Mr. Sammy Mak

102-104 Kew Road
Richmond
Surrey TW9 2PQ

Energy strategy – scheme 2

Incorporating the baseline and
renewable energy statement

20/2649 ene rev A

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Estimation of Energy Demand for the proposed development

Background

The proposal consists of the change of use/refurbishment of the two upper floors plus loft space to form four new studio apartments and three one-bed units on these floors plus ancillary works following the alteration of the existing building on the development site at 102-104 Kew Road, Richmond, Surrey TW9 2PQ.

Where new materials etc. are provided, the development will employ a full range of sustainable measures commensurate with BREEAM requirements, responsible purchasing of materials and services on the project; existing materials will be re-used wherever possible.

The subjects dealt with below are in line with the Council's requirements taken from the relevant planning guidance.

AED Design has been commissioned by Mr. Saher Chaudhry to prepare this 'energy strategy' the purpose of which is to show compliance with the 'Local Plan Policy' of the London Borough of Richmond (adopted 03 July 2018) and the 'Sustainable Construction Checklist'.

Policy LP20 [climate change adaption] requires that all new development should minimise the effects of overheating as well as minimise energy consumption and policy LP22 [sustainable design and construction] requires that development of 1 dwelling unit or more, or 100m^2 or more of non-residential floor-space will be required to comply with the 'Sustainable Construction Checklist'; and achieve a minimum 35% reduction on carbon dioxide emissions over the building regulations 2013 utilising the following steps.

1) Analysis of the site.
2) Baseline energy assessment.
3) Supplying energy efficiently (CHP).
4) Assessment of the different renewable energy technologies available for the site.
5) Calculation of the amount of site renewable energy.
6) Conclusion.

As the development consists of the change of use/refurbishment to create new apartments to the upper floors and loft space the calculations for the dwellings will be prepared using SAP2012

software (NHER/Elmhurst) and the calculations for the commercial unit will be prepared using benchmark figures.

1.0 - Analysis of the Site

The site, 102-104 Kew Road, is situated on the south-east side of Kew Road midway between its junctions with Selwyn Avenue and Evelyn Gardens on the outskirts of Richmond town centre.

It consists of the site of an existing commercial use at ground level with a pair of mid-terraced three/four-bedroom dwellings over. The site is generally level and sits within an area of mixed commercial/residential units and it is surrounded by 3/4 storey structures.

To the north-west (front) is 'Kew Road and nos. 147+149 Kew Road, to the north-east is no.106 Kew Road, to the south-east (rear) is the rear garden to no. 2 Selwyn Avenue and to the south-west is no. 100 Kew Road.

The scheme consists of the change of use/refurbishment of the existing mid-terrace three storey building within a row of terraced units to form four new studio and three one-bedroomed apartments plus ancillary works to the existing pair of semi-detached maisonettes.

The proposed units are oriented south-east/north-west with the front of the building (main entrance) facing north-west; the location is sheltered by other buildings to all sides.

2.0 - Baseline Energy Assessment (assessment of the annual energy demand)

The calculations (summarised below) have been carried out using SAP2012 based upon the floor plans elevations, sections and site plan etc. provided by Mr Saher Chaudhry:

Site location plan

102-104KEW/PA1A	-	existing and proposed ground floor plans
102-104KEW/PA2	-	existing first + second floor plans
102-104KEW/PA3	-	proposed first + second floor plans
102-104KEW/PA4A	-	existing and proposed loft plans
102-104KEW/PA5A	-	existing and proposed front elevations
102-104KEW/PA6A	-	existing and proposed rear elevations
102-104KEW/PA7A	-	existing and proposed roof plans

Assessing the annual energy demand (known as the 'Baseline Energy Calculation') is all the energy that would be used by the development for heating, cooling and power if no energy efficiency measure or renewable energy generation was applied.

The baseline energy figure is dependent on the methods of heating and cooling that would be installed as a minimum provision; it is the energy delivered to the site via utilities – usually gas & electricity.

How this energy has been calculated:

- Dwellings – using SAP2012 and NHER
- Other energy uses not covered in above – estimated separately

2.1 residential

Table A - Calculation Methodology of Baseline Annual Energy Use

Area	Energy use	Fuel	Calculation method	Reference
Residential	Space heating	Gas	SAP2012	BRE/ADL1A
	Hot water	Gas	SAP2012	BRE/ADL1A
	Lights & appliances	Electric	SAP2012	BRE/ADL1A
	Cooking	Gas/Electric	SAP2012	BRE/ADL1A
	cooling	n/a	---	
	Communal lighting	Electric	Assessment	
	Communal heating	Electric	Assessment	
External	Lighting	Electric	Benchmark	

Table B - Basis of calculation – schedule of floor area[s] for the development

Initial SAP calculations have been carried out on the dwelling and the annual energy values from the SAP calculations for each dwelling type have been applied to the number of each unit of that type shown in the accommodation schedule.

House type	Floor area (m²)
Flat 1 – studio flat	46.0
Flat 2 – one bed flat	51.0
Flat 3 – studio flat	38.5
Flat 4 – one bed flat	53.0
Flat 5 – one bed flat	50.0
Flat 6 – studio flat	37.0
Flat 7 – studio unit	37.0
Total	312.5

Table C - Basis of calculation – B Regs. dwelling CO_2 emissions using baseline specification

Plot no.	TER	Total emissions corresponding to TER	DER	Total emissions corresponding to DER	% improvement over part L 2013 TER
Flat 1	32.18	902	102.65	2812	(-176.09%)
Flat 2	35.35	876	82.57	2268	(-133.58%)
Flat 3	25.37	934	55.68	2407	(-119.47%)
Flat 4	32.02	876	87.54	2929	(-174.64%)
Flat 5	35.27	796	94.02	2403	(-166.57%)
Flat 6	33.38	781	71.69	1825	(-114.77%)
Flat 7	22.38	867	45.68	1931	(-104.11%)
Total (site average)	31.42		79.65		(-145.24%)

Specification used for baseline calculation

- Floor 1 (ground) – n/a for proposal.

  Floor 2 (upper - over commercial) – assumed existing timber upper floor with insulation to meet the building regulations AD part B (fire)/part E (sound) U-value = 0.25W/m²K (to meet AD part L).
- Wall 1 (external wall) – assumed brick faced existing solid masonry wall with no added insulation U-value = 2.10W/m²K (appendix S/by calculation).

  Wall 2 (party) – assumed solid masonry party to adjacent structure/building U-value = 0.0W/m²K (SAP2012 default).

  Wall 3 (sheltered – common/flat) insulated masonry/timber framed wall U-value = 0.302.10W/m²K (appendix S).

  Wall 4 (external – new) – 300mm overall insulated cavity masonry wall, U-value = 0.30W/m²K (SAP2012 default).
- Roof 1 (pitched - joist) - roof finish on insulated timber roof structure U-value = 0.16W/m²K (SAP 2012 default).

  Roof 2 (flat) - roof finish on insulated timber roof structure U-value = 0.25W/m²K (SAP2012 default).
- Windows – PVCu/timber framed double glazed sash windows U-value = 2.0W/m²K (SAP2012 default).
- Doors [flat entrance] – solid timber framed doors to achieve 3.0W/m²K (SAP2012 default).
- Ventilation – individual extract fans provided to the wet areas (kitchens + bathrooms etc.).
- Air permeability – default air permeability of 15.00m³/hm² @50pa to be used for calculation.
- Heating – electric panel heaters for heating controlled by appliance stat and programmer.
- Hot water from main plus 150litre Megaflo hwc or equal.
- WWHRS – no wastewater heat recovery system provided.

- No secondary heating system provided.
- Renewable energy – none provided for baseline calculation.
- Internal lighting – min 75% low energy fittings located in accordance with AD part L1A.
- External lighting – in accordance with AD part L1A requirements.
- Thermal bridging – default y-value of 0.15W/m²K used for calculation/construction.
- Thermal mass parameter - taken as medium (250kJ/m²K) for calculation.
- Summer overheating – allowance made for cross ventilation by opening windows (as required).

3.0 – Supplying energy efficiently

The use of microgeneration CHP will be investigated for use to determine whether there is enough space to provide/locate a gas fired CHP boiler to each of the dwellings and whether it would be suitable for the size of the development.

There are six boilers available in the marketplace which will be looked at for the space heating and hot water with exhaust gases being used to generate electricity.

Heatloss calculations will be carried out on the units prior to any decision being made on the use of the method to allow boiler sizes to be determined.

Notwithstanding this the dwellings will be highly insulated and be fitted with a minimum of a gas fired boiler heating and hot water systems plus efficient system controls and be fitted with a minimum of 100% low energy light fittings to ensure that the energy supplied is done so efficiently.

Table D - Basis of calculation – using enhanced/upgrade specification (AD L1A 2013)

Plot no.	TER	Total emissions corresponding to TER	DER	Total emissions corresponding to DER	% improvement over part L 2013 TER
Flat 1	36.49	902	29.11	777	20.20%
Flat 2	34.97	876	27.47	744	21.45%
Flat 3	24.53	934	18.04	769	26.46%
Flat 4	30.04	876	22.86	732	23.90%
Flat 5	34.79	796	46.63	1128	4.19%
Flat 6	33.24	781	42.95	1054	6.58%
Flat 7	22.29	867	19.26	813	13.59%
Total (site average)	31.45		26.38		16.49%

Specification used for upgrade calculation (to meet SAP2012 – upgrades highlighted bold

- Floor 1 (ground) – n/a for proposal.

  Floor 2 (upper - over commercial) – assumed existing timber upper floor with upgraded insulated to meet the building regulations AD part B (fire)/part E (sound) and part L1 (conservation of fuel and power) U-value = 0.13W/m²K (to meet AD part L1).

- **Wall 1 (external wall) – assumed brick faced existing solid masonry wall upgraded with added insulation U-value = 0.30W/m²K (to meet AD L1B).**

  Wall 2 (party) – assumed solid masonry party to adjacent structure/building U-value = 0.0W/m²K (SAP2012 default).

  Wall 3 (sheltered – common/flat) upgraded insulated masonry/timber framed wall U-value = 0.30W/m²K (to meet ADL1B 2013).

  Wall 4 (external – new) – upgraded 300mm overall insulated cavity masonry wall, U-value = 0.28W/m²K (to meet AD L1B).

- **Roof 1 (pitched - joist) - roof finish on upgraded insulated timber roof structure U-value = 0.13W/m²K (to meet AD L1).**

  Roof 2 (flat) - roof finish on upgraded insulated timber roof structure U-value = 0.13W/m²K (to meet AD L1).

- **Windows – PVCu/timber framed sash windows with upgraded double-glazing U-value = 1.60W/m²K (to meet ADL1B 2013).**
- **Doors [flat entrance] – upgraded solid timber framed doors to achieve 1.80W/m²K (to meet AD L1B 2013).**
- Ventilation – individual extract fans provided to the wet areas (kitchens + bathrooms etc.).
- **Air permeability – air permeability taken as 5.00m³/hm² @50pa for upgrade calculation.**
- **Heating – exhaust air heat pump (NIBE) controlled by programmer, TRV's and bypass to all plots.**
- Hot water from main plus 150litre Megaflo hwc or equal.
- WWHRS – no wastewater heat recovery system provided.
- No secondary heating system provided.
- Renewable energy – none provided for upgrade calculation.
- Internal lighting – 100% low energy fittings located in accordance with AD part L1A.
- External lighting – in accordance with AD part L1A requirements.
- **Thermal bridging – accredited details used to allow calculated y-value of ≤ 0.08W/m²K used for calculation/construction.**
- Thermal mass parameter - taken as medium (250kJ/m²K) for calculation.
- Summer overheating – allowance made for cross ventilation by opening windows (as required).

4.0 - Assessment of the different renewable energy technologies available for the site

Available renewable technologies:

1. solar thermal energy (water heating)
2. biomass
3. solar photovoltaics

4a ground source heat pumps – geothermal

4b air source heat pumps

5. wind turbines
6. hydropower
7. CHP (combined heat and power)

All the above technologies have been considered for the development as follows:

No.1 - solar thermal (water heating) – this is a preferred choice for residential units based on size, practicality, the cost and the ability to locate the collectors with a suitable orientation.

However, it is not always possible to source a system that can provide the required percentage of a developments overall energy requirements from a renewable source therefore this method will be looked at alone (for comparison purposes) and in conjunction with photovoltaics to allow the determination of the most efficient and cost-effective method

No.2 - biomass – although a much favoured and efficient method of providing energy from a renewable source it is generally more suitable for large projects/dwellings in a rural setting.

Due to the site location on a main road/high street/site constraint related to boiler size, fuel storage, fuel delivery and potential particulate emissions it will not be looked at in this case as an alternative method of meeting the LPA aspiration.

No.3 – solar PV (electric) – this is a preferred method to be used for dwellings; where the main roof styles allow for the panels to be suitably orientated (south being the optimum) and the location of the dwelling (in relation to others) precludes shading from adjacent properties/obstructions.

This method will be looked at as a standalone system and in conjunction with other systems (solar thermal/micro CHP) to resolve the most efficient and cost-effective method for the development.

No.4a – geothermal (ground source heat pumps) – there is insufficient space on the development site to provide either a suitable underground pipe/loop system or borehole system, and the amount of works required, and potential costs involved mean that this method will be discounted.

No.4b – air source heat pumps – although gas is available for heating and is usually more efficient for dwellings than electricity air source heat pumps provide better results when used with larger properties.

Accordingly, the method will be looked at as part of the investigation for comparative purposes / with a view to using it for the dwellings.

No.5- wind turbines - The wind speed data website gives a predicted wind speed for the area of the site at 4.60 metres per second at a height of 10m above ground level (3.0m below the top of the roof level) or 5.40 metres per second at a height of 25m above ground level (12.0m above the top of the roof level).

Where the average wind speed is below 5.0 metres per second the installation of a domestic scale wind turbines is not recommended.

It can be seen from the website' that the wind speed for the area is suitable for a wind turbine at a height between 10m-25m above ground level. To ensure a functional system requires the turbine to be set a minimum of 10.0m above the top of the surrounding buildings/trees which would be necessary in this case (20m+).

As this is unlikely to be acceptable to either the adjacent occupants or the planning officers the method has been discounted.

No.6 - hydropower – as there is no (flowing) water source either on or adjacent to the site to allow a method of hydropower to be utilised this item has been discounted on grounds of impracticality for the size and location of the site.

No.7 – micro CHP (or cogeneration) – as noted in section 4 (above) the provision of a micro CHP boiler system will be looked at and investigated in depth to establish whether it would be practical or provide a cost-effective alternative to the PV (should it be required).

Accordingly, this method will not be used but considered as an alternative should the preferred system prove to be not practical.

5.0 - Calculation of the amount of site renewable energy

Although all the above methods have been looked at/considered for the development the arrangement of the dwellings and the location of the development will preclude several the methods from use.

To achieve the 35% improvement over the building regulations 2013 TER and also provide an effective but simple solution for the development a single use system has been considered as the most appropriate which has been set out below in table E.

Table E – Basis of calculation – Annual Energy Consumption using preferred renewable energy.

Plot no.	TER	Total emissions corresponding to TER	DER	Total emissions corresponding to DER	% improvement over part L 2013 TER
Flat 1 - (0.4 kWp PV)	36.48	902	22.92	598	37.17%
Flat 2 – (0.4 kWp PV)	34.97	876	21.38	564	38.86%
Flat 3 – (0.4 kWp PV)	24.53	934	14.29	589	41.74%
Flat 4 - (0.4 kWp PV)	30.44	876	17.78	552	40.81%
Flat 5 - (0.5 kWp PV)	34.86	796	25.19	603	27.74%
Flat 6 - (0.5 kWp PV)	33.30	781	23.05	557	30.78%
Flat 7 - (0,4 kWp PV)	22.29	867	15.50	634	30.46%
Area weighted average	31.45		25.14		35.35%

6.0 - Conclusion

The results from section 5 (table E) of the report (above) show that of the preferred system/ method could provide an improvement over the 2013 building regulations TER.

As a change of use/refurbishment scheme assessed under the building regulations AD part L1B which means that the fabric U-values are not as good as for new build; in addition there is a finite area of roof space available to provide sufficient solar panels to achieve the 35% improvement required by the LB Richmond planning validation checklist.

Accordingly, the recommendation for the development is to use the upgrade specification (exhaust air heat pumps) together with solar photovoltaic panels (as shown in table F above) that will provide a total of 3.0kWp (approx. 12m^2 – 8 panels) located in two arrays on the rear flat roof sections (as shown on the proposed roof plan) oriented to face south and elevated a minimum of 10° to ensure that they work efficiently with no over-shading from adjacent obstructions.

This will provide a 35.35% improvement for the development over the building regulations AD part L 2013 TER; it will also provide 13.61% of the development's annual energy requirement from a renewable source (solar photovoltaics [PV[).

There are several proprietary PV panel systems on the market and a specialist supplier/ manufacturer will be employed to design the most efficient and cost-effective systems to meet the required parameters set out in section 5.