

JOSTEC

BUILDING REGULATIONS COMPLIANCE SERVICES



ENERGY STATEMENT FOR THE PROPOSED DEVELOPMENT AT

Curzon Club
362 Oxford Rd,
Reading, RG30 1AQ

Produced by	Date	Client
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Contents

1.	General Overview	3
2.	Policy Context	3
2.1.	National Planning Policy Framework (February 2019)	3
2.2.	Approved Document Part L1A 2013 of Building Regulations	4
2.3.	Reading Borough Local Plan	5
3.	Baseline Target Emission Rates	6
3.1.	Residential Units	6
3.2.	Commercial	7
4.	Proposed Specification	8
4.1.	Residential Units	8
4.2.	Commercial	10
4.3.	Carbon offset payment	12
	Low or Zero Carbon Technology	13
4.4.	Wind Energy	13
4.5.	Biomass	14
4.6.	Air Source Heat Pump	14
4.7.	Ground Source Heat Pump	15
4.8.	Combined Heat & Power (CHP)	16
4.9.	Photovoltaics	17
4.10.	Solar Thermal Collectors	18
5.	Summary of LZC feasibility study	19
6.	Conclusion	20
7.	SAP & SBEM Calculations	21

1. General Overview

This energy statement has been prepared by JosTec to help satisfy the policy requirements of the Reading Borough Local Plan adopted in 2019, in relation to the proposed new development at Curzon Club, 362 Oxford Rd, Reading, RG30 1AQ.

Using approved calculation methods (SAP 2012 and DesignBuilder SBEM) we can produce predicted carbon reductions above the minimum baseline rates through enhanced building fabric and by exploring the use of low and zero carbon technologies, including potential local decentralised energy projects.

2. Policy Context

In this section of the report, National, Regional and Local planning policies and requirements are presented.

The energy and sustainability strategies to meet the policies have also been briefly introduced. The details of how the scheme incorporates these policies have been presented in the body of this report.

2.1. National Planning Policy Framework (February 2019)

Policy 14. Meeting the challenge of climate change, flooding, and coastal change:

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable, or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new developments to:

- a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- b) take account of landform, layout, building orientation, massing, and landscaping to minimise energy consumption.

2.2. Approved Document Part L1A 2013 of Building Regulations

AD Part L1A sets the standard for energy performance for new residential buildings. The proposed new buildings must comply with the criteria set out in the Approved Document, as follows:

- For domestic units, the calculated Dwelling CO₂ Emission Rate (DER) must not be greater than the Target CO₂ Emission Rate (TER).
- For domestic units, the calculated Dwelling Fabric Energy Efficiency (DFEE) rate must not be greater than the Target Fabric Energy Efficiency (TFEE) rate.
- The performance of the individual building fabric elements and fixed building services should achieve reasonable overall standards of energy efficiency.
- The dwellings should have appropriate passive control measures to limit the effect of heat gains on indoor

temperatures in summer, irrespective of whether the dwelling has mechanical cooling.

- For domestic units, the performance of the buildings as built should be consistent with the DER rates.

2.3. Reading Borough Local Plan.

The Government has sought to consolidate the wide range of standards required for new housing across the country. Housing standards serve an important role in ensuring resident health and well-being.

H5: STANDARDS FOR NEW HOUSING

New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:

- a. All new build housing outside the Central Area as defined on the Proposals Map will comply with the nationally-described space standard.
- b. All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations.
- c. All major new-build residential development should be designed to achieve zero carbon homes.
- d. All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.
- e. All new build housing will be accessible and adaptable in line with M4(2) of the Building Regulations, unless it is built in line with M4(3).

Given the scale of residential development in Reading up to 2036, achieving the aims of the Climate Change Strategy will not be possible without that development having a minimal impact on carbon emissions.

Therefore, the requirement will be that major new housing is built to zero carbon homes standard. A revised Sustainable Design and Construction SPD to be produced in 2019 will contain more detail on achieving this requirement, but in general, where homes are not designed to be carbon neutral, this will mean as a minimum a 35% improvement in the dwelling emission rate over the 2013 Building Regulations plus a contribution of £1,800 per tonne towards carbon offsetting within Reading (calculated as £60 per tonne over a 30 year period).

The following report will show how this can be achieved.

3. Baseline Target Emission Rates

3.1. Residential Units

The following results are calculated using approved SAP2012 software with minimum standards used to achieve Part L 2013 Building Regulations compliance, including a gas fired combi boiler with an integrated flue gas heat recovery system to provide heating and hot water.

362 Oxford Rd	Target Emission Rates KG CO ₂ /m ² /year (TER)	Target Fabric Energy Efficiency kWh/m ² /year (TFEE)
Average	18.35	45.33

The development is subject to Zero Carbon Policy for the new build major residential units, as per the latest Reading Local Plan.

A fabric first approach has been followed, incorporating passive design measures such as low u-values, low air leakage and low thermal bridging.

Active design measures were then incorporated via energy efficient building services, such as 100% low energy lighting, and a flue gas heat recovery system.

We can now explore several options to reduce the Dwelling Emission Rates (DER) in order to comply with the Reading Borough Local Plan target requirements.

3.2.Commercial

A commercial space with an area of 123.6m² will be located at the ground floor of the development. The type of this space will be 100% A1/A2 Retail/Financial and Professional services. The following results were calculated using the Design Builder SBEM calculation engine with minimum standards to achieve Part L Building Regulations compliance.

Target Emission Rates KG CO ₂ /m ² /year (TER)	
362 Oxford Rd	32.20

4. Proposed Specification

4.1. Residential Units

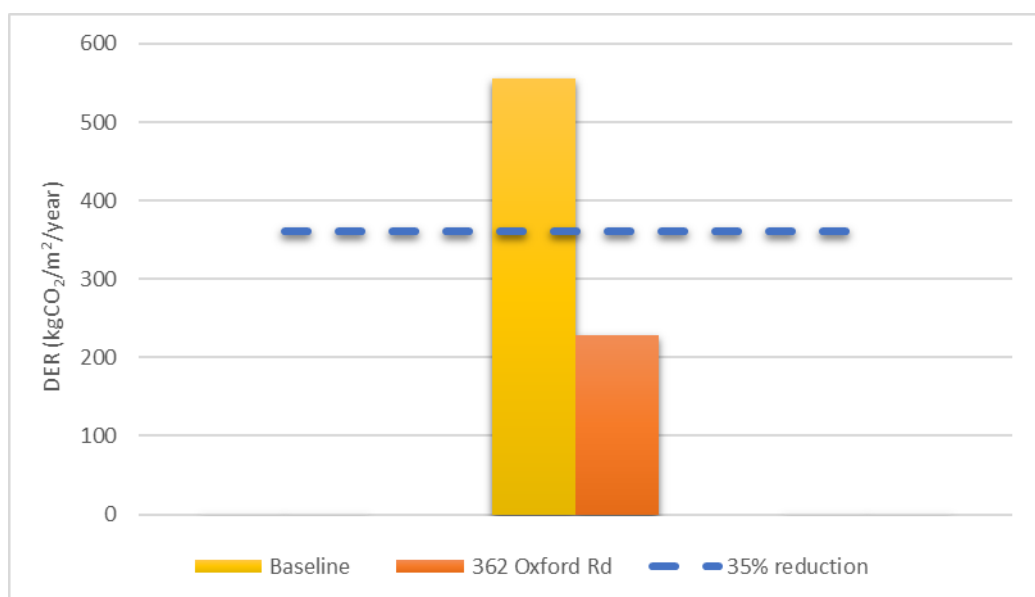
The table below shows how a 49.43% reduction in carbon emissions over Part L1A 2013 of Building Regulations, as required by the planning policies can be achieved for the new build units.

Building Element	Limiting Parameters Building Regulations Part L1A Table 2	Proposed Values
External Walls	0.30 W/m ² K	0.12 W/m ² K
Dormer Walls	0.30 W/m ² K	0.15 W/m ² K
Party Walls	0.20 W/m ² K	0.0 W/m ² K
Roof 1 (Flat roof)	0.20 W/m ² K	0.14 W/m ² K
Roof 2 (Dormer roof)	0.20 W/m ² K	0.14 W/m ² K
Exposed floor	0.25 W/m ² K	0.10 W/m ² K
Windows: U-value/G-value	2.00 W/m ² K	≤1.20 W/m ² K / 63%
Doors	2.00 W/m ² K	≤1.20 W/m ² K
Air permeability	10.00 m ³ /m ² h @ 50pa	5 m ³ /m ² h @ 50pa
ψ values (Thermal Bridging)	Accredited Construction Details	Accredited Construction Details

Service	Proposed
Space Heating	Mains gas combi boiler with flue gas heat recovery system to radiators (Alpha InTec 40 GS2).
Hot Water	From Main heating – No hot water cylinder
Mechanical Cooling	None
Renewables	35 kW _p Photovoltaic Panels
Ventilation	Natural, extractor fans to wet rooms.
Lighting	100% low energy lighting

	DER Kg CO ₂ /m ² /year	DFEE kWh/m ² /year	DER % reduction	DFEE % reduction
362 Oxford Rd	9.37	37.78	49.43	16.79

The comparison between the Target Emission Rate (TER) and the Dwelling Emission Rate (DER) is illustrated in the figure below.



The proposed strategy for the residential units achieves a total reduction of 49.43% in CO₂ emissions when compared to Building Regulations 2013. This represents a shortfall of 50.57%, when compared to zero carbon status. This is equivalent to 12.03 tonnes CO₂.

4.2.Commercial

The table below shows how a 37.57% reduction in carbon emissions over Part L1A 2013 of Building Regulations, as required by the planning policies can be achieved for the commercial unit.

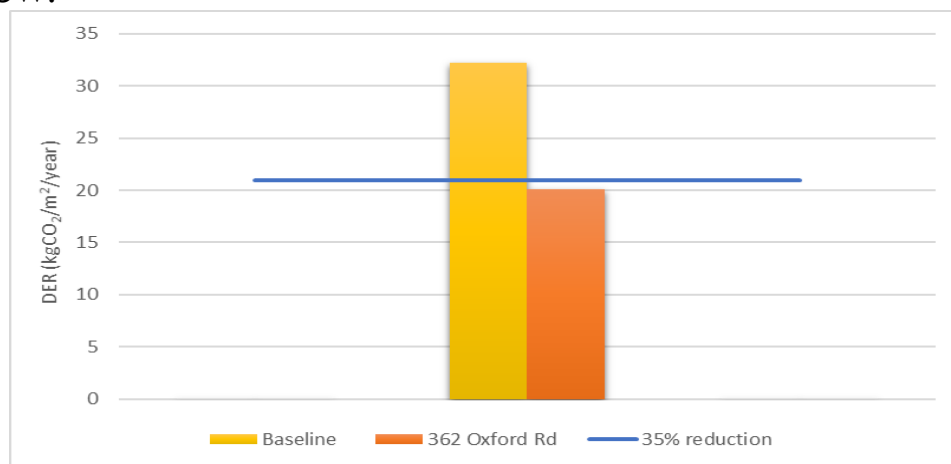
Building Element	Limiting Parameters Building Regulations Part L1A	Proposed Values
Walls	0.35 W/m ² K	0.25 W/m ² K
Roof	0.25 W/m ² K	N/A
Floor	0.25 W/m ² K	0.09 W/m ² K
Windows: U-value	2.20 W/m ² K	≤1.40 W/m ² K
High Usage Entrance Doors	3.50 W/m ² K	≤2.82 W/m ² K
Air permeability	10.00 m ³ /m ² h @ 50pa	4 m ³ /m ² h @ 50pa

Service	Proposed
Space Heating	Electric room heaters – Unfanned
Hot Water	Instantaneous at point of use – Storage loss factor: 0.015 kWh/l/day
Mechanical Cooling	None

Renewables	1.40 kW _p Photovoltaic Panels
Ventilation	Natural
Lighting	LED light fittings - Efficacy > 100 lm/W.

	BER Kg CO ₂ /m ² /year	DER % reduction
362 Oxford Rd	20.1	37.57

The comparison between the Target Emission Rate (TER) and the Building Emission Rate (BER) is illustrated in the figure below.



The proposed strategy for the commercial unit achieves a total reduction of 37.57% in CO₂ emissions when compared to Building Regulations 2013. To reach this target, a further 1.40 kW_p should be added to the system of PV panels.

4.3. Carbon offset payment

The total CO₂ reduction achieved for the whole development is: 41.88%. This represents a total shortfall of 58.12% when compared to the Net zero carbon status. This is equivalent to 14.51 tonnes CO₂. As presented in the table below, the rest 58.12% is subject to a one – off payment of £30,528.

Carbon offset Payment	
Total Shortfall from 51.47%	14.51 tonnes/annum
Payment per annum per tonne	£ 60
Payment period	30
Carbon offset payment	£26,118

Low or Zero Carbon Technology

There are several renewable energy solutions which can be explored to help a development reduce its energy usage and carbon emissions including, solar thermal, wind turbines, biomass community heating schemes & photovoltaic units. Some options have been assessed as follows.

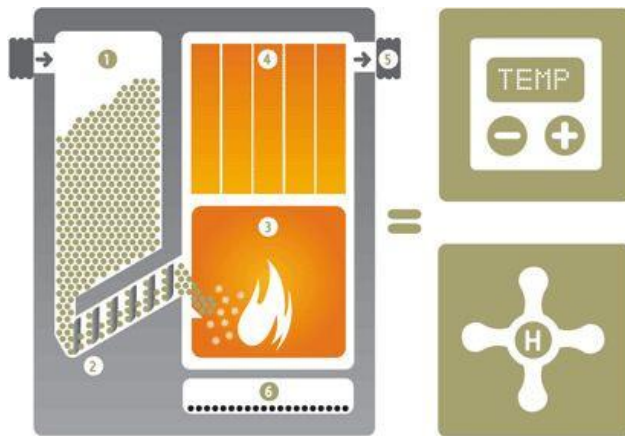
4.4.Wind Energy



Although wind turbines can generate up to 3MW of electricity, smaller units are available generating between 0.5 kW to 6.0kW. The area would need to be accessed to establish the practicality of installing a wind turbine. Electricity is generated in DC and requires an inverter to convert to AC to operate domestic appliances. Where electricity is generated but not required, it can be sold to the local electricity company. Given the location and the wind speed available provides minimal feasible electrical generation and as such has been discounted. It should also be noted there is a number of considerations with regards to daylight impact on the surrounding buildings, further providing rational for discounting wind technology.

This technology is not considered feasible for the development.

4.5.Biomass

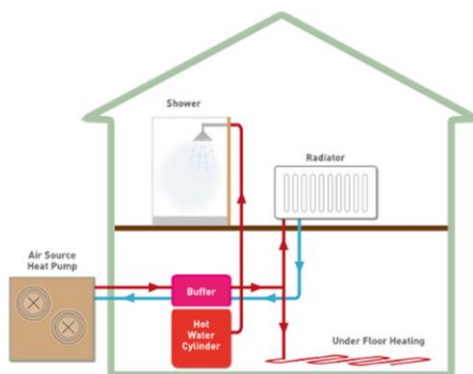


Biomass boilers burn renewable fuel to generate hot water for direct use, or for heating purposes. The fuel they burn is renewable because it is in a constant carbon cycle. There are three main forms of biomass boilers

available, namely those using wood chips as fuel, those using wood pellets as fuel and those using wood logs. The operation and installation of Biomass requires additional plant space for the storage of solid fuel and design of access routes for delivery of fuel. Given the urban location of the development, this has been discounted owing to practical constraints associated with Biomass.

This technology is considered not feasible for this scheme.

4.6.Air Source Heat Pump



Air Source Heat Pumps (ASHP) provide an efficient method of providing space heating and cooling requirements. Heat is absorbed from the air into liquid via a heat exchanger where 'useful' heat is extracted and absorbed. Low grade heat is then extracted by a refrigeration

system compressed and concentrated to temperatures suitable for space heating and hot water requirements.

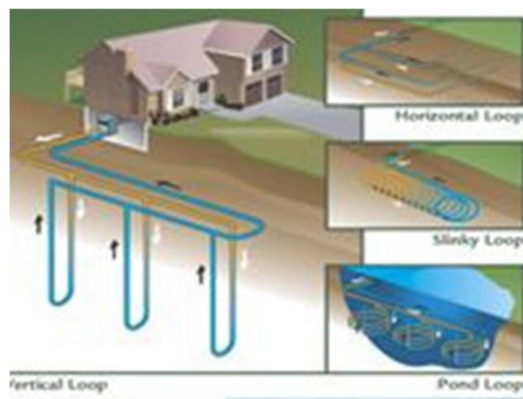
While ASHP utilise electricity to generate this process, the heat gained is taken directly from the available air and produces fewer greenhouse gases when compared to a conventional gas system.

ASHP have been classified as a renewable system under the European Directive on 'Promotion of Renewable Energy Sources' and Policy 5.7 'Renewable Energy' of the London Plan 2011.

ASHP and associated plant require annual maintenance and adequate space for condensing units. Expected lifetimes range from 7-10 years.

Air Source Heat Pumps are considered not feasible for this scheme.

4.7.Ground Source Heat Pump

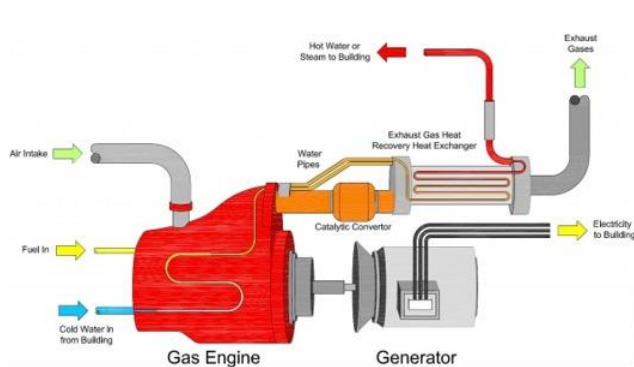


A Ground Source Heat Pump (GSHP) transfers energy from the ground to the building to provide space heating or pre-heating of domestic hot water. Unlike wind and solar heating, it requires an electrical input, however, the heat recovered is three to four times the required electrical input. Heat is transferred from the ground using a ground loop, which can either be within a vertical borehole arrangement or laid as coils in a horizontal trench. The heat pump works in the same way as a domestic refrigerator in reverse, by extracting heat from the borehole/trench to evaporate the refrigerant on the heat pump circuit. Heat is then input to the building as the refrigerant condenses. Any proposed GSHP would require

the use of a large number of vertical boreholes across the site. Given the site's size, the piling of the foundations and the network pipes that run below ground, this has been discounted owing to practical constraints associated with GSHP.

This technology is not feasible for the development.

4.8. Combined Heat & Power (CHP)



CHP effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system

efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional boilers. A further advantage is that because electricity is generated close to the point of use, the losses incurred in High Voltage (HV) transmission are avoided. CHP is considered as a low carbon technology when fired by gas or fuel oil to generate electricity and provide heating and hot water. At this scale, a gas-fired reciprocating engine CHP is the preferred technology due to efficiency, maintenance and plant space considerations, and is well-proven with many successful installations in UK. CHP systems offer optimum carbon and cost savings when matched to the site electricity and heat load profiles such that the units see a high utilisation and make a significant contribution to the

site's annual energy demands. CHP units should be replaced every 15-17 years, with replacement timeframes subject to alteration pending regular maintenance and part failure. Once an understanding of the site's heat and electricity demand profile has been established the designer is then faced with the task of deciding on the size of the CHP. There is no straightforward way to size a CHP. Some guidance recommends sizing only to meet the lowest demand that occurs — the base-load that will result in the longest running hours and the shortest payback period. However, this is not necessarily the most economically advantageous approach and certainly would limit the amount of CO₂ savings that could be achieved on a given site. The most accurate models are hourly models simulated over a whole year with occupancy, heat, DHW and electricity demand profiles representing an average year. This is the recommended approach for new buildings where dynamic simulation modelling can be carried out. Whereas in most engineering calculations it is possible to make simplifications that result in a conservative or a worst-case scenario, simplifying a CHP model generally will result in a more optimistic result (best case scenario) with respect to the CHP operating hours and hence the economic payback and efficiency, which is usually not the case.

A CHP unit is considered not feasible because there are no decentralised heating projects within the vicinity.

4.9. Photovoltaics



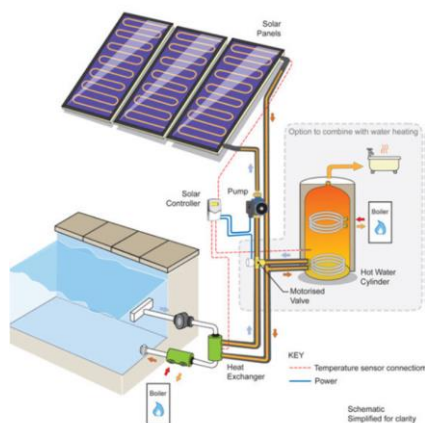
Photovoltaic (PV) panels create electricity from solar radiation with efficiency ranging between 5 and 19%. PV modules generally require

Stirling Way, Borehamwood, WD6 2BW

minimal maintenance, usually consisting of a visual inspection and associated electrical testing. They have no moving parts and an expected lifetime of over 30-40 years. Manufacturers typically offer a warranty on power output of 20-25 years. PV modules have no operating emissions and produce no noise, making them the most benign zero-carbon technology.

Therefore, PVs is considered viable for this scheme.

4.10. Solar Thermal Collectors



Solar thermal collectors utilise solar radiation to heat water for use in water heating of a building. The radiation is converted using a solar collector, of which there are two main types available: Flat Plate and Evacuated Tube collectors. Evacuated tube systems occupy a smaller area and are more efficient, but also generally more expensive.

Flat plate systems are cheaper to install but generally less efficient. The solar coverage indicates what percentage of the annual domestic hot water energy requirement can be covered by a solar water heating system. The higher the solar coverage, the more conventional energy usage can be offset, but can cause excess heat generation in the peak summer months and generally lower the average collector

efficiency. Therefore, solar coverage of 40-70% are recommended for most domestic applications and up to 40% in non-domestic buildings. Solar thermal systems in the UK normally operate with a back-up fuel source, such as gas or electricity. The solar system pre-heats the water up to a maximum hot water temperature. If there is not enough solar power available to fully meet the required hot water load, then the back-up fuel system fires up to meet this short fall. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30° from the horizontal. However, orientation is not critical, with azimuths of +/-30o from South and angles of +/-20o from 30o still achieve reasonable outputs.

This technology was tested, however, it was ruled out in favour of PVs, as it provides better efficiency.

5. Summary of LZC feasibility study

Technology	End Use	Result
Wind Turbine	Electricity	NOT Feasible
Ground Source Heat Pumps (GSHP)	Thermal Energy	NOT Feasible
Air Source Heat Pumps (ASHP)	Thermal Energy	NOT Feasible
Biomass	Thermal Energy	NOT Feasible
Combined Heat & Power (CHP)	Electricity and Thermal Energy	NOT Feasible
Solar Hot Water	Thermal Energy	NOT Feasible
Photovoltaics	Electricity	FEASIBLE

6. Conclusion

The Energy Statement seeks to address the measures of Sustainability (where applicable) and demonstrate the design intention in relation to policies at National, Regional and Local level as appropriate.

Inclusion of Energy Hierarchy has been addressed in this report.

The SAP methodology has been used to calculate the energy consumption and resultant CO₂ emissions for the proposed development.

Whilst the development will benefit from a well-designed building fabric which should help reduce the need for heating demand, the 36.4 kWp PV panels combined with efficient heating controls, will satisfy the lighting, space and water heating demand achieving the 41.88% CO₂ emissions reduction over Building Regulations as required by the Reading Local Plan. The remaining 58.12% will be subject of a one-off Carbon Offset payment of £26,118.

7. SAP & SBEM Calculations

BLOCK COMPLIANCE		J O S T E C			
Calculation Type: New Build (As Designed)					
Block Reference	22009 - Curzon Club V2	Issued on Date			
Block Name	22009 - Curzon Club V2				
Assessor Details	Mr. Mohamed Egal, Mohamed Egal, Tel: 01923 518 923, mohamed@jostec.co.uk	Assessor ID	H664-0001		
Client					
Block Compliance Report - DER					
Block Reference: 22009 - Curzon Club V2		Block Name: 22009 - Curzon Club V2			
Property-Assessment Reference	Multiplier	Floor Area (m²)	DER (kgCO ₂ /m²)	TER (kgCO ₂ /m²)	% DER/TER
22009 - Flat 01-As Designed V2	1	50.56	11.53	22.87	49.58 %
22009 - Flat 02-As Designed V2	1	70.12	9.33	18.50	49.56 %
22009 - Flat 03-As Designed V2	1	47.15	9.03	20.26	55.43 %
22009 - Flat 04-As Designed V2	1	64.6	7.41	15.89	53.38 %
22009 - Flat 05-As Designed V2	1	75.39	10.78	18.69	42.33 %
22009 - Flat 06-As Designed V2	1	69.47	9.92	19.04	47.89 %
22009 - Flat 07-As Designed V2	1	53.63	10.71	21.74	50.73 %
22009 - Flat 08-As Designed V2	1	50.56	9.72	19.98	51.35 %
22009 - Flat 09-As Designed V2	1	70.12	7.49	15.95	53.05 %
22009 - Flat 10-As Designed V2	1	47.15	6.55	16.95	61.35 %
22009 - Flat 11-As Designed V2	1	64.6	7.25	15.71	53.86 %
22009 - Flat 12-As Designed V2	1	75.39	8.91	16.04	44.46 %
22009 - Flat 13-As Designed V2	1	69.47	7.81	16.16	51.68 %
22009 - Flat 14-As Designed V2	1	53.63	8.27	18.48	55.24 %
22009 - Flat 15-As Designed V2	1	50.56	9.72	19.98	51.35 %
22009 - Flat 16-As Designed V2	1	70.12	11.12	20.17	44.87 %
22009 - Flat 17-As Designed V2	1	47.15	6.55	16.95	61.35 %
22009 - Flat 18-As Designed V2	1	64.6	7.30	15.83	53.89 %
22009 - Flat 19-As Designed V2	1	75.39	8.91	16.04	44.46 %
22009 - Flat 20-As Designed V2	1	69.47	7.81	16.16	51.68 %
22009 - Flat 21-As Designed V2	1	53.63	8.27	18.48	55.24 %
22009 - Flat 22-As Designed V2	1	50.56	11.27	21.93	48.61 %
22009 - Flat 23-As Designed V2	1	47.15	11.29	22.50	49.81 %
22009 - Flat 24-As Designed V2	1	64.6	11.08	19.84	44.15 %
22009 - Flat 25-As Designed V2	1	75.39	8.91	16.04	44.46 %
22009 - Flat 26-As Designed V2	1	69.47	7.81	16.16	51.68 %
22009 - Flat 27-As Designed V2	1	53.63	8.27	18.48	55.24 %
22009 - Flat 28-As Designed V2	1	75.39	13.03	20.85	37.50 %
22009 - Flat 29-As Designed V2	1	69.47	11.55	20.06	42.42 %
22009 - Flat 30-As Designed V2	1	53.63	10.09	20.12	49.84 %
Totals:	30	1852.05	277.69	555.85	
Average DER = 9.28 kgCO ₂ /m²		% DER/TER	PASS		
Average TER = 18.35 kgCO ₂ /m²		49.43 %			

BLOCK COMPLIANCE
Calculation Type: New Build (As Designed)

J O S T E C

Block Compliance Report - DFEE

Block Reference: 22009 - Curzon Club V2		Block Name: 22009 - Curzon Club V2			
Property-Assessment Reference	Multiplier	Floor Area (m ²)	DFEE (kWh/m ² /yr)	TFEE (kWh/m ² /yr)	% DFEE/TFEE
22009 - Flat 01-As Designed V2	1	50.56	52.04	64.69	19.55 %
22009 - Flat 02-As Designed V2	1	70.12	37.04	49.00	24.42 %
22009 - Flat 03-As Designed V2	1	47.15	39.09	46.61	16.13 %
22009 - Flat 04-As Designed V2	1	64.6	29.03	34.83	16.63 %
22009 - Flat 05-As Designed V2	1	75.39	42.90	51.46	16.65 %
22009 - Flat 06-As Designed V2	1	69.47	38.32	51.06	24.94 %
22009 - Flat 07-As Designed V2	1	53.63	45.07	58.16	22.50 %
22009 - Flat 08-As Designed V2	1	50.56	44.40	49.77	10.77 %
22009 - Flat 09-As Designed V2	1	70.12	28.59	35.90	20.36 %
22009 - Flat 10-As Designed V2	1	47.15	27.74	29.56	6.16 %
22009 - Flat 11-As Designed V2	1	64.6	28.31	33.92	16.54 %
22009 - Flat 12-As Designed V2	1	75.39	34.28	37.92	9.61 %
22009 - Flat 13-As Designed V2	1	69.47	28.71	36.38	21.08 %
22009 - Flat 14-As Designed V2	1	53.63	34.16	41.59	17.86 %
22009 - Flat 15-As Designed V2	1	50.56	44.40	49.77	10.77 %
22009 - Flat 16-As Designed V2	1	70.12	44.04	56.28	21.75 %
22009 - Flat 17-As Designed V2	1	47.15	27.74	29.56	6.16 %
22009 - Flat 18-As Designed V2	1	64.6	27.77	33.73	17.69 %
22009 - Flat 19-As Designed V2	1	75.39	34.28	37.92	9.61 %
22009 - Flat 20-As Designed V2	1	69.47	28.71	36.38	21.08 %
22009 - Flat 21-As Designed V2	1	53.63	34.16	41.59	17.86 %
22009 - Flat 22-As Designed V2	1	50.56	51.49	59.74	13.81 %
22009 - Flat 23-As Designed V2	1	47.15	52.66	60.73	13.29 %
22009 - Flat 24-As Designed V2	1	64.6	44.70	53.79	16.91 %
22009 - Flat 25-As Designed V2	1	75.39	34.28	37.92	9.61 %
22009 - Flat 26-As Designed V2	1	69.47	28.71	36.38	21.08 %
22009 - Flat 27-As Designed V2	1	53.63	34.16	41.59	17.86 %
22009 - Flat 28-As Designed V2	1	75.39	54.45	63.66	14.47 %
22009 - Flat 29-As Designed V2	1	69.47	45.91	56.34	18.51 %
22009 - Flat 30-As Designed V2	1	53.63	42.28	49.89	15.25 %
Totals:	30	1852.05	1,139.44	1,366.14	
Average DFEE = 37.72 kWh/m ² /yr		% DFEE/TFEE	PASS		
Average TFEE = 45.33 kWh/m ² /yr		16.79 %			

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	13.18	23.01
Cooling	0	0
Auxiliary	0.13	0
Lighting	30.69	48.23
Hot water	1.36	1.57
Equipment*	16.26	16.26
TOTAL**	45.36	72.81

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	6.65	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	237.92	314.73
Primary energy* [kWh/m ²]	139.25	171.41
Total emissions [kg/m ²]	20.1	32.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.