Mr. John Hyland

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Energy strategy

Incorporating the baseline and
renewable energy statement

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Estimation of Energy Demand for the proposed development

Background

The proposal consists of the sub-division of the existing five-bedroom semi-detached dwelling-house to form a new two-bedroom end terrace unit and a three-bedroom mid-terraced dwelling house plus ancillary works on the development site at 96 Court Way, Twickenham TW2 7SW.

Where new materials etc. are provided, the development will employ a full range of sustainable measures (commensurate with the now defunct Code for Sustainable Homes), 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 John Hyland to prepare this 'energy strategy' the purpose of which is to show compliance with the renewable energy policy of the London Borough of Richmond '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 formation of two new terraced dwellings (two-bedroom and three-bedroom) the calculations will be prepared using SAP2012 software (NHER/Elmhurst).

1.0 - Analysis of the Site

The site 96 Court Way, Twickenham, is situated to the north side of Court Way at its junction with Egerton Road opposite Richmond upon Thames College close to Twickenham town centre.

It consists of the site of an existing two storey five-bedroom end-terrace dwelling and sits within an area of residential units and it is surrounded by 2/3 storey structures.

To the north (rear) are the rear gardens to both properties and the rear accessway serving properties in Court Way and Heathfield South (nos. 88-94 Heathfield South), to the east is the flank of no.94 Court Way, to the south is the junction of Court Way with Egerton Road and dwellings fronting it and to the west is Court Way and the flank of no.16 Egerton road facing it..

The scheme consists of the sub-division of the existing property to form a new two-bedroom end-terrace dwelling and a new three-bedroom mid-terrace dwelling plus ancillary works on the development site.

The proposed units are oriented north/south with the front entrances of the dwellings facing south; 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. prepared and issued by AJT Design Services Ltd:

CW/96/01 - existing plans and elevations

CW/96/02 - proposed plans and elevations

CW/96/03 - proposed site plan and location plan

CW/96/04 - proposed site plan

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 were 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

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 (m^2)
96 Court Way	107.90
98 Court Way	96.70
Total	204.60

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
96 Court Way	16.23	1482	42.53	4364	(-167.05%)
98 Court Way	17.63	1448	29.35	2667	(-66.48%)
Total (site average)	16.90		36.25		(-19.14%)

Specification used for baseline calculation

- Floor 1 (no.96-original ground) – assumed timber suspended floor with no added insulation U-value = 0.38W/m^2K (by calculation).

Floor 2 (no.96–rear ground) – insulated solid floor U-value = 0.25W/m2K (by calculation)

Floor 3 (no.98 ground) – insulated solid floor U-value = 0.25W/m2K (by calculation)

- Wall 1 (external) – cavity masonry wall (as-built) U-value = 1.60W/m²K (appendix S).

  Wall 2 (party) – assumed solid/filled cavity (sealed edges)U-value = 0.0W/m²K (SAP2012 default)

  Wall 3 (external) – insulated cavity masonry wall U-value = 0.30W/m²K (appendix S).
- Roof 1 (pitch-joist) – timber roof structure with insulation at ceiling joist level U-value = 0.16W/m²K (appendix S).

  Roof 2 (flat) - timber roof structure with insulation between roof joists U-value = 0.25W/m²K (appendix S)
- Windows – PVCu framed double glazed windows throughout U-value = 2.20W/m²K (SAP2012 default).

  Rooflights – PVCu/metal framed double glazed U-value = 2.20W/m²K (SAP2012 default
- Doors – half glazed PVCu framed double glazed external doors U-value = 2.40W/m²K (SAP2012 default)
- Ventilation – individual extract fans provided to the wet areas (kitchens + bathrooms etc.).
- Air permeability – air permeability taken as 10.00m³/hm² @50pa.
- Heating – gas fired condensing combination boiler (88% min efficiency) and radiator heating + hot water system controlled by room stat, programmer and TRV's to meet SAP2012.
- Hot water from main condensing combination boiler.
- 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.
- 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 in the new 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 unit prior to any decision being made on the use of the method to allow boiler sizes to be determined.

Notwithstanding this the dwelling 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
96 Court Way	15.44	1482	17.13	1664	(-10.95%)
98 Court Way	16.64	1448	18.73	1652	(-12.56%)
Total (site average)	16.01		17.89		(-11.72%)

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

- **Floor 1 (no.96-original ground) – assumed timber suspended floor with added insulation U-value = 0.21W/m²K (by calculation).**

  Floor 2 (no.96–rear ground) – insulated solid floor U-value = 0.20W/m2K (by calculation)

  Floor 3 (no.98 ground) – insulated solid floor U-value = 0.20W/m2K (by calculation)
- **Wall 1 (external) – upgraded cavity masonry wall (as-built) U-value = 0.30W/m²K (appendix S).**

  Wall 2 (party) – assumed solid/filled cavity (sealed edges)U-value = 0.0W/m²K (SAP2012 default)

  Wall 3 (external) – insulated cavity masonry wall U-value = 0.30W/m²K (appendix S).
- **Roof 1 (pitch-joist) – timber roof structure with upgraded insulation at joist level U-value = 0.13W/m²K (by calculation).**

  Roof 2 (flat) - timber roof structure with upgraded insulation between roof joists U-value = 0.20W/m²K (by calculation)
- **Windows – upgraded PVCu framed double glazed windows throughout U-value = 1.60W/m²K (to meet AD L1B 2013).**

  Rooflights – upgraded PVCu/metal framed double glazed U-value = 1.60W/m²K (to meet AD L1B 2013t
- **Doors – upgraded half glazed PVCu framed double glazed external doors U-value = 1.20W/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.**
- **Heating – Vaillant Ecotec pro 24h wall mounted gas fired condensing combi boiler (89.5% min efficient) with delayed start thermostat (DST) + flue-gas heat recovery system (FGHRS), radiator heating + hot water system controlled by room stat, programmer and TRV's to meet SAP2012.**

- Hot water from main condensing combination boiler.
- 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 for all junctions to allow y-value of 0.08W/m²K used for calculation.**
- 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 more suitable for large projects/dwellings in a rural setting.

Due to the site location close to a busy road and 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 and micro-CHP) to determine 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 can provide better results when used with larger properties.

Accordingly, in line with current thinking 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 4.80 metres per second at a height of 10m above ground level (2.0m above the top of the highest roof level) or 5.60 metres per second at a height of 25m above ground level (17.0m above the top of the highest 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

Table E – Basis of calculation – Annual Energy Consumption using upgrade specification plus renewable energy options.

Plot no.	TER	Total emissions corresponding to TER	DER	Total emissions corresponding to DER	% Improvement over part L 2013 TER
96 Court Way					
9.0m² solar + 120litre store	15.44	1482	14.53	1382	5.89%
4.0m² solar + 0.9kWp PV	15.44	1482	11.13	1017	27.91%
1.75kWp (7.50m²) PV	15.44	1482	9.89	888	35.95%
Micro CHP	15.09	1482	18.43	1741	(-22.13%)
Micro CHP + 1.75kWp PV	15.09	1482	11.20	965	25.78%
ASHP	22.07	1482	14.33	1426	35.07%
Exhaust air HP	22.07	1482	13.88	1353	37.11%
Biomass	15.09	1482	5.56	560	63.15%
98 Court Way					
9.0m² solar + 120litre store	16.64	1448	16.11	1395	3.19%
4.0m² solar + 0.9kWp PV	16.64	1448	12.28	1022	26.20%
1.75kWp (7.50m²) PV	16.64	1448	10.78	876	35.22%
Micro CHP	16.26	1448	20.88	1804	(-28.41%)
Micro CHP + 1.75kWp PV	16.26	1448	12.93	1028	20.48%
ASHP	23.82	1448	15.96	1447	33.00%
Exhaust air HP	23.82	1448	15.62	1387	34.42%
Biomass	16.26	1448	6.09	559	62.55%

Table F – 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
96 Court Way – solar PV	15.44	1482	9.89	888	35.95%
98 Court Way – solar PV	16.64	1448	10.78	876	35.22%
Total (site average)	16.01		10.31		35.60%

6.0 - Conclusion

The results from section 5 (table E) of the report (above) show that of the eight systems/methods looked at seven (all bar the use of micro-CHP) could provide an improvement over the 2013 building regulations TER.

Of these, three [solar photovoltaics (PV), an exhaust air heat pump and biomass boiler] will provide an improvement on the 2013 building regulations TER in excess of the 35% as required for the dwelling by the LB Richmond core strategy policy CP2 plus policy DM SD1 and the London Plan policy 5.2.

As can be seen the best result is shown to be the use of biomass boilers (62.86%); however, as previously noted this will not be proposed due to site location etc. the next best is shown to be an exhaust air heat pump (35.83%) this method will not be suggested as it is not considered to be appropriate for the types of dwelling or the development.

Accordingly, the recommendation for the development is to install solar photovoltaic panels that will provide 3.50kWp (approx. 15.0m^2) of solar panels which will provide a 35.60% improvement over the building regulations AD part L 2013 TER and a minimum of 20.48% of the development's energy requirement from a renewable source.

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.