

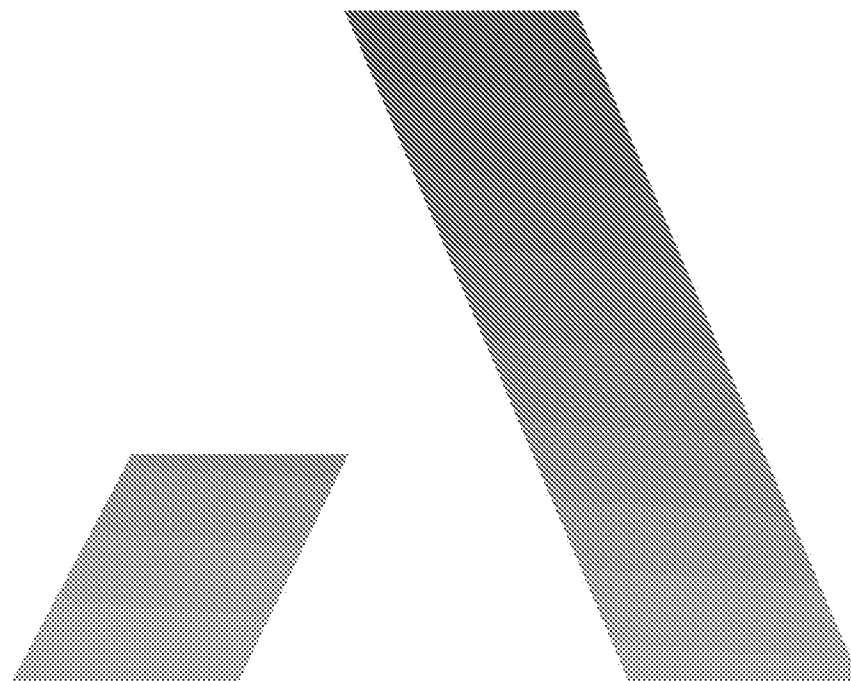
Land North of Water Lane, Angmering

Rydon Homes Ltd / Gleeson Land

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

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This statement has been commissioned by Rydon Homes Ltd / Gleeson Land to detail the proposed approach to energy and CO₂ reduction to be employed in the development at the Land North of Water Lane. 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.



Contents

1.	Introduction	4
2.	Planning Policy and Conditions.....	5
3.	Energy Reduction Strategy - Fabric First	8
4.	As-Designed Performance after fabric measures.....	12
5.	Low Carbon and Renewable Energy Systems.....	13
6.	Proposed Renewable Energy Systems	17
7.	As-Designed Performance after renewables	18
8.	As-Designed Performance under Part L 2021.....	19
9.	Overheating Risk and Passive Design.....	20
10.	Sustainable Design	21
11.	Conclusions.....	23

List of figures & tables

Figure 1. Proposed Site Layout	4
Table 1. CO ₂ Emissions improvements from successive Part L editions	8
Figure 2. The Energy Hierarchy	8
Table 2. Benefits of the Fabric First approach.....	9
Table 3. Proposed construction specification - main elements.....	10
Table 4. Sample dwelling as-designed energy demand after fabric measures (Part L 2013).....	12
Table 5. Sample dwelling as-designed CO ₂ emissions after fabric measures (Part L 2013)	12
Table 6. Site-wide as-designed energy demand and CO ₂ emissions after fabric measures (Part L 2013).....	12
Table 7. Individual Biomass Heating feasibility appraisal.....	14
Table 8. Solar Thermal systems feasibility appraisal.....	14
Table 9. Solar Photovoltaic systems feasibility appraisal.....	15
Table 10. Air Source Heat Pump systems feasibility appraisal.....	15
Table 11. Ground Source Heat Pump systems feasibility appraisal.....	16
Table 12. Proposed renewable energy systems and CO ₂ offset achieved	17
Table 13. Sample dwelling as-designed Energy Demand after renewables (Part L 2013)	18
Table 14. Sample dwelling as-designed CO ₂ emissions after renewables (Part L 2013).....	18
Table 15. Site-wide as-designed energy demand and CO ₂ emissions after fabric measures (Part L 2013).....	18
Table 16. Sample dwelling as-designed CO ₂ emissions after renewables (Part L 2021)	19
Table 17. Typical Water Demand Calculation	22

1. Introduction

Preface

- 1.1. This Energy and Sustainability Statement has been prepared on behalf of Rydon Homes Ltd / Gleeson Land in support of the reserved matters application for development of the site known as Land North of Water Lane.

Development Description

- 1.2. The development site is located on the north eastern edge of Angmering, a village located between Littlehampton and Worthing in West Sussex, within the boundary of Arun District.
- 1.3. Outline planning permission was granted in August 2019 (ref: A/30/18/OUT) for:

"Outline application with some matters reserved for the development of up to 525 residential dwellings (Class C3) 3 ha (gross) of employment land (Class B1), public open space, play areas, access, associated infrastructure and landscaping."

- 1.4. The proposals would deliver 525 dwellings across a mix of one to four bed detached, semi-detached, and terraced houses and apartments. The proposed site layout is shown in Figure 1

Purpose and Scope of the Statement

- 1.5. The statement has been prepared to address Condition 22 of the outline planning permission (ref: A/30/18/OUT) as well as relevant national and local policies relating to sustainable development, including "Policy ECC SP1: Adapting to climate change" and "Policy ECC SP2: Energy and climate change mitigation" of the Arun Local Plan 2011-2031.
- 1.6. Future changes to national guidance affecting the application of these policies have additionally been reviewed, together with an examination of how the proposed strategy aligns with the future direction of government policy relating to carbon reductions and the Building Regulations.

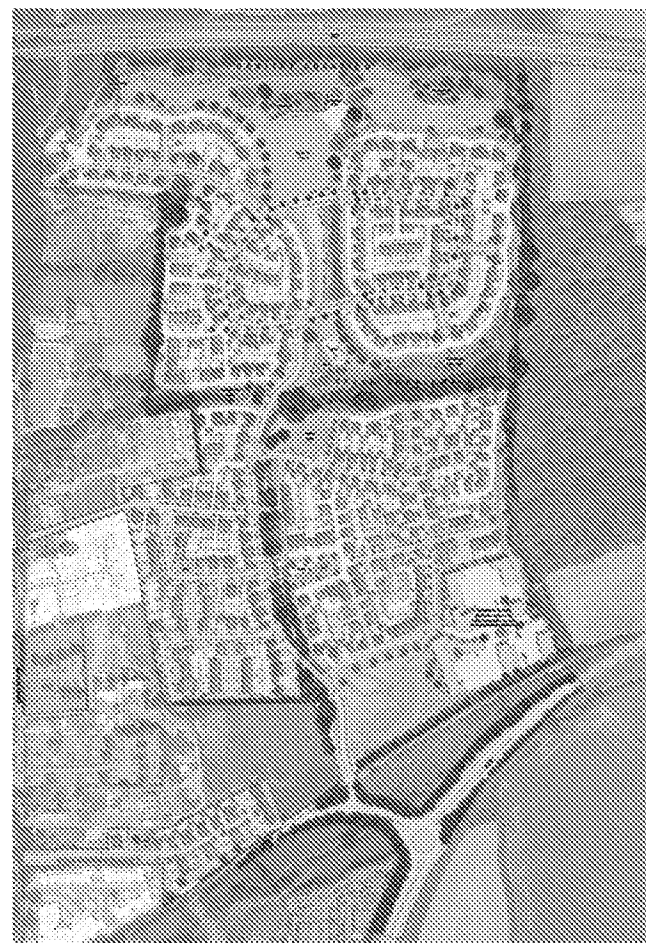


Figure 1. Proposed Site Layout

2. Planning Policy and Conditions

Local Planning Policy

- 2.1. The development will address relevant planning policy contained within the Arun Local Plan 2011 – 2031, adopted in July 2018), relating to sustainable design and construction:

Policy ECC SP1: Adapting to climate change

The Council will support development which is located and appropriately designed to adapt to impacts arising from climate change such as the increased probability of tidal and fluvial flooding; water stress; health impacts as a result of extreme temperatures and a decline in the quality of habitats and richness of biodiversity.

In order to achieve this, development must be designed to take account of the following issues:

- Location (in relation to flood risk and vulnerability to coastal erosion);
- Water efficiency;
- Shade, cooling, ventilation, solar gain;
- Connectivity to the green infrastructure network;
- Layout and massing;
- Resilience of buildings and building materials to extreme weather events; and
- Capacity of drainage systems and incorporation of Sustainable urban Drainage Systems (SuDS)

Policy ECC SP2: Energy and climate change mitigation

All new residential and commercial development (including conversions, extensions and changes of use) will be expected to be energy efficient and to demonstrate how they will:

- Achieve energy efficiency measures that reflect the current standards applicable at the time of submission;
- Use design and layout to promote energy efficiency; and
- Incorporate decentralised, renewable and low carbon energy supply systems, for example small scale renewable energy systems such as solar panels.

Policy ECC SP2: Energy and climate change mitigation (continued)

All major developments must produce 10% of the total predicted energy requirements from renewable or low carbon energy generation on site, unless it can be demonstrated that this is unviable. Energy efficiency measures will be taken into consideration when the total predicted energy requirements are calculated. The Council will consider 'allowable solutions' where it is clearly demonstrated that the provision of on site renewable or low carbon energy generation is unviable or not feasible.

Where planning permission is required to retrofit energy efficiency measures into existing development, schemes will be permitted, subject to the Design and Built Heritage policies.

In assessing the achievement of these standards the Council will consider:

- Site constraints;
- Technical viability;
- Financial viability; and
- Delivery of additional benefits.

Planning Conditions

- 2.2. Outline planning permission for the development was granted in August 2018 under application reference A/40/18/OUT. This statement will address Condition 22, extracted below:

Condition 22

At least 10% of the energy supply of the development shall be secured from decentralised and renewable or low carbon energy sources (as described in the glossary at Annex 2 of the National Planning Policy Framework) unless it can be demonstrated that a fabric-first approach would achieve an equivalent energy saving. Details and a timetable of how this is to be achieved for each phase or sub phase of development, including details of physical works on site, shall be submitted to and approved in writing by the Local Planning Authority before any development in that phase or sub phase begins. The development shall be implemented in accordance with the approved details and timetable and retained as operational thereafter, unless otherwise agreed in writing by the Local Planning Authority.

Reason: In order to secure on site renewable energy in accordance with national planning policy, and in accordance with Policy ECC SP2 of the Arun Local Plan.



National Planning Policy Framework

- 2.3. On the 20th July 2021, the Government published the revised National Planning Policy Framework (NPPF), which sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development
- 2.4. Chapter 14 of the NPPF outlines its energy and climate change policies. New development should be planned in ways that:
- avoid increased vulnerability to the range of impacts arising from climate change...
 - can help to reduce greenhouse emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
- 2.5. In determining planning applications, local planning authorities should expect new developments to:
- 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
 - take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.
- 2.6. This chapter also outlines the requirement of Local Plans to take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. The key focus of the NPPF is to support local and regional planning authorities.

Current and Future National Policy Standards

- 2.7. Government policy in relation to the energy performance of buildings has been evolving over the past decade, following government commitments to reduce the emission of greenhouse gases - particularly CO₂. This obligation was enshrined in the Climate Change Act 2008, which commits the UK to achieving a mandatory 80% reduction in the UK's CO₂ emissions by 2050, compared with 1990 levels.
- 2.8. In 2016, the UK government ratified the Paris Agreement, which provides a framework for governments to pursue the target of limiting global warming below 2°C.
- 2.9. In June 2019, the Government announced it had set a new net zero greenhouse gas emission target for the UK by 2050, compared with the previous target of at least 80% reduction from 1990 levels.
- 2.10. The built environment has a key role to play in delivering on these international commitments, as it accounts for approximately a third of overall CO₂ emissions. These commitments have been translated into national policies within the built environment driven by, amongst other mechanisms, the EU Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive.
- 2.11. Following the introduction of the 2013 edition of Building Regulations Part L, the successive updates now require regulated CO₂ emissions levels from new build domestic buildings to be approximately 30% lower than 2006 levels.
- 2.12. The Government proposes that the Building Regulations are the appropriate mechanism to drive future standards with respect to energy consumption, with local authorities able to apply the optional requirements of the national technical standards with respect to water consumption and space.
- 2.13. As an acknowledgement of the challenge to the built environment in meeting future 'net zero' targets, the Government published a consultation on the next revision to the Building Regulations Approved Document L1A (Part L) in October 2019. A government response was received in early 2021, conforming the proposed carbon standards, however further consultation has been undertaken on fabric standards which at the time of writing a government response is still awaited.
- 2.14. The uplift to Part L 2021 will incorporate:



Higher Standards for Carbon Dioxide Emissions

- 2.15. This is to be delivered through what is expressed as a 'fabric' approach to deliver a 31% reduction over current standards (referred to as 'Option 2' in the original consultation).

Introduction of Primary Energy Demand Compliance Metric

- 2.16. The regulations will introduce a primary energy demand compliance metric. This is in order to align the regulations with the amended EU Energy Performance of Building Directive (2018), which states:

"The energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/(m².y) for the purpose of both energy performance certification and compliance with minimum energy performance requirements."

- 2.17. Primary energy is an expression of the energy content available in a fuel / fuel source which has not undergone any conversion or transformation process. Individual factors are assigned to all fuel types to take account of upstream processes and energy use – e.g. mains electricity has a higher factor due to the additional transformation and distribution processes that the energy undergoes before it reaches the home, compared with gas where the fuel is burned directly within the dwelling.
- 2.18. Dwellings will therefore be assessed based on their primary energy consumption in a similar way to current carbon compliance.

Revised Transitional Arrangements

- 2.19. Revised transitional arrangements will apply once the new regulatory standards are introduced. Dwellings will now need to be covered by the building notice, initial notice, or full plans before July 2022 and individual plots commenced prior to July 2023 in order to continue under Part L 2013. Registration or commencement falling after these dates means that dwellings will be required to meet Part L 2021 standards.

Proposed Approach

- 2.20. Due to the development timescales, it is considered that a portion of the development is likely to fall under Part L 2021, and therefore it is expected that a proportion of the development will be built to current Part L 2013 and a proportion to Part L 2021. However, the precise requirements of these future revisions of Buildings Regulations and the accompanying SAP compliance software are not yet fully finalised.
- 2.21. In recognition of these variables, this Energy and Sustainability Statement has considered the likely impact of future Building Regulations requirements. With respect to carbon reduction, the dwellings built to meet Part L 2021 will deliver a >31% reduction compared with current regulatory standards, thereby exceeding the requirements as set out in Policy ECC SP2 the Arun Local Plan 2011-2031 and Condition 22 of the outline planning permission (ref: A/40/18/OUT).
- 2.22. The development will achieve these carbon reductions through higher fabric standards and low carbon and renewable energy systems being installed to offset emissions and reduce fuel bills for residents.
- 2.23. This statement provides an indicative fabric specification and a strategy which would enable the dwellings to meet these higher standards, however as elements of the regulatory standards are still under consultation it is primarily the carbon reduction objective that is being expressed, with the precise strategy to achieve this being subject to change as this progresses.
- 2.24. Additional sustainable construction considerations are additionally addressed, including overheating risk and climate resilience, sustainable and responsible materials use, water consumption and electric vehicle (EV) charging.

3. Energy Reduction Strategy – Fabric First

- 3.1. As one of the key areas of ongoing impact of any development, the energy demand of the dwellings to be constructed is a key consideration in the overall sustainability strategy.
- 3.2. As set out within the policy review section of this statement, it is considered that Building Regulations form the minimum requirement for new dwellings in terms of energy performance.
- 3.3. As shown in Table 1, the CO₂ standards contained within Part L were increased in 2010 and 2013, reducing the 'Target Emission Rate' (TER) by approximately 25% and a further 6% (9% for non-residential) respectively, requiring substantial improvements to thermal insulation and heating services, or a significant increase in on-site renewable energy provision.
- 3.4. The 2021 uplift to the regulations will require a further 31% reduction in emissions, delivering dwellings with emissions levels less than half of homes built to L1A 2006 standards.

Table 1. CO₂ Emissions improvements from successive Part L editions

Building Regulations	CO ₂ emissions improvements
L1A 2006	-
L1A 2010	25%
L1A 2013	6%
L1A 2021	31%

Energy Reduction Strategy – Fabric First

- 3.5. The proposed construction specification and sustainable design principles to be applied to the development will ensure that each dwelling meets the CO₂ reductions mandated by Part L1A of the Building Regulations through fabric measures alone.
- 3.6. It is proposed that the energy demand 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 2).

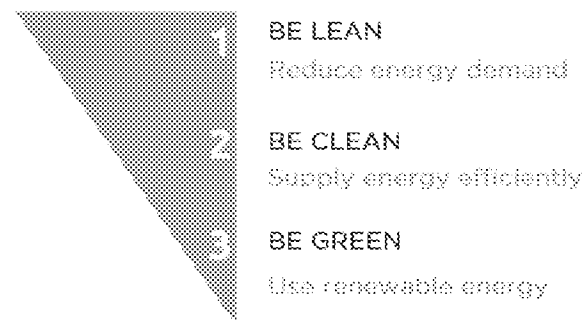


Figure 2. The Energy Hierarchy

Be Lean – reduce energy demand

- 3.7. The design of a development – from the masterplan to individual building design – will assist in reducing energy demand in a variety of ways, with a focus on minimising heating, cooling and lighting loads. Key considerations include:
- Building orientation – maximise passive solar gain and daylight
 - Building placement – control overshadowing and wind sheltering
 - Landscaping – control daylight, glare and mitigate heat island effects
 - Building design – minimise energy demand through fabric specification

Be Clean – supply energy efficiently

3.8. The design and specification of building services to utilise energy efficiently is the next stage of the hierarchy, taking into account:

- High efficiency heating and cooling systems
- Ventilation systems (with heat recovery where applicable)
- Low energy lighting
- High efficiency appliances and ancillary equipment

Be Green – use low carbon / renewable energy

3.9. Low carbon and renewable energy systems form the final stage of the energy hierarchy and can be used to directly supply energy to buildings, or offset energy carbon emissions arising from unavoidable demand. This may be in the form of:

- Low carbon fuel sources – e.g. biomass
- Heat pump technologies
- Building scale renewable energy systems
- Small-scale heat networks
- Development-scale heat networks

3.10. 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, this approach is referred to as 'fabric first' and concentrates finance and efforts on improving U-values, reducing thermal bridging, improving airtightness, and installing energy efficient ventilation and heating services

3.11. This approach has been widely supported by industry and government for some time, particularly in the residential sector, with the Zero Carbon Hub¹ and the Energy Savings Trust² having both stressed the importance of prioritising energy demand as a key factor in delivering resilient, low energy buildings.

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

Table 2. Benefits of the Fabric First approach

	Fabric energy efficiency measures	Bolt-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	✓	✗

Building Regulations Standards – Fabric Energy Efficiency

3.13. In addition to the CO₂ reduction targets, the importance of energy demand reduction was further supported by the introduction of a minimum fabric standard into Part L1A 2013, based on energy use for heating and cooling a dwelling. This is referred to as the 'Target Fabric Energy Efficiency' (TFEE), and expressed in kWh/m²/year.

3.14. This standard enables the decoupling of energy use from CO₂ emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO₂ emissions through low carbon or renewable energy technologies.

3.15. The TFEE is calculated based on the specific dwelling being assessed with reference values for the fabric elements contained within Approved Document L1A. These reference values are described as 'statutory guidance' as opposed to mandatory requirements, allowing full flexibility in design approach and balances between different aspects of dwelling energy performance to be struck so that the ultimate goal of achieving the TFEE is met.

3.16. These standards will be tightened under Part L 2021, however the exact requirements are still subject to consultation. The proposed approach and indicative construction

¹ Zero Carbon Hub, Zero Carbon Strategies for tomorrow's new homes, Feb 2013

² Energy Savings Trust, Fabric first: Focus on fabric and services improvements to increase energy performance in new homes, 2010

specifications are set out in the following sections of this Strategy subject to the conclusion of this consultation process.

Fabric Standards

- 3.17. In order to ensure that the energy demand of the development is reduced, the dwellings have been designed to minimise heat loss through the fabric wherever possible. Table 3 details the proposed fabric specification of the major building elements, with the first column in this table setting out the Part L1A 2013 and Part L1A 2021 limiting fabric parameters in order to demonstrate the potential improvements.

Table 3. Proposed construction specification – main elements

	Part L1a 2013 Limiting Fabric Parameters	Part L1a 2021 Limiting Fabric Parameters	Proposed Specification
External wall – u-value	0.30 W/m ² K	0.26 W/m ² K	0.21 – 0.26 W/m ² K
Party wall – u-value	0.20 W/m ² K	0.20 W/m ² K	0.00 W/m ² K
Plane roof – u-value	0.20 W/m ² K	0.16 W/m ² K	0.11 W/m ² K
Ground floor – u-value	0.25 W/m ² K	0.18 W/m ² K	0.10 – 0.17 W/m ² K
Windows – u-value	2.00 W/m ² K	1.60 W/m ² K	1.20 – 1.30 W/m ² K
Doors – u-value	2.00 W/m ² K	1.60 W/m ² K	0.84 – 1.40 W/m ² K
Air Permeability	10 m ³ /h.m ² at 50 Pa	8.00 m ³ /h.m ² at 50 Pa	4.50 – 5.01 m ³ /h.m ² at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Y = 0.150 (default)	Y = ≤ 0.047 (calculated)

Thermal bridging

- 3.18. The significance of thermal bridging as a potentially 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.

- 3.19. The specification seeks to minimise 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 will be undertaken to assess the performance of all main building junctions. It is calculated that the average total Y value is around 0.041, against the SAP default figure of 0.150.

Energy Efficient Heating and Lighting

- 3.20. 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. High efficiency combi boilers should be installed to properties to eliminate the need for hot water cylinders where feasible. Primary pipework should be fully insulated, and time and temperature zoning controls installed in all dwellings.
- 3.21. Internal lighting should be low energy wherever possible, and areas of infrequent use will be fitted with occupancy sensors. External security and space lighting should be low energy and fitted with PiR and daylight sensors where appropriate.
- 3.22. Where necessary, units will be installed with a Waste Water Heat Recovery (WWHR) system. WWHR retrieves thermal energy from hot water used in a shower before it disappears down the drain. This happens through a heat exchanger, in which cold mains water is passed around a copper waste pipe to gain a temperature rise, before continuing to the boiler 'pre heated'. This in turn relieves the workload of the boiler.
- 3.23. Where necessary, units will be installed with a Flue Gas Heat Recovery (FGHR) system. FGHR recovers waste heat from flue gases. The recovered heat is used to preheat the cold water entering the boiler, decreasing the energy required to warm the water up to the required level.

Passive Design Measures and Overheating Risk Mitigation

- 3.24. 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.
- 3.25. Where feasible, dwellings will be fitted with high-efficiency combination boilers, removing the need for hot water cylinders which would lose useful heat to the dwelling at the rate of around 1.5kWh/day, or circa 550kWh over the course of a year.
- 3.26. 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.



- 3.27. By following these principles, the development will be designed to build in resilience to a potentially changing climate over the lifetime of the buildings and minimise overheating risk, which can be exacerbated by the drive to build better insulated, more airtight homes if not considered within the design and construction process.

Air Leakage

- 3.28. 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 $\leq 4.50 - 5.01 \text{ m}^3/\text{h.m}^2$ at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Provisions for Energy-Efficient Operation of the Dwelling

- 3.29. The occupant of the dwelling should be provided with all necessary literature and guidance relating to the energy efficient operation of fixed building services. Currently it is assumed that all dwellings will be provided with modern gas-fired heating systems, with controls enabling different temperature profiles in a minimum of two defined zones, a measure which services to avoid unnecessary heating of spaces when not required – for example, bedrooms and living rooms with differing hours of occupancy.

4. As-Designed Performance after Fabric Measures

- 4.1. Through following the strategy described, the dwellings will significantly reduce energy demand and consequent CO₂ emissions beyond a Part L compliant level of performance through the dwelling fabric.
- 4.2. A sample range of dwellings have been assessed under Part L 2013 to establish the baseline energy demand and CO₂ emissions of the development, with the proposed fabric strategy applied to provide an overview of the typical as-designed energy demand and CO₂ emissions. The results of these calculations are shown in Tables 4 & 5.

Table 4. Sample dwelling as-designed energy demand after fabric measures (Part L 2013)

House Type	Part L 2013 Target Energy Demand (kWh/yr)	As-Designed Energy Demand (kWh/yr)	Reduction %
1 Bed Apartment	4,393	4,218	3.97
2 Bed Mid Terrace	5,652	5,173	8.46
2 Bed End Terrace	5,917	5,214	11.88
3 Bed Semi Detached	6,428	5,657	11.99
3 Bed Detached	7,538	6,700	11.11
4 Bed Semi Detached	7,066	6,153	12.92
4 Bed Detached	8,589	8,245	4.00

Table 5. Sample dwelling as-designed CO₂ emissions after fabric measures (Part L 2013)

House Type	Part L 2013 Target CO ₂ Emissions (kgCO ₂ /yr)	As-Designed CO ₂ Emissions (kgCO ₂ /yr)	Reduction %
1 Bed Apartment	1,040	1,016	2.37
2 Bed Mid Terrace	1,162	1,105	4.94
2 Bed End Terrace	1,407	1,267	8.56
3 Bed Semi Detached	1,642	1,463	10.87
3 Bed Detached	1,748	1,611	7.82
4 Bed Semi Detached	1,781	1,572	11.72
4 Bed Detached	2,052	1,977	3.66

- 4.3. Table 6 demonstrates the site-wide savings over and above the Part L 2013 compliant baseline that will be delivered.

Table 6. Site-wide as-designed energy demand and CO₂ emissions after fabric measures (Part L 2013)

	Energy Demand (kWh/yr)		CO ₂ Emissions (kgCO ₂ /yr)	
Part L 2013 compliant	3,948,423		910,570	
After fabric measures	3,644,002		862,178	
	kWh/yr	%	kgCO ₂ /yr	%
Total site-wide savings	304,421	7.71	48,392	5.31

5. Low Carbon and Renewable Energy Systems

- 5.1. In accordance with Regulation 25A of the Building Regulations, a full range of low carbon and renewable energy systems have been assessed for their potential to deliver suitable emission savings and meet the requirements of Policy ECC SP2 the Arun Local Plan 2011-2031

Combined Heat and Power (CHP) and District Energy Networks

- 5.2. A CHP unit is capable of generating heat and electricity from a single fuel source. The electricity generated by the CHP unit is used to displace electricity that would otherwise be supplied from the national grid, with the heat generated as effectively a by-product utilised for space and water heating.
- 5.3. 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 mainly 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. For this reason, the use of a CHP system is considered unfeasible for this development.
- 5.4. There are currently no heat networks which extend near the proposed development. High network heat losses associated with distribution to individual houses, as opposed to large high-rise apartment blocks and commercial developments mean that a new heat network to serve the area is not considered viable or an environmentally preferred option. Due to these reasons, the provision for future connection to a district heating system is also not proposed.

Wind Power

- 5.5. 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, including the significant amount of woodland on and around the development.
- 5.6. A preliminary examination of the BERR wind speed database indicates that average wind speeds at 10m above ground level are around 5.0m/s³. Wind turbines at this site are therefore

unlikely to generate sufficient quantities of electrical energy to be cost effective⁴. For these reasons wind power is not considered feasible.

Building Scale Systems

- 5.7. 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)
 - Air Source Heat Pumps (ASHPs)
 - Ground Source Heat Pump (GSHPs)
- 5.8. The advantages and disadvantages of these technologies are evaluated in Tables 7-11.

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

⁴ CIBSE TM39:2006. Renewable energy sources for buildings.

Table 7. Individual Biomass Heating feasibility appraisal

Advantages	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. • Local environmental impacts potentially include increased NO_x and particulate emissions
Estimated costs and benefits	
• Cost £2,000 upwards for a wood-pellet boiler, not including cost of fuel • Not eligible for RHI payments as new-build properties	
Conclusions	
Biomass heating is considered technically feasible in large dwellings provided sufficient space can be accommodated for fuel supply, delivery and management.	

Table 8. Solar Thermal systems feasibility appraisal

Advantages	Disadvantages
• Mature and reliable technology offsetting the fuel required for heating water (typically gas) • Solar thermal systems require relatively low maintenance • Typically, ~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)
Estimated costs and benefits	
• Cost £2,000 - 5,000 for standard installation • Not eligible for RHI payments as new-build properties • Ongoing offset of heating fuel, minimal maintenance requirements	
Conclusions	
Solar thermal systems are considered technically feasible on all buildings with suitable roof orientations.	

Table 9. Solar Photovoltaic systems feasibility appraisal

Advantages/Strengths	Disadvantages/Weakness
• The technology offsets 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 • Adaptable to future system expansion • 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 • Service and maintenance requirement minimal, and 2-3 storey buildings should not require significant additional safety measures (mansafe systems etc) for roof access	• Poor design and installation can lead to lower than expected yields (e.g. from shaded locations) • Installation is restricted to favourable orientations • Feed in Tariff support mechanism has been discontinued • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g. AONB) or conservation areas • Reflected light may be a concern in some locations
Estimated costs and benefits	
• Cost £1,500 upwards (1kWp+) and scalable • Ongoing offset of electricity fuel costs, minimal maintenance requirements	
Conclusions	
PV panels are considered technically feasible for all buildings with suitable roof orientations. The relatively low cost, high carbon saving potential and limited additional impacts mean that PV is considered a feasible option for this development.	

Table 10. Air Source Heat Pump systems feasibility appraisal

Advantages/Strengths	Disadvantages/Weakness
• Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle • Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 250% • Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	• Air source heat pumps are powered by electricity, with a significantly higher unit price than gas, leading to potentially increased running costs • It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved. Users must be educated in how heat pump systems should be operated for optimal efficiency • Air source heat pump plant should be integrated into the building design to mitigate concerns regarding the visual impact of bolt-on technology • Noise in operation may be an issue particularly when operating at high output
Estimated costs and benefits	
• Cost £5,000 - £7,000 for standard installation • Not eligible for RHI payments as new-build properties	
Conclusions	
Air source heat pumps are technically feasible for the buildings in this scheme. At this stage the capital cost and running costs of these systems means they are a potential but not preferred option.	

Table 11. Ground Source Heat Pump systems feasibility appraisal

Advantages	Disadvantages
- Heat pumps are relatively mature technology providing heat using the reverse vapor compression refrigeration cycle - Heat pumps are a highly efficient way of providing heat using electricity, with manufacturers reporting efficiencies from 320% - Can be of increased benefit where cooling is also required, therefore particularly relevant to commercial buildings	- Low temperature heating circuits (underfloor heating) would be required to maximise the efficiency of heat pumps - A hot water cylinder would also be required for both space and water heating - Ground source heat pumps are powered by electricity with a significantly higher unit price than gas, leading to potentially increased running costs - It is critical that heat pump systems are designed and installed correctly to ensure efficient operation can be achieved - Ground source heat pumps either require significant land to incorporate a horizontal looped system or significant expense to drill a bore hole for a vertical looped system
Disadvantages and Potential	
- Cost circa £10,000+ - Shared ground loop approach eligible for non-domestic RHI. Estimated simple payback at circa 18 years (systems only) - Running cost linked to COP of heat pump, however likely to be higher than mains gas - Additional costs to upgrade electricity infrastructure currently unknown	
Conclusions	
Ground source heat pumps are considered technically feasible for buildings in this scheme. However, the cost and difficulty associated with vertical boreholes at this site means that they are not considered a preferred low carbon technology at this stage.	

Summary

- 5.9. Following this feasibility assessment, it is considered that as biomass heating systems would require significant storage space for fuel as well as regular deliveries at different times to all dwellings, they are not appropriate for this development.
- 5.10. Roof-mounted systems are therefore likely to be most suited to the development.
- Solar thermal systems to dwellings that have space to incorporate a hot water cylinder and a suitable roof orientation.
 - Solar photovoltaic modules to dwellings that have suitable roof orientations.
- 5.11. It is considered that solar PV systems are most appropriate in meeting a significant proportion of energy demand without introducing additional energy loss through larger hot water cylinders.



6. Proposed Renewable Energy Systems

- 6.1. The baseline energy demand has been calculated as 3,948,423 kWh/year. After fabric measures, the total residual energy demand has been calculated at 3,644,002 kWh/year. In order to meet the requirements of Policy ECC SP2, low carbon or renewable energy systems should be capable of delivering a further energy demand reduction of 90,421 kWh/year.
- 6.2. As demonstrated in Table 12, in order to deliver the required energy demand reduction and CO₂ offset, a total system size of approximately 106 kWp should be installed across the development, capable of offsetting 90,421 kWh/year.

Table 12. Proposed renewable energy systems and CO₂ offset achieved

Proposed renewable energy	
Total PV system annual generation	90,421 kWh
Size of system	106 kWp
Annual CO ₂ offset	46,929 kgCO ₂ /yr

- 6.3. It should be noted that due to the stage of development, all calculations are indicative and have been based on sample SAP calculations extrapolated to represent the site. Revised calculations will therefore be undertaken during detailed design stage to accurately represent the final housing mix, and both the choice of solar PV systems and the total system output may be revised accordingly, whilst ensuring that the policy targets are met.
- 6.4. 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.

7. As-Designed Performance after Renewables

- 7.1. Through following the strategy described, the dwellings will significantly reduce energy demand and consequent CO₂ emissions beyond a Part L compliant level of performance through the dwelling fabric and the incorporation of solar PV systems.
- 7.2. Tables 13 & 14 provide an overview of the typical as-designed energy demand and CO₂ emissions of the sample dwellings assessed under Part L 2013 to with the proposed fabric and renewables strategy applied.

Table 13. Sample dwelling as-designed Energy Demand after renewables (Part L 2013)

House Type	Part L 2013 Target Energy Demand (kWh/yr)	As-Designed Energy Demand (kWh/yr)	Reduction %
1 Bed Apartment	4,393	3,954	10.00
2 Bed Mid Terrace	5,652	5,086	10.00
2 Bed End Terrace	5,917	4,692	11.88
3 Bed Semi Detached	6,428	5,092	11.99
3 Bed Detached	7,538	6,030	11.11
4 Bed Semi Detached	7,066	5,538	12.92
4 Bed Detached	8,589	7,730	10.00

Table 14. Sample dwelling as-designed CO₂ emissions after renewables (Part L 2013)

House Type	Part L 2013 Target CO ₂ Emissions (kgCO ₂ /yr)	As-Designed CO ₂ Emissions (kgCO ₂ /yr)	Reduction %
1 Bed Apartment	1,040	879	15.48
2 Bed Mid Terrace	1,162	1,066	8.25
2 Bed End Terrace	1,407	1,287	8.56
3 Bed Semi Detached	1,642	1,463	10.87
3 Bed Detached	1,748	1,611	7.82
4 Bed Semi Detached	1,781	1,572	11.72
4 Bed Detached	2,052	1,706	16.87

- 7.3. Table 15 demonstrates the site-wide savings over and above the Part L 2013 compliant baseline that will be delivered.

Table 15. Site-wide as-designed energy demand and CO₂ emissions after fabric measures (Part L 2013)

	Energy Demand (kWh/yr)		CO ₂ Emissions (kgCO ₂ /yr)	
Part L compliant	3,948,423		910,570	
After fabric measures	3,644,002		862,178	
After renewable energy	3,279,602		815,249	
	kWh/yr	%	kgCO ₂ /yr	%
Total site-wide savings	394,842	10.00	95,321	10.47

8. As-Designed Performance under Part L 2021

- 8.1. It is expected that a proportion of the development will be built to current Part L 2013 and a proportion to Part L 2021. It will be ensured as design progresses that revised calculations will be undertaken on a plot-by-plot basis under the relevant Part L to accurately represent the final CO₂ emissions and energy demand of the development, whilst ensuring that the requirements of Condition 22 and Policy ECC SP2 are met.
- 8.2. Revised calculations will therefore be undertaken during detailed design stage to accurately represent the final housing mix, and both the choice of solar PV systems and the total system output may be revised accordingly, whilst ensuring that the policy targets are met.
- 8.3. With respect to carbon reduction, the dwellings built to meet Part L 2021 will deliver a >31% reduction compared with current regulatory standards, thereby exceeding the requirements as set out in Policy ECC SP2 the Arun Local Plan 2011-2031 and Condition 22 of the outline planning permission (ref: A/40/18/OUT).
- 8.4. These carbon reductions will be achieved through higher fabric standards, and the use of Waste Water Heat Recovery systems (WWHR), Flue Gas Heat Recovery systems (FGHR), and the use of solar PV systems.
- 8.5. Using Beta software, a sample range of dwellings have been assessed under Part L 2021 to establish the baseline CO₂ emissions of the dwellings that will be constructed under Part L 2021, with the proposed fabric strategy applied to provide an overview of the typical as-designed CO₂ emissions. The results of these calculations are shown in Table 16.

Table 16. Sample dwelling as-designed CO₂ emissions after renewables (Part L 2021)

House Type	Part L 2021 Target CO ₂ Emissions (kgCO ₂ /yr)	As-Designed CO ₂ Emissions (kgCO ₂ /yr)	Reduction %
1 Bed Apartment	692	671	3.00
2 Bed Mid Terrace	733	720	1.81
2 Bed End Terrace	733	720	1.81
3 Bed Semi Detached	1,044	1,013	3.00
3 Bed Detached	922	918	0.40
4 Bed Semi Detached	1,242	1,205	3.00
4 Bed Detached	1,257	1,220	3.00



9. Overheating Risk and Passive Design

9.1. Dwellings constructed today may be operating in a substantially different climate over the coming decades, and therefore should be designed to ensure that they are able to adapt and reduce the risk of overheating with potentially higher summer temperatures and longer hot spells.

9.2. Key design decisions can affect the potential risk of overheating:

- Poor consideration of orientation of large glazed facades
- High density development contributing to urban heat island effects
- High glazing ratios contributing to excessive unwanted solar gain
- Inadequate ventilation strategies
- Very high levels of thermal insulation without considering heat build-up

9.3. Other factors which additionally contribute to heat build-up within homes and should be addressed where possible include:

- High levels of occupation
- Appliance use contributing to internal gains

Cooling Hierarchy

9.4. In common with sustainable heating strategies, it is possible to apply a sustainable 'cooling hierarchy' which sets out the priorities to ensure overheating risk is minimised:

- Minimise internal heat gain
- Manage heat through internal thermal mass and design of spaces
- Passive ventilation strategies
- Mechanical ventilation systems
- Active cooling systems

Addressing Overheating Risk

9.5. The cooling hierarchy described has been considered, with passive measures of reducing overheating risk given priority. Key measures which will be taken within the development include:

- A layout which incorporates significant green space around the site and in rear gardens reducing the potential for heat build-up in enclosed and low albedo external areas such as tarmac and dark roofs
- Glazing specification which has been considered to balance the requirements for useful solar gain with unwanted summer gain
- Consideration of thermal mass of construction materials to smooth internal temperature profiles, storing excess heat during the day and releasing at night



10. Sustainable Design

- 10.1. This section sets out details of additional resource efficiency and sustainable design principles to be applied at the development.

Materials

- 10.2. The impacts of construction materials range from the depletion of natural resources to the greenhouse gas emissions and water use associated with their manufacture and installation.
- 10.3. Within the development choices will be made in order to reduce the consumption of primary resources and using materials with fewer negative impacts on the environment, including but not limited to the following;
- Use fewer resources and less energy through designing buildings more efficiently
 - Specify and select materials and products that strike a responsible balance between social, economic and environmental factors
 - Incorporate recycled content, use resource-efficient products and give due consideration to end-of-life uses
 - Influence, specify and source increasing amounts of materials which can be reused and consider future deconstruction and recovery
 - All insulating materials will have a Global Warming Potential (GWP) of < 5 in manufacture and installation.
 - All materials used in construction will be responsibly sourced, with certification obtained wherever possible. Materials with a low environmental impact as per the BRE Green Guide will be preferred.

Waste

- 10.4. Sending waste to landfill has various environmental impacts, such as the release of local pollution, ecological degradation and methane emissions, in addition to exacerbating resource depletion. Waste in housing comes from two main streams; construction waste and domestic waste during occupation.

Household waste

- 10.5. In this respect regard has been given to the policy advice contained in the NPPF together with the Council's current guidance to ensure that the new dwellings are provided with adequate storage facilities for both waste and recyclable materials.

- 10.6. Arun District Council currently operates domestic waste collection services through which households are able to recycle materials including paper and cardboard, plastic bottles and food containers, tins, glasses and metal foils, together with garden waste.

Construction waste

- 10.7. The construction process will be managed to effectively and appropriately monitor and manage construction site waste. Target benchmarks for resource efficiency will be set in accordance with best practice – e.g. m³ of waste per 100m² / tonnes waste per m².
- 10.8. Wherever possible materials will be diverted from landfill through re-use on site, reclamation for re-use, returned to the supplier where a 'take-back' scheme is in place or recovered and recycled using an approved waste management contractor.

Electrical Vehicle Charging Points

- 10.9. There is a government ambition for all new cars to be effectively zero emission by 2035. The 'Road to Zero' strategy set out a £1.5b package of support for the transition. A number of initiatives are already in place including grants, as well as road tax and vehicle excise duty exemptions
- 10.10. It is recognised that there is a need to ensure that the development is adaptable to accommodate a future shift in personal transportation to electric vehicles, to promote sustainable transport and to minimise air pollution. As Electric Vehicle (EV) ownership increases, developers have an increasing responsibility to provide EV charging points for occupants.
- 10.11. The development will ensure adequate provision of electric vehicle charging points is made.
- 10.12. Further technical details of the charger along with locations will be provided at the appropriate time as preparation for the development progresses.

Water Conservation

- 10.13. In line with current Building Regulations, water use will be managed effectively throughout the development through the incorporation of appropriate efficiency measures.
- 10.14. Water efficiency measures including the use of efficient dual flush WCs, low flow showers and taps and appropriately sized baths will be encouraged with the aim to limit the use of water during the operation of the development to limit water use.



- 10.15. Table 17 shows how the development could achieve a result less than the required 125 litres/occupier/day calculated in accordance with Building Regulations 17.K methodology.
- 10.16. The calculation results in a total water consumption of 105.9 Litres/Person/Day for the intended specification, well below the maximum of 125 Litres/Person/Day required by Building Regulations.

Table 17. Typical Water Demand Calculation

Installation Type	Unit of measure	Capacity/ flow rate	Litres/Person/Day
WC (dual flush)	Full flush (l)	6	8.76
	Part flush (l)	4	11.84
Taps (excluding kitchen taps)	flow rate (l/min)	5	9.48
Bath	Capacity to overflow (l)	181	19.91
Shower	Flow rate (l/min)	6	26.22
Kitchen sink taps	Flow rate (l/min)	6	13.00
Calculated Use			110.9
Normalisation Factor			0.91
Total Internal Consumption (L)			100.9
External Use			5.0
Building Regulations 17.K			105.9



11. Conclusions

- 11.1 This Energy and Sustainability Statement has been prepared by AES Sustainability Consultants Ltd on behalf of Rydon Homes Ltd / Gleeson Land to detail the proposed approach to sustainable construction to be employed at the development known as the Land North of Water Lane, Angmering.
- 11.2 The development site is located in on the north eastern edge of Angmering, a village located between Littlehampton and Worthing in West Sussex, within the boundary of Arun District. The proposals would deliver 525 dwellings across a mix of one to four bed detached, semi-detached, and terraced houses and apartments.
- 11.3 The statement has been prepared to address Condition 22 of the outline planning permission (ref: A/30/18/OUT) as well as relevant national and local policies relating to sustainable development, including "Policy ECC SP1: Adapting to climate change" and "Policy ECC SP2: Energy and climate change mitigation" of the Arun Local Plan 2011-2031.
- 11.4 The statement sets out a fabric first approach to sustainable construction, demonstrating that decisions about the built form, orientation and design as well as improvements in insulation specification, a reduction in thermal bridging, unwanted air leakage paths and further passive design measures will ensure that energy demand is reduced by 7.71% from the Part L baseline.
- 11.5 A range of potentially appropriate technologies have been assessed for feasibility in delivering a further reduction in energy demand of 2.29%, concluding that solar PV constitutes both the preferred and viable technology for this site. A system capacity of circa 90,421 kWh/annum is proposed, to offset 46929 kgCO₂/year
- 11.6 The overall savings from the combination of fabric efficiency measures and renewable energy lead to site wide energy demand reductions of 10.00% over 2013 Building Regulations standards, therefore meeting the requirements of Condition 22 and Policy ECC SP2.
- 11.7 Due to the development timescales, it is considered that a significant portion of the development is likely to fall under Part L 2021, and therefore it is expected that a proportion of the development will be built to current Building Regulations 2013 and a proportion to 2021. However, the precise requirements of these future revisions of Buildings Regulations and the accompanying SAP compliance software are not yet fully finalised.
- 11.8 In recognition of these variables, this Energy and Sustainability Statement has considered the likely impact of future Building Regulations requirements. With respect to carbon reduction, the dwellings built to meet Part L 2021 will deliver a >31% reduction compared with current regulatory standards, thereby exceeding the requirements as set out in Policy ECC SP2 the Arun Local Plan 2011-2031 and Condition 22 of the outline planning permission (ref: A/40/18/OUT)
- 11.9 The statement additionally details the proposed approach to addressing overheating risk, sustainable and responsible materials usage, electric vehicle charging provision and water consumption of the dwellings.