



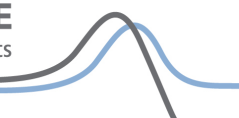
BNDH B03: Domestic Central Heating Systems Government Standards Evidence Base 2009: Policy Scenario

Version 1.1

This Briefing Note and referenced information is a public consultation document and will be used to inform Government decisions. The information and analysis forms part of the Evidence Base created by Defra's Market Transformation Programme.

1 Introduction

- The Policy Scenario is a projection of what would happen if a defined set of new product-specific and related cross-cutting policies were implemented. The policies in the Policy Scenario have not yet been agreed or funded but represent those policies which are expected to be introduced as well as likely future revisions to existing policies and, in some cases, novel policy options. These policies aim to improve the average efficiency of products in the stock through a variety of mechanisms (e.g. minimum standards, product information and labelling, procurement, incentives) and thus reduce energy consumption and carbon emissions resulting from these products.
- As product policy is considered within the context of climate change policy, the UK government considers policies with net UK costs of up to around £20 per tonne of CO₂ saved (compared to the reference scenario). The ambition level, at a minimum, matches the Least Life Cycle Cost (LLCC) level to society of increased energy efficiency of products.
- The costs for each policy, where known, are also included, separated out for government, consumer and industry.



1.1 Product definition

Conventional Central Heating (CH) Boiler

- This briefing note and related model include the energy consumed by domestic boilers to both heat domestic hot water and provide space heating. Dedicated water heaters are dealt in a separate set of briefing notes¹.
- The definition of a CH Boiler has been adopted from the ErP Working Document (published 29 Feb 2008) that: *A CH-boiler is a product that is equipped to generate heat and to transfer this heat to a heat transfer fluid (CH-water) circulating in a distribution system (CH distribution network) to which at least one heat exchanging means is connected (CH-emitter) that is equipped to transfer the heating energy of the CH-water into space heating of (a part of) buildings.*
- Domestic Boilers can be regular boilers (CH-boiler) or combi boilers (CH-combi)² type: A CH-boiler provides heating directly and can provide domestic hot water through a separate CH-water tank (i.e. insulated storage tank or cylinder). A CH-combi is a product with the functionality of both a CH-boiler and a Water Heater. CH-Combi has the capability to provide domestic hot water directly. Some CH-combis, defined also as 'primary storage' combis, can include a small hot water store of up to 15 litres. Secondary storage CH-combis include a built in hot water store of 15 litres or more³ (Figure 1)

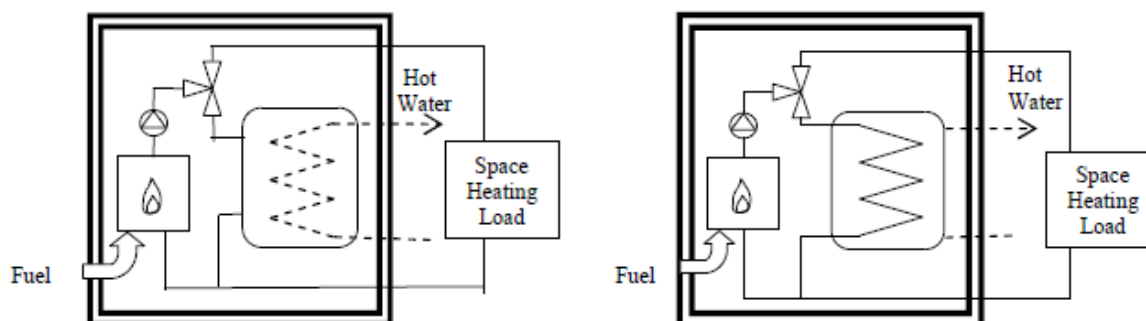


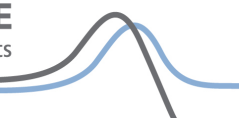
Figure 1 - Primary storage CH-combi (left) and Secondary storage CH-combi (right)⁴.

¹ BNDH GWH01: Domestic Gas Water Heaters Government Standards Evidence Base 2009 and BNDH EWH01: Domestic Electric Water Heaters Government Standards Evidence Base 2009.

² Working Document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water Heaters – February 2008 - p5

³ Combination Boilers and Low Flow Fittings - Elemental Solutions 2007. www.environment-agency.gov.uk/savewater

⁴ The Government's Standard Assessment Procedure for Energy Rating of Dwellings 2005 (SAP 2005) edition revision 2.

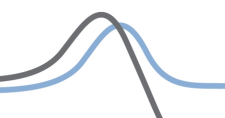


- Condensing boilers can achieve seasonal efficiencies (SEDBUK)⁵ between 83% and 92%. This is higher than for non-condensing boilers due to the extraction of latent heat by condensing water from the flue gases.
- Most boilers comprise a single combustion chamber enclosed by the waterways of the heat exchanger. Combustion gases are expelled through the flue having given up most of their heat to the water. The temperature at which these gases are expelled to atmosphere is a major determinant of the efficiency of the boiler.
- Non-condensing boilers expel these gases at around 180°C.
- Condensing boilers are designed to allow a reduction of the flue gas temperature to a much lower temperature, 55°C when other conditions permit. This reduction of temperature causes some of the water vapour to condense and the remaining gases are expelled to the outside environment.
- According to The UK Government's Standard Assessment Procedure for Energy Rating of Dwellings 2005 [SAP 2005] a Condensing boiler is '*a boiler designed to make use of the latent heat released by the condensation of water vapour in the combustion flue products. The boiler must allow the condensate to leave the heat exchanger in liquid form by way of a condensate drain*'.
- SAP 2005 therefore defines Non-Condensing Boilers as boilers [...] without the means to remove the condensate in liquid form.
- The current domestic boiler stock in the UK is evenly split between regular and combi boilers. However, sales figures show that the latter are becoming increasingly popular in the UK, although these almost exclusively use gas.
- The Domestic CH-Boilers covered by this brief have been subdivided into three main categories:
 1. Gas Fired – Regular Boilers (Condensing and Non-Condensing);
 2. Gas Fired – Combi Boilers (Condensing and Non-Condensing);
 3. Oil Fired – all boilers

Alternative Heating Technologies

- Additionally, three groups of alternative technologies have been considered as likely replacements for boilers:

⁵ Seasonal Efficiency Domestic Boiler UK – this is an industry standard for measuring and publishing the thermal efficiency of a boiler



4. *Alt- Elect* - (alternative, electrically-driven systems: *ground source heat pumps, air source heat pumps ...*)
5. *Alt-Gas* - (alternative, gas-driven systems: *gas heat pumps, micro CHP...*)
6. *Alt- Biomass* - (alternative, biomass-fired systems: *solid fuel boiler*)

- Heat pumps are identical in operation to refrigerators, incorporating an electrically driven compressor to create a pressure difference between two volumes of refrigerant. In the refrigerator the aim is to extract heat from the food compartment (i.e. cool it down) and reject this heat to atmosphere as waste heat. In the heat pump, the “waste heat” is transferred to a heating medium. Heat is extracted from a convenient source such as the atmosphere or the ground. In effect heat is “pumped” from a low temperature to a higher temperature.
- The main advantage of a heat pump is that it produces more useful heat (kW) than is used to drive the compressor. As such, the efficiency is greater than 100%.
- Ground source heat pumps use buried pipes to extract heat from the ground, which is usually used to warm water for space heating systems. It can also be used to pre-heat water before it goes into a more conventional boiler.⁶
- Air source heat pumps absorb heat from the outside air. This heat can then be used to warm water for radiators or under floor heating systems, or warm the air directly.
- As both ground source and air source systems heat water to a lower temperature than a standard boiler system would, they are more suitable for under floor than radiator distribution systems. An air-to-air system produces warm air which is circulated through a dwelling by fans.
- Micro CHP systems simultaneously generate usable heat and electricity in a single process. They are suited to single dwellings, and range in size from around 4kW heat output (suited to small, well-insulated dwellings) up to 36kW (these units will incorporate a supplementary boiler for additional heat output in larger or hard to heat dwellings). Electrical power output is typically 1kW to 3kW and can be grid connected.⁷
- Biomass heating comprises a modified solid fuel boiler designed to operate on unprocessed wood chips or logs, or wood pellets (a processed form of waste wood and sawdust). Such boilers are available for individual dwellings or as community heating boilers.
- Biomass boilers reduce CO₂ emissions compared to conventional fossil-fuelled boilers by virtue of the comparatively low effective carbon content of the biomass.

⁶ <http://www.energysavingtrust.org.uk/Generate-your-own-energy/Ground-source-heat-pumps>

⁷ <http://www.energysavingtrust.org.uk/business/Business/Building-Professionals/Helpful-Tools/Hard-to-treat-homes/Matrix/Micro-CHP>



The residual effective carbon content is from the energy expended in harvesting, processing and transport.

- All of these alternative technologies utilise renewable energy sources that do not directly contribute to greenhouse gas emissions. They do however require conventional power sources to control and drive the equipment (mainly compressor, pumps and fans).⁸

2 Scenario outputs

- The Policy scenario identifies possible energy consumption due to implementation of a defined set of new product-specific and product-related policies, not yet agreed or funded, which improve energy efficiency and thus reduce energy consumption and emissions by products.
- The main policies delivering these reductions are Part L of Building Regulations 2010 (and equivalents in Scotland and Northern Ireland) related to new and existing dwellings (Part L1A and L1B) and the Ecodesign of Energy related Products (ErP); Ecodesign and Labelling of boilers.
- From 2010, Part L proposes that *boilers* installed in either existing or new dwellings be SEDBUK A rated. ErP is expected to come into force in 2011, but not to impact on the UK market until 2013, when *CH systems* will need to achieve efficiencies in excess of 76%⁹.
- The graph below provides a comparison of scenarios for Domestic Heating. The energy consumption calculation used is described in BNDH B02: Domestic Boilers Government Standards Evidence Base 2009: Reference Scenario.

⁸ UK Heating 2008 BRG Consult; Section 3.124. <http://www.brgconsult.com/>

⁹ The ErP Working Document on possible Ecodesign and Labelling for boilers and water heaters dated 2nd September 2008 was used as the basis for the boiler modelling. This is superseded by a revision dated 4th June 2009. The differences in efficiencies proposed in each of these documents are very small

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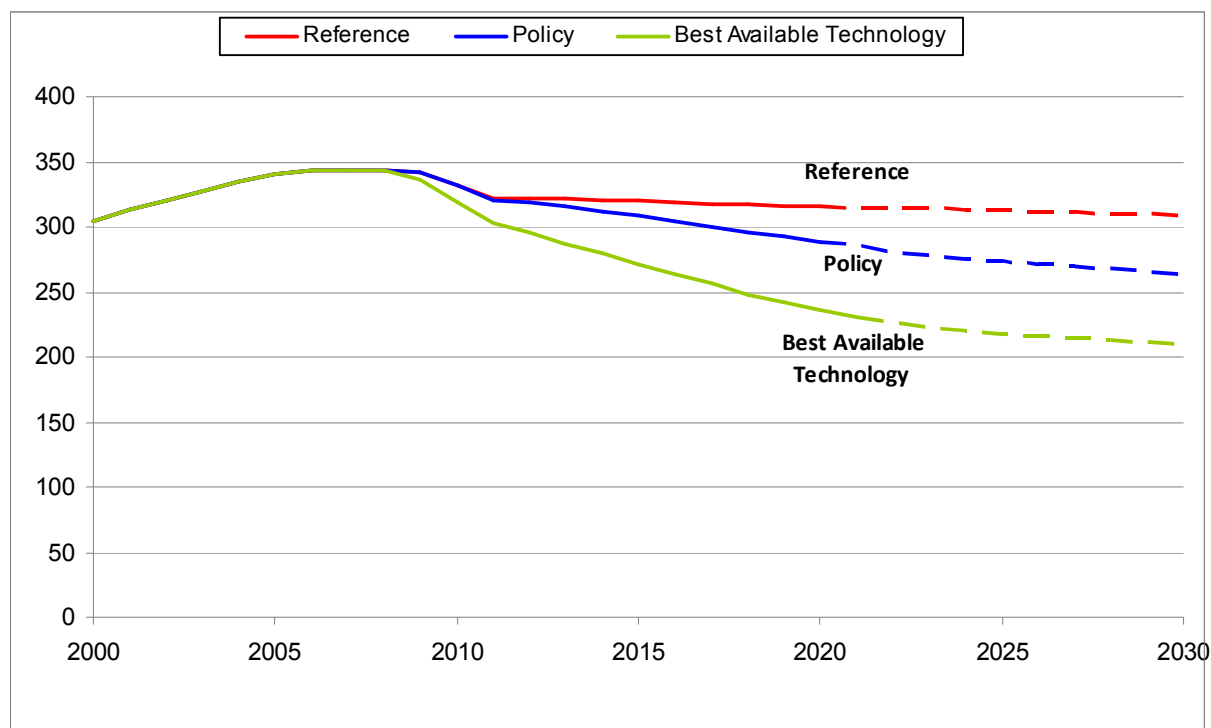


Figure 2– Summary Graph Energy Consumption (TWh) –Domestic Central Heating

- As shown in figure 2, boiler energy consumption falls under the Policy Scenario from 2009 to 2030. This is due to assumed improvements in efficiencies of conventional boilers, and increased displacement of conventional boilers by alternative technologies. Changes in energy consumption differ between boiler types:
 - Gas regular boiler energy consumption falls rapidly due to a shift in sales from gas regular boilers to gas combi boilers and alternative technologies, in addition to improved boiler efficiency.
 - Much of the savings from efficiency improvements in combi boilers are offset by increased sales.
 - Energy consumption of highly efficient alternative technologies increases substantially, as the sale of these products rise, displacing sales of conventional boilers.
- The tables below indicate energy consumption under the Policy Scenario, by product group.
- Note that the energy and CO₂ savings presented result from changes in both efficiency *and* sales, between the Reference and Policy Scenarios.
- Due to the accelerated displacement of conventional boilers, energy consumption of alternative technologies *increases*, as compared to the Reference Scenario. Therefore savings for these technologies appear negative. However total savings are positive.

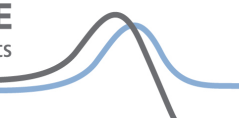


Table 1 – Summary energy consumption and savings – Domestic Oil CH-Boiler

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂) ¹⁰
2010	29,200	100	0.03
2020	24,100	3,400	0.90
2030	19,200	6,900	1.83

Table 2 – Summary energy consumption and savings – Domestic Gas Regular CH-Boiler

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	155,500	200	0.04
2020	97,800	7,700	1.42
2030	67,800	17,200	3.16

Table 3 – Summary energy consumption and savings – Domestic Gas Combi CH-Boiler

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	146,700	565	0.10
2020	160,400	20,500	3.78
2030	154,800	37,200	6.84

Table 4 – Summary energy consumption and savings – Alt - Electric

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	-	-	-
2020	1,900	-1,300	-0.56
2030	6,900	-4,800	-2.06

¹⁰ Assumes conversion factor for savings from MTP Briefing Note BNXS01.

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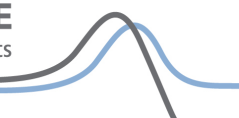


Table 5 – Summary energy consumption and savings – Alt - Gas

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	-	-	-
2020	2,400	-1,700	-0.31
2030	8,700	-6,300	-1.16

Table 6 – Summary energy consumption and savings – Alt - Biomass

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	-	-	-
2020	1,800	-1,400	0.0
2030	6,600	-4,900	0.0

Table 7 – Summary energy consumption and savings – All

Policy Scenario year	Total energy consumption (Policy, GWh)	Annual energy savings (Reference - Policy, GWh)	Annual CO ₂ Savings (Reference - Policy, MtCO ₂)
2010	331,300	850	0.14
2020	288,500	27,200	5.79
2030	264,000	45,400	8.61

Table 8– Summary Stock – Domestic CH-Boilers and alternative technologies: Policy Scenario (000's)

	Oil Boilers	Gas Regular	Gas Combi	Alt Electric	Alt Gas	Alt Biomass	Total ¹¹
2010	1,580	10,900	11,400	-	-	-	23,800
2020	1,640	8,120	14,900	390	340	170	25,500
2030	1,450	6,470	15,100	1,460	1,260	610	26,400

¹¹ Totals may differ from sum due to rounding in all cases

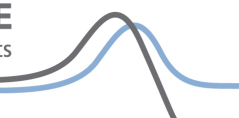


Table 9– Summary Sales - Domestic CH-Boilers and alternative technologies: Policy Scenario Sales (000's)

	Oil Boilers	Gas Regular	Gas Combi	Alt Electric	Alt Gas	Alt Biomass	Total
2010	130	350	1,120	-	-	-	1,600
2020	110	300	1,470	75	65	32	2,060
2030	92	310	1,360	160	130	65	2,120

Table 10 Summary cost and benefit¹² data

	Average annual energy savings (£m)	Average annual product & policy cost increases 2030 (£m)	Net Benefit (2009 – 2030) (£m)	Cost Effectiveness Traded (£/tCO ₂)	Cost Effectiveness Non-traded (£/tCO ₂)
All boilers	723.4	532.8	2900	213.30	13.50

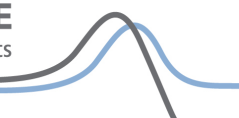
3 Future potential policy & measures

- Policies included in this scenario:
 - Building Regulations Part L1 (and equivalents in Scotland and Northern Ireland)
 - ErP; Ecodesign and labelling of boilers
 - CfSH – Code for Sustainable Homes
 - Warm Front and related devolved administration policies
 - SO (Supplier Obligation) and CESP (Community Energy Saving Programme)

3.1 Building Regulations Part L1 (2010-)

- The first policy to have a major impact on domestic heating, is Building Regulations Part L (and equivalents in Scotland and NI)
- Reductions in predicted CO₂ emissions will occur as a result of planned improvements in Part L1A and 1AB of the current (2006) Building Regulations:
 - 40% reduction of DER over TER by 2013
 - 100% reduction of DER over TER by 2016
- These reductions apply to total regulated energy (space heating, domestic hot water and lighting) in new dwellings. In order to achieve these savings, improvements in “U” value and air tightness alone will not be sufficient. Alternative (low and zero

¹² Refer to BNXS26 Rationale for Policy Cost Estimates used in MTP Policy Briefs for details on factors used.



carbon) technologies such as heat pumps and solar, will be required. These will displace conventional domestic gas and oil boilers.

- In 2010 minimum boiler efficiencies (new and replacement) are expected to increase from a minimum SEDBUK B, to SEDBUK A rating¹³.
- From 2013 fewer conventional domestic boilers are expected to be installed in new-build dwellings a consequence of new Building Regulations¹⁴ encouraging take up of alternative technologies such as heat pumps and solar.
- It is assumed that all new homes will be 'Zero Carbon'¹⁵ from 2016, leading to accelerated up take of alternative technologies.

3.2 ErP Ecodesign and Labelling of Boilers (2011 -)

- The second policy to have a major impact on domestic heating is a regulation on wet heating systems¹⁶ under the Energy related Products (ErP) framework Directive 2005/32/EC. The Directive establishes a framework for the setting of eco-design requirements for energy-using products.
- Proposed timing and performance requirements projected for the ErP policy measures are shown below. These Ecodesign requirements are set out in Annex I of the Working Document¹⁷. Separate minimum system efficiency¹⁸ standards are set for space heating and water heating. A CH-regular boiler will need to comply with the minimum standard for space heating only. A CH-combi boiler will need to comply with both minimum standards.

Table 11 Minimum requirement for the 'system efficiency' % of domestic gas and oil fired Boilers¹⁹ (space heating only)

Size	XXS	XS	S	M	L	XL
<i>From 1 January</i>						
2011	56%	56%	56%	56%	56%	56%
2013	76%	76%	76%	76%	76%	76%

¹³ SEDBUK (Seasonal Efficiency of Domestic Boilers UK) was developed under the UK Government's energy efficiency best practice programme for measuring seasonal (gross) efficiency for individual boilers for use in the UK Building Regulations Part L

¹⁴ Expected to tighten Target Emissions Rate (TER)

¹⁵ <http://www.communities.gov.uk/planningandbuilding/theenvironment/zerocarbonhomes/>

¹⁶ Often referred to simply as 'boilers'

¹⁷ Working document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water heaters – http://www.ebpg.bam.de/de/ebpg_medien/001_workd_08-02_version1.pdf

¹⁸ System efficiency refers to the efficiency achieved by the entire heating and hot water system in serving the needs of the building. It requires modelling the demand of the building to be heated and comparison of that with the fuel required by the boiler and heating system. The methodology used for calculating this is described in Section 4 of this report. See <http://www.ecoboiler.org/>

¹⁹ Working document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water heaters – http://www.ebpg.bam.de/de/ebpg_medien/001_workd_08-02_version1.pdf

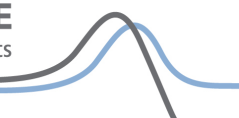


Table 12 Minimum requirement for the ‘system efficiency’ % of gas and oil fired boilers²⁰ (water heating only)

Size	XXS	XS	S	M	L	XL
From 1 January						
2011	16%	17%	18%	23%	26%	31%
2013	24%	27%	30%	44%	50%	58%

- Emissions of NOx from CH Boilers and CH Combis will also be subject to minima, which are currently under discussion.
- Information requirements are optional from the Measure’s entry into force; and compulsory for CH Boilers and CH Combis placed on the market from 1/1/2010²¹.
- For CH boilers up to size XL, manufacturers shall supply:
 - 1) The label (with Energy Efficiency Rating)
 - 2) The information fiche /technical input sheet form (Data report CH-Boilers & Water Heaters from Annex V section B1.
 - 3) NOx ratings
- Applying ErP regulations in the UK will have implications for test standards as shown in table 13.

Table 13: Test Standards

Test Standard name	Date in force	Description	Comments
<i>SEDBUK</i>	2005	Standard tests require certification by a suitably qualified Notified Body (i.e. an independent test house deemed competent under European rules for boiler testing) ²²	Well established UK standard
ErP proposed calculation procedure ²³	Expected 2011	From the 2009 draft of the working document: calculation methodology sets out test conditions required for the derivation of boiler efficiency values for incorporation in the calculation.	Currently under discussion

3.3 Code for Sustainable Homes (from 2010)

- To comply with this guideline, it is expected that new, publicly funded housing in England and Wales is required to achieve 44% (CfSH Level 4) carbon dioxide

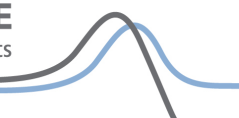
²⁰ Working document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water heaters – http://www.ebpg.bam.de/de/ebpg_medien/001_workd_08-02_version1.pdf

²¹ At time of writing

²² Guidance Notes for Submissions to UK Government’s Boiler Efficiency Database

[http://www.sedbuk.com/download/Solid%20Fuel%20Boiler%20Info%20Pack%20Version%202%20\(October%202007\).pdf](http://www.sedbuk.com/download/Solid%20Fuel%20Boiler%20Info%20Pack%20Version%202%20(October%202007).pdf)

²³ Ecodesign and labelling of boilers. Working Document on possible Ecodesign requirements for boilers. http://ec.europa.eu/energy/efficiency/ecodesign/doc/forum/2009_06_24/2009_06_24_boilers1.pdf



reduction through building fabric and heating efficiency compared to notional building emission rate.

3.4 Warm Front

- Warm Front (England), Home Energy Efficiency Scheme (Wales), Central Heating Programme (Scotland) and the Warm Homes Plus Scheme (Northern Ireland): grants are available primarily or exclusively to those in receipt of certain benefits, for upgrades to efficient central heating systems. In this Policy Scenario, these schemes are assumed to continue beyond the current funding period (e.g. Warm Front's funding is currently approved to 2011).

3.5 Supplier Obligation (2011-) and Community Energy Saving Programme (2009-)

- SO (from 2011, replacement for CERT (Carbon Emissions Reduction Target)) and CESP (from 2009) are assumed to offer a range of measures to reduce energy consumption in the home. This is expected to include support for early replacement of inefficient boilers, advanced controls in heating systems, and direct support for alternative technologies such as heat pumps, biomass boilers and community heating.

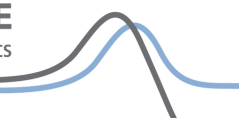
4 Future policies and measures

Table 14 Future potential policies & measures, Policy Scenario

Policy name	Period in force	Description	Impact	Cost	Justification
Building Regulations; Part L 1 (in England and Wales and equivalent in Scotland and Northern Ireland)	From 2010	Specifies minimum SEDBUK efficiency (expressed in gross calorific value). All installed boilers to be A rated.	From 2010 about 15% of the boiler market will be required to increase in efficiency. Subsequent Regulations are expected to lead to advanced controls and greater uptake of alternative technologies	Cost differential between an A and a B rated boiler is about 3%	Forthcoming changes in Building Regulations have been proposed.

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Policy name	Period in force	Description	Impact	Cost	Justification
ErP Ecodesign and Labelling of Boilers; tier one	From 2011	Minimum system efficiency levels are set for all sizes. All boiler systems to be labelled according to energy performance	Assuming Part L is in force in 2010 (SEDBUK A), ErP 2011 minimum standards will have no impact on heating or hot water. Labelling expected to pull some of the market to higher efficiencies.	No cost	Proposals currently under negotiation at the EU level; UK implementation (tier one) expected in 2011
ErP; tier two	From 2013	Minimum system efficiency levels are set for all boiler sizes.	Likely to affect entire boiler market	Cost premium estimated at 30%	Proposals currently under negotiation at the EU level; UK implementation (tier tier) expected in 2013
Code for sustainable homes	From 2010	To encourage best practice and indicate direction of future	Improvements over Part L 2006: * 10% ** 18% *** 25% **** 44% ***** 100% ***** Zero Carbon	Not estimated	England and Wales target in order to reduce country's CO ₂ emissions.

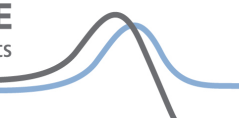
4.1 Policy timeline

The following policy timeline identifies when policies come into effect, including future revisions.

Table 15 Policy timelines for the Policy Scenario

Policy name	Current specification in force	2009	2010	2011	2012	2013	2014	2015-30
Part L	2006		estimate			estimate		estimate (2016)
ErP	no			estimate		estimate		

- Note the Feed-in Tariff (FIT) and Renewable Heat Incentive (RHI) were not factored into the modelling.



5 Efficiency

5.1 Summary

- Average system efficiency in the policy scenario is expected to improve significantly, primarily driven by new and replacement system requirements under ErP (second tier; 2013). Labelling, Code for Sustainable Homes, the Supplier Obligation and other supporting policies offer greater support for the take up of alternative technologies.
- See Section 4.1 of BNDH B02: Domestic Boilers Government Standards Evidence Base 2009: Reference Scenario, for description of general approach to modelling system efficiency

Table 16 Summary - Average system efficiency sold – all scenarios

Scenario	Average heating system efficiency		
	Reference	Policy	BAT
2010	0.57	0.59	0.93
2020	0.59	0.70	0.92
2030	0.60	0.75	0.92



Figure 3 - Summary - Average system efficiency sold – all scenarios

5.1.1 Building Regulations Part L (2010-), ErP (2011-2013)

- Part L is expected to require that boilers achieve a minimum boiler efficiency of SEDBUK 90% (space heating). A boiler meeting this efficiency is expected to surpass the ErP 2011 space heating minimum system efficiency of 56%. In addition, ErP requires minimum efficiencies for domestic hot water (these vary according to the size of the boiler – see Table 12). However boilers meeting Part L are also expected to meet these requirements. Therefore due to Part L 2010, ErP 2011 is expected to have no impact.

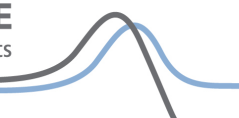
5.1.2 Labelling (2011-)

- The ErP energy efficiency rating is applied to a boiler when it achieves target “system efficiency”. The CH Boilers Energy Efficiency Rating Scale proposed is described below. Product information requirements are currently intended to be compulsory for CH-boilers, Water Heaters and CH-combis.

Table 17– CH Boilers Energy Efficiency Labelling Scale²⁴

“System efficiency” of CH-Boilers “I”	Energy efficiency label	
	Smaller CH-boilers	Larger CH-boilers
I ≥ 120%	A+++	A+++

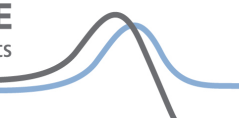
²⁴ Working document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water heaters – http://www.ebpg.bam.de/de/ebpg_medien/001_workd_08-02_version1.pdf. Labelling Scale may change prior to implementation.



"System efficiency" of CH-Boilers "I"	Energy efficiency label	
120% > I ≥ 104%	A++	A++
104% > I ≥ 88%	A+	A+
88% > I ≥ 80%	A	A
80% > I ≥ 72%	B	B
72% > I ≥ 64%	C	C
64% > I ≥ 56%	D	D
56% > I ≥ 48%	E	E
48% > I ≥ 40%	F	F
40% > I	G	G

5.1.3 ErP 2013

- Using the minimum ErP efficiency standards for the separate provision of space heating and hot water, a combined overall weighted average heating system efficiency was calculated. For 2013, (space heating efficiency 76%, water heating efficiency 44%) a typical, weighted average for heating system efficiency is 65%.
- In order to meet this efficiency it was assumed that a SEDBUK A rated boiler of approximately 92% efficiency was used (this is about the best on the market currently) with advanced controls (selected from Ecoboiler) chosen specifically to achieve the 76% space heating efficiency. These include modulating burner with 15% turn-down, auto-timer, electronic optimizer and a good standard of TRVs or PID zone valve control.
- For CH- boilers up to XL manufacturers shall supply the following information:
Copies of:
 - 1) The label (with energy efficiency Rating)
 - 2) The information Fiche /Technical input sheet form
 - 3) NO_x ratings



5.1.4 CfSH – Code for Sustainable Homes

- CfSH Level 4 is assumed to improve the efficiency of heating systems beyond minimum standards required under Part L Building Regulations and ErP.
- Only heating system-related savings achieved by this policy are attributed to the Policy Scenario

5.1.5 Warm Front (and equivalent in devolved nations)

- Warm Front is assumed to improve the efficiency and increase the take up of heating systems beyond minimum standards required under Part L Building Regulations and ErP.
- Only heating system-related savings achieved by this policy are attributed to the Policy Scenario

5.1.6 SO (Supplier Obligation) and CESP

- These two policy instruments are assumed to improve the efficiency and increase the take up of heating systems beyond minimum standards required under Part L Building Regulations and ErP.
- Only heating system-related savings achieved by these policies are attributed to the Policy Scenario

1.1 Data sources – efficiency

Table 18 Efficiency data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
2010-2013	SEDBUK	2008	various	Demanded by draft Part L Building Regulation	High
2010-2013	www.ecoboiler.org	2007	VHK	Used to calculate system efficiency based on UK housing stock and SEDBUK A boilers	High
2010-2013	The UK Housing Stock 2005 to 2050:	2005	Environmental Change	Used with the Ecoboiler	High

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Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
	Assumptions used in Scenarios and Sensitivity Analysis in UKDCM2.		Institute - UK	model to generate system efficiency for UK housing stock.	
2013	Working document on possible Ecodesign Energy labelling and Installation requirements for Boilers and Water Heaters	2008	European Commission	This policy dominates for sales of new boilers from 2013	High

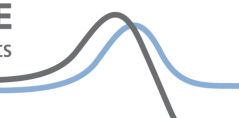
Note: Historic data sources are included in BNDH B02: Domestic Boilers Government Standards Evidence Base 2009: Reference Scenario

5.2 Methodology & key assumptions – efficiency

- The MTP boiler model (2009) uses the Eco boiler model, with the thermal properties of existing housing stock normalised as for the reference scenario (which was compared with the annual domestic energy demand for space heating and hot water published in DUKES), but in a form that meets the data input requirements of Eco boiler.

Table 19 Summary Policy system efficiency – by technology type (%)

Product	2010	2020	2030
Oil Boilers	56	65	65
Gas Regular Boilers	58	65	65
Gas Combi Boilers	60	65	65
Alt - Electric	160	160	160
Alt – Gas systems	110	110	110
Alt - Biomass	70	70	70



- The proportion of alternative technology ‘boilers’ sold is substantially higher than for the Reference Scenario after 2010, due to the influence of policies such as Building Regulations, ErP, the CfSH, Warm Front and Supplier Obligation.

5.2.1 Future data

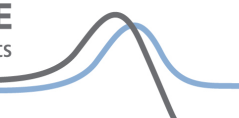
Table 20 Extrapolation & background calculations – efficiency

Year	Methodology & assumptions
2009-2030	Input from EcoBoiler elaborated in MTP Boiler Model (2009) and averaged, based on sales and boiler size
2009 - 2013	Efficiencies for conventional boilers installed in this period based on SEDBUK A, with appropriate controls to meet the expected requirements of Part L of Building Regulations 2010
2013 - 2030	Efficiencies and control arrangements for conventional boilers and installed in this period are matched to the expected requirements of the ErP measure described above
2009 - 2030	Efficiencies for alternative technologies are as described in Table 17.
2009 - 2030	Water heating requirements for these boilers are included within the EcoBoiler calculation methodology

5.3 Data issues – efficiency

Table 21 Data issues – efficiency

Issue/risk	Approach taken/rationale
Key efficiency values are taken from draft policy documents. These values may change before policy implementation	Most recent draft documents used at time of modelling
In some cases (e.g. Part L) policy efficiency metrics used are dissimilar to those required by EcoBoiler v5b	Policy metrics (e.g. boiler efficiency) augmented with reasonable assumptions (e.g. about controls, radiators) to complete EcoBoiler input parameters
Boiler Efficiency values from SEDBUK do not match those required for the EcoBoiler model	In keeping with default boiler efficiency values in EcoBoiler, boiler efficiency at full and part load has been taken to be the same. For condensing boilers, the boiler efficiency under non-condensing operation has been taken as 6 percentage points lower than in condensing mode based on a comparison of SEDBUK efficiencies for condensing and non-condensing boilers.
Difficulties assigning specific heating systems to each identified dwelling type.	Resolved by inspection of the heating and hot water demands of different types of property against the ErP categories of boiler size.



1.2 Confidence level – efficiency

Data quantity / size of data set	HIGH		
	LOW		
		LOW	HIGH
		Source integrity / robustness of data	

Figure 4 Confidence indicator for efficiency data

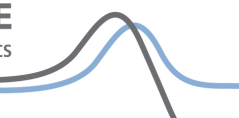
6 Cost

6.1 Summary

- The costs presented in this section consist of product purchase prices, and relate to the industry/consumer costs associated with product efficiency requirement due to new Part L Building Regulations from 2010, and ErP from 2011 and 2013 only.
- Conventional²⁵ boilers: there are inconsistencies between Part L cost data which is UK derived, and ErP data, which is EU derived, viz.
- Part L 2010:
 - The estimated average cost of a boiler sold in the Reference Scenario is £860
 - The average cost of a boiler sold due to implementation of Part L 2010 is **£883**
 - Installation costs are the same in both cases
 - The average additional cost of Part L 2010 is therefore **£25²⁶**
- ErP 2011 and 2013
 - Part L 2010 satisfies ErP 2011 requirements. Therefore, no additional costs to the consumer/industry are anticipated in 2011 due to ErP
 - Additional costs due to ErP 2013 are derived from EU-wide averages found in the Boilers preparatory study and are to be **treated with caution**.
 - As EU-wide absolute costs were not comparable to the UK, the EU-wide percentage increase in costs (40%) due to ErP 2013 was applied to the Part L 2010 average UK unit cost instead.
 - The average cost of a boiler sold due to implementation of ErP 2013 is **£1,239**

²⁵ Includes regular gas, combi gas, and oil boilers

²⁶ This is low because approximately 85% of boilers currently sold (in the reference scenario) conform with Part L 2010 (SEDBUK A)

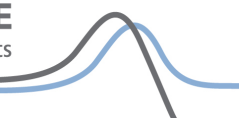


- The average additional cost of ErP 2013 is therefore **£354**
- Alternative technologies: Costs of alternative technologies are not expected to increase under the Policy Scenario. Estimated average cost (installed) for each of the alternative technologies are as follows:
 - Alternative Gas: **£4,138**
 - Alternative Electric: **£2,759**
 - Alternative Biomass: **£1,406**

6.2 Data sources – Cost

Table 22 Cost data sources

Year	Reference	Reference date	Author	Justification	Confidence in sources (High/Low)
Part L Building Regulations 2010					
2009-2030	Web sources: http://boiler-sales.co.uk http://www.discountedheating.co.uk http://www.boilers2go.co.uk http://www.tradeplumbing.co.uk https://www.plumb-point.co.uk	May 2009	n/a	Best available data	High
ErP 2013					
2013-2030	Preparatory Study on Eco-design of Boilers: Task 6 Design Options	September 2007	Van Holsteijn en Kemna (VHK)	Best available cost data	Low
Alternative technologies					
2008	The European Heating Product Markets (2008 Update) United Kingdom	2008	BRG Consult	Heat pumps, solid fuel boiler: Credible source	Low



6.3 Methodology & key assumptions – Cost

6.3.1 Conventional Boilers

Part L Building Regulations (2010)

- In the Reference Scenario, Part L 2006 requires virtually all conventional boilers sold to be minimum SEDBUK B rated. However most (~85%) sold are A rated.
- Part L 2010 requires all conventional boilers sold to be SEDBUK A rated. Therefore the impact of Part L 2010 is limited to a minority of the market (~15%) not already A rated
- The average Reference cost is based on the cost of typical SEDBUK A and SEDBUK B boilers, sales-weighted according to 2008-2009 HHIC sales data (approximately 85% and 15% respectively) - estimated for all conventional boilers as **£858**.
- The average Policy cost of Part L 2010 is the average cost of SEDBUK A rated boilers only – estimated for all conventional boilers as **£883**.
- Installation costs are assumed to be the same in both cases
- The average additional cost to consumers/industry, due to Part L is therefore £25 per boiler, or 3%

Energy related Products Directive, 2011

- 2011: Part L Building Regulations 2010 meet ErP 2011 system efficiency requirement of 56%. Therefore no additional cost to industry/consumer is assumed.

Energy related Products Directive 2013

- Cost data for ErP is taken from ErP Preparatory Study on Ecodesign of Boilers Task 6, which estimates the additional cost of ErP 2013.
- However, 'base case' costs are weighted according the features of boilers sold across the EU, which differ to the UK (e.g 25% of EU boilers sold are condensing; in the UK this share is close to 100%)²⁷
- Consequently ErP base case costs differ to the Reference scenario costs used to evaluate Part L 2010, and **are to be treated with caution**.
- The table below shows the expected increase in both product and installation costs, due to ErP 2013, over the ErP base case

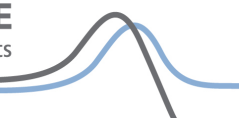
Table 23 Conventional boiler product price and installation costs for Reference Scenario and ErP 2013 requirements weighted by % sales.

All Boilers	ErP 2013	Base Case
Installation cost	£1,266.55	£1,177.52

²⁷ For more detail see Eco Design Boilers, Task 6, Final, 30 September 2007, VHK for European Commission, p3

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All Boilers	ErP 2013	Base Case
Purchase price	£2,429.86	£1,457.01
	£3,696.41	£2,634.53
Additional cost compared to Base Case	£1,061.88	
Additional cost compared to Base Case [%]	40%	

- The table below lists the design options used, for both the Base case and BAT Scenario, to determine cost:

Table 24 Design options selected to derive base case costs

ErP Size	Design Option ²⁸	Efficiency	Steady state efficiency %	Controls			
				auto timer control	valve control	boiler temperature control	electronic optimiser
XXS	1	53%	80/80/80/80	yes	TRV 2K	on/off RT	no
XS/S	1	52%	80/80/80/80	yes	TRV 2K	on/off RT	no
M	1	54%	80/80/80/80	yes	TRV 2K	on/off RT	no
L	1	55%	80/80/80/80	yes	TRV 2K	on/off RT	no
XL	2	58%	80/80/80/80	yes	TRV 2K	fixed BT	no

Table 25 Design options selected to derive ErP 2013 policy costs

ErP Size	Design Option ²⁹	Efficiency	Steady state efficiency %	Controls			
				auto timer control	valve control	boiler temperature control	electronic optimiser
XXS	4	77%	89/89/97/97	yes	TRV 2K	modulating RT	yes
XS/S	4	75%	89/89/97/97	yes	TRV 2K	modulating RT	yes
M	4	74%	89/89/97/97	yes	TRV 2K	modulating RT	yes
L	5	74%	89/89/97/97	yes	motor and PID-loop	weather control BT	yes
XL	6	77%	89/89/97/97	yes	motor and PID-loop	weather control BT	yes

- NB: Cost data for alternative technologies was not obtained in sufficient detail to present here.
- It is possible that costs will reduce in the future as more sophisticated controls become available in the market and development costs are recovered. However, this has not been accounted within the model.

²⁸ Eco Design Boilers, Task 6, Final, 30 September 2007, VHK for European Commission

²⁹ Eco Design Boilers, Task 6, Final, 30 September 2007, VHK for European Commission

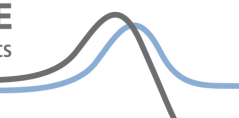


Table 26 Extrapolation & background calculations – cost

Year	Methodology & assumptions
2010 - 2012	The average product purchase prices for Building Regulations Part L 2010 have been taken from internet sources and derived from sales volume. The policy cost was determined as the difference between the sales-weighted average cost of SEDBUK A (85%) and SEDBUK B (15%) boilers, and the 'typical' cost of SEDBUK A boiler
2013-2030	The weighted average cost of a base case and ErP 2013 (76% efficiency) has been derived from the ErP Preparatory Study, Eco Design Boilers, Task 6.

6.3.2 Alternative technologies

- Cost data for alternative technologies are particularly sparse: market data was not obtained for some technologies which have yet to reach market (e.g. gas-driven heat pumps, mCHP).
- Due to the lack of confidence in data, the cost impacts of switching from conventional alternative technologies are not modelled in detail.
- Impacts under the Policy Scenario are confined to encouraging switching from conventional boilers to alternative technologies: the efficiencies of alternative technologies are not projected to improve in the Policy Scenario. Consequently the relevant cost comparison is between Reference Scenario conventional boiler costs, and alternative technology costs.
- Marginal costs are assumed to fall by 18% for every doubling of these markets.

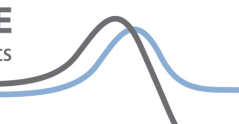
Table 27 Alternative technology - absolute cost estimates 2011

Technology group	Product	Cost (£)
Alternative Gas	Gas Heat Pump	4,138
Alternative Electric	Electric Heat Pump	2,759
Alternative Biomass	Solid fuel boiler	1,406

6.4 Data issues – cost

Table 28 Data issues – cost

Issue/risk	Approach taken/rationale
Cost data associated with Part L Building Regulations 2010 are from internet sources. Risk associated with variation between retailers and small data set.	Desk based research for retail price data, taken from boiler retailers' websites as the only source available.



Issue/risk	Approach taken/rationale
ErP 2013 cost data derived from ErP Preparatory Study: Task 6 Design Options - which is not UK specific. The specification of ErP Base case boilers differ to those of the MTP Reference Scenario	Average European cost data used as this is the only available data identified to represent the cost associated with reaching the 76% product efficiency requirements of ErP 2013.
ErP cost data provided from source in Euros	Converted to GBP using conversion factor derived from 03/04/09 – 0.9126 for consistency with other GSBNs.
The cost differential for more efficient products is likely to reduce in time as the market for them increases and the technologies mature	The data is too uncertain at the present to predict this as present so constant costs have been assumed.

6.5 Confidence level – cost

- Overall confidence level is low due to quantity of cost data sources identified and level of variation in cost between retailers and the European average cost derived from the ErP Preparatory Study.

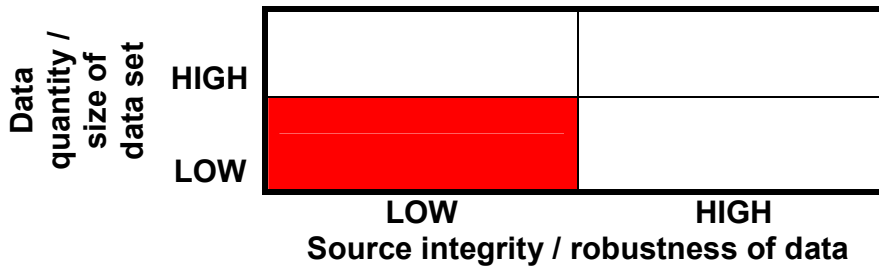
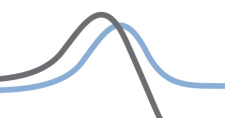


Figure 5 Confidence indicator for cost data



Related MTP information

- BNDH B01: Domestic Central Heating Government Standards Evidence Base 2009: Key Inputs
- BNDH B02: Domestic Central Heating Government Standards Evidence Base 2009: Reference Scenario
- BNDH B04: Domestic Central Heating Government Standards Evidence Base 2009: BAT Scenario
- BNDH KO01: Domestic Central Heating Government Standards Evidence Base 2009: Key outputs

Changes from version 1.0

- Table 10 (cost effectiveness) updated
- Data in table 6 completed
- Summary data on alternative technology costs added
- Minor changes to the template

Consultation and further information

Stakeholders are encouraged to review this document and provide suggestions that may improve the quality of information provided, email info@mtprog.com quoting the document reference, or call the MTP enquiry line on +44 (0) 845 600 8951.

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