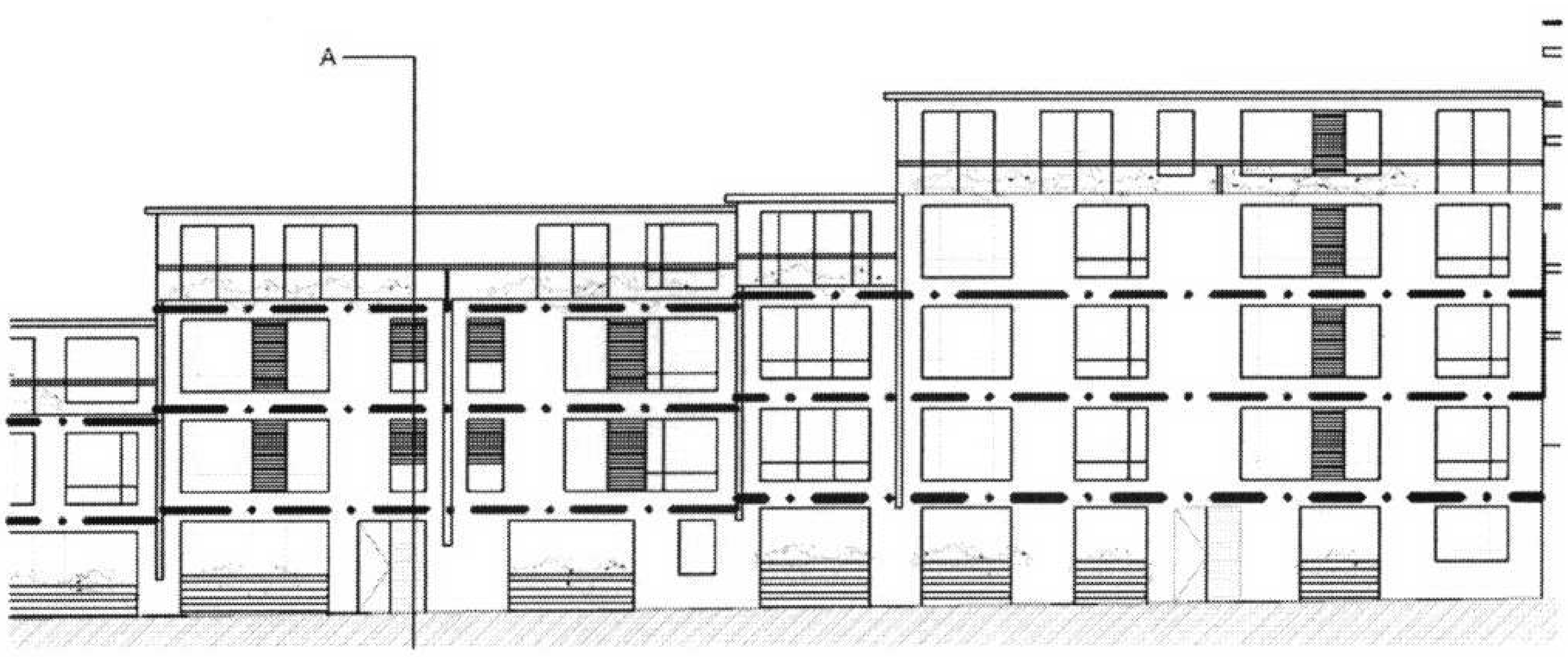
waterstonedesign
building services consultants

Kings Mews and Grays Inn Road
London

RENEWABLES STATEMENT



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1.0 Introduction

Waterstone Design have been commissioned by Grays Inn Road Properties to provide a renewable energy study for the above development. This study will concentrate on the use of Geothermal power, solar power through the use of both photovoltaics and water heaters, wind power and biomass boilers. The intention is to provide advice on how best to ensure that the development meets the 10% renewable energy quotient required to obtain Planning Consent.

The Site is located between Grays Inn Road and King's Mews, it is made up of 34 Residential Units and a single Retail Unit, the development has a dual aspect East and West. As the development is largely new build the housing will be constructed in accordance with current Building Regulations. The predicted CO_2 emissions are based upon a specific study of this building and its internal fixtures and fittings.

The total site emissions have been estimated to be in the region of 74 tons of CO_2 Per Year. This is based upon the following baseline loadings.

- 64,000 kWHrs/ Annum Space Heating
- 70,000 kWHrs/ Annum Hot Water Heating
- 113,000 kWHrs/ Annum Electricity Usage

The combined annual total is 247,000 kWHrs/ Annum

In order to save 10% of the total Site Carbon Emissions renewable energy systems should aim to achieve a reduction of 7.4 tons per year in CO_2 generated.

Additionally the following areas shall be utilised to reduce the Carbon output of the building.

- PIR Linked extract fans to bathrooms
- LED light fittings where practical and applicable
- Dimmable light fittings
- Photocell controlled external and communal lighting

Whilst this list is not exhaustive , site conditions will determine the suitability of other energy reducing measures.

Points for further investigation

- Due to the location of the Site there may be significant planning restrictions on the visual impact of some renewable energy sources which would discount their suitability.
- The use of Geothermal and Biomass would both require centralised plant, reducing Net Lettable area, additionally there is not likely to be enough ground space to install ground loops.

2.0 Solar Water Heating

The hot water supply systems for the development is very likely to be an unvented storage cylinder. The system is likely to see high levels of draw off twice daily with little further usage throughout the day and night. This type of demand pattern lends itself well to solar water heating. A large storage vessel can be utilised to make the most of the daytime sunlight reducing the need for a secondary heat source to top up the system.

It is expected that during summer months up to 100 % of the hot water supply could be met using this method of heating utilising Evacuated Tubes, however winter months would not allow a great contribution to be made with only 30% being achieved. The use of larger collectors could boost these figures however the area required to make a significant impact may have a detrimental visual impact and this is likely to be unacceptable for planning.

There are two options available in terms of solar water heating, these are flat plate types and evacuated tubes. Flat plate panels are cheaper but less efficient according to both manufacturers information and Ofgem quoted figures.

Solar Water Heating	Flat Plate	Evac Tubes
Dimensions and Quantity	2 x 1 34 No.	1 x 1 34 No.
Required Energy (HWS only) kWHrs/Annum	69496	69496
Gas Energy Demand (Eff. 86%) kWHrs/Annum	80809	80809
CO2 emitted from Gas based system (Tons)	15.677	15.677
Solar energy produced (kWHrs/Annum/m²)	430	750
CO2 emitted from Solar System (Tons)	0.25877	0.25877
Delivered Gas Replaced by Solar (kWh/y)	20468	17850
Overall CO2 saving (Tons)	8.37	7.27
% of total Site CO2 emissions saved	11.38	9.88
Cost installed (£)	34000	32300

3.0 Solar PV

Solar photovoltaics could be installed to meet some of the electrical load of the building however the initial capital cost is very high and would require specialist switching gear and space for batteries. The use of photovoltaics allows a higher percentage saving than other methods of solar energy usage because it eliminates the high carbon output required to generate electricity at a power station. This is, however, generally outweighed by the cost of installation itself. As technology improves and prices drop, photovoltaics will increase in popularity but currently they are not generally regarded as competitive and do not offer a suitable payback period, if at all, within the life expectancy of the photocells.

Active Panel Area (m²)	34
Orientation Factor	100
kWp installed	5.24
Annual Electricity Generated (kWHrs)	4454
Cost (£)	40000
Reduction in CO2 per year (Tons)	2.57
% of total site CO2 emissions saved	3.49

4.0 Wind

A small wind farm on the roof of the development will benefit from the raised location but is likely to cause an unacceptable aesthetic to the surroundings and generate unwelcome wind noise. The turbines would require installation on support poles which would require additional strengthening of the roof structure. It is unlikely that this method of renewable energy will be satisfactory for planning due to its visual and audible implications.

The DTI (Department of Trade and Industry) wind resource database shows that the location of the development has the following mean wind speeds 4.7m/s at a height of 10 metres. Wind turbines are generally not recommended for wind speeds of less than 5.5 – 6 m/s. Additionally, if the farm cannot be sited in "clear air" then the performance of the turbines could be further affected due to turbulence created by surrounding trees and structures.

Wind	Swift	XCO2
Rating (kW)	1.5	6
Turbine Diameter (m)	2.1	3.1
Height above ground (m)	18	18
Annual electricity generation (kWHrs)	1370	5475
unit installed cost per turbine (£)	4500	30000
Quantity of Turbines	4	1
Total Electricity generated (kWHrs)	5480	5475
Annual CO_2 emissions reduction (Tons)	3.11	3.10
% of site CO_2 emissions saved	4.23	4.22
Total Cost (£)	18000	30000

5.0 Ground Source Heat Pumps

A ground source heat pump can be utilised to supply the entire development with a district heating and hot water system from centralised plant. To get the best performance from this type of system it should be coupled with an underfloor heating system. There are currently three types of groundsource system which could be installed, a bore hole type with either an open or closed loop or a "slinky" system. The "slinky" system is generally a cheaper option and would offer the same performance, however such a system would require a larger surface area for the installation itself. For larger capacity systems boreholes become more cost effective. In this instance the lack of available space and the large costs involved with a district heating and hot water system coupled with the requirement for plant space are likely to render this form of renewable energy impractical.

Groundsource Heat Pump (200kW)	
Required Energy (Space and Water Heating) (kWHrs/Annum)	182675
Gas Energy Demand (Eff. 86%) (kWHrs/Annum)	212413
CO_2 emitted from Gas based system (Tons/Annum)	41.20
Assume 85% of demand is met by Geo. (kWHrs/Annum)	155273
GSHP Elec Demand Assuming COP = 3.5 (kWHrs/Annum)	51757
CO_2 Emissions from GSHP (Tons/Annum)	21.84
CO_2 emissions from pumping system (Tons/Annum)	1.84
Delivered Gas Replaced by GSHP (kWh/y) (kWHrs/Annum)	180551
CO_2 emissions saved with GSHP (Tons/Annum)	19.36
Overall CO_2 saving (Tons/Annum)	17.51
% of total Site CO_2 emissions saved	23.80
Cost installed per kW (£)	1000

6.0 Biomass

A biomass boiler will require an adjacent fuel store and regular deliveries of a suitable fuel, given that there is no current plant space allocation it is unlikely that sufficient space to accommodate this system could be found. The boiler would be able to provide all of the heating and hot water requirements of the development but would require centralised plant to be installed. The CO_2 savings available will easily allow the 10% renewables criteria to be met however servicing to ensure the reliable and efficient running of the plant may be an issue for the management company who take charge of the development. The initial cost of Biomass is significantly higher than a standard heating system however, it will, in time pay for itself in energy cost savings.

Required Energy (Space and Water Heating) (kWHrs/Annum)	133093
Gas Energy Demand (Eff. 86%) (kWHrs/Annum)	154760
CO_2 emitted from Gas based system (Tons/Annum)	30.02
CO_2 emitted from Biomass System (Tons/Annum)	4.15
Delivered Gas Replaced by Biomass (kWHrs/Annum)	154760
Overall CO_2 saving (Tons/Annum)	25.86
% of total Site CO_2 emissions saved	35.15
Cost installed per kW (£)	200

7.0 Conclusions

The renewable sources considered for this project offer varying degrees of success and value for money. Photovoltaics and Wind Generated Power fail to deliver the 10% reduction on CO_2 emissions required, whilst these figures could be improved with the introduction of larger collectors or farms the visual impact would be likely to affect the planning application and the price would be prohibitively expensive. Similarly the installation of Biomass Boilers or a geothermal system to serve the Site is unlikely to be feasible due to space restrictions and cost.

Whilst the Biomass and Geothermal systems can offer the 10% renewables comfortably they both require centralised boiler rooms and plant. The installation of solar powered water heaters for each apartment offers the CO_2 savings required for a reasonable cost. Evacuated Tube systems are becoming more and more efficient and with a 1 x 1 metre panel will be likely to meet the 10% required. Failing this a larger 2 x 1 Flat plate panel can be utilised offering over 10% but at the aesthetic cost of physically larger panels. The governing factor for the choice between the 2 types of solar panel is one of cost and availability. Both systems perform comparably for a similar outlay. The suppliers of both types of solar heating should be approached for a full quotation with the most competitive being selected, for installation.

8.0 Summary

Technology	Installed Cost	Potential Savings	Cost/kW installed	Cost/Annual ton CO_2 Saved	
	£	%CO_2 Emissions	£/kW	£/t	£/t
SWH (Evac Tubes)	32300	11.4	N/A	4442	
SWH (Flat Plate)	34000	9.9	N/A	4050	
Solar PV	40000	3.5	N/A	15564	
Wind	18000/ 30000	4.3/ 4.3	3000/ 5000	5782	9646
Biomass	40000	35	200	1546	
GSHP	200000	24	1000	11415	