FES GROUP

Energy Statement

Energy and Carbon Reduction

Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell

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Contents

Company Profile

Established in 2007 as a family business, we set out to create a sustainable, resilient business, establishing a happy and positive working environment for both clients and colleagues. It was important for us to offer adaptable and growing solutions for the areas of the construction industry that would benefit from them the most.

Creating an environment that was a pleasure to work in for both colleagues and clients was, and remains, incredibly important to us. Building our future on the foundations of honest relationships, flexibility and efficiency means that we value every client's success as though it were our own.

We have grown to become a trusted construction compliance partner. We continue to grow, to offer packages of sustainability, environmental and acoustic services, with the long-term aim of making our clients' lives easier, so they can focus on the jobs that they enjoy.

Today, the business works with a wide spectrum of clients from household name plc firms, one-off builds and everything in between. Our client list includes many of the nation's major house builders and contractors, as well as universities and public sector organisations. The team also lends their know-how to many architectural practices, M&E consultants and planners.

Introduction

This report has been prepared by the FES Group on behalf of Persimmon Severn Valley to accompany the planning application for the proposed development known as Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell.

The development proposals will see the construction of 125 new dwellings, consisting of a mix of detached, semi detached and terraced dwellings.

This report reviews the proposed energy and carbon reduction strategy advanced by Persimmon Severn Valley within the context of local and national planning policy. The report in particular considers and evaluates the measures incorporated into the design of the development to reduce the predicted CO_2 consumption of the site equal to a 15% Carbon Reduction improvement over Part L 2013 in SAP2012.

The following documents were considered when formulating the report:

- National Planning Policy Framework 2019 – The NPPF strengthens the emphasis on sustainable development and encourages Local Authorities to adopt standards consistent with the Government's zero carbon building policy and other nationally described standards.
- Building Regulations Part L1A 2012 – Approved Document L1A 2013 Conservation of Fuel and Power in new dwellings sets minimum energy efficiency and fabric efficiency standards for all new domestic buildings.

Sustainable Design

The building fabric, the building services and the management of a building broadly determine the energy use of a building. In understanding this, design teams can take measures to advance sustainable design from the earliest stages of a development. However sustainability is not limited to issues concerning energy consumption. Material selection, the protection of local environments, addressing flood risk and the health and wellbeing of future occupants are all issues requiring consideration. Addressing all these issues in an integrated and intelligent manner will result in truly sustainable developments.

Material Selection

Significant amounts of energy and natural resources are consumed in the production, transportation and disposal of building materials. Two issues are of significant importance in the procurement of materials: the environmental impact of materials and the sourcing of materials. Persimmon Severn Valley is dedicated to taking pro-active measures to addressing these issues.

	BRE Green Guide Rating
External Wall	A+
Ground Floor	B
Intermediate Floor	C
Roof	A+
Internal Walls	A
Windows	A

Table 1- Green Guide Rating of Specification

Persimmon Severn Valley will choose materials which have a lesser environmental impact. This will be implemented during the procurement process. Suppliers will be obliged to produce Environmental Management System certificates covering the sourcing and production of materials. Timber or timber composite products will be sourced from responsible sources. Suppliers will be obliged to provide full Chain of Custody Certificates right through the supply chain; from the initial timber yard, manufacturing process, transformation and distribution. Secure certificates must be produced by valid accrediting bodies – FSC, PEFC, CSA, SFI & MTCC.

Flood Risk

The Flood and Water Management Act 2010, directs developers to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses through the use of Sustainable Urban Drainage Systems (SUDS) with the aim of protecting watercourses and reducing the risk of localised flooding and pollution.

This obligation is taken seriously:

Sustainable Drainage Systems have been incorporated on the site and have been designed to carry the whole site's surface water runoff, this is in line with the guidance published in the CIRIA SUDS Manual (2015).

Pollution during Construction

The contractor will be required, under the terms of their contract, to minimise dust, fumes, discharges and any other form of pollution on site, in line with best practice policies:

- The Control of Dust and Emissions from Construction & Demolition: Best Practice Guidance.

The sustainable management and monitoring of waste generated during the construction of a development is a major concern to local and national planners.

Due to the size and anticipated construction costs Persimmon Severn Valley will not be required by regulations to implement a Site Waste Management Plan.

Furthermore the site will be too small to allow the successful segregation of waste on site in line with Best Practice policies. However Persimmon Severn Valley will be obliged to adopt many of the principles of the waste hierarchy:

- Accurate specifications of materials and volumes.
- Recycling and re-use of waste on site.
- Arrange take back schemes with suppliers.
- Instruct a licensed waste contractor to segregate site waste for recycling.

Health and Wellbeing

In achieving ever stricter levels of energy efficiency, it is important that designers do not lose sight of the fact that they are building homes that people can live in and not just occupy. This is an integral part of sustainability, and a hugely important consideration if the population (and the market place) is to tolerate the sustainability agenda. While it is quite difficult to measure or even quantify health and wellbeing, the following measures are a sample of the efforts made by Persimmon Severn Valley to address this issue: The proposed have sufficient living /dining space. While this is obviously a marketing consideration, it does fall within this category.

The principal living rooms have sufficient glazing to allow natural light to penetrate into the rooms. Numerous studies have shown this to be beneficial to the general health and happiness of occupants. Daylighting calculations can be undertaken to demonstrate that living rooms, dining rooms, kitchen and home offices receive adequate daylighting.

- The property will benefit from a garden or private space for recreation. This will take the form of secure rear gardens to each property.
- The property has dedicated internal recycling facilities and accessible external storage in line with the local council waste and recycling collection scheme.

Water Efficiency

The average person consumes some 150 litres per day; this represents an annual increase of 1% since the 1930s. Despite the United Kingdom's wet and temperate climate, climate change will most probably result in an increase in the occurrence of drought orders and hosepipe bans. With this in mind, it is not difficult to appreciate that within the next few decades the UK (particularly the South East) will face regular water shortages.

In response to this water efficiency has gained equal billing, alongside energy efficiency. The following are the principle policy drivers.

- The new Approved Document G (2015) for the first time restricts new build dwellings to a maximum consumption of 125 litres per person per day. The Water Efficiency Calculator of New Dwellings also includes an allowance for external water use.
- The Code for Sustainable Homes was first introduced in April 2007. Included within the Code was mandatory water efficiency standards. Homes constructed to Code for Sustainable Homes Level 3 and 4 must achieve a maximum internal water consumption of 105 litres per person per day. Dwellings constructed to Code Levels 5 and 6 must achieve an internal water consumption of 80 litres per person per day.
- Part L 2013 and SAP 2012 will take account of Part G and water consumption in the calculation of the forecasted energy demand of a dwelling.

The below table details the recommended sanitary ware fittings to be adopted by Persimmon Severn Valley to meet with the requirement to achieve 125 Litres per person per day as required by Building Regulations Part G 2015.

Installation Type	Unit of Measurement	Capacity/Flow Rate	Use Factor	Fixed Use	Litres Per Person Per Day
WC (Dual Flush)	Full Flush (litres)	4	1.46	0.00	5.84
	Part Flush (litres)	2.6	2.96	0.00	7.70
Taps (excluding kitchen tap)	Flow rate (litres/minute)	6	1.58	1.58	11.06
Baths (where shower present)	Capacity to overflow (litres)	180	0.11	0.00	19.80
Showers (where bath present)	Flow rate (litres/minute)	9	4.37	0.00	39.33
Kitchen sink tap	Flow rate (litres/minute)	6	0.44	10.36	13.00
Washing Machine	Litres/kg dry load	8.17	2.1	0.00	17.16
Dishwasher	Litres/place setting	1.25	3.60	0.00	4.50
				Total	118.39

Total Internal Water Consumption	118.39
Normalisation Factor	0.91
Water Consumption with Normalisation Factor	107.73
External Use	5.00
Part G Water Consumption	112.73

Table 2 – Water Consumption

Renewable Technologies

There are a number of recognised renewable technologies which have the potential to reduce the energy consumption of a dwelling. However given the nature of the development, we judge that the following technologies are worthy of consideration;

- Solar thermal panels.
- Biomass
- Photovoltaic panels.
- Air source heat pumps.
- Combined Heat & Power
- Wind Power

Solar Thermal

Solar thermal panels use radiant solar energy to heat water for domestic consumption. The system works successfully across the UK as they can work in diffuse weather conditions.
In comparison to other technologies it is considered a reliable and proven technology.
The system works most efficiently when the panel or evacuated tube is mounted on a 10-60° pitch facing due south, though other combinations do work successfully. During late spring to early autumn months, the system can be expected to meet some 70-90% of a dwellings domestic hot water needs.

Most systems in the UK are two panel systems, typically 4 sq m in size and accompanied with a 180-250 litre cylinder with a dedicated solar storage capacity of 65-110 litres. The typical installation costs for solar thermal vary, especially when large volumes are considered. However a rough estimate is £3500 per plot.

Occupants can expect annual savings in the region of £50-85 per year, which is relatively modest. Solar thermal panels do not qualify for feed in tariffs, however it is expected that solar thermal systems will benefit from the Renewable Heat Incentive. A 20-25 year payback can be expected, dependent on usage and dwelling type.

Taking into consideration the proposed dwelling it is unlikely to offset adequate emissions needed to achieve the condition.

However, the technology could be considered alongside other bolt-on technologies.

Biomass

Biomass boilers offer an environmentally sound, heating solution. Heating is generated by burning biomass, such as wood pellets or logs. This will emit the same amount of CO2 as is absorbed while the plants were growing, therefore, the biomass is classed as carbon neutral.

Additional space would bee needed for plant and fuel storage, as a result we would not recommend this solution for consideration on this development

Photovoltaic

Photovoltaic panels convert sunlight into electricity for use within a dwelling. PV panels use cells to convert light into electricity. A PV cell usually consists of 1 or 2 layers of a semi-conducting material such as silicon. The greater the intensity of sunlight, the more electricity is generated. PV systems can come in different forms. The most aesthetically pleasing are PV tiles which resemble roof tiles. However the most popular are modules which can either sit on the roof or be integrated into it. The technology is most efficient when oriented due south. However panels orientated south of east or west are suitable. Generally panels orientated away from due south require a greater surface area to generate a set amount of energy.

It is recommended that a PV array installed on the dwelling is a cost effective solution to a CO2 & Energy reduction. As a result we recommend this technology for consideration.

Air Source Heat Pumps

Air source heat pumps extract heat from the outside air. The heat is absorbed into a fluid, which is pumped through a heat exchanger. Low grade heat is then extracted by the refrigeration system and after passing through the compressor is concentrated into a higher temperature. This energy is then used to heat water for space and hot water use within the dwelling. While heat pumps use national grid electricity, and so are not a renewable resource, they utilise a heat source which is naturally renewed in our environment and so are considered a low carbon technology.

Heat pumps have stated CoPs in the region of 2-4, though test results outside of the laboratory have produced mixed results. Typically the heat pump is located on an external wall. It is generally accepted that 1kW in heat pump size will provide enough heating for 20m2 of floor space.

While the use of heat pumps reduces the energy consumption of a dwelling (when gas is considered the baseline), the carbon benefit is currently not correctly represented within the SAP software methodology, Which does not take into account the decarbonised grid over the last 5 years. This is set to be updated with the upcoming SAP10 methodology and as a result we would recommend ASHP's for consideration in the lifetime reduction of the dwelling.

ASHP's are also been considered as the primary space and hot water heating source for the Future Homes Standard 2025 and the SAP11 methodology.

Combined Heat and Power (CHP)

Combined heat and power utilises the waste energy in the generation of electricity to provide space heating and hot water to a development. In conventional means of power generation copious amounts of energy is wasted in the form of heat. The utilisation of this waste heat can see efficiencies of CHP systems typically exceed 90%.

Combined heat and power is not a renewable technology but instead is a DECC recognised low carbon technology which qualified for the Low Carbon Building Programme. To qualify as a renewable technology the use of biomass pellet or bio-diesel would be required. At the present time biomass CHP is very much in its infancy in the UK. Furthermore it is imagined there will be significant problems in locating a sustainable and local source of pellet. Without such a source the reliability of such a system and the net carbon benefit of pellet sourced from a distance are questionable.

Additional space would be needed for such a system with it's implementation to less then 150 dwelling would be seen as unfeasible.

Wind Power

The principle of harnessing wind power is well established in the UK with access to over 40% of the total European wind resource. Until recently, developments have been concentrated within coastal regions; however technological advances mean that wind power is viable in many urban locations.

Wind turbines are a means of capturing the power within a moving air mass (wind) and converting it into electricity. As yet there is no simple and practical method of incorporating wind generated electricity to sites containing a number of buildings, or requiring high energy usage.

Furthermore, the urban location also means that it would prove difficult to harness sufficient wind energy to meet the needs of the development. The high density of urban areas obstructs air patterns and reduces the efficiency of the turbine. The size of the turbine required is also likely to detract unacceptably from the local area and generate a significant amount of noise, both of which prejudice local residential amenity.

For these reasons, together with the high installation costs, potential noise pollution and high likelihood of not achieving planning approval we are not proposing to employ wind turbines on this site.

Energy Strategy

The Context

The proposed works fall under the scope of Approved Document L1A 2013. The Approved Document sets minimum fabric energy efficiency standards and a maximum CO2 emission rate for residential buildings. To place the proposed energy strategy into its correct regulatory context it is worthwhile summarising the minimum standards included in the Approved Document.

Element	Part L1A 2013 Minimum Standard
External Walls	0.30W/m2K
Roof	0.20W/m2K
Floor	0.25W/m2K
Glazing & Doors	2.00W/m2K
Air Test	10m3/h.m2 at 50Pa

Table 3 – Minimum Fabric Efficiency Standards

Proposed Strategy

The National Planning Policy Framework requires that all development proposals are in line with the Government's zero carbon buildings programme.

At the present time the Government's best practice benchmark is Part L 2013 which Is equivalent to Code for Sustainable Homes Level 3, 2014 Addendum.

The figures and calculations detailed in this report have been taken from SAP 2012 (2013 building regulations).

In response to this guidance, and recent shifts within the industry, Persimmon Severn Valley proposes the adoption of a fabric first energy strategy which addresses the core policy goals of sustainable construction:-

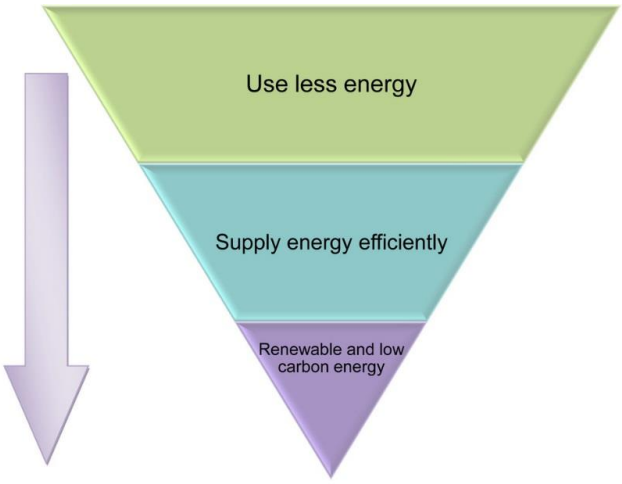
- Reduced CO2 emissions to combat the causes of climate change.
- Reduced energy consumption to address legitimate concerns of energy security.

By reducing the energy requirement of the building, the sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on fabric performance and the provision of efficient heating systems each dwelling is intrinsically "green".

Before the potential of various technologies can be assessed, it is first necessary to calculate the base line energy consumption of the development and hence the target reduction.

The proposed dwellings were modelled in SAP2012 to determine the energy consumption and corresponding CO2 emissions of the development. Standard Assessment Procedure, or SAP, is the Government's approved methodology for the calculation of energy consumption and CO2 emissions for new build dwellings.

In line with best practice the proposed energy strategy for Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell will adhere to the principles of the Energy Hierarchy;



- Be Lean – reduce the need for energy.
- Be Clean – supply and use energy in the most efficient manner.
- Be Green – supply energy from renewable sources.

Adhering to the principles of the Energy Hierarchy has a number of benefits. The principle benefits are;

- By reducing the energy requirement of each dwelling the renewable requirement shrinks in proportion. This has obvious cost benefits.
- The sustainable credentials of each development are enhanced and are not validated by simply bolting on expensive renewable equipment. By focusing on the fabric performance and the provision of efficient heating systems each dwelling is intrinsically "green".

Establishing a Baseline

To adequately ascertain the potential of Persimmon Severn Valley preferred strategy, a baseline carbon consumption associated with the development must be calculated. As such the development was modelled in SAP 2012 to determine the current CO^2 emission and associated energy requirement prior to the incorporation of improved fabric efficiencies and renewable technologies. The table below summarises the results calculated from the TER where electric is the main heating fuel.

House Type	No	Baseline Energy Rate (kWh/year)	Baseline Emission Rate (kg/year)
2 Bed - End - HA	14	88,906.58	21,230.17
2 Bed - Mid - HA	5	29,227.10	7,035.99
3 Bed - End - HA	12	82,523.16	19,674.23
3 Bed - Mid - HA	4	25,467.00	6,115.51
4 Bed - End - HA	2	13,812.96	3,260.06
4 Bed - Det - HA	1	4,667.65	1,031.06
2 Bed - End	10	50,024.30	11,849.73
3 Bed - Mid	4	25,026.04	5,991.58
3 Bed - End	30	208,704.90	49,480.34
3 Bed - Det	22	177,825.78	41,729.29
4 Bed - End	4	29,465.68	6,914.97
4 Bed - Det	8	71,525.84	16,773.18
5 Bed - Det	4	47,919.08	11,131.22
TOTAL	120	855,096.07	202,217.32

Table 4 – Baseline Energy Consumption & CO^2 Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell has a site wide associated CO^2 emission rate of 202,217.32 kg/year and a site wide energy requirement of 855,096.07 kWh/year.

Fabric and Building Services Specification

Persimmon Severn Valley proposes a series of fabric and building service enhancements that exceeds the minimum requirements of Part L1A 2013. By placing a significant emphasis on the performance of the fabric of each property, reductions in energy and carbon will be achieved. The following table details the anticipated fabric efficiency and building services standards to be incorporated into the design. These measures constitute the lean efforts.

Element	Part L 2013	Enhanced Specification
Wall	0.30W/m^{2}K	0.25 W/m^{2}K
Roof	0.20W/m^{2}K	0.11 W/m^{2}K
Floor	0.25W/m^{2}K	0.15 W/m^{2}K
Glazing & Doors	2.00W/m^{2}K	1.35 W/m^{2}K
Air Test	10m3/h.m^2 at 50Pa	5.00m3/h.m^2 at 50Pa

Table 5 – Enhanced Specification Summary & Comparison

The U values above show that the minimum requirements of Part L1A have been exceeded.

In addition to the summary above the following additional measures will be incorporated into the design, constituting the **clean** measures to reduce energy consumption;

- Persimmon Severn Valley has calculated a set of Bespoke thermal bridging details. These reduce thermal bridging throughout junctions and penetrations through the building fabric by approximately 60% over the governments SAP Appendix K ACD Scheme.
- Efficient independent Gas heating systems will be provided with a programmer, and duel zone controls. These will allow the eventual occupants to exercise control over their heating system and thus reduce energy consumption.
- Persimmon Severn Valley propose the inclusion of electric vehicle charging via applicable cabling and ducting to each dwelling suitable of providing a minimum output of 7kw.
- Energy efficient lamps will be installed in each light fitting.
- Water consumption is now included in the calculation of a property's energy consumption. Thus each property will adhere to the requirements of Approved Document G It is clear that the proposed strategy places a great importance on the efficiency of a buildings thermal envelope and internal building services.
- This emphasis is to be encouraged. It recognises that it is inherently more sustainable to invest resources in reducing a property's long term energy consumption in contrast to short term generation benefits.

Proposed Solution

To show the benefits of the Persimmon Severn Valley Fabric Performance a site wide carbon reduction is indicated below. Persimmon Severn Valley have considered an Fabric First Approach to energy reduction alongside the incorporation of sustainable materials and construction techniques.

House Type	No	Enhanced Energy Rate (kWh/year)	Enhanced Emission Rate (kg/year)
2 Bed - HA	21	85,000.86	20,380.51
2 Bed - HA	22	27,332.75	6,627.35
2 Bed	30	78,663.12	18,840.30
3 Bed - HA	17	23,842.80	5,764.38
3 Bed - HA	17	13,397.88	3,168.94
2 Bed	15	4,465.04	1,002.88
2 Bed	15	49,019.00	11,635.02
3 Bed	125	23,736.24	5,714.08
4 Bed - HA	14	208,546.20	48,278.51
3 Bed - HA	34	168,788.18	39,767.38
2 Bed - HA	21	28,582.96	6,725.98
2 Bed - HA	21	70,516.00	16,549.29
5 Bed	19	47,617.40	11,124.24
TOTAL	550	829,508.43	195,578.84

Table 5 – Fabric First Energy Consumption & CO^2 Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell has a site wide associated CO^2 emission rate of 195,578.84 kg/year and a site wide energy requirement of 829,508.43 kWh/year.

The above table confirms that the Persimmon Severn Valley construction specification achieves a 2.99% reduction in energy consumption across the site and a 3.28% reduction in the site wide emissions.

This approach is encouraged as it is reconsider that it is fundamentally more sustainable to provide a improved fabric reduction over the implementation of bolt on renewable technologies.

To satisfy the requirements of achieving a 15% Carbon reduction, Persimmon Severn Valley proposes the incorporation of PV panels to a portion of the development. These panels can be designed and allocated for the most appropriate plots based on orientation and available roof space.

The technology can be justified on the following grounds:-

- PV is a proven and reliable LZC technology.
- There is sufficient roof space to accommodate the technology.

In order to comply with this Persimmon Severn Valley must offset a total of **30,332.60 Kg/year.**

A total CO_2 reduction after fabric first improvements have been applied reduces CO_2 on the site by **6,638.48 Kg/year.** This figure is 3.28% of the site wide emissions.

Persimmon Severn Valley will be required to supply a suitably sized PV array across the site capable of generating at least **23,694.12 Kg/year.** This figure is 11.72% of the site wide emissions calculated post fabric improvement.

The above figure can also be converted into kWh/year as follows.

- 23,694.12 / 0.519 =45,653.41 kWh/year.

A Proposed PV plan should be provided by a supplier to confirm that an additional PV array over and above the minimums listed previously for Part L1a 2013 compliance has been designed in accordance with the above minimum offset needed to achieve a site wide 15% reduction in emissions.

Evaluation

The FES Group was instructed Persimmon Severn Valley to review the performance of the proposed Energy Strategy for the development at Land at Farleigh Farm and 54 & 56 Farleigh Road, Backwell. The energy strategy was detailed previously but can be best summarised as follows;

- Persimmon Severn Valley proposes an energy strategy, which addresses the two policy concerns of sustainable design and construction: climate change and energy security.
- Persimmon Severn Valley has proposed a fabric first strategy, which aims to achieve long term reductions in CO2 emissions and climate change.
- In order to address the planning requirements, renewable technologies have been proposed capable of producing 15% on site reduction in Carbon.
- The proposed fabric and building services specification will permanently reduce emissions by **3.28%** and the proposed energy demand by **2.99%**This is a significant betterment and demonstrates that the proposed development will have a reduced reliance on national resources (gas and electricity)
- In order to address the planning policy requirements, renewable technologies have been proposed capable of offsetting 11.72% of the site wide emission. This will be achieved through the installation of a suitably sized solar PV array capable of generating **23.694.12** kg/year or **45,653.41** kWh/year.

After detailed analysis we can conclude that the recommended energy strategy adheres to the principles and aspirations of sustainable design and construction as advanced by national and local government and the house building industry. We therefore recommend the adoption of the proposed energy strategy to show compliance with Part L1A 2013.