VILLAGE ENERGY AUDIT
BURY VILLAGE, WEST SUSSEX
SOUTH EAST

31 August 2011

NEA Technical Team

Executive Summary

Calor Gas Ltd has provided support to NEA in 2011/12 to develop a village energy audit programme to identify opportunities to improve the energy efficiency of nominated off-gas villages across England. The village energy audit programme is a component of the Calor Future of Rural Energy in Europe (FREE) programme also supported by Calor.

It is recognised that it is often not financially viable to provide energy efficiency improvements to single households in remote rural off-gas communities. Identifying multiple properties requiring improvements in one locality via an energy audit of a village makes a multiple intervention a more viable proposition for providers.

A total of eight village audits were progressed in 8 regions of England as part of the programme. The programme employed actual energy audits of homes and a community building within individual areas identified as well as gathering profile data from other households via a freepost questionnaire. This report presents the findings of one village audit and recommendations on the potential for multiple energy efficiency interventions locally.

Key findings

Bury village energy audit concluded the following key findings:

- From a total of 270 questionnaires distributed 68 were returned, totalling a 25.1% return rate
- Of the questionnaires returned 3 households are eligible for the CERT super priority group and 33 are eligible for the CERT priority group
- 50% of the households who returned their questionnaires live in pre 1930 constructed dwellings, 39% live in post 1930 dwellings and 11% were unsure
- In total from the questionnaires returned there are 9 homes which require loft insulation, 8 which still require cavity wall insulation and 24 which still require solid wall insulation
- The questionnaires detailed that 17.6% of households surveyed suffer from cold related health issues
- 18 households would welcome a benefit entitlement check

1. Background

NEA estimates that more than 6 million households in the UK cannot afford to heat their homes to the standard required for heath and comfort. They may have to choose between the misery of living in a cold, damp home, the anxiety of getting into debt with their fuel suppliers or economising on other essentials such as food and clothing. Off-gas households are particularly affected by fuel poverty as they do not have access to mains gas which is currently the cheapest fuel for space and water heating in England and thus may be reliant on more expensive fuel types.

Fuel poverty not only affects individual households but also the broader community resulting in poor housing stock, poor health and well being and less disposable income being spent in the local economy.

Calor Gas Ltd has provided support to NEA in the year to develop a village energy audit programme to identify opportunities to improve the energy efficiency of nominated off-gas villages across England. This village energy audit programme aligns and compliments the Calor FREE programme also supported by Calor.

2. Introduction

It is widely recognised that insulation and heating installers often don't find it financially viable to travel to remote rural areas to undertake single boiler or insulation installations meaning that households are subsequently denied access to energy efficiency measures that might otherwise help to alleviate fuel poverty. NEA believes that community level assessments of rural properties are a more viable proposition allowing for a group of homes within a rural setting to be surveyed and to subsequently benefit from heating and insulation measures as a group intervention. Group interventions are likely to be a more financially attractive option for service providers and allow for multiple measures to be installed at a cost effective price.

This report details the findings from the village energy audit of Bury Village, West Sussex and incorporates recommendations on potential energy efficiency and other interventions that may in turn help to reduce fuel poverty locally.

3. Methodology

The village energy audit programme is an NEA project which sought to ascertain the energy efficiency needs of selected off-gas rural communities across England in 2011-2012.

The project employed actual energy audits of homes and a community building as well as gathering profile data sourced directly from households via a FREEPOST questionnaire.

NEA determined that each village had to be off-gas, with 100-300 households living in different tenures with different household types and fuel use.

NEA staff worked with FREE Rural Community Council partners to identify villages matching the eligibility criteria in 8 localities across England.

RCC contacts were prompted to engage a local 'wilful individual' in each village to act as a trusted intermediary with households, to undertake promotional activity and to assist the project in eliciting key profiling information about the village.

RCC contacts and wilful individuals were encouraged to engage up to 5 households in each village that were amenable to having an energy audit of their homes. In addition the local contact was asked to engage a community building representative to arrange a building audit and village-level awareness/advice event to coincide with the domestic audits.

NEA prepared and issued a household questionnaire to local contacts (and RCCs) to distribute directly to households and via planned events and meeting points in each village. The questionnaires sought feedback from villagers on the energy efficiency of their own homes by asking a series of related questions. NEA used this questionnaire approach to supplement the feedback from the energy audits of selected homes to provide a more detailed picture of local energy efficiency levels and potential eligibility for available government-funded and energy supplier energy efficiency scheme provision.

An NEA assessor subsequently undertook the domestic and community building audits and produced SAP[1] ratings for all buildings in question using NHER Plan Assessor 4.5.

NEA collated all incoming questionnaire feedback from households to provide supplementary information for the audit report.

All the incoming information was analysed by NEA and the findings comprise the content and recommendations in this report.

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[1] For the purpose of this report a SAP modelling exercise has been undertaken to produce recommendations on how to improve the energy efficiency of buildings.

4. Overview of Bury village

Bury village is a civil parish in the district of Chichester in West Sussex, England. The parish has a land area of 3,247 acres. The village is located approximately 4 miles from Pulborough on the South Downs.

Bury village comprises 270 properties containing a large number of dwellings of varying construction both in size and type. The construction dates of housing range from pre-1800 to post 1970's.

The 2001 census indicates that 691 people live within 264 households in Bury village, of whom 319 were economically active at the time.

Bury village possesses a large modern village hall located near the centre of the village used by a variety of groups from surrounding areas.

5. Overview of the energy audit

Bury village energy audit was undertaken by NEA's Technical Project Development Co-ordinator on 31 August 2011.

NEA's South East Project Development Co-ordinator provided support for the audit accompanied by a member of Access in Rural Sussex who is also NEA's FREE contact. Both provided support for the planned local awareness event within the village hall to promote the project and to offer villagers energy advice.

The audit involved four domestic energy audits of a variety of housing types. Data was subsequently input into NHER Plan Assessor 4.5 to generate SAP results. Two local volunteers accompanied the NEA assessor to gain an insight into domestic energy auditing. Volunteers may subsequently act as local energy champions for the FREE programme locally.

A 'walkthrough' audit of the village hall was also undertaken by the NEA assessor on the day to generate recommendations on potential energy saving measures and actions.

6. Detailed housing profile

The village energy comprised four domestic energy audits. The original scope was to carry out five domestic audits however due to one householder not being available on the day this was not possible. Three energy audits were carried out on the morning of the village energy audit and one in the afternoon upon completion of the village hall audit.

The four houses which were audited during the day were a mix of both cavity and solid wall construction and they also varied in construction date. An overview is as follows:

6.1 Property “A”

The property is a detached bungalow constructed in 1970. The property has 11-inch brick cavity walls with a pitched roof and loft access. There is cavity wall insulation present indicated by the visible drill pattern in the external walls. There is also 100mm of loft insulation installed at the joists. The heating is supplied via an external floor mounted oil boiler as primary heating (Grant Vortex Eco 26-35 kW) and a biomass wood burner is used to provide heat to the main living room as a secondary heating source (6kW stove). The domestic hot water is supplied to a 250 litre domestic hot water cylinder by the oil boiler; this is a dual coil cylinder which also integrated a solar thermal system which comprises of a 2m^2 evacuated tube collector on the rear south facing roof of the property. The heating system controls consist of a 24 hour seven day programmer and room thermostat.

NEA has assessed the following thermal values and efficiencies for the property in question as follows:

- Cavity wall construction – 0.5 w/m2K
- Roof – 0.35 w/m2K
- Windows (double glazed pre 2002) – 2.8 w/m2K
- Windows (double glazed post 2002) – 2.7 w/m2K
- Floor – 0.5 w/m2K

6.2. Property “B”

This property is a detached four bedroom property originally constructed in 1750. The property has been previously modified with two newer extensions, resulting in three construction types and construction dates. The original construction comprises 18 inch solid walls (stone) which was originally built in 1750. The first extension added to the rear side of the property incorporates a rear extension; this was constructed in 1930 and comprises 13.5 inch solid walls. The second extension was built in 1980 and tied the two rear sections of the property together by constructing an extension to the main living room and kitchen; this was mainly a glazed area which also incorporated 11 inch cavity walls. There is no internal or external wall insulation present on the solid wall construction and the cavity walls were deemed as not being filled. There is 100mm of loft insulation present within the small loft void; this was placed at the joints. A DIY installation of 100mm of loft insulation has also been installed at the eves. The heating is supplied to the property by using older large storage heaters throughout the main rooms and also on peak electric heating in the two bedrooms on the top floor. Storage heating used to be present within the two rooms on the top floor but was removed to prevent scalding when the householder’s children were younger. Secondary heating is also used within the front living room and kitchen using biomass room heaters (log burners). The domestic hot water is supplied by using off peak immersion heaters. The heating system controls comprise input and output storage system controls.

NEA has assessed the following thermal values and efficiencies for the property in question:

- 18 inch solid wall construction – 2.54 w/m2K
- 13.5 inch solid wall construction – 2.6 w/m2K
- 11 inch cavity wall construction – 1.5 w/m2K
- Windows (single glazed wood) – 4.8 w/m2K
- Windows (double glazed wood) – 2.8 w/m2K
- Floor – 0.5 w/m2K

6.3. Property “C”

This property is a mid terraced house constructed in 1971; located within a large estate at the bottom of the village. The property is system built which is classed as non traditional construction and comprises of a brick lower external cavity walls and an infill upper construction. The lower property comprises 11-inch brick cavity walls and the upper is a 10-inch system built construction with external weatherproofing in the form of tiling; NEA has estimated due to the construction date this was insulated at the time of construction. There is a pitched roof and loft access present. There is cavity wall insulation present and this is vindicated by the drill pattern in the external walls in the lower construction of the property. There is no evidence that insulation, either external or internal had been installed on the upper construction, and thus NEA deems that the thermal value of this is that of the date of construction. There is also 100mm of loft insulation installed at the joists. The heating is supplied via a floor mounted oil boiler as primary heating (Grant Vortex 15-26.6 kW/94% efficient) located within the kitchen and there is no form of secondary heating. The heating system controls consists of a 24-hour seven-day programmer and room thermostat.

NEA has assessed the following thermal values and efficiencies for the property in question as follows; however actual construction details would give a more in depth actual assessment:

- Cavity wall construction lower – 0.5 w/m2K

- Upper construction – 0.5 w/m2K
- Windows (double glazed pre 2002) – 2.8 w/m2K
- Floor – 0.5 w/m2K
- Roof – 0.4 w/m2K

6.4 Property “D”

This property is a detached three bedroom property originally constructed in 1895. The property has been modified and has two extensions, making a total of three construction types at different construction dates. The original construction comprises 9 inch solid walls originally built in 1895. The first extension was added to the side and upper section of the property around 1940-1960 and comprises 11.5 inch cavity walls with an external coating/render. The final extension was built in 2000 to the rear section of the property and forms a large conservatory at the rear of the living area. There is no internal or external wall insulation present on the solid wall construction and the cavity wall construction on the first extension was deemed to be filled, this was hard to judge due to the external covering. Penetrating the external wall and carrying out a further inspection could be completed, for the purpose of this report it is deemed as a filled cavity. The final extension constructed in 2000 is a 50% glazed construction to current building regulation standard and incorporated argon filled glazing. There was 270mm of loft insulation present within the loft void; this is placed at the joists. The heating is supplied to the property by using a high efficiency oil boiler (Grant Vortex) and this also supplies the domestic hot water cylinder in the upper airing cupboard (250 litre storage tank). The heating system feeds traditional radiators throughout all of the property except the rear extension constructed in 2000. This is supplied by under floor heating but is isolated from the system and manually operated by the household when required. Secondary heating is not present within the property. The heating system controls consist of a 24-hour seven-day programmer, room thermostat and TRV’s.

NEA assessed the thermal values and efficiencies for the property in question to be as follows:

- 9 inch solid all – 2.1 w/m2K
- 11.5 inch cavity wall – 0.5 w/m2K
- Final extension cavity wall – 0.3 w/m2K
- Windows (double glazed pre 2002) – 2.8 w/m2K – argon filled 1.9 w/m2K
- Roof – 0.16 w/m2K
- Floor – 0.5 w/m2K

6.5 Property “E”

The fifth property NEA planned to be audited but couldn’t as the householder was unavailable is profiled as follows:

- *1970 – Detached cavity – Solid fuel with no central heating.*

From the external look of this dwelling it was determined that there would be a possibility to insulate the cavity walls should this not have already been completed. There is a pitched roof present and the current loft insulation level will require inspecting in order to determine the present depth. Further recommendations could be made upon a more in detailed assessment being carried out.

7. SAP analysis and modelling

In order to determine the SAP rating of the four properties that took part in the energy audits at Bury village (domestic only); NEA’s technical team used the detailed data derived from the audits to reconstruct the individual properties using the NHER Plan Assessor programme version 4.5. This would determine the actual cost and carbon figures for each dwelling as well as also deriving a SAP rating in draft format. This then allowed NEA to model cost effective improvements in a range of rural construction types, which could then also lead to further recommendations for similar existing housing stock within the village. The information which was used to derive the results for the individual properties is detailed below along with the SAP rating in draft format:

7.1 Assessed SAP results

House type	Occupancy	Fuel type	Heating system	Wall/insulation type	SAP	Heating cost/carbon emissions per annum	Total cost/carbon emissions per annum
A.	2 adults 60+ standard heating pattern	Oil	Grant Vortex ECO (26-35kW) Externally mounted	Brick cavity construction / cavity filled	**70**	£633 / 2,765Kg/Yr	£1,360 / £5,047Kg/YR
B.	2 adults and 2 children standard heating pattern	Storage heating	Old large storage heaters with manual control	Mixture of 18 inch solid wall, 13.5 inch solid wall and unfilled cavity	**17**	£1,738 / 14,863Kg/Yr	£3,639 / 21,523Kg/Yr
C.	1 adult standard heating pattern	Oil	Grant Vortex floor mounted 15-26Kw / 94% efficient	Cavity filled lower construction / upper timber construction with insulation upon construction	**77**	£383 / 1,674Kg/Yr	£930 / 3,576Kg/Yr
D.	2 adults standard heating pattern	Oil	Grant Vortex 40kW utility mounted / 94.1% efficient	Mixture of 9 inch solid wall, filled cavity construction (0.5) and new build (0.3)	**58**	£1,233 / 5,389Kg/Yr	£2,119 / 8,589Kg/Yr

An individual assessment was carried out on the four properties detailed above in order to derive the estimated cost and carbon figures through SAP analysis over a mixture of rural housing stock. Two of the properties which were audited comprised cavity wall constructions with filled cavities, for the purpose of this report a further cost and carbon based assessment is provided later within the report to detail cost and carbon figures should the properties not have been cavity filled (*Section 7.2.5*). This is to provide further analysis on cost savings to householders living within the village who may occupy a similar dwelling without cavity wall and/or loft insulation.

Of the four properties audited two were a mixture of different constructions and integrated modifications to the original dwelling. These two properties in question were both mixtures of solid wall and cavity wall construction.

7.1.1 Resident feedback

Of the residents visited by NEA, two are very interested in renewable energy and installing different technologies to reduce their energy consumption. Basic energy efficiency advice was also given to each of the householders visited during the audits.

Of the two solid wall properties visited one was very interested in the advantages of installing solid wall insulation, not only to reduce energy costs but also to improve their warmth and health. Issues such as the Green Deal were briefly outlined to householders resulting in a difference of opinion on the viability of the potential offering. One older client visited asked about payback periods associated with Green Deal and the installation of measures, once explained they indicated that this is unlikely to be a viable proposition for them due to their age. There was also a concern from one householder regarding selling their property in the future should there be a perceived “debt” associated with their home. NEA countered this perception noting the reduction in heating; however the householder went on to note:

“I would be taking up such a mechanism to improve my level of warmth as a priority as I am getting older, not to reduce my energy consumption. So the payback on such an installation may not build a good case for me”

7.2 Modelled SAP results

Using SAP analysis there are two main approaches which are generally used in order to improve the energy rating (SAP rating) of a property. The first involves improving the fabric of the building by upgrading the current insulation, and the second involves an upgrade to the property’s heating system.

When looking at cost effective methods of improving the SAP rating of a property by installing insulation the most cost effective measure to be installed is cavity wall and/or loft insulation. The two main areas of heat loss within a domestic dwelling are the walls (up to 35%) and the roof (up to 25%). Insulation methods such as cavity wall and loft insulation can often be installed at a reduced cost by using funding available from utilities (measures are dependent upon the householders eligibility). When we look at more rural housing stock this tends to be older, larger properties which were constructed before building regulations were implemented to govern the standard of domestic constructions. These properties were often constructed without a cavity present making the construction that of solid wall construction. This is what NEA class as Hard to Treat (HTT) homes which comprise of non-traditional and solid wall constructions. Insulating these solid walls can be done using two approaches either internal or external insulation, however this is often deemed as not being cost effective by households due to the upfront capital investment required. In some cases the capital investment can be up to ten times as much as it would cost to install cavity wall insulation.

When looking at cost effective methods of improving the SAP rating of a property through upgrading the current heating system there are a number of approaches which can be taken. A very cost effective approach is to install a high efficiency boiler in order to increase the efficiency of the heating system, obtaining quick cost and carbon savings in order to increase the properties SAP rating. Not only are the more rural housing stock of an "older" construction having less energy efficient insulation standards they are also not connected to the natural gas grid, which is the cheapest form of fuel for domestic heating today. In turn they must use alternative fuels for heating which tends to have a higher cost per kW/h, be prone to price fluctuations and are sometimes more carbon intensive. There is also the added problem of delivery of certain fuels in severe weather conditions; this has been a problem that has been highlighted over the previous two severe winters which have been experienced in the UK.

NEA has used modelled SAP data for the four dwellings surveyed to estimate cost savings which can be obtained by installing insulation, energy efficiency measures and using alternative heating fuels and systems. Below is an overview of the possible different approaches in table format:

7.2.1 Modelled SAP results – Improving building fabric and lighting only

House type	Fuel	Current SAP / Heating costs per annum	Current construction / insulation	Fabric improvement	Improved SAP	Heating cost per annum	Savings per annum (heating only)
A.	Oil	70 / £633	Brick cavity construction / cavity filled. 100mm loft insulation	Top up loft insulation to 270mm, replace lighting	**72**	£586	£47
B.	Storage heating	17 / £1,738	Mixture of 18 inch solid wall, 13.5 inch solid wall and unfilled cavity	Internal insulation to all solid walls and fill existing cavity. Top up current loft insulation level	**56**	£547	£1,191
C.	Oil	77 / £383	Cavity filled lower construction / upper timber construction with insulation	Top up current loft insulation level, replace all lighting to energy efficient lighting	**79**	£348	£35
D.	Oil	58 / £1,233	Mixture of 9 inch solid wall, filled cavity and new build construction.	Install internal insulation to the 9 inch solid walls	**67**	£817	£416

Below are the modelled improvements used by NEA to the current building fabric in order to obtain the improved SAP rating and cost savings detailed above:

- A - 1970 detached bungalow – Top up current quilted loft insulation from 100mm to 270mm, replace all lighting with energy efficient lighting.

- B - 1750 detached bungalow – Install internal insulation to both 18 inch and 13 inch solid walls to current building regulation standard of 0.3w/m2K. Install cavity wall insulation to the existing cavity wall and top up the quilted loft insulation from 100mm to 270mm.

- C - 1971 mid terraced house – Top up current quilted loft insulation from 100mm to 270mm, replace all existing lighting with energy efficient lighting.

- D - 1895 detached house – Install internal insulation to the 9 inch solid walls to current building regulation standard of 0.3w/m2K.

As the data shows, insulating cavity walls, solid walls and lofts can reduce energy costs required for heating homes dramatically. The larger the surface area of the walls and roof the greater the energy savings obtained. When using such approaches it is vital that the capital cost for investment over energy and cost saving data is derived. Considering this cost saving alongside the necessary capital investment will be essential for householders wanting to take up the Government's Green Deal finance mechanism in 2012. This is in order to ensure that the "golden rule" can be met, which states that the cost savings must be greater than the required return/payback for the installation of particular measures.

7.2.2 Modelled SAP results – changing fuel type and heating system

The results below are based on the current insulation levels of individual properties as assessed by NEA. The information below details a variety of heating costs for a number of constructions in Bury village.

In order to ensure a constant was maintained throughout the modelling exercise the alternative heating system data, changing the fuel type and appliance for each property has been input using the SAP appendix.

House type	**LPG** **SAP/Heating cost per annum**	**Solid fuel (back boiler with house coal)** **SAP/Heating cost per annum**	**Electricity (storage heating)** **SAP/Heating cost per annum**	**Oil** **SAP/Heating cost per annum**	**Renewable heating** **SAP/Heating cost per annum**
A	39 £736	52 £563	50 £480	**70** **£633**	(ASHP) 52 £601
B	10 £2,613	18 £2,028	**17** **£1,738**	35 £2,626	(GSHP) 31 £1,702
C	52 £422	64 £320	63 £254	**77** **£383**	(ASHP) 63 £354
D	28 £1,436	37 £1,110	37 £916	**58** **£1,233**	(GSHP) 47 £945

When using renewable heating technologies NEA has modelled the installations dependent upon property size. Should the property be defined as suitable for an Air Source Heat Pump (ASHP) then this has been used as the primary renewable heating technology due to the lower capital cost for installation. Should an ASHP not be suitable due to building heat loading then a Ground Source Heat Pump (GSHP) has been specified.

The data above details the trend on system efficiencies relating to SAP. Each individual property, no matter what the construction obtains the greatest SAP result when using oil central heating. The worst SAP rating achieved is when each property is using LPG heating. This is due to the SAP Appendix using average data and figures in order to derive actual SAP efficiencies.

Although storage heating systems do seem to be a cost effective method of heating using this SAP modelling analysis it should be highlighted that this is often more carbon intensive. All data indicates that storage heating systems are one of the cheapest systems to run within all four construction types, however alternative heating is often necessary dependent upon the age of the storage heating system. Households that operate storage heating effectively using an Economy 7 or Economy 10 tariff may make cost savings over alternative off-gas fuels. It is also to be noted that every off-gas fuel can bring advantages to particular households dependent upon their lifestyle and demand and it is vital that these factors are taken into consideration during the specification and design stages of installations.

7.2.3 Modelled SAP results – Potential improvement scenarios

Based on a practical judgement of potential cost effective solutions, NEA has below provided different scenarios for recommend improvements to selected housing types.

NOTE: recommended improvements are highlighted in the following table

House type	**Current SAP**	**Current heating costs per annum**	**Current fuel type**	**Fuel / system replacement**	**Insulation improvement**	**New SAP**	**Heating cost per annum post improvement**
A	70	£633	Oil	N/A	**Top up loft to 270mm**	72	£586
B	17	£1,738	Storage heating	Install GSHP dependent upon household and capital investment	**Top up loft to 270mm**	31	£1,675
C	77	£383	Oil	N/A	**Top up loft insulation to 270mm, upgrade lighting**	79	£348
D	58	£1,233	Oil	N/A	**Install**	67	£817

					internal insulation on 9 inch solid walls		

The above data table has been produced for the purpose of this report. The recommended improvements to the assessed properties have been determined using a SAP modelling exercise. It is to be noted that the capital investment required by householders to meet needs will differ depending on eligibility for free/discounted measures, meaning further analysis will be required on actual spend needed for improvements. The integration of renewable heating systems has not been specified as a recommendation although some may show a reduction in heating costs. This is due to renewable heating technologies being specified in conjunction with the clients understanding, lifestyle and demand and will differ in individual households. This also involves a large capital investment in certain circumstances.

7.2.4 Integrating renewable technology into the existing properties

House type	Current SAP rating and cost per annum (£)	Improvement when installing Solar thermal	Improvement when installing Solar photovoltaic	Improvement when installing Micro-wind
A	70 £1,360	N/A (already installed)	79 £1,192 (£168)	71 £1,344 (£16)
B	17 £3,639	17 £3,520 (£119)	19 £3,416 (£223)	16 £3,577 (£62)
C	77 £930	79 £874 (£56)	87 £766 (£164)	78 £915 (£15)
D	58 £2,119	60 £2,052 (£67)	65 £1,954 (£165)	59 £2,104 (£15)

Draft SAP ratings have been produced using the following installations:

- Solar thermal – 4m^2 evacuated tube collector, combined thermal store, south facing with minimal shading
- Solar photovoltaic – 2kW peak energy, south facing with minimal shading
- Micro wind turbine – 1 turbine, 1m rotor diameter, 1m height above ridge

7.2.5 Possible insulation approach

The third property which was assessed by NEA was that of a 1971 cavity wall constructed terraced property, this also consisted of timber upper construction. The property which was assessed by NEA did have cavity wall insulation installed (although similar properties may not). However as this was the largest housing estate within the village the questionnaires will provide feedback on how many of these properties do not have cavity wall and loft insulation, leading to an opportunity to insulate a number of identical dwellings in one whole approach. Below is the estimated cost and carbon saving should an un-insulated property have cavity wall insulation and loft insulation installed:

House type	**Un-insulated** **1. SAP** **2. Total energy cost per annum** **3. Total carbon per annum**	**Insulated** **1. SAP** **2. Total energy cost per annum** **3. Total carbon per annum**	**Improvement/reductions** **1. SAP** **2. Total energy cost per annum** **3. Total carbon per annum**
PROPERTY "C"	1. 64 2. £1,321 3. 5,284 Kg/Yr	1. 78 2. £894 3. 3,417 Kg/Yr	1. 14 points 2. £427 3. 1,867 Kg/Yr

NOTE: based on un-insulated property having no loft insulation present and unfilled lower cavity wall construction; heating using a 94% efficient oil boiler.

8. Potential energy efficiency improvement opportunities in the village

There are approximately 270 properties in Bury village; these are a variety of different constructions and mostly owner occupied properties. There is a large 1970's housing estate at the bottom of the village, however sections of this housing are also now privately owned. There is sections cavity wall construction present and households could benefit from cavity wall and loft insulation methods should this not already be installed.

As per the agreed NEA methodology questionnaires were distributed to all properties within Bury village to gather feedback on current levels of energy efficiency and where potential opportunities exist for improvements. **68** completed questionnaires were returned, which totals a response rate of **25.1%.**

Of the questionnaires returned, **3** fit into the current CERT super priority group and **33** into the CERT priority group. It is anticipated that these will be similar to the ECO eligibility criteria. **32** would be considered able to pay and potential Pay-As-You-Save customers. Meaning that of the **68** questionnaires returned **53%** are eligible for grant assisted schemes.

Based on the questionnaires returned, other key findings are as follows:

Opportunity	**CERT priority**	**CERT super priority / WF / ECO**[2]	**Possible able-to-pay**
Number of lofts to be insulated	**3**	**0**	**6**
Number of cavities to be insulated	**4**	**0**	**4**
Number of possible solid wall insulation opportunities	**7**	**2**	**15**
Number of possible heating system replacement opportunities	**3**	**1**	**3**

NOTE: Some solid wall opportunities are partial solid wall and cavity construction.

Analysis

From the total households surveyed **34 (50%)** lived in properties constructed pre 1930, **27 (39%)** lived in properties constructed post 1930 and **7 (11%)** were unsure.

In total from the questionnaires returned **9 (13%)** of households require loft insulation, **8 (11.7%)** of households still require their cavities to be filled and there are **24 (35.2%)** possible solid wall opportunities.

The questionnaires returned detailed that **12 (17.6%)** of the total households surveyed suffered from health related cold issues. From these **8 (66%)** were CERT priority group eligible and **4 (34%)** are classed as able to pay households. **18 (26.4%)** of the total households would welcome a benefit entitlement check.

9. Bulk buying fuel

Of the four houses assessed by NEA three use oil central heating as their primary source of fuel. NEA was informed during the audits that a large number of the households in Bury village use oil as their primary source of fuel.

From the returned questionnaires **51 (75%)** of households use oil central heating, **6 (9%)** use LPG (bulk) and **11 (16%)** use electricity as their primary source of heating. Of the 51 households who use oil central hating **14 (27.5%)** would be interested in bulk buying schemes.

A possible approach for the village to take would be to look at implementing a bulk buying scheme in order to reduce their capital cost for oil deliveries and obtain a reduction within their heating bills. This would require a dedicated volunteer within the

[2] Although we cannot be sure of ECO criteria, we can assume this will be similar to the second iteration of Warm Front, which in turn was similar to the CERT super priority group

village to calculate the amount of oil required from each individual scheme member and order the delivery of the required amount for a particular day in conjunction with households. A possible approach which NEA would recommend would be to raise this point, or promote this approach within the local village hall and/or in local village scheduled meetings in the near future to obtain a householders view.

10. Village hall audit

As part of the village energy audit the community building was gifted for use to the VEA team between 12:00 and 15:00 in return for a walk through energy audit. This was in order to allow local residents to come to the community building to ask particular energy efficiency questions to NEA. Between these times the NEA Technical Project Development Co-ordinator also conducted a walk round of the building to produce a simple energy audit report and detail possible recommendations to the parish council to conserve energy consumption and reduce energy costs. A member of the parish council was present to assist within the audit and provide the relevant information to NEA in order to produce the recommendations enclosed within this report.

Figure: Main hall

Figure: Loft void at end

10.1 Building structure

The building was constructed in 1975 in accordance with the building regulation standard. It has cavity walls and a pitched roof with minimal loft access. All windows throughout the building were double glazed post 2002. The floor throughout the building comprises both solid concrete and suspended timer construction. For the purpose of this report the floor thermal value has been estimated using the given building parameter of heat loss without any insulation present. The internal ceiling in the main hall is apex with small loft voids present over the rear Sidney room and a section of the lobby/entrance to the main hall. There is also a further meeting room within the upper area of the entrance to the main hall. NEA believes that the suspended timber floors of these rooms are also un-insulated.

Wall construction

The NEA assessor determined that the building has cavity walls given the construction date and from external inspection. The walls are approximately 11 inches thick, comprising 9 inches of brick and a 2 inch (50mm) cavity. Upon further inspection of the external wall no drill pattern was visible indicating a lack of cavity wall insulation, leading NEA to believe that the building's main wall construction comprises of 9 inch brick and a 2 inch (50mm) unfilled cavity – pending a more detailed assessment.

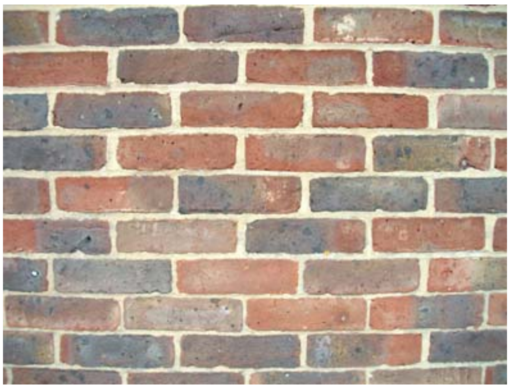

Figure: Buildings external cavity wall construction

Roof construction

The main roof comprises a pitched roof with a large internal apex ceiling covering the main hall. There are small loft voids present at either end of the hall and it is estimated that there is no loft insulation present within the voids. The NEA assessor was unable to access the voids on the day of the audit to carry out an inspection.

Figure: main apex ceiling and loft void

Windows

The windows throughout the building are replacements to the originals. It is believed that the original were single glazed windows with a PVC or wood frame; this also would have incorporated an in-fill panel believed to have been u-PVC or wood below the window construction. The replacement of the existing single glazed windows was carried out and this also included the construction of a cavity wall where the in-fill panel was previously situated in order to reduce heat loss and incorporate double glazed window panels. The existing double glazed windows are post 2002 manufacture.

Figure: Double glazed windows with constructed wall replacement

Floor

The floor construction comprises both solid and suspended timber construction elements. As the thermal value/heat loss from the floors is determined by the external perimeter of the building in question an estimated thermal value has been derived for the floor construction. Due to the disruption level, cost of installation and minimal cost savings obtained from the installation of floor insulation within the given building this is not an approach that NEA would recommend.

10.2 Current insulation analysis

All thermal values detailed within this report are based on assumptions from the assessment carried out by the NEA assessor. If a further in-depth analysis is required of actual construction thermal values then NEA recommends that the original construction schematics be reviewed.

Assumed current thermal values for the building without having analyses of the original schematics are:

- 11" Cavity walls – 1.4 w/m^{2}K
- Main hall apex ceiling – 2.6 w/m^{2}K (assuming no insulation present)
- Ceiling voids – 2.4 w/m^{2}K
- Floor – 0.5 w/m^{2}K
- Windows – 2.7 w/m^{2}K

35% of heat lost from buildings is lost through the walls, by insulating the walls we can reduce the required heat load dramatically thus reducing the cost and carbon emissions. Bury village hall was originally constructed in 1975 and comprises cavity walls which consist of external and internal brick and a 50mm cavity (deemed as no-thermal block internal and cavity un-insulated). NEA classes this wall construction as "traditional" and the most cost effective method would be to cavity fill the wall using a mineral fibre, this would be blown into the wall from the external surface.

25% of heat lost within a building is lost through roof space. Bury village hall does have two small loft voids present at each end of the building. By installing quilted loft insulation to the joists of these voids, at a depth of 270mm we can retain more heat and reduce energy consumption. The main hall ceiling is that of an apex ceiling. The NEA assessor has deemed this as having no insulation present due to the construction date.

10.3 Current heating system

The hall uses an oil fired central heating system located in a rear boiler room for its primary space heating. The system is fully pumped providing heating to three separate zones. The three zones are the main hall; entrance and toilet area; and rear Sidney room of the building. The emitters in all three zones are traditional radiators; with thermostatic radiator valves (TRV's) installed on particular radiators but not within the main hall due to the required heat load. There is a controllable programmer also installed to control the individual timing of the system zones, this is set by the community building representatives and locked off to ensure that groups using the building do not alter any settings. NEA was informed that during the winter the main hall did feel cold and needed to be sufficiently heated prior to planned events.

The existing boiler is around five years old and is a Grant manufactured boiler which is floor mounted within the boiler room. The system components such as the pressure vessel etc are also located within the boiler room. The oil tank is located externally at the rear of the building, to the side of the boiler room and holds a storage capacity of 2,400 litres.

Figure: Flow to individual zones

Figure: Fan assisted flue

Figure: Floor mounted boiler

Figure: TRV located on radiator at entrance

In order to ensure that the main hall is at a sufficient temperature the heating system has been programmed to operate for a given period of time prior to use. In order to establish a habitable room temperature on demand NEA feels that the main hall may benefit from instantaneous heaters to initially heat the room, and then the room temperature could be maintained by the traditional oil heating system. However it is vital that an insulation first approach is taken on this building to reduce the required heat load.

10.4 Draught proofing

Although the hall has a satisfactory standard NEA recommends that DIY draught proofing measures be installed where appropriate. This should be applied principally to the exit doors from the main hall leading to the draughty lobby and main entrance. This is where most heat will be lost during air changes as people enter and exit the hall whilst it is in use.

10.5 Appliances

The main appliances used within the hall which were visible to the NEA assessor are in the kitchen. The higher energy consumers are the electric cooker, hot water urn and dishwasher. The building representative noted that larger energy consuming appliances were only used on days of full building occupancy for large events. For the smaller events kettles are used to reduce energy consumption.

Figure: Cooker

Figure: Dishwasher

10.6 Lighting

Strategically placed windows provide natural light in the main hall. The main hall also uses florescent strip lighting around the perimeter. Replacing these with high efficiency lighting will require a conversion adaptor kit to be fitted to each light. All other lighting should be replaced to energy efficient CFL lighting, not only will this reduce maintenance by extending the lifespan of the lighting but it will also reduce energy consumption.

Figure: Strip lighting around main hall perimeter

10.7 Toilets and communal area

Within the toilet areas of the hall it is possible to install push fit taps in order to reduce water consumption. Single flush toilets could also be replaced with dual flush systems. NEA only recommends that these options be considered if refurbishment is planned in future.

10.8 Renewable energy and innovative technologies

Due to the efficiency and age of the current heating system in place within the hall it would not be cost effective to specify any renewable heating technologies for the building in question. Should the hall wish to obtain an income from the Governments

Renewable Heat Incentive (RHI) then this is an approach which could be focused on using renewable heat technologies. However an independent review of the capital costs for installation over that of the return from investment will need to be carried out. NEA understands that this is not an approach which has or will be explored in the near future.

Solar Photovoltaic's

Solar photovoltaic technology uses a semi-conductive material to generate electricity from photon light by the movement of electrons. The building has a south facing roof with sufficient amount of space for a large solar photovoltaic installation to be installed; however planning permission would be required prior to installation. Should planning permission not be accepted then the installation of solar PV could carried out at ground level to the rear of the hall, mounting the systems on "A" frames. A major advantage of solar PV is that of the available *Feed-in-Tariff*. The feed-in-tariff means the building could obtain income for every kW/h generated and also sell the excess electrical energy back to the electricity network. However it is more beneficial to consume this generated energy on site by offsetting the building's demand from the infrastructure. As the electrical energy we buy from our suppliers is at a higher cost than we can sell it back for; consuming this energy we generate brings greater cost savings.

The building representative noted that this is an approach which had been explored. However the initial survey report indicated that the pitch angle of the roof was above that required to install solar photovoltaic using an external investor. Further research is being carried out by the building representative on the most applicable approach for installation of solar photovoltaic technology.

It is recommended that if the village hall representatives are looking at replacing the existing roof then this could be done using a pitch more suitable (designed specifically for) solar photovoltaic. However NEA feels that investment should be focused on an insulation first approach as a priority.

Micro/community wind

This is probably the most familiar and established renewable electrical generation system on the market within the UK today, and in this context, the most conducive for larger scale generation. Wind power uses potential wind energy to turn a rotary blade (either vertical or horizontal) which turns a rotating shaft through to a generator to generate electricity. These systems come in wide ranges of sizes and electrical output ratings and obtaining optimisation is highly dependent upon a building's location and local wind speeds. Micro or community wind could be a possible installation at Bury, however as the village is located within a 'dip' within the surrounding countryside wind speeds would need to be assessed to ensure they both reach the manufacturers specifications and are not turbulent. Planning permission would also need to be sought prior to installation of any system. Feed-in-tariffs are also available using wind technology; however the cost per kW/h generated is not as high as that of solar PV technology.

Voltage optimisation

Voltage optimization is not a new technology but one which has been used in industry for many years. A unit is designed to be installed between the main infrastructure breaker and the electricity meter and is mainly designed for single phase supplies but larger units can be specified and purchased to install in three phase supplies and in local system sub stations. The incoming supply to most single phase buildings is 240v 60Hz. Due to EU legislation all electrical appliances must be tested and able to run at a voltage between 207v – 253v, this is due to the fluctuation in supply throughout Europe and design of the infrastructure. Due to our appliances within the UK running at 240v it is claimed that the excess voltage is wasted as heat energy. The optimisation unit will regulate incoming supply to 220/230v thus saving on electrical consumption, reducing carbon and cost.

10.9 Village hall recommendations

As detailed previously NEA recommends an insulation first approach to improvements as a key recommendation to retain heat in the building. As such the following interventions should be considered:

1. Draught proofing
2. Cavity wall insulation
3. Loft insulation and obtain thermal value of apex ceiling

    1. It was noted by NEA that there is certain aspects of the hall where draught proofing is not present. All external entrances to the main hall have sufficient draught proofing and a small draughty lobby is present in-between the main entrance doors and the entrance doors to the main hall. However in order to ensure that heat is retained within the main hall NEA recommends that draught proofing is carried out on the main hall doors at the entrance side. It is also vital

to ensure that all other areas within the main hall have appropriate draught proofing. This installation can be a DIY installation at minimal cost.

2. As the hall has a cavity wall construction and there was no external drill pattern visible to NEA, it is also recommended that cavity wall insulation be installed. This will require a further inspection of the wall by an accredited installer who can drill an inspection hole to ensure it is possible to fill the cavity.

3. As NEA is unsure of the roof/loft thermal values and current insulation levels the next step will be to assess the level of insulation within the loft voids at either end of the building. Thereafter hall representatives should obtain quotes for installing loft insulation within the voids at the joists to a depth of 270mm. The main apex ceiling of the hall will require a further detailed inspection in order to establish if there is any insulation present, this can be actioned by having an accredited installer carry out an inspection and could be done in conjunction with the inspection of the of the cavity wall and loft voids. Further recommendations can be made post inspection.

Upon completion of the insulation works

It was noted that the main hall may benefit from the installation of instantaneous heaters in order to lift the main hall internal temperature quicker in colder ambient temperatures. However NEA feels that once the insulation is installed within the building the internal temperature will improve and heating costs will be reduced. Should hall representatives deem it necessary to explore such an approach for instantaneous heating once the insulation is installed then quotes for this work can be obtained from accredited installers.

An approach which could also be taken would be to install roof mounted fans in order to drive down the warmer air to the bottom of the main hall. When heat is emitted from the radiators the largest amount of this heat is via convection, meaning the heat rises. By installing fans this heat can then be driven down to floor level. However due to the operation hours specifying such equipments will be highly dependent upon the capital costs for installation against the estimated cost savings. Due to the hall being insufficiently insulated at this moment in time NEA feel that this approach should be looked at upon completion of the insulation installations.

Voltage optimization - Again as detailed previously this could be a technology which is implemented within the village hall upon completion of the insulation priorities. The incoming voltage supply would need to be assessed to estimate the average cost savings from the electrical circuits per annum. Once this cost is known then a business case could be made by the hall committee for installation of voltage optimisation technology.

Radiator panels - The warm room radiator magnet is a flexible magnetic panel that fits to a steel radiator preventing radiation occurring through the external wall. The panels are attached by their strong magnetic force to the back of a radiator with a panel being fitted to a standard radiator within a few minutes. Should the hall committee deem this necessary upon completion of the insulation works cost savings could be made by installing this simple technology.

11. Residents' feedback from drop in session

Although the village hall drop in session as part of the audit was over a three-hour period the NEA technical assessor was only able to attend for approximately 30 minutes due to the domestic audits of the large properties selected taking longer than expected, and the village hall energy audited being completed over this time period. Rebecca Jones of NEA and Rowena Tyler of Action in Rural Sussex were present within the hall to answer all related questions from the public. There was a variety of energy efficiency products within the local hall which were given to particular householders during the open event and these were used as an incentive tool to entice households to attend and ask questions.

The main questions from the local residents who attended the drop in session were focused around the actual village energy audit itself and why we were carrying out the project. This was explained to the residents who attended whilst also highlighting the importance of energy efficiency and assisting the more vulnerable within local communities. It was noted again to NEA the reoccurring problem of transportation of fuels, which has been highlighted over the previous two severe winters we have experienced within the UK.

One householder in particular was unable to attend the event but did email NEA early on the morning of the energy audit. This email was replied to by the NEA staff and the resident was asked to come down to the drop in session to ask any further questions or raise any concerns they may have. Unfortunately the householder could not attend the drop in session but did reply to NEA via email and quoted he was looking forward to seeing the recommended approach to reduce energy consumption within his home from the questionnaire he had returned. This will be followed up by NEA.

During one of the audits it was highlighted to the NEA assessor that a particular household may not attend the drop in session but would benefit from energy efficiency advice and measures. The householder from the audit then attended the drop in session upon completion of the audit and had a discussion with Rowena and Rebecca to follow up on this matter and provide assistance where it was most needed. This is currently being followed up by the South East FREE team.

12. Village energy audit conclusions

Bury has a very active village community who participate in many aspects of village life. The commitment is there to deliver the project in order to assist more vulnerable households within the village. However it will be important to raise awareness of cost effective solutions to reduce energy consumption with “key players” in the village to aid local promotion. This could be done in a number of ways, including appointing a local energy champion.

To exemplify this a local village hall champion might have been able to identify that cavity wall insulation would be a more cost effective intervention (alongside the high efficiency heating system) for reducing energy consumption rather than installing solar photovoltaic which was under consideration. ‘Energy champions’ need to understand that cavity wall insulation should be a primary consideration before even considering renewable solutions.

In turn the installations which are recommended for the village hall could act as an exemplar project should these works be carried out. Information could be displayed within the hall to identify and detail the cost savings through the installation of traditional insulation which would highlight the effectiveness of these methods for local villagers within Bury village and surrounding areas.

From the received questionnaires and data provided within this report it is clear to see that there are aspects of energy efficiency and education which could be delivered to bury village, again by possibly implementing a village energy champion or using additional mechanisms.

13. Village energy audit recommendations

Following the village energy audit at Bury Village, West Sussex the following recommendations have been made to reduce residents' energy consumption and improve the overall village energy efficiency standard:

- Work with a CERT provider to promote and install insulation measures free and at reduced cost for households who returned their questionnaires and who are eligible for assistance. Signpost households to other sources of assistance as necessary (such as benefit entitlement checks etc)
- Increase take up of CERT schemes by to those who didnt return their questionnaire via local marketing and promotion
- Work with the village hall committee in order to specify and then install recommended energy efficiency measures
- To appoint and support local energy champions to act as a focus for providing basic energy advice to local people, signpost them into available energy efficiency provision and provide a sustainable resource for supporting future local action
- Provide advice to households on the advantages of existing grant schemes and services as well as promoting the Governments new Green Deal programme.
- Obtain further interest and possibly implement a oil bulk buying scheme in order to reduce residents fuel costs (e.g. using an appointed energy champion as co-ordinator).

14.Acknowledgements

NEA is grateful for the support of Calor Gas Ltd, the Rural Community Council and other local representatives in the development and delivery of the village energy audit.