

Title: Green Deal and the Cambrians:  
A scoping study for the LEAF project

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## Executive Summary

The Green Deal is a UK government scheme which aims to reduce the energy consumption of both domestic and non-domestic buildings through the installation of a range of energy efficiency measures. The main two reasons for this are to meet carbon reduction targets and as a buffer against rising energy prices.

The scheme has an innovative payment mechanism such that there will be no upfront costs to the householder; instead the payments will be linked to the property's electricity bill and will be repaid over a number of years. Which measures can be installed in a property will be determined by a trained adviser. A key part of the Green Deal is that the repayment charge cannot be any greater than the estimated savings that the improvements will make. This is known as meeting the "golden rule".

As the Green Deal charge will also take into account the cost of running the scheme and interest payments, there are concerns that a high rate of interest could not only mean that some efficiency measures fail to make the "golden rule" but will also dissuade people from taking out a Green Deal loan.

When considering the Cambrian Mountains area in terms of the opportunities the Green Deal may offer, there are a higher than average number of older and hard to heat properties. This includes a large proportion of solid walled properties which have traditionally been costly to retrofit. The government aims to help with refurbishments on these properties by introducing a mechanism known as 'ECO' to subsidise the cost of retrofitting measures. There will also be a second 'ECO' scheme to allow Green Deal work to be done in those households on low incomes and those containing 'vulnerable' people.

In this scoping study, local housing data and the latest available information on how the Green Deal assessment will work were used to produce a set of eight case studies of properties. These scenarios looked at the costs of example efficiency measures for the eight most relevant housing types in this area using a range of interest rates and repayment periods. The results show that the Green Deal could be beneficial to houses in this area. However it is crucial that the Green Deal Assessment reflects the differences in older properties such as the thermal mass and the fabric of the building before recommending specific measures that could do more harm than good.

There is potential for local businesses to work with the Green Deal but currently larger national companies are more prepared for the launch, so the government needs to address accessibility for small and medium sized businesses. The government also needs to consider how it will market the Green Deal. A new approach is needed with an emphasis on how the Green Deal can make houses warmer, cosier and modern.

At the time of writing there are worries that the scheme may not be ready for launch as intended in October 2012. Furthermore, opposition parties and business groups think that in its current state the scheme will not do enough to address the long term improvements that need to happen to meet carbon reduction targets. The government counters that the scheme will be launched in Autumn 2012 and is the best chance for a generation to improve the energy efficiency of Britain's leaky homes. It will deliver its consultation response and secondary legislation by the Summer parliamentary recess so we will have to wait until then to find out the exact way the Green Deal strategy will unfold.

## Crynodeb Gweithredol

Cynllun gan lywodraeth y DU yw'r Fargen Werdd. Ei nod yw gweld adeiladau domestig ac annomestig yn defnyddio llai o ynni, a hynny trwy roi amrywiaeth o fesurau ynni-ffeithlon ar waith. Y prif resymau dros wneud hyn yw er mwyn cyrraedd targedau'n ymwneud â lleihau carbon a chynnig help llaw i bobl yn wyneb y cynnydd mewn prisiau ynni.

Mae gan y cynllun ddull arloesol o ymdrin â'r taliadau, felly ni fydd angen i berchennog y tŷ dalu unrhyw gostau ymlaen llaw. Yn hytrach, bydd y taliadau'n cael eu cynnwys ym mil trydan y tŷ a bydd modd eu had-dalu dros gyfnod o flynyddoedd.

Ymgynghorydd cymwys fydd yn gyfrifol am bennu pa fesurau y gellir eu rhoi ar waith yn y tŷ. Rhan hollbwysig o'r Fargen Werdd yw na all cost yr ad-daliadau fod yn fwy na'r arbedion a ddaw yn sgil y gwelliannau. Dyma'r "rheol aur".

Gan y bydd cost y Fargen Werdd hefyd yn ystyried y gost o redeg y cynllun a'r taliadau llog, y pryder yw y gall cyfraddau llog uchel olygu y bydd rhai o'r mesurau ynni-ffeithlon yn methu â bodloni'r "rheol aur" ac y gallai hyn berswadio pobl i beidio â chymryd benthyciad y Fargen Werdd.

Wrth ystyried ardal Mynyddoedd Cambria o ran y cyfleoedd y gallai'r Fargen Werdd eu cynnig, mae mwy na'r cyfartaledd o dai hŷn ac anodd eu cynhesu i'w cael yn yr ardal. Hefyd ceir nifer helaeth o dai â waliau solet – tai sy'n gallu bod yn ddrud i'w trin. Nod y llywodraeth yw cynorthwyo i ailwampio'r tai hyn trwy gyflwyno cynllun 'ECO' a all dalu am y gwaith. Hefyd, bydd ail gynllun 'ECO' yn cael ei roi ar waith er mwyn galluogi'r Fargen Werdd i weithio ar dai pobl sydd ag incwm isel neu bobl 'fregus'.

Yn yr astudiaeth gwmpasu hon, cafodd gwybodaeth am dai'r ardal, ynghyd â'r wybodaeth ddiweddaraf am y modd y bydd asesiad y Fargen Werdd yn gweithio, eu defnyddio i lunio wyth o astudiaethau achos. Aeth y senarios hyn ati i ystyried y gost o roi mesurau ynni-ffeithlon enghreifftiol ar waith ar gyfer yr wyth math o dŷ mwyaf perthnasol trwy ddefnyddio amrywiaeth o gyfraddau llog a dulliau ad-dalu. Dengys y canlyniadau y gallai tai yn yr ardal hon elwa ar y Fargen Werdd. Fodd bynnag, mae'n hollbwysig i Asesiad y Fargen Werdd adlewyrchu'r gwahaniaethau mewn tai hŷn, er enghraifft mäs thermal a gwneuthuriad yr adeilad, cyn argymell mesurau penodol a allai wneud mwy o ddrwg nag o dda.

Mae yna bosibilrwydd y bydd modd i fusnesau lleol allu gweithio gyda'r Fargen Werdd, ond ar hyn o bryd mae cwmnïau cenedlaethol mawr yn fwy parod ar gyfer y lansiad. Mae angen i'r llywodraeth ystyried sut y gellir hwyluso busnesau bach a chanolig yn hyn o beth. Hefyd, mae angen i'r llywodraeth ystyried sut y bydd yn marchnata'r Fargen Werdd. Mae angen cael dull newydd lle canolbwyntir ar sut y gall y Fargen Werdd wneud tai'n gynhesach, yn fwy clyd ac yn fwy modern.

Ar adeg ysgrifennu'r ddogfen hon, y pryder yw na fydd y cynllun yn barod erbyn y lansiad ym mis Hydref 2012. Ymhellach, mae'r gwrthbleidiau a grwpiau busnes o'r farn na fydd y cynllun, ar ei ffurf bresennol, yn gwneud digon i ymdrin â'r gwelliannau hirdymor sydd eu hangen i gyrraedd targedau lleihau carbon. Ond mae'r llywodraeth o'r farn y bydd modd lansio'r cynllun yn ystod hydref 2012 ac mai dyma'r cyfle gorau sydd ar gael i wella effeithlonrwydd ynni cartrefi Prydain. Bydd yr ymatebion i'r ymgynghoriad a'r is-ddeddfwriaeth yn cael eu cyflwyno erbyn gwyliau haf y senedd, felly rhaid disgwyl tan hynny cyn gweld beth yn union fydd dyfodol strategaeth y Fargen Werdd.

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## Introduction

This paper will examine the new Green Deal strategy with a focus on the implications for consumer take-up in a rural part of Wales. The Cambrian mountains has an above average number of older and harder to heat homes spread out across a large low-populated area. This will make some elements of the Green Deal more specific to this area.

This paper is split into several sections. Firstly there will be a general introduction to the Green Deal and an examination of some of the more consumer focussed elements of the strategy. Then more information will be provided on the specifics of the 'ECO' (Energy Company Obligation) element of the Green Deal which could be relevant to a large number of homes in this area.

Financial issues will be examined given the innovative way that Green Deal improvements will be repaid. There will then be an examination of the housing stock in the Cambrians area. This information will be used to create the eight Green Deal scenarios which are available to view in Appendix 2.

The final two sections will look at ways in which the Green Deal could be promoted and what the next steps are before the launch in Autumn 2012.

## What is the Green deal?

The Green Deal is the UK government's forthcoming programme to reduce the energy footprint of buildings through a nationwide retrofitting programme. It aims "to revolutionise the energy efficiency of both British residential and commercial properties" and is being hailed by the government as:

*"the biggest home energy programme of modern times." (Barker 2012b)*

The coalition government's Energy Act 2011 laid the foundations for the Green Deal and it is expected to launch in Autumn 2012. Alongside this a new 'ECO' (or energy company obligation) will begin to replace existing energy efficiency schemes such as CERT and CESP. The government expects the scheme to create up to 250,000 new skilled jobs (Warmzone 2011).

The UK Green Building Council have hailed the Green Deal as a:

*"once-in-a-generation chance to reduce carbon emissions, improve the fabric of our homes and workplaces and create potentially hundreds of thousands of new jobs." (Jansen 2011)*

So why is this scheme being introduced now? One key reason is increasing fossil fuel costs. For decades the UK had access to its own cheap indigenous oil and gas sources but more recently the UK has become a net-importer of energy. Reducing the consumption of energy has therefore become increasingly important.

Furthermore, four million people in the UK currently live in 'fuel poverty'. This is defined by the scenario where a household is paying more than 10% of their income in fuel costs (Barker 2012a). This is a worsening problem and by 2015 the "average household will be fuel poverty if energy bills stay on their current path... Energy bills [have been] rising 6 times faster than incomes since 2004" (Davies 2012).

The current building stock is responsible for 43% of total emissions and as 85% of current houses are estimated to still be standing in 2050, retrofitting has been made a key part of the government's carbon reduction policy. Our 'addiction' to cheap energy since the industrial revolution has produced some of the 'leakiest housing stocks' in the world according to the Rocky Mountain Institute (Jansen 2011). 650,000 homes are going to have to be retrofitted in the UK every year to help achieve the UK's climate reduction targets.

The vision of the Green Deal by the Department of Energy and Climate Change (DECC) is “an innovative policy designed around consumers, a new open and dynamic market for businesses and investment driving economic growth.” DECC says this will result in

*“less carbon emissions, fewer families in fuel poverty and improved homes”*

This will be achieved in practise by householders taking out a long-term financial agreement to pay for energy saving improvements to the home; the repayments being less than the savings on the energy bill. The cost of the repayments will also be attached to the home not the individual.

Repayments over a long period of time removes the upfront cost which has previously been a huge to barrier to entry for home energy efficiency improvements (Curtis-Knight 2012). A behavioural study from the Cabinet Office also showed the issues of short-termism:

*“the human tendency to heavily discount future energy savings, coupled with the natural predisposition to focus on the short term... could limit people’s readiness to take action.”*  
Cabinet Office (2011)

The Green Deal will address this problem by making immediate tangible savings on energy costs.

So now we know some of the reasons behind the reasoning for the Green Deal, how is it going to work?

## A Green Deal Overview

The Green Deal is a process which involves nine main stages which can be viewed below in illustration 1 below:

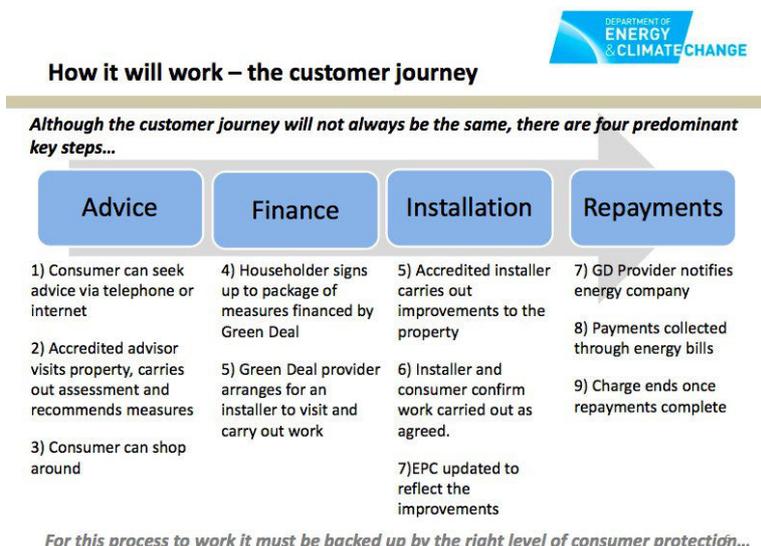


Illustration 1: DECC (2011)

Three key sections which are crucial to understand how the Green Deal differs from any previous government energy efficiency scheme are home assessment, types of energy efficiency measures and an explanation of the golden rule. These are examined in more detail below. Full details on the specifics of the Green Deal can be found on the DECC website ([www.decc.gov.uk](http://www.decc.gov.uk)) and also in 'The Green Deal: A summary of the Government's proposals' (DECC 2010).

### *Home Assessment*

The Green Deal Assessment (GDA) is perhaps the most important stage of the process as it will define which energy saving measures the house can have and will also be the first interaction for the householder with a representative of the scheme. The GDA will take place by an accredited trained advisor and use a modified version of rSAP software that is currently used to produce Energy Performance Certificates (EPC) (cutcarbon.info 2012). Information such as existing energy saving measures (eg. loft insulation, double glazing), type of house, floor space, occupancy levels are used to draw up an EPC and a list of measures that could be installed as part of the Green Deal.

As well as processing the computer based part of the assessment, the adviser will also explain to the householder how they might reduce their energy bills and to discuss other energy saving measures (even non-energy related measures such as how to save water). The customer will be given the list of measures that could potentially be installed in their home and are then free to shop independently to find providers to do the work.

### *Impartiality of the Assessment*

One of the key concerns raised in the Green Deal consultation was the issue of who Green Deal advisers will work for and how they will be paid. Some consumer organisations are pushing for advisers to only be able to work independently so the advice they produce is independent of any third party. The Centre for Sustainable Energy highlighted this in their response to the consultation, stating that:

*"there is nothing to stop that adviser from finishing the impartial assessment and then moving onto a hard sell. While customers will be made aware of the fact they can take their assessment results elsewhere, in practice many will be tempted to take up a solution that is provided to them there." CSE (2012a)*

They go on to mention that a large provider could offer the assessment at no upfront cost which an independent agent would financially not be able to afford to do; so an adviser working for a large energy company could be doing free assessments subsidised by the scale of their employer's business.

However it seems that perhaps working for a large vertically integrated business such as a large energy company may be the only way for assessors to make a living. Despite the Green Deal Advisor Association receiving assurances from DECC that they are investigating the best way of making sure that there is a requirement that advisers get paid for the work they do (Green Deal Advisor Association 2012), there is currently no definitive information on how a Green Deal Assessment will be paid for.

Worcester-Bosch (Hughes 2012) have also warned of the potential for 'rogue' Green Deal assessors who may inaccurately sell Green Deal packages pushing a specific technology. They worry Green Deal savings may be over-estimated by an assessor to clinch a deal.

Getting a property inspected correctly will determine the outcome of the whole process; it is vitally important that the best 'measures' are installed for the specific property being assessed. Which measures can be installed will all depend on them fitting the golden rule which will be examined next.

### *The Golden Rule*

The Golden Rule is a key feature of the Green Deal. Simply it means that the Green Deal charge must be lower than the estimated savings on energy bills. This will be based on the amount of energy typically used in a house and typically paid for a property of a certain type. This can be seen graphically in illustration 2 below.

As DECC point out in their blog, "the Golden Rule is not a guarantee that the charge will never exceed energy savings, nor that bills will never rise" (Green Deal Team 2011). They are proposing however that the Green Deal charge will be limited in the first year to the estimate provided by the assessment to give some stability to the householder.



*Illustration 2: The Golden Rule (www.actonenergy.org.uk)*

One issue with the figures used to calculate the golden rule is that they are based on an 'average' consumption use for a particular type and size of house rather than specifically tailored to the household being assessed (Green n.d.). This ultimately means customers could potentially pay back more than they are saving. As will be discussed later, there could be issues for future inhabitants of the same house if their energy usage or the composition of the household differs greatly from that at the time of the assessment.

In their paper, Wetherall and Hawkes (2011) discuss how SAP has proved very ineffective at predicting annual fuel usage as well as energy savings made through refurbishment. There are several issues they point out that the software assessment misses. Firstly that the 'rebound effect' means that energy improvements actually mean people just use energy differently and those in fuel poverty may just use as much energy but warm the house to a greater degree. Also

the number of occupants could be different to what SAP suggests, daytime occupancy is not assumed at all neither is the geographical location of the house. Different seasons and climates could make a big difference to energy usage especially in the mountains of Wales. In their consultation response, the CSE (2012a) were concerned that BREDEM and SAP consistently over-predict consumption, meaning that assessments may suggest that:

*“potential energy bill savings will be larger than those likely to be realised in practise.”*

Curtis-Knight (2012) suggests that the predicted savings will not be realised in practise and that the behavioural changes from the user might be more important than consumer changes. She points out a study from the Energy Saving Trust looking at the performance of heat pumps which found that only 13% in the trial achieved the expected level of performance. She goes on to point out that if the savings do not start to be realised then there will be disillusionment of the whole scheme. Early adopters are vitally important to the scheme as a whole and without positive feedback being passed onto friends and neighbours, the scheme may be dismissed by the millions who need to have their houses retrofitted.

DECC have said they are aware of this issue and are going to provide an advice leaflet about how to use less energy. They state that the Green Deal assessment is supposed to point out if a person under or over uses energy and how this might affect future Green Deal payments.

### *House sales*

One of the main issues with the scheme is when the property changes hands. As the energy efficiencies for a particular home are read in a standardised way, the new owner may end up paying for discrepancies for a long period of time if their usage of the house is different, meaning that the original installer is almost taking a “leap of faith” in installing the measures. Allen & York (2012) believe that this might reduce take up in the Green Deal.

Whether or not this will affect the saleability of the property is something that can't really be predicted. The government announced in March 2012 that if a Green Deal charge is paid off early (which may potentially happen to improve saleability of a house), the interest payments for any remaining years may have to be paid back (Hansard 2012).

### *Rental Property*

One problem with traditional rented properties is there is no incentive for the landlord to make the home more energy efficient as they are not seeing the benefits themselves. The Green Deal is different; the tenant can make a reasonable request for Green Deal measures and as long as the landlord agrees, the Green Deal can take place as described in the previous sections.

Furthermore, in order to improve the standards of rented property, the Government has inserted a clause in the energy bill to potentially legislate against renting out properties from 2018 which have lower than an E rating on the EPC energy ratings scale (Lockie 2012).

Whether tenants will want the inconvenience of house improvements while they are living in their property for a short period of time is unknown. This could be avoided by refurbishing the property in the periods between tenants. In this way, the landlord is free to install measures without the permission of any tenant. The costs of measures would legally have to be presented to the tenant when they view the property.

However as with the issue of selling a house with a Green Deal charge attached, the repayment cost must be attractive to the prospective tenant. How a Green Deal charge would be calculated without knowing anything about the occupants of the house is unknown at present (Roberts 2012). Furthermore it could be seen that tenants are paying for upgrades to the landlord's property, however on the flip-side, having a warmer, more efficient property should be a benefit for the tenants.

So as we have seen, the golden rule is the cornerstone of the Green Deal. Without adhering to the formula, measures can not be installed. The types of measures which could be included in a retrofit will now be examined.

### *What measures are included?*

The government has published a list of Approved Measures which can be part of the Green Deal (DECC 2011). This list can be seen in Appendix 1 on page 25. Inclusion on this list does not necessarily mean that the measure can be installed in a house as the golden rule or ECO subsidy still has to be adhered to. What is interesting is that alongside the 'usual' energy saving measures such as loft insulation, cavity walls and double glazing, there is also scope for improvements which generate energy. The government states that "if a measure is capable of paying for itself because occupiers use less energy as a result, then it can potentially qualify." (DECC 2011, p.4). It hopes that:

*"energy saving measures should be selected and installed in a 'whole building approach' which limits the trade interfaces and any potential disruption." (Lockie 2012)*

Some examples of these measures include 'innovative hot water systems', solar PV, micro CHP and solar thermal. One issue with these measures is that it appears to be impossible to make the measures fit the golden rule especially given a commercial rate of interest being used in the payback. The technologies are expensive and without any subsidy do not appear to pay back in the Green Deal period of a maximum of 25 years. There will be more discussion of this later.

However if a group of measures are installed as part of a Green Deal package, with one measure making a large energy saving at a low price (for example cavity wall insulation), it may mean that other measures could be installed at the same time. Another option is that the householder could pay upfront for some of the cost or arrange another loan outside of the Green Deal to make the remainder of the cost fit the golden rule. It will be interesting to see how the larger companies market this once the Green Deal appears.

Despite the potential for other funding options, one can only assume that some of the measures will need to be given a subsidy to work within the Green Deal. As this information is not yet available, the author has not used any examples of 'energy producing measures' in any of the scenarios listed later.

## **Other government strategies**

The government have stated that although the current FIT scheme will not be part of the Green Deal, there may be some interaction with forthcoming schemes such as the renewable heat initiative (RHI). This is currently under consultation and DECC have stated in a recent web-chat that although the interaction between the schemes is complicated, some RHI and micro-

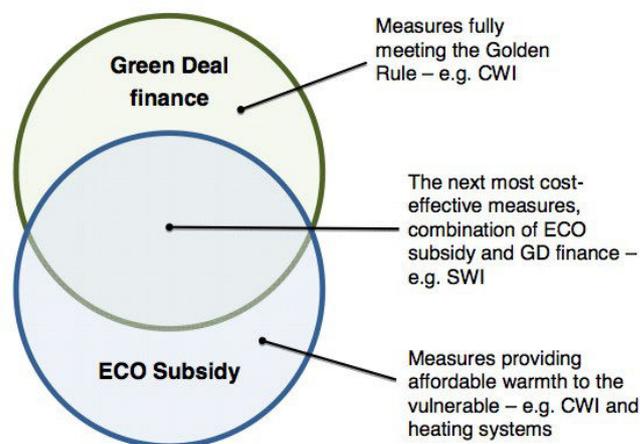
generation would indeed be eligible for Green Deal financing (DECC 2012).

There may be changes to building regulations in 2013 which may increase the take up of the Green Deal. The government is currently consulting on changes in 'Part L' of the regulations in March 2012. This may mean that householders will have to increase the energy efficiency of their property when making home improvements such as extensions or loft conversions (Building4Change 2012). For instance a house would have to have an energy performance certificate and then perhaps some Green Deal measures installed before these improvements could be built. One government source said that this could result in an extra 200,000 homes taking up the Green Deal scheme if it went ahead. The building press has called these changes 'another green tax' (BusinessGreen 2012).

## ECO and the Green Deal

As mentioned in the previous section, there are a host of measures which may not fit the golden rule as the financial savings they generate do not match the payback costs. The government is going to introduce a subsidy to address this issue. Known as the ECO (or 'Energy Company Obligation'), it is designed to be a mechanism to fix the "market failure" of certain measures not fitting the Green Deal. Around £1.3 billion a year will be paid by energy companies for 2 strands of the scheme: 'Carbon Saving' and 'Affordable Warmth'. These two ECO schemes will replace current subsidised schemes such as CERT which are running until the end of 2012.

The interaction between the Green Deal and ECO is shown below in Illustration 3:



*Illustration 3: ECO and the Green Deal (DECC 2010)*

The first element of ECO, Carbon Saving, should be open to all houses that fit the criteria. One of the key parts of the Green Deal is the need to retrofit existing homes. This means having to insulate those houses with solid walls. This is more of an issue in Wales as 37% of rural houses have solid walls compared to a quarter of those in England (Centre for Sustainable Energy 2006). Given up to 45% of heat is lost through walls, the Energy Saving Trust (EST) estimates that up to £475 could be saved yearly per household. However the cost of installing solid wall insulation could be £5000-£13000 meaning it would be unlikely to fit the golden rule even over a 25 year

payback period. An ECO subsidy should match the difference in cost and bring the savings within the scope of the golden rule. The government hopes that the ECO subsidy will drive innovation and reduce costs as more homes get this work done. Further details on ECO will be released in Summer 2012.

Element two of ECO is 'Affordable Warmth' which will be for low income and vulnerable households. This should be a subsidy for any of the measures mentioned in Appendix 1 to be installed. In effect, a Green Deal assessment will take place and a level of subsidy will be attached to the house to reduce the repayments. How this would then work if the current householders left the house and then were replaced by 'non-vulnerable' people is unknown at present.

The way that the ECO subsidies will be allocated is under consultation but the government favours an ECO brokerage. This effectively is a mechanism as per the carbon trading scheme which allocates ECO independently of the large energy suppliers such that they cannot disproportionately support their own Green Deal businesses and will enable independent and small companies to complete (Centre for Sustainable Energy 2012a).

There has been criticism from some quarters that ECO will not do enough to address fuel poverty. Monbiot (2012) believes that the current CERT scheme means the energy companies are paying out £2.4 billion a year whereas the ECO will only be £1.3 billion. In a strong attack on the Green Deal and ECO, he went on to describe the scheme as "a useless, middle-class subsidy." He believes that it transfers money from the poor to the rich and that the poorest 10% of the population will end up "spending a greater fraction of their cash on energy than if the Green Deal and ECO did not exist."

Furthermore he believes that the existing schemes such as CESP and Warm Front currently do more for the vulnerable than the Green Deal will. Greg Barker (2012b) refutes these claims, saying that "ECO is specifically designed to help the poorest and most vulnerable households." He believes that the Green Deal will address the problems with subsidised schemes of the past such as dishing out millions of free light-bulbs and will make genuine and long term savings.

The Committee on Climate Change (Turner 2012) also have their worries about the Green Deal and the levels of work that will be done. They point out that only 10% of the potential lofts and only 15% of potential walls will be insulated in their estimates. This is less than current schemes such as CERT.

## **Financing the Green Deal**

Two key components of the Green Deal are that there are no upfront costs to be paid and that the loan is attached to the property rather than the home-owner, landlord or tenant. This is the first time a loan scheme such as this has been used in the UK and the government hopes it will drive growth of the Green Deal. Others worry that a charge associated with the house may become a burden on the property as we will see later.

Once the Green Deal assessment has taken place and measures have been installed in accordance with the golden rule (or taking into account any ECO subsidies), a Green deal charge is then placed on the electricity bill of the house. The mechanisms for this are beyond the scope of this document, but it appears that a database will be managed by central government such that the householder is still free to switch electricity companies. Electricity bills were chosen over gas due to larger proportions of the population having electricity meters.

This does mean however that if a property is off-grid they will be unable to use Green Deal finance measures. However the government has stated that a 100% 'ECO' subsidised piece of work that doesn't involve Green Deal financing could still take place on these properties.

A Green Deal charge is comprised not only of the cost of the work done but can also include make good costs, unexpected costs, the cost of assessment and cash back of up to 5%. As this is a consumer finance charge, it is associated with all the safeguards that consumers are currently protected with when they take out a loan.

### *Interest Rates*

A key issue that has been raised with the Green Deal is the matter of interest rates. The golden rule does not only focus on a refurbishment cost but also has to include administration costs of the scheme and the interest payments (Killip 2012). These extra costs can make a big difference to the total price paid over 25 years. The government has said it does not currently deem it necessary to intervene in setting the rates of interest. They consider an average retail loan to be around 11% for the average consumer (DECC 2010) but point out however that as the loan is attached to an energy bill not the property, there is a relatively low likelihood of a customer defaulting so the average cost of finance should be lower than this.

However, independent market research for the 'Great British Refurb' suggested that only 7% would take up the Green Deal if the interest rate more than 6% (Warmzone 2011), whilst the environmental think-tank E3G suggests that charging "market rate loans" of around 8% is "not viable as consumers will not see enough benefits in savings to make up for the rates charged." They also calculated that even a good retrofit saving half the energy a year would not cover the costs for anything other than a heavily subsidised interest rate of 2%.

The author's own research suggested that each 1% increase in interest rates would need a 7% increase in efficiency improvements to meet the golden rule. So in simplistic terms, more of the savings made through energy efficiency savings are going to the provider of the loan rather than the householder as the interest rate increases. As mentioned earlier, the author has found it difficult to make golden rule calculations work with anything greater than than interest rate of 8%.

### *Alternative Finance Options*

Having a low interest rate seems essential for the success of the Green Deal. Similar schemes have been shown to work elsewhere when the cost of financing is low. In Germany, the government used it's own state-owned bank to offer loans at 2.65% for home retrofits plus a further direct government subsidy. The scheme has been popular with around 100,000 homes refitted each year. (Jansen 2011)

Transform UK want this scheme replicated in the UK with a near to zero interest rate using a Green Investment Bank and subsidies from the government. The German government's findings were that there would be not be a mass take up without subsidies, which asks the question why would the UK market be any different (Shankleman 2011)?

The 'Energy Bill Revolution' launched on 27<sup>th</sup> February called on the government to use the £4 billion it will raise in carbon taxes each year for the next 15 years to super insulate all UK homes.

They forecast this money would bring 9 out of 10 households out of fuel poverty. A grant of £6,500 could make 600,000 fuel poor homes energy efficient each year (Transform UK 2012).

One UK option for funding is the Green Deal Finance Company. The GDFC has been set up as a not-for-profit group of blue chip companies. The aim is to pool together loans made through the Green Deal, accessing capital and bond markets and driving down the interest rate from retail levels to around 6%. This may also mean that credit checks are not required and everyone can get loans at the same price (Wright 2011). Money may also be borrowed from the Green Investment Bank once it starts lending in a few years.

However as mentioned before, even 6% may be deemed too high for payments to meet the golden rule and the savings to the householder decrease as the interest rate rises. The opposition government has been putting pressure on the government as of March 2012 to make changes to how the Green Deal is calculated to increase the benefits for householders rather than finance companies (Berger 2012), stating that:

*"affordable interest rates are absolutely crucial in determining the success of the Green Deal."*

We will now look more specifically at the Green Deal in Cambrian mountains area.

## Housing in the Cambrians

The Cambrian Mountains area takes in parts of 3 counties in mid-Wales; Powys, Carmarthenshire and Ceredigion. Although statistics for the exact number of houses were not available for the actual Cambrian area, the following calculations have used the totals of the three aforementioned counties in which there are around 200,000 properties.



*Illustration 4: Cambrian Mountains Map*

As mentioned earlier, this part of Wales has a higher proportion of older houses than the UK average, with 10% of houses older than 1850 and just under 50% built before 1945 as can be seen in table 1 on the next page.

<b>Age of House</b>	<b>Number</b>
Pre 1850	20,096
1850 - 1899	27,386
1900 - 1918	24,222
1919 - 1944	15,291
1945 - 1964	37,294
1965 - 1974	26,271
1975 - 1980	9,478
1981 - 1990	14,606
1991 - 1995	7,175
1996 - 2002	11,831
Post 2002	6,206
<b>Total</b>	<b>199,855</b>

*Table 1: Average age of properties*

Older houses tend to have solid walls, use more energy and require upgrading to heat them sufficiently. This is reflected in these houses having lower SAP (Energy Performance Certificate) ratings (a lower value being worse). Before 1850, houses average an "F" (31) SAP rating compared to post 1990 which have "D" (64). Rural properties also tend to have lower ratings than urban areas: "F" (38) as opposed to "E" (54) (Statistics for Wales 2010).

	<b>Average SAP rating</b>	
	<b>2004</b>	<b>2008</b>
<b>Date of construction:</b>		
Pre 1850	28 (F)	31 (F)
1850 - 1899	41 (E)	40 (E)
1890 - 1918	46 (E)	46 (E)
1919 - 1944	43 (E)	47 (E)
1945 - 1964	45 (E)	52 (E)
1965 - 1974	47 (E)	53 (E)
1975 - 1980	50 (E)	55 (D)
1981 - 1990	55 (D)	57 (D)
Post 1990	61 (D)	64 (D)
<b>Total</b>	<b>46 (E)</b>	<b>50 (E)</b>

*Table 2: Average SAP rating by date of construction*

With help from Darren Hatton of the Statistics department of the Welsh Government and their Living in Wales study (Statistics for Wales 2010), data was compiled to examine the energy efficiency measures already installed in these properties.

It was found that 17,472 had no loft insulation and up to a third have not have their cavity wall insulation filled (Hatton 2012).

Another study considered what are known as 'hard to treat properties' in Wales (Centre for Sustainable Energy 2006). Hard to Treat properties are defined as having solid walls and no access to gas. The report showed a larger number of these properties in mid-Wales as compared to the rest of Wales. This can be seen in Table 3 below. Rural areas also tend to have more harder to treat properties than urban areas.

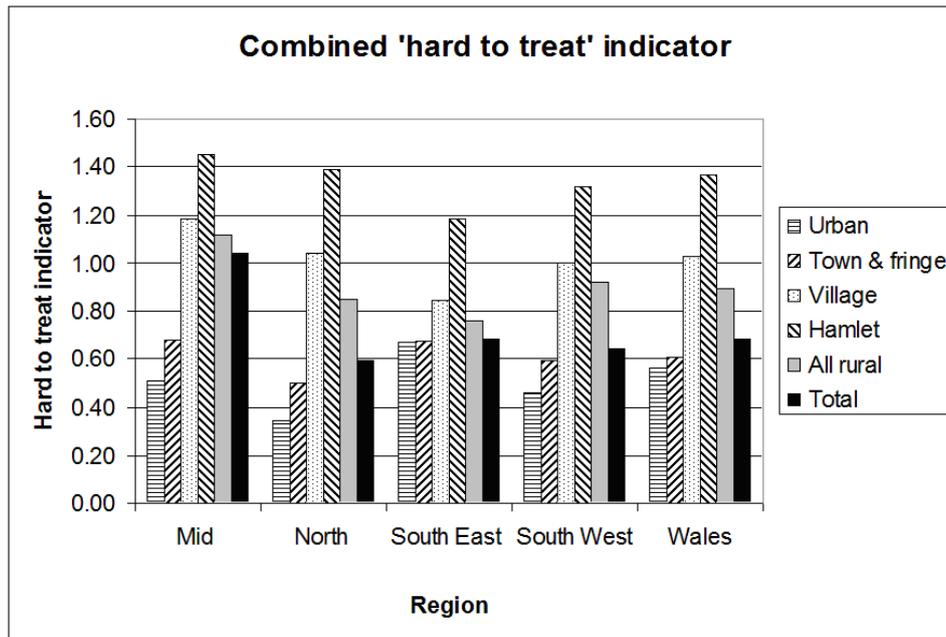


Table 3: Hard to Treat indicator

Llanidloes Energy Solutions (LLES) have surveyed over 200 houses in the Llanidloes area over the last few years. Although the results of these surveys are different to a standardised SAP assessment as will be used in the Green Deal, they do give some interesting results which are summarised below:

- 40% have insufficient loft insulation
- 31% have no draught-proofing on doors
- 30% have single glazed windows
- 25% have a boiler that is older than 15 years

These are all improvements that could be included as part of the Green Deal. So on the basis of the above studies it seems that measures mentioned earlier as part of the Green Deal and ECO would be extremely suitable to retrofit properties in the Cambrian mountains area.

## *Older Properties and the Green Deal*

How properties will be assessed and how the work is undertaken is crucial to a successful implementation of the Green Deal. This is especially important in older properties as retrofitting these properties is a highly skilled job.

In January 2012, RIBA (Royal Institute for British Architects) warned the Green Deal would fail at the first hurdle under present proposals. They demanded assurances that installations were done in an integrated way so as to not end up with “shoddy upgrades” (GreenWise 2012). The government have responded by commissioning British Standards to produce a new specification; PAS 2030:2012 - “improving the energy efficiency of existing buildings” which will assist installers in installing measures in accordance with the customer's expectations. This specification aims to be a good practise benchmark for installations.

The Country Land & Business Association responded to the Green Deal consultation with a strong attack on the methodology of the Green Deal (Thompson 2011). They think it should be about:

*“loft, cavity wall insulation, cylinder lagging and draught-proofing... and not about double glazing, bolt-on wind turbines, heat pumps and (in general) external wall insulation.”*

They believe the golden rule could be fudged by salesmen and worry that the Green Deal could be “as damaging as town centre redevelopments were in the 1960s.” The main issues they raised were around the Green Deal Assessment and that a standard computerised methodology such as that used for Energy Performance Certificates ignores thermal mass and other features of older houses, giving inaccurate results. They say that the software produces recommendations that are inappropriate for these buildings and that SAP measures need to be improved before Green Deal assessments begin such that they need to be aware of the benefits of heritage buildings. This is something that the government has said it will consider in its consultation response.

Finally in terms of development control such as planning permission, building control, listed building status, the Green Deal does not relax any of the red tape. Therefore any changes will have to go through the usual channels which may add time and cost to the process.

## **Example Scenarios for the Green Deal**

Creating a range of example scenarios was a challenge given that the author had no access to the existing rdSAP software which is currently used to produce Energy Performance Certificates nor any information on what changes to this software will be made for the Green Deal assessment. Having spoken to experts on the Green Deal, it was agreed that the only real way of creating example scenarios was to use existing calculations for specific energy efficiency technologies and make assumptions about all the other inputs.

So the first decision was to examine the breakdown of housing types in the area to decide which properties to look at. This chart can be seen in the table 4 on the next page. This data was then combined with the average ages of houses as displayed in table 1 on page 15 to derive eight example houses that reflect the majority of houses in the area. It was obviously not possible to give examples of every housing type so these were deemed to be representative.

Flat	9,112
End terrace	10,923
Mid terrace	28,510
Semi-detached	57,368
Detached	93,766
<b>Total</b>	<b>199,681</b>

*Table 4: Housing Types*

The eight house types/ages chosen were: Mid terrace (early 20<sup>th</sup> century), End terrace (19<sup>th</sup> century), Stone Cottage (18-19<sup>th</sup> century), Farmhouse (19<sup>th</sup> century), New Build (late 20<sup>th</sup> century), Semi-detached (early 20<sup>th</sup> century), Semi-detached (late 20<sup>th</sup> century), Flat (late 20<sup>th</sup> century)

The next stage was choosing particular measures to include in each of the properties. A range of web-based sources were used to find the potential energy and cost saving for each of the measures. Specific calculations were made for each property according to the size, age and type of building. The data was sourced from the following sites:

- CESP Carbon Scores - <http://t.co/A2DOLHYw>
- [www.energysavingtrust.org.uk/In-your-home](http://www.energysavingtrust.org.uk/In-your-home)
- <http://www.ggf.org.uk/energy-savings-calculator>
- [http://www.carbonindependent.org/sources\\_home\\_energy.htm](http://www.carbonindependent.org/sources_home_energy.htm)

The key measures that were installed for each property are listed below in table 5

<b>Property</b>	<b>Key measures</b>
Mid-terrace	Glazing, loft, draught-proofing
End-terrace	Loft, internal solid wall insulation
Stone Cottage	Loft, secondary glazing, boiler lag, thermo controls
Detached farmhouse	Boiler, loft insulation
New detached	Cavity Wall
Older Semi	External solid wall, double glazing, draught proof
Newer Semi	Boiler, heating, cavity

*Table 5: Measures for each property*

Another sticking point was the interest rate to use and the length of loan. Again no commercial information has been released to say what interest rates may be used or indeed any other incentives. Therefore a range of rates from 2% (where it was assumed this was from a credit union) to 9% were used.

The table below shows the key financial calculations for each property. For specific costings for each of the measures, the eight example scenarios can be found in Appendix 2

<b>Property</b>	<b>Yearly energy Usage (kWh)</b>	<b>Savings Estimate (£)</b>	<b>Green Deal Charge (£)</b>	<b>Payback Years</b>	<b>Interest Rate %</b>
Mid-terrace	14000	£27	£25.88	25	6
End-terrace	10000	£35	£35	25	5
Stone Cottage	19000	£21	£14	10	8
Detached farmhouse	22000	£28	£20	25	8
New detached	30000	£16	£8.30	5	9
Older Semi	19000	£46	£44.50 (ECO)	25	8
Newer Semi	23000	£44	£20.00	25	7
Flat	8000	£13.75	£9.40	25	2

*Table 6: Financial information for the 8 scenarios*

The scenarios show that there are a range of measures that can be installed into these example homes if slightly lower than typical commercial loan rates are assumed. As can be seen above the difference between estimated savings and the Green Deal charge is general quite small. If this is the case in a real assessment, it is questionable whether people will consider it a benefit to have work done for such a small financial saving.

In terms of interest rates, for measures where the monthly savings are not great, a lower interest rate would allow more measures to fit into the 'golden rule' so it will be interesting to see what rates of interest will be. Also as we have seen, surveys have shown that consumers are unlikely to take out Green Deals with higher interest rates.

It was found that that the greatest savings could be made using 'traditional' cheap methods of insulating roofs, draught-proofing and filling cavity walls with less savings from more expensive options. It is a worry that these are the measures that have been offered at very low cost or even freely in the past, so whether people will now consider having the work done with a cost attached is questionable.

However when considered in terms of a "whole-house retrofit" with a package of measures and the opportunity to improve your home, more people may be interested in taking up the Green Deal. The marketing of the Green Deal is therefore going to be important as we will see later.

## **Local Opportunities**

Given the scale of retrofitting a large majority of the nation's housing stock, there are potential benefits for local businesses from Green Deal advisers, installers and suppliers of materials such as local builders merchants. However there are worries from small and medium enterprises (SMEs) that the Green Deal favours "vertically integrated national businesses that will dominate." (Builders' Merchants News 2012). Currently businesses such as Tesco and B&Q appear to be building up for the launch of the Green Deal whilst it is very difficult for smaller businesses to get a foothold. In informal discussions with businesses in the area, the author has found little knowledge about the Green Deal and how it may help local businesses.

One example of non-multinational businesses attempting to create a viable model for the Green Deal is the alliance between the Severn Wye Energy Agency and the Centre for Sustainable Energy (CSE) (Centre for Sustainable Energy 2012b). What they call the “Green Deal Local Incubator” is the idea of a social enterprise which aims to involve more local businesses in the Green Deal process and also engaging the community. By integrating local councils, community groups and builders they hope to create a model which could easily be transferred across the country and potentially compete with larger business models. The reason for this is given by Phillip Morris from the CSE:

*“What worries us is that this Government scheme, with its heavy regulatory framework, extensive accreditation systems and innovative financing mechanism, is designed to suit the big players: the energy utilities, major retailers and large insulation and property service companies.” (Centre for Sustainable Energy 2012b)*

He also thinks that the success of the Green Deal will ultimately depend on communities seeing local organisations which are generally more trusted doing the work and helping to reinforce changes in low-carbon behaviours; something he doesn't think can happen with a large anonymous big business. This viewpoint is shared by Simon Steedan who believes that local authorities and community groups are the key to making the Green Deal work in the fact that they are 'trusted advocates' in the community as opposed to large energy companies (ClickGreen 2012).

In terms of the Cambrian mountains area, it is a very sparse region which traditionally has retained many independent shops and businesses (compared to large populated areas). Given that community links are still strong, there is an opportunity for local businesses to take some of the work but the government must do more to provide information on how the Green Deal will work for them.

## **Promoting the Green Deal**

Although a discussion of behavioural science is beyond the scope of this document, it is important to consider the reasons why people might sign up for the Green Deal. Barker (2012b) says that the Green Deal should be “bling not boring.” He points out also the people are always wanting to “improve their homes, even in times of austerity.” E3G believe that driving demand should focus on the 15% of innovators who will “make the market” rather than just a general launch (Holmes 2011). This fits in with positive word-of-mouth driving the market, once neighbours hear about a scheme that can upgrade your home without any upfront costs there may then be an increase in interest around the scheme.

Behavioural studies may be just as important as the actual installation. Hopwood (2012) examined work by Newcastle City Council looking at the attitudes and beliefs of households. By using the words 'comfort', 'warmth' and 'get snug' on a leaflet rather than the usual messages such as 'reducing CO2' and 'saving the planet' had the highest take up. So it may be important to focus on how the retrofit could “modernise your home”.

Currently, the UK government are not directly promoting the Green Deal, preferring to leave that to the free market. They have however announced financial benefits to get early adopters to sign up. In November 2011, £200 million of government money was committed to encourage early adoption of the scheme (Carrington 2011). Although how this money would be spent is still unknown, a payment of up to £150 can be given as cash-back. Other methods that Carrington thinks could be used to promote the Green Deal are “discounts on council tax, cuts to stamp duty when house is sold or further cash-back offers.” We will have to wait and see what the government opts to do to push the Green Deal message.

## **What Happens Next**

As of the end of March 2012, there are concerns that the Green Deal will be delayed until later than the expected October launch (Gardiner 2012). However the government has stated that the secondary legislation and responses to the consultation will happen before the parliamentary Summer recess and there will be a launch in Autumn 2012. There are also worries that the six largest energy companies may not have the infrastructure in place to take Green Deal charges at the launch. There may now be a change in how the launch happens with DECC confirming that a “soft-launch” may take place rather than a complete roll-out.

## **Conclusions**

The Green Deal will offer a completely new way of funding retrofit improvements on UK housing with an emphasis on ensuring the cost of the paybacks will be greater than the energy costs would have been. How the Green Deal will work how been examined including the main mechanisms of the scheme from the point of view of the householder. This includes the assessment, golden rule calculations and which measures may be included. A closer examination of the housing stock of the Cambrians shows that the Green Deal could have benefits for the housing stock with the caveats that more needs to be done to ensure that the unique characteristics of older properties are understood whilst assessments and upgrades take place.

There is insufficient information to make a complete judgement on how every part of the scheme will actually work given that the government's consultation response has not yet been published. Therefore despite creating a set of example scenarios of how the Green Deal may work there may be differences when the Green Deal launches in terms of applicable measures, interest rates, payback times and other costs.

Despite all the above issues, the government is optimistic that when the scheme does launch it will offer the best opportunity of a generation to sort out the problems with the UK's housing stock. To see whether it is right we will have to wait and see what happens in the months and years to come.

## References

- Allen & York, 2012. Advantages and Disadvantages of the Government's Green Deal. Available at: <http://allenandyork.wordpress.com/2012/02/24/advantages-and-disadvantages-of-the-governments-green-deal/> [Accessed February 28, 2012].
- Barker, G., 2012a. Green Deal will take energy efficiency from boring to bling. Available at: <http://www.businessgreen.com/bg/opinion/2156006/greg-barker-green-deal-energy-efficiency-boring-bling> [Accessed February 29, 2012].
- Barker, G., 2012b. The Green Deal will be the biggest home energy programme of modern times. *the Guardian*. Available at: <http://www.guardian.co.uk/environment/2012/jan/17/green-deal-home-energy> [Accessed February 28, 2012].
- Berger, L., 2012. Opposition delivers four-point plan to sort out the Green Deal chaos. *Clickgreen*. Available at: <http://www.clickgreen.org.uk/opinion/opinion/123347-opposition-delivers-four-point-plan-to-sort-out-the-green-deal-chaos.html> [Accessed March 25, 2012].
- Builders' Merchants News, 2012. MP George Freeman hears supply chain fears on the Green Deal. Available at: [http://www.buildersmerchantsnews.co.uk/news/fullstory.php/aid/5519/MP\\_George\\_Freeman\\_hears\\_supply\\_chain\\_fears\\_on\\_the\\_Green\\_Deal.html](http://www.buildersmerchantsnews.co.uk/news/fullstory.php/aid/5519/MP_George_Freeman_hears_supply_chain_fears_on_the_Green_Deal.html) [Accessed February 28, 2012].
- Building4Change, 2012. Homeowners could be asked to include green measures when making home improvements. Available at: <http://www.building4change.com/page.jsp?id=1141> [Accessed February 28, 2012].
- BusinessGreen, 2012. Householders 'could be forced to green their home' when building extensions. *the Guardian*. Available at: <http://www.guardian.co.uk/environment/2012/feb/01/green-deal-building-extensions> [Accessed February 28, 2012].
- Cabinet Office, 2011. Behaviour Change and Energy use. Available at: <http://www.cabinetoffice.gov.uk/resource-library/behaviour-change-and-energy-use> [Accessed March 17, 2012].
- Carrington, D., 2011. Treasury injects £200m cash into home insulation 'Green Deal'. *the Guardian*. Available at: <http://www.guardian.co.uk/environment/2011/nov/24/treasury-200-million-green-deal> [Accessed February 28, 2012].
- Centre for Sustainable Energy, 2012a. CSE Green Deal consultation response. Available at: [http://www.cse.org.uk/downloads/file/CSE\\_response\\_to\\_green\\_deal\\_consultation.pdf](http://www.cse.org.uk/downloads/file/CSE_response_to_green_deal_consultation.pdf).
- Centre for Sustainable Energy, 2006. Identifying and Mapping Hard to Heat Homes. Available at: [http://www.ruralfuelpoverty.org.uk/rural/downloads/Identifying\\_and\\_Mapping\\_HTHs\\_Freport.pdf](http://www.ruralfuelpoverty.org.uk/rural/downloads/Identifying_and_Mapping_HTHs_Freport.pdf).
- Centre for Sustainable Energy, 2012b. The Green Deal. Available at: <http://www.cse.org.uk/pages/information/local-authorities/the-green-deal> [Accessed February 28, 2012].
- ClickGreen, 2012. Community groups are key to Green Deal success, expert argues. Available at: <http://www.clickgreen.org.uk/opinion/opinion/123211-community-groups-are-key-to-green-deal-success,-expert-argues.html> [Accessed February 28, 2012].
- Curtis-Knight, L., 2012. The Green Deal - The importance of Behaviours. *The Discovery Mill*. Available at:

<http://www.thediscoverymill.co.uk/the-green-deal-the-importance-of-behaviours-2/> [Accessed February 28, 2012].

cutcarbon.info, 2012. Common Minimum Technical Competencies for Green Deal. Available at: [http://cutcarbon.info/green\\_deal\\_cmtc](http://cutcarbon.info/green_deal_cmtc) [Accessed February 28, 2012].

Davies, R., 2012. Marches Sustainable Houses Partnership: Update.

DECC, 2012. DECC Green Deal and ECO Consultation webchat. Available at: <http://www.decc.gov.uk/assets/decc/11/tackling-climate-change/green-deal/4041-decc-green-deal-and-eco-consultation-webchat-thur.pdf>.

DECC, 2010. The Green Deal: A summary of the Government's proposals. Available at: <http://www.decc.gov.uk/assets/decc/legislation/energybill/1010-green-deal-summary-proposals.pdf>.

DECC, 2011. What measures does the Green Deal cover? Available at: [http://www.decc.gov.uk/assets/decc/what%20we%20do/supporting%20consumers/green\\_deal/1734-what-measures-does-the-green-deal-cover.pdf](http://www.decc.gov.uk/assets/decc/what%20we%20do/supporting%20consumers/green_deal/1734-what-measures-does-the-green-deal-cover.pdf).

Gardiner, J., 2012. Industry fears government timetable for Green Deal may slip. Available at: [http://www.building.co.uk/technical/sustainability/sustainability-news/industry-fears-government-timetable-for-green-deal-may-slip/5032391.article?utm\\_source=Building&utm\\_medium=Twitter&utm\\_campaign=Feed:+BreakingNewsFromBuilding+\(BLDG+|+Breaking+news\)](http://www.building.co.uk/technical/sustainability/sustainability-news/industry-fears-government-timetable-for-green-deal-may-slip/5032391.article?utm_source=Building&utm_medium=Twitter&utm_campaign=Feed:+BreakingNewsFromBuilding+(BLDG+|+Breaking+news)) [Accessed February 28, 2012].

Green Deal Advisor Association, 2012. Green Deal Advisor Association works to ensure that sdvisors will be paid. Available at: <http://www.gdaa.org.uk/Press5.html> [Accessed February 28, 2012].

Green Deal Team, 2011. The Golden Rule. Available at: <http://blog.decc.gov.uk/2011/12/22/the-golden-rule/> [Accessed February 28, 2012].

Green, J., The Green Deal's 'golden rule' has lost its shine. *Which? Conversation*. Available at: <http://conversation.which.co.uk/energy-home/green-deal-chris-huhne-energy-efficiency/> [Accessed February 28, 2012].

GreenWise, 2012. RIBA and UKERC weigh in with 'serious concerns' about Green Deal. Available at: <http://www.greenwisebusiness.co.uk/news/riba-and-ukerc-weigh-in-with-serious-concerns-about-green-deal-2972.aspx> [Accessed February 28, 2012].

Hansard, 2012. *House of Commons Hansard Written Answers for 19 Mar 2012 (pt 0001)*, Available at: <http://www.publications.parliament.uk/pa/cm201212/cmhansrd/cm120319/text/120319w0001.htm#12031933000086> [Accessed March 25, 2012].

Hatton, D., 2012. Housing Types.

Holmes, I., 2011. Financing the Green Deal. Available at: <http://www.e3g.org/programmes/systems-articles/financing-the-green-deal/>.

Hopwood, T., 2012. How selling comfort and warmth can encourage more homeowners to insulate. *green alliance blog*. Available at: <http://greenallianceblog.org.uk/2012/03/12/how-selling-comfort-and-warmth-can-encourage-more-homeowners-to-insulate/> [Accessed March 16, 2012].

Hughes, E., 2012. Worcester Bosch warns of rogue Green Deal assessors. *Solar Power Portal*. Available at: [http://www.solarpowerportal.co.uk/news/worcester\\_bosch\\_warns\\_of\\_rogue\\_green\\_deal\\_assessors\\_5478/](http://www.solarpowerportal.co.uk/news/worcester_bosch_warns_of_rogue_green_deal_assessors_5478/) [Accessed February 28, 2012].

Jansen, M., 2011. Tesco and B&Q join interest in 'Green Deal' to insulate homes. *The Ecologist*. Available at: [http://www.theecologist.org/News/news\\_analysis/708566/tesco\\_and\\_bq\\_join\\_interest\\_in\\_green\\_deal\\_to\\_insulate\\_homes.html](http://www.theecologist.org/News/news_analysis/708566/tesco_and_bq_join_interest_in_green_deal_to_insulate_homes.html) [Accessed February 28, 2012].

Killip, G., 2012. Beyond the Green Deal: Market Transformation for low-carbon housing refurbishment in the UK.

Lockie, S., 2012. The Green Deal – just how green a deal is it? Available at: <http://www.fgould.com/uk/research-and-features/article/green-deal-just-how-green-deal-it/> [Accessed February 28, 2012].

Monbiot, G., 2012. The Green Deal is a useless, middle-class subsidy. *the Guardian*. Available at: <http://www.guardian.co.uk/environment/georgemonbiot/2012/jan/13/green-deal> [Accessed February 28, 2012].

Roberts, M., 2012. Could void properties hold the key to Green Deal success? *the Guardian*. Available at: <http://www.guardian.co.uk/housing-network/2012/feb/21/void-properties-green-deal> [Accessed February 28, 2012].

Shankleman, J., 2011. Will low cost loans ensure Green Deal abides by its golden rule? *Business Green*. Available at: <http://www.businessgreen.com/bg/opinion/2111305/low-cost-loans-ensure-green-deal-abides-golden-rule> [Accessed February 28, 2012].

Statistics for Wales, 2010. Living in Wales 2008: Energy Efficiency of Dwellings. Available at: <http://wales.gov.uk/docs/statistics/2010/101126sdr2042010en.pdf>.

Thompson, J., 2011. Green deal and older properties. Available at: [http://www.cla.org.uk/Policy\\_Work/Consultation\\_responses/Heritage/Heritage/1008321.htm/](http://www.cla.org.uk/Policy_Work/Consultation_responses/Heritage/Heritage/1008321.htm/).

Transform UK, 2012. Energy Bill Revolution Begins. Available at: <http://www.transformuk.org/en/articles/930/27th-february---energy-bill-revolution-begins/> [Accessed February 28, 2012].

Turner, A., 2012. Proposals for the Green Deal / Energy Company Obligation.

Warmzone, 2011. The Green Deal: Overview and training/skills implementation.

Wetherell, S. & Hawkes, J., 2011. *Are SAP based assessments an accurate way of predicting the energy savings made through refurbishment?* University of East London.

Wright, A., 2011. The Green Deal explained. *Yougen*. Available at: <http://www.yougen.co.uk/blog-entry/1766/The+Green+Deal+explained/> [Accessed February 28, 2012].

## Appendix 1: List of Measures available for the Green Deal

<b>Box 4: Measures<sup>1</sup></b>	
<b>Heating, ventilation and air conditioning</b>	<ul style="list-style-type: none"> <li>Condensing boilers</li> <li>Heating controls</li> <li>Under-floor heating</li> <li>Heat recovery systems</li> <li>Mechanical ventilation (non-domestic)</li> <li>Flue gas recovery devices</li> </ul>
<b>Building fabric</b>	<ul style="list-style-type: none"> <li>Cavity wall insulation</li> <li>Loft insulation</li> <li>Flat roof insulation</li> <li>Internal wall insulation</li> <li>External wall insulation</li> <li>Draught proofing</li> <li>Floor insulation</li> <li>Heating system insulation (cylinder, pipes)</li> <li>Energy efficient glazing and doors</li> </ul>
<b>Lighting</b>	<ul style="list-style-type: none"> <li>Lighting fittings</li> <li>Lighting controls</li> </ul>
<b>Water heating</b>	<ul style="list-style-type: none"> <li>Innovative hot water systems</li> <li>Water efficient taps and showers</li> </ul>
<b>Microgeneration</b>	<ul style="list-style-type: none"> <li>Ground and air source heat pumps</li> <li>Solar thermal</li> <li>Solar PV</li> <li>Biomass boilers</li> <li>Micro-CHP</li> </ul>

Source: DECC 2011

## **Appendix 2: Example Scenarios**

These are included on the following pages and take in the following 8 housing types:

- *Mid Terrace*
- *End Terrace*
- *Stone Cottage*
- *Detached Farmhouse*
- *New-build Detached*
- *Older Semi-detached*
- *Newer Semi- detached*
- *Flat*