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Energy Statement

Richard Avenue, Wivenhoe CO7 0HY

On behalf of Taylor Wimpey London Ltd

TA.RA.CO7

Revision – 00

Date: 5th April 2022

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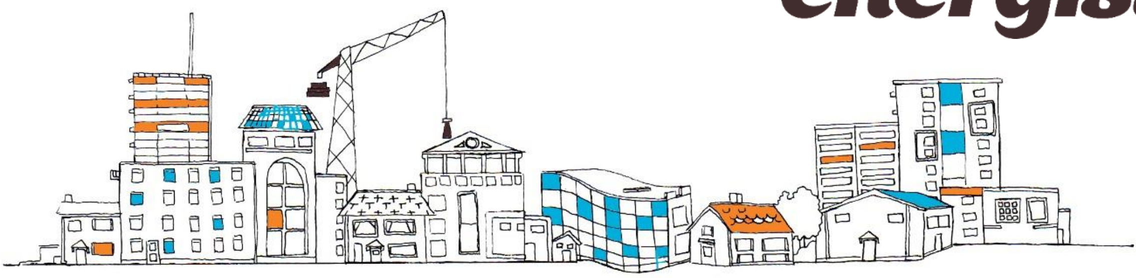

REVISION HISTORY

Revision	Issue Date	Description	Issued By	Checked By
R00	05/04/2022	Original Document	TW	

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 Taylor Wimpey London Ltd ('the Applicant').

It will set out the measures planned by the Applicant to achieve energy reductions at the proposed development site: Richard Avenue, Wivenhoe ('the Development') demonstrating compliance with:

i) National Planning Policy Framework.
ii) Approved Document Part L of the Building Regulations 2013.
iii) The local planning policy requirements for Colchester Borough Council to meet:

- Policy CC1: Climate Change

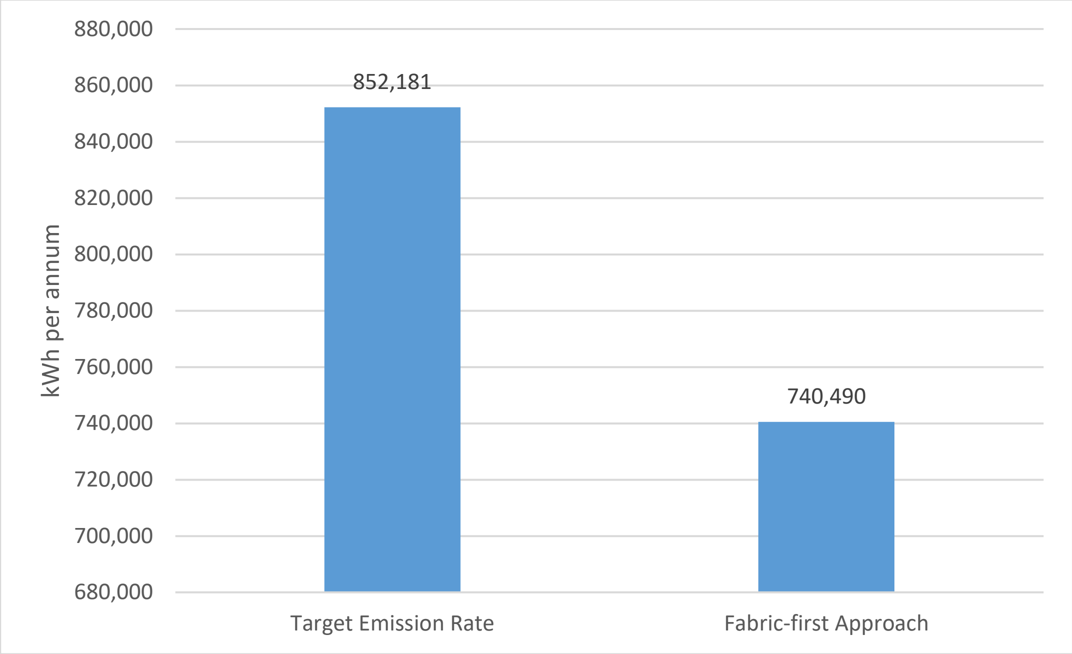
The Energy Statement concludes that the following combination of measures, summarised here in Table 1, will be incorporated into the Development demonstrating how the energy standard will be delivered by the Applicant.

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. ▪ Decentralised Mechanical Ventilation Extract system. ▪ Low-energy lighting throughout the building.
Low-carbon & Renewable Energy	▪ The applicant has opted to develop the site using the fabric-first approach in order to reach the required target.

The impact of these design measures in terms of how the Applicant delivers the energy standard is illustrated in Figure 1 overleaf.

Figure 1: How the Development meets the energy standard.



The calculated reduction in energy and the percentage reduction in kWh over the ADL 2013 Baseline is demonstrated in Table 2.

Table 2: Energy in kWh and percentage reduction over ADL 2013.

	Energy in kWh	
	kWh per annum	% reduction
Target Energy in kWh: Compliant with ADL 2013	852,181	-
Fabric first: Demand-reduction measures	740,490	13.1%
Target Energy Reduction in kWh	111,691	13.1%

2. INTRODUCTION

2.1 Site Description

This Energy Statement has been prepared for the residential development at Richard Avenue, Wivenhoe. This falls under the jurisdiction of Colchester Borough Council.

The Development consists of 120 new build dwellings, a mixture of two, three, and four-bedroom properties.

Map 1: Development layout for Richard Avenue, Wivenhoe.

Source: Development Layout Option 9 (TW027-PL03)

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 local planning policy requirements for Colchester Borough Council to meet:

- Policy CC1: Climate Change

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 Richard Avenue, Wivenhoe will be set out in this Statement as follows:

- **Baseline energy demand**: The Development's Baseline in kWh will be calculated to establish the minimum on-site standard for compliance with ADL 2013.

- **Fabric first – reduced energy demand:** The Development's reduced energy in kWh 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 energy savings presented.

2.3 Methods

Energist UK has used SAP 2012 methodology to calculate energy demand for 11 sample dwellings. The data has then been extrapolated to reflect more accurately the expected energy demand for all proposed dwellings included in the development proposals for planning purposes. Once design stage is underway, full calculations will be carried out in order to further assess the entire development.

SAP 2012 is the Standard Assessment Procedure (SAP), adopted by Government as the UK methodology for calculating the energy performance of dwellings.

3. BASELINE ENERGY DEMAND

3.1 Introduction

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 methodology.

The resulting ADL 2013 Baseline for Richard Avenue, Wivenhoe has been calculated using Part L model designs which have been applied to the Applicant's Development details. The baseline energy demand represents the maximum kWh energy permitted for the Development to comply with ADL 2013.

3.2 The Development Baseline

The resulting Baseline, representing the total maximum energy in kWh permitted for the Development, has been calculated as 852,181kWh per annum. To ensure compliance with ADL 2013, energy demand should not exceed this figure.

Table 3. Baseline design specification.

Element	Baseline Design Specification
Ground Floor U-Value (W/m^2.K)	0.15
External Wall U-Value (W/m^2.K)	0.27
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
Glazing U-Value, including frame (W/m^2.K)	1.6
Door U-Value (W/m^2.K)	1.0
Design Air Permeability	5
Space Heating	Mains Gas boiler
Heating Controls	Standard Heating System Controls
Domestic Hot Water	From main heating system.
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.
- Decentralised Mechanical Ventilation Extract system.
- 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 methodology as before for the baseline results. This allows us to assess the effectiveness of demand-reduction measures as a percentage reduction in energy over the Baseline.

The total calculated energy for Richard Avenue, Wivenhoe is 740,490 kWh per annum, which is a reduction of 13.1% or 111,691 kWh per annum over the Baseline. Refer to Appendix 3 for SAP Results and Table 4 for the fabric-first design specification.

Table 4. The fabric-first design specification at Richard Avenue, Wivenhoe.

Element	Fabric-First Design Specification
Ground Floor U-Value (W/m^2.K)	0.15
External Wall U-Value (W/m^2.K)	0.25
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
Glazing U-Value – including Frame (W/m^2.K)	1.4
Door U-Value (W/m^2.K)	1
Design Air Permeability	5
Space Heating	Ideal Logic Combi ESP1
Heating Controls	Time and temperature zone control and a delayed start thermostat.
Domestic Hot Water	From main heating system
Ventilation	Decentralised Mechanical Ventilation Extract
Low Energy Lighting	100%
Thermal Bridging	Taylor Wimpey bespoke psi values.

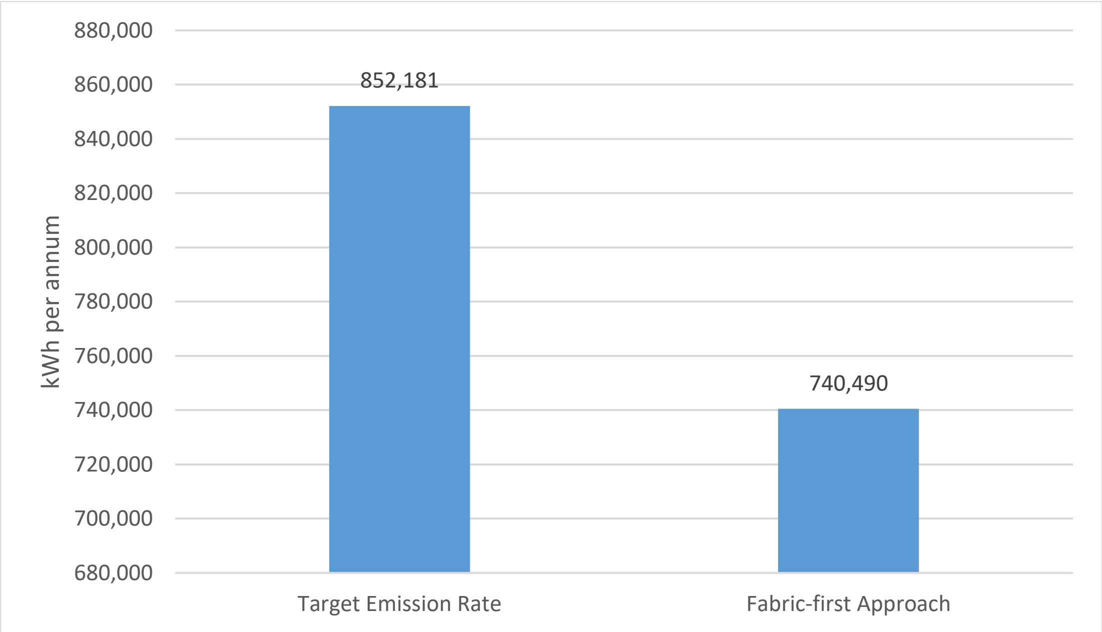
4.3 Conclusion

By incorporating sustainable design and energy-reduction design measures at Richard Avenue, Wivenhoe the Applicant will reduce energy by 13.1% over the Baseline for ADL 2013. This is illustrated in Table 5 and in Figure 2 below.

Table 5: The baseline and fabric-first, demand-reduction measures.

	Energy in kWh	
	kWh per annum	% reduction
Target Energy in kWh: Compliant with ADL 2013	852,181	-
Fabric first: Demand-reduction measures	740,490	13.1%
Target Energy Reduction in kWh	111,691	13.1%

Figure 2: Baseline and fabric-first summary.



5. HEATING STRATEGY – DECENTRALISED ENERGY FEASIBILITY

5.1 District Heat Networks

Where location and development permits; the opportunity of connecting to existing district heating networks or the creation of new district heating networks should be considered. District heating networks have the potential to offer significant energy, carbon, and cost savings over localised alternatives. District heating networks often utilise low-carbon energy generation/harnessing technologies such as Anaerobic Digestion (AD), Combined Heat and Power (CHP) and Waste Heat Recovery (WHR). District networks also enable heat loads to be balanced between sites and therefore plant to operate more continuously and efficiently.

District energy networks are only generally feasible where there is a high density of heat demand. Capital costs and distribution losses must be relatively insignificant to support their viability. Where an opportunity exists, the network operator should be contacted to assess the viability and costs of current or, future connection.

The proposed development comprises of 120 no. residential dwellings. In addition to a high-performance specification, the predominant annual heating load is likely to be from Domestic Hot Water (DHW) and limited to one or two peak periods during the day. In addition to capital costs, the thermal losses and circulation energy required to distribute between and throughout the multiple buildings are likely to make a district or, community network technically and economically unviable.

5.2 Combined Heat and Power (CHP)

CHP systems are recognised as a desirable way of reducing energy wastage and resulting carbon dioxide emissions. While generally operating on fossil fuel, mainly natural gas, and using reciprocating engines or gas turbines to drive electrical generators, their advantage is that the waste heat produced by the engine or turbine (the reason for the familiar “cooling towers” at power stations) is collected and put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly.

However, CHP, although it can be desirable, does have practical limitations. The principal requirement is that to be effective, all of the energy produced must be utilised. This means that all the electricity must be used in a financially sound manner and all the waste heat must be put to good use – preferably to meet a heat demand. This is generally not an issue when CHP is used in a large-scale district heating scheme as these schemes, with a substantial number of users, tend to have a good balance of loads through the year, but can it pose significant challenges when CHP is proposed for a single type of user, building or site. As such, and in order to be economically and technically feasible, a base heating load should exist to support regular and constant operation. The current rule of thumb calls for a minimum running hours of 5000 per annum.

CHP engines are most ideally suited to developments which require significant and regular heat, e.g. swimming pools, care homes and hotels. They are not generally

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suited to developments where the heat load is sporadic or infrequent, e.g. residential, offices and schools.

It is considered, that where residential developments are large, i.e. circa 500+ units, CHP may be an economic solution. In smaller residential developments, heat loads are likely to be too low and infrequent to support CHP without small engines and large buffer vessels. In addition to higher relative distribution losses, a smaller CHP system is also likely to offer a lower electrical efficiency and higher resulting NOx emissions.

5.3 Feasibility

There are currently no existing or under development district heating networks within the vicinity of the development site. The proposed development comprises of 120 no. residential dwellings. In addition to a high-performance specification, the predominant annual heating load is likely to be from Domestic Hot Water (DHW) and limited to one or two peak periods during the day. In addition to this, the properties are predominantly houses, meaning that significant lengths of pipework would be required in order serve all properties, so there would be significant heat loss making the system far less efficient than a more densely built development such as a block of flats.

Integration of CHP or a local heat network to this development would not be technically or economically viable due to a low and infrequent heat demand and high relative distribution losses. These losses typically increase costs for consumers, as the financial loss from waste from the system must be recovered by the operator, and these costs are typically added to the overall service charge, which means they can be unfairly distributed, unlike individual systems, where residents only pay for the energy they use, with complete control.

Therefore, individual gas boilers have been specified as the preferred conditioning strategy for the dwellings. This shall allow maximum control over energy bills for residents, who will have the ability to change their heating system should they require and residents would not have to pay additional maintenance fees to the landlord. This type of system would also reduce overheating risk and reduce energy waste from distribution losses.

6. WATER MANAGEMENT & EFFICIENCY

6.1 Increasing water efficiency and reducing water demand in new dwellings.

It is acknowledged that the water consumption of houses has a significant impact on not only direct operational running costs (i.e., water consumption charges), but also indirectly through additional energy usage and the heating of water for domestic use. This is, in part, reflected in SAP 2012 methodology which assumes reduced energy consumption should a dwelling be compliant with Approved Document Part G 2013.

The Applicant will reduce water demand within the proposed development by incorporating water-efficient fixtures and fittings as a standard specification within each new dwelling. A standard of 110 litres per person per day will be achieved (excluding an allowance of 5 litres or less per person per day for external water consumption).

A water-efficiency calculation will be completed to measure the anticipated average water consumption by adding up flow rates for taps and showers as well as the size of devices such as baths, dishwashers and washing machines. Assumptions will be included within the model to accommodate how frequently these are likely to be used.

Refer to Table 6 below for an overview of a sample water-efficiency calculation for the Richard Avenue, Wivenhoe Project.

6.2 Managing Water Supply.

A specification for water meters on the mains water supply will facilitate water consumption management and monitoring to reduce the impacts of inefficiencies and leakage.

Flow control devices that regulate the supply of water to each WC area/facility will be considered as an installation for the Development in order to reduce water wastage.

Examples of flow control devices are listed below:

- A time controller, i.e., an automatic time switch device to switch off the water supply after a predetermined interval.
- A programmed time controller, i.e., an automatic time switch device to switch water on and/or off at pre-determined times.
- A volume controller, i.e., an automatic control device to turn off the water supply once the maximum pre-set volume is reached.
- A presence detector and controller, i.e., an automatic device detecting occupancy or movement in an area to switch water on and turn it off when the presence is removed.

Table 6, Water calculations for new dwellings at Richard Avenue, Wivenhoe

Element	Performance
Kitchen Taps flow rate	7 Litres per minute
Other basin Taps flow rate	4 Litres per minute
WCs Flush Volume	6/3 Litres
Shower Flow rate	8 Litres per minute
Bath Volume	170 Litres
Dishwasher water consumption	1.25 litres per place setting
Washing-machine water consumption	8.17 litres per Kg

7. FLOOD RISK

7.1 Introduction

The Development will be considered for its exposure to flooding. To inform this process, the Applicant will be completing a Flood Risk Assessment (FRA), which will assess whether the Development is at risk of any form of flooding. Sustainable Urban Drainage (SuDS) is appropriately considered, and measures will also be put forward as part of an evolving Drainage Strategy.

7.2 Sustainable Urban Drainage

The Applicant's drainage strategy will ensure that appropriate measures for the management of surface water run-off and flood risk are considered and incorporated within the scheme. The following will be included within the Development:

- Sustainable Urban Drainage Systems (SuDS) will be designed to contain the 1 in 100 (1%) rainfall event with an increase in peak rainfall intensity of 40% to allow for the currently predicted effects of climate change.
- The drainage strategy will consider the increase in surface water runoff, and the measures required to control and convey this to an appropriate and available discharge receptor. In terms of the discharge receptor, the sustainable drainage hierarchy will be followed, as required by local and national guidance.

8. OVERHEATING AND COOLING

With a continual drive for energy efficiency through both the Building Regulations 2013 and Local Planning Authority requirements, the risk of overheating to buildings in the summer months is becoming more prevalent. Overheating can be a mild discomfort or a hazard to health if managed incorrectly so it is vitally important that overheating risk is mitigated to ensure a building is both energy efficient and comfortable to live in or occupy.

Summer overheating is caused when there is excess build-up of heat within a building. This can occur where there is excessive solar gain and limited means to absorb excess heat into the building fabric or purge this heat through ventilation. Summer overheating can be managed through a variety of measures and the chosen solution will vary from development to development.

8.1 Limiting Solar Gain

- Glazing g value: This is a measure of how much solar radiation penetrates the glazing. The lower the g value, the less solar gain that enters a building. Glazing with low g values may have a darker tint to the glazing so aesthetic considerations are also a factor. Lower g values (below 0.5) are often required in properties with single facades. Specifying g values below 0.2 will increase cost substantially and also limit the number of available suppliers for glazing.

- External shading: Windows can be shaded using solar shading to reduce solar gain in the summer months. If aligned correctly, external shading can reduce solar gain in summer whilst allowing solar gain in the winter when the sun is lower.

- Internal shading: Blinds can be used to limit solar gain in a building. They can either be automatic, triggered by the sun's presence on the window, or operated manually. Manual operation requires the occupant to be present, so this option is not reliable when trying to mitigate for the risk of overheating.

8.2 Purging Excess Heat Build Up

- Thermal Mass: Thermal mass is the measure of a building's ability to absorb energy. A building with a high thermal mass (high proportion of concrete) has the ability to absorb heat during the day which helps to maintain a steady internal temperature. This heat can be released back into the building at night-time when the temperature is lower, helping to maintain a consistent internal temperature.

- Ventilation: A building can be ventilated to purge excess heat build-up. This can be done through openable windows, especially where cross ventilation is possible. Where ventilation through windows is not possible, due to security, noise or pollution issues, Mechanical Ventilation can be used. The ventilation rates required to purge a building can often be quite high, requiring oversized systems.

9. CONSTRUCTION MATERIALS & PROCUREMENT

9.1 Introduction

The impact of materials selection is an important consideration when designing new development. The energy and natural resources consumed over the course of extraction or procurement, processing and manufacturing can be significant.

The applicant requires all suppliers to provide timber from legally logged sources in line with their Supply Chain Policy and the EU Timber Regulation. Their tender documents and trade specifications state that they require all suppliers to supply timber from responsibly managed forests certified by recognised schemes such as the Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification (PEFC) or Sustainable Forestry Initiative (SFI).

The Applicant will continue to implement an environmentally responsible approach to the procurement of construction materials and supply chain management for the development scheme at Richard Avenue, Wivenhoe.

9.2 Sustainable Procurement of Materials

The origin of materials chosen in the design and construction of the Development will be selected to minimise the local and wider negative impact to the natural environment.

The applicants' materiality assessment will help them to identify and focus on the sustainability (environmental, social and economic) issues and impacts that matter most to their business and stakeholders, including customers, investors, people and regulators.

The assessment takes into account a range of factors including our business priorities, stakeholder views, the UN Sustainable Development Goals, long term trends and government policy.

The Applicant will demonstrate their commitment to sourcing environmentally sustainable materials during the construction of the Development as follows:

9.2.1 Materials will be responsibly sourced

The applicant will implement their Materiality Assessment, Supply Chain Policy, and a preference for using materials with a low environmental impact, as well as seeking to use locally sourced, recycled, and reclaimed materials where available.

The Applicant is committed to procuring timber from sustainable sources through approved schemes such as the Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC).

9.2.2 Materials will be environmentally sustainable

The selection of construction and insulation materials will be considered for their potential impact on the internal and external environment and specified, where feasible, to ensure they do not contain gases that have an Ozone Depleting Potential (ODP) or Global Warming Potential (GWP).

9.2.3 Materials will be durable and robust

The development scheme will be constructed to incorporate, where possible, robust materials which have low embodied impact, high recycled content where possible (for example, PFA in concrete) and high durability.

9.2.4 Materials will be 'healthy'

The Applicant will avoid the use of materials which have the potential to impact on human health. Building materials and products that produce VOC (Volatile Organic Compounds and Formaldehyde) will be avoided whilst non-toxic and environmentally sensitive materials will take precedence.

10. AIR QUALITY, NOISE & VIBRATION

Air pollutants can be a contributing factor to health problems as well as damaging ecosystems, biodiversity and value habitats. Exposure to high concentrations of certain pollutants is associated with numerous effects on human health ranging from premature deaths caused by heart or lung disease to worsening of asthmatic conditions, which often leads to a reduced quality of life.

In most urban areas in the UK, the main local source of air pollutants is road traffic, emissions from vehicles causing a complete mixture of pollutants, quantities of which varies from car to car. Other sources of air pollutants will generally include public transport, building heating systems and industrial processes.

There is potential for dust raising activities during the construction phase of the development. Suitable mitigation measures for the site will be outlined and should be applied by the developer. In this instance, the dust effects should be ‘not significant’ if best practicable means are applied to avoid effects.

Noise at low levels is not necessarily harmful. Environmental noise can also convey a sense of liveliness in an area, which can be desirable. However, the adverse effects of noise exposure could include: interference with speech or other ‘desired’ sounds, annoyance, sleep disturbance, anxiety, hearing damage and stress-related cardiovascular health problems.

Noise from transportation is typically emitted by machinery (e.g., the engine or exhaust) and aerodynamic noise (see aerodynamics and aircraft noise) caused by the compression and friction in the air around the vessel during motion.

Acoustic assessments are being carried out on the surrounding site, looking at the effects on the development as a whole. These assessments will also consider the potential for noise arising from the development in relation to its impact on surrounding homes. These results will determine the requirement for any additional measures in order to mitigate the potential risks caused by the heightened noise within the area. These may include a more efficient ventilation system, improved glazing and acoustic reduction systems.

11. SUSTAINABILITY – ECOLOGY & BIODIVERSITY

An Ecological Appraisal will be prepared to evaluate the site, and the habitats within it, which will be based on the results of the field surveys, any designations pertaining to the site, and existing ecological information collected during an initial desk study.

Following investigation of the site, recommendations will be provided to ensure the protection and enhancement of the site and its inhabitants.

The report and its conclusions will then be monitored and managed in order to protect and improve upon the ecological factors of the existing site.

12. TRANSPORT

A site-specific Travel Plan will be prepared to provide more details of comprehensive sustainable measures to influence travel choice with a provision of modal share targets. Furthermore, Delivery and Servicing and Construction Logistics Plans will also be developed to mitigate the impact of vehicle activities during the operational and build stages, i.e., reducing the number of trips to the sites during peak hours, ensuring that adequate recycling and freight consolidation measures are introduced to reduce the number of lorry movements, and encouraging use of cleaner vehicles.

EV charging points will also be provided to satisfy new guidelines.

13. LOW-CARBON AND RENEWABLE ENERGY

13.1 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 an 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

13.2 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 energy (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 4.7 metres per second (m/s) which is below 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.

13.3 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. ▪ Where PV panels are 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.

13.4 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.
	▪ 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

Disadvantages	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. ▪ The costs of installing an ASHP, compared to the costs of installing an A-rated boiler, are substantially more which means there is a capital-cost implication to consider. For this reason, ASHPs are not considered a commercially viable option for this development scheme.

13.5 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	▪ Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.)

considerations	▪ 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 not considered a technically viable option for this development scheme due to the physical constraints in terms of ground conditions and area available for installation. ▪ The capital installation cost would also be high which leads us to the conclusion that GSHPs would not be a commercially viable option for this development scheme.

13.6 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 carbon.
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 not considered a technically viable option for this development scheme as there are physical constraints on site in terms of installing biomass boilers or storing a sufficient supply. ▪ There are also concerns regarding a sustainable supply of biomass to the site.

✗	▪ Biomass is not considered a technically viable option for the development scheme. The primary reason for this is down to the Development's location and the negative environmental impact of high levels of NOx gases that are emitted from biomass boilers and the subsequent impact on local air quality. This is contrary to planning policies for air quality.

13.7 Conclusion

The following low-carbon and renewable energy technologies, summarised here in Table 7, are considered potentially viable options for the residential development scheme at Richard Avenue, Wivenhoe.

Table 7: Summary of Feasibility for Richard Avenue, Wivenhoe.

✓	▪ Solar PV ▪ Solar thermal
✗	▪ Wind ▪ Aerothermal ▪ Geothermal ▪ Biomass

The applicant has opted to develop the site using the fabric-first approach in order to reach the required target.

14. CONCLUSIONS AND RECOMMENDATIONS

The Applicant demonstrates commitment to delivering the energy standard at Richard Avenue, Wivenhoe as follows:

- The Development has been designed to generate a total reduction in energy of 13.1% over the TER ADL 2013.

A combination of demand-reduction measures and energy-efficiency measures will deliver the Applicant's target for on-site reduction in energy.

The following measures, summarised here in Table 7, are incorporated in the development proposals.

Table 8. Measures incorporated to deliver the energy standard.

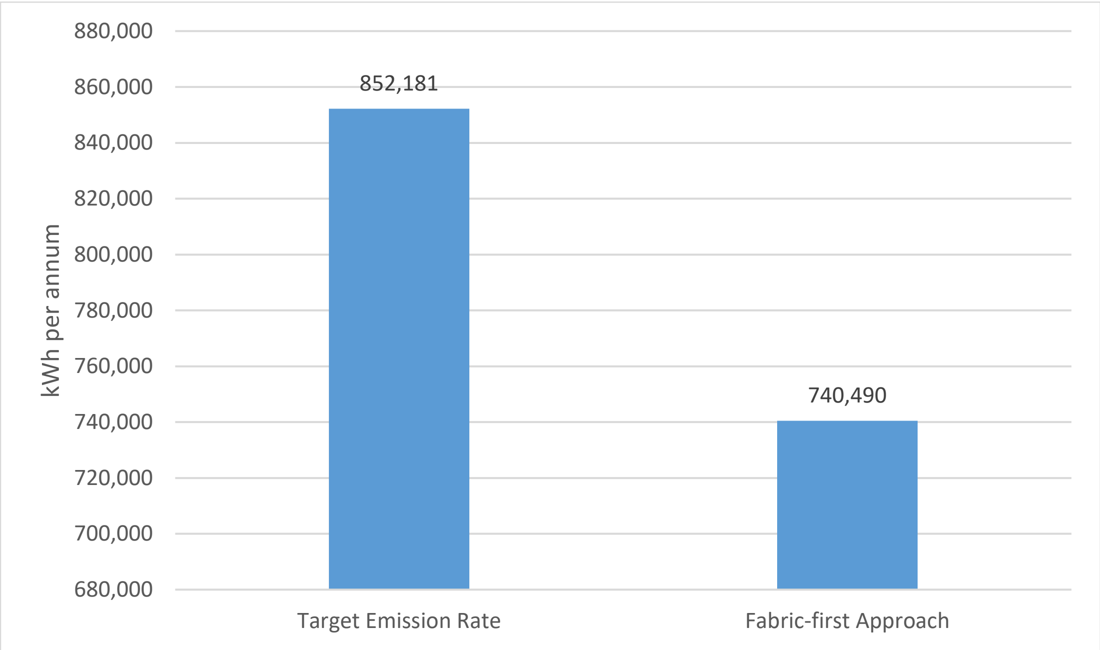
Fabric first: Demand-reduction measures	▪ Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs. ▪ High-efficiency double-glazed windows throughout. ▪ Quality of build will be confirmed by achieving good air-tightness results throughout. ▪ Efficient-building services including high-efficiency heating systems. ▪ Decentralised Mechanical Ventilation Extract System. ▪ Low-energy lighting throughout the building.
Low-carbon & Renewable Energy	▪ The applicant has opted to develop the site using the fabric-first approach in order to reach the required target.

The way in which these design measures deliver the Applicant's commitment to the energy standard is illustrated in Figure 3 and Table 8 overleaf.

Table 9: Energy in kWh and percentage reduction over ADL 2013.

	Energy in kWh	
	kWh per annum	% reduction
Target Energy in kWh: Compliant with ADL 2013	852,181	-
Fabric first: Demand-reduction measures	740,490	13.1%
Target Energy Reduction in kWh	111,691	13.1%

Figure 3: How the Development delivers the energy standard.



15. APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

ADL 2013	Approved Document Part L of Buildings Regulations 2013
ASHP	Air Source Heat Pump
DER	Dwelling Emission Rate
DHN	District Heat Network
DHW	Domestic Hot Water
GSHP	Ground Source Heat Pump
LPA	Local Planning Authority
PV	Photovoltaics
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 Planning Policy Framework 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 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.'*

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.

Colchester Borough Council Emerging Local Plan

Planning Policy CC1: Climate Change

Colchester Borough Council will continue to adopt strategies to mitigate and adapt to climate change. In addressing the move to a low carbon future for Colchester, the Local Planning Authority will plan for new development in locations and ways that reduce greenhouse gas emissions, adopt the principles set out in the energy hierarchy and provide resilience to the impacts of a changing climate.

A low carbon future for Colchester will be achieved by:

(i) Encouraging and supporting the provision of renewable and low carbon technologies.

(ii) Encouraging new development to provide a proportion of the energy demand through renewable or low carbon sources.

(iii) Encouraging design and construction techniques which contribute to climate change mitigation and adaptation by using landform, layout, building orientation, massing, tree planting and landscaping to minimise energy consumption and provide resilience to a changing climate.

(iv) Requiring both innovative design and technologies that reduce the impacts of climate change within the garden communities.

(v) Supporting opportunities to deliver decentralised energy systems, particularly those which are powered by a renewable or low carbon source. Supporting connection to an existing decentralised energy supply system where there is capacity to supply the proposed development, or design for future connection where there are proposals for such a system.

(vi) Requiring development in the Northern Gateway and East Colchester to connect to, or be capable of connecting to the district heating scheme where there is capacity to supply the proposed development and where it is appropriate and viable to do so.

(vii) Supporting energy efficiency improvements to existing buildings in the Borough where appropriate.

(viii) Minimising waste and improving reuse and recycling rates.

(ix) Development will be directed to locations with the least impact on flooding or water resources. All development should consider the impact of and promotion of design responses to flood risk for the lifetime of the development and the availability of water and water infrastructure for the lifetime of the development.

(x) Green infrastructure should be used to manage and enhance existing habitats. Opportunities should be taken to create new habitats and assist with species migration. Consideration should be given to the use of green infrastructure to provide shade during higher temperatures and for flood mitigation. The potential role of green infrastructure as 'productive landscapes' should also be considered.

Planning Policy DM25: Renewable Energy, Water, Waste and Recycling

The Local Planning Authority's commitment to carbon reduction includes the promotion of efficient use of energy and resources, alongside waste minimisation and recycling.

The Local Planning Authority will support residential developments that help reduce carbon emissions in accordance with national Building Regulations. The use of the Home Quality Mark will be supported. Non-residential developments will be encouraged to achieve a minimum BREEAM rating of 'Very Good'.

The Local Planning Authority will encourage the use of sustainable construction techniques in tandem with high quality design and materials to reduce energy demand, waste and the use of natural resources, including the sustainable management of the Borough's water resources.

To achieve greater water efficiencies new residential developments will be required to incorporate water saving measures in line with the tighter optional requirement of Part G2 of national Building Regulations of 110/l/h/d.

To help meet waste reduction and recycling targets, the Local Planning Authority will support proposals for sustainable waste management facilities identified in the Waste Management Plan which minimise impacts on the communities living close to the sites (noise, pollution, traffic) and on the local environment and landscape. New developments will be expected to support this objective by employing best practice technology to optimise the opportunities for recycling and minimising waste and by providing better recycling facilities.

The Local Planning Authority will support proposals for renewable energy projects including micro-generation, offshore wind farms (plus land based ancillary infrastructure) solar farms, solar panels on buildings, wind farms, District Heating Networks and community led renewable energy initiatives at appropriate locations in the Borough to help reduce Colchester's carbon footprint.

Renewable energy schemes with potential for adverse effects on internationally designated sites or nationally designated landscapes (Dedham Vale AONB), will only be supported in exceptional circumstances, where it can be demonstrated that the designation objectives for the area will not be compromised, that adverse impacts can be adequately mitigated or where it can be demonstrated that any adverse impacts are clearly outweighed by the social and economic benefits provided by the energy proposal.

All applications for renewable energy proposals should be located and designed in such a way to minimise increases in ambient noise levels. Landscape and visual impacts should be mitigated through good design, careful siting and layout and landscaping measures. Transport Assessments covering the construction, operation and decommissioning of any wind farm or solar farm proposal will be required and should be produced at the pre-application stage so acceptability can be determined and mitigation measures identified. A condition will be attached to planning consents for wind turbines and solar farm proposals to ensure that the site is restored when the turbines or panels are taken out of service.

All proposals for solar farm development or wind farms should have regard to the advice in the Local Planning Authority's Guidance Note 'Designing solar farm renewable energy development' and in the Overarching National Policy Statement for Energy EN1.

APPENDIX 3: SAP RESULTS

Dwelling Type	Target Energy (kWh)	Fabric-First (kWh)	Low-carbon & renewable energy (kWh)
NA20	60,924	52,204	52,204
NA21	65,506	55,411	55,411
NA32	66,130	53,681	53,681
NB32	79,761	69,502	69,502
NB41	84,061	73,976	73,976
NB50	104,131	95,668	95,668
NA42	76,200	64,477	64,477
NT31	79,849	70,037	70,037
ND42	98,283	88,013	88,013
PA22	51,723	43,711	43,711
PT42	85,613	73,810	73,810

Total Energy (kWh)	852,181	740,490	740,490