



UNDERSTANDING THE RISKS OF THE GREEN DEAL

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"The people who believe in faith healing have not to worry about science at all because nobody argues with them ... I think that we must mainly write some articles."

Richard Feynman, 1964

Introduction & summary

Over the past 18 months, Britain's coalition government has developed a truly radical and innovative climate change strategy. "As we come out of recession, the Coalition is determined to reduce our reliance on fossil fuels", said Energy and Climate Change Minister Chris Huhne in July 2011, "the Coalition's once-in-a-generation reforms ... show we're serious about making the long-term structural changes that are vital to cut emissions and keep the lights on".¹

For environmentalists, this was heady stuff. And it was particularly good news that the central set of reforms was designed to target the households – the domestic sector now accounts for 1 in every 4 tonnes of UK emissions, and household CO₂ now exceeds the combined total CO₂ of the entire transport sector, including cars, trucks, trains, vans, buses, national shipping and fishing vessels, domestic aviation and military transport combined. So it was good news that the government was developing a policy for households.

The challenge, however, is a staggeringly difficult one. To put numbers on the scale of the problem:

- UK emissions have fallen at 1.4% pa since 1990 – but domestic emissions by only 0.5% pa
- UK emissions are 75 years off target for 2050 – but domestic emissions are 150 years off target
- To get back on track, UK progress must be at twice the historic rate – but domestic progress must be at 7 times the historic rate²

The government's response to this challenge is the 2011 Energy Act, containing legal provisions for a scheme called the Green Deal. The details are complex, but the idea is simple: to make it easier for households to install Energy Saving Measures ("ESM") by creating a loan scheme in which repayments are made by whoever lives in the property and financed by the energy savings that the refurbishment itself brings about. The loan scheme is also accompanied by a revamp in the Energy Company Obligation ("ECO"), which will make additional funds available for certain kinds of household.

This combination of ideas seemed inspired to many people and benefited as a result from widespread support in parliament. The Labour Party were generally supportive of the Energy Bill as it passed through parliament, perhaps seeing it as a natural development of the Pay As You Save (PAYS) scheme under development when Ed Miliband was Minister for Energy and Climate Change.³ Caroline Lucas, parliament's single Green Party MP, argued for improvements to the scheme, including a link to the Green Investment bank, but was generally supportive of the concept: "as an idea", she said, "this has the potential to revolutionise the energy efficiency of our homes and other properties".⁴

Other members of parliament were even more positive, having found the Green Deal an attractive policy to talk about when knocking on constituency doors during the 2010 general election. During the bill's second reading, one coalition MP commented as follows:

*"The green deal was a positive policy to sell as a candidate in the general election. It was one of those rare beasts in politics, because everyone who heard about it saw the logic of it, and no doubt thought, "Why didn't I think of it?" including the Labour party.... what I like about the green deal is that it replaces the stick with the carrot... Yes, it is a game-changer, but I would prefer to describe it as a no-brainer. To my mind, it changes behaviour and reduces carbon footprints the easy way."*⁵

Yet it is this kind of language which should have set alarm bells ringing in Westminster. Given the scale of change required we should expect that long term improvement will require hard decisions and tradeoffs. We should be extremely cautious about anything which claims to be an easy way to reduce carbon emissions – not least because if such an easy path existed, we would surely have taken it already.

And as it turns out, the policy does indeed carry a number of important risks. The purpose of this paper is to set out what these risks are, and to encourage a discussion of how they may possibly be mitigated when the new legislation is completed. Part I highlights the environmental risks of the policy, in other words the risk that it will not deliver significant carbon reduction, and Part II looks at the political risks – in other words, the ways in which the policy could possibly backfire, both politically and perhaps economically.

Fortunately, there are measures that can be taken to mitigate the greatest risks that we identify, and these are discussed in Part III, along with a wider set of policies for the domestic sector – set out in Part IV – that can be implemented in parallel to the Green Deal, to offset the environmental risk. These policies offer greater consumer protection, significantly better carbon savings in the long run and some surprising political rewards for those with the courage to pursue them.

Part I – Environmental Risks

The environmental risk for the Green Deal is that it may not meet its own target of reducing domestic carbon emissions. The risks reflect a range of uncertainties in how households will respond to the policy, and the impact of their response. The following sections discuss how and why these environmental risks arise.

Risk #1. The Green Deal has been designed as a loan-finance scheme. But what if the problem is not the upfront cost, but the poor return on saving energy?

The Green Deal has been designed as a finance scheme: "we're bringing in the Green Deal", explained the Minister, "to help address the stumbling block of access to capital for green improvements".⁶ A leading journalist explained that the Green Deal is "ambitious and absolutely necessary" as it "solves the problem of people not having the cash available to invest in efficiency measures".⁷ The belief is that households are cashflow constrained and that this is why they do not refurbish their homes. But there are some reasons to believe that cashflow is not the real constraint. The evidence is as follows:

UK households currently spend around £60 billion a year on home furnishings, equipment, maintenance and repairs – including £12 billion a year on furniture and £3 billion a year on carpets.⁸ The total spend on homes, furnishing etc. is twice the total spend on alcohol and tobacco combined. (Exhibit 1) Although individual households are more constrained than others, as a whole the household sector has sufficient access to capital to finance the things that households want to finance. Moreover the private sector easily arranges finance for capital items that households regularly demand – e.g. sofas, carpets, kitchens, cars, Nintendos. The problem may therefore be that households do not want to finance ESM, not that they could not do so if they wanted to.

If access to capital were the barrier, wealthier households would have completed more ESM than poorer households as they have more capital. However this is not the case. The average SAP score of UK properties owned by the richest 20% of households is 52.2, compared to 53.7 in the poorest quintile, in other words the richer households are slightly *less* efficient.⁹ (Exhibit 3) Moreover, from 1991-2007 the poorest quintile improved SAP scores twice as fast as the richest quintile: the *wealthiest* households are investing *less* than the poorest, perhaps because they benefit from subsidies more often or feel the pressure of prices more acutely.

Richer households invest less than poorer households, even though they generally have more and better opportunities to save energy. Richer households tend to live in larger properties where energy bills are higher and the available savings are larger in cash terms. On average, the savings predicted by SAP are 3 times larger for properties over 200m² than for properties under 100m², in terms of both the lower and higher cost

categories of home improvement.¹⁰ So access to capital does not appear to accelerate ESM even when there are better opportunities available.

The lowest cost / faster payback forms of ESM are unpopular even when backed by regulation and subsidies.

The lowest cost measure for most households are energy saving lightbulbs, but 90% of London households surveyed in 2009-10 had still not switched over completely.¹¹ The next lowest cost measures are loft and wall insulation, which remain difficult to distribute despite subsidies of 30-100%. The payback on these measures (after subsidies) is usually 1-3 years at most.¹² There are complex sociological reasons why households do not carry them out, but it is not clear how important the role of cashflow really is.

Most energy saving projects offer a very low return at current prices. Exhibit 2 shows the Net Present Value (cashflow NPV) of a selection of 12 common ESM projects. Using figures provided by The Energy Saving Trust, all of the selected actions costing £500 or above have a negative NPV even when only a 5% discount rate is applied, which is a very low estimate for the household sector. The major actions with a positive NPV are those that cost less than £500 to install: loft insulation, cavity wall insulation, and draught proofing. This is interesting because the Green Deal appears to target high value actions with a significant upfront cost – the kind of project which a household might want to undertake, but is deterred for cashflow reasons. But as it turns out, there are few such actions: retrofit projects are either low cost and high return (e.g. loft or cavity wall insulation) or high cost and low return (e.g. a new boiler, underfloor insulation, solid wall insulation, or double glazing).

The perception of poor returns on energy saving may be increased by a belief that energy prices will fall in future. Although DECC forecasts that gas and electricity prices will rise by 52% and 70% respectively by 2020, households do not appear to agree. Only 9% of UK households have subscribed to fixed price energy deals, although the cost to fix prices is around 5-10%, or £5-10 per month extra for the average household.¹³ Exit fees are £20-30 per fuel or around £50 per household, so households who fix are better off if prices increase by more than 5-10%, with a downside of only £50 if prices fall. Yet the vast majority of households do not fix prices.¹⁴

In summary, consumer feedback about upfront costs may be misleading. When a typical consumer comments that ESM projects "sound expensive", what she may really be saying is that these projects "sound expensive *for something I do not want*". By contrast, when the purchase in question is viewed as desirable, households have no trouble accessing capital, as many examples demonstrate.

Conclusion: The Green Deal is a loan scheme, but improving access to capital may not be enough to encourage widespread uptake of ESM. We assume that people want to carry out ESM, but do not have the money, yet the opposite may be true: it could be that households as a whole do have money, but they do not want to carry out ESM, because the financial return is so low – particularly for the bigger ticket items that might present a cashflow barrier. In addition, households may worry that prices will fall in future, resulting in even lower returns.

Risk #2. Green Deal loans will transfer automatically to a new owner of your property. But what if buyers dislike the idea, and bargain down house prices by the amount of the outstanding debt?

The second premise of the Green Deal is that a loan will be more attractive if attached to the property rather than to the borrower. The idea is that transferability will help you, if you fear that a future buyer of your property may not value the ESM you carry out. Tim Harford writing in *The Financial Times*' summarised the argument as follows:

*"At least [this] idea addresses a genuine problem: people fear that if they move house after buying an energy-efficient boiler or double-glazed patio windows, the new occupants will reap the benefits without paying more for the house."*¹⁵

Tim is right in his description of what people fear, but he wrong to suggest the Green Deal addresses this problem. Arguably, vendors face the same valuation risk regardless of how they have paid for their patio windows. The question has simply shifted along slightly: instead of hoping that your buyer will value the new windows for as much as *you* paid for them, you will have to hope they value the windows for as much as *they* will have to pay for them, since they will be taking over the Green Deal repayments when they buy the house. If they do not value the ESM, they will bargain down the price of the house by the appropriate amount. Exhibit 4 shows a worked example.

If true, then the way you finance your improvements is irrelevant. If your buyer values them for less than you paid, then you will lose money regardless of whether you used the Green Deal. It is worth walking through the numbers in Exhibit 4, as Tim's article shows it is easy to be confused about how exactly this works. Furthermore, the government's consumer research shows that many people already struggle to understand the basic Green Deal concept: "the principles that some participants struggled with included the ideas that ... the repayment stays with the property via the energy bill."¹⁶ If some people do not understand the basic concept of a transferable debt, isn't it possible that many will not understand if or how a transferable debt can help them?

Many people will be confused and make the wrong decision. If people are confused, they may believe that the Green Deal allows them to make energy saving investments in their house, that are not valued by buyers, but without paying the price. In the case of low value items (e.g. loft insulation) the amounts in question may be small enough not to matter when negotiating over a house price, but for larger value items (debts of £5,000 or £10,000, say) there is clearly a problem.

Worse, the Green Deal might even make you worse off when selling your property. This may be true because, as a vendor you will now have to disclose the outstanding loan amount when selling your home. Publishing the loan details makes the cost of ESM explicit, in a way that it would not have been in a traditional transaction. This

removes the possibility that a buyer might *overvalue* the ESM allowing you to make a profit on it. If the upper valuation is capped at 100% then the average valuation must be lower than 100%. Walking the logic through from start to finish:

- The Green Deal makes the cost price of ESM explicit, as the loan value must be disclosed
- Making the cost price explicit puts a cap on the price the most enthusiastic buyer will pay
- Capping the upper valuation **at cost** means the average valuation will be **below cost**
- Therefore, the Green Deal makes it a certainty that you will lose money on ESM, when without the Green Deal it was only a possibility that you would lose money

We will not know how serious this problem is until the first properties with Green Deal loans attached are marketed for sale. At that point, buyers we may find that buyers use the GD loan amount as a reference number when bargaining over the property price. If the buyer does not value the ESM at all, they may bargain down the house price by the full amount of the outstanding loan. As this pattern starts to be recognised in the market, vendors will decide to pay off loans in order to market properties as “Green Deal” free.

If people decide to pay off Green Deal loans early, unprecedented early redemption penalties will apply.

Current Green Deal proposals include a provision to modify the Consumer Credit Act in order to allow Green Deal providers to charge higher penalty fees for early redemption than have historically been permitted by law. The proposals include an amendment to the CCA to allow providers to charge penalty fees up to "the total interest the provider would have received in the period from the date of the early repayment to the date fixed by the agreement for the discharge of the debtor's indebtedness".¹⁷ The rationale is to reduce the risk to providers and to keep the cost of loans low. But allowing providers to recoup the lifetime interest payments due on a loan is excessive, and – when consumers discover this provision – may turn out to be wildly unpopular.

Conclusion: A transferable loan may not protect you from losing money on your house if your buyer does not value the investments you have made. Worse, it might increase the chances that you lose money by making the cost of those investments explicit and capping the upper valuation that you can expect, which is a particular problem for larger value debts. When vendors realise this is happening, they may decide to pay off their Green Deal loans before marketing their properties, at which point they will wish they had not taken the loan in the first place. Finance providers will enjoy a surge in early redemption fees, which will be applied at higher rates than have historically been permitted. There is a risk of a political backlash at this stage.

Risk #3. Green Deal loans will be collected through energy bills, which have a lower default rate than other types of debt. But what if there is an adverse selection effect, and the default rate turns out to be *higher* for GD loans than for other types of debt?

The third principle of the Green Deal is that loans will be offered at below market rates, improving the attractiveness of ESM. But if the loans are below market rates, the difference has to be made up somehow: either with a subsidy, or an innovation that reduces the cost of lending.

The Green Deal offers an innovation by collecting payments through energy bills. A DECC Minister has explained that the default rate for Green Deal loans "will be the same as the standard default rate for electricity bills generally", which he explained, "is a very low percentage". This is correct, in that the arrears rate on energy bills is around 3 – 4% of invoices, compared to perhaps 5 or 6% of loan value for conventional personal loans.¹⁸

But the default rates on energy bills and conventional loans are not comparable, because everybody has an energy bill. No other credit product has 100% penetration. But what this means is that the "very low" default rate on energy bills is an average including millions of households who will never miss a payment. The Green Deal will not benefit from the same effect because not all households will take out a Green Deal loan.

What the default rate turns out to be for Green Deal loans depends on who signs up for them, and that in turn depends on how much they cost. If loans are expensive, they will only be attractive to households with no cheaper option, and those households by definition are already a higher credit risk. According to an IFS study of 2005 data, even before the financial crisis 25% of UK households had no cash or housing assets at all.¹⁹ These households will currently borrow at uncollateralised rates via credit cards, personal overdraft or money lenders, suggesting a marginal cost of capital of 20% pa or much higher in some cases. At the other end of the range 25% of households have £16,000 or more in cash savings and 10% have roughly £60,000 or more, suggesting a marginal cost of capital in the range 0-3% depending on what return they make on their liquid savings.

There is therefore at least some risk of an adverse selection. Around 1 million energy accounts are currently in arrears.²⁰ At the extreme, if those same million households are the first to sign up for the Green Deal, then the arrears rate for Green Deal loans would be 100%. If none of those households sign up, it might in theory be 0%. In practice it could be anything in between. (Exhibits 5 and 6)

In addition, there may be some ways in which the Green Deal actually increases the risk of default. There are at least a few scenarios in which exactly that might happen. For example:

- The promised savings from an ESM project do not materialise. The household is annoyed, cannot see the benefit of the measures being paid for, and refuses to make repayments.

- Measures are poorly installed and have to be replaced or refitted. The household refuses to repay the loan on the basis that they have had to pay to have the works redone again.
- A property is unoccupied. There is no energy consumption, therefore no savings. Repayments are either refused or deferred to a later time.
- A household doesn't understand the Green Deal. They feel they were tricked into taking out a loan. They make a case for mis-selling and refuse to maintain repayments in the meantime.

If such cases affect 1% of households, they could increase the current level of arrears (around 3%) by one third. It is worth noting that energy companies have few sanctions available when households do not pay bills as disconnection of supply is legally cumbersome and politically unpopular. There are currently around 500 energy disconnections per quarter, compared to 10,000 mortgage repossessions.²¹ The energy companies' only realistic option is to install a pre-payment meter, for which they must gain access to the property. At present around 15% of UK households have a prepayment meter.

The debt situation could change dramatically when smart meters are installed because the specification for smart meters requires that they be remotely switchable to prepayment mode by the supplier, and every household is expected to have a smart meter by the end of the decade.²² Smart meters could therefore reduce energy defaults in future by allowing suppliers to switch households in arrears immediately to prepayment mode, without having to gain physical entry to the property. However the method is blunt and may be unpopular, and amounts to saying we will be able to collect Green Deal payments effectively because we will disconnect the energy supply to households who do not pay. This would be an extraordinarily effective technique compared to existing alternatives for debt collection, and may imply a future role for energy companies collecting any type of debt, but it is not true at present that the underlying credit risk on energy bills is lower.

Conclusion: The low rate of default on energy bills reflects the fact that everyone has an energy bill, not that extending credit to an individual is less risky if done through the energy company. The rate of default on Green Deal loans could be anything from 0 to 100% depending on who signs up, which in turn depends on the cost of loans and how they are marketed. Some features of the Green Deal might even increase the underlying default rate. By the end of the decade, smart meters will change this, but automatically switching households to prepayment will be unpopular, and until that time there is a reasonably high debt risk.

Risk #4. The energy efficiency of UK housing is improving fast without the Green Deal and may be on track to hit a natural ceiling before 2050. What if the Green Deal just picks up investment that was happening anyway?

Over the past 40 years the average SAP score of UK housing has been steadily improving, at an average rate of about 0.9 SAP points a year. (Exhibit 7) This is mostly as a result of tighter building regulations, renewal of the housing stock and rising energy prices. It reflects the privately funded investment described under Risk #1.

This trend is relatively stable over 40 years and may be set to accelerate as a consequence of rising energy prices. The government's consumer research shows that 76% of households have done some kind of home improvement in the past 10 years, and even prior to any discussion of the Green Deal, 58% plan to do more in the next 5 years, and 33% plan to do a major refurbishment.²³

If the long term trend continues the national average SAP score would rise from around 50 to around 90 points out of 100 by 2050. However, many properties can never achieve higher than a B rating (equivalent to 81-90 points out of 100) without heroic investment, so it may be impossible to reach a national *average* SAP score as high as 90 / 100. The Energy Saving Trust's 2010 guide to Sustainable Refurbishment shows how to improve 8 types of dwelling to a B rating: it was not possible to improve those properties to an A rating.²⁴

Improving properties beyond the higher cost and further measures recommended on an EPC can be extremely expensive. The Energy Saving's Trust demonstration refurb of a terrace house in Sheffield cost £45,000 and saved around £1000 in annual energy costs (bring the SAP score to 92).²⁵ Their refurb of a 6 bedroom Victorian family home in Fulham cost £108,000 and saved £1800 a year (bringing the SAP score to 90).²⁶ The Guardian's featured Green Deal "eco-home" cost £77,000 to refurbish saving around £800 in annual costs.²⁷ A full refurbishment of a Victorian family home to PassivHaus standards can cost £250,000.²⁸ These projects have a strongly negative net present value at any discount rate above 1.5%, even assuming the predicted savings are fully realised every year and forever.

The current trajectory may well take us as far as we can reasonably expect to go on SAP scores, within the timescale of our 2050 targets. Because this momentum already exists, the Green Deal may simply become a vehicle for financing home improvements that would take place anyway.

The experience may be similar to that of the 2010 boiler scrappage scheme, in which 60% of those receiving a scrappage voucher said they would have replaced the boiler anyway with a year. In practice, 60% of those who applied but did not get a voucher had already replaced their boiler anyway *within 6 months*. The

implication is that the Green Deal may simply pick up large volumes of refurbishment work that would be happening anyway.²⁹

The Green Deal may accelerate the speed at which we approach the ceiling of what is achievable, but the potential to bring forward investment is relatively small. As shown in Exhibit 8, the total cost of all available ESM in the UK housing stock, is probably around £500 billion, or around £18, 500 per property, compared to expected spending under Green Deal and ECO of around £25 billion over the next decade. Therefore even if 50% of Green Deal projects are genuinely new (i.e. additional to investment that would have happened anyway) the net potential is to bring forward approximately 2.5% of the total required investment.

Conclusion: Existing approaches (a combination of regulation, renewal of the housing stock, and rising energy prices) has led to a steady improvement in average SAP scores stock over 40 years. This trend may take us to a natural ceiling in fabric efficiency even without the Green Deal, and within the timeframe of our current carbon targets – in other words, Britain’s houses may be on track to improve as much as they physically can anyway. Providing Green Deal finance could bring the total improvement forward slightly, but the potential effect is limited because the total investment requirement is large (perhaps around £500 billion).

Risk #5 – Recent studies suggest that ESM often does not lead to reductions in energy usage. What if we are under-estimating the rebound effect?

If the previous sections can be summarised as saying that the Green Deal will not improve the energy efficiency of UK housing stock as measured by SAP, then the suggestion of this section is that improving energy efficiency as measured by SAP may not noticeably reduce carbon emissions anyway. Some of this is based on very recent studies that throw light on the relationship between SAP and actual consumption. The data is as follows:

An improvement of 1 SAP point correlates with saving around £3-4 of energy per household per year, based on a 2011 Cambridge University working paper and controlling for income, property size, temperature, occupancy and behaviour. Improving a property by 10 SAP points (enough to improve by about one band, say from an E to a D) is worth around £37 in theory. By comparison, in the same study, increasing household income by £10,000 is correlated with an increase in energy consumption of £88 / year, and behavioural factors such as heating an extra bedroom with additional consumption of £27 – 108 / year.³⁰ (Exhibit 9)

The difference between actual energy consumption in efficient properties (SAP score over 50) and inefficient properties (SAP under 50) is only around 5%, driven by sharply lower consumption among the least efficient households. This is based on a 2005 study by BRE, Defra and The Energy Saving Trust which collected meter readings over 2 years from around 3000 properties and which is one of a rare number of studies to analyse actual rather than theoretical energy use.³¹

Improvements in efficiency for properties with the lowest SAP ratings appear to *increase* actual consumption, as shown in Exhibit 10.³² This may be because households in the hardest to heat homes radically adjust their behaviour and spend 30-50% less on energy than their SAP rating would predict, meaning that they often spend less than households in more efficient properties. As a rule of thumb, improvements in SAP score will not lead to an actual reduction in energy consumption until the improved score exceeds 50 points. For households in the worst rated properties, all of the energy saving benefit appears to be taken as an improvement in comfort (the rebound effect). According to the Energy Saving Trust 40-45% of properties have a SAP score below 50.³³

The rebound effect offsets 10-30% of any energy saving improvement expected by SAP, as shown by a 2006 review of the literature by The Energy Saving Trust and Glasgow Caledonian University, looking at studies of the relationship between SAP predictions and actual consumption, and by a yet more comprehensive review in 2007 by Steve Sorrel for the Energy Research Centre.³⁴ The first review concluded that if SAP predicted a 50% reduction in energy use, the household would only save 35%, i.e. 30% less than expected.³⁵ The second review concluded that the rebound effect was at least 10% and perhaps around 30% for residential consumption. The Green Deal materials discuss a possible rebound effect of 15% but policymakers have agreed the true range may be 15-40%.³⁶ The European Commission estimates that the range of the rebound effect is actually 20-80%.³⁷ The Khazzoom/Brookes postulate argues that such rebound effects are greater than 100% in the long term.³⁸

The importance of such effects was underlined by second report of The House of Lords Select Committee on Science and Technology published in 2006 and which concluded that "the Government have so far failed to engage with this fundamental issue."³⁹

Other studies exist with similar observations, but these findings show the importance of working with actual consumption data rather than theoretical savings. SAP is fundamentally a method for estimating emissions while controlling for or standardising the behavioural component, and what these studies show is (i) that the behavioural component is much more important than the SAP component in explaining actual consumption, so should not be standardised away; and (ii) that behaviour in itself can be strongly affected by the SAP score of the property. A significant proportion – sometimes the entirety – of the energy savings theoretically made possible by property refurbishment will be offset by changes in behaviour associated with that same refurbishment.

Modern studies reflect an idea that has been around for over a century. The Jevons Paradox, established in *The Coal Question* (1865), is the proposition that technological progress that increases the efficiency with which a resource is used, will tend to increase (rather than decrease) the rate of consumption of that resource. "It is a confusion of ideas", Jevons wrote, "to suppose that the economical use of fuel is equivalent to diminished consumption. The very contrary is the truth." If applied to the Green Deal, we might formulate the proposition as follows: "All else equal, measures to improve the energy efficiency of UK housing will increase (not decrease) the amount of domestic energy consumed."

We do not know this is true, but nor at this stage do we know it is false. But the key claim is not that fabric improvements are unnecessary, because the important clause is "all else equal". The claim is that efficiency improvements can increase demand by making the unit cost of consumption lower, which implies that SAP improvements would not matter *in the absence of rising prices*. But when effective and sustained price signals are in fact in place, people make SAP improvements on their own, and that is how they work.

Conclusion: In the absence of price signals, schemes to make our houses more energy efficient may not save much energy and could even lead to increased consumption in many cases. Around 20-30% of the value in SAP improvements could be lost to the rebound effect, and in some cases (houses with SAP scores below 50, which are a good proportion of the total housing stock) SAP improvements might even increase total consumption, an example of the Jevons Paradox or Khazzoom-Brookes postulate. In general, the importance of behaviour is underestimated, and the role of fabric improvements is over-estimated.

Risk #6. The most cost-effective way to save energy is by changing our consumption habits, often linked to changes in how much energy costs us. What if the Green Deal misses this opportunity, by focusing on fabric improvement rather than price signals?

DECC's home page for the Green Deal shows a picture of a hand poised to turn down a thermostat, one of the most effective energy saving measures available to households. It is also the most cost effective as it costs nothing. Yet the Green Deal legislation is likely to have much more impact on physical fabric improvements than on conservation behaviours such as turning down the thermostat, and the risk is that fabric improvements on their own are not enough to change behaviour.

Green Deal advisors will provide face to face advice during their home assessment, but it is not clear if or for how long this kind of advice has an impact. In the context of the CERT scheme, Ofgem were prepared to give energy suppliers a credit of 675kg lifetime tonnes of CO₂ (worth about £5 in the market) for each household receiving an advice package, compared to 15-20 tonnes for a loft insulation. Ofgem apparently did not believe that face to face advice would deliver actual reductions in energy usage, at least not over a sustained period.⁴⁰

On the other hand, behaviour does respond to prices: a meta-analysis of peer reviewed studies of the price elasticity of demand for electricity in the USA showed an average short term price elasticity of -0.35.⁴¹ Recent studies of UK and European elasticities gave an estimate closer to -0.2.⁴² Similar findings have been made in studies of the impact of rising block tariffs.⁴³ In other words, all else equal we should expect a 1% increase in prices to lead to at least a 0.2% decrease in demand. The elasticity of demand for energy is both powerful and predictable, evidenced by numerous studies around the world.

In addition to prices, there are three other factors affecting energy demand at the macro level. These factors are real GDP; annual average temperature, and the annual average grid carbon factor: combined with energy prices in a simple model, these factors explain 80-90% of the variation in domestic carbon emissions over the past 40 years and are statistically significant at the 97-99% level.⁴⁴ (See Exhibits 11 and 12). The model is very simple, but as one Nobel Prize winner in Economics has observed: "an algorithm that is constructed on the back of an envelope is often good enough to compete with an optimally weighted formula, and certainly good enough to outdo expert judgement."⁴⁵

Controlling for these macro factors, average SAP scores have no effect. A 40 year time series of SAP scores is not statistically significant in either a normal or a first differences regression. Adding in the SAP data hardly improves the explanatory power of the model in the basic version, and does not improve it at all in the first differences model, in which it is also not statistically significant even at the 75% level. This analysis supports the view that fabric improvements have very little impact on consumption independent of the wider effect of prices.

(It is notable that one of the few studies to find a robust relationship between energy efficiency and energy saving fails to control for energy prices, or even mention the word 'price' or 'prices'.⁴⁶)

Of the four variables which do have an impact, only two are within our control: the grid carbon factor and the real price of energy. The weather is out of our control, although its effect is slightly favourable as the underlying trend is towards warming and therefore reduced heat demand. Similarly the growth rate in real GDP is probably out of the remit of environmental policy, unless we wish to advance carbon reduction through a policy of encouraging recessions.

However, policies focusing on the two controllable variables (energy prices and the mix of fuels used to generate electricity) may still be enough to achieve an 80% reduction in domestic emissions. The model suggests that the change required is something roughly in the order of a 3-4% real increase in energy prices every 6 months, along with a 3-4% annual reduction in the average grid carbon factor (assuming trend growth in real GDP of 2% pa, no Green Deal, and no acceleration of the warming effect on UK weather). By 2050, energy would need to cost 3-4 times as much as it does today.

A price based approach has a further advantage, that it makes no assumption about how households save energy. In this scenario, people choose their own way to save energy, in some cases simply by turning down the thermostat and in others perhaps by carrying out expensive ESM. But in either case, there is no need for a centralised government process to accredit and monitor providers and indeed it may be easier to exempt people from blanket pricing strategies than it is to have them actively sign up for subsidies. All that is required are the normal consumer protection measures that government delivers for any other unsubsidised industry (fair trading; statutory rights; and so on).

“Government should not pick winners”, a DECC minister wrote in a recent newspaper article.⁴⁷ But the irony of the Green Deal is that it does require government to pick winners, because it is essentially a subsidy and so we have to be careful about who can have it. Under this approach, the authorities will have to manage a list of permitted measures; they will have to run tests to accredit products, assessors, and finance providers; and they will expose themselves both to the cost of doing all this, and to the economic and political problems which arise when these checks and balances fail, as they surely do at least some of the time.

Conclusion: The Green Deal risks under-performing because it does not directly target behaviour or prices. In the long run, we are unlikely to achieve meaningful reductions in usage without a substantial further increase in prices. Price-based approaches have the further advantage that they tackle the emissions problem without specifying a solution, and they also have the advantage that they work, as numerous studies have shown. There is no such study to show that the Green Deal will work, certainly not without the backing of a strong price signal.

Risk #7. Nearly half of domestic energy use comes from a minority of users (around 20%) with high consumption. These are typically wealthy families in big, owner-occupied properties. What if the Green Deal misses the opportunity to target these households?

Perhaps the most important risk in the Green Deal is that it may not be attractive to the households with the greatest potential to make energy savings. Indeed, it may be most attractive to those households who have the least to save. The evidence is not conclusive, but the indications are as follows:

44% of UK electricity consumption comes from the top 20% of users, who consume anything from 250% to 1000% more than the median household, as shown in Exhibit 13.⁴⁸ The minority of high volume users are typically large families in large houses and with large incomes. One reason for their excessive usage is that these households have large properties that are expensive to heat, including stately homes, townhouses, farmhouses, etc. But another reason is possibly that these households are wealthier, and fundamentally less sensitive to the price of energy. In general, around 80% of emissions are from owner occupiers. (Exhibit 14)

Green Deal loans may not be most attractive to these households, because they are financially better off and can already borrow at lower rates in conventional ways. The highest use households typically have savings (currently yielding 1 or 2%) or a mortgage (currently costing between 2% and 5%) so the Green Deal would have to be interest free, or nearly so, to offer a significant improvement. If the loans come in at 6% to 9% as the Green Deal Finance Company anticipates, the effect will be to make ESM less attractive than it already is for these people.

The transferable feature of the Green Deal may also not be attractive to the target, high volume users because high volume users live in larger properties and 90% of larger properties are owner-occupied.⁴⁹ Owner occupiers move house on average every 12 years, so there is much less incentive for them to take part. If it turns out that the loan transferability does not have a real benefit anyway, as argued in section 1.2, Green Deal loans may only be attractive for households in rental properties, who account for only around 20% or less of domestic emissions.⁵⁰

Conclusion: Green Deal finance may be most attractive to households that cannot borrow at normal mortgage rates, for example because they have bad credit or no collateral. While it may be socially desirable to introduce green schemes for these households, it would not be a good strategy for carbon reduction – because it is the richest households, not the poorest, which have the highest carbon emissions. The Green Deal risks missing the best opportunity in the sector, which is to target the highly concentrated segment of high income / high consumption households.

Summary of Part I – The environmental risk

The purpose of Part I has been to highlight the risk that the Green Deal will not deliver a significant change in household carbon emissions. The various different reasons can be summarised under two headings, as follows:

Firstly, the scheme may not be as popular as policymakers expect, because

- It offers a solution to cashflow problems, but cashflow may not be the real barrier to ESM
- If you worry about losing money on your investments when you move house, the Green Deal may not help you (although the reasons why are quite confusing)
- The loans may well cost more than anticipated, and the debt risk may have been underestimated
- The scheme may be least attractive to the highest volume energy users

Secondly, even if take-up is widespread, the scheme may not result in substantial carbon savings. It may pick up investments that are happening anyway, like the boiler scrappage scheme. It may be most attractive to the least efficient properties, and when you improve the efficiency of such households it turns out that they consume more, not less. And finally it does not directly tackle behaviour, or prices, which are the most effective – as well as the most *cost* effective – opportunities that we have in this sector.

What would it take to say that the scheme has ‘worked’?

The overall risk is not that households will never sign up for the Green Deal, or that domestic carbon emissions will not continue to decline in the future, at least in line with recent trends. The scheme will surely be attractive to many people. Instead, the risk is that the Green Deal may fail to meet the following definition of success:

The Green Deal should result in a greater reduction in domestic emissions than can be explained through simple modelling of real GDP, energy prices, the carbon intensity of grid electricity and the weather.

A stronger requirement would be that the effect of the scheme should be enough to put household emissions on track for an 80% reduction by 2050 or sooner. The risks identified in this chapter suggest make it hard for the Green Deal to meet either the weak form or the strong form of this requirement.

Part II – Political risks

Part I addressed the environmental risk of the Green Deal, in other words the risk that it might not lead to actual carbon savings. This section by contrast looks at five ways in which the Green Deal could potentially backfire politically: in other words, ways in which the policy could go wrong in some areas, potentially triggering a backlash against green schemes in general.

Risk #8. Delivering a Green Deal loan entails a number of new costs, that are significant in the context of low cost interventions like loft and cavity wall insulation. What if these interventions actually become *less attractive* under the new scheme than they are today?

The first challenge of the Green Deal model is how to afford the cost of a high quality, customised and accredited home survey. Such surveys may end up at around £150 per property, of which £30 pounds will be the cost of VAT and a further £5 or 10 / property will be charged by whoever provides the software, accreditation and monitoring of home assessors. The remaining £100 or so must cover scheduling, travel, parking, wages, paperwork plus a contribution to overheads such as training, equipment, management, holidays, sick pay and a profit margin.

The experience of the Carbon Census was that it was nearly impossible to deliver a sufficiently high quality home survey and advice session for £100 / household. It is unlikely that large companies with higher overheads and a more complex proposition can do it for less than £150 / house, perhaps not for less than £200. “The days of the £100 survey are over”, said one participant in the early DECC meetings on this theme.⁵¹ There may also be additional costs related to raising bond finance and administering bills through the energy company, which are harder to quantify at this stage.

In comparison, loft or cavity wall insulation typically costs around £300 / house, around a third or a half of which has been subsidised in recent years through the CERT scheme. So a product which used to cost households around £150-200 looks likely to cost them something in the order of £450-500, depending on the cost of the home survey.

Knauf Insulation has estimated that, as a direct result of the Green Deal, the total UK market for mineral wool insulation will collapse by 40% in 2013, the first full year of the Green Deal, and will only recover to 80% of 2010 levels by the end of the decade. This is despite the fact that there is a trend increase in demand from the

new build sector: the drop off in the refurbishment sector itself is even more severe. The Managing Director of Knauf Insulation has commented as follows:

“The Green Deal and ECO in their current form offer no real incentive to upgrade loft and cavity wall insulation for the ‘able to pay’ sector This approach will damage insulation industry capacity, miss out on significant low hanging fruit and ultimately impact on Government’s low carbon ambitions for the residential sector.”⁵²

Clearly these comments reflect the commercial interests of the Knauf insulation company, not an independent analysis of public policy. But even so, we are faced with a major national refurbishment campaign that does not play to the interests of the insulation industry, which is a fact that on its own merits serious consideration. If the loft and insulation market collapses by 40% in the first year of the scheme, the potential for embarrassment is substantial.

Risk #9. We don't yet know what Green Deal loans will cost. They may need to be priced at 10 - 20%, rather than 3% - 6% as recently anticipated, but at those rates there would be no takers. What if the true finance costs are passed on to installers, as an increase in the cost of ESM projects?

During the second reading of the Energy Bill, the government was asked to make a commitment on the rate at which Green Deal loans would be offered. “It is irresponsible”, said one MP in the debate, “for Ministers to present such a major Bill to the House and yet remain silent on the intended rate of interest, when the success or otherwise of the entire Bill—certainly the green deal part of it—hinges on that point”.⁵³

The government has indicated that the rate will be lower than the normal cost of an unsecured personal loan, around 11% in the current market.⁵⁴ The expectation is that rates will be lower because there will be a lower level of default (section 1.3) and because of the potential to reduce funding costs by securitising loans through the Green Deal Finance Company, a private sector proposal which the government has welcomed.⁵⁵

However, it is possible that 11% is not the correct benchmark for loans of this size. 11% is the benchmark rate for loans of £10,000, but the rate for loans of £5,000 is actually 16%, reflecting the higher relative processing cost of smaller loans and also a selection effect, with larger loans generally available to better quality borrowers.⁵⁶ The government has not stated what size it expects Green Deal loans to be, but the 2010 election manifesto used a figure of £6500 per household. At this level, 16% is the appropriate benchmark, not 11%.

Even with a benchmark of 16%, Green Deal loans may not be cheaper than conventional lending because they do not require collateral or a credit check and there is a lack of easy sanctions for households who do not repay. In addition, it has been suggested that non-payment of Green Deal loans will not affect the personal

credit rating of the defaulter. By contrast conventional lending is always credit-screened and the borrower's credit score is always at risk if she doesn't keep up the repayments.

If the benchmark is 16%, but GD loans are harder to collect, then it is possible that the eventual rates could be as high as 19-20%, i.e. about the same as credit card debt or personal overdrafts. This follows from the lack of screening; the lack of sanctions for non payment; the risk of adverse selection; the higher cost of smaller loans; and the possibility that survey costs and other overheads will be rolled into the repayment schedule.

At effective rates of 10-20%, there will be no takers. Research by the Great British Refurb Campaign and YouGov in 2010 found that "34% [of households] say that they are 'very' or 'fairly likely' to take up [a Green Deal type loan] with a low interest rate of 2%. However, this drops to a mere 11% with an interest rate of 4% each year, and just 7% with an interest rate of 6%." ⁵⁷

At a rate of 0% interest there would be many takers, because of the additional, especially powerful appeal of things that are free. "Most transactions have an upside and a downside, but when something is FREE! we forget the downside", observes Dan Ariely, Professor of Psychology and Behavioural Economics at Duke University. "FREE! gives us such an emotional charge that we perceive what is being offered as immensely more valuable than it really is." ⁵⁸

If providers wish to harness the power of FREE! to promote the Green Deal, and the government is not providing a subsidy, then the loans will have to be cross-subsidised with the profits made on another service. Providers may do this by taking a minority stake in independent installers or assessors, or by running those services themselves. The finance market for cars, kitchens and sofas has operated in this way for decades, but the Green Deal faces the unique problem that the cross subsidy must recover the *excess* lending cost that follows from the way Green Deal finance has been designed, i.e. with no credit checking, sanctions or collateral.

If providers cross-subsidise loans, they will need to add 10 to 20% to the cost of measures, even if the loan itself is free. Consequently consumers will pay a higher total cost for services than they would under a conventional secured loan, or if paying for services out of income.

Risk #10. The targets for rolling out the scheme are very ambitious, and households will be offered cashback to ensure take-up at this rate. But what if future occupiers, who have to pay back the cashback, think that is unfair?

The government has suggested that the Green Deal will be taken up by 14 million households by 2020 and by all households in the UK (26 million) by 2020.⁵⁹ The benefit of achieving 100% penetration would be significant in terms of pooling risk and reducing the impact of bad debt. But to achieve such penetration, the Green Deal will

have to match the take-up rates of mobile telephones, in terms of penetration rates the most successful consumer electronics product ever, and exceed the take-up rate of broadband internet, which after rolling out for 15-20 years still only reaches 17 out of 27 million UK households.⁶⁰

This is a bold aspiration for a product which is already under-demanded, and requires strong incentives to ensure it can be met. In October the government announced that £200 million would be available to finance incentives for participation in the first year. Yet even this may not be enough: the Great British Refurb / Yougov research showed that even if a £500 council tax rebate were promised, 51% of households would still not be interested in taking out a loan.⁶¹

The incentive payments required to make home energy plans as popular as mobile phones will be unaffordable in the long run. The only way to make these payments affordable is to have the future occupier pay for them, so it is likely they will be rolled back into the initial loan for future occupiers to pay back. Even if the first £200 million are funded out of the public purse, future incentives will not be affordable at this level, and indeed a general provision has been made for all households to be eligible for cashback schemes, up to 5% of the value of works, to be rolled into the loan amount. The future occupier would object, if she were in the room at the time, but she is not.

Cashback schemes make the economics of energy saving worse, not better, but not for everybody. Those who receive cashback will be better off, but those who have to pay the cashback back will be worse off, although by the time they are paying back the cash, it will be too late to exit the scheme.

Risk #11. Separating the person who takes out a loan from the person who pays it back introduces the risk of moral hazard and over-charging. What if suppliers target people who plan to move house soon, effectively colluding with them at the expense of future occupiers?

The risk of moral hazard is very relevant for the Green Deal and applies on several different levels. A risk of moral hazard in general arise when an individual or organisation:

*does not take the full consequences and responsibilities of its actions, and therefore has a tendency to act less carefully than [he/she] otherwise would, leaving another party to hold some responsibility for the consequences of those actions.*⁶²

Moral hazard in the Green Deal could lead current occupiers to carry out overpriced works, because they will not be responsible for the long term repayments – and in the short run they are still better off. The Golden Rule – which requires that repayments not exceed savings from the measures undertaken – is not sufficient to prevent this, as the example in Exhibit 15 shows. A green deal plan offering the insulation for free in exchange

for annual repayments of £100 for 12 years, would satisfy the Golden Rule but quadruple the cash cost of the measure.⁶³

In this example, the current occupier makes herself £250 better off, but makes the future occupier £850 worse off. The current occupier is unarguably better off with a GD loan. But the future occupier, who moves in and stays put for 10 years, pays out £850 than she would have, nearly three times the upfront cost of the measure. So she is unarguably worse off with the GD loan than she would be if she had paid in cash. In total, the loan arrangement has taken £850 of value away from the future occupier, of which £250 is received by the current occupier.

In sum, for this example and before calculating interest rates, £600 of value has been taken away from consumers for works that are worth £300. The £600 will accrue to whoever in the supply chain turns out to have the greatest market power. That may be the finance provider, if funds are scarce; or the installer, if skills are scarce; or the assessor, if the home survey business turns out to be a natural monopoly. The excess profit to be made at the expense of future occupiers dwarves the margin to be made on the works themselves, and creates the perfect conditions for a supply driven bubble.

If buyers are astute, they will recognise what is happening and bargain down the house price to offset the extra costs of the loan they inherit, effectively forcing the original borrower to reimburse the excess cost that has been charged by suppliers. But if buyers are not able to assess exactly how much the loan has been overpriced, they are likely to err on the side of caution and may seek to bargain down the house price by the entire value of the outstanding loan. It will become the norm to accept a reduction in sale price equal to the entire value of the GD loan, or to require the vendor to pay off the loan before completing, further reinforcing the dynamic of section 1.2.

The details of this example can be varied to include the time value of money, depreciation, the cost of the home survey, and other factors – but the conclusions are the same. The Green Deal creates a situation in which providers have strong incentives to sell overpriced loan arrangements which benefit the current occupier of a property, but which severely penalise the future occupier and destroy value overall. They also have incentives to over-promise on the future savings of any measure, knowing that the current occupier has no reason to scrutinise these forecasts.

The result could be a supply bubble even in the relatively straightforward case of loft insulation where there is limited potential for variation in installation quality or effectiveness; where the asset installed does not deteriorate quickly after installation; and where savings are relatively more predictable. The impact is even more extreme in the case of more complicated measures such as double glazing, where the quality of both the product and the installation can vary widely; the savings are harder to estimate because of behavioural factors; and the majority of depreciation occurs in the early years of the product's lifetime.

Another impact of the moral hazard risk may be that a future occupier finds poor quality measures have been installed and must be renewed or replaced before the loan is repaid. In other words she risks finding herself in negative equity on her Green Deal loans. The greatest risk of Green Deal negative equity arises in the rental market, where properties turn over more quickly and where there is no chance for a new occupier to bargain down the purchase price. But if we have to rely on a house price bargaining process to eliminate moral hazard, then we are back to square one: there is no benefit left in the idea of a transferable loan. The current occupier would do better to avoid the extra costs of Green Deal lending, and pay for works out of savings or by drawing down on her existing mortgage with an equity release plan.

Moral hazard may be further increased by securitising Green Deal loans on the secondary market, so not even the financing company will share the risk that savings don't materialise as forecast. In fact, the two parties who will actually carry the long term risk associated with the loan – the investor in Green Deal securities, and the future occupier of the house – are by definition the only two parties who will not be in the room when the terms are agreed.

The parties who market the Green Deal on the other hand will have strong incentives to promote the scheme. They may quickly realise that the way to make money is to find households where the current occupier has plans to move house soon, and can be made better off in the short run by a loan agreement that is over-priced for the long run. Most of these opportunities may be in the rental sector, but there will be niches where the same logic applies in the owner occupied segment too. They may even find they can devise product and marketing strategies that increase the opportunities for commercial exploitation of the moral hazard dynamic, such as offering loans with an initial teaser rate, or even at the extreme an interest-only Green Deal loan (which would transfer all the cost to future occupiers, and give the original tenant longer before they have to move out).

The experience of Feed In Tariffs and the Renewable Heat Incentive shows that sales focused organisations cannot be relied upon to exercise restraint. An undercover probe by consumer organisation Which? in April 2010 found that 10 out of 14 companies selling solar thermal systems exaggerated the potential savings. Which? CEO Peter Vicary-Smith commented that 'most of the firms in our investigation behaved like true cowboys - they promised huge savings that bore no relation to reality, and some really piled pressure on the homeowner'.⁶⁴ One solar assessor told me off the record that "the solar industry is going the way of double glazing in the 1980s".⁶⁵

In summary, the greatest risk created by the Green Deal is the opportunity for a current occupier and a GD provider to collude at the expense of future occupiers to extract, up front and for their own benefit, the entire lifetime benefit of an energy saving measure. This risk could be mitigated if installers were in hot competition with each other, but competition among providers will be limited both by the high barriers to entry of this market; time consuming nature of home surveys; and the likelihood that cross-subsidy will be required

between assessors and installers. In the absence of primary competition, an investment threshold is required, such as a minimum NPV or IRR condition. This will not solve the moral hazard problem, but it will put a cap on it.

Risk #12. If the scheme is successful, total energy demand will fall, and the industry will increase prices, offsetting 20-30% of any savings made. This is the market price effect. What if consumers react badly when their forecast savings do not materialise for this reason?

The energy industry is relatively relaxed about policies to reduce energy consumption, because they assume that reduced consumption will be offset by rising prices. This is the 'market price effect' of energy saving. The market price effect arises if average volumes decline, but the industry is required to maintain the same level of fixed costs. E.g. to build the same number of power plants; to maintain the same level peak capacity; to staff the same number of call centres; to send the same number of bills to consumers. If volumes fall, unit prices must rise as these fixed costs must be spread across a lower volume of energy sold.

The market price effect is quite predictable. If the fixed costs of the industry are 25%, then prices will rise to offset 25% of the volume savings made. A household which expects to save £200, will find they only save £150 in practice. 25% is a rough estimate of current fixed costs, based on the latest segmental accounts provided by Ofgem.⁶⁶ If fixed costs are actually 20 or 30% of all costs, then savings will be 20 or 30% less than expected.

The market price effect is not noticeable if only a few households save energy, but if many households save energy it could be significant. Mathematically, if the market price effect is 25% as above and 10% of households save energy, then on average 2.5% of expected financial savings will not materialise. However if 50% save energy, then the offset will be 12.5%; and if 80% save energy, it will be 20%.

If the architects of the Green Deal are planning for success, they should consider an amendment to the Golden Rule to require a safety margin between savings and repayments. This is because the Green Deal is a loan scheme and is marketed on the basis of a promise of savings to consumers. To the extent that the market price effect applies, the promise is deceitful; if the market affect is not acknowledged, it could expose the scheme's designers to a legal challenge.

Alternatively, policymakers could choose strategies that offer growth in the utility sector to offset any success in the delivery of household demand reduction programs. For example, policies to encourage electrification of the transport system (cars, trains, trams, buses) can reduce total emissions but increase the total demand for electricity. Such policies would abate the market price effect for electricity, effectively by transferring the net impact of demand reduction initiatives to the oil sector.

Summary of Part II

The purpose of Part II has been to show that the Green Deal carries substantial political as well as environmental risk. The risk is not just that the carbon saving targets will be hard to meet, but that along the way certain things may go wrong that cause a backlash – against the scheme, and against other green policies. The five ways in which the Green Deal could go wrong are:

- First, by requiring a home survey, which will make the cheapest and most cost effective interventions less attractive than they currently are, especially loft and cavity wall insulation
- Second, by issuing loans with no credit screening, collateral or sanctions for non-payment and thereby increasing the cost of ESM relative to conventional lending
- Third, by introducing the concept of ‘cashback’ at the expense of future occupiers
- Fourth, by separating the person who takes out the loan from the person who has to pay it back, creating the opportunity for suppliers and current occupiers to agree unfavourable loan arrangements, to their mutual gain but to the disadvantage of future occupiers who are not in the room to protest
- Fifth, by overlooking the potential for a market price effect if the scheme is successful

In the first three cases, these problems could largely be avoided if the government were to subsidise the loans or guarantee their debt, and indeed this is what many organisations and lobby groups have called for. But the arguments of Part I suggest that this might not be a good use of so much public money. The purpose of Part III, therefore, is to offer a number of recommendations to limit the potential risks associated with the policy, but without conceding to a large scale subsidy or loan guarantee.

Part III – Actions to de-risk the policy

Some of the greatest risks identified in Part II can be mitigated by implementing the recommendations in this section. These measures will slow down the speed at which the Green Deal grows, allowing it to develop in a more gradual and controlled manner and reducing the risk of a backlash. As such, if and when energy prices rise sufficiently to drive increased investment in ESM, a solid and robust scheme will be in place and of use to at least some households. The required actions are as follows:

To protect consumers from moral hazard

Tighten the Golden Rule to require that loan repayments not exceed 75% of the forecast savings, acknowledging that the rebound effect, market price effect and the possibility of falling prices will substantially eat into the available savings from which repayments can be made.

Add a second requirement that all projects satisfy a minimum NPV or IRR hurdle to reduce the risk of a current occupier making themselves better off by accepting an overpriced loan arrangement that a future occupier would not accept.

Disallow any sales or marketing practices that transfer value from future occupiers to current occupiers in particular cashback or other benefits that can be rolled into the loan amount; teaser rates; floating rate loans; interest-only loans; up front payment holidays; grace periods; or annual percentage increases.

Require any organisation issuing Green Deal securities to retain a significant percentage of the loans or bonds they originate on their own balance sheet to ensure that some share of risk is retained by those assessing and approving credit applications.

Require at least one quote to be obtained for every package from an installer with no financial relationship to the provider, to ensure competitive prices are passed on to future occupiers. Consider requiring that providers/assessors not recommend or introduce any installers directly.

To protect bondholders from adverse selection

Require that no individual or household with a history of energy bill arrears may participate in the scheme, unless they have a pre-payment meter (or smart meter, with facility to switch to pre-payment mode remotely) installed at their address.

Allow for an individual's credit rating to be adversely affected if Green Deal loans are not repaid in the same way as if any other credit arrangement were neglected.

To protect the Treasury from moral hazard

Explicitly state in secondary legislation that public funds not be used for the subsidy of Green Deal loans to ensure that any funds available for green purposes (such as e.g. from the Green Investment Bank) be reserved for the most productive areas.

Explicitly state in secondary legislation that public funds not be used to bail out Green Deal borrowers, providers, bondholders or other parties such as the Green Deal Finance Company in the event of rising debt defaults – the purpose being to avoid the impression of an implicit government guarantee, such as enjoyed by US securitisation houses (Fannie Mae / Freddie Mac).

To protect the insulation market from sudden shrinkage

Reassign the £200 million allocated for take-up incentives in the first year to provide continued grant subsidies for loft and cavity wall insulation – to help the insulation industry manage the transition into a period where CERT subsidies are no longer available.

To protect Westminster from a political backlash

Require that a new homeowner be allowed to pay off the outstanding balance of a Green Deal loan on acquisition of the property, without paying early redemption penalty fees. Consider requiring that the homeowner be allowed to pay off the loan *at any time* without fees or charges.

Ensure that all loans are accompanied by clear disclaimers explaining the limitations of Green Deal loans in particular that a GD loan may reduce the sale price of your home; that you can expect a higher sale price if you finance the works yourself and sell your property without any debt attached; that non-payment of Green Deal loans may result in the installation of a pre-payment meter in your home; and that forecast savings may not materialise if energy prices fall or if behaviour patterns are not adjusted following installation of measures.

Scale down expectations for Green Deal penetration and instead publish overall weather and growth adjusted carbon targets for the domestic sector which may be achieved through the Green Deal or other policies set out in the following section.

Part IV – Alternative policies to pursue in parallel

The recommendations in Part III will significantly slow down the development of the Green Deal, but they will leave it in place (with suitable protections) for those households who may find it a helpful solution. In the meantime, there are a number of other policies which can be pursued in parallel, which may be complementary to the Green Deal and substantially more effective. These are as follows:

Remove the VAT subsidy on domestic fuel for households with high consumption

The rate of VAT on domestic energy consumption is currently 5%, no matter how much of it you consume, and average energy prices are 30-40% lower than in the rest of Europe, mostly because of lower taxation of domestic energy in the UK.⁶⁷ As a result, any attempts at conservation must first overcome the impact of a large fiscal subsidy which encourages consumption.

This could (and should) be immediately addressed by bringing VAT on domestic energy to the normal rate of 20% for households above median consumption and then also to a penalty rate at some even higher threshold point: for example, VAT could rise to 50% or 100% for consumption over twice or three times the median. These taxes would need to be accompanied by measures to prevent tax avoidance through sub-division of existing meter points, but such measures would be relatively simple to implement. Overall, the benefits of introducing a rising VAT ladder for energy consumption would be to:

- Increase the marginal cost of energy for high usage households, without significantly increasing their total bills (allowing for a small demand response, total bills may not increase at all, but consumption would fall)
- Increase the attractiveness of energy saving projects, reduce the payback time by one third for high use households, and incentivise energy saving behaviour
- Generate significant new revenues for the Treasury

This policy is in contrast to that advocated by supporters of the Green Deal, who have lobbied for VAT reductions for the various measures eligible for finance. While the idea of VAT reductions is attractive, it overlooks the large existing markets for many of the services in question, in particular double glazing and high efficiency boilers. The expenditure on blanket VAT reductions in these markets would be significant and untargeted, and therefore also unaffordable.

Introduce a link between Council Tax and actual energy consumption

The advantage of linking energy use to Council Tax, in the way that fuel economy for motor vehicles is now linked to road tax, is that Council Tax bands already reflect property values and therefore energy taxes can be scaled progressively to create the strongest incentives for the households that can most afford to respond. The benefits of linking council tax to actual energy consumption would be:

- Further improve the economics of energy saving for all households
- Improve the targeting of energy saving measures on high consumption households, since there is a strong correlation between energy consumption and council tax bands
- Introduce a correlation between higher energy taxes and higher household wealth

The challenge would be in connecting actual consumption data to individuals and to council tax records, but this could be solved in several ways, including an option to collect Council Tax on energy bills. If it is possible to collect Green Deal loans on these bills, it should be possible to collect Council Tax balances, which will typically be smaller in value. Households could elect to pay the highest rate of council tax for their Property Band, by paying direct to the Local Authority, or to have their tax collected through the energy company and benefit from a discount if consumption is below a specified threshold. Linking Council Tax to EPC ratings is not recommended as it would not provide incentives for energy saving behaviour and would overcharge many households (such as single occupier properties and second homes).

Replace the decreasing block tariff schemes currently used by energy companies with flat rate or slightly rising block systems, as used widely around the world and in 50% of US states, and to encourage a different kind of competition in the market for high use customers

Rising Block Tariffs (RBTs) have generally been opposed in the UK because of a perceived impact on the fuel poor, in particular those households who are considered fuel poor *both* because of high energy consumption and low income, rather than because of low income alone. The number of such households has been over-estimated however because of the reliance on estimated consumption – as shown earlier, price sensitive households are able to, and do, reduce their consumption by 30-50% compared to standardised usage estimates. Accordingly RBTs would adversely affect many fewer fuel poor households than is commonly forecast and those that are affected could be exempted through a means tested social tariff scheme.

However, pending resolution of the fuel poor question a step could be taken towards RBTs by eliminating their opposite, decreasing block tariffs, which have emerged as the default price plan in the UK market. Government should require that no energy company offer a tariff which decreases as consumption increases. Over time, this regulation could be adjusted on a rolling basis to introduce slightly rising blocks, with the following advantages:

- Further increase the marginal cost of energy, incentivise economic behaviour and further accelerate the payback times of energy saving projects
- Further focus incentives on higher income / higher wealth households
- Create new incentives for energy companies to win market share in the higher consumption segments, typically achieved with a value proposition based on helping high use customers to reduce their usage (e.g. First Utility)

The implications of the last point are significant. High use customers are always the most profitable, but at present energy companies compete for these accounts on price, encouraging them to consume more. The opportunity to shift retail competition in the high end of the market to a volume focus (rather than a unit price focus) could be as powerful – perhaps even more so – than the independent effect on demand of increasing marginal prices.

Introduce a no-fee mortgage drawdown product for energy refurbishment, available to anyone with an existing mortgage and good personal credit

The greatest difficulty with the Green Deal scheme is the risk of moral hazard following the separation of the person who takes out a loan from the person who pays it back. However, as we have shown the transferable property of Green Deal loans has no value to owner occupiers. So an alternative approach would be for households to borrow funds through their existing mortgage lender, since households with mortgages are generally those with the greatest carbon savings to make. By attaching the debt to a single individual with collateral, the moral hazard problem is eliminated and the cost of lending is reduced.

However, households would find that a small drawdown facility is more expensive than their original mortgage, because the admin costs are significant for low value loans. Either the lending rate is higher, or application fees are applied. To address this, government could exercise its influence on the financial sector to encourage a standardised drawdown product to finance ESM. For example, this product could be made available

- To any household with an existing mortgage which is not in arrears
- To pay for any measures recommended on an Energy Performance Certificate
- For loans of any amount, subject to a cap on the total loan-to-value ratio (to protect the bank) and on the loan-to-income ratio (to protect the individual)
- At the same rate and terms as the existing mortgage facility
- Free of any arrangement fees or charges

Banks would have to absorb the admin cost, but they would also benefit from a small increment in lending to known customers with pre-approved credit. However the process to administer and approve such loans for existing customers could be highly automated, and indeed low value equity release mortgages are already

available on instant-approval, automated bank websites. So it is possible the net costs to the banking sector would be zero or even positive, therefore that industry standards for such a product could be agreed voluntarily and without need for legislation.

Efforts to secure a voluntary industry agreement could begin with The Royal Bank of Scotland Group plc and Lloyds Banking Group plc, in which the government holds an 83% and 41% share respectively.⁶⁸ These two banks currently serve approximately 40% of the mortgage market.⁶⁹

From the point of view of policymakers, a universal, no-fee drawdown product has several interesting advantages because the loans will be:

- Attractive to owner occupiers – who account for ~80% of domestic emissions
- Cheaper than Green Deal loans because they will be credit checked and backed by the collateral, solving the excess cost problem
- Attractive to households with existing mortgages and low LTV ratios, solving the adverse selection problem
- Private credit agreements with a single individual, solving the moral hazard problem
- Self-financing, or nearly so, with the low admin cost paid for by the net income spread on the increased debt balance
- Issued without any new infrastructure, such as the Green Deal Finance Company or central government processes for monitoring assessors, providers and so on

Because these are private credit arrangements with no transferability, there would be no need for the government to intervene to manage how the funds were allocated or spent. The funds would simply be made available for households to take advantage of as they see fit – the bank would not need to require an undertaking that the funds be spent on energy saving (since it would already consider the loan safe on LTV and affordability criteria) although such an undertaking would help to define the market and encourage take-up of the product.

In summary, a private mortgage based scheme would be vastly simpler than the Green Deal, cost less and raise fewer problems. There is a strong argument for introducing such a scheme instead of the Green Deal, or at least as an alternative to it – for those households who have got to grips with the arguments in Parts I and II of this paper, and are therefore not willing to take out a Green Deal loan.

Reconfigure the ECO as a social programme, providing support to the fuel poor and to national heritage buildings. Reduce the focus on wealthy households in period properties (aka ‘hard to treat’ homes)

The ECO scheme should be reconfigured to provide a greater share of the available funds in support to the fuel poor, especially to those fuel poor households who are affected by the measures to increase prices, VAT and Council Tax recommended above. In this light, the ECO is more of a social safety net than an environmental scheme, but a share of its funding should be directed to support properties of historic or national heritage value, which typically have very high energy bills, and where fabric improvement is even more expensive than for other households (because of the requirement to conserve and protect the original aspect of the property). The consequence is that fewer funds would be available to well-off families in period properties (typically ‘hard to treat’ homes) which is justified on the basis that such households are better targeted with price based measures.

Address the market price effect by introducing a supplier obligation for oil companies – to accelerate the electrification of transport and provide new volumes for electricity generators to offset reductions in domestic demand

The only way to address the market price effect discussed in Part III is for energy suppliers to recover volumes elsewhere, and the obvious way for them to achieve this is through electrification of transport, i.e. at the expense of the oil industry. The additional volumes sold by generators for vehicle battery charging will help to offset the volumes lost as prices rise, regulations tighten and consumer behaviour adapts to a more economical usage pattern.

A significant barrier to electric vehicle take up is ‘range anxiety’ – the concern motorists have about where they will recharge an electric car if caught short with a low charge. The same concern could exist for petrol cars but it doesn’t, because petrol stations are ubiquitous. So the government should introduce a supplier obligation for oil companies to provide fast charging points for electric vehicles at all of their existing petrol stations.

These charging points will scarcely be used, as most vehicles will be charged overnight at home, or perhaps in office car parks. So oil companies will have to be obliged to provide them. But once this obligation is introduced, consumers would have confidence in buying and driving an electric vehicle – knowing that the nearest charge point is never further away than the nearest filling station.

How much volume electricity generators could recover in this way is uncertain, and the government will need other strategies in the same area, for example for the electrification of other forms of transport (buses, trains, trams) and electrification of domestic heat (studies suggest that the grid is not clean enough to generate savings yet in this way, but that may change in the future). But the point is that a strategy to reduce domestic

consumption is incomplete without measures to help power generators recover volumes from elsewhere, because without those measures the market price effect will undermine the original strategy. Energy saving will be seen as a swindle, and consumers will reject it.

Announce some of these policies now – begin to set expectations of sustained price increases over time, rather than the opposite

The advantage of policies to raise the price of energy is that they can affect behaviour long before they are introduced. Consider the impact of an announcement that government expects the real cost of energy to triple by 2050, and a commitment to introduce policies to ensure this comes about. Even if current prices do not change, the present value of energy saving projects increases overnight, because the future value of energy savings increases.

Or, imagine an announcement that from the year 2015, domestic energy consumption above a certain level, let's say 12 MWh a year or about 4 times the median household, would be taxed at a marginal VAT rate of 200%. The present value of investment proposals for households in this category (from insulation to glazing to solar panels or zone control) would immediately rise, long before any households actually start paying the higher rate. Indeed if the signal was strong enough, by the time the new VAT rate came into force, there might be no consumption remaining in the relevant consumption band, and the tax revenues might be zero.

The message is that because of the long term nature of ESM, where measures may be in place for 25 or 50 years, the power of price expectations is very significant. It is possibly more significant even than the power of current prices, because of the tendency of households to believe that short term price increases will soon be reversed. And because households have such steep apparent discount rates, price expectations may be a much less controversial target for policy than current prices.

The disadvantage of course is that policies to increase energy prices are perceived to be unpopular. But their unpopularity is exaggerated by the media. The latest issue of the British Social Attitudes survey⁷⁰ shows that in order to combat climate change:

- 26% of all respondents would pay higher prices
- 36% of higher earners would pay higher prices
- 22% of all respondents would pay higher taxes

Prior to ClimateGate, the respective figures were 42%, 53% and 31% respectively – so in other words, in recent times there has been as much underlying support for higher energy prices as there is for any individual political party, whose best poll results fluctuate mostly in the 30-40% range. Indeed at a time when the BSA survey shows environmental concerns at an all time low, there is still twice as much support for the idea of paying

higher energy prices than there is for the third place party which has recently polled at around 10-11%.⁷¹ Moreover, policies focusing price increases on higher income segments of society – who are also the highest carbon emitters – might be even more popular, especially if supported by measures (such as a no fee drawdown mortgage) which can be delivered by the financial sector without a public cost.

In short, we may mistakenly assume that the electorate demands permanently low energy prices. It is not clear that this is what the electorate, as opposed to the media, actually want. Moreover, in playing to the low price agenda, we risk setting expectations that prices will fall in future, undermining new policies and increasing current consumption in the process.

These policies can all be introduced in parallel to the Green Deal. They add to rather than replace the Green Deal itself, but introducing them would make the Green Deal more effective too

All of these actions can be implemented alongside the existing plans for a Green Deal. They provide an added incentive for households to take action on emissions, by improving the economics of energy saving, and they offer an alternative source of finance for high use households which avoids the adverse selection and moral hazard problems of the green deal as currently conceived.

None of the recommendations in Part III or Part IV require new government spending, and since some measures will generate new Treasury receipts, the net impact on the PSBR is positive.

Conclusion

The purpose of this paper is to encourage a rethink of the Green Deal – not a rethink about *what* the policy is trying to achieve, but about *how* it is trying to achieve that goal. In writing this paper, however, it has struck me how far we have already come with a piece of legislation that carries such an extraordinarily broad array of risks. What is striking is not so much the individual risks, but the very large number of them. It is quite difficult to understand how such a risky policy has been able to proceed so far through the legislative process, but as Jo Whitehead recently wrote in the Harvard Business Review:

the daunting reality is that enormously important decisions made by intelligent, responsible people with the best information and intentions are sometimes hopelessly flawed ⁷²

Certainly, the proponents of the Green Deal are not alone in holding on to risky policies long after they should perhaps have set them aside. The real question is not whether this has happened, but why? In his book *Think Again* (Harvard Business Press, 2008), Jo and his colleagues provide some answers that may be helpful in this case. Analysing a database of around 80 cases of failed strategies – including numerous public sector examples such as Tony Blair's decision to go to war in Iraq; Matthew Broderick's response to Hurricane Katrina; Paul Wolfowitz' decision to award a pay package to his partner, while she was working for him at the World Bank – the authors identify the following causal factors:

- "Misleading experiences" in 64% of cases
- "Misleading prejudgements" in 82% of cases
- "Inappropriate self-interest", including wanting to be popular, in 69% of cases
- "Inappropriate attachments" in 43% of cases

Have some or all of these factors been part of the story of how the Green Deal could have come so far? One guess is that the policy was formed on the basis of a pre-judgement and further encouraged by a growing belief that it would deliver an easy solution to an economically hard problem. The desire to find an easy route through the carbon debate is so strong that attachments are quickly formed to ideas which appear painless, and these attachments are then reinforced when consultations are held with vocal industry partners, most of whom stand to gain financially from the scheme and are among the few who do indeed see it as attractive.

But perhaps more importantly, we should ask what could have been done to prevent the development of such a problematic strategy. In *Think Again*, the recommendations are to do more analysis of the underlying assumptions (which has been the goal of this paper); to use provocative data to challenge strongly held prejudgements; to consult advisers who have different experiences and viewpoints; and above all, to challenge

decision makers directly to reflect on their emotional attachments - the most dangerous of which in this case, was the belief that it is possible to reduce fossil fuel usage without raising prices or introducing a carbon tax.

In the spirit of Jo's recommendations, this paper attempts to provide a direct challenge and to stimulate a strongly renewed debate on the Green Deal and our expectations of it. The goal has been to be as provocative as possible, and to cover as wide a range of arguments as possible, and it may be that in some cases there are counter-arguments to the counter-arguments presented here. But it is hard to imagine that that the collective impact of all these issues will not be failure – in the sense that the basic conditions for success stated on page 18 of this paper will not be met.

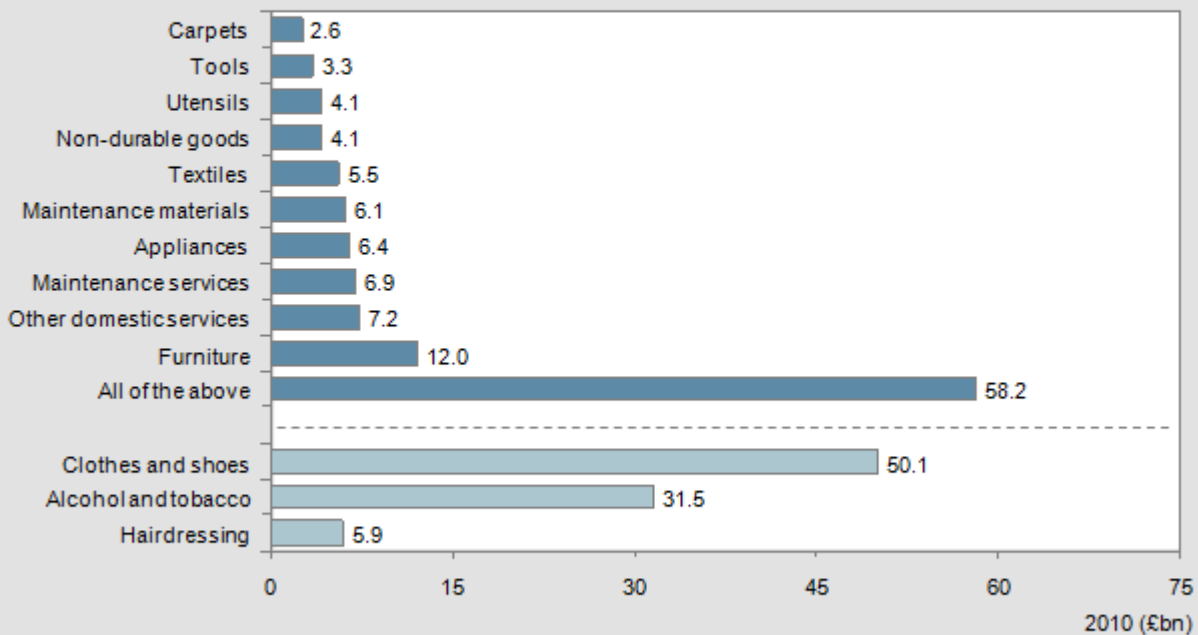
But at this stage, it is also hard to imagine that these arguments can be accepted, after so much political capital has been invested in bringing the policy to this point. Nobody gives a better explanation of why this is unlikely than Matthew Hancock and Nadhim Zahawi, coalition MPs after all who must presumably have supported this policy. In their excellent book *Masters of Nothing* they explain how compelling the dynamics of a bubble can be, even in the greatest moments of extreme. They recognise that a dissenting opinion will often exist, for those who want to hear it, but go on to say:

*.. it is extremely hard to tell people something they do not want to hear. If a friend is infatuated with someone, the awkward conversation where you try to tell them their beloved is absolutely wrong for them is inevitably ineffective. They have bought into the story of romance wholeheartedly. Your intervention doesn't stand a chance.*⁷³

If Matthew and Nadhim are right, then it is too late to save ourselves from a wasted decade of Green Deal euphoria and the inevitable political backlash that will follow. But on the other hand, Matthew and Nadhim may be wrong, and Jo Whitehead and colleagues may be right and it may be possible, even at this late stage, to *Think Again* about how this important policy is expected to work.

Exhibit 1. Access to capital is not the problem

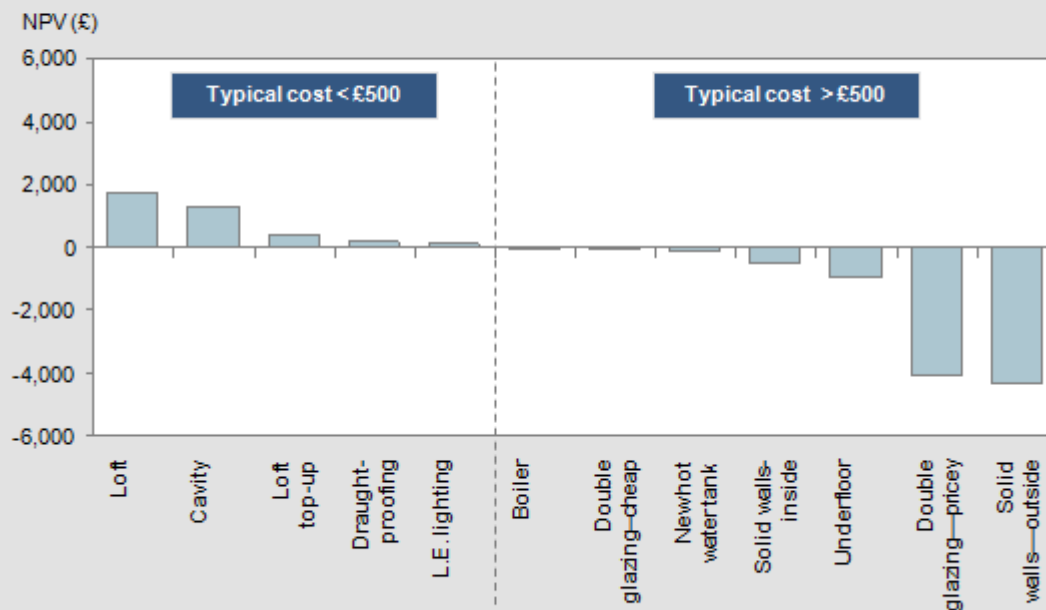
UK households spend £58B a year on home furniture, furnishing, repairs and improvement – around twice as much as the nation spends on alcohol and tobacco combined



Source: ONS Consumer Trends Q3 2011; <http://www.ons.gov.uk/ons/rel/consumer-trends/consumer-trends/q3-2011/index.html>

Exhibit 2. Twelve common energy saving measures

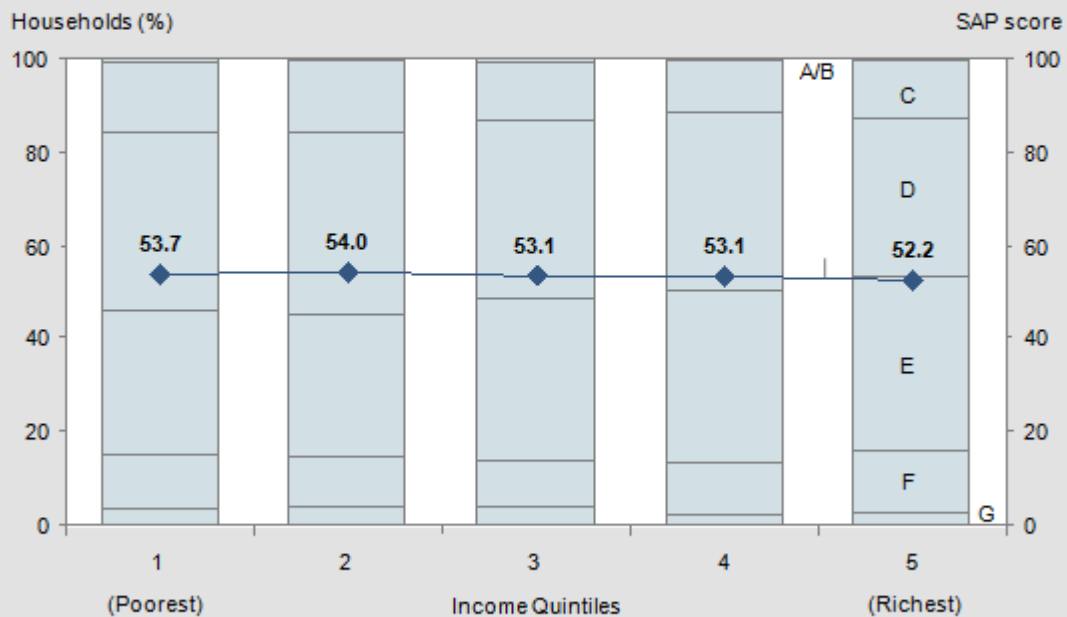
Among the common ESR measures, all those costing > £500 have a negative NPV even when using a 5% discount rate. There are no measures which are high value/high cost



Source: Costs and savings from The Energy Saving Trust, analysis shows NPV at 5% discount rate

Exhibit 3. Households with access to money are not more efficient

There is hardly any difference in mean SAP score by income quintile – if anything richer households are slightly less efficient than poorer households



Source: <http://www.communities.gov.uk/housing/housingresearch/housingsurveys/englishhousingurvey/ehstables/>; http://www.bre.co.uk/filelibrary/SAP/2009/SAP-2009_9-90.pdf; Data from the English Housing Survey and BRE

Exhibit 4. Neutrality of finance method

If the buyer of your house values your improvements at less than the cost of installing them, then you will lose money when you move house – whether or not you used the Green Deal

Example

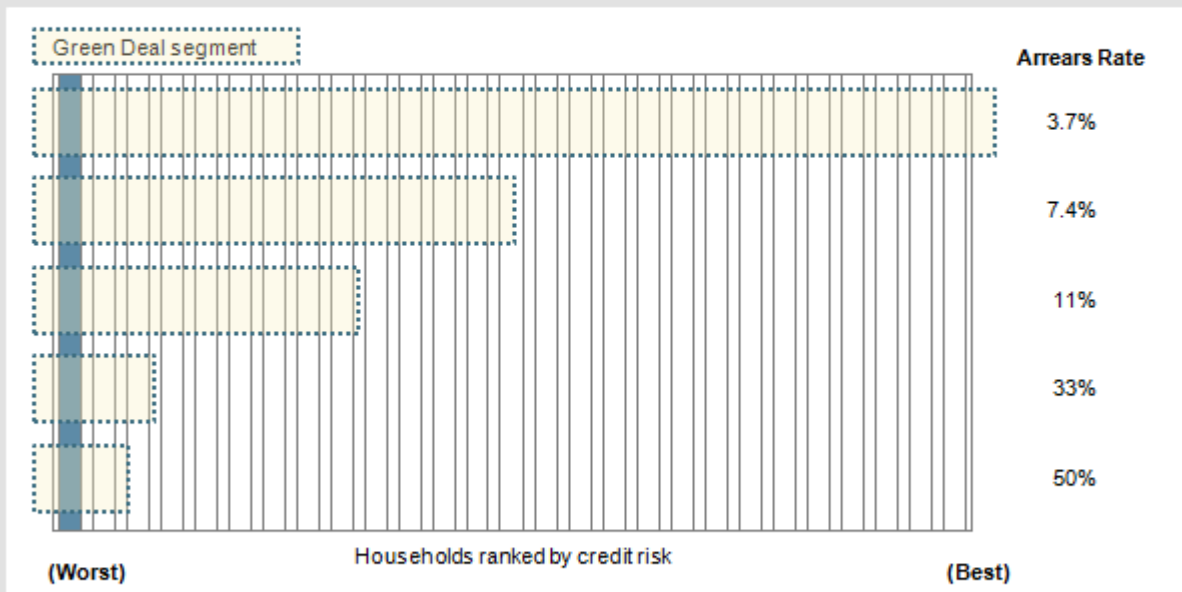
	How much you paid to install your ESM (your expenses)	Value to buyer of the ESM you installed (example)	Value to buyer of the GD debt you incurred	How much more the buyer will pay for the property (your capital gain)	Overall outcome for you (your expenses — your capital gain)
Self pay	-£10K	£5K	N/A	£5K	-£5K
Green Deal	N/A	£5K	-£10K	-£5K	-£5K

Note: example assumes ESM costs £10K to install but is only worth £5K to your buyer. Also ignores depreciation, discounting and partial repayment for the sake of simplicity

Source: Data from the English Housing Survey and BRE

Exhibit 5. Adverse selection in the Green Deal

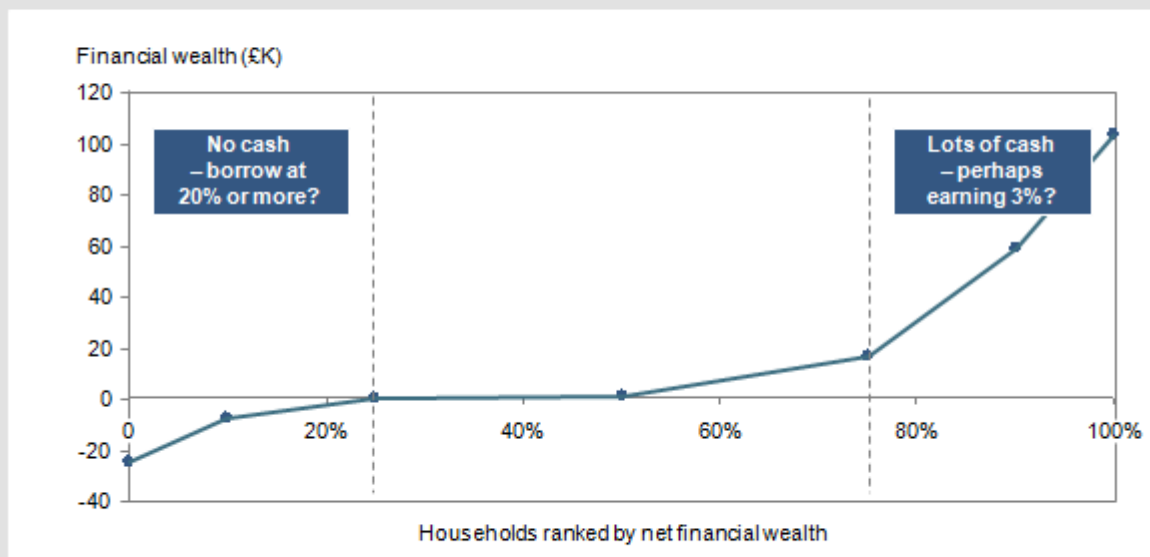
Illustration of how the arrears rate varies according to who signs up for the Green Deal – each column represents 1 million households, the dark column are already in energy bill arrears



Source: Data on current arrears from Ofgem /debt and disconnection reviews

Exhibit 6. Who would take a loan at 20% interest or above?

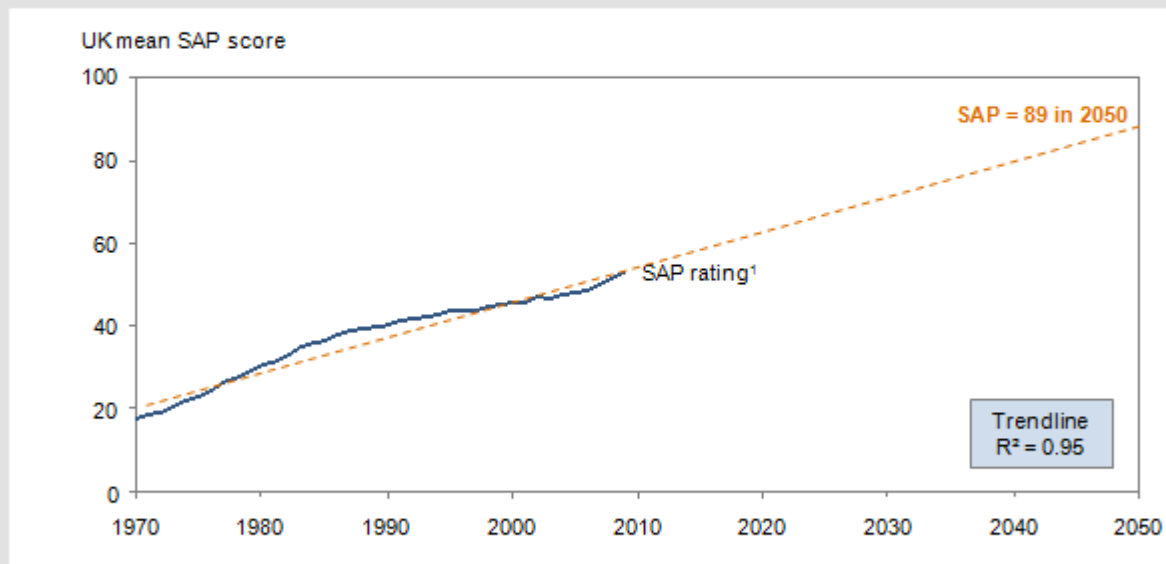
The poorest 25% of households have no savings or housing collateral. They may typically pay rates of 20% for unsecured loans. The wealthiest 25% have at least £16,300 in savings on which they may be earning a marginal interest rate of 0–3% pa, depending on how it is invested



Source: Data from the IFS (July 2010) from 2005 British Household Panel Survey. 0/100th are extrapolations;
<http://www.ifs.org.uk/comms/r71.pdf>

Exhibit 7. Existing trend improvement in SAP score

Average SAP scores (which measure the energy efficiency of domestic property) have improved at a rate of around 0.9 points/year since 1970. The existing trend extrapolated would take us to an average SAP score of 89 by 2050, but such a score may not in fact be possible



Source: Domestic energy fact file and analysis of EHS data by BRE; Cambridge econometrics and Cambridge architectural research; <http://www.decc.gov.uk/en/content/cms/statistics/publications/ecuk/ecuk.aspx>

Exhibit 8. Total investment required

A rough estimate of the investment required to deliver a 60% reduction in domestic emissions by 2050, allowing for the remaining savings to come from a 50% reduction in the carbon content of grid electricity. The total requirement is ~£500 billion, or ~£18K/home, even assuming all theoretical savings are delivered 100% and there is no rebound effect

	Typical Payback	Available savings	Saving (£ bn)	Cost (£ bn)
Basic and higher cost measures	10 yrs	20%	7	70
Further measures	25 yrs	30%	10.5	264
Architectural redesign	50 yrs	10%	3.5	175
[Reduce grid carbon by 50%]	—	[20%]	—	—
Total saving / payback / cost	24 yrs	80%	£21 bn	£509 bn

Source: EHCS; ONS; Carbon Census; author's analysis and estimates. Residential market size of £35.2B

Exhibit 9. Correlation between usage and SAP score

A 60 point increase in SAP score is expected to save £222/year, or £3-4 for each SAP point of improvement

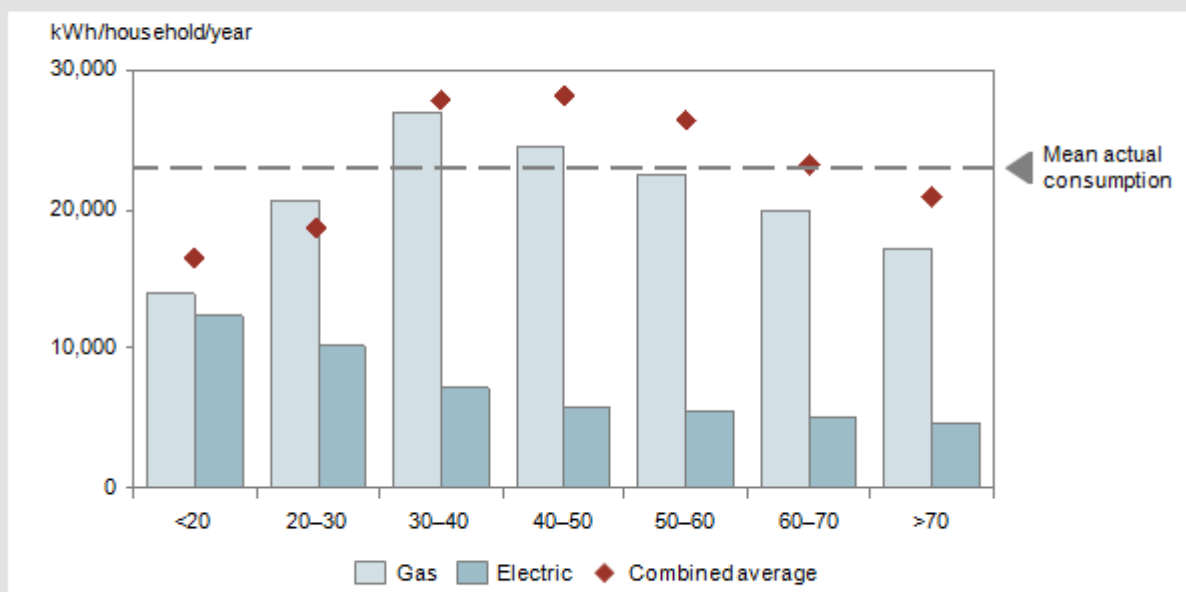
Real effects on annual energy expenditure (£1996)

Variable	Effect	Annual household energy expenditure
HHLID income	Increase £10,000	£67.80
Number of occupants	each extra person	£88.32
Floorarea	Each extra 10m ²	£23.44
Temperature	Each 1°C increase	£2.50
Energy pattern	Living room heated week	£27.70
Energy pattern	Bedroom heated week	£27.70
SAP	30 → 90 SAP	(£222.00)
SAP	+1 point	(£3.70)

Source: Do homes that are more energy efficient consume less energy? A structural equation model for England's residential sector, Scott Kelly, Cambridge University Electricity Policy Working Group (May 2011)

Exhibit 10. Relating actual consumption to SAP score

Actual consumption rises as SAP scores increase, until the SAP score exceeds 50 points. Occupants of properties with very low SAP scores have 30-50% lower usage than might be expected.



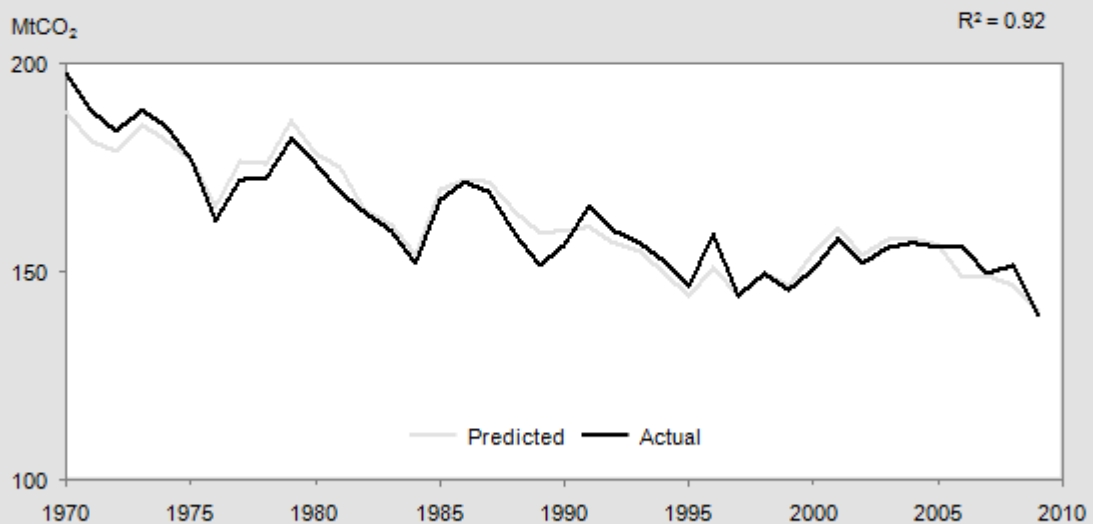
Note: Mean consumptions categorised by SAP rating bands

Source: Energy use in homes — a series of reports on domestic energy use in England: no. 4 fuel consumption (published jointly by BRE, Defra and The Energy Saving Trust 2005)

Exhibit 11. Simple model of residential CO₂

92% of the variation in domestic carbon emissions can be explained by four variables: GDP, temperature, prices and the grid carbon factor (i.e., the mix of fuels used to generate electricity)

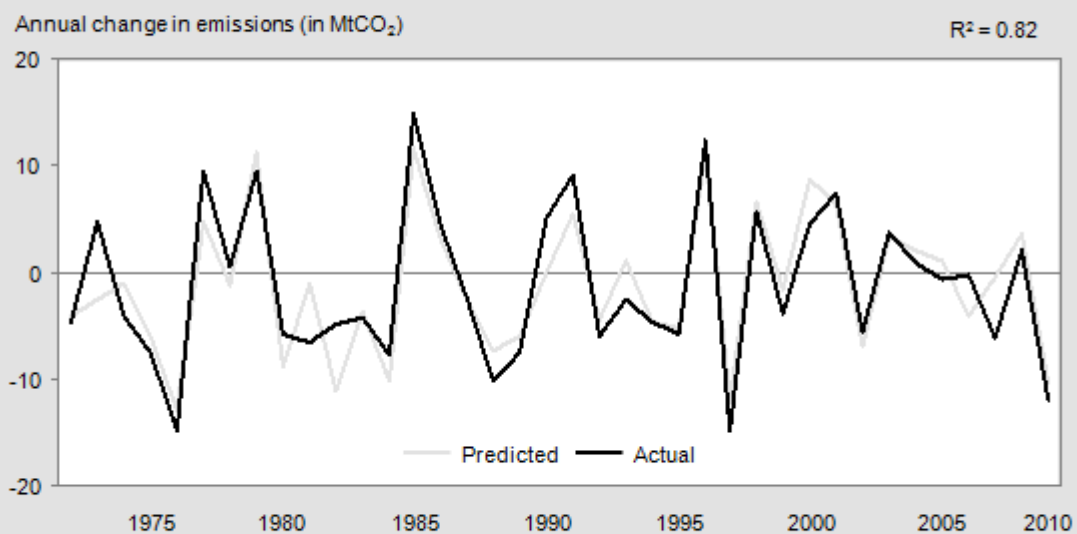
All four variables are significant at the 99% confidence level. Adding in average SAP scores only improves the explanatory power by three points, to 95%



Source: ONS; DECC; ONS; Met office; MTP; author's analysis

Exhibit 12. Simple model of residential CO₂ (first differences)

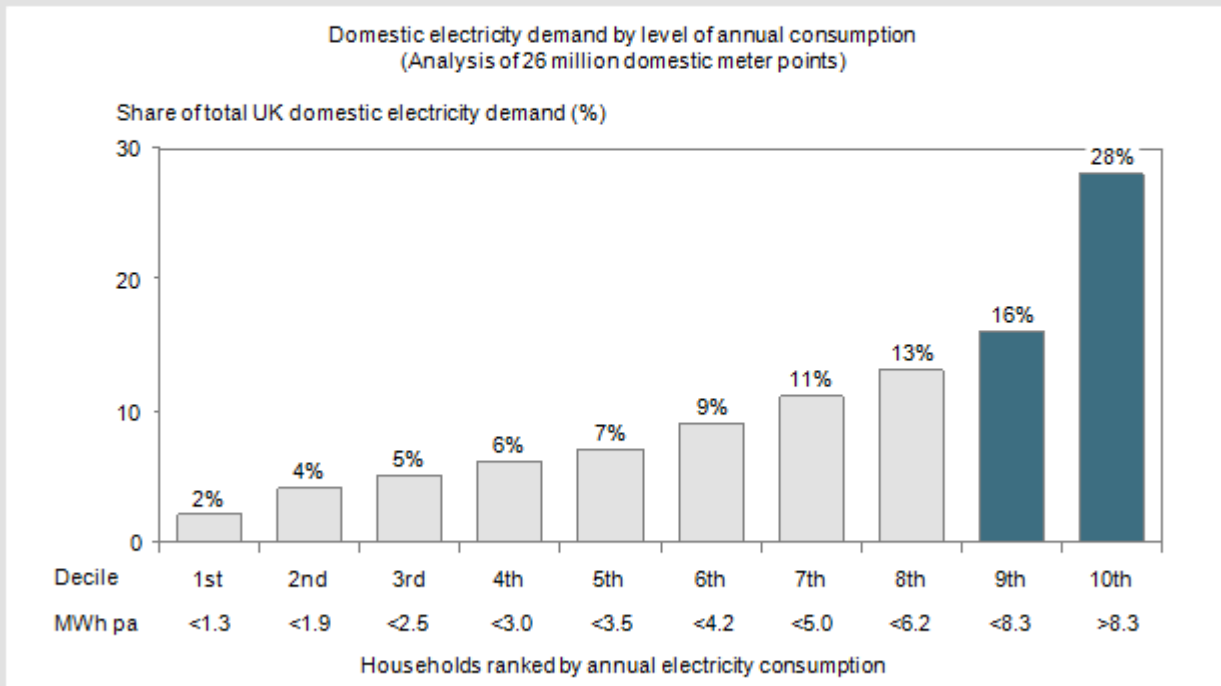
The first differences method shows a similar result. In this model, R-squared falls to 82%, but SAP is not significant at all – even at the 75% confidence level – and does not improve the explanatory power of the model. The four original variables remain strongly significant



Source: OONS; DECC; ONS; Met office; MTP; outliers in 1972, 1976 and 1984 controlled with a dummy variable

Exhibit 13. Concentration of use among a few households

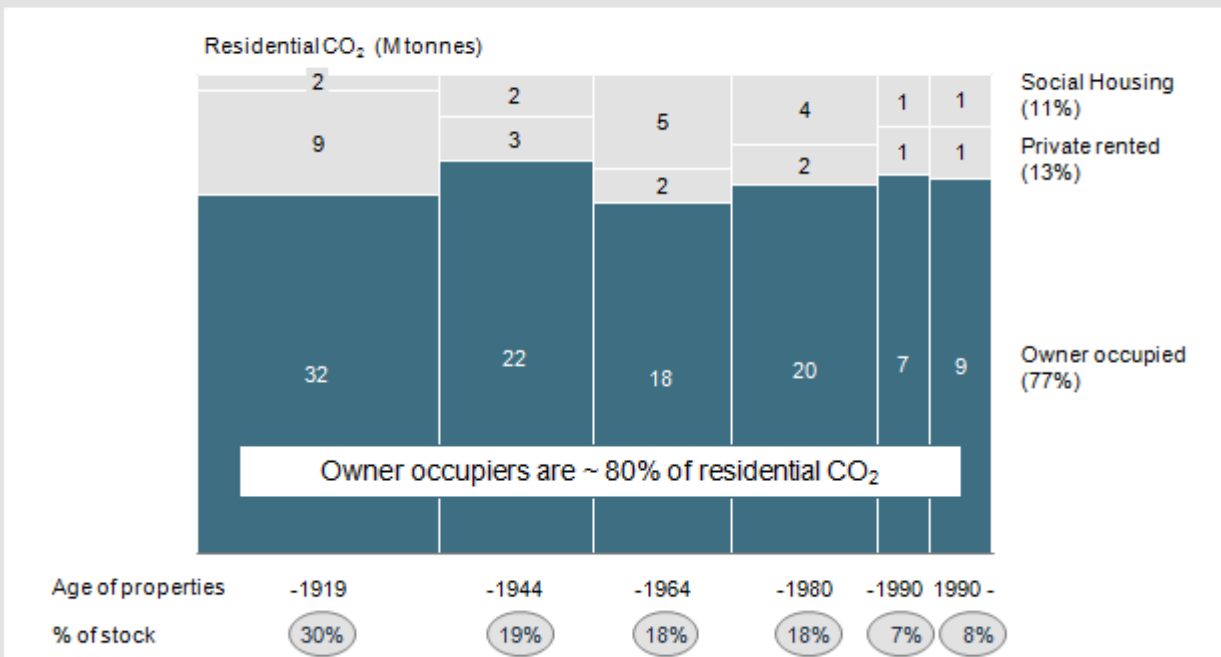
28% of domestic power consumption comes from the heaviest 10% of users. 44% of usage comes from the heaviest 20%. A similar picture applies for dual rate meters, and for gas



Note: Analysis by the UK Carbon Census Ltd, www.co2census.com/blog
Source: DECC; author's analysis April 2010; Data from Energy Trends, March 2009 (DECC)

Exhibit 14. Concentration of use among high volume households

77% of residential CO₂ comes from owner occupied properties, half of that from pre-war properties. The true share may be even higher (80-90% of the total) as this analysis is based on predicted usage, which often overstates consumption for lower income households



Source: BRE; EHS; author's analysis April 2010

Exhibit 15. The overcharging problem

The Green Deal separates the person who takes out the loan from the person who pays it back, creating the opportunity for suppliers to over-price services, while still making the current occupier better off and meeting the Golden Rule.

		Current occupier (2 years)		Future occupier (10 years)		
		Year 1	Year 2	Year 3	...	Year 12
Self pay	Install	-300		-300	...	-
	Save	+150	+150	+150	...	+150
	Pay	-	-	-	...	-
	Net	-150	+150	-150	...	+150
		Breakeven		+£1,200		
Green Deal	Install	-	-	-	...	-
	Save	+150	+150	+150	...	+150
	Pay	-100	-100	-100	...	-100
	Net	+50	+50	+50	...	+50
	Cashback	+150		-15	...	-15
		+£250		+£350		
Impact		£250 <i>better off</i>		£850 <i>worse off</i>		

Analysis of an illustrative example; time value / interest / depreciation ignored for simplicity

References

- ¹ Press release from the Department of Energy & Climate Change (30 Jun 2011)
- ² Analysis of 2009 final UK carbon emissions data provided by DECC (March 2010)
- ³ *Warm homes, greener homes: a strategy for household energy management*, DECC (31 Mar 2010)
- ⁴ *This Energy Bill is Not So Green*, Caroline Lucas, The Guardian (10 May 2011)
- ⁵ Mr Steve Brine MP Conservative (Winchester), Hansard Column 1093 (10 May 2011)
- ⁶ *A low carbon reality*, Greg Barker, The New Statesman (3 Nov 2011)
- ⁷ *Predicting energy prices is hard, but doing nothing is fatal*, Damian Carrington, The Guardian (24 Nov 2011)
- ⁸ *Consumer Trends*, The Office of National Statistics (Q3 2011)
- ⁹ *Energy Use in Homes 2007 - A series of reports on domestic energy use in England - Energy Efficiency*, one of a series of reports prepared by BRE Housing with the funding and support of the Department of Energy and Climate Change (DECC) through a contract managed by the Energy Saving Trust. The underlying data is from the English House Condition Survey.
- ¹⁰ Operational data collected by The Carbon Census, www.co2census.com
- ¹¹ Carbon Census data from 2009-10, 90% of households surveyed received a recommendation to install low energy lighting, meaning that low energy lighting could improve the SAP score of their properties by at least 1 point
- ¹² Data provided to the author by The Energy Saving Trust in 2011
- ¹³ *Energy Trends*, March 2010 p50, DECC. Price forecasts from *Green Deal and ECO Consultation Report* (Nov 2011)
- ¹⁴ Average exit fees are described in the *Consultation on practices concerning Fixed Term Offers in the domestic retail energy markets*, Ofgem (24 Jan 2011).
- ¹⁵ *The real cost of keeping warm*, Tim Harford, The Financial Times (12 Nov 2011)
- ¹⁶ *Research Report – Consumer Needs and Wants for the Green Deal*, Ipsos Mori (Nov 2011)
- ¹⁷ *Green Deal and Energy Company Obligation Consultation Report*, Page 99 Paragraph 51. DECC (Nov 2011)
- ¹⁸ Personal loan default rates explained in *Understanding the price of new lending to households*, Richard Button, Bank of England Quarterly Bulletin (Q3 2010)
- ¹⁹ *The wealth and saving of UK families on the eve of the crisis*, Thomas Crossley and Cormac O’Dea, Institute for Fiscal Studies (July 2010)
- ²⁰ *Annual Social Obligations Report*, Ofgem (2010)
- ²¹ Energy disconnections from *Domestic suppliers social obligations: 2010 annual report*, Ofgem (June 2011) and mortgage repossessions from Council of Mortgage Lenders website (www.cml.org.uk)
- ²² *Response to Prospectus Consultation on Smart Meters*, DECC (30 Mar 2011)
- ²³ *Research Report – Consumer Needs and Wants for the Green Deal*, Ipsos Mori (Nov 2011)
- ²⁴ *Sustainable Refurbishment*, The Energy Saving Trust (2010)
- ²⁵ *Sheffield Eco-Terrace – A refurbishment case study*, The Energy Saving Trust (May 2010)
- ²⁶ *19 Sterndale Road – Refurbishment Case Study*, The Energy Saving Trust (July 2010)
- ²⁷ *How a leaky 1990s terraced home's energy bills were cut by 69%*, The Guardian (23 Nov 2011)
- ²⁸ Estimated cost of Tom Pakenham / Green Tomato Energy's PassivHaus project, see <http://ecohome.tumblr.com/>
- ²⁹ *Boiler Scrappage Scheme 2010 Evaluation Report*, Matthew Murray, The Energy Saving Trust and Julie Law, TNS Research International (September 2010)
- ³⁰ *Do homes that are more energy efficient consume less energy? A structural equation model for England's residential sector*, Scott Kelly, University of Cambridge Energy Policy Research Group (May 2011)
- ³¹ *Energy Use in Homes 2003 - A series of reports on domestic energy use in England - Fuel Consumption*, one of a series of reports prepared by BRE Housing with the funding and support of Defra and through a contract managed by the Energy Saving Trust. The underlying data is from the English House Condition Survey.
- ³² *Energy Use in Homes 2003* – cited above
- ³³ *Sustainable Refurbishment*, The Energy Saving Trust (2010)
- ³⁴ *The Rebound Effect*, Steve Sorrell, University of Sussex (Oct 2007)
- ³⁵ *Review of Differences between Measured and Theoretical Energy Savings for Insulation Measures*, Chris Sanders and Mark Phillipson, Centre for Research on Indoor Climate and Health, Glasgow Caledonian University (Dec 2006)
- ³⁶ *Green Deal is not a good deal for all homeowners*, Juliette Jowitt, 24 November 2011
- ³⁷ Janez Potočnik European Commissioner for Environment speaking at the Green Alliance Conference, *Europe: Looking ahead on climate change*, in London 15 September 2010. "increasing energy efficiency allows more to be produced for a given amount of energy – so it makes energy more useful. This increases the attractiveness of using energy... for the economy as a whole it is estimated to be between 20% and 80% of the saving, depending on the source of the energy."

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- ³⁸ See for example Khazzoom, J. Daniel (1980) *Economic Implications of Mandated Efficiency Standards for Household Appliances*. The Energy Journal 11(2): 21-40 and Brookes, Leonard (1990) *Energy Efficiency and Economic Fallacies* Energy Policy, March: 783-785.
- ³⁹ *Chapter 3: The economics of energy efficiency*, House of Lords Select Committee on Science and Technology Second Report, www.publications.parliament.uk/pa/ld200506/ldselect/ldsctech/21/2106.htm
- ⁴⁰ Credits awarded by Ofgem for individual energy saving measures are listed in the CERT scheme spreadsheet (v13) available for download on the Ofgem website for CERT scheme project managers
- ⁴¹ *Turning on the Lights: A Meta-Analysis of Residential Electricity Demand Elasticities*, James A. Espey and Molly Espey Journal of Agricultural and Applied Economics, April 2004, Vol. 36, No.1, pp.65-81
- ⁴² European elasticities – *Electricity and fuel consumption in Europe: a panel error correction model for residential demand elasticities*, Jan Duerinck, VITO (October 2009) . UK elasticities – *What drives the change in UK household energy expenditure and associated CO₂ emissions, economic or non-economic factors?* M Chitnis & L Hunt, RESOLVE Working Paper 08-09
- ⁴³ *Inclining Toward Efficiency: Is Electricity Price-Elastic Enough for Rate Designs to Matter?*, Ahmad Faruqui, Public Utilities Fortnightly, August 2008, Vol. 146, No. 8, pp.22-27
- ⁴⁴ Author's analysis using weather data from the UK Met Office; GDP data and fuel price indices from the Office of National Statistics; and the historical grid fuel mix from the Market Transformation Programme.
- ⁴⁵ *Intuitions v Formulas*, Ch 21 of *Thinking Fast & Slow*, Daniel Kahneman, Penguin (2011)
- ⁴⁶ *A detailed analysis of the historical role of energy efficiency in reducing carbon emissions from the UK housing stock* Les Shorrocks, BRE 2003
- ⁴⁷ *Britain can't afford to bet its future on shale gas - wind turbines are here to stay*, The Telegraph (8 Nov 2011)
- ⁴⁸ Analysis of meter point consumption data published in *Energy Trends*, DECC (March 2009)
- ⁴⁹ Tenure and occupancy data from the English Housing Survey
- ⁵⁰ Author's calculations based on data from the English House Condition Survey
- ⁵¹ Participant comment at DECC's Green Deal working group on assessor standards (March 2011)
- ⁵² *Knauf insulation backs proposal for further incentives under green deal*, company press release (11 Oct 2011)
- ⁵³ Hansard 10 May 2011 Column 1093
- ⁵⁴ Green Deal briefing document published on the DECC website (2011)
- ⁵⁵ "This is an exciting initiative with the potential to reduce interest rates on Green Deal finance, while also supporting healthy competition amongst Green Deal providers including small businesses. New firms like the Green Deal Finance Company are testament to the attractiveness of the Green Deal framework and its potential to offer a better deal to consumers." Chris Huhne, DECC press release (3 Oct 2011)
- ⁵⁶ "Quoted Household Interest Rates" sourced from the Bank of England Statistical Interactive Database (Nov 2011)
- ⁵⁷ *Government Green Deal must offer financial incentives*, Great British Refurb campaign, 21 Sep 2010 <http://www.greatbritishrefurb.co.uk/news/government-green-deal-must-offer-financial-incentives>
- ⁵⁸ *Predictably Irrational – Chapter 3 The Cost of Free*, Dan Ariely (HarperCollins 2008)
- ⁵⁹ "such is the scale of this programme that it should reach 14 million homes by 2020 and 26 million homes by 2030" – Greg Barker on www.conservatives.com (The Blue Blog) 8 June 2011
- ⁶⁰ Broadband and mobile telephone take-up rates from Euromonitor and The Office of National Statistics
- ⁶¹ *Government Green Deal must offer financial incentives*, Great British Refurb campaign, 21 Sep 2010
- ⁶² http://en.wikipedia.org/wiki/Moral_hazard
- ⁶³ Analysis ignores the time value of money for simplicity. Adding a discount rate complicates the example, and the discussion, without altering the overall result.
- ⁶⁴ *Solar panel sellers slammed in Which? probe*, Which? Press Release (Apr 2010)
Read more: <http://www.which.co.uk/news/2010/04/solar-panel-sellers-slammed-in-which-probe-212256/#ixzz1ifxAgfLj>
Consumer Champions Which?
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- ⁶⁵ Confidential comment by a London based solar surveyor
- ⁶⁶ *Financial information reporting – 2009 results*, Ofgem (March 2011)
- ⁶⁷ Domestic electricity and gas prices for small, medium and large consumers, DECC (Dec 2011)
- ⁶⁸ Shareholdings as reported by UK Financial Investments on 19 December 2011 <http://www.ukfi.co.uk/about-us/market-investments/>
- ⁶⁹ Mortgage market shares as reported by The Financial Times in September 2010, <http://www.ft.com/cms/s/2/3a5881bc-bbf6-11df-a972-00144feab49a.html#axzz1gzTgeKvZ>
- ⁷⁰ *British Social Attitudes* (BSA), National Centre for Social Research, December 2011
- ⁷¹ Yougov / Sunday Times voting intention polls, as reported at <http://ukpollingreport.co.uk/>
- ⁷² *Think Again – Why Good Leaders Make Bad Decisions*, Sydney Finkelstein, Jo Whitehead & Andrew Campbell, Harvard Business Press (2008)
- ⁷³ *Masters of Nothing – How the crash will happen again unless we understand human nature*, Matthew Hancock & Nadhim Zahawi, Biteback (2011)

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