COSSALL ESTATE

REPORT ON THE OVER HEATING OF DWELLINGS

CAUSES AND OPTIONS FOR RESOLUTION

COSSALL ESTATE
REPORT ON THE OVER HEATING OF DWELLINGS
CAUSES AND OPTIONS FOR RESOLUTION

Client:	Project Site Address:
Southwark Council	Cossall Estate, Peckham, London

Prepared By:	
Barry Henson	Project Ref: 1214 Issue Status: For Review Issue Date: January 2015

Approved	Signature	Date
Stephen Roberts		08 January 2015

CONTENTS

Appendices

Appendix 1	Photographs Existing installations.
Appendix 2	Packaged Hot Water Cylinder Product Data
Appendix 3	Heat Interface Unit Product Data
Appendix 4	Domestic Water Pressure Accumulator Product Data
Appendix 5	Costed Options
Appendix 6	Costed Options

Drawings

Existing District Heating Network Arrangements, by Alstom Power Flow.

1.0 INTRODUCTION

1.1 General Introduction

Phoenix Compliancy Management (PCM) are engaged by Southwark Council to undertake a review of the space heating at the Cossall Estate, located near Queens Road, Peckham train station.

In the first instance the main thrust of the review is to investigate the incidence of overheating in the apartments and consider options for resolution of this problem together with a number of key objectives and considerations.

1.2 Client Brief

The client brief identifies the key objectives as follows

- Identifying the root causes of the overheating.
- What impact, if any, has the Warm, Dry, Safe (WDS) work contributed to the issue.
- Identify future risks of potential overheating within the current WDS programme.
- Explore technical solution undertaken by other social housing providers.
- Costed short term design solution.
- Costed long term design solution.
- Overall cost/benefits/risk analysis of removing the district system and installing individual systems across the estate.

A number of factors have been identified to be considered in the reporting in summary these are as follows. The full briefing is available as a separate document.

- The Cossall Estate heating system is a two pipe system, and the same pipe supplies both the heating and hot water. Internally, these pipes run within the main structural concrete floor slab within all dwellings.

- The construction of the heating system means that irrespective of the season, residents are subject to ‘heating’ all year around through the circulation of the hot water/heating circuit.

- New doubled glazed windows and overall improvement of the thermal efficiency has exacerbated the problem of overheating.

- The study will need to consider all systems across the borough with the same design characteristics to understand the potential link and impact of improving thermal efficiencies and the possibility of causing overheating. Blocks and estates currently in the WDS programme will need to be investigated as a priority to ensure we identify potential problems before any investment works start on site.

- Climate change needs to be taken into consideration

- Other social housing providers operate district heating systems of similar age and design; investigate their approach to this issue as the study may identify simple cost effective solutions.

Our report is based upon record drawings of the district heating mains, and visual inspections of the following buildings:-

- The Energy Centre / Boiler Room
- Cossall Walk Sheltered Apartments
- Sunwell Close Apartments
- Hoods Close Apartments
- General inspection of the external areas.

In considering the short term and long term solutions we have identified those actions which address the immediate overheating problems in the short term solutions, and then considered in the long term solutions the wider system works which arise if the district heating is retained. We then consider the benefits of adopting individual boilers / heat sources within each apartment.

For the purposes of discussing the pipe distribution from the boiler room, through to the final heat emitters in the apartments we have used the following terms:-

District Heating

The buried pipework emanating from the boiler room and extending to external valve boxes.

Block Distribution

Pipework extending from the various valve boxes and principle entry points on the blocks of apartments and extending into each apartment.

Local Distribution within Apartments.

Pipework distributing within the apartments from the cylinder cupboards.

2.0 SUMMARY

This report considers the options for addressing the overheating problems in the Cossall Estate.

We have identified the minimum works required to do no more than address the overheating issue, but recommend that this is not the best value option, taking into account the imminent requirement for hot water cylinder replacement, and the ongoing maintenance liabilities of the systems.

On this basis, and retaining the existing district heating system we recommend provision of new packaged hot water cylinder assemblies, including heat exchanger interface, all controls and pre piped with only simple connections to make. We also recommend inclusion of accumulator water boosters in place of the existing header tanks, and that the apartments are re piped and new radiators provided with local thermostatic control valves.

We consider the benefits of abandoning the district heating scheme in favour of local gas fired boiler plant.

We find that the lifecycle capital and running costs of the two options are quite close at this moment in time, but that the provision of individual boilers is more expensive over the lifecycle of the installations, and is therefore not the favoured option on financial grounds.

Our consideration of the features of the D'Eynsford Estate have led us to consider the wider issues confronting Southwark in the ongoing commitment to their various estates, which we understand many of which are in a poor condition with pending decisions to be made on investments.

We strongly recommend that medium term opportunities for developing small area heat networks between the various estates would outweigh short term consideration and in fact presents a genuinely exciting opportunity to enjoy benefits of scale.

For example a single energy centre could serve two or three estates. Local heat network links between estates could be more economically installed in cooperation with Gas, Water and Power utilities when undertaking works in the highway and so on.

Having developed this local area heat network there would be an opportunity to link with the wider area London Heat Network. It is an opportunity worthy of serious consideration.

All this is somewhat beyond the scope of this report which fundamentally is to consider overheating in one estate, but is never the less pertinent to Southwark's medium and long term strategy.

3.0 GENERAL DESCRIPTION OF THE EXISTING SYSTEMS

General Description.

Low temperature hot water (LTHW) emanates from a common boiler room, and is distributed through buried district heating distribution pipework to serve each block. Within each larger blocks, the LTHW distributes horizontally and within risers to serve each flat.

For the individual apartments and maisonettes the district heating feeds into external valve boxes, from which branch distribution extends to serve the apartment.

Each flat is provided with its own hot water cylinder and steel panel radiators.

Boiler Room

The boiler installation comprises 3 No shell and tube type boilers with gas fired pressure jet burners and conventional flues. The flue sets across from the boiler room at high level and rises to discharge at high level in the adjacent block to atmosphere. The boilers are manufactured by Allen Ygnis, and are approximately 35 years old - probably dating from the original construction of the estate. These are non condensing type boilers.

There are 2 No principal winter boilers each rated at 1900 kW and 1 No summer boiler rated at 1170 KW. The system is vented to a feed and expansion tank located in a plant space with the adjacent building.

LTHW is circulated throughout the distribution pipe work by 3No end suction direct drive pumps, each operating under a variable speed controller. It is not clear how the pumps are set up to actually vary speed during operation or if this facility is only for commissioning.

The boiler plant and the associated LTHW distribution remains at operational temperature throughout the winter and the summer, this is because the LTHW serves to provide domestic hot water, and space heating within the flats. Whilst the space heating is only required in the winter, clearly the domestic HWS is required all year.

District Heating Distribution Pipework.

The district / buried distribution pipe work is of a pipe in pipe type with steel core pipes, thermal insulation and protective outer shell. The pipe system was installed approximately 12 years ago, by Alstom Power Flow Systems according to the record drawings. Where it was visible rising from the ground it appears to be a propriety encased / clad pipe system

The distribution pipework emanates from the boiler room and extends buried in the ground around the site, with branch connections locally into each block. At the connection into the block there are local pressure differential valves, isolation valves, drain cocks and strainers.

Installations in the blocks and flats.

Local Distribution in blocks.

The LTHW distribution enters into the blocks at various locations, and in general distributes horizontally at high level garage level and serves into risers up to the flats. Where distribution takes place externally / above ground the pipes are enclosed within bespoke boxing. At entry to the building a valve set is provided at the main point of entry and / also at riser cupboards servicing a group of flats.
The valve sets comprise pressure differential control valve, strainer, double regulating valve, drain cocks and isolation at the connection to each flat / pair or flats.

At ground floor in single apartments and maisonettes the district heating feeds into external valve boxes, from which branch distribution extends to serve the apartment, buried in the slab screed

Within the flats

Having distributed within the block the LTHW enters each flat and serves a hot water cylinder (HWS) primary coil and the heating system circuit in each flat. There is no interposing heat exchanger, so the flat installation is directly connected to the principal district heating distribution.

The hot water cylinder is as noted an indirect type, fed with cold feed from a small break tank located at high level in the cylinder cupboard. The primary LTHW flow through the HWS primary coil is controlled by means of a local self acting two port valve.

The heating within each flat comprises a series of steel panel radiators, connected onto a single pipe circulation. Each radiator is provided with an isolating radiator valve and lock shield radiator valve.

The pipe work distributes at skirting level between the radiators, dropping into the floor void to pass under door openings etc.

The floor build up in the apartments we visited above ground floor is understood to be a timber boarding supported on battens laid directly onto the concrete slab. Hence there is a small void for the pipe to pass under doors etc as noted.

At ground floor the floor build up is screed.

The pipe circulation returns to the HWS cupboard after serving the radiators.
A self acting thermostatic two port valve is provided on the flow connection of the single pipe system and modulates to maintain the manually set temperature, with a remote capillary sensor generally located in the hall.

4.0 OBSERVATIONS ON THE EXISTING SYSTEMS

Boiler Plant Age and Condition

The boilers are somewhat aged, dating from the original construction of the estate it is thought. They have been maintained over the years, but are approaching or at the end of their normal economic life. The pressure jet burners have been replaced and should have at least five years operation in them. We consider that if the common boiler room strategy continues to be adopted for the site that the replacement of the boiler plant and associated flues and ancillaries should be budgeted for in the foreseeable future.

The 3 No LTHW distribution pumps and associated secondary pipe work in the boiler room appears in fair condition and the pumps possibly have been replaced in the last 5 years or so. If suitable for the requirement of a new boiler installation these could be retained to serve the LTHW distribution.

District Heating Distribution Pipework.

This was installed in 2002 and with a regular maintenance regime in place this pipe installation should be serviceable for a least another 20 years or more.

Where we observed the pipe work rising into valve cupboards, the installation appeared in fair condition commensurate with age.

We understand that there have been some repairs made on the buried distribution.

Installations in the blocks and flats.

Local Distribution in blocks.

Condition

Thermal insulation was either missing, poor or damaged on the installations we observed and whilst this was a very small percentage it does suggest a general problem.

The block distribution pipework appears to date from the construction of the blocks some 35 years old. There is corrosion at fittings and joints, in particular at the point where buried district heating pipe rises to connect the local block distribution – commonly housed in a valve cupboard or riser cupboard.

We noted that the principal district heating branch connection to ground floor properties was buried in the screed / slab from the external valve box, until reaching the internal cylinder cupboards. In the apartments we observed it is apparent that the thermal insulation to such pipework was poor. This was evidenced by the floor surface being warm / hot along the length of the run in the screed.

We have some reports of pipe failures, leaks within flats.

Within the Apartments

Condition

The hot water cylinder and tank installations vary in age, from what appear to be cylinders and break tanks dating from the blocks original construction, through to replacements, possibly made in the last 10 years or so. Radiators appear to range from new to about 15 years old in the flats we visited.

The hot water cylinders themselves are of a variety of materials copper and older ones of galvanised steel. The units we inspected varied in age from 10 years old and more. All were considered to be in poor condition, in particular in terms of their thermal insulation.

The thermostatic two port valve is not particularly effective for the following reasons:-

- The adjustment of the thermostatic valve is quite difficult due to their location in the cylinder cupboards.
- It is not immediately obvious to occupants that this valve is acting as general control over the whole heating system.
- Sometimes the thermostatic control valves do not close properly because there are faults on the local differential pressure control valves which expose the thermostatic control valves to pressures that force them open. This arises due to dirt and debris in the differential pressure control valves.
- Once the thermostatic control valve opens, all the radiators and the distribution pipework become hot irrespective of the heat demand in each room.

The hot water cylinders are commonly poorly insulated, and the local distribution pipework and fittings within the cylinder cupboards commonly uninsulated. This leads to high heat emissions from the cylinder and pipework throughout the year.

5.0 KEY CAUSES OF OVERHEATING

Our findings from visual inspections and examination of records lead us to the following findings regarding the principal issues which result in overheating. We discuss the effect of the warm safe dry programme in the next section of the report.

Systems Within the Apartments

- Poor Thermal Insulation

  The hot water cylinders we inspected varied in age, and quality of the thermal insulation. At its worst the thermal insulation took the form of a loose jacket, in poor condition and inadequately secured. The heat loss from the body of the cylinder in such cases is excessive. The escaping heat effects the temperature of the spaces around the cylinder cupboard all year round and potentially leads to the warming of the water storage tank sited at high level in the cylinder cupboard, representing a Legionella risk.

  Low temperature Hot Water pipe work, comprising the incoming district heating main, the local heating distribution branch and the local hot water service primary pipework, all poorly insulated or wholly missing thermal insulation. Again heat emissions from this pipework will occur all year round, leading to elevated temperatures in the cylinder cupboard and adjacent rooms.

  Serving the ground floor apartments, the branch connection from the district heating valve set in the external boxes, extending through the screed (or slab top) to the cylinder cupboards is poorly thermally insulated leading to uncontrolled heating of the slab all the year round.

- Poor Controls

  The heating circuit is controlled by a single self acting two port valve with remote, wall mounted sensor element, connected to the control valve head.

  As previously noted the valve head (which includes the set point adjustment) is located generally at low level in the cylinder cupboard and is not easy to access, nor is it intuitively clear that this is to be adjusted to control the heating.

  Further, these valves are commonly forced open by the pressure head of the district heating systems and so pass hot water when it is not required. (Refer discussion in previous section)

- The System Configuration and Piping.

  Emanating from the cylinder cupboard, the heating pipework extends in un insulated single pipe loops at skirting level – and at some points concealed with the floor void. The pipe loops serve steel panel radiators within each space. The radiators have manual valve controls.

  When the pipe loops are provided with LTHW under the dictates of the self acting two port valve, the whole circuit and all the radiators connected to it

become hot, irrespective of the heating demand in each of the spaces served. Additionally, even if the radiators are manually isolated, there will still continue to be heat emission from the pipe loop.

- System Sizing

  Having reduced the heat losses from the apartments it is evident that the existing heating system radiators are oversized for the spaces served.
  To a large extend, good local controls can overcome this problem as an initial response. In the longer term, as emitters require replacement, or where refurbishment works afford an opportunity as part of a larger programme, the local radiators should be replaced with lower duty units to better match the space heat losses.

Heating Distribution within the Blocks.

The heating distribution within the blocks does contribute to overheating, principally where the branch mains enter the apartments at ground floor level and are buried in the screed as noted previously. Internal pipework also distributes vertically within risers. The installations we saw did suffer from poor or lack of thermal insulation, which will obviously lead to heat loss. In many cases this heat loss is generally be into common areas and hence is not specifically a cause of overheating within the flats themselves.

These pipe systems are approaching the end of their economic life, and replacement (assuming a district heating approach is continued) should be budgeted for in the foreseeable future. At this time it will be possible to economically provide appropriate thermal insulation, and indeed consider pipe work which is more resilient to corrosion such as plastic types for the longer term operation.

District Heating

The district heating pipework, being buried and external to the buildings does not contribute to the overheating within the buildings or within the apartments. We draw a distinction to the pipe work forming connections from the valve boxes and into the apartments at ground floor. This is not “buried” in the ground, but merely set into the slab screed and may be isolated from the buried district heating at the local valve boxes. Refer above.

The buried district heating installation appears sound in principal being a thermally insulated pipe in pipe systems, so the heat losses associated with the distribution should be within normally accepted margins.

6.0 IMPACT OF THE WARM DRY SAFE PROGRAMME

The warm, dry, safe, (WDS) programme (in terms of the thermal qualities of the buildings) has sought to improve the thermal envelope standards by means of provision of new windows, and thermal insulation cladding to the building fabric.

This has been successful to the extent that heat losses from the buildings have been greatly reduced.

Now the heating systems within the buildings were designed many years ago, on the basis of the original building thermal characterises, as such requiring significantly higher heat output than is now the case following WDS programme works.

The heat output being higher than required, coupled with the poor heating controls and system characteristics, as previously noted have resulted in overheating of the flat internal spaces.

In its response the effects of climate change The London Plan identifies three maxims in policy 5.2 for minimising the carbon emissions of schemes:-

These are:-

- Be Lean – Use Less Energy
- Be Clean – Supply Energy Efficiently
- Be Green – Use Renewable Energy

In addressing the fundamental thermal losses from the existing building stock the WDS programme is addressing the first maxim by reducing the energy demands imposed by the buildings, and this is the right approach for the long term.

This has perhaps been rather too successful and it is now appropriate to consider the second maxim, and improve the efficiency with which the energy is supplied. In our view this includes the local controls and quality of systems at the user interface in apartments, and extends to considering the wider system delivering heat energy to the apartments.

It is important to note that in replacing the windows there would have been no choice in terms of the thermal qualities of the glazing, in that windows are controlled components and therefore must meet the minimum requirement of the building regulations Part L in terms of energy efficiency.

The other affect that the WDS programme has had upon the apartments, is that the natural infiltration (by infiltration we mean uncontrolled ventilation) that would have been experienced through “leaky” window frames, doors, and poorly sealing opening lights, has been greatly reduced. Whilst the requisite trickle ventilation measures are apparent on the replacement windows, it is apparent that the flats previously experienced a higher infiltration rate, which had the fortuitous effect of negating excess heat from the poorly controlled heating systems.

On the basis that the appropriate trickle ventilation, and opening windows etc for rapid ventilation is provided we do not consider that providing additional natural ventilation is appropriate. This will merely increase waste of energy by exhausting

warm air. The correct approach is to address the local controls for the heating systems to suitable modulate the heat output to suit the space demands.

We discuss proposal later in this report.

7.0 FUTURE RISKS OF THE WARM DRY SAFE PROGRAMME

7.1 Climate Change

The London Plan notes that peak summer temperature rises are predicted in the following magnitude.

- by the 2020s, see an increase in summer mean temperature of 1.5 degrees Celsius, a decrease in mean summer rainfall of six per cent and an increase in mean winter rainfall of six per cent, all from a 1961–1990 baseline
- by the 2050s, see an increase in mean summer temperature of 2.7 degrees, an increase in mean winter rainfall of 15 per cent and a decrease in mean summer rainfall of 18 per cent
- by the 2080s, see an increase in mean summer temperature of 3.9 degrees, an increase of 20 per cent in mean winter rainfall and a decrease in mean summer rainfall of 22 per cent.

Now the context of this report is primarily to consider the issues of overheating arising from the space heating and domestic hot water systems.

The likely temperature rises of 2.7°C over the next 35 years do not significantly affect the ability of the space heating systems in the buildings to control the winter season temperatures. Indeed in theory annual heating energy demand should fall.

However the increase in summer time temperatures does lead to a consideration that good thermal insulation of the block distribution and equipment within the apartments will become increasingly important.

7.2 Measures for the WDS Programme to Adopt.

The associated aspect to this for the WDS programme should be, we suggest, to consider the impact of the WDS measures – such as double glazing and improvement in air tightness in particular, on the likely internal summer time temperatures.

This could take the form of thermal modelling to establish likely temperature profiles allow a consideration of mitigation measures such as solar shading and design of opening windows for ventilation. (This we emphasise is not an alternative to providing the previously discussed controls and **thermal** insulation in connection with thermal heating and hot water systems.)

Given that our review of the D'Eynsford Estate revealed overheating in its current condition it would be prudent to consider improving the heating systems before the glazing and thermal envelope if the condition of the windows allows this.

8.0 COMPARISON REVIEW OF THE D'EYNSFORD ESTATE

As part of the commission for this report we were asked to review the space heating installations on another typical Estate in the context of overheating problems and to draw comparison with the issues at the Cossall Estate.
We therefore were invited to visit the D'Eynsford Estate, where we inspected the main boiler room / energy centre and a number of typical apartments.

8.1 Description of the Existing Installations.

Boiler Room

The boiler room installation comprises 2No main load / winter boilers and 1 No summer load boiler of smaller duty. The main boilers are of shell and tube type, and the summer boiler is of sectional type. The boilers are provided with conventional flues and gas fired pressure jet burners.
The boilers generate LTHW. The LTHW is distributed through a four pipe district heating system to serve the apartments. The four pipe system comprises two pairs of flow and return pipes, one which serves to generate domestic hot water service within each apartment and one pair which serve to provide space heating in each apartment. The space heating LTHW is divided into two zones across the site (zone A and zone B) and the domestic hot water LTHW is a single zone. Each space heating zone and the domestic hot water service LTHW have their own run and standby distribution pumps located in the boiler room.
In the summer time, the LTHW serving the space heating is shut down leaving only the domestic hot water circuit operational.

Within the Apartments and Blocks

Block Distribution

The blocks of apartments on the estate all generally appear of the same basic type, apart from some larger maisonette type properties which are in the minority. We therefore assume that the same principals of distribution etc will apply.
The LTHW rises vertically within the blocks in a number of service riser shafts, which are accessible within the corridors on each level. LTHW emanates from these risers to serve adjacent apartments down the length of each corridor.

Apartments

Domestic Hot Water Generation

Within the apartments themselves, the domestic hot water LTHW serves into an indirect hot water cylinder – these types have a heat exchanger coil within them through which the LTHW flows, passing heat into the water in the cylinder and thus generating hot water for domestic use at taps etc. The cylinders are provided with a cylinder thermostat and two port motorised valve to control the LTHW supply to the heat exchanger coil. Above the hot water cylinder there is a cold water header tank which supplies water to feed into the cylinder below, where it is heated to become the hot water supply.

Space Heating

The LTHW for the space heating appears to enter the apartments with no local control. It then distributed within the apartment on a single pipe loop, serving steel panel radiators within each room. The radiators have manual on / off hand operated valves and this is the only form of control we could find.

8.2 Comment on the Existing Installations Condition and Effectiveness.

Boiler Room

The boiler room installations are aged and at / approaching the end of their practical life. This is true for the boilers, pumping, controls and ancillaries, although we did note that new pressure jet burners were provided to the main boilers.
At the time of our inspection one of the main boilers, and the summer boiler, were undergoing repairs.

Apartments

Within the apartments we inspected the installations are aged and approaching the end of their life. The hot water cylinders and associated pipe work are poorly insulated and the cold water tanks above them uninsulated, resulting in excessive heat loss and the warming of the cold water stored in the tank. This is a high risk for the generation of Legionella.
The space heating in the apartments is very poor in terms of control. The apartments we visited were unoccupied and the radiators all manually isolated, yet the apartments were uncomfortably warm. This is because there is no control on the incoming LTHW feed, and because the single pipe loop distributes uninsulated at low level through much of the apartment.
We also noted that the corridors were quite warm. Heat from the LTHW pipe in the corridor risers could be felt on the warm access panels to the corridor risers.

Conclusions and Comparison with Cossall Estate

The D' Eynsford Estate has a four pipe district heating system; where as the Cossall Estate has a two pipe system. This does not really have great bearing upon as the D' Eynsford Estate apartments are suffering from the same basic problems in terms of causes of overheating as we found on the Cossall Estate. There are differences in the block distribution arrangements, but this is incidental to the fundamentals. We consider that in the apartments we visited the overheating issues at D' Eynsford are in fact more severe than at the Cossall Estate, since there is no control on the incoming LTHW to each apartment.

The Estate suffers from poorly insulated block distribution, poorly insulated, poorly controlled and poorly arranged space heating within the apartments. The problems, resulting overheating, and, we suggest, the appropriate solutions are fundamentally the same as for the Cossall Estate.

Importantly we noted that in the apartments we visited, the windows remain as older single glazed units, and there is still an overheating issue. This suggests that the basic design is fundamentally flawed judged against today's standards of control and energy conservation.

9.0 REVIEW OF PROBLEMS AND ACTIONS TAKEN BY OTHER AUTHORITIES.

We approached Wandsworth Council property services to establish what approach they have undertaken to address problems of overheating within exciting housing and apartments.

9,1 Wandsworth – Their problems and solutions.

Wandsworth have experienced difficulties with heat emissions from heating mains distributing within blocks of apartments, and poor controls and general arrangements associated with aged heating installations within the residences.

For the LTHW mains distribution they have generally replaced the existing with well insulated new pipe work, and sought to re route the distribution so that it does not run through apartments, but instead runs through corridors, or risers outside of the apartment envelope.

To address the issues of poor control of heat output within the residences they have either improved the existing installations by application of local thermal insulation, new control valves and associated pipe work modifications, or where budget allowed opted to for a renewal of the heating installation within the apartments including new packaged and pre-insulated cylinders, or heat interface units, with new distribution and emitters.

9.2 Comment

Broadly Wandsworth appear to be experiencing the same issues with their residential housing stock as experienced by Southwark.

The approach that they have taken in terms of immediate fix solutions appears to be the same as that implemented by Southwark. I.e. within apartments the application of improved thermal insulation and provision of new control valves with local pipe modifications and so to accommodate.

For their longer term approach the provision of new packaged cylinders or Heat Interface Units is the same conclusion that this report recommends for the Cossall Estate currently under consideration

10.0 SHORT TERM SOLUTIONS

We suggest that the initial response to the overheating problems within the apartments should address the poor thermal insulation, and poor controls within the apartments themselves.

We have discussed the basic reasons for the problems and this leads to a number of options for addressing them, which we can present in order of cost.

General Considerations

We have considered the options for improvement in a tiered fashion – in the first instance focussing on what is immediately necessary to resolve the overheating issues, and then examining the benefits of taking a more holistic view of the ongoing needs for the building stock. The short term solutions therefore focus on the former immediate actions and the longer term solutions (refer next section) focus on holistic whole estate and issues – which to a large extent are concerned with carbon emissions, energy use, maintainability, and adaptability.

10.1 Minimum Measures

We suggest that the minimum requirement would be those needed to eliminate the overheating issues at minimum capital cost. We note however that these minimum measures do not in our view constitute a best value option, as they do not take advantage of technical synergies that present themselves with regard to the need for hot water cylinder replacements. We state them here for the sake of completeness.

Apart from dealing with the physical system faults in terms of heat loss and controls, we believe it is essential that the new controls provide the following:-

- User friendly and intuitively clear in operation for the users.
- Accessible to users and for maintenance
- Simple and economic to replace and maintain with flexibility for future suppliers and installers.

Broadly we identify the first and minimum cost response as the following:

- Provide thermal insulation to the pipe work, and hot water cylinders, valves and ancillaries within the apartments.

- Replace and provide thermal insulation to the branch pipes extending from the external valve boxes, through the screeds and into the cylinder cupboards at ground floor. This will involve breaking out the slab screed along the route, pipe replacement and making good.

- Replace local controls to the heating and to the hot water service primary with motorised two port or flow share valve, new time clock controller and wall mounted thermostat. Basically replicating a common domestic system control.

- Re pipe local radiator heat emitters on a two pipe system emanating from the cylinder cupboard. This could be undertaken by routing pipe through the floor void formed by the floor panels and battens on the upper floors, but would

require floors to be taken up. On the ground floors a consideration of suitable pipe routes could allow this to be achieved routing the pipes at low level and with limited interventions into the screeds.

- Provide thermostatic controls to the radiator heat emitters.

10.2 Renewal of HWS Cylinders and Cold Water Tanks

The approach outlined in 10.1 in itself will deal with the immediate over heating problems.

However it is apparent that the hot water cylinder installations in a large proportion of the apartments are at or approaching the end of their life. We also noted previously that the cold feed water tanks are poorly insulated and in poor condition and therefore similarly in need of replacement in the foreseeable future.

There is consequently an opportunity to consider the benefits of replacement with new and enhanced products which can address the base controls requirements for the heating, hot water service, and renew the hot water generation and cold feed arrangements in one package.

Assuming for this element of the report that we proceed on the basis of retaining the district heating system, the replacement product could take the form of either a replacement hot water cylinder (HWS) or of a Heat Interface Unit (HIU).

In both cases there are benefits over the existing arrangements.

We consider the options as follows:-

10.2.1 Hot Water Cylinder Packages.

In this case we would propose a packaged unit incorporating:-

- Integral Controls for HWS and the Heating
- Integral plate heat exchanger to separate the district heating system from the flat system. We suggest this is a desirable feature, since any damage or leaks experienced to the installation within an individual flat will not cause the landlords district heating to be affected.
- Pre piped and pre wired package for simple connection to district heating mains, to the flat heating distribution, to the incoming mains water, to outgoing domestic hot water service, and providing pre wired controls and power arrangements for simple connection to power, time and temperature controls.
- Integral hot water storage vessel with encapsulated thermal insulation meeting or exceeding current requirements.
- Integral heat and domestic cold water metering capabilities, with enhancements to allow a variety of reading and billing options. These can be in place for engagement in the future if not required in the first instance.

The obvious benefit here is that the hot water cylinder is upgraded, and all equipment thermally insulated, with improved controls all in one action saving on labour and indeed on the basis that the hot water cylinder requires replacement now or in the near future there is a cost saving over all, compared with undertaking the improvement of controls / thermal insulation and then subsequently replacing the cylinder.

The existing domestic water arrangements include a cold water break tank located above the hot water cylinder which is served with mains cold water by a 15mm incoming main. This main also splits to serve the kitchen cold water tap. We would recommend a system that eliminates the cold water storage tank if possible. This is recommended on a number of counts:-

- Eliminating the tank leads to a direct mains pressure system which affords a flow capability to showers. Currently the shower head would be at virtually the same height as the tank so there will be no effective gravity flow. Currently showers will require pumping.
- The direct fed option eliminates maintenance associated with cold water tanks.
- The cold water tanks are poorly insulated leading to the potential of stored cold water being warmed by surplus heat in the cylinder cupboard. This is a Legionella risk which is reduced by the direct mains fed option.

10.2.2 Mains Water Pressure and Flow.

There is a problem however to consider with the direct mains fed option, and this is that the mains feeds to the apartments are 15mm in size, which is basically the smallest service, and could possibly lead to flow starvation and on the upper levels, pressure starvation.

Now the majority of the apartments have one kitchen and one bathroom, so at ground floor level there is likely to be sufficient pressure to serve the accommodation, not withstanding that pipe velocities through the 15mm pipe will be higher than ideal.

At first and second floors daily fluctuations in mains water pressure could lead to an inadequate supply if fed directly from the main.

In order to allow the apartments to be served direct from the mains, and implement the above strategy we would therefore recommend that there are two options.

The first is to approach the water authority to establish costs and practicality to provide 22mm supplies to each apartment. This solution addresses the flow issue, but still leaves a pressure issue at the upper levels.

The second is to consider the application of “accumulator” vessels provided to each apartment instead of a water tank.

In apartments at first floor and above we would additionally recommend “charging” pump sets which provide a pressure boost to the

The accumulator vessel comprises a sealed vessel which charges with water and pressure and allows a volume of draw off from the vessel which is in excess of the

general capacity of the incoming main for a given demand duration / volume. The unit is sized to deal with the anticipated maximum demand scenario. Once

discharged the water continues to be available at mains pressure and the unit recharges during periods of low demand to deal with the next surge. Refer to Appendix!! for details of typical accumulator equipment.

Anticipated size would be 100L unit size 890 mm long and 410mm diameter, in a horizontal configuration at high level in the cylinder cupboard.

10.2.3 Central Boiler Plant Benefits

As noted in the schedule of benefits for the hot water cylinder, these units incorporate a plate heat exchanger (PHX) which separates the district heat system from the system in the flats.

The use of the PHX allows the district heating side to operate at higher temperature differentials than with a conventional hot water cylinder primary coil. Potentially having a return temperature some 20 deg K lower than the flow. Also it may be possible to drop the flow temperature a little due to the high efficiency of the PHX.

The net result of this is that the flow volumes and associated pumping energy use can reduce.

The reduced temperatures will also tend to reduce distribution heat losses.

10.3 Replacement of Hot Water Cylinders with Heat Interface Units (HIU)

Please refer to Appendix for details of a typical Heating Interface Unit.

The HIU is a packaged unit, served with low temperature hot water from the district heating mains, and providing domestic hot water and space heating to the flat. The major difference between this unit and the Packaged Hot Water Cylinder (HWS) is that there is no domestic hot water storage. Instead the unit is rated to heat the domestic hot water instantaneously when required.

The HIU packages include all the benefits noted with the HWS, but is somewhat smaller as there is no storage.

Since the unit does not store hot water and therefore has no cylinder / vessel, the standing heat losses from these units is smaller than that of the HWS system.

Similar to the HWS system – these units employ plate heat exchangers within them to generate the domestic hot water and space heating for the flat. The temperature differentials across these units may be greater than that across HWS systems – leading to return temperatures potentially below 50 deg at peak demand and thus maximising the potential for condensing boiler high performance and in the future greater potential for use of renewables and waste heat.

This implementation would need to be subject to a detailed design study for the central plant options and system operating temperature differentials, but it possibly brings the return water temperatures down low enough to be in the realm of condensing boiler operation. Such boilers require return temperatures in the region of max 55 deg C to operate.

Condensing boiler efficiency being maximised should see peak efficiencies in the region of 90% or more at the main boiler plant.

10.4 Flat Heating Distribution Pipework

We noted that the heating distribution pipe work is poorly arranged in the single pipe circuit loops within the flat.

These pipes are generally arranged at the perimeter affixed to the skirting board, with branch T connections to each radiator served.

Whilst we noted that these pipes should be reconfigured / adapted into a two pipe circuit, in our view the best arrangement would be to run small bore plastic pipes (eg12mm) , within conduit sleeves, though the floor void rising to serve each radiator individually. The pipes would emanate from a manifold located within the cylinder cupboard. This would likely be a solution more suited to an apartment refurbishment scenario where it would be possible to take up the flooring where needed.

Clearly at ground floor where a screed exists a consideration of new distribution will need to minimise intrusion into the screed and establish the best two pipe routing.

Each radiator would be provided with a thermostatic control valve.

11.0 LONG TERM SOLUTIONS

We submit that the local overheating problems will be largely solved by the measures described in the short term solutions.

In the section we therefore consider the options for system improvement on the assumption that the district heating system remains in place.

As per the brief we have considered the replacement of the district heating system with local heat source later in this report.

The longer term measures take advantage of the system characteristics which arise from the short term measures.

11.1 Central Boiler Plant

The existing boilers are some years old at approaching the end of their life as noted.

When replaced there will be a clear advantage if these are replaced with condensing boiler plant, or a combination of condensing and high efficiency subject to detailed design.

The extent to which this is possible will depend upon how the existing installations are upgraded and replaced.

The best opportunity will be available if the local HW cylinders are replaced with HIU units. This is because the HIU units will lead to potentially lower return water temperatures in the district heating mains. in particular in the summer when there is no space heating demand.

11.2 Block Distribution Pipework

The existing pipework within the blocks is approaching the end of its working life. However this mainly affects the larger multi storey blocks which are in the minority on the site.

Some intake valve sets and associated pipe work have been replaced, but for the most part this remains (we believe) as existing from the original construction of the buildings. The thermal insulation to this pipe work is poor or in some cases missing.

There is clearly an opportunity when replacing this pipe work to opt for long life span plastic type pipework with enhanced thermal insulation.

Whilst we do not consider that this pipe work is a major contributor to the flat over heating in aggregate the reductions of its heat losses will have a benefit, and probably more so in the summer time, than in the winter, when the wasted heat into the common areas is generally dissipated.

11.3 Low Carbon Technologies and Renewables

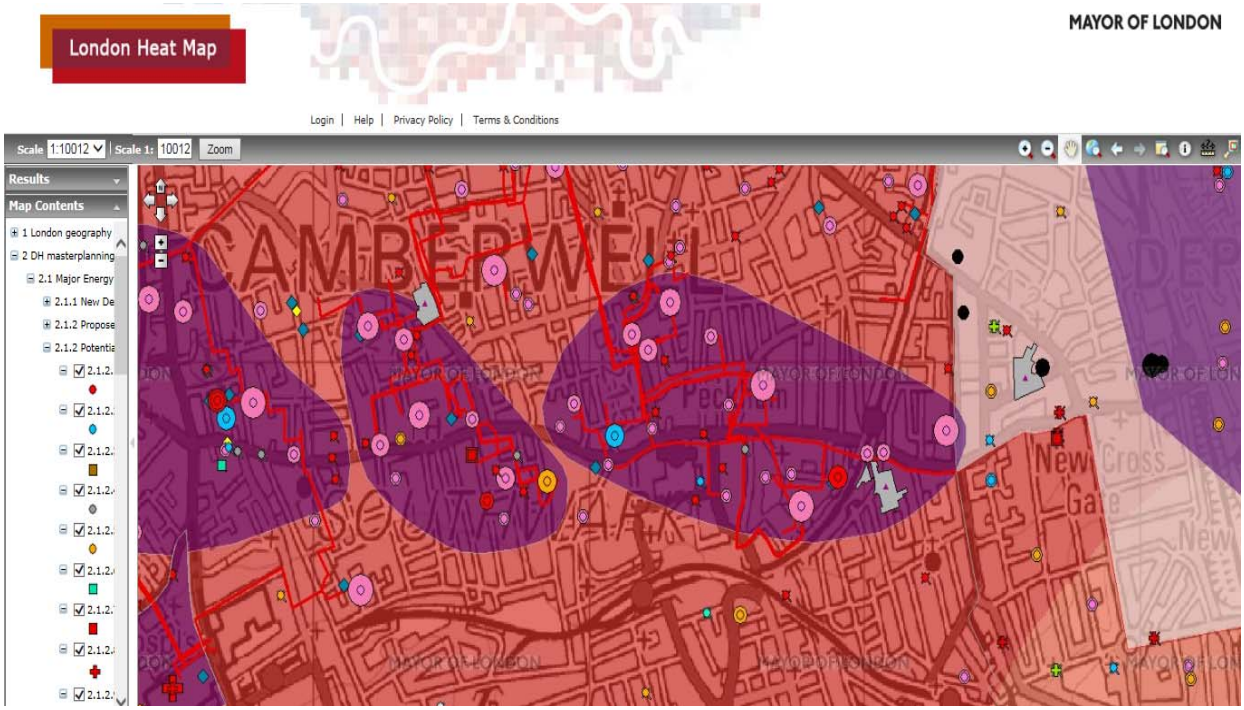
There will be an opportunity to consider the application of suitably sized Combined Heat and Power (CHP) and in theory solar thermal, if the return water temperatures can be designed low enough - for example down to 40 deg C.

11.4 Connection to Heat Networks

The London Heat Network is a scheme whereby heat and electrical power generating sites are linked through district heating mains to share waste heat from small scale generators such as combined heat and power schemes.

The Cossall Estate on its own is very much at the smaller scale of the schemes considered in the London Heat Network. However looking at the heat map, which shows potential heat networks, the Cossall Estate is located within a zone which could potentially become connected onto a major network.

Please see map below which indicates zones of high potential for heat network connections (purple) and potential heat network district heating mains (red lines).



Considering the high density / close proximity of housing estates with district heating already existing in Southwark and (we understand) the need to undertake works to them in the foreseeable future, there would appear to be a very good opportunity to seriously consider linking the sites into small area / local heat network. With the

close proximity of sites the additional costs of the linking could prove to be economically, and certainly environmentally viable.

The potential to link this into a major heat network in the foreseeable future should – we suggest – be seriously considered and be appraised before major investment decisions are made on renewal and upgrade of existing district heating on the various estates. In the short term (10 years) there is still much potential benefit to be had from the creation of a small area local heat network. The scale of this network would certainly make the inclusion of suitably sized combined heat and power a consideration for inclusion in energy centres. Further the establishment of larger energy centres, perhaps serving several estates that are in close proximity will bring benefits of scale in reducing the number of plant installations to be maintained.

12.0 REMOVING DISTRICT HEATING AND REPLACEMENT WITH INDIVIDUAL SYSTEMS

Removing - or perhaps more realistically abandoning, the existing buried district heating installation will mean that domestic hot water service and space heating will need to be generated locally.

The other point is that – as previously noted – disconnection from the district heating mains, will not contribute to controlling the overheating problem, since all this pipe work is buried.

Clearly such an option negates any possibility of connection to future heat networks noted in the previous section.

There are three options for this - in our view.

1. Local Boiler Rooms Serving each block.
2. Individual Boilers to Each Property.
3. Electrical Heating and Domestic Hot Water Service to each property.

12.1 Local Boiler Rooms Serving each Block

For the purposes of this report we have not examined this option, since the brief focuses on individual heat sources.

12.2 Individual Boilers to Each Property

12.2.1 Gas Supplies

There is in existence a gas distribution pipe network across the site. Our enquiries on site suggest that the gas distribution extends to the majority of apartments and residences.

We noted some apartments where the gas had been capped and some where there was still a meter in place. Where the meter was in place, they were in locations where the provision for ventilation would not be adequate for a new installation, and we anticipate that for new gas boilers to be connected there will need to be an improvement to provide adequate ventilation. The gas network is administered by Southern Gas Networks.

If the gas were to be utilised we recommend that the meters should be located in the external wall, within a proprietary recessed meter box. This will give full compliance and eliminate any future issues with the retention of the gas metering.

Where new gas meters are required, discussions with (for example) British Gas indicate that provided the gas network is sound and live, that they would install new gas meters at no cost, provided that they are initially contracted to provide the gas for an agreed period of time.

For the purposes of this report we are assuming that the remedial works to establish gas meters in each apartment are limited to works within the apartment. We have

made enquiries with SGN who advise that they need a schedule of addresses to verify the status of the gas infrastructure to them.

If we can receive this we will progress a confirmation with SGN.

Now one issue that we wish to raise for consideration by the Client is that of the potential resistance of occupants to accepting direct billing of the gas used from the gas utility. There will presumably be potential fuel poverty issues, if occupants were unable to pay their gas bills. The gas utility policy on non payment would therefore be a consideration.

This is, we suggest, an issue a little outside of our remit to advise on, but is clearly an important factor.

12.2.2 New Gas Boilers.

We propose that the works to provide new gas boilers to each apartment would be of the combination type providing domestic hot water service, and space heating. These boilers typically include integral controls and pumping, so all that is required is to connect the boiler up to the heating distribution, cold feed and domestic hot water supply distribution.

The existing hot water cylinder and associated cold water storage tank would become redundant, and be removed.

The boilers, being “room sealed” and with balanced flues providing fresh air for combustion and the exhaust of combustion gasses, do not need to be in an externally ventilated space. They can therefore be located within the existing hot water cylinder cupboards if desired. A grille would be required in the door of the cylinder cupboard for simple ventilation. Alternatively the boilers could perhaps be incorporated into the kitchen high level unit arrangements if preferred.

Local gas boilers will be a very efficient option and will certainly result in reduced carbon emissions, and energy use compared to the existing central plant. This assumes correct use of the new local boiler equipment of course, but basically a gas fired condensing boiler providing hot water and heating should be operating in excess of 95% efficiency, and has virtually no standing losses. Additionally there will be no district heating or central plant losses.

On the negative side local boilers do negate any possibility in the future of connecting to a heat network, and the integration of low and zero carbon technologies, eg combined heat and power. The adoption of these technologies into the central plant “energy centre” could potentially sway the balance – from an energy and carbon emissions point of view in favour of the district heating scheme. Such an approach is also in accordance with the London Plan.
Clearly the resolution of this would depend upon the energy centre investment, strategy and particulars of the circuit designs.

12.2.3 Mains Water Pressure and Flow.

As with the HWS solution the boilers are mains fed to provide domestic hot water service, and there is a problem with flow starvation and on the upper levels, pressure starvation.

We have adopted the same solution as for the HWS option which is that of “accumulator” vessels provided to each apartment instead of a water tank.

12.3 Electrical Heating and Domestic Hot Water Service to each property.

Whilst this is technically an option we have not undertaken an analysis since the inevitably high running costs - some three times that of gas domestic gas cost, would make the system very expensive to run, and increase carbon emissions massively due to the high carbon content of electrical power at this time.

Possibly an option to consider in 30 years time if the carbon cost of electricity has been lowered.

There is also the inevitable capital costs arising from strengthening the local electrical infrastructure, requiring additional substations and potentially HV main stations, which would bear upon the scheme.

13.0 CONCLUSIONS

13.1 General Conclusions

The report has considered a number of issues which naturally become of concern when substantial sums are involved in addressing the problems on the site.

The fundamental and initial purpose of the investigations, analysis and brief was to consider the options for preventing overheating in the apartments.

Following on from this basic consideration we have reviewed the next logical steps, which take advantage of technical synergies arising from the likely additional works that will be required in the very near future to replace the hot water cylinders and header tanks.

Our recommendation for addressing the overheating problem and the imminent replacement of hot water cylinders is that the existing arrangements are replaced with new pre piped, packaged cylinders, incorporating all controls, new accumulator units, and the apartments and houses provided with new piping arrangements to new radiators.

We also consider the benefit of abandoning the district heating system in favour of local boilers within apartments.

Referring to the following tabulated data and discussions, on balance the decision between local gas boiler and retention of the district heating system seems fairly finely balanced on purely cost grounds. However considerations other than simply the cost leads us to favour retention of the district heating scheme. In particular if the opportunity to develop heat networks is found viable this would definitely be a financial and environmental benefit if eventually linked to major heat networks, which are being developed.

Our review of the D'Eynsford Estate revealed a common problem with the Cossall Estate.

We find ourselves able to recommend from a technical point of view, both the local boiler option and the hot water cylinder / district heating scheme.

Both offer improvements over the existing installations in the apartments, with separation from the district heating system being a point to note with the new hot water cylinder package. Leaks etc in an apartment will not shut down the district heating scheme.

Both have local metering of energy / gas use although it is optional with the hot water cylinder scheme from the residents point of view.

The local gas fired option offers a simple system with no central plant and distribution liabilities for the council. However this option creates a very difficult situation from an administrative and occupant relation point of view because it will require all such occupants to have direct billing agreements with the gas utility.

For many occupants this may create a “fuel poverty” problem which does not currently exist.

At the moment the council is able to charge occupants and agreed tariff based upon an area rate which may be averaged across the many various use patterns so as to benefit those in need.

Consideration of costs for the council need also to be considered with replacement, servicing and maintenance costs of the individual boilers over a whole life period

The other major consideration which in our view counts against the local boiler option is that the use of local boilers loses the very real possibility of developing heat networks.

The hot water cylinder / district system allows connection onto heat networks and offers flexibility to incorporate new and existing CHP technologies into an “energy centre” as opposed to the current boiler room.

13.2 Findings for Capital, Life Cycle and Running Costs. Local Boilers and District Heating Comparison.

Capital and Life Cycle Costs

Reference is made to the various appendices for the break down analysis supporting the following summary table data.

The following table summarises the Capital Installation and Life Cycle cost analysis findings. The costs for the plate heat exchanger heat interface unit are similar to that of the Packaged Hot Water Cylinder.

CAPITAL AND LIFE CYCLE COSTS			
System Option	Minimum Works Costs	Packaged Hot Water Cylinder	Local Gas Fired Boiler Installation
Capital Cost	£1,887,995.00	£2,095,632.00	£1,844,175.00
25 Year Cost (2014 values)	£4,218,120.00	£4,302,032.00	£4,992,175.00

Annual Energy Use and Fuel Cost

We have included an analysis of the energy use and likely running costs.

We have made some assumptions as the existing central boiler plant is at the end of its life, and is in need of replacement, so new installations will be needed imminently, and it is the likely efficiencies of the new installations that we have compared the local boiler installations with, rather than the existing. Within the capital costs for the minimum works option we have included the cost for the replacement cylinder and accumulators, to give a fair comparison, since as with the central plant these are in imminent need of replacement.

The other point to note is that the fuel use is currently paid for by the council and – we assume – running costs including maintenance and fuel billed back to the

residents on the estate. The tariff arrangements will therefore affect the cost of the "fuel" to the residents in the district heating scenario. The running costs in the comparison are those to the council.

Finally if direct billing of the gas use for local boiler plant was changed to be between occupants and the utility, the price of the fuel per kWh would be somewhat greater to the residents than that to the council so we have use as "domestic" rate for the local boilers and a "commercial" rate for the district heating.

The first step of the energy analysis is to establish the thermal energy requirement for the apartments, for the purposes of comparing the systems.

ENERGY DEMANDS			
Dwelling Type	Energy Demand Pa each. kWh/Pa	Number of dwelling type.	Site Energy Demand kWh/Pa
1BF	7929	271	2148708
2BF	10144	75	760800
3BH	17333	46	797295
		Total Appt's	**3706803**

Now taking into account the system efficiencies, site distribution losses and so on, and with the tariffs as noted able, leads to the following fuels and use and associated costs. Details of the tariffs used are noted in the detailed calculation sheets. We have used industry typical but of course the rates can be adjusted.

ENERGY COSTS			
System	Energy Use Gas	Energy Use Elec	Energy Cost
Local Boilers	3599846	NA	**£ 193,143.96**
Energy Centre	5145493	262800	**£ 172,858.44**

Overall if the energy centre were optimised with new condensing boiler plant and CHP it is possible that the nett efficiency including distribution losses would not be far away from the efficiency of local boilers. The fuel cost of the local boilers – even if they did use slightly less energy would still be greater as noted.

13.3 Minimum Works Option

This option does offer the cheapest short term solution to the issue of overheating in the apartments, if the need to also imminently replace the HW cylinders and tanks is ignored. We do not however recommend that this is the best course of action.

As noted, in principal it leaves the existing hot water service cylinders and existing cold water storage tanks in place. Our view is that the condition of this equipment is such that it will need to be replaced in the very near future, both on grounds of operational reliability and on health grounds, since there are concerns regarding the warming up of the water in the cold water storage tanks, and that these are fabricated from galvanised mild steel which is not an approved material for such tanks. Hence we have included cost for the replacement of the tank and the cylinder in the capital costs as noted above.

It will therefore be advantageous to consider replacement of the cylinder and controls etc as a packaged piece of equipment instead of individual component improvement of the controls, thermal insulation of cylinder and tanks, pipes and valves and so on, as considered in 13.4 below.

Further we consider that the ongoing maintenance of such a site assembled collection of equipment will inevitably be more problematic and expensive than a single – guaranteed package. The 25 year costs only consider what must be done under statute, not likely adhoc "breakdown" costs.

13.4 Replacement Packaged Hot Water Cylinder Option

A packaged hot water cylinder unit will incorporate all controls, time clocks, interconnection pipe work, a plate heat exchanger to separate the apartment from the district heating system, and all in an easy to connect single unit with casing and thermal insulation. Installation time is reduced and savings afforded improve the viability of this option.

These units incorporate integral heat metering equipment and can be arranged to transmit on hard wired or wireless read out. This could give occupants the option to change to billing on energy used if they so desired and it was in accord with the councils management strategy.

Referring to the cost analysis for this one can see that this practically the same cost as the minimum works option and less cost than compared to the local gas boiler option over the system lifecycle. The figures are noted to be quite close.

There are other potential advantages to keeping the district heating based scheme that are not wholly financial.

These are :- The possibility of connection to heat networks in the future.
The potential inclusion of combined heat and power into a new "energy centre".
The potential of improving central boiler plant efficiencies subject to detailed design including the use of condensing boilers.
Philosophy in accordance with London Plan.

We believe that the benefits of developing a small area's heat network and the future possibility of linking to major heat networks is a major factor in swaying the decision in favour of the Hot Water Cylinder Option, even though the lifecyle costs considered on the existing arrangements are quite close.

13.5 Local Gas Fired Boiler Option

As can be seen from the take of cost comparisons the local gas fired boiler option is the lowest capital cost.

The costs are quite close but the local gas fired option is not the most economic over the lifecycle of the installations.

This is a simple system, which takes away from the council the requirements of central plant maintenance, district heating maintenance, and the long term capital replacement thereof.

On the negative side, it strays away from the direction the London plan suggests in terms of building up heat networks, providing local power generation, and reduces the options for integration of low carbon technologies that might become viable in the future. See our comments elsewhere and above on this heat network opportunities.

There is also the issue of implementing direct billing of the gas use between the occupants and the gas utility. This is a management / organisation issue which the council will be best informed on regarding its viability and raises issues of fuel poverty where the cost of heating provision would rise significantly for those occupants staying in their properties for long periods over the heating season.