportunities in order to help to reduce capital costs of developing an energy centre.

[1] Powering Ahead, Delivering low carbon energy for London, GLA, October 2009

The existing boiler house serving the Grahame Park estate is located to the east of the Grahame Park Estate, is spacious and in good repair. The site has significant future heat demands in close proximity whilst it would make use of existing infrastructure. In this masterplan the use of the existing Grahame Park boiler house as an energy centre for the whole area has been considered to be the main opportunity and is the scenario around which the options appraisal has been conducted.

Heat Network Infrastructure Proposal

The identified route for the district heating network has been chosen taking into account two primary factors: the locations of the primary heat loads and the existing layout of roads and other infrastructure.

In-house hydraulic calculation software has been used to design the required pipe sizes. The resulting pipe schedule has been assigned costs and included in the financial modelling.

Key Economic and Carbon indicators for the DH network

The main conclusions of the economic and carbon modelling indicate that:

- The IRR of the coordinated network over 25 years is 3.6% with carbon savings of over 62,300 tonnes.
- If the coordinated DH network (scenario 1) is progressed but the loads along Colindale Avenue and Edgware Road do not materialise (scenario 3) the carbon savings are estimated to be 52,526 tonnes CO_2 over 25 years.
- For scenario 3 if a junior supply license for the electricity sales can be achieved then the scheme is still an attractive proposition (IRR = 5.0%).
- For scenario 3 if the DH network developer is willing to accept a 40 project lifetime then an IRR of 6.9% is achieved.
- For scenario 3 if a degree of private wire supply is possible such as to Barnet College and other schools in the proximity to Grahame Park then an IRR of 6.8% over 25 years is achievable.

Next steps

Due to the identified internal rates of return of the project, it is likely that London Borough of Barnet will need to play a proactive role in delivering the project, since the appetite amongst the private sector for advancing the scheme alone will be limited.

There are a number of actions required by London Borough of Barnet to progress the District Heating opportunity. Stakeholder engagement, instigating planning related recommendations and safeguarding technical issues will enable the implementation of the District Heating network.

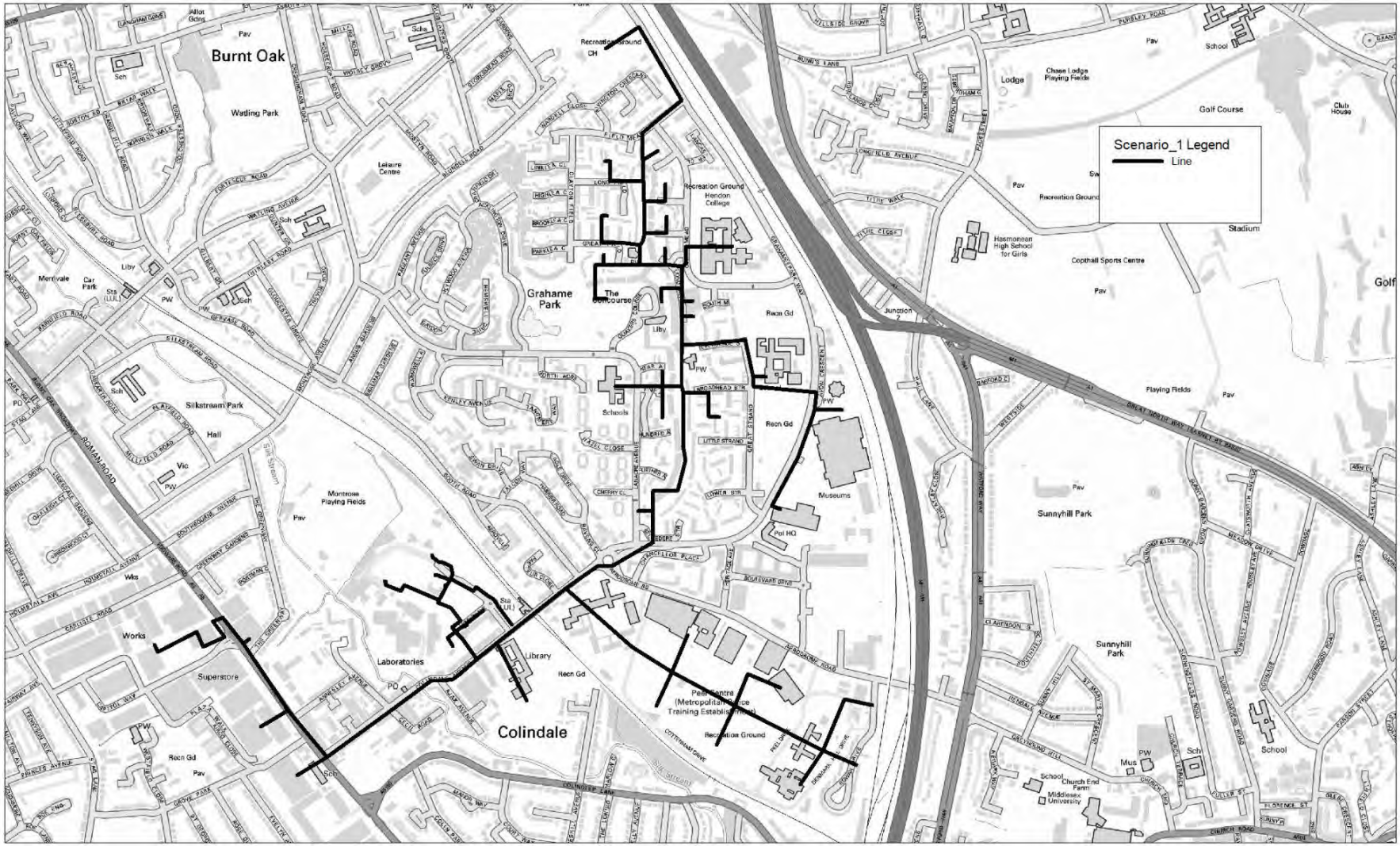

Figure 1 Proposed Scheme Layout

1. INTRODUCTION, BACKGROUND AND METHODOLOGY

The London Borough of Barnet and the Greater London Authority (GLA) have commissioned Ramboll Energy to undertake a decentralised Energy Masterplan (EMP) study to identify the opportunity for developing a decentralised energy heat network within the Colindale Regeneration Area (CRA).

1.1 Background

The study area is predominantly residential buildings with some mixed use developments. The Area Action Plan[2] sets out the framework for future development in the Colindale Area. Colindale has been identified as an area of significant strategic growth in the Mayor of London's spatial development strategy.

The CRA covers an area of approximately 200ha with the M1 bordering the east, the Edgware Road the south west and Woodcroft Park the north. The London Plan sets a minimum delivery target of 10,000 homes and 500 jobs for the area.

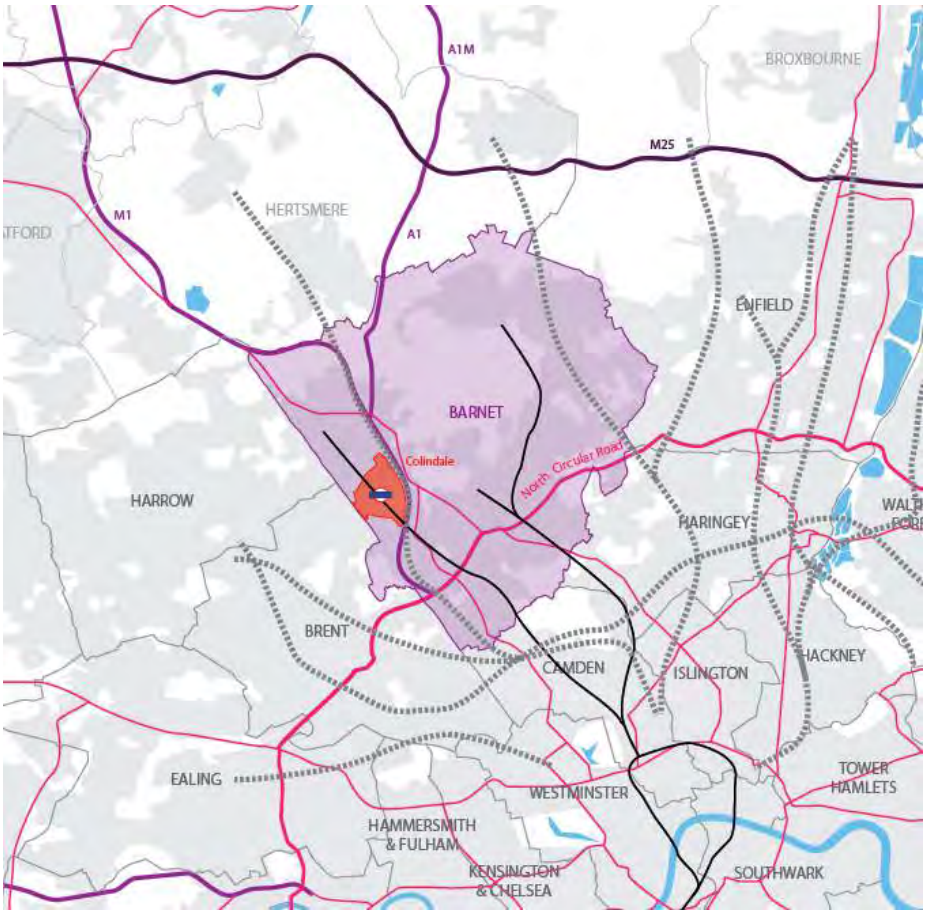

Figure 2 Location of the Colindale Regeneration Area with the London Borough of Barnet

[2] Area Action Plan June 2009 http://www.barnet.gov.uk/downloads/download/774/colindale_area_action_plan

1.2 Objectives

The purpose of the study is to establish an EMP based on decentralised energy serving the Colindale Regeneration Area, as defined in the Colindale Area Action Plan (AAP). The EMP shall determine the extent of a decentralised energy that has the potential to supply market competitive, low carbon energy to new developments and existing properties.

The specific objectives of this study can be summarised as follows:

- Identify energy loads and determine the current and future energy demand and supply balance
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- Identify indicative costs and revenues for the various phases and appraise financial viability of the proposed DE scheme over its whole life cycle.

1.3 Previous Work Undertaken

The London Heat Map for Barnet was completed in May 2010 where five focus areas were identified for district heating. Colindale was ranked highest in the study and it was suggested that a feasibility study was performed to develop the network.

1.4 Other Local Authority involvement in DH projects in London

There are a number of DH schemes within London where there has been a role from the public sector in enabling opportunities. Policy is continuing to develop in support of decentralised energy and public work is underway to unlock commercial opportunities for private sector involvement in the delivery of schemes.

Across London DH schemes are being planned and constructed. The successful rollout of some of these schemes will create the backbone of a pan-London DH network.[3] Public sector funding is being applied both to initiate and de-risk projects through a number of initiatives.

A description of four decentralised schemes which are being developed with Local Authority involvement in London is given below:

1.4.1 London Borough of Islington

The London Borough of Islington is developing district heating schemes that will be comprised of housing and leisure stock which build upon an existing DH network. The London Development Agency (LDA) is providing technical and procurement support to Islington as well as initial match funding to cover development costs. Capital for one of the schemes is to be funded through the Mayor's Innovation and Opportunity Fund. The Bunhill scheme is currently in transition from feasibility to detailed design.

1.4.2 Gospel Oak (Camden) DH scheme

The Camden DH scheme sources waste heat rejected in the exhaust gases of an existing gas turbine located at the Royal Free Hospital (RFH) in London. The scheme delivers 1,500 kW of heat to 1450 apartments in 6 residential blocks owned by Camden Council. The total distance of pipework is over 1km at pipe size varying from 200ø to 100ø. This scheme is now operational.

[3] Powering Ahead, Delivering low carbon energy for London, GLA, October 2009

1.4.3 Greenwich Peninsula

The Homes and Communities Agency (HCA) together with the London Borough of Greenwich have successfully attracted funding of £7.8 million to progress a decentralised energy scheme delivering low carbon energy at Greenwich Peninsula. The infrastructure will have the potential to supply power and heat to 13,000 homes and significant business users together with the further potential to connect to the proposed London Thames Gateway Heat Network. Together with Greenwich Peninsula Regeneration Ltd, they are exploring practical solutions to facilitate delivery. The scheme is progressing at the basic design stage.

1.4.4 Vauxhall / Nine Elms / Battersea Opportunity area

The Vauxhall, Nine Elms, Battersea Opportunity Area (OA) Energy Masterplan (EMP), developed by the LDA, has determined that the proposed developments will be sufficiently dense and diverse to support a low carbon decentralised energy network. The scheme could initially supply heat to developments in the heart of Nine Elms, the Battersea Power Station (BPS) and the New Covent Garden Market (NCGM), with the potential to expand northwards to the Albert Embankment and west to existing industrial sites. Currently the Battersea Power Station Energy Centre is being investigated as a supply for future demands.

A - Whitehall and Pimlico
B - Euston Road District Heating Scheme
C - South Bank Employer Group
D - Cranston Estate Retrofit
E - Islington District Heating Schemes
F - London Thames Gateway Heat Network
G - Leopold Estate Regeneration
H - Victoria Transport Interchange (VTI) Scheme Land Securities
I - Brent Cross and Cricklewood, Hammerson and Brookfield Europe
J - Southwark MUSCo
K - King's Cross Central
L - South East London Combined Heat and Power (SELCHP)
M - Riverside Resouce Recovery Limited (RRRL)
N - Olympic Fringe
O - Greenwich Peninsula
P - Vauxhall/Nine Elms/Battersea OAPF
Q - Lower Lee Valley DE
R - Upper Lee Valley OAPF
S - White City OAPF

Figure 3 Locations of decentralised energy schemes in London as given in the GLA's Powering Ahead document [4]

[4] Powering Ahead, Delivering low carbon energy for London, GLA, October 2009

1.5 Report Structure

The report is presented in nine main sections.

Section 2 presents the results of an energy demand appraisal that has been carried out as part of this project. This has resulted in a heat map to 2055.

Section 3 presents an energy supply appraisal. This identifies existing, planned and potential future low carbon supply sources within the study area and establishes associated costs and carbon content of heat production.

An appraisal of the heat network opportunity has been carried out in Section 4. A number of potential scenarios have been developed, modelled and characterised in terms of key economic and carbon performance indicators. A sensitivity analysis of the identified opportunities and an outline phasing plan have been presented

In Section 5, heat network infrastructure proposals together with a route assessment are presented and in Section 6 a brief description is given around a possible operational structure to support the identified opportunity.

An outline risk assessment is presented in Section 7 of the report and recommended next steps and an implementation plan are presented in Section 8

Assumptions, energy demand, supply and heat network opportunity maps and cost and carbon plans for identified opportunity are presented in a series of Appendices.

2. ENERGY DEMAND APPRAISAL

This section explores the heat demand within the Colindale study area. The peak heat demands and phased timescales of demand will form the basis of determining a heat network strategy. The heat demand information has been collected from a variety of sources as is described in Appendix 1. The heat demands presented in this chapter are provided as demand per annum.

2.1 Existing and Proposed Developments

There are a number of existing and proposed developments which have been considered within this study as potential heat network customers. The demands follow the AAP designations and the numbering system has been preserved with some additions. Not all the AAP development sites have been included in the proposed heat network whilst other developments not in the AAP have been examined for inclusion (see AAP numbering in Figure 4).

Four principal clusters of heat demand have been identified within the Colindale study area including both existing and planned developments. The clusters are shown in Figure 4 below. These are identified as: Grahame Park, the Peel Centre, Colindale Avenue and Edgware Rd.

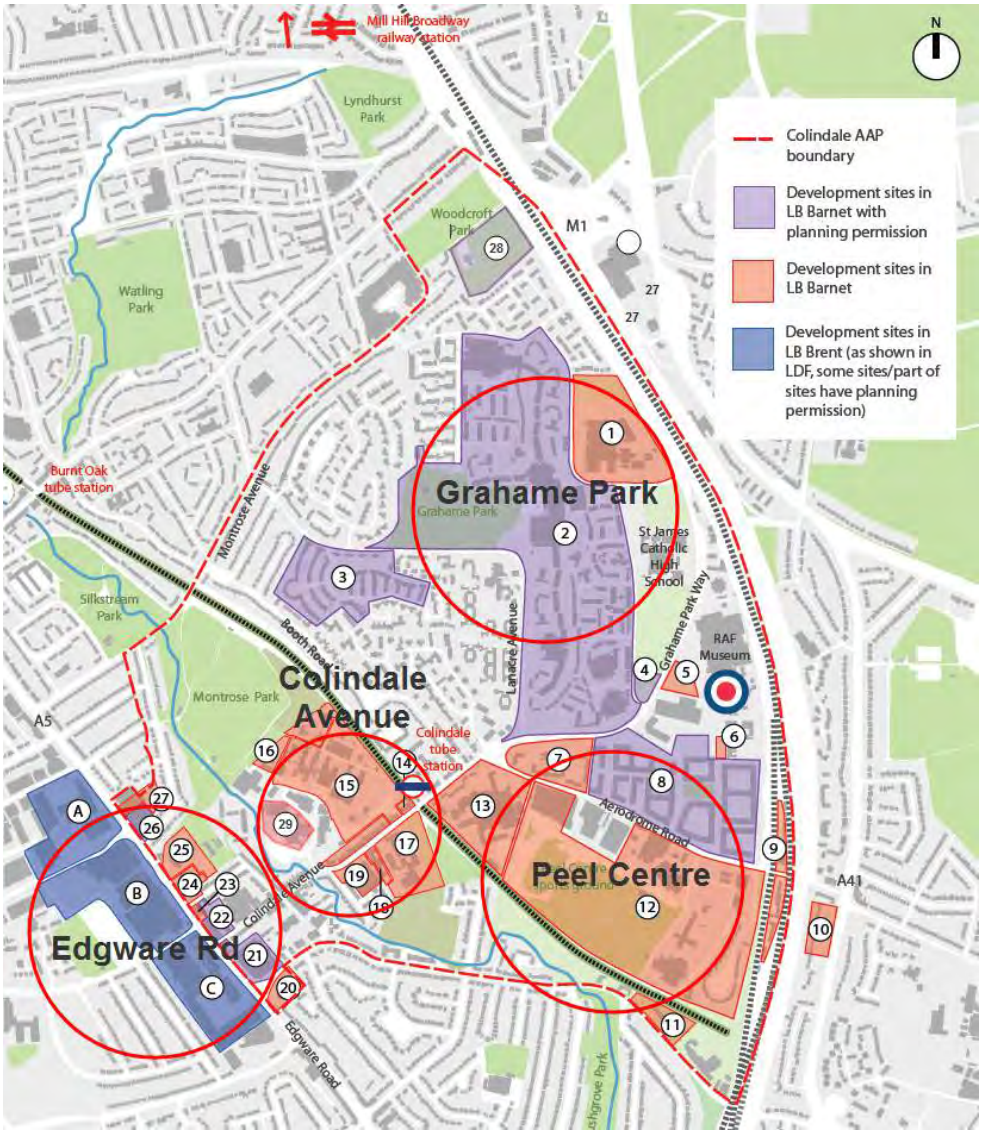


Figure 4 Plot from the Area Action Plan (AAP) Showing the Numbering System

2.2 Centres of Development by AAP designation

2.2.1 AAP 1 Barnet College Site (old) Barratt Homes development

Barnet College is moving to a new Grahame Park Site to the west of Lanacre Avenue. A new housing development is planned for the old Barnet College site. A planning application has been recently been submitted for 396 new residential units. Sixty percent of the development will be apartments while the remaining 40% will be detached units. Barratt homes are reserving a site within the development for a secondary school. Currently the planning submission incorporates two centralised gas fired boilers serving the apartment blocks through a community network which is safeguarded for future connection to a district heating network. The development's total heat demand of 760 MWh is expected to be developed by 2017 for possible connection to the network.

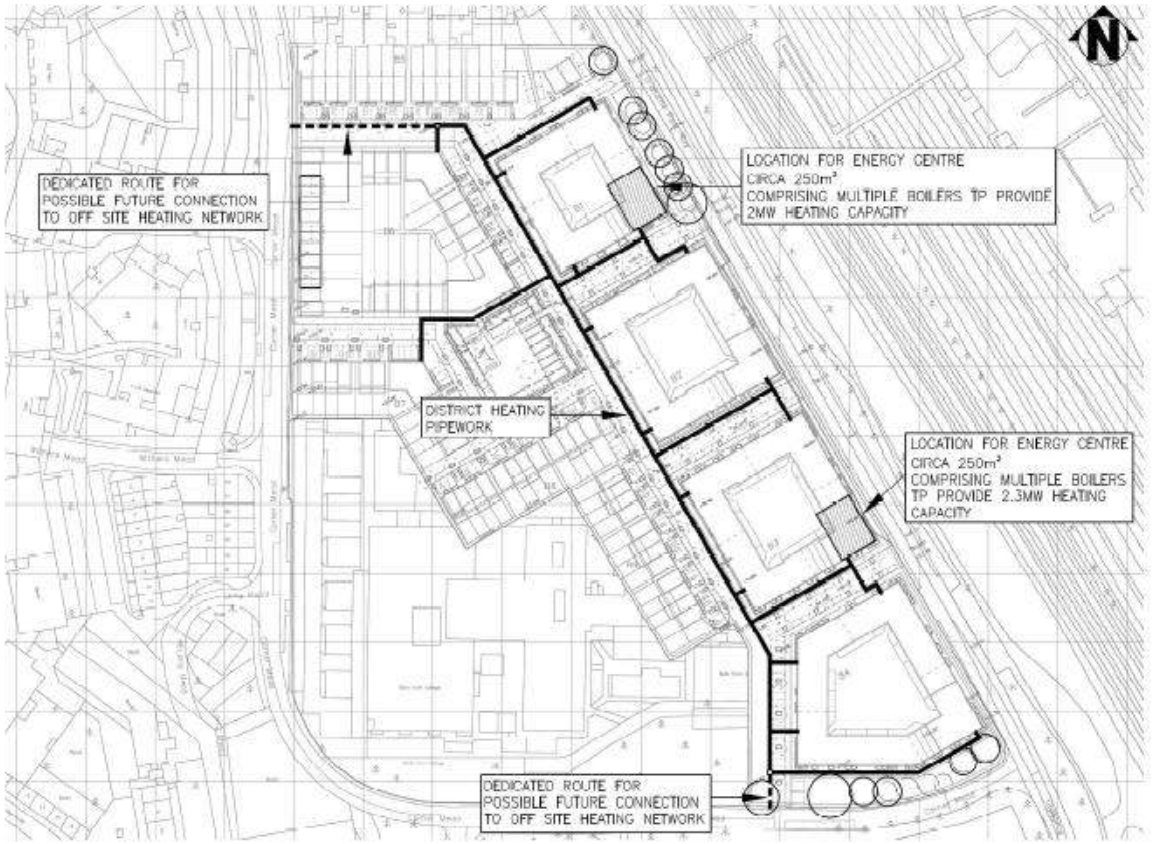


Figure 5 Barratt Homes Development

2.2.2 AAP 2 Grahame Park

The overall vision for Grahame Park (including Phases D1, D2, D4 and D6) is for a total of 3,434 units, of which approximately 1000 are refurbishments of existing homes.

The Grahame Park development comprises a number of construction phases, some of which have already taken place or are in the process of construction. Phases A to C will approximately follow an alpha-numeric older, with A1 expected to commence in 2016. Phase D6 to the east of the Grahame Park site is now complete, while phases D1, D2 and D4 to the south of the site are under construction. Phase D demands are understood not to be future proofed for connection to a DH area network.

Figure 6 Grahame Park Masterplan by Phase

The development of Grahame Park by phase is presented in Table 1. The first developments could be connected in 2017. This assumes DH network construction commencing in 2016. The final Grahame Park development, E2, would be connected in 2027.

Area of Development	Heat on Year	Annual Heat Demand (kWh)
A1	2017	739,968
A2	2017	460,339
A3	2018	829,670
B1	2019	320,410
B2	2020	251,597
B3	2021	276,826
B4	2022	155,520
C1	2023	1,228,378
C2	2024	276,634
C3	2025	869,530
C4	2026	596,160
E1	2026	971,520
E2	2027	615,514

Table 1 Grahame Park Heat Loads by Phase

In the short term there is significant heat demand from the existing Barnet Homes owned Grahame Park. This load is due to steadily decline and is supplied by an existing DH scheme served by an existing energy centre. The loads from the existing Grahame Park DH and the developments that have already occurred at D1/D2/D4/D6 are not included in the proposed area wide DH network because all have been built with individual gas boilers.

Barnet College shall be relocating to a location in the south west corner of the site adjacent to Lanacre Avenue. The intention is to realign Lanacre Avenue to the east in order to provide space for Barnet College. The College could be available for connection in 2017 with a load of 91,524 kWh.

2.2.3 AAP 3 Adastral South

The 318 homes are now complete and this is considered a missed opportunity for connection to a DH network due to being installed with individual gas boilers within each of the flats.

2.2.4 AAP 4 Runway Close

This has not been considered for the area heating network due to having been developed with individual gas boilers.

2.2.5 RAF Museum (existing) and AAP 5 and 6 (Planned Development)

There are plans for longer term redevelopment (AAP 5 and 6) but these have been put on hold and it is not known when this will occur. The building management at the RAF museum are in the process of developing a strategic plan for the 2018 centenary and within that plan the Museum Hall usage will change and so will the consumption. The site is split between two main developments; the Bomber/Camm Hall to the north (2,355, MWh) and the Battle of Britain Hall to the south (480 MWh). The existing boiler house is identified in Figure 7.

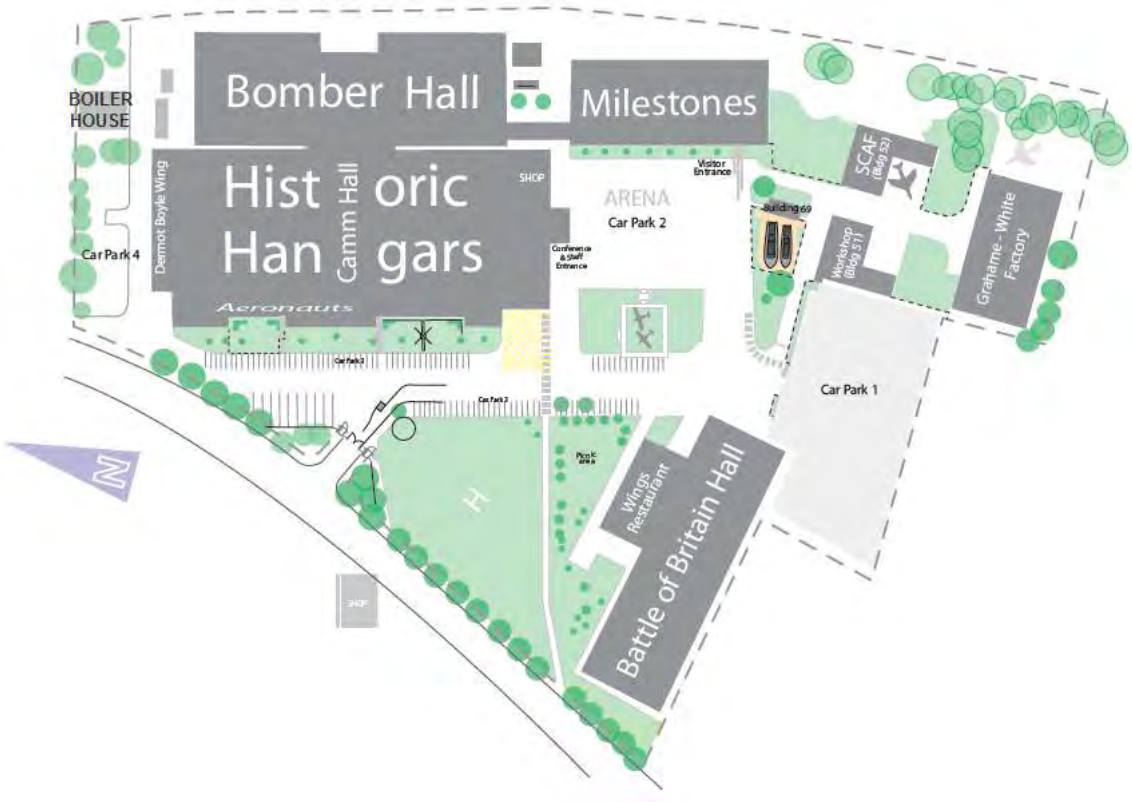


Figure 7 The RAF Museum Showing the Building Layout with the Existing Boiler House to the North

The RAF museum boiler plant (installed capacity of 2.9 MW) is nearing the end of its life and the museum's owners are keen to engage in a district heating scheme. Consultants were recently engaged to determine the cost of replacing plant and determined the cost to be £1.3M. Boiler tubes are regularly being replaced to keep the system operational whilst the chimney stacks also need replacement.

There are plans for longer term redevelopment but these have been put on hold and it is not known when this will occur. One of the options that the RAF museum is considering is the potential for a CHP gas engine or turbine.

The boiler house to the north of the site produces heat for most of the site. There are plans to extend the wet heating system to the Bomber Hall. It is currently served by radiant gas fired tubes. The Battle of Britain Hall is considered geographically too far from the boiler house for a connection there and has its own heating system. However, a future district heating network running along Grahame Park Way would present an opportunity to convert this building to operate on a wet heating system for the first time.

2.2.6 AAP 7 Middlesex University Student Accommodation

The early stage plans for Platt Halls within Middlesex University are a 1500 bed residential development over a 5 year development horizon. The long term contract is with Viridean but timescales are unclear and negotiations are ongoing. The heat demand for Platt Halls, which could be connected to the DH network is 591 MWh. The University of Middlesex has also proposed a Halls of Residence to the east of the Peel Centre with a demand of 1,069 MWh.

2.2.7 AAP 8 Beaufort Park

A total of 3,000 homes have been either been built or have received planning approval for construction with individual gas boilers. This development is considered to be a missed opportunity for the purposes of the DH area network.

2.2.8 AAP 9 Land in Between the Railway Lines

This has not been considered as part of the DH network opportunity since it is a relatively small demand with potentially very costly connection requirements due to its location (possibly requiring horizontal drilling under the railway).

2.2.9 AAP 10 Watford Way

This has not been considered as part of the DH network opportunity since it is a relatively small demand with potentially very costly connection requirements due to its location (possibly requiring horizontal drilling under the railway).

2.2.10 AAP 11 Farrow House

This has not been considered as part of the DH network opportunity since it is a relatively small demand with potentially very costly connection requirements due to its location (possibly requiring horizontal drilling under the railway).

2.2.11 AAP 12 and 13 Red Row Site (Formerly Peel Centre)

The Peel Centre site is situated on the former Metropolitan Police training complex. A masterplan is under development to include areas of housing, apartments, retail, leisure, school and public amenity space. Additionally a police training academy is proposed and has been granted planning permission. Additional developments at this site include student accommodation for Middlesex University with space for 1,500 people.

The existing police training centre is remaining in its current location, it should be noted that for security reasons it is believed that the police would prefer all heating plant to be on-site or at the very least that adequate redundancy is in place on-site to cover any eventuality. This may make connection to this building problematic and therefore the existing centre will not be included in the heat demand within this study.

Buro Happold is the energy consultant for the scheme and has provided Ramboll Energy (RE) with information regarding predicted energy demands and timescale phasing. The development plans involve an on-site DH scheme with an energy centre likely to be located at the western edge of the site.

The development is expected to take place in four phases. Currently the preferred option for CHP sizing at the site is a 650 kW_{th} gas CHP for phases 1 and 2 followed later by an 850 kW_{th} gas CHP for phases 3 and 4. The developer is understood to be receptive to the opportunity to connect directly to a DH network rather than using its own energy centre under future phases, should there be a DH network in place at the time of this development. There are two opportunities for this connection to occur, at the completion of phase 1 before installation of the first CHP, or at the completion of phase 3, before installation of the second CHP. The developer is likely to agree to the use of temporary gas boilers to supply the network should there be a short time discrepancy between the requirement for heat at the Peel Centre and the completion of a Colindale DH network.

Figure 8 illustrates the location of the proposed energy centre and the location of the development with each phase of construction:

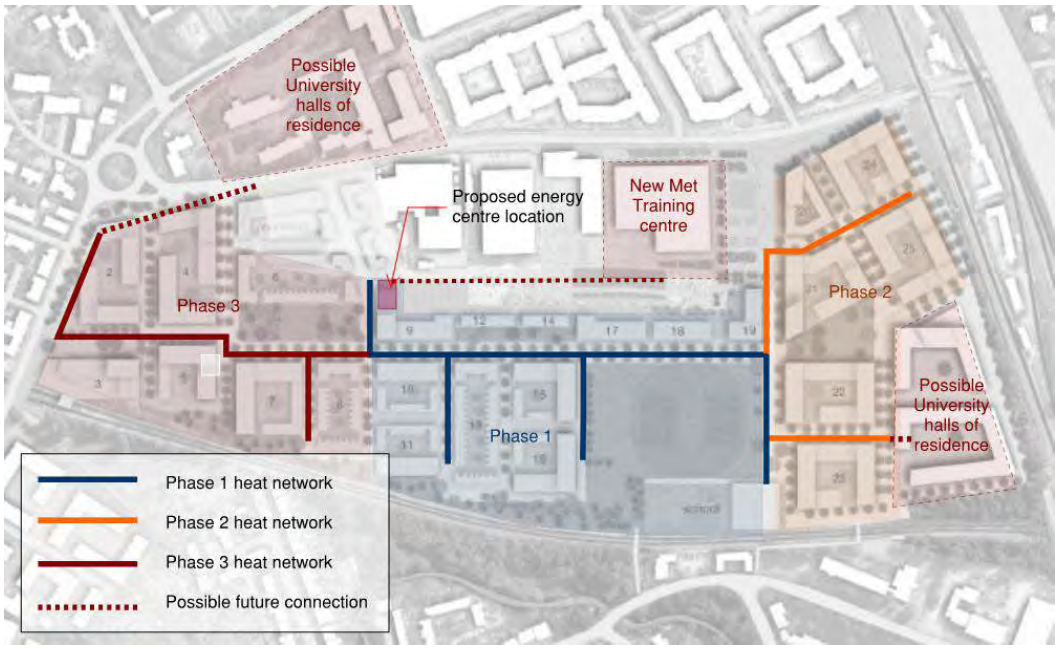


Figure 8 Proposed Decentralised Network at the Former Peel Centre

It is understood that the developer is sizing the proposed community heating network pipes to enable them to be connected to a wider DH network in the future. More specifically, the pipe supplying the North Eastern corner of the development towards Colindale Avenue has been sized to be able to transfer heat to the whole Peel Centre development.

From the energy demand figures provided, the heat demands have been grouped by phase and building type as follows:

Area of Development	Heat on Year Area network	Annual Heat Demand (kWh)
Peel Phase 1 - Houses	2017	518,376
Peel Phase 1 - Apartments	2017	2,698,912
Peel Phase 2 - Business	2018	5,638
Peel Phase 2 - Houses	2018	105,603
Peel Phase 2 - Apartments	2018	3,585,056
Peel Phase 2 - School	2018	127,512
Peel Phase 3 - Retail	2020	46,445
Peel Phase 3 - Business	2020	25,013
Peel Phase 3 - Houses	2020	161,691
Peel Phase 3 - Apartments	2020	3,554,512
Peel Phase 4 - MET Training	2020	230,651
Peel Phase 4 - UoM East	2020	1,068,672
Peel Phase 4 - UoM North	2020	591,376

Table 2 Peel Centre Estimated Heat Demands

2.2.12 AAP 14 Colindale Tube Station House

Ramboll Energy enquired with the building manager at Colindale underground station about potential demands for heat within the station buildings. Currently the limited heating demand for the ticket and back office is provided by electric heaters. It is unlikely that it would be worthwhile making the connection to such a small demand.

2.2.13 AAP15 Fairview Development Colindale Hospital Site

The redevelopment of the former Hospital site by Fairview Homes includes the erection of 726 residential units with a community heating network and energy centre owned and operated by E.On. This energy centre is modular and is currently feeding the Brent Works (AAP 19) via a tunnelled connection under Colindale Avenue. It is believed that a similar arrangement will be reached with the British Library redevelopment site (AAP 17). It is however understood that there is no spare capacity in this energy centre beyond these 2 connections.

A 384 bedroom Aparthotel with restaurant space and commercial space is due to be constructed adjacent to the Colindale Underground Station. This will be also supplied by the Fairview energy centre to the south east of the site.

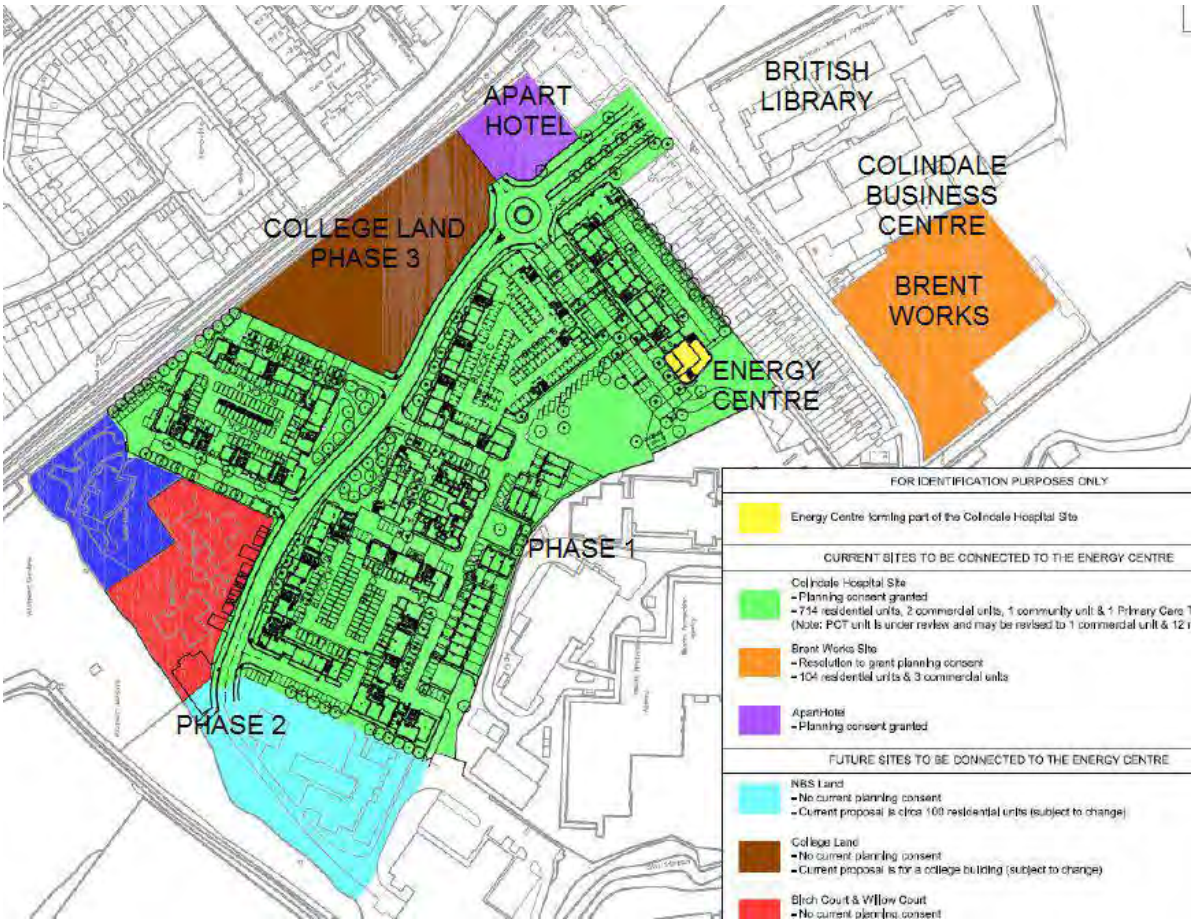


Figure 9 Phase Plan and Location of Energy Centre for the Colindale Hospital Site and Surrounds

The heat demands have been grouped by phase and building type as given in Table 3. The energy centre would need an overhaul after 15 years of operation. At this point i.e. 2030 it would be reasonable to expect that potential for connection to a DH network could be explored and a connection made if the economic proposition were favourable at that time.

Area of Development	Heat on Year Area network	Annual Heat Demand (kWh)
Phase 1 Site 1 Residential	2030	3,418,538
Phase 1 Site 1 Commercial	2030	27,075
Phase 1 Site 1 Retail	2030	99,275
Phase 1 Site 1 Neighbourhood	2030	4,513
Phase 1 Site 2 Brent Works	2030	539
Phase 1 Site 3 Aparthotel Residential	2030	2,000,384
Phase 1 Site 3 Aparthotel Retail	2030	5,616
Phase 2 Site 4 Residential (National Blood Service)	2030	395,000
Phase 2 Site 5 Residential (Birch & Willow)	2030	776,000
Phase 3 Site 6 Residential	2030	770,334
Phase 3 Site 6 Commercial	2030	18,426
British Newspaper Library Site Residential	2030	1,823,912
British Newspaper Library Site Commercial	2030	65,088
126 Colindale Avenue Residential	2030	110,600
126 Colindale Avenue Commercial	2030	7,987

Table 3 Colindale Hospital and Surrounding Estimated Heat Demands

2.2.14 AAP 16 National Blood Service (NBS) Expansion Site

The NBS expansion site heat demand is included within the Phase 2 Site 4 development shown in Table 3.

2.2.15 AAP17 British Library Site

A proposal was submitted in November 2013 for the development of the British Newspaper Library site to be redeveloped into 388 residential units, commercial units and managed amenity areas. The British Newspaper Library area is included within the wider Colindale Hospital Site's heat network scheme described above.

2.2.16 AAP 18 Colindale Business Centre

Colindale Business Centre (126 Colindale Avenue) will feature two, five storey buildings containing a total of 40 flats and commercial office space. The annual heat demand is 111 MWh residential and 8 MWh commercial.

2.2.17 AAP 19 Brent Works

The plan for Brent Works is for 104 new residential units and some additional commercial space. The heat demand is included in phase 1 site 2 of Colindale Hospital is included in that provided by the E.On energy centre.

2.2.18 AAP 20, 24, and 25

London Borough of Barnet has indicated that these development sites are not going ahead.

2.2.19 AAP 21 Zenith House Site

The redevelopment of the former Zenith House comprises the erection of 309 residential apartments has been recently completed. The plans for the site are for a 110kW$_e$ CHP engine producing 181 kW of heat from a single heat network and energy centre with peaking gas fired boilers. Inlets/outlets for connection to a future district heating network have been made. The energy centre is located under the main tower.

Figure 10 Plan of the Zenith House Development Showing the Location of the Energy Centre

Similar to the development at Colindale Hospital, the plant has only recently been installed and therefore it would be reasonable to assume that any connection to a DH network would not occur until an overhaul of the boilers and CHP would be required (after 15 years). Accordingly, a possible connection date of 2030 has been assumed. The annual heat demand for Zenith House residential units is 854, MWh and for the commercial units is 16 MWh.

2.2.20 AAP 22 Kidstop Site

84 residential units and 375m^2 office space have been built at the former Kidstop-National Grid site on the corner of Edgware Road and Colindale Avenue. The energy statement for Kidstop was not available at the Barnet Planning Department but it has assumed that the building which has been completed is provided with heat by community boilers with an annual demand of 4 MWh residential and 0.4 MWh commercial based on benchmarks for the floor plan areas.

2.2.21 AAP23, 26 and 27

Details for the development of the Kwik Fit, Greenpoint and Imperial House sites on Edgware Rd are currently limited and consequently no demand has been assumed connected to the area wide network.

2.2.22 Sites A, B and C

These three sites all sit within the London Borough of Brent, but given their close proximity to the Colindale study area these developments have been included in the masterplan for the DH network.

Development	Description	Annual Heat Demand (kWh)
Site A: Capitol Way	The development contains approx. 460 flats and a total of 5,360 m^2 of retail and commercial space. The site has its own distributed heating system supplied by natural gas CHP. Heat demands were obtained from the planning energy strategy.	2,461,000
Site B: Oriental City	Oriental City comprises 520 residential flats, Far Eastern retail, a Morrisons superstore and a school. A planning energy statement provided floor areas and benchmarking was used to estimate the heat demand.	1,165,000
Site C: Sarena House/Grove Park/Edgware Road	At the time of writing, there was little information available regarding the development at Sarena House. The information available stated 277 residential units and 300 m^2 of commercial space. Benchmarks have been applied to these figures.	534,800

Table 4 Summary of Colindale AAP sites A, B and C

In 2011 the London Borough of Brent published a Site Specific Allocations document outlining ambitions for up to 2,500 new homes by 2026[5]. As only the three developments presented in Table 4 are in the planning, development or completion stage they are the only loads included in the analyses featured in section 5 of this report. However, it should be noted that there may be scope to include additional heat demand at a detailed feasibility stage.

2.2.23 AAP 28 New Orion School, Grahame Park Way

[5] Site Specific Allocations DPD, London Borough of Brent Local Development Framework, July 2011

The New Orion School annual heat energy consumption obtained from the energy statement comprises mostly hot water demand (87%) with the remainder from space heating giving 281 MWh.

2.2.24 AAP 29 Public Health England (PHE) Building

The PHE building could potentially export heat due to the nature of the laboratory processes within the building. It is possible that the PHE building could choose to export heat to a district heating system, however, the grade of heat is unlikely to be sufficiently high to make this worthwhile.

The PHE facility is undecided as to whether to remain at the current site in the long-term.

2.2.25 Summary

The spatial arrangement of the heat demands that are considered connected within the CRA are shown in Figure 11. Both the existing and proposed demands are shown. The year of connection to the area network is also indicated.

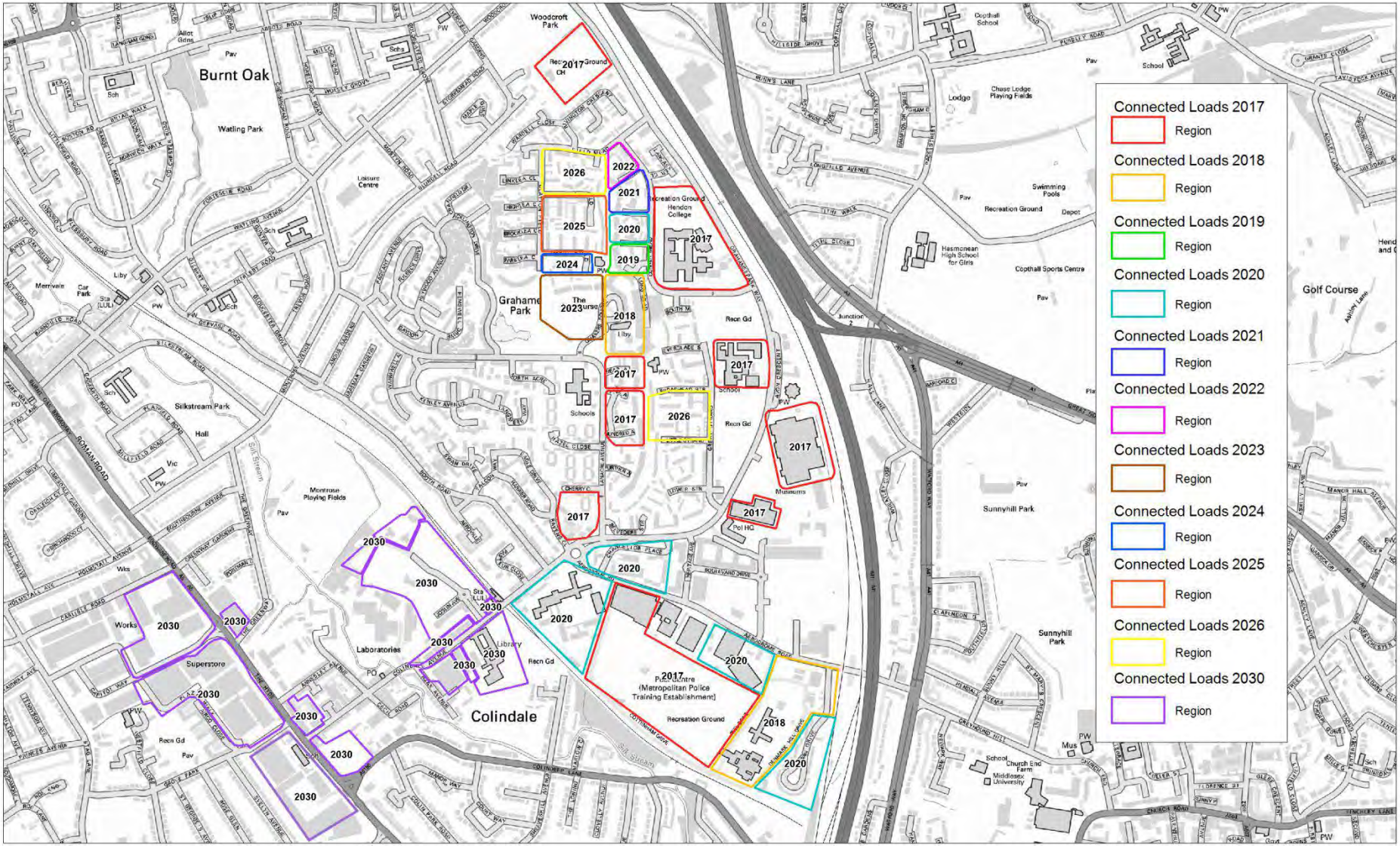


Figure 11 Connected Developments by Year

2.3 Heat Mapping Assessment for Centres of Development

The annual heat demand in each of these areas is presented in Appendix 1. Assumptions made in the process of carrying out this analysis are briefly outlined below and further detail around the basis, methodology and assumptions applied in developing the energy demand appraisal is presented in Appendix 1.

2.4 Heat Demand Phasing

The estimated growth of total annual heat demand on the network over a 25 year project lifetime is shown in Figure 12. This is broken down into areas of development in Figure 13. The projected long term DH network connected demand within the CRA is once all development has been fully built is 41.4 GWh/a.

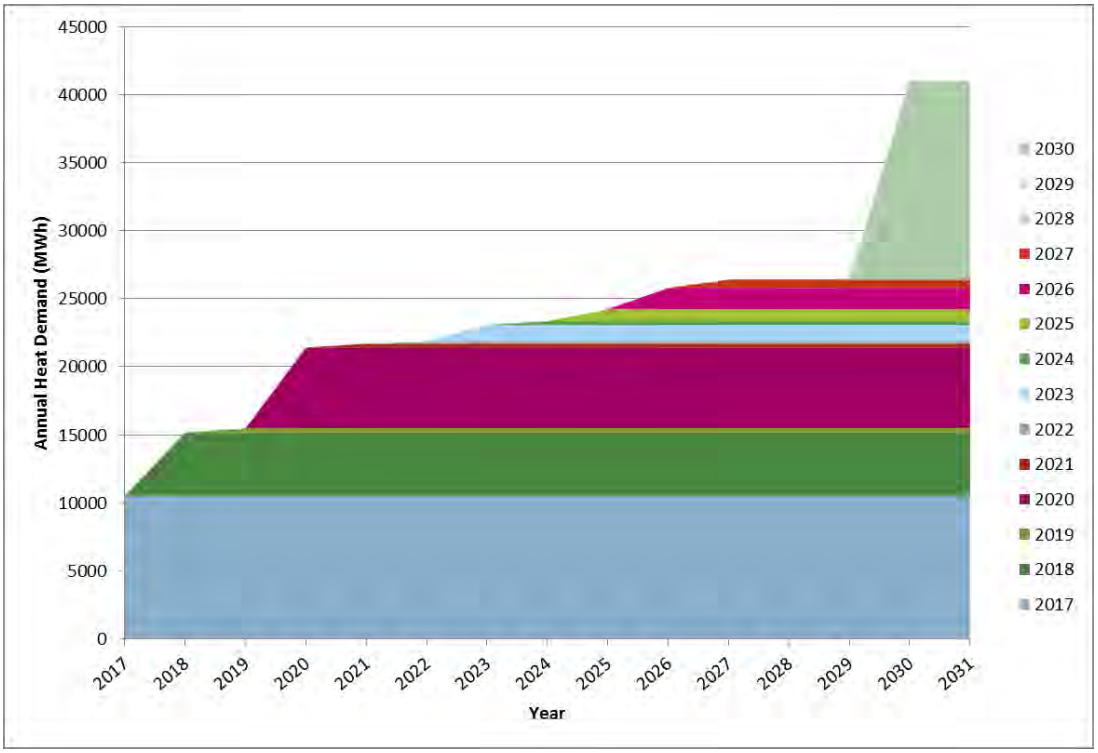


Figure 12 Projected Growth in Heat Demand Over the 25 Year Project Lifetime

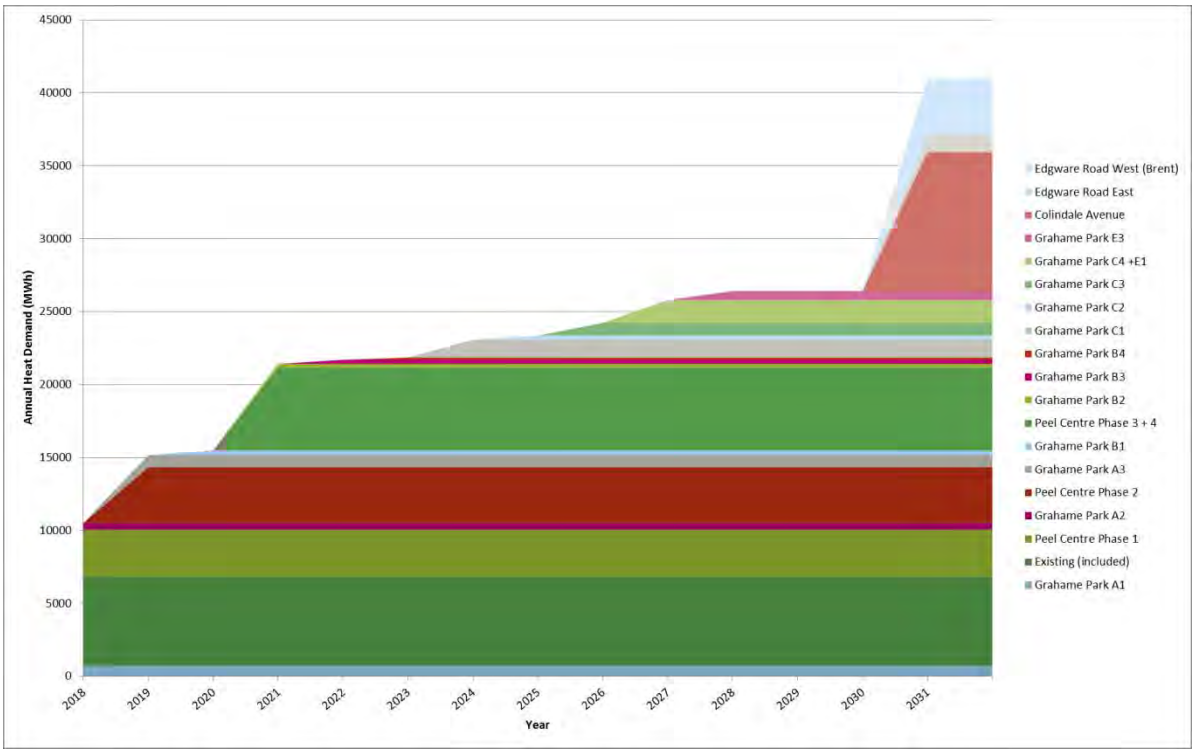


Figure 13 Projected Growth in Heat Demand Shown Per Phase of Development

It is clear that the connection of the Colindale Avenue and Edgware Road sites in 2030 increase the total annual demand by a large proportion and therefore are likely to have a significant effect on the overall project feasibility. However, these demands are connected in 2030 so with an internal rate of return viewed over 25 years the inclusion of these demands could have a detrimental effect. The effect of removing various development areas on the project economics will be explored in Section 4.

A heat map showing the relative size of heat demands in the study area is shown in Figure 14 below. Point load data for heat demands at the various developments are represented as graduated circles. This map shows the anticipated heat demands for all loads considered in the study. Existing demands are demands from existing buildings whilst proposed demands are planned future developments. The clustering of heat demands can be seen quite clearly in this image and it is possible to determine how the finished network may look just from observing the pattern of demands.

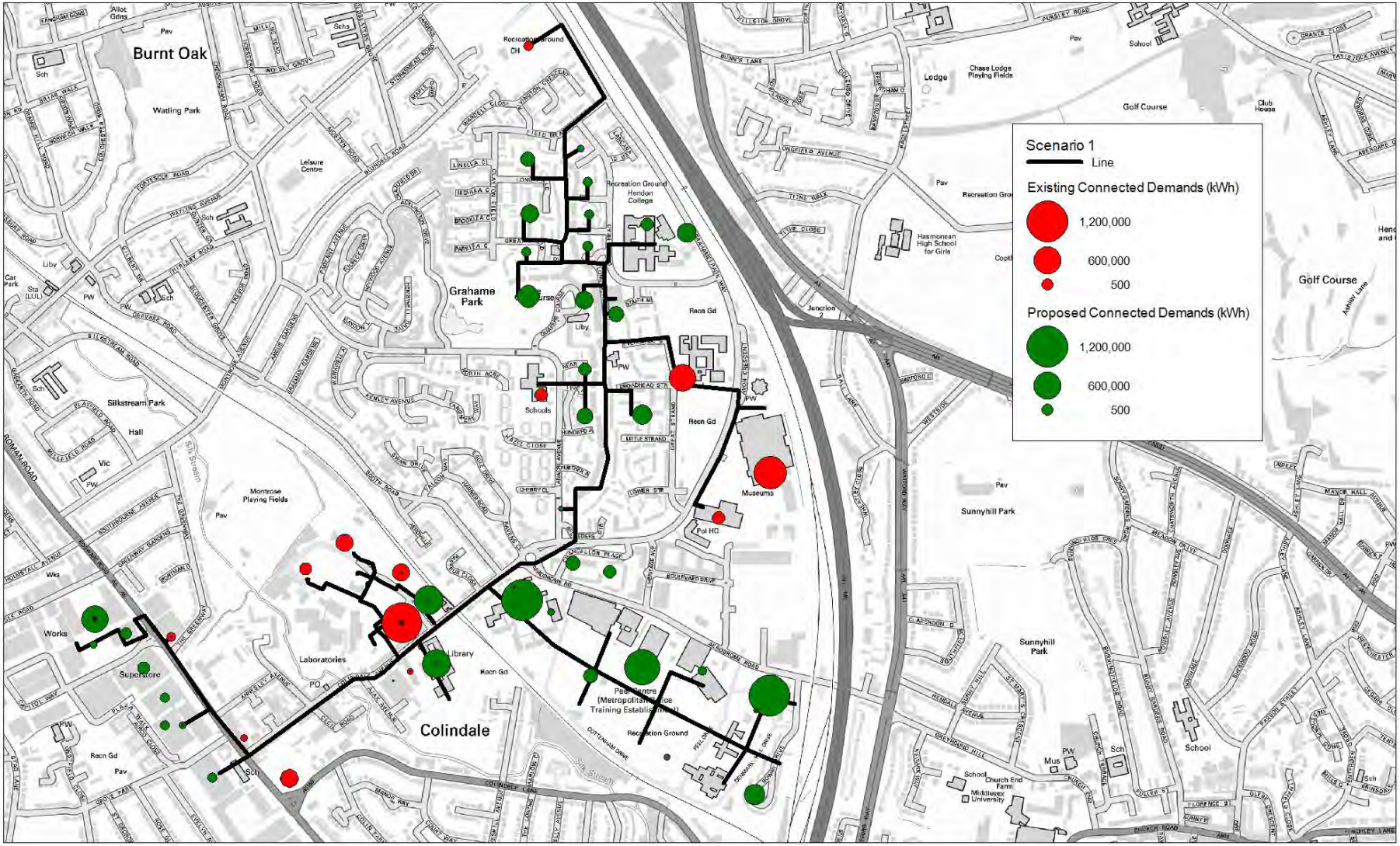


Figure 14 Heat Map and the coordinated network for the Colindale Regeneration Area

3. ENERGY SUPPLY APPRAISAL

This section of the report summaries the relevant heat network supply opportunities identified under this study. Information is presented within the following sub sections.

3.1 Energy Centre location

A number of possible energy centre locations for the decentralised network have been considered (see Figure 15). There are a number of existing and proposed CHP engine sites within the CRA. To make use of existing infrastructure as far as possible Ramboll has investigated existing sites where there is an existing energy centre along-side new demand opportunities in order to help to reduce capital costs of developing an energy centre.

In the Grahame Park Masterplan[6] an energy centre for the Genesis development is indicated adjacent to the Lanacre Avenue at the south western side of the Grahame Park development (phase D1 in Figure 6). This site is a completely new development and does not make use of any existing infrastructure. It is believed that this location has been superseded within Genesis' masterplan and therefore this option has not been perused.

The existing E.On energy centre on the former Colindale Hospital site (see Section 3.3.1) has been considered as a site from which a DH network could be supplied. However, the plant room is tight on space and there is limited room for expansion in the immediate vicinity. This opportunity has therefore been ruled out.

There are plans to develop an energy centre on the Peel Site (see Section 3.4.1). There is potentially significant room for expansion, however, there is no existing infrastructure that can be reused. An area wide energy centre at the Peel site should not be ruled out and although not investigated further in this study could be looked at in a detailed feasibility investigation.

The existing boiler house serving the Grahame Park estate is located to the east of the Grahame Park Estate. The site has significant future heat demands in close proximity whilst it would make use of existing infrastructure. In this masterplan the use of the existing Grahame Park boiler house as an energy centre for the whole area has been considered as to be the main opportunity and is the scenario around which the options appraisal has been conducted.

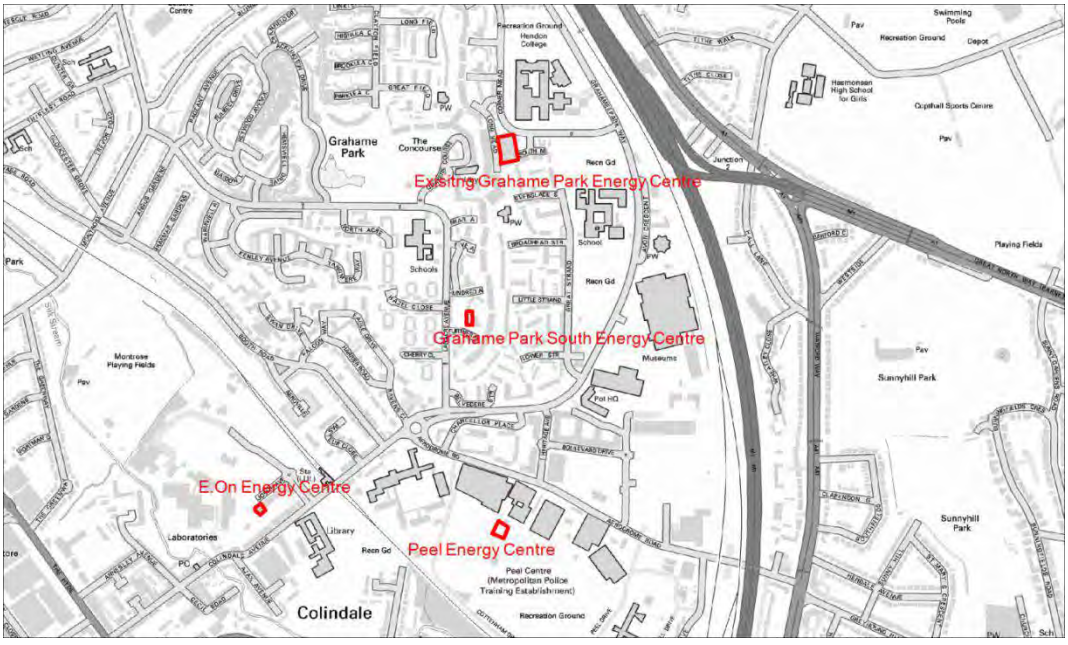


Figure 15 Possible Energy Centre Locations within Colindale for an Area Wide District Heating Network

[6] Grahame Park Regeneration Programme: Stage B Review

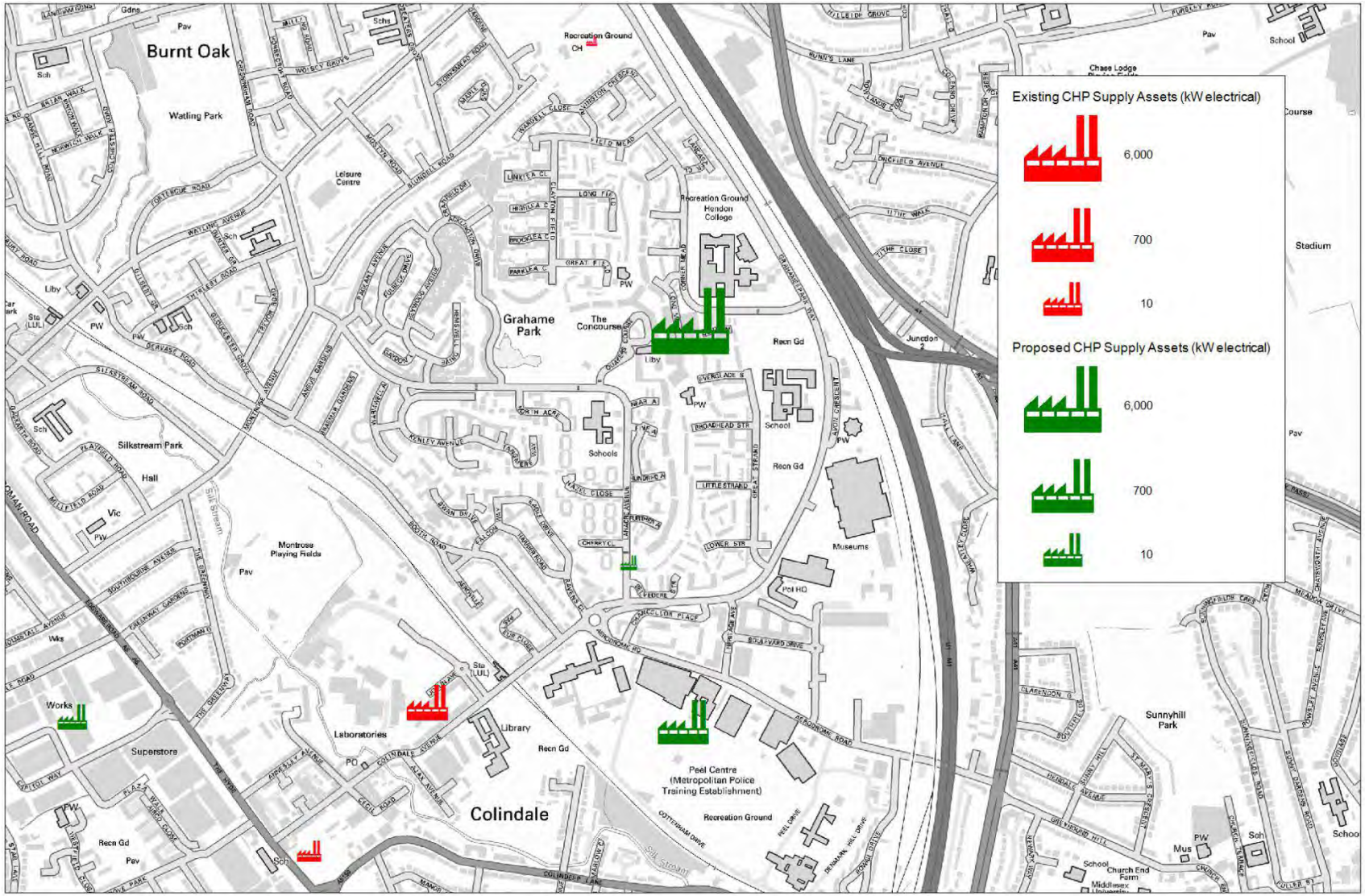


Figure 16 CHP assets existing and proposed in the CRA by size

3.2 Grahame Park Boiler House

The Grahame Park boiler house provides heat to the existing Grahame Park residential flats, the Community Centre, the Health Centre, Wingfields Children's centre, the Youth Centre, the Library, St James' High School and Barnet College. It is due to be decommissioned and demolished when the remainder of the Grahame Park site is redeveloped by the Genesis Housing Association.

The existing boiler house is managed by Barnet Homes and is required to continue to provide heat to the existing customers until those properties are demolished. To date there is no formal adoption the Genesis ownership of the EC site but there this is likely to occur as the rest of Grahame Park is redeveloped.

Those portions of the site which have already been constructed are not supplied with heat from the existing energy centre. Phases D1 (under construction) and D6 (complete) have been supplied with individual boilers for each of the residential units. It is likely that the remaining development phases will also follow this route unless an area wide plan is proposed.

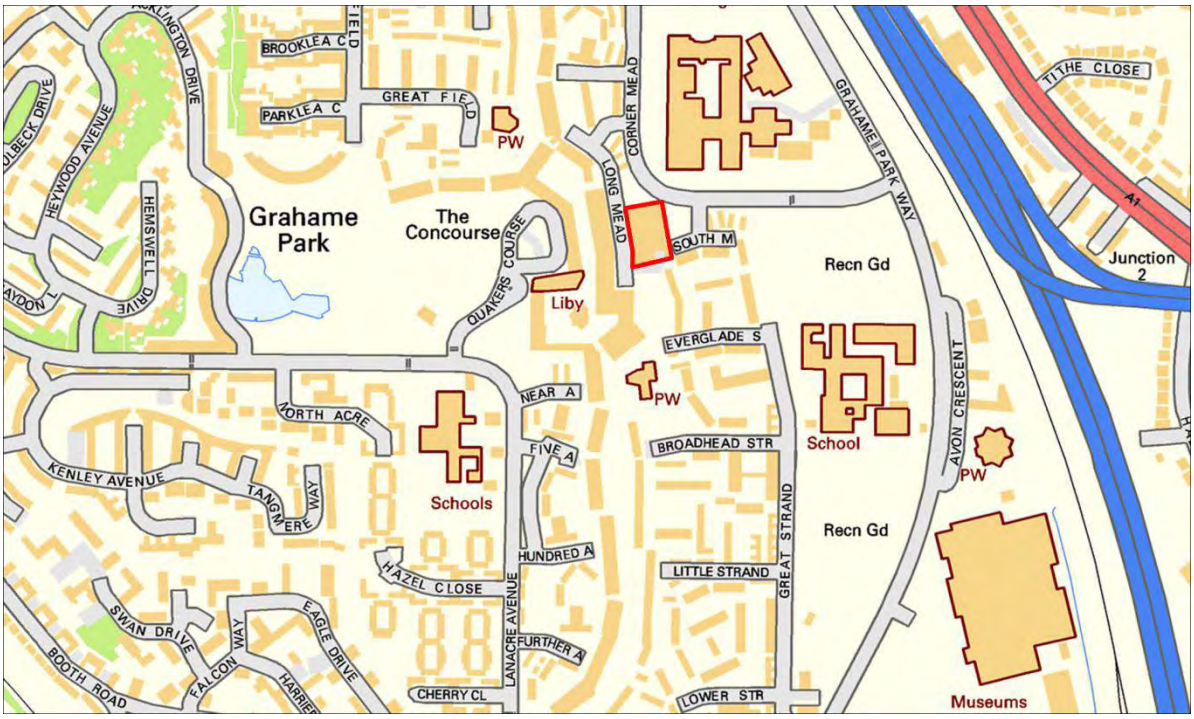


Figure 17 Existing Grahame Park Energy Centre Location Shown at the Corner of Long Mead and Corner Mead

The existing plant room is in good repair and has significant space for expansion (see Figure 18). As such it represents a good opportunity to act as a centralised energy centre for a future district heating network serving the whole Colindale regeneration area. This would involve replacing the boilers and the installation of a new CHP with storage.

The basement energy centre contains a set of 6 gas fired 2.1MW boilers (recently de-rated to 1.2MW). The boilers are dual fuel gas and oil, however, are currently operating on only mains gas. Four of the six boilers are operational, one is a decommissioned boiler and one is not connected. At an earlier point in the energy centre's operation it has been noted that a CHP was in operation. All of the electricity is now supplied from the grid.

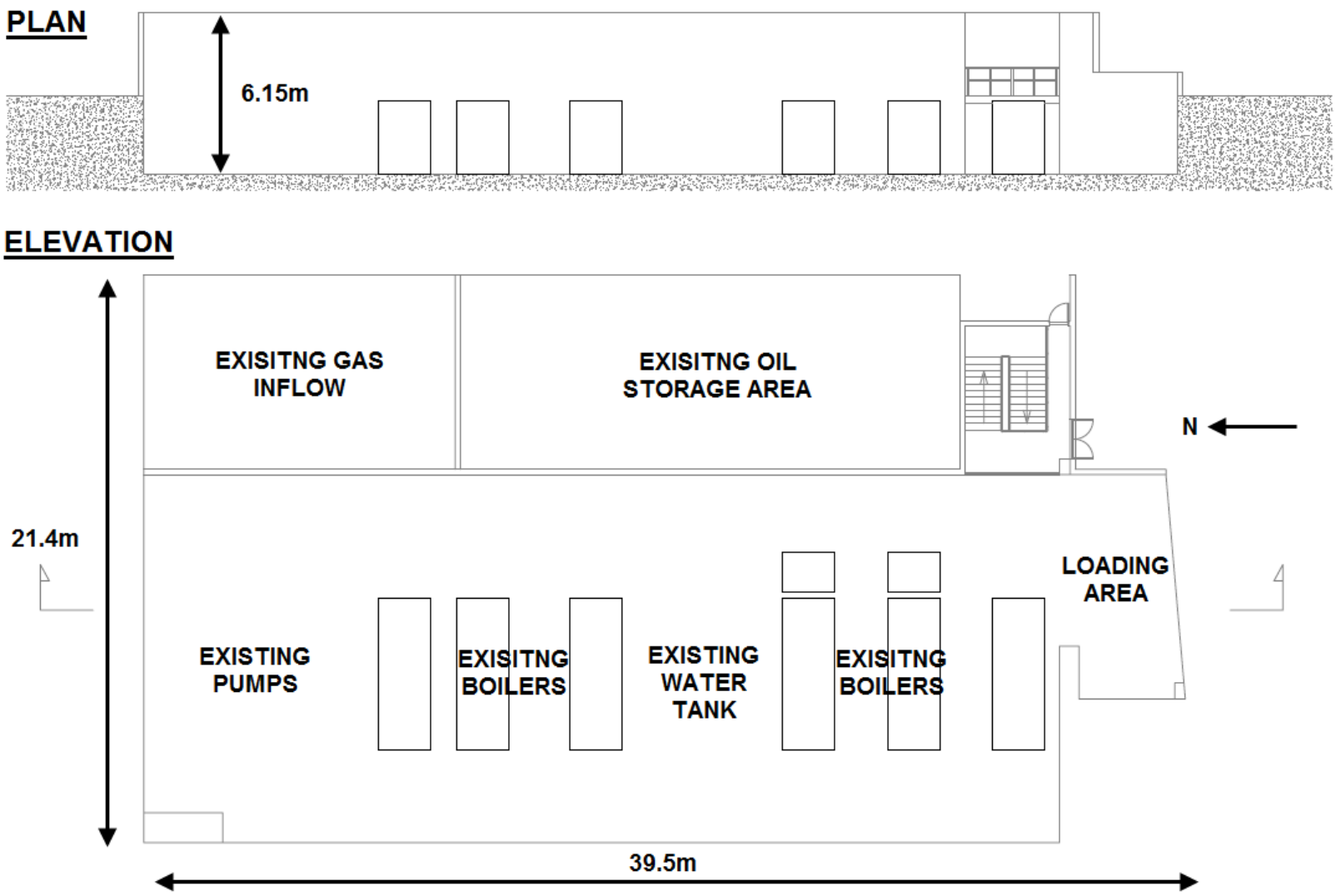


Figure 18 Existing Grahame Park Boiler House Basement

3.2.1 Transition of the Boiler House and Re-Commissioning as an Area Wide Energy Centre

It is likely that 3 or less of the operational boilers at the southern end of the boiler house would be sufficient to continue to service the declining existing loads. The preference stated in the NIFES report[7] and the AWA report [8]for the decommissioning of the boiler house is to reduce the number of existing boilers to two and install a new 1000kW modulating condensing boiler. Therefore the new condensing boiler would become the lead boiler with an existing boiler for standby.

The boilers at the northern end could be removed freeing up space at the northern end for a phased introduction of new CHP and peaking boilers. Above the loading area (see Figure 18) there is a set of removable reinforced concrete beams that would allow lowering of new plant into the basement.

The oil storage units, which are 50% full and the gas inflow room could both provide space for peaking boiler plant and thermal accumulators. The ground floor areas of the same building as the boiler house currently let to Lovell and used for Barnet Homes care taker storage could be used for ancillary equipment such as pumps. Further analysis of this will be required at project feasibility stage to determine the exact location of plant and phasing.

If the full network potential was to be realised the following plant capacities and phasing have been determined to offer the highest internal rates of return (see chapter 5).

Plant	Capacity	Operational year
CHP 1	2000 kWe	2017
CHP 2	2000 kWe	2020
CHP 3	2000 kWe	2030
LTHW Boilers	28000 kWth total	2017
Thermal storage accumulators	425 m3 total	2017

Table 5 Grahame Park Energy Centre (E.On) Scenario 1 (Full Network) Plant Capacities

The original architecture of the energy centre can be considered to be part of the old aesthetic and therefore it is suggested that the redevelopment of the site would include cladding in a sympathetic material. Regarding the boiler flues that currently exit in the Martynside and Moineau buildings; these would need to be rerouted into a new chimney terminating a sufficient height above the ground level. This chimney should be sized for the final flue demand once the energy centre has been fully redeveloped. This would likely involve leaving vacant flue conduits that can be occupied when needed.

3.3 Existing Supply Opportunities within the Study Area

3.3.1 E.On Energy Centre at the Former Colindale Hospital Site

The Fairview development along Colindale Avenue has constructed an energy centre to supply the Pulse, British Library, Brent works and Apart Hotel sites. It has been sized to supply these demands and there is limited spare capacity to supply developments beyond this site. The energy centre is also limited in space for expansion. A mezzanine could be constructed as the building is quite tall however a new flue would be necessary.

[7] Decommissioning of Grahame Park Estate District Heating System by NIFES, April 2010

[8] AWA Building Services Consultants, Choices for Grahame Park Feb 2010

The energy centre is operated by E.ON. and comprises the following equipment:

Plant	Capacity
Gas CHP engine	600 kWe / 640 kWth
Biomass Boiler	~500kW
LTHW Boilers	3no 2000 kWth
Thermal storage accumulators	15000 / 20000 litres each

Table 6 Fairview (E.On) Installed Plant Capacities

The community heat network served by the energy centre is designed around at 30 ^{O}C delta T at design condition (85 ^{O}C flow, 55 ^{O}C return). Electricity generated by the gas CHP engine is sold to the grid.

E.On would be receptive to the possibility of connecting to an area wide district heating network if the heat charge was lower than their cost of heat generation at the Energy Centre. There could be potential to both connect the demands served by the E.On Energy Centre to the area wide network and extend the life of plant with residual value.

The energy centre's accumulators could also be used as distributed thermal stores to redistribute loads. However, regarding an area wide district network in the long term the Pulse Energy Centre can be seen principally as the point of connection. The E.On energy centre is not considered a realistic supply opportunity for the area wide network primarily due to space constraints.

3.4 Planned Supply Opportunities within the Study Area

3.4.1 Peel Centre

The Peel Centre is currently developing an energy strategy which is proposing a community heat network supplied via a gas CHP based energy centre. Their intention is to safeguard the network for a DH network area connection by sizing the connection to Colindale Avenue for the full demand of the site.

The draft energy strategy being developed suggests a 650 kW_{th} CHP is likely to be installed in time for the connection of the phase 1 development (commencing 2017). This would be followed by the installation of a second CHP of 850 kW_{th} in time for the phase 3 development (commencing 2020).

If connection was made to a DH network it would be necessary to install a temporary energy centre until connection to the DH network has been made. If the Peel Centre were to install their first CHP this could potentially contribute to feeding the DH network. Alternatively the Peel Centre Energy Centre could become the central supply source for the DH network. For reasons given at the start of the chapter the Grahame Park led energy centre has been considered in this study.

3.5 Other Low Grade Waste Heat Opportunities

The GLA's[9] report into London's Zero Carbon Resource Secondary Heat quantifies the opportunity for low grade heat recovery in relation to supplying heat networks from the following sources:

- Heat rejection from power generation
- Waste water treatment plants
- Air source heat pumps
- Closed loop ground source abstraction
- Closed loop ground source abstraction
- Building Heat Rejection (offices, retail, gyms)
- Industrial Sources
- Commercial Building Sources - Non HVAC
- Sewer heat mining
- Transformer heat recovery from 132 KV National Grid Substations
- Transformer heat recovery from the 11 KV UK Power Networks Substations

The most relevant of these for the Colindale Regeneration Area is likely to be transformer heat recovery (see Section 3.5.1). Water source heat pumps might be possible especially at the Public Health England facility where there are significant cooling activities.

3.5.1 Transformer substations

Transformer substations have been identified on Colindale Avenue and the substation contained within the Grahame Park Boiler House building. Heat rejection from the transformers could with the application of heat pumps become a secondary source of heat supply to a future DH network. Heat supply from these sources has not been modelled as part of the whole life costing model within this study.

[9] London's Zero Carbon Resource Secondary Heat Report Phase 1 and 2, Greater London Authority January 2013

4. HEAT NETWORK INFRASTRUCTURE PROPOSALS

This section outlines the heat network infrastructure proposed for the Colindale heat network feasibility study. Several of the conclusions drawn and assumptions made are carried across to the technical and economic models discussed in Section 5.

4.1 Route Assessment and Viability

The identified route for the district heating network has been chosen taking into account two primary factors: the locations of the primary heat loads and the existing layout of roads and other infrastructure.

A utility search has not been carried out. As such, the route assessment is provisional and will require further planning and route proving at detailed feasibility stage and thereafter into the procurement phase once a contractor is on board.

The identified route is shown in Figure 19. The route has only been considered up to the edge of developments as a detailed route assessment for these sections as this is outside the scope of this study.

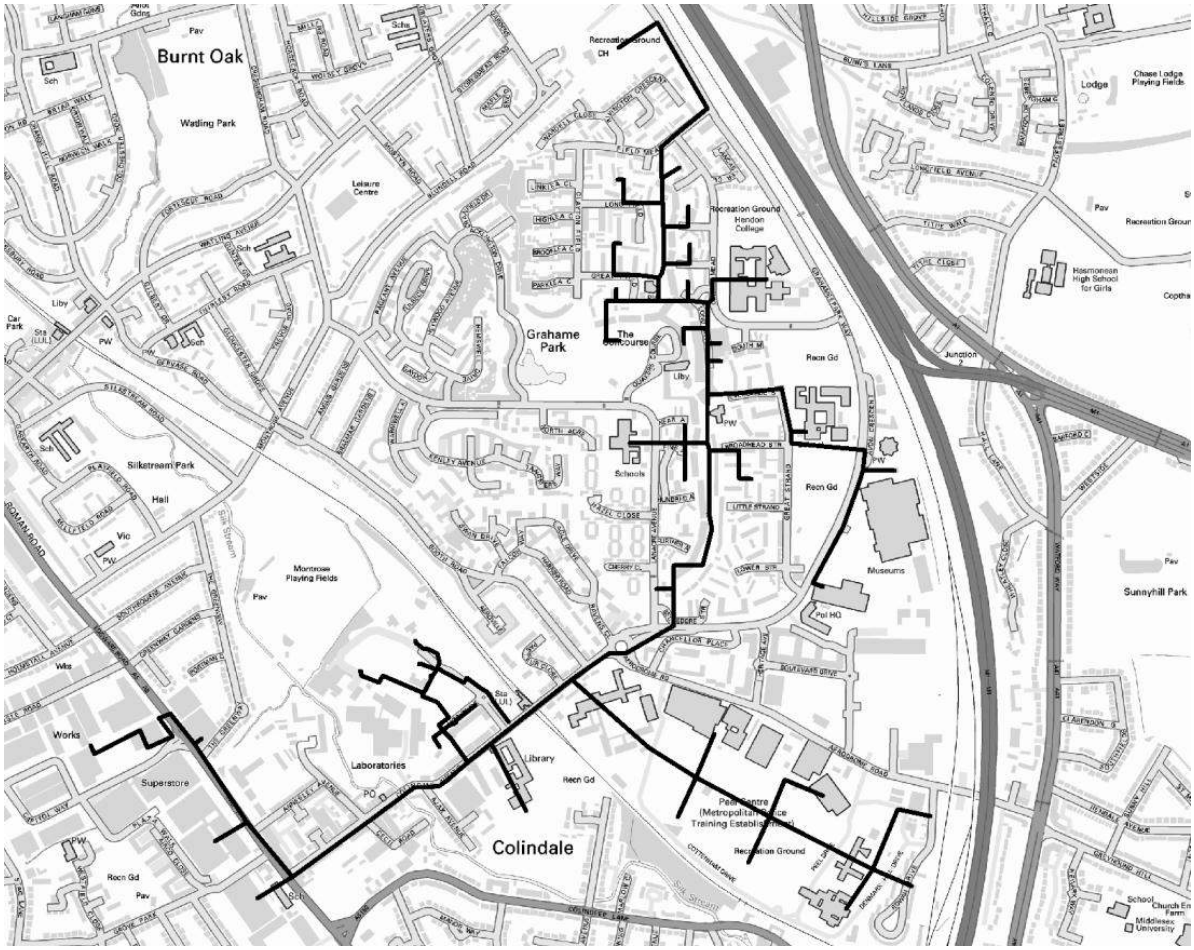


Figure 19 Proposed Network Route

This network route is likely to follow the construction phasing shown below.

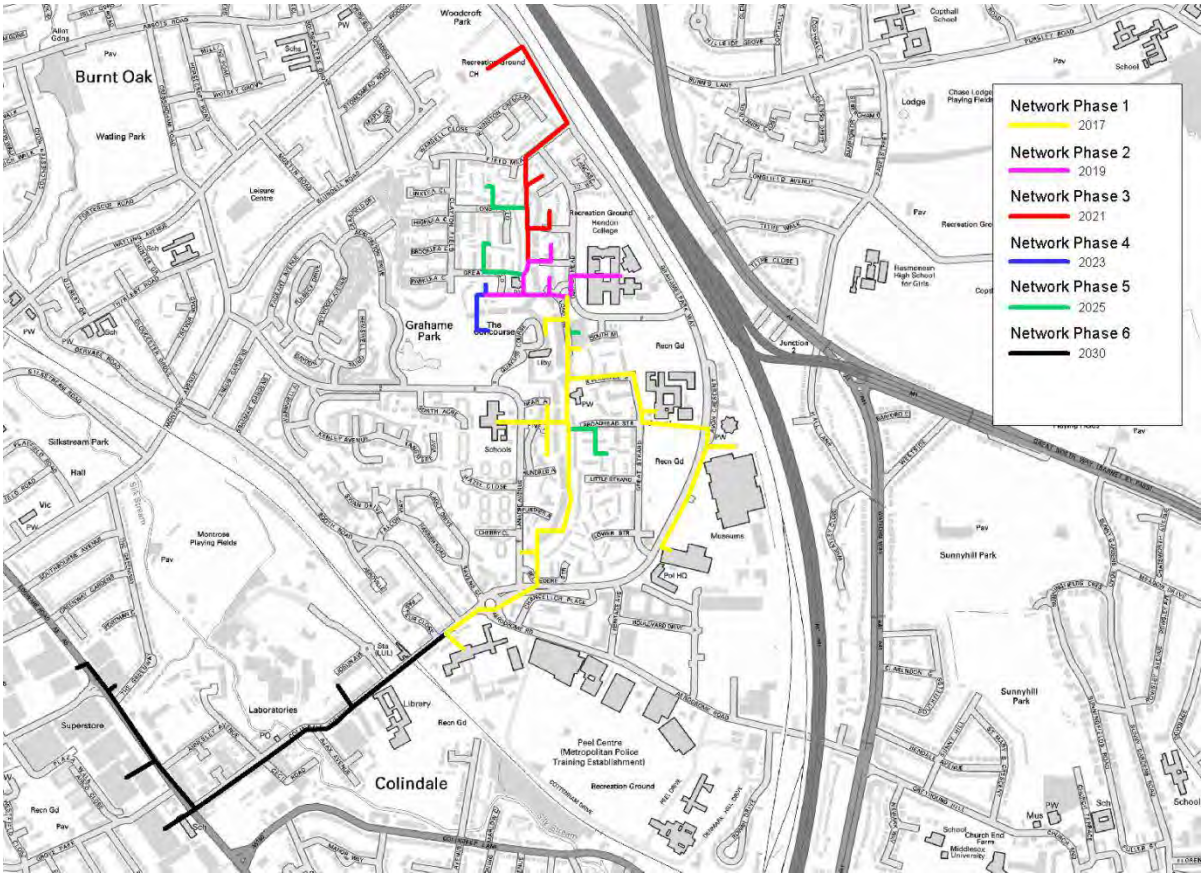


Figure 20 Proposed Network Shown by Construction Phase

4.2 Network Sizing

Ramboll has used in-house hydraulic design software System Rørnet (SR) to conduct a high-level design of the DH network. The network route is broken down into a set of branches and nodes. Peak energy demands are assigned to the relevant nodes and the branches are designed accordingly.

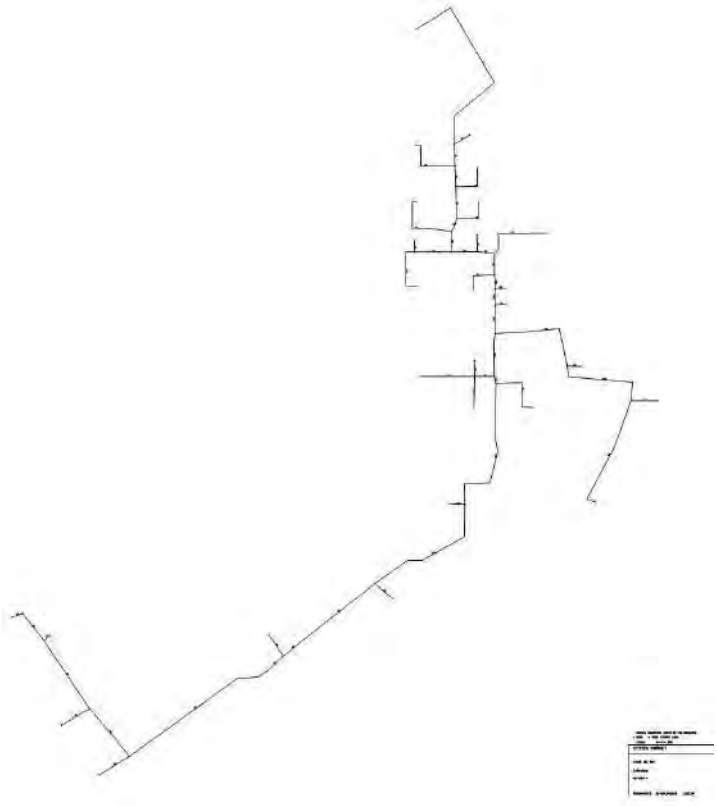


Figure 21 SR Modelling Image

It is assumed for the purpose of this study that all pipes will be installed as pre insulated rigid steel. At detailed feasibility stage it may be desirable to explore other options for the smaller pipes such as plastic and flexible steel which can significantly reduce costs.

The network has been designed around primary flow and return temperatures of 95^{0}C/55^{0}C for new buildings and 95^{0}C/75^{0}C for existing buildings. This reflects designs typically being employed for gas engine CHP based projects and has been specified for this reason. It is noted that a maximum design temperature of 110 ^{0}C could be employed and further optimisation around this option should be carried out at detailed feasibility stage.

The pipe schedule for the full network route at flow and return temperatures of 95^{0}C /75^{0}C is shown in Table 7.

Pipe Nominal Diameter	Total Length (m)
32	501
40	802
50	264
65	853
80	172
100	554
125	1,157
150	370
200	994
250	240
TOTAL	**5,907**

Table 7 Provisional Pipe Schedule

4.3 Heat Network Control Concept

The operating concept of the strategic heat network is likely to be based on a variable flow, variable temperature design.

The working pressure will be controlled within the system to ensure the pressure and flow characteristics are met at critical locations in the network at all times. This will be achieved through distribution pumps operating to maintain a minimum pressure difference between flow and return at each customer and a minimum pressure difference across the index point of the circuit. This will guarantee the required flow of heat to customer substations and ensure that heat demand is met at all times. Heat flow into customer substations will be controlled by 2-port control motorised valves so that customers can take all the heat they need at any moment in time.

A typical pressure distance diagram for such an arrangement is shown in Figure 22.

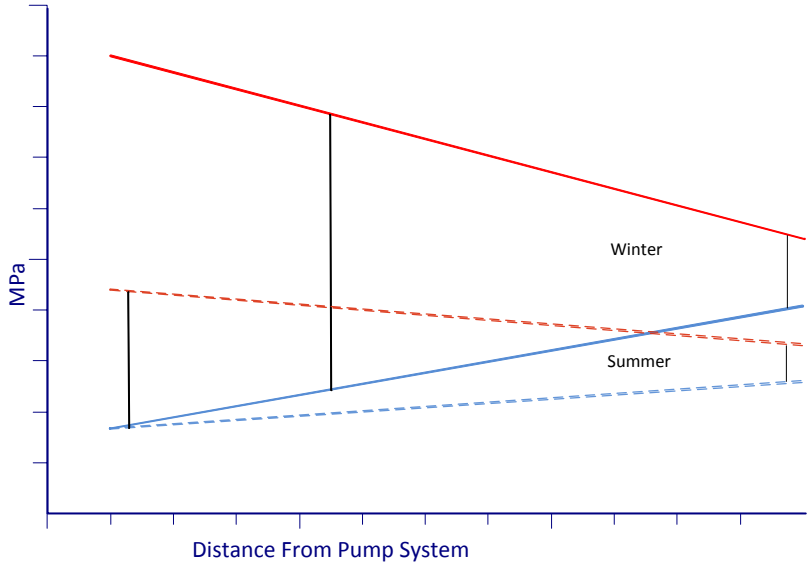


Figure 22 Typical Pressure Distance Diagram for Variable Volume Network

In addition to volume control, heat network delivery temperature will be controlled on the basis of ambient temperature in order to minimise heat losses throughout the year and maximise capacity at lowest investment cost.

The primary flow temperate into the heat network will typically be controlled between[10] 80 °C and 90 °C when outdoor temperature exceeds +5°C. It will then typically be increased to a maximum of 95 °C when the outdoor temperature reaches the design condition.

Appropriate temperatures for this project would depend on a number of factors including available capacity margins in the pipework as a function of design temperature, type of pipe system, design pressures, heat offtake pressure and certain other parameters.

Whichever design temperatures are proposed, the operating temperatures across the year can be matched at the power plant through a mixing circuit (to reduce temperatures in part load) or by boosting supply temperatures at the design condition using gas boilers.

In the medium to long term, it may be possible to reduce the supply temperature into the network to 65 or 70 °C for outdoor temperature exceeding +5°C. This depends on the level of improvements made to the fabric of existing buildings connecting to the network and on the design of heating systems of new buildings constructed now and in the future.

[10] dependent on requirements of existing buildings connected to the heat network.

Work carried out by the GLA[11] suggests that supply temperatures of 70 °C should be achievable without noticeably impairing internal comfort levels for residential and non-residential buildings.

4.4 Grahame Park Energy Centre

Heat will be delivered into the heat network from the energy centre at Grahame Park though a distribution pumping station.

This will comprise inverter-driven distribution pumps, pressurisation equipment, water treatment plant, a supervisory control and data acquisition (SCADA) system and associated M&E systems. As described in Section 3, back up boiler plant will also be located at this facility.

A typical distribution pumping station arrangement is shown in Figure 23.

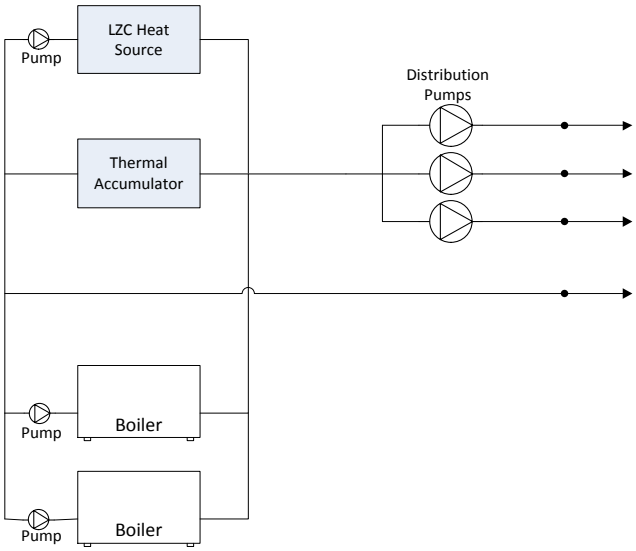


Figure 23 Indicative Distribution Pumping Station Schematic Arrangement

Control of the network will be centralised through a central control system located at the energy centre. This will typically schedule the heating assets and pumps across the system and control and maintain pressurisation across the network.

The heat network will be pressurised at a single point. This should be located at the Grahame Park Energy Centre. This should also house the primary distribution pumps, water treatment and pressurisation and expansion systems for the heat network.

4.4.1 Distribution of Heat Demands

Figure 24 provides an indication of the distribution of heat demand under the full network including the developments at Edgware Road and Colindale Avenue. These figures provide a basis for refining the design of the heat offtake for the facility, although it is noted that they are based on indicative information only and do not take into account the detailed feasibility of connecting the identified demands to the network, which is something that will need to be identified at the next stage.

[11] London's Zero Carbon Resource Secondary Heat Report Phase 1 and 2, Greater London Authority January 2013

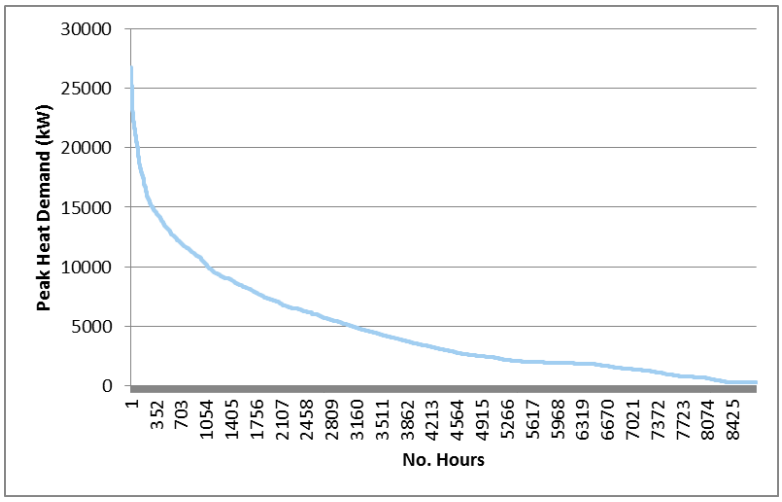


Figure 24 Distribution of Heat Demand

4.5 Accumulators

Accumulator storage will be used to enable more efficient use of the CHP engines and a greater amount of heat to be utilized.

The sizing of the accumulators will depend on the trade-off between capital and operational costs. The modeling carried out at this stage assumes a capacity to store the rated CHP output over a 2.5 hour charging cycle. For example the network with 6 MW of CHP capacity would have a thermal store capable of supplying 15 MWh of heat.

Further work will be required at the design phase to establish exact sizing.

Accumulators can be directly or indirectly connected to the heat network. For this scheme, it is envisaged that the accumulator could be directly connected to the heat network.

4.6 Consumer Connections

The point of connection between the DH network and the individual developments will generally be as follows:

- within newly constructed energy centres for new residential, mixed use or commercial developments
- within basement level, ground floor level or roof level plant rooms for existing buildings and new single building developments.

Connections to existing buildings will typically be connected at the point where the existing heating assets reside.

In each case, heat sold will be metered at the point of connection through newly installed heat meters.

Connection between local heat networks serving multiple customers and the network can be either direct or indirect. Direct connections offer some advantages in terms of avoiding temperature reductions across heat exchanger stations with consequent reductions in achievable temperatures differences across the network. However, this requires compatible design pressures, which will potentially increase costs. It also introduces risk in relation to water quality and complicates commercial demarcation of ownership. The modelling in Section 5 assumes HIU connection costs.

Figure 25 Heat Exchanger Substation

(photo courtesy of Danfoss)

Figure 26 Typical HIU without front cover

(photo courtesy of Danfoss)

4.6.1 Description of Heat Exchanger Interface Equipment

The typical design connection for commercial and industrial customers will comprise a heat exchanger station containing two heat exchangers complete with all necessary pumps, controls, valves and heat metering. One heat exchanger will provide heating and one will provide centralised, instantaneous domestic hot water production. Indicative assembly and schematic arrangements for such a consumer substation are shown in Figure 27.

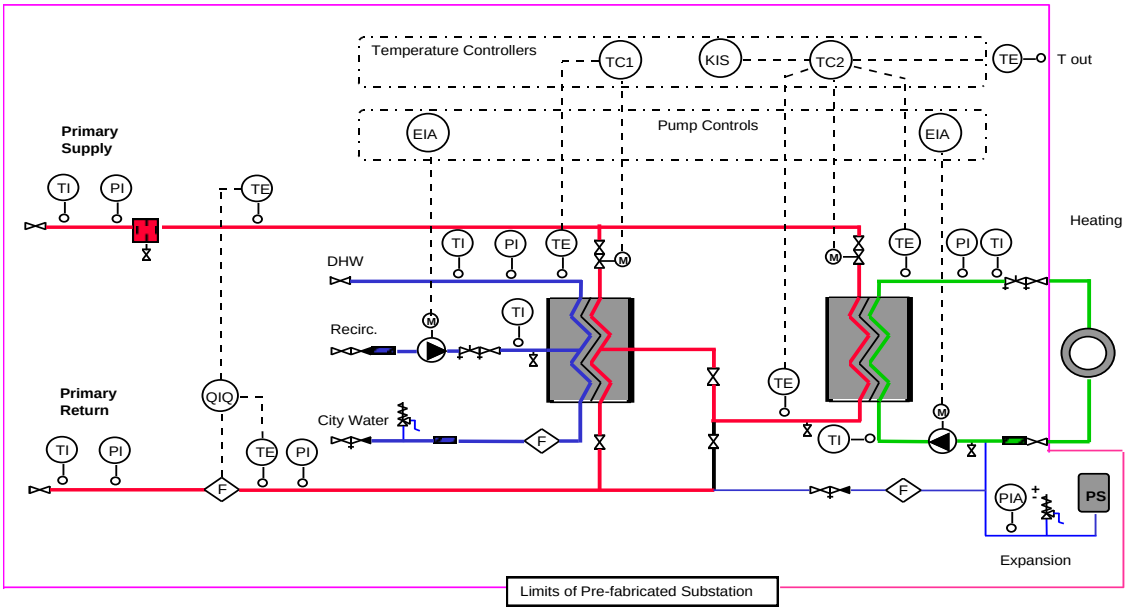


Figure 27 Typical Substation Connection Arrangement (image courtesy of LDA/GLA)

A similar arrangement would be adopted when connecting into existing energy centres such as that at the Fairview development or the Peel Centre. In this case however, it is more likely that a single heat exchanger would connect in parallel with the existing boilers across the flow and return header, from which both heating and hot water circuits would be supplied.

For multi residential developments, a range of connection options are possible. For example, residential blocks can be directly connected, with heat exchanger stations (HIUs) located at apartment level only, with a direct connection at the building interface and at the incoming supply to the energy centre. This maximises temperature differences in the system, reduces internal heat gains and makes use of the available pressure in the network thereby minimising additional circulation pumping at block level. Alternatively, communal heat exchanger stations can be located at block level to provide a hydraulic break and a clear commercial demarcation point between the network operator and the maintenance company responsible for the individual buildings. Individual developers will have their own preferences and may choose to adopt either strategy.

New residential town houses would connect with individual HIUs.

4.6.2 Size Considerations

Consumer substations are significantly smaller than conventional boiler plants and consequently, a lot of space can be saved in new developments or taken to other use when existing boilers are removed. A heat exchanger substation can take as little as 10% of the space required by conventional boiler plant. Heat exchanger sizes vary from building to building.

The following table provides a guide to the space requirements of a typical floor mounted heat exchanger. The space identified does not include for any equipment required for distribution, e.g. circulating pumps, pressurisation system.

Heat Exchanger Size (kW)	Packaged Brazed Plate	Gasket type
200	2.5m x 2m	3.5m x 2m
500	3m x 2m	4m x 2m
750	3.5m x 2m	4m x 2m
1000	3.5m x 2.5m	4.5m x 2.5m
1500	4m x 2.5m	4.5m x 2.5m
2000	4m x 3m	5m x 3m

Table 8 Heat Exchanger Space Requirements

Each heat exchanger space allocation allows for a minimum working space to all four sides of the unit.

Heat exchanger stations for individual residences are comparable in size to wall mounted boilers.

5. HEAT NETWORK OPPORTUNITY APPRAISAL

This section outlines the assumptions and methodology applied to the technical and economic modelling of the proposed heat network. Several scenarios have been considered and a sensitivity analysis has been conducted in order to observe the effect of key variables on project feasibility.

5.1 Methodology

Ramboll has conducted the analysis using in-house Energy Performance and Economic Modelling (EPEM) software. EPEM takes into account the demand and cost phasing over the project lifetime to show the performance of the project over its lifetime.

Four core scenarios have been considered around the identified DH network opportunity. These scenarios test the impact of connection of the four principal clusters of heat demand (as identified in Section 2) on a design safeguarded for the connection of all clusters. The scenarios are outlined in further detail in Section 5.4.1.

The first stage in the analysis has been to establish the 'business as usual' (BaU) or 'do nothing' scenario, which enables the calculation of relative energy and cost savings of the DH network against the scenario where each stakeholder uses an independent heat source.

Following this the various heat network cases have been assessed. The energy demand and supply information for each scenario has been inputted into the model to generate results to indicate the feasibility of the scheme as according to the following key performance indicators:

- Internal rate of return
- Net present value at 10% discount factor
- $C0_2$ savings against business as usual

5.2 Business as Usual Scenario – Individual Developer Solutions

The likely BaU scenario is considered to be one in which individual developers choose their preferred heating solutions in isolation of other developments in the area.

Development Area	BaU Description
Grahame Park	The BaU scenario for Grahame Park is taken to be natural gas boilers supplying a community heating network. The boiler efficiency is taken to be 85% and natural gas prices are in line with DECC forecasts.
The Peel Centre	Under the BaU scenario the Peel development would be supplied by the community heat network outlined in Section 2.2. A consumer heat price of 6p/kWh has been assumed based on previous modelling carried out by Ramboll for new developments.
Colindale Avenue	The developments on Colindale Avenue are being supplied by a new heat network and energy centre as discussed in previous sections. This is taken to be the BaU case with a consumer heat price of 6p/kWh as above.
Edgware Road (Brent)	The energy planning statement for Capitol Way stated that the development will contain its own heat network fuelled by a CHP engine. This has been assumed as the BaU case with a consumer heat price of 6p/kWh. The remainder of the developments along Edgware Road are assumed to use natural gas boilers.
Other	The existing consumers around the Grahame Park area such as the RAF Museum, Barnet College and the Orion School are all assumed to be supplied by natural gas boilers. The boiler efficiency is taken to be 80% and natural gas prices are in line with DECC forecasts.

Table 9 Business as Usual Descriptions for Colindale Development Areas

5.3 District Heating Network Scenario

The coordinated district heating network scenario assumes the interconnection of the major new development clusters into a single district heating network.

Any such solution is likely to take place in a phased manner over a number of years. The estimated phasing of demand has been presented briefly in the heat demand appraisal in Section 2.4 and this section provides further detail around the assumptions.

5.3.1 Grahame Park

As previously mentioned, the development of Grahame Park phases 1 and 1b are considered to be outside the possible scope of a district heat network since they are operating on individual boilers. These have been installed recently (within the last few years) and as such there is no reasonable case for considering conversion of the heating systems for these flats over the coming decade.

Under a district heating scenario, the future development phases of Grahame Park are expected to come forward in the same way, with no appreciable difference in the design of the buildings connecting to the network.

5.3.2 Peel Centre

Under the district heating scenario, the Peel development would construct a community heat network as per the BaU scenario but would safeguard for connection to the Colindale DH network. As installation of the first CHP at the Peel site under the BaU is expected in 2016, it is assumed that in the case of the coordinated DH network, temporary boilers would be installed until the development could connect to the main network.

This could be implemented through a planning condition stating that the site would agree to retrofit CHP after a number of years if a district heat network doesn't materialise within an agreed timescale. The development cost savings arising from this temporary safeguarding could be ring fenced to support investment in a connection to the heat network. Initial discussions with the consultants acting for the developer of the Peel Centre indicate that they are receptive to the prospect of connecting into a district heating network.

5.3.3 Colindale Avenue

Given that the Pulse site has recently constructed its own energy centre with a CHP plant, it is considered likely that the interconnection of this site to a district heat network would only become viable at the point when the Pulse energy centre requires significant overhaul/replacement. For the economic modelling this is assumed to take place in 2030.

5.3.4 Edgware Road

The developments along Edgware Road are remote from the major development opportunities within the site masterplan. The connection of these developments is likely to be contingent on connection of Fairview's Pulse site and/or on significant additional heat load coming forward in Brent in the vicinity of these developments.

It is therefore assumed that the developments on Edgware Road will be connected to the network in 2030.

5.3.5 Other

The existing and planned developments within Grahame Park are assumed to connect as the nearest area of the Grahame park housing development is connected.

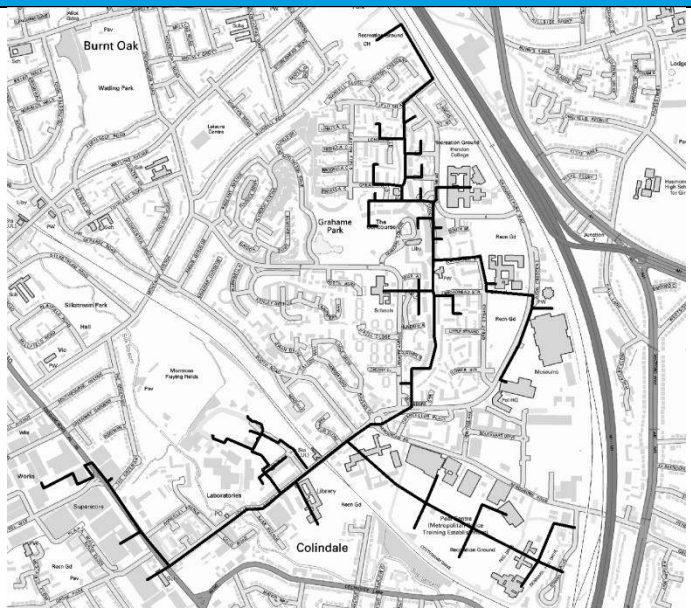
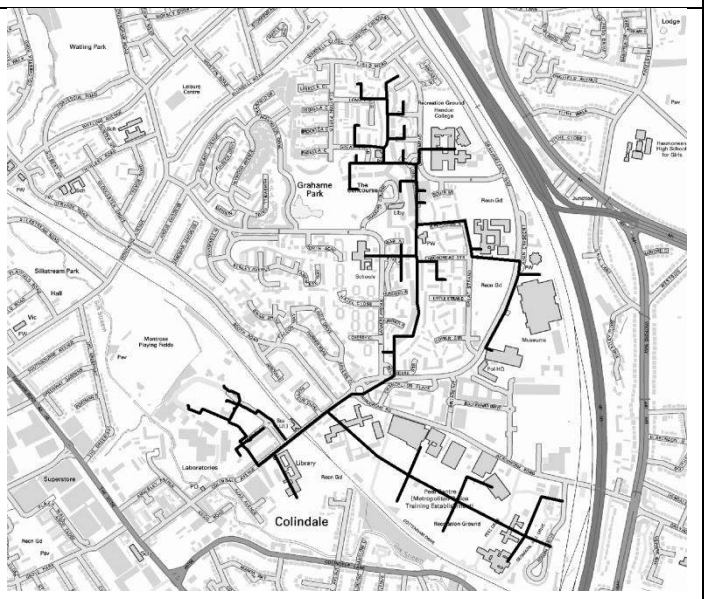
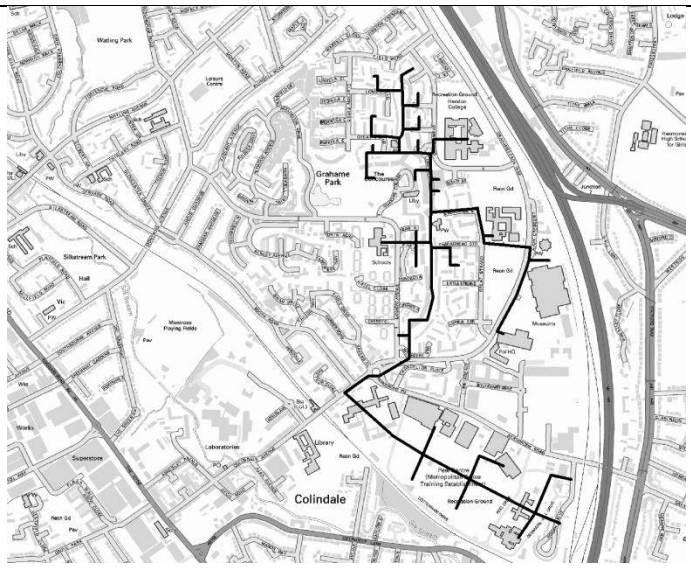
The RAF Museum is assumed to be connected to the network at the project outset, which is assumed to be 2017.

5.4 Assumptions and Scenarios Modelled

This section summarises the key modelling assumptions used to determine the feasibility of the proposed heat network. Full details of the investment and carbon appraisal assumptions are presented in Appendix 2.

5.4.1 Network Scenario Testing

Four core scenarios have been considered around the identified DH network opportunity. These test the impact of connection of the four principal clusters of heat demand on a design safeguarded for the connection of all potential future heat loads. This design, which is presented as scenario 1 is proposed as the strategic network opportunity for the Colindale Masterplan area.

Scenario No.	Description	Illustration
1	Coordinated network supplying all identified opportunities within the Masterplan area	
2	Testing impact of removing Edgware Rd developments and the new Orion School	
3	Testing impact of removing the Colindale Avenue sites	

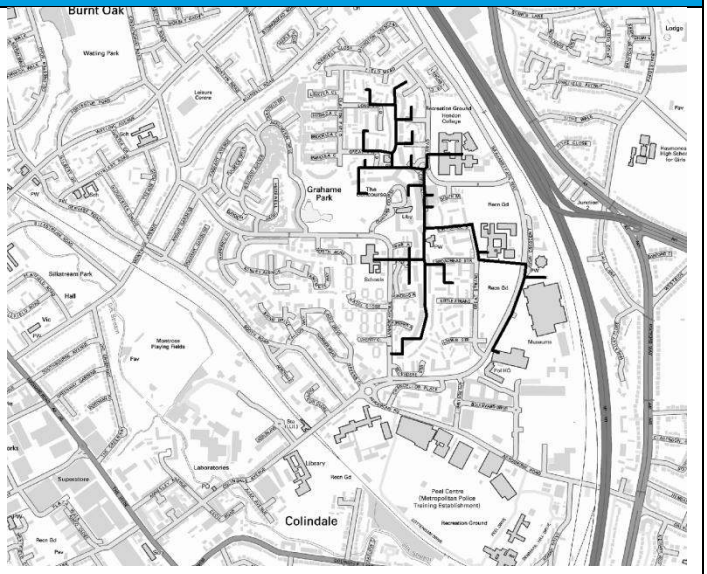
Scenario No.	Description	Illustration
4	Testing impact of removing the Peel Centre	

Table 10 Description of Modelling Scenarios

A comparison of the results of these scenarios shows highlights the risks associated with developing a DH network around a potential future opportunity that may never materialise

5.4.2 Heat Demands and Consumer Connection

The annual heat demands outlined in Section 2 are used directly in the EPEM model. These are used to develop peaks and annual profiles using daily demand profiles and degree day scaling.

The daily demand profiles have been determined through Ramboll's past experience of building energy modelling. Normalised profiles are applied for each building type. An example of a daily heat profile is shown below:

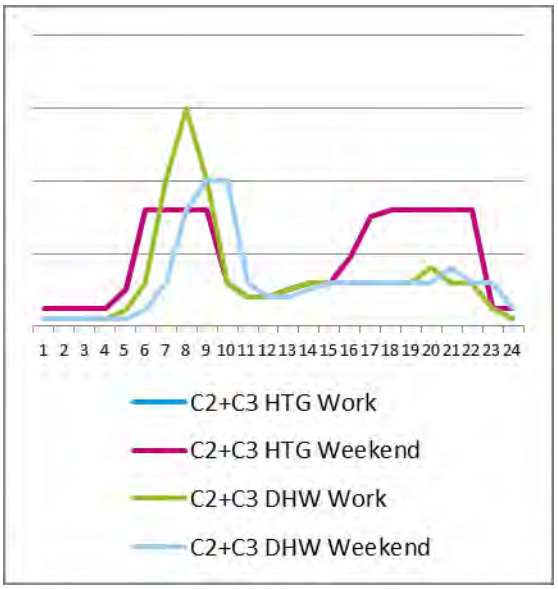


Figure 28 Normalised Daily Space Heating and Hot Water Profile Assumed for Residential Buildings

The annual demand profile is based on degree day data for London.

It is assumed that all buildings will be connected to the network via a heat interface unit (HIU). Costs have been included for the connection of the buildings to the heat network and the largest proportion of this cost is due to the HIU.

5.4.3 Energy Centre and Plants

As described in the energy supply appraisal, gas fired CHP is taken to be the primary heat source in combination with thermal stores and backup/peaking boilers.

A breakdown of the CAPEX costs is presented in Appendix 2.

5.5 Modelling Results

The modelling has been carried out in two stages: Firstly results have been generated for each scenario to test the project KPI's under different eventualities. Secondly, scenario 3 has been tested in greater detail to establish its sensitivity to a number of key parameters. Scenario 3 has been selected for this purpose, since it represents the case of greatest commercial risk to the DH network developer, i.e. that a coordinated DH network is developed in mind of connecting future demands along Colindale Avenue and Edgware road but that these connections never materialise.

The analysis has been undertaken over 25 and 40 year project lifetimes. The resulting IRRs under each scenario are presented in Table 11.

Scenario	Project Lifetime	IRR over project lifetime	NPV at 10% discount Factor (£M)	Total CAPEX (£M)	CO_2 Saving at full build out (Tonnes CO_2)
1	25 years	3.6%	-£4.14	£14.4	62,300
1	40 years	5.9%	-£3.66	£17.7	110,500
2	25 years	3.9%	-£4.49	£13.4	57,700
2	40 years	5.3%	-£4.09	£16.5	99,900
3	**25 years**	**2.9%**	**-£4.07**	**£11.2**	**52,500**
3	**40 years**	**5.1%**	**-£3.61**	**£12.6**	**88,600**
4	25 years	-7.6%	-£5.87	£7.99	21,300
4	40 years	-2.5%	-£5.78	£8.32	35,500

Table 11 Scenario Modelling Outcomes

From the results in Table 11 the following conclusions are drawn:

None of the scheme options deliver an IRR over 25 years that could be considered attractive to the private sector. When viewed over 40 years, the coordinated scheme delivers an IRR that could potentially attract public sector investment through PWLB money.

The coordinated scheme is likely to perform better without extension over to Edgware Road (i.e. if it is limited to future connection of the Fairview development along Colindale Avenue). However, as mentioned in section 2.2.22, Brent intends on developing up to 2,500 homes on Edgware Road by 2026 and increased demand may improve the business case. A high level EPEM model was run to reflect this scenario, which showed an increased IRR of only 0.1% over 25 years, but it is recommended that this is explored further at detailed feasibility stage.

A scheme predicated on future expansion along Colindale Avenue that does not ultimately connect the Fairview development will not achieve a positive NPV over 25 years at the minimum discount factor required under Treasury Green Book guidance. However, viewed over 40 years, the scheme can be expected to deliver an IRR that could potentially attract public sector investment through PWLB money.

A scheme based around existing demands which does not also connect the Peel Centre development, is not viable. Inclusion of the Peel Centre is therefore central to the financial success of any DH network in the Colindale area.

Scenario 3 has been selected as the model to focus on for further analysis. As noted above this is intended to reflect the commercial risk to the DH network developer under a coordinated DH network scenario in which the network is developed in mind of connecting future demands along Colindale Avenue and Edgware road that never materialise. The annual energy demand profile of Scenario 3 is show in Figure 29.

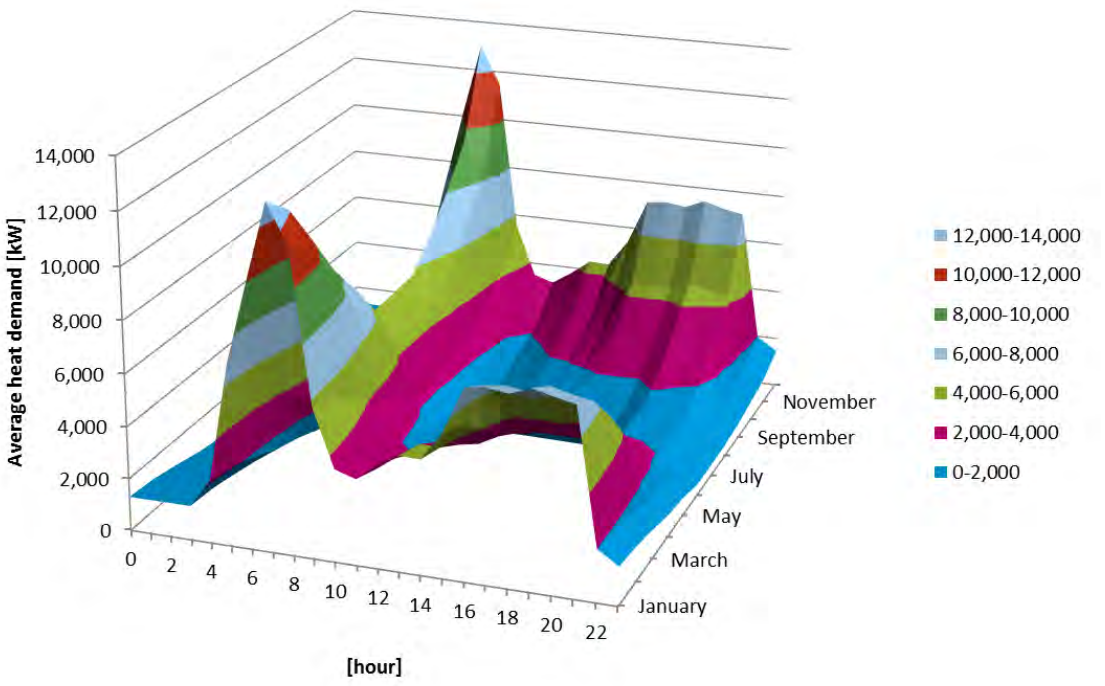


Figure 29 Annual Energy Demand Profile of Scenario 3

The supply assets in this scenario have been reduced against the scenario 1 base case energy centre described in Section 3. The model includes two 2 MW CHP engines, 280 m^3 of thermal storage and 20 MW of peaking and standby boilers. The CAPEX is scaled down accordingly.

To test the model under Scenario 3 the following variable factors have been explored:

CAPEX Phasing	impact of phasing the installation of thermal storage and peaking boilers in line with the proposed phasing of the CHP plant.
Energy Inflation modelling	impact of energy inflation according to DECC 2013 forecasts[12], which under reference scenario indicates an increasing spark gap, which would have a positive effect on gas CHP.
Electricity Sale Price (1)	impact of increase in electricity selling price as might result from a higher rate achievable under a Junior Supply Licence or under a netting off arrangement between the local authority and its supplier. The value has been increased to 6.5p/kWh.
Electricity Sale Price (2)	as above, assuming a value of 7.20p/kWh, which could include a mix of the above and an element of private wire supply to selected local buildings.
Pipe Costs (1)	impact of reduction in pipe costs. Pipe costs have been reduced by 10%.
Pipe Costs (2)	impact of sizing the heat network for the scheme under scenario 3 to remove safeguarding for future connection to Colindale Avenue and Edgware Road which results in a smaller diameter network and therefore reduced CAPEX.

Table 12: Variable factors explored in Scenario 3

[12] DECC Updated Energy and Emissions Projections for September 2013

The key modelling results are summarised in Table 13. In each case the variable has been independently altered.

Table 13 Summary of modelling results for 25 year Project Lifetime

Variable	Base case modelled under Stage 1	CAPEX Phasing	Energy Inflation	Electricity Sale Price (1)	Electricity Sale Price (2)	Pipe Costs (1)	Pipe Costs (2)
Total Investment CAPEX (£M)	£11.2	£11.2	£11.2	£11.2	£11.2	£10.7	£11.1
IRR over 25 Years	2.9%	2.9%	7.4%	5.0%	6.8%	3.4%	3.1%
NPV at 10% discount (£M)	-£4.07	-£4.00	-£0.65	-£2.96	-£1.97	-£3.55	-£3.84
CO_2 Savings (Tonnes CO_2)	52,526	52,526	88,597	52,526	52,526	52,526	52,684
IRR over 40 Years	5.1%	5.2%	9.3%	6.9%	8.3%	5.6%	5.3%

The figure below shows simple and discounted cash flows over 25 years for Scenario 3 Electricity Sale Price (1). Discounting is shown at a 10% discount rate.

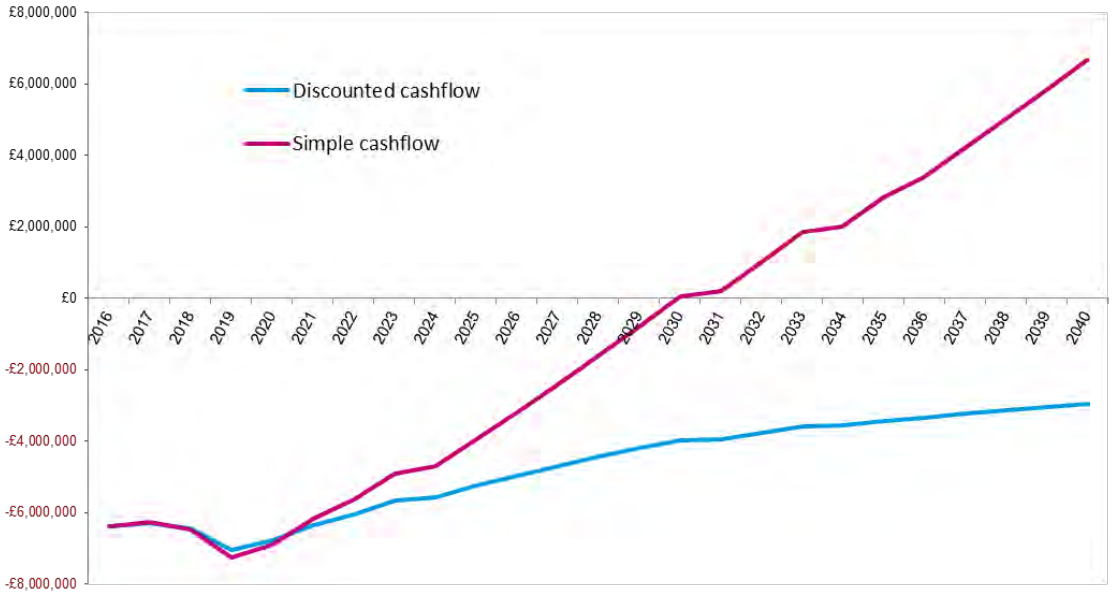


Figure 30 Simple and Discounted Cash Flow under Scenario 3 Electricity Sale Price (1)

5.5.1 Main conclusions

The following conclusions are drawn from these investigations:

- The assumption of energy inflation has the greatest effect on the IRR. However, this factor is uncertain.
- The electricity sale price has a significant effect on the IRR and therefore at the next project stage it will be important to explore ways to achieve the highest possible price.
- A combination of all of these measures results in an IRR of 9.20% over a 25 year project lifetime and 10.70% over a 40 year project lifetime. The carbon savings are estimated to be 52,526 tonnes CO_2 over 25 years.
- If the coordinated DH network (scenario 1) is progressed, however, the loads along Colindale Avenue and Edgware Road do not materialise so long as a junior supply license for the electricity sales is achieved then the scheme is still an attractive proposition (IRR = 5.0%)
- If the DH network developer is willing to accept a 40 project lifetime then an IRR of 6.9% is achieved.
- If a degree of private wire supply is possible such as to Barnet College and other schools in the proximity to Grahame Park then an IRR of 6.8% over 25 years is achievable.

6. PROJECT OUTLINE RISK ASSESSMENT

An outline risk assessment for the project has been carried out. This is presented in Appendix 4. The key risks are discussed below.

1. The planned build out of the DH network is dependent on developments occurring as anticipated. If key developments such as the Peel Centre are delayed and the heat connection date is pushed back then the rates of return for the network developer will be further reduced. Whilst the initial cluster networks such as the Peel Centre and Colindale Hospital may be successfully delivered through the private sector, it is unlikely that the DH opportunity identified in this report will be realised without local authority involvement due to the low internal rates of return identified, the complex stakeholder picture, the long and uncertain timescales for delivery and the long payback periods. This implies the need for high level individual and organisational commitment by the Local Authority and a degree of appetite to become a co-investor/partner in a delivery vehicle for the project. In the absence of this, there is a risk that the project will fail to gain momentum. Stakeholders may also be weary of engaging in the projects without the backing of the local authority and its support and commitment will also be important in this respect.

2. If the Local Authority takes forward the project opportunity it is likely to need to partner with the private sector in order to deliver the project since it won't have the necessary in house expertise to develop or operate the scheme alone. The Local Authority will therefore need to develop an understanding of the technical, commercial and legal risks to which it will be exposed so that it can secure the best partnering arrangement to secure its interests and t hose of the local community. It will therefore need advice and support around how to structure and procure the project as the project gets taken forward into the business planning phase.

3. The 2013 building regulations have set the carbon intensity for electricity generation from CHP equal to that of imported grid electricity. This has reduced the carbon savings arising from gas CHP, making it harder for new developments to achieve compliance using this technology. The likely implication of this is difficult to gauge with certainty at this stage, since there aren't a sufficient number of planning applications in place under the 2013 Regulations to form a robust view. Developers are likely to choose to invest in higher fabric efficiency standards as part of the solution to achieving the more onerous compliance standards. As developers adopt higher fabric efficiency standards, the economic case for community heat networks will worsen. However, at the development densities relevant to Colindale, the majority of Developers are likely to continue to implement gas CHP / community heat networks since these will continue to offer a market competitive approach to achieving compliance. The alternative solutions to achieving required carbon savings such as increased solar PV coverage, biomass fired systems and block level heat pumps are likely to experience a small increase in take up by the change in building regulations.

4. Financing of the energy centre will be a challenge if the DH opportunity is to be safeguarded without any certainty of future heat sales. A modular build out could mitigate this risk.

5. Financing of the energy centre will be a challenge if the wider area opportunity is to be safeguarded without any certainty of future heat sales. This is an area that is likely to require financial support or underwriting from the public sector to give certainty to the investors and to avoid a private developer choosing to size the early network for the initial demands only, which would miss a future opportunity to expand the network as described in this report.

6. A supply capacity risk will arise when designing the energy centre's heat demand now to meet a future DH network that may never materialise. It may not be in the scheme's

short term interests and may represent too great a risk to the business and its lenders at this stage. This risk can be mitigated by using a modular build out programme.

7. The economic proposition for the DH network is likely to rely on a Junior Supply License arrangement. Therefore uncertainty around the uptake of Junior Supply License presents a risk to the project and the development of the network is likely to be contingent on a Junior Supply License being established.

8. Safeguarding for future expansion along Colindale Avenue risks a scenario that the Fairview development (and those beyond) never connect. Consideration needs to be given to a safeguarding strategy that is supported by the freeing up of capacity in the network through a programme of operating temperature reductions in existing buildings. This will help to minimise capital outlay in the early years which may never pay back.

9. In the absence of a regulated market for heat supply, the commercial structures of the DH network need to address issues of supply resilience, customer protection, perception about heat networks and monopoly of supply. Without this customers may be unwilling to sign up to the long term contracts needed to provide guaranteed heat sales against which the project will be able to borrow. Key to this will be marketing the benefits of DH to customers, clear structuring of contracts with provisions to protect customers from being locked in to long term pricing mechanisms/tariff structures and the representation of customers through an independent body acting in a quasi-regulatory role. Clear technical standards should also be developed together with clear terms and conditions outlining how the tariffs will be set and escalated over time. The local authority may have a facilitating role to play in all of these areas and should work with GLA to disseminate information on heat contracts and tariff structures to make prospective customers more willing to engage.

10. In the absence of a regulated heat market the developments that come forward in the near term are likely to have their own heat sales agreements with customers. The adoption of different standards may be detrimental to the aim of connecting the developments into the proposed DH network in the future. This risk could potentially be mitigated by adopting standard forms of heat sales agreements for residential and non-residential customers. This will need to be coordinated through the Local Authority and or the GLA.

11. New developments and existing large non-domestic heat and electricity users e.g. RAF Museum may install combined heat and power units or alternative measures which may undermine the viability of the network by removing or reducing the heat demand from these customers. The local authority should use its powers to allow temporary solutions to be adopted in lieu of installing CHP or other compliance measures insofar as the building regulations will permit.

12. Commercial and financial risks around managing bad debts in the residential sector needs to be managed through appropriate structuring of heat sales agreements. The project vehicle needs to consider its relationship with the identified customer base and measures that can be implemented to mitigate bad debt risks.

13. Existing buildings may require retrofitting work to internal heating systems to ensure compatibility with the proposed heat network system. Further de risking should take place at feasibility stage. A connection standards document should be developed to outline the requirements and highlight the benefits to customers and to the network operator. Consideration could also be given to adopting a tariff structure that incentivises retrofitting measures that address heating system return temperatures.

14. In the absence of an adopted set of standards, there is a risk that the various developments are not designed in mind of future interconnection. This risks a sub optimal network solution, which will have on-going implications in terms of running costs and operating efficiencies. The Local Authority has a role to play in ensuring that design standards are developed, adopted and implemented.

15. The re-use of the Grahame Park Boiler House rather than its proposed land use change to residential development by Genesis is a risk associated with locating the area wide district heating energy centre at this location. The ownership of the boiler house is intended to pass from Barnet Homes to Genesis. The London Borough of Barnet could mitigate this risk by imposing a land use requirement within the transfer of ownership agreement.

16. The willingness of developers to connect into the network if they have already built energy centres e.g. Pulse at Colindale Hospital and the Peel Centre development. For these developments with installed plant the DH network would need to provide heat at a lower cost to the individual energy centre suppliers e.g. E.On.

7. NEXT STEPS AND IMPLEMENTATION PLAN

7.1 Immediate Actions to Progress the Identified District Heating Opportunity

London Borough of Barnet needs to consider the whether it wishes to take forward the DH opportunity identified in this report and if so role it wishes to play in developing the project.

Due to the identified internal rates of return of the project, it is likely that London Borough of Barnet will need to play a proactive role in delivering the project, since the appetite amongst the private sector for advancing the scheme alone will be limited.

If London Borough of Barnet decides to bring forward the opportunity it should consider carrying out the following measures:-

1) Building internal political support and commitment, overseeing the development of strategies and policies to develop the project opportunities and to obtain budget commitment to take forward the project through detailed feasibility, business planning and procurement.

2) Establish the appetite amongst major stakeholders to engage in the project. Establish a stakeholder engagement plan and work with stakeholders to establish a project delivery group to take forward the recommendations of this report. Key stakeholders should include Genesis Housing Association, Redrow and the RAF Museum, relevant schools, Fairview, E.On and London Borough of Brent and be involved due to the long term opportunity for connection.

3) Establish commercial options for delivery of the infrastructure and London Borough of Barnet's appetite for involvement. This should include an assessment of its key drivers and motivations for taking the project forward, as well as risk it is willing to take on and the internal commitment and resource it can allocate to delivering the project. The outcome of this should be to establish the London Borough of Barnet's role in the identified project opportunity and the commercial basis on which the future strategic opportunity could be delivered.

4) Commission a detailed feasibility study to further evaluate the technical opportunity, de risk technical issues such as the DH route, compatibility of customer connections, energy centre options and technical implementation issues and electricity selling arrangement options. A number of alternative scenarios should be explored when developing the scheme for the feasibility study.

   Retaining the distributed peaking plant at E.On and Peel Centre sites when they connect to the DH network should be investigated. By sizing the main energy centre for the area wide base load with distributed boilers the pipe sizes could potentially be reduced.

   A scenario where a Peel Centre energy centre is used to supply the DH network should be explored. By locating the energy centre near the large demands of the Peel Centre and the possible private wiring of electricity to the nearby Police and Peel Commercial may give a preferable IRR.

   Within the feasibility study the financing of a Peel Centre energy centre rather than Grahame Park energy centre should be considered. The Peel Centre would likely be obliged to have an energy centre with a communal system without a DH network. If a DH network with an energy centre is established at the Peel Centre then this could be partially funded by the Peel Centre and a council subsidy. Alternatively if the energy centre is installed at Grahame Park the Peel Centre avoids needing to finance an energy centre. Therefore an arrangement could then be reached whereby a portion of the network is partially financed with these unspent funds.

5) Explore funding options. This should include consideration of investment through capital reserves, collection of revenues through Community Infrastructure Levy (CIL), S106 Agreements and Allowable Solutions (refer to Section 7.5) and opportunities for low cost borrowing though the Public Works Loan Board (PWLB), and the London Energy Efficiency Fund, which has recently opened to DE projects and is likely to be interested in investing in publicly backed opportunities of this nature. It is also noted that a portion of the GLA regeneration fund could be allocated to Grahame Park. Genesis, who is managing the development of the Grahame Park, could be in receipt of a loan. Barnet Council could take a lead and put up some capital whilst a 'soft loan' might be available from the treasury via the GLA on a leaseholder buyback.

6) Draw on support from GLA through the Decentralised Energy Programme Delivery Unit (DEPDU) and/or HNDU through its heat networks delivery fund to action 4 and 5 above.

7) Engage with the private sector around possible joint venture development opportunities. A local delivery vehicle could potentially be established with the private sector and London Borough of Barnet each having a stake in the project company.

8) If the outcome of 3, 4 and 5 above indicate a case for taking forward the project, develop a detailed financial model, a business case and carry out business planning in order to secure the necessary funding to take the project to procurement.

9) Address planning related recommendations as set out in Section 7.3 of this report.

10) Address technical safeguarding related recommendations as set out in Section 7.4 of this report.

11) If a scheme is taken forwarded important to address the marketing and public perceptions of DH networks.

12) Keep under review developments in the area of Electricity Licence Lite with a view to adopting this model if it is taken forward through a Local Authority route.

7.2 Stakeholder Engagement

7.2.1 Internal

A project board should be established with senior representation from planning, regeneration, legal, finance, highways, housing and facilities departments.

The benefits of the project should be articulated to the group so that there is a common understanding of the implementation process and the intended outcomes.

The resourcing implications of delivering the project should be considered and safeguarded. A dedicated project champion will need to be appointed. This person should have the relevant skills, knowledge and drive to take forward the project.

A project objectives workshop should be implemented to align objectives for the project across the various departments and to build knowledge, secure senior support and begin to explore attitudes to risk and control of the scheme

7.2.2 External

Engagement with a number of developments around Grahame Park (and consequently stakeholders) will be necessary to develop the initial project opportunity. The participation of these developments will be critical to the success of the overall scheme. E.On's early participation/enthusiasm is considered key as they are already a local ESCo. An initial discussion with E.On would be useful exercise to test a possible ESCos appetite.

There are also uncertainties surrounding the timescales and size of some of these developments as many will subject to external influencing factors beyond the immediate control of the relevant stakeholders such as the wider national economic situation. As such it recommended that the next stage should be to engage to a greater extent with the identified parties to ascertain the level of interest in connecting to the network and the extent to which development plans/timescales may have changed.

During the course of this study, stakeholder consultation has taken place with most of the key stakeholders to gauge interest a heat network as a replacement to their existing heating supplies. Positive feedback was generally received subject to the receipt of further details on the cost of such an alternative scheme.

Moving forward the following are recommended:-

- Hosting workshops with all of the key stakeholders in order to present the findings of this report and to seek further information from these organisations that could serve to inform the next stage of the project process. Existing building owners and developers will need to understand the implications of connecting to the district heating scheme both financially and technically. An engagement strategy should be developed and implemented with the purpose of addressing customer needs as part of the development process. Regular communication with these stakeholders should be maintained throughout the development process.

- Engagement with possible project partners and with the existing energy centre operator at Grahame Park, Barnet Homes as many of the recommendations in this report will directly affect the operation and future planning of the energy centre.

- Hosting stakeholder open days whereby stakeholders are invited to meet with the Local Authority to determine the appetite for involvement in the scheme and to identify additional opportunities with regards to future developments that have not yet come to the notice of the Local Authority's planning department.

- Establishing Memorandums of Understanding (MoUs) with the key stakeholders critical to the success of the project.

7.3 Planning Related Recommendations

The outcomes of this study should be cross referenced to existing council policies and strategies and local planning documents should be updated to reflect the heat network opportunity identified in this report.

The proposals should be disseminated to relevant departments within the Council to raise awareness of the planned infrastructure proposals.

This will involve cross-departmental co-operation and careful consideration of the key drivers for district heating in Colindale.

Recommendations for technical safeguarding measures have been made in this report. These should be complimented by recommendations set forward in the GLA's District Heating Manual for London. Further work is required to ensure that there is alignment between policies and that policy levers can be utilised to support the growth of the identified DH network opportunity.

London Borough of Barnet should consider adopting Local Development Orders (LDO) to facilitate deployment of the future DH network. This would allow the Councils to create a blanket planning permission to a future Project Company for constructing heat networks without the need for specific planning applications at each stage of development of the heat network.

7.4 Technical Safeguarding Measures

7.4.1 Safeguarding Energy Centre Locations

London Borough of Barnet should consider safeguarding the Grahame Park Boiler house site.
This should include exploration of options for making a condition of sale that the existing boiler house is retained and to be used as a future energy centre. This could be performed as part of the concession bestowed upon Genesis.

Other potential sites for an energy centre should be explored and safeguarded as appropriate through planning conditions.

The energy centre recently completed at the former Colindale Hospital site and the energy centre planned at the Peel site both offer opportunities for the network.

Although discounted in this study for reasons given chapter 3, the possibility of locating the energy centre at the Peel Centre instead of at the Grahame Park boiler house should be explored.

The Peel Centre is one of the area wide scheme's largest demands and locating the energy centre here might offer a lower risk profile albeit with likely higher capital costs due to the lack of existing infrastructure.

Whilst the existing and planned small scale embedded CHP plants within the CRA will not have a major role to play as future supply assets, the potential for these to be adopted by a future network operator for use as topping up / back up plants should be kept in mind.

7.4.2 Ensuring Correct Design Standards are Adopted for New Developments

The design of customer connections and internal heating systems for new developments will have a significant impact on the operational capacity and efficiency of a future DH network.

Developers should be required to implement appropriate internal heating system designs to ensure flow and return temperatures are compatible with the heat network. The London Borough of Barnet, through their planning and Building Control departments, should ensure that systems are being designed, installed and commissioned appropriately.

Recommendations contained in the GLA's London Heat Network Manual for district heating[13] should be adopted and disseminated to developers to ensure that heating systems are designed to a common standard, capable of future integration into the proposed heat network.

As a minimum the following future proofing measures should be adopted.

- Requiring 'wet' heating systems to be installed and prohibiting electrical heating systems.
- Requiring the incorporation of communal heating systems instead of individual boilers. Communal heating systems should be fed from plant rooms producing low temperature hot water for space heating and domestic hot water. Future proofing should include for providing 'tees' and isolation valves to facilitate future connection of heat exchangers. Space should be reserved for heat exchangers, or it should be planned for heat exchangers to replace heat-only boilers at time of connecting to the heat network.
- Ensuring internal heating systems are designed so that they can be connected to supply a district heating network with minimum retrofit. This should be achieved through measures such as built-in penetrations allowing pipes to be pushed through into plant rooms without structural alterations or significant works, designing heating systems to minimise return water temperatures and allowing provision in the building fabric to facilitate the installation of district heating pipework at a later time.
- External buried pipework routes should be safeguarded to the boundary of the plot where connection to the heat network will be made.

Under current building regulations, developments can achieve compliance using gas only boilers. However, future updates of the building regulations are set to adopt the compliance targets set out under the government's zero carbon homes policy. This will require developments to install compliant technologies in order to meet the building regulations and may not include provision to defer installation of such technologies in lieu of connecting to a heat network in the future.

There may be an opportunity for London Borough of Barnet to allow developers to defer installation of alternative compliant technologies in lieu of making a provision to connect to a heat network. This will depend on provisions under future updates to the building regulations, which the London Borough of Barnet will need to be mindful of in policy setting terms.

[13] London Heat Network Manual (GLA): April 2014

In such circumstances, the London Borough of Barnet could place a requirement on developments to retrofit compliant technologies within a fixed period, in the event that a heat network is not taken forward.

The following requirements should be applied to developments of a scale where CHP would ordinarily be considered and that are planned to be developed within 5 years of the point in time when a local heat network is to be constructed. The RAF museum is likely to fall into this category.

- The development should be designed on the basis of its own CHP with standby boilers and 'future-proofed' to connect into the heat network in the future.

- Allowance should be made to defer investment (installation) in the CHP plant for five years to allow time for the heat network to be constructed and connected to the network. Once the network connection is made, the requirement to install CHP should fall away.

- If the heat network connection is not made within five years and there is no reasonable prospect of doing so, then the development should be required to install a CHP plant. A section 106 obligation could be employed from the outset to ensure the CHP installation is carried out retrospectively.

- During the five year period, the development will be supplied with heat from its own heat-only boilers, noting that the environmental benefits will not accrue until either the heat network connection is made or CHP installed.

- The developer could be given a planning condition to allow any 'freed-up' plant space resulting from the heat network connection to be used for more profitable purposes.

These recommendations are subject to acceptable provisions under future updates to the building regulations.

For developments coming forward over a horizon of beyond 5 years from the date of construction of a heat network opportunity, provisions should be made for developments as follows:-

- For developments of a relevant scale[14] that are being planned with a horizon of 10 years to the point at which the heat network is intended to be constructed in the vicinity of the development, the development should be required to safeguard to connect to the heat network at the end of the economic life of the CHP plant.

- For developments of a relevant scale[15] that may in future be planned and at locations where they could connect into the heat network, these developments should be designed for a district heating connection from the outset. This would entail a smaller plant room to accommodate the interfacing district heating heat exchanger and displace the requirement for heat-only boiler and CHP plant.

7.4.3 Programme of heating system operating temperature reductions in existing and any local authority controlled buildings

London Borough of Barnet should consider initiating a programme of heating system operating temperature reductions in both existing buildings (e.g. RAF museum) and any Local Authority controlled buildings – this will improve operating efficiencies (reduce network losses, reduce pumping energy requirements, improving heat pump efficiency where implemented and also free up capacity in the network for additional connections.

[14] where CHP would be considered

[15] where CHP would be considered

7.5 Establishing London Borough of Barnet as an Allowable Solutions Provider

The government's proposed Allowable Solutions framework will require developers to meet Carbon Compliance requirements through a combination of on-site and offsite measures. There two routes that developers can take under the proposed framework, one of which can involve local authorities with approved policies are in place, to establish local Community Energy Fund into which developers can pay to offset their shortfall in compliance through on-site measures.

Depending on London Borough of Barnet's appetite for involvement in the Allowable Solutions framework, the collection of funds through this mechanism across the borough could become a future source of funding for the DH network.

Any such income could help to plug the funding gap and thereby improve the economic proposition to the local authority and to potential project partners alike.

London Borough of Barnet should consider this opportunity in the light of the project opportunity identified in this report.

8. REFERENCES

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