

How the Green Deal will reflect the in-situ performance of energy efficiency measures

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Introduction

Purpose of this document

- 1. The Green Deal is a new government-backed programme that lets people pay for home improvements like insulation through savings on their energy bills.**
- 2. The Green Deal and the Energy Company Obligation (ECO) will work in combination to drive the installation of energy efficiency improvements, commonly referred to as “measures”.**
- 3. This publication sets out DECC’s approach for increasing confidence and consumer protection around the energy savings that can be achieved from installing energy efficiency measures used for calculating Green Deal finance. It complements the publication “Which measures qualify for Green Deal finance” on 11 June and the Government response to the consultation on the Green Deal and ECO¹.**
- 4. This publication explains the policy on in-use factors, the process for determining the levels of in-use factors and the levels set for launch of Green Deal. It also covers the review process for amending the levels in future.**
- 5. This publication focuses on the domestic Green Deal. The position on in-use factors in the non-domestic Green Deal will be published prior to October 2012.**

Intended Audience

- 6. It is aimed at organisations intending to supply-in to the Green Deal and ECO markets to provide greater clarity and to aid industry preparations.**

¹ http://www.decc.gov.uk/en/content/cms/consultations/green_deal/green_deal.aspx

The application of “in use factors” and the need for this approach

1. The Green Deal has been designed to finance, or part finance, the installation of a broad range of measures, products and systems. Improving the energy efficiency of a building helps to:
 - a. reduce the impact of rising energy prices,
 - b. maintain or increase levels of comfort, and
 - c. deliver fuel bill savings.
2. Provided a measure has been recognised as being capable of improving the energy performance of a building, it can potentially be added to the list of qualifying improvements. They also need to be recommended for a property by the Green Deal Advisor.
3. The Golden Rule determines the amount of Green Deal finance a Green Deal Provider can attach to the energy meter in any given property. It is a consumer protection mechanism which requires that the amount of finance a package of measures can attract cannot be greater than the estimated energy bill savings the measures can generate over a specified period of time. This is to protect against fuel bills rising following the introduction of the Green Deal charge. The expected fuel bill savings will be generated during the Green Deal assessment² and so it is crucial that these are based on the best available evidence on performance of measures.
4. There is longstanding evidence of a performance gap, which means a difference in savings than is predicted and is actually achieved in the property.
5. The reasons for the gap between the theoretical savings possible and the savings households actually realise are complex and will differ from property to property. It is not necessarily the case that products are not performing, but could be due to the fact some properties are not as standard as the models assume. Buildings across the UK vary in terms of their construction and their materials. Particularly for existing dwellings, it is impossible to collect all necessary information needed to enter into the methodologies to make perfect predictions.
6. Reasons for this performance gap are likely to include:
 - a. the difference between in-situ performance compared with laboratory test results
 - b. imperfect installations

² The Green Deal Occupancy Assessment will include the in-use factors that Green Deal finance is based on.

- c. obstructions to insulating parts of walls, e.g. due to garages or conservatories
 - d. natural variations in the thermal performance of structural and fabric elements that cannot be fully determined by the assessment, e.g. the possibility that the un-insulated walls have different U-values than the standard assumptions and that U-value varies across different parts of the wall.
 - e. comfort taking by the household, where some households may choose to heat their homes to a higher temperature
 - f. the household failing to operate the product/system effectively
7. The evidence base on the in-situ performance of the full range of eligible measures is patchy but is improving. Evidence has come from field trials of certain measures, such as cavity wall insulation, and other research such as DECC's National Energy Efficiency Data framework (NEED). In addition, DECC and others are putting in place programmes to improve our understanding of how measures perform in buildings, for example the ongoing Renewable Heat Premium Payment (RHPP) monitoring of renewable heat technologies.
 8. In the interim, there is a need to ensure that Green Deal finance is adjusted, by the introduction of 'in-use' factors. The in-use factors will have the effect of lowering the amount of finance that can be offered to consumers by a specified percentage per measure. The percentage reduction set will be based on the application of evidence and research and on expert recommendation.
 9. The application of in-use factors is necessary to ensure confidence in the savings estimates on which the Golden Rule is based. This will provide additional protection to the Golden Rule to prevent bills rising as a result of the charge. This is particularly important in the early days of the Green Deal where confidence is crucial for driving investment in energy efficiency measures.
 10. This policy was consulted on in the Green Deal and ECO Consultation and responses have agreed that this is a necessary mechanism to protect the consumer.
 11. It is our objective to use this mechanism to drive innovation. This is a flexible approach and we are committed to updating in-use factors on a regular basis to incorporate new evidence on performance. Further details on this are found on page 9.

What the in-use factor covers

12. As set out above, there are many reasons for the potential difference between tested performance in the lab and actual performance in the home. Whilst these are difficult to separate, the main factors the in-use factor is designed to account for are differences in performance in-situ compared to laboratory testing and imperfect installation. We anticipate that the gap in performance will reduce due to the application of minimum standards that will be set for Green Deal. For example, we have made it a mandatory requirement for an

installer to be authorised to operate under the Green Deal and ECO and to have been certified by an accredited certification body to have met the new Green Deal standard.

13. The in-use factor is not intended to protect against occupants changing their behaviour, for example, comfort taking to achieve a warmer home. We recognise that such comfort taking can be a major reason for the apparent underperformance. Green Deal Advisors will provide advice to occupiers about the impact of their behaviour on making energy savings. They will also be offered advice during the Green Deal Occupancy Assessment on ways to save energy through simple changes in behaviour.

How in-use factors were determined

14. DECC convened a task group of experts to review the available evidence and to make a recommendation on what in-use factors should be used at the launch of the Green Deal. Membership of the group drew from industry, testing organisations and academia. For a full list, see annex A.
15. The Group met three times between December 2011 and April 2012 and discussions centred on the available evidence from field trials and statistical analysis, the other evidence to draw on from industry experience and how to improve both the evidence base and standard industry practice, where appropriate. Where possible the in-use factors have been based on actual evidence of performance, otherwise they have been based on expert judgement. Details of the sources that were drawn on are found in annex B.
16. This publication outlines the levels of in-use factors for the launch of Green Deal in October 2012. Following this we will have regular reviews of the evidence and amend the in-use factors when needed.

How in-use factors will be applied

17. The in-use factors will be applied to the Green Deal Occupancy Assessment report, part of the domestic Green Deal Advice Report in the domestic sector. This means the occupier can clearly see the expected fuel bill savings that the Golden Rule will be based on at the impartial assessment stage. Applying on the Occupancy Assessment enables the in-use factors to be updated frequently, every six months, as we gain further information and performance is improved.
18. This means the savings figures on the Energy Performance Certificate (EPC) will be different from the Occupancy Assessment. In order to minimise any consumer confusion from the difference in figures on the Occupancy Assessment and the EPC, we have

included clear advice for the reasons behind this difference and have carried out consumer research and testing on the Occupancy Assessment to ensure that it is well understood³.

19. The in-use factor will be applied to each measure that is installed with Green Deal finance. If more than one measure is installed in a package, the in-use factors should be applied sequentially. They will be included in the EPC Adviser tool for Green Deal should the package change from the assessment to the final quote.

The level of in-use factors

20. The table below shows the level of the in-use factor to be applied to the savings estimates for each specific measure for the launch of Green Deal. It is a percentage figure, so for example, the savings calculated for cavity wall insulation, will be reduced by 35% for use in the Green Deal finance calculation.
21. The in-use factors have been based on, as far as possible, existing evidence of performance in-situ. There are some measures where specific evidence or research on that particular measure is not available and so the in-use factor has been extrapolated from evidence on similar measures that the expert group considered. For some measures, such as Microgeneration, the treatment in the methodology⁴ is already conservative and therefore we consider that an in-use factor is not needed. For further details on the sources used for each measure, see Annex B.
22. An in-use factor has been set for each measure, rather than a blanket reduction for a Green Deal package irrespective of the measure.. This means that where performance of a specific measure improves, the in-use factor can be revised. This will therefore act as an incentive for industry to innovate.
23. This does not cover non-domestic measures, which have different considerations than in the domestic sector. Firstly, the Golden Rule will be based on occupant-specific savings due to the much wider variety of ways in which a property can be used (which often vary greatly from the standard assumptions in the SBEM methodology). Secondly, the assessment methodology has in-built conservatism in the estimates of savings, since these are calculated assuming a good standard of energy management in the property. DECC intend to further consider the appropriate level of in-use factors for non-domestic and will announce this prior to October 2012.

³ A mock up of the assessment is available at <https://www.gdsap.org.uk/>

⁴ The Standard Assessment Procedure (SAP)

Measure	Sources of Evidence	In-use factor (%)
Cavity Wall Insulation	Field trials and NEED	35
Internal Solid Wall Insulation	Recommendation	25
External Solid Wall Insulation	Recommendation	25
Loft insulation (including loft hatch, rafter insulation)	Field trials and NEED	35
Flat roof insulation	Recommendation	15
Room in roof insulation	Recommendation	25
Floor insulation	Recommendation	15
Heating controls	Field monitoring	50
Non condensing to condensing gas or oil boiler	Field trials and NEED	25
Biomass boiler	Recommendation	25
Biomass room heater	Recommendation	25
Flue Gas heat recovery device	Recommendation	10
Hot water cylinder insulation	Recommendation	15
Double Glazing	Recommendation	15
Secondary glazing	Recommendation	15
High thermal performance external doors	Recommendation	15
Draught-proofing	Recommendation	15
Cylinder thermostat	Recommendation	10
New or replacement storage heaters	Recommendation	10
Replacement warm-air unit	Recommendation	10
Waste water heat recovery devices	Recommendation	10
Solar water heating	Field trial	0
Photovoltaic panel	Recommendation	0
Ground source heat pump	Field trial	10
Air source heat pump	Field trial	25
Micro CHP	Recommendation	25
Building mounted wind turbine	Field trial	0

How in-use factors will be amended

24. The in-use factors will be reviewed on a regular basis, and at least annually, drawing on new evidence of in-situ performance and revised if appropriate. It is anticipated that the application of in-use factors will incentivise manufacturers and installers to improve product and in-situ performance, a secondary benefit. The objective is to lower in-use factors over time.
25. In the review of the in-use factors, DECC will continue to consult experts from academia and industry in this field to build a consensus over necessary amendments. DECC anticipates that the recommendations made will be scrutinised by the Integrity Group that is intended to support development of SAP⁵.
26. There are three sources of evidence we expect to draw on for amending the in-use factors.
27. The first is research, analysis or field trials on the in-situ performance of measures. For example, NEED will continue to be an important source of evidence on the impact of key energy efficiency measures. Work is underway to develop previous estimates of the impact of cavity wall insulation, loft insulation and condensing boilers, with the outputs from this due to be published in Autumn 2012. As data becomes available, NEED will be able to provide evidence for a wider range of measures, such as solid wall information, and this information will feed into future reviews of in-use factors.
28. The second is additional monitoring of installed measures in-situ performance. Monitoring will take place under Green Deal. For example the oversight and registration body will carry out in-situ checks of equipment to ensure that it delivers the savings claimed by manufacturers as well as spot checks to ensure compliance against the code of practise. In addition, the Renewable Heat Premium Payment (RHPP) scheme made provision for the metering of the measures under the scheme, starting with heat pumps.
29. The third is information from industry on how they are improving their practises and innovating to improve the savings performance of measures. Industry has a vital role to play in improving the performance of the energy efficiency measures so that they reach their energy saving potential. One example would be through education of consumers on how to use measures, such as heating measures, to achieve the optimum savings could increase the delivered savings. Another example is innovation in installation practises to ensure that all parts of the wall are insulated and which would result in higher savings.

Development of Assessment Methodologies

30. DECC will continue to review the SAP and RdSAP methodologies to improve the accuracy of energy assessments and thereby effectively support Government policy initiatives. For the assessment of existing dwellings, RdSAP will be reviewed on an annual basis,

⁵ For more details on the proposed group, please see the SAP 2012 consultation:
<http://www.decc.gov.uk/media/viewfile.ashx?filetype=4&filepath=11/consultation/standard-assessment-procedure/4014-consultation-proposed-changes-sap.doc&minwidth=true>

particularly to update the cost of measures and to introduce new measures that have been added to the SAP methodology.

Product Differentiation

31. DECC intends to allow for product differentiation to drive innovation through the Green Deal and to recognise enhanced performance of products for Green Deal finance purposes. DECC consulted on proposals to enable (on a voluntary basis) suppliers to have the performance of their individual products verified so that product-specific data can be used in the Golden Rule calculation.

32. This means that if a product can create better fuel bill savings than those estimated for the “generic” measure, it can attract additional Green Deal finance. This proposal was strongly supported during the consultation. It will drive innovation within existing measures categories and encourage the supply of the best products on the market. DECC will issue a tender to procure such a product differentiation mechanism shortly. The mechanism for allowing higher levels of finance for highly performing products that demonstrate strong in-situ performance will be determined during the procurement. A potential method may be for the product to receive a lower in use factor.

Annex A – Membership of Green Deal Measures Group

British Board of Agrément (BBA)

Building Research Establishment (BRE)

University of Leeds

University College London (UCL)

Construction Products Association (CPA)

Gastec at CRE Ltd

BSRIA

Annex B: Sources of evidence for each measure

Cavity wall insulation (CWI)

1. Evidence drew from following sources which showed this measure does not achieve the theoretical savings.
 - a. Glasgow Caledonian University review of field trials evidence⁶
 - b. DECC's NEED⁷ analysis.

Loft insulation (including rafter insulation)

2. Evidence drew from following sources which showed this measure does not achieve the theoretical savings.
 - a. Glasgow Caledonian University review of field trials evidence
 - b. DECC's NEED analysis.

Solid Wall Insulation (SWI) (including room-in-roof insulation)

3. Research is ongoing on the performance of solid wall insulation. In the interim, 25% in-use factor will be used, in line with similar measures.

Other insulation

4. This includes flat roof insulation, floor insulation, hot water cylinder insulation, energy efficient glazing, and replacement doors and also draught proofing is also set at 15%.
5. These are precautionary adjustments to reflect underperformance against theoretical models and installation issues, in line with similar measures.

⁶ Review of Differences between Measured and Theoretical Energy Savings for Insulation Measures By Chris Sanders and Mark Phillipson Centre for Research on Indoor Climate and Health Glasgow Caledonian University December 2006

⁷ National Energy Efficiency Data-Framework, Report on the development of the data-framework and initial analysis. DECC, June 2011.

Condensing Boilers

6. Evidence drew from following sources which showed this measure does not achieve the theoretical savings.
 - a. Field trial evidence on performance of condensing boilers⁸
 - b. DECC's NEED analysis

Heating controls

7. Evidence drew from following source which showed this measure does not achieve the theoretical savings.
 - a. Research on heating control performance by Shipworth et al.⁹

Other heating measures

8. This includes flue gas heat recovery device, cylinder thermostat, replacement storage heaters, replacement warm-air unit, and waste water heat recovery devices. They will have a precautionary 10% reduction.

Microgeneration and Renewable Heat

9. In order to achieve expected savings from micro-generation measures requires the measures having been installed in optimum locations and being installed, used and maintained correctly.

Ground source and air source heat pumps

10. In calculating in-use factors, DECC used the results from:
 - a. Energy Saving Trust (EST) heat pump field trials¹⁰ and comparisons to RdSAP defaults

⁸ Final Report: In-situ monitoring of efficiencies of condensing boilers and use of secondary heating. Gastec at CRE Ltd, 2009.

⁹ Shipworth M et al. (2010) Central heating thermostat settings and timing: building demographics. Building Research and Information 38, 50-69

¹⁰ http://lis/decc/latest-news/docs/2900074%20HEAT%20PUMP%20FIELD%20TRIALS%20v0_1A.pdf

Solar Water heating

11. We have drawn on evidence from:

- a. EST field trials of domestic solar thermal systems¹¹ and comparisons to the results for an average dwelling in RdSAP and its assumptions around location and overshadowing.

Solar PV

12. There is no field trial evidence on which to draw however since RdSAP makes the same conservative assumptions about shading as solar water heating, we will apply no in-use factor.

Micro-wind

13. We have drawn on evidence from:

- a. EST field trials of roof mounted micro-wind turbines¹² and comparisons to RdSAP results for a series of average properties

Micro CHP

14. We considered the in-use factor for the most common system currently available, the Sterling engine. We also considered results from trials¹³. We consider that this should be treated like a boiler and have the same in-use factor.

¹¹ "Solar thermal field trial", EST, July 2011

[http://www.microgenerationcertification.org/admin/documents/Heat%20Emitter%20Guide%20final%20A4%20printer%20version\[1\].pdf](http://www.microgenerationcertification.org/admin/documents/Heat%20Emitter%20Guide%20final%20A4%20printer%20version[1].pdf)

¹² "Location, Location, Location: The Energy Saving Trust Domestic Wind Field Trial" Funders' Report, 12th June 2009

¹³ <http://www.chpa.co.uk/medialibrary/2011/05/18/fd8249cf/Micro-CHP%20Accelerator%20-%20Final%20Report%20-%20Mar11.pdf> Carbon Trust, Micro CHP Accelerator

Glossary

Code of Practice: Document setting out the criteria that advisors, installers, providers and

Energy Company Obligation (ECO): The ECO Carbon Saving obligation will provide additional support alongside the Green Deal for hard to treat homes requiring measures which include SWI.

The ECO Affordable Warmth obligation will focus on providing support to low income households, identified by their entitlement to certain means tested benefits and tax credits, who are also vulnerable to detrimental health impacts from living in cold homes. Eligibility for the Affordable Warmth obligation is intended to be further focused on private tenure properties where energy efficiency standards are lowest and there are fewer alternative forms of support.

Energy Performance Certificate (EPC): Energy Performance Certificates (EPCs) give information on how to make your home more energy efficient and reduce your energy costs. All homes bought, sold or rented require an EPC and they will contain key financial information about the Green Deal.

Golden Rule: The Golden Rule refers to the estimated savings on a customer's energy bill due to the energy efficiency improvements made to the property. In most cases repayment levels will be based on heating bills for the property or the typical energy bills of a similar property. The Green Deal is designed to try to save the customer at least as much money as they will have to repay. However, the actual level of savings will depend on how much energy is used (e.g. to heat your home) and the future cost of energy.

Green Deal Advice Report: Is produced by a Green Deal Advisor and consists of an EPC and occupancy assessment in the domestic sector and a SBEM (or an approved equivalent) Green Deal assessment in the non-domestic sector.

Green Deal Advisor: Only a Green Deal Advisor is authorised to carry out and produce a Green Deal Advice Report, recommendations and provide related advice on the Green Deal to the consumer. A Green Deal Advisor must hold a qualification that meets the standard required by the relevant National Occupational Standards and syllabus and be a registered member of a certification body.

Green Deal Installer: Only an authorised Green Deal Installer can install energy efficiency improvements under the Green Deal finance mechanism and use the Green Deal Mark.

Green Deal Plan: This is the contract that sits between the Green Deal Provider, the improver and the Bill payer (if different at the property). It sets out the financial terms of the agreement (e.g. amount and duration of instalments).

Green Deal Provider: A Green Deal provider provides the finance, arrange for the Green Deal measures to be installed and the point of contact for customer service enquiries after the Green Deal is complete.

Improver: The occupier or owner of a property who makes the arrangement for energy efficiency improvements to be made to the property.

Measures/Improvements: A type of Green Deal eligible energy efficiency improvement made to a property.

Occupancy Assessment: the second part of the Green Deal assessment in the domestic sector. The occupancy assessment considers the energy use of the household and the impact this is likely to have on the standard energy savings predicted by the EPC. It also contains a tailored package of measures based on householders' preferences and behavioural information to help households reduce their energy use at no cost.

Product: This is the actual product installed, which must fall within a category of measures.

Property Assessment: An assessment of the property to determine the correct measures that can be installed in the property to improve the energy and thermal performance of the building and ensure eligibility for Green Deal finance. An assessment is carried out by an authorised Green Deal assessor.

Quality Mark: Green Deal participants must use the Green Deal Quality Mark on identifying documentation and certain promotional material so that customers can see they are accredited to the standards of the Green Deal Scheme.

System: A measure or product which is made up of component parts which is often constructed or put together on of off-site, such as External Wall Insulation systems.

Acronyms

DECC	Department of Energy and Climate Change
ECO	The proposed new Energy Company Obligation
EPC	Energy Performance Certificate
EST	Energy Saving Trust
NEED	National Energy Efficiency Data framework (
RdSAP	Reduced data Standard Assessment Procedure
RHPP	Renewable Heat Premium Payment
SAP	Standard Assessment Procedure
SBEM	Simplified Building Energy Model

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