HOARE
LEA

3 KIDDERPORE AVENUE

ENERGY STRATEGY REPORT

18 MARCH 2009

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EXECUTIVE SUMMARY

This report has been produced by Hoare Lea to outline the proposed approach to energy use at 3 Kidderpore Avenue.

This energy strategy has been developed based on a “Be Lean”, “Be Clean” and “Be Green” hierarchy of scenarios to reduce the energy consumption of the development. Low carbon technology (i.e. CHP), energy-efficient equipment and passive design will be incorporated into the scheme. The “Be Lean” and “Be Clean” measures are estimated to reduce the predicted annual energy consumptions and CO2 emissions for the development.

Central heating/HWS and CHP plant are proposed for the whole development, thus achieving higher efficiencies.

The table below shows the proposed size of the CHP and area of photovoltaic panels proposed.

Item of Plant	Capacity
CHP unit	15 kWe, 30 kWth
Photovoltaics	$20m^2$

On the basis of the above, the following reductions in CO2 emissions will be achieved:

Approaches		Reduction in CO2 emissions
“Be Lean” – energy efficiency measures		7.7%
“Be Clean”	CHP	15.3%
“Be Green” – Renewable energy	Photovoltaics	1.1%

The total reduction in CO2 emissions is equal to the difference between the Base Line and Be Green, which is found to be 22.8%

1.0 INTRODUCTION

This report has been produced by Hoare Lea to support the planning application for the development at 3 Kidderpore Avenue.

This report summarises the approach to energy conservation and adoption of renewable energy sources proposed for the development to demonstrate the proposed measures for energy conservation.

A low carbon approach will be adopted for the design of the building and engineering systems and for the provision of energy services for the development.

A range of energy technologies have been appraised as potential on-site renewable energy sources in relation to the development. These comprise:

- Wind turbines
- Photovoltaic (PV) electricity generation
- Solar water heating
- Ground source aquifer thermal energy system (ATES) for heating and cooling
- Biomass heating

2.0 ENERGY REDUCTION

The use of an energy hierarchy ensures that energy needs are met in the most efficient way:

i. Be Lean -Use less energy
ii. Be Clean - Use low carbon technology
iii. Be Green -Use renewable energy

It is therefore important that energy efficiency as well as renewable energy be considered. In this study the energy consumptions of the development have been assessed based on the "Baseline", "Be Lean", "Be Clean" and "Be Green" models.

2.1 The Baseline Scenarios (Part L 2006)

The "Baseline" scenario is based on the current proposal for the development and the selected architect's drawings which detail Kidderpore Avenue and show compliance with Part L 2006 of the building regulations.

The energy assessment is based on SAP using Elmhurst V15 software to calculate the energy consumption results.

The energy performance of the building will comply with the current Building Regulations and include:

- The use of gas fired heating systems to provide space heating and domestic hot water for the development.
- Air tight construction using robust detailing to reduce wasteful air leakage.

2.2 Energy Efficiency (Be Lean)

The "Be Lean" measures proposed will reduce the energy consumptions and the development will be constructed to exceed the energy standards required by the Part L 2006 Building Regulations. This will be achieved by limiting heat loss through roofs, walls, floors, windows, doors, etc by suitable means of thermal insulation and to specify U-valves that exceed the minimum requirements of Part L 2006.

The "Be Lean" measures include:

- Insulation of pipework, ductwork and hot water systems to current and proposed future highest standards.
- Avoidance of excessive 'Thermal Bridging' by using appropriate design details and fixings.
- Provision of the required lighting levels whilst minimising energy consumption by effectively controlling the lighting systems by:-
  using energy efficient lamps and luminaries
  having either suitable manual/automatic switching to control lighting.
  having suitable energy consumption metering
  using lighting systems which are efficient and make use of daylight where possible/practical
  avoiding the use of lighting when spaces are unoccupied by means of local switching to facilitate user control and/or photo-electric type switching.
- Limitation of unnecessary ventilation heat loss by providing building fabric which is reasonably air-tight, but still provide adequate ventilation for health (Building Regulations Part F), and combustion appliances (Building Regulations Part J).
- Use of efficient systems and equipment with suitable time and temperature controls which have been appropriately commissioned such that the systems can be operated efficiently.
- Minimisation of lengths and diameters of 'dead-legs'. Components i.e. fans, pumps, refrigeration equipment, should be efficient and appropriately sized to have no more capacity for demand and standby than is required for the task so to operate at their optimum levels.
- The comfort cooling will be provided by VRF heat pumps which have a Coefficient of Performance (COP) of between 3.5 – 4.0, resulting in a highly efficient method of providing comfort cooling.
- The ventilation plant for the swimming pool will incorporate a 3 stage heat recovery system to provide up to 85% efficiency of the system.

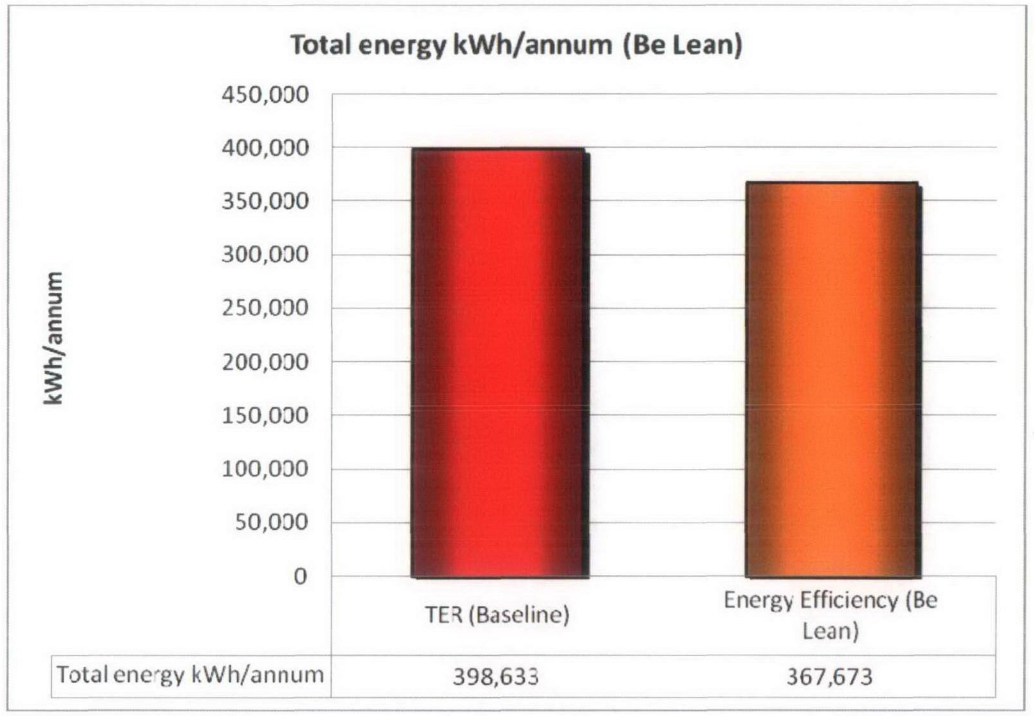

***Figure 1** – Reduction in Energy Consumption between the Baseline and Be Lean Secenarios*

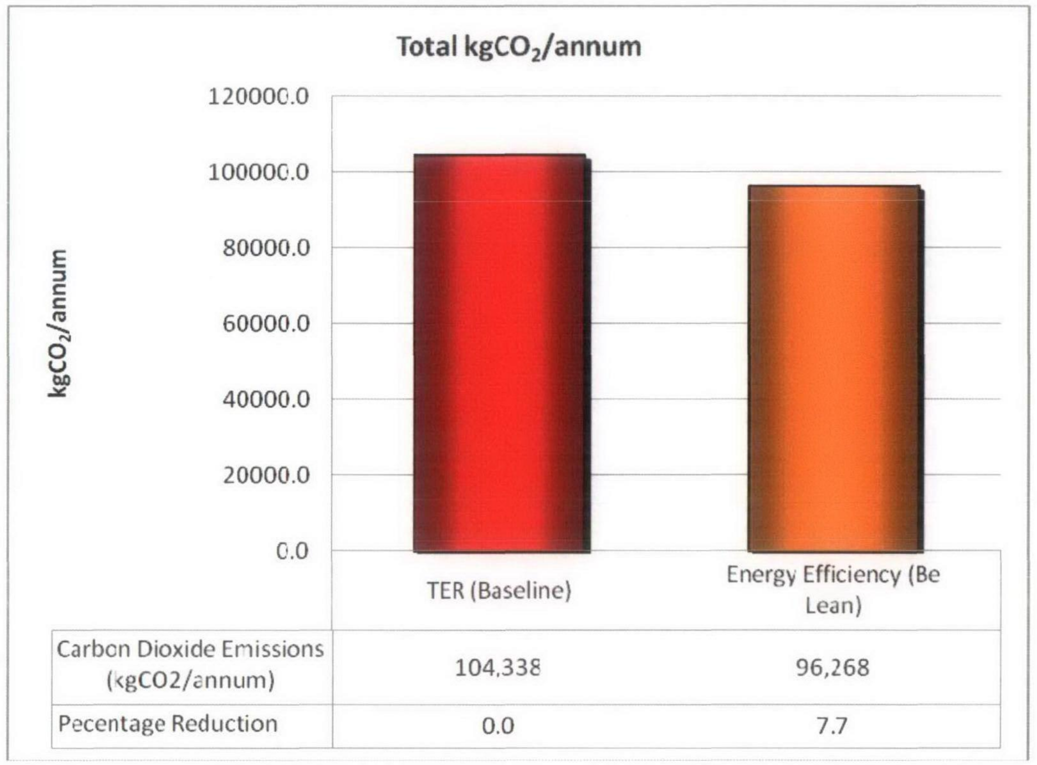

***Figure 2** – Reduction in Carbon Dioxide Emissions between the Baseline and Be Lean Scenarios*

2.3 Low Carbon Technology Assessment (Be Clean)

It is proposed to include Combined Heat and Power (CHP) in the development. The electricity generated by the CHP will be fed into the electrical network and distributed around the development. The use of this co-generation improves the overall efficiency of the primary energy delivered to the site. This corresponds to a reduction in the CO2 emissions.

The amount of thermal energy provided by the CHP unit will be dependent on the calculated electrical base load for the building and the most efficient size unit to ensure its continued operation for more than 12hours/day, 365 days/year.

The heating and hot water base thermal loads for the development will be calculated and if possible matched to the CHP unit's thermal output, however it is not proposed to export electricity to the grid, hence the electrical base load will be the determining factor in establishing the optimum size of the CHP unit.

The selected CHP is maximised to produce 15 kWe and 30 kWth.

The CHP plant will reduce the carbon emissions by approximately 15.3%.

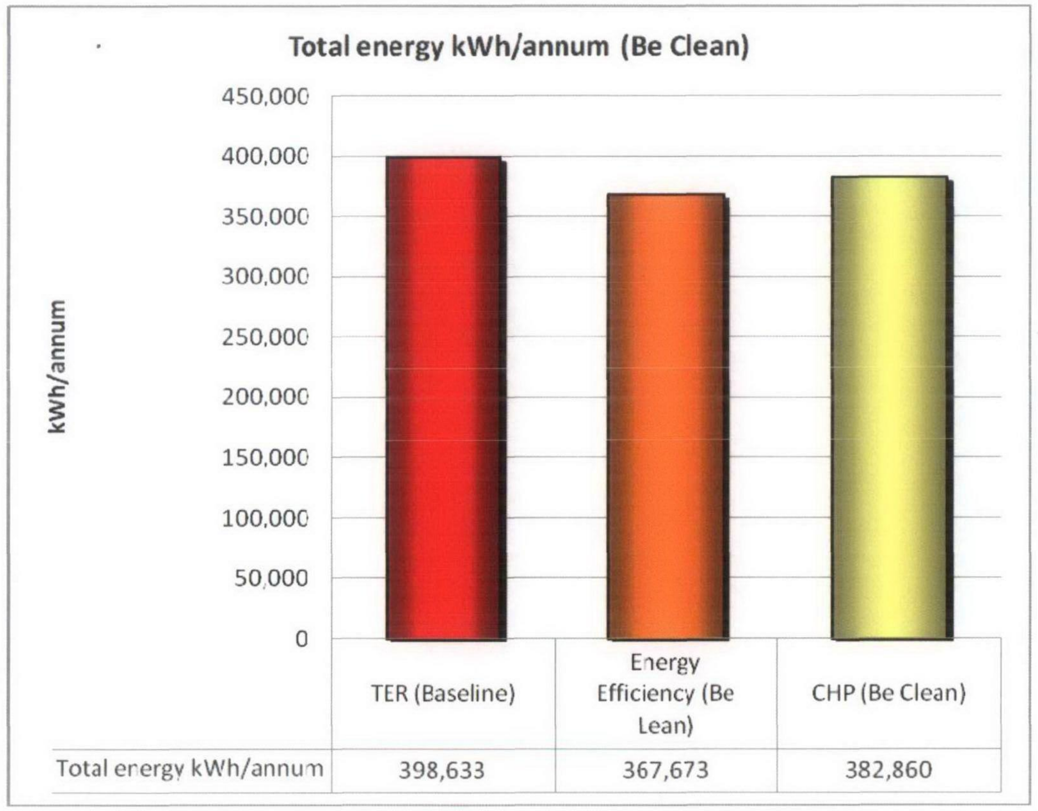

Figure 3 – Comparision of Energy Consumption between the Baseline, Be Lean and Be Clean Scenarios

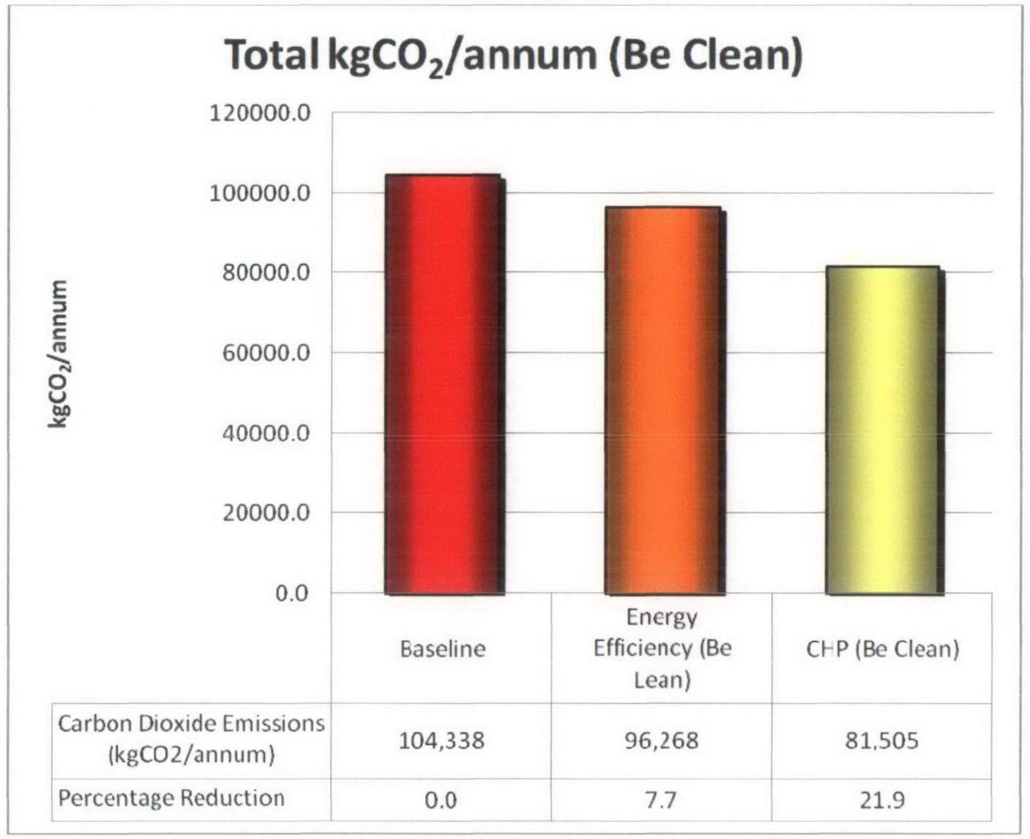

Figure 4 – Reduction in Carbon Dioxide Emissions between the Baseline, Be Lean and Be Clean Scenarios

2.4 Zero Carbon Technologies (Be Green)

The following renewable energy sources are considered to have the potential to be employed on developments within the London region:-

- Wind Turbines
- Solar Photovoltaic (PV) panels
- Solar Thermal Systems
- Ground Sourced Heating and cooling
- Biomass Heating

There are various location and physical factors particular to the site at 3 Kidderpore Avenue which will influence the choice of renewable technologies which need to be considered, these include, but are not limited to:-

- it is an urban development
- budget cost limitations
- the close proximity of other premises
- Compact or tight nature of the site

Feasibility of Ground Source Heating and Cooling Systems

The development does not have a significant cooling load (only limited to rooms with minimal occupancy throughout the day), which makes ground source heating and cooling unfeasible because a balanced heating and cooling load is required throughout the year. Therefore, a ground source heat pump system is not proposed for this development.

Feasibility of Wind Turbines

The average wind speed on the site is not sufficient for the application of this technology. Roof mounted wind turbines would also increase the noise levels of the development which would not be acceptable to the Environmental Health Department. Therefore, this technology is not proposed for this development.

Feasibility of Solar Thermal Systems

If approximately 20m² of solar hot water heating panels were installed on the roof of the house this would reduce the development's total carbon dioxide emission by approximately 1.2%.

Despite this technology providing a 1.2% reduction in carbon emissions, this system will not integrate well with CHP because it will reduce the efficiency of the CHP, during the summer when the base hot water load will be the only load on the system. This system is therefore not considered as a feasible option.

	**Technology** 20m² roof mounted Solar Panels, at 35 °incline (from horizontal) and facing south. **Gas contribution** Typical annual gas generation offset 4,900 kWh/year equating to 1.2% reduction in total annual carbon contribution

Feasibility of Biomass Heating

Biomass boilers are an established technology, using natural fuel such as wood chips or wood pellets for combustion. Typically, boiler efficiencies in excess of 80% are achievable. Carbon dioxide that is emitted during combustion of wood matter is absorbed during growth, forming a virtually carbon neutral cycle. In general, emissions will be lower using wood chips rather than pellets, as they are less energy-intensive to process

It is acknowledged that the use of biomass heating to achieve a reduction in on-site carbon dioxide emissions is not suitable for every site, particularly in cities due to implications with deliveries of fuel supplies and associated fume discharge from boilers.

Therefore, due to the constraints of this site, the use of biomass heating is not considered a suitable renewable energy technology.

Feasibility of Solar Photovoltaic (PV) Panels

The integration of 20m² of roof-mounted PV panels would deliver an estimated 1.1% reduction in the total annual carbon dioxide emissions for the development.

The 20m² of roof mounted PV panels required to achieve the 1.1% reduction could be incorporated into the flat roof area of the main house. Due to the size of the development there is a sizeable base load for electricity through pumps, fans and lights etc that it is not considered to conflict with the electricity generated by the CHP.

	**Technology** 20m² roof mounted PVs, at 35 °incline (from horizontal) and facing south. **Electricity contribution** Typical annual electricity generation 2,189kWh/year equating to 1.1% reduction in total annual carbon contribution

The incorporation of photovoltaics (PVs) in to the scheme will generate electricity for the site which will provide a further CO2 reduction of 1.1% and provide electricity generation from renewable source on site. The graphs below show the impact of incorporating PVs.

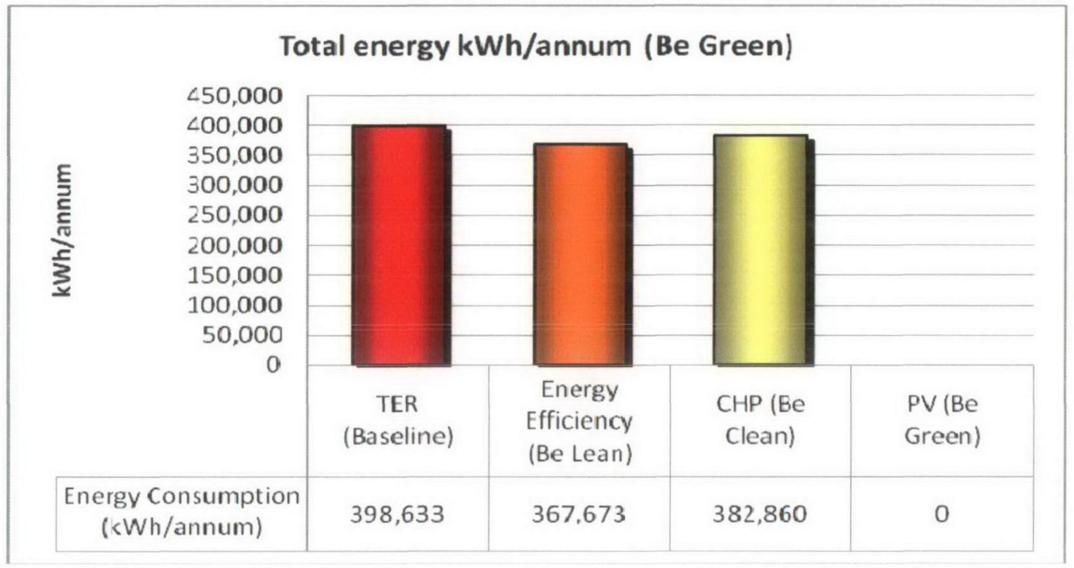

Figure 5 – Comparision of Energy Consumption between the Baseline, Be Lea , Be Clean and Be Green Scenarios

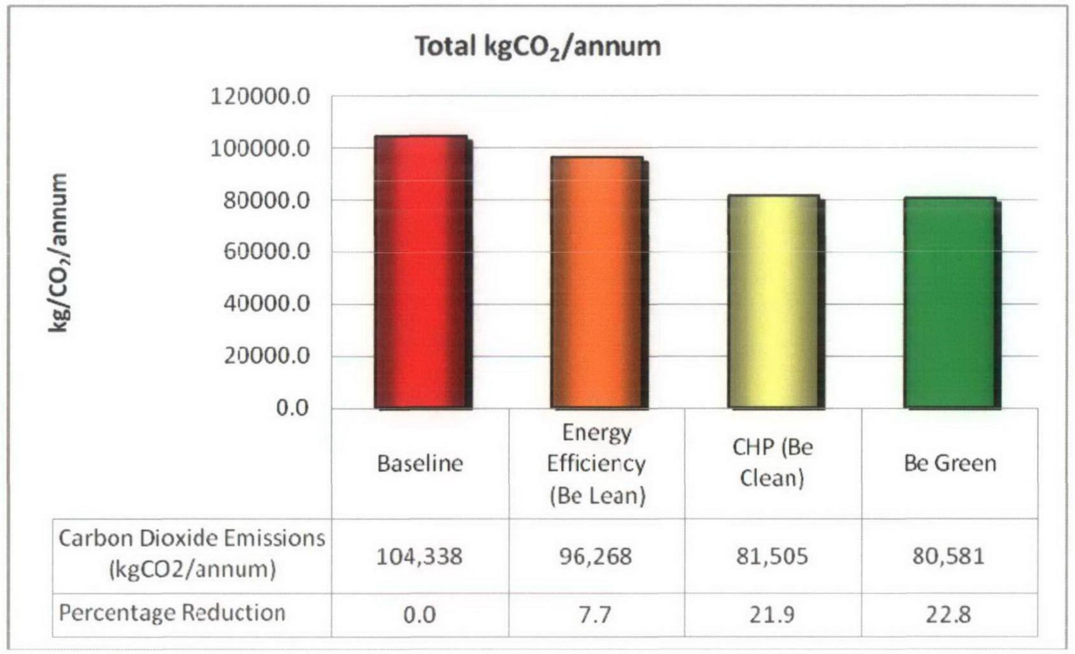

Figure 6 – Reduction in Carbon Dioxide Emissions between the Baseline, Be Lean, Be Clean and Be Green Scenarios

3.0 CONCLUSION

The baseline carbon emission calculations undertaken, indicate that the proposals to develop the site to energy efficiency standards go beyond Part L 2006 Building Regulations.

In summary, through the inclusion of CHP, photovoltaics and many 'Be Lean' energy efficient measures the following reduction in C02 emissions will be achieved:

Approaches	Reduction in CO2 emissions
"Be Lean" – Energy efficiency measures	7.7%
"Be Clean"	15.3%
"Be Green" – Renewable energy	1.1%

This equates to a 22.8% overall reduction in CO2 emissions for the development over Part L 2006 Building Regulations.

APPENDIX A - RENEWABLES CARBON EMISSIONS

	Photovoltaic(PV) Assessment Procedure	Value	Unit
1	Determine maximum annual irridiation at the specific location (London = 1022 kWh/m²/year)	1022.0	kWh/m²/year
2	Determine module conversion efficiency	60.0%	
3	Determine positioning factor based on the systems tilt and orientation	65.0%	
4	Determine inverter efficiency	65.0%	
5	Determine system losses factor	65.0%	
6	Determine packing density factor	65.0%	
7	Calculate resulting annnual kWh system electrical output from 1 m^2 of panel	109.5	kWhr/year
8	Look up carbon emissions factor for electricity	0.422	kgCO_2/kWhr
9	Calculate annual carbon saving from 1 m2 of panel	46.2	kgCO_2/year
10	Specify panel area of proposed rooftop PV array	20.0	m2
11	Calculate delivered electricity requirement substituted by electricity generated by PV	2,189	kWh/year
12	**Calculate reduction in carbon emissions due to application of rooftop photovoltaic array**	**924**	**kgCO_2/year**
13	Determine total delivered gas energy in base building	351,149	kWhr/year
14	Look up carbon emission factor for Gas	0.194	kgCO_2/kWhr
15	Calculate carbon emissions due to delivered gas in building with PV (same as base building)	68,123	**kgCO_2/year**
16	Determine total delivered electrical in base building	31,711	kWhr/year
17	Calculate delivered electricity requirement for building with proposed PV array	29,522	kWhr/year
18	Calculate carbon emissions due to delivered electricity in building with proposed PV array	12,458	**kgCO_2/year**
19	Calculate base building total carbon emissions	81,505	**kgCO_2/year**
20	**Calculate total building carbon emissions in building with the proposed PV array**	**80,581**	**kgCO_2/year**
21	**Calculate the percentage carbon emissions reduction due to the proposed PV Array**	**1.1%**	