

Energy Statement

Land at the Former Eastergate Fruit Farm

Linden Homes South

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This Statement has been commissioned by Linden Homes South to detail the proposed approach to sustainable construction to be employed at the site at Land at the Former Eastergate Fruit Farm. It should be noted that the details presented, including the proposed specifications, are subject to change as the detailed design of the dwellings progresses, whilst ensuring that the overall commitments will be achieved.

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1 Introduction

Preface

- 1.1 Written by AES Sustainability Consultants Limited on behalf of Linden Homes South, this strategy has been prepared for the development of 60 dwellings at Land at the Former Eastergate Fruit Farm to address local planning policy and conditions relating to sustainable construction.

Purpose and Scope of the Statement

- 1.2 The purpose of this statement is to serve as evidence that Condition 21 set out in outline planning consent EG/71/14/OUT is addressed by the proposed approach.
- 1.3 The statement therefore demonstrates that 10% of the energy demand of the development shall be secured from decentralised and renewable or low carbon energy sources or equivalent fabric first standards are incorporated that would secure a 10% reduction in energy use.

Development Description

- 1.4 The proposed development is located north of Barnham Road, Barnham and comprises 60 new build dwellings in total.
- 1.5 Outline planning consent was granted in February 2015 under reference EG/71/14/OUT subject a number of conditions, where Condition 21 addresses sustainability and energy demand reduction.

2 Planning Policy

Planning Conditions

- 2.1 This statement aims to address Condition 21 of outline planning consent granted under reference EG/71/14/OUT:

Condition 21

At least 10% of the energy supply of the development shall be secured from decentralised and renewable or low-carbon energy sources. Details and a timetable of how this is to be achieved, including details of physical works on site, shall be submitted to and approved in writing by the local planning authority [as part of the reserved matters submissions required by condition 1]. The approved details shall be implemented in accordance with the approved timetable and retained as operational thereafter, unless otherwise agreed in writing by the local planning authority.

Reason:

In order to seek to achieve high levels of energy efficiency in accordance with the aims of the NPPF.

3 Baseline Energy Performance

- 3.1 Sustainability measures are assessed under Part L of Building Regulations through a baseline Target Emissions Rate (TER – expressed in kilograms CO₂ per meter squared of total useful floor area per annum) and a baseline Target Fabric Energy Efficiency (TFEE – expressed in kWh per meter squared per annum).
- 3.2 The baseline energy demand for the compliant development can be obtained alongside the SAP calculation. The baseline TER, TFEE and total energy demand for the proposed development are summarised in Table 1.

Table 1. Part L compliant emissions and fabric efficiency

	Land at Former Eastergate Fruit Farm Part L compliant baseline
CO₂ Emissions	93,130 kgCO ₂ /yr
Fabric energy efficiency	298,269 kWh/yr
Energy demand	414,146 kWh/yr

- 3.3 The strategy for reducing this demand in line with Condition 21 is outlined within this statement.

4 Energy Reduction Strategy

- 4.1 The energy hierarchy should be applied whenever carbon emissions and energy demand are targeted to be reduced.
- 4.2 It is proposed that the energy reduction strategy for the development incorporates further improvements beyond a Part L compliant specification and initially concentrates finance and efforts on reducing energy demand as the first stage of the Energy Hierarchy (Figure 1).

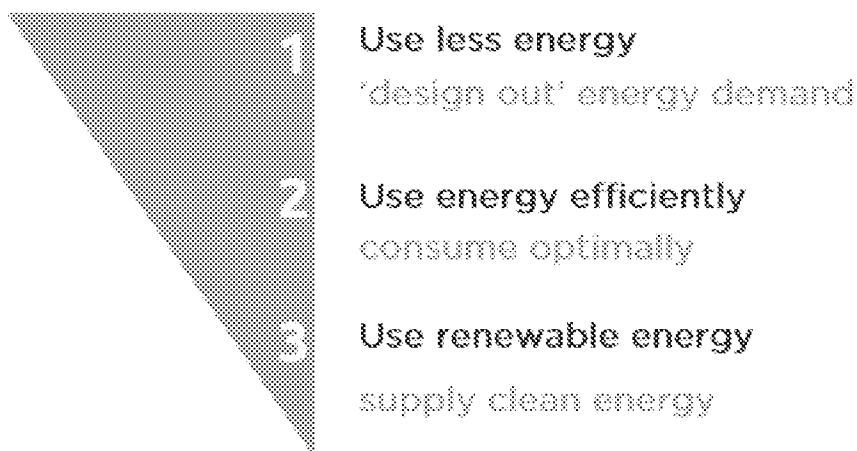


Figure 1. The Energy Hierarchy

- 4.3 As this hierarchy demonstrates, designing out energy use is weighted more highly than the generation of low-carbon or renewable energy to offset unnecessary demand. Applied to the development of new housing, this approach is referred to as 'fabric first' and concentrates finance and efforts on i

- 4.5 The benefits to prospective homeowners of following the Fabric First approach are summarised in Table 2.

Table 2. Benefits of following the Fabric First approach

	Fabric energy efficiency measures	Boil-on renewable energy technologies
Energy/CO ₂ /fuel bill savings applied to all dwellings	✓	✗
Savings built-in for life of dwelling	✓	✗
Highly cost-effective	✓	✗
Increases thermal comfort	✓	✗
Potential to promote energy conservation	✓	✓
Minimal ongoing maintenance / replacement costs	✓	✗
Significant disruption to retrofit post occupation	✓	✗

- 4.6 The decoupling of energy use from CO₂ emissions through the inclusion of the 'target fabric energy efficiency' (TFEE) within SAP in 2013 serves as an acknowledgment of the importance of reducing demand, rather than offsetting carbon emissions through low carbon and renewable energy technologies.

Improved fabric specification

- 4.7 In order to ensure that the energy demand of the development is reduced, the dwellings will be designed to minimise heat loss through the fabric wherever possible. Table 3 details the design fabric specification of the major building elements, with the first column in this table setting out the Part L1A limiting fabric parameters in order to demonstrate the improvements that have been made.

Table 3. Construction specification – major elements

	Part L1a Limiting Fabric Parameters	Design Specification
External wall – u-value	0.30 W/m ² K	0.24 W/m ² K
Party wall – u-value	0.20 W/m ² K	0.00 W/m ² K
Plane roof – u-value	0.20 W/m ² K	0.11 W/m ² K
Ground floor – u-value	0.25 W/m ² K	≤ 0.14 W/m ² K
Windows – u-value	2.00 W/m ² K	1.4W/m ² K
Doors – u-value	2.00 W/m ² K	1.3 W/m ² K
Air Permeability	10 m ³ /h.m ² at 50 Pa	5.00 m ³ /h.m ² at 50 Pa

Thermal Bridging

- 4.8 The significance of thermal bridging as a potential major source of fabric heat losses is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the thermal bridging will not achieve the desired energy and CO₂ reduction targets.
- 4.9 The specification as proposed minimises unnecessary bridging of the insulation layers, with avoidable heat loss therefore being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy demand of the dwellings, and as such thermal modelling has been undertaken to assess the performance of all main building junctions. The average total Y Value has been assessed as 0.060, against a SAP default figure of 0.150.

Air Leakage

- 4.10 After conductive heat losses through building elements are reduced, convective losses through draughts are the next major source of energy wastage. The proposal adopts an airtightness standard of 5.00 m³/m²@50Pa, a significant enhancement on Part L1A minimum requirements. Pressure testing of all dwellings on completion will be undertaken to confirm that the design figure has been met.

Passive design measures and overheating risk mitigation

- 4.11 In order to further reduce energy demand, where practical dwellings have been designed with regard to the principles of passive design, including consideration of building orientation and site placement to maximise the potential for solar gain.
- 4.12 Within the development layout, orientation and massing will be designed to maximise (within reason) passive solar gain. Glazing will be specified with a solar transmittance value (g-value) to strike the balance between useful solar gain in the winter and unwanted solar gain in the summer.
- 4.13 Heat generation and distribution systems will be designed to give the occupants a high level of control over their use, encouraging and allowing energy-efficient behaviour. Time and temperature zone controls will be included with fully insulated primary pipework being installed throughout.
- 4.14 Due to these measures to reduce internal heat gain, natural ventilation provided through window openings and the opportunity for cross ventilation will allow sufficient air exchange rates to purge any heat build-up. Active cooling systems are therefore not proposed.
- 4.15 These measures will serve to ensure that the development builds in resilience to a potentially changing climate over the lifetime of the buildings and minimises the overheating risk that can be exacerbated by the drive to build better insulated, more airtight homes if not considered within the design and construction process.

As-designed performance

- 4.16 By following the strategy described, the dwellings will reduce energy demand and consequent CO₂ emissions beyond the level of a Part L compliant development. The CO₂ emissions arising from the development after demand reduction measures have been taken into account are shown in Table 4.

Table 4. Site-wide emissions after energy demand reduction

	kgCO ₂ /year	
Annual site emissions – Part L compliant	97,775	
Annual site emissions – as designed	93,130	
	kgCO ₂ /year	%
CO₂ savings from demand reduction	4,645	4.75

- 4.17 This approach also benefits the fabric energy efficiency of the development. Table 5 outlines the significant improvement over the standard required for building regulations compliance achieved by following this strategy.

Table 5. Site wide Fabric Energy Efficiency of proposed development

	kWh/year/m ²	
Site-wide Target Fabric Energy Efficiency (TFEE)	54.98	
Site-wide Dwelling Fabric Energy Efficiency (DFEE)	48.94	
	kWh/m ² /yr	%
Saving from demand reduction	6.04	10.99

- 4.18 Condition 21 of the planning approval requires a 10% overall reduction in energy demand. The demand reduction measures which have been prioritised in accordance with the energy hierarchy approach to sustainable construction deliver approximately 6.6% of the required demand reduction, and shown in Table 6.

Table 6. Reduction in energy demand

	kWh/yr	
Site-wide Compliant Energy Demand	414,146	
Site-wide Proposed Energy Demand	386,645	
	kWh/yr	%
Saving from demand reduction	27,501	6.64

5 Low Carbon and Renewable Energy Systems

- 5.1 Condition 21 of outline planning consent EG/71/14/OUT requires at least 10% of the energy demand to be supplied through low carbon or renewable solutions.
- 5.2 A 6.64% reduction is achieved through improved fabric measures. This strategy proposes the remaining 3.34% for the requirement is met through low carbon and renewable energy systems in keeping with the energy hierarchy.
- 5.3 A full range of low carbon and renewable energy systems have been assessed for their potential to deliver suitable emission savings, outlined below.

Combined Heat and Power (CHP) and District Energy Networks

- 5.4 A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as a by-product utilised for space and water heating.
- 5.5 There are no suitable heating networks in the vicinity, and the economic and technical viability of a CHP system is largely reliant on a consistent demand for heat throughout the day to ensure that it operates for over 5000 hours per year. Heat demand from residential schemes is not conducive to efficient system operation, with a defined heating season and intermittent daily profile, with peaks in the morning and the evening. Further to this, the low heat density and the small-scale nature of the development lead to the conclusion that a CHP system is not considered feasible for this development.

Wind Power

- 5.6 A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 4.8m/s³. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective⁴.
- 5.7 Locating wind turbines adjacent to areas with buildings presents a number of potential obstacles to deployment. These include the area of land onsite required for effective operation, installation and maintenance access, environmental impact from noise and vibration, visual impact on landscape amenity and potential turbulence caused by adjacent obstacles. For these reasons wind power is not considered feasible.

Building Scale Systems

- 5.8 The remaining renewable or low carbon energy systems considered potentially feasible are at a building scale. These are as follows;
- Individual biomass heating
 - Solar thermal
 - Solar photo-voltaic (PV)
- 5.9 The advantages and disadvantages of these technologies are evaluated in Tables 7-9.

³ NOABL Wind Map (<http://www.rensmart.com/Weather/BERR>)

⁴ CIBSE TM38:2006. Renewable energy sources for buildings.

Table 7. Biomass Heating feasibility appraisal

Biomass Heating	
Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO₂ emissions as the majority of space and water heating will be supplied by a renewable fuel • Decreased dependence on fossil fuel supply	• A local fuel supply is required to avoid increased transport emissions • Fuel delivery, management and security of supply are critical • Space is required to store fuel, a thermal store and plant • A maintenance regime would be required even though modern systems are relatively low maintenance • Building users or a management company must be able to ensure fuel is supplied to the boiler as required. This may have a negative impact on marketing of buildings • Local environmental impacts potentially include increased NO_x and particulate emissions
Conclusions	
Biomass heating is considered technically feasible in large dwellings provided sufficient space can be accommodated for fuel supply, delivery and management. It is not considered feasible in smaller houses or apartments.	

Table 8. Solar Thermal systems feasibility appraisal

Solar Thermal	
Potential Advantages	Risks & Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water (typically gas) • Solar thermal systems require relatively low maintenance • ~50% of hot water demand in dwellings can be met annually	• Installation is restricted to favourable orientations on an individual building basis • The benefit of installation is limited to the water heating demand of the building • Safe access must be considered for maintenance and service checks • Buildings need to be able to accommodate a large solar hot water cylinder • Distribution losses can be high if long runs of hot water pipes are required • Visual impact may be a concern in special landscape designations (e.g. AONB)
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations and space to accommodate hot water cylinders.	

Table 9. Solar Photovoltaic systems feasibility appraisal

Solar Photovoltaic (PV)	
Potential Advantages	Risks & Disadvantages
• The technology offsets the high carbon content of grid supplied electricity used for lighting, pumps and fans, appliances and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • PV systems generally require very little maintenance • Occupiers could benefit from Feed in Tariff payments	• Poor design and installation can lead to lower than expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Occupiers may not benefit from Feed in Tariff payments where the contract is held by a landlord • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) • Reflected light may be a concern in some locations
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientations.	

Summary

- 5.10 Air source and ground source heat pumps have not been considered in detail for this scheme - whilst they are highly efficient, both technologies rely on grid-sourced electricity and therefore potentially increase the CO₂ emissions associated with the development.
- 5.11 Following the appraisal of renewable and low carbon technologies the following technologies are considered to be technically feasible to some of the plots on this scheme;
- Biomass heating to the larger houses that have space to store fuel and a thermal store.
 - Solar thermal collectors to the houses that have space to incorporate a hot water cylinder and have suitable roof orientations.
 - Solar photovoltaic panels to the dwellings that have suitable roof orientations.

Proposed renewable energy systems

- 5.12 The total energy demand in a Building Regulations compliant scenario is calculated at 414,146kWh, where a 6.64% reduction is achieved through a fabric first approach for the proposed development. It is proposed that solar photovoltaic (PV) systems are installed to deliver the minimum 14,000kWh/yr required to meet the 10% requirement set out in Condition 21 of outline planning consent EG/71/14/OUT.

PV Distribution

- 5.13 The PV panels will be distributed to take advantage of favourable pitch and orientation where feasible, and grouped into cost-effective system sizes to ensure that the capital outlay for the systems is biased towards the energy-producing element – i.e. the panels themselves – rather than the balance of system components. This will additionally ensure that any ongoing maintenance requirements, including replacing the inverters during the working life of the panels, is minimised.
- 5.14 An example distribution schedule developed in conjunction with a specialist PV designer is included in Appendix A evidencing how an output of 15,440kWh can be achieved to exceed the requirement. A site plan is included in Appendix B to reference plots included in the PV schedule.

6 Overall Energy Reduction Achieved

- 6.1 Combining an improved fabric specification with renewable technologies provides an overall energy reduction of 10% over that required for Building Regulations compliance, in line with the energy hierarchy outlined in this statement. Table 10 outlines the reductions achieved by taking this approach.

Table 10. Overall energy reduction achieved

	kWh/yr	
Energy Demand – Part L Compliant	414,146	
Energy Demand – As Designed	386,645	
	kWh/yr	%
Energy Demand Reduction	27,501	6.64
Contribution by renewables	15,440	3.73
Total achieved	42,941	10.37

- 6.2 Table 11 shows how this approach substantially reduces the site-wide CO₂ beyond those required for Part L compliance.

Table 11. Overall CO₂ site-wide reduction

	kgCO ₂ /yr	
CO₂ Emissions – Part L Compliant	97,774	
CO₂ Emissions – As Designed	93,130	
CO₂ Emissions after renewables	85,119	
	kgCO ₂ /yr	%
Reduction after fabric improvement	4,644	4.75
After renewables	12,665	12.94

7 Conclusions

- 7.1 The statement has been prepared in support of the development at Land at the Former Eastergate Fruit Farm.
- 7.2 The primary purpose of this statement is to address Condition 21 of outline planning consent EG/71/14/OUT, granted in February 2015 relating to energy demand reduction and renewable energy systems.
- 7.3 This statement demonstrates that the development will incorporate a number of energy demand reduction measures in accordance with the energy hierarchy/fabric first approach to sustainable construction.
- 7.4 Improvements in insulation, a reduction in thermal bridging and unwanted air leakage paths and further passive design measures will ensure that energy demand and consequent CO₂ emissions are minimised, delivering an emissions reduction of 4.75% above the level required for Building Regulations compliance and an imported energy demand reduction of 27,501kWh equivalent to 6.64% of the baseline demand.
- 7.5 Solar photovoltaics constitutes the preferred renewable technology for this site, after a range were considered. A system capacity of at least 14,000kWh is required to comply with the 10% energy demand requirement conditioned for this development, when combined with the energy savings achieved through an improved fabric specification.
- 7.6 An example PV schedule has been designed by a specialist designer to evidence how the requirement can be met. The solution in this case demonstrates how 15,440Wh can be provided through PV, providing an improvement over the output required.
- 7.7 The combined energy demand reduction measures and renewable energy systems proposed will deliver an overall saving of 10.37% across the proposed development.

8 Appendices

Appendix A: Indicative PV Schedule

Plots	kWp	Type of house	System Size m2	Roof Pitch	Degs from South	kWh per year	CO2kg/year	Module Output	No. of modules	kk
Total	16.5		99			15439.875	8013.29513		60	
51	4.125	404c	24.75	40	25	3984.75	2068.08525	0.275	15	966
60	4.125	404c	24.75	40	25	3984.75	2068.08525	0.275	15	966
57	4.125	404c	24.75	40	25	3984.75	2068.08525	0.275	15	966
12	4.125	404	24.75	40	70	3485.625	1809.03938	0.275	15	845

Appendix B: Indicative PV Distribution



12/10/2018

Detail Plotting

Plot	Area	Area (sqm)	Area (sqft)	Area (acres)
Plot 12	Plot 12	1,200	12,800	0.28
Plot 51	Plot 51	1,200	12,800	0.28
Plot 57	Plot 57	1,200	12,800	0.28
Plot 60	Plot 60	1,200	12,800	0.28