BRITANNIA HOTELS

HAMPSTEAD HOTEL – LOWER GROUND AND GROUND FLOOR EXTENSION.

REPORT ON PROPOSED ENERGY CONSERVATION MEASURES.
(Energy Assessment)

PROJECT REF: 2667 LZC

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1. INTRODUCTION

Services Design Associates Ltd have been appointed by Britannia Hotels to review the architectural proposals for the extension of their Hampstead Hotel and to identify cost effective engineering solutions which will improve the energy performance of the Hotel and demonstrate compliance with Building Regulations and the Local Planning Authorities requirements as prescribed within London's Response to Climate Change Chapter 5, Policy 5.2 – Minimising Carbon Dioxide Emissions.

2. DESCRIPTION OF PROPOSED EXTENSION

The project as a whole comprises a 21 bedroom extension to the existing Britannia Hotels Hampstead. The whole extension has a floor area in the order of 492m^2. It is proposed to introduce 14 bedrooms at lower ground floor level with a further 7 at ground level. Each bedroom will be provided with an Ensuite shower/bathroom.

The extension equates to approximately 11% of the existing hotels floor area and as such, Approved Document L2B, (ADL2B), should apply.

3. DESCRIPTION OF EXISTING SERVICES

In brief, the engineering services within the existing hotel comprise:

- LTHW heating derived from 4nr, 200kW, Wessex HE Boilers.
- Domestic hot water fed via domestic water cylinders located within the development close to the point of load all of which are fed via the existing HE boilers
- Ventilation to most bedrooms via openable windows
- Ventilation to low level bedrooms achieved utilising 2 supply and extract ventilation units each fitted with LTHW heater batteries. which appear to have been sized to temper the incoming air
- Kitchen, bar and restaurant area ventilated via commercial standard ventilation units.

4. DESCRIPTION OF PROPOSED

The proposed lower ground and ground floor extension comprises simple hotel bedrooms with ensuite bath / shower facilities. It is anticipated that this new facility will be supplied, as far as is practically possible, from the Hotel's existing infrastructure with individual circuits configured as follows:

- Heating supplied from the existing LTHW heating system with each bedroom heated via a wall mounted LTHW radiator complete with thermostatic controls.
- Hot water generated from the existing LTHW constant temperature system albeit with a new hot water storage calorifier installed to increase the hot water storage capacity.
- Electrical services derived from the existing hotels electrical distribution network.

It is anticipated that each bedroom will be naturally ventilated via openable windows fitted with trickle vents. It is anticipated that these windows will be centrally hung in order to optimise the ventilation rate within the bedroom concerned. Mechanical extract ventilation will be applied to shower and bathrooms in order to comply with Building Regulations Part-F.

Automatic occupancy controls will be applied in each room to ensure that energy consuming equipment such as lights, heating, televisions etc are not left operational when the room is unoccupied. This system may be integrated with a card access system or take the form of microwave detections where appropriate.

5. COMPLIANCE WITH BUILDING REGULATIONS/PLANNING

5.1 Performance Targets

5.1.1 Compliance with Approved Document L2B (ADL2B)

As the proposed extension's floor area is less than 25% of the total useful floor area of the existing building, this extension falls under the category of 'Other Extensions' as defined in ADL2B and the thermal performance figures described in Table 3 - Standards for Control Fittings of Guide 6 will apply. In order to satisfy Building Regulations, no 'fittings' shall have a lesser performance than those described within this table. A summary of the table is listed below.

Extracts from Table 3 - Guild 6

Fitting	Standard for New Fittings in Extensions
Windows and glazed roof lights	U-Value = 1.8W/m^{2}K (Whole Unit)
Roof Ventilators	U-Value = 3.5W/m^{2}K
Pedestrian Doors with a glazed face > 50%	U-Value = 1.8W/m^{2}K (Whole Unit)
High Use Entrance Doors	U-Values = 3.5 W/m^{2}K

Similarly, Table 4 – Standards for Thermal Elements of Guide 6 will apply and in order to confirm with Building Regulations no 'thermal element' within the proposed extension shall have a lesser performance figure than those stated in Tables 4. An extract from Table 4 is listed below. There are minor exemptions and conditions described within Guide 6 which should be read in conjunction with this report.

Extracts from Table 4 - Guild 6

Thermal Element	Standard for New Fittings in Extensions
Wall	U-Value = 0.28W/m^{2}K
Pitched Roof – Insulation at Ceiling Level	U-Value = 0.16W/m^{2}K
Pitched Roof – Insulation at Rafter Level	U-Value = 0.18W/m^{2}K
Flat Roof or roof with integral Insulation	U-Values = 0.18W/m^{2}K
Floors	U-Values = 0.22W/m^{2}K

In addition to providing guidance on the installation standards applicable to fittings and thermal elements, the Guide also advises that luminaires (lights) within the development should not have an efficacy less that 55 lumens per circuit watt unless particular automatic lighting controls are applied. (See Guide 6 for further details).

5.1.2 Planning Requirements over and above Building Regulation

In addition to satisfying the requirements of Building Regulations Approved Document L2B, the planning department have indicated that the extension should comply with London's response to climate change and in particular Policy 5.2 – Minimising Carbon Dioxide Emissions.

As this development has a floor area less that 500m^2, it cannot be considered to be a Major Development, nevertheless, Britannia Hotels require that this development conform to the spirit of the aforementioned guidance and minimise CO_2 emissions as far as reasonably practical and thereby reduce running costs.

Unfortunately, the confined nature of the site and its location within a residential area does not favour the use of sustainable technology such as wind turbines or air source heat pumps as the noise generated by this equipment would be unwelcome.

In keeping with the Council's energy hierarchy, emphasis has been placed upon avoiding energy usage by achieving a high construction standard and improving insulation standards and air tightness over and above that required by building regulations. Furthermore, the use of high efficiency LED luminaires and automatic lighting controls will reduce energy further.

5.2 Directly Applied Improvements Proposed For This Project

As a general principal, it is proposed that the U-values of fittings and thermal elements be improved to achieve 30% better thermal insulation than the minimum requirement stated within Approved Document L2B – Guide 6. Additionally, automatic lighting controls will be introduced into each of the bedrooms to ensure that the lights are not left on when the rooms are unoccupied. The table below identifies the proposed improvements in the thermal performance of the fabric.

Table Showing the Proposed Improvements In Performance of Fittings and Thermal Elements (Over and Above Building Regulations)

Fitting or Thermal Element	Standard Required By Guild 6	Proposed Standard Applied to this Project	Percentage Improvement
Windows and glazed roof lights	U-Value = 1.8W/m^2K (Whole Unit)	U-Value = 1.26W/m^2K (Whole Unit)	30%
Roof Ventilators	U-Value = 3.5W/m^2K	U-Value = 2.45W/m^2K	30%
Pedestrian Doors with a glazed face > 50%	U-Value = 1.8W/m^2K (Whole Unit)	U-Value = 1.26W/m^2K (Whole Unit)	30%
High Use Entrance Doors	U-Values = 3.5 W/m^2K	U-Values = 2.45W/m^2K	30%
Wall	U-Value = 0.28W/m^2K	U-Value = 0.20W/m^2K	30%
Pitched Roof – Insulation at Ceiling Level	U-Value = 0.16W/m^2K	U-Value = 0.13W/m^2K	30%
Pitched Roof – Insulation at Rafter Level	U-Value = 0.18W/m^2K	U-Value = 0.126W/m^2K	30%
Flat Roof or roof with integral Insulation	U-Values = 0.18W/m^2K	U-Values = 0.13W/m^2K	30%
Floors	U-Values = 0.22W/m^2K	U-Values = 0.15W/m^2K	30%
Luminaire Efficacy	55lm/$W_{(lum)}$	63lm/ $W_{(lum)}$	12.6%

It is also anticipated that the application of occupancy controls will reduce energy use still further. Typically the energy used by the lighting may be reduced by around 15% by the application of occupancy controls.

5.3 Indirectly Applied Improvements Proposed For This Project (Consequential Improvements)

In addition to adopting high construction standards, Britannia Hotels are also propose to apply energy conservation measures to the existing hotel. It is anticipated these consequential improvements will take the form of:-

5.3.1 Replacement of Existing Low Efficiency Lighting

Whilst recent modifications to the Hotels lighting installation have been undertaken using high efficient luminaires (LED and fluorescent) there are still substantial proportions of the building which utilise luminaires with a lamp efficacy less than 40 lumens per circuit watt. Consequently it is proposed to introduce high efficiency LED and / or fluorescent luminaires into approximately 670m^2 of the existing Hotel. The areas concerned will comprise bath / shower rooms, bedrooms and communication spaces. Assuming the lighting in these area burns for approximately 5.3 hour per day (average including corridors and bedrooms) and the average luminance is around 100 Lux the 12.6% improvement in efficiency will save around 384kWh per year which relates to a reduction in CO_2 Emissions of 199.3kg per year.

5.3.2 Modification of Existing Ventilation Systems to Introduce Heat Recovery

A recent reordering of the Hotel carried out in 2008 introduced bedrooms to the lower levels. These bedrooms are serviced by 2No. supply and extract ventilation systems. These ventilation systems operate continuously with intake air tempered via LTHW heating batteries located within the supply air plant.

As part of this project it is proposed to relocate this ventilation plant and in doing so, introduce energy recovery equipment, in the form of heat exchangers in order that energy can be recovered from the extract air and reintroduced into the supply air. Using CIBSE weather data for the area, calculations have been undertaken which demonstrate that this measure will reduce energy consumption by approximately 12,813.34kWh per year which in turn equates to a reduction in CO_2 emissions of 2.77 Tonne. Appendix A of this includes a table which summarises how these figures have been calculated.

5.3.3 Introduction of Photo Voltaic Panels

It is proposed to install, upon the roof of the existing building, approximately 28.8m^2 of monocrystalline photovoltaic panels interconnected into the Hotel's electricity network via static inverters. The installation will conform to the recommendations of the Micro Generation Certification Scheme.

Each array will be orientated to the south and mounted on proprietary ballasted mounting trays which elevate the panels to 15° from the horizontal.

It is anticipated that the peak output of this system will be in the order of 9.9kW and that it will generate approximately 5,472kWh per year. This in turn will reduce the Hotels CO_2 emissions by a further 2.8 tonnes per year.

6. SUMMARY - PROPOSED ENERGY CONSERVATION & RECOVERY MEASURES

The energy conservation measures associated with this project may be broken down into two categories these being:

- **Category 1**
  Directly Applied Energy Conservation Measures
- **Category 2**
  Energy conservation measures applied to the existing building(consequential improvements)

The energy conservation measures directly applied to the building will include:

- Enhanced thermal insulation (over and above the requirements of Building Regulations)
- Improved air tightness (over and above the minimum standards prescribed by Building Regulations)
- The application of the efficiency LED lighting
- The introduction of automatic lighting controls

6.1 Energy / CO_2 Saving achieved by Directly Applied Measures

In order to evaluate the benefits achieved by the application of the aforementioned measures, a dynamic thermal model has been applied to a typical part of the development utilising Hevacomp SBEM. The output data of this assessment has been included in Appendix B of this report. As can be seen, a combined effect of these measures results in an annual energy saving of 8,093kWh per annum when compared to the buildings performance if Fittings and Thermal Elements are selected by simply applying the tabulated performance criteria within Approved Document L2B of the Building Regulations. This equates to reduction in CO_2 emissions of 2.41 Tonnes per annum.

6.2 Energy / CO_2 Saving achieved by Indirectly Applied Measures

Over and above the energy saving measures applied directly to the extension, consequential improvements will be applied to the existing building which will further enhance the thermal performance of the whole development. Consequential improvements will be achieved by the application of:

- Heat recovery equipment applied to existing ventilation systems
- The introduction of high efficiency luminaires within the existing building (approximately 670m^2)
- The installation of a photovoltaic array on the roof of the existing building.

Together these indirectly applied measures can be expected to reduce the energy consumption of the development by 16,613kWh per year which in turn results in a reduction of CO_2 emissions of 5.77 Tonne per year.

7. CONCLUSION

The combined effect of the directly applied and indirectly applied energy saving measures is expected to reduce the energy consumption of the proposals by approximately 24,706kWh per year which in turn related to a combined CO_2 saving of 8.18 Tonnes per annum.

Given the very modest nature of the proposed extension we believe these savings demonstrate Britannia Hotel's commitment to reducing CO_2 emissions and the environmental impact of this development.

8. APPENDIX A

8.1 POTENTIAL ENERGY AND CO_2 SAVINGS WITH HEAT RECOVERY INSTALLED ON EXISTING AIR HANDLING UNITS

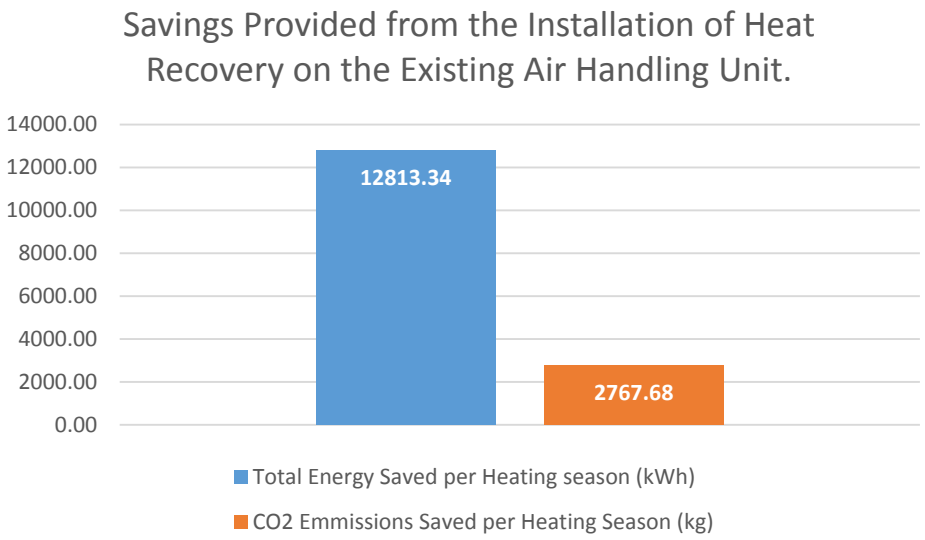
The follow tables show the recoverable energy for each existing extract fan, during the heating months.

Extract Fan 1

Heating Season	Air Mass Flow Rate (kg/s)	Potential (kWh/month)	Recoverable Energy	Actual Savings (kWh)
September	0.24	868.32	15%	130.25
October	0.24	1615.0752	27%	436.07
November	0.24	2083.968	36%	750.23
December	0.24	2691.792	45%	1211.31
January	0.24	2604.96	45%	1172.23
February	0.24	2518.128	45%	1133.16
March	0.24	2332.8864	39%	909.83
April	0.24	1910.304	33%	630.40
May	0.24	1435.6224	24%	344.55
Total				6718.02

Extract Fan 2

Heating Season	Air Mass Flow Rate (kg/s)	Potential (kWh/month)	Recoverable Energy	Actual Savings (kWh)
September	0.144	538.3584	15%	80.75
October	0.144	937.7856	27%	253.20
November	0.144	1208.70144	36%	435.13
December	0.144	1615.0752	45%	726.78
January	0.144	1562.976	45%	703.34
February	0.144	1615.0752	45%	726.78
March	0.144	1354.5792	39%	528.29
April	0.144	1184.38848	33%	390.85
May	0.144	833.5872	24%	200.06
Total				4045.19



	Total Energy Saved per Heating season (kWh)	CO2 Emissions Saved per Heating Season (kg)
Savings Provided from the Installation of Heat Recovery	12813.34	2767.68

Notes:
The above figures are calculated on a boiler efficiency of 84% and a CO_2 emission factor of 0.216 kgCO_2/kWh.

9. APPENDIX B

9.1 Energy Model Analysis

A representative area of the proposed extension has been used to calculate and estimate the energy consumption for the total area (492m^2) of the proposed extension.

Multiple versions of the model have been created to incorporate various energy saving measures:

Model 1 – Initial Model
U Values (W/m^2K)
Walls: 0.28
Windows: 1.8
Flat Roof: 0.18
Ground Floor: 0.22

Infiltration at 5 m^3/h/m^2

Lighting at 55 lumens/Watt

Model 2 – Improvements to Lighting

Lighting has been improved to 63 lumens/Watt

All other parameters match Model 1

Model 3 – U Value Improvements

U Values (W/m^2K)
Walls - 0.20
Windows - 1.26
Flat Roof - 0.13
Ground Floor - 0.15

All other parameters match Model 1

Model 4 – Infiltration Improvements

Infiltration has been improved to 3m^3/h/m^2

All other parameters match Model 1

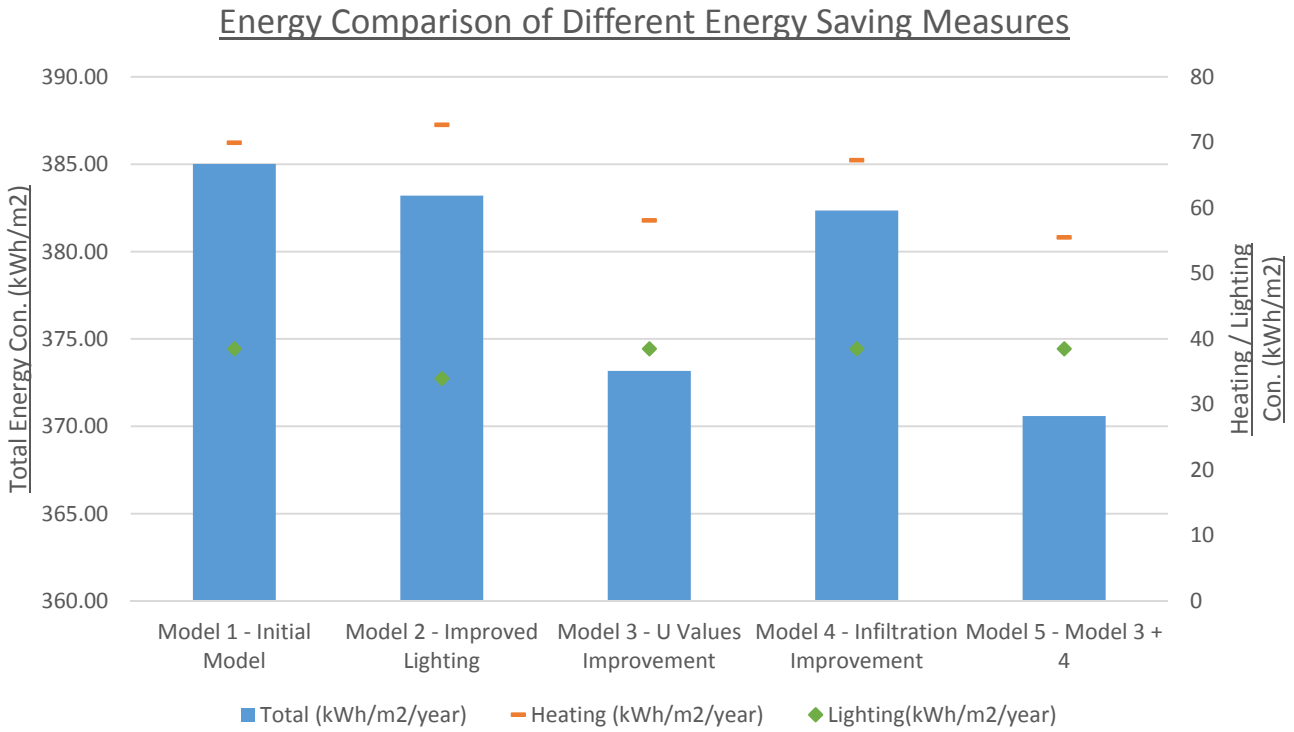
Model 5 – Combination of Model 3 & 4
This model combines the U Value improvements made in made in Model 3 and the Infiltration improvements in Model 4.

All other parameters match Model 1

Model 6 – Combination of Models 2, 3 & 4
This model combines the lighting improvements in Model 2, U Value improvements made in Model 3 and the Infiltration improvements in Model 3

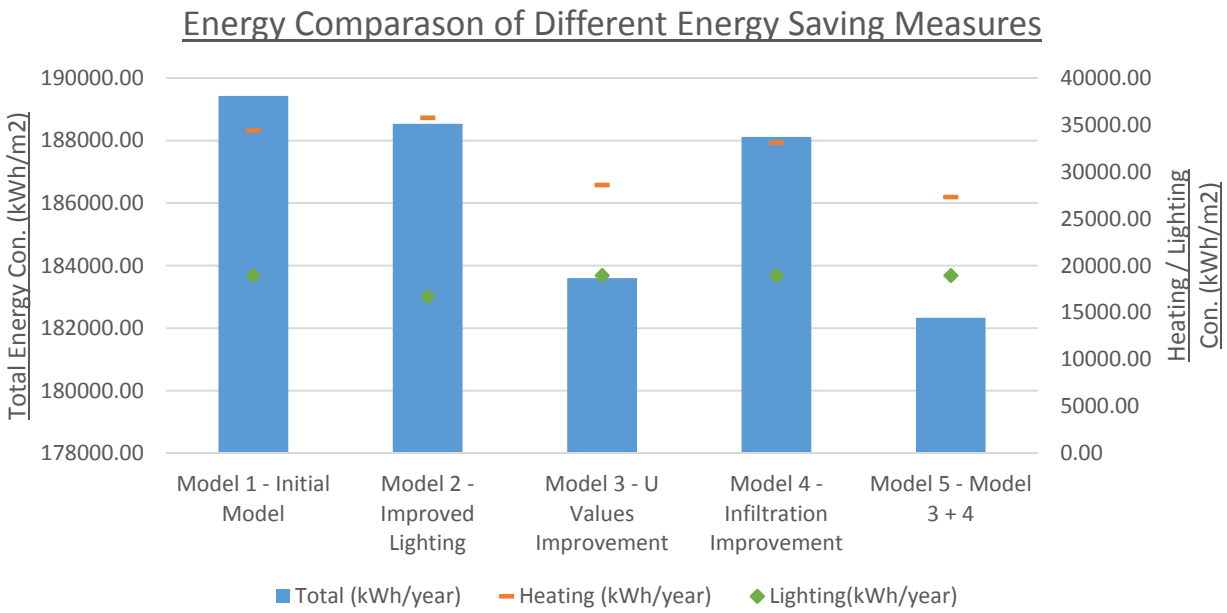
9.2 Comparison of Model Results

9.2.1 Energy Usage (kWh/m^2/year)



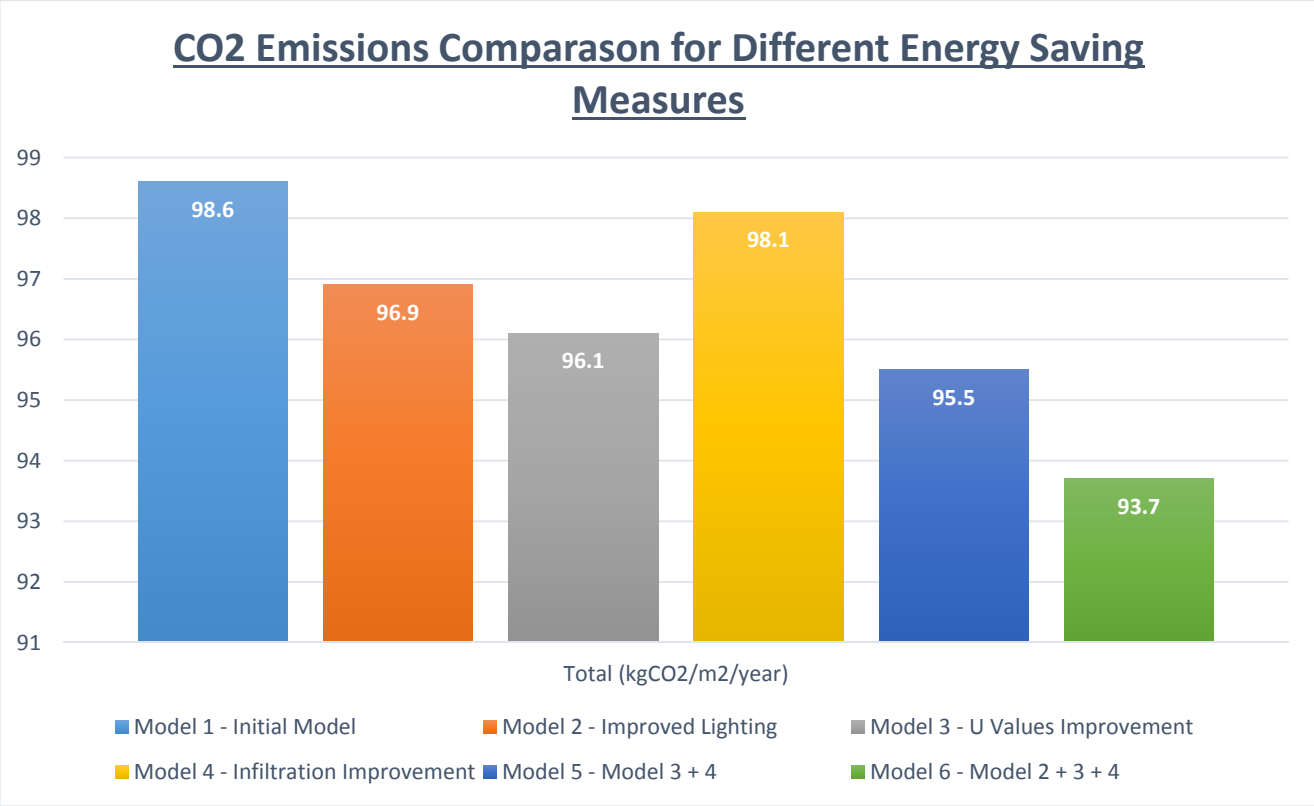
	Total (kWh/m^2/year)	Reduction to Model 1	Heating (kWh/m^2/year)	Reduction to Model 1	Lighting(kWh/m^2/year)
Model 1 - Initial Model	385.02		69.95		38.51
Model 2 - Improved Lighting	383.20	0.5%	72.69	-3.9%	33.95
Model 3 - U Values Improvement	373.17	3.1%	58.10	16.9%	38.51
Model 4 - Infiltration Improvement	382.35	0.7%	67.28	3.8%	38.51
Model 5 - Model 3 + 4	370.59	3.7%	55.52	20.6%	38.51
Model 6 - Model 2 + 3 + 4	368.57	4.3%	58.06	17.0%	33.95

9.2.2 Energy Usage (kWh/year)



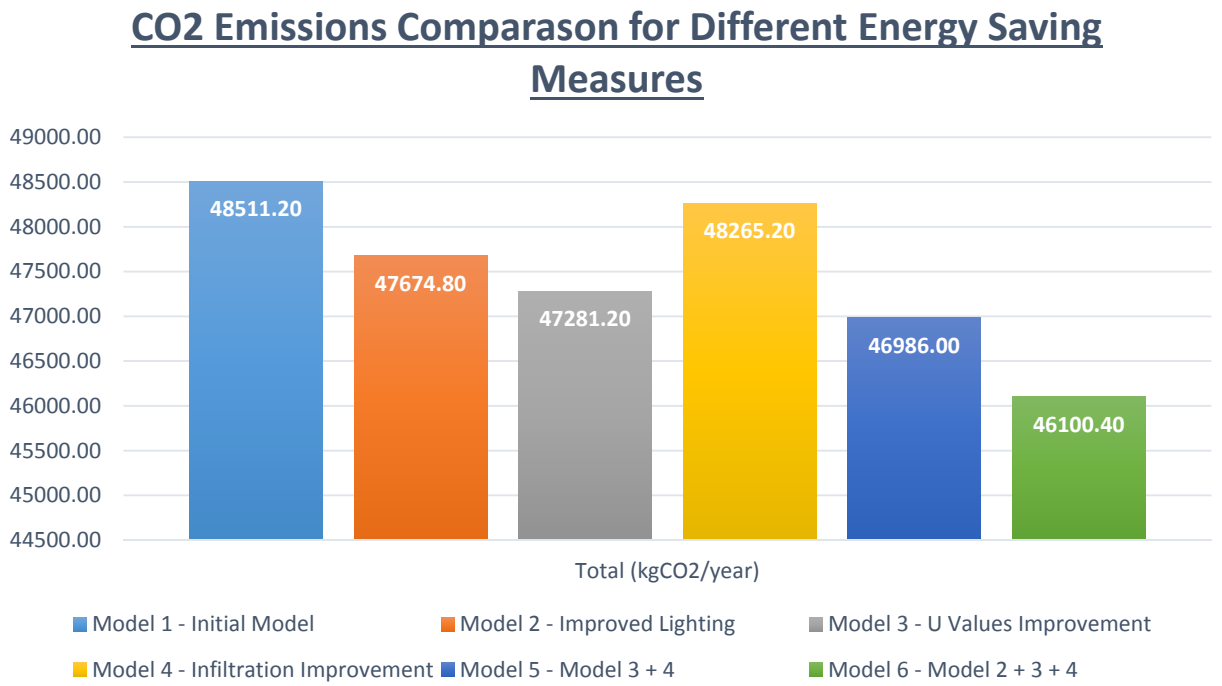
	Total (kWh/year)	Reduction to Model 1	Heating (kWh/year)	Reduction to Model 1	Lighting(kWh/year)
Model 1 - Initial Model	189429.84		34415.40		18946.92
Model 2 - Improved Lighting	188534.40	0.5%	35763.48	-3.9%	16703.40
Model 3 - U Values Improvement	183599.64	3.1%	28585.20	16.9%	18946.92
Model 4 - Infiltration Improvement	188116.20	0.7%	33101.76	3.8%	18946.92
Model 5 - Model 3 + 4	182330.28	3.7%	27315.84	20.6%	18946.92
Model 6 - Model 2 + 3 + 4	181336.44	4.3%	28565.52	17.0%	16703.40

9.2.3 Carbon Dioxide Emissions ($kgCO_2/m^2/year$)



	Total ($kgCO_2/m^2/year$)	Reduction to Model 1
Model 1 - Initial Model	98.6	-
Model 2 - Improved Lighting	96.9	1.72%
Model 3 - U Values Improvement	96.1	2.54%
Model 4 - Infiltration Improvement	98.1	0.51%
Model 5 - Model 3 + 4	95.5	3.14%
Model 6 - Model 2 + 3 + 4	93.7	4.97%

9.2.4 Carbon Dioxide Emissions (kgCO_2/year)



	Total (kgCO_2/year)	Reduction to Model 1
Model 1 - Initial Model	48511.20	-
Model 2 - Improved Lighting	47674.80	1.72%
Model 3 - U Values Improvement	47281.20	2.54%
Model 4 - Infiltration Improvement	48265.20	0.51%
Model 5 - Model 3 + 4	46986.00	3.14%
Model 6 - Model 2 + 3 + 4	46100.40	4.97%