



Department  
of Energy &  
Climate Change

# Illustrative savings for Green Deal improvement measures

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# 1. Introduction

- 1.1. This publication provides illustrative calculated savings and other information about Green Deal measures installed in example domestic dwellings. Savings for non-domestic measures are highly variable depending on the use of the building, so illustrative figures would not be meaningful and are therefore not provided. However, background information about non-domestic Green Deal measures is included.
- 1.2. This document is aimed at organisations intending to supply products into the Green Deal and ECO markets.
- 1.3. The illustrative savings reflect 2014 updates to the methodology and software used to calculate the cost savings from improvement measures and the 2014 update of the Statutory Instrument<sup>1</sup> which made the following changes to the list of eligible measure categories:
  - Item (ea) has been added: *circulator pumps*
  - Item (rr), *waste water heat recovery devices*, are no longer required to be attached to showers<sup>2</sup>
- 1.4. The full list of measures categories is given in Table 1.
- 1.5. This publication supersedes the earlier document entitled ‘Information for the supply chain on Green Deal measures’.

**Table 1 – Green Deal measures categories from the Statutory Instrument**

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		√
(ea)	circulator pumps	√	
(f)	cylinder thermostats	√	
(g)	draught proofing	√	√
(h)	duct insulation*		
(i)	gas-fired condensing boilers	√	√

<sup>1</sup> <http://www.legislation.gov.uk/ukdsi/2014/9780111116517>

<sup>2</sup> This is to broaden the definition to include waste water heat recovery devices with storage capability.

Item	Descriptor	Domestic	Non-domestic
(j)	ground source heat pumps	√	√
(k)	hot water showers*		
(l)	hot water systems	√	√
(m)	hot water taps*		
(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	√	√
(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		√
(z)	micro combined heat and power	√	√
(aa)	micro wind generation	√	√
(bb)	oil-fired condensing boilers	√	√
(cc)	photovoltaics	√	√
(dd)	pipework insulation*		
(ee)	radiant heating		√
(ff)	replacement glazing	√	√
(gg)	roof insulation	√	√
(hh)	room in roof insulation	√	
(ii)	sealing improvements (including duct sealing)		√
(jj)	secondary glazing	√	√
(kk)	solar blinds, shutters and shading devices		√
(ll)	solar water heating	√	√
(mm)	transpired solar collectors		√
(nn)	under-floor heating	√	√

Item	Descriptor	Domestic	Non-domestic
(oo)	under-floor insulation	√	√
(pp)	variable speed drives for fans and pumps		√ (for pumps)
(qq)	warm-air units	√	√
(rr)	waste water heat recovery devices	√	
(ss)	water source heat pumps	√	√

\* Asterisked measures are not currently covered by Green Deal software, but are included in the SI to allow for their use in future.

- 1.6. In the remainder of this document an illustrative measure with a defined set of assumptions is used to represent each of the above measures categories (some categories cover multiple measures).
- 1.7. For each domestic measure category the following information is provided:
  - A description of the illustrative improvement measure
  - A description of the other measures that can fall within the same category
  - An explanation of when this measure would be recommended
  - The assumptions made when calculating the saving
  - The assumed lifetime and an indicative cost for the measure
  - Illustrative cost savings for the measure installed in some archetype dwellings
- 1.8. For non-domestic measures a description of measures for each category is provided and a description of the assumptions made by software when savings are calculated. The circumstances in which measures are recommended are also shown, along with their assumed lifetimes.
- 1.9. No illustrative savings or indicative installation cost is provided for non-domestic measures because these are highly variable.

## 2. Illustrative savings (domestic measures)

### Changes in domestic savings due to calculation methodology updates

- 2.1. The modelling methodology used to estimate the savings from Green Deal measures, known as the Green Deal Occupancy Assessment<sup>3</sup>, was updated in December 2014 to enable new measures to be included in the Green Deal and to make improvements to the modelling based on recent research.
- 2.2. As a consequence the savings attributed to most measures have changed slightly. In most cases the difference is very small. Savings are typically 1-2% higher than before. However, for the following measures, changes to the methodology have been made which directly affect the way in which they are treated, resulting in more significant changes to savings (>5%).
  - **Draught-proofing:** New wind-speed data is used following the update, leading to higher savings for draught-proofing.
  - **Replacement storage heaters:** The 'responsiveness' associated with each type of storage heater has been adjusted resulting in lower savings for some types.
  - **Cylinder thermostats:** The method for calculating losses from primary pipework (pipework between the boiler and hot water cylinder) has been improved, leading to reduced savings from fitting a cylinder thermostat.
  - **Heat pumps:** The default efficiencies associated with ground and air source heat pumps have been updated, leading to increased savings.
  - **Solar water heating:** A change has been made to the way hot water provided by electric showers is treated in the solar water heating calculation, resulting in larger savings where an electric shower is not present, or smaller savings where one is present.

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<sup>3</sup> For an overview of this method and how it is used in Green Deal assessments see here: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/383543/A\\_Description\\_of\\_the\\_Green\\_Deal\\_Occupancy\\_Assessment\\_ProcessFINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/383543/A_Description_of_the_Green_Deal_Occupancy_Assessment_ProcessFINAL.pdf)

## (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.

**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:** This measure is offered as an option where there is any existing heating system except community heating or an existing heat pump.

**Assumptions for savings estimate:** From direct-acting electric heaters to SAP default air source heat pump (seasonal performance factor 224%), providing space and water heating.

**Assumed lifetime:** 15 years

**Indicative cost:** £3,000 - £10,000

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 <sup>2</sup>	0	8323	4264	1083	25%	812
Bungalow, 67 m <sup>2</sup>	0	5987	3043	772		579
Semi-detached, 89 m <sup>2</sup>	0	6828	3481	884		663
Mid-terrace, 80 m <sup>2</sup>	0	4756	2398	609		457
Mid-floor flat, 61 m <sup>2</sup>	0	2962	5534	303		227

## (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%, providing space and water heating.

**Assumed lifetime:** 20 years

**Indicative cost:** £7,000 - £13,000

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 <sup>2</sup>	5943	0	13607	344	25%	258
Bungalow, 67 m <sup>2</sup>	4423	0	10362	282		211
Semi-detached, 89 m <sup>2</sup>	4726	0	11077	301		226
Mid-terrace, 80 m <sup>2</sup>	3357	0	7868	214		160
Mid-floor flat, 61 m <sup>2</sup>	3357	0	7868	214		160



### (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%, providing space and water heating.

**Assumed lifetime:** 20 years

**Indicative cost:** £7,000 - £13,000

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 <sup>2</sup>	1605	0	13864	69	25%	52
Bungalow, 67 m <sup>2</sup>	3708	0	10188	77		58
Semi-detached, 89 m <sup>2</sup>	1017	0	11212	84		63
Mid-terrace, 80 m <sup>2</sup>	-234	0	7365	82		62
Mid-floor flat, 61 m <sup>2</sup>	-1011	0	4357	91		69

## (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.<sup>4</sup>

**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 - £1,500<sup>5</sup>

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 <sup>2</sup>	7468	0	1537	247	35%	160
Bungalow, 67 m <sup>2</sup>	3411	0	737	118		77
Semi-detached, 89 m <sup>2</sup>	4640	0	1003	161		105
Mid-terrace, 80 m <sup>2</sup>	2724	0	589	95		61
Mid-floor flat, 61 m <sup>2</sup>	1947	0	421	68		44

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<sup>4</sup> 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.

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

## (e) Chillers

*Not applicable to domestic sector*

## ea) Circulator pumps

**Description:** Replacing an inefficient circulator pump with an efficient one.

**What is the measure:** The replacement of the circulator pump used to move water from the boiler to the radiators and hot water cylinder with a new more efficient model. There has recently been a step change in the technology used in new circulation pumps so significant energy savings are possible.

**When recommended:** The existing pump was installed prior to 2012.

**Assumptions for savings estimate:** Boiler providing heat to radiators and also heating hot water cylinder. Pump is upgraded from a pre-2012 model to a post-2012 model.

**Assumed lifetime:** 10 years

**Indicative cost:** £150 - £250

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 <sup>2</sup>	0	90	38	10	10%	9
Bungalow, 67 m <sup>2</sup>						
Semi-detached, 89 m <sup>2</sup>						
Mid-terrace, 80 m <sup>2</sup>						
Mid-floor flat, 61 m <sup>2</sup>						

## (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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	3129	0	675	109	10%	98
Bungalow, 67 m <sup>2</sup>	2615	0	565	91		82
Semi-detached, 89 m <sup>2</sup>	2241	0	484	78		70
Mid-terrace, 80 m <sup>2</sup>	2241	0	484	78		70
Mid-floor flat, 61 m <sup>2</sup>	1854	0	400	65		58

## (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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	909	0	195	32	15%	27
Bungalow, 67 m <sup>2</sup>	478	0	103	17		14
Semi-detached, 89 m <sup>2</sup>	858	0	185	30		26
Mid-terrace, 80 m <sup>2</sup>	806	0	174	28		24
Mid-floor flat, 61 m <sup>2</sup>	576	0	124	20		17

## (h) Duct insulation

*Not applicable to domestic sector*

## (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%), providing space and water heating.

**Assumed lifetime:** 12 years

**Indicative cost:** £2,200 - £3,000

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 <sup>2</sup>	4632	0	1001	161	25%	121
Bungalow, 67 m <sup>2</sup>	3358	0	725	117		87
Semi-detached, 89 m <sup>2</sup>	3801	0	821	132		99
Mid-terrace, 80 m <sup>2</sup>	2606	0	563	90		68
Mid-floor flat, 61 m <sup>2</sup>	1569	0	339	55		41



## (j) Ground source heat pumps

See also (a) Air source heat pump.

**Description:** Changing the current heating system to a ground source heat pump<sup>6</sup>.

**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:** This measure is offered as an option where there is any existing heating system except community heating or an existing heat pump.

**Assumptions for savings estimate:** From non-condensing oil boiler, efficiency 79%, to SAP default ground source heat pump (MCS compliant), providing space and water heating.

**Assumed lifetime:** 20 years

**Indicative cost:** £9,000 - £17,000

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 <sup>2</sup>	26118	-8012	3667	371	10%	334
Bungalow, 67 m <sup>2</sup>	19226	-5908	2712	278		250
Semi-detached, 89 m <sup>2</sup>	21392	-6546	3029	313		282
Mid-terrace, 80 m <sup>2</sup>	14692	-4472	2122	229		206
Mid-floor flat, 61 m <sup>2</sup>	9175	-2785	1359	155		140

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<sup>6</sup> Recommendation is for a ground or air source heat pump

### (k) Hot water showers

*Not applicable to the domestic sector*

### (l) Hot water showers

*Not applicable to the domestic sector as a separate item, only as part of some heating system upgrade.*

### (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).

**What is the measure:** External insulation systems can be foam or fibre based and fixed to the 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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	14422	0	3114	511	33% <sup>7</sup>	358
Bungalow, 67 m <sup>2</sup>	6991	0	1510	248		173
Semi-detached, 89 m <sup>2</sup>	9516	0	2055	331		232
Mid-terrace, 80 m <sup>2</sup>	5668	0	1223	201		141
Mid-floor flat, 61 m <sup>2</sup>	4086	0	882	145		101

<sup>7</sup> The IUF is 33% for pre-1965 solid walls and 25% for any solid wall built after 1965.

## (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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	0	1924	999	218	10%	196
Bungalow, 67 m <sup>2</sup>	0	1455	756	161		145
Semi-detached, 89 m <sup>2</sup>	0	1458	757	167		150
Mid-terrace, 80 m <sup>2</sup>	0	756	393	92		83
Mid-floor flat, 61 m <sup>2</sup>	0	324	169	42		38

## (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-£900<sup>8</sup>

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 <sup>2</sup>	522	0	112	18	10%	16
Bungalow, 67 m <sup>2</sup>	431	0	92	15		13
Semi-detached, 89 m <sup>2</sup>	460	0	99	16		14
Mid-terrace, 80 m <sup>2</sup>	377	0	79	13		12
Mid-floor flat, 61 m <sup>2</sup>	269	0	56	9		8

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<sup>8</sup> 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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	3623	0	802	132	50%	66
Bungalow, 67 m <sup>2</sup>	2592	0	595	96		48
Semi-detached, 89 m <sup>2</sup>	2943	0	654	108		54
Mid-terrace, 80 m <sup>2</sup>	1888	0	442	73		37
Mid-floor flat, 61 m <sup>2</sup>	1095	0	254	43		21

(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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	369	0	80	13	15%	11
Bungalow, 67 m <sup>2</sup>	172	0	37	6		5
Semi-detached, 89 m <sup>2</sup>	378	0	82	13		11
Mid-terrace, 80 m <sup>2</sup>	212	0	45	7		6
Mid-floor flat, 61 m <sup>2</sup>	228	0	49	8		7



(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	CO2 saving kg/yr	Financial saving £/yr	GD In-use factor	Saving with in-use factor £/yr
Detached, 104 m <sup>2</sup>	600	0	129	22	15%	19
Bungalow, 67 m <sup>2</sup>	627	0	134	23		19
Semi-detached, 89 m <sup>2</sup>	605	0	131	22		19
Mid-terrace, 80 m <sup>2</sup>	619	0	133	22		19
Mid-floor flat, 61 m <sup>2</sup>	648	0	139	24		20

## (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.

**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 <sup>2</sup>	15264	0	3297	513	33% <sup>9</sup>	359
Bungalow, 67 m <sup>2</sup>	7698	0	1663	259		181
Semi-detached, 89 m <sup>2</sup>	10195	0	2202	355		249
Mid-terrace, 80 m <sup>2</sup>	5896	0	1274	198		139
Mid-floor flat, 61 m <sup>2</sup>	4013	0	867	135		94

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<sup>9</sup> The IUF is 33% for pre-1965 solid walls and 25% for any solid wall built after 1965.

## (w) Lighting systems, fittings and controls

**Description:** Replacement of luminaires using incandescent lamps with those only capable of accepting low energy lamps.

**What is the measure:** A luminaire (light fitting) which is designed in such a way that it is not possible to replace its efficient, low energy lamps (CFLs or LEDs) with less efficient incandescent lamps.

**When recommended:** When some or all fittings use inefficient lamps and these are judged by the assessor to be suitable for replacement.

**Assumptions for savings estimate:** 50% of fixed lighting is replaced with luminaires which can only use CFL or LED lamps.

**Assumed lifetime:** 5 years

**Indicative cost:** £5 per lamp

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 <sup>2</sup>	-139	202	75	21	10%	19
Bungalow, 67 m <sup>2</sup>	-116	168	62	18		16
Semi-detached, 89 m <sup>2</sup>	-130	189	70	20		18
Mid-terrace, 80 m <sup>2</sup>	-124	181	67	19		17
Mid-floor flat, 61 m <sup>2</sup>	-111	162	60	17		15

## (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 <sup>2</sup>	3942	0	850	138	35%	89
Bungalow, 67 m <sup>2</sup>	4826	0	1041	168		109
Semi-detached, 89 m <sup>2</sup>	3466	0	748	121		79
Mid-terrace, 80 m <sup>2</sup>	3430	0	739	120		78
Mid-floor flat, 61 m <sup>2</sup>	5357	0	1156	187		122

## (y) Mechanical ventilation with heat recovery systems

*Not applicable to the domestic sector as a retrofit measure*

## (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:** This measure is offered as an option where there is any existing heating system except community heating or an existing heat pump.

**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 <sup>2</sup>	3476	1505	1535	324	25%	243
Bungalow, 67 m <sup>2</sup>	1418	1037	868	191		144
Semi-detached, 89 m <sup>2</sup>	1695	1197	1011	222		167
Mid-terrace, 80 m <sup>2</sup>	1102	666	604	132		99
Mid-floor flat, 61 m <sup>2</sup>	-735	666	148	43		32

## (aa) Micro wind generation

**Description:** Addition of mast-mounted wind turbine

**What is the measure:** Wind turbines are turbines mounted on a mast to provide electricity generation.

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

**Assumptions for savings estimate:** 4m rotor diameter on 10m mast in rural location (rated 3kW at 11m/s wind speed).

**Assumed lifetime:** 15 years

**Indicative cost:** £15,000 - £25,000

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 <sup>2</sup>	0	3576	1856	517	0%	517
Bungalow, 67 m <sup>2</sup>	0	3576	1856	517		517
Semi-detached, 89 m <sup>2</sup>	0	3576	1856	517		517
Mid-terrace, 80 m <sup>2</sup>	0	3576	1856	517		517
Mid-floor flat, 61 m <sup>2</sup>	0	3576	1856	517		517



## (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%), providing space and water heating

**Assumed lifetime:** 12 years

**Indicative cost:** £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 <sup>2</sup>	4215	0	1256	229	25%	171
Bungalow, 67 m <sup>2</sup>	3038	0	906	165		124
Semi-detached, 89 m <sup>2</sup>	2656	0	792	144		108
Mid-terrace, 80 m <sup>2</sup>	2361	0	705	128		96
Mid-floor flat, 61 m <sup>2</sup>	1396	0	416	76		57

## (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 over-shading.

**Assumed lifetime:** 25 years

**Indicative cost:** £5000 - £8000

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 <sup>2</sup>	0	1647	855	217	0%	217
Bungalow, 67 m <sup>2</sup>	0	1647	855	217		217
Semi-detached, 89 m <sup>2</sup>	0	1647	855	217		217
Mid-terrace, 80 m <sup>2</sup>	0	1647	855	217		217

#### (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, or triple glazed windows having Window Energy Rating C or better.

**What is the measure:** New double or triple-glazed windows replacing those that are single glazed. This measure category also covers the replacement of only the glazed units of existing windows.

**When recommended:** Where existing windows are single glazed, or, in the case of replacing the glazed units, where existing glazing is pre-2002 double glazing in uPVC frames.

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

**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 <sup>2</sup>	2351	0	490	78	15%	66
Bungalow, 67 m <sup>2</sup>	1650	0	347	55		47
Semi-detached, 89 m <sup>2</sup>	2396	0	513	82		70
Mid-terrace, 80 m <sup>2</sup>	2066	0	432	69		58
Mid-floor flat, 61 m <sup>2</sup>	1062	0	254	40		34

## (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 <sup>2</sup>	2719	0	588	96	15%	81
Bungalow, 67 m <sup>2</sup>	3304	0	714	116		99
Semi-detached, 89 m <sup>2</sup>	2390	0	516	84		71
Mid-terrace, 80 m <sup>2</sup>	2365	0	510	83		71
Mid-floor flat, 61 m <sup>2</sup>	3734	0	807	131		112

## (hh) Room in roof insulation

**Description:** Insulation of roof rooms.

**What is the measure:** Adding internal insulation to the walls and ceilings of roof rooms.

**When recommended:** Dwelling has roof rooms with U-value > 0.35 W/m<sup>2</sup>K.

**Assumptions for savings estimate:** Roof rooms improved from U=1.5 to U = 0.25 W/m<sup>2</sup>K

**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 <sup>2</sup>	6368	0	1374	222	25%	166
Bungalow, 67 m <sup>2</sup>	7671	0	1656	267		200
Semi-detached, 89 m <sup>2</sup>	6117	0	1321	213		160
Mid-terrace, 80 m <sup>2</sup>	5956	0	1287	208		156
Mid-floor flat, 61 m <sup>2</sup>	0	0	0	0		0

## (ii) Sealing improvements (including duct sealing)

*Not applicable to the domestic sector*

## (jj) Secondary glazing

See also (ff) replacement 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,  $U = 2.4 \text{ W/m}^2\text{K}$  (existing windows taken as having  $U = 4.8 \text{ W/m}^2\text{K}$ ).

**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 <sup>2</sup>	1803	0	333	59	15%	50
Bungalow, 67 m <sup>2</sup>	1264	0	237	42		36
Semi-detached, 89 m <sup>2</sup>	1821	0	389	62		53
Mid-terrace, 80 m <sup>2</sup>	1584	0	293	52		44
Mid-floor flat, 61 m <sup>2</sup>	765	0	173	30		26



## (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 m<sup>2</sup>, 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 <sup>2</sup>	1258	0	286	37	0%	37
Bungalow, 67 m <sup>2</sup>	1198	0	234	35		35
Semi-detached, 89 m <sup>2</sup>	1336	0	263	40		40
Mid-terrace, 80 m <sup>2</sup>	1243	0	243	37		37

## (mm) Transpired solar collectors

*Not applicable to the domestic sector*

## (nn) Under-floor heating

*Not available as a stand-alone measure, but an option for heating system improvements.*

## (oo) Under-floor insulation

**Description:** Adding insulation to external suspended or solid floors.

**What is the measure:** Insulation would usually take the form of foam for solid floors or fibre for suspended floors.

**When recommended:** Any property without floor insulation.

**Assumptions for savings estimate:** Adding insulation to improve the U-value of the uninsulated floor to 0.25 W/m<sup>2</sup>K (roughly equivalent of 150 mm mineral wool).

**Assumed lifetime:** 42 years

**Indicative cost:** £800 - £1,200 for suspended floors or £5,000 - £6,000 for solid floors.

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 <sup>2</sup>	1864	0	403	65	15%	55
Bungalow, 67 m <sup>2</sup>	1970	0	425	69		58
Semi-detached, 89 m <sup>2</sup>	1289	0	279	45		38
Mid-terrace, 80 m <sup>2</sup>	684	0	147	24		20
Mid-floor flat, 61 m <sup>2</sup>	1026	0	221	36		30

## (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:** £2,500 - £4000

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 <sup>2</sup>	1952	0	497	80	25%	60
Bungalow, 67 m <sup>2</sup>	1465	0	380	61		46
Semi-detached, 89 m <sup>2</sup>	1927	0	417	67		50
Mid-terrace, 80 m <sup>2</sup>	1150	0	303	49		37
Mid-floor flat, 61 m <sup>2</sup>	757	0	208	34		26

## (rr) Waste water heat recovery devices

**Description:** Add waste water heat recovery system

**What is the measure:** A heat recovery system that recovers heat from the drain of a shower and returns it to the cold water shower inlet or the cold feed of a combi boiler. This measure category covers both instantaneous and storage type devices.

**When recommended:** In the case of instantaneous heat recovery devices, when the existing dwelling has one or more showers. Storage devices are applicable to any dwelling.

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

**Assumed lifetime:** 20 years

**Indicative cost:** £585 - £725 for instantaneous, or £2,200 - £4,800 for storage type

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 <sup>2</sup>	370	0	80	13	10%	11
Bungalow, 67 m <sup>2</sup>	303	0	65	10		9
Semi-detached, 89 m <sup>2</sup>	352	0	76	12		11
Mid-terrace, 80 m <sup>2</sup>	338	0	73	11		10
Mid-floor flat, 61 m <sup>2</sup>	292	0	63	10		9

## (ss) Water source heat pumps

*See also (j) Ground source heat pump.*

*Not explicitly considered in RdSAP.*



## 3. Information on non-domestic measures

### (a) Air source heat pumps

Description: Changing the current heating system to one or more air source heat pumps 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 Advisor (GDA) 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 heat generator to a biomass boiler.

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 GDA 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 (including with radiators)

Description: Changing the current heating system to biomass room heaters 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 GDA 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 GDA 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 GDA 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. All ducting is currently assumed to be insulated to comply with Building Regulations.

When recommended: Not currently recommended automatically by software – but, once modellable, 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 GDA 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

Description: Changing the current heating system to one or more ground source heat pumps 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. 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 Advisor (GDA) 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: 15 years

### (k) (efficient) 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. Once available, hot water demand for the zones served by the showers would 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) (efficient) Hot water systems

Description: Changing to a more efficient hot water system (HWS).

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 HWS secondary circulation, replace HWS with point of use system.

Assumptions: GDA would need to enter the new improved seasonal efficiency.

When recommended: Whenever HWS 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. Once available, hot water demand for the zones served by the taps would 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: 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 replacement 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 GDA, based on performance of boiler plus device according to agreed parameters.

When recommended: Not recommended on its own.

Assumed lifetime: 16 years

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

Description: This means any improvement to the HVAC control systems, by adding where there are none or by upgrading to add functionality.

What is the measure: The following controls can currently be added to the heating system: central time control, optimum start/stop 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 in the Green Deal version of the tool.

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.

Assumptions: GDA can upgrade external doors by entering improved U value.

When recommended: Not currently recommended automatically by software, but can be recommended by EPC or GD 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: GDA to enter details on storage volume, insulation type and thickness.

When recommended: As part of HWS recommendations

Assumed lifetime: 10 years

## (v) Internal wall insulation (of external walls) systems

Description: Applying an internal insulation system to uninsulated external wall(s).

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 GDA to recommend).

Assumed lifetime: 36 years

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

### **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 GDA selects that a proper lighting design has been carried out with the new fittings – in which case GDA will need to enter design data.

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

Assumed lifetime: 5 years

### **Rooflights**

Description: Rooflights 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 rooflights and their thermal and light performance.

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

Assumed lifetime: 25 years

### **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 EPC or GD assessor.

Assumed lifetime: 10 years

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

Description: Increasing loft insulation

What is the measure: This refers to adding or improving the current insulation levels in the loft or rafters.

Assumptions: GDA 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/m<sup>2</sup>K).

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 GDA 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 EPC or GD assessor.

Assumed lifetime: 15 years



## (z) Micro combined heat and power

Description: Installation of micro-chp in domestic-scale building, as replacement for conventional heating.

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 EPC or GD 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 GDA has confirmed that the location and local wind environment are suitable for a turbine. The GDA 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 GDA 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 (PV) panels to the building to provide electricity generation.

Assumptions: The GDA would add PV to the building and enter specification details as required by the tool.

When recommended: Where there is no existing PV

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.

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

Assumed lifetime: 15 years

## (ff) Replacement glazing

Description: Where current glazing is poorly insulated, then replace glazing and (usually) frames. If frames are replaced, Building Regulations Part L applies (windows are 'controlled fittings')

What is the measure: Double or triple-glazed windows, in frames which minimise heat loss through them

Assumptions: The GDA 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/m<sup>2</sup>K, in line with Part L (ADL2B 2010).

When recommended: Where existing windows are single-glazed.

## (gg) Roof insulation

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 Draughtproofing 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 GDA 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 GDA can add these by introducing internal or external shading, the colour of the shading and the translucency.

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

Assumed lifetime: 20 years.

## (ll) Solar water heating

Description:

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 GDA 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 the 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 GDA would then add this to the building and enter the required information.

When recommended: Not currently automatically recommended by software, but could be by EPC or GD 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 GDA 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 EPC or GD 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 GDA 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 GDA would be able to add 'variable speed' only to pumps in the HVAC system. Variable speed fans are not yet modellable in SBEM.

When recommended: Not currently automatically recommended by software, but could be by EPC or GD 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 GDA 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.

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