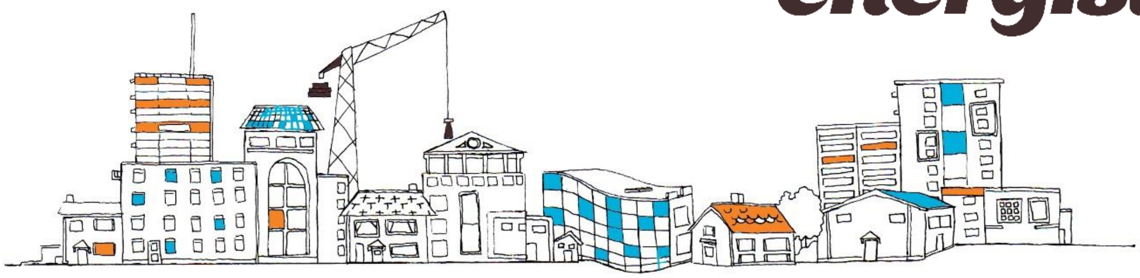
Energy Statement

Land East of Rayleigh Road, Thundersley

On behalf of This Land Ltd

Revision 01

Date: 1st December 2022



REVISION HISTORY

Revision	Issue Date	Description	Issued By	Checked By
A	10/09/2021	Original Document	TW	MA
01	01/11/2022	Rev 01 – Amendments following comments	TW	

All advice provided by Energist regarding the performance of materials is limited solely to the purposes of demonstrating compliance with the Energy Statement. The performance of materials under other criteria, including but not limited to fire, structural, acoustics are not considered in our advice. It is the responsibility of the client to ensure the wider suitability of materials specified in our assessments.

Calculations contained within this report have been produced based on information supplied by the Client and the design team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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CONTENTS

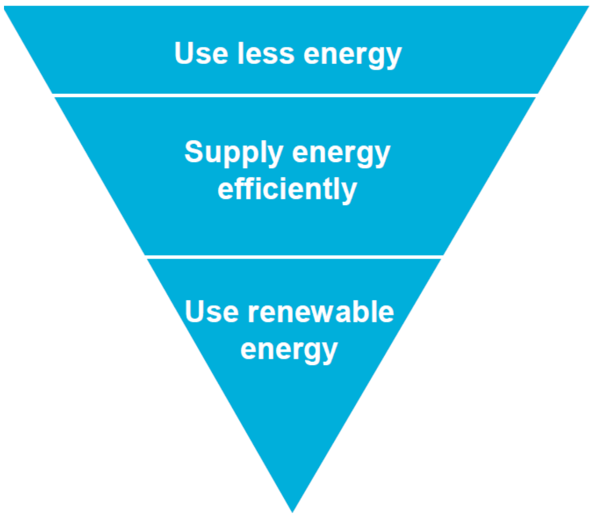
1. EXECUTIVE SUMMARY

This Energy Statement has been produced by Energist UK on behalf of This Land Ltd ('the Applicant') and is written in support of the Outline Planning Application for Land East of Rayleigh Road, Thundersley.

It will set out the measures planned by the Applicant to achieve CO_2 reductions at the proposed development site demonstrating compliance with:

i) National Planning Policy Framework.
ii) Approved Document Part L of the Building Regulations 2013.
iii) The emerging local planning policy requirements for Castle Point Borough Council
iv) Policy HO13 Accessible housing and lifetime home
v) Residential Design Guidance (Nov 2012) Policy RDG9

The Energy Statement sets out how design measures will be incorporated as part of the Development, aligning with the principles of the energy hierarchy.



The Energy Statement concludes that the following combination of measures, summarised overleaf in Table 1, will be incorporated into the Development demonstrating how the energy standard will be delivered by the Applicant. This is described in this Statement as an improvement in CO_2 emissions over the Approved Document Part L (ADL) 2013.

Table 1: Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services including high-efficiency heating systems. ▪ Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	▪ Photovoltaic array to each residential property ▪ Air source heat pumps systems to underfloor heating

The impact of these design measures in terms of how the Applicant delivers the energy standard for the residential areas is illustrated in Figure 1 and Table 2 below.

Figure 1: How the Development meets the energy standard (Residential).

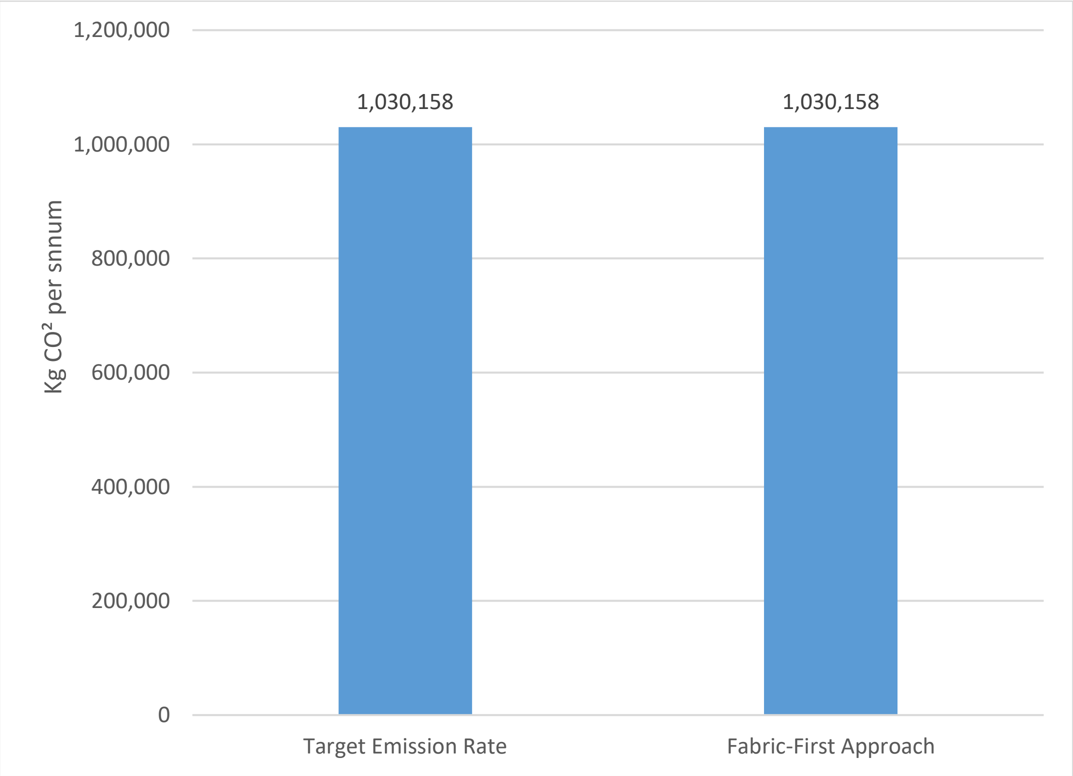


Table 2: CO_2 emissions and percentage reduction over ADL 2013 (Residential).

	CO_2 emissions	
	Kg/CO_2 per annum	% reduction
Target Emission Rate: Compliant with ADL 2013	1,030,158	0%
Fabric first: Demand-reduction measures	1,030,158	0%
Low-carbon and renewable energy	1,017,739	1.2%
Total savings	**12,419**	**1.2%**

The calculated reduction in CO_2 emissions and the percentage reduction in CO_2 over ADL 2013 is demonstrated in Figure 2 and Table 3 for the commercial areas of the project.

Figure 2: How the Development meets the energy standard (Commercial).

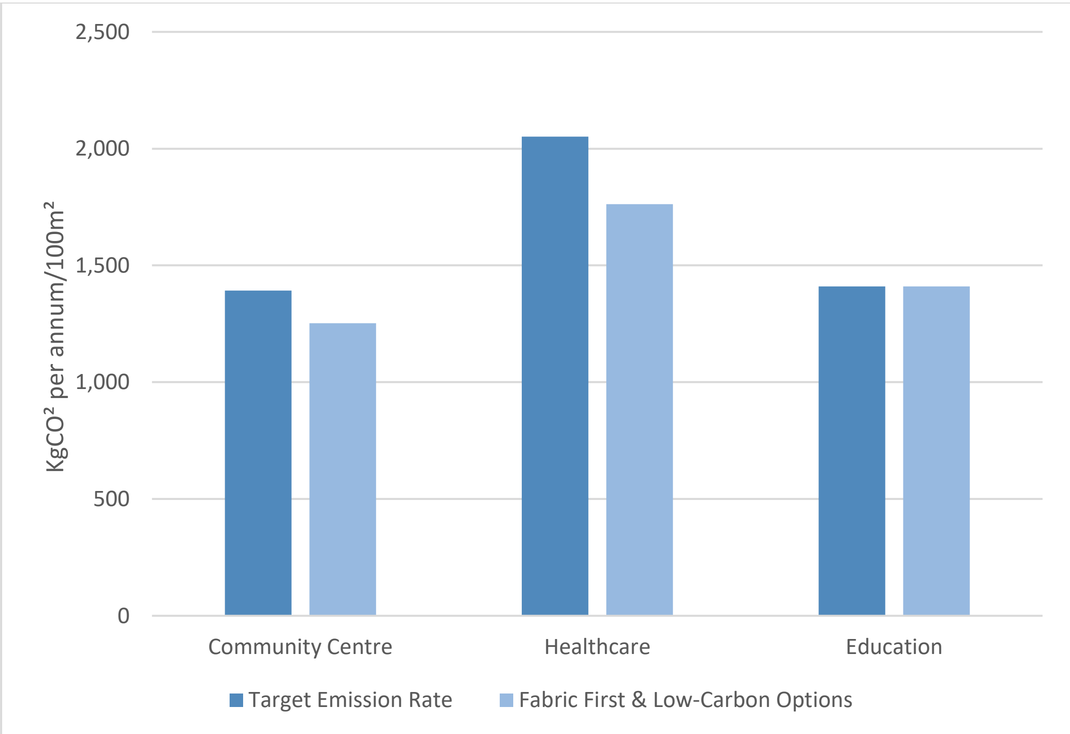


Table 3: CO_2 emissions and percentage reduction over ADL 2013 (Commercial).

	Community Centre	Healthcare	Education
Target Emission Rate: Compliant with ADL 2013 (Kg/CO_2 per annum)	1,393	2,051	1,410
Fabric first & Low-Carbon Options (Kg/CO_2 per annum)	1,253	1,763	1,410
Reduction in CO^2 emissions (Kg/CO_2 per annum)	140	288	0
Reduction in CO^2 emissions (%)	10%	14%	0%
Total savings	**10%**	**14%**	**0%**

2. INTRODUCTION

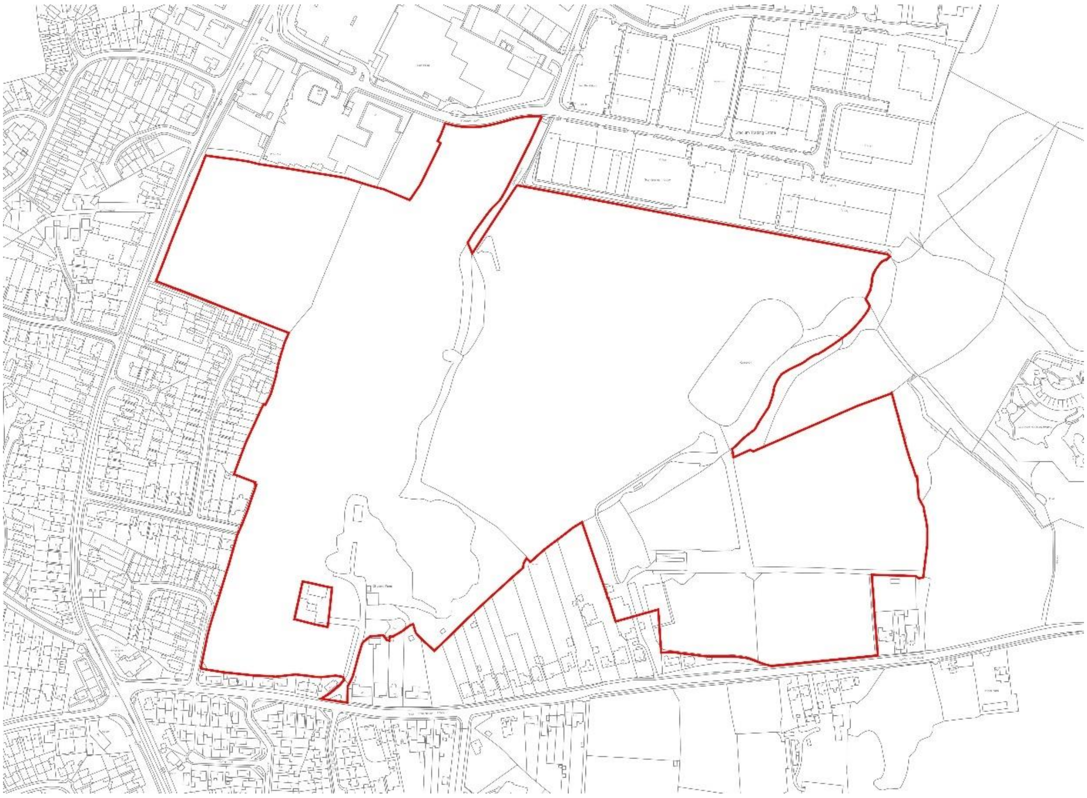
2.1 Site Description

This Energy Statement has been prepared for the residential development at Land East of Rayleigh Road, Thundersley. This falls under the jurisdiction of Castle Point Borough Council.

The Development consists of up to 455 dwellings consisting of a mixture of detached and semi-detached properties. The site will also incorporate several commercial properties within the site, potentially including a community centre, a children's nursery, and healthcare facilities of various sizes.

The site lies within Green Belt land to the East of Rayleigh Road.

Map 1: Extent of Site Plan for Land East of Rayleigh Road, Thundersley.



Source: Broadway Malyan dwg 101 (November 2022)

2.2 Purpose of the Energy Statement

This Statement sets out how the Applicant intends to meet:

i) National Planning Policy Framework.
ii) Approved Document Part L of the Building Regulations 2013.
iii) The emerging local planning policy requirements for Castle Point Borough Council
iv) Policy HO13 Accessible housing and lifetime home
v) Residential Design Guidance (Nov 2012) Policy RDG9

For a detailed overview of the planning policy requirements specific to this development, refer to Appendix 2.

The way in which the Applicant meets the energy standard at Land East of Rayleigh Road, Thundersley will be set out in this Statement as follows:

- **Baseline energy demand**: The Development's Target Emission Rate (TER) will be calculated to establish the minimum on-site standard for compliance with ADL 2013.

- **Fabric first – reduced energy demand:** The Development's Dwelling Emission Rate (DER) and Building Emission Rate (BER) will be calculated to explain how the Applicant's design specification will lead to a reduced energy demand and an improved fabric energy efficiency. The better the design of the building fabric in terms of, for example, insulation, air tightness and orientation to maximise solar gain, the less energy required to heat the dwelling and so the better the fabric energy efficiency.

- **Low-carbon and renewable energy:** Low-carbon and renewable energy technologies will be assessed for their suitability and viability in relation to the Development. Solutions will be put forward for the development and the resulting CO_2 emission savings presented.

2.3 Methods

Energist UK has used SAP 2012 and SBEM NCM methodologies to calculate energy demand for sample dwellings and commercial entities. The data has been extrapolated to reflect more accurately the expected CO_2 emission rates and energy demand for all proposed properties included in the development proposals.

3. BASELINE ENERGY DEMAND

3.1 Introduction

In order to measure the effectiveness of demand-reduction measures, it is first necessary to calculate the baseline energy demand, and this has been done using SAP 2012 and SBEM NCM methodologies. This can also be referred to as the Target Emission Rate (TER.)

The resulting ADL 2013 TER for Land East of Rayleigh Road, Thundersley has been calculated using Part L model designs which have been applied to the Applicant's Development details. The TER, or baseline energy demand, represents the maximum CO_2 emissions that are permitted for the Development in order to comply with ADL 2013.

3.2 The Development Baseline (Residential)

The resulting TER, representing the total maximum CO_2 emissions permitted for the Development, has been calculated as 1,030,158 kg/CO_2 per annum. To ensure compliance with ADL 2013, CO_2 emissions should not exceed this figure.
The development baseline specification is shown in Table 4 below.

3.3 The Development Baseline (Commercial)

The resulting TER, representing the total maximum CO_2 emissions permitted for the Development, has been calculated as:

Education
1,410 kg/CO_2 per annum, per 100m^2. To ensure compliance with ADL 2013, CO_2 emissions should not exceed this figure.

Healthcare
2,005 kg/CO_2 per annum, per 100m^2. To ensure compliance with ADL 2013, CO_2 emissions should not exceed this figure.

Community Hall
1,393 kg/CO_2 per annum, per 100m^2. To ensure compliance with ADL 2013, CO_2 emissions should not exceed this figure.

The development baseline specification is shown in Table 5 below.

Table 4. Baseline design specification (Residential).

Element	Baseline Design Specification
Ground Floor U-Value (W/m^2.K)	0.17
External Wall U-Value (W/m^2.K)	0.23
Party Wall U-Value (W/m^2.K)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value (W/m^2.K)	0.11
Roof – flat, U-Value (W/m^2.K)	0.22
Glazing U-Value, including frame (W/m^2.K)	1.4
Door U-Value (W/m^2.K)	1.5
Design Air Permeability	5
Space Heating	Mains Gas
Heating Controls	Heating System Controls
Domestic Hot Water	Mains Gas
Ventilation	Natural ventilation with intermittent extract fans
Low Energy Lighting	100%
Thermal Bridging	Appendix R values

Table 5. Baseline design specification (Commercial).

Element	Baseline Design Specification
Ground Floor U-Value (W/m^2.K)	0.25
External Wall U-Value (W/m^2.K)	0.30
Party Wall U-Value (W/m^2.K)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value (W/m^2.K)	0.25
Glazing U-Value, including frame (W/m^2.K)	1.8
Design Air Permeability	5
Space Heating	Mains Gas
Heating Controls	Heating System Controls
Domestic Hot Water	Mains Gas
Ventilation	Natural ventilation with intermittent extract fans
Low Energy Lighting	100%
Thermal Bridging	Appendix R values

4. FABRIC-FIRST APPROACH - REDUCED ENERGY DEMAND

4.1 Introduction

Many Local Planning Authorities are now recognising the benefits of a fabric-first approach, where the lifetime energy consumption of a building takes precedence over the use of bolt-on renewable energy technologies.

It is clear that the fabric-first approach can create buildings with a very comfortable living and working environment. The internal temperature is consistent and fuel bills are kept to a minimum. One key advantage of a fabric-first approach is that it does not require changes to the behavioural patterns of the occupants and, as such, a building designed using a fabric-first approach will often perform more effectively once completed than a building that incorporates a low-carbon or renewable-energy technology that requires behavioural change (e.g., solar thermal). This becomes an increasingly important consideration as energy costs rise and the issue of fuel poverty becomes commonplace.

Energist UK has considered a fabric-first approach as the priority solution for this Development.

4.2 The Development - Reduced Energy Demand

The Applicant will integrate the following design measures to reduce energy demand:

- Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs.
- High-efficiency double glazed windows throughout.
- Quality of build will be confirmed by achieving good air-tightness results throughout.
- Efficient-building services including high-efficiency heating systems.
- Low-energy lighting throughout the building.

The Applicant's design specification and intended demand-reduction measures for the Development have been modelled using the same SAP 2012 and SBEM NCM methodologies as before. This allows us to assess the effectiveness of demand-reduction measures as a percentage reduction in CO_2 emissions over the Baseline.

The total calculated CO_2 emissions for the residential areas at Land East of Rayleigh Road, Thundersley is 1,030,158 Kg/CO_2 per annum, which is a reduction of 0% over the Baseline. Refer to Appendix 3 for SAP Results and Table 6 for the fabric-first design specification.

Table 6. The fabric-first design specification at Land East of Rayleigh Road (Residential).

Element	Fabric-First Design Specification
Ground Floor U-Value ($W/m^2.K$)	0.17
External Wall U-Value ($W/m^2.K$)	0.23
Party Wall U-Value ($W/m^2.K$)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value ($W/m^2.K$)	0.11
Roof – Flat U-Value ($W/m^2.K$)	0.22
Glazing U-Value – including Frame ($W/m^2.K$)	1.4
Door U-Value ($W/m^2.K$)	1.5
Design Air Permeability	5
Space Heating	ASHP – UFH (Mitsubishi Ecodan or similar)
Heating Controls	Full time and temperature controls
Domestic Hot Water	From main heating system & cylinder
Ventilation	Natural
Low Energy Lighting	100%
Thermal Bridging	ACDs

The total calculated CO_2 emissions for the commercial areas at Land East of Rayleigh Road, Thundersley is:

Education
1,410 kg/CO_2 per annum, per 100m², which is a reduction of 0% over the Baseline. Refer to Appendix 4 for SBEM NCM Results and Table 7 for the fabric-first design specification.

Healthcare
1,763 kg/CO_2 per annum, per 100m², which is a reduction of 14% over the Baseline. Refer to Appendix 4 for SBEM NCM Results and Table 7 for the fabric-first design specification.

Community Hall
1,253 kg/CO_2 per annum, per 100m², which is a reduction of 10% over the Baseline. Refer to Appendix 4 for SBEM NCM Results and Table 7 for the fabric-first design specification.

Refer to Appendix 4 for SBEM Results and Table 7 for the fabric-first design specification.

Table 7. The fabric-first design specification at Land East of Rayleigh Road (Commercial).

Element	Fabric-First Design Specification
Ground Floor U-Value (W/m^2.K)	0.25
External Wall U-Value (W/m^2.K)	0.30
Party Wall U-Value (W/m^2.K)	0 (fully filled and sealed)
Roof – insulated at ceiling U-Value (W/m^2.K)	0.25
Glazing U-Value – including Frame (W/m^2.K)	1.8
Design Air Permeability	5
Space Heating	ASHP – Split system/ VRF
Heating Controls	Full time and temperature controls
Domestic Hot Water	Standalone electric water heaters
Ventilation	Natural with intermittent extract
Low Energy Lighting	100%
Thermal Bridging	Appendix R values

4.3 Conclusion

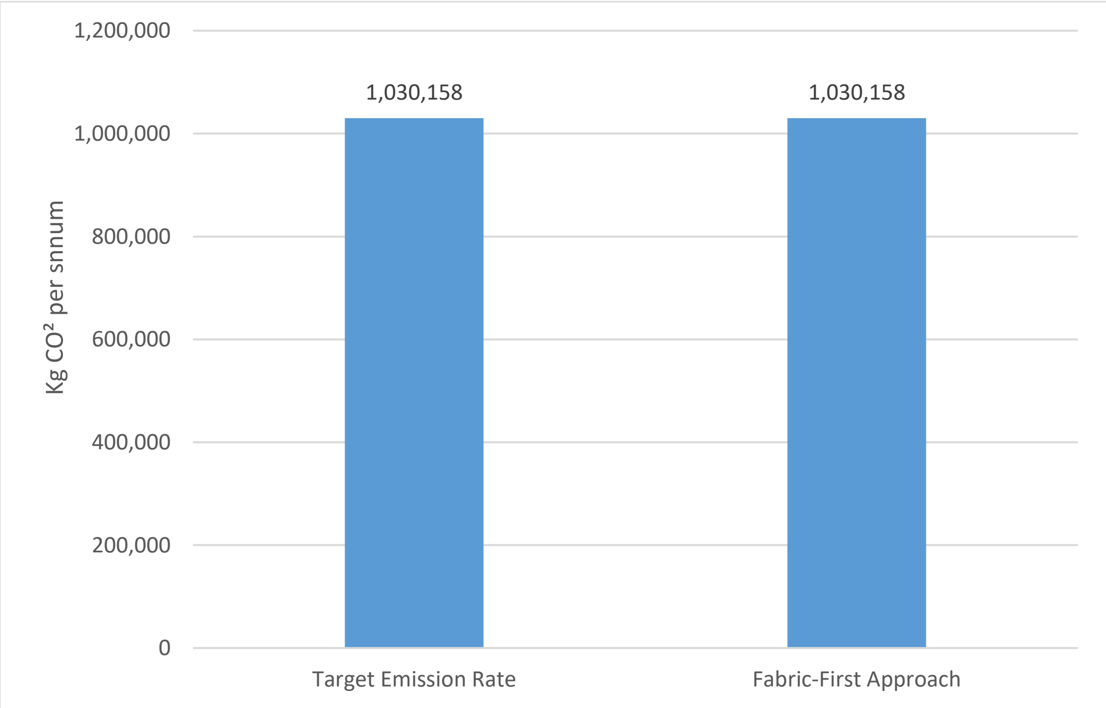
By incorporating sustainable design and energy-reduction design measures at Land East of Rayleigh Road, Thundersley, the Applicant will reduce CO_2 emissions by:

0% over the Baseline for the Residential ADL 2013. This is illustrated in Table 8 and in Figure 3 below.

Table 8: The CO_2-emissions baseline and fabric-first, demand-reduction measures (Residential)

	CO_2 emissions	
	Kg/CO_2 per annum	% reduction
Target Emission Rate: Compliant with ADL 2013	1,030,158	-
Fabric first: Demand-reduction measures	1,030,158	0%

Figure 3: Baseline and fabric-first CO_2-emissions summary (Residential)



By incorporating sustainable design and energy-reduction design measures at Land East of Rayleigh Road, Thundersley, the Applicant will reduce CO_2 emissions by:

Education
A reduction of 0% over the Baseline. This is illustrated in Table 9 and in Figure 4 below.

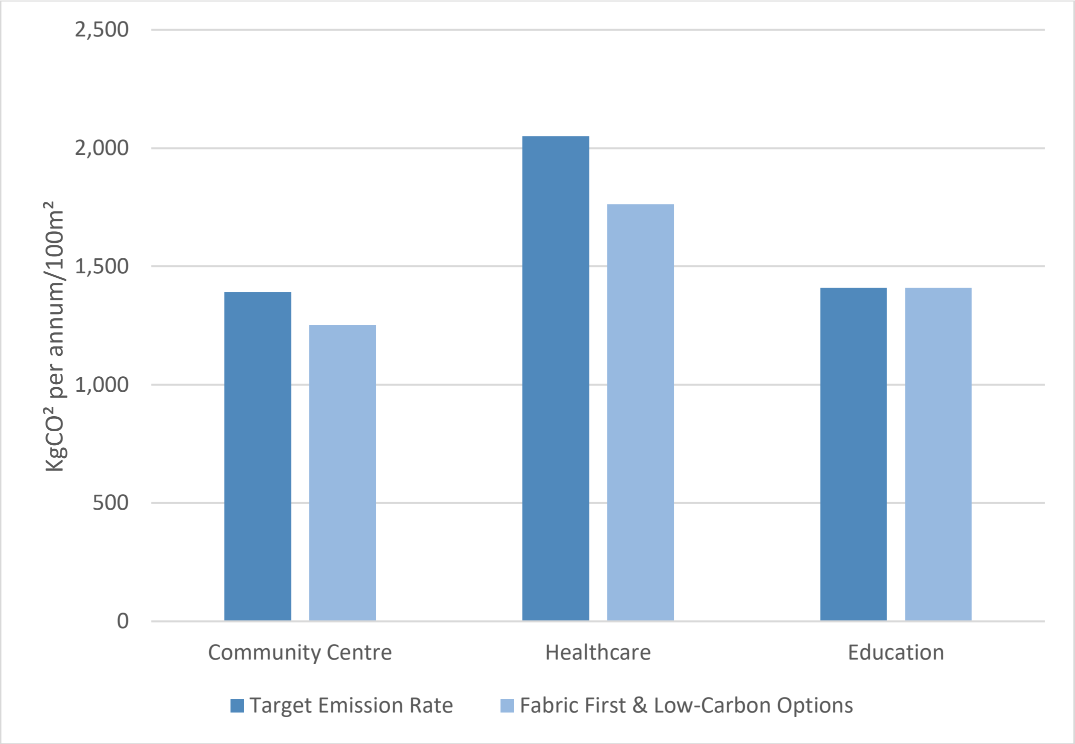
Healthcare
A reduction of 14% over the Baseline. This is illustrated in Table 9 and in Figure 4 below.

Community Hall
A reduction of 10% over the Baseline. This is illustrated in Table 9 and in Figure 4 below.

Table 9: The CO_2-emissions baseline and fabric-first, demand-reduction measures (Commercial)

	Community Centre	Healthcare	Education
Target Emission Rate: Compliant with ADL 2013 (Kg/CO_2 per annum)	1,393	2,051	1,410
Fabric first & Low-Carbon Options (Kg/CO_2 per annum)	1,253	1,763	1,410
Reduction in CO^2 emissions (Kg/CO_2 per annum)	140	288	0
Reduction in CO^2 emissions (%)	10%	14%	0%
Total savings	**10%**	**14%**	**0%**

Figure 4: Baseline and fabric-first CO_2-emissions summary (Commercial)



5. LOW-CARBON AND RENEWABLE ENERGY

5.1 Introduction

The Applicant adopts a fabric-first approach as the priority solution for this Development and steps have been taken to reduce energy demand through high-quality sustainable design. The planned integration of efficient building fabric and building services has been modelled and is predicted to lead to the required enhancement over Part L of the Building Regulations 2013.

The low-carbon and renewable energy solutions applicable to this development scheme are assessed and potentially-viable solutions recorded.

Viability of the following low-carbon and renewable energy technologies have been considered:

- Wind
- Solar
- Aerothermal
- Geothermal
- Biomass

5.2 Wind	*The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).*
Installation considerations	▪ Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available. ▪ A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier) ▪ Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required. ▪ Noise considerations can be an issue dependent on density and build-up of the surrounding area. ▪ Buildings in the immediate area can disrupt wind speed and reduce performance of the system. ▪ Planning permission will be required along with suitable space to site the turbine, whether ground installed, or roof mounted.
Advantages	▪ Generation of clean electricity which can be exported to the grid or used onsite. ▪ Can benefit from the Feed in Tariff, reducing payback costs.
Disadvantages	▪ Planning restrictions and local climate often limit installation opportunities. ▪ Annual maintenance required. ▪ High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.
Development feasibility	▪ Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the

hum of the generator and the possibility of stroboscopic shadowing from the blades on homes.

- Wind speed has been checked for the development scheme using the NOABL wind map: http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 5.6 metres per second (m/s) which is above the minimum of 5 m/s and threshold for technical viability.

- Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially-viable option.

5.3 Solar PV and Solar Thermal

The ability to generate energy (either electricity, hot water, or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly, to turbines, can be considered both on and offsite.

Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.

Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.

Installation considerations

- Operate most efficiently on a south-facing sloping roof (between 30 and 45-degree pitch.)
- Shading must be minimal (one shaded panel can impact the output of the rest of the array.)
- Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading.
- Large arrays may require upgrades to substations if exporting electricity to the grid.

	▪ Local planning requirements may restrict installation of panels on certain elevations. ▪ Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room. ▪ The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	▪ Relatively straightforward installation, connection to landlord's supply and metering. ▪ Linear improvement in performance as more panels are installed. ▪ Maintenance free. ▪ Installation costs are continually reducing. ▪ Can benefit from the Feed in Tariff to improve financial payback.
Disadvantages	▪ Not appropriate for high-rise developments, due to lack of roof space in relation to total floor area. ▪ With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating.
Development feasibility ✓	▪ The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option. ▪ There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays. ▪ The Development is not on land, which is protected or listed, so it is considered that Solar panels would not have a negative impact on the local historical environment or the aesthetics of the area. ▪ If PV panels were to be used, the occupants may be entitled to claim the Feed-In-Tariff for any energy which is generated. If solar thermal panels were to be used, the occupants would see a reduction in hot water bills.

- The commercial viability of Solar PV or Solar Thermal would need to be fully explored if considered part of an Energy Strategy as the economical investment would need to be justified by the return on the Applicant's investment.

5.4 Aerothermal

The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems.

Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water.

They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.

Installation Considerations

- ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability.
- Underfloor heating will give the best performance, but oversized radiators can also be used.
- Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months.
- Noise from the external unit can limit areas for installation.
- £7,000-£11,000 per dwelling (taken from the Energy Saving Trust, TBC by supplier.)

Advantages

- Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings.
- They require additional space when compared to a gas boiler. Space for an external unit is needed, as is space for the hot water cylinder and internal pump.

	▪ Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation. ▪ Running costs between heat pumps and modern gas boilers are comparable.
Disadvantages	▪ Residents need to be made aware of the most efficient way of using a heat pump; as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system. ▪ Will not perform well in homes that are left unoccupied and unheated for a long period of time. ▪ Back-up immersion heating can drastically increase running costs. ▪ Noise and aesthetic considerations limit installation opportunities.
Development feasibility ✓	▪ ASHPs are considered a technically-viable option for this development scheme.

5.5 Geothermal

The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils.

Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10℃ at 4 metres depth). This leads to a reliable source of heat for the building.

	Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.
Installation considerations	▪ Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.) ▪ Decision between coils or piles can lead to significant extra cost. ▪ Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators. ▪ Similar to ASHPs, perform best in well-insulated buildings with a low heating demand. ▪ Electric immersion heater required for winter use. ▪ £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust, TBC by supplier.)
Advantages	▪ Perform well in well-insulated buildings, with limited heating demand. ▪ More efficient than ASHPs.
Disadvantages	▪ The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. ▪ Will not perform well in buildings that are left unoccupied and unheated for a long period of time. ▪ Back up immersion heating can drastically increase running costs. ▪ Large area of ground needed for coil installation.
Development feasibility	▪ GSHPs are considered a technically-viable option for this development scheme as there are no physical constraints in terms of ground conditions and area available for installation.

✗	▪ The capital installation cost would, however, be high which leads us to the conclusion that GSHPs would not be a commercially-viable option for this development scheme.

5.6 Biomass	*Providing a heating system fuelled by plant-based materials such as wood, crops, or food waste.* Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.
Installation considerations	▪ Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided. ▪ Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations. ▪ Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle. ▪ £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust, TBC by Supplier).
Advantages	▪ Considerable reduction in CO_2 emissions.
Disadvantages	▪ Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost. ▪ Plant room space required for boiler and storage. ▪ Dependent on consistent delivery of fuel. ▪ Ongoing maintenance costs (need to be cleaned regularly to remove ash.)

Development Feasibility	
✗	▪ Biomass is considered a technically-viable option for this development scheme as there are no apparent physical constraints on site in terms of installing biomass boilers or storing a sufficient supply. ▪ There are, however, concerns regarding a sustainable supply of biomass to the site. ▪ The capital installation cost would, however, be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme.

5.7 Conclusion

The following low-carbon and renewable energy technologies, summarised here in Table 10, are considered potentially-viable options for the residential development scheme at Land East of Rayleigh Road, Thundersley.

Table 10: Summary of Feasibility for Land East of Rayleigh Road, Thundersley

✓	Solar PV Aerothermal
✗	Geothermal Wind Biomass

6. CONCLUSIONS

The Applicant demonstrates commitment to delivering the energy standard at Land East of Rayleigh Road, Thundersley as follows:

- The Development has been designed to generate a reduction in CO_2 emissions over the TER ADL 2013.

- This energy standard is delivered through a fabric-first approach to design and low-carbon and renewable energy.

A combination of demand-reduction measures, energy-efficiency measures and low-carbon and renewable energy will deliver the Applicant's target for on-site reduction in CO_2 emissions.

The following measures, summarised here in Table 11, are incorporated in the development proposals.

Table 11. Measures incorporated to deliver the energy standard.

Fabric first: Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services including high-efficiency heating systems. ▪ Low-energy lighting throughout the building.
Renewable and low-carbon energy technologies	▪ Installation of 0.78 kWp Photovoltaic array to each residential property. ▪ Air source heat pumps throughout the development.

The way in which these design measures deliver the Applicant's commitment to the residential energy standard is illustrated in Figure 5 and Table 12 and for the commercial areas is illustrated in Figure 6 and Table 13 overleaf.

Figure 5: How the Development delivers the energy standard (Residential)

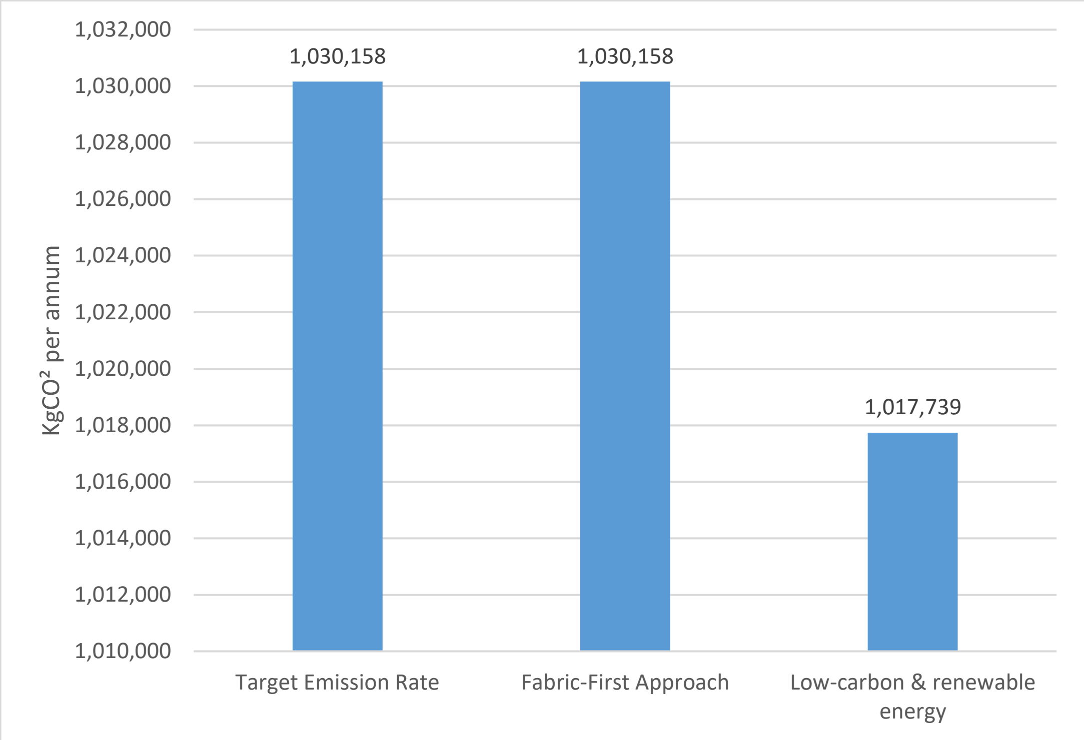


Table 12: How the Development reduces CO_2 emissions (Residential)

	CO_2 emissions	
	Kg/CO_2 per annum	% reduction
Target Emission Rate: Compliant with ADL 2013	1,030,158	-
Fabric first: Demand-reduction measures	1,030,158	0%
Low-carbon and renewable energy	1,017,739	1.2%
Total savings	**12,419**	**1.2%**

Figure 6: How the Development delivers the energy standard (Commercial)

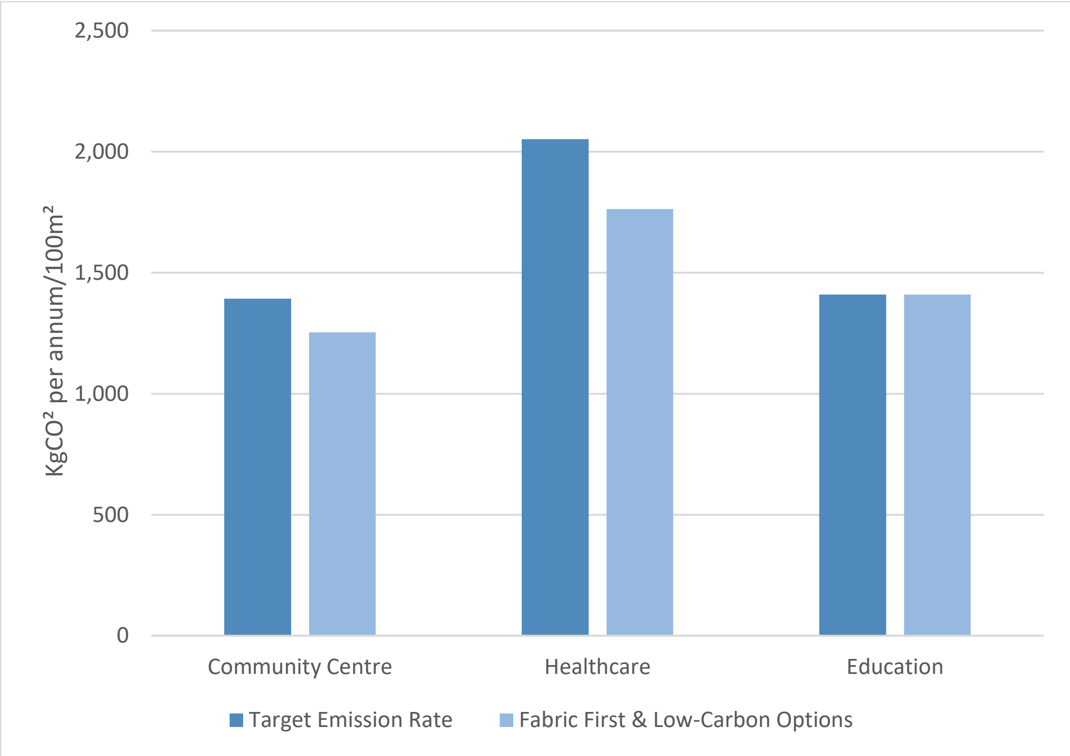


Table 13: How the Development reduces CO_2 emissions (Commercial)

	Community Centre	Healthcare	Education
Target Emission Rate: Compliant with ADL 2013 (Kg/CO_2 per annum)	1,393	2,051	1,410
Fabric first & Low-Carbon Options (Kg/CO_2 per annum)	1,253	1,763	1,410
Reduction in CO^2 emissions (Kg/CO_2 per annum)	140	288	0
Reduction in CO^2 emissions (%)	10%	14%	0%
Total savings	**10%**	**14%**	**0%**

7. APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

ACDs	Accredited Construction Details
ADL 2013	Approved Document Part L of Buildings Regulations 2013
ASHP	Air Source Heat Pump
BER	Building Emission Rate
CHP	Combined Heat & Power
DER	Dwelling Emission Rate
DHN	District Heat Network
DHW	Domestic Hot Water
ESCO	Energy Services Company
GSHP	Ground Source Heat Pump
LPA	Local Planning Authority
NCM	National Calculation Method
PV	Photovoltaics
SBEM	Simplified Building Energy Model
SAP	Standard Assessment Procedure
TER	Target Emission Rate

APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE

The Climate Change Act (2008)
Passed in November 2008, the Climate Change Act mandated that the UK would reduce emissions of six key greenhouse gases, including Carbon Dioxide, by 80% by 2050. As a consequence, the reduction of carbon dioxide emissions is at the forefront of National, Regional and Local Planning Policy, along with continuing step changes in performance introduced by the Building Regulations Approved Document L (2013).
Approved Document L (2013)
This development is subject to the requirements of Approved Document L (2013). ADL 2013 represented an approximate reduction of 6% in the Target Emission Rate (Kg/CO_2/sqm per annum) over the requirements of Approved Document L (2010) for residential development and an aggregate 9% reduction for non-residential development. ADL (2013) also sees the introduction of a Fabric Energy Efficiency Target, a measure of heating demand (kW hrs/sqm per annum) to ensure new-build dwellings with low-carbon heating systems still meet satisfactory energy-efficiency standards.
National Policy 2021
The National Planning Policy Framework encourages Local Planning Authorities to '*support the transition to a low carbon future in a changing climate, taking full account of flood risk and costal change' (*NPPF paragraph 152), *'whilst taking a proactive approach to mitigating and adapting to client change, taking into account the long-term implication for flood risk, costal change, water supply, biodiversity and landscapes, and the risk of over shading from rising temperatures'.* (NPFF Paragraph 153). Paragraph 155, upholds the requirement for Local Plans to: *'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 of 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 collocating potential heat customers and suppliers.'* In paragraph 157, NPPF stipulates that local planning authorities should take account of the benefits of decentralised energy and passive design measures as a means of energy efficiency in new development: *'In determining planning applications, local planning*

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authorities should expect new development 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.'

Emerging local plan Castle Point Borough Council (Dec 2019)

Policy CC1

Responding to Climate Change

1. The Council will seek to mitigate and adapt to climate change and move to reducing the carbon footprint of the borough. This will be achieved by:

a. Identifying development locations with good access by foot, cycling and public transport to services and public transport provision which reduce the need for travel;

b. Providing improvements to the public transport network, and footpaths and cycle paths;

c. Providing opportunities to deliver multi-functional green infrastructure and new habitat creation;

d. Promoting the efficient use of natural resources such as water and energy;

e. Encouraging high-quality sustainable design and construction techniques that contribute to climate change mitigation and adaptation; and

f. Encouraging opportunities for the provision of renewable energy, low carbon technologies and decentralised energy as part of development proposals as appropriate.

2. The Council will seek to minimise the impacts of climate change on its communities through flood risk management that reduces the risk to people and property from extreme weather and flooding events.

Policy CC2

Tidal Flood Risk Management Area

1. The extent of the Canvey, Hadleigh Marshes and South Benfleet Tidal Flood Risk Management Areas is defined on the Policies Map. Within these areas:

a. The Council will support the necessary improvements to the sea defences in the Borough as set out in the Thames 2100 Plan.

b. New bungalows will be refused on Canvey Island unless safe refuge areas can be provided within the development, and favourable consideration will be given to the conversion of bungalows to houses, subject to those privacy, amenity and urban design considerations set out in the Residential Design Guidance SPD;

c. The Council will work with partners to maintain and improve nature conservation in the Hadleigh Marshes area, with a long-term view of securing appropriate compensatory sites within the Thames Estuary for any loss of particular habitats resulting from climate change; and

d. South Benfleet Playing Fields will be retained as a flood storage area for both tidal flooding and surface water management. Opportunities to increase the storage capacity of this area will be secured in the long-term;

2. The Council will work with partners in the railway industry to identify economically viable solutions to the potential risk of flooding of local railway lines in the long-term, to ensure the ongoing provision of services.

3. Within flood zones 2 and 3 new development proposals will be permitted only where they meet the following criteria:

a. They pass the Sequential Test as set out in the National Planning Policy Framework;
b. They have been designed to make space for water and reduce the risk of flooding to prospective users/residents of the site, and to neighbouring properties; and
c. They are designed to be flood resistant and resilient and provide safe refuge for users/residents above predicted flood water depths for a 1 in 1,000 + climate change flood event.
4. Land adjacent to the existing flood defences on Canvey Island, as shown on the Policies Map, is safeguarded for future flood defence works and landscaping. Only temporary development will be permitted on this land.
5. Where land safeguarded for future flood defence works falls within a development site, opportunities should be taken to integrate future flood defence requirements into the landscaping and open space provision for the site.

Policy CC3

Non-Tidal Flood Risk Management
1. The Critical Drainage Areas for the borough are defined by Essex County Council as the Lead Local Flood Authority.
2. New development proposals within Flood Risk Zones for fluvial flooding, or within an area at risk from surface water flooding in a 1 in 1,000-year event, will be considered against the sequential test set out in the NPPF.
3. Built development proposals on sites where the majority of the land is at risk from non-tidal flooding will not normally be permitted unless there is a clear and robust evidence of wider sustainability benefits to the community that outweigh the flood risks.
4. Where a development proposal is located in an area at risk of fluvial or surface water flooding and passes the sequential test and, where appropriate, the exception tests, the design and layout of development must be taken to avoid built development on those parts of the site most at risk of flooding. This includes those parts of the site that form natural or pre-existing flow paths for fluvial flood water or surface water.
5. Where a development proposal is for a site in an area at risk of fluvial or surface water flooding, or is within a Critical Drainage Area, any natural or semi-natural water features such as ditches, dykes and ponds must be retained in their natural or seminatural form in order to maintain existing attenuation provision and existing flow paths.
6. All development proposals, including the redevelopment of existing buildings, will be required to manage surface water run-off so that the rate is no greater than the run-off prior to development taking place or if the site is previously developed, development reduces run-off rates and volumes, as far as is reasonably practical. Where possible, SuDS should be incorporated into the landscaping proposals for development schemes in order to achieve additional benefits for the built, natural, and historic environment.
7. Consideration must be given to whether the capacity of existing flow paths, and the design capacity of any SuDS proposals for a development, could cope with extreme rainfall events. Where appropriate, additional flow paths should be provided to direct excess surface water away from people and property. This must not increase the risk to existing properties nearby.
8. In order to protect people and property, any development located in an area at risk from fluvial or surface water flooding should be designed to be flood resistant to a 1 in 1,000 year + climate change level. Fluvial and/or surface water must not be able to enter property, and buildings should be hydrostatically and hydrodynamically resistant to prevent damage to the structure. Regard should be had to the Essex County Council Interactive Flood and Water Management Map, to determine the need for flood resistant design. Where an application relies on guidance from the Map, a precautionary approach

will be taken, and upper flood depths for the location of the site will be applied when determining the appropriateness of the resistance proposed. Applications which seek to provide lower levels of resistance must be supported by their own robust, site specific, modelling which demonstrates that the development will be resistant to fluvial and/or surface water inundation and hydrostatic damage.

Policy CC4

Sustainable Buildings

1. All new development must minimise its impact on the environment by incorporating the following principles:

a. Incorporate measures for achieving high levels of energy efficiency, and the use of decentralised energy sources.

b. Demonstrating how its design, siting and layout has maximised the opportunities for solar gain, daylight penetration and the use of decentralised energy sources.

2. The design of all new development should incorporate measures for achieving high levels of energy efficiency, and the use of decentralised energy sources. Development is expected to demonstrate how its design, siting and layout has maximised the opportunities for solar gain, daylight penetration and the use of decentralised energy sources.

3. As a minimum non-residential development should achieve at least 50% of the credits available for reduction in CO2 emissions under the relevant BREEAM very good scheme or its equivalent for the development proposed.

4. The design of all new development should incorporate measures for achieving high levels of water efficiency. As a minimum:

a. Non-residential development should achieve at least 50% of the credits available for water consumption under the relevant BREEAM very good scheme or its equivalent for the development proposed: and

b. Space should be made available within the site to enable segregated waste storage for that waste arising from the proposed use of the development.

5. The materials, including aggregates, used in the construction of all new buildings should be sustainable in terms of the energy that has been expended in their production, and the energy that is required to transport them to the location of the development.

6. The waste resulting from the construction of all new buildings should be managed in a way that maximises the re-use and recycling of materials, including aggregates, onsite where possible.

7. Sustainability measures installed, and sustainable materials must be consistent with the overall architectural approach of the development. Their design and siting should be an integral part of the development and must not result in prominent, dominant, alien, or incongruous features which detract from the visual appearance of the development or its surroundings.

Policy HO13

Land east of Rayleigh Road, Hadleigh

1. Land east of Rayleigh Road, Hadleigh, as identified on the Policies Map, is allocated for residential purposes, to deliver around 455 new homes by 2033.

2. A master plan approach to this site will be taken to ensure that the development is attractively designed, contributing to environmental quality, and that infrastructure is provided to support growth in this location. The master plan must deliver the following:

a. Access arrangements for the site, which also addresses peak time congestion at nearby junctions;
b. An urban design framework using a mix of urban design approaches built around the Arcadia approach in areas located within the Historic Natural Landscape and in the vicinity of important landscape features, and the Boulevard and Major Entry Point approaches, to create an attractive green, parkland environment, integrated into the existing landscape and topography;
c. Respects and retains as a far as possible the hedge and tree-lined boundaries established;
d. An approach to wildlife that results in a net gain in biodiversity;
e. The provision of greenways through the site, linking to the existing network of green infrastructure;
f. An increase in public open space provision across the site consistent with the requirement of policy HS3, delivering additional accessible natural green space and children's play equipment;
g. Sustainable drainage measures will be implemented to ensure no increase in the risk of surface water flooding to the site or nearby properties;
h. The provision of a multi-use community building on site;
i. Land (circa 0.13 hectares) for a stand-alone early years and childcare nursery; and 46
j. Main vehicular access will be taken from Stadium Way in the north and Daws Heath Road in the south.
3. Detailed design proposals for the site must have regard to the Council's Residential Design Guidance.
4. Public transport waiting facilities and services must be improved on Rayleigh Road and Daws Heath Road.

Residential Design Guidance (Nov 2012)

Policy RDG9

RDG9 – Energy & Water Efficiency & Renewable Energy

The design of all development should incorporate measures for achieving high levels of energy and water efficiency. Development is expected to demonstrate how its design, siting and layout has maximised the opportunities for solar gain, daylight penetration, and the re-use/recycling of water, and where appropriate, how its construction has followed nationally agreed principles for sustainable dwellings.

The design and siting of energy and water efficiency measures and renewable energy systems must not result in prominent, dominant, alien or incongruous features which detract from the visual appearance of the dwelling or the public realm.

Regard should be taken to the guidance contained in RDG8.

The Housing Standards Review and implications on Local Planning Policy

On March 25th, 2015, the Government confirmed its policy to limit energy-efficiency targets that can be imposed on a development as a result of the Housing Standards Review. New developments should not be conditioned to achieve a reduction in Carbon Emissions exceeding a 19% improvement over the requirements of Approved Document L (2013) – the equivalent energy performance of a Code for Sustainable Homes Level 4 dwelling.

In addition, the Government confirmed that the Code for Sustainable Homes is no longer an applicable standard for planning permissions granted on or after March 26th, 2015. If a Local Planning Authority has an existing policy requirement for the CSH it may still condition the Ene 1 and Wat 1 requirements for CSH Level 4 but cannot require assessment against the remaining categories and full CSH Certification.

Sites with planning permission granted prior to March 25th, 2015, can still be assessed, and certified against the Code for Sustainable Homes, where there is a requirement to do so (known as legacy sites).

A CSH requirement can also apply where a previously approved Outline Planning Permission has been granted prior to March 25th, 2015.

APPENDIX 3: SAMPLE SAP RESULTS

Dwelling Type	Total Target Emissions	Total Reduction in emissions (kg/CO2 per year)
Type G Detached 4B	2,377	2,351
Type D Detached 3B	2,577	2,509
Type C Detached 3B	2,441	2,445
Type E Detached 4B	3,179	3,016
Type A Semi-detached 3B	1,584	1,618
Type B Semi-detached 3B	1,818	1,821
Type B Detached 3B	1,938	1,943
Type A Detached 3B	1,710	1,750
Type F Detached 4B	2,736	2,663
Total Emissions	20,360	20,116

APPENDIX 4: SBEM RESULTS

Building Type	Total Target Emissions (kg/CO2 per year/ 100m²)	Total Reduction in emissions (kg/CO2 per year/ 100m²)
Community Centre	1,393	1,253
Healthcare	2,051	1,763
Education	1,410	1,410
Total Emissions (kg/CO2 per year/ 100m²)	4,854	4,426