Land at Lynchmead Farm

Mead Realisations Limited

Energy and Sustainability Statement

AES Sustainability Consultants Ltd

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Sustainability
Consultants

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Rev0	Alice Gent	29.07.2019	Initial Issue

MEAD
REALISATIONS

This statement has been commissioned by Mead Realisations Ltd to detail the proposed approach to energy and CO$_2$ reduction to be employed in development the Land at Lynchmead Farm site. 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.

AES Sustainability Consultants

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1. Introduction

Preface

1.1. This Energy and Sustainability Statement has been prepared on behalf of Mead Realisations Ltd in support of the outline planning application for the development of the Land at Lynchmead Farm.

Development Description

1.2. The development site is located on the north-eastern edge of Weston-super-Mare, adjacent to the settlement boundary, approximately 1.5 miles to the west of the M5 motorway.

1.3. The proposals consist of up to 75 dwellings and associated development such as roads and open spaces. The proposed site is shown in Figure 1.

Purpose and Scope of the Statement

1.4. This statement has been prepared to address relevant national and local policies relating to sustainable development, including North Somerset Council Core Strategy Policy CS2 and North Somerset Replacement Local Plan 2007 Policy GDP/3.

1.5. The statement demonstrates that the development will incorporate significant renewable energy provision, sufficient to deliver 15% of the residual primary energy demand, meeting the requirements of Policies CS2 and GDP/3.

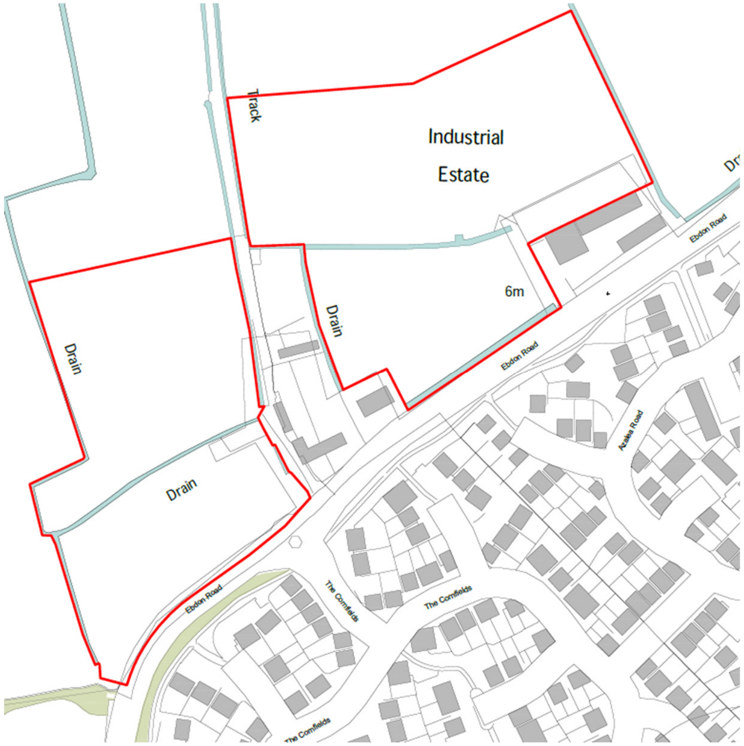

Figure 1. Proposed Site

2. Planning Policy

Local Planning Policy

2.1. Local policy relating to the sustainable design and construction of buildings is contained within the North Somerset Replacement Local Plan, adopted in March 2007 and the North Somerset Core Strategy, adopted in April 2012 and revised in March 2013. The following extracts from these documents are relevant to the energy strategy:

North Somerset Core Strategy 2012

CS2: Delivering sustainable design and construction

New development both residential (including conversions) and non-residential should demonstrate a commitment to sustainable design and construction, increasing energy efficiency through design, and prioritising the use of sustainable low or zero carbon forms of renewable energy generation in order to increase the sustainability of the building stock across North Somerset.

When considering proposals for development the council will:

1) *require designs that are energy efficient and designed to reduce their energy demands;*
2) *require the use of on-site renewable energy sources or by linking with/contributing to available local off-site renewable energy sources to meet a minimum of 10% of predicted energy use for residential development proposals involving one to nine dwellings, and 15% for 10 or more dwellings; and 10% for non-residential developments over 500m² and 15% for 1000m² and above;*
3) *require as a minimum Code for Sustainable Homes Level 3 for all new dwellings from October 2010, Level 4 from 2013, rising to Level 6 by 2016.*

North Somerset Replacement Local Plan 2007

Policy GDP/3 – Promoting good design and sustainable construction

In determining proposals, where appropriate and relevant, account will be taken of:

xi. *whether the proposal makes a positive contribution to a high level of energy saving, over and above that required by building regulations, through siting, orientation, built form, renewable energy technologies, design and materials;*

Paragraph 4.45

Policy GDP/3 seeks a high level of energy saving. A written appraisal of how sustainable construction principles will be incorporated into the development will therefore be required. The Council expects that … all new dwellings, will generate a minimum of 15% of predicted energy requirements through on-site renewable energy generation systems.

2.2. These policy documents are additionally supported by the 'Creating Sustainable Buildings and Places' SPD adopted in March 2015, which reinforces the renewable energy requirements contained within CS2 and GDP/3. It additionally confirms that following the Housing Standards Review and accompanying ministerial statement[1], clause 3 of Policy CS2 requiring Code Level 4 is now out of date and will no longer be enforced. The SPD states:

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[1] DCLG Written Statement to Parliament, 25th March 2015

Creating Sustainable Building and Places in North Somerset SPD – March 2015

3.10 The council accepts that part of clause 3) that applies to Code for Sustainable Homes… of policy CS2 has become out of date upon release of this government planning statement and cannot be implemented in their adopted form.

3.11 In moving towards zero carbon development, applicants will be required to adhere to standards set out in national policy. With the introduction of national zero carbon homes standards (from 2016), where zero carbon standards cannot be met by on-site measures; applicants will need to invest in allowable solutions. It is for the applicant to decide the method of allowable solution, but this must be agreed with us in advance of the development commencing.

National Policy – Zero Carbon

2.3. The SPD additionally references 'national zero carbon policy'. 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. This obligation was enshrined in the Climate Change Act 2008, which commits the UK to achieving a mandatory 80% reduction in the UK's CO_2 emissions by 2050, compared with 1990 levels.

2.4. The built environment therefore has a key role to play in delivering on these international commitments, accounting for approximately a third of overall CO_2 emissions. The translation of these commitments into national policies within the built environment has been driven by, amongst other mechanisms, the EU Energy Performance of Buildings Directive[2] and the 2012 Energy Efficiency Directive.

2.5. Following the introduction of the 2013 edition of Building Regulations Part L, the successive updates now require regulated CO_2 emissions levels from new build domestic buildings to be approximately 30% lower than 2006 levels.

2.6. Current government policy subsequent to the conclusion of the Housing Standards Review is that this progression in energy standards is appropriate in delivering dwellings with significantly lower energy demands and consequent CO_2 emissions than the existing housing stock.

2.7. A policy announcement as part of the July 2015 productivity plan "Fixing the Foundations"[3] therefore advised that the Government was not intending to proceed with zero carbon policy at this time, commenting that *"energy efficiency standards introduced through the 2013 amendment to Approved Document L1A 'need time to become established and will therefore persist until further notice".*

2.8. 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.

Proposed Strategy

2.9. It is proposed that the development is designed to incorporate all applicable guidance contained within CS2 and GDP/3 relating to renewable energy provision and the construction of highly efficient buildings which seek to minimise energy demand and CO_2 emissions.

2.10. The following sections of this document set out the specific measures to be incorporated and an assessment of appropriate technologies and methods in meeting the requirements of the relevant policies.

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[2] 2010/31/EU – Energy Performance of Buildings Directive (Recast)

[3] HM Treasury, July 2015 - Fixing the Foundations: Creating a more prosperous nation

3. Baseline Energy Demand and CO_2 Emissions

3.1. The development is to be designed and constructed to meet the requirements of Part L1A of the Building Regulations 2013, therefore compliance with this standard forms the first stage in the sustainable construction approach.

3.2. Part L compliance is assessed through the Standard Assessment Procedure (SAP), which uses the 'Target Emission Rate' (TER) – expressed in kilograms CO_2 per metre squared of total useful floor area, per annum – as the benchmark. The calculated performance of the dwelling as designed - the Dwelling Emission Rate (DER) – is required to be lower than this benchmark level.

3.3. The energy demand of the Part L compliant development is also calculated as part of this process, and takes into account all regulated energy demand, in line with North Somerset guidance on the requirements for Energy Statements.

3.4. At this stage dwelling designs have not been undertaken, and therefore in order to develop the proposed strategy, indicative calculations have been undertaken to a range of dwelling types covering a range of potential housetypes in order to build a representative site model to establish the renewable energy provision required to meet the planning policy.

3.5. The Part L compliant calculated baseline carbon emissions and primary energy demand for each dwelling type are reported in Table 1.

Table 1. Part L compliant energy demand & CO_2 emissions

House Type	Primary Energy Demand (kWh/yr)	CO_2 emissions ($kgCO_2$/yr)
Sample HT 1	16721	2940
Sample HT 2	15116	2657
Sample HT 3	12908	2268
Sample HT 4	7959	1397
Sample HT 5	11690	2054
Sample HT 6	12890	2265
Sample HT 7	9804	1723
Sample HT 8	11494	2019

4. Energy & CO_2 Reduction Strategy – Fabric First

Overview

4.1. The proposed construction specification and sustainable design principles to be applied to the development will ensure that each dwelling meets the CO_2 reductions mandated by Part L1A of the Building Regulations through fabric measures alone.

4.2. It is proposed that the CO_2 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 2. The Energy Hierarchy

Be Lean – reduce energy demand

4.3. 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 overshading 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

4.4. 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

4.5. 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

4.6. 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.

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

4.8. 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

4.9. In addition to the CO_2 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/m^2/year.

4.10. This standard enables the decoupling of energy use from CO_2 emissions and serves as an acknowledgement of the importance of reducing demand, rather than simply offsetting CO_2 emissions through low carbon or renewable energy technologies.

4.11. 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. The proposed approach and indicative construction specifications are set out in the following sections of this Strategy.

Improved fabric specification

4.12. In order to ensure that the energy demand of the development is reduced, the dwellings should be designed to minimise heat loss through the fabric wherever possible. Table 3 details an indicative 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 potential improvements.

Table 3. Indicative construction specification – main elements

	Part L1a Limiting Fabric Parameters	Indicative Specification
External wall – u-value	0.30 W/m^{2}K	0.25 W/m^{2}K
Party wall – u-value	0.20 W/m^{2}K	0.0 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	1.4 W/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	5.0 m^3/h.m^2 at 50 Pa
Thermal Bridging	Y = 0.150 (default)	Y = 0.050 (calculated)

Thermal bridging

4.13. 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 CO_2 reduction targets.

4.14. The specification should seek 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 0.050, against a SAP default figure of 0.150.

Air leakage

4.15. 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 5.0 $m^3/h.m^2$ at 50Pa, with pressure testing of all dwellings to be undertaken on completion to confirm that the design figure has been met.

Passive design measures and overheating risk mitigation

4.16. Glazing should 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.

4.17. Where feasible, dwellings should 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.

4.18. 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.

4.19. 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.

As-designed performance

Fabric Energy Efficiency

4.20. By following the strategy described, the dwellings will build in a reduction in energy demand. In addition to an overall level of CO_2 emissions, the Building Regulations set a minimum level of efficiency for the dwelling fabric, expressed in terms of energy requirements for heating and cooling per unit of floor area. The assessed target fabric energy efficiency (TFEE) for compliance and the designed fabric energy efficiency (DFEE) after demand reduction measures are shown in Table 4.

Table 4. Fabric Energy Efficiency of indicative dwellings

House Type	Target FEE (kWh/yr)	Design FEE (kWh/yr)	% Reduction
Sample HT 1	56.22	46.48	17.33
Sample HT 2	57.39	47.96	16.43
Sample HT 3	55.61	47.89	13.88
Sample HT 4	52.80	46.01	12.86
Sample HT 5	62.97	51.29	18.54
Sample HT 6	58.85	49.28	16.26
Sample HT 7	62.15	54.63	12.10
Sample HT 8	58.00	48.67	16.08

4.21. As demonstrated, through following the demand reduction approach proposed, the fabric energy efficiency of the dwellings will be improved by an average of approximately 12-17% compared with a Part L compliant specification.

4.22. This approach builds in energy demand reductions and carbon savings before low carbon or renewable energy systems are considered to offset residual demand, as shown in Table 5.

Table 5. Energy demand – after efficiency measures

Energy demand after efficiency measures	
Total primary energy demand - kWh / year	905,907

4.23. The strategy to demonstrate compliance with CS2 requires 15% of the energy demand to be met through low carbon or renewable energy sources, therefore the appropriate technologies should be capable of offsetting 135,886kWh of primary energy demand in order to demonstrate compliance. An analysis of potentially appropriate technologies is undertaken in the following section of this Strategy.

4.24. Table 6 demonstrates the improvement on Part L CO_2 emissions standards achieved through energy efficiency measures to the sample dwelling types.

Table 6. CO_2 emissions – after efficiency measures

House Type	Part L compliant (kgCO_2/yr)	As designed (kgCO_2/yr)	% Reduction
Sample HT 1	3304	3231	2.22
Sample HT 2	2961	2918	1.45
Sample HT 3	2331	2268	2.68
Sample HT 4	1497	1397	6.69
Sample HT 5	2330	2255	3.25
Sample HT 6	2504	2484	0.80
Sample HT 7	1783	1723	3.38
Sample HT 8	2243	2215	1.26

5. Low Carbon and Renewable Energy Systems

5.1. A range of technologies have been assessed for potential incorporation into the scheme in accordance with Regulation 25A of the Building Regulations and with the intent of meeting 15% of the primary energy demand of the development, in accordance with policy CS2.

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 5.3m/s4. Wind turbines at this site are therefore unlikely to generate sufficient quantities of electrical energy to be cost effective[5]. 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

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[4] NOABL Wind Map (http://www.rensmart.com/Weather/BERR)

[5] CIBSE TM38:2006. Renewable energy sources for buildings.

Table 7. Individual Biomass Heating feasibility appraisal

Potential Advantages	Risks & Disadvantages
• Potential to significantly reduce CO_2 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

Potential Advantages	Risks & 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

<table>
<tr><th>Potential Advantages</th><th>Risks & Disadvantages</th></tr>
<tr><td>• 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
• 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
• Occupiers could benefit from Feed in Tariff payments
• Service and maintenance requirement minimal, and 2-3 storey buildings should not require significant additional safety measures (mansafe systems etc) for roof access.</td><td>• 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</td></tr>
<tr><th colspan="2">Estimated costs and benefits</th></tr>
<tr><td colspan="2">• Cost £1,500 upwards (1kWp+) and scalable
• Ongoing offset of electricity fuel costs, minimal maintenance requirements</td></tr>
<tr><th colspan="2">Conclusions</th></tr>
<tr><td colspan="2">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.</td></tr>
</table>

Table 10. Air Source Heat Pump systems feasibility appraisal

<table>
<tr><th>Potential Advantages</th><th>Risks & Disadvantages</th></tr>
<tr><td>• 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</td><td>• Air source heat pumps are powered by electricity. The current carbon factor of electricity as stated in SAP2012 is 0.519 $kgCO_2/kWh$, higher than other potential fuel sources in the short term.
• 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</td></tr>
<tr><th colspan="2">Estimated costs and benefits</th></tr>
<tr><td colspan="2">• Cost £5,000 - £7,000 for standard installation
• Not eligible for RHI payments as new-build properties</td></tr>
<tr><th colspan="2">Conclusions</th></tr>
<tr><td colspan="2">Air source heat pumps are technically feasible for the buildings in this scheme. However, the potential increase in CO_2 emissions associated with their use in comparison to a gas baseline means that they are not considered a preferred low carbon technology at this stage.</td></tr>
</table>

Table 11. Ground Source Heat Pump systems feasibility appraisal

<table>
<tr><th>Potential Advantages</th><th>Risks & Disadvantages</th></tr>
<tr><td>- 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</td><td>- 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. The current carbon factor of electricity as stated in SAP2012 is 0.519 kgCO_2/kWh and compared to a gas heated building this can lead to an overall increase in building emissions.
- 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</td></tr>
<tr><th colspan="2">Estimated costs and benefits</th></tr>
<tr><td colspan="2">- 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, circa 3.0 equates to 66% reduction vs electricity or around 5-6p/kWh (higher than mains gas)
- Additional costs to upgrade electricity infrastructure currently unknown</td></tr>
<tr><th colspan="2">Conclusions</th></tr>
<tr><td colspan="2">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.</td></tr>
</table>

Proposed renewable energy systems

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. In addition, solar PV systems have a higher CO_2 reduction potential, due to the offset of highly carbon intensive grid-sourced electricity.

Proposed system capacity

5.12. PV systems are most effective when orientated as close as possible to due south, and in the location of the development, at approximately 40 degrees from horizontal.

5.13. In order to offset the required 15% of primary energy demand, it has been calculated that a total system size of approximately 49kWp should be installed across the development, capable of offsetting 44,263kWh of primary energy demand.

5.14. The total primary energy offset achieved from these systems is shown in Table 12.

Table 12. Energy demand & CO_2 emissions – after renewables

	kWh / year
Total primary energy demand - kWh / year	905,907
Primary energy demand offset through solar PV	135,886
Percentage reduction in demand	15.00%

6. Overall Energy Savings Achieved

6.1. Through a combination of the described fabric first approach to sustainable construction and the installation of solar PV panels, the development will deliver energy demand reductions and CO_2 savings in line with policy CS2, and GDP/3, as shown in Table 13.

Table 13. Total site-wide energy savings

	Primary Energy Demand	
Part L compliant	924841	
After fabric measures	905,907	
After renewable energy	770,021	
	kWh/year	%
Total savings	154,820	**16.74**

7. Conclusions

7.1. This Energy and Sustainability Statement has been prepared on behalf of Mead Realisations Ltd in support of the outline planning application for the development of the Land at Lynchmead Farm.

7.2. The development site is located on the north-eastern edge of Weston-super-Mare, adjacent to the settlement boundary, approximately 1.5 miles to the west of the M5 motorway.

7.3. This statement addresses policy CS2 of the North Somerset Core Strategy 2012, and Policy GDP/3 of the North Somerset Replacement Local Plan 2007 in relation to renewable energy provision and the construction of highly efficient buildings which seek to minimise energy demand and CO_2 emissions.

7.4. A fabric first approach to sustainable construction is proposed, incorporating improvements in insulation specification, a reduction in thermal bridging and unwanted air leakage paths and further passive design measures to ensure that energy demand and consequent CO_2 emissions are minimised through the dwelling fabric as a first priority.

7.5. A range of potential technologies have been assessed for feasibility in meeting the energy requirements of policy CS2, concluding that solar PV constitutes the preferred technology for this site. Calculations establish that an installed capacity of 49kWp would be capable of offsetting approximately 135,886kWh of primary energy demand, equivalent to 15.00% of the residual demand of the development.

7.6. Through following the approach described, total primary energy savings equate to 16.74% compared with a Building Regulations Part L1A 2013 compliant development.