Energy Strategy Report

ONE YMCA

Prepared by: Stroma Built Environment Ltd

On behalf of: ONE YMCA *Oct 2019*

Report Prepared By:

Date:	Aug 2019	Chris Armstrong Bsc, LCC

Document History:

Issue	Date	Comment	Author
D.01	19.08.2019	Initial Draft	C.A.
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Contents

1. Executive Summary

The following Energy Assessment has been prepared to support the planning application for the redevelopment to the ONE YMCA site, at 90 Peartree Lane, Welwyn Garden City.

The site proposals consist of a total of 43 residential units and a 100-bed YMCA hostel.

A fabric first approach to energy efficiency has been specified in order to minimise demand and create inherent efficiency. With the stated details the energy efficiency measures alone can be shown to bring the proposals in line with the *Building Regulations Part L: Conservation of Fuel and Power*.

Integration of low carbon technologies has been investigated and will be considered in more detail at the design stage of the development.

The stated measures reduce carbon emissions by 2.23% in the case of dwellings, and 1.31% in the case of the hostel, when compared to the notional target emission rates.

The following tables detail the site energy hierarchy results.

Residential

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	49.90	-	-
After energy efficient measures	48.78	1.114	2.23

Hostel

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	218.98	-	-
After energy efficient measures	216.12	2.86	1.31

Whole Site

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	268.88	-	-
After energy efficient measures	264.90	3.98	1.48

2. Introduction

This Energy Assessment report has been prepared on behalf of the Applicant, ONE YMCA, by Stroma Built Environment, a construction consultancy specialising in sustainability, energy conservation and the application of renewable energy technologies.

It has been prepared to support a planning application for the proposed redevelopment of the ONE YMCA site. The development consists of two buildings; a hostel containing 100 rooms; and a residential block containing 43 units self-contained private apartments.

This statement shall set out the applicable policies on energy for the proposed scheme, as well as the methodology for, and results from, an Energy Assessment.

It contains CO2 emissions predictions and shall detail the energy efficiency measures proposed within the design, and a feasibility study to establish which low carbon renewable technologies might be most appropriate for the site.

It should be noted that all specification detailed within this report is subject to review throughout the design stage. The specification is largely assumed at this stage, to establish the likely predicted regulated energy requirements, and is typical of standards required to reach compliance with *Building Regulations Part L: Conservation of Fuel and Power*. The design team are always bound by the requirements Part L, and any future design changes will therefore comply with Part L as a minimum standard.

3. Planning policy

Welwyn Hatfield District Plan 2005 Policy R3 requires developments to include measured to maximise energy conservation through the design of building, site layout and provision of landscaping and incorporate the best practical environmental option of energy supply.

The Pre application advice states that *'It is recommended that new dwellings deliver some of their energy requirements from decentralised and renewable or low-carbon sources. A statement illustrating how this would be achieved would be required to be submitted with any planning application.*

It should be noted that since the adoption of the District Plan, Part L of the Building Regulations has been updated multiple times where each revision has required lower carbon emission rates. Therefore, the current regulations enforce most the requirements of Policy R3 in the Welwyn Hatfield District Plan.

4. Calculation methodology

The schemes regulated energy demand and carbon emissions have been calculated using the Standard Assessment Procedure (SAP) 2012, and the Simplified Building Energy Model (SBEM) or Dynamic Simulation Model (DSM). These are the Government's approved tools for assessing regulated carbon emissions from dwellings and non-dwellings respectively, and are used to demonstrate compliance with *Building Regulations Part L: Conservation of Fuel and Power*.

The 'Baseline' case for emissions was determined by using the 'Target Emission Rate' (TER) from the compliance calculations. These figures provide an emission rate for the 'notional' target building, and hence a figure for acceptable total regulated emissions. The emissions saving from energy efficiency proposals were determined by comparing the total emissions from the TER figures, with the predicted emission rates (BER or DER), based on the proposed specification.

It should also be noted that the compliance methodology was produced with the sole intention of demonstrating compliance with the *Building Regulations Part L*. As such, standardised assumptions are made regarding building occupancy, use, conditioning setpoints etc. It is therefore important to note that they are intended to be used on a comparable scale, rather than give accurate predictions of real energy use. The results herein are provided solely for the purposes of demonstrating compliance and are not envisioned as an accurate prediction of operational energy use.

The energy calculations have been undertaken by an accredited Energy Assessor, licensed to use all applicable assessment software's.

5. Establishing the baseline emissions

The SAP and DSM calculations have been undertaken to assess regulated energy use, accounting for energy demands from space heating and hot water, and electricity for pumps, fans and lighting.

The energy assessment has first established the regulated CO_2 emissions assuming the development complied with Part L 2013 of the Building Regulations using the Building Regulations approved compliance software.

The TER is the maximum permitted emissions for each dwellings/non-dwelling, and is expressed in $kgCO_2/m^2$. Thus, the total baseline emissions for the scheme are the sum of all the products of the TER and the total floor area (TFA).

The TER is variable depending on the design of the scheme, so the below figures are subject to change depending on the design stage decisions.

Residential

Scenario	Annual CO_2 emissions (Tonnes CO_2/annum)
Baseline Regulated	49.90

Hostel

Scenario	Annual CO_2 emissions (Tonnes CO_2/annum)
Baseline Regulated	218.98

Site Total

Scenario	Annual CO_2 emissions (Tonnes CO_2/annum)
Baseline Regulated	268.88

6. Energy Efficiency

This section outlines the energy efficiency proposals to minimise energy demand. Performance and savings are assessed against the previously calculated notional baseline emissions.

At an early stage, the design team have explored a range of energy efficiency measures including but not limited to, enhanced U-values, enhanced construction details to minimise thermal bridging, and enhanced insulation to any thermal stored and distribution pipework.

The design of the buildings is such that both buildings are 'narrow' around a central courtyard. This has enabled all habitable rooms to be provided with an openable window. This ensures that daylight levels are high to ensure lower usage of artificial lighting and ensures that all habitable rooms have natural ventilation via the openable window. This will reduce the risk for future occupants needing to install cooling retrospectively. In the case of the residential units, every dwelling has at least two exposed facades (dual aspect), which enables cross ventilation which will significantly reduce the risk of overheating, and therefore further reduce the risk of future occupant needing to install cooling. Providing cross ventilation to the rooms in the hostel is problematic due to the need for a central corridor separating the two facades. However, all habitable spaces are provided with an openable window which will assist in reducing energy as described above.

6.1 Thermal envelope

Fundamental to achieving energy efficiency in any new building is a suitably designed and specified thermal envelope. Passive design features such as appropriate orientation, balancing solar gain and limiting heat loss are all proven techniques to reduce energy consumption. In addition, minimising thermal bridging and controlling air infiltration are important factors.

The following tables illustrate the proposed building fabric performance specification, with respect to the limiting values stipulated in Part L 2013. It is shown that the proposed specification represents a significant betterment of the minimum standards.

Element	Proposed	Part L 2013	Improvement
External Walls	0.20 W/m^2K	0.30 W/m^2K	33%
Exposed Floor	0.12 W/m^2K	0.25 W/m^2K	52%
Exposed Roofs	0.12 W/m^2K	0.25 W/m^2K	52%
Doors / Windows (External)	1.40 W/m^2K	2.20 W/m^2K	36%
Air Permeability	4.0 m^3/hm^2	10 m^3/hm^2	60%

In addition to the primary envelope specification, non-repeating thermal bridging shall play a vital role in reducing energy demand, by ensuring that heat leakage at junctions is kept to a minimum. As a minimum, it is proposed that all junctions shall match or exceed Accredited Construction Details (ACD) standards where possible.

The G-Value of glazing is the fraction of solar radiation that passes through the glazing. A high level of solar gains will help heat the space and reduce the demand for heating. However, high solar gains can increase the risk of overheating is summer months, and for cooled zones can add to the cooling demand. The design team aim to avoid specifying cooling, therefore careful consideration to the G-Value will be investigated throughout design stage, to reduce the overall energy demand, but also to ensure there is not an unacceptable risk of overheating.

The hostel will have a high hot water demand making up approximately 70% of the total regulated energy demand, and to ensure it is reduced all thermal stores and distribution pipes will be highly insulated.

6.2 Building services

For the hostel the heating systems used within the assessment are a community heating system, and this report assumes that it will be supplied by a highly efficient gas fired boiler. Other alternatives may be explored during design stage, and may affect all results stated within this report, but as mentioned the buildings will be compliant with Approved Document Part L.

For the residential block each dwelling will be provided with their own highly efficient gas combination boiler to provide heating and hot water.

All heating controls will be highly responsive and zoned appropriately to ensure areas are only heated to the required level for their needs.

Ventilation will be mainly natural via openable windows, but any proposed mechanical ventilation will have low specific fan power to ensure reduced energy demand.

Lighting will be of high efficacy throughout. The design of the building also aims to maximise the levels of natural light to reduce the need for artificial light.

The below tables detail the assumed building services specification.

Residential Services	Specification
Heating & Hot Water System	Highly efficient individual gas combination boiler
Heating System Controls	Time and temperature zone control
Internal fixed lighting	Low energy throughout
Ventilation	Natural with intermittent extracts to wet rooms

Hostel Services	Specification
Heating & Hot Water System	Highly efficient communal gas boilers
Heating System Controls	Central & local control
Internal fixed lighting	Low energy throughout Sophisticated controls where appropriate
Ventilation	Natural with intermittent extracts to wet rooms

Regarding the residential communal access corridors, these spaces are not assessed within the compliance calculations, and shall not be conditioned. Lighting consumption to these areas will be minimised in any case, with the installation of PIR occupancy sensors and low energy LED lighting.

6.3 Energy Efficiency Results

The below tables detail the CO_2 savings from the energy efficiency measures:

Residential

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	49.90	-	-
After energy efficient measures	48.78	1.114	2.23

As detailed in the table above, the passive design assumption demonstrate a 2.23% reduction in CO_2 emissions over the regulatory requirement of the building regulations.

Hostel

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	**218.98**	**-**	**-**
After energy efficient measures	**216.12**	2.86	1.31

As detailed in the table above, the passive design assumptions demonstrate a 1.31% reduction in CO_2 emissions over the regulatory requirement of the building regulations.

Whole Site

Scenario	Regulated CO_2 emissions (Tonnes CO_2/annum)	Regulated CO_2 savings (Tonnes CO_2/annum)	CO_2 reduction (%)
Baseline	**268.88**	**-**	**-**
After energy efficient measures	**264.9**	3.98	1.48

As detailed in the table above, the passive design assumptions demonstrate a 1.48% reduction in CO_2 emissions over the regulatory requirement of the building regulations.

7. Renewables

7.1 Overview

Renewable energy is defined as energy derived from energy flows that occur naturally and repeatedly in the environment. It may be contrasted with energy sources that can be depleted such as fossil fuels or uranium-238-based nuclear power. It therefore follows that the commonly used phrase “equipment to generate renewable energy” is an oxymoron since renewable energy cannot be “generated” – the true function of the technology is to harness a natural energy flow.

Renewable energy technologies, with a couple of exceptions, all utilise energy from the sun – either directly or indirectly, the exceptions being true geothermal, which uses heat from the earth’s core, and tidal / marine current electricity generation which uses the gravitational forces between the earth and the moon, (although some marine currents are also greatly affected by solar energy). Insofar as this report is only concerned with practical options for on-site renewable energy, these options are not considered further. The remaining range of “solar” technologies are however vast, and some would not even appear to be solar on superficial inspection. They can be summarised as follows:

- Solar thermal – direct heating of water for space heating or domestic hot water;
- Photovoltaic – direct generation of electricity from sunlight;
- Hydroelectricity – use of solar (water cycle) driven water flows to generate electricity;
- Wind turbines – use of solar driven air movement to generate electricity;
- Heat pumps – extraction of solar heat from the earth, atmosphere or water bodies;
- Bio-fuels – combustion of solid or liquid bio-fuels to produce heat or electricity;

The technologies, and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions – mainly carbon dioxide, and none of the technologies are wholly “zero carbon”. This is because when the whole life cycle is considered, some energy must be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels, the diesel fuel used to transport wood pellets to the development and to power the wood processing machinery, and where applicable to bio-fuels, the energy used to manufacture the fertilizers needed to maintain soil fertility.

Finally, due to the dynamic and innovative nature of the renewable energy technology industry even apparently similar products can differ in vital practical details which means that detailed design of installations must be undertaken by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following section contains an overview of the technologies, and their feasibility for inclusion within these proposals.

7.2 Solar Thermal

Solar thermal hot water is not considered to be feasible for the residential block as it would require a central plant room with thermal store, where the water would then be distributed around the block to dwellings. The losses from the thermal store and circulation pipework are likely to be considered too high to be feasible as the demand for hot water from the residential units would not be large enough. A central plant room is not incorporated into to design, as individual boilers are considered to be the most appropriate approach.

For the Hostel block, the hot water demand is far greater, and there is also a central plant as part of the proposal. However, extra pipe losses would occur when transferring the water from the roof level to the ground floor plant room. Also, a principle disadvantage with solar thermal systems is that the heat cannot be stored for long periods, and unlike electricity cannot be exported when surplus is available.

7.3 Solar photovoltaics

The development proposal is well suited to photovoltaic panel technology. There is adequate south facing roof where an array can be sited. The advantage of photovoltaic in comparison solar thermal is that the energy that is not utilised on site can be exported to the grid.

Solar photovoltaics will be further investigated by the design team at design stage.

7.4 Hydroelectricity

Hydro is clearly not suitable for this development.

7.5 Wind Turbines

While large wind turbines installed in “wind farms” in exposed locations and increasingly off shore, can and are providing a substantial amount of the UK’s current renewable electricity, the use of micro wind turbines on small residential or commercial developments is of questionable value, and is frequently no more than a token gesture. They are not considered feasible for a site within this location, and they will not be considered further by the design team.

7.6 Heat Pumps

There are two common types of heat pump – ground source and air source. In urban locations ground source heat pumps are rarely viable, due to the complexity of drilling boreholes to collect heat. These are typically up to 100m deep and should be spaced at least 6m apart to avoid over-cooling the ground. A typical borehole can deliver a maximum output of 4kW of heat. Air source heat pumps collect heat from the ambient air using air-heat-exchanger units.

The proposal for the residential development are individual heating systems. Therefore, each dwelling would require an ASHP to be house outside which is not likely to be welcome for aesthetic reasons. They are therefore not considered to be feasible.

For the hostel the most appropriate way to incorporate ASHP's would be to pre heat the hot water, and use the gas boiler as a supplementary boiler. In the near future it is anticipated that this approach will become much more common, due to the decarbonisation of the grid, which has meant that this technology gives the best results in terms of carbon emissions. However, the gas boiler approach remains the most conventional approach and it is considered the most likely proposals for this development.

The design team indent to consider ASHP in more detail at the design stage.

7.7 Bio Fuels

In the UK there are essentially two types of bio-fuels available at present. Biomass generally refers to either wood chips or wood pellets. Bio-diesel (or plant oil) is a liquid bio-fuel (chemically modified vegetable oil) that can be used in place of heating oil or to run diesel engines. In the built environment, bio-diesel is not a viable proposition at present due to fuel availability and cost.

Biomass heating systems generally need a lot of room to store the fuel, and suitable arrangements to enable it to be delivered to the plant rooms. There would also be the issue of solid/liquid fuelled appliances emitting Particulate Matter.

For the above reasons bio fuels are not considered to be feasible in this instance.

8. Conclusions

This Energy Statement has outlined the possible preliminary specification for the development and the resulting savings implemented by the energy efficient measures. A fabric-first approach has been taken to realise savings against the calculated baseline.

Additional energy and CO_2 savings will be considered throughout the design of the development, and this report suggests that PV and ASHP's would be the most suitable technologies in this instance, the former probably being the most likely.

Therefore, the foregoing results show that the development has been assessed against the applicable planning policies as detailed in Section 3.

Appendix A – Part L Calculations

The below is a sample of the Preliminary SAP and SBEM calculations.

SBEM

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Proposed YMCA Hostel As designed

Date: Fri Aug 16 16:58:24 2019

Administrative information

Building Details

Address: Peartree Lane, Welwyn Garden City,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Stroma Built Environment Limited

Telephone number: 01892 893727

Address: Teaselwood Barn, Lamberhurst Vineyard, Furnace Lane, Lamberhurst, Tunbridge Wells, TN3 8LA

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	61.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	61.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	60.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	RM000010:Surf[2]
Floor	0.25	0.12	0.12	RM000010:Surf[0]
Roof	0.25	0.12	0.12	CR000005:Surf[2]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	RM00001D:Surf[0]
Personnel doors	2.2	1.4	1.4	RM000010:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

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SAP Block Summary

Block Compliance WorkSheet: Site Wide

User Details

Assessor Name:	Chris Armstrong	**Stroma Number:**	STRO002044
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.0.4.12

Calculation Details

Dwelling	DER	TER	DFEE	TFEE	TFA
07-19-78920 Flat 1 PL1	21.71	21.91	56.2	59.3	50.33
07-19-78920 Flat 2 PL1	20.92	21.24	53	55.9	50.21
07-19-78920 Flat 3 PL1	19.57	20.13	47.5	50.3	50.33
07-19-78920 Flat 4 PL1	18.12	18.46	45.8	49.2	69.97
07-19-78920 Flat 5 PL1	19.34	19.39	50.9	54	69.97
07-19-78920 Flat 6 PL1	17.87	18.4	45.8	49	70.15
07-19-78920 Flat 7 PL1	18.22	18.76	42.1	43.7	50.74
07-19-78920 Flat 8 PL1	18.14	18.69	46.9	50.4	70.21
07-19-78920 Flat 9 PL1	18.03	18.6	46.4	50	70.21
07-19-78920 Flat 10 PL1	17.61	17.96	42.6	45.4	68.78
07-19-78920 Flat 11 PL1	18.18	18.78	46.3	50	70.14
07-19-78920 Flat 12 PL1	22.37	22.46	59.2	62.2	50.39
07-19-78920 Flat 13 PL1	18.8	19.38	48.9	53	70.23
07-19-78920 Flat 14 PL1	21.76	22.05	56.6	60	50.51
07-19-78920 Flat 15 PL1	22.39	22.78	60	64	50.33
07-19-78920 Flat 16 PL1	20.35	20.61	50.8	52.6	50.21
07-19-78920 Flat 17 PL1	19.32	20.04	47.3	50	50.33
07-19-78920 Flat 18 PL1	15.8	16.25	35.9	37.8	69.97
07-19-78920 Flat 19 PL1	15.8	16.25	35.9	37.8	69.97
07-19-78920 Flat 20 PL1	22.95	23.27	63	66.6	50.33
07-19-78920 Flat 21 PL1	17.18	17.9	43	46.4	70.15
07-19-78920 Flat 22 PL1	17.83	18.58	41.4	43	50.74
07-19-78920 Flat 23 PL1	15.8	16.25	35.9	37.8	69.97
07-19-78920 Flat 24 PL1	15.8	16.25	35.9	37.8	69.97
07-19-78920 Flat 25 PL1	15.23	15.73	32.4	33.9	68.78
07-19-78920 Flat 26 PL1	15.89	16.56	36.4	38.6	70.14

Block Compliance WorkSheet: Site WideCont...

Dwelling	DER	TER	DFEE	TFEE	TFA
07-19-78920 Flat 27 PL1	21.35	21.45	55.8	57.2	50.33
07-19-78920 Flat 28 PL1	18.22	18.85	41.6	43.7	50.39
07-19-78920 Flat 29 PL1	16.46	17.14	38.8	41.5	70.23
07-19-78920 Flat 30 PL1	19.21	19.67	45.7	47.9	50.51
07-19-78920 Flat 31 PL1	18.77	18.78	48.7	50.8	69.97
07-19-78920 Flat 32 PL1	18.77	18.78	48.7	50.8	69.97
07-19-78920 Flat 33 PL1	18.77	18.78	48.7	50.8	69.97
07-19-78920 Flat 34 PL1	17.84	17.97	44.8	46.6	69.97
07-19-78920 Flat 35 PL1	15.23	15.73	32.4	33.9	68.78
07-19-78920 Flat 36 PL1	15.89	16.56	36.4	38.6	70.14
07-19-78920 Flat 37 PL1	17.65	18.2	40	40.7	50.33
07-19-78920 Flat 38 PL1	20.61	21.09	52	55.2	50.39
07-19-78920 Flat 39 PL1	18.28	18.9	46.9	50.5	70.23
07-19-78920 Flat 40 PL1	21.27	21.45	54.7	56.9	50.51
07-19-78920 Flat 41 PL1	18.06	18.52	44.6	48.2	68.78
07-19-78920 Flat 42 PL1	17.75	18.27	44.6	47.4	70.14
07-19-78920 Flat 43 PL1	21.29	21.23	55.5	56.1	50.33

Calculation Summary

Total Floor Area	2654.03
Average TER	18.80
Average DER	18.38
Average DFEE	45.52
Average TFEE	48.09
Compliance	Pass
% Improvement DER|TER	2.23