Summary: Intervention & Options

Department /Agency:	Title:	
Office of Climate Change	**Impact Assessment of Financial Measures**	
Stage: Consultation	**Version:** 4	**Date: 6 February 2009**
Related Publications: HES Consultation IA Summary, Delivery Mechanisms for Supplier Obligation, District Heating: Economic Assessment and Evaluation of Evidence		

Available to view or download at:

http://www.

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What is the problem under consideration? Why is government intervention necessary?

In common with all issues arising from climate change, the problem under consideration is the social cost of CO2 emissions. Government intervention is necessary to reach agreed CO2 emission reduction targets by 2020.

In the particular case of energy efficiency measures in domestic dwellings, there are problems inherent in high upfront costs in installations that amortise over an extended period. These problems are exacerbated when householders sell their property without reaping a gain to sales prices.

What are the policy objectives and the intended effects?

Policy objectives aim to promote uptake of more expensive energy efficiency and low carbon heat measures. The effect will be to support government's 2020 targets for reducing CO2 emissions.

The options in this IA could help deliver the Supplier Obligation post CERT targets more easily and allow us to consider going beyond those targets should Government consider necessary.

What policy options have been considered? Please justify any preferred option.

This Impact Assessment is concerned with the feasibility setting out potential delivery routes for financing higher cost energy efficiency and low carbon heat technology:

a) A standard finance model (Energy Suppliers or other companies offering finance packages)

b) Innovative finance is transferable to future owners of a property (Distribution Network Operator (DNO) model).

When will the policy be reviewed to establish the actual costs and benefits and the achievement of the desired effects?

Policy planned for introduction from 2012, for review in line with Carbon Budget periods.

Ministerial Sign-off For Consultation Stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible Minister:

Signed by Secretary of State on 10th February 2009

Summary: Analysis & Evidence

Policy Option: A	Standard finance model [offered by Energy Suppliers or other companies]

COSTS

ANNUAL COSTS[1]	Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition) **Yrs**	Cost of implementation of measures for consumers Cost of financial assistance for the government Administrative cost of information and delivery services
£ 12m	
Average Annual Cost (excluding one-off)	**Total Cost** (PV) **£ 4,740m-£6,410m**
£591m - £800m	

Other **key non-monetised costs** by 'main affected groups'
Hidden costs (e.g. aesthetic) and disruption costs for consumers
Costs of adpation for energy supply companies

BENEFITS

ANNUAL BENEFITS[2]	Description and scale of **key monetised benefits** by 'main affected groups'
One-off **Yrs**	Energy cost savings by consumers (and increased value of property), lower or more equitable energy bill cost of Supplier Obligation, lower search costs, carbon savings, increased comfort-taking
£0	
Average Annual Benefit (excluding one-off)	**Total Benefit** (PV) **£ 6,750m-£6,800m**
£844m - £850m	

Other **key non-monetised benefits** by 'main affected groups' Reduced fuel poverty; Supporting innovation in energy efficiency market; Increased security of energy supply; Reduced cost of meeting carbon saving obligations via other means; Improved international reputation on climate change; Improved air quality, lower requirement for Renewables

Key Assumptions/Sensitivities/Risks DECC's energy resource cost and carbon prices used. Central Gas price assumed 3.09p/kWh, but sensitivity tests examine impact of higher energy prices. Central estimates assume no improvement in technology, no economies of scale, 20% reduction in monetary benefits of measures due to comfort-taking

Price Base Year 2008	Time Period Years 12	**Net Benefit Range** (NPV) **£340m - £2,060m**	**NET BENEFIT** (NPV Best estimate) **£ £340m - £2,060m**

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			TBA	
Which organisation(s) will enforce the policy?			TBA	
What is the total annual cost of enforcement for these organisations?			£ unknown	
Does enforcement comply with Hampton principles?			Yes	
Will implementation go beyond minimum EU requirements?			TBA	
What is the value of the proposed offsetting measure per year?			£ unknown	
What is the value of changes in greenhouse gas emissions?			£ 1,260m - £1,310	
Will the proposal have a significant impact on competition?			To be determined	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large
Are any of these organisations exempt?	TBD	TBD	N/A	N/A

[1] Costs of schemes calculated over the SO period 2012-2020. Estimated annualised costs take total costs and divide by eight

[2] Benefits of schemes calculated over SO period 2012-2020. Estimated annualised benefits take total benefits and divide by eight

Impact on Admin Burdens Baseline (2005 Prices)						(Increase - Decrease)	
Increase of	£	TBD	Decrease of	£	TBD	**Net Impact**	**£** TBD

ANNUAL	Description and scale	Key

Summary: Analysis & Evidence

Policy Option: B	Finance transferable to future inhabitants of a dwelling: Distribution Network Operator model

COSTS

ANNUAL COSTS	Description and scale of **key monetised costs** by 'main affected groups'
One-off (Transition) **Yrs**	Cost of implementation of measures for consumers
£ 574m	Cost of financial assistance for the government
Average Annual Cost (excluding one-off)	Administrative cost of information and delivery services
£ 589m - £798m	**Total Cost** (PV) **£ 5,287m-£6,957m**

Other **key non-monetised costs** by 'main affected groups'
Hidden costs (e.g. aesthetic) and disruption costs for consumers
Costs of adpation for energy supply companies

BENEFITS

ANNUAL BENEFITS	Description and scale of **key monetised benefits** by 'main affected groups'
One-off **Yrs**	Energy cost savings by consumers (and increased value of property), lower or more equitable energy bill cost of Supplier Obligation, lower search costs, Carbon savings, increased comfort-taking
£ 0	
Average Annual Benefit (excluding one-off)	
£844m-£850m	**Total Benefit** (PV) **£ 6,750m-£6,800m**

Other **key non-monetised benefits** by 'main affected groups' Reduced fuel poverty; Supporting innovation expansion in energy efficiency market; Increased security of energy supply; Reduced cost of meeting carbon saving obligations via other means; Improved international reputation on climate change; Improved air quality; reduced demand for renwables

Key Assumptions/Sensitivities/Risks DECC's energy resource cost and carbon prices used. Central Gas price assumed 3.09p/kWh, but sensitivity tests examine impact of higher energy prices. Central estimates assume no improvement in technology, no economies of scale, 20% reduction in monetary benefits of measures due to comfort-taking

Price Base Year 2008	Time Period Years 12	**Net Benefit Range** (NPV) **£-207m to £1,513m**	**NET BENEFIT** (NPV Best estimate) **£-207m to £1,513m**

What is the geographic coverage of the policy/option?			GB	
On what date will the policy be implemented?			TBA	
Which organisation(s) will enforce the policy?			TBA	
What is the total annual cost of enforcement for these organisations?			£ unknown	
Does enforcement comply with Hampton principles?			YES	
Will implementation go beyond minimum EU requirements?			TBA	
What is the value of the proposed offsetting measure per year?			£ unknown	
What is the value of changes in greenhouse gas emissions?			£ 1,260m - £1,310	
Will the proposal have a significant impact on competition?			TBD	
Annual cost (£-£) per organisation (excluding one-off)	Micro	Small	Medium	Large
Are any of these organisations exempt?	TBD	TBD	TBD	TBD

Impact on Admin Burdens Baseline (2005 Prices) (Increase - Decrease)

Evidence Base (for summary sheets)

[Use this space (with a recommended maximum of 30 pages) to set out the evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Ensure that the information is organised in such a way as to explain clearly the summary information on the preceding pages of this form.]

Introduction

Householders face high upfront costs for the installation of measures such as solid wall insulation (between £3,000 and £5,000 per property[3]). This is a big disincentive to householders where these upfront payments would significantly outweigh any immediate fuel bill savings.

Subsidies available through the current energy efficiency policy (CERT) spread the cost of measures across all consumer bills. This approach could be unfair for more measures with higher costs which only a limited number of households can access.

To overcome these barriers the government is considering whether it should encourage a standard finance model or consider innovative finance solutions where payments are transferable to future occupants.

Overlaps

The potential financing routes in this IA could help deliver the Supplier Obligation post CERT targets more easily and allow us to consider going beyond those targets should Government consider necessary. The reader is advised to consider the overalaps with the Supplier Obligation IA and the Regualtion IA – these are discussed in the over-arching IA.

Barriers to household energy efficiency – rationale for intervention

The barriers are the same as those addressed in the Supplier Obligation –post CERT.

These are:

- Lack of information
- Up front "hassle costs" and/or high effective discount rates
- Lack of access to credit
- Market failures in the private rented sector
- In the owner occupied sector payback periods which may exceed the future period of occupation of the home (and likelihood that investment in energy saving products will not be reflected in the sale price of the home)

Other issues with current delivery mechanisms – equity considerations

Under the current CERT mechanism and its successor Supplier Obligation (SO) suppliers provide subsidised measures to households such as loft and cavity wall insulation which is currently believed to be provided at around 50% cost for households who are able to pay[4] and recover the cost of that subsidy across all consumer bills. Currently, all consumers pay approximately £35 a year for CERT subsidies. This approach is fair because a large number of consumers can access CERT measures - there are around 8 million unfilled cavities in 2008, and around 5.5 million number of lofts with less than 150mm of insulation. In addition the actual sums consumers have to pay are relatively modest at around £200-£500 per property.

However, an increased focus on higher cost measures in the future will raise a number of issues for the current CERT model.

Equity considerations - A high cost measure such as solid wall insulation can only be installed in a limited number of households, both because of absolute number of properties with solid walls (8 million out of 27 million households) and likely reluctance of householders to take up a measure which is

[3] BRE estimates 2008

[4] Defined as "Non-priority group" in CERT

disruptive and potentially reduces living space. The outcome of the supplier obligation is uncertain but using current assumptions suppliers are estimated to spend £1.8bn on expensive measures[5] out of their £10.35bn, or 17% on only 4% of homes[6]. Compare this against lower cost measures like cavity wall insulation in which suppliers are estimated to £1bn of their £10.35bn, or 9.7% on 12.9% of homes[7]. This raises a concern at the fairness of asking all consumers to pay for measures that can only be accessed by a relatively small number.

High cost measures

To highlight the difference between low cost and high cost measures consider the below example:

Energy efficiency measure	Cost	Subsidy under CERT	Balance householder expected to pay (assuming measures offered at half price)
Cavity wall insulation	£461	50% / £230	£230
Professional loft insulation	£346	50% / £173	£173
External Solid Wall insulation	£4447	50% / £2223	£2223
Photovoltaic panels (2.5 kWp)	£6554	50% / £3200	£3200

Under the current mechanism (CERT) if we assume the typical 50% discount is available from suppliers, this leaves a larger balance for householders to cover

Energy efficiency and low carbon heat subsidies

The new financial incentives planned to promote renewable heat generation (the Renewable Heat Incentive, or RHI) and small-scale low carbon electricity generation (feed-in tariffs, or FITs) will help households who wish to generate their own low-carbon energy to overcome some of the upfront costs of installations. This support for household energy generation, as well as existing subsidies for energy efficiency, will help to make 'whole house' packages of measures, combining insulation and small-scale generation, more accessible.

Government will need to consider the future design of energy efficiency subsidies in the light of the RHI and FIT. Currently energy suppliers may install small-scale generation technologies and count them towards their CERT targets. There is a question about whether this should remain the case once these technologies are also supported through the RHI and FIT. A degree of double incentivisation (where suppliers are rewarded for taking actions within CERT, yet also benefit from the RHI) might be justifiable if this drove rapid uptake in desired measures. Alternatively, an argument could be made for keeping each support mechanism focussed on distinct outcomes (i.e. energy efficiency/renewable heat/small scale electricity generation).

Beyond 2012

Using subsidies alone may not be the most efficient way to ensure all homes have access to low carbon heating and energy savings measures. Subsidies for energy saving and low carbon technologies will be paid for by consumers, whether that is through taxes or through mechanisms such as CERT. High subsidies for expensive measures therefore mean that all households are paying for a few to receive large benefits in terms of long-term reductions in fuel bills. It may therefore be fairer to encourage households to contribute their own money to investing in energy saving measures, if they are able. This would release additional resource for investment in energy saving and ensuring that those who benefit in the long-term also bear the costs.

[5] Expensive measures are defined here as measures with high upfront costs such as solid wall insulation. The £1.8bn will pay for 1.1m measures, 850,000 of which are solid wall insulation.
[6] 1.1m homes out of 27m
[7] 3.5m homes out of 27m

The more that people are able to finance some of the changes themselves, the lower the subsidies that are needed from others. For example, if 100,000 households per year part-financed a £5,800 package of insulation measures for their homes between 2012 and 2020, this could save a total of £776 million in subsidies[8].

The potential delivery routes in this IA focus on models for financing energy efficiency and low carbon heat investments where the consumer is encouraged to agree to a finance package

For a financial agreement to be attractive and fair to consumers it will need to:

- Reduce the upfront cost to the consumer of installing the more expensive measures given evidence about the impact of upfront costs on household decisions.
- Save households money on their energy bills[9].
- Ensure agreements fit within the appropriate regulatory frameworks, and where financial products are involved, ensure the financing payments made by householders are sustainable and agreements are based on responsible lending practices,
- Allow for people to change energy supplier
- Be simple to access and easy to understand.

Two models are considered:

1. Finance by Energy Suppliers or other companies

Households would be offered an energy efficiency and / or low carbon heat package by their energy supplier or by another company working with them. The company would draw up a contract outlining financing arrangement, length of repayment period and estimated energy bill savings because of the measures. The household would need to agree to the contract terms and conditions, and to allow repayments to be collected via their energy bill or other payment methods.

2. Finance by Distribution Network Operators (DNO)

Companies utilise the DNOs permanent association with the house by offering consumers longer term contracts, and make arrangements for payment to be embedded within the energy bill, much as DNOs do for current network infrastructure investment. Network charges already vary by property, and so this would be an extension of that system. If a householder agreed to the installation of an energy efficiency or low carbon energy package, they would agree to an additional element added to and collected with their network charge. The level of the charge would be proportionate to the cost of the work done in that property.

As the cost of the energy package received by the household is incorporated within its network charge, it may be more straightforward to pass it on to future occupiers than with other models. When the initial occupier moves out, the new occupier would continue to pay the higher network charge assigned to that house for the period permitted by the regulator. If an occupier decides to change supplier the DNO would be informed and would let the new energy supplier know the household has been assigned a higher network charge reflecting the investment that has been made.

[8] An insulation package which includes: solid wall insulation, floor insulation and glazing combined costs about £5,800. If energy suppliers' part funded this package by contributing £600 themselves and encouraged householders to contribute the rest, this would free up resource which would otherwise have been spent on fully funding solid wall insulation.

[9] Energy bill savings will be dependent on household behaviour as well as external factors out of their control such as the global price of fuel. It will be crucial for financing packages to be accompanied by best practice guides to inform customers how to ensure they see the full benefit of their energy saving measures i.e. by reducing their demand for heating

Costs and benefits of financing energy saving and low carbon heat technology

There are six main categories of **cost** associated with the proposed schemes:

1. Loan financing/subsidising costs: the interest rate paid by households on for finance will need to be below the market rate. This creates a cost for the provider of the finance who must make up the difference between the rate paid by households and the rate at which they can access funds.
2. Billing set-up costs: the host institution (either the ES, the DNO or a third party) must set up a billing system (or modify the existing one) to track the loan, repayments and other relevant information.
3. Billing administration costs: the institution (either the ES, the DNO or a third party) incurs a cost for issuing monthly statements, there will also be additional administrative costs under some models if households switch suppliers. There is also a third potential set of costs which arise from the fact that savings are likely to come from reduced use of gas rather than electricity use. There will have to be some mechanism for tracking and appropriately allocating the savings across gas and electricity suppliers. We do not quantify this third cost in the analysis below.
4. Installation costs: the household incurs the cost of the energy saving measure that is installed. This cost is equivalent to the present value of the loan repayment costs.
5. Government administrative costs: the Government may need to make some one-off changes to licenses and regulations to implement the models described above.
6. Fraud monitoring: ES, DNOs or other companies will have to ensure appropriate levels of fraud monitoring to ensure that cost of the installation accurately reflects the work carried out.

There are two main categories of **benefits** that arise from the proposed policy:

1. Energy savings: households consume less energy and pay commensurately less in the monthly fuel bills.
2. Carbon savings: the lower energy consumption also means lower carbon emissions which benefit society as a whole.

Below we summarise the main assumptions in the analysis, the cost, benefits and net impact of the options that were considered.

In this impact assessment we do not consider the hidden up front “hassle” costs associated with the installation of energy saving equipment. They are likely to include:

- inconveniences stemming from the installation works, that are especially important for the measures like internal solid wall insulation that require redesigning the whole interior of the house;
- search costs that are associated with finding contractor to perform the works;
- lack of awareness about benefits that could be delivered by energy efficiency measures;
- visual impacts of some energy efficiency measures, loss of space; and
- necessity to coordinate action among several properties for some measures.

In the next stage of policy development, it is important to classify these costs and to estimate them in monetary terms in order to receive better understanding of the initial “hurdle” for household investments in energy efficiency measures.

Input assumptions for cost and benefits estimations
The following assumptions are made to estimate costs and benefits to households from the energy saving measures that have been examined.

General assumptions
We use a bottom-up analysis to calculate the potential benefits. We first calculate the benefits of two typical residences and then aggregate the savings from those two typical residences based on the proportions in the overall housing stock to derive a UK-wide impact.

The two typical residences for which we calculate benefits are:

- **Representative house**: 3 bedroom semi detached house, total floor area of 88.8 m2, total wall area 81.8 m2, total window surface 17 m2. According to the BRE report *("Delivering cost effective carbon saving measures to existing homes", BRE, prepared for DEFRA, 27 September 200, p.10)* the main features of this house are set to housing stock average values. These parameters of a typical house are widely used to assess the efficiency of energy saving measures for households, for example they were used in the report prepared by UK Green Building Council *(UK Green Building Council* "*Low carbon existing homes")*

- **Representative flat**: 2 bedroom top floor flat with three external walls, total floor area of 60.9 m2, total wall area 28.9 m2, total window surface 9.1 m2. Parameters regarding this type of dwelling are taken from DECC analysis

Furthermore, we use retail gas prices based on current Defra guidance. Defra guidance[10] assumes that starting from 2010 the gas prices increase at the rate of 0.3% (in real terms) per year. We use domestic retail gas prices starting in 2012 because this new scheme is envisaged to be introduced from 2012 onwards. This gas price allows us to calculate the benefit of reduced energy consumption by households who install energy savings devices. At the end of this impact assessment we provide sensitivity analysis that examines the impact of different gas prices.

Finally, we use the shadow price of carbon to evaluate the carbon savings, since the change of emissions happens in the non-traded housing sector. The values of the shadow price of carbon are based on Defra guidance.[11]

Finance characteristics

As described above, households will agree to a finance package that covers the cost of a set of installations for energy saving. We assume that households are offered between £3,000 and £6,000 to install solid wall insulation, floor insulation and glazing.

The precise amount depends on:

- package of measures the household decides to install; and
- the type of property used by the household – either an average house or flat.

We examine two possible packages:

- **Package 1** includes *internal* solid wall insulation, floor insulation and glazing; and
- **Package 2** includes *external* solid wall insulation, floor insulation and glazing.

The key cost difference between packages is the type of solid wall insulation. Solid wall insulation is the most costly element and there is a substantial difference between external and internal insulation. External solid wall insulation is 50% more expensive than insulation of internal walls. Therefore, we consider two packages: package 1 is cheaper because it includes internal solid wall insulation and package 2 is more expensive as it includes external solid wall insulation.

The cost of both packages depends on the type of property. The total wall area in the representative flat is 2.8 times smaller than that of the representative house, the floor area is 45% smaller and window surface is 85% smaller. As a result, the cost of insulation measures for a flat is cheaper than for the average semi-detached house.

Costs and savings of energy efficiency packages

The differences between the costs of the two packages are summarized in the Table 1.

10 Valuation and appraisal of greenhouse gas policy, Chapter 4, Table 4: Gas values p/kWh, 2008 prices

11 Evaluation and appraisal of greenhouse gas policy, Chapter 9, Table 11: Shadow price of carbon in 2008 prices, £/t

	Flat	House
Solid wall insulation external	£3,050	£4,500
Solid wall insulation internal	£2,030	£3,000
Floor insulation	£290	£800
Glazing to C rated	£270	£500
Package 1: Solid wall insulation internal+ Floor insulation+ glazing	**£2,590**	**£4,300**
Package 2: Solid wall insulation external + Floor insulation+ glazing	**£3,610**	**£5,800**
Loan required	**£2,600 - £3,700**	**£4,300 - £5,800**

Table 1. Costs installing energy saving measures

Source: BRE, DECC

Note: (a) the costs for solid wall insulation may be understated – we anticipate the costs could be revised

(b) costs do not take account of imperfect installations

Data on the costs of particular measures come from:

- A report prepared by BRE for DEFRA "*Delivering cost effective carbon saving measures to existing homes*", 27 September 2007. This report estimated the technical potential of various energy efficiency measures in terms of costs and energy and carbon savings.

- DECC illustrative mix of the Supplier Obligation for the cost of floor insulation (£800).The costs of floor insulation for a semi-detached house in the BRE report is significantly lower (£150) so we adopt the conservative approach of using the higher estimate.

- The costs for a representative flat come DECC analysis. The costs are estimated using the technical data on the average dwelling and applying proportions of the area designated for insulation.

- In order to estimate the costs of glazing for a flat, we used the costs for an average house and adjusted it based on the window surface area for the typical flat.

- Note: typical costs may vary significantly depending on size of dwelling, ease of installation and whether the installations are part of a wider package of renovations

Savings of energy efficiency packages

Each energy efficiency measure saves energy and reduces greenhouse emissions. We calculated the monetary value of the energy and carbon savings using the assumptions on the gas price and the shadow price of the carbon specified above.

In order to calculate the present value of the savings we discounted the savings at 7% discount rate over the period of asset lifetime (30 years for external and internal solid wall insulation, 30 years for floor insulation and 20 years for glazing to C rated). The discount rate reflects commercial longer run discount rate (see discussion below).

Table 2 provides the estimated energy and carbon savings from each measure and the savings from implementing package 1 and package 2. All the savings are calculated for an individual household.

	Energy savings (kWh/year)		CO2 savings (kg CO2/year)		PV of energy savings over the asset lifetime per household (£ of 2008)		PV of carbon savings over the asset lifetime per household (£of 2008)	
	Flat	**House**	**Flat**	**House**	**Flat**	**House**	**Flat**	**House**
Solid wall insulation (internal)	4,610	10,290	940	2,090	£1,830	£4,080	£410	£920
Solid wall insulation (external)	4,620	10,290	1,000	2,210	£1,830	£4,080	£440	£970
Floor insulation	670	1,490	140	310	£270	£590	£70	£140
Glazing	970	2,150	210	450	£330	£720	£80	£160
Package 1	**6,250**	**13,920**	**1,330**	**2,970**	**£2,430**	**£5,390**	**£590**	**£1,270**
Package 2	**6,240**	**13,920**	**1,280**	**2,850**	**£2,430**	**£5,390**	**£560**	**£1,220**

Table 2. Energy savings from energy saving measures

Source: BRE, DECC

The data on the potential energy savings from these efficiency measures is derived from a BRE report and DECC analysis

- The data on energy saving comes from the BRE report *("Delivering cost effective carbon saving measures to existing homes", 27 September 2007, prepared by BRE for DEFRA).* The BRE report does not provide separate numbers for energy savings from internal and external solid wall insulation, and presents only the average number for these two measures. We use this average number for both external and internal solid wall insulation.

- The data on carbon saved from the insulation of solid walls is taken from DECC analysis. This is a little lower than the data on carbon savings provided in BRE report.

Why might long-term finance be required to incentivise investment in the energy saving?

Commercial lending terms suggest that households that borrow to install energy saving equipment would incur an interest rate of about 9% per year with a 5 year repayment period. This is based on current terms of a typical commercial loan offered by key UK banks. Such terms result in negative net impact for both the typical household and the typical flat. They are presented in Table 3.

The benefits for the consumer are their savings of energy that result from lower need for energy. To calculate the energy saving in particular year the energy saved is multiplied by the gas prices in that year. We use gas prices to calculate the savings since gas is used for space heating, and all the measures in the packages are directed towards saving of space heating.

The costs for consumers are the installation costs described in detail in Table 1.

	PV of benefit for consumer £		PV of cost for consumer £		Net benefits for consumers £	
	Flat	**House**	**Flat**	**House**	**Flat**	**House**
Package 1	£770	£1,690	£2,590	£4,300	**-£1,820**	**-£2,610**
Package 2	£770	£1,690	£3,610	£5,800	**-£2,840**	**-£4,110**

Table 3. Impact for a representative flat and household of installing energy saving measures if they borrow at commercial rates

Source: see text above

Costs and benefits for households of energy efficiency investment if repayment is spread over a longer period of time

Improving lending terms is one way in which households may be encouraged to invest in energy saving measures, and overcome some of the market failures discussed above. The UK Green Building Council suggests that loans may be available at around 5.4% for 25 years if they can be secured against the property itself. *(UK Green Building Council "Low carbon existing homes)*. We use the same conditions for long-term preferential loan: 5.4% interest rate for the loan available for 25 years.
On these terms, some of the packages begin to offer net benefits to households, as recorded in Table 4.

Cost and benefits for households

	PV of benefit for consumer £		PV of cost for consumer £		Net benefits for consumers £	
	Flat	**House**	**Flat**	**House**	**Flat**	**House**
Package 1	£2,320	£5,170	£2,240	£3,720	**£80**	**£1,450**
Package 2	£2,320	£5,170	£3,110	£5,010	**-£790**	**£160**

Table 4. Impact for a representative flat and household of installing energy saving measures if they borrow at discounted rates

Source: see text above

The costs and the savings in Table 4 are calculated using the same methodology as described above for the commercial loan. The only difference is that costs and benefits are discounted over longer period (25 years).

Aggregate energy and carbon savings for the UK

As stated above, there are two major types of savings from installations of the energy efficiency measures: energy savings and carbon savings.

The aggregate savings for the UK as a whole that would result from the implementation of these packages depends crucially on the number of households who take up the measures. We held discussions with energy suppliers and distribution network operations, to understand their experience of

the take-up of previous programs and thoughts about likely future take up. As a central scenario we assume a take-up by 50,000 households annually for 25 years, such that 1.25 million households have taken up the measures by the end of the program. We have also modeled annual take-up of 100,000 and 200,000 households.

For the 50,000 dwellings there are around 33,000 semi-detached houses and 17,000 flats. This assumption is based on the data on the proportion of these types of dwelling in the current UK housing stock. *(The data is presented by the Office of National Statistics)*

The evidence from the Energy Efficiency Commitment *(The EEC Annual Report 2008, Ofge*m) that was in place in 2005-2008 provide further support for the assumption about the potential take up of the measures. For example, during the three years of EEC more than 40,000 households received solid wall insulation; around 11,000 were in a non-priority group. The particularly low take-up of solid wall insulation during EEC was due, in part, to the potential for cheaper measures such as cavity wall insulation and loft insulation to be installed.
Given that by the start of the program the potential of cheaper measures will be depleted, we consider of 50,000-100,000 installations per year to be a reasonable estimate, especially if the Government wanted to set more ambitious targets within CERT. We assume that a package is installed at the beginning of the period in all households that have potential for saving energy from the measures.

Given the number of households that will opt for measures, we can estimate energy and carbon savings for UK as a whole. In order to estimate the savings for UK as a whole we make two further important assumptions:

- The present value of the energy savings and carbon savings are estimated over the asset lifetime, since we assume that assets serve the whole period indicated by their technical potential.

- To calculate the total savings, the present value of energy savings for household is multiplied by 1.25 million households.

The results are presented in the Table 5. The savings are presented separately for flats and houses, the last two columns of the table show total energy and carbon savings.

Aggregate Benefits

	Total energy savings (£ million)		**Total carbon savings (£ million)**		**Total energy savings (£ million)**	**Total carbon savings (£ million)**	**Total savings from the policy (£ million)**
	Flat	House	Flat	House			
Solid wall insulation (internal)	£300	£1,230	£70	£260	£4,140	£940	£5,080
Solid wall insulation (external)	£780	£3,360	£180	£760	£4,140	£990	£5,130
Floor insulation	£780	£3,360	£190	£800	£610	£150	£760
Glazing	£120	£490	£30	£120	£740	£170	£910
Package 1	**£1,040**	**£4,450**	**£260**	**£1,050**	**£5,490**	**£1,310**	**£6,800**
Package 2	**£1,040**	**£4,450**	**£250**	**£1,010**	**£5,490**	**£1,260**	**£6,750**

Table 5. Aggregate UK savings from energy efficiency measures (£s 2008)

Source: see text above

Aggregate costs of the policy

The above benefits have to be set against the costs. As noted above, there are six categories of costs:

1 Loan financing /subsidising costs
2 Installation costs
3 Billing set-up costs
4 Billing administration costs
5 Government administrative costs
6 Fraud monitoring

Below we discuss all the costs in turn.

1 Loan financing /subsiding costs

The benefits set out above are based on an interest rate of 5.4% over 25 years. In practice, loans for that length of time appear to be available for a minimum of about 7% over that period. This is based on current terms of a typical mortgage using the evidence on the conditions of 20-25 year mortgages offered by key UK banks.

The difference between the 7% borrowing costs of financial institutions and the 5.4% rate at which the money is lent out creates a cost of financing the loans.

Similar to total energy savings, the aggregate financing costs depend on the number of households that take up the measures and the balance between take-up by houses and flats.

As noted above, we assume that out of the 50,000 dwellings there are around 33,000 semi-detached houses and 17,000 flats. In order to calculate the total financing costs, financing costs per household is multiplied by the number of households (1.25 million).

That results in aggregate financing costs summarised in the Table 6 below.

	Financing / subsiding cost per household, £		**Total financing / subsidising costs, £ million**		**Total financing / subsidising costs, £ million**
	Flat	House	Flat	House	
Package 1	£370	£610	£170	£510	**£680**
Package 2	£510	£820	£230	£680	**£910**

Table 6. Cost of providing loans at a discount to commercial rates (2008£)

Source: *see text above*

2 Installation costs

Another important cost item of the energy saving measures is actual engineering costs of installing the energy saving equipment. The costs associated with installation of each of the components of the packages are presented in Table 1.

Using the costs per individual measure we estimate the overall costs of installation. The individual installation costs are multiplied by the number of households. The costs are calculated separately for flats and houses, since the installation costs for flats are lower and then aggregated to determine the final costs.

Table 7 presents the overall installation costs.

	Installation cost per household, £		Total installation costs, £ million		Total installation costs, £ million
	Flat	House	Flat	House	
Package 1	£2,240	£3,720	£960	£3,060	**£4,020**
Package 2	£3,110	£5,010	£1,330	£4,130	**£5,460**

Table 7. Aggregate costs for UK of installing energy saving measures (2008£)

Source: *see text above*

3 Billing set-up costs

Neither energy suppliers or energy service companies or distribution network operators (DNOs) are currently able to process the loan repayments envisaged under these schemes. Thus, in order to allow these transactions the relevant host institution would face a one-off investment cost of either

a. modifying their existing IT/Billing system (in the case of ES); or
b. setting-up a new billing IT/Billing system (in case of DNOs).

Standard finance model

There is a lot of uncertainty about the exact costs incurred by different loan providers to set up or amend the required systems. For example, when prompted during the interviews, the stakeholders confirmed that these set-up costs would represent by far their largest cost item; however they could not provide any exact estimate at this stage.

Consequently, estimates of the billing costs have been based on available public information:

i. BERR's total one-off cost estimate of £9.4million faced by energy suppliers for bill and system design to add historical usage information to energy bills [Source: BERR (2008), '*Explanatory Memorandum to the Electricity & Gas (Billing) Regulations 2008 (2008 No.1163)*']
ii. Centrica's £5m direct cost estimate for adding historical usage information to energy bills [Source: Centrica's response to BERR (2006), 'Energy Billing and Metering - Changing customer behaviour - An Energy Review Consultation']
iii. EMC Australia's one-off cost estimates faced by energy suppliers of changing their IT system to allow for 'new and enhanced' market transactions in the context of smart metering – ranging from £600,000 to £900,000 per company [Source: EMC Australia (2008):*'Smart metering CBA: Phase 2 Transitional costs'*]

Combing the above average set-up cost estimates with an assumption on the number of energy suppliers providing the loan payback facilities (i.e. only 'Big 6' vs. all 27 suppliers), results in a range of possible one-off set-up costs faced by energy suppliers for the entire UK economy. They are presented in Table 8 below. It indicates that:

a) The <u>minimum cost estimate</u> is based on the assumption that only the 'Big 6' energy suppliers provide the energy efficiency loans, each facing set-off cost based on the EMC study on the minimum set-up costs.
b) The <u>maximum cost estimate</u> is based on the assumption that all 27 UK energy suppliers provide the energy efficiency loans, each facing set-off cost based on the EMC study on the maximum set-up costs.
c) The <u>average cost estimate</u> is the (un-weighted) average of the total costs estimates resulting from all possible combinations of the above costs per company and the two take-up assumptions.

	Min, £ million	Average, £ million	Max, £ million
Billing system modification costs for ES	£3.6	£12.1	£24.3

Table 8. IT/Billing system modification costs for energy suppliers (total for the UK)

Source: *see text above*

Note that the costs estimated presented in Table 8 represent economy-wide cost estimates. If, for example, 1.25m households were to take up the energy efficiency loans (as suggested above), the average one-off costs would be about £3 to £20 per household.

Distribution Network Operators (DNO) finance model

Presently consumers have a direct relationship with their supplier(s) of electricity and gas, and none with the DNO. Direct debit and standard credit consumers pay suppliers every month or quarter based on estimated usage with periodic reconciliations as their meters are read. Prepayment consumers pay in advance for actual metered usage. Part of the charge to consumers includes the supplier's assessment of the use of system charges it will incur from the DNO in making the supply to the customer.

In turn the suppliers pay electricity distribution charges to the DNOs every month based on a bulk calculation of the electricity which has flowed through the network to consumers it has served. The bulk calculation is derived from the number of meters served by the supplier, aggregate flows through the DNO network and a profiled consumption for each meter every half an hour in the case of domestic customers based on two standard profiles (with and without Economy 7 metering, being profile classes 1 and 2 respectively) and the expected annual consumption. Consumers may be further grouped into generic types with practices varying by DNO. Such billing is referred to as the "super-customer" approach.

A similar set of relationships based around reconciling wholesale flows on a daily basis exists between customers gas suppliers/shippers and the gas distributors.

Potential relationships that could exist include:

- customer direct to supplier to DNO as at present;
- customer direct separately with DNO and supplier (two bills); and
- customer direct to DNO to supplier (a reversal of the current situation). This is theoretically possible but practically unattractive.

The present billing structures can accommodate any or all of these relationships, but set-up costs faced by DNOs under such schemes are difficult to estimate. We assume a continuation of the present relationship of customer to supplier to DNO.

Available public information confirms that the possible costs faced by DNOs could be substantial. For example, a recent study by Ofgem [Source: Ofgem (2008), *'Energy Supply Probe - Initial Findings Report'*] has estimated that the total set-up costs of IT systems could range from:

a) £1.5million for smaller energy companies [serving 50,000 customers] – about £30 per connection; to
b) £100million for smaller energy companies [serving 5 million customers] – about £20 per connection

Grossing these company-specific cost estimates up to economy-wide cost estimates would result in higher costs than those reported for the Supplier scheme. They are presented in Table 9.

	Min, £ million	Average, £ million	Max, £ million
Billing system modification costs for DNO	£571.6	£574.4	£857.3

Table 9. IT/Billing system modification costs for DNOs (total for the UK)

Source: *see text above*

Billing administration costs

In addition to the one-off set-up costs, there are expected to be three main, incremental administrative costs associated with this scheme in form of:

- the costs of approving the loans which is expected to be relatively low
- the costs of handling loan repayments, including:
  - additional billing costs (i.e. printing, paper and monitoring);
  - administrative costs of channelling payment to loan provider.
- the incremental administrative 'hand-over' costs if customers switch energy suppliers

With the exception of the 'switching costs', the magnitude of the above costs are expected to be identical across the schemes considered here.

Deriving economy-wide estimates of the above incremental administrative costs requires a set of assumptions:

a) Number of households taking up the finance: 50,000 per year (see earlier discussion)

b) Number of additional staff hours required for:

   i. Loan approval: 0.5 to 1 hour per loan

   ii. Payment channelling: 0.5 to 1 hour per loan

   iii. Switching costs: 1 to 2 hours per loan

The assumptions about the staff hours required for finance approval, payment channelling and switching the costs are made using the observations from the banking system and discussions with suppliers and DNOs.

c) Average hourly wage of relevant staff: £9.48 [Source: Quarterly published average gross hourly earnings - 'Administration/Secretary - Energy Sector', ONS (2008)]

d) Additional annual billing costs:

   i. Min: £0.86 per loan [Source: Centrica's response to Ofgem(2008), *'Energy Supply Probe - Initial Findings Report*' - Based on British Gas estimate on supplying historic consumption; assuming monthly billing]

   ii. Max: £4.30 per loan [Source: Sustainability First (2006), '*Smart Meters: Commercial, policy and regulatory drivers*']

e) Annual wage inflation: 3%

The resulting economy-wide estimates for each of the schemes under consideration are reported in Table 10.

Standard finance scheme	Min, £ million	Average, £ million	Max, £ million
Loan approval costs	£3.6	£5.5	£7.3
Loan handling costs	£4.3	£7.4	£10.6
'Switching' costs	£7.3	£14.6	£10.9
Total incremental admin costs	**£15.2**	**£27.5**	**£28.8**
DNO finance scheme	**Min, £ million**	**Average, £ million**	**Max, £ million**
Loan approval costs	£3.6	£5.5	£7.3
Loan handling costs	£4.3	£7.4	£10.6
Total incremental admin costs	**£7.9**	**£12.9**	**£17.9**

Table 10. Incremental administration costs of new models (2008£)

Source: *see text above*

Government administrative costs and fraud monitoring

There are two further categories of costs: government might need to amend relevant legislation and regulations to allow the models to be implemented and a system must be put in place by the suppliers, other companies or DNOs to ensure no fraudulent use of the system (e.g. contractors installing energy saving measures that are less valuable than the amount invoiced). We do not estimate the financial cost of either of these measures. However, it is important to note that fraud monitoring could be a significant additional cost.

Overall costs and benefits

Based on the figures above we can now calculate the overall costs and benefits to the UK. This combines the benefits of reductions in energy use and carbon emissions with the costs associated with installation of the energy saving measures, the financing/subsidising of those measures and the required billing and other systems needed to ensure the finance system works. The overall costs and benefits are summarised in the tables below. The costs and benefits are calculated for each scheme – standard and the DNO, since different billing costs are involved.

Table 11 present the overall costs and benefits for the standard scheme. The benefits in both schemes are the same

	Package 1, £ million	Package 2, £ million
Total energy savings	£5,490	£5,490
Total carbon savings	£1,310	£1,260
Total savings	**£6,800**	**£6,750**
Costs of installation	£4,020	£5,460
Costs of providing finance	£680	£910
Costs of setting the billing	£12	£12
Administration costs of billing	£28	£28
Total costs	**£4,740**	**£6,410**

Net benefit	**£2,060**	**£340**

Table 11. Impact of energy saving measures using Standard finance scheme

Table 12 presents the overall costs and benefits for the DNO scheme.

	Package 1, £ million	**Package 2, £ million**
Total energy savings	£5,490	£5,490
Total carbon savings	£1,310	£1,260
Total savings	**£6,800**	**£6,750**
Costs of installation	£4,020	£5,460
Costs of providing finance	£680	£910
Costs of setting the billing	£574	£574
Administration costs of billing	£13	£13
Total costs	**£5,287**	**£6,957**
Net benefit	**£1,513**	**-£207**

Table 12. Impact of energy saving measures using DNO scheme

Sensitivity analysis

Several factors might alter the outcomes of costs and benefits estimations, we examine changes in future:

- energy prices;
- the actual level of energy savings (rebound effects); and
- level of loan uptakes (100,000 or 200,000)

Energy prices

Higher prices of energy will increase the savings achieved from energy efficiency measures. For example, increase in gas price at 3% (real) per year dramatically increases the gains from energy efficiency measures. As shown in Table 13, the net benefits are becoming positive for all schemes and rises two to three fold. Note: if energy prices fall, this is also likely to have a dramatic impact on the net benefits of the schemes. This scenario has not been modelled here.

	Package 1, £ million	**Package 2, £ million**
Standard schemes		
Total savings	£8,520	£8,470
Total costs	£4,740	£6,410
Net benefit	**£3,780**	**£2,060**

DNO scheme		
Total savings	£8,520	£8,470
Total costs	£5,287	£6,957
Net benefit	**£3,233**	**£1,513**

Table 13. Impact of energy saving measures using Standard scheme with higher energy prices than assumed in the base case.

Actual level of energy savings

Actual level of energy savings of different measures might be lower because of two major reasons:

- rebound effects; and
- optimistic engineering estimates.

Rebound effects are the phenomenon of increasing energy consumption as a result of the installation of the energy efficiency measures. They are explained by the behavioural pattern when improvements in energy efficiency encourage greater use of the services (for example heat or mobility) which energy helps to provide. Consequently, energy savings that are supposed to be achieved through installation of energy efficiency equipment are not achieved. Rebound effects are estimated to be in the range of 10-30%. This means that actual energy savings would be 10-30% lower than those assumed in engineering specifications.[12]

Rebound effects decrease the expected benefits from energy savings and thus diminish the potential net gains. We test the sensitivity when rebound effects are 20%. Consequently, energy savings and carbon saving are 20% lower.

Table 14 shows that rebound effects have substantial impact on the benefits of energy efficiency installations.

	Package 1, £ million	**Package 2, £ million**
Standard schemes		
Total savings	£5,440	£5,400
Total costs	£4,740	£6,410
Net benefit	**£700**	**-£1,010**
DNO scheme		
Total savings	£5,440	£5,400
Total costs	£5,287	£6,957
Net benefit	**£153**	**-£1,557**

Table 14. Impact of energy saving measures for ES and ES-DNO schemes with lower energy saving than assumed in base case.

[12] See, for example, "The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency", report by the Sussex Energy Group for the Technology and Policy Assessment function of the UK Energy Research Centre, October 2007.

Optimism Bias

Field work to scope the extent of the rebound effect and of optimism bias provides indications of the margin for error in our forecasts, but falls short of implying material qualifications to our projections.

BRE has detailed heating regime assumptions in a report for OFGEM[13] (used in drafting the Supplier Obligation). We are aware of a degree of uncertainty regarding heat demand from different households even when they occupy similar dwellings.[14] Moreover, we do not have conclusive evidence whether new appliances replace old ones, or whether are added to a household's inventory. Our approach is to apply consistent standards across Impact Assessments but remain mindful of a residual element of uncertainty.

Actual level of finance package uptake

The overall level of costs and benefits for the economy is determined by the number of households that will use the opportunity of long-term finance to install energy saving equipment.

In the core estimations above, we use a quite cautious assumption that 50,000 households will be engaged in the long-term finance every year. However, if the information campaign is held in efficient way and the customers understand their benefits well, the actual level of uptake could be substantially higher. Tables below present our estimation for more ambitious number of loan uptakes: 100,000 and 200,000 households per year. It amounts to 2.5 and 5 million households that will install energy efficiency measures over the course of the scheme.

The main outcome of higher package uptake is that large one-off costs (i.e. costs of setting the billing system) are spread across the larger number of consumers. Consequently, the costs per consumers are smaller for the same value of benefits achieved per each consumer. As a result, the overall benefits increase, most notably for the DNO scheme the net benefits are becoming positive for the Package 2 (it is not the case for the core estimations for 50,000).

Table 15 sets out the estimates for 100,000 uptakes annually – for use in the consultation document

	Package 1, £ million	**Package 2, £ million**
Standard schemes		
Total savings	£13,540	£13,430
Total costs	£13,540	£12,720
Net benefit	**£4,150**	**£710**
DNO scheme		
Total savings	£13,540	£13,430
Total costs	£9,937	£13,267
Net benefit	**£3,603**	**£163**

Table 15. Costs and benefits for uptake level of 100,000 loans per year

Table 16 sets out the estimates for 200,000 uptakes annually.

[13] "Energy Efficiency Commitment 2008-2011 and BREDEM Calculations of Energy Savings", report 237027, (SO-07-198), May 2007

[14] See for example, data from Gastec, showing very poor correlation between SAP rating and energy use. (2008-05-12-SO-043). See also data from the Carbon Vision Programme, showing that a group of high consuming customers living in energy efficient housing have increased their electricity consumption very significantly more since 1990 than lower consuming customers.

	Package 1, £ million	Package 2, £ million
Standard schemes		
Total savings	£27,020	£26,800
Total costs	£18,680	£25,340
Net benefit	**£8,340**	**£1,460**
DNO scheme		
Total savings	£27,020	£26,800
Total costs	£19,227	£25,887
Net benefit	**£7,793**	**£913**

Table 16. Costs and benefits for uptake level of 200,000 loans per year

Distributional effects of the long-term loans for energy efficiency measures
Finally, we consider the distributional impacts of the proposed measures. In particular, we examine the impact of the requirement to repay the loan on households across the income distribution.

We calculate the proportion of monthly payment towards the energy efficiency loan with respect to the average monthly income of households in different deciles groups. The data on average household income for deciles groups is collected by Office of National Statistics, (Economics & Labour Market Review, Vol 2, No 7, July 2008). The results of these estimations are presented in Table 17. These estimates are based on the costs of the loans under the base case assumptions.

	FLAT		HOUSE	
HH groups	Package 1,%	Package 2,%	Package 1,%	Package 2,%
Bottom	2.4%	3.3%	4.0%	**5.4%**
2nd	1.6%	2.2%	2.6%	**3.5%**
3rd	1.3%	1.8%	2.2%	**2.9%**
4th	1.1%	1.5%	1.8%	**2.5%**
5th	0.9%	1.2%	1.5%	**2.0%**
6th	0.8%	1.1%	1.3%	**1.8%**
7th	0.7%	0.9%	1.1%	**1.5%**
8th	0.6%	0.8%	0.9%	**1.2%**
9th	0.5%	0.6%	0.8%	**1.0%**
Top	0.3%	0.4%	0.4%	**0.6%**

Table 17. Proportion of monthly income taken up by loan under base case scenario

Source: Office of National Statistics, cost estimates as set out above

Specific Impact Tests: Checklist

Use the table below to demonstrate how broadly you have considered the potential impacts of your policy options.

Ensure that the results of any tests that impact on the cost-benefit analysis are contained within the main evidence base; other results may be annexed.

Type of testing undertaken	***Results in Evidence Base?***	***Results annexed?***
Competition Assessment	Yes/No	Yes/No
Small Firms Impact Test	Yes/No	Yes/No
Legal Aid	Yes/No	Yes/No
Sustainable Development	Yes/No	Yes/No
Carbon Assessment	Yes/No	Yes/No
Other Environment	Yes/No	Yes/No
Health Impact Assessment	Yes/No	Yes/No
Race Equality	Yes/No	Yes/No
Disability Equality	Yes/No	Yes/No
Gender Equality	Yes/No	Yes/No
Human Rights	Yes/No	Yes/No
Rural Proofing	Yes/No	Yes/No

Annexes