



Department
of Energy &
Climate Change

Information for the Supply Chain on Green Deal Measures

Version 1

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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, referred to in legislation as “qualifying energy improvements” but commonly referred to as “measures”.
3. This publication sets out how Green Deal measures are described within the assessment tools and when the tools will recommend the measures in question.
4. This publication covers the position for the Green Deal only. Detailed guidance on Energy Company Obligation measures will be produced by Ofgem.

Intended Audience

5. This document is aimed at organisations intending to supply-in to the Green Deal to provide greater clarity.

Introduction to the links between Green Deal measures and the Green Deal assessment tools

1. The energy efficiency improvements - otherwise known as “measures” - which are eligible for Green Deal finance are set out in the Green Deal (Qualifying Energy Improvements) Order 2012 (S.I.2012/2105) and were listed in DECC’s publication entitled “Which energy efficiency improvements qualify for Green Deal finance”, published in June 2012.
2. Potentially any energy saving measure can be a Green Deal measure. If the potential saving can be quantified (and verified), and the performance is then modelled in our Green Deal assessment tool(s) – if it is not already included in the list of eligible measures it can in the future be added to the list of Green Deal measures in S.I. 2012/2105. Quantified energy savings are necessary in order to determine how much Green Deal finance can be offered for the installation of the measure.
3. In the domestic sector the tools are based on the Reduced Data Standard Assessment Procedure (RdSAP) and in the non domestic sector the Green Deal assessment tools are based on the Simplified Building Energy Model (SBEM). Whether certain measures are recommended in either sector depends on which tool they are modelled in. A list of which measures are contained in RdSAP and SBEM is on pages 6 to 8.
4. In order to provide greater clarity for the supply chain on what the eligible measures are and what key assumptions the assessment tools make, DECC commissioned BRE to produce this document.
5. This document provides further information on:
 - a. How the Green Deal assessment tools describe the measure;
 - b. The circumstances in which it will be recommended, including whether it will be recommended in the domestic or non domestic properties (or both);
 - c. Other information about assumptions including costs, savings and lifetime estimates.
6. DECC does not define eligibility for finance at the product level, however Green Deal Providers, manufacturers, distributors and installers can use this information to help them determine whether products or product – types qualify . The performance assumptions contained in this document are also a helpful baseline for understanding the level savings assumed for the generic measures.
7. It is important to recognise that the assumptions contained in the assessment tools are for generic measures, such as “cavity wall insulation” or “flue gas heat recovery”. In reality costs, lifetimes and savings¹ will vary from product to product. Green Deal Providers will be using this real-world information when calculating the level of finance they will offer. It is a requirement of the Green Deal that products installed are the type capable of delivering at

¹ Note that as savings estimates differ across properties due to many factors, such as what type of fuel is used or the floor area, therefore the savings estimates in this document will not be identical to savings assumptions in the Green Deal Impact Assessment, which uses average estimates.

least the level of savings assumed for the measure. DECC will also provide a mechanism to enable Green Deal Providers to use product-specific savings estimates in their finance calculation provided certain requirements have been met (see “Which energy efficiency improvements qualify for Green Deal finance”, published in June 2012) .

8. The following text box sets out key terms used in this document:

Definitions

Measure – A generic energy efficiency improvement which can be made to a property, for example, loft insulation, cavity wall insulation or a replacement boiler.

Improvement – The term used in the Green Deal legal framework to describe the installation of a measure in a property.

Product - The actual product installed with Green Deal finance (falling within a category of qualifying energy improvement).

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

The Energy Act 2011 makes clear that the Green Deal may cover measures which generate renewable energy, as well as those termed “energy efficiency” measures. Energy efficiency will often be used as short-hand for the types of measures which can lower energy bills and therefore be eligible for the Green Deal, even if not all such measures technically reduce energy use or increase its efficiency in every case. For example, Microgeneration will use renewable sources of energy (such as the air, sun and ground heat) to generate energy and this ultimately results in fuel bill savings.

Lists of measures that can be recommended in domestic or non-domestic properties?

9. Table 1 shows whether measures will be recommended by assessors for domestic properties, non-domestic properties or both.

Table 1

| Item | Descriptor | Domestic | Non-domestic |
|------|--|----------|-----------------------------------|
| (a) | air source heat pumps | √ | √ |
| (b) | biomass boilers | √ | √ |
| (c) | biomass room heaters (with radiators) | √ | |
| (d) | cavity wall insulation | √ | √ |
| (e) | chillers | | √ |
| (f) | cylinder thermostats | √ | |
| (g) | draught proofing | √ | √ |
| (h) | duct insulation | | To be added in Spring 2013 update |
| (i) | gas-fired condensing boilers | √ | √ |
| (j) | ground source heat pumps | √ | √ |
| (k) | hot water showers | | To be added in Spring 2013 update |
| (l) | hot water systems | | √ |
| (m) | hot water taps | | To be added in Spring 2013 update |
| (n) | external wall insulation systems | √ | √ |
| (o) | fan-assisted storage heaters | √ | |
| (p) | flue gas heat recovery devices | √ | √ |
| (q) | heating controls for wet central heating systems or warm air systems | √ | √ |

| Item | Descriptor | Domestic | Non-domestic |
|------|--|----------|---|
| (r) | heating ventilation and air-conditioning controls (including zoning controls) | | √ |
| (s) | high performance external doors | √ | √ |
| (t) | hot water controls (including timers and temperature controls) | | √ |
| (u) | hot water cylinder insulation | √ | √ |
| (v) | internal wall insulation systems (for external walls) | √ | √ |
| (w) | lighting systems, fittings and controls (including rooflights, lamps and luminaires) | | √ |
| (x) | loft or rafter insulation (including loft hatch insulation) | √ | √ |
| (y) | mechanical ventilation with heat recovery systems | | √ [heat recovery can be added to ventilation system] |
| (z) | micro combined heat and power | √ | √ |
| (aa) | micro wind generation | √ | √ |
| (bb) | oil-fired condensing boilers | √ | √ |
| (cc) | photovoltaics | √ | √ |
| (dd) | pipework insulation | | To be added in Spring 2013 version |
| (ee) | radiant heating | | √ |
| (ff) | replacement glazing | √ | √ |
| (gg) | roof insulation | √ | √ |
| (hh) | room in roof insulation | √ | |
| (ii) | sealing improvements (including duct sealing) | | √ |

| Item | Descriptor | Domestic | Non-domestic |
|------|---|--|--|
| (jj) | secondary glazing | √ | √ |
| (kk) | solar blinds, shutters and shading devices | | √ |
| (ll) | solar water heating | √ | √ |
| (mm) | transpired solar collectors | | √ |
| (nn) | under-floor heating | To be added to Occupancy Assessment in next update | √ |
| (oo) | under-floor insulation | √ | √ |
| (pp) | variable speed drives for fans and pumps | | √ (for pumps) For fans, will be added in Spring 2013 update |
| (qq) | warm-air units | √ | √ |
| (rr) | waste water heat recovery devices attached to showers | √ | |
| (ss) | water source heat pumps. | √ | √ |

Green Deal Measures – Domestic

10. Typical savings from installing domestic energy efficiency measures are provided in the tables in this section (using RdSAP's methodology). These have been calculated assuming a typical UK climate. Any energy savings which are primarily achieved by reducing the amount of fuel required for space heating will be affected by regional weather variation (e.g. saving will be higher in cooler parts of the UK).
11. The following map has been provided to give an indication of the scale of this effect. A percentage is provided for each region which can be used to scale heating savings. For example, when cavity wall insulation is installed in North East Scotland fuel saving would be around 10% higher than the average figure shown.
12. Note that these factors do not apply to savings from measures which do not reduce space heating energy (e.g. photovoltaics, cylinder insulation).



(a) Air source heat pumps

See also (j) *Ground source heat pump*

Description: Changing the current heating system to an air source heat pump to provide heating and/or hot water.² The heat pump could be electric or gas/oil.

What is the measure: A heat pump is a device which upgrades heat taken from a low temperature source and delivers it at a higher temperature in the form of warm air or hot water. An air-source heat pump uses outside air as its heat source.

When recommended: As an alternative measure³ when another heating system is recommended in the main table of recommendations and changing the heating to an air source heat pump would result in a lower energy cost.

Assumptions for savings estimate: From direct-acting electric heaters to SAP default air source heat pump (Seasonal performance factor 250%), provides space and water heating.

Assumed lifetime: 15 years

Indicative cost: £3,000 - £10,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 0 | 6376 | 3229 | 808 | 25% | 606 |
| Bungalow, 67 m ² | 0 | 4587 | 2304 | 576 | | 432 |
| Semi-detached, 89 m ² | 0 | 5231 | 2636 | 659 | | 495 |
| Mid-terrace, 80 m ² | 0 | 3644 | 1816 | 454 | | 341 |
| Mid-floor flat, 61 m ² | 0 | 2269 | 4191 | 226 | | 169 |

² Recommendation is for a ground or air source heat pump

³ Alternative measures are included on EPCs when another measure of the same type is shown in the table of recommendations.

(b) Biomass boilers

Description: Changing the current heating system to a biomass boiler (wood logs or wood pellets).

What is the measure: A heating boiler which uses wood chips or similar plant-based (biomass) fuel, rather than more conventional gas, oil or coal.

When recommended: When dwelling has an independent solid fuel boiler (not biomass or dual fuel).

Assumptions for savings estimate: From smokeless fuel boiler, efficiency 60%, to wood logs independent boiler, efficiency 73%, provides space and water heating.

Assumed lifetime: 20 years

Indicative cost: £7,000 - £13,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 6269 | 0 | 11708 | 357 | 25% | 268 |
| Bungalow, 67 m ² | 4665 | 0 | 8916 | 292 | | 219 |
| Semi-detached, 89 m ² | 4985 | 0 | 9531 | 313 | | 234 |
| Mid-terrace, 80 m ² | 3541 | 0 | 6770 | 222 | | 166 |
| Mid-floor flat, 61 m ² | 3541 | 0 | 6770 | 222 | | 166 |

(c) Biomass room heaters (with radiators)

Description: Changing the current heating system to a biomass room heater with a boiler that provides heat to other rooms.

What is the measure: Replacing the existing heating system with a biomass room heater with boiler for space and water heating.

When recommended: When dwelling has a solid fuel open fire or room heater with or without boiler (not biomass or dual fuel).

Assumptions for savings estimate: From closed room heater burning smokeless fuel, efficiency 60%, to wood pellet stove with boiler, efficiency 63%, provides space and water heating.

Assumed lifetime: 20 years

Indicative cost: £7,000 - £13,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 1127 | 0 | 10158 | 37 | 25% | 28 |
| Bungalow, 67 m ² | 2603 | 0 | 7465 | 42 | | 32 |
| Semi-detached, 89 m ² | 714 | 0 | 8215 | 46 | | 34 |
| Mid-terrace, 80 m ² | -164 | 0 | 5396 | 45 | | 34 |
| Mid-floor flat, 61 m ² | -710 | 0 | 3192 | 50 | | 37 |

(d) Cavity wall insulation

Description: Filling cavities of walls without insulation.

What is the measure: Introducing insulation in one of several free-flowing forms into the cavities in existing external walls.

When recommended: When there are unfilled cavity walls.⁴

Assumptions for savings estimate: All unfilled cavity walls are treated, blown mineral wool into a 60 mm cavity.

Assumed lifetime: 42 years

Indicative cost: £500 - £1,500⁵

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 7323 | 0 | 1380 | 238 | 35% | 154 |
| Bungalow, 67 m ² | 3345 | 0 | 662 | 114 | | 74 |
| Semi-detached, 89 m ² | 4550 | 0 | 901 | 155 | | 101 |
| Mid-terrace, 80 m ² | 2671 | 0 | 529 | 91 | | 59 |
| Mid-floor flat, 61 m ² | 1909 | 0 | 378 | 65 | | 42 |

⁴ Not partially filled cavities. If the cavity may be narrower than usual, or if the walls may be exposed on wind-driven rain or may be difficult to access for cavity fill, it is flagged on the EPC that further investigation is needed.

⁵ The large range assumes a proportion of cavities will be “hard to treat” and therefore more expensive.

(e) Chillers

Not applicable to domestic sector.

(f) Cylinder thermostats

Description: Adding a surface-mounted cylinder thermostat.

What is the measure: Adding a thermostat to the hot water cylinder and associated control circuitry to prevent boiler from firing when there is no demand for heat.

When recommended: Hot water cylinder without a thermostat.

Assumptions for savings estimate: Thermostat is wired in a way that the boiler is turned off when there is no demand for heat, this results in boiler efficiency 5% points higher.

Assumed lifetime: 12 years

Indicative cost: £200 - £400

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 2734 | 0 | 541 | 93 | 10% | 84 |
| Bungalow, 67 m ² | 2285 | 0 | 453 | 78 | | 70 |
| Semi-detached, 89 m ² | 1958 | 0 | 388 | 67 | | 60 |
| Mid-terrace, 80 m ² | 1958 | 0 | 388 | 67 | | 60 |
| Mid-floor flat, 61 m ² | 1620 | 0 | 321 | 55 | | 50 |

(g) Draught proofing

Description: Adding draught proofing to windows and doors.

What is the measure: Installation of specialist draught-proofing strips around doors and windows (selecting most appropriate type for each situation) and sealing up other openings not required for ventilation.

When recommended: Draught proofing absent or in poor condition (absent or poor condition are treated as the same).

Assumptions for savings estimate: All windows and doors draught proofed, reducing air infiltration by up to 0.2 air changes per hour.

Assumed lifetime: 10 years

Indicative cost: £80 - £120

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 805 | 0 | 159 | 27 | 15% | 23 |
| Bungalow, 67 m ² | 423 | 0 | 84 | 14 | | 12 |
| Semi-detached, 89 m ² | 760 | 0 | 151 | 26 | | 22 |
| Mid-terrace, 80 m ² | 714 | 0 | 142 | 24 | | 21 |
| Mid-floor flat, 61 m ² | 510 | 0 | 101 | 17 | | 15 |

(h) Duct insulation

Not applicable to domestic

(i) Gas-fired condensing boilers

Description: Replacing a current, non-condensing boiler with a condensing boiler in order to improve heating efficiency.

What is the measure: Modern gas boilers use condensing technology to increase efficiency to at least 85%, compared to older boilers which might be as low as 65%.

When recommended: Existing heating by a non-condensing gas boiler, or by gas fires, or (if mains gas available) solid mineral fuel boiler, non-condensing LPG or oil boiler, oil warm air, solid mineral fuel room heaters, oil room heaters, electric room heaters, electric ceiling heating, electric storage heating, electric off-peak under-floor heating.

Assumptions for savings estimate: From typical non-condensing gas boiler, efficiency 73%, to replacement condensing boiler with characteristics typical of those found on the market (SEDBUK(2009) = 89%), provides space and water heating.

Assumed lifetime: 12 years

Indicative cost: £2,200 - £3,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 5599 | 0 | 1109 | 191 | 25% | 143 |
| Bungalow, 67 m ² | 4059 | 0 | 804 | 138 | | 104 |
| Semi-detached, 89 m ² | 4595 | 0 | 910 | 157 | | 118 |
| Mid-terrace, 80 m ² | 3150 | 0 | 624 | 107 | | 81 |
| Mid-floor flat, 61 m ² | 1897 | 0 | 376 | 65 | | 49 |

(j) Ground source heat pumps

See also (a) Air source heat pump.

Description: Changing the current heating system to a ground source heat pump⁶.

What is the measure: A heat pump is a device which upgrades heat taken from a low temperature source and delivers it at a higher temperature in the form of warm air or hot water. A ground-source heat pump uses the ground around the building as its heat source, using pipes buried either horizontally or vertically.

When recommended: As an alternative measure⁷ when another heating system is recommended in the main table of recommendations and it would provide an energy cost saving.

Assumptions for savings estimate: From non-condensing oil boiler, efficiency 79%, to SAP default ground source heat pump (Seasonal performance factor 320%), provides space and water heating.

Assumed lifetime: 20 years

Indicative cost: £9,000 - £17,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 16002 | 0 | 2495 | 184 | 10% | 166 |
| Bungalow, 67 m ² | 11769 | 0 | 1845 | 138 | | 124 |
| Semi-detached, 89 m ² | 13123 | 0 | 2061 | 155 | | 140 |
| Mid-terrace, 80 m ² | 9036 | 0 | 1444 | 114 | | 102 |
| Mid-floor flat, 61 m ² | 5651 | 0 | 925 | 77 | | 69 |

⁶ Recommendation is for a ground or air source heat pump.

⁷ Alternative measures are included on EPCs when another measure of the same type is shown in the table of recommendations.

(k) Hot water showers

Not applicable to the domestic sector

(l) Hot water systems

Not applicable to the domestic sector as a separate item, but as part of e.g. change to efficient boiler

(m) Hot water taps

Not applicable to the domestic sector

(n) External wall insulation systems

See also (v) *Internal wall insulation system*.

Description: Applying external insulation to uninsulated solid walls (no cavities to insulate)⁸.

What is the measure: External insulation systems can be foam or fibre based and fixed to existing wall surface by a range of proprietary systems, installed by specialist contractors. Associated work to window sills and rainwater goods would also be required.

When recommended: Dwelling has un-insulated solid walls.

Assumptions for savings estimate: Applicable walls insulated to $U = 0.3 \text{ W/m}^2\text{K}$ (existing walls have U-values between 1.0 and 2.1 $\text{W/m}^2\text{K}$ depending on building age – 2.1 assumed for this estimate).

Assumed lifetime: 36 years

Indicative cost: £4,000 - £14,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 14205 | 0 | 2812 | 484 | 25% ⁹ | 363 |
| Bungalow, 67 m ² | 6886 | 0 | 1364 | 235 | | 176 |
| Semi-detached, 89 m ² | 9373 | 0 | 1856 | 314 | | 235 |
| Mid-terrace, 80 m ² | 5583 | 0 | 1105 | 190 | | 143 |
| Mid-floor flat, 61 m ² | 4025 | 0 | 797 | 137 | | 103 |

⁸ EPC recommendation is for internal or external wall insulation, without making a distinction

⁹ 33% for solid brick walls build before 1967 if situated in England or Wales or 1965 if situated in Scotland.

(o) Fan-assisted storage heaters

Description: Replace existing storage heaters by fan-assisted storage heaters.

What is the measure: Replacing existing heating system with fan-assisted storage heaters for space heating and an electric immersion for water heating.

When recommended: Existing heating is by storage heaters which are not fan-assisted.

Assumptions for savings estimate: From old heavyweight storage heaters with manual charge control. All existing storage heaters replaced with fan-assisted units with automatic charge control. Savings result from better controllability of fan-assisted heaters.

Assumed lifetime: 20 years

Indicative cost: £300 - £400 per heater

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 0 | 2224 | 1150 | 227 | 10% | 204 |
| Bungalow, 67 m ² | 0 | 1682 | 870 | 168 | | 151 |
| Semi-detached, 89 m ² | 0 | 1685 | 871 | 174 | | 157 |
| Mid-terrace, 80 m ² | 0 | 874 | 452 | 96 | | 86 |
| Mid-floor flat, 61 m ² | 0 | 375 | 195 | 44 | | 39 |

(p) Flue gas heat recovery devices

Description: Flue gas heat recovery system attached to boiler as part of replacement boiler package.

What is the measure: A heat-exchanger to extract additional heat from boiler flue gases before venting to the atmosphere.

When recommended: A new or replacement gas boiler is being recommended. It is not recommended on its own.

Assumptions for savings estimate: Typical flue gas heat recovery device fitted to a new gas condensing boiler.

Assumed lifetime: 12 years

Indicative cost: £400-£900¹⁰

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 489 | 0 | 97 | 17 | 10% | 15 |
| Bungalow, 67 m ² | 404 | 0 | 80 | 14 | | 12 |
| Semi-detached, 89 m ² | 431 | 0 | 86 | 15 | | 13 |
| Mid-terrace, 80 m ² | 353 | 0 | 69 | 12 | | 11 |
| Mid-floor flat, 61 m ² | 252 | 0 | 49 | 9 | | 8 |

¹⁰ This figure assumes installation in conjunction with a new boiler.

(q) Heating controls for wet central heating systems or warm air systems

Description: Improving heating controls for a system with boiler, heat pump or warm air unit.

What is the measure: The following controls can currently be added to the heating system: central time control, local time control (room by room), local temperature control (room by room), weather compensation control.

When recommended: If radiators: controls do not include room thermostat and TRVs. If underfloor: not time and temperature zone control. If warm air: no room thermostat.

Assumptions for savings estimate: Radiator systems upgraded from no thermostatic control to room thermostat and TRVs. Underfloor systems upgraded from no thermostatic control to time and temperature zone control. Warm air systems upgraded from no thermostatic control to room thermostat. Savings below are for a radiator system.

Assumed lifetime: 12 years

Indicative cost: £350 - £450

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 4834 | 0 | 977 | 170 | 50% | 85 |
| Bungalow, 67 m ² | 3459 | 0 | 725 | 123 | | 62 |
| Semi-detached, 89 m ² | 3927 | 0 | 797 | 139 | | 69 |
| Mid-terrace, 80 m ² | 2519 | 0 | 539 | 94 | | 47 |
| Mid-floor flat, 61 m ² | 1461 | 0 | 309 | 55 | | 27 |

(r) Heating ventilation and air-conditioning controls (including zoning controls)

Not applicable to domestic

(s) High performance external doors

Description: Replacing current external doors with high performance doors which have an improved U value.

What is the measure: New external doors insulated to $U = 1.5 \text{ W/m}^2\text{K}$.

When recommended: External doors are not insulated doors.

Assumptions for savings estimate: External doors upgraded to $U = 1.5 \text{ W/m}^2\text{K}$, existing doors being taken as having $U = 3.0 \text{ W/m}^2\text{K}$.

Assumed lifetime: 30 years

Indicative cost: £500 per door

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 362 | 0 | 72 | 12 | 15% | 10 |
| Bungalow, 67 m ² | 169 | 0 | 33 | 6 | | 5 |
| Semi-detached, 89 m ² | 371 | 0 | 74 | 13 | | 11 |
| Mid-terrace, 80 m ² | 208 | 0 | 41 | 7 | | 6 |
| Mid-floor flat, 61 m ² | 224 | 0 | 44 | 8 | | 6 |

(t) Hot water controls (including timers and temperature controls)

Not applicable to the domestic sector.

(u) Hot water cylinder insulation

Description: Improving insulation of hot water cylinder.

What is the measure – Adding an insulation jacket to the hot water cylinder which currently has either poor or no insulation.

When recommended: Un-insulated cylinder, or factory-applied insulation 25 mm or less, or loose jacket less than 80 mm.

Assumptions for savings estimate: From 25 mm to 80 mm cylinder jacket.

Assumed lifetime: 10 years

Indicative cost: £15 - £30

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO ₂ saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 602 | 0 | 119 | 21 | 15% | 17 |
| Bungalow, 67 m ² | 629 | 0 | 124 | 21 | | 18 |
| Semi-detached, 89 m ² | 607 | 0 | 121 | 21 | | 18 |
| Mid-terrace, 80 m ² | 621 | 0 | 123 | 21 | | 18 |
| Mid-floor flat, 61 m ² | 650 | 0 | 128 | 22 | | 19 |

(v) Internal wall insulation systems (for external walls)

See also (n) *External wall insulation system*

Description: Applying an internal insulation system to un-insulated external walls.¹¹

What is the measure: Internal insulation systems can be foam or fibre based and fixed to existing wall surface by a range of different systems.

When recommended: Dwelling has un-insulated solid walls.

Assumptions for savings estimate: Solid walls upgraded to $U = 0.3 \text{ W/m}^2\text{K}$ (existing walls have U-values between 1.0 and 2.1 $\text{W/m}^2\text{K}$ depending on building age – 2.1 assumed for this estimate).

Assumed lifetime: 36 years

Indicative cost: £4,000 - £14,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|-------------------|--------------------------------|
| Detached, 104 m ² | 15021 | 0 | 2974 | 512 | 25% ¹² | 384 |
| Bungalow, 67 m ² | 7576 | 0 | 1500 | 258 | | 194 |
| Semi-detached, 89 m ² | 10033 | 0 | 1986 | 354 | | 266 |
| Mid-terrace, 80 m ² | 5802 | 0 | 1149 | 198 | | 148 |
| Mid-floor flat, 61 m ² | 3949 | 0 | 782 | 135 | | 101 |

¹¹ EPC recommendation is for internal or external wall insulation, without making a distinction.

¹² 33% for solid brick walls build before 1967 if situated in England or Wales or 1965 if situated in Scotland.

(w) Lighting systems, fittings and controls (including rooflights, lamps and luminaires)

Not applicable to the domestic sector

(x) Loft or rafter insulation (including loft hatch insulation)

Description: Increasing loft insulation.

What is the measure: Adding or improving the current insulation levels in the loft or rafters.

When recommended: Pitched roof with loft space, existing insulation less than 200 mm.

Assumptions for savings estimate: Upgrade from 50mm to 270 mm mineral wool, loft hatch is insulated.

Assumed lifetime: 42 years

Indicative cost: £100 - £350

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 1980 | 0 | 392 | 68 | 35% | 44 |
| Bungalow, 67 m ² | 2424 | 0 | 480 | 83 | | 54 |
| Semi-detached, 89 m ² | 1741 | 0 | 345 | 59 | | 39 |
| Mid-terrace, 80 m ² | 1723 | 0 | 341 | 59 | | 38 |
| Mid-floor flat, 61 m ² | 2691 | 0 | 533 | 92 | | 60 |

(y) Mechanical ventilation with heat recovery systems

Not applicable to the domestic sector

(z) Micro combined heat and power

Description: Replacing existing heating system with micro combined heat and power for space and water heating; provides both heat and electricity generation..

What is the measure: A Combined Heat and Power (CHP) plant, whether micro or 'normal' size generates both heat and electricity in an engine. Plant serving a single building is sized on the heat demand of the building; electricity which cannot be used within the building at the time it is generated is exported to the grid.

When recommended: As an alternative measure¹³ when another heating system is recommended in the main table of recommendations.

Assumptions for savings estimate: From typical non-condensing gas boiler, efficiency 73%, to micro-CHP with characteristics typical of those found on the market.

Assumed lifetime: 15 years

Indicative cost: £5,500

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 3443 | 1496 | 1497 | 317 | 25% | 237 |
| Bungalow, 67 m ² | 1405 | 1031 | 847 | 187 | | 140 |
| Semi-detached, 89 m ² | 1679 | 1190 | 986 | 217 | | 163 |
| Mid-terrace, 80 m ² | 1092 | 662 | 589 | 129 | | 96 |
| Mid-floor flat, 61 m ² | -728 | 662 | 144 | 42 | | 32 |

¹³ Alternative measures are included on EPCs when another measure of the same type is shown in the table of recommendations.

aa) Micro wind generation

Description: Addition of roof mounted micro wind turbine to the building

What is the measure: Micro wind turbines are small turbines mounted on a building to provide electricity generation.

When recommended: House or bungalow, usually rural location where there is no existing wind turbine.

Assumptions for savings estimate: 1 kW unit.

Assumed lifetime: 10 years

Indicative cost: £1,500 - £4,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 0 | 1321 | 699 | 171 | 0% | 171 |
| Bungalow, 67 m ² | 0 | 1321 | 699 | 171 | | 171 |
| Semi-detached, 89 m ² | 0 | 1321 | 699 | 171 | | 171 |
| Mid-terrace, 80 m ² | 0 | 1321 | 699 | 171 | | 171 |
| Mid-floor flat, 61 m ² | 0 | 1321 | 699 | 171 | | 171 |

(bb) Oil-fired condensing boilers

Description: Replacing a current, non-condensing oil-fired boiler with a condensing boiler in order to improve heating efficiency.

What is the measure: modern oil boilers use condensing technology to increase efficiency to around 85%, compared to older boilers which could be as low as 65%.

When recommended: Existing heating by a non-condensing oil boiler.

Assumptions for savings estimate: From typical non-condensing oil boiler, efficiency 79%, to replacement condensing oil boiler with characteristics typical of those found on the market (SEDBUK(2009) = 90%), provides space and water heating.

Assumed lifetime: 12 years

Indicative cos: £3,000 - £7,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 4199 | 0 | 1150 | 211 | 25% | 158 |
| Bungalow, 67 m ² | 3027 | 0 | 829 | 152 | | 114 |
| Semi-detached, 89 m ² | 2646 | 0 | 725 | 133 | | 100 |
| Mid-terrace, 80 m ² | 2352 | 0 | 645 | 118 | | 89 |
| Mid-floor flat, 61 m ² | 1391 | 0 | 381 | 70 | | 52 |

(cc) Photovoltaics (PV)

Description: Add Photovoltaics (2.5 kWp) panels to the building to provide electricity generation.

What is the measure: Installation of Photovoltaic panels on the roof of the property to provide electricity generation.

When recommended: House or bungalow, not thatched roof

Assumptions for savings estimate: 2.5 kWp PVs, south facing, 30° pitch, modest overshadowing.

Assumed lifetime: 25 years

Indicative cost: £9,000 - £14,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 0 | 1717 | 908 | 222 | 0% | 222 |
| Bungalow, 67 m ² | 0 | 1717 | 908 | 222 | | 222 |
| Semi-detached, 89 m ² | 0 | 1717 | 908 | 222 | | 222 |
| Mid-terrace, 80 m ² | 0 | 1717 | 908 | 222 | | 222 |
| Mid-floor flat, 61 m ² | 0 | 1717 | 908 | 222 | | 222 |

(dd) Pipework insulation

Not applicable to the domestic sector

(ee) Radiant heating

Not applicable to the domestic sector

(ff) Replacement glazing

Description: Replace single glazed windows with double glazed windows having Window Energy Rating C.

What is the measure: New double-glazed windows replacing those that are single glazed.

When recommended: Where existing windows are single glazed.

Assumptions for savings estimate: All single glazed windows replaced with $U = 1.5$ W/m^2K (existing windows taken as having $U = 4.8$ W/m^2K).

Assumed lifetime: 20 years

Indicative cost: £3,300 - £6,500

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 2481 | 0 | 482 | 83 | 15% | 70 |
| Bungalow, 67 m ² | 1742 | 0 | 342 | 59 | | 50 |
| Semi-detached, 89 m ² | 2529 | 0 | 505 | 87 | | 74 |
| Mid-terrace, 80 m ² | 2181 | 0 | 425 | 73 | | 62 |
| Mid-floor flat, 61 m ² | 1121 | 0 | 250 | 42 | | 36 |

(gg) Roof insulation (flat roof)

Description: Insulation of flat roof.

What is the measure: Adding insulation to a flat roof.

When recommended: Dwelling has flat roof with insulation less than 50 mm.

Assumptions for savings estimate: Roof improved to $U = 0.18 \text{ W/m}^2\text{K}$ (existing roof taken as having U-value between 2.3 and 0.7 $\text{W/m}^2\text{K}$ depending on its age (U-value of 1.0 assumed for this estimate))

Assumed lifetime: 20 years

Indicative cost: £850 - £1,500

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 2679 | 0 | 531 | 91 | 15% | 78 |
| Bungalow, 67 m ² | 3256 | 0 | 645 | 111 | | 94 |
| Semi-detached, 89 m ² | 2355 | 0 | 466 | 80 | | 68 |
| Mid-terrace, 80 m ² | 2330 | 0 | 461 | 79 | | 68 |
| Mid-floor flat, 61 m ² | 3679 | 0 | 729 | 126 | | 107 |

(hh) Room in roof insulation

Description: Insulation of roof rooms.

What is the measure: Adding internal insulation to roof rooms.

When recommended: Dwelling has roof rooms with U-value > 0.5 W/m²K.

Assumptions for savings estimate: Roof rooms improved from U=1.5 to U = 0.25 W/m²K.

Assumed lifetime: 42 years

Indicative cost: £1,500 - £2,700

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 6652 | 0 | 1317 | 227 | 25% | 170 |
| Bungalow, 67 m ² | 8013 | 0 | 1587 | 273 | | 205 |
| Semi-detached, 89 m ² | 6390 | 0 | 1266 | 218 | | 163 |
| Mid-terrace, 80 m ² | 6222 | 0 | 1233 | 212 | | 159 |
| Mid-floor flat, 61 m ² | 0 | 0 | 0 | 0 | | 0 |

(ii) Sealing improvements (including duct sealing)

Not applicable to the domestic sector

(jj) Secondary glazing

Description: Add secondary glazing to single-glazed windows.

What is the measure: Secondary glazing is an independent glass or plastic glazing system fitted on the room side of existing window frames.

When recommended: Existing dwelling has single glazed windows and assessor doesn't recommend double glazing.

Assumptions for savings estimate: Secondary glazing to all windows, $U = 2.4$ W/m^2K (existing windows taken as having $U = 4.8$ W/m^2K).

Assumed lifetime: 20 years

Indicative cost: £1,000 - £1,500

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 1736 | 0 | 335 | 57 | 15% | 49 |
| Bungalow, 67 m ² | 1217 | 0 | 238 | 41 | | 35 |
| Semi-detached, 89 m ² | 1753 | 0 | 391 | 60 | | 51 |
| Mid-terrace, 80 m ² | 1525 | 0 | 295 | 50 | | 43 |
| Mid-floor flat, 61 m ² | 736 | 0 | 174 | 29 | | 25 |

(kk) Solar blinds, shutters and shading devices

Not applicable to the domestic sector

(II) Solar water heating

Description: Add solar water heating system.

What is the measure: Addition of a solar water heating system, comprising solar collector, dual coil cylinder and associated plumbing and controls to heat water which is then used within the building.

When recommended: House or bungalow, not thatched roof, where there is no solar system.

Assumptions for savings estimate: Solar panel, 3 m², South facing, 30°, modest overshadowing.

Assumed lifetime: 25 years

Indicative cost: £4,000 - £6,000

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 1261 | 0 | 262 | 36 | 0% | 36 |
| Bungalow, 67 m ² | 1201 | 0 | 214 | 34 | | 34 |
| Semi-detached, 89 m ² | 1339 | 0 | 241 | 39 | | 39 |
| Mid-terrace, 80 m ² | 1246 | 0 | 223 | 35 | | 35 |
| Mid-floor flat, 61 m ² | 1214 | 0 | 216 | 34 | | 34 |

(mm) Transpired solar collectors

Not applicable to the domestic sector

(nn) Under-floor heating

To be added in next update as an option in occupancy assessments for heat pump improvements.

(oo) Under-floor insulation

Description: Adding insulation to floors to improve current levels.

What is the measure: Insulation could take the form of foam or fibre. Its form would depend on the existing floor construction

When recommended: Any property without floor insulation.

Assumptions for savings estimate: Adding insulation of equivalent of 150 mm mineral wool to existing floor.

Assumed lifetime: 42 years

Indicative cost: £800 - £1,200

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 1835 | 0 | 364 | 63 | 15% | 54 |
| Bungalow, 67 m ² | 1939 | 0 | 384 | 66 | | 56 |
| Semi-detached, 89 m ² | 1269 | 0 | 252 | 43 | | 37 |
| Mid-terrace, 80 m ² | 673 | 0 | 133 | 23 | | 20 |
| Mid-floor flat, 61 m ² | 1010 | 0 | 200 | 34 | | 29 |

(pp) Variable speed drives for fans and pumps

Not applicable to the domestic sector

(qq) Warm-air units

Description: Replacing existing warm air unit with a more efficient unit.

What is the measure: Stand-alone warm air heating units use gas or oil to directly heat air, which may then be delivered to the local target area by fan. An efficient unit would have an improved burner efficiency and possibly an improved fan efficiency.

When recommended: Existing heating is gas-fired warm air.

Assumptions for savings estimate: From typical existing warm air unit, efficiency 70%, to new warm air unit, efficiency 76%.

Assumed lifetime: 20 years

Indicative cost: £1,250 - £2,500

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 2298 | 0 | 478 | 84 | 25% | 63 |
| Bungalow, 67 m ² | 1724 | 0 | 365 | 65 | | 49 |
| Semi-detached, 89 m ² | 2268 | 0 | 401 | 71 | | 53 |
| Mid-terrace, 80 m ² | 1354 | 0 | 291 | 52 | | 39 |
| Mid-floor flat, 61 m ² | 891 | 0 | 200 | 36 | | 27 |

(rr) Waste water heat recovery device attached to showers

Description: Add waste water heat recovery system to showers.

What is the measure: A heat recovery system that recovers heat from the drain of a shower and return it to the shower inlet.

When recommended: Existing dwelling has one or more showers.

Assumptions for savings estimate: Waste water heat recovery efficiency typical of units available on the market

Assumed lifetime: 20 years

Indicative cost: £585 - £725

| Dwelling type | Fuel saving kWh/yr | Electricity saving kWh/yr | CO2 saving kg/yr | Financial saving £/yr | GD In-use factor | Saving with in-use factor £/yr |
|-----------------------------------|--------------------|---------------------------|------------------|-----------------------|------------------|--------------------------------|
| Detached, 104 m ² | 435 | 0 | 86 | 15 | 10% | 13 |
| Bungalow, 67 m ² | 356 | 0 | 70 | 12 | | 11 |
| Semi-detached, 89 m ² | 414 | 0 | 82 | 14 | | 13 |
| Mid-terrace, 80 m ² | 397 | 0 | 79 | 14 | | 12 |
| Mid-floor flat, 61 m ² | 344 | 0 | 68 | 12 | | 11 |

(ss) Water source heat pumps

See also (j) Ground source heat pump.

Not explicitly considered in RdSAP.

Green Deal Measures – Non domestic

(a) Air source heat pumps

Description: Changing the current heating system to an air source heat pump to provide heating and/or hot water. The heat pump could be electric or gas/oil.

What is the measure: A heat pump is a device which upgrades heat taken from a low temperature source and delivers it at a higher temperature in the form of warm air or hot water. An air-source heat pump uses outside air as its heat source. Any proposed device should meet the requirements of the Non-Domestic Building Services Compliance Guide, published by DCLG in support of Part L of Building Regulations.

Assumptions: The Green Deal Assessor would need to enter the seasonal efficiency for the recommended plant (or use default value if not known) and other information on system adjustment (eg. duct work, leakage and specific fan power).

When recommended: As an alternative measure when another replacement heating system is recommended in the main table of recommendations.

Assumed Lifetime: 15 years

(b) Biomass boilers

Description: Changing the current heating system to a biomass boiler (wood logs or wood pellets).

What is the measure: A heating boiler which uses wood chips or similar plant-based (biomass) fuel, rather than more conventional gas, oil or coal. Any proposed boiler should meet the requirements of the Non-Domestic Building Services Compliance Guide, published by DCLG in support of Part L of Building Regulations.

Assumptions: The Green Deal Assessor will need to enter in iSBEM the seasonal efficiency obtained from the manufacturer (or use default value).

When recommended: As an alternative fuel to coal, oil, LPG or natural gas

Assumed Lifetime: 20 years

(c) Biomass room heaters (with radiators)

Description: Changing the current heating system to a biomass room heater with a boiler that provides heat to other rooms. (Unlikely in non-domestic buildings)

(d) Cavity wall insulation

Description: Filling cavities of walls without insulation.

What is the measure: Introducing insulation in one of several free-flowing forms into the cavities in existing external walls.

Assumptions: The Green Deal Assessor will need to change the appropriate U-values accordingly (or redefine wall in DSM tools), based on standard reference values or installer documentation.

When recommended: When the tool detects an uninsulated cavity wall has been specified

Assumed lifetime: 42 years

(e) Chillers

Description: The replacement of existing chiller plant by a more efficient alternative.

What is the measure: A comfort cooling system uses one or more chillers to provide chilled water or other fluid to the distribution elements of the system. The chiller can be based on a number of different technologies, some of which are more efficient than others. Any proposed chiller should meet the requirements of the Non-Domestic Building Services Compliance Guide, published by DCLG in support of Part L of Building Regulations

Assumptions: The Green Deal Assessor would need to enter the seasonal efficiency for the recommended plant (based on manufacturer data) and other information on system adjustment (eg. duct work leakage and specific fan power).

When recommended: When EPC assessor selects default chiller efficiency or efficiency is low.

Assumed lifetime: 15 years

(f) Cylinder thermostats

Not applicable to non-domestic

(g) Draught proofing

Description: Adding draught proofing to windows and doors.

What is the measure: Installation of specialist draught-proofing strips around doors and windows (selecting most appropriate type for each situation) and sealing up other openings not required for ventilation,

Assumptions: The Green Deal Assessor can account for this by reducing/improving the infiltration rates in SBEM.

When recommended: When infiltration levels are high. Recommendation includes suggested pressure test and leak detection.

Assumed lifetime: 10 years

(h) Duct insulation

Description: Improving or installing insulation on ducts used to carry air for heating and/or cooling.

What is measure: Installation of recommended thickness and type of insulation around air ducts either where there is none, or where thickness is significantly below current standards.

Assumptions: Not currently modelled explicitly as an improvement measure in SBEM (though will be in the Spring 2013 update); all ducting is currently assumed to be insulated to comply with Building Regulations.

When recommended: Not currently recommended automatically by software – but, once modelled, can be added by EPC or GD assessor.

Assumed lifetime: 15 years

(i) Gas-fired condensing boilers

Description: Replacing a current, non-condensing gas boiler with a condensing boiler in order to improve heating efficiency.

What is measure: Modern gas boilers use condensing technology to increase efficiency to at least 85%, compared to older boilers which might be as low as 65%.

Assumptions: The Green Deal Assessor will need to enter the new seasonal efficiency (or use default value)

When recommended: When existing plant is non-condensing or of low efficiency (below 70%)

Assumed lifetime: 12 years

(j) Ground source heat pumps

See also (a) Air source heat pump

Description: Changing the current heating system to a ground source heat pump.

What is the measure: A heat pump is a device which upgrades heat taken from a low temperature source and delivers it at a higher temperature in the form of warm air or hot water. A ground-source heat pump uses the ground around the building as its heat source, using pipes buried either horizontally or vertically. Any proposed device should meet the requirements of the Non-Domestic Building Services Compliance Guide, published by DCLG in support of Part L of Building Regulations.

Assumptions: The Green Deal Assessor would need to enter the seasonal efficiency for the recommended plant (or use default value if not known) and other information on system adjustment (e.g. duct work, leakage and specific fan power).

When recommended: As an alternative measure when another replacement heating system is recommended in the main table of recommendations.

Assumed Lifetime: 20 years

(k) Hot water showers

Description: Replacing existing showers with more efficient devices, for example with low-flow sprays.

What is measure: Low-flow showers use spray technology to reduce flow rates while maintaining cleaning performance and user experience. Average hot water use per shower is therefore reduced.

Assumptions: Not currently modelled in SBEM, but will be in Spring 2013 update. Hot water demand for the zones served by the showers will be reduced by an agreed margin.

When recommended: Not currently recommended automatically by software, but, once modellable, can be recommended by EPC or GD assessor.

Assumed lifetime: 10 years

(l) Hot water systems

Description: Changing to a more efficient hot water system

What is the measure: This could be simply an improved seasonal efficiency or could also involve fuel switching. According to the current EPC recommendations this could also include improving the insulation on HWS storage, add time controls to hot water system secondary circulation, replace hot water system with point of use system

Assumptions: Green Deal Assessor would need to enter the new improved seasonal efficiency

When recommended: Whenever hot water system efficiency is low.

Assumed lifetime: 15 years

(m) Hot water taps

Description: Installing low-flow hot water taps (e.g. spray taps)

Assumptions: Not currently modelled in SBEM, but will be in Spring 2013 update. Hot water demand for the zones served by the taps will be reduced by an agreed margin.

When recommended: Not currently recommended automatically by software, but, once modellable, can be recommended by Energy Performance Certificate (EPC) or Green Deal assessor

Assumed lifetime: 15 years

(n) External wall insulation systems

Description: Applying external insulation to uninsulated solid walls (no cavities to insulate).

What is measure: External insulation systems can be foam or fibre based and fixed to existing wall surface by a range of proprietary systems, installed by specialist contractors. Associated work to window sills and rainwater goods would also be required.

Assumptions: Introduce external wall insulation where appropriate and change the U-values accordingly, based on standard reference values or supplier documentation..

When recommended: Where tool detects poor performing solid walls

Assumed lifetime: 36 years

(o) Fan-assisted storage heaters

Not applicable to non-domestic

(p) Flue gas heat recovery devices

Description: Flue gas heat recovery system attached to boiler as part of replacement boiler package.

What is measure: A heat-exchanger to extract additional heat from boiler flue gases before venting to the atmosphere.

Assumptions: Overall seasonal efficiency will need to be entered by Green Deal Assessor, based on performance of boiler plus device according to agreed parameters.

When recommended: Not recommended on its own.

Assumed lifetime: 12 years

(q) Heating controls for wet central heating system and warm air system

Description: Improving heating controls for a system with boiler, heat pump or air unit.

What is the measure: The following controls can currently be added to the heating system: central time control, local time control (room by room), local temperature control (room by room), weather compensation control.

Assumptions: The tool currently asks whether or not these controls are present. If not, it generates a recommendation but does not (currently) adjust performance other than through the management score. This will be adjusted in the Spring 2013 update.

When recommended: When controls are absent.

Assumed lifetime: 12 years

(r) Heating ventilation and air-conditioning controls (including zoning controls)

As for heating controls above.

(s) High performance external doors

Description: Replacing current external doors with high performance doors which have an improved U value.

What is the measure: New external doors insulated to $U=1.5 \text{ W/m}^2\text{K}$.

Assumptions: Green Deal Assessor can upgrade external doors by entering improved U value.

When recommended: Not currently recommended automatically by software, but can be recommended by Energy Performance Certificate or Green Deal assessor.

Assumed lifetime: 30 years

(t) Hot water controls (including timers and temperature control)

As for hot water systems above.

(u) Hot water cylinder insulation

Description: Improving insulation of hot water cylinder.

What is the measure: Adding an insulation jacket to the hot water cylinder which currently has either poor or no insulation.

Assumptions: Green Deal Assessor to enter details on storage volume, insulation type and thickness.

When recommended: As part of hot water system recommendations

Assumed lifetime: 10 years

(v) Internal wall insulation systems (for external walls)

Description: Applying an internal insulation system to uninsulated external walls.

What is measure: Internal insulation systems can be foam or fibre based and fixed to existing wall surface by a range of different systems.

Assumptions: Introduce internal wall insulation where appropriate and change the U-values accordingly, based on standard reference values or supplier documentation..

When recommended: Where tool detects poor performing solid walls (doesn't distinguish between internal and external solution – up to Green Deal Assessor to recommend).

Assumed lifetime: 36 years

(w) Lighting systems, fittings and controls (including rooflights, lamps and luminaires)

i) Systems/fittings:

Description: This means changing current lamp types and/or luminaires to more efficient ones.

What is measure: Efficient lamps have a higher efficacy, in terms of light output per watt of power consumed than older technology. The luminaire in which the lamp is held will also affect the performance by directing light to the correct direction and minimising 'wasted' light. The optimum combination will depend on the function and geometry of the particular space.

Assumptions: System allocates default efficacy values for the proposed fittings, unless Green Deal Assessor selects that a proper lighting design has been carried out with the new fittings – in which case Green Deal Assessor will need to enter design data.

When recommended: When lighting type selected is of one of the following types. More efficient lamp types currently in EPC recommendations/SBEM are: replace T12 tubes on failure with T8 tubes, replace tungsten GLS lamps with CFLs, replace high pressure mercury discharge lamps with plug-in SON replacements, replace tungsten GLS spotlights with low voltage tungsten halogen, consider replacing T8 lamps with retrofit T5 conversion kit, replace high pressure mercury discharge lamps with complete new lamp/gear SON (DL).

Assumed lifetime: 5 years

ii) Roof lights

Description: Roof lights could be added to improve light levels inside the building (and hence reduce need for electric light)

Assumptions: Modelling of building geometry would take account of new roof lights and their thermal and light performance.

When recommended: Not currently recommended automatically by software, but can be recommended by Energy Performance Certificate or Green Deal assessor.

Assumed lifetime: 25 years

iii) Lighting controls:

Description: This means any improvement to the way in which lighting is controlled, by adding where there are none or by upgrading to add functionality.

What is the measure: The following controls can currently be added to lighting: local manual switching, photoelectric control,, automatic daylight zoning, occupancy sensing, time switching for display lighting.

Assumptions: Software makes standard allowance for presence of any or all of such controls

When recommended: Not currently recommended automatically by software, but can be recommended by Energy Performance Certificate or Green Deal assessor

Assumed lifetime: 10 years

(x) Loft or rafter insulation (including loft hatch insulation)

Description: Increasing loft insulation

What is the measure: Adding or improving the current insulation levels in the loft or rafters.

Assumptions: Green Deal Assessor to add or improve insulation by changing U-values for "Construction for Roofs" accordingly, based on standard reference values.

When recommended: When roof insulation is poor (U-value greater than 1.0W/m²K)

Assumed lifetime: 42 years

(y) Mechanical ventilation with heat recovery

Description: Installation of some form of heat recovery system, normally to an existing mechanical ventilation system.

What is the measure: The tools offer various heat recovery options under "ventilation" – plate heat exchanger (recuperator), heat-pipes, thermal wheel and run around coils.

Assumptions: Selection and installation of appropriate technology for a given ventilation system will be made by Green Deal Assessor and/or specialist installer. Resulting performance is determined by fixed default parameters in SBEM.

When recommended: Not currently recommended automatically by software, but can be by Energy Performance Certificate or Green Deal assessor

Assumed lifetime: 15 years

(z) Micro combined heat and power

Description Replacing existing heating system in a domestic scale building with micro combined heat and power for space and water heating; providing both heat and electricity generation

What is measure: A Combined Heat and Power (CHP) plant, whether micro or 'normal' size, generates both heat and electricity in an engine. Plant serving a single building, is sized on the heat demand of the building; electricity which cannot be used within the building at the time it is generated is exported to the grid.

Assumptions: Treat as CHP.

When recommended: Not currently recommended automatically by software, but could be by Energy Performance Certificate or Green Deal assessor.

Assumed lifetime: 15 years

(aa) Micro wind generation

Description: Addition of roof mounted micro wind turbine to the building.

What is measure: Micro wind turbines are small turbines mounted on a building to provide electricity generation

Assumptions: Assumes that the Green Deal Assessor has confirmed that the location and local wind environment are suitable for a turbine. The Green Deal Assessor would add wind generator(s) to building and enter the required details in the tool.

When recommended: Where there is no existing wind turbine

Assumed lifetime: 10 years

(bb) Oil-fired condensing boilers

Description: Replacing a current, non-condensing oil-fired boiler with a condensing boiler in order to improve heating efficiency.

What is measure: modern oil boilers use condensing technology to increase efficiency to at least 85%, compared to older boilers which might be as low as 65%.

Assumptions: The Green Deal Assessor will need to enter the new seasonal efficiency (or use default value)

When recommended: When existing plant is non-condensing or of low efficiency (below 70%)

Assumed lifetime: 12 years

(cc) Photovoltaics

Description: Addition of Photovoltaic (2.5 kWp) panels to the building to provide electricity generation.

What is the measure: Installation of Photovoltaic panels on the roof of the property to provide generation.

Assumptions: The Green Deal Assessor would add Photovoltaic to the building and enter specification details as required by the tool.

When recommended: Where there is no existing Photovoltaic.

Assumed lifetime: 25 years

(dd) Pipe-work insulation

Description: Insulating hot-water pipes to reduce heat loss.

Assumptions: This is not currently an option in SBEM, but is available in DSMs. It will be added to the Spring 2013 update.

When recommended: Not recommended automatically by software, but, once modellable, can be by Energy Performance Certificate or Green Deal assessor.

Assumed lifetime: 20 years

(ee) Radiant heating

Description: This refers to the types of systems that might be found in warehouses or industrial premises which have high ceilings and/or are well ventilated.

What is the measure: These gas heating methods are options which are built into SBEM and other tools. The types of radiant heaters included in SBEM currently are unflued, flued and multiburner.

Assumptions: The Green Deal Assessor would need to change the system from current to radiant and enter information on efficiency etc. These types of systems are not universally more efficient and therefore their use would depend on each individual situation, including what they are replacing.

When recommended: Not recommended automatically by software, but can be by Energy Performance Certificate or Green Deal assessor.

Assumed lifetime: 15 years

(ff) Replacement glazing

Description: Replace single glazed windows with double glazed windows having Window Energy Rating C. If frames are replaced, Building Regulations Part L applies (windows are 'controlled fittings')

What is the measure: New double glazed windows, replacing those that are single glazed.

Assumptions: The Green Deal Assessor would do this by changing the relevant U-values to match the proposed glazing system, based on manufacturer's documentation..U-value should be at least as good as 1.8 W/m²K, in line with Part L (ADL2B 2010).

When recommended: Where existing windows are single-glazed.

Assumed lifetime: 20 years.

(gg) Roof insulation (flat roof)

See Loft insulation above.

(hh) Room in roof insulation

Not relevant to non-domestic buildings

(ii) Sealing improvements (including duct sealing)

Description: This refers to any ductwork which is found to have a high level of leakage. The ductwork would be inspected and sealed to a relevant standard in order to improve efficiency. (Other sealing covered by Draught proofing above)

Assumptions: Software has performance parameters for different standard levels of duct sealing.

When recommended: When existing leakage is greater than 10%

Assumed lifetime: 10 years

(jj) Secondary glazing

Description: Add secondary glazing to single-glazed windows.

What is the measure: Secondary glazing is an independent glass or plastic glazing system fitted on the room side of existing window frames.

Assumptions: The Green Deal Assessor would do this by changing the relevant U-values.

When recommended: When existing glazing is single-glazed.

Assumed lifetime: 20 years

(kk) Solar blinds, shutters and shading devices

Description: Where current windows or rooflights have none or limited blinds/shutters/shading devices, then these could be added to reduce heat gains.

Assumptions: The Green Deal Assessor can add these by introducing internal or external shading, the colour of the shading and the translucency.

When recommended: When one or more spaces exceeds solar gain limit .

Assumed lifetime: 20 years.

(II) Solar water heating

Description: Add solar water heating system.

What is a measure: Addition of a solar water heating system, comprising solar collector, dual coil cylinder and associated plumbing and controls to heat water which is then used within the building.

Assumptions: The Green Deal Assessor would need to add solar water heating to the building and enter the required information.

When recommended: Where there is no existing solar water heating.

Assumed lifetime: 25 years

(mm) Transpired solar collectors

Description: This refers to solar air heating systems which pre-heat air before its entry to the building. This offsets heat required from main heating system in colder weather. Very unlikely to be added in retrofit, but could be if an element of external wall was to be renovated..

Assumptions: The Green Deal Assessor would then add this to the building and enter the required information.

When recommended: Not currently automatically recommended by software, but could be by Energy Performance Certificate or Green Deal assessor

Assumed lifetime: 20 years

(nn) Under-floor heating

Description: This refers to the replacement of the current heating system with under-floor heating in instances where it will reduce energy consumption.

Assumptions: The Green Deal Assessor would need to change the current heating system to under floor heating and enter the seasonal efficiency (or use the default).

When recommended: Not currently automatically recommended by software, but could be by Energy Performance Certificate or Green Deal assessor

Assumed lifetime: 20 years

(oo) Under-floor insulation

Description: Adding insulation to floors to improve current levels.

What is the measure: Insulation could take the form of foam or fibre. Its form would depend on the existing floor construction

Assumptions: The Green Deal Assessor would do this by changing the relevant U values, using standard reference values or installer documentation

When recommended: Where existing floor insulation level is poor or non-existent.

Assumed lifetime: 42 years

(pp) Variable speed drives for fans and pumps

Description: Variable speed drives (VSDs) can be used on fans or pumps to reduce the amount of energy used by the motor by more efficiently matching speed to load.

Assumptions: Within SBEM, the Green Deal Assessor would be able to add variable speed pumps to the HVAC system. Variable speed fans will be added in the Spring 2013 update.

When recommended: Not currently automatically recommended by software, but could be by Energy Performance Certificate or Green Deal assessor

Assumed lifetime: 15 years

(qq) Warm-air units

Description: Replacing an existing warm-air heating unit with a more efficient unit.

What is the measure: Stand-alone warm air heating units use gas or oil to directly heat air, which may then be delivered to the local target area by fan. An efficient unit would have an improved burner efficiency and possibly an improved fan efficiency, in compliance with the Non-Domestic Building Services Compliance Guide for Part L.

Assumptions : The Green Deal Assessor would input the resultant annual system efficiency, as specified in the NDBSCG.

When recommended: When existing unit has a poor efficiency (software does not explicitly mention warm air).

Assumed lifetime: 20 years

(rr) Waste water heat recovery devices attached to showers

Not relevant to non-domestic buildings

(ss) Water source heat pumps

As Ground Source heat pumps above.

