District Heating Feasibility

Phase 2: Network Development and Financial Modelling

FINAL REPORT
16th February 2018

Prepared for:
London Borough of Merton
Executive Summary

District Heating (DH) can provide low cost energy to the residents and businesses in Merton, whilst delivering increased energy security, carbon savings and other environmental benefits. District Heating provides heat, which is generated in an Energy Centre (EC), to identified buildings in the area through the distribution of hot water in buried pipework.

This report is the second of two reports detailing the findings of an investigation into the feasibility of DH in the London Borough of Merton and should be read in conjunction with the Phase 1 report¹.

Phase 1 Summary

Phase 1 mapped the relevant existing and future heating, cooling and electrical demands and supplies in the borough. Only the demands of public and commercial buildings with significant energy consumption were reviewed, as smaller loads are less viable for connection to a district heating network. The mapping of heat supplies focused on industrial waste heat, heat recovery from substations, energy from waste plants, existing gas fired combined heat and power (CHP) plant and heat that could be sourced from Merton’s surface water (e.g. rivers).

The study concluded with two opportunity areas for district heating in the borough: Colliers Wood and South Wimbledon (CWSW) and Morden Town Centre and Leisure Centre (MTCML). Energy masterplanning for these two areas then sought to: prioritise buildings for connection; define how heat would be generated; determine pipework routes; evaluate Energy Centre (EC) locations; and develop capital costs.

The resultant CWSW network was based around a gas CHP solution with back up boilers housed in an energy centre located in the proposed High Path Estate development. In MTCML, a gas CHP based solution with back up boiler provision was also proposed, with the EC intended to be located in the car park adjacent to the Merton Civic Centre.

Phase 2 Summary

This report describes the design development and business case analysis of both network opportunities. Stakeholder engagement and site surveys assessed the buildings considered for connection, as well as other key assumptions such as EC location, the distribution of electricity generated by the CHP engines, proposed pipework routes and the appetite for connection of new developments.


EC layouts, plant sizing, pipework diameters and lengths, network operating temperatures and assessing the utilities connection requirements were all developed.

Detailed technical operating parameters for each network were established. Hourly heat and electrical demand profiles for each building were estimated and amalgamated. In line with the CIBSE Code of Practice for Heat Networks (CP1), estimates were made for parameters such as network heat losses, EC ancillary electrical requirements and CHP and boiler operating characteristics. These parameters form the backbone of the bespoke techno-economic model (TEM).

Capital cost estimates were made. Work was undertaken to assess what residents and businesses are currently paying for heat and electricity in Merton. These figures were used as a ceiling to ensure customers would realise a saving by connecting to the network. The associated revenues from the sale of heat and electricity, alongside CAPEX, REPEX (replacement expenditure) and OPEX values were consolidated into the TEMs.

The networks then underwent more detailed financial modelling (carried out by Grant Thornton). The outputs from the TEM were used to forecast a return for both Private and Public Sector investors. The internal rate of return (IRR) and net present value (NPV) were modelled for a number of network scenarios, in order to understand the economic robustness of the projects. The types of funding that might be available for a DH scheme in Merton were also identified, and a number of project sensitivities were explored.

CWSW network results

The proposed gas (CHP and boiler) fired district heating CWSW network was modelled to deliver 15,852MWh of heating, with a peak demand of 10.9MW, 75% of the heat demand would be met by the CHP, (a pre-requisite for State aid compliance). The network includes a 715m² EC located on the High Path Estate, with 4km of district heating pipework serving predominantly privately owned commercial and residential properties in the area. The study has included engagement with Clarion Housing Group (formerly Circle Group), the developers of the High Path Estate, who have been supportive of the plans detailed in this report and have not ruled out hosting the EC.

The wider DH network is proposed to operate at conventional temperatures of 95°C flow and 65°C return, with a dedicated lower temperature network for the High Path Estate. This would future-proof part of the network for lower carbon technologies such as heat pumps sourced from the nearby River Wandle or from London Underground ventilation shafts.

The phasing of the High Path Estate and the private ownership of the buildings on the network means that much of the network’s heat demand is not realised until a number of years after construction. This is damaging to cash flow and increases the investment risk.
The CWSW network was shown to make a net carbon emission saving until 2035. Thereafter the model suggests that network will start to emit more carbon than the business as usual case due to the expected decarbonisation of the electricity grid. Carbon saving projections are based on BEIS future carbon emissions factor projections for CHP.

Customers in Morden Industrial Estate have shown interest in purchasing electricity from the DEN. This would improve the revenues generated due to the higher price at which electricity can be sold to private customers compared to wholesale export to the grid. Due to the uncertainty of supplying the Morden Industrial Estate with electricity, the modelling has assumed that a proportion of the electricity generated by the CHP can be sold to the private heat customers on the network (rather than exported to the grid). Electrical demand modelling has been undertaken, and the amount of electricity sold privately has been calculated to be 54% of the total amount generated. This approach to the analysis means that the calculated network returns are conservative estimates and could be improved by increasing the amount of electricity sold privately. The results of the base case of the CWSW network are provided in Table 0-1.

### Table 0-1: Summary of CWSW financial results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>A – Base Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Gas CHP &amp; Boilers</td>
</tr>
<tr>
<td>CAPEX (real)</td>
<td>£15.2m</td>
</tr>
<tr>
<td>Project IRR (Real, 40 year)</td>
<td>6.01%</td>
</tr>
<tr>
<td>Investor IRR (Nominal, 40 year)</td>
<td>7.69%</td>
</tr>
<tr>
<td>Investor NPV (Nominal, 40 year)</td>
<td>£3.97m</td>
</tr>
<tr>
<td>Project viable based on projections?</td>
<td>No</td>
</tr>
</tbody>
</table>

Whist the base case was not shown to be attractive, scenarios which were found to bring the CWSW network to a more commercially viable proposition are as follows:

- Scenario C – this considers the impact of a CAPEX grant of 30% and generates an investor IRR of 9.92%.
- Scenario D – this increases the heat price by 5% (relative to the assumed 10% discount on the price of heat offered to customers over their current tariff) and generates an investor IRR of 8.08%.
- Scenario F – this increases the electricity price by 5% (relative to the assumed 10% discount on the price of electricity offered to customers over their current tariff) and generates an investor IRR of 7.94%.

### MTCML network results

The proposed gas (CHP and boiler) fired DH network in MTCML provides heating to the Merton Civic Centre, the proposed Morden Town Centre development, the new Morden Leisure Centre, and Thames Valley College. The modelled peak heat demand of the network is 8.3MW, and 11,359MWh of heat is provided annually, of which 75% is met by CHP engines (pre-requisite for State aid compliance). 1.5km of pipework is proposed to distribute low temperature heat (75°C flow, 45°C return) around the network, with a dedicated higher temperature supply for the Merton Civic Centre.

The 706m² energy centre is proposed to be located in the car park to the rear of the Merton Civic Centre; exploiting space currently used for plant where possible. Plant is proposed to be installed in two phases to meet the network demand as it increases over time.

Like the CWSW network, carbon savings of the MTCML network are significantly reduced beyond 2035 due to predicted grid decarbonisation.

Engagement with Transport for London (TfL) was undertaken to assess their appetite for purchasing generated electricity. At the meeting, TfL confirmed they would be interested if the relevant substations were in place to make this possible. This needs further verification. As such, and for the purposes of the modelling, it is assumed that electricity is sold privately to customers on the network with the remainder exported to the grid. This has been calculated as 55% of the electricity generated. The results of the base case of the MTCML network are provided in Table 0-2. As with the CWSW network, the financial performance of the network could be improved with capital grant funding, or by increasing the revenues generated from the sale of heat or electricity.

### Table 0-2: Summary of MTCML financial results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>A – Base Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Gas CHP &amp; Boilers</td>
</tr>
<tr>
<td>CAPEX (real)</td>
<td>£9.2m</td>
</tr>
<tr>
<td>Project IRR (Real, 40 year)</td>
<td>9.55%</td>
</tr>
<tr>
<td>Investor IRR (Nominal, 40 year)</td>
<td>9.55%</td>
</tr>
<tr>
<td>Investor NPV (Nominal, 40 year)</td>
<td>£5.12m</td>
</tr>
<tr>
<td>Project viable based on projections?</td>
<td>Likely, providing the working capital position can be resolved</td>
</tr>
</tbody>
</table>

2 Subject to confirmation that Thames Valley College buildings can accept a 75°C flow temperature.
Key Risks

If LBM choose to pursue either network, it shall need to secure the energy centre sites at the earliest opportunity.

There is a risk that some of the customers identified for connection will either not be interested in connection, or technically unable (for example due to the use of an incompatible heating/cooling water system). In particular, operators of the identified existing private buildings must be engaged with as early as possible. Full building audits must be carried out to assess technical viability.

The ability to operate the MTCML network at lower operating temperatures is dependent on the design of the buildings and their suitability for accepting lower supply temperatures than conventional. LBM should engage with Thames Valley College at the earliest opportunity to ascertain the ability to supply heat at 75°C to their building(s). Furthermore, planning conditions should be imposed on the developers of the Morden Town Centre and Morden Leisure Centre developments to ensure that buildings are designed with heating supply temperatures of 75°C or lower.

Developers of future buildings such as that of the High Path Estate and the Morden Town Centre development should be consulted and made aware of any planning conditions that might affect them with regard to the district energy system in the area.

The importance of maximising the sale of electricity to private customers, as opposed to selling it to the grid, was highlighted in Phase 1. The higher revenues realised through private sales increases financial returns of the networks. Where possible, all electricity generated should be sold privately; it is generally preferable to supply electricity to a small number of large consumers rather than several small consumers.

The council must work to ensure that the proposed network serves to improve air quality in the local area when compared to the business as usual case. Detailed air dispersion modelling is necessary to show both the business as usual case and the proposed scheme effects.

Recommendations and next steps

Both the CWSW and MTCML areas present viable network opportunities for DH in Merton.

The CWSW network was shown to be viable mainly under the capital grant scenarios, i.e. LBM would need to secure additional funding on top of what could be obtained from investors. Schemes such as the UK Government’s HNIP fund may be applicable and should be explored. Although the High Path Estate was not modelled as a standalone network, it is likely that a DH network to serve this development alone would be viable. Furthermore, such a strategy for the High Path Estate would align well with the Mayor of London’s new London Plan. Detailed project development in the CWSW area could be led by Clarion Housing Group (formerly Circle) and could focus more specifically on the High Path Estate.

The MTCML network presents a better opportunity for DH in Merton, providing good investor returns and being future proofed for low carbon technologies in the future. LBM has a degree of control and influence over the Morden Town Centre scheme and as such can condition the developers to ensure that the design of buildings is carried out in a way that enables connection to DH. The town centre development has not been modelled as a standalone network, but its own district heating scheme is likely to be found to be viable for a development of this type and scale, regardless of whether the wider network is pursued. LBM should take care to ensure that further work aligns with the phasing of the Morden Town Centre development.

The next phase of assessment (detailed project development – DPJ) should seek to develop the findings of this study. HNDU funding may be available to assist with this work. This DPJ phase should:

- assess delivery vehicle options and risk appetite
- add technical development to designs, including investigation into air quality aspects
- form a better understanding of commercial arrangements including bespoke negotiation with customers (and possible soft market engagement)
- prepare an Outline Business Case (OBC)
- prepare a bid for HNIP funding

Stakeholder engagement will be key - with new developers and owners/operators of the existing buildings proposed for connection; engagement internally within LBM - to secure areas necessary for hosting ECS and routes for pipework (planning and highways); engagement within the LBM finance and environmental teams - to discuss the benefits and risks associated with the schemes, and to identify if there are any opportunities for additional funding.