PEAK DISTRICT NATIONAL PARK

Case Studies

Climate Change and Sustainable Building

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This and other Local Development Plan documents can be made available in large copy print, audio cassette, Braille or languages other than English. If you require the document in one of these formats please contact: Brian Taylor, Policy Planning Manager, PeakDistrict National Park at the address above, Tel: 01629 816303, or email **brian.taylor@peakdistrict.gov.uk**

Front cover: Wind Turbine at Bushey Heath Farm

Designed and produced by the Peak District National Park Authority Design & Photography Team. 01629 816305.

1 Bushey Heath Farm

Bushey Heath Farm

Bushey Heath Farm has been developed for the past decade as a business with sustainability at its heart. It operates as a farm smallholding (it covers an area of 12 acres) with a variety of accommodation types consisting of a campsite, a set of three camping barns and a meeting area. The latter two are within a single, traditional stone built barn, which was restored by the present owner using reclaimed building materials. The farmhouse and barn are Grade II listed buildings.

Figure 1.1 Bushey Heath Farm and wind turbine.

Features:

- High Levels of insulation
- Secondary double glazing
- Two wood fuelled burners
- Ground Source Heat Pump
- Rainwater harvesting & rainwater flush toilets
- Wind turbine
- Recycling facilities

1 Bushey Heath Farm

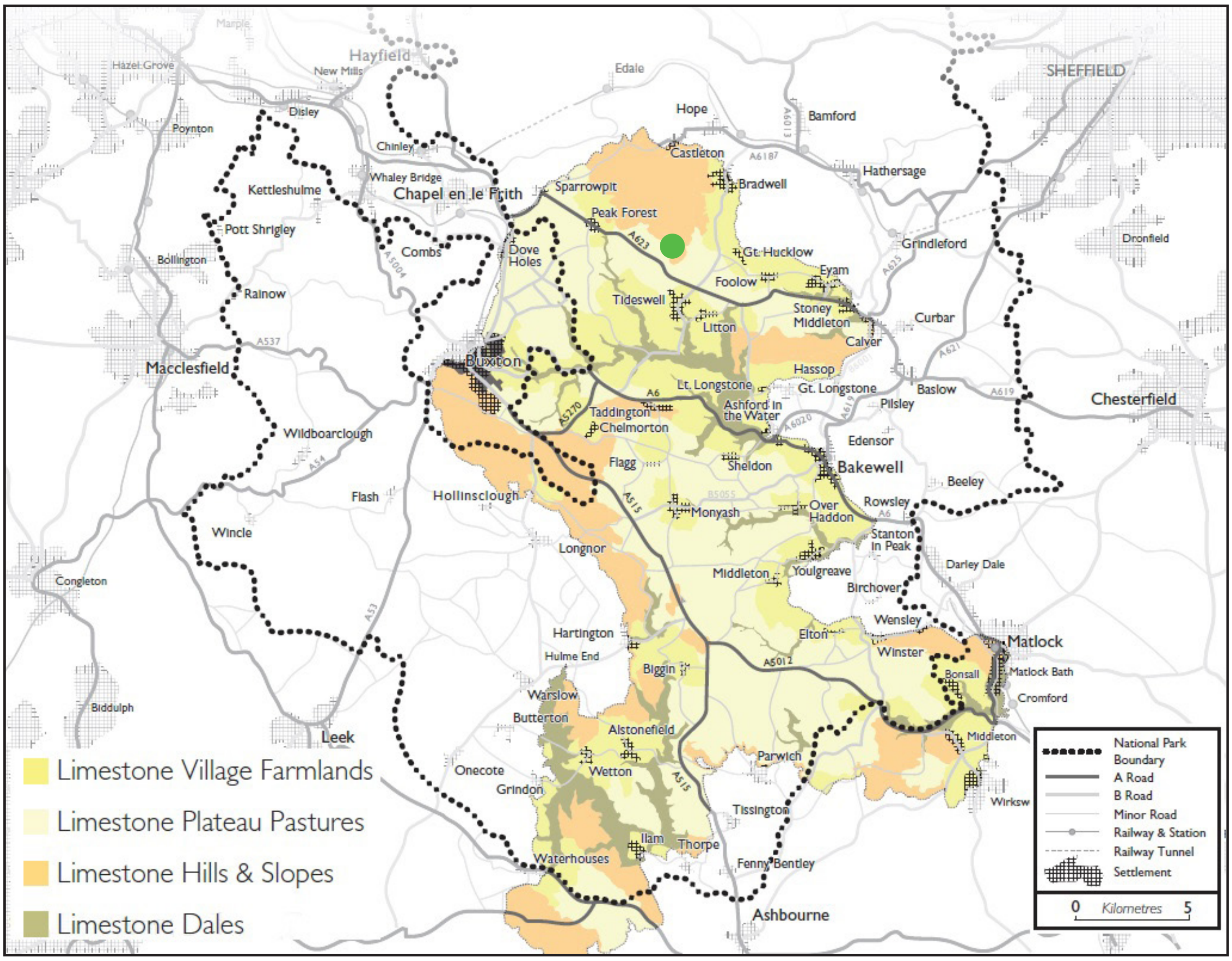

Figure 1.2 White Peak Landscape Character Types ● Bushey Heath Farm

Key characteristics of the Limestone Hills and slopes are:

- High, undulating, in places steeply sloping topography
- Frequent rock outcrops on steeper ground
- Rich wildlife habitats including large patches of limestone grassland and limestone heath on the highest ground
- A regular pattern of medium to large walled fields
- Occasional groups and belts of trees
- Prehistoric monuments, often on hilltops
- Relict lead mining remains
- Wide open views to distant skylines

Energy costs at Bushey Heath have been reduced due to the use of renewable energies and techniques on the farm. Planning permission was required for some of the work undertaken, and future applicants should always check with the Authority before proceeding with projects of their own.

1 Bushey Heath Farm

Heating

Heat for the main farm house is generated by two wood burning stoves. The wood comes from woodland on the small holding, and is therefore carbon neutral, as not only does it simply replace the carbon in the atmosphere that was absorbed as the tree grew, but there is no carbon produced through transporting it either. Whilst there are three electric storage heaters, two are only used during the coldest winter months.

Figure 1.3 Wood before and after chopping in one of the farm sheds.

Heat in the barns is generated through a Ground Source Heat Pump (GSHP). This takes the form of a set of pipes buried in the same field as the wind turbine, through which a mixture of antifreeze and water is pumped. This absorbs heat from the surrounding ground and uses it to heat water, which then provides hot water and underfloor heating for the barns.

Ground Source Heat Pump: Facts
2x 200m pipes of 40mm diameter
Buried at a depth of 1m.
Has an approximate lifespan of about 25 years.

1 Bushey Heath Farm

Figure 1.4 Part of the apparatus for the GSHP, also showing the levels of insulation used to prevent heat loss.

Insulation

In order to capitalise on the heat produced by the GSHP, during renovation high levels of insulation were used in the roof of the barn. Moreover, in the farmhouse, the roof and storm porch were also insulated, and the windows benefitted from secondary double glazing in the form of plastic sash windows, which are invisible from the outside. In addition, the original sash windows were also renovated, adding to the historic character of the property.

Rainwater harvesting

Rainwater is collected and stored on site. Tanks with a capacity of 65,000 litres from the 1960's were modified to store rainwater. This included rendering of the tanks and painting with 3 coats of tanking material. The visual impact of the tanks on the landscape is minimal. The rainwater is used to flush ten separate toilets in the barns, which cut water bills by around £350. Silt traps were made using standard fittings from a plumbing supplier.

Wind turbine

Although the farm is connected to mains electric, electricity is provided as far as possible by a 6 kW wind turbine. The turbine hub is 15m above the ground, but including the blade tip the maximum distance of the turbine from the ground is 17.2m. The average wind speed at the site is 6.4m/s, with 4.9 m/s being the minimum speed recommended for wind turbine viability. Moreover, when the wind turbine is operating, it provides the energy required to operate the GSHP, meaning that it is effectively free to operate at these times.

1 Bushey Heath Farm

The owner claims that points in favour of the wind turbines location were:

- The turbine is sited in a hollow
- The prevailing wind allows it to be sited relatively close to buildings.
- A belt of trees provides screening.
- It is not near a main road.
- Views of it from the surrounding area are very limited.
- It is of simple construction.
- Its scale is not at odds with the surrounding landscape.

The National Park Authority provided Sustainable Development funding for the project, which goes to demonstrate what can be achieved with careful siting and a sensitive approach to the landscape.

Figure 1.5 The wind turbine at Bushey Heath Farm. Also of interest, the lean to barn on the right is a source of rainwater collection. The woods in the background provide firewood for the wood burning stoves in the farmhouse.

- The conditions of planning consent for the wind turbine can be summarised as:
- Agreement with regards to the colour of the mast, turbine head and blades.
- Tree management by written consent of National Park.
- Tree planting along roadside.
- Removal of turbine and the restoration of land on discontinuance of use.

All service lines in connection with wind turbine will be underground.

Recycling

Recycling bins are provided on site for effective aste management.

Winner of Environmental Business of the Year in the Sentinel Business Awards, this organic farm is an exemplar project in reducing the environmental impact of a farming and tourism business in a protected landscape

2 Beechenhill Farm, Ilam

Beechenhill Farm

Beechenhill Farm is a working dairy farm with ancillary visitor use that lies between Ilam and Stanshope in the Limestone Plateau Pastures of the White Peak .

The farmhouse and barns are grade 2 listed buildings. They are well detailed limestone buildings under blue clay tile roofs, with a range of modern agricultural buildings to the North.

Figure 2.1 Beechenhill Farm

Features:

- Insulating lime plaster with perlite.
- Sheep wool insulation
- Internal shutters
- Low – energy lighting
- Sunpipe
- 120 kW biomass wood pellet boiler
- Mini District Main (hot water distribution system)
- One house and the barn have under-floor heating
- 8 kW Lightweight, flexible photovoltaic panels.
- Rayburn burner conversion
- Induction hob
- Electric bikes.
- Rainwater harvesting. Rainwater flush toilet
- Waste Recycling
- Electric car charging unit

2 Beechenhill Farm, Ilam

Finding practical and appropriate ways to address rural resource efficiency, economic pressures and reduce the carbon footprint of the farm and tourism business in ways that protect the National Park is fundamental to the owners of Beechenhill:

'The pristine protected landscapes of England are under ever increasing pressure. As we face the challenges of climate change, a steadily increasing population and economic difficulties, people everywhere try to find economic solutions. Some of these solutions could increase the risk to our protected landscapes. Once we have lost them, they can never come back.

Centralised energy solutions are appropriate where there are centralised populations; however, rural areas have scattered and dispersed populations which would suit decentralised renewable energy solutions'.

Sue Prince, Owner

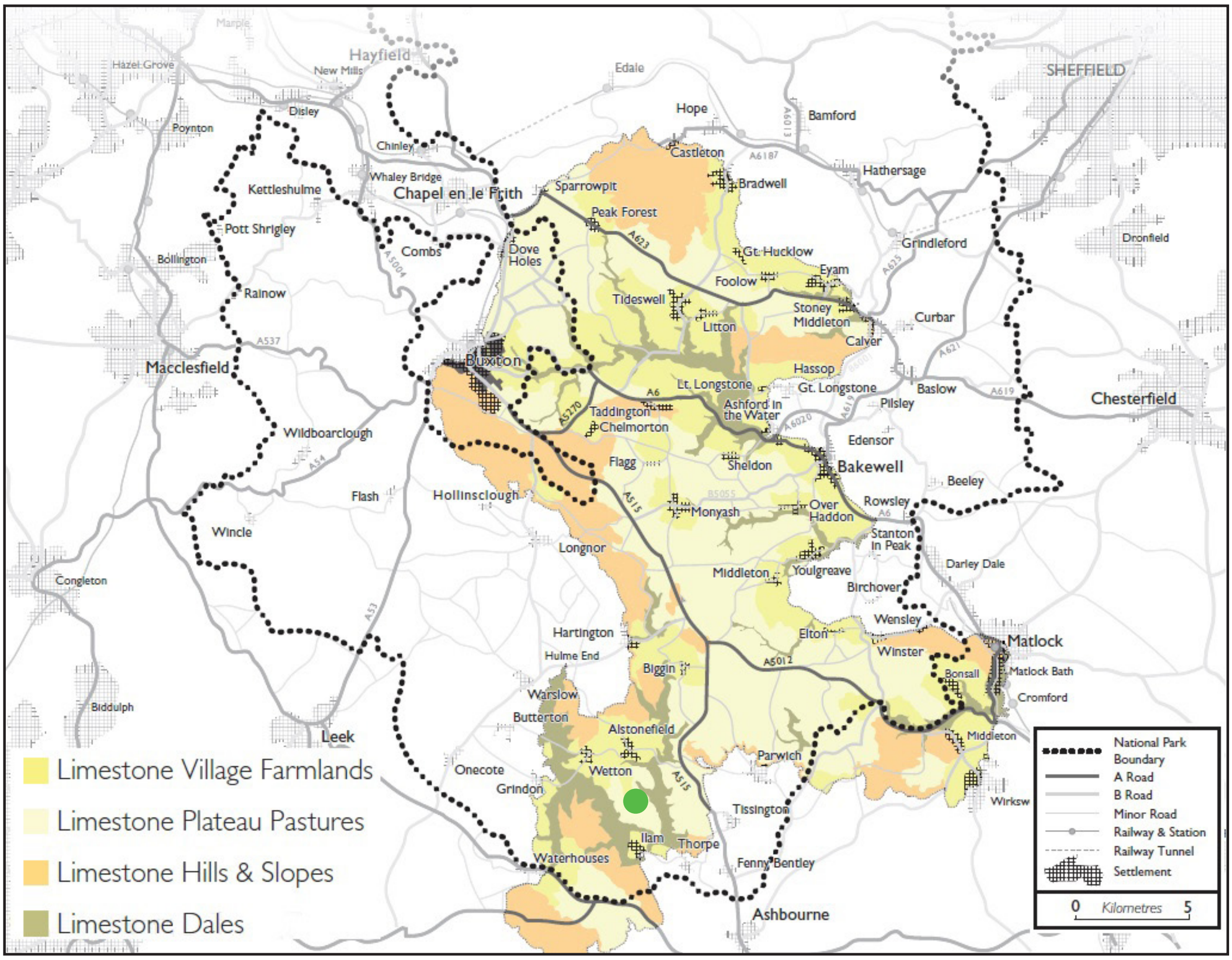

Figure 2.2 Landscape Character Types

Beechenhill Farm

2 Beechenhill Farm, Ilam

Key characteristics of the Limestone Plateau Pastures are:

- A rolling upland plateau
- pastoral Farmland enclosed by limestone walls
- a regular pattern of small to medium-size rectangular fields
- localised field dewponds and farm lime kilns
- discrete tree groups and belts of trees
- isolated stone farmsteads and field barns
- medieval granges surrounded by older fields
- relic lead mining and quarrying remains
- prehistoric monuments, often on hilltops
- open views to surrounding high ground

Beechenhill Farm had two old oil boilers, six immersion heaters and one cottage with entirely electric heating. Energy costs were rising year on year, making the business increasingly unsustainable. Over the last three years, even though the business has grown it has reduced its carbon footprint from 41 tonnes to 14.4 tonnes, and reduced its energy costs by using energy conservation methods and the installation of a range of low carbon and renewable technologies.

Insulation and draught proofing have been carried out incrementally over the years since they are the cheapest methods that have the biggest impact. Home-made internal shutters made from painted MDF were installed to all windows.

Figure 2.3 Insulated lime plaster walls conserve the internal appearance of the historic building whilst conserving energy. Home made internal shutters also conserve energy.

Sheep wool insulation from a neighbour's flock was used in the loft spaces.

Figure 2.4 Sheeps wool insulation

2 Beechenhill Farm, Ilam

Where it was important to retain original beam features, as in the Haybarn conversion, thin profile insulation was used incorporating aluminium foil. The walls were insulated with lime plaster with perlite to maintain the character of the building rather than dry lining the walls. The owners checked that the insulation values of the products used would meet building regulations requirements through discussions with the relevant district Council.

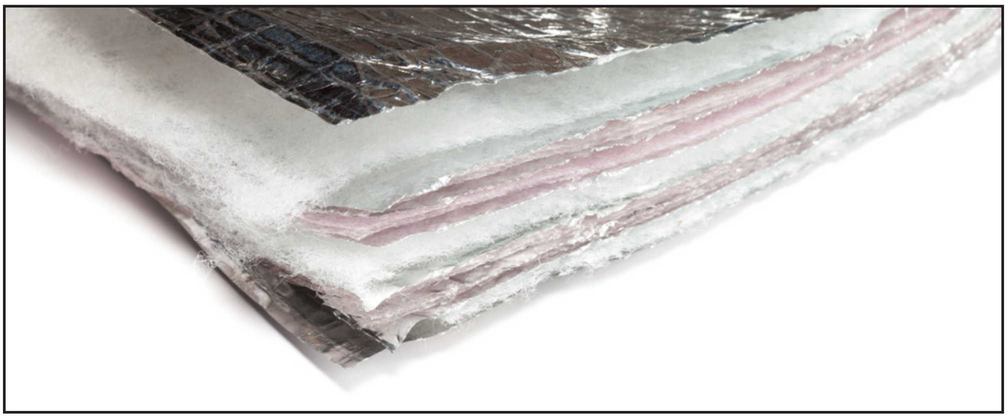

Figure 2.5 Insulation material that has been installed between beams in the converted barn to conserve the internal appearance of the building whilst reducing energy loss.

Low energy lighting is gradually being replaced by LED lighting in order to reduce the consumption of electricity. The kitchen lighting, for example, has been reduced from 540 W to 90 W due to the use of LEDs. An induction hob has also reduced the use of electricity. When appliances need to be replaced they are being replaced with energy efficient appliances, at least A rated. The replacement of the Rayburn burner with a new burner has reduced by half the oil used to feed it.

Figure 2.6 Induction hob

To avoid the need for electric lighting during the daytime, a sun pipe has been installed to allow daylight into a room without windows. The external appearance of the sun pipe is that of a skylight which fits in well with the building design.

2 Beechenhill Farm, Ilam

Figure 2.7 Sun Pipe – minimal impact on Grade II listed building

Having carried out fabric first measures to reduce carbon emissions and the cost of running the business, low carbon and renewable energy installations appropriate to the protected landscape were considered.

Research was carried out into the possibility of installing a wind turbine for the farm business. A feasibility study was carried out on wind speeds, which found that the optimum sites were in open fields and on the crest of the hill. It was considered that a wind turbine in either of these locations would be damaging to the landscape. Had there been a site within the cluster of buildings with sufficient wind speed, it would have been considered more seriously. The owners are interested to find out how efficient ridge blade technology will be when it is more readily available as it could be sympathetically integrated into farm buildings.

Having ruled out the feasibility of a wind turbine due to the landscape sensitivity of the optimum locations, research was carried out into other more appropriate renewable energy technologies. Following initial research it was decided to further investigate

- a wood burning boiler
- a mini district main (a hot water distribution system),

A 120 kW biomass boiler and mini district main has been installed in one of the farm buildings to heat the accommodation at Beechenhill. It replaces two oil boilers and four immersion heaters. The new system provides a ready supply of hot water to pipework in the holiday cottages that is used when needed to heat the accommodation. The hot water is also used in the milking parlour. Wood pellets are fed automatically by auger into the firebox of the boiler and as a backup the boiler can also be manually fed with logs. The lower embodied energy and the need for more on-site storage with woodchip led the owners to choose wood pellets instead. The woodfuel boiler comprises a wood gasification heating system with integrated suction draft plan and ceramic plates with an efficient secondary combustion chamber and heat resistant catalyst. The chimney for the boiler comprises a stainless steel core with 25 mm of mineral wool insulation and the flue is clad and powder coated to match the roofing material. The storage cylinder for the water is insulated steel and has a capacity of 2000 L.

Figure 2.8 Wood gasification heating system and water storage cylinder

The development of the biomass boiler did not require a separate building as it has been incorporated into one of the existing portal frame farm buildings. Thick concrete block walls form the enclosure and wood store with vertical hit and miss timber cladding above the block work to match the existing construction of the building.. The enclosure was provided with a one-hour fire resistant roof and waterproof coating since cattle are housed in the building in winter.

2 Beechenhill Farm, Ilam

The possibility of the installation of either solar thermal or solar photovoltaics had been ruled out due to the fact that the roofs of the portal frame farm buildings were inadequate to carry the load of the installations, however, with the introduction of flexible photovoltaic sheeting to the market, it has been possible to retrofit sheeting onto the farm buildings and to generate electricity from solar sources.

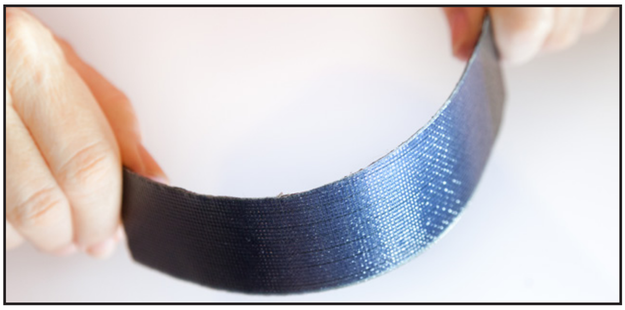

Figure 2.9 Flexible photovoltaic sheeting

The system involves bonding solar film to lightweight metal panels which means that it can be installed on fragile awkward shaped roofs. The benefit of using the sheeting is that it is lightweight and therefore there is no need to upgrade the roof, furthermore the original drill holes that are used to construct the roof can be used for its installation. Planning consent was granted in 2011 for 2 x 22 m lengths of the solar PV material, 2.8 m deep on the south facing slope of the agricultural building. The material of the sheeting is non- reflective and the film covers an entire section of the building without metal framing. Electrical output of the thin-film photovoltaics is monitored and energy savings in general are calculated by the owners.

Figure 2.10 Photovoltaic sheeting installed on portal framed building. Location of installation minimises impact on landscape surroundings

2 Beechenhill Farm, Ilam

Figure 2.11 Rainwater harvesting for toilet flushing

Rainwater harvesting systems have been introduced for toilet flushing, and for washing out the milking parlour.

A recycling area is provided for guests and guests are encouraged to buy local products whilst locally sourced products are used for the bed and breakfast business.

Figure 2.12 Recycling area

3 New Community Building – Over Haddon Village Hall

Over Haddon Village Hall

A new purpose built community facility to replace the existing village hall provided an opportunity for the parish to consider function, design and sustainability. Refurbishment of the old village hall had been considered but the fabric of the building was poor and heating was provided by 6 double bar heaters on the wall which provided less than adequate heating and for which the fuel bills were very high.

Central to the design brief of the new village hall was:

- Provision of a dual purpose hall
- To reduce the carbon footprint of the building.
- For the building to be as sustainable as possible.
- Provision of disabled toilet facilities and baby change.
- Better toilet and kitchen facilities.
- A design which reflected the design of the old hall on the footprint of the new building.
- A design in keeping with the area.
- Provision of green space to the front of the building.

The replacement village hall demonstrates the advantages of sustainable building design in terms of reduction in carbon emissions, running costs and water usage. It achieved an A rated Energy Performance Certificate and is a building of traditional design.

Features

- High levels of insulation
- Thermostats and Monitor
- Energy efficient lighting
- Energy efficient underfloor heating
- Air source heat pumps
- Solar photovoltaic panels
- Rainwater harvesting

3 New Community Building – Over Haddon Village Hall

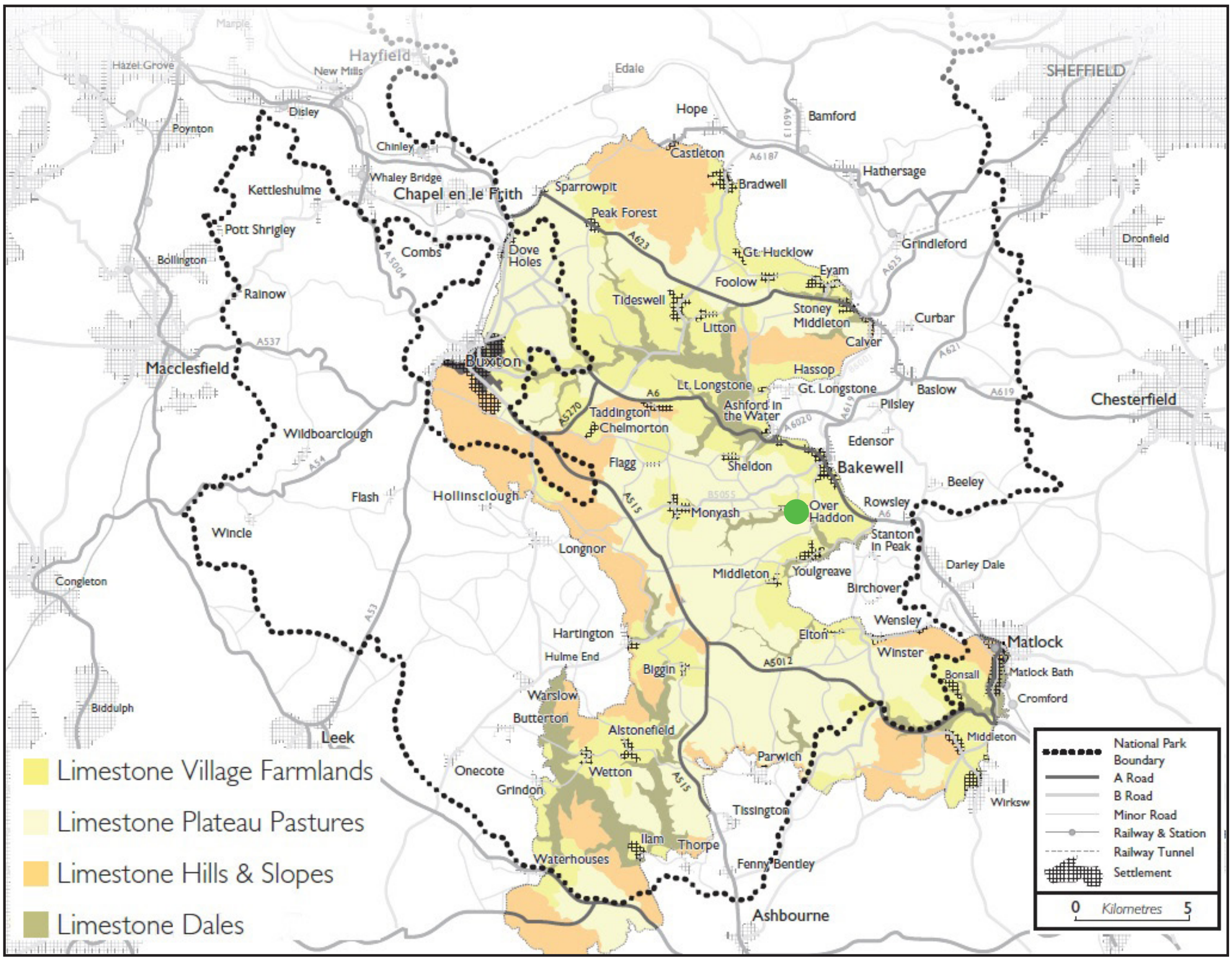

Figure 3.2 Landscape Character Types

Community Building, Over Haddon Village Hall

The village hall stands prominently in the landscape of the Limestone Village Farmlands where

the key characteristics are:

- A gently undulating plateau
- Pastoral farmland enclosed by drystone walls made from limestone
- A repeating pattern of narrow strip fields originating from medieval open fields
- Scattered boundary trees and tree groups around buildings
- Discrete limestone villages and clusters of stone dwellings
- Relict mine shafts and associated lead mining remains
- Localised field dewponds

3 New Community Building – Over Haddon Village Hall

Figure 3.3 Over Haddon Village ©PDNPA 2015

A new building with a high thermal mass was proposed to reduce carbon emmisions and to improve the ambient temperature, in order to significantly reduce running costs.   Energy efficient heating and lighting systems, renewable energy installation and rainwater harvesting were also proposed.

Figure 3.4 LED lighting

3 New Community Building – Over Haddon Village Hall

Benefits

Use of the village hall by the local community and others has increased since it was rebuilt because it now provides a light and comfortable environment.

Use of the heating system, using the air source heat pump and under floor pipe work, has been minimal because the ambient temperature of the building is high as a result of its design and insulation.

Rainwater harvested is used to flush the toilets, which saves on water bills. If there is insufficient rainwater a valve shuts off the harvesting system and water is fed from the mains.

The photovoltaic panels supply electricity to the building: any extra electricity produced is providing a useful source of income via the "Feed In" Tariff.

Figure 3.5 Solar photovoltaic panels

Right: Figure 3.6 Air Source Heat Pump[1]

Lessons learned

The replacement village hall has been grant funded both in terms of the building fabric and the low carbon and renewable energy installations. Had been a limited budget for low carbon and renewable energy installations, the Energy Performance certificate for Over Haddon Village Hall shows how much can be achieved simply through careful design and insulation.

Originally a vertical bore ground source heat pump was specified instead of the air source heat pumps but a perched water table in the vicinity of the village hall meant that this was not feasible.

1 *Figure 7 taken and modified from www.geograph.org.uk/photo/2308579*

3 New Community Building – Over Haddon Village Hall

The Energy Performance Certificate suggested that the energy performance of the building could be further improved. Recommendations in the short term, (less than 3 years) to improve the energy performance of the building included:

- Solar control measures such as the application of reflective coating or shading devices to windows.
- An optimum start / stop to the heating system.
- Replacement of T8 lamps with retrofit TS conversion kit.

Over Haddon Village Hall is a very good example of a low carbon building, which demonstrates that low carbon emissions can be achieved in a traditional style building.

The Target Emission Rate (TER) for the hall was 28.5 kg CO/ m^2 per annum, and the calculated Building Emission Rate (BER) was 11.6 kg CO / m^2 per annum, 59% less than the Target Emission Rate. The Energy Performance Certificate for the building gave an Energy Performance Asset Rating of A7.

Comments from users of the hall:

“Great example of Solar power in a ‘traditional style’ building.”

“Excellent new village hall and great that it is sustainable.”

Technical Details:

Insulation

Ground floor slab – underfloor heating pipes in 75mm screed on 75mm Eco – Therm Eco Versal in 125 mm dense concrete slab “U” value = 0.18.

Walls – 100 mm cavity filled with 100mm Dritherm cavity slab32 Ultimate “U” value = 1.27.

Roofs– 170 mm Eco Therm Eco Versal between trusses with 37.5mm Eco Therm Eco – liner under trusses. “U” value = 0.14.

Low Carbon and Renewable Energy Installations.

Mitsubishi 5 kw and 14 kw Ecodan heat pumps – Annual energy performance estimated to be 13333 kwh being the running time of the heat pump based on 2400 heating hours.

Sundog Energy Powerglaz (BP Solar Modules)

Solar photovoltaic integrated panels.

Estimated annual generation – 6502.00 kw

Monitoring and Controls

Heatmiser Touch Pad Controller – Underfloor Heating.

Heatmiser Netmonitor Programmable room thermostats.

Photovoltaic energy output / carbon reduction monitor

Rainwater Harvesting System

WPL system

Polythylene tank with lid.

Filter.

Pump and control module with water tank with AB air gap, a pressure sensor, pump with integrated 3 way valve and float switch.

4 Mill Wheel Restoration, Calver

Mill Wheel Restoration, Calver

The owners of a former water mill, in partnership with their neighbour have taken advantage of a disused penstock headrace and mill wheel pit by installing a new wheel to generate power for both homes. This helped to reduce their overall electricity usage, with the dual benefit of reducing their carbon footprint and saving on energy bills.

Other key features of the property include insulation of the main house, installation of low energy lighting, and solar panels on the roof. Furthermore, during the winter, the owners run two wood burning stoves to reduce dependency on gas central heating.

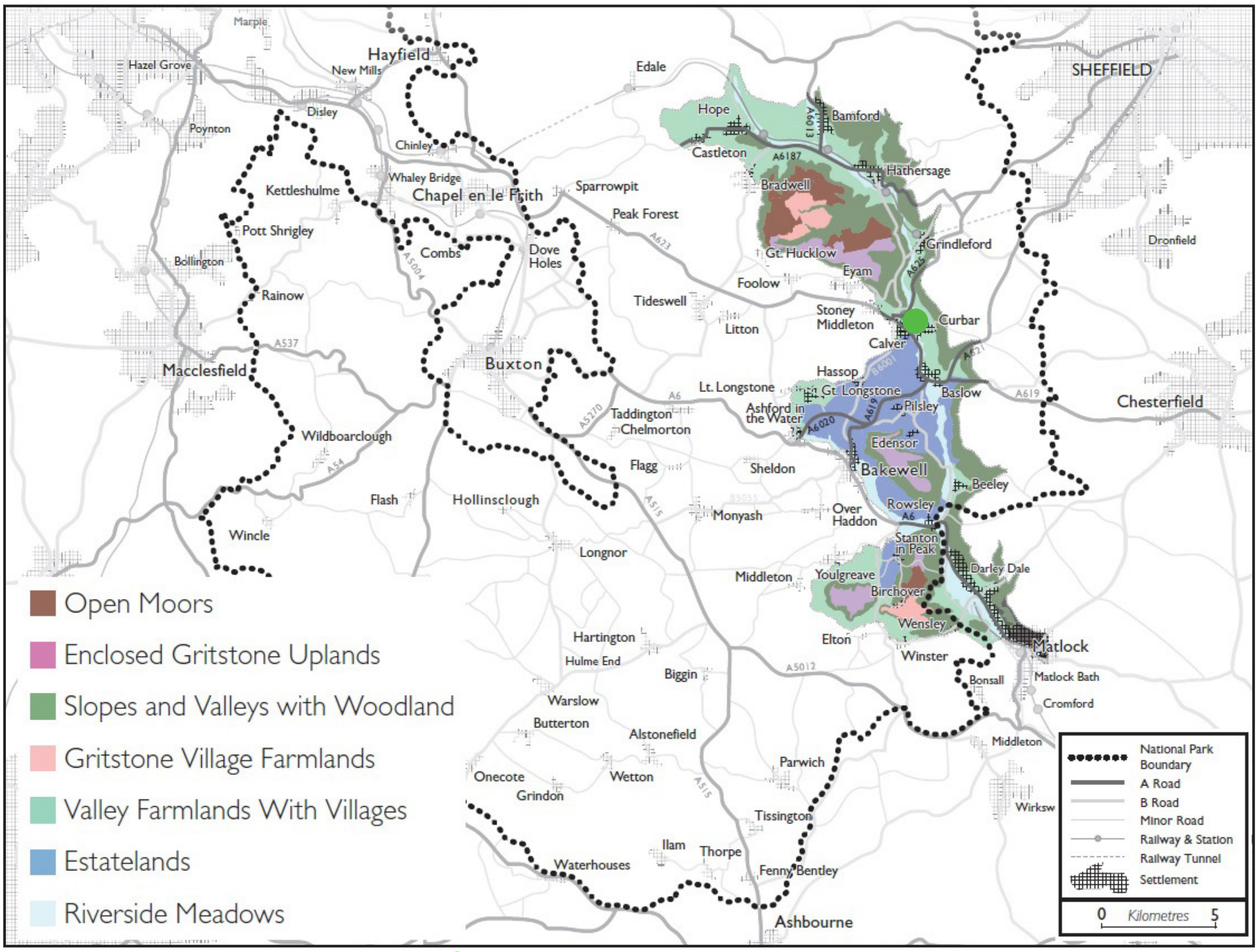

Figure 4.1 Landscape Character Types. Calver Mill

The village of Calver sits within the Derwent valley and has a landscape character of 'Valley Farmlands with Villages.' Key characteristics of this area are:

- A low lying, gently undulating topography
- Network of streams and localised damp hollows
- Pastoral farmland enclosed by hedgerows and some drystone walls
- Small to medium sized fields
- Dense streamline and scattered hedgerow trees
- Gritstone villages and outlying farms with associated dwellings and field barns

4 Mill Wheel Restoration, Calver

History

Formerly, the site was used as a smelting mill, from at least 1616. In the mid or late 19th century the building was replaced with a corn mill and mining soughs were adopted for its water supply. Work ceased there probably before 1914 and the mill was adapted for domestic use in mid 1987.

The Mill Wheel

Figure 4.2 The new wheel, with its compact generator below.

The new wheel, with its axle to drive the generator, was installed in Spring 2010. Around 12,000 kW of electricity was generated in the first year, an average of 1.37 kilowatts per hour. The amount of electricity generated fluctuates with the flow of water; around 1 kW per hour is produced in the summer and up to 4 kW per hour is produced in the winter.

Monitors in the two houses show how much electricity is being produced at any given time and how much each house is using when devices such as slow cookers or electric towel rails are connected to the green energy supply. Unfortunately providing a means of storing electricity was not feasible or cost effective due to the constraints of the site.

4 Mill Wheel Restoration, Calver

Solar Panels

Figure 4.3 Solar panels on the roof of the building.

There are 10 panels (see figure 3) which can generate up to 2.25 kWh. They were installed in February 2012 and, by August 2014, had generated 4538 kWh, which translates into a saving of 1500 kg of C02. This equates to the energy consumption of an average house for 42.12 days[1]. The panels are positioned on the west facing side of the roof, meaning that they generate more power in the afternoon. Their colouring (black) and positioning with regards to the street layout means that they are visually unobtrusive. Power generated is fed into the National Grid and the owners benefit through feed-in tariffs.

Lessons Learned and Moving Forward

The owners worked closely with the Planning Authority on this scheme from the outset. People are often surprised to find that even the alternation, refurbishment or replacement of a minor part of a hydro scheme requires planning consent and an Environmental Impact Assessment screening opinion. This is because even with minor schemes the potential for harm to amenity, to the water environment or to flora and fauna is great.

Further information on micro-hydropower potential in the Peak District National Park and surrounding areas is found in the reports Peak power: the quick guide to micro-hydro and Peak Power: developing micro hydro power in the Peak District.

Finally, the owners are considering a future project to store excess power (this is especially relevant as the mill wheel is not connected to the national grid). If an efficient and cost effective way of doing this can be found and implemented, than the householders could be self-sufficient in terms of electricity.

Finally, the owners are considering the installation of a ground or water source heat pump to provide partial under floor heating.

1 http://www.yousustain.com/footprint/howmuchco2?co2=1,500+kg

5 Brentwood Close Development

Brentwood Close Development

Nottingham Community Housing Association (NCHA) designed and built (with the support of the Homes and Community Agency) a scheme of 8 affordable rented houses. These are now managed by High Peak Borough Council.

Figure 5.1 An example of one of the houses in the Brentwood close development.

Features:

- 8 affordable, semi-detached local houses
- The properties are built of gritstone under hardrow tiled roof. Four are three bedroomed units
- Wall, floor and roof insulation
- Energy-efficient window glazing
- Energy efficient boiler to provide heating and hot water
- Energy efficient light bulbs
- Reduced water usage
- Sustainably sourced materials
- Recycling facilities
- Use of bat and bird boxes on site
- Solar panels to provide hot water

5 Brentwood Close Development

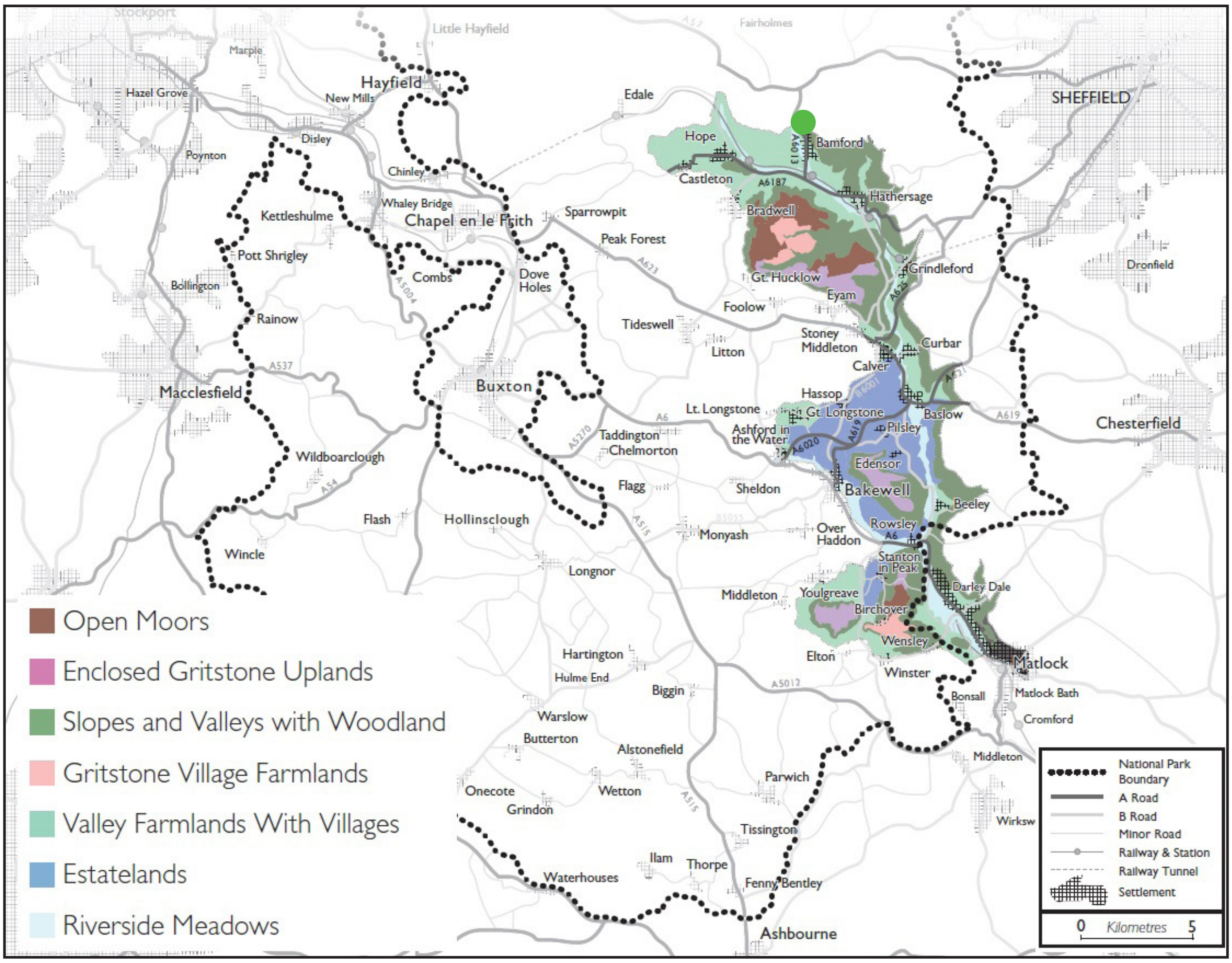

Figure 5.2 Landscape Character Types. Brentwood Close Development

Key characteristics of valley farmlands with villages are:

- A low lying, gently undulating topography
- Network of streams and localised damp hollows
- Pastoral farmland enclosed by hedgerows and some drystone walls
- Small to medium sized fields
- Dense streamline and scattered hedgerow trees
- Gritstone villages and outlying farms with associated dwellings and field barns

5 Brentwood Close Development

This scheme meets an identified local need within Bamford and adjoining parishes for affordable housing. The houses are semi-detached, two storey buildings, arranged around a cul-de-sac. They are built of gritstone under a hardrow tiled roof. Four of the houses have three bedrooms, with a floor area of $83m^2$, and the other four have two bedrooms each, with a floor area of $72m^2$.

Figure 5.3 Local gritstone walls

The houses were built in 2011 and achieved Code for Sustainable Homes (CSH) Level 3. CSH assessment covers a variety of aspects surrounding the design of the house, such as the:

- Energy efficiency
- Water usage
- Source of building materials
- Recyclability of these materials.

It was mandatory to achieve level 3 on the CSH in order to qualify for the Homes and Community Agency grant money which helped to build the homes.

Insulation

The houses were built in such a way as to keep heat in. The outer gritstone walls have two layers of insulation within them (Frametherm roll and Reflective Vapour membrane). The floor is also insulated with Thermafloor and the roof with wool insulation. Double glazed low emissivity glass windows were used, which also contribute to reduced heat loss.

Figure 5.4 Double glazed window with low emissivity glass.

Solar Panels

Solar panels on the roofs of the houses are not only environmentally friendly, but they provide a source of hot water without needing to use the boiler. The choice to use panels was that of the NCHA tenant groups and the contractor, who had used the system in the past.

Figure 5.5 Solar panels on the roofs.

5 Brentwood Close Development

Water usage

The houses were designed with reduced water usage in mind, with a goal of limiting use to 86.5 litres per person per day. Dual flush toilets were installed, with the option of either flushing using 4 or 6 litres of water. The bath is smaller than average and showers and taps have low flow rates. In the garden, water butts (with a capacity of 200 litres) were installed to limit the amount of mains water used for plant watering.

Figure 5.6 Water butt in the garden

Surface Water Run-off: restricted flow into the mains surface water system.

The houses are not at a high risk of flooding. Even so, the houses and their surroundings were designed with a sustainable drainage system so as to have a lower surface runoff during wet weather than the site had before construction. One of the ways this was achieved was through the use of soakaways.

Recycling

Recycling provision is available for at least three recyclable materials. During construction, the builder set out a SMART waste management plan to reuse, recycle and reduce waste produced.

Ecology

Whilst the site was of low ecological value, the existing trees were protected and bat and bird boxes were installed.

Other

To maximise energy, energy efficient boilers were installed in the houses. Low energy light fittings were also used.

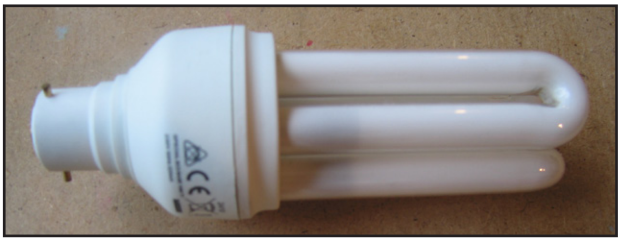

Figure 5.7 Low energy light bulb.

Lessons learned:

On subsequent schemes where gas is available to the site, it has been possible to omit the solar panels by improving the wall u-values, reducing the air leakage of the homes and in some cases adding boiler flue heat exchangers to save further energy. The Housing Association found however, that every scheme is different and early advice from a qualified Code for Sustainable Homes Assessor is essential before submitting a planning application or making any major building specification decisions.

One thing that the developers did well at was to liaise with the National Park Authority from an early stage. This ensured that the development was suitable to the area.

5 Brentwood Close Development

Technical Details:

Construction:

Note: the U value is a measure of heat loss in a building. A low U value implies high levels of insulation.

Wall U-value: 0.22W/m2K. Natural locally sourced Grit Stone external wall skin, 50mm cavity, timber frame external wall 148mm timber studs, filled with 140mm Frametherm Roll, sheathed in sterling board and Reflective Vapour membrane.

Ground floor U-value: 0.20W/m2K with beam and block flooring plus 75mm Thermafloor under a 40mm screed.

Roof U-value: 0.09W/m2K. Hardrow roof tile and timber roof trusses. 500mm mineral wool insulation at ceiling level.

UPVC windows low-e glass- u-value 0.14W/m2K

Timber external doors – U-value better than 1.6W/m2K.

Materials: sustainably sourced materials.

90% of Green guide A+ and A rated materials, All timber FSC certified and 90 % of non timber materials are EMS certified.

Pollution: reduced C02

All the insulation had a global warming potential GWP less than 5. Heating and Hot water will be provided by Valliant EcoTec boiler 91.2% efficient with NOx emission of 30.14mg/KWhr.

Management: pre & post construction

Home user guide provides non-technical information to the residents. The contractor partook of the "Considerate Contractor Scheme" with "Performance beyond compliance certificate" achieved.