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construction & property consultants

ENERGY STRATEGY REVISED FOR:

PACKINGTON ESTATE REGENERATION, ISLINGTON

On behalf of:

Hyde Housing

Date: March 2014
Revision No: 004

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1) Introduction

The following report provides a review of the current and proposed alternative energy strategy for the Packington Estate regeneration development.

This report compares the energy strategy submitted and approved by Islington, prepared by Hoare Lea in December 2010 *'Packington Phase 3-6 Energy Strategy; Issue 2.1';* the initial discussions to revise the approved strategy between Hoare Lea and Islington in February 2011; and the current site energy and emissions calculations. The report also includes additional information requested by Islington following a meeting to discuss the revised strategy held in October 2013.

The regeneration of the Packington Estate in the London Borough of Islington was approved in April 2007 following the grant of outline planning permission ref: 2062806. The energy strategy sought to provide a CHP unit and Biomass boiler within the energy centre that had been built in phase 1. The energy assessment at the time concluded that the strategy would reduce energy reduce CO2 emissions by 44% when compared to a baseline scheme. A condition attached to the planning permission required the developer to investigate the potential for larger plant sizes and capacity in relation to the CHP. This was discharged in June 2008 following consultation with the GLA.

The approved energy strategy comprised the following;

- 145kWe/231kWt CHP unit contributing to an 18% reduction in CO2 emissions.
- A 350kW Biomass Boiler contributing to an 16% reduction in CO2 emissions.
- A 50,000litre thermal store to optimise the operation of the CHP and Biomass Boiler.

As well as the above the new buildings were planned to be designed to improve energy efficiency by approximately 17% compared to current (2006) Part L.

The CHP was proposed to be installed in Phase 5, with the biomass boiler following in Phase 6. It is noted that Phase 3 is currently under construction at the time of this application.

The energy strategy was revisited through subsequent applications for Phase 2-6 (ref: P081704) and Phase 3-6 (ref: P102754); however, the energy strategy remained as approved.

In 2011 Hoare Lea suggested a revised strategy to remove the biomass boiler from the approved energy strategy. The removal of the biomass was on the basis that there had been a shift in planning emphasis on how CO_2 emissions reductions should be achieved on larger schemes; with a greater priority now for implementing low carbon CHP ahead of renewable technologies, e.g. biomass heating.

Islington comments requested greater detail and modelling, using a sample of different units to establish a Part L compliant baseline from which further reductions could be demonstrated.

This document outlines those modelled sample dwellings based on the current design methodology and actual Part L SAP calculations from Phase 3.

2) Executive Summary

The following outlines the calculated emissions, overall percentage reductions and strategy for each of the different energy strategy submissions.

December 2010 Hoare Lea Energy Strategy (current approved strategy):

Be Lean – Passive reductions improvements over Part L
Be Clean – 145kWe / 230kWth CHP
Be Green – 350kW Biomass Boiler
Total Reductions over Part L – 44%

	Gas	Electricity	Total	Stage	Cumulative Reductions
Part L Compliant Baseline Scheme	904,567	1,194,030	2,098,598	-	-
Part L Compliant Baseline Scheme + Energy Efficiency	764,274	965,150	1,729,424	17%	17%
Part L Compliant Baseline Scheme + Energy Efficiency + CHP	1,064,016	339,303	1,403,319	18%	33%
Part L Compliant Baseline Scheme + **Energy Efficiency + CHP+ Biomass Boiler**	828,638	339,303	1,167,940	16%	44%

February 2011 Hoare Lea Draft Revised Energy Strategy:

Be Lean – Passive reductions improvements over Part L
Be Clean – 250kWe / 326kWth CHP
Be Green – 200m^2 PV
Total Reductions over Part L – 43%

	Gas	Electricity	Total	Stage	Cumulative Reductions
Part L Compliant Baseline Scheme	904,567	1,194,030	2,098,598	-	-
Part L Compliant Baseline Scheme + Energy Efficiency	707,061	965,150	1,672,210	20%	20%
Part L Compliant Baseline Scheme + Energy Efficiency + CHP	151,147	54,671	1,205,818	27%	42%
Part L Compliant Baseline Scheme + **Energy Efficiency + CHP + PV**	151,147	42,747	1,193,894	1%	43%

Proposed Energy Strategy September 2011:

Be Lean – Passive reductions improvements over Part L
Be Clean – 210kWe / 337kWth CHP
Be Green – none
Total Reductions over Part L – 53%

	Total	Stage	Cumulative Reductions
Part L Compliant Baseline Scheme	1,482,104	-	-
Part L Compliant Baseline Scheme + Energy Efficiency	1,102,306	26%	26%
Part L Compliant Baseline Scheme **+ Energy Efficiency + CHP**	683,918	28%	53%

Summary

Percentage Reduction in CO_2 emissions	Approved	Proposed
Energy Efficiency	17%	26%
CHP	18%	28%
Renewables	16%	-
Total	44%	53%

3) Hoare Lea Energy Strategy Review:

Hoare Lea prepared an energy strategy document that was approved by November 2011 (ref:P10754). This strategy was based on providing a CHP and Biomass Boiler to achieve an overall 44% emission reduction.

This strategy was revised (although not formally approved) and calculations submitted to Islington in February 2011 that demonstrated that by removing the biomass boiler, up sizing the CHP and including a proportion of Photovoltics an emissions reduction of 43% could be achieved.

3.1) Be Lean

The following passive measures were outlined to achieve a 17-20% emissions reduction over baseline:

Residential Passive Improvements			
Component		Phases 1,2	Phases 3-6
		Approved	Passively improved
U values (W/m2/K)	Windows	1.8	1.5
	Ground	0.25	0.2
	Walls	0.22	0.18
	Roof	0.25	0.1
Air permeability (m3/m2/hr)		7	4 - 5
Ventilation strategy		MEV	MVHR

3.2) Be Clean

Although the Hoare Lea reports do not provide the calculation methods to achieve the stated emissions saving, working the figures back from the CHP unit sizes and overall emissions reductions achieved, the following breakdown of emissions reductions are calculated:

CHP SIZE		
Strategy Issued	Dec-10	Feb-11
	Approved	Suggested
Fuel Type	Natural Gas	Natural Gas
kWe Electrical (*based on power ratio)	145	204*
kWt Thermal	230	326
KW Input (*estimated from thermal efficiency)	460*	657.25*
Thermal Efficiency %	50	49.6
Heat to Power Ratio	1.6	1.6
Assumed Operating Hrs	15-20	23
Annual Hours	7000-7599	7867
CHP Thermal Contribution	45-50%	79%
Emissions Used (Gas)	678,134	1,003,140
Thermal Emissions Offset	339,067	559,054
Electrical Emissions Offset	625,847	1,117,114
Net Emissions Saved	286,780	673,028
CHP Percentage Emissions Reduction	18%	27%

3.3) Be Green

Both strategies included an element of renewable technologies. The draft revised strategy opted to remove the Biomass boiler due to the change of emphasis of London Planning guidance to prioritise CHP and overall emissions reduction.

Compared Strategies: Be Green		
Strategy Issued	Dec-10	Feb-11
	Approved	Suggested
Renewable Technology	Biomass Boiler	PV
Details:	350kW	200m^2
Percentage Emissions Reduction	11%	1%

The following strategies gave approximately the same emissions overall reductions:

Stage	Dec-10	%	Feb-11	%
Part L Compliant Baseline Scheme	2,098,598	-	2,098,598	-
Be Lean	1,729,424	17%	1,672,210	20%
Be Clean	1,403,319	33%	1,205,818	42%
Be Green	1,167,940	44%	1,193,894	43%

3.4) Summary

Both the approved and draft strategy were based on the same CO_2 benchmark baseline figures, although considered slightly different passive values between phases 1-2 and 3-6. In line with current London planning emphasis the revised February 2011 draft strategy goes towards achieving the required emissions reductions.

Islington council had previously noted that the load calculations from the development appeared abnormally high given the high passive performance of the scheme and had requested more rigorous modelling be undertaken, using a sample of different units to establish a Part L emissions calculations. The original December 2010 approved strategy calculations were based on benchmark figures which have overestimated the overall load of the development. This was reflected in the design of the energy centre where the engineering consultants had planned for a boiler capacity in the region of 6MW.

The next section will re-evaluate the emissions calculations based on a sample of different units and actual Part L SAP emissions calculations used in Phase 3 design, to establish a more accurate emissions baseline.

4) Proposed Energy Strategy Review:

The following strategy has re-evaluated the emissions figures, as the previously approved strategy as based on benchmark data. Part L SAP worksheets and code and building regulations compliance documents have been taken for sample dwellings from the Phase 3 development. The non-domestic calculation for the time being have remained as per the approved strategy, when Part L SBEM data is available this will be added to the final calculations.

Non-Domestic Building Type	Unit Size (m^2)
Office	500
Retail	800
Community	250

Domestic Building Type	No. Units
1 Bedroom Flats	333
2 Bedroom Flats	308
3 Bedroom Flats	13
3 Bedroom Houses	75
4 Bedroom Houses	29
5 Bedroom Houses	28
6 Bedroom Houses	3
Total	789

4.1) Baseline – Non-domestic

Non-Domestic Building Type	Unit Size (m^2)	Heating kWh/m^2	Hot Water kWh/m^2	Cooling kWh/m^2	Electricity kWh/m^2
Office	500	85	12	14	38
Retail	800	140	10	30	106
Community	250	200	139	10	76

Non-Domestic Building Type	Unit Size (m^2)	Heating $KgCO_2$	Hot Water $KgCO_2$	Cooling $KgCO_2$	Electricity $KgCO_2$
Office	500	8,245	1,164	2,954	8,018
Retail	800	21,728	1,552	10,128	35,786
Community	250	9,700	6,742	1,055	8,018

Non-Domestic Building Type	Unit Emissions ($KgCO_2$)
Office	20,381
Retail	69,194
Community	25,515
Total Non-domestic	**115,089**

Baseline – Domestic

All domestic energy and emissions data are based on actual design Part L SAP calculations, as assessed for phase 3.

Domestic Building Type	Area m^2	No. Units
1 Bedroom Flats	54	333
2 Bedroom Flats	83	308
3 Bedroom Flats	116	13
3 Bedroom Houses	111	75
4 Bedroom Houses	140	29
5 Bedroom Houses	158	28
6 Bedroom Houses	165	3
Total	-	789

Unit Ref	Area	TER	Unit Emissions	No. Units	Total Emissions
	m2	$KgCO_2/m^2$	$KgCO_2$/annum		$KgCO_2$/annum
	SAP (box 4)	-	-	-	-
1 Bedroom Flats	54	22.15	1,205	333	401,263
2 Bedroom Flats	83	23.94	1,999	308	615,607
3 Bedroom Flats	116	21.18	2,446	13	31,802
3 Bedroom Houses	111	18.33	2,035	75	152,597
4 Bedroom Houses	140	17.12	2,397	29	69,507
5 Bedroom Houses	158	19.61	3,098	28	86,755
6 Bedroom Houses	165	19.16	3,161	3	9,484
Total Domestic Baseline Emissions				**789**	**1,367,015**

Building Type	Site Emissions
Non-domestic	115,089
Domestic	1,367,015
Total site emissions	**1,482,104**

4.2) Be Lean

The following table demonstrates the changes in passive design considerations between the different approved and draft strategies; plus comparisons with the recommendations of Islington Environmental Design Planning Guidance, which was adopted in October 2012.

Comparative Residential Passive Improvements					
Component		Strategies			
		Islington Guide	Approved Dec 10	Draft Feb 11	Revised Sep 13
U values (W/m2/K)	Windows	1.50	1.80	1.50	1.50
	Ground	0.13	0.25	0.20	0.18
	Walls	0.20	0.22	0.18	0.15
	Roof	0.13	0.25	0.10	0.18
Air permeability ($m^3/m_2/hr$)		5.0	7.0	4 - 5	5.0 min
Ventilation strategy		-	MEV	MVHR	MEV

MVHR

It is the intent to review the passive strategies at each new phase of the development, to take full advantage of potential industry improvements and post-occupancy experience.

Phases one to three have been served via the approved strategy which was for continuous extract ventilation (MEV); Part F System 3. This type of system continuously extracts air at a reduced rate (with timed boost facility) from kitchen and other wet rooms, with make-up air provided via window trickle vents. This type of system provides a reliable means of ventilation with low energy use (SAP appendix Q rated) and requires no maintenance to be taken by the resident or housing association.

Mechanical Ventilation with Heat Recovery (MVHR) is a whole house ventilation system where air is supplied as well as extracted; Part F System 4. The proposed benefit of MVHR is that heat is recovered from the extracted air and used to preheat the incoming air. This is beneficial in winter when the air outside is lower than the desired internal temperature and thus preheating the air reduces heating demands.

MVHR is often suggested as a further passive improvement over MEV and suitable for building with high thermal air-tightness (<$3m^3h.m^2$).

MVHR consists of two fans (supply and extract) where a MEV system only has one, therefore MVHR have higher specific fan powers although savings through heat recovery mean that MVHR should be more efficient than MEV. It should be noted that MVHR systems contain filters (typically two); these filters need to be cleaned regularly and typically replaced at least twice annually. MVHR therefore requires attention by the residents (or housing association) to clean and replace the filters. In a high density development this is a large and costly maintenance regime to implement. On a phased scheme where there is continuous construction dust over a number of years, will require the MHVR filters to be cleaned much more frequently.

A report from the NHBC Zero Carbon Hub *'Mechanical Ventilation with Heat Recovery in New Homes'* July 2013; has highlighted concerns regarding the ability of MVHR to provide suitable air quality. The report highlighted several case studies where there was a large variation in performance; identifying that performance is related to installation, commissioning and often misuse (e.g. turning the system off or not cleaning the filters). The report suggests there is a lack of quantitative data on the actual performance of MVHR which is required as part of Government research activity to inform future revisions to Approved Documents F and L.

As there are case studies suggesting that MHVR often does not deliver actual energy savings and air quality, especially when filters are not cleaned and replaced regularly; at this time MVHR is not considered a guaranteed level of passive improvement for the development. The additional maintenance requirement for the occupants (whom are already subject to new technologies, i.e. HIU and heat metering and billing systems) it is unlikely that the MVHR would be kept to an optimum performance condition.

A study due to be released in 2014 '*A meta-study of MVHR systems in new housing*' should provide the much needed quantitative data on the performance of MVHR systems and their maintenance and use. This report will help inform future design decisions of incorporating MVHR into later future phases.

A further study into overheating from the NHBC *'Understanding Overheating: where to start' (2012)* has identified that MVHR potential distributes unwanted heat around the dwelling. In a development this is likely to have increased internal gains (i.e. DH pipework and HIU), it would not be desirable to install a system that would not benefit the heat reduction measures being installed.

<u>Air Tightness</u>

The Islington Environmental Design Planning Guidance, states that where MVHR systems are being proposed the air tightness should be below 3.0 $m^3h.m^2$. Where MEV systems are proposed the air tightness should be below 5.0 $m^3h.m^2$. The minimum design performance expected at Packington for phase three onwards is 5.0 $m^3h.m^2$, however this figure has been routinely succeeded in the first two phases (where the expectation was 7.0 $m^3h.m^2$), achieving the typical following air pressure test results:

UNIT	**CERTIFICATE NO.**	**TEST RESULT ($m^3/(h.m^2)$)**
214	Packington Estate Ph 2, 214	3.01
218	Packington Estate Ph 2, 218	4.33
250	Packington Estate Ph 2, 250	4.96
256	Packington Estate Ph 2, 256	4.82
267	Packington Estate Ph 2, 267	4.59
268	Packington Estate Ph 2, 268	4.20
269	Packington Estate Ph 2, 269	3.31

<u>Summary</u>

The following table outlines the domestic energy and emissions requirements per sample unit. SAP worksheet boxes have been given for calculation reference. SAP worksheets are included in appendix A.

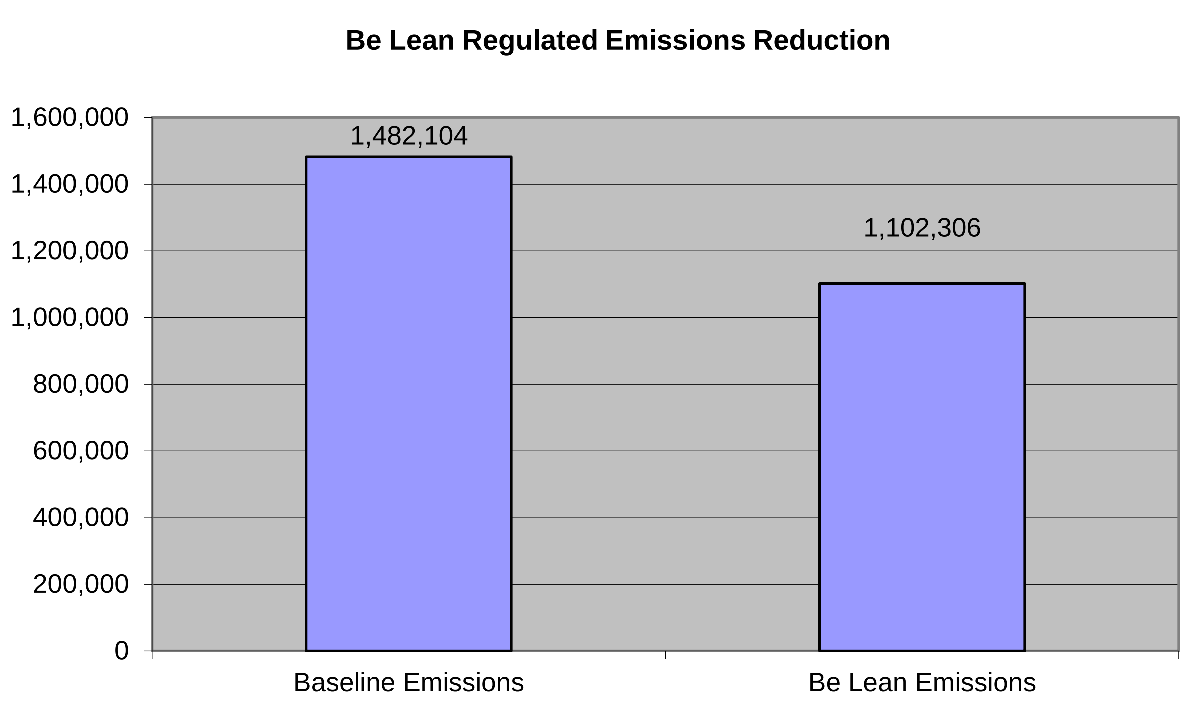
	Space & Water Heating		Auxiliary Power		Lighting		Unit Total	
	kWh/ Annum	$KgCO_2$/ Annum	kWh/ Annum	$KgCO_2$/ Annum	kWh/ Annum	$KgCO_2$/ Annum	kWh/ Annum	$KgCO_2$/ Annum
Domestic Building Type	SAP (box 51+ 81)	EF ~ 0.194	SAP (box 88)	SAP (box 114)	SAP (Appendix L)	(box 116)	-	-
1 Bedroom Flats	3,636	705	51.8	22	248.59	105	3,936	832
2 Bedroom Flats	5,606	1,088	72.37	31	704.63	297	6,383	1,415
3 Bedroom Flats	7,102	1,378	132.81	56	552.57	233	7,788	1,667
3 Bedroom Houses	5,963	1,157	101.19	43	890.82	376	6,955	1,575
4 Bedroom Houses	7,113	1,380	130	55	1,091	460	8,333	1,895
5 Bedroom Houses	8,964	1,739	146	62	1,228	518	10,339	2,319
6 Bedroom Houses	45,851	8,895	150	63	1,344	567	47,344	9,525

Domestic Building Type	Unit Emissions	No. Units	Total Emissions
	KgCO2/annum	-	KgCO2/annum
1 Bedroom Flats	832	333	277,103
2 Bedroom Flats	1,415	308	435,957
3 Bedroom Flats	1,667	13	21,672
3 Bedroom Houses	1,575	75	118,157
4 Bedroom Houses	1,895	29	54,955
5 Bedroom Houses	2,319	28	64,934
6 Bedroom Houses	9,525	3	28,576
Total Domestic Be Lean Emissions			**1,001,354**

Building Type	Unit Emissions
Non-domestic	100,952
Domestic	1,001,354
Total site emissions	**1,102,306**

Baseline Emissions	KgCO2 / Annum	1,482,104	-
Be Lean Emissions	KgCO2 / Annum	1,102,306	26%

The calculations are demonstrating a high contribution of emissions reduction to passive measures. This is attributed to the SAP 2005 methodology favouring passive elements. It is also noted that Phase 3 (i.e. the sample dwellings taken) has an improved passive design over Phase 1 and 2. Part L calculations for phases 1 and 2 can be reviewed to ensure the same level of passive measures exists or if calculations need adjusting.



4.3) Be Clean

In line with the February 2011 draft strategy and current London planning guidance, the energy strategy has been based on achieving as high as possible emission reductions via a district network CHP. The main heating system within the SAP calculations is a CHP to achieve a minimum of 44% emission reductions.

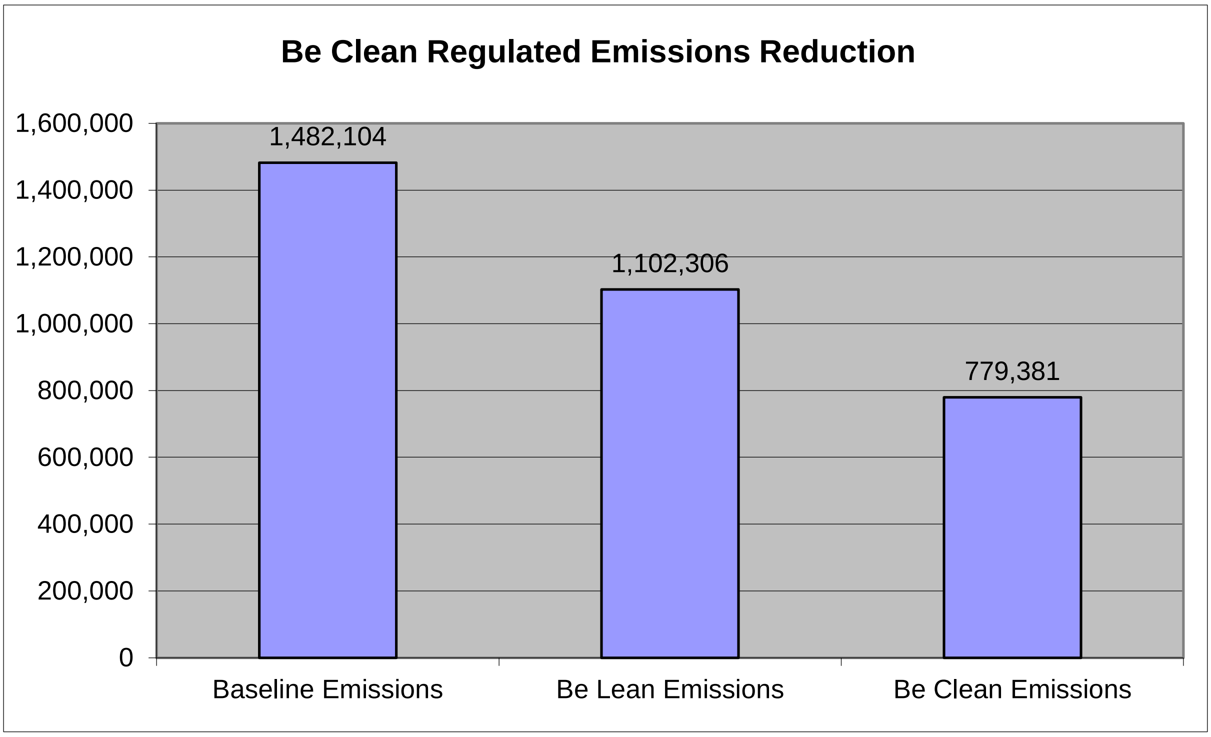
	CHP Space & Water Heating	Gas Boilers Space & Water Heating	Auxiliary Power	Lighting	Unit Total
	$KgCO_2$	$KgCO_2$	$KgCO_2$	$KgCO_2$	$KgCO_2$
Domestic Building Type	(box 108 + 112)	(box 110 + 113)	(box 88)	(box 379)	-
1 Bedroom Flats	-127	555	22	105	555
2 Bedroom Flats	-195	856	31	297	989
3 Bedroom Flats	-248	1085	56	233	1127
3 Bedroom Houses	-208	911	43	376	1122
4 Bedroom Houses	-248	1087	55	460	1354
5 Bedroom Houses	-312	1369	62	518	1637
6 Bedroom Houses	-305	1337	63	567	1662

On average the CHP thermal load is approximately 40% of the domestic heating and hot water demand.

Unit Ref	Unit Emissions	No. Units	Total Emissions
	$KgCO_2$/annum	-	$KgCO_2$/annum
1 Bedroom Flats	555	333	184,980
2 Bedroom Flats	989	308	304,589
3 Bedroom Flats	1,127	13	14,647
3 Bedroom Houses	1,122	75	84,130
4 Bedroom Houses	1,354	29	39,260
5 Bedroom Houses	1,637	28	45,837
6 Bedroom Houses	1,662	3	4,986
Total Domestic Be Clean Emissions			**678,429**

Building Type	Unit Emissions
Non-domestic	100,952
Domestic	678,429
Total site emissions	779,381

Baseline Emissions	KgCO2 / Annum	1,482,104	-
Be Lean Emissions	KgCO2 / Annum	1,102,306	26%
Be Clean Emissions	KgCO2 / Annum	779,381	47%



4.4) CHP Size

From the above Part L calculations a CHP would need to offset 322,924kgCO2 to achieve overall 47% emissions reductions of Part L baseline.

The approved and draft strategy considered two sizes of CHP, with different operating hours; 145kWe/230kWt (approved) at 21 hours and 250KWe/326kWt (draft) at 23 hours. From our recent discussions with CHP manufactures, review of other schemes and analysis with energy broker's, suggests the optimum operational and economic running hours of a CHP is 17 hours per day.

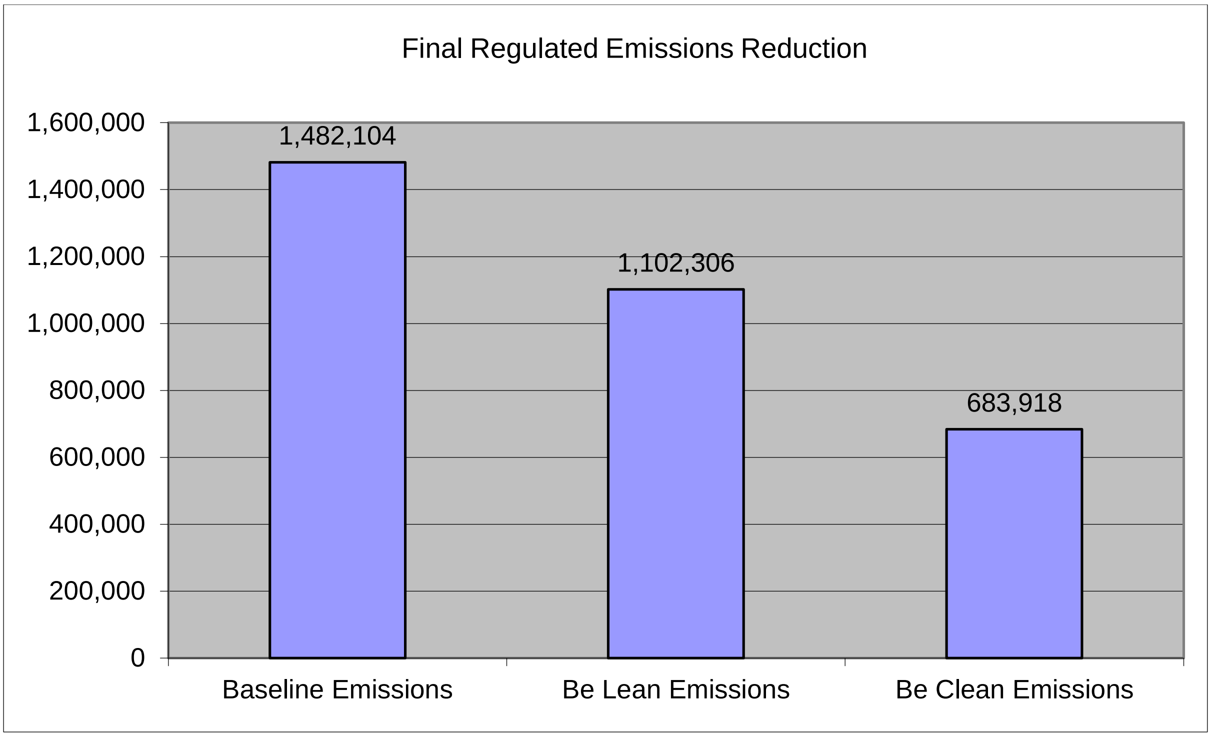
Several CHP sizes have been compared in order to demonstrate emissions reduction when operating for 17 hours per day.

The following calculations methods have been used to calculate emissions:
CHP Emissions = Fuel input (KW) x Carbon factor of fuel (natural gas - 0.194)
Heat Emissions Offset = Heat Output (KWt) x Carbon factor of offset heat (natural gas - 0.194)
Electricity Emissions Offset = Electric Output (KWe) x Carbon factor of offset grid electricity (0.568)
Net Emissions Reductions = [Heat Offset + Electricity Offset] - CHP Input Emissions

Electrical output	Total heat output	Fuel input (LHV)	Electrical offset	Total heat offset	Fuel emissions	Net Emissions Reductions $kgCO_2$/hr	Net Emissions Reductions $kgCO_2$/annum
kWe	kWth	kW	$kgCO_2$	$kgCO_2$	(LHV)	$kgCO_2$	6200hrs
135	217	392	77	42	76	43	265,140
152	236	432	86	46	84	48	299,776
210	337	604	119	65	117	67	418,726

A CHP in the range of 210kWe could provide emissions savings in excess of the 322,924$kgCO_2$ minimum required

Baseline Emissions	$KgCO_2$ / Annum	1,482,104	-
Be Lean Emissions	$KgCO_2$ / Annum	1,102,306	26%
Net CHP emissions Saving	$KgCO_2$ / Annum	-418,388	-
Be Clean Emissions	$KgCO_2$ / Annum	683,918	53%



Comparative CHP Sizes			
Strategy Issued	Dec-10	Feb-11	Sept 13
	Approved	Draft	Suggested
Fuel Type	Natural Gas	Natural Gas	Natural Gas
kWe Electrical	145	250	210
kWt Thermal	230	326	337
KW Input	460	657.25	604
Thermal Efficiency %	50	49.6	50
Heat to Power Ratio	1.6	1.6	1.6
Assumed Operating Hrs	15-21	23	17
Annual Hours	7000-7599	7867	6200
CHP Thermal Contribution	45-50%	79%	40-50%
Emissions Used (Gas)	678,134	1,003,140	726,491
Thermal Emissions Offset	339,067	559,054	405,343
Electrical Emissions Offset	625,847	1,117,114	739,536
Net Emissions Saved	286,780	673,028	418,388
CHP Percentage Emissions Reduction	18%	27%	28%

Preparing for a District Wide Area Network

As part of the revised strategy Islington have requested that the details of how the existing energy centre could potentially connect to a future larger District Energy Network. Reviewing the current guidance from Islington on the performance and technical requirements of district energy schemes (note this literature was released post construction of the energy centre at Packington), the following table highlights the key performance and technical points and how the existing energy centre has the facility to meet them. Energy centre schematics and site heating mains distribution is included in Appendix B.

Islington Guidance	Packington Energy Centre
The selection of low temperature operating systems such as under floor heating systems to significantly reduce return temperature. Low flow rate radiator circuits for buildings, complete with thermostatic control. Where used radiator circuits should be designed to operate satisfactorily at low temperatures with a maximum 70°C / 50-40°C flow and return (as opposed to the traditional 82°C / 71°C) without compromising the ability of the system to deliver the required level of heat.	The scheme design has been based on radiator circuits within dwellings, from the requirements of the employer and residents preferences. These radiator systems were principally designed on a high flow temperature. However, as the experience of the current phases have demonstrated excellent thermal performance of the dwellings, the scheme is currently being tested at reduced flow temperatures all year round. Maximising the opportunity for lower return temperatures.
The use of direct instantaneous hot water generation should be considered.	Instantaneous hot water generation is used on site.
Control Valves and Variable Speed Pumping	The network and HIU use two port and pressure control valves; as well as remote pressure sensors to control the speed of the pumps to reduce demand.
Circuit Mixing: Wherever possible, water returning from one heating circuit at a high temperature should be used in a second circuit. This is not always possible since one circuit may demand energy at a different time to another.	The system is single circuit and designed on a constant temperature.
Metering: Energy meters measure volume flow rates and supply and return temperatures to provide an accurate record of energy usage.	Energy meters are provided within the energy centre and at entry to each block.
Route onto and through site: It is a requirement that there is space on site for piping connecting the point at which primary piping come onto onsite with the onsite heat exchanger.	Refer to Appendix B for a schematic and site plan to demonstrate the possible route and utilisation of plant for future connection.
Plant Layout: New developments where the detailed connection arrangement to a DEN is unknown will require physical space to be allotted for installation of heat exchangers and any other equipment required to allow connection.	The energy centre consist of 3No plate heat exchanges which are in excess of the total expected final demand onsite. Therefore one of the existing heat exchanges can be utilised to provide the connection from a future DEN to the energy centre.

4.5) Be Green

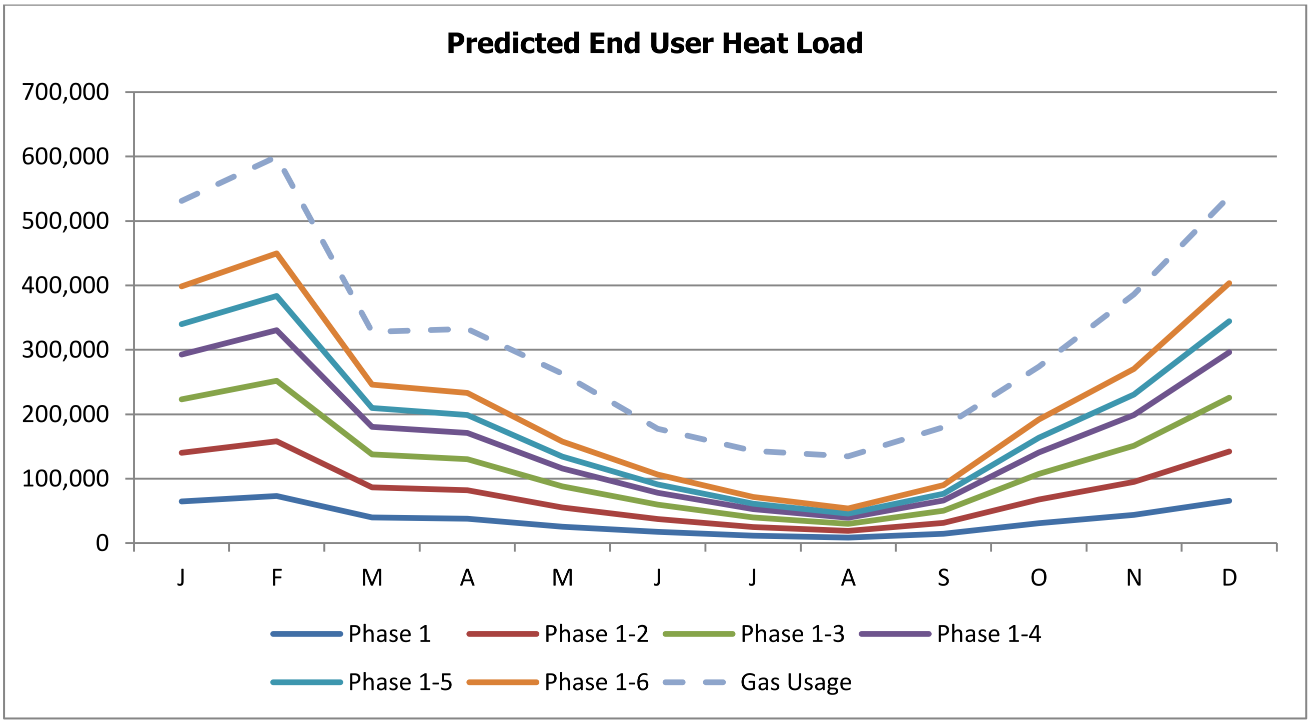
The Be Lean and Be Clean measures have surpassed the emission reductions requirements of the London Plan and Islington; furthermore the new energy strategy exceeds the emissions reductions expected in the approved strategy. Removing the renewable element of a biomass boiler has been demonstrated to provide a better technical and economical solution to the development.

5) Actual Site Heat Meter Data:

As part of the on-going phased design of the Packington estate, the delivery team are continually reviewing the energy strategy approach in terms of passive design, energy centre operation and control strategy, as well as collecting and monitoring actual heat demands onsite.

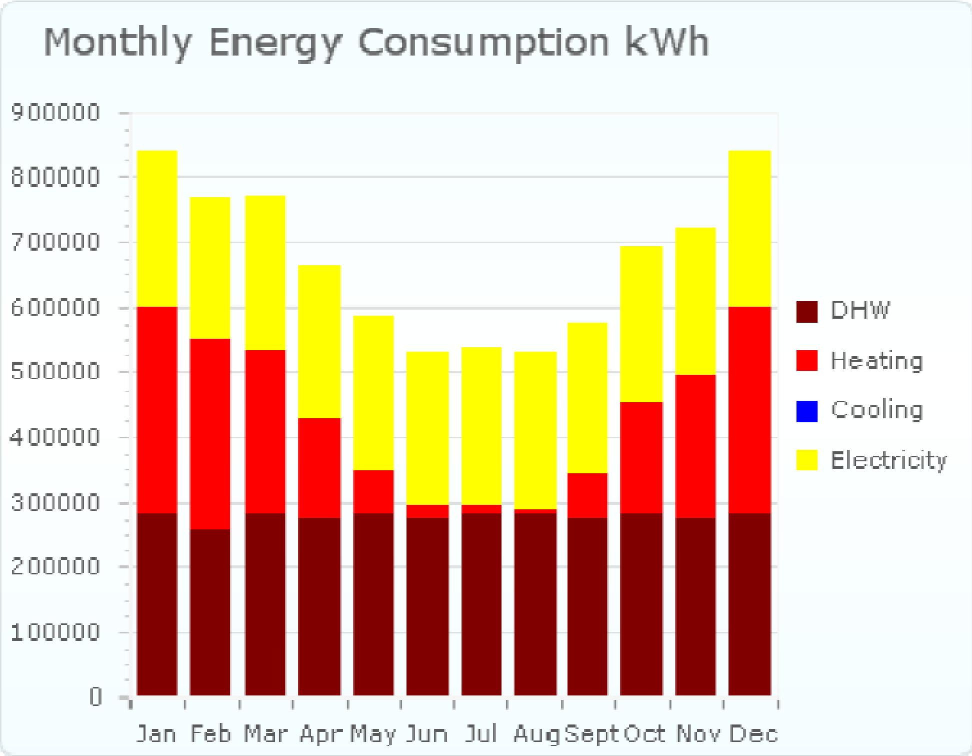
As part of this strive to understand and optimise the energy on site, the heat meter data collected from the end users has been collected and amalgamated to create an average end user heat demand. The data has then been proportioned to the number of occupied dwellings per completed phased to predict an actual future end-user heat demand onsite.

The following graph demonstrates the predicted future end-user heat demand onsite per phase of completion.



As a total yearly figure, the estimated future end-user heat demand for the site is 2,245,312KWh. Based on fuel source of natural gas this would equate to 435,590 $KgCO_2$/annum. Which is effectively half that predicted by the Part L SAP 2005 calculations at 839,053 $KgCO_2$/annum.

Comparing this graph with the load profile estimated in the approved Energy Strategy (Dec 10), demonstrates the likely previous overestimate of heat demand.



6) Conclusions:

This report compared the energy strategy submitted and approved by Islington, prepared by Hoare Lea in December 2010 *'Packington Phase 3-6 Energy Strategy; Issue 2.1';* the initial discussions to revise the approved strategy between Hoare Lea and Islington in February 2011; and the current site energy and emissions calculations discussed with Islington in October 2013.

The report demonstrated how each of the strategies (Dec 10, Feb 11 and Sep 13) had formed the respective calculations and the percentage emissions saving.

Due to the change of emphasis in London Planning policy to prioritise CHP and overall emissions reduction, the later strategies of February 11 (draft) and September 13 (proposed) opted to remove the biomass boiler and upsize the CHP to achieve the same relative emissions reductions percentage.

The report has identified that Islington council previously noted that the load calculations from the development (from strategies December 10 and February 11) appeared abnormally high given the high passive performance of the scheme and had requested more rigorous modelling be undertake, using a sample of different units to establish a Part L emissions calculations. This revised strategy has addressed this and outlined revised calculations in this report based on current Part L SAP calculations for Phase 3. Additionally this report has given actual data being monitored onsite which demonstrates a further reduced heat demand that will result in further emissions saving from the CHP, than currently modelled.

Percentage Reduction in CO_2 emissions	Approved	Proposed
Energy Efficiency	17%	26%
CHP	18%	28%
Renewables	16%	-
Total	44%	53%

This report provides an up to date strategy in line with current planning policy, actual Part L calculations and current site performance.

Appendix A
Sample SAPs

Appendix B
CHP Proposal & DHN Future Proof

Appendix C
Energy Centre Phased Plant Implementation

The following table provides a simple timeline of the proposed phasing of the development and the implementation of key items of plant; past and future. The table does not include the associated pipe and fittings or network distribution extensions to the future phases. At the completion of each phase the control strategy and commissioning of key plant will be reviewed to optimise performance.

Phase	Date	Plant	Suitable for Phases
One	September 2007	1500kW Boiler 1A	Four to Six
		2No. 350kW Boiler 2A & 2B	One to Two
		Primary Pumps 3No. (S1, S2 & S3)	One to Six
		Secondary Pumps 3No. (S4, S5 & S6)	S4 – One S5 – Four to Six S6 - Four to Six
		Plate Heat Exchangers 3No. 3.5MW	One to Six
Two	March 2010	2No. Modulating Condensing Boilers 720kW 3A & 3B	One to Five
Three	July 2012	Secondary Pumps S7	One to Three
Four	August 2014	CHP and Thermal Stores	Four to Six
Five	March 2016	N/A	-
Six	April 2016	N/A	-

Final Plant Gas Boiler Capacity – 3.6MW
CHP Capacity – 210kWe / 337kWth
Plate Heat Exchanger Capacity (including future wider DN connection) – 3No. 3MW

CHP Selection
Current proposed unit is an *ENER-G 210* (210kWe / 337 kWth). Details are included in Appendix B.

Plant Room Control Strategy
The current plant is served from a range of natural gas boilers. The new CHP will form the lead heat source when installed and working to charge the buffer vessels will provide the base thermal load for the development. The CHP is designed to charge the thermal stores to 85^{o}C. A variable temperature circuit in the plant room ensures that the flow temperature to the heat network can be varied seasonally, but the CHP can still run at the higher temperatures.

While the CHP is undergoing maintenance, the system will be served by the natural gas boilers.

Pumping strategies are being reviewed at each phase completion of the scheme to ensure the energy centre is running efficiently as possible.

Three plate heat exchangers hydraulically separate the energy centre primary system from the district network (secondary system). This allows for any future heat sources to be seamlessly integrated into the energy centre, including any potential borough wide network.

Maintenance

The energy centre is maintained and operated by a Contracts Energy Manager (CEM) company. The CEM provides scheduled monthly maintenance to all plant and reactive response upon reported failures. A Building Energy Management system (BEMs) provides automatic control of the system and remote system alerts. The CHP and associated equipment will be included within the same contract arrangement for all maintenance and operation.