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Method Statement 3.6 - CHP Plan

MS 3.6a - Background

The Contractor is to develop the Key Facility in Beddington, South London, and have commissioned a number of district heating (DH) studies linked to this facility.

These ongoing DH studies will develop the technical, economic, environmental and commercial issues and provide sufficient information on a preferred district heating scheme to allow the Contractor to make strategic decisions on the feasibility and deliverability of heat export.

This plan is based on these studies and aims to present an implementation strategy for a district heating scheme for the Key Facility.

There is also an opportunity to export heat from the existing landfill gas engines located at the Beddington landfill site. Heat will be available from these engines until approximately 2020 although due to the high investment costs and short supply period it would not be possible to implement a standalone district heating system based on using these engines. It is therefore proposed to amalgamate the heat export capacity of the engines and the Key Facility to feed a single district heating system.

MS 3.6b - Plan Objectives

The Key Facility at the Beddington Lane Site will provide potential for a district heating output of up to 20,000 kW. The thermal energy is derived from the steam supply to the turbine, and is therefore not ‘waste’ heat. The export of heat from the Key Facility will result in a reduction in electrical export of up to 20% but will improve the overall plant efficiency.

To become a CHP plant, thermal energy needs to be exported from the Beddington Lane Site in the form of hot water. A hot water based system is proposed as it provides the widest opportunities for heat users.

In order to deliver a district heating network, the scheme scope needs to be defined and technically assessed to prove that it is deliverable. Potential consumers need to be identified and approached so that there is a high degree of certainty over heat sales. The economic viability then needs to be confirmed. Once these steps are completed final negotiations with potential energy service companies (ESCOs) can take place with a high degree of certainty. This process needs to be repeated if the initial assessment is not positive, as circumstances can and will change.

The main objectives of this plan are to:

(1) identify potential heat user developments that could present future connections to the district heating scheme;

(2) estimate the average and peak heat demand for key developments;

(3) provide estimated heat tariffs for commercial and domestic residential heat consumers;

(4) review provisional DH network routing and sizing;

(5) carry out carbon savings calculations for the scheme;

(6) demonstrate the business case for district heating; and

(7) develop an action plan to identify the strategic phases required for the district heating scheme development.

MS 3.6c - Anchor Heat Users

Potential anchor heat users have been identified, on both sides of the Key Facility: west towards Hackbridge and east towards Croydon. For each of the two areas the average and peak heat demands have been estimated for the identified anchor heat consumers and a cumulative heat demands have been determined.

It is expected that the development of a district heating system will take place over a number of phases due to the potential size of the scheme. This will minimise the initial investment while providing a base heat load that will demonstrate to other potential heat users the benefits of utilising the system. It is anticipated that the network will be further developed over a number of years with sections connecting a number of buildings being brought on line for each phase.

No pre-existing single development exists in the area which is of sufficient size to accept a significant amount of heat from the Key Facility, but there is the potential to supply a proportion of the heat exported to existing and proposed local developments. There are a number of other developments which also present good opportunities for heat use although they are some distance away. Potential additional heat users have been identified and these provide an economic incentive for extending the network.

The potential anchor connections to the system are described in section iii below with a general description of the types of heat consumers. Separate sections have been provided on the heat users within Hackbridge (section a) and Croydon (section b).

i. Modelling Assumptions

District heating network design is based on peak heat demand. Peak heat demand will usually be determined from the winter daily heat use profiles. However, no daily heat consumption data is available for the potential anchor heat users. Instead typical daily profiles which represent the heat users have been used. The estimated annual heat demand was applied to this typical daily profile to estimate the peak heat demand.

A combined heat demand profile for each period was then developed to model the seasonal and daily change in heat demand. The peak demand figure for each period was set by the maximum total capacity of the heat users.

ii. Confirmed heat users

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

The total estimated heat load is approximately 1,200 kW (average).

A breakdown of the type of heat users is provided in Table 1 and Table 2, for commercial and residential respectively. The surface area is indicated and has been used to calculate the heat load for each property type based on the Guide for energy efficiency in buildings published by the Chartered Institution of Building Services Engineers.

Table 1 – Felnex commercial type of heat users	
Property Type	**Surface area**
Supermarket	4,000 m^2
Other retail	1,902 m^2
Offices	5,795 m^2
Care Home	3,050 m^2
Community Centre	821 m^2

Table 2 – Felnex residential type of heat users	
Property Type	**Surface area**
Residential above the supermarket	10,964 m^2
Town houses	23,354 m^2
Residential above retail	13,599 m^2
Other apartments	13,846 m^2
Residential in business forest	6,180 m^2

iii. Potential additional connections

[redacted]

[redacted]

This study has identified potential heat consumers in the vicinity of the Key Facility based on publicly available information and data provided by Inventa Partners. Further investigations are likely to identify more potential heat consumers. Currently, it is not financially viable for some heat users to connect individually but with economies of scale, groups of smaller heat users are more likely to become viable connections.

This assessment has concluded that seven phases are appropriate for the supply of heat to the identified key heat users.

Table 3 – Key Heat Users

Phase	**Potential key heat user**
1	Felnex Trading Estate (**confirmed heat user**)
2	Carshalton College
	Westcroft Leisure Centre
3	St. Helier Hospital
	Corbett Close
	Durand Close
4	Kelvin House
5	Whitgift Shopping Centre
6	Bernard Weatherill House
	College Green
	Taberner House

Table 3 – Key Heat Users	
	Davis House
	Waddon
7	Menta site

Maps showing the location of these potential anchor heat users are provided in Appendix MS 3.6-1 and Appendix MS 3.6-2 representing the west and the east side opportunities respectively.

We have assumed that the Key Facility will be capable of supplying an average up to 20 MW (20,000 kW) of heat for a minimum of 30 years, which is the nominal life of the energy recovery facility.

Table 4 – Cumulative demand for the Beddington District Heating network			
Phases	Annual demand kWh[1]	Average demand kW[2]	Peak demand kW
1	10,512,000	1,200	3,700
1+2	14,450,000	1,600	6,800
1+2+3	36,619,000	4,200	13,700
1+2+3+4	36,809,000	4,200	13,800
1+2+3+4+5	38,329,000	4,400	14,200
1+2+3+4+5+6	50,135,000	5,700	18,100
1+2+3+4+5+6+7	**68,031,000**	**7,800**	**23,400**

Note 1: annual heat demand being the billing unit for energy delivered to consumers by energy utilities (kW·h).

Note 2: average demand is the ratio between the annual demand and the total hours in a year (8760 hrs/yr).

We have included Phase 1 to represent the connection to Felnex Trading Estate which is a confirmed heat user within South London. The developer has been actively engaged in discussions in response to a draft condition included in the London Borough of Sutton's report to Committee which requires the proposal to indentify and include renewable technologies to achieve a 20% reduction in carbon dioxide emissions. This developer has expressed a strong interest in receiving heat from the Key Facility.

A detailed optioneering study is outlined in section MS 3.6d - . The commercial heat users within the Felnex Trading Estate include a supermarket, retail outlets, offices, a care home and a community centre. The residential heat users include apartments above the supermarket, town houses, apartments above the retail units, other apartments and residential units. A Memorandum of Understanding (MoU) is being developed between the Contractor and the developer Shroeder, responsible for the development at the Felnex Trading Estate, for the use of heat from both the Key Facility and the landfill gas engines. Shroeder are currently negotiating with two major utility companies who are bidding to be the ESCO for Hackbridge (more information on ESCO's is provided in section 11). These two utilities companies are seeking options to supply heat to the customers: buying heat from the proposed Key Facility is one of the possibilities that these utilities companies are actively considering.

The total estimated average Felnex heat load is approximately 1,200 kW with an estimated a peak load of 3,700 kW.

a. West side of the Key Facility development (Hackbridge)

Discussions with Hackbridge Sustainable Suburb resulted in a number of developments being identified as having potential for connection to the South London CHP scheme. These are set out below. In particular a meeting was held at BedZed, the Beddington Zero Energy Development in Hackbridge. Amongst the attendees there were representatives from Bioregional, LB Sutton, Hackbridge & Beddington Corner Neighbourhood Development Group (HNDG).

[redacted]

[redacted]

[redacted]

[redacted]

The total estimated heat load is approximately 5,500 kW (average). Some of the developments that have been identified are Westcroft Leisure Centre, Carshalton High School for Girls, Boys College, Durand Close housing, St Helier Hospital, BedZed, Corbet Close, Mullards Estate and many others. The most relevant developments, in terms of heat demand, are described below.

The CHP strategy that has been adopted and potential heat demand has been discussed with Jeff Wilson and the London Borough of Sutton who advocated the approach to developers and potential developers as undertaken by the Contractor.

(1) Carshalton College

Carshalton College has expressed interest in connecting to the proposed district heating system in preference to a forthcoming boiler replacement programme.

The annual gas usage data from 2010/11 suggests the College has an annual average demand of approximately 334 kW. The capacity of the existing gas boilers, which will need replacement in the near future, is 330 kW per unit. Based on a typical heat profile, we estimate the College has a peak heat demand of 1,140 kW.

(2) Westcroft Leisure Centre

The Westcroft Leisure Centre is due to replace its existing gas boilers in the near future. The Centre is also in the middle of a significant refurbishment and construction is scheduled to be complete in November 2012. The heat demand from the leisure centre prior to the refurbishment was as follows:

- average annual load = 1,008,000 kWh; and
- peak load = 1,860 kW.

(3) St. Helier Hospital

St. Helier Hospital will be embarking on a major re-development programme across a large portion of their existing site during 2012/13.

This will include redevelopment of their existing boiler house. The management at the St. Helier Hospital has expressed strong interest in being part of a local heat network.

The annual gas usage for the existing buildings, is approximately 19,427,877 kWh (2,200 kW annual average) and the existing boiler capacity is 8,000 kW to cope with peak demand. Based on a typical heat profile for a hospital, we estimate the hospital's peak heat demand to be 5,800 kW.

(4) Corbett Close

Corbett Close is being developed by Affinity Sutton, a registered social housing provider. Affinity Sutton has confirmed it would be interested in connecting to a local heat network.

The development consists of the following:

- 10 x 2 bedroom houses;
- 34 x 3 bedroom houses; and
- 14 x 4 bedroom houses.

The development will require space heating as well as domestic hot water heating with a total annual heat demand of 50 kW. The annual requirements are estimated as follows:

- space heating = 241,287 kWh;
- domestic hot water heating = 203,058 kWh.

Based on typical heat profiles, we estimate the peak heat demand to be 170 kW.

Corbett Close is scheduled to be developed from 2013.

(5) Durand Close

Durand Close is also being developed by Affinity Sutton who have expressed an interest in connecting this development to a local heat network.

The development consists of the following:

- 132 x 1 bedroom flats;
- 218 x 2 bedroom flats;
- 3 x 3 bedroom flats;
- 6 x 2 bedroom houses;
- 43 x 3 bedroom houses; and
- 30 x 4 bedroom houses.

The development will require space heating as well as domestic hot water heating for a total heat demand of 265 kW. The annual requirements are estimated as follows:

- space heating = 1,071,837 kWh; and
- domestic hot water = 1,225,007 kWh.

Based on typical heat profiles, we estimate the peak heat demand to be 895 kW.

Durand Close is scheduled to be developed slightly later than Corbett Close, starting in 2013/14.

(6) Kelvin House

Kelvin House sits on the opposite side of Hackbridge Road to the Felnex development. This development comprises of 87 apartments.

Kelvin House is nearing completion however as part of its planning consent is has been developed to allow it to connect to any future heat network. Construction has started on site and it is due for completion before the end of 2012.

The estimated heat demand is approximately 190,000 kWh. Based on a typical heat profile, we estimate the peak heat demand to be 74 kW.

b. East side of the Key Facility development (Croydon)

Croydon Council is currently developing a strategy to establish a district heating network for the central Croydon area through the Croydon Council Urban Regeneration Vehicle (CCURV). The scheme would be based on the regeneration plans for the town centre with key development plots being supplied by a central energy centre. The team at the Council has developed a detailed financial model to test the viability of the scheme and this assumes that there is a single gas fired CHP energy centre. It is envisaged that there will be an average heat load demand of approximately 27,000 kW (average) potentially increasing up to 64,000 kW (average) from the sites identified, subject to planning permission being granted for the development proposals.

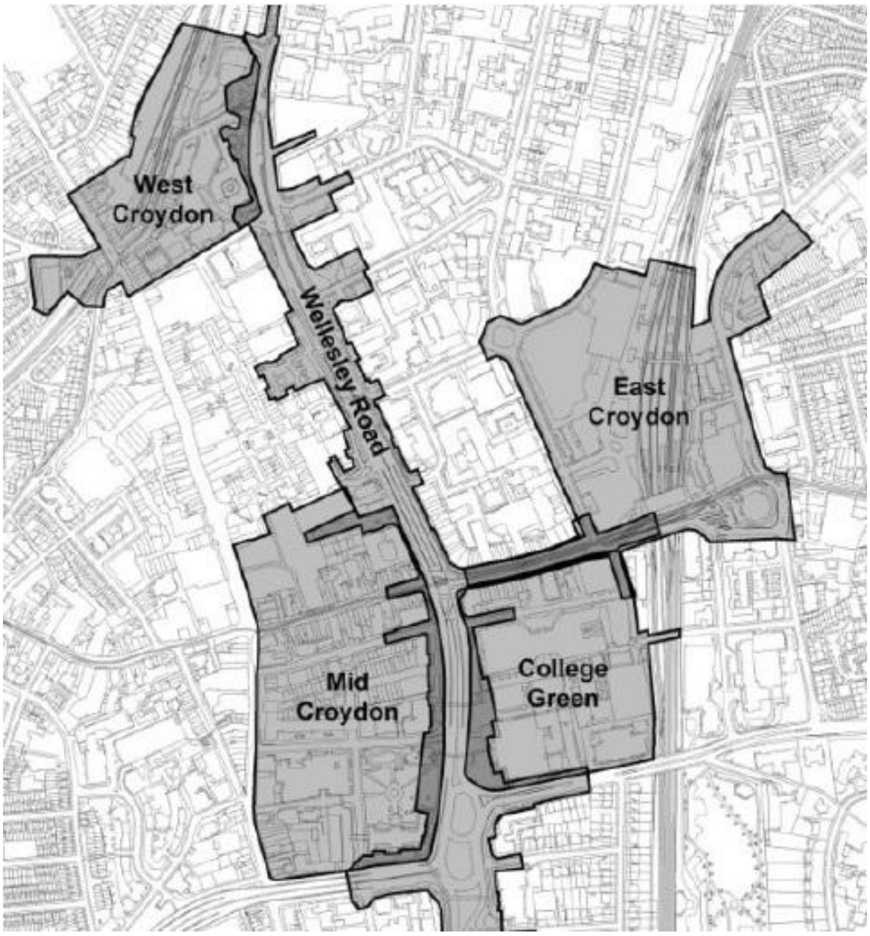

Figure 2 – Croydon development areas

The list of potential heat users within Croydon Council's financial model includes, but is not limited to:

(1) Ruskin Square;

(2) Bernard Weatherill House;

(3) College Green;

(4) Taberner House;

(5) Davis House;

(6) Waddon;

(7) Menta site;

(8) Whitgift Shopping Centre;

(9) NHS Croydon hospital;

(10) Fairfield Halls school; and

(11) a development on the existing Taberner House.

Some of the developments that could potentially join this scheme are shown in Figure and are outlined in the section below.

(1) Whitgift Shopping centre

Whitgift Shopping centre has been carrying out construction works for the erection of a 5 storey extension building which comprises a total floor space of 7,830 m^2. The estimated annual additional heat demand is approximately 1,520,000 kWh (170 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 455 kW.

(2) Bernard Weatherill House

The Bernard Weatherill House (BWH), formally the Public Service Delivery Hub (PSDH) is CCURV's corner stone project. The development is a 22,300 m^2 office building designed to house Croydon Council and a range of local service providers. Works started in March 2010 and construction work is programmed for completion in summer 2013. The estimated annual heat demand is approximately 1,760,000 kWh (200 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 527 kW.

(3) College Green

College Green is located in the centre of Croydon. The site is made up of several components. The College Green masterplan is to create a learning and cultural area with a mixture of cultural, educational, leisure, residential and retail uses and covers approximately 5,740 m^2 floor area. The estimated annual heat demand is approximately 792,000 kWh (90 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 309 kW.

(4) Taberner House

Taberner House is located in the centre of Croydon. Croydon Council are in the process of preparing a masterplan for mid-Croydon, which encompasses Taberner House. Initial proposals suggest a high quality residential development with the ground floor uses having active frontages onto Queens Gardens. Uses could include leisure, retail, health and/or the Council's Register Office. Full details of this masterplan are uncertain at present. The estimated annual heat demand is approximately 6,175,000 kWh (700 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 1,850 kW.

(5) Davis House

The property was built in the early 1970's and it has been subject to an extensive refurbishment programme, including a newly designed reception area, upgraded lift lobbies, refurbished male and female services and Disability Discrimination Act (DDA) compliant accommodation including new lifts.

The property comprises retail accommodation at ground level at the front of the property totalling 970 m^2, office accommodation on ground and seven upper floors totalling 8,304 m^2. Car parking is provided at basement floor level. The estimated annual heat demand is approximately 845,000 kWh (100 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 253 kW.

(6) Waddon

The project comprises the following units:

- a new leisure centre incorporating a swimming pool;
- 98 private flats;
- 2 private houses;
- 87 affordable flats;
- 66 affordable and 30 private flats;
- 58 private flats;
- a children's education centre; and
- an office.

Construction works started on the Waddon Leisure and Housing scheme in January 2011 with completion of the first residential phase due in summer 2012. The estimated annual heat demand is approximately 3,965,050 kWh (450 kW average). It is estimated that approximately 1,731,178 kWh will be required for space heating and 2,233,872 kWh for domestic hot water. Based on typical heat profiles, we estimate the peak heat demand to be 1,190 kW.

(7) Menta site

The Menta site is a 54 storey skyscraper (75,000 m^2 development) and comprises of:

- 499 flats;
- 4 star hotel (165 bed plus 22 serviced apartments);
- retail space, 2 ground floors of tower block;
- office space (6,596 m2); and

- community centre (529.5 m2).

The combined estimated annual heat demand for the Menta site is 17,896,000 kWh (approximately 2,040 kW average). Based on typical heat profiles, we estimate the peak heat demand to be 6,160 kW.

MS 3.6d - District heating network sizing and routing

Several site surveys have been carried out at the Beddington landfill site to determine a pipe route to serve the Felnex site. An underground service survey was undertaken to identify any service pipe running underground within the area which will be subjected to the works for the installation of the DH pipework. These services are: gas main, sewage pumping main (SPM) and low voltage underground electricity cable (LVUG).

The proposed CHP pipe route was amended following on from the outcome from the tree survey so oak trees could be retained.

A suitable CHP pipe route has now been defined and submitted to the Construction Sub-Contractor for quotation. This is shown in **Error! Reference source not found.**. The proposed route runs to the South of the main effluent carrier (MEC) overflow channel to the western edge of the site, where it turns south. The pipe route ends at the boundary of the Contractor’s land ownership adjacent to London Road. This provides a direct link to the public highway. Access to the heat supply for the Felnex site and other potential users in Hackbridge will be taken from this point, crossing the railway via the London Road bridge.

The pipe route toward Croydon will run beneath the new site access road which is to be created to serve the Key Facility. The services and ground conditions along this route will be established. It will end at Beddington Lane, from where heat will be available to be taken to various locations in Croydon subject to contacts being secured. The precise details of pipe routing from this point will be established in conjunction with future contracts and the exact location of potential heat users.

i. Preliminary pipe size calculations

This section summarises the assumptions and the technical issues to size the DH pipework for supplying district heat from the Beddington landfill gas engines to the Felnex site.

For this size estimate, it is assumed a flow temperature at 90°C, and return temperature at 70°C, as advised by the landfill gas engine operators. This is a lower supply temperature than can be achieved by the Key Facility. As a result supply capacity will increase when the Key Facility starts supplying heat.

From the data supplied by Inventa Partners, the annual average heat demand is estimated to be 1,240 kW, including the heat losses in the pipework.

These are preliminary pipe sizing calculations and are based on the current information on heat loads and availability. It is recommended to use these figures as an indicative assessment and then to re-size the pipework accordingly if necessary once the routes to heat users to the east and west of the Beddington Lane Site are finalised, taking into account the requirements of the heat end users.

ii. Assumptions

In calculating the preliminary size of the DH pipework, the following assumptions have been made:

- Pipe route length = 1.6 km;
- Peak heat load = 3,600 kW; (excluding heat loss);
- Supply hot water temperature = 90°C;
- Return hot water temperature = 70°C; and
- Heat loss across the pipe = 100 kW (function of pipe length).

We have not been provided with the peak heat demand from Inventa Partners therefore calculations of the peak heat load have been based on a combination of typical residential and commercial heating profiles. An hourly typical profile is shown in Figure ; an annual typical heating profile is shown in Figure . This results in a peak heat demand of 3,600 kW.

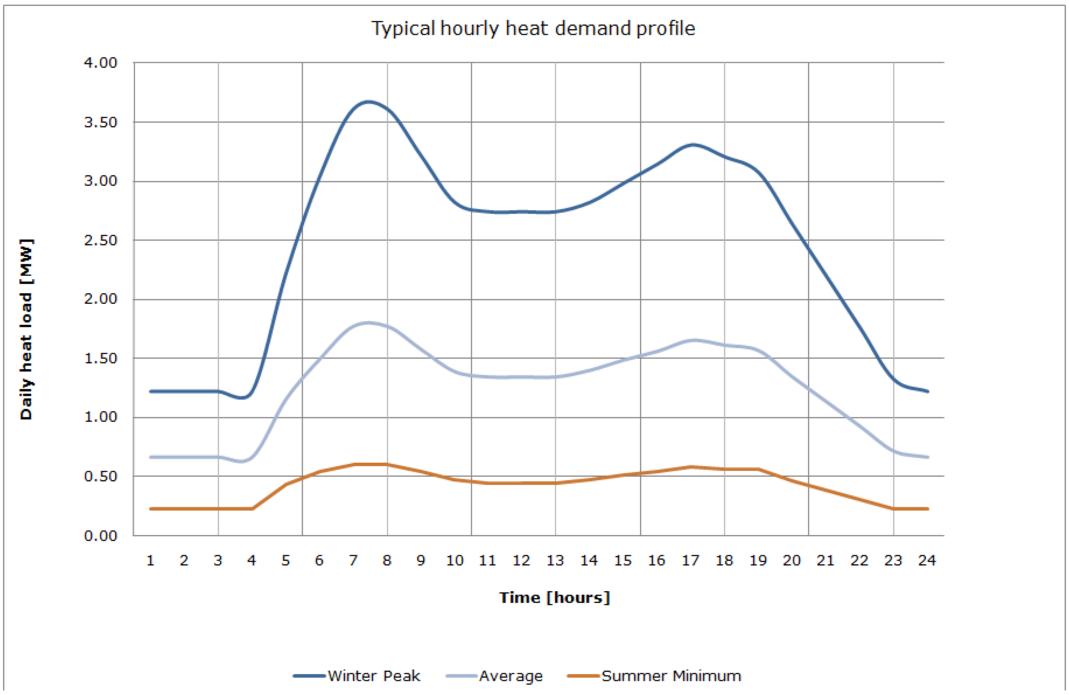

Figure 3- Typical hourly heat demand profile

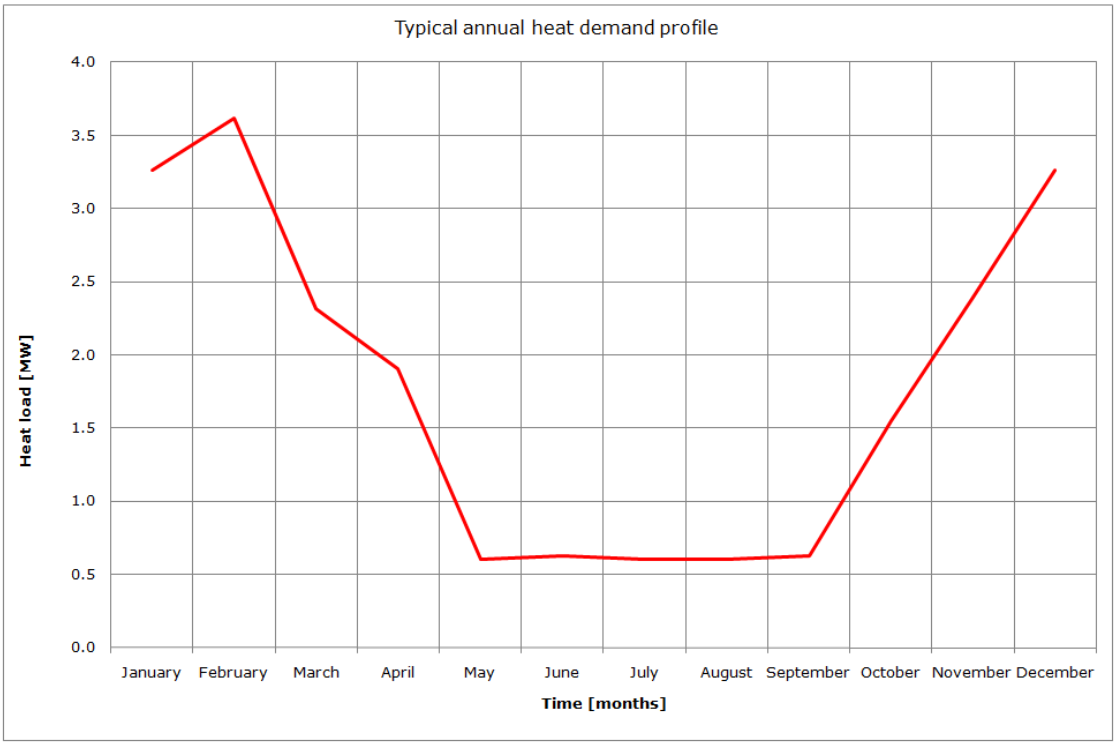

Figure 4 - Typical annual heat demand profile

District heating network design is based on peak heat demand. Peak heat demand will be determined from the winter daily heat use profiles. However, no daily heat consumption data is available for Felnex Trading Estate. Instead typical daily profiles which represent the heat users have been used. The estimated annual heat demand was applied to this typical daily profile to estimate the peak heat demand.

iii. Results

An internal pipe diameter of 200 mm, a **DN200 pipe** (300 mm external, including the casing and insulation), has been found to be the most appropriate for the scenario described above. This is based on a peak heat demand of 3,700 kW, which is the calculated peak heat demand plus the heat loss across the pipe from the landfill gas compound to the Felnex Trading Estate.

The flow velocity within the pipework is 1.31 m/s, which is within acceptable design limits. The velocity of the water in a pipe should range between 1.0 m/s and 2.0 m/s. At lower velocities there will be control problems due to time lag issues. At higher velocities there could be pipe erosion issues.

As this pipework will also be used to supply heat from the Key Facility the capacity has been checked using a higher supply temperature. At the likely heat export conditions from the Key Facility this pipe line is able to deliver over 15,000 kW of heat to Hackbridge which exceeds the currently identified peak heat load. Further heat could be added at another location should heat demand exceed pipe line capacity.

iv. Heat availability supplied from gas engines

Energy recovery potential from the Beddington landfill has been evaluated by the Contractor. This study is based on gas collection data, waste deposition data and information from the landfill operators. Assumptions on the gas collection efficiency and average methane content of the landfill gas have been made. These assumptions along with the waste deposition data have been used in an empirical gas generation model that predicts the future energy recovery potential of the site.

Based on the information provided from this study, the back-up required at the Felnex site to cope with peak heat demand has been calculated.

Subject to financial viability the Contractor proposes to convert two of the four landfill gas engines in order to meet the Felnex heat demand, prior to the Key Facility becoming operational.

Two landfill gas engines will be capable of providing heat availability up to 2018 based on the predicted Felnex average heat demand. However the security of heat supply will be guaranteed by the heat produced at the Key Facility which, subject to planning consent, is scheduled to be operational in 2016/2017. With the Key Facility operational, the Contractor will be in a position to provide sufficient heat to cope with Felnex's peak demand. Details of DH pipe sizing from the Key Facility to the landfill gas compound and to Beddington Lane (towards Croydon) are illustrated in section v.

During peak times, the ESCO will require a back-up system capable of supplying up to 2,500 kW of heat. The ESCO will be responsible for designing and providing the back-up systems and for determining a suitable location. It is currently assumed that Felnex would be able to accommodate a site for a back-up heat station.

The back-up boiler will be designed by the ESCO to provide sufficient back-up in case a major failure at the engines occurs or there is any issue associated with the pipeline. These boilers are likely to be gas fired but could potentially be biomass fired. It is currently envisaged that these will be located at the Felnex site.

Further investigation is currently being carried out to understand the level of heat supply if a full heat recovery system from the landfill gas engines was to be implemented. A full heat recovery system would recover the exhaust heat as well as heat lost from the engines. An initial proposal from the CHP gas engine supplier indicates that by recovering heat from the water jacket and exhaust the heat available would be 1,081 kW per engine. This would require additional capital costs but would be capable of meeting the normal heat demand by converting only two of the four gas engines and would leave the possibility of converting just one of the four engines.

Based on our calculations, on the assumption that two gas engines were to be converted then the Contractor will be in a position to supply enough heat to meet the annual average heat demand. However during peak times, the ESCO will still require a back-up system capable to supply up to 1,500 kW, if the heat recovery included heat from the exhaust.

The difference between peak heat demand and heat available from the landfill gas engines decreases if four gas engines were converted instead. It must be noted that even in this scenario, the landfill gas engines will not be capable of supplying enough heat during peak demand if the heat was only recovered by a water jacket. However, if the Contractor opted for a full heat recovery (including the heat from the exhaust gasses) then the back-up to meet the peak heat demand will not be required.

It would be prudent to size the back-up boilers to meet the Felnex peak load regardless of how many engines are converted. This would provide back-up in case a major failure at the engines occurs or there is any issue associated with the pipeline.

v. Heat from the Key Facility

Four different scenarios have been investigated to understand the sizing implications when interfacing the heat from the landfill gas engines and the Key Facility. This was done to ensure the optimum pipe sizing was determined taking into consideration initial and ultimate operating conditions. Only the optimum solution, Scenario 1, is considered in this plan.

Additional pipework will have to be considered when connecting the CHP building at the Key Facility to the landfill gas compound. In addition, a provision for pipework from the CHP building to the Beddington Lane Site will have to be included, as part of the plan to export heat on the east side of the Beddington Lane Site. These sections of pipework and corresponding approximate pipe lengths are shown in Figure 5.

The CHP pipe route sections are described in Table below.

Table 5 – Sections of CHP pipe route (description)

From	To	Approximate length m	Reference colour in Figure 5 – Sections of the CHP pipe route (not to scale) below
Landfill gas compound	West lease site boundary (direct to Public Highway)	1,600	**red**
Beddington ERF	Landfill gas compound	360	**green**
Beddington ERF (separate set of pipes)	Beddington Lane (east side)	500	**orange**

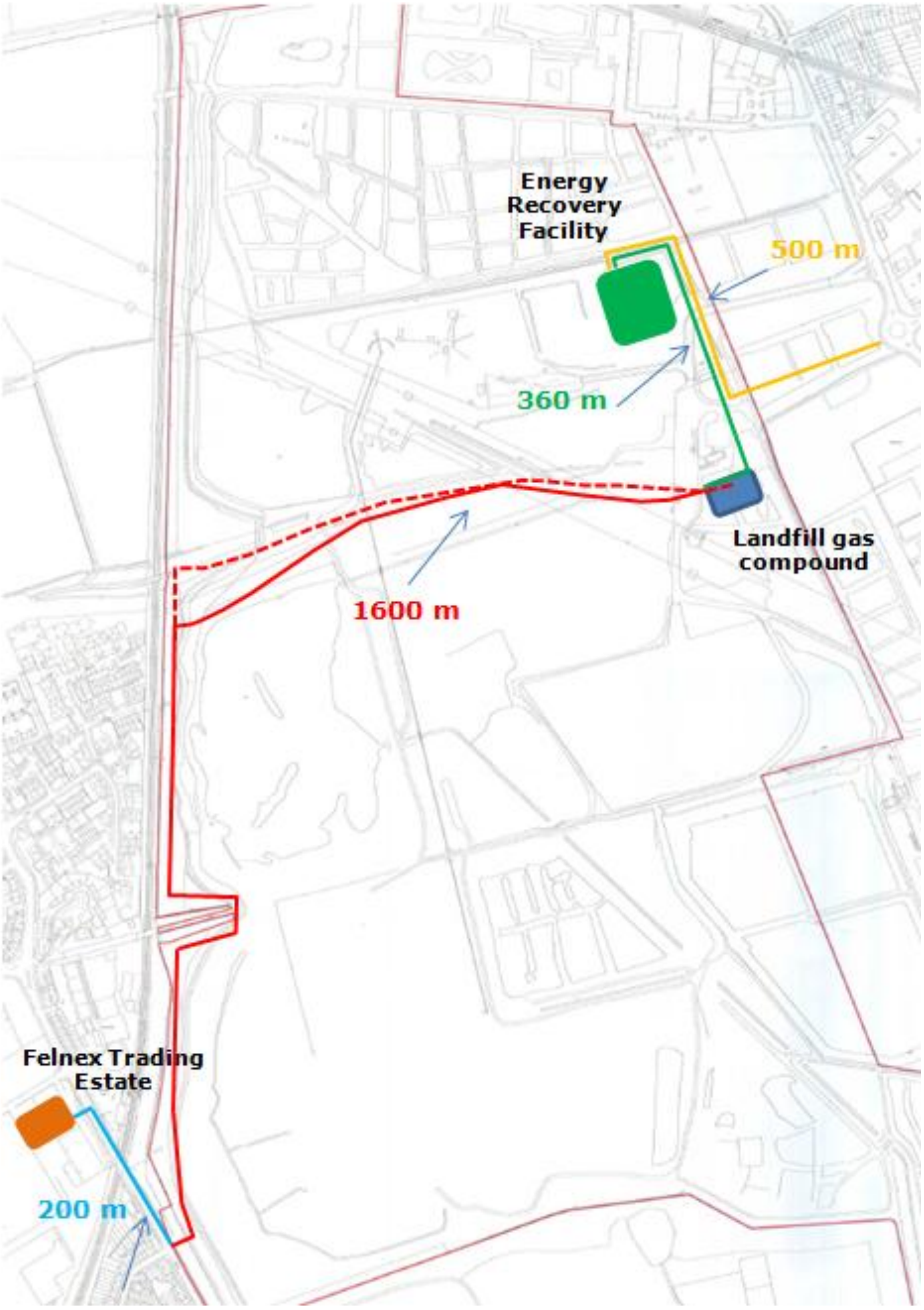

Figure 5 – Sections of the CHP pipe route (not to scale)

Scenario 1: the supply heat temperature increases to 110°C (from 90°C).

This increase in temperature provides a more efficient system and consequently a reduction in costs, capital and operational.

As a consequence of the increase of differential temperature between the supply water and return water, the water flowrate decreases in order to maintain a constant heat load.

$$\textbf{\textit{Heat demand = flowrate surface}}\ (T_{supply} - T_{end\ user})$$

$$Heat\ demand = Flowrate \cdot surface$$

Where the 'surface' is the cross sectional area of the pipe.

We have sized the DH pipe sections from the Key Facility to the landfill gas compound and from the Key Facility to Beddington Lane. The pipework arrangements include two separate sets of pipes: one set supplying heat to the east side (i.e. Croydon), the other set supplying heat to the west side (i.e. Felnex and other potential users in Hackbridge).

In order to do so we have assumed that all the heat available from the turbine at the Key Facility, which is up to 20,000 kW, will be distributed between Felnex and future heat users in Hackbridge and Croydon.

We have calculated what the internal pipe diameter would have to be if the Key Facility had to supply 20,000 kW of heat which is the design maximum heat that can be extracted from the turbine. The most likely arrangements in terms of internal diameters of those sections of pipes would be as follows:

- Pipe from the Key Facility to Beddington Lane: DN300 (length of 500 m);
- Pipe from the Key Facility to the landfill gas compound: DN200 (length of 360 m);

The pipe sizes described above would have to be subjected to detailed design.

DN300 would be the pipe diameter used for the pipeline for supplying heat to Croydon.

It must be noted that supply diversification has not been applied to the known heat loads at this stage. Further investigations will provide a greater level of information which normally confirms that individual peak demands rarely coincide. This will allow more buildings to be connected without exceeding pipeline capacity. This will also greatly increase the ability to provide heat to both Hackbridge and Croydon.

MS 3.6e - District heating equipment

i. Piping

The heat transfer loop from the landfill gas engines to the Key Facility will require a flow and return pipe with an internal diameter of 200 mm for the pipe. Pressure drop across the pipe was a determining factor on pipe sizing. The heat supply from the landfill gas engines will be at lower temperatures than that supplied by the Key Facility. This means that the pipes will have a higher capacity when fed from the Key Facility. The DH pipes from the Key Facility will be sized to allow the full 20,000 kW of heat available to be delivered towards either Hackbridge or Croydon to maximise supply flexibility. It is currently assumed two pipe lines will be installed to maintain flexibility but other options will be investigated as detailed design progresses.

DH pipes are pre-insulated and the materials are steel for the service pipe, polyurethane (PUR) for the insulation and high density polyethylene (HDPE) for the outer casing. The pipes will be installed in accordance with BS EN 13941: Design and installation of pre-insulated pipe systems for district heating. It is very straightforward to add additional pipework to this type of system.

ii. Primary plant area

Two separate primary plant areas will have to be accounted for: one at the landfill gas compound and one at the Key Facility within the CHP building.

The primary heat exchanger at the Key Facility recovers energy from the steam turbine and transfers this to hot water which will be pumped to the landfill gas engine primary plant area and then onwards to Hackbridge. A separate pipe line would take heat to Croydon direct from the Key Facility.

The primary heat exchanger at the landfill gas engines recovers energy from the landfill gas engine and transfers this to hot water which will be pumped to the Felnex Trading Estate.

The heat exchangers would either be a shell and tube type or plate type, constructed from stainless steel to ensure longevity. The heat exchangers have been sized for the maximum duty for this option applying a conservative approach to heat transfer for a supply and return temperature of 90°C and 70°C respectively. Heat exchangers sized for a supply and return temperature of 110°C and 70°C respectively would be cheaper due to higher efficiency.

There will be two DH circulation pump sets: one at the Key Facility and one at the landfill gas compound. The set of pumps at the landfill gas compound will provide service for the main pumping system; the set of pumps at the Key Facility will serve as booster pumps for circulation.

A DH circulation pump set will include two pumps arranged in a duty/standby configuration to provide 100% redundancy. It is necessary to overcome pressure losses through the system and to maintain an adequate water flow. Booster pumps could be provided at the Key Facility primary plant to provide sufficient pressure to reach the landfill gas compound.

The design of the pumping station will depend on the location (Key Facility, landfill gas compound) and the timing for the installation(s) to be operational. The final configuration will be subjected to detailed design due to its complexity.

The main primary plant area would probably have to be at the landfill gas compound as that is likely to start operating sooner than the Key Facility. This heat station would include all the necessary equipment to allow heat to be supplied until the Key Facility is available.

Due to the nature of the system being considered it may be that both primary plant areas will have similar but different sized equipment. Both will require heat exchangers and pumps. A pressurisation system and basic water treatment dosing plant are required and this could be located at either or both sites. Final configuration will depend on timing and heat export capacity. The Key Facility will include a dedicated CHP room which will have sufficient space to accommodate all the required equipment.

iii. Secondary plant area

A secondary heat exchanger at the heat user's plant room will be required to transfer heat between the two hot water systems. A plate heat exchanger is considered to be the most appropriate for this application. One heat exchanger, complete with local controls and a heat meter will be supplied to each heat user by the ESCO.

iv. Back-up Boilers

Guaranteeing heat to the various consumers at all times will require a back-up boiler system provided by the ESCO for continuous supply when the gas engines are not operational. It is currently assumed space can be made available at Felnex as the required capacity is quite low. Should a more substantial back-up system be required in the future then it may be possible to locate this at the landfill gas engine compound once the engines are taken out of service.

MS 3.6f - Capital Costs

The estimated capital costs for providing the district heating infrastructure (section MS 3.6e -) required to supply Felnex Trading Estate, at approximately 2 km away from the site, include the following:

- infrastructure at the Key Facility, to be located in the CHP room;
- pipework from the Key Facility to the east boundary of the site, towards Beddington Lane and pipework from the Key Facility to the landfill gas compound, as a separate set of DH pipes; and
- infrastructure at the landfill gas compound (as described in the primary plant area) and pipework from the landfill gas compound to the west boundary of the site, towards Felnex Trading Estate.

The total estimated capital investment required by the Contractor is approximately £3.5 million.

The estimated capital costs that the ESCO will have to incur to provide the required infrastructure to supply heat to the Felnex heat users is approximately £1.5 million.

Therefore in order to initiate an operating district heating scheme a total investment of circa £5.0 million is required.

MS 3.6g - Operating and Maintenance Costs

Operational and maintenance (O&M) costs for the district heating network have been estimated based on Fichtner's experience of similar CHP projects. The market has not been approached for actual quotations and as the scheme progresses more accurate figures will need to be obtained.

The annual O&M costs for the Contractor are estimated to be approximately £31,000. The O&M costs for the ESCO are estimated to be approximately £50,000 per year for Phase 1. These costs include the inspection and maintenance of the back-up boilers, usually associated with the ESCO. The ESCO's costs will increase as additional phases are added to the system.

The operating costs at the Key Facility will be looked at in conjunction with a reduction in revenue from electricity export. By exporting heat, the Key Facility will have a reduced electrical output therefore this will be taken into account in the financial modelling. The heat available from the Key Facility is not surplus heat or waste heat but heat that could be used to generate electricity. At this stage the heat to power ratio can only be estimated but this is expected to be 4:1, i.e. for each 1,000 kW of heat generated there is a decrease of 250 kW of electricity production. Providing the heat sale tariff is set correctly the gross income to the Contractor will be unchanged.

MS 3.6h - Heat tariffs

In order for a district heating scheme to be successful it must be able to compete with the alternative fuels available to each of the identified developments. Energy demands for each development have been assumed to be met by gas.

It is difficult to estimate the costs that each development will pay for their heating and hot water due to the sensitivities in being able to access commercial information. A heat tariff that offers the consumer a saving against gas will be attractive providing the heat source can also demonstrate that it is low carbon.

The heat tariffs for domestic and commercial consumers will be different to reflect the volume of usage and the potential for debt risk. It is now uncommon for domestic energy tariffs to include a monthly standing charge so all fixed and variable costs will need to be recovered through a single unit charge. Standing charges are still a feature of some commercial energy tariffs and provide the benefit of increasing cash flow during the summer months when energy sales will be at their minimum. Commercial energy users tend to pay less per unit of energy than domestic energy users due higher volumes of usage.

Heat supply tariffs will be set based upon current commercial gas prices converted to output energy unit prices, which will provide competitive prices for the energy supplied. Different tariffs will be required for commercial and residential heat users.

The diagram in Figure 6 illustrates the key players of the proposed CHP scheme and associated heat prices.

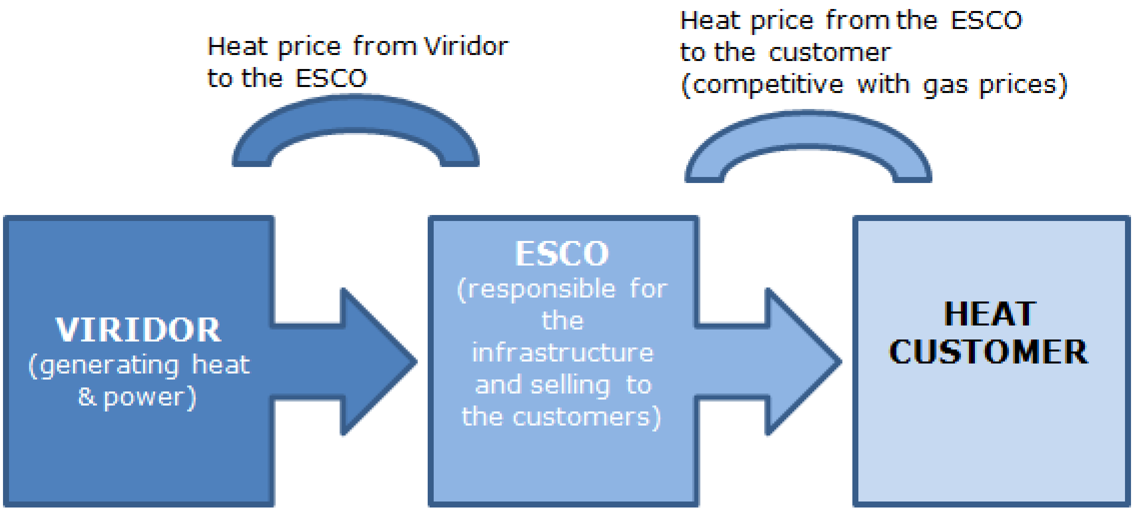

Figure 6 – Key players of the proposed CHP scheme

A DH unit energy price is not directly comparable to gas prices. Gas prices represent a gross energy price with the amount of net energy available being a function of boiler efficiency. In normal circumstances Building Regulations require very high energy efficiencies for both commercial and residential buildings. This is often achieved through a mixture of energy conservation measures and high efficiency boilers. It is now not uncommon to expect boiler efficiencies to exceed 85% with over 90% being achievable on domestic boilers. District heating is supplied via a plate heat exchanger which is a very efficient method of transferring energy with efficiencies of at least 99%.

The unit gas price for commercial district heating users has been estimated based on DECC data for small commercial gas users at 2.891p/kWh excluding Climate Change Levy. This represents an input energy price. If a reasonable boiler efficiency of 85% is applied, the output energy unit price will be 3.401p/kWh plus Climate Change Levy of 0.177p/kWh (rising to 0.182pkWh from April 2013). The heat user will avoid paying Climate Change Levy by using district heating. The heat user will also make savings on boiler maintenance costs. Therefore it has been assumed that a unit heat price of **4.0p/kWh** is reasonable for an ESCO to charge commercial heat customers. This will present a cost saving against using gas and maintaining a boiler.

The unit gas price for residential district heating users has been estimated based on DECC data for domestic residential gas users at 3.997p/kWh. This represents an input energy price. If a reasonable domestic boiler efficiency of 90% is applied, the output energy unit price will be 4.441p/kWh. The heat user will also make savings on boiler maintenance costs. Therefore it has been assumed that a unit heat price of **4.5p/kWh** is reasonable for an ESCO to charge domestic residential heat customers. Subject to investment costs, it will be possible to develop a lower tariff to social housing developments.

Although these suggested heat prices are very similar to gas prices the heat consumer will actually require less energy due to the differential between boiler efficiencies and heat exchanger efficiencies. Therefore the heat consumer will be able to make energy cost savings of at least 10%. Heat prices will be indexed to gas prices so as to preserve the competiveness of the heat tariff.

Based on the heat price suggested above, from the ESCO to the end heat users, the ESCO for the Felnex Trading Estate could generate revenues of £405,000 per year, just on Phase 1. The annual revenue could potentially reach approximately £6.6 million over time taking into consideration that the ERF could export up to 20,000 kW of heat consistently.

MS 3.6i - Viability

In order to assess the commercial viability of the initial basic CHP scheme a basic financial model was developed. This model was used to quantify the financial impact of the proposed heat export so that an attractive heat price for the ESCO could be determined.

The financial model shows that the ESCO will be able to achieve an **Internal Rate of Return (IRR) of 13%** over a 25 year project life assuming heat is provided by the landfill gas engines initially and then by the Key Facility. The wholesale heat price from the Contractor to the ESCO would need to be higher for heat supplied by the landfill gas engines than for heat supplied by the Key Facility. Heat supply just from the landfill gas engines for only the remaining life of the landfill gas engines would not provide the Contractor with an economic rate of return.

Some basic assumptions over the timing of the phases of district heating scheme have been made. It has been assumed that heat supply could start in 2013 from the landfill gas engines with heat from the Key Facility becoming available in 2016. In order for the scheme to gain local credibility it has been assumed Phase 2 heat supply would not commence until 2020.

The wholesale heat price from the Contractor to the ESCO has been investigated on the basis of the Contractor recovering the initial capital costs, after allowing for inflation. Inflation was assumed to be a flat rate of 2.5% over the life of the project. Taking into account the declining gas yield from the gas engines and the timescales of the Key Facility an IRR of 10% was targeted. This is equivalent to an IRR of 7.5% if inflation is not considered.

Two scenarios have been considered:

- scenario 1: no government support; and
- scenario 2: Renewable Heat Incentives (RHI) provided.

A target wholesale heat price has been determined on this basis for each of the two heat sources. These are subject to review and confirmation once investment costs have been confirmed. It is assumed that the heat sales will be the only source of revenue for this scheme. For scenario 1 the target IRR of 10% cannot be achieved. The calculated IRR was 8.0% which although low should provide a sufficient rate of return in the wider context of the CHP scheme. To ensure viability the scheme would have to extend beyond Phase 1 (Felnex).

To be conservative, the revenues under the Renewable Heat Incentive (RHI) tariffs and Renewables Obligation Order (ROC) (Key Facility only) are not considered in this assessment, as it is not clear whether the Government will have sufficient funds for all eligible schemes in the future. The landfill gas engines are not eligible to receive RHI.

The wholesale price of heat provided by the existing landfill gas engines will depend on the final level of investment required to deliver the heat to the Beddington landfill site boundary. The wholesale heat price charged by the Contractor to the ESCO for heat from the Key Facility must fulfil two objectives. Firstly it must compensate the Contractor for the reduction in power output caused by exporting heat and cover the investment costs for providing the infrastructure required to enable heat export. Secondly it must offer the ESCO a sufficient margin on the retail heat price so that the ESCO can cover their costs and make a reasonable level of return.

It is currently envisaged that the wholesale price will be of the order of 1.5p/kWh from the Key Facility and 3.0 p/kWh from the landfill gas engines. However, if RHI were provided, assuming a rate of 1.0p/kWh, the heat price from the Contractor to the ESCO could be reduced to 0.05 per kWh from the Key Facility and would make the scheme even more attractive to the ESCO.

MS 3.6j - Environmental benefits

The National target, which has been set by the UK Government, is for a 34% reduction in CO_2e emissions from 1990 levels by 2020 and a reduction of 80% by 2050. Additionally the draft Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate highlights the importance that decentralised energy supply will play in reducing carbon at a local level through national policy. This builds on the European Directive (2009/28/EC) which promotes the use of renewable energy and led to the UK's commitment to sourcing 15% of its energy from renewable sources by 2020.

The Contractor is actively tackling the issue of carbon emissions resulting from its operations. Recently the Contractor fully engaged with the trade body for the sector, the Environmental Services Association (ESA), to produce its carbon reporting protocol for the waste sector. Under this protocol, carbon reporting follows internationally recognised categories of emissions; direct emissions, indirect emissions and avoided emissions.

Over the previous year, the Contractor conducted a review of its current data capture related to carbon management which has enabled improvements to be identified and changes to be made. By making improvements to the methods of data capture and base lining for the reporting of carbon emissions, the Contractor will be able to meet its obligations under the Carbon Reduction Commitment (CRC). The CRC, which was recently renamed the CRC Energy Efficiency Scheme, is a mandatory carbon emissions trading scheme covering all organisations using more than 6,000,000 kWh of electricity per year. It has been implemented by the UK Government as a new climate change and energy saving scheme to promote energy efficiency and help reduce carbon emissions. The CRC requires the Contractor to monitor and report emissions and to purchase allowances to emit CO_{2e}. The more CO_{2e} the Contractor emits, the more allowances The Contractor will need to purchase, therefore there is a direct incentive to reduce emissions.

i. Energy Recovery Facility CO_2 emissions

High-level calculations have been performed as part of the Planning application to estimate the carbon dioxide emissions for the Key Facility with CHP mode. These calculations have been based on a number of assumptions. These assumptions will be tested and the calculation revisited on an annual basis as a key task carried out under the carbon management plan. The base case benchmark will be established once the Key Facility has received Planning Permission in order to establish a more meaningful figure.

Overall the Key Facility is predicted to reduce CO_2 emissions compared to conventional forms of electricity and heat production for a comparable output even when landfill emission offset is not considered in the calculation. Therefore, if the net carbon produced is considered to be attributable to the production of electricity, which is the primary energy production operation, then the heat produced from the Key Facility can be considered not to contribute any carbon dioxide emissions.

ii. CO_2 savings to potential heat users

As noted above the heat from the Key Facility in CHP mode could be considered as not contributing any carbon emissions, the heat exported from the plant can be considered zero carbon energy and be used by the outlined developments to achieve their carbon target.

This means that the district heating scheme will be saving carbon emissions compared to the carbon emissions from a gas heating system, which is normally estimated at 194 gCO_2/kWh.

iii. Comparison with the Authority baseline scenario

A WRATE model was developed to compare the carbon emissions of the Key Facility with the Key Facility exporting electricity only against the Authority's baseline scenario. The climate change potential of the proposed solution in electricity only mode equates to a carbon benefit of 56,400 tonnes of CO_{2e}. Considering that the Authority's baseline scenario has a carbon burden of approximately 38,400 tonnes of CO_{2e}, the overall carbon saving for this project would be approximately 94,800 tonnes of CO_{2e}.

The carbon saving per tonne of waste treated is approximately 209 kg of CO_{2e} for the proposed solution in electricity only mode. A net saving of over 293 kg of CO_{2e} per tonne of waste could be achieved when moving from the Authority's baseline scenario (landfill) to the Contractor's solution.

When the Key Facility exports heat, a proportional reduction in electricity production occurs but the carbon benefit increases. The carbon savings relating to the heat export would increase compared to the WRATE model outputs, and overall CO_2e and CO_2e per tonne of waste treated would improve because additional carbon saving is provided by the heat export.

MS 3.6k - Policy Drivers

There are national and regional policy drivers that seek to encourage and deliver on the potential for combined heat and power and district heating represented by energy recovery facilities in general.

The 2008 Climate Change Act sets a legally binding target to cut UK emissions by 80% by 2050. In seeking to achieve this target, the UK Renewable Energy Strategy (DECC, 2009) sets out a pathway to generating 15% of the UK's energy from renewable sources by 2020 in line with the EU Renewable Energy Directive.

National energy policy generally aims for development to be planned to limit carbon dioxide emissions and to make good use of opportunities for the decentralised and renewable production of low carbon energy.

Against this background the Mayor of London has set targets to achieve an overall reduction in London's carbon dioxide emissions of 60% below 1990 levels with 25% of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. Within this context, the Mayor's draft Climate Change Mitigation and Energy Strategy (October 2010) recognises that one of the main opportunities for increasing renewable energy generation in London is from energy recovery technologies.

Accordingly, Policy 5.17 of the 2011 London Plan supports developments that contribute towards renewable energy generation. Wherever possible, opportunities should be taken to provide combined heat and power (CHP) and combined cooling heat and power (CCHP).

Policy 5.8 of the London Plan supports and encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions. It is expected that all proposed technologies recovering energy from non-recyclable waste should achieve at least a positive carbon outcome, whereby the direct emissions from the technology are offset by carbon dioxide emissions savings from the generation and distribution of heat and electricity to users.

Policy 5.5 prioritises the development of decentralised heating and cooling networks, including decentralised energy opportunities through the use of energy recovery technologies.

Policy 5.6 requires that where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy WP8 of the South London Waste Plan addresses sustainable energy rspecifically in the context of recovery of energy from waste. It states that proposed energy recovery developments will be required to deliver renewable heat and power (or heat, power and cooling), for local users where feasible. In particular, any proposed thermal treatment facilities must allow for the recovery of renewable heat and power (or heat, power and cooling).

Against this background it is clear that the development plan context supports the provision of energy recovery facilities of all kinds, subject to meeting other relevant plan policies, and that these facilities are particularly welcomed where there is potential to provide decentralised energy.

Policy WP8 further requires that thermal treatment facilities allow for recovery of heat and power.

It is apparent that the design of the Key Facility meets this requirement. It will include a boiler and turbine that will generate 26MW of electricity, 22MW of which will be for export to the national grid. It will also allow for the export of heat, since:

- the design of the turbine includes heat off take capability;
- the proposals include a dedicated area for the CHP plant; and
- the Planning Application includes the routes for pipework to take heat to the public road at the site boundaries to east and west, from where it can be accessed by potential heat users subject to the necessary supply contracts being in place and the future provision of the required infrastructure to connect to the end users.

It is therefore clear that, in taking the opportunity to provide CHP and provide for connection to future district heating networks, the Contractor meet the planning policy requirements of the London Plan and Policy WP8.

It is notable that paragraph 237 of the Government's Review of Waste Policy (2011) states that:

"Experience to date with CHP infrastructure has highlighted a potential difficulty in securing long term customers for heat ahead of construction of the plant. Without heat off take, the lower efficiencies achievable from electricity only generation could waste valuable opportunities to help decarbonise the heat sector. This is a particular opportunity for business, particularly larger firms, through the greater exploitation of CHP for commercial and industrial premises".

This highlights the difficulties faced in securing customers up front, and also that potential heat users are being encouraged to be more open to the opportunities provided by facilities such as the Key Facility.

There is also a significant role for local authorities in providing encouragement and an enabling role in bringing about the desired district heat networks. It is therefore significant that national political will is creating a favourable policy framework for decentralised energy, helping to change the investment environment. The public sector is working to remove barriers and harness the private sector's financing and delivery capability.

Against this background, the Contractor is seeking to work with the Greater London Authority (GLA) and the Authority to maximise the potential for delivery of the district heating opportunity presented by the Key Facility. The indications are that there is strong political support for district heating and feedback from potential heat users has been positive.

MS 3.6I - Energy Services Company (ESCO)

It is common to utilise an ESCO to manage the interface between the energy producer and the energy consumers for a major district heating system. This is normally because the energy producer does not have the experience or systems for retailing energy which is a specialised business area. This also allows for separate accountability and risk management. The ESCO would buy energy from the producer at a rate that provided a return to the producer and the ability for the ESCO to make sufficient margin to cover their costs and risks.

The ESCO would normally be responsible for:

- ensuring that there is sufficient heat available at all times to meet the demand of the DH system;
- maintaining the DH system;
- DH system operational costs such as peak lopping fuel, pumping and water treatment;
- billing, revenue collection and debt risk;
- sales and marketing activities; and
- customer care.

Financing of the initial infrastructure and any subsequent additions is a major undertaking. In this instance the scale of the investment required could be a disincentive for a third party sponsored ESCO if this is not accounted for in the heat tariffs. If the ESCO were required to fund the initial investment they would need to provide considerable equity and possibly to source project finance from a bank. In the current financial climate this may be hard to achieve. Also in this case the heat purchase price from the Key Facility would need to be low and there would need to be guarantees in place over long term heat supply and back up supplies. The issue of debt risk could be a significant factor to any funder. It is therefore important to select an ESCO that has the right experience and financial backing who are willing and able to take a long term view.

The ESCO would need to put in place key agreements with the Contractor to cover the following critical items:

- System operation. It would be logical in this scenario for the Key Facility operator to be contracted to operate the DH system to operating instructions provided by the ESCO. An operating fee would need to be included in this agreement.
- Heat supply. The Key Facility operator would need to guarantee to meet the actual heat demand either from the Key Facility or from standby boilers. Alternatively the Key Facility operator could agree only to supply heat when the ERF is operational and at a level determined by the plant performance. The option chosen would affect the heat purchase price as the cost of the standby heat will need to be factored into the tariff calculation.

The maintenance of the DH system is normally contracted out to various specialist contractors. The key issue with DH system maintenance is to maintain supply by responding rapidly to breakdowns. Loss of supply affects DH system reputation and consumer confidence. If the DH system is not delivering heat it is not earning revenue so the ESCO will benefit from maintaining high availability and from meeting full demand. The level of maintenance costs will depend on the ownership of the standby facilities and the agreed supply termination point. Also the ownership and therefore maintenance responsibility of the steam to water shell and tube heat exchanger will need to be clarified.

A key area for the ESCO is the ability to bill the heat consumers and collect the revenue due. Proving individual heat meters is a straightforward task using proven technology. Heat meters for domestic applications will include tamper indicators. Meter reading will range from the basic manual reading to remote wireless meter interrogation at whatever frequency is deemed appropriate. The debt risk with commercial consumers is relatively low although some care must be taken when the consumer is only a tenant in the building being served. On the other hand the debt risk with domestic users is often higher due to a number of factors. Whilst the level of debt will be low, the number of debtors can be high and redress will be slow and difficult, particularly where social housing is concerned. It is possible to contract with companies who will read the meters and collect the revenue and who will also take the debt risk but the fees involved can be high.

In the context of this particular project and considering the level of investment required it is considered that the ESCO could be one or even more than one company, given the potential heat demand identified. The ESCO will have to invest in the infrastructure outside the Contractor's lease boundaries and the planning application boundaries.

As Phase 1 of Felnex Trading Estate could be ready before the Key Facility is ready to supply heat it will be necessary to install local infrastructure and supply heat from the landfill gas compound. The two landfill gas engines will be capable of supplying heat until 2017/18.

A number of potential experienced companies who could act as an ESCO for this project have already been identified. Initial discussions have been held with one major utility company so far. Companies that offer these services include:

- E.ON Sustainable Energy;
- SSE;
- Vital Energi;
- Dalkia; and
- MITIE.

In order to be able to progress discussions with potential ESCO's draft heads of terms have been developed, see Appendix MS 3.6-3 These have been developed for a similar project. A more detailed draft heat supply agreement has also been developed for use once the project progresses.

An expression of interest has been received from E.ON Sustainable Energy who wishes to be considered as the ESCO.

Although engaging with a single experienced company to act as the ESCO is considered a prudent course of action it may be possible to set up a dedicated ESCO with an experienced company as the main shareholder and with local or regional stakeholders as minority shareholders such as LB Sutton and LB Croydon.

MS 3.6m - Action plan

i. Plan

The Key Facility will as a minimum be CHP enabled to be able to deliver 20,000 kW of heat. To become a CHP plant thermal energy needs to be exported from the site in the form of hot water. A hot water based system provides the widest opportunities for heat users. In order to deliver a district heating network, the scheme scope needs to be defined and technically assessed to prove that it is deliverable. Potential consumers need to be identified and approached so that there is a high degree of certainty over heat sales. The economic viability then needs to be confirmed. Once these steps are completed final negotiations with potential ESCO's will take place with a high degree of certainty. This process needs to be repeated if the initial assessment is not positive, as circumstances can and will change.

To ensure that this process happens a CHP action plan has been drawn up and will be implemented by the Contractor. It will involve local and regional stakeholders and be supported at the highest levels within the Contractor. It is intended to involve the GLA and the LB Sutton and LB Croydon in developing and implementing the plan. The action plan identifies the strategic phases required for the district heating scheme development.

The following project development phases have been defined:

Initial phase:

- initial heat load survey and research;
- follow up detailed heat load survey;
- engage with London Development Agency and Sutton and Croydon Councils;
- engage with Network Rail;
- build data base of potential heat users;
- target buildings identified as potential heat users;
- carry out heat use surveys at targeted heat users;
- determination of seasonal heat demand over time;
- preliminary pipe routing;
- infrastructure sizing and configuration;
- technical viability confirmation;
- capital cost estimates;
- operation and maintenance cost estimates;
- economic viability assessment;
- establish carbon saving benchmark;
- develop project master plan;
- draw up communications plan;
- determine baseline carbon emissions;
- set up joint working group with stakeholders;
- set out a marketing strategy to end users; and
- approach potential ESCOs.

Intermediate phase:

- detailed negotiations with heat consumers;
- finalisation of initial heat demand;
- finalisation of infrastructure sizing;
- detailed discussions with Highway Authority over pipe routing;
- finalisation of pipe routing;
- planning applications for pipe routing;
- tenders for initial infrastructure;
- tender for Energy Services Company (ESCO); and
- sign heads of terms for heat supply agreements.

Implementation phase:

- sign agreement with ESCO;
- community liaison;
- installation of initial infrastructure; and
- commissioning of scheme.

Operational phase:

- ongoing marketing and publicity of the scheme to end users;
- promote scheme benefits;
- annual review of carbon savings;
- expansion of the scheme by adding major phases; and
- expansion of the scheme by infilling on existing infrastructure.

The initial phase will be repeated annually until a viable scheme is developed. A joint working group will be established involving the GLA, Sutton Council, Croydon Council and other local stakeholders. Once an ESCO is in place they would also join the group. The objective of this group is to maximise the potential of the district heating scheme.

ii. Actions

The following actions will be carried out by the Contractor as part of the initial phase:

a. Create data base of potential heat users

Constructing a data base of potential heat users is a key activity. This data base will be revisited annual and updated. New and planned developments will be added. Change in building ownership and use can affect the potential to be a heat customer. Boiler age will be tracked so that the consumer can be targeted when they are already considering investing in a new heating system. The data base will become a powerful tool over the life of the project. The data base will be used to maintain contact with potential heat users.

b. Maintain dialogue with the identified heat users;

Regular meetings will be held with each organization already contacted to ensure every heat sales opportunity is maintained.

c. Continue liaison with Network Rail;

Securing a crossing of the railway line at Hackbridge is essential for the success of this scheme. Initial contact has already been made with Network Rail and dialogue will be maintained until an agreement is put in place.

d. Make contact with other potential heat users in Hackbridge;

A programme of canvassing and surveys will be carried out annually to build up a picture of the potential for more heat consumers.

e. Develop a master plan;

It is essential that a proper plan and organized approach is adopted if a viable district heating scheme is to be progressed. A clear strategy is required with objectives and targets. This will then be developed into a commercial business plan. The development of the master plan must involve the members of the joint working group and other interested stakeholder. The actions from the CHP plan will be fed into the development of the master plan and the outcomes of the master plan will be used to inform the actions required under the CHP plan.

f. Open negotiations with potential ESCO's;

Choosing the right ESCO will be an important step for this project. Not all potential ESCO's have the same experience or capability. Contact will be made with suitable organizations and discussions held over how they could make this project a success. Heads of Terms will be put in place while the final definition of the scheme is developed.

g. Set up a working group involving local and regional stakeholders;

Involving local stakeholders will improve the chances of a positive outcome. Demonstrating to local businesses that there is widespread support for the project will encourage them to become involved. Giving out a positive impression will generate confidence that committing to the scheme will be a benefit.

The GLA have suggested the working group be led by their Decentralised Energy Project Delivery Unit (DE:PDU). The Contractor will seek to work with the GLA to ensure the working group has the appropriate drivers and objectives. It is intended to set up the working group within 6 months of Contract Award .

h. Carry out an annual review of potential heat load and scheme costs;

By carrying out annual reviews it will be possible to measure progress and identify any barriers preventing the project from gaining real momentum. This will help inform the decision makers on the next steps to be taken.

i. Produce an annual progress report.

An annual report will help focus the stakeholder on those things that have been a success and those things that have not produced the desired results. This provides a learning opportunity which will then lead to a more informed decision making process. The annual report will be used to demonstrate the success of the project and in turn it then becomes a powerful marketing tool. As part of the annual report a progress statement will be provided. A progress report can be seen in Appendix MS 3.6-4 (as at report date stated within Appendix).