Financing the Green Deal

Carrots, sticks and the Green Investment Bank

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Executive summary

> There is strong quantitative data linking public stimulus of energy efficiency investment to the 'crowding in' of private sector capital and subsequent catalysing of economic growth. At a time when the UK's growth forecasts have been downgraded, now could not be a better time to use public funds and institutions to stimulate growth in this market.

> The Green Deal energy efficiency policy is a flagship programme for the UK coalition Government. It aims to create a framework to enable households and smaller business to make energy efficiency investments with no upfront cost. Critically it attaches loans to the property not the individual – and so enables loans to be transferred to the new occupier in the event a property is vacated before the loan is fully repaid. Successful roll out of this programme is critical to delivering the UK's ambitious carbon targets. However, there is significant doubt over whether it will deliver an ambitious retrofit programme as the policy stands.

> The policy outcomes/goals are unclear: no detail has been provided on expected market size or annual rate of retrofits to be achieved for example. There is also a lack of detail on how demand will be driven, beyond the basic finance mechanism and an as yet undefined role for an unspecified level of subsidy in parts of the market.

> Under the policy framework there are therefore significant risks that consumer demand for Green Deal programmes will be low. The economics of energy efficiency retrofits at today's energy prices are not attractive – there is a significant gap between project returns and the cost of borrowing, even at Government rates. E3G analysis indicates that even quite modest Green Deal retrofits will require significant support from subsidies to meet the Green Deal 'golden rule' of being able to pay for improvements from current savings. For example, if the subsidy was used to reduce the interest rate, a 25 year loan would need to be offered at an interest rate of 2% or less compared to commercial rates of 8% or more.

> However there should not be a one-size-fits-all approach to stimulating demand. Nor should there be a focus on driving mass demand from day 1. Instead efforts should be focused on driving demand among the 15% of the population who are innovators and will 'make the market'.

> These innovators will come from a variety of income groups – and a range of approaches will be needed to incentivise them to act, depending on income level. For higher income households, cash-backs should be considered. For middle income households, upfront grants worth 40% or more should be considered alongside long term Green Deal loans; for low income households upfront grants worth 55% or more should be considered alongside long term Green Deal loans.

> Consideration should also be given to linking the depth of retrofit to the level of subsidy provided – in order to drive the market toward whole-house retrofits.

> In the longer term, and in the absence of much higher energy prices, regulation will need to be considered to drive demand. Research carried out on behalf of the Committee on Climate Change indicates 30% of households ('laggards') would not install energy efficiency measures even if they were free of charge. There are also significant structural problems in the rental sector that mean landlords have low incentives to improve energy efficiency. Thus to successfully drive a large scale market for 'wholehouse' retrofits, additional regulation must also be considered.

> The marked gap at today's energy prices between returns that can be expected from Green Deal investments and the costs of borrowing even at low sovereign rates means it is debateable whether there is any initial role for private finance to play in sourcing up front capital for the Green Deal.

> Instead, while energy prices are relatively cheap the Green Investment Bank (GIB) is the most obvious provider of low cost up front capital. The expectation is that the GIB will enjoy quasi-sovereign AAA or AA borrowing rates and that it will be focused on addressing market failures and making modest returns rather than maximising profit. For these reasons it should be able to provide lower cost capital compared to the private sector, which will minimise the level of subsidy required to drive demand for the Green Deal. Relying on commercial provision of upfront capital for the Green Deal will either make the loans uneconomic for the householder or simply increase the amount of subsidy required to make the economics of Green Deal investments work.

> However this will not always be the case since energy prices will rise. Thus a phased approach should be taken to the provision of upfront capital for the Green Deal.

> In Phase 1, an era of relatively low energy costs, where a large amount of subsidy is required to make investments attractive, the GIB should be used to source upfront capital for the Green Deal. This would be on lent to householders, for a fee, via third-party finance providers who act as agents contracted to disburse loans on behalf of the GIB but do not take on any of the risk. Loans warehoused by the GIB could be used to grow its balance sheet and build a track record.

> In Phase 2, as rising energy costs close the gap between project returns and the cost of borrowing, there should be a transition to the private sector financing the Green Deal. Existing Green Deal loans could be sold on as Green Deal securities, enabling the GIB to exit its positions and recycle capital into other investments. The combination of the GIB being perceived as an honest broker, the data accumulated on the performance of Green Deal loans, and the use of transparent structuring (simple low risk senior and higher risk junior tranches) should be enough to overcome any initial scepticism to such products so that appetite is created in the market for these securities.

> In Phase 3, the GIB should step away to enable the private sector to fund the Green Deal on a fully commercial basis as market failures will have been addressed at this point.

1. The energy efficiency challenge

The very significant contribution to UK carbon emissions made by the building stock (40% overall)[1] means it is widely accepted that an ambitious programme of energy efficiency retrofits is a pre-requisite for the UK meeting its 2020 and 2050 carbon targets. This need to meet carbon targets is augmented by increasing concern about energy security, rising energy costs and the fact UK households and businesses waste £3bn per year on energy[2] – so that delivering an ambitious energy efficiency programme has become one of the top priorities for the UK coalition Government. The new "Green Deal" policy framework aims to address a legacy of poorly insulated housing stock and rising fuel poverty as well as climate and energy security concerns. Estimated to create 100, 000 jobs over the next 5 years, the programme is described by the Secretary of State as a "once-and-for-all refit that will make every home in Britain ready for a low-carbon future"[3]. This level of political ambition supports the 2009 recommendations of the UK's Committee on Climate Change, which noted there needs to be a step change in delivery of energy efficiency and that a whole house approach retrofitting should be used[4]. Estimates vary, but the cost of significantly upgrading the energy efficiency of the UK's housing stock could be in the region of £7bn–£11bn per year over the next 15 years[5], a major ramp up from existing investment of £1–2bn per year[6].

However, there is significant doubt over whether the Green Deal framework will deliver an ambitious retrofit programme for two reasons: concerns over levels of demand; and concerns over whether low cost upfront capital will be forthcoming.

[1]The UK housing stock is responsible for 25% of UK carbon emissions, with non-domestic buildings accounting for a further 15% of UK emissions.
[2]DECC (2010) Green Deal Summary proposals
[3]Speech by The Secretary of State 21 September 2010 at http://www.libdems.org.uk/news_detail.aspx?title=Chris_Huhne:_Green_Deal_will_be_a_revolution_&pPK=88186f4a-e1d5-4b34-9fc9-83cff3bf195d
[4]Committee on Climate Change (2009) Meeting the Carbon Budgets: the need for a step change notes there should be a whole house approach involving an energy audit with a follow up package including installation and financing.
[5]The Secretary of State announced £7bn would be invested by the private sector per annum in the Green Deal. This seems on the low side, given the scale of retrofits required. In 2009 the Sustainable Development Commission estimated in 'A Sustainable New Deal' that £11bn per year would be required. For the purposes of this paper, however, we use the more conservative figure of £7bn per year.
[6]Most of the recorded investment has been subsidy-based not private spending. The Government's Carbon Emission Reduction Target (CERT) is costing £5.5bn over 2008–2012, subsidised by consumers via the energy suppliers. For private sector spending, as an indicative figure, the EEC2 programme stimulated £1.1bn in private investment - from Eoin Lees Energy (2008) Report to DECC: Evaluation of the Energy Efficiency Commitment 2005-08.

2. The Green Deal Proposals: moving UK energy efficiency policy forward

The UK has a track record of low demand for energy efficiency retrofits compared to the energy saving opportunities available. The traditional approach to overcoming this has been to apply subsidies. To date the Government's Carbon Emission Reduction Target (CERT) programme – subsidised by £5.5bn in funds from energy suppliers – has saved 169 Mt CO2 emissions reductions (58% of the current target of 293 Mt CO2). However, despite programmes such as CERT and its several predecessors including the Energy Efficiency Commitment Parts 1 and 2 (EEC 1 and EEC2) a large commercial market for energy efficiency has not emerged. This is because energy efficiency suffers from multiple market failures, which the new Green Deal policy must address if an ambitious "once and for all retrofit programme" is to be created.

The Coalition Government acknowledges that intervention is needed to correct market failures and overcome the financial and behavioural barriers to wider energy efficiency uptake[7]. The Energy Security and Green Economy Bill, which will implement a statutory framework for the Green Deal, is currently going through the legislative process, which is expected to be completed by Autumn 2011. The Government states the purpose of this Bill is to drive a step change in the provision of energy efficiency retrofits to homes and businesses by tackling barriers to investment in energy efficiency. Measures include:

> The Green Deal financing mechanism – a loan facility attached to the property not the householder, which could last as long as 25 years, that enables efficiency improvements to be funded with no upfront costs and repaid via a charge on energy bills. It also enables the charge to be passed onto the next owner occupier or tenant in the event a householder moves – since liability for loan repayment will sit with the person who pays the energy bill;

    - Critically the Government has specified that the Green Deal charge should be less than the repayment cost resulting from installation of the measure –the Green Deal 'golden rule' – thereby driving demand;

> A requirement for energy suppliers to collect Green Deal payments and pass them onto the finance provider;

> A Green Deal accreditation regime for assessors and installers;

> A new Energy Company Obligation (ECO) from 2012 – some form of financial contribution from energy companies which could be used to "underpin the Green Deal";

> Enabling powers to mandate the upgrade of the lowest rated properties (EPC Bands F and G) in the private rented sector if required;

[7]DECC (2010) Energy Bill 2010 Impact Assessment

> Other measures including making data from Energy Performance Certificates more widely available and extending the time-limit on powers to implement and direct the roll-out of smart meters to November 2018.

The Government's Bill and the supporting Green Deal policy paper quite rightly identify and aim to address several of the most significant energy efficiency market failures, including the upfront costs of measures and access to capital, length of payback times and the hassle factor – including lack of reliable suppliers available to assist with planning and carrying out work[8]. But while the proposed Green Deal policy remedies will go some way to addressing these barriers, there is significant concern that they do not go far enough. In particular there is concern that the proposed Green Deal policy framework does not provide enough clarity on the level of ambition for the programme, likely annual uptake, or details on how demand for retrofits, and whole house retrofits in particular, will be created over what time period. The issue of how demand will be created is particularly critical. Without clarity on this, upfront finance is unlikely to be forthcoming at scale.

[8]DECC (2010) The Green Deal: A summary of the Government's proposals

3. Enhancing the Green Deal policy framework: driving demand

The Government considers that the Green Deal 'golden rule', i.e. that consumers will save more on their energy bills than they repay in loan costs, and the fact the responsibility for continuing repayments falls to a new householder once a property is vacated, should be sufficient to drive demand for energy efficiency. However, market research commissioned by the Great British Refurb Campaign indicates that although the Green Deal is attractive to consumers as a concept, mass demand will be contingent on a number of issues including the financial package being attractive and including elements of subsidy[9].

E3G analysis reinforces this finding and indicates that at *today's* energy prices and at *commercial* interest rates, this 'golden rule' cannot be met for a 25-year loan. This is due to the gap between project returns based on current energy prices and the cost of borrowing – a gap that can only be met if substantive subsidies are applied. The Government understands the need to use subsidy to support investments in hard to treat properties as well as investments by poorer households, but clarity on how the proposed new ECO subsidy regime will address the gap, for how long and at what level are urgently required. In addition, E3G analysis indicates that subsidy will be needed for more modest investments by regular households too if an ambitious Green Deal programme is to emerge. If such support is not likely to be made available from the ECO, visibility must be provided on alternative sources of subsidy for this group.

Some of the omissions in the Green Deal policy framework reflect an only partial diagnosis of the barriers to driving greater uptake of energy efficiency to date. For example, access to capital is not a *universal* problem, but is an issue for less wealthy members of society. Equally important is the *opportunity cost of capital* – which means energy efficiency investments are competing with other more attractive spending opportunities such as new bathrooms, kitchens or cars. Further analysis of the barriers and implementation of more detailed policy remedies is required from Government. Only then will a policy framework emerge that is considered truly 'bankable' i.e. that creates an investment opportunity that meets the quite different needs both of householders and the providers of up front finance.

Three major barriers currently exist to delivering an ambitious retrofit programme – which are only partially addressed in the current Green Deal framework.

Access to capital (also known as high upfront cost) – The Green Deal aims to address this barrier in particular. But while it is often cited as a major barrier to energy efficiency uptake, it is not the whole story. For those that can afford them, savings or mortgage extensions and personal loans have long been a readily available option for providing upfront capital for energy efficiency investments. However they have not been utilised at any scale. E3G analysis

[9]Great British Refurb (2010) Green Deal – Public Appetite Market Research, which surveyed over 2000 UK adults found that 56% of respondents said they found the Green Deal attractive. However only 7% of respondents said they were prepared to take it up at a 6% interest rate.

indicates that the economics of retrofit projects could be attractive over the lifetime of the asset if loans are of short duration. For high income groups[10] therefore the focus for policy should be on undertaking market research to understand what level of incentive (perhaps as a cashback) may be required to persuade this group to invest in retrofits and designing an incentive programme around those findings. For middle and low income groups[11], however, access to capital is not the only issue − there is also a need to make upfront capital available at accessible cost.

The opportunity cost of capital − More significant than access to capital, perhaps, is the opportunity cost of capital. Energy efficiency struggles to compete with alternative investments. This is for two main reasons. First, demand is suppressed because a low value is placed on energy efficiency improvements. This in turn is driven by relatively cheap energy costs and the fact that energy efficiency is a fairly intangible asset, physically hidden and hard to quantify[12]. This can in part be addressed through better information and marketing of the benefits of energy efficiency. But it also means that closer attention needs to be paid to the potential returns from energy efficiency investment and the role that subsidies will need to play in the short term to ensure project economics stack up for consumers. Subsidies will also help address the second major barrier − the hassle factor: i.e. the disruption caused by major refurbishment and the perceived risks in implementing retrofits due to the complexity of projects and lack of familiarity with some of the technologies required. Subsidies will need to be set at such a level that the returns provided by retrofits to householders are attractive enough to overcome any downside and incentivise action. The alternative is the use of 'sticks' − i.e. requiring householders to invest. However regulation for the non-rented sector will be politically difficult to deliver unless technologies and markets are fairly mature. Additional measures can be deployed to 'ease' the hassle such as ensuring the consumer proposition is simple (promoting retrofits on a package rather than individual measures basis for example) and that measures such as the Government's proposed accreditation and verification schemes are in place to ensure a high quality market for retrofits is created.

Split incentives − Long-term Green Deal loans attached to the home and not the householder will address the split incentives issue arising from the fact average homeownership is only 10 years in the UK[13], and a full package of retrofit measures is likely to take much longer than that to pay back. But they don't address the split incentives arising when property is rented. Split incentives will only be fully addressed across the housing stock if energy performance becomes reflected in property value (in both the lettings and the sales market). This may happen naturally over time, as energy prices rise: in a scenario in which energy prices have doubled, energy efficiency investments look far more attractive. But a passive approach risks very slow uptake in the private rented housing sector in particular, and more households falling into fuel

[10]Those earning £38,000 or more pa.

[11]Those earning less than £38,000 pa.

[12]This finding is supported by a study by the Department for Communities and Local Government with the Royal Institute for Chartered Surveyors, which found there is little demand for energy efficiency among property owners. CLG and RICs (2010) Energy Efficiency and Value Report.

[13]Discussion with Royal Institute of Chartered Surveyors. Average tenancy, for comparison, is only 17 months.

poverty in the meantime. Moves to consider regulating the Private Rented Sector are helpful[14] but do not provide the certainty required by potential providers of upfront capital that a market for Green Deal loans of any significance will be forthcoming before then. In addition, over the longer term regulation of only part of the housing stock will not be enough, even if incentives are applied elsewhere. Research carried out on behalf of the Committee on Climate Change indicates 30% of households would not install energy efficiency measures even if they were free of charge[15].

To successfully drive demand and create a large scale market for whole house retrofits, all these issues must be considered and fully addressed bearing in mind the requirements for Transparency, Longevity and Certainty in policy design, including detail on the role 'carrots and sticks' will play in driving a healthy trajectory for market growth. This in turn will deliver clear signals to the supply chain and to investors on the market opportunity, enabling appropriate ramp up in the size of the businesses that will be needed to deliver the Green Deal at scale.

[14]In a speech on 2 November 2010 the Secretary of State for Energy and Climate Change announced it will look into taking powers to "ensure that from 2015, any tenant who asks for energy efficiency improvements cannot be refused" and that it will "give local authorities the power to insist that landlords improve the worst performing homes".

[15]Analysis commissioned by the Committee on Climate Change (2009) to support the report Meeting Carbon Budgets – the need for a step change.

4. The need to treat householders more like investors

Despite the fact energy prices are increasing and heading towards what the IEA's chief economist recently described as "a dangerous zone" for the global economy[16], they are not yet high enough to persuade most householders that substantive retrofits are a worthwhile investment. E3G undertook some illustrative modelling to understand the underlying reasons for this. Summary findings are shown in Table 1. Our initial analysis looked at a very optimistic basic investment scenario in which a whole house retrofit costing £11,000 delivered 50% energy savings and that loan repayments were spread over 25 years. We assumed energy prices increased by 2.45% year on year[17]. The modelling is illustrative and absolute values were used (i.e. no discount rates were applied).

Our analysis indicates that for the average household, the economics of Green Deal investments as currently planned do not stack up for the rational investor. The annual energy bill for an average household was calculated at £1,029 per year – so a good retrofit would save just over £500 per year. This is not enough to cover the costs of borrowing £11,000 or more at anything other than a very heavily subsidised rate. To illustrate, at today's energy prices in order to drive demand through meeting the 'Green Deal golden rule', 25 year loans offered at 2% or less would be required (see Table 1 for a summary and see Annex Tables A1 and 2 for details of financial modelling)[18].

We ran a number of other scenarios for comparison. For example a £15,000 0% loan that delivered 50% energy saving, lifetime savings of £2,461 over 25 years could be achieved with the investment meeting the golden rule in Year 8. But the same loan offered at 2% incurred losses of £1,747 over 25 years. The same £15,000 loan delivering a 35% energy saving did not break even if offered at 0% – under this scenario over 25 years a loss of £2,777 was incurred[19]. At more commercial rates of 8% or more, our analysis indicated the economics of projects are unmanageable.

This analysis indicates that for many investments even to break even over 25 years will require a huge injection of subsidy via the ECO subsidy, unspecified interest rate subsidies or both. E3G estimates that for a £7bn annual investment programme an annual subsidy requirement of up to £3.4bn per year (equivalent to nearly half the size of the programme) may be needed. So greater clarity is required on the role and size of the ECO and any other subsidies that could be provided in supporting project economics and the timelines for which such subsidy will be made available in order for the market to gauge and respond to potential levels of demand.

[16]FT 5 January 2011 'Oil price enters dangerous zone'. In 2010 the EU saw its import bill rise by $70bn.
[17]2.47% was our baseline scenario – with data taken from the Impact Assessment for DECC's 2010 Energy Market Reform Consultation, averaged and weighted for gas versus electricity usage.
[18]This would seem to fit with some of DECC's own assumptions about capital costs on investments and the energy savings they would deliver. For example in DECC (2010) The Green Deal: Energy savings for homes and businesses it is estimated that solid wall insulation at a capital cost of £7,600 – £12,600 could deliver savings of £400 per year, loft insulation at £250 could deliver annual savings of £45 per year. These costs do not factor in transaction costs or loan repayment costs.
[19]All the various iterations of modelling are not shown in this paper due to lack of space.

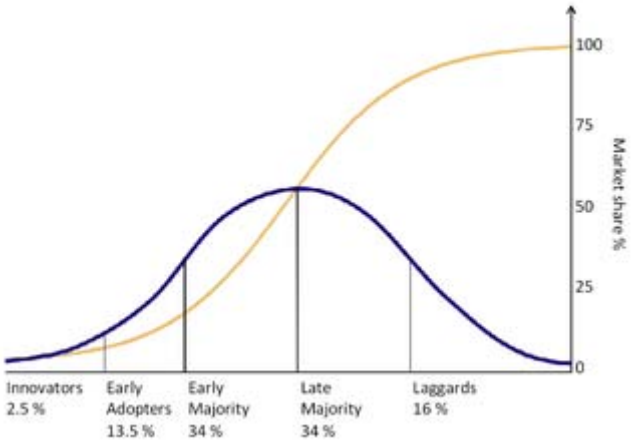
Table 1. Ability of £11,000 25-year Green Deal investments to meet the golden rule

£11,000 loan achieving 50% energy savings				
Interest rate	Golden rule met on Day 1	Golden rule met over lifespan of investment	Year in which cost<saving	Lifetime savings for the investment
0%	Yes	Yes	Year 1	£6,461
2%	No	Yes	Year 5	£3,375
6%	No	No	No	N/A
8%	No	No	No	N/A
£11,000 loan achieving 35% energy savings				
Interest rate	Golden rule met on Day 1	Golden rule met over lifespan of investment	Year in which cost<saving	Lifetime savings for the investment
0%	No	Yes	Year 10	£1,223
2%	No	No	No	N/A
6%	No	No	No	N/A
8%	No	No	No	N/A

5. Driving the diffusion of energy efficiency: the need for a phased approach to creating demand

In terms of the process of creating demand for energy efficiency, Government's efforts should initially be focused on driving demand among the 'pre-mainstream' 15% of the population – in terms of innovation diffusion theory, the 'innovators' and 'early adopters' – who will make the market (see Figure 1).

Figure 1. Rogers "Diffusion of Innovation" curve describes the technology adoption lifecycle according to the demographic and psychological characteristics of defined adopter groups.



According Rogers' Theory of Innovation Diffusion, the first group of people to take up a new product/methodology are the 'innovators' (the 2.5% of the population who are enthusiasts and move early), they are followed by 'early adopters' (13.5% of the population who are opinion leaders and try new ideas out but in a careful way). The early adopters are key to driving marketplace innovation because they have the credibility needed to engage the 'mainstream' – the early majority (thoughtful people who accept change more quickly than the average person) and late majority (who only adopt new innovations when the majority are using it). The last group, laggards, are skeptics, who will only adopt an innovation after it has become mainstream[20].

Applying this theory to the creation of a scaled market for energy efficiency and delivery of a successful Green Deal programme, means the Government should be focusing efforts on creating commercial demand for retrofits among the 15% of the population that are innovators and early adopters. However, this cohort is likely to come from various income groups, and so a one-size-fits-all approach incentivising them to act is unlikely to work.

[20]Rogers, Everett M. (1962). Diffusion of Innovation. New York Free Press

6. Proposed solutions: the need for a differentiated approach to policy support

In the absence of higher energy prices, a substantive body of evidence is accumulating on the role of subsidies, grants/cashbacks in overcoming the opportunity cost barrier and driving uptake among innovators and early adopters required to make a market for energy efficiency. In the UK, programmes such as the British Gas Council Tax Rebate Scheme[21], where a cashback is provided by Councils when households install loft and cavity wall insulation, or the Pay As You Save Pilots[22] – which offered retrofits at 0% finance, have been successful at driving demand. This is consistent with experience in Germany (where grants covering up to 17.5% of costs or loans of up to €75,000 at subsidised interest rates are available), in France (where 0% interest loans are being offered to households) and in the Netherlands (also offering grants and loans)[23]. Similarly, a recent study of 18 energy efficiency programmes in the USA, found existing loan programmes cannot address much of the need without significant public support in the form of grants, rebates and soft loans[24].

As noted, the Coalition Government does recognise a role for subsidies, provided via a new ECO charge, to support investment by poor households and drive demand for more expensive measures such as solid wall insulation but there is a lack of clarity on how this will be disbursed and at what level. In addition, as also noted, there is a need to support investment more widely, including for households that are not classed as vulnerable or hard to treat, if a market for energy efficiency is to be created and an ambitious Green Deal programme delivered. Such additional support could be provided under the ECO regime or through alternative sources of subsidy such as ring-fenced revenues from the proposed new carbon floor price or ETS auction revenues.

An additional observation is that if the Green Deal policy is to encourage uptake of packages of wholehouse retrofits, there needs to be a shift in focus from the provision of subsidies for single measures to package-based subsidies, as best international practice shows. Package-based subsidies should also be time-limited to encourage early uptake, tapered over time[25] to ensure fairness and to reflect the likely increase in energy prices and weighted to different income groups to ensure equity.

In terms of designing subsidy support systems, international experience indicates a mixture of cashbacks, grants and soft loans have been successful. These will need to be targeted carefully at different income groups to ensure value for money is delivered and equity achieved.

[21] http://www.britishgas-savings.co.uk/energy-efficiency/insulation/council-tax-rebate/
[22] http://www.energysavingtrust.org.uk/Home-improvements-and-products/Pay-As-You-Save-Pilots
[23] Discussion with KfW and French and Dutch officials.
[24] Merrian Fuller (2010) Enabling investments in energy efficiency: A study of energy efficiency programs that reduce first-cost barriers in the residential sector
[25] This ensures that those that undertake retrofitting early when packages are more expensive receive higher subsidies that those who retrofit later when costs have come down.

Below is an illustration of how financial incentives could be packaged for these different groups. For middle and low income groups an estimation is made of the level of up front grant required to ensure the 'golden rule' is met if more commercial loan rates of 6% and 8% are used.

Solutions for high income households (>£38K per year) – These households make up ~20% of the potential market[26] and already have access to capital – in the form of bank loans, mortgage extensions or savings. So the focus of subsidies should be on persuading householders to act through providing information on the aggregate economic benefits of retrofitting and by offering a one-off cash incentive for action. Particular care should be taken with this group to address concerns over equity, especially in the face of rising energy costs.

E3G analysis underscores that the economics of Green Deal investment are altered depending on the loan maturities and that this should be taken into account when designing a subsidy programme for high income households. Taking the basic optimistic scenario of a whole house retrofit costing £11,000 and delivering 50% energy savings we looked at how the length of the loan impacted on overall project economics at more commercial rates of 6% and 8% (see Table 2 and Annex Table A3a for details of financial modelling).

The analysis indicates that the attractiveness of investments over a 25 years period decreases as loan maturity increases – so policies for this income group should focus on incentivising householders to take out not long-term but short-term loans. This could be achieved through a combination of marketing the opportunity and market research to understand what level of cashback might be required to incentivise actual investment[27]. This approach has been used for Poland's Thermomodernisation programme[28].

[26]Data taken from 2008/09 ONS analysis of the effect of taxes and benefits on household income. http://www.statistics.gov.uk/STATBASE/Product.asp?vlnk=10336

[27]One of the recommendations of the Regulatory Assistance Project is for energy efficiency programmes to deploy a Portfolio Manager to oversee incentives and ensure they drive uptake while maximising value for money.

[28]Discussion with Polish state bank BGK and Tadeusz Skoczkowski from the Polish National Energy Conservation Association.

Table 2. Impact of loan maturity on overall project economics at 6% and 8% (real not discounted numbers are used)

£11,000 Green Deal loan offered at 6%		
Length of loan	Average annual increase in energy outgoings during loan term	Value to the household over 25 years (i.e. energy cost savings minus cost of loan repayments)
3 years	£3,588	£5,115
5 years	£2,071	£4,404
10 years	£919	£2,515
25 years	£799	N/A
£11,000 Green Deal loan offered at 8%		
3 years	£3,741	£4,656
5 years	£2,215	£3,686
10 years	£1,064	£1,068
25 years	£741	N/A

Middle income households (£23.5K–£38K per year) – These households make up 20% of the potential market, although some properties will be rented and actually owned by wealthier households or commercial or social landlords. They are more financially constrained so the affordability of repayments is key: longer loans of 25 years will be needed to minimise the impact of loan repayments on existing household outgoings. Subsidy will be needed and assuming Green Deal loans are to come from commercial providers upfront grants offer greater value for money compared to soft loans because they reduce the overall interest accumulated. Our illustrative modelling indicates that under our optimistic scenario a package of measures costing £11K would require a 40% upfront grant to reduce costs to a point where the remainder of the capital could be borrowed over 25 years at commercial rates and meet the golden rule. For a loan at 6% this would deliver savings of £4,553 over 25 years to the household. For a loan at 8% this would deliver savings of £2,004 over 25 years – however an additional £400 cashback would need to be considered to cover costs incurred in Year 1–8 when energy prices were still too low. See Annex Table A3b for more detail of the underlying modelling.

Low income households (<£12K per year) – These households make up 60% of the potential market. They almost certainly fall into the 'fuel poor group', although many properties will be rented and actually owned by wealthier individuals or commercial or social landlords. A similar approach should be taken for low income as for middle income households. However, because these households are highly cash-constrained, higher levels of support will be needed. Our illustrative modelling indicates that for a package of measures costing £11K, a 55% upfront grant would be required to reduce costs to a point where the remainder of the capital could be borrowed over 25 years at commercial rates without negative impacts on annual household

outgoings (a 6% loan would deliver annual savings of upwards of £127 per year from day 1; an 8% loan would deliver annual savings of upwards of £51 per year from day 1). For comparison a loan offered at 2% would require an upfront 10% grant to ensure the golden rule is met in Year 1 (delivering savings of £4,794 over 25 years). See Annex Table A3c for more detail of the underlying modelling.

For all three income groups the level of the cashback or grant could be explicitly linked to the number of measures installed in the property – incentivising more ambitious levels of investment and driving the market toward whole-house retrofit. This is the approach used in Germany's KfW Energy Efficient House Programme.

Additional fiscal measures – The use of direct subsidies to drive demand could be further complemented by increasing customer interest in the energy performance of their home. The provision of better information on household energy usage through Energy Performance Certificates (EPCs) is a major step forward, but interest may be further increased by linking energy performance to high profile measures such as taxation. Linking tax to the energy performance of a property will also improve the economics of measures, in time reducing the need for direct subsidies, and reinforcing the message that everyone has a responsibility to reduce carbon[29]. Examples include Stamp Duty and Capital Gains Tax varied according to EPC rating and Council Tax rebates based on measures installed.

The role of regulation – The use of various subsidies as described and – in time – rising energy prices (refer to Annex Tables A2a and b for comparison returns on projects at today's energy prices versus a scenario in which energy prices are doubled) will drive demand among the majority of the population. However they are unlikely to deliver the "once-and-for-all refit" envisaged by the Secretary of State for all households. This is because there is evidence that around 30% of households would be very unlikely to undertake energy efficiency retrofits regardless of incentives in place[30]. In terms of the 'innovation diffusion curve' these are the 'laggards'. To drive demand in this sector of the housing market, regulation will be required to introduce minimum energy performance standards on property – just as has happened for appliances and for cars – before it can be sold or rented. However, to be politically acceptable such a move would need to be predicated on a successful retrofit programme already being in place.

[29]According to an article in The Times 20 July 2010, the Government was at one stage considering introducing variable Stamp Duty linked to EPC rating. This would not have been at a significant enough level to drive investment alone, but could have worked well as one of a suite of measures aiming to 'nudge' householder towards action.

[30]Analysis commissioned by the Committee on Climate Change during 2009 indicated 30% of households would not install energy efficiency measures even if they were free of charge. More recent 2010 research by the Great British Refurb Campaign showing that 28% of households sampled would not undertake energy efficiency retrofits, even with the Green Deal in place.

7. Sourcing upfront capital for the Green Deal

To help create an effective Green Deal which can lead to high quality retrofits at scale, there remains one final set of barriers that need to be addressed: the sourcing of low cost, upfront capital. The Government hopes to see the private sector provide the capital, however there are issues with balance sheet constraints, liquidity and risk.

7a. Balance sheet constraints

The UK's binding carbon targets mean that household retrofit investment must take place over the next 15 years and alongside decarbonisation of the UK's energy infrastructure. According to Ernst and Young the total cost of these demand *and* supply side investments will be ~£450bn. Yet the traditional sources of energy infrastructure financing – utilities and investment banks – can deliver only 10–20% of the *total* required[31].

These capital constraints are driven by:

(i) the sheer volume of funds needed in a short time period compared to the balance sheets of the traditional capital providers – energy utilities and investment banks;

(ii) uncertainty over levels of demand for Green Deal securities[32], which are needed to recycle Green Deal and other energy system investments to the capital markets, thus freeing up balance sheets for further activity;

(iii) the flight of capital to well understood and lower risk investments[33].

All three of these issues directly affect the availability of capital to finance the Green Deal, which is perceived as unsecured consumer finance, has no track record and is competing with other better understood infrastructure investment opportunities[34].

(As an aside, Green Deal financing may not be suitable for retailers such as M&S and B&Q – who tend towards highly leveraged balance sheets and who, in any case, tend to retail financial products that are provided by wholesalers such as banks or insurance companies[35].)

7b. Liquidity

Green Deal loans are currently expected to last 25 years and without a track record and data on performance could be very illiquid investments. This lack of liquidity poses a problem to

[31]Ernst and Young (2010) Capitalising the Green Investment Bank: Key issues and next steps.
[32]This is an approach traditionally used for selling on various types of consumer finance such as residential mortgages and credit card debt obligations. The principal and interest on the debt is paid back from regular cashflows (in this case the Green Deal energy bill repayments).
[33]Discussions with fund managers.
[34]Infrastructure UK notes that £40–50bn in investment is required across the UK economy every year over the coming decades. IUK (2010) National Infrastructure Plan
[35]For example M&S Home Insurance is provided by AXA Insurance. B&Q loans are backed by HSBC group.

banks in particular, who have limited balance sheets, prefer to recycle investments frequently – typically lending for around 5–7 years – and often rely on short-term and volatile borrowing from the capital markets to finance projects. It also poses a problem to utilities who can select from a range of other more attractive investment opportunities with a shorter payback.

Green Deal loans would be made more attractive to banks and utilities if investments could be recycled as securities. However, without a track record of investment performance the market is likely to be fairly nervous of such new securities and exhibit a limited appetite for such investments.

7c. Risk

Green Deal loans are regarded as carrying quite significant potential risks by many of the potential providers of upfront capital who might finance Green Deal loans in the first instance (banks and utilities for example) *and* by the eventual holders of securitised Green Deal loans (institutional investors). While some of these are being addressed, until they are proven to be insignificant through the creation of a track record of successful investment, they will increase the cost of borrowing, pushing up required returns.

Some of the risks cited as being of concern by financiers include:

- as already discussed, a lack of visibility on demand for energy efficiency retrofits;
- concerns the 'Green Deal golden rule' doesn't hold true so that householders are unlikely to save more on their energy bills than they pay out on loans for all but the most cheap and effective measures (loft and cavity wall insulation);
- the impact of the rebound effect[36] on customer willingness to repay Green Deal loans;
- a lack of data on the performance of Green Deal assets once installed because there is no track record yet;
- a lack of clarity on quality control measures for Green Deal providers or checks on the quality of individual installations;
- a lack of data on Green Deal loan default rates, again because there is no track record, and a lack of clarity on who bears risk in the event of loan default.

Before it will become financeable at scale, an enhanced Green Deal policy framework should provide clarity on how each of these performance risks will be mitigated through policy design. The Government is already working to put in place accreditation and verification schemes[37], and separately there is ongoing work focused on smart meter deployment. However, this is not currently linked into Green Deal policy development – this should be addressed. The issue of Green Deal default rates is also being dealt with – the Coalition Government is proposing to amend legislation to permit disconnection of unpaid Green Deal charges as with unpaid energy

[36]The rebound effect, or comfort taking, is where the introduction of energy saving measures leads to greater than expected energy use due to higher usage of the more efficient technologies.
[37]DECC (2010) The Green Deal: A summary of Government's proposals

bills[38]. This will have the effect of homogenising Green Deal and energy debt and creating a proxy track record for default rates of around 1–2%. However, this may well not be enough to satisfy investor concerns in the first instance.

However, it remains to be seen how robust these measures are: they will need to be clearly auditable by investors before capital is likely to flow. In addition, as mentioned in Section 2, there has been limited discussion on how demand will be driven at scale.

To help overcome these risks and to ensure that low cost capital can be raised at scale there is one clear solution that must be supported – using the Green Investment Bank to help raise the capital.

[38]DECC (2010) The Green Deal: A summary of Government's proposals

8. The role of the Green Investment Bank in ensuring upfront capital is available: the need for a phased approach

Discussions to date have indicated little appetite from the financial sector to back the Green Deal principally because of the issues around balance sheet constraints and liquidity already noted but also critically because it has no track record or visible demand.

Added to this, the marked gap between the returns that can be expected from Green Deal investments at today's energy prices (we estimate in the region of 2% for our optimistic illustrative scenario) and the costs of borrowing even at the zero risk gilt rate (currently about 4%) means it is debateable whether there is any initial role for private finance to play in providing up front capital for the Green Deal. Instead, while energy prices are relatively cheaper the GIB should be deployed to provide low cost up front capital.

The expectation is that the GIB will enjoy quasi-sovereign AAA or AA borrowing rates[39] and that it will be focused on addressing market failures and making a modest return rather than maximising profit. For these reasons it should be able to provide lower cost capital compared to the private sector, which will minimise the level of subsidy required to drive demand for the Green Deal. Relying on commercial provision of upfront capital for the Green Deal will simply increase the amount of subsidy required to make the economics of Green Deal investment work.

However this will not always be the case since energy prices will rise. Thus a phased approach should be taken to the provision of upfront capital to finance the Green Deal.

Phase 1: GIB provides upfront capital, the private sector acts as an agent to disburse loans

In an era of relative low energy costs, where a large amount of subsidy is required to make investments attractive, the GIB should be used to source upfront capital for the Green Deal. Early stage transactions could include the GIB issuing 'covered bonds'[40] backed by both the Green Deal cashflow and its own balance sheet. This money could be used to provide upfront capital for the Green Deal through on-lending to householders through financial intermediaries. These intermediaries (which could be retail banks or building societies) could provide this low cost capital to Green Deal customers, supplemented with different levels of

[39]This will in the first instance depend on the nature of any guarantee on GIB bonds – a subject currently under discussion. Later it will depend on the GIB's rating and investment track record.

[40]Covered bonds have a good track record in public finance: for new areas of investment they offer investors high levels of comfort while they get used to new asset classes because they provide recourse both to the asset being financed and to the bank itself.

Government subsidy allocated based on income level. With an AAA rating the GIB could for example borrow at 4% and lend at 5%, enabling it grow its balance sheet at a modest rate[41].

This approach is a version of the financing approach taken by KfW Bankengruppe, which has provided €31bn in low cost energy efficiency loans and grants to support the Government's KfW-Efficient House Programme since 2001[42]. However it differs from the KfW model because of the way it is proposed risk be allocated. Under the KfW model the commercial bank lending on the capital takes the risk. Under this model, the GIB takes the risk, with the financial intermediary contracting with the GIB to act as its agent to simply disburse Green Deal loans to the market for a fixed fee. The Green Deal loans would appear as an asset and a liability on the intermediaries balance sheet, should therefore cancel out any impact on Tier 1 capital requirements for banks for example. This would need to be agreed with the Regulator but it would mean that in the event of a Green Deal loan default, the GIB and not the financial intermediary bears the cost.

The GIB could warehouse the loans, using them to grow its balance sheet, until such time as energy prices have increased to a point that subsidies are no longer needed and the private sector is willing to take over.

Phase 2: Transition phase

During the time the GIB has financed early Green Deal loans, on lent through financial intermediaries, the private sector will have developed an understanding of the risks around the Green Deal product through handling loans contracted by the GIB. This will also create a visible track record for the Green Deal and prepare the market for the commercial sector to take over.

At this point, and once energy prices have risen sufficiently to close the gap between project returns and costs of commercial borrowing, the GIB should start to exit its Green Deal investments through selling Green Deal securities, freeing up its balance sheet, releasing the UK Government from any Green Deal underwriting liabilities and making GIB capital available for other strategic UK investments in the low carbon economy. Such securities should be attractive to investors if the GIB is perceived as an honest broker, and if transparent structuring is used (AAA senior tranches protected from credit risk and more junior tranches that take on some of this risk for a higher return) so that appetite for Green Deal securities is created by the GIB in the market.

[41]In the early stages of the GIB financing the Green Deal, the Government will need to provide additional capital or a promisary note to provide the capital to cover any losses incurred by the GIB so that it can repay its bond holders. As the GIB builds up its balance sheet, and Green Deal investments are shown not to be unduly risky, such potential losses could be covered by the GIB's own reserves.

[42]The German KfW-Efficient House Programme offers a combination of both upfront grants and soft loans subsidised to 2.75%. There are 5 levels of retrofit package that can be installed – incentives are more attractive for the more expensive packages of measures to encourage greater ambition. The commercial banks charge a handling fee of 0.75% of the loan value for taking on the risk – funded by the German Government via an annual allocation in the region of €400m–€2bn per year.

Phase 3 Commercial financing of the GIB

In an era of higher energy prices, and in the event the Green Deal securities have proven successful the GIB should step away to enable the private sector to fund the Green Deal on a commercial basis.

The approach described is a classic approach to development/promotional banks partnering with the private sector to grow new markets. The aim is to address the concerns raised by financiers who have looked at the Green Deal proposals – and enable the private sector to fully take over when market failures have been addressed.

9. Conclusions

In the future Green Deal loans could become very attractive investments funded at scale and by the private sector. But first more effort is required to enhance the policy framework. Currently there is no real clarity on the objectives for the Green Deal policy and greater Transparency, Longevity and Certainty are needed. For example, how many homes should be retrofitted and by when? What are the detailed policy provisions that will be made to address risk and drive demand? Without an enhanced framework to create a clear, auditable and bankable investment opportunity neither householders nor investors are likely to respond at the scale needed to meet the UK's climate and energy security targets.

Enhancements should be made with the quite separate needs of both householders and the capital markets in mind, and ensure as much risk as possible is removed, strong demand is created and low cost capital enabled to flow.

In addition, greater consideration must be given to how incentives will be provided, not just for vulnerable groups and hard to treat homes but, in the early years of the Green Deal, for the wider market. It must be clear how they will be sourced, targeted and managed. The sheer scale of the gap between returns on energy efficiency investments and the costs of borrowing means the ECO subsidy will need to be supplemented with additional funds to drive wide uptake.

The nature and scale of the barriers to driving a Green Deal at scale means there must be a substantive role for the GIB in the early years to help provide sufficient low cost finance to drive the Green Deal forward. However the GIB may not need to fund the programme in the long term, since energy prices will increase to a high enough level to make commercial loans attractive. Instead it should be used to help provide low cost capital and build track record. Once the gap in project economics has been closed the GIB should be able to step back, enabling the private sector to lead on financing the Green Deal since at this point market failures would have been addressed.

There are strong quantitative data linking public stimulus of energy efficiency investment to the 'crowding in' of private sector capital and subsequent catalysing of economic growth[43]. At a time when the UK's growth forecasts have been downgraded, citing rising oil prices, higher than expected inflation and the fall in UK GDP at the end of 2010 – now could not be a better time to use public funds and institutions to stimulate growth in this market[44].

[43]UN (2009) World Economic and Social Survey. Chapter 1 pp. 23-28; 31-34, available at: http://www.un.org/esa/policy/wess/index.html This documents the growth catalysed in USA, Switzerland, Japan, France etc through public stimulus for energy efficiency investment.

[44]Forecasts are provided by the OBR, which is an independent body that sets forecasts for growth based on current Government policies. See OBR (2010) Pre-Budget Forecast, which forecast growth of 2.1% in 2011 and 2.6% in 2012 and OBR (2011) Budget Forecast, which forecast downgraded growth expectations to 1.7% in 2011 and 2.5% in 2012. The OBR cited rising oil prices, higher than expected inflation and the fall in UK GDP at the end of 2010.

Annex: Illustrative financial modelling

Table A1. Assumptions and variables common to all modelling scenarios

Cost of renovation works	£11,000[a]
Annual energy bill	£1,029[b]
Annual energy price increase	2.45%[c]
Saving on energy bills after retrofit	35–50%[d]
Interest rate 1	0%
Interest rate 2	2%
Interest rate 3	6%
Interest rate 4	8%

Notes: [a]There is no single answer for how much a 'good retrofit' might cost. This is because each home is unique and requires a different retrofit solution. However, estimates based on real projects range from £10,000 to £40,000, with a corresponding range of impacts in terms of energy use reduction. Partnerships for Homes states that anything less than £10,000 per retrofit is unrealistic. [b]Based on Ofgem data on average household energy use – 3300kWh electricity used per year at 13p/kWh for power and 20,500 kWh gas used at 4p/kWh. [c]Data taken from the Impact Assessment for DECC's 2010 Energy Market Reform Consultation, averaged and weighted for gas versus electricity usage. [d]In the past DECC has stated that a 'good retrofit' should deliver 35–50% energy savings.

Table A2a. Impact of interest rate on ability to meet the Green Deal Golden rule over 25 years assuming 35% energy savings are achieved after retrofit. At today's prices, even with 0% loans, the Golden Rule was not achieved. In a world where energy prices have doubled, it can be achieved if loans are offered at 2% or less. Negative figures in the tables are shown in parentheses.

Maturity:		**25**	**years**																							
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Annual energy bill post renovation (£)		669	685	702	719	737	755	773	792	812	832	852	873	894	916	939	962	985	1,009	1,034	1,059	1,085	1,112	1,139	1,167	1,196
Gross savings ie excl loan repayment (£)		**360**	**369**	**378**	**387**	**397**	**406**	**416**	**427**	**437**	**448**	**459**	**470**	**482**	**493**	**505**	**518**	**530**	**543**	**557**	**570**	**584**	**599**	**613**	**628**	**644**
Interest rate 1	0.0%	Annual loan repayment for given maturity:					*440*																			
Loan repayment - interest plus principal (£)		440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
New total energy cost (£)		1,109	1,125	1,142	1,159	1,177	1,195	1,213	1,232	1,252	1,272	1,292	1,313	1,334	1,356	1,379	1,402	1,425	1,449	1,474	1,499	1,525	1,552	1,579	1,607	1,636
Net savings i.e. incl loan repayment (£)		**(80)**	**(71)**	**(62)**	**(53)**	**(43)**	**(34)**	**(24)**	**(13)**	**(3)**	**8**	**19**	**30**	**42**	**53**	**65**	**78**	**90**	**103**	**117**	**130**	**144**	**159**	**173**	**188**	**204**
Interest rate 2	2.0%	Annual loan repayment for given maturity:					*563*																			
Loan repayment - interest plus principal (£)		563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563
New total energy cost (£)		1,232	1,249	1,265	1,283	1,300	1,318	1,337	1,356	1,375	1,395	1,415	1,436	1,458	1,480	1,502	1,525	1,549	1,573	1,597	1,623	1,649	1,675	1,703	1,731	1,759
Net savings i.e. incl loan repayment (£)		**(203)**	**(194)**	**(185)**	**(176)**	**(167)**	**(157)**	**(147)**	**(137)**	**(126)**	**(116)**	**(105)**	**(93)**	**(82)**	**(70)**	**(58)**	**(46)**	**(33)**	**(20)**	**(7)**	**7**	**21**	**35**	**50**	**65**	**80**
Interest rate 3	6.0%	Annual loan repayment for given maturity:					*860*																			
Loan repayment - interest plus principal (£)		860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860
New total energy cost (£)		1,529	1,546	1,563	1,580	1,597	1,615	1,634	1,653	1,672	1,692	1,713	1,733	1,755	1,777	1,799	1,822	1,846	1,870	1,895	1,920	1,946	1,972	2,000	2,028	2,056
Net savings i.e. incl loan repayment (£)		**(500)**	**(492)**	**(482)**	**(473)**	**(464)**	**(454)**	**(444)**	**(434)**	**(423)**	**(413)**	**(402)**	**(390)**	**(379)**	**(367)**	**(355)**	**(343)**	**(330)**	**(317)**	**(304)**	**(290)**	**(276)**	**(262)**	**(247)**	**(232)**	**(217)**
Interest rate 4	8.0%	Annual loan repayment for given maturity:					*1,030*																			
Loan repayment - interest plus principal (£)		1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
New total energy cost (£)		1,699	1,716	1,732	1,750	1,767	1,785	1,804	1,823	1,842	1,862	1,882	1,903	1,925	1,947	1,969	1,992	2,016	2,040	2,065	2,090	2,116	2,142	2,170	2,198	2,226
Net savings i.e. incl loan repayment (£)		**(670)**	**(661)**	**(652)**	**(643)**	**(634)**	**(624)**	**(614)**	**(604)**	**(593)**	**(583)**	**(572)**	**(560)**	**(549)**	**(537)**	**(525)**	**(513)**	**(500)**	**(487)**	**(474)**	**(460)**	**(446)**	**(432)**	**(417)**	**(402)**	**(387)**
Tomorrow's energy prices																										
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		2,058	2,108	2,160	2,213	2,267	2,323	2,380	2,438	2,498	2,559	2,622	2,686	2,752	2,819	2,888	2,959	3,031	3,106	3,182	3,260	3,340	3,421	3,505	3,591	3,679
Annual energy bill post renovation (£)		1,338	1,370	1,404	1,438	1,474	1,510	1,547	1,585	1,624	1,663	1,704	1,746	1,789	1,832	1,877	1,923	1,970	2,019	2,068	2,119	2,171	2,224	2,278	2,334	2,391
Gross savings ie excl loan repayment (£)		**720**	**738**	**756**	**775**	**794**	**813**	**833**	**853**	**874**	**896**	**918**	**940**	**963**	**987**	**1,011**	**1,036**	**1,061**	**1,087**	**1,114**	**1,141**	**1,169**	**1,197**	**1,227**	**1,257**	**1,288**
Interest rate 1	0.0%	Annual loan repayment for given maturity:					*440*																			
Loan repayment - interest plus principal (£)		440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
New total energy cost (£)		1,778	1,810	1,844	1,878	1,914	1,950	1,987	2,025	2,064	2,103	2,144	2,186	2,229	2,272	2,317	2,363	2,410	2,459	2,508	2,559	2,611	2,664	2,718	2,774	2,831
Net savings i.e. incl loan repayment (£)		**280**	**298**	**316**	**335**	**354**	**373**	**393**	**413**	**434**	**456**	**478**	**500**	**523**	**547**	**571**	**596**	**621**	**647**	**674**	**701**	**729**	**757**	**787**	**817**	**848**
Interest rate 2	2.0%	Annual loan repayment for given maturity:					*563*																			
Loan repayment - interest plus principal (£)		563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563
New total energy cost (£)		1,901	1,934	1,967	2,002	2,037	2,073	2,110	2,148	2,187	2,227	2,267	2,309	2,352	2,396	2,441	2,487	2,534	2,582	2,632	2,682	2,734	2,787	2,842	2,898	2,955
Net savings i.e. incl loan repayment (£)		**157**	**175**	**193**	**211**	**230**	**250**	**269**	**290**	**311**	**332**	**354**	**377**	**400**	**423**	**447**	**472**	**498**	**524**	**550**	**577**	**605**	**634**	**663**	**693**	**724**
Interest rate 3	6.0%	Annual loan repayment for given maturity:					*860*																			
Loan repayment - interest plus principal (£)		860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860
New total energy cost (£)		2,198	2,231	2,265	2,299	2,334	2,370	2,407	2,445	2,484	2,524	2,565	2,606	2,649	2,693	2,738	2,784	2,831	2,879	2,929	2,979	3,031	3,084	3,139	3,195	3,252
Net savings i.e. incl loan repayment (£)		**(140)**	**(123)**	**(104)**	**(86)**	**(67)**	**(48)**	**(28)**	**(7)**	**14**	**35**	**57**	**80**	**103**	**126**	**150**	**175**	**200**	**226**	**253**	**280**	**308**	**337**	**366**	**396**	**427**
Interest rate 4	8.0%	Annual loan repayment for given maturity:					*1,030*																			
Loan repayment - interest plus principal (£)		1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
New total energy cost (£)		2,368	2,401	2,435	2,469	2,504	2,540	2,577	2,615	2,654	2,694	2,735	2,776	2,819	2,863	2,908	2,954	3,001	3,049	3,099	3,149	3,201	3,254	3,309	3,365	3,422
Net savings i.e. incl loan repayment (£)		**(310)**	**(293)**	**(274)**	**(256)**	**(237)**	**(217)**	**(198)**	**(177)**	**(156)**	**(135)**	**(113)**	**(90)**	**(67)**	**(44)**	**(20)**	**5**	**31**	**57**	**83**	**110**	**138**	**167**	**196**	**226**	**257**

Table A2b. Impact of interest rate on ability to meet the Green Deal Golden rule over 25 years assuming retrofits achieve 50% energy savings. At today's prices, the only scenario under which the golden rule was met was 0% finance – saving households upwards of £75 pa. In a world where energy prices have doubled, it can be achieved even if loans are offered at 8%, although in Year 1 the householder is predicted to make a £1 loss. Negative figures are shown in parentheses

Maturity:		**25**	**years**																							
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Annual energy bill post renovation (£)		515	527	540	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Gross savings ie excl loan repayment (£)		**515**	**527**	**540**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**
Interest rate 1	0.0%	Annual loan repayment for given maturity:					*440*																			
Loan repayment - interest plus principal (£)		440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
New total energy cost (£)		955	967	980	993	1,007	1,021	1,035	1,049	1,064	1,080	1,095	1,111	1,128	1,145	1,162	1,180	1,198	1,216	1,235	1,255	1,275	1,295	1,316	1,338	1,360
Net savings i.e. incl loan repayment (£)		**75**	**87**	**100**	**113**	**127**	**141**	**155**	**169**	**184**	**200**	**215**	**231**	**248**	**265**	**282**	**300**	**318**	**336**	**355**	**375**	**395**	**415**	**436**	**458**	**480**
Interest rate 2	2.0%	Annual loan repayment for given maturity:					*563*																			
Loan repayment - interest plus principal (£)		563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563
New total energy cost (£)		1,078	1,091	1,103	1,117	1,130	1,144	1,158	1,173	1,188	1,203	1,219	1,235	1,251	1,268	1,285	1,303	1,321	1,340	1,359	1,378	1,398	1,419	1,440	1,461	1,483
Net savings i.e. incl loan repayment (£)		**(49)**	**(36)**	**(23)**	**(10)**	**3**	**17**	**31**	**46**	**61**	**76**	**92**	**108**	**124**	**141**	**159**	**176**	**194**	**213**	**232**	**251**	**271**	**292**	**313**	**334**	**356**
Interest rate 3	6.0%	Annual loan repayment for given maturity:					*860*																			
Loan repayment - interest plus principal (£)		860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860
New total energy cost (£)		1,375	1,388	1,401	1,414	1,427	1,441	1,455	1,470	1,485	1,500	1,516	1,532	1,548	1,565	1,583	1,600	1,618	1,637	1,656	1,675	1,695	1,716	1,737	1,758	1,780
Net savings i.e. incl loan repayment (£)		**(346)**	**(333)**	**(320)**	**(307)**	**(294)**	**(280)**	**(266)**	**(251)**	**(236)**	**(221)**	**(205)**	**(189)**	**(173)**	**(156)**	**(138)**	**(121)**	**(103)**	**(84)**	**(65)**	**(46)**	**(26)**	**(5)**	**16**	**37**	**59**
Interest rate 4	8.0%	Annual loan repayment for given maturity:					*1,030*																			
Loan repayment - interest plus principal (£)		1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
New total energy cost (£)		1,545	1,558	1,570	1,584	1,597	1,611	1,625	1,640	1,655	1,670	1,686	1,702	1,718	1,735	1,752	1,770	1,788	1,807	1,826	1,845	1,865	1,886	1,907	1,928	1,950
Net savings i.e. incl loan repayment (£)		**(516)**	**(503)**	**(490)**	**(477)**	**(464)**	**(450)**	**(436)**	**(421)**	**(406)**	**(391)**	**(375)**	**(359)**	**(343)**	**(326)**	**(308)**	**(291)**	**(273)**	**(254)**	**(235)**	**(216)**	**(196)**	**(175)**	**(154)**	**(133)**	**(111)**
Tomorrow's energy prices																										
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		2,058	2,108	2,160	2,213	2,267	2,323	2,380	2,438	2,498	2,559	2,622	2,686	2,752	2,819	2,888	2,959	3,031	3,106	3,182	3,260	3,340	3,421	3,505	3,591	3,679
Annual energy bill post renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Gross savings ie excl loan repayment (£)		**1,029**	**1,054**	**1,080**	**1,106**	**1,134**	**1,161**	**1,190**	**1,219**	**1,249**	**1,279**	**1,311**	**1,343**	**1,376**	**1,410**	**1,444**	**1,479**	**1,516**	**1,553**	**1,591**	**1,630**	**1,670**	**1,711**	**1,753**	**1,796**	**1,840**
Interest rate 1	0.0%	Annual loan repayment for given maturity:					*440*																			
Loan repayment - interest plus principal (£)		440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440	440
New total energy cost (£)		1,469	1,494	1,520	1,546	1,574	1,601	1,630	1,659	1,689	1,719	1,751	1,783	1,816	1,850	1,884	1,919	1,956	1,993	2,031	2,070	2,110	2,151	2,193	2,236	2,280
Net savings i.e. incl loan repayment (£)		**589**	**614**	**640**	**666**	**694**	**721**	**750**	**779**	**809**	**839**	**871**	**903**	**936**	**970**	**1,004**	**1,039**	**1,076**	**1,113**	**1,151**	**1,190**	**1,230**	**1,271**	**1,313**	**1,356**	**1,400**
Interest rate 2	2.0%	Annual loan repayment for given maturity:					*563*																			
Loan repayment - interest plus principal (£)		563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563	563
New total energy cost (£)		1,592	1,618	1,643	1,670	1,697	1,725	1,753	1,782	1,812	1,843	1,874	1,906	1,939	1,973	2,007	2,043	2,079	2,116	2,154	2,193	2,233	2,274	2,316	2,359	2,403
Net savings i.e. incl loan repayment (£)		**466**	**491**	**517**	**543**	**570**	**598**	**626**	**656**	**685**	**716**	**747**	**779**	**812**	**846**	**881**	**916**	**952**	**989**	**1,027**	**1,066**	**1,106**	**1,147**	**1,189**	**1,232**	**1,276**
Interest rate 3	6.0%	Annual loan repayment for given maturity:					*860*																			
Loan repayment - interest plus principal (£)		860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860	860
New total energy cost (£)		1,889	1,915	1,941	1,967	1,994	2,022	2,050	2,079	2,109	2,140	2,171	2,203	2,236	2,270	2,305	2,340	2,376	2,413	2,451	2,490	2,530	2,571	2,613	2,656	2,700
Net savings i.e. incl loan repayment (£)		**169**	**194**	**220**	**246**	**273**	**301**	**329**	**358**	**388**	**419**	**450**	**482**	**515**	**549**	**584**	**619**	**655**	**692**	**730**	**769**	**809**	**850**	**892**	**935**	**979**
Interest rate 4	8.0%	Annual loan repayment for given maturity:					*1,030*																			
Loan repayment - interest plus principal (£)		1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
New total energy cost (£)		2,059	2,085	2,111	2,137	2,164	2,192	2,220	2,249	2,279	2,310	2,341	2,373	2,406	2,440	2,475	2,510	2,546	2,583	2,621	2,660	2,700	2,741	2,783	2,826	2,870
Net savings i.e. incl loan repayment (£)		**(1)**	**24**	**50**	**76**	**103**	**131**	**159**	**189**	**218**	**249**	**280**	**312**	**345**	**379**	**414**	**449**	**485**	**522**	**560**	**599**	**639**	**680**	**722**	**765**	**809**

Table A3a. High income household scenario – energy cost savings over 25 years assuming 50% energy savings and repayment of an £11K Green Deal Loan in 3 years at 6% and 8%. Note that if 35% energy savings are achieved at today's energy prices, there is no net cost saving to the householder even over a 25 year period. Negative figures are shown in parentheses

	Maturity:	**25**	**years**																						
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Annual energy bill post renovation (£)		515	527	540	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Gross savings ie excl loan repayment (£)		**515**	**527**	**540**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**
	Maturity:	**3**	**years**																						
Interest rate	6.0%	Annual loan repayment for given maturity:					*4,115*																			
Loan repayment - interest plus principal (£)		4,115	4,115	4,115	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New total energy cost (£)		4,630	4,642	4,655	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Net savings i.e. incl loan repayment (£)		**(3,601)**	**(3,588)**	**(3,575)**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**
Interest rate	8.0%	Annual loan repayment for given maturity:					*4,268*																			
Loan repayment - interest plus principal (£)		4,268	4,268	4,268	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New total energy cost (£)		4,783	4,795	4,808	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Net savings i.e. incl loan repayment (£)		**(3,754)**	**(3,741)**	**(3,728)**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**

Table A3b. Middle income scenario – £11,000 Green Deal loan taken out and 6% or 8% and subsidised with a 40% upfront grant (so that capital borrowed is £6,600 rather than £11,000). Repayment over 25 years; 50% energy savings at today's energy prices are assumed. Note that if 35% energy savings are achieved, the householder's annual outgoings will increase substantively. Negative figures are shown in parentheses.

	Maturity:	25	years																							
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Annual energy bill post renovation (£)		515	527	540	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Gross savings ie excl loan repayment (£)		**515**	**527**	**540**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**
Interest rate	6.0%	Annual loan repayment for given maturity:					*516*																			
Loan repayment - interest plus principal (£)		516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516	516
New total energy cost (£)		1,031	1,043	1,056	1,070	1,083	1,097	1,111	1,126	1,141	1,156	1,172	1,188	1,204	1,221	1,238	1,256	1,274	1,293	1,312	1,331	1,351	1,372	1,393	1,414	1,436
Net savings i.e. incl loan repayment (£)		**(2)**	**11**	**24**	**37**	**51**	**64**	**79**	**93**	**108**	**123**	**139**	**155**	**172**	**188**	**206**	**223**	**242**	**260**	**279**	**299**	**319**	**339**	**360**	**381**	**403**
Interest rate	8.0%	Annual loan repayment for given maturity:					*618*																			
Loan repayment - interest plus principal (£)		618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618	618
New total energy cost (£)		1,133	1,145	1,158	1,172	1,185	1,199	1,213	1,228	1,243	1,258	1,274	1,290	1,306	1,323	1,340	1,358	1,376	1,395	1,414	1,433	1,453	1,474	1,495	1,516	1,538
Net savings i.e. incl loan repayment (£)		**(104)**	**(91)**	**(78)**	**(65)**	**(51)**	**(38)**	**(23)**	**(9)**	**6**	**21**	**37**	**53**	**70**	**86**	**104**	**121**	**140**	**158**	**177**	**197**	**217**	**237**	**258**	**279**	**301**

Table A3c. Low income scenario – £11,000 Green Deal loan taken out and 6% or 8% and subsidised with a 55% upfront grant (so that capital borrowed is £4,950 rather than £11,000). Repayment over 25 years; 50% energy savings at today's energy prices are assumed. Note that if 35% energy savings are achieved, the householder's annual outgoings will increase substantively. Negative figures are shown in parentheses.

	Maturity:	25	years																							
		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	Y21	Y22	Y23	Y24	Y25
Annual energy bill without renovation (£)		1,029	1,054	1,080	1,106	1,134	1,161	1,190	1,219	1,249	1,279	1,311	1,343	1,376	1,410	1,444	1,479	1,516	1,553	1,591	1,630	1,670	1,711	1,753	1,796	1,840
Annual energy bill post renovation (£)		515	527	540	553	567	581	595	609	624	640	655	671	688	705	722	740	758	776	795	815	835	855	876	898	920
Gross savings ie excl loan repayment (£)		**515**	**527**	**540**	**553**	**567**	**581**	**595**	**609**	**624**	**640**	**655**	**671**	**688**	**705**	**722**	**740**	**758**	**776**	**795**	**815**	**835**	**855**	**876**	**898**	**920**
Interest rate	6.0%	Annual loan repayment for given maturity:					*387*																			
Loan repayment - interest plus principal (£)		387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387	387
New total energy cost (£)		902	914	927	940	954	968	982	997	1,012	1,027	1,043	1,059	1,075	1,092	1,109	1,127	1,145	1,164	1,183	1,202	1,222	1,243	1,264	1,285	1,307
Net savings i.e. incl loan repayment (£)		**127**	**140**	**153**	**166**	**180**	**193**	**208**	**222**	**237**	**253**	**268**	**284**	**301**	**318**	**335**	**352**	**371**	**389**	**408**	**428**	**448**	**468**	**489**	**511**	**533**
Interest rate	8.0%	Annual loan repayment for given maturity:					*464*																			
Loan repayment - interest plus principal (£)		464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464	464
New total energy cost (£)		978	991	1,004	1,017	1,031	1,044	1,059	1,073	1,088	1,103	1,119	1,135	1,152	1,168	1,186	1,203	1,222	1,240	1,259	1,279	1,299	1,319	1,340	1,361	1,383
Net savings i.e. incl loan repayment (£)		**51**	**63**	**76**	**90**	**103**	**117**	**131**	**146**	**161**	**176**	**192**	**208**	**224**	**241**	**258**	**276**	**294**	**313**	**332**	**351**	**371**	**392**	**413**	**434**	**456**