NORTH EALING PRIMARY SCHOOL

EXPAND THE NUMBER OF PUPIL PLACES

ENERGY STATEMENT

Contents

1. EXECUTIVE SUMMARY

The following document describes how the development of North Ealing Primary School meets the Energy Standards required under the Mayor of London's Supplementary Planning Guidance (SPG) for Sustainable Design and Construction.

This documents also deals with the requirements by Part L Building Regulations 2006 and make references to various CIBSE Guides and Carbon Trust Website.

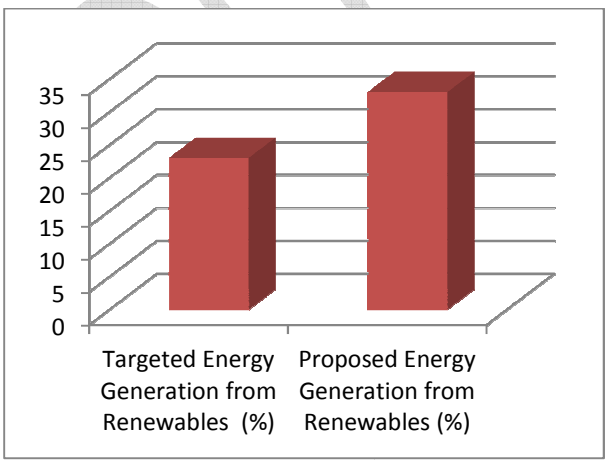
This report demonstrates,

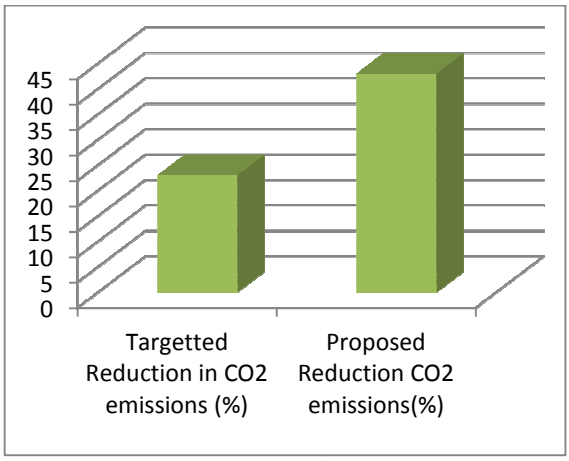
- Energy assessment of the site has been carried out.
- Comparison of various Renewable options considered
- Outlined the methodology we have adopted to achieve 40 % Reduction in CO2 emissions exceeding the target set by (SPG) 20%.

Energy demand has been calculated using baseline figures. Thermal model of the building is developed in HEVACOMP v24 and is used as basis for this report.

Following figures shows the targeted and proposed CO2 reductions and energy production from Renewable Energy

SUMMARY OF RENEWABLE ENERGY CONTRIBUTION





2. INTRODUCTION

This report has been developed to assess potential energy strategies and use of possible Renewable Energy. The analysis has been carried out using software HEVACOMP v 24

2.1. NORTH EALING PRIMARY SCHOOL

Ealing Council has commissioned Babcock to manage and Design the project to expand North Ealing Primary School. The scheme is for a new two-storey building towards the north west of the site to accommodate an additional form of entry (equivalent to 210 additional primary school children). The scheme also includes a new nursery to accommodate 100 part time equivalent children (an increase from 50PTE), demolition of some existing building accommodation, and associated playground works.

3. REVIEW OF CURRENT POLICY

According to London Plan consolidated with alterations Policy 4A.7and any subsequently amendment thereafter: Renewable Energy requires all new developments to achieve a reduction of 20 % in CO2 emissions from on-site renewable energy generation. This support the Mayor's Climate Change Mitigation and Energy Strategy and its objectives of increasing the percentage of energy generated from renewable sources.

The requirement of the above act is that all developments should seek to reduce overall CO2 emissions through energy efficiency measures and use of Renewable Energy.

The requirements for all of the above acts of legislation are that all developments Should seek to reduce overall CO2 emissions through better energy efficiency and reduction in the use of fossil fuels.

4. ENERGY ANALYSIS

Energy loads have been estimated using HEVACOMP which is based on the thermal model previously created in HEVACOMP.v24

4.1. HEVACOMP

HEVACOMP building simulation software package described as thermal modelling and compliant with CIBSE AM11 – building energy and environmental modelling. Using this software, an hourly loads analysis has been performed on a model using established usage figures to predict annual energy consumption.

These values refer back to the SBEM benchmarks for occupancy patterns, occupancy density, small power loads, and ventilation loads etc. The software uses the building geometry to generate a notional building (a building of the same size and shape and

compliant to the 2002 Building Regulations), a Target Emission Rate (TER, the carbon emission target to meet 2006 Building Regulations)

Calculation for renewable is done on the basis of baseline figures developed by software.

Following tables show the summary of benchmark energy consumption

	Baseline	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	$kgCO^2$/year
Heating (Natural Gas)	33309	5546
Hot Water (Natural Gas)	10607	1766
Auxiliary (Electricity)	6157	3306
Lighting (Electricity)	19376	10404
Total heat & hot water	43916	7312
Total electricity	25533	16198
Total	***69449***	***21022***

CO2 emissions are calculated on the basis of baseline figures published by Carbon Trust Website (ww.carbontrust.co.uk)

Carbon Emission factors	
Fuel	$kgCO_2$/kWh
Natural Gas	0.185
Grid Electricity	0.54

Summary of results from HEVACOMP are given below.

Please see Appendix A for the BRUKL output .

BUILDING ELEMENT	LIMITING U-VALUES STANDARDS W/m^2.K	PROPOSED/IMPROVED U-VALUES W/m^2.K
Walls	0.35	0.35
Floors	0.25	0.2
Roofs	0.25	0.19
Windows, roof windows and rooflights	2.2	2.2
Doors	2.2	1.94
Other Parameters		
Air permeability (m^3/m^{2}hr@50Pa)	10	10
Mechanical Ventilation with heat recovery		MHVR used with high efficiency heat exchanger (up to 70%) Energy efficient controls provide a simple control solution with BMS interface and trickle and boosts as standard. Control strategy for HRU is per Building Regulations, BB101, to maintain adequate indoor air quality and maximum average concentrations for pollutants. All units are installed with CO2 sensors to make sure that CO2 levels do not exceed 1500 ppm.

4.2. NON-REGULATED ENERGY

CIBSE Guide F has been followed for the calculation of non-regulated energy. There is no electrical cooking appliance in the kitchen. And for computer room, the value is zero as per CIBSE GUIDE F. Therefore non-regulated energy is not contributing to the energy consumption in this building.

5. PROPOSED ENERGY STRATEGY

To meet the current legislation following strategies has been adopted.

- Demand Reduction Measures
- Green – Renewable Energy

5.1. DEMAND REDUCTION MEASURES/ENERGY EFFICIECNY MEASURES

Following demand reduction measures have been adopted to reduce the CO2 emissions

- Highly efficient centralised plant such as condensing boilers and direct fired hot water calorifiers
- Heat recovery on all supply and extract ventilation plant
- Passive design measures like orientation, site layout etc. has already been taken into account.
- Improved U- values for glazing, walls and roofs from standards have been used.
- For Air-permissibility, we are within the limits. We can try to improve.
- Day lighting Aspect is utilized to minimize electricity consumption.
- Dimmers and energy efficient measures are used to reduce electrical demand.
- All the equipment should be switched off, when not in use.
- All appliances are SEDBUK Rated A

In order to significantly exceed the requirements of Part L of the Building Regulations North Ealing School will incorporate the following specific energy efficiency measures.

- **Mechanical Ventilation with Heat Recovery**

To get maximum recovery from the heat being discharge in to the atmosphere all occupied spaces at North Ealing will be mechanically ventilated. High efficiency heat exchanger on all air-handling units will recover heat from the warm air exhausting from the building to heat incoming cold fresh air.

- **Variable Speed Pumps and Ventilation Fans**

All pumps and fans have been specified with variable speed drives and constant pressure control. This means that system will be able to run at partial load as per building demand for most of the year rather than at the peak load. This is also especially beneficial for MHVR where most of the building is mechanically ventilated.

- **Airtight Building Envelope**

Air tightness plays an important role in reducing energy consumption in buildings Primarily through reduced heating demand in unoccupied spaces and heat loss overnight..

We have stipulated an air-leakage rate of 10m3/m2/s; which is maximum air tight rate required under building regulations. Mandatory air testing of the building envelope will be followed up by a requirement under the specification to seal the building to the design air-leakage rate.

- **Good Daylighting and Lighting Controls**

The new North Ealing School has been designed in order to comply both with the DfES and BREEAM requirements for good daylighting, meaning that daylight levels in all teaching rooms will exceed 2%, this maximises the use of natural light.To facilitate this, lighting controls providing occupancy sensing and daylight control have been specified, together with high efficiency fittings. This will substantially reduce energy consumption in the building.

5.2. GREEN – RENEWABLE ENERGY

The following table shows targeted and proposed CO2 emissions from renewable energy.

Required and Proposed energy generation and CO_2 emission reduction		
	Amount	**%**
	kgCO2/year	
Required CO_2 emissions reduction from renewables	4700	20
Proposed CO_2 emissions reduction from renewables	***9330***	***40***
	Amount	**%**
	kWh/yr	
Required energy generation from renewables	13890	20
Proposed energy generation from renewables	***20834***	***30***

Following are the renewable technologies considered for the school.

- **Wind Power**

Wind has been ruled out because of the relatively poor wind speeds achieved at the site. Planning issues with respect to noise and flicker from the turbines also made them difficult to locate on the site effectively. The relatively high cost of wind turbines was also a factor in their exclusion.

- **Ground Source Heat Pump**

It is proposed to use Ground Source Heat Pump to achieve the 20 % target. Underfloor heating is used in the school which makes it the best available option economically and technically. Ground Source heat pumps are used to extract heat from the ground to provide space and water heating. They take in heat from ground and release it at a higher temperature using refrigerants. Water is circulated through pipes buried in the ground and passes through a heat exchanger in the heat pump that extracts heat from the fluid. The heat pump then raises the temperature of the fluid via the compression cycle to supply hot water to the building as from a normal boiler.

Calculation for GSHP is attached in appendix.

- **Photovoltaic Panels**

Photovoltaics have been ruled out because they are cost prohibitive. Additionally they were not easily integrated into the building and because their peak production occurs during the summer when only moderate demand requirement.

- **Solar Hot Water**

Solar Hot water collectors are not proposed because their peak production occurs during the summer when only low heat load is required.

- **Combined Heat and Power (CHP)**

Although CHP is not considered as Renewable energy, but still it is clean energy. CHP in this school has been ruled out due to economic reasons. For CHP systems to be economically viable, they need to run for at least 4,000 hours per year. CHP systems produce roughly twice as much waste heat as they generate electricity. To be viable economically they require a large and constant demand for heat. This makes their application to schools problematic. Current insulation standards mean the requirement for space heating is very low and demand is present for only part of the year.

5.3. Comparison of Renewable Energy Technologies

Technology	Potential CO2 Savings	Advantages	Disadvantages	Considered/Rejected
Ground Source Heat Pump	40 %	Unobtrusive, Cost effective	Suitable for low temperature heating demands	Considered
Micro Wind		Produces grid-displaced electricity	Semi-sheltered site not ideal for wind power, expensive, visual impact, noise concerns, intermittent production of power	Rejected
Solar PV		High grade energy. Unobtrusive. Low maintenance.	Peak production during times of community occupancy only	Rejected
Solar Hot Water Collectors		Unobtrusive.	Peak production during times of community occupancy only	Rejected
CHP		Clean Energy, utilization of rejected waste heat	Economically not feasible (requires 4000 running hours)	Rejected

6. CONCLUSION

In this document we have assessed school's energy consumption using HEVACOMP. Software. The figures included shows that 40% reduction can be achieved by the use of GSHP.

The renewable technology proposed for this development meet the London Borough of Ealing's aspirations through carefully selected system.

Following GSHP system have been selected to serve the purpose.

GROUND SOURCE HEAT PUMP	
Heat pump type	1 X 17 kW Brine to Water
Ground Collector Type	Bore Hole Ø40, 2nos X 130M
Heating Distribution System	Low temperature Underfloor Heating
Design Operating Temperature	35 ^{o}C Flow Δt 7 ^{o}C
COP	4.5

After the implementation of GSHP, following reductions can be achieved

	Total energy and CO^2 emission after the implementation of the energy efficiency measures plus the renewable/low carbon technology	
	Energy demand	**CO_2 emissions**
	kWh/yr	kgCO^2/year
Heating	12474	2077
Hot Water	10607	1766
Auxiliary	6157	5795
Lighting	19376	10404
Total heat & hot water	23081	7312
Total electricity	30163	13710
Total	***48614***	***14170***

Renewable Energy Technology, Energy cost & CO_2 emission savings		
Technology	Ground Source Heat Pump	
No of units	1	
Unit Size	kW	17
COP		4.5
Heat Output	kWh/yr	20,834
% Heat Demand of the building provided by	%	46

GSHP		
Annual Emissions Savings	$kgCO_2/yr$	9330
Percentage emission reduction	%	40
Equipment and installations Budgetary Cost	**£**	**50,000**
Payback	***years***	***10***

APPENDIX

A - Building Annual Energy performance and Renewable Energy Calculation and GSHP selection

B- BRUKL Output Document by HEVACOMP v24