COMMERCIAL IN CONFIDENCE

OPTIONS APPRAISAL

Of

HEATING SERVICES

At

CURNOCK STREET ESTATE

For

LONDON BOROUGH OF CAMDEN

On Behalf Of

LONDON BOROUGH OF CAMDEN
CAPITAL INVESTMENT GROUP
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Ref:	DES089/LBC/Curnock/CPP/Rel 9.0
Date:	April 2008
Status:	Release 9

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1 MANAGEMENT SUMMARY

1.1 INTRODUCTION

NIFES Consulting Group was appointed by the London Borough of Camden to carry out this project in accordance with the terms and conditions of our proposal to provide Mechanical and Electrical Consultancy Services Term Commission dated 26 June 2002.

The project includes a Feasibility Report and Options Appraisal for the replacement of heating and hot water services at Curnock Street Estate.

A survey was undertaken over a period of time focusing on communal areas and a sample selection of dwellings.

It is understood that the purpose for undertaking the options appraisal survey is due to complaints received from residents with regard to ineffectiveness and noisiness of the heating system. Also Camden's Planned Maintenance Group identified that the existing heating pipe work was in a very poor state and likely to fail.

The content of the report is based on Camden's "Heating Policy (1st revision 11-10-06) which states that Camden will; *"Undertake "whole life cost" option appraisal when considering improvements to whole block heating. The selected option will be determined by the least negative Net Present Value (NPV). Where the NPV of one or more options are within 5% of the lowest option, the recommendation shall be determined using economic, social and environmental impact assessment."*

The estimated life cycle costs are based on a period of 30 years and a discount rate of 3.5% and take into account all installation costs and likely repairs and maintenance costs based on the current term maintenance contractor rates.

The expected running costs due to gas and electrical consumption has been factored into the net present value costs assuming gas price annual inflation rate of 3%.

The aim of the report is to: -

a) Confirm whether the current budget available to Camden is sufficient to replace heating mains, solve acoustic problems and install cold water storage tanks.

b) Survey existing services.

c) Provide nett present value costs over a 30-year period based on capital cost, repair, maintenance, and fuel costs.

d) Evaluate Prudential Borrowing as an option to fund some or all of the works.

e) Make a recommendation as to which should provide the best long-term benefits.

1.2 SUMMARY OF MAIN WORKS OPTIONS APPRAISAL

1.2.1 General

The mechanical and electrical services are generally in a workable condition but most services, with the exception of the boilers, plate heat exchangers, controls and pumps are the same age as the buildings (circa 40 years old).

1.2.2 Options Considered

The options that have been considered for whole life cycle costs analysis:

Option 1A	-	Replace heating mains, solve acoustic problems and install cold water storage tanks.
Option 1B-CON	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (reading and billing by a nominated Contractor)**.
Option 1C-PPU	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (payment via a point of sale unit)**.
Option 1D-CHWS	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new thermostatic radiator valves within flats, retain existing communal hot water service system **and no heat metering.**
Option 2A	-	As Option 1A but with complete replacement of communal heating, new heating controls **and no heat metering**.
Option 2B	-	As Option 1a but with complete replacement of communal heating, new heating controls **and heat metering**.
Option 3	-	Replacement of communal heating with domestic condensing boilers.
Option 4	-	Replacement of communal heating with domestic condensing combination boilers.
Option 5	-	Replacement of communal heating with electric heating and hot water.

1.2.3 Cost Information

The estimated capital costs are based on a number of similar projects undertaken by NIFES Consulting Group in Camden over the last 9 years with due allowance for inflation material, labour costs and Final Account records.

The estimated life cycle costs are based on a period of 30 years and a discount rate of 3.5% and take into account all installation costs and likely repairs and maintenance costs, based on the current term maintenance contractor rates. The expected running costs due to gas and electrical consumption has been factored in to the net present value costs. The fuel discount rate has been based on 3%.

The costs presented are those expected to be returned under a competitive tender basis although these would need to be reviewed over time.

Preliminaries costs, provisional sums and contingency are included or excluded where indicated in the costs tables or schedules. All costs presented exclude VAT.

1.3 GENERAL STATEMENT OF RESULTS

This report concludes the following: -

1.3.1 Whole Life Cycle Costs

The conclusion of the report is that Option 2B is the most environmentally friendly option over a 30 year period.

However, in terms of whole life cycle costs Option 1D-CHWS attracts the lowest whole life cycle cost.

1.3.2 Whole Life Cycle Costs including Prudential Borrowing

The conclusion of the report is that Option 1D-CHWS is the most viable based on whole life cycle costs and cost borrowing when compared to the other options.

1.3.3 Prudential Borrowing Exercise

An exercise was undertaken to run Prudential Borrowing (PB) calculations for defined options to review the economics of funding heat metering via the PB route.

The conclusion for the Curnock Street case is not economically viable for funding heat meters because at the end of the term the amount of total borrowing exceeds the benefits gained.

It is clear that the PB calculations are sensitive to VAT on fuel and management costs and such costs can outweigh the benefits. If there was some way of offsetting management costs advised at 4.7% then PB may become more viable.

Also, it is clear that PB is sensitive to the level of initial funding or budget available. For instance, the calculations have been based on a budget provision of £1,339,096, but if this was say £1,000,000, the PB cost would be more and the total benefits would less. So in this case PB would not be viable.

However, it is considered that PB could be viable for some heating schemes but only where nominal capital costs produce high energy savings. An example would be to change redundant boilers to high efficiency condensing boilers.

1.3.4 Initial Capital and Whole Life Cost Summary

The Whole Life Costing Net Present Value is summarised in the table below: -

Option	COSTS TO LEASEHOLDERS AND CAMDEN			NPV WHOLE LIFE CYCLE COSTINGS					
	Capital Cost if Capital Scheme	Leasehold Charge	Net Cost to Camden	Replace Costs	Fuel Cost	Meter Reading	Maintenance Cost	Residual Value of Plant	Total Life Cycle Cost
	£	£	£	£	£	£	£	£	£
1A	1,339,096	516,872	822,223	484,544	3,844,975	0	903,601	78,977	6,493,239
1B-CON	1,673,984	646,135	1,027,849	484,544	3,423,849	318,918	903,601	78,977	6,725,919
1C-PPU	1,942,322	749,709	1,192,612	484,544	3,360,010	318,918	903,601	78,977	6,930,418
1D-CHWS	1,680,054	648,478	1,031,577	497,332	3,346,248	0	584,683	81,946	6,345,290
2A	2,632,474	1,016,098	1,616,375	537,700	2,913,556	0	903,601	82,584	6,904,747
2B	2,692,080	1,039,106	1,652,974	537,700	3,018,374	318,918	903,601	82,584	7,388,089
3	3,197,640	1,234,245	1,963,395	658,495	4,719,128	0	776,034	91,999	9,259,298
4	3,462,471	1,336,466	2,126,005	773,649	4,508,088	0	776,034	108,087	9,412,155
5	2,441,899	942,539	1,499,360	449,725	6,686,503	0	265,765	62,831	9,781,061

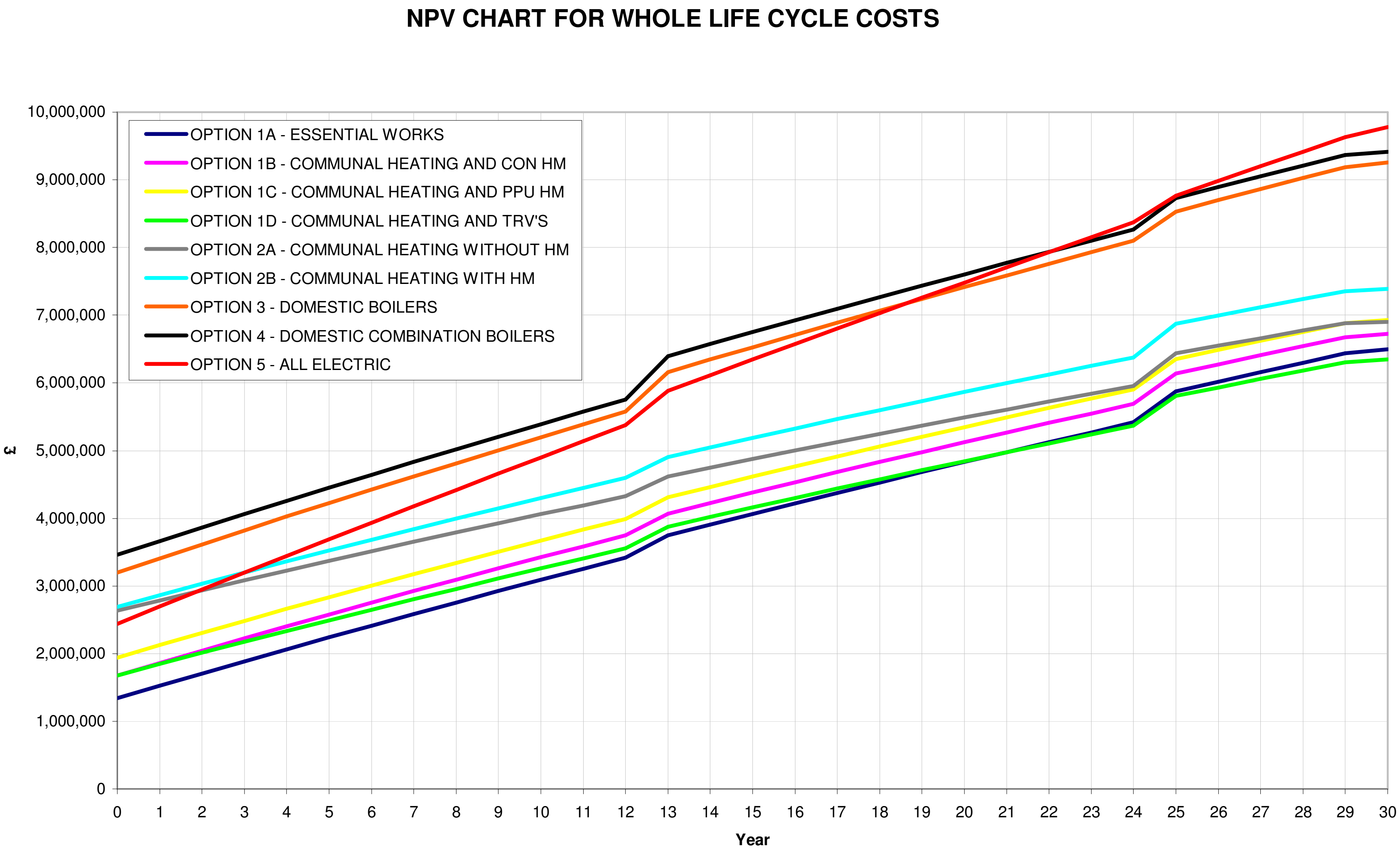
The leasehold charges are approximate only as NIFES Consulting Group are not authorised to calculate such charges.

Scheme Capital Costs include provisional sums and contingencies but exclude fees.

The chart below indicates the results graphically.

1.3.5 NPV Chart for Whole Life Cycle Costs

The following chart shows “at a glance” the results of whole life cycle costs over 30 year period.



1.3.6 Energy Consumption and Environmental Benefits

The estimated annual energy consumptions due to space heating and hot water are tabled below. Due to the various options/types of heating discussed each option would attract different annual energy consumption. It has to be noted that communal heating boilers would be more efficient than domestic boilers, as communal boilers have reduced cycling and more sophisticated controls. However, communal systems do have additional pipe heat losses due to the length of pipe work to get to each dwelling.

Option	Heating kWh	HWS KWh	Total kWh	% Savings	Saving CO_2 Tonnes
1A	5,788,034	1,110,368	6,898,403	4%	57
1B-CON	4,688,308	899,398	5,587,706	22%	255
1C-PPU	4,584,123	899,398	5,483,522	24%	275
1D-CHWS	4,948,769	1,054,850	6,003,619	17%	174
2A	4,427,846	799,465	5,227,311	27%	325
2B	4,206,454	719,519	4,925,973	32%	383
3	4,071,417	843,880	4,915,297	32%	385
4	3,890,465	759,492	4,649,957	35%	437
5	4,863,081	843,880	5,706,961	21%	-1,054

1.3.7 Environmental Benefits

It can be seen that the most environmentally friendly solution would be Option 4 Condensing Combination Boilers. However, this does not attract the lowest Whole Life Cycle Costs. The worst solution would be Option 5 – All Electric in that this would increase CO_2 emissions by 1,054 tonnes per annum.

Retention of communal heating would enable future installation of, or connection to, combined heat and power which is the best solution in Camden for delivering carbon reduction.

1.3.8 Heat Metering

Heat metering has been discussed by Camden many times and considerable benefits can be achieved. The advantage of heat metering means that residents would pay for what they use. A disadvantage is that the meters have to be read manually, by hard wiring, digital signal or radio signals, and then the bill has to be produced and managed. In other words the raising of bills and collection of payment can be labour intensive.

As an alternative to this prepayment heat meters are available whereby a smart card is credited and the resident simply inserts it into the meter. Such an option may be suitable for most but vulnerable residents may be at risk during cold periods if for instance the card “ran out” of funds. Heat metering issues will be discussed later in this report.

1.3.9 Social Cost and Benefits

Each radiator would have individually control, giving flexibility for different temperatures in different rooms. Hydraulic boards, and heat meters, if fitted, result in less energy consumption and hence more social benefits.

In terms of basic weekly running costs the following table indicates the estimated weekly fuel costs for each type of dwelling based on 16 hours per day operation.

Option	Bedsit	1-Bed	2-Bed	3-Bed	4-Bed
2007/2008 (H/HW) Charges	£7.03	£9.30	£14.10	£15.89	£17.58
1A	£8.09	£8.71	£9.33	£9.96	£12.44
1C-CON	£7.20	£7.76	£8.31	£8.87	£11.08
1B-PPU	£7.07	£7.61	£8.16	£8.70	£10.88
1D-CHWS	£7.04	£7.58	£8.12	£8.66	£10.83
2A	£6.13	£6.60	£7.07	£7.54	£9.43
2B	£6.35	£6.84	£7.33	£7.82	£9.77
3	£9.93	£10.69	£11.46	£12.22	£15.27
4	£9.48	£10.21	£10.94	£11.67	£14.59
5	£14.07	£15.15	£16.23	£17.31	£21.64

The first row reflects actual Camden heating and hot water charges for the year 2007/2008.

The remaining rows indicate the predicted fuel and meter reading costs that Camden may pay based on calculation methodology on fuel demand for the new system.

1.3.10 Energy Tariffs

The running costs include for the estimated consumption of natural gas for both Domestic British Gas and Camden Communal Tariffs. The running costs are based on costs and annual percentage increase of 3% per annum. The tariffs used to calculate the heating charges for all options are indicated in Section 3 of the report.

1.3.11 Evaluation Matrix

It is a requirement of Camden's Option Appraisal Methodology that an Economic, Social and Environment impact assessment be undertaken if one or more options are within 5% of each other.

In this case the two lowest "main" options 2A and 2B are separated by around 9% and as such the matrix calculations are excluded.

1.3.12 Gas Supply

For the purposes of this report, costs have been included to reinforce the underground mains and above ground lateral mains.

1.3.13 Conclusions

The conclusion of the report is as follows: -

a) It is understood that funds are available to implement the basic Option 1A for replacement heating mains, solving acoustic problems and installing cold water storage tanks. However, this option would only attract predicted savings of 5% per annum.

b) Option 1D-CHWS for replacement of heating mains, solving acoustic problems, installing cold water storage tanks, installing new thermostatic radiator valves within flats, retaining existing communal hot water service system **and no heat metering**, provides the lowest whole life cycle cost over a 30 year period.

In general the existing heating systems do not meet current day standards. Optional enhancements for replacement of the individual heating systems are discussed within this report and priced accordingly.

The Options discussed in the conclusion are not subject to Planning Permission or the requirement to upgrade the gas supply.

1.3.14 Recommendations

Subject to further discussions on policy regarding the logistics of installing heat meters, it is recommended that **Option 2B** be implemented as this is the most beneficial to London Borough of Camden and residents. It would also provide a reliable, controllable and energy-efficient system that would last at least 30 years with boiler plant and pipe work replacement at year 25 and also in comparison with regular planned preventative maintenance.

Option 1D-CHWS offers the lowest whole life cycle costs over a 30-year period.

For budget purposes a sum of **£1,800,000** should be allowed to implement Option 1D-CHWS.

For budget purposes a sum of **£2,850,000** should be allowed to implement Option 2B.

This figure excludes VAT but includes Contingency sums, Provisional Sums and Professional Fees.

1.3.15 Further Items for Consideration

Benefits in terms of fuel savings for electricity and gas may be applicable by the inclusion of a combined heat and power unit whereby electricity is generated at site level and the by-product "heat" is utilised to supplement the boiler plant.

Capital Cost	-	£100,000
Estimated savings	-	26,857.21 per annum
Simple payback	-	3.72 Years

It can be seen from basic calculations that the payback period is 3.72 years. Therefore, in true financial terms such a scheme would be viable.

CHP should be subject to further discussion and a separate and fully detailed feasibility report.

However, CHP technology is not considered part of this report but would be the subject of a further Options Appraisal.

1.4 OPTIONS FOR POTENTIAL PRUDENTIAL BORROWING

The Prudential Code for capital finance was introduced by the Local Government Act 2003 and came into effect on the1st April 2004 for the control of local authority debt. It gives local authorities responsibility for deciding how much they can afford to borrow. The compulsory Prudential Indicators are as follows: -

- Affordability
- Prudence
- Capital Expenditure
- External Debt
- Treasury Management

When assessing the feasibility of different energy efficiency improvement options, Prudential Indicators such as the Affordability, Prudence and Capital Expenditure can be considered against each option. However, the External Debt and Treasury Management indicators need to be considered at council board level as additional information would be required for example Authorised Limit of Debt.

Prudential Borrowing funding can be granted based on a good return on capital expenditure, i.e. to have sufficient annual revenue savings to cover the principal and the interest each year until the debt is paid.

The following PB Options were considered: -

Option 1A	-	Replace heating mains, solve acoustic problems and install cold water storage tanks.
Option 1B-CON	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (reading and billing by a nominated Contractor)**.
Option 1C-PPU	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (payment via a point of sale unit)**.
Option 1D-CHWS	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new thermostatic radiator valves within flats, retain existing communal hot water service system **and no heat metering.**
Option 2A	-	As Option 1A but with complete replacement of communal heating, new heating controls **and no heat metering**.
Option 2B	-	As Option 1a but with complete replacement of communal heating, new heating controls **and heat metering**.
Option 3	-	Replacement of communal heating with domestic condensing boilers.
Option 4	-	Replacement of communal heating with domestic condensing combination boilers.
Option 5	-	Replacement of communal heating with electric heating and hot water.

1.4.1 Capital Costs for PB Options

The PB Capital Costs are shown in the following table. This is derived by taking the capital cost for each scheme, less the budget available. We understand that the budget available is £1,339,096 (the same cost for the basic Option 1A).

Option	Cost
1A	1,339,096
1B-CON	334,888
1C-PPU	603,226
1D-CHWS	340,959
2A	1,293,378
2B	1,352,985
3	1,858,545
4	2,123,376
5	1,102,804

These costs include Provisional and Contingency Sums.

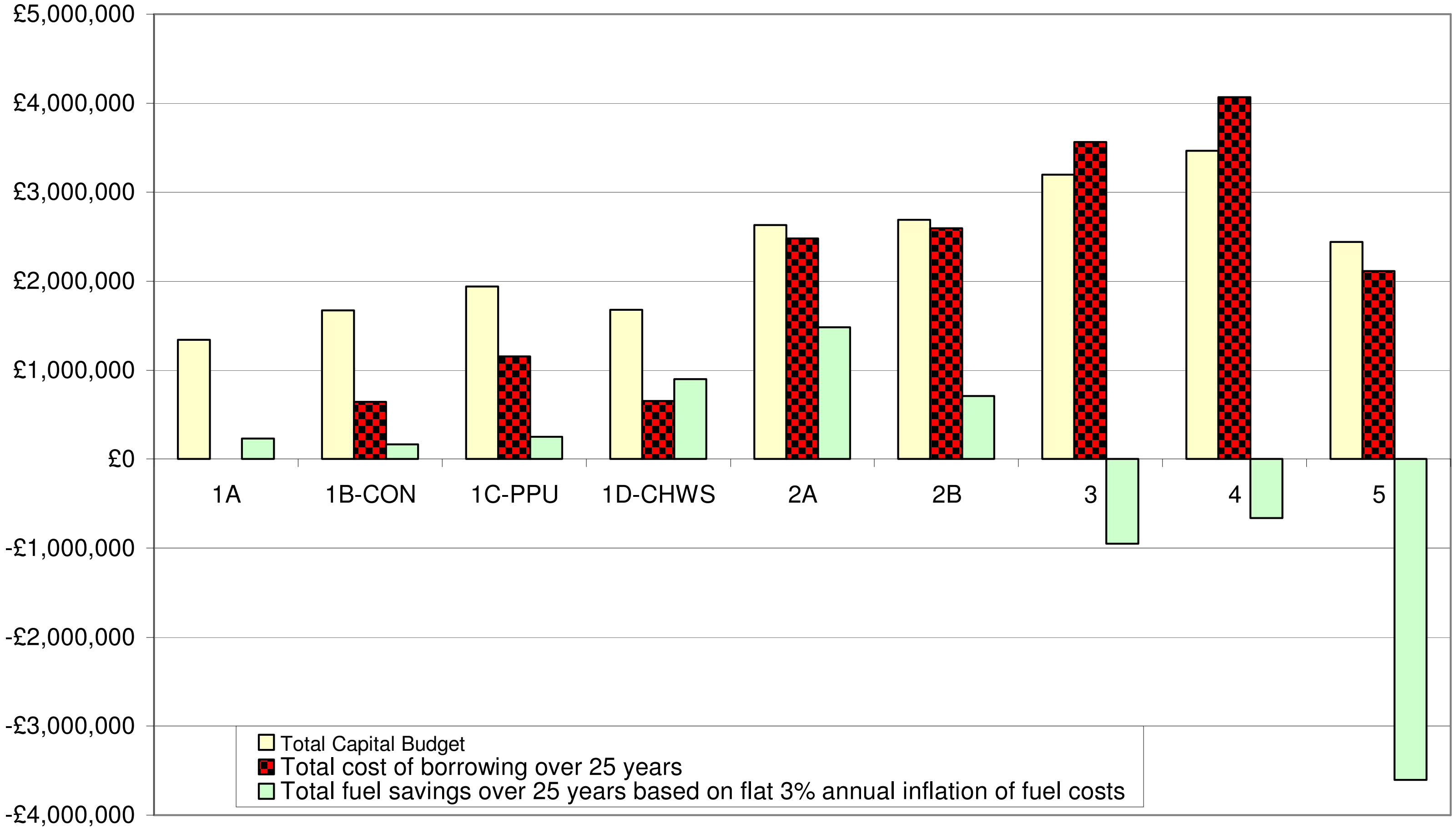
1.4.2 PB Calculations

Prudential borrowing calculations are illustrated in the table and chart below: -

Options for Potential Prudential Borrowing	Options Description	Total Capital Budget	Capital Available	Total Prudential Borrowing for Metering only	Current total fuel usage	Current fuel price	Current total cost of fuel	Estimated total fuel usage	Fuel price including Camden Management Fee (4.7%)	Fuel price including Camden Management Fee (4.7%) and VAT (5%)	Estimated total cost of fuel	Annual billing charge	Incurred cost for Heat Metering	Predicted fuel usage saving from PB measures	Predicted fuel usage saving from PB measures	Predicted fuel bill saving from PB measures	Predicted fuel bill saving from PB measures	Annual return on capital	Simple payback period	Annual Debt charges on Prudential Borrowing over 25 years	Total cost of borrowing over 25 years	Total fuel savings over 25 years based on flat 3% annual inflation of fuel costs	Net saving over 25 years based on flat 3% annual inflation of fuel costs
		£	£	£	kWh/year	£/kWh	£/year	kWh/year	£/kWh	£/kWh	£/year	£/year	£/year	kWh/year	%	£	%	%	years	£/year	£	£	£
1A	Replace heating mains, solve acoustic problems and install cold water storage tanks	£1,339,096	£1,339,096	£0	7,203,036	£0.02061	£148,455	6,898,403	£0.020610	£0.02061	£142,176	£0	**£142,176**	£304,633	4%	£6,278	4%	-	0.0	£0	£0	£228,909	**£228,909**
1B-CON	As Option 1A with installing new heating controls and **heat metering (Contracting)**	£1,673,984	£1,339,096	£334,888	7,203,036	£0.02061	£148,455	5,587,706	£0.02158	£0.02266	£126,604	£17,340	**£143,944**	£1,615,330	22%	£4,511	3%	1.3%	74.2	£25,677	£641,919	£164,451	**-£477,468**
1C-PPU	As Option 1A with installing new heating controls and **heat metering (Pre-Payment Unit)**	£1,942,322	£1,339,096	£603,226	7,203,036	£0.02061	£148,455	5,483,522	£0.021579	£0.02266	£124,243	£17,340	**£141,583**	£1,719,514	24%	£6,871	5%	1.1%	87.8	£46,251	£1,156,273	£250,516	**-£905,758**
1D-CHWS	As Option 1C retaing communal hot water system with new heating controls and **without heat metering**	£1,680,054	£1,339,096	£340,959	7,203,036	£0.02061	£148,455	6,003,619	£0.020610	£0.02061	£123,735	£0	**£123,735**	£1,199,417	17%	£24,720	17%	7.3%	13.8	£26,142	£653,555	£1,484,610	**£831,055**
2A	Complete replacement of communal heating, new heating controls but **NO** heat metering	£2,632,474	£1,339,096	£1,293,378	7,203,036	£0.02061	£148,455	5,227,311	£0.020610	£0.02061	£107,735	£0	**£107,735**	£1,975,725	27%	£40,720	27%	3.1%	31.8	£99,167	£2,479,167	£1,484,610	**-£994,558**
2B	As Option 2A but **WITH** heat metering	£2,692,080	£1,339,096	£1,352,985	7,203,036	£0.02061	£148,455	4,925,973	£0.021579	£0.02266	£111,611	£17,340	**£128,951**	£2,277,063	32%	£19,504	13%	1.4%	69.4	£103,737	£2,593,422	£711,096	**-£1,882,326**
3	Replacement of communal heating with domestic condensing boilers	£3,197,640	£1,339,096	£1,858,545	7,203,036	£0.02061	£148,455	4,915,297	Different price tiers (See Section on Data)		£174,500	£0	**£174,500**	£2,287,739	32%	-£26,045	-18%	-1.4%	-71.4	£142,499	£3,562,487	-£949,587	**-£4,512,074**
4	Replacement of communal heating with domestic condensing combination boilers	£3,462,471	£1,339,096	£2,123,376	7,203,036	£0.02061	£148,455	4,649,957	Different price tiers (See Section on Data)		£166,696	£0	**£166,696**	£2,553,079	35%	-£18,241	-12%	-0.9%	-116.4	£162,805	£4,070,120	-£665,072	**-£4,735,191**
5	Replacement of communal heating with electric heating and hot water	£2,441,899	£1,339,096	£1,102,804	7,203,036	£0.02061	£148,455	5,706,961	Different price tiers (See Section on Data)		£247,248	£0	**£247,248**	£1,496,075	21%	-£98,793	-67%	-9.0%	-11.2	£84,555	£2,113,871	-£3,601,920	**-£5,715,791**

In order for Prudential Borrowing (PB) to be viable the benefits or savings over the whole term need to be greater than the cost of borrowing. For Option 1D-CHWS (assuming that the budget of £1,339,096 is available) PB is a viable option because the predicted savings are higher than the total cost of borrowing.

1.4.3 PB CHART



The PB Chart indicates at a glance the benefits, or not as the case may be, of Prudential Borrowing.

It can be seen for Option 1D-CHWS that the predicted saving are greater than the cost of borrowing and is therefore a viable option.

For this site, PB or the installation of heat meters are not viable.

2 CLIENT BRIEF

2.1 GENERAL

London Borough of Camden commissioned a report to undertake a survey of the existing services at Curnock Street Estate.

The main purpose for undertaking the condition report was due to complaints received from residents with regard to ineffectiveness and interruptions to service of the heating system. However, due to the age of the services within the housing blocks it was proposed that other services be surveyed including hot and cold water services.

As such the intention was to produce a report on condition to enable costs to be presented and decisions made on options to implement for “Raising the Standard”.

The brief advised by Capital Projects was to inspect the following services: -

- Central plant room
- A selection of dwellings
- Heating distribution mains
- Communal water tanks
- Recommendations and various methodologies of dealing with any issues discovered during the surveys.
- Liaison with Planned Maintenance Group to obtain more detailed and historical information of the heating and water supply services

In addition to the above topics we were requested to include prudential borrowing calculations.

3 DATA

3.1 GENERAL

The following data has been used to form the calculations of the report.

3.2 ENERGY TARIFFS

The running costs include for the estimated consumption of natural gas for both Domestic British Gas and Camden Communal Tariffs. The running costs are based on costs and annual percentage increase of 3% per annum. The Tariffs used for the appraisal are as follows: -

Tariff	Night Tariff Pence per kWh	Tier 1 pence per kWh	Tier 2 pence per kWh	Flat Rate pence per kWh
British Gas	-	5.207*	2.941**	-
Camden Gas	-	-	-	2.016
Electricity	2.726+++	27.131+	13.080++	

3.2.1 Gas

*Tier 1 tariff cost based on first 1,143kWh consumption per quarter. Equivalent cost is **£238:06** (which is equivalent to £4:60 per week) for the first 4,572kWh consumed annually.

**Tier 2 tariff costs based on consumption after the first 1,143kWh consumption per quarter used up to a maximum of 73,288kWh consumed per quarter.

The fuel cost under option 1B and 2B includes VAT at 5%, which Camden would have to charge to residents with a metered supply.

3.2.2 Electricity

+Tier 1 tariff cost based on first 900kWh consumption per quarter. Equivalent cost is **£244:18** per annum (which is equivalent to £4:70 per week) for the first 900kWh consumed annually.

++Tier 2 tariff costs based on consumption after the first 900kWh consumption per quarter used.

+++The night tariff would apply to the majority of energy consumption due to energising the electric storage heaters overnight.

However, a 5% proportion of daytime electricity has been included for daytime boosting.

3.2.3 Heat Metering

For options that include installing of heat meters within dwellings the following was considered: -

Option 1B CON - Contractor (reading and billing by a nominated Contractor).

Option 1C PPU - PPU (pre-payment unit where residents credit the unit)

Option 2B - As Option 1B but with complete replacement of communal heating, new heating controls and with heat metering

Camden would charge tenants 4.7% of the gas flat rate (currently 2.061 p/kWh) as management fees; this would increase gas price to 2.158 p/kWh.

In addition 5% vat would be applied to the above price which would further increase gas price to 2.266 p/kWh.

To manage the reading and billing process the following options have been considered: -

- Reading and billing by a contractor whereby the annual billing charge per dwelling (quarterly billing) including the set-up of direct debit mandates and collection of money but with no debt risk. The initial price quoted by a heat metering Company is £60 per dwelling.
- Resident payment via a point of sale unit whereby residents would utilise a smart card to credit the card and in turn credit the heat meter. The chosen Contractor would undertake regular billing check per dwelling so as to monitor performance. Collection of money would be via the metering company but with no debt risk. The initial price quoted by a heat metering Company is £60 per dwelling.

3.3 LIFE CYCLE COSTS

The life cycle costs include all installation, maintenance, replacement and fuel costs for a 30 year period.

The life cycle costs are based on a discount rate of 3.5% per annum.

The repair costs are embedded in the comprehensive Term Maintenance Contract so periodic repairs are included.

It has been assumed that boilers for communal heating option would be replaced at year 13 due to age/remaining life and for individual domestic heating options at year 13 and 25.

For domestic and communal systems the appraisal includes radiator replacement at years 13 and 25.

3.4 MAINTENANCE COSTS

For communal and domestic systems the maintenance cost per dwelling has been based on the following: -

Option	Maintenance Cost £ per Dwelling per Annum
Communal	170
Domestic Condensing Boilers	146
Domestic Combination Boilers	146
All Electric Systems	50

4 SITE DESCRIPTION

The site comprises 12 individual blocks of varying types of dwellings. The respective blocks are detailed below: -

4.1 DWELLINGS

4.1.1 Barnborough

Barnborough comprises two levels of 2-bedroom maisonettes.

Each level consists of 11 dwellings.

From records provided eight dwellings are leasehold, these being 7, 8, 13, 15, 17, 18, 20 and 22.

4.1.2 Billingley

Billingley comprises two levels of 2-bedroom maisonettes.

Each level consists of 9 dwellings.

From records provided six dwellings are leasehold, these being 1, 3, 7, 9, 13 and 17.

4.1.3 Darfield

Darfield comprises two levels of 2-bedroom maisonettes.

Each level consists of 9 dwellings.

From records provided seven dwellings are leasehold, these being 2, 3, 5, 6, 14, 15 and 18.

4.1.4 Goldthorpe

Goldthorpe comprises two levels of 3-bedroom maisonettes.

Each level consists of 17 dwellings.

From records provided 13 dwellings are leasehold, these being 3, 4, 6, 8, 16, 17, 23, 25, 26, 29, 30, 33 and 34.

4.1.5 Hickleton

Hickleton comprises two levels of 2-bedroom maisonettes.

Each level consists of 10 dwellings.

From records provided nine dwellings are leasehold, these being 2, 3, 10, 11, 13, 14, 15, 17 and 20.

4.1.6 Mexborough

Mexborough comprises three levels of bedsits and three levels of 1-bedroom flats. The bedsits and 1-bedroom flats are situated on alternate levels.

Each level consists of 11 dwellings.

From records provided three dwellings are leasehold, these being 7, 27 and 55.

4.1.7 Ravenscar

Ravenscar comprises two levels of 2-bedroom maisonettes.

Each level consists of nine dwellings.

From records provided six dwellings are leasehold, these being 5, 8, 10, 11, 13 and 18.

4.1.8 The Marr

The Marr comprises one level of bedsits and one level of 3-bedroom maisonettes.

Each level consists of seven dwellings.

From records provided nine dwellings are leasehold, these being 1, 3, 4, 6, 7, 11, 12, 13 and 14.

4.1.9 Thurnscoe

Thurnscoe comprises two levels of 3-bedroom maisonettes.

Each level consists of nine dwellings.

From records provided seven dwellings are leasehold, these being 1, 3, 6, 7, 8, 9 and 13.

4.1.10 Trimdon

Trimdon comprises two levels of 3-bedroom maisonettes.

Each level consists of 16 dwellings.

From records provided 20 dwellings are leasehold, these being 1, 2, 4, 5, 6, 10, 11, 12, 13, 17, 18, 19, 20, 21, 22, 24, 25, 27, 29 and 31.

4.1.11 Warmsworth

Warmsworth comprises two levels of 3-bedroom maisonettes.

Each level consists of nine dwellings.

From records provided nine dwellings are leasehold, these being 1, 3, 4, 5, 6, 8, 13, 17 and 18.

4.1.12 Conisborough

Conisborough comprises nine three storey 4-bedroom town houses.

From records provided there are no leasehold dwellings.

4.2 CONSTRUCTION DETAILS

The buildings have concrete floor slabs, with 225mm brick, cavity and plaster finished block work inner walls.

Windows were replaced approximately 3 years ago as part of an XRD with double glazed units.

5 SERVICES DESCRIPTION

5.1 GENERAL

The boiler room is located below the Goldthorpe block.

The boiler room houses the boilers, primary and secondary heating pumps, plate heat exchangers, hot water calorifiers, pressurisation unit, water treatment unit, domestic hot water primary and secondary pumps and control panel.

5.2 COMMUNAL SERVICES

5.2.1 Boiler Plant, Flues and Ventilation

The boiler room houses three Allen Ygnis gas fired boilers each rated at 1171 kW output. The boilers do not have a name plate but appear to be around 12 years old. The boilers generate water at 90°C flow and 79°C return. The boiler water passes through the primary side of the plate heat exchangers. Heat transfer takes place to produce secondary temperatures of 82°C flow and 71°C return.

The boilers are classed as low temperature hot water type providing heated water to serve the hot water calorifier primary coil and the heating systems within each flat.

Each boiler has a short flue branch connecting to a horizontal steel flue header. The flue header turns vertically upwards and rises to exhaust and discharge the products of combustion above the roof level. The chimney was replaced approximately three years ago.

The boiler room is ventilated naturally via louvres direct to outside adjacent the pedestrian walkway and via two fan and ductwork systems (mechanical ventilation) to the rear and front of the boiler room adjacent the louvres. The mechanical ventilation also provides air for combustion.

5.2.2 Primary Heating Circulating Pumps

Two duty and standby primary heating circulating pumps circulate heating water from the boilers and through the primary side of the plate heat exchangers. Each pump has a duty of 300 m^3/h and 13 m head.

5.2.3 Secondary Heating Circulating Pumps

Six duty and standby secondary heating circulating pumps circulate heating water from the plate heat exchangers to the respective dwellings via three pumped circuits. Each pump has a duty of 36-84 m^3/h and 30.6-14.8 m head.

Each circuit serves a separate part of the site.

The secondary heating circulating pumps were replaced approximately 5 years ago under the guidance of Planned Maintenance Group. The existing pumps should be suitable for the proposed new system.

5.2.4 Domestic Hot Water Primary Pumps

Two duty and standby domestic hot water primary pumps provide circulation to the hot water calorifiers primary heating coils. Each pump has a duty of 140 m^3/h and 8.5 m head.

The domestic hot water primary pumps were replaced approximately 5 years ago as part of a plant room refurbishment project under the guidance of Capital Projects. These pumps appear acceptable for the proposed new system but would be subject to performance tests when in Contract.

5.2.5 Domestic Hot Water Secondary Pumps

Domestic hot water secondary pumps provide circulation to the hot water service to ensure outlet temperatures are maintained within the dwellings.

There are three hot water distribution circuits installed within the boiler room. Single pumps (390 - 680W) are installed in each circuit to prevent stagnation of water within any standby equipment. Spare replacements pumps were provided in the event of failures occurring.

The domestic hot water secondary circulation pumps were replaced under the boiler room refurbishment project approximately 5 years ago.

5.2.6 Heating Pipe Work

The thermally insulated heating pipe work within the boiler room, and to and from the boilers, is arranged on a reverse return basis to provide equal flow through each boiler.

During 2001 the heating pipe work was partially re-piped and renewed to suit the new equipment layout installed at that time.

A dosing pot is installed on the system to enable the system water to be chemically treated.

The distribution pipe work is installed throughout the underground parking areas and within service ducts. This pipe work is some 40 years old and is beyond its useful life. This pipe work will be replaced as part of this project.

5.2.7 Natural Gas Pipe Work

The natural gas supply enters the boiler room at high level. It passes through a gas meter then drops to low level to serve the boilers.

The Camden side gas pipe work is in good condition.

The whole site has underground PE Gas mains which are owned and managed by Transco. Only Transco can work on these mains and any work/upgrade cost is reflected in the capital costs for domestic boilers.

5.2.8 Control Panel

A new control panel with Trend Digital Controls was installed in 2001 complete with the facility to monitor remotely within Planned Maintenance Group.

The panel comprises isolators, starters, switches and controls to initiate and maintain the operation of all plant to the parameters required. The control panel would remain unaltered apart from minor upgrade and software changes.

5.2.9 Cold Water Storage Tanks

Cold water storage tanks are located within tank rooms of each block.

The tanks serve the dwellings within the respective blocks.

A large tank located in the tank room of Mexborough serves the hot water calorifiers installed in the boiler room. This tank provides the cold water make-up for the hot water service to all dwellings on the site.

The majority of the tanks are of galvanised steel manufacture and require replacement. The tanks do not comply with current Water Regulations. It is proposed to incorporate the tank replacement works within this project.

5.2.10 Boiler Room Acoustics

Complaints have been received from residents relating to excessive noise being emitted from the boiler room. A report on the level of noise emitted is given later in the Appendices.

5.3 SERVICES WITHIN FLATS

5.3.1 Heating

Heating to each flat is via radiators and copper pipe work served by a network of underground and basement level distribution pipe work.

Control of the individual systems is minimal via on/off valves and occasional thermostatic radiator valves. There are no timed controls within dwelling.

5.3.2 Domestic Cold Water

Domestic cold water down service and mains water services are provided to each flat by distribution risers housed within service shafts. Access to the shafts at each level is from access panels.

Cold water storage tanks are located within roof top tank rooms of each respective block and are generally manufactured from galvanised mild steel and do not have lids or insulation. The tanks currently do not meet current Water Regulation requirements.

5.3.3 Domestic Hot Water

Domestic hot water to each flat is provided by communal hot water storage calorifiers located within the boiler room and is distributed via a network of below ground and basement level pipe work complete with domestic hot water service circulation pumps.

5.3.4 Ventilation

Ventilation within dwellings is provided on an individual basis.

5.4 ASBESTOS

During the survey it was not obvious that asbestos materials were present. However, the asbestos register has been viewed and it would appear that a few isolated areas contain asbestos. A further review will be undertaken prior to commencement of any works.

5.5 ACOUSTIC PROBLEMS

Following complaints from some residents noise readings were undertaken to identify the contributing source of noise.

The noise readings taken outside the boiler room at the paved area were between 48 and 51dB(A), one metre from the boiler room louvers. This reading is in excess of that required by Environmental Health (40dBa @ 1 metre from grilles) and therefore does not comply.

6 OPTIONS AND SCOPE OF WORKS

The options that have been considered for whole life cycle costs analysis and the scope of work required for each option are discussed below:

6.1 OPTION 1A

Option 1 includes the replacement of heating mains, solve acoustic problems and install cold water storage tanks

Due to the age of the heating mains and communal cold water tanks, as well as the complaints received from the residents with regard to the noise from the boiler house and heating system, Camden has secured funds to solve these problems. It is therefore required to confirm whether the available budget would be sufficient for this purpose.

The below ground and basement level heating distribution mains would be replaced and new pipe work connected to existing risers serving dwellings. New isolation valves and flushing points would be incorporated as part of the installation.

The individual dwelling heating systems would be retained. The hot water provision would remain as a communal service. The roof top water storage tanks would be replaced, re-sized as necessary and installed to water regulation standards.

The acoustic works would solve the noise levels currently being experienced by residents in dwellings and externally.

Minor builders work and making good items would be required following the installation of new heating distribution mains.

6.2 OPTION 1B-CON

Replace heating mains, solve acoustic problems, install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (reading and billing by a nominated Contractor)**.

This option is the same as Option 1A but with the installation of a new hydraulic board and heat meter in each dwelling.

It is proposed that all dwellings be provided with individual heating controls with provision of connections for future hot water controls when and if dwellings are converted to individual hot and cold water systems. These would be mounted on a "hydraulic board" located in each dwelling at an agreed location, preferably the airing cupboard or as agreed with each resident. The hydraulic board would contain all controls and valves necessary for the user operation, maintenance of the system and emergency shut down.

The heating control valve mounted on the hydraulic board would be wired to a domestic programmer to enable on and off times to be set by the resident. This would compliment the thermostatic radiator valves fitted to each radiator to enable temperatures to be set by the resident.

This option would also include installing a heat meter in each dwelling, installed by the Contractor and supplied by a nominated contractor. The heat meter measures heat usage in each property and the usage data will be transmitted by radio at a pre-determined interval. The contactor will use a receiver unit and a handheld computer to tour the Estate and collect the meter readings wirelessly; download them to a billing computer and produce bills for a pre-determined period (monthly or quarterly). Once payment is received from the tenant, the bill is marked as complete and paid in the system. Camden would be provided with such back-up data.

6.3 OPTION 1C-PPU

Replace heating mains, solve acoustic problems, install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (payment via a point of sale unit)**.

This option is the same as Option 1B-CON. It also would include installing a heat meter in each dwelling.

However, the heat meter in this case will measure heat usage in the property and send it to a card reader situated within the property. The tenant would purchase credit by taking a Smart Card to the local Retailer or Estate Office where the resident would credit onto the smart card using the point of sale terminal.

The tenant would then transfer the credit into the card reader within his/her property by inserting the smart card into it.

The card reader is pre-programmed with a low credit audible alarm and also with an amount of emergency credit which is activated by inserting the smart card once normal credit has expired.

6.4 OPTION 1D-CHWS

Replace heating mains, solve acoustic problems, install cold water storage tanks (but without complete communal replacement), install thermostatic radiator valves to existing radiators and retain existing communal hot water service system Dwelling control boards are not included in the option.

6.5 OPTION 2A

As Option 1A but with complete replacement of communal heating, new heating controls and **no heat metering.**

Option 2A would consist of the removal of existing heating system and renewing it in its entirety, together with the addition of cylinders of hot and cold water to each flat. The majority of boiler house would remain as the boilers have at least a further 10 to 12 year life remaining. The existing heating pipe work in the boiler room has been replaced in part over the years so a further 10 year life is envisaged.

6.5.1 Boilers and Associated Equipment

The existing boilers still have a further 10 to 12 years life although they are not the most efficient type of boiler compared to current day standards. The boilers have enough capacity to bring the heating up to current standards especially as double glazed windows were installed as part of an XRD. This means that the existing boilers need not be replaced at this tome.

A review would be undertaken on the existing heating circulation pumps as to whether they can be upgraded. However, upgrading pump motors and impellers can be just as expensive as replacing pumps, in which case it is a better option to replace them. Also there would be no warranty offered by a Contractor if they were simply upgraded.

6.5.2 Flue System

The existing flue stack was replaced approximate 3 years ago and other than commissioning no work is envisaged.

Electrically operated boiler fans/burners would be adequately silenced to the satisfaction of the Environmental Officer. Similarly noise emissions to outside would be addressed as this has been an issue raised by residents, again compliant with the Environmental Officer.

6.5.3 Natural Gas Services

Based on a review of the gas main infrastructure a new natural gas supply would not be required as the boiler room has a dedicated supply.

Ventilation to the gas meter room would be brought up to current standards.

No work is required to the gas supply for dwellings as these would still serve gas cookers.

6.5.4 Boiler Control System and Wiring

A digital control system exists at present and no further work is envisaged other than software upgrade and commissioning.

6.5.5 Internal Heating Distribution Pipe Work

As the existing heating pipe work runs concealed within the structure of the building and can make it very difficult to maintain or replace.

The option exists for the new pipe work to be run in the same position as the existing but in order to gain access to the risers the majority of boxing and decorative tiles, etc., would have to be removed and would cause disruption.

Having reviewed the dwelling and block layouts it would appear that heating pipe work would have to run internally and therefore careful installation, liaison and timing would be required.

6.5.6 External Heating Distribution Pipe Work

The existing heating distribution pipe work would be replaced.

6.5.7 Heating, Hot and Cold Water Services within Flats

For this option it is proposed that the existing communal hot water system be removed and new domestic hot and cold water services replaced.

It is proposed that all dwellings be provided with individual heating controls, which would be mounted on a “hydraulic board” located in each dwelling.

From the hydraulic board future connections would be made to serve a new hot water cylinder.

Copper heating pipe work would run at high and low level and connect to pre-finished, powder coated, steel radiators at positions agreed with each individual resident, although under windows is the best location to counteract down-draughts.

The heating pipe work can be boxed in or painted to suit resident’s choice. For costing purposes it has been assumed that all pipe work within dwellings will be boxed in with plastic proprietary casing.

The heating control valve mounted on the hydraulic board would be wired to a domestic programmer to enable on and off times to be set by the resident.

The controls would enable residents to control the following: -

- The times of day that dwelling is heated.
- The temperature to which dwellings are heated via thermostatic radiator valves.
- An internal sensor would enable frost protection when residents are away.

6.5.8 Builders Work and General Items

Builders work would be required as a result of installing new pipe work and radiators within flats and in communal areas.

Builders work within the boiler room would be required to accommodate the repositioned cold water booster set, pump plinths and boiler bases.

In addition, a provisional sum for decorations is allowed. Also, despite accurate records, a provisional sum is included for asbestos removal.

6.6 OPTION 2B

As Option 1A but with complete replacement of communal heating, domestic water services and new heating controls and heat metering

This option is the same as Option 2A but **with installing new heat meters** in each dwelling.

6.7 OPTION 3 - DOMESTIC CONDENSING BOILERS

Option 3 would include the removal of the existing heating systems and replacement with individual domestic boilers together with installation of hot water cylinders and cold water storage tanks serving cylinders and individual controls.

All existing boiler plant and heating mains would be removed and structures made good.

New gas fired condensing wall mounted domestic boilers would be installed to each dwelling with flues positioned to comply with Camden's Planning Department requirements. Initial discussions suggest that planning permission would be granted.

A domestic heating controls package would provide individual time and temperature control for each dwelling.

A new gas service would be required for the whole site to cater for the increased demand relative to the installation of the domestic boilers.

The existing boiler room equipment would be decommissioned and removed.

The addition of domestic boilers would give an additional burden to the Council due to the need to undertake gas safety checks on an annual basis and increasing the flow of gas.

6.8 OPTION 4 - DOMESTIC CONDENSING COMBINATION BOILERS

Option 4 would be the same as Option 3 except that hot water would be generated via the combination boiler.

All gas pipe work would need to be removed and replaced to comply with current regulations and would be larger than those for the domestic condensing boilers described above due to the provision of domestic hot water directly from the boiler.

The existing boiler room equipment would be decommissioned and removed.

Due to the water requirements of the condensing combination boilers the water pipe work would need to be renewed and additional water boosters installed to convey adequate flow and pressure.

The addition of a domestic condensing combination boiler would give an additional burden as described above in terms of annual gas safety tests.

6.9 OPTION 5 - ALL ELECTRIC HEATING AND HOT WATER

Option 5 would provide hot water in the same manner as described for communal and domestic heating.

The heating would be provided by electric storage heaters located in similar positions to the existing radiators. The storage heaters would "charge-up" overnight on off-peak electricity then discharge or dissipate throughout the day.

The controllability of storage heaters is such that once the heat has been dissipated the resident would then have to wait until the next morning for additional heat. Modern storage heaters have an option for a supplementary heater to cover events described above but this would mean running on on-peak price electricity.

Due to increased electrical demand the whole electrical infrastructure would need to be replaced.

Electric heating has an advantage in that the installation cost and maintenance costs are low, but given that electricity is approximately 3 to 7 time more expensive than gas which Camden purchase then the 30 year life cycle costs are not viable.

6.10 SOLAR PANELS AND COMBINED HEAT AND POWER SYSTEMS

Solar panels and combined heat and power (CHP) systems are discussed later in the report.

A full feasibility for capital cost, environmental benefits and risks associated with CHP in particular has not been undertaken as part of this report but the background to such technology and technical information is provided. However, some “broad brush” calculations have been undertaken to indicate possible benefits.

7 DISCUSSION ON HEATING AND WATER SERVICES

7.1 GENERAL

The fact that the majority of the systems are some 40 years old means that they have exceeded the life expectancy indicated by Trade Associations.

7.2 BOILERS

The existing Allen Ygnis boilers appear to have been installed in 1986 although no badge plate exists.

Boilers of this type generally have a life expectancy 30 years. These boilers have approximately a period of 10 to 12 years remaining provided that a suitable maintenance regime is in place and completed.

If the boilers are replaced, condensing boilers would be required to comply with current Building Regulation requirements. The installation would also benefit from improved energy efficiencies.

7.3 HEATING TO FLATS

The existing heating installations within the flats comprise steel panel radiators and copper pipe work. The installations are 40 years old and approaching the end of their useful life.

The level of control of the installations is minimal and hence would not comply with current Building Regulation requirements.

The repair and replacement costs of the existing systems will continue to increase as the systems become older. In addition parts will become difficult to obtain or even obsolete.

If replaced the systems would have a 30 year life expectancy, be more efficient with better control and would comply with Building Regulation requirements.

An enhancement to the replacement of the heating system would be the installation of individual hot water cylinders and cold water tanks within each dwelling. This would result in the removal of the communal hot water Calorifiers and distribution pipe work and reducing the risk of Legionnella proliferation within the hot water system.

8 ESTIMATED CAPITAL COSTS

The estimated capital costs for each option are summarised below.

All costs include contingency sums, provisional sums, but exclude professional fees and VAT.

As a reminder the options considered are as follows: -

Option 1A	-	Replace heating mains, solve acoustic problems and install cold water storage tanks.
Option 1B-CON	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (reading and billing by a nominated Contractor)**.
Option 1C-PPU	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new heating controls **and heat metering (payment via a point of sale unit)**.
Option 1D-CHWS	-	Replace heating mains, solve acoustic problems and install cold water storage tanks (but without complete communal replacement), install new thermostatic radiator valves within flats, retain existing communal hot water service system **and no heat metering.**
Option 2A	-	As Option 1A but with complete replacement of communal heating, new heating controls **and no heat metering**.
Option 2B	-	As Option 1a but with complete replacement of communal heating, new heating controls **and heat metering**.
Option 3	-	Replacement of communal heating with domestic condensing boilers.
Option 4	-	Replacement of communal heating with domestic condensing combination boilers.

8.1 OPTION 1A: IS BUDGET SUFFICIENT?

The estimated costs are listed in the following table: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£129,375
3	Cold water tanks	£329,900
4	Distribution pipe work	£564,130
5	Dwellings	£0
6	General items	£12,000
7	**Sub-Total**	**£1,125,405**
8	Contingency sum @ 10% of sub-total	£112,541
9	**Sub-Total**	**£1,237,946**
10	Provisional sums	£101,150
11	**GRAND TOTAL**	**£1,339,096**

Although the budget provision was believed to be £750,000, it is understood that Camden has secured funds to implement this option.

8.2 OPTION 1B-CON

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£129,375
3	Cold water tanks	£329,900
4	Distribution pipe work	£564,130
5	Dwellings	£304,444
6	General items	£12,000
7	**Sub-Total**	**£1,429,849**
8	Contingency sum @ 10% of sub-total	£142,985
9	**Sub-Total**	**£1,572,834**
10	Provisional sums	£101,150
11	**GRAND TOTAL**	**£1,673,984**

8.3 OPTION 1C-PPU

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£129,375
3	Cold water tanks	£329,900
4	Distribution pipe work	£564,130
5	Dwellings	£548,388
6	General items	£12,000
7	**Sub-Total**	**£1,673,793**
8	Contingency sum @ 10% of sub-total	£167,379
9	**Sub-Total**	**£1,841,172**
10	Provisional sums	£101,150
11	**GRAND TOTAL**	**£1,942,322**

8.4 OPTION 1D-CHWS

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£129,375
3	Cold water tanks	£329,900
4	Distribution pipe work	£564,130
5	Dwellings	£309,963
6	General items	£12,000
7	**Sub-Total**	**£1,435,368**
8	Contingency sum @ 10% of sub-total	£143,537
9	**Sub-Total**	**£1,578,904**
10	Provisional sums	£101,150
11	**GRAND TOTAL**	**£1,680,054**

8.5 OPTION 2A

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£128,125
3	Cold water tanks	£329,900
4	Distribution pipe work	£614,750
5	Dwellings	£1,117,338
6	General items	£12,000
7	**Sub-Total**	**£2,292,113**
8	Contingency sum @ 10% of sub-total	£229,211
9	**Sub-Total**	**£2,521,324**
10	Provisional sums	£111,150
11	**GRAND TOTAL**	**£2,632,474**

8.6 OPTION 2B

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£128,125
3	Cold water tanks	£329,900
4	Distribution pipe work	£614,750
5	Dwellings	£1,171,525
6	General items	£12,000
7	**Sub-Total**	**£2,346,300**
8	Contingency sum @ 10% of sub-total	£234,630
9	**Sub-Total**	**£2,580,930**
10	Provisional sums	£111,150
11	**GRAND TOTAL**	**£2,692,080**

8.7 OPTION 3

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£22,688
3	Distribution pipe work	£329,900
4	Cold water tanks	£797,250
5	Dwellings	£1,558,063
6	General items	£8,000
7	**Sub-Total**	**£2,805,900**
8	Contingency sum @ 10% of sub-total	£280,590
9	**Sub-Total**	**£3,086,490**
10	Provisional sums	£111,150
11	**GRAND TOTAL**	**£3,197,640**

8.8 OPTION 4

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£22,438
3	Distribution pipe work	£913,938
4	Cold water tanks	£329,900
5	Dwellings	£1,683,381
6	General items	£7,000
7	**Sub-Total**	**£3,046,656**
8	Contingency sum @ 10% of sub-total	£304,666
9	**Sub-Total**	**£3,351,321**
10	Provisional sums	£111,150
11	**GRAND TOTAL**	**£3,462,471**

8.9 OPTION 5

The estimated capital costs are tabled as follows: -

ITEM	DESCRIPTION	TOTAL
1	Preliminaries	£90,000
2	Boiler house	£22,188
3	Distribution pipe work	£587,368
4	Cold water tanks	£329,900
5	Dwellings	£1,090,499
6	General items	£8,000
7	**Sub-Total**	**£2,127,954**
8	Contingency sum @ 10% of sub-total	£212,795
9	**Sub-Total**	**£2,340,749**
10	Provisional sums	£101,150
11	**GRAND TOTAL**	**£2,441,899**

8.10 SUMMARY OF COSTS

The estimated capital costs for all options are summarised below:

Option	Cost
1A	1,339,096
1B-CON	1,673,984
1C-PPU	1,942,322
1D-CHWS	1,680,054
2A	2,632,474
2B	2,692,080
3	3,197,640
4	3,462,471
5	2,441,899

8.11 SOLAR PANELS AND COMBINED HEAT AND POWER

8.11.1 Solar Panels

General details for solar panels are given below. However, in summary it is not considered viable to install solar heating due to the capital cost for piping from the roof to each dwelling and with only the low grade heat available would not achieve sufficient energy savings to pay back the capital cost in a reasonable time period.

8.11.2 Combined Heat and Power (CHP)

General details for CHP are given below. However, CHP should be subject to further discussion and a separate feasibility report.

9 ENVIRONMENTAL ITEMS

9.1 GENERAL

Environmental issues are discussed below in terms of estimated energy savings that would result from reduced consumption of natural gas. As a general observation it is often noticed that windows are opened to regulate heat when dwellings are too hot during periods of mild weather. Therefore energy is being wasted due to a lack of control.

The major benefit achieved from the work described will be consistent and reliable heating to all rooms due to a combination of radiant and convective heat from radiators positioned under external windows. Also, each dwelling will have its own individual time control and each room will have temperature control via thermostatic radiator valves.

9.2 HEATING

As the existing heating system was designed to meet the heating/temperature standards of the day (18^{o}C) against an outside temperature of 0^{o}C, the new heating requirements will be higher due to higher room temperatures required at 21^{o}C internal against -3^{o}C external.

Domestic hot water is generated by the boilers and stored in two calorifiers existing in the boiler house. It is then distributed to each flat by a network of pipe work which runs in parallel to the space heating pipe system. Those pipes are more than 40 years old and they suffer from corrosion and lack of insulation, which makes them an obvious source of system thermal inefficiency.

9.3 ENERGY CONSUMPTION

The estimated annual energy consumptions are tabled below. Due to the various options/types of heating discussed each option would attract different annual energy consumption.

Option	Heating kWh	HWS KWh	Total kWh	% Savings
1A	5,788,034	1,110,368	6,898,403	4%
1B-CON	4,688,308	899,398	5,587,706	22%
1C-PPU	4,584,123	899,398	5,483,522	24%
1D-CHWS	4,948,769	1,054,850	6,003,619	17%
2A	4,427,846	799,465	5,227,311	27%
2B	4,206,454	719,519	4,925,973	32%
3	4,071,417	843,880	4,915,297	32%
4	3,890,465	759,492	4,649,957	35%
5	4,863,081	843,880	5,706,961	21%

It can be seen that a communal heating system would save more energy when heat meters and controls installed in dwellings compared to one without heat meters, i.e. Option 2B is more than 2A.

However, this data is based on theoretical calculations and the energy savings listed may or may not be achieved as the occupancy patterns and residents particular comfort levels are so varied. Nevertheless if the occupancy patterns are different to that assumed the fuel savings for each option would follow a similar trend.

9.4 CARBON DIOXIDE EMISSIONS

The implementation of all options would reduce carbon dioxide emissions as shown in the table below apart from Option 5 which would result in an increase in carbon dioxide emissions (by about 1,054 tonnes CO_2 annually) because electricity is the most polluting fuel.

Option	kg CO_2 emissions	% Savings
1A	1,340,360	4%
1B-CON	1,085,691	22%
1C-PPU	1,065,448	24%
1D-CHWS	1,166,503	17%
2A	1,015,667	27%
2B	957,116	32%
3	955,042	32%
4	903,487	35%

9.5 SOCIAL AND ENVIRONMENTAL COST AND BENEFITS

Adopting a new communal heating and hot water system would bring social and environmental benefits to the Curnock Street Estate. Space heating and hot water services would be supplied in a clean, energy-efficient and noisy-free way. Residents would be able to control the temperatures required in each room and the times of day that a dwelling is heated. Each dwelling would be provided with individual heating controls (with hot water control in the case of option 2) which would be mounted on a "hydraulic board". The hydraulic board would contain all controls and valves necessary for the user operation, maintenance of the system and emergency shut down. The heating control valve mounted on the hydraulic board would be wired to a domestic programmer to enable on and off times to be set by the resident. This would compliment the thermostatic radiator valves fitted to each radiator to enable temperatures to be set by the resident.

Option	Bedsit	1-Bed	2-Bed	3-Bed	4-Bed
2007/2008 (H/HW) Charges	£7.03	£9.30	£14.10	£15.89	£17.58
1A	£8.09	£8.71	£9.33	£9.96	£12.44
1C-CON	£7.20	£7.76	£8.31	£8.87	£11.08
1B-PPU	£7.07	£7.61	£8.16	£8.70	£10.88
1D-CHWS	£7.04	£7.58	£8.12	£8.66	£10.83
2A	£6.13	£6.60	£7.07	£7.54	£9.43
2B	£6.35	£6.84	£7.33	£7.82	£9.77
3	£9.93	£10.69	£11.46	£12.22	£15.27
4	£9.48	£10.21	£10.94	£11.67	£14.59
5	£14.07	£15.15	£16.23	£17.31	£21.64

It can be seen that some options would provide residents with savings when compared to the existing charge.

10 APPRAISAL BASED ON COST, FUEL AND MAINTENANCE

The cost appraisal takes the form of estimated capital costs, running costs and life cycle costs.

The estimated capital costs include for supply and installation of all equipment, associated electrical and builders works and contractors costs. The running costs include for the estimated consumption of natural gas and electricity, repair and maintenance. The life cycle costs include all installation, replacement, maintenance, residual value of equipment and fuel costs for a 30 year period.

The running costs of fuel are based on annual percentage inflation of 3%.

The life cycle costs are based on a discount rate of 3.5% per annum.

The repair costs are based on average failure rates for all the installed equipment.

For communal heating it has been assumed that the boilers would not need to be replaced. Boilers, burners, pumps and radiators would need to be replaced at around year 13.

For domestic systems it has been assumed that radiators and boilers would need to be replaced at around year 13 and 25.

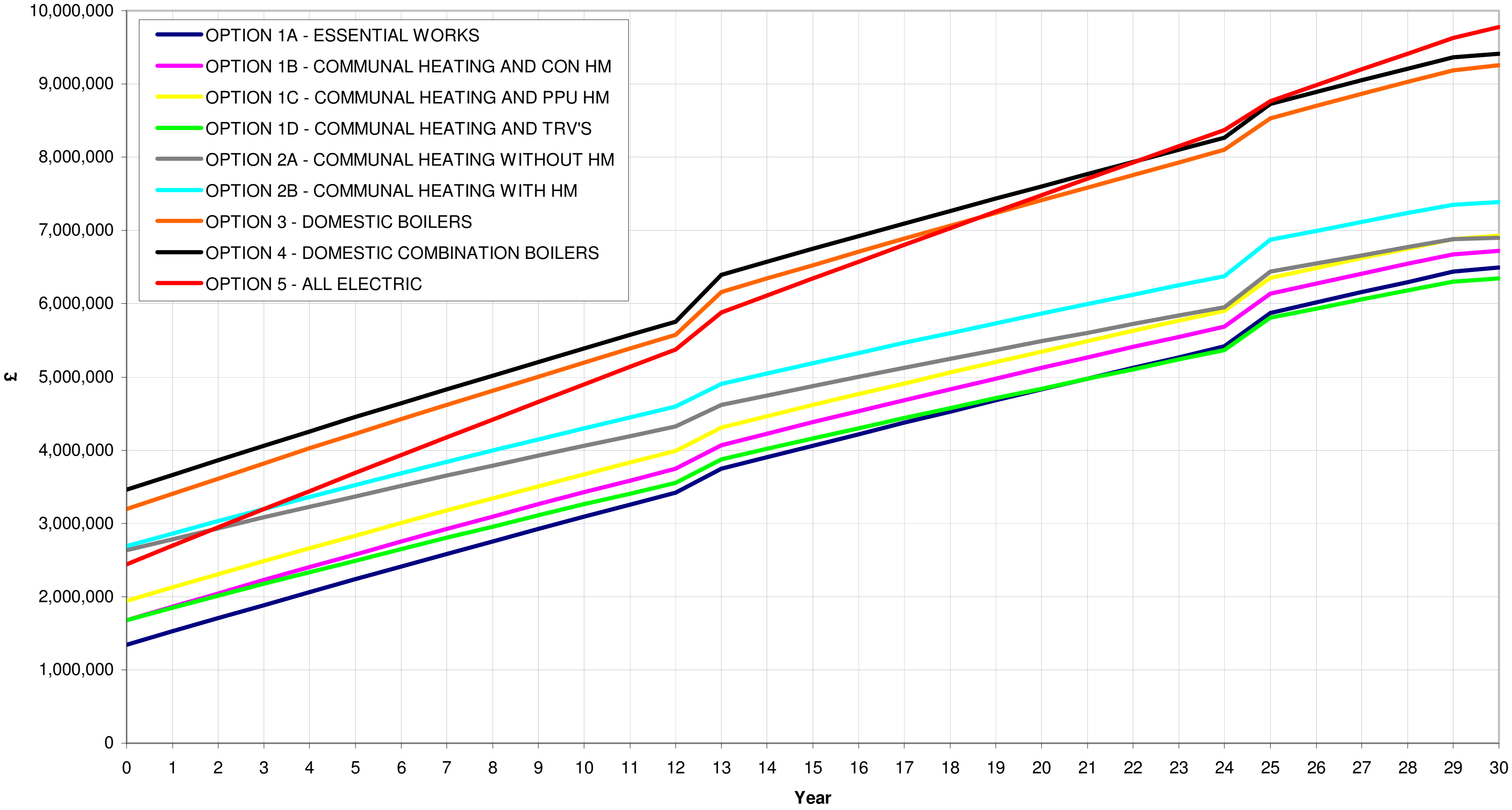
For both communal and domestic it has been assumed that radiators would need to be replaced at year 13 and 25.

All costs indicated in the appraisal are exclusive of contingencies, day-work and VAT as these costs would have an effect on the long term costs/results.

10.1 WHOLE LIFE CYCLE COST APPRAISAL

This chart shows the NPV of all costs involved; i.e. capital, replacement, residual, repair, maintenance and fuel costs. It can be seen that Option 1D is the most economic option when compared with other “complete replacement options” while Option 5 has the highest whole life cycle cost.

NPV CHART FOR WHOLE LIFE CYCLE COSTS



10.2 RISK – FEASIBILITY CALCULATIONS

The discount rate that has been used throughout this report was the treasury discount rate of 3.5% and all the results provided in this report are based on this discount rate. Variations in the assumed discount rate may significantly affect the results of this feasibility study.

10.3 SUMMARY

Based on the above NPV of the whole life cycle costs the best option would be option 1D attracting the lowest whole life cycle costs Net Present Value over a 30 year period.

11 SOLAR PANELS AND COMBINED HEAT AND POWER SYSTEMS

11.1 SOLAR PANELS

Solar panels are a device that extracts heat from the sun and converts it into useful energy. The panels are solar collectors that absorb the heat from the sun and transfer it to the water passing through them. This heat is then pumped to places or equipment where it can be of benefit. The heat is usually of low grade and low temperature therefore its use is limited. Some solutions are indicated below for this site.

11.1.1 Supplement Hot Water Service Cylinders

The existing hot water is provided by indirect Calorifiers located within the boiler house. The primary heating coils are served by low temperature hot water from the boiler plant.

The benefit achievable by the use of solar panels would be minimal for a stored water capacity approximately 4000 litres and the area available to locate the receptor panels.

11.1.2 Supplement Communal Heating System

Solar panels could be used to supplement the central boiler plant. This would be achieved using solar panels with a hot water buffer tank, with a heating coil, to inject heat into heating return water. This would only occur when the buffer tank water was higher than the heating return water. This may happen on occasion, but with the draw-off it would not be used very frequently.

Heating return water would be diverted from the heating boilers to the buffer tank, at the dictates of the controls. When the buffer tank heating water temperature begins to fall, the controls would then divert the heating return water back to the heating boilers.

However, additional controls would be required to monitor the heating return temperature and divert the return water to the buffer tank when the return water temperature is below that in the buffer tank.

In summary it is not considered viable to install solar heating due to the capital cost for piping from the roof to each dwelling and with only the low grade heat available would not achieve sufficient energy savings to pay back the capital cost in a reasonable time period.

11.2 COMBINED HEAT AND POWER PLANT

Generally, a Combined Heat and Power plant (CHP) for this project would comprise the installation of a gas engine, alternator, and heat exchanger. Although there would be a heating load in winter, the load during the summer would be minimal, i.e. hot water only. Although there would be a fair amount of electricity generated during the winter, there would be only a minimal amount generated during the summer period.

There would need to be a continuous base load throughout the year to make CHP viable for this site.

The following describes the CHP system, its benefits, the risks and also gives a background to the Climate Change Levy.

11.2.1 What is CHP?

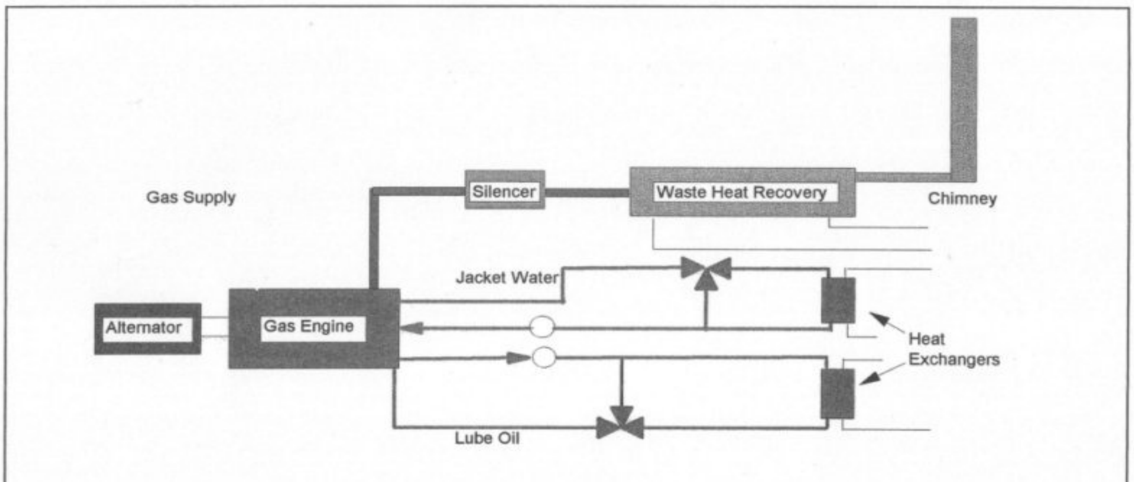
The acronym CHP refers to Combined Heat and Power, which is the simultaneous production of usable heat and power, usually electricity. By simultaneously generating heat and power from a single plant, CHP can provide a cost effective and environmentally responsible solution to energy needs (electricity and heat in the form of hot water).

In most conventional power stations, some 65% of the heat produced by burning fossil fuels is usually lost via the cooling towers and hence they are only about 35% efficient in utilising the energy in the fossil fuels. In contrast, site based generation of electricity provides an opportunity to use the heat generated in the process and as a result the overall efficiency of fuel utilisation can reach around 90%. It is this gain in efficiency of fuel utilisation that leads to CHP being cost effective and significantly more environmentally friendly than conventional power generators. CHP can also offer the added benefit of security of supply because the generation is on site.

The main components of a CHP plant are a prime mover that can be a reciprocating gas or diesel fuelled engine, gas turbine or a steam turbine driving an alternator that produces electricity. Other main elements of the plant include a heat recovery system, which recovers the heat from the waste gasses in the form of hot water and/or steam and a control system to ensure safe and efficient operation of the plant.

A steam turbine based CHP plant involves the use of a high-pressure steam boiler. The cogeneration of heat and power can also be obtained by a combined cycle system involving gas and steam turbines and high-pressure boiler connected in series. They are mainly used in industry or when high power is needed.

A simplified diagram of a gas engine based CHP plant with an alternator providing electricity and waste heat recovery system is shown below.



SCHEMATIC OF A GAS ENGINE BASED CHP PLANT

Packaged CHP units are now commercially available with electrical output rating of a few kW (e) to hundreds of MW (e). These can be linked to suitable heat loads in public and commercial buildings, industrial sites and district heating schemes. In addition, the heat produced by a CHP plant can be utilised to provide cooling load using absorption chillers. This means that a CHP plant can be operated cost effectively throughout the year.

Installing a CHP plant involves a significant financial investment and payback, when economically viable, is generally achieved in three to five years, but energy cost savings will continue for a further 15 to 20 years.

11.2.2 Benefits of CHP

Combined Heat and Power (CHP) is a well-established and reliable technology for the simultaneous production of heat and power. It offers several benefits that are outlined below.

- It can achieve considerable reduction in the use of primary energy when compared with separate generation of the two forms of energy.

- Reduced energy consumption means reduced cost.
- Reduced energy consumption also means lower quantities of polluting emissions such as CO_2.
- It provides security of service because generation is on site. This could be a very important consideration for some businesses.
- The heat generated by CHP units can now be used to provide cooling via an absorption chiller, thus providing better year round plant utilisation (although cooling is not applicable to this scheme).

'Good quality' CHP schemes are exempt from the Climate Change Levy (or CCL) introduced by the government on business use of energy (electricity, gas or coal) from April 2001. Even 'lower quality' CHP schemes will be exempt from some CCL payments. Therefore, if a CHP plant for a site qualifies to be a 'good quality' plant, then the site may be exempt from paying CCL tax on energy. The exemption on electricity would be 0.43 pence/kWh and for gas 0.15 pence/kWh.

11.2.3 Risks Associated with CHP

The following risks are associated with CHP.

- Changes or fluctuations in fuel/power prices, e.g. increase in the price of gas (or other primary fuel) and decrease in the price of electricity. These could lead to increase/decrease in payback of investment and could affect the economics of the scheme.
- Changes or fluctuations in the interest rates on any loans could affect the payback on investment.
- Any future changes in government regulation on generation of power could affect the operating and running of CHP.
- Future changes in the company business (increase/decrease in the use of energy) could affect the economics and investment payback of the scheme.
- Where export of generated electricity is concerned, the average price received is generally lower (just covering the generating costs) than what is charged by the electricity suppliers for imported power. The current New Electrical Trading Arrangements governing the sale and supply of electricity effectively discourage export from CHP plants.
- Technical risk associated with the reliability of the plant can prove a risk in the development of CHP. In general the technology available for CHP schemes is well proven and manufacturers can offer guarantees on reliability and availability of the plant.

11.2.4 Sizing of CHP plant

There are many parameters to take in to account in the sizing and selection of CHP. It is considered that such a review and report on CHP is beyond the scope of the consultancy fees for this report but a review could be separately undertaken at a later stage.

In “broad brush terms” CHP falls into two categories for Council owed sites: -

- Small scale CHP
- Large scale CHP.

Also these categories can be further divided into: -

- Electrically led.

- Thermal led.

Electrically led CHP means that the priority of operation lies with power generation. The feasibility report to select such equipment would be such that the energy savings on electricity means that no matter how much heat is generated, utilised or rejected (wasted) still means that savings are provided.

Thermal led CHP means that the priority of operation lies with heat generation. The feasibility report to select such equipment would be such that the energy savings on heat would be achieved by the electricity generated in that the excess electricity would be utilised or sold to local businesses or the “grid”.

Small scale CHP would involve a small scheme whereby just enough electricity would be generated to provide power to the boiler plant and landlords power supply. The by-product of generating electricity would be heat. This heat could be utilised through the new heating mains to supplement the heating load in winter and hot water load in summer. The sizing of the plant needs to be just right in that if the heat cannot be utilised than the machine would shut down, or the heat would have to be rejected or wasted.

Large scale CHP would involve a large scheme whereby electricity would be generated to provide power to the boiler plant; landlord’s power supply, resident’s power supply and excess electricity sold to the grid. The by-product of generating electricity would be heat. This heat could be utilised through the new heating mains to supplement the heating load in winter and hot water load in summer and also be piped and heat sold to other local businesses. If such heat could not be utilised then it would be rejected to atmosphere. One of the downsides to providing electricity to residents is that Camden would need to become a “supplier” which would involve extensive responsibilities and health and safety issues.

For this site a separate feasibility report might suggest the installation of a small scale CHP plant, or, it might suggest a larger scale plant to take into account other local Estates.

11.2.5 Basic Example of Benefits

As a “broad brush” exercise a small scale plant that would generate, say, 60kW of electricity and say 90kW of heat. The electricity could be used during the day and night to run the landlords supply and the waste heat could be piped into the boiler plant to supplement the boiler plant. Heat would be injected into the system prior to the boilers such that the heating water is pre-heated prior to the boilers firing.

Given typically operating 17 hours per day (peak electric period) and 50 weeks per year it is possible to achieve the following benefits based on the data below: -

Capital Cost	-	£100,000
Gas price	-	2.1 pence/kWh
Electricity price	-	11 pence/kWh
Electrical efficiency	-	29.3%
Gas Climate Change Levy	-	0 pence/kWh
Electricity Climate Change Levy	-	0 pence/kWh
Maintenance cost	-	1 pence/kWh Generated
Estimated savings	-	26,857.21 Per annum
Simple payback	-	3.72 Years

It can be seen from basic calculations that the payback period is 3.72 years. Therefore, in true financial terms such a scheme would be viable.

CHP should be subject to further discussion and a separate feasibility report.

12 PROGRAMMING CONSIDERATIONS

12.1 RISK - WORKS

Where new heating distribution pipe work replaces old distribution pipe work a conflict of services can often result if for instance: -

- The existing heating needs to remain in operation during installation.
- There is no convenient location to run the new services.
- The design of the new system is not thought out in sufficient detail.

In the instance of this site all services generally run through underground parking areas that communicate with flats directly above. This means that it would be possible to run the new services adjacent the existing whilst maintaining service to all dwellings. This would reduce the disruption to residents to an absolute minimum during the change-over periods for the respective risers.

12.2 PLANNING

Careful planning and phasing between retaining existing while the “new” is being installed is required to enable disruption to be kept to a minimum.

The ideal time for commissioning is during the winter. However, this would cause some disruption in the heating service and affect residents. The careful issue of portable electric heaters (with due regard to electrical demand) would however compensate the heating disruption.

12.3 ACCESS

The key to the success of any scheme involving residents in occupation is the ability of the contractor to gain access to each dwelling. Access is of particular importance during the re-commissioning exercise.

Access to dwellings with residents in occupation can be a frustrating exercise and therefore any implementation contract should include a procedure for the contractor to gain access via a number of letter drops, cards, door knocking, telephone calls and if necessary Special Delivery letters. A "Resident Liaison Officer" would be provided.

However, it is a general fact that access is greatly improved with careful and structured consultation at scheme inception.

12.4 CONTRACT PERIOD

The contract period for implementing the proposed scope of work could be relatively short, provided good access is afforded.

In reality 'residents in occupation' contracts can be difficult due to access and therefore the contract period should be selected to give a balance between giving the contractor a reasonable time whilst keeping the contract preliminary costs to a minimum, resulting in value for money.

For discussion the contract period might be as follows: -

- Option 1A - 25 weeks
- Option 1B-CON - 30 weeks
- Option 1B-PPU - 30 weeks
- Option 1D - 30 weeks
- Option 2A - 35 weeks
- Option 2B - 35 weeks
- Option 3, 4 and 5 - 35 weeks.

13 NOISE SURVEY REPORT

13.1.1 Management Summary

13.1.2 Introduction

NIFES Consulting Group undertook a noise survey at the Boiler Room at the Curnock Street Housing Estate, Pratt Street, London Borough of Camden, due to a specific complaint from the occupied resident at 4 Goldthorpe House.

It is understood that another consultant has recorded and reported on noise levels within the above flat which prove to be acceptable with the published design guides, however, this report is intended to extend scope of noise readings so as to the identify: -

- The cause of the problem
- Measures to rectify
- Estimated cost to rectify

The conclusions of the report are given below.

13.1.3 Summary

A noise level survey has been conducted in the boiler room located directly below the flat of 4 Goldthorpe, Curnock Street Estate in Camden. The noise levels recorded external to the boiler room are in excess of those required by Environmental Health although no complaints have been lodged in relation to this.

Despite the noise levels (28dB(A)) within the flat recorded by another consultant being less that those required by WHO (World Health Organisation) recommendations and CIBSE (Chartered Institution of Building Services Engineers) publications for restorative sleep, the resident feels that the noise is still excessive.

In order to reduce the perceived noise in the flat, all pumps and pipe work will require vibration isolation treatment and in addition the option exists to interface electrically with the existing secondary circulating pumps to enable the flow rates to be reduced overnight.

The level of noise reduction is difficult to quantify and because the noise levels are already low, will be difficult to reduce further. However, stage 1 should provide 3dB(A) reduction and stage 2 should provide 2dB(A) reduction. A further 1dB(A) reduction should be available if the circulating pumps are electrically controlled.

The duration to undertake the works would be no more than 20 working days although a lead-in time would be required to procure parts and materials. Resident consultation would be required and dependant upon the overall cost of the scheme, it might involve S151 consultation meaning that all Leaseholders may contribute due to the plant being communal.

13.1.4 Recommendations

It is recommended that works identified are implemented at an estimated cost of **£45,000**. This cost is subject to the addition of fees and VAT.

13.2 EXISTING PLANT

The existing boiler room houses various items of plant in addition to that described above, comprising three boilers, gas boosters, hot water cylinders and pumps and ventilation fans. This plant was unaltered during the Capital Projects Scheme although it was connected to the new control panel.

The existing secondary heating circulation pumps are of the inverter driven type which means they can be automatically adjusted by fitment of additional equipment.

The boiler room is ventilated naturally via louvres direct to outside adjacent the pedestrian walkway and via two fan and ductwork systems (mechanical ventilation) to the rear and front of the boiler room adjacent the louvres. The mechanical ventilation also provides air for combustion.

13.3 CAPITAL PROJECTS SCHEME

A Scheme known as Miscellaneous Plant Rooms was undertaken by Capital Projects and NIFES Consulting Group. The scheme involving some 19 plant rooms and boiler rooms boroughwide and was completed March 02.

The scope of work included the following: -

- New digital control panel.
- Plate heat exchangers to separate aged heating system and boiler plant so as to protect the boilers.
- Associated primary pipe work from the boilers to the plate heat exchangers.
- Remedial work and control valves to communal hot water system.
- Insulation of new services and commissioning of the system.

The implementation works has resulted in significant energy savings throughout the Borough.

13.4 HISTORIC DETAILS

The noise nuisance at 4 Goldthorpe has been in existence for some time.

Both NIFES Consulting Group and Capital Projects have inspected the flat on a number of occasions and these visits concluded (although not measured) that the noise was not excessive.

Another consultant was appointed by Planned Maintenance Group to investigate and measure the noise level within 4 Goldthorpe and it is understood that the conclusion of the report was that the noise level was to an acceptable level when compared to relevant design guides.

The complaint of noise was resurrected 19 November 03 and a visit was made by NIFES Consulting Group to the boiler room to view and listen to the boiler plant. There was a change to the conditions within the boiler room since previous visits in that the external boiler room louvres had been removed and a primary pump did make a strange noise upon start-up.

Another change was that their was a very low frequency rumble that was emanating from boiler no. 3 associated with the flue connection (possibly as a result of a change of conditions due to the new chimney installation) this should be investigated by the TMC.

13.5 NOISE SURVEY

13.5.1 Instrumentation

The noise survey was carried out 18 December 03 using the following instrumentation: -

a) Castle Associates Ltd sound level meter, model GA 112 with octave ban analyser confirming to BS6569.

b) Acoustic calibrator rated at 94.0 dB @ 1000 Hz.

c) Pre-polarised ½" free field microphone fitted with acoustically transparent windshield

13.5.2 Method

Noise levels from various items of plant were recorded at standard octave bands in the boiler room. By switching the items of plant on individually it was possible to identify which items of equipment were contributing to the noise within the boiler room.

Noise levels within the property were not recorded as these have been undertaken by others.

The sound level meter was calibrated before and after the test work with no drift in calibration noted.

A total of 19 sets of noise level readings were taken outside and within the boiler room and recorded as follows: -

1) Ambient noise level within boiler room.

2) External ambient noise level 1.0 metre from the boiler room grille.

3) External ambient noise level 5.0 metres from the boiler room grille.

4) External ambient noise level 10.0 metres from the boiler room grille.

5) Internal noise with boiler No.1 **on** with fans and **with** boiler acoustic shroud.

6) Internal noise with boiler No.1 **on** with fans and **without** boiler acoustic shroud.

7) Internal noise with boilers **off** but with primary and secondary heating pumps **on**.

8) As 7) above, externally 1.0 metre from the boiler room grille.

9) As 7) above, externally 5.0 metres from the boiler room grille.

10) As 7) above, externally 10.0 metres from the boiler room grille.

11) Internal noise with boiler No.1 **on, without** acoustic shrouds on boiler and gas booster.

12) As 11) above but **with** acoustic shrouds on boiler and gas booster.

13) External noise level 1.0 metre from the boiler room grille with boiler No. 1, fans and primary pumps **on**.

14) External noise level 5.0 metres from the boiler room grille with boiler No. 1, fans and primary pumps **on**.

15) External noise level 10.0 metre from the boiler room grille with boiler No. 1, fans and primary pumps **on**.

16) Internal noise with all items of plant **on**.

17) As 16) externally, 1.0 metre from the boiler room grille.

18) As 16) externally, 5.0 metres from the boiler room grille.

19) As 16) externally, 10.0 metres from the boiler room grille.

Noise levels were not taken within the flat so a comparison of plant versus internal noise could not be achieved. However, please note comments in the "discussion" below.

13.5.3 Noise Level Results

Noise level readings were taken outside and within the boiler room to establish the level with plant on and off. Noise levels readings should be read in conjunction with the above list. Noise level readings at different frequencies are indicated as sound power levels SPL (dB).

Reading	**dB(A)**	**Frequency – Hz**							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
1	48	61	51	45	42	43	39	40	25
2	53	68	59	54	54	54	51	44	34
3	60	67	59	55	54	56	53	46	37
4	60	66	60	54	54	56	52	44	33
5	77	77	83	79	75	71	68	64	57
6	82	75	84	81	78	78	75	71	64
7	69	61	62	63	66	65	62	56	51
8	62	67	62	57	57	58	55	53	47
9	61	65	59	57	58	58	54	48	43
10	65	69	62	57	61	61	59	51	43
11	82	75	83	80	79	78	75	72	68
12	77	76	82	77	74	72	68	65	59
13	68	72	72	68	64	63	61	56	48
14	62	68	65	53	59	57	55	49	40
15	62	69	66	62	58	58	54	46	36
16	81	81	86	81	78	78	76	73	68
17	71	75	77	72	67	65	63	59	51
18	66	74	72	64	63	61	54	53	44
19	62	70	70	64	56	57	54	48	39

13.6 DISCUSSION

The above noise levels record the noise emissions measured within the boiler room and indirectly to outside under various operating conditions. The readings were taken during typical autumn/winter use and simulated summer conditions. The readings taken under simulated summer conditions do not take into account the varying heating water flow rates that are likely to occur as a result of varying heat load for the production of hot water.

Therefore the while the summer boiler room conditions may stay reasonable consistent the summer dwelling noise may increase due to heating water flow rates becoming more and more restricted as the load reduces. The same scenario applies to Spring/Autumn conditions.

With all heating system comprising thermostatic radiator valves problems with noise can occur (especially on communal systems) when the weather becomes mild as a result of the thermostatic radiator valves shutting down. As all radiators shut down a restriction is caused and with the constant volume of heating water being circulated there is a build-up of pressure in the system. As the pump is trying to circulate the same amount of water, this water is trying to be forced through ever reducing openings in the heating system.

As with any flowing fluid it will always take the least line of resistance and whoever has a commissioning valve or radiator valve more open than others will receive a higher flow rate and hence more velocity than others. Those dwellings closest to the boiler room are even more susceptible due to high pressures generated by circulating pumps.

There are various solutions to achieve adequate heating at an acceptable noise level (although systems can never be completely silent). There are constant volume systems or variable volume systems as with Curnock Street.

Variable volume system have a frequency inverter driven pump which via pressure or flow readings in the pipe work, increases or decreases the speed of the motor and hence water flow rate. Therefore in mild weather the pump runs slowly and in cold weather the pumps runs at full speed (or more) at design conditions.

Both types of heating systems rely on an effective balance throughout the heating system pipe work but both types of systems have there problems.

Inverter driven pumps have there problems in that if the system calls for a large demand, without effective balance, the pump can run at more than design condition. Similarly at low demand, without effective balance, the pump can run so slowly that some dwellings do not receive any heating at all (which has occurred at Curnock Street).

For clarification inverter pumps were not installed as part of this Capital Projects Scheme.

The added problem with inverter pumps is that pipe work throughout a whole estate can become cool so that when heating is required the response time can be very slow. Given that some systems in Camden are very old, a constant variation in heating water temperature may cause undue stress on the pipe work due to expansion and contraction.

For constant volume systems system noise can be created as described above but the heating system itself remains fairly stable.

There are various ways to remove the excess pressure build-up in constant volume heating systems, but the method commonly adopted by NIFES is the same as that installed for Mary Green, Denton Estate, Fleet Road Estate, Henderson Court and Greenwood Annexe. This includes thermostatic valves throughout, together with a "hydraulic board" located in the dwelling. The board includes a pressure differential valve connected across the heating flow and return that opens or closes proportionally to the thermostatic radiator valves. Therefore when all thermostatic radiator valves shut down the pressure differential valve is wide open, etc.

Another option is to install larger automatic bypass valves to main heating circuits rather than within each dwelling so that the whole circuit is bypassed. Generally this is acceptable but on occasions when in bypass mode the whole heating circuit can cool down causing stress on the pipe work and complaints due to the delay in providing heating when it doesn't arrive quick enough.

The installation of dwelling controls maybe something for the future but the clear action required at this time is to reduce vibration (that maybe re-radiating as noise) within the flat to an acceptable level.

From the above readings taken there are two distinct problems, noise within the flat and noise to atmosphere. A further cause of noise would be that due to the velocity of heating water within the heating pipe work. However, it is considered that the noise to atmosphere is not the cause of complaint at 4 Goldthorpe.

13.7 COMMENTS ON NOISE READINGS

There are two areas of discussion with regard to the noise readings taken. The first being the residents perception of noise within the flat and secondly the noise outside the boiler room onto public areas. Both noise items can be resolved which would attract various levels of cost. The noise level normally expected by Environmental Health is 45dB(A) at 1 metre from a boiler room or item of plant, or a noise level that was sufficiently low enough so as not to contribute to the ambient noise level. An interesting observation is that when all plant was off the noise reading (1) in the boiler room was 48dB(A) yet the noise reading (2) outside was 51dB(A).

From the above results that the main noise problem would occur under the winter operating conditions (reading 16) where noise levels within the flat would be the highest. If this can be adequately treated then no action would be required for the summer condition as the number of plant items in operation would be reduced.

The WHO (World Health Organisation) provides guidelines of 30dB(A) for restorative sleep. However, it should be noted that at the time of build design noise levels there were no statutory guidelines on noise levels with domestic premises. There was a publication by ASHRAE that gave minimum, normal and maximum noise level guidelines of 30, 40 and 48dB(A) respectively. The other consultants recorded noise level of 28dB(A) therefore complies with the noise levels at today's standard and is considered acceptable.

As a general observation it is understood that the other consultant reported that the "domestic fridge" produced a higher noise than the general noise in the flat!

Despite the noise level being acceptable the resident of the flat is not happy with noise levels and therefore options to reduce noise levels even further are proposed together with the associated costs.

The boiler room that is built directly below the flat is constructed from reinforced concrete, concrete beams and brick infill to the walls. This structure has excellent properties to contain and reflect noise but this is compromised due to penetrations where heating pipe work passes through.

It is considered that the primary problem is that of structure borne vibration transmission that is re-radiating from the less substantial or flimsier building fabric as noise even though the noise level within the boiler room with all plant running and acoustic shrouds in place is 81dB(A).

Although some anti-vibration measures were installed as part of the new scheme, in effect, boiler room equipment and pipe work is rigidly connected to the building (which was not part of the scheme).

Generally with retro-fitting noise isolation measures, the solution becomes more difficult (when compared with a brand new boiler plant and system) since all plant must be disconnected from the building fabric and isolated by means of suitable vibration isolators. In addition all pipe work should be resiliently supported. This will mean incorporating spring anti-vibration hangers to all drop-rod supports. Where pipe work passes through the building wall etc, this should be sleeved and packed with high density mineral wool, such that there is no direct contact between the pipe work and structure, or alternatively rubber in-line bellows installed to provide a break.

The noise from the boiler room equipment is not considered to be a major noise issue and no additional acoustic treatment will be necessary in terms of noise to the flat. However, the noise level radiating to outside would need to be reduced if compliance with Environmental Health is required, in which case the system would have to be treated as a whole, including acoustic louvres, burner shrouds.

With regard to the noise level from the boilers and plant, this appears to be a marginal situation since the majority of the noise is being generated in the mid-frequencies. Purpose built burner shrouds could be fitted as a second stage operation after the primary vibration issues have been resolved. This will also reduce noise in the boiler room for a safer working environment.

The options below detail an approach to reducing noise levels both in the flat and to atmosphere, although the level of noise reduction is difficult to quantify. In some instances remedial work can create a reverberation noise, in which case additional damping may be required.

The noise level recorded by the other consultant is quite low and as such the lower the noise level the more difficult to reduce it further. As the noise becomes lower it can start to introduce other noises such as the fridge, external traffic noises and movement of residents in the flat above may appear louder and give the perception of further noise nuisance. If the latter becomes a problem you could be into the realms of acoustic flooring i.e. remove all floor finishes, kitchen, bathroom, then reapply mineral wool slabs, chipboard flooring and refit kitchen, bathroom, skirting board, decorate and carpets!

There are other forms of technology where with a microphone and speaker set-up measures the noise and the speakers emit an equal and opposite noise such that it “blanks out” the noise nuisance.

13.8 OPTIONS FOR NOISE REDUCTION

The following options are proposed to reduce noise within Flat 4 to a level that is acceptable to the resident. The noise level the resident requires is not known although the current noise level complies with current WHO Guidelines. In addition, works to the heating circulatory system would reduce noise as a result of restrictions caused by heating system closing down during mild weather.

With noise isolation solutions it is usual to provide a phased approach by concentrating the major source of noise measuring the effect, comparing with original noise readings and then moving on to the next stage.

As discussed above the noise from the boiler room equipment is not considered to be a major noise issue and no additional acoustic treatment will be necessary in terms of noise to the flat. However, the noise level radiating to outside would need to be reduced if compliance with Environmental Health is required, in which case the system would have to be treated as a whole, including acoustic louvres, burner shrouds. In order to comply with Environmental Health requirements the noise level would have to reduce from 71dB(A) (reading 17) to 45dB(A), one metre from the grilles of the boiler room. There are various ways of achieving this as described below.

The following describes the extent and order or stages to treat three distinct elements, vibration, heating circulation noise and airborne noise. Vibration reduction is proposed in 2 stages, circulation noise in 1 stage and airborne noise reduction is dealt with in 2 stages.

The elements are proposed in order of priority although the final airborne noise stages are not fully detailed or priced as this is not considered to be the cause of the complaint. However, should Environmental Health seek to reduce the noise levels then this can be implemented at a later date.

13.8.1 Vibration - Stage 1

An option to reduce vibration transmission would be to install the following components in the boiler room. All existing plant and equipment would be retained.

a) Install inertia bases (25mm deflection) to the primary circulating pumps, 2 in total. Estimated cost (2 x 1,500) - £3,000.

b) Install inertia bases (25mm deflection) to the secondary circulating pump sets, 6 in total. Estimated cost (6 x 800) - £4,800.

c) Install resilient mountings to secondary heating pump pipe work. Estimated cost (12 x 200) - £2,400.

d) Install resilient mountings to hot water services pumps. Estimated cost (4 x 200) - £800.

e) Check and re-commission heating water flow rates. Estimated cost (6 x 250) - £1,500.

f) Measure noise in flat after stage 1 works. Estimated cost - £400.

Stage 1, would be an estimated cost of £12,900.

The estimated noise reduction would be 3dB(A) at winter conditions.

13.8.2 Vibration - Stage 2

A further option to reduce vibration transmission would be to install the following components in the boiler room. All existing plant and equipment would be retained.

a) Install spring hangers (25mm deflection) in lieu of existing rigidly mounted hangers. Estimated cost (30 x 100) - £3,000.

b) Disconnect pipe work from structure by rubber bellows or sleeve and pack with mineral wool insulation. Estimated cost (8 x 250) - £2,000.

c) Sleeve and pack heating pipe work and any other penetration through the floor slab. Estimated cost (12 x 50) - £600.

d) Measure noise in flat after stage 1 works. Estimated cost - £400.

Stage 2, would be an estimated cost of £6,000.

The estimated noise reduction would be 2dB(A) at winter conditions.

13.8.3 Circulation Noise - Stage 3

The existing secondary heating circulation pumps, that circulate heating to all flats to the site, are of the inverter driven type which means they can be automatically adjusted by fitment of additional equipment.

Provided a 0 to 10 volt interface can be connected to each inverter the existing digital control system can be arranged to increase or decrease the speed of the pumps automatically or at different times of the day or night.

For instance the pump speeds could be reduced at night when full heating is not required and then increased at early morning and throughout the day.

The estimated cost for this option would be £4,000.

The noise reduction is difficult to quantify but levels might reduce by 1dB(A) at winter conditions.

13.8.4 Air Bourne Noise

There are two distinct ways to reduce noise to atmosphere by a) treating the noisy equipment at source or b) treating the envelope of the boiler room.

13.8.4.1 Treating the existing equipment

This would involve fitting acoustic shrouds to boiler burners, acoustic screens to primary pumps and gas boosters and fitting silencers to existing ventilation fans. The existing louvres would remain unaltered.

The estimated cost would be £ 10,000 and estimated noise reduction to outside would be 15dB(A), therefore it is not expected that Environmental Health requirements would be achieved.

13.8.4.2 Treating the envelope

This would involve fitting large silencers in lieu of the existing louvres and upgrading ventilation fans due to reduced air openings

The estimated cost would be £30,000 and estimated noise reduction to outside would be 25dB(A), therefore it is expected that Environmental Health requirements would be achieved.

13.9 CONCLUSIONS

A noise level survey has been conducted internally and externally to the boiler room at the Curnock Street Estate.

A variety of noise readings were taken although it is considered that vibration from plant is re-radiating as noise within the flat.

Despite the noise levels (28dB(A)) within the flat recorded by another consultant being less that those required by WHO (World Health Organisation) recommendations and CIBSE (Chartered Institution of Building Services Engineers) publications for restorative sleep, the resident feels that the noise is still excessive.

In order to reduce noise further, all pumps and pipe work will require vibration isolation treatment and in addition the option exists to interface electrically with the existing secondary circulating pumps to enable the flow rates to be reduced overnight.

The level of noise reduction is difficult to quantify and because the noise levels are already low, will be difficult to reduce further. However, stage 1 should provide 3dB(A) reduction and stage 2 should provide 2dB(A) reduction. A further 1dB(A) reduction should be available if the circulating pumps are electrically controlled.

The duration to undertake the works would be no more than 20 working days although a lead-in time would be required to procure parts and materials. Resident contact and consultation would be required and dependant upon the overall cost of the scheme, it might involve S151 consultation meaning that all Leaseholders may contribute due to the plant being communal.

13.10 RECOMMENDATIONS

It is recommended that works identified in stage 1 are implemented at an estimated cost of £12,900, and the noise readings measured in the flat. Stages 2 and 3 may be required and is subject to the review of stage 1 at a further estimated cost of £10,000.

However, as noise reduction is sometimes not an exact science due to a multitude of parameters and conditions a budget of £45,000 should be allowed.