

Energy Strategy

Land West of Kingfisher Grove, Three Mile Cross,
Berkshire, RG7 1LZ.



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Report produced by –

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1 Blewburton Limited

Blewburton Limited (BBL) was established in April 2016 and are the follow-on company to The Blewburton Partnership (BBP) which was established in 2008 to provide energy and sustainability consultancy to clients in both the private and public sectors. Staffing has since increased and all employees have been involved in the project management, assessment and consulting on projects involving renewable and sustainable energy for over twenty years, both with BBL, BBP and in former employment.

BBL is well placed to analyse and assess the potential for low and zero carbon energy technologies to contribute towards the energy mix and the offset of carbon emissions associated with new developments. We can help to determine the most cost effective and technically appropriate means of meeting the sustainable energy requirements relating to planning conditions and policies in whichever format the Local Planning Authority requires as part of their general policy.

BBL are also licensed Elmhurst SAP, BREEAM, HQM & Code for Sustainable Homes assessors.

2 Executive Summary

2.1 Background

Blewburton Limited have been commissioned to prepare a report identifying the options to reduce emissions (based against 2021 Building Regulations standards) through the use of energy efficient design and low or zero carbon technologies (LZCs - often referred to as 'renewable energy') for a proposed development at Land West of Kingfisher Grove, Three Mile Cross, Berkshire, RG7 1LZ. The proposed development involves the construction of 49 new dwellings, ranging from 1 to 4 beds.

The site is located within Berkshire and Condition 4 of the permission requires:

- a 10% reduction in the predicted carbon emissions arising from operation of the development through the use of decentralised renewable and/or low carbon sources.

This requires that a hierarchy approach to reducing energy consumption and carbon emissions should be taken.

First, measures to reduce energy use should be taken, known as the 'lean' approach, secondly where possible the development should connect to 'clean' energy sources, primarily locally generated heat and electricity in CHP or heat only plant. Finally, the residual carbon emissions should be reduced through the use of on-site low and zero carbon (LZC) energy technologies, with all the measures employed showing a reduction on 2021 Part L of the Building Regulations.

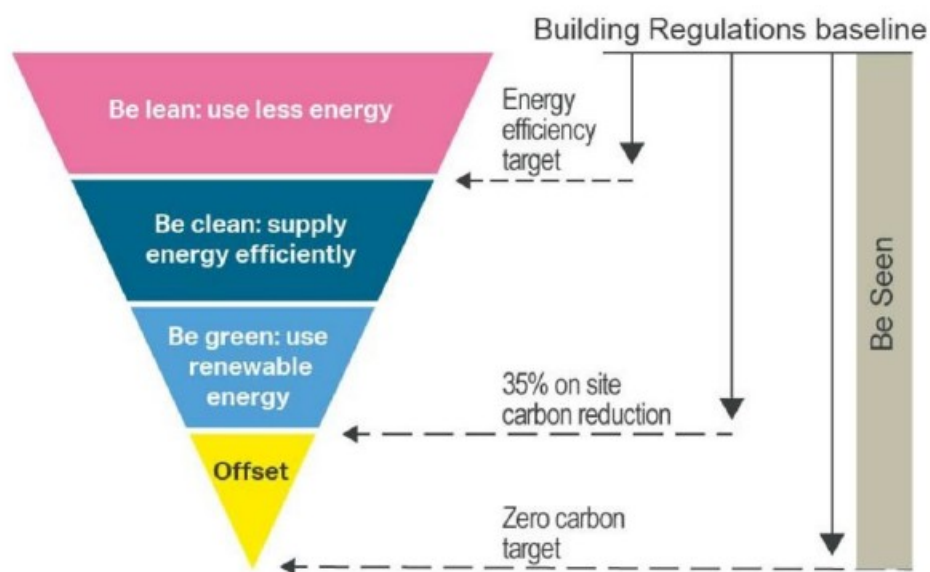


Figure 1 – Energy Hierarchy

2.2 Calculations & Conclusion

SAP calculations to analyse energy demand for the proposed development have been undertaken with Elmhurst SAP10 software and this produces carbon emission figures for regulated energy use as required.

Be Lean - The proposed approach to energy reduction is already better than good practice, in that it exceeds Part L minimum standards.

Be Clean - The site is not located near to an existing district heating system and the development is not large enough for CHP to work effectively and communal heating has been ruled out due to the size of the development and lack of space for a central plant.

Be Green - The feasibility of low and zero carbon technologies has been assessed and ASHPs and solar PV panels have been found suitable.

The CO₂ figures for the are shown in Table 1.

Site wide TER	Site wide DER	Percentage Reduction
10.89	2.49	77.18%

Table 1 – Regulated emissions and reduction

The development has been assessed using SAP methodology and Building Regulations Part L 2021. Compliance with Building Regulations can be seen through the use of energy efficiency measures, solar PV and ASHPs.

Using figures from section 12 of the SAP DER calculations the contribution from the proposed solar PV arrays will be 43.75% for the site as a whole. This demonstrates compliance with Condition 4.

3.2 Report Objectives

The aim of this document is to assess the annual carbon emissions arising from the proposed development and to present the selected options that the developer will undertake to reduce the demand through the introduction of energy efficient design, on-site LDC technologies and communal/district based low carbon heating and power generation systems.

This study will enable the design team to influence the development to optimise the opportunity of integrating energy efficient design and low and zero carbon technologies into the development. The dwelling has been modelled in Elmhurst Energy's full SAP software to determine reduction in emissions following the energy hierarchy.

The site is located within Berkshire and Condition 4 of the permission requires:

- a 10% reduction in the predicted carbon emissions arising from operation of the development through the use of decentralised renewable and/or low carbon sources.

Figures in this report are based on preliminary SAP calculations and site drawings current at the time of writing.

3.3 Methodology

This study will investigate the implementation of energy efficient design and low and zero carbon technologies on the proposed scheme.

The approach that has been taken in this study is as follows:

- **Calculate energy efficiency rating:** Calculate predicted energy efficiency rating from initial SAP calculations.
- **Energy efficient measures:** After discussion with the design team additional energy efficiency improvements may be considered.
- **Decentralised energy:** Determine if the site is near an existing or proposed district heat network. Consider the feasibility of CHP systems and future connections to district heating.
- **Low and zero carbon technologies feasibility study:** Assess technical feasibility of renewable energy technologies suitable for the site. For the feasible technologies, estimate suitable system sizes giving energy produced and CO₂ offset through their application.
- **Unregulated emissions:** calculate unregulated emissions based on SAP appendix L methodology.
- **Calculate DER:** Calculate the Dwelling or Building Emission Rate to determine if the minimum requirements are met.
- **Meeting planning requirements:** Determine the best combinations of technologies to achieve the sustainable energy requirements for the site.

4 Be Lean

The design team recognises the need to improve the fabric and overall efficiency of the buildings and supplied services as the first steps in achieving a sustainable energy solution for the proposed buildings and proposes the following.

Element	Specification
External wall	0.16 W/m ² K
Internal partitions	Timber frame
Roof	0.11 W/m ² K
Ground floor	0.11 W/m ² K
Windows	1.20 W/m ² K G-value 0.63
Front door	1.00 W/m ² K G-value 0.63
Thermal bridges	ROI Accepted Construction
Ventilation	Greenwood Unity CV2.1CTA110
Pressure	3.0 m ³ /h.m ² @50
Cooling	None
Showers	7l/min
Lighting	80lm/W.

Table 2 – Be Lean specification

The Building Regulations limiting factors are shown in Table 3. The proposed specification improves upon all of these areas.

Element	Part L1 limiting values (W/m ² .K)
Ground floor U-value	0.18
Roof U-value	0.16
External walls U-value	0.26
Glazing U-value	1.60
Doors U-value	1.60
Air permeability m ³ /(h.m ²) at 50Pa	8.00m ³ /h.m ² at 50Pa

Table 3 - Building regulations limiting fabric parameters

5 Be Clean

5.1 District heat networks

There are no local sources of supply that could be connected to the proposed development.

5.2 Communal heating and CHP

Communal energy systems are generally attractive where economies of scale can be exploited. Block scale CHP units could be considered on small schemes, but unless they can utilise the technology cost-effectively this is unlikely to offer significant efficiency gains over individual high efficiency gas boilers or heat pumps.

Measures to reduce the space heating demand through improved building envelopes will impact on the viability of a CHP system providing heat and power to the development since the heat density decreases and this will be the situation in this instance. Although advances in CHP technology are allowing smaller developments to benefit from the efficiencies of CHP, these small-scale CHP technologies are less efficient than their large-scale counterparts and would incur proportionally higher operation and maintenance costs for every Kg/CO₂ saved.

When looked at with SAP 10 carbon factors CHP is less favourable due to the lower emissions associated with grid electricity. Therefore, this development is considered too small to enable a viable local energy generating facility to be developed.

5.3 Future proofing

Wet central heating systems serving radiators are proposed for the dwellings. If a district heat network becomes available in the future it may be possible to connect to this.

6 Be Green

6.1 Feasibility

The technical viability of low and zero carbon technologies has been assessed. Preferred options have then been identified and taken forward to determine how best to meet the targets.

Table 4 shows the results of the feasibility study, which found ASHP's and solar technologies to be suitable.

Technology	Feasible	Reason
Wind turbines (stand-alone)	✗	Insufficient open area for installation of a stand-alone wind turbine
Solar photovoltaics	✓	Each dwelling has available roof space
Solar thermal	✓	Each dwelling has available roof space. Solar thermal would offer lower savings when compared to PV.
Wood-fuel heating	✗	Biomass boiler may be feasible however when compared to gas heating this would be expensive to run. Space for a large plant room and fuel store would need to be considered. There may also be issues with local air quality.
Ground source heating	✗	Ground source heat pumps may be feasible however they would be expensive to install and ground tests would be required.
Air source heating	✓	ASHPs are feasible and will be investigated further.

Table 4 – Technical feasibility of technologies

Solar PV arrays are proposed to generate electricity and ASHP's are proposed to provide heating and hot water.

6.2 Air source heat pumps

Mitsubishi Ecodan PUZ-WM50VHA (5kW) for the 1 and 2 bed dwellings and Mitsubishi Ecodan PUZ-WM85VAA (8.5kW) for the 3 and 4 bed dwellings have been modelled to provide heating and hot water.

Radiators and underfloor heating with a flow temperature of 35 degrees are proposed with zone controls. 180l hot water cylinders has been modelled for the 1 and 2 beds, 200l cylinders have been modelled for the 3 and 4 beds.

End users will be provided with information regarding the control and operation of the heating and hot water system.

6.3 PV

Solar PV arrays are proposed; each dwelling will have a 1.35kWp array with an export capable meter. The indicative locations of the solar PV arrays are showing in Figure 3.



Figure 3 – Site plan showing proposed PV arrays

6.4 Unregulated emissions

For this development it is assumed that the only unregulated energy uses within the dwellings will be:

- General small power
- Cooking

Measures to reduce unregulated energy use include:

- Provision of smart meters to allow residents to be aware of their energy usage
- Provisions of energy saving information within the Home User Guide, including white goods

It is estimated that these measures may reduce unregulated emissions by more than 10%. However, as this is dependent on occupant behaviour it is only an assumption.

6.5 Future-proofing for zero-carbon

By using electric systems for heating and hot water the dwellings will reduce their emissions in the future as the National Grid decarbonises.

7 Results

This report shows that the proposed development will comply with Part L of Building Regulations 2021 and meet the Bracknell Forest targets through a combination of energy efficient design, ASHPs and solar PV.

Condition 4 of the permission requires:

- a 10% reduction in the predicted carbon emissions arising from operation of the development through the use of decentralised renewable and/or low carbon sources.

Site wide TER	Site wide DER	Percentage Reduction
10.87	2.49	77.08%

Table 5 – Reduction in emissions

A reduction of 77% against Part L 2021 is reported for the site as a whole. This demonstrates compliance with Part L.

7.1 Renewable energy production

Site wide energy demand (kWh/yr)	Site wide electricity generated by PV (kWh/yr)	Percentage of energy demand met by PV
120,695.69	52,700.63	43.66%

Table 6 – Low and zero carbon technologies

Condition 4 requires 10% of the energy requirements to be met by on-site renewable energy production. Using figures from section 12 of the SAP DER calculations the contribution from the proposed solar PV arrays will be 43.66% for the site as a whole. This demonstrates compliance with Condition 4.

7.2 Fabric Energy Efficiency (Part L)

Building Regulations sets requirements for fabric energy efficiency (FEE) for dwellings. A site wide improvement of 10.56% has been achieved, demonstrating compliance with Part L. Whilst some individual plots may not comply independently, they do when block compliance is used. This is an acceptable method under Part L 2021.

7.3 Primary Energy Rating (Part L)

Building Regulations also sets requirements for primary energy for dwellings. An improvement of 46.97% has been achieved for the site as a whole, demonstrating compliance with Part L.

8 Annex

8.1 Data sources

Drawings used for the calculations are listed below:

- 24009-DWC-HB01-01-DR-A-0050-D-Plots 1-2, Plans and Elevations
- 24009-DWC-HB02-01-DR-A-0050-D-Plots 3-4, Plans and Elevations
- 24009-DWC-HB03-01-DR-A-0050-D-Plots 5-6, Plans and Elevations
- 24009-DWC-HB01-02-DR-A-0050-D-Plots 7-8, Plans and Elevations
- 24009-DWC-HB08-01-DR-A-0050-D-Plots 9-10, Plans and Elevations
- 24009-DWC-HB04-01-DR-A-0050-D-Plots 11-12, Plans and Elevations
- 24009-DWC-HB08-02-DR-A-0050-E-Plots 13-14, Plans and Elevations
- 24009-DWC-HB04-02-DR-A-0050-D-Plots 15-16, Plans and Elevations
- 24009-DWC-HB03-02-DR-A-0050-D-Plots 17-18, Plans and Elevations
- 24009-DWC-HB08-03-DR-A-0050-E-Plots 19-20, Plans and Elevations
- 24009-DWC-HB02-02-DR-A-0050-E-Plots 21-22, Plans and Elevations
- 24009-DWC-HB05-01-DR-A-0050-D-Plots 23-25, Plans and Elevations
- 24009-DWC-HB06-01-DR-A-0050-E-Plots 26-27, Plans and Elevations
- 24009-DWC-HB01-03-DR-A-0050-D-Plots 28-29, Plans and Elevations
- 24009-DWC-HB02-03-DR-A-0050-D-Plots 30-31, Plans and Elevations
- 24009-DWC-HB07-01-DR-A-0050-E-Plots 32-35, Plans and Elevations
- 24009-DWC-HB04-03-DR-A-0050-D-Plots 36-37, Plans and Elevations
- 24009-DWC-HB01-04-DR-A-0050-D-Plots 38-39, Plans and Elevations
- 24009-DWC-HB01-05-DR-A-0050-D-Plots 40-41, Plans and Elevations
- 24009-DWC-HB03-03-DR-A-0050-D-Plots 42-45, Plans and Elevations
- 24009-DWC-HB08-04-DR-A-0050-E-Plots 46-47, Plans and Elevations
- 24009-DWC-HB08-05-DR-A-0050-E-Plots 48-49, Plans and Elevations
- DWC-SP001-01-DR-A-0010 - Location Plan-_-Location Plan
- DWC-SP003-01-DR-A-0010-Q-Development Site Plan Sheet 1 of 2
- DWC-SP003-02-DR-A-0010-Q-Development Site Plan Sheet 2 of 2
- HB01-01 - 0500 – Sections
- HB01-02 - 0500 – Sections
- HB01-03 - 0500 – Sections
- HB01-04 - 0500 – Sections
- HB01-05 - 0500 – Sections
- HB02-01 - 0500 – Sections
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- HB08-05 - 0500 - Sections

8.2 *SAP calculations*

SAP calculations and compliance reports have been provided separately.

8.3 Site wide results

Emission rate:

Plot Reference	Total Floor Area	DER	DERxm2	TER	TERxm2	% DER < TER
Plot 01	98.28	2.83	278.13	10.91	1072.23	74.06
Plot 02	95.80	2.34	224.17	10.44	1000.15	77.59
Plot 03	116.54	2.21	257.55	9.38	1093.15	76.44
Plot 04	116.54	2.2	256.39	9.35	1089.65	76.47
Plot 05	79.90	2.62	209.34	11.67	932.43	77.55
Plot 06	79.90	2.61	208.54	11.63	929.24	77.56
Plot 07	95.80	2.35	225.13	10.48	1003.98	77.58
Plot 08	98.28	2.34	229.98	10.44	1026.04	77.59
Plot 09	79.98	3.26	260.73	12.21	976.56	73.3
Plot 10	79.90	2.61	208.54	11.63	929.24	77.56
Plot 11	95.80	2.35	225.13	10.48	1003.98	77.58
Plot 12	95.80	2.34	224.17	10.44	1000.15	77.59
Plot 13	79.98	2.62	209.55	11.65	931.77	77.51
Plot 14	79.90	2.62	209.34	11.67	932.43	77.55
Plot 15	95.80	2.34	224.17	10.44	1000.15	77.59
Plot 16	95.80	2.35	225.13	10.48	1003.98	77.58
Plot 17	79.90	2.59	206.94	11.53	921.25	77.54
Plot 18	79.90	2.58	206.14	11.49	918.05	77.55
Plot 19	79.90	2.59	206.94	11.53	921.25	77.54
Plot 20	79.98	2.62	209.55	11.65	931.77	77.51
Plot 21	116.54	2.21	257.55	9.38	1093.15	76.44
Plot 22	116.54	2.2	256.39	9.35	1089.65	76.47
Plot 23	79.90	2.85	227.72	11.65	930.84	75.54
Plot 24	50.28	1.98	99.55	13.58	682.80	85.42
Plot 25	62.45	2.71	169.24	12.44	776.88	78.22
Plot 26	98.28	2.58	253.56	10.68	1049.63	75.84
Plot 27	116.54	2.36	275.03	9.33	1087.32	74.71
Plot 28	98.28	2.23	219.16	10.29	1011.30	78.33
Plot 29	95.80	2.53	242.37	10.45	1001.11	75.79
Plot 30	116.54	2.19	255.22	9.27	1080.33	76.38
Plot 31	116.54	2.19	255.22	9.3	1083.82	76.45
Plot 32	50.28	2.16	108.60	13.72	689.84	84.26
Plot 33	62.45	3.12	194.84	13.56	846.82	76.99
Plot 34	50.28	2.2	110.62	13.86	696.88	84.13
Plot 35	62.45	3.18	198.59	13.79	861.19	76.94
Plot 36	95.80	2.31	221.30	10.29	985.78	77.55
Plot 37	95.80	2.31	221.30	10.33	989.61	77.64
Plot 38	95.80	2.31	221.30	10.29	985.78	77.55
Plot 39	98.28	2.81	276.17	10.79	1060.44	73.96
Plot 40	98.28	2.32	228.01	10.33	1015.23	77.54
Plot 41	95.80	2.31	221.30	10.33	989.61	77.64
Plot 42	79.90	2.58	206.14	11.49	918.05	77.55

Plot 43	79.90	2.45	195.76	10.45	834.96	76.56
Plot 44	79.90	2.45	195.76	10.45	834.96	76.56
Plot 45	79.90	2.59	206.94	11.53	921.25	77.54
Plot 46	79.90	2.58	206.14	11.49	918.05	77.55
Plot 47	79.98	3.26	260.73	12.21	976.56	73.3
Plot 48	79.90	2.58	206.14	11.49	918.05	77.55
Plot 49	79.98	3.26	260.73	12.21	976.56	73.3
Total	4315.95		10756.96		46923.89	77.08%
Site wide average				2.49		10.87

Energy demand:

Plot Reference	Main Heating 1 Fuel Requirement	Water Heating Fuel Requirement	Pumps and Fans Requirement	Lighting Requirement	Total demand	Electricity generated by PV	Percent reduction
Plot 01	773.54	1611.21	35.51	214.43	2634.69	-830.96	31.54%
Plot 02	682.25	1589.72	34.61	226.34	2532.92	-1111.52	43.88%
Plot 03	807.16	1652.42	42.1	256.34	2758.02	-1111.52	40.30%
Plot 04	802.24	1652.42	42.1	256.34	2753.10	-1111.52	40.37%
Plot 05	715.76	1480.51	28.87	200.8	2425.94	-1111.52	45.82%
Plot 06	710.25	1480.51	28.87	200.8	2420.43	-1111.52	45.92%
Plot 07	687.25	1589.72	34.61	226.34	2537.92	-1111.52	43.80%
Plot 08	710.91	1611.21	35.51	214.43	2572.06	-1111.52	43.22%
Plot 09	796.79	1484.41	28.89	192.88	2502.97	-830.96	33.20%
Plot 10	710.25	1480.51	28.87	200.8	2420.43	-1111.52	45.92%
Plot 11	687.25	1589.72	34.61	226.34	2537.92	-1111.52	43.80%
Plot 12	682.25	1589.72	34.61	226.34	2532.92	-1111.52	43.88%
Plot 13	719.59	1484.41	28.89	192.88	2425.77	-1111.52	45.82%
Plot 14	715.76	1480.51	28.87	200.8	2425.94	-1111.52	45.82%
Plot 15	682.25	1589.72	34.61	226.34	2532.92	-1111.52	43.88%
Plot 16	687.25	1589.72	34.61	226.34	2537.92	-1111.52	43.80%
Plot 17	696.6	1480.51	28.87	200.8	2406.78	-1111.52	46.18%
Plot 18	691.26	1480.51	28.87	200.8	2401.44	-1111.52	46.29%
Plot 19	696.6	1480.51	28.87	200.8	2406.78	-1111.52	46.18%
Plot 20	719.59	1484.41	28.89	192.88	2425.77	-1111.52	45.82%
Plot 21	807.16	1652.42	42.1	256.34	2758.02	-1111.52	40.30%
Plot 22	802.24	1652.42	42.1	256.34	2753.10	-1111.52	40.37%
Plot 23	713.75	1480.51	28.87	200.8	2423.93	-980.48	40.45%
Plot 24	322.57	1249.27	16.86	149.96	1738.66	-1165.89	67.06%
Plot 25	639.32	1355.19	21.18	190.42	2206.11	-1165.89	52.85%
Plot 26	741.89	1611.21	35.51	214.43	2603.04	-980.48	37.67%
Plot 27	799.11	1652.5	42.1	256.34	2750.05	-980.48	35.65%
Plot 28	691.24	1611.21	35.51	214.43	2552.39	-1165.89	45.68%
Plot 29	683.86	1589.72	34.61	226.34	2534.53	-980.48	38.68%
Plot 30	789.73	1652.42	42.1	256.34	2740.59	-1111.52	40.56%
Plot 31	794.57	1652.42	42.1	256.34	2745.43	-1111.52	40.49%
Plot 32	332.63	1249.27	16.86	149.96	1748.72	-1111.52	63.56%
Plot 33	750.78	1355.57	25.28	190.42	2322.05	-1111.52	47.87%
Plot 34	342.87	1249.27	16.86	149.96	1758.96	-1111.52	63.19%
Plot 35	775.95	1355.57	25.28	190.42	2347.22	-1111.52	47.35%
Plot 36	662.07	1589.72	34.61	226.34	2512.74	-1111.52	44.24%
Plot 37	666.9	1589.72	34.61	226.34	2517.57	-1111.52	44.15%

Plot 38	662.07	1589.72	34.61	226.34	2512.74	-1111.52	44.24%
Plot 39	757.2	1611.21	35.51	214.43	2618.35	-830.96	31.74%
Plot 40	696.14	1611.21	35.51	214.43	2557.29	-1111.52	43.46%
Plot 41	666.9	1589.72	34.61	226.34	2517.57	-1111.52	44.15%
Plot 42	691.26	1480.51	28.87	200.8	2401.44	-1111.52	46.29%
Plot 43	623.85	1477.51	28.87	203.02	2333.25	-1111.52	47.64%
Plot 44	623.85	1477.51	28.87	203.02	2333.25	-1111.52	47.64%
Plot 45	696.6	1480.51	28.87	200.8	2406.78	-1111.52	46.18%
Plot 46	691.26	1480.51	28.87	200.8	2401.44	-1111.52	46.29%
Plot 47	796.79	1484.41	28.89	192.88	2502.97	-830.96	33.20%
Plot 48	691.69	1480.53	28.87	200.8	2401.89	-1111.52	46.28%
Plot 49	796.79	1484.41	28.89	192.88	2502.97	-830.96	33.20%
Total					120695.69	-52700.63	43.66%

Finally, it is recommended that specialist suppliers are contacted at an early stage to confirm feasibility and price. In all cases it is recommended that suppliers accredited under the Renewable Energy Assurance scheme are used. Details can be found at <http://www.realassurance.org.uk/>.