9 Policy Recommendations

9.1 Analysing the Impact of Policy

The impact of the policy options being considered for new development has been tested by considering the energy strategies that may be proposed for the typical case study developments (Table 8.4, Chapter 8) to demonstrate compliance. The model developed for this study compares a range of technology options and selects the cheapest option (in terms of capital cost) which will comply with the target in question. The modelling approach is described in detail in Appendix B

The impact of each policy, in terms of technologies selected, CO_2 emissions saved and cost per unit of development, depends on which year a development comes forward for planning permission and which energy opportunities are available.

The results are summarised for each of the case study development types in this chapter, comparing the potential outcomes in each of the case studies and for each of the policy options proposed.

Note: The technologies listed in the model outputs are only proposals for technologies/technology mixes that could be viable in order to meet the policy target. These are for reference only and may not always be exhaustive. The Energy Opportunities Plan should be cross-checked against all development locations and used to make recommendations on the energy strategy for that site.

9.2 Summary of Policy Testing and Analysis

The following pages summarise the results of the modelling for the 20 case study development types. They set out an indicative technology choice to comply with the policy option in place at the time, together with the associated cost and percentage CO_2 saving over and above the Building Regulations requirement. The results are given for each policy and for each step change in the Building Regulations requirements (2010, 2014, 2016, 2019).

The RLC technologies are described in Appendix C, whilst details of the modelling approach and the assumptions used are explained in Appendix B. An explanation of the role of “EE1” and “EE2” is also provide in Appendix B.

.

9.3 Case Study x – Explanatory example

- Development type: Housing – small city infill
- Development size: Provides information about development size in terms of numbers of dwellings and sqm of non-residential
- Source: Stipulates where case study development originated

Discussion

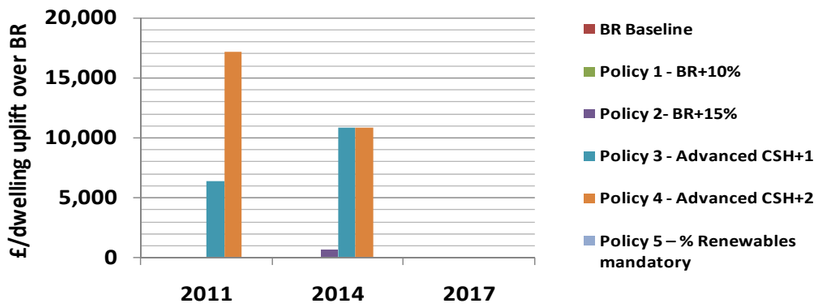

Figure 9.1a - capital cost uplift of Policy Options above BR baseline (Case Study x)

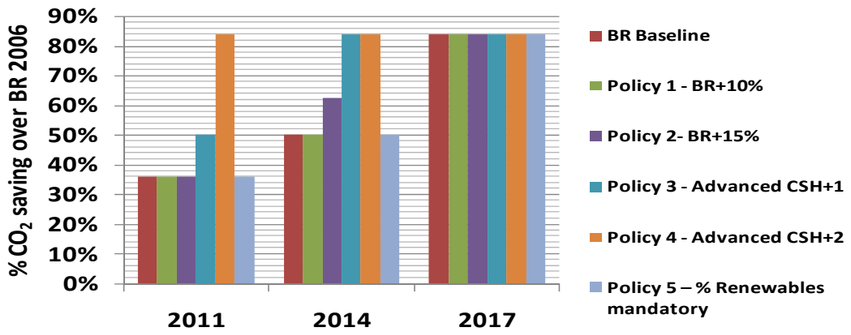

Figure 9.1b - %CO_2 saving above BR 2006

Where the same technology option as the Building Regulations baseline is chosen by the model to comply with a policy, (e.g. solar water heating +EE1), with the same capital cost and CO_2 saving, this does not mean that the capital cost and CO_2 saving cannot vary for the given technology option. Rather, it is assumed that a standard sized module (e.g. standard sized solar panel) would be installed to meet Building Regulations, regardless of whether the size of installation exceeded Building Regulations requirements, rather than opting for a bespoke panel size to just comply Building Regulations. In other words, technologies or approaches adopted by developers to achieve Building Regulations compliance may give greater than 'necessary' CO_2 savings.

For graphs that show £/sqm uplift and £/dwelling uplift over Building Regulations, if no capital cost uplift is given, this means that the modelling shows that there is no cost uplift required to meet the given policy.

'Allowable solutions' contributions – although there is no certainty around the final list of solutions it is assumed that there will be a pathway to allow all development types to achieve CO_2 reductions in excess of the 70% 'carbon compliance' that will be required below the equivalent PartL of Building Regulations 2006.

DOMESTIC	Year*	BR (2006) Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011	Lowest Capital Cost Technology Option that complies with BR policy in 2011
	2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014	Lowest Capital Cost Technology Option that complies with BR policy in 2014
	2017	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi	ZeroCarbon all policies to comply with BR (ZeroCarbon is 2019 for non-resi
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006
	2014	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006
	2017	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006	% regulated CO_2 reduction over PartL of BR2006
£/dwelling uplift over BR Baseline	2011	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy
	2014	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy	Capital cost uplift over BR cost required to meet Policy
	2017	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon
£/tonne CO_2 uplift	2011	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved
	2014	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved	Capital cost of technology option/tonnes CO_2 saved
	2017	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon	ZeroCarbon

9.4 Case Study 1

- Development type: Housing – small city infill
- Development size: 1 house
- Source: Notional

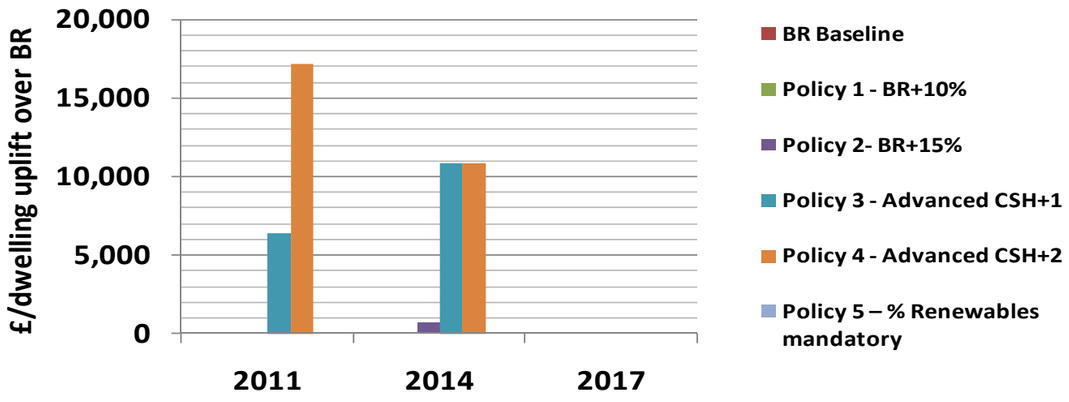

Figure 9.2b - capital cost uplift of Policy Options above BR baseline (Case Study 1)

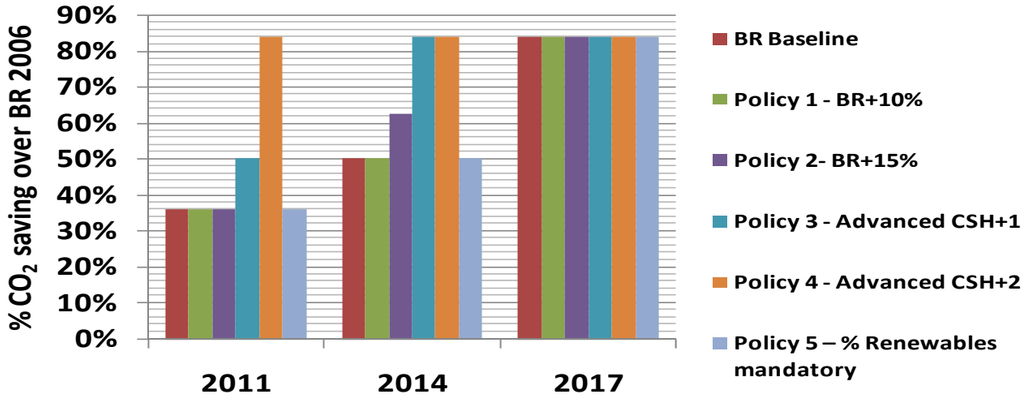

Figure 9.2b - %CO_2 saving above BR 2006

Discussion

Policy 1 has no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 2 shows a modest cost uplift in 2014 over BR (at 2011 the CO_2 savings are the same as BR 2006). It can be surmised therefore that Policies 1 and 2 will require little or no capital cost increase over BR for this type of development.

Policies 3 and 4 however show cost uplifts of approximately £6,000 and £17,000 respectively in 2011 and approximately £10,000 each in 2014.

Policy 5 costs the same and saves the same amount of CO_2 as BR. This is because a renewable technology makes a significant contribution to meeting BR in the years up to 2017.

DOMESTIC Case Study1	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	PV - medium installation + EE1	PV (maximum) + EE1 + Allowable Solutions Contribution	Solar Water Heating + EE1
	2014	PV - medium installation + EE1	PV - medium installation + EE1	PV - medium installation + EE2	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution	PV - medium installation + EE1
	2017	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution	PV (maximum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	36%	36%	36%	50%	84%	36%
	2014	50%	50%	62%	84%	84%	50%
	2017	84%	84%	84%	84%	84%	84%
£/dwelling uplift over BR Baseline	2011	0	0	0	6,361	17,199	0
	2014	0	0	708	10,839	10,839	0
	2017	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	20,510	16,347	0
	2014	0	0	2,695	14,608	14,608	0
	2017	0	0	0	0	0	0

Table 9.2 - Case Study 1 Results Summary

9.5 Case Study 2

- Development type: Housing – small rural
- Development size: 1 house
- Source: Local authority

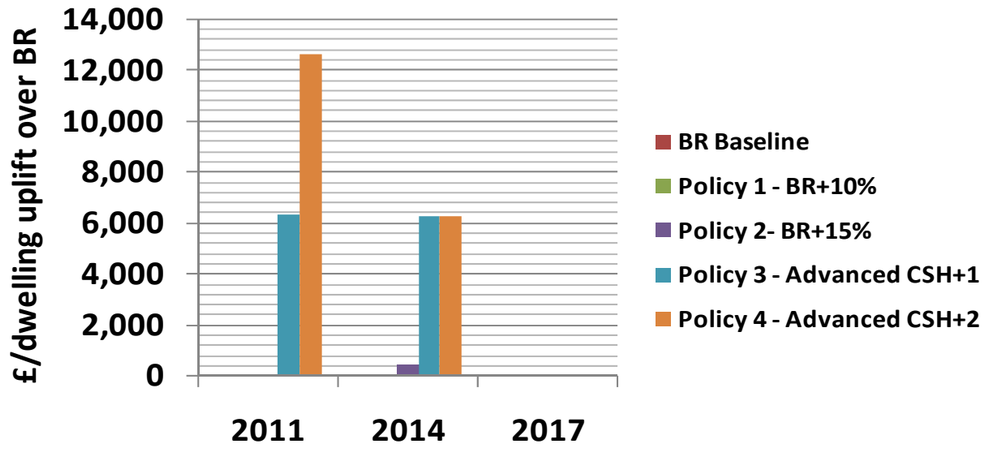

Figure 9.3a capital cost uplift of Policy Options above BR baseline (Case Study 2)

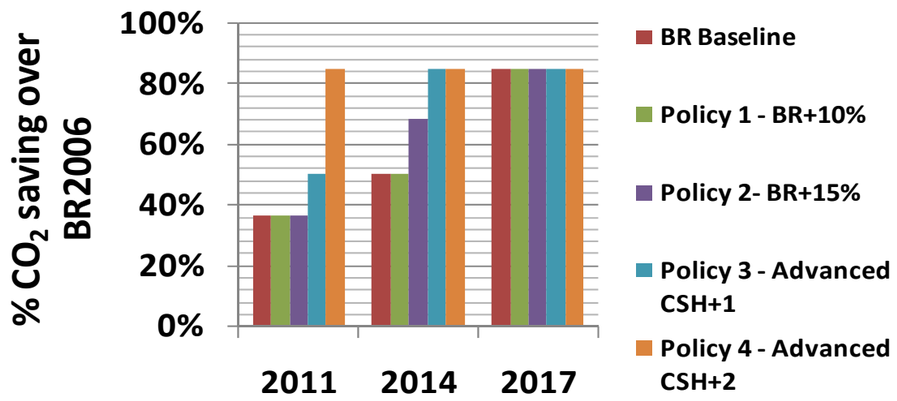

Figure 9.3b %CO_2 saving above BR 2006

Discussion

Policy 1 has no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 2 shows a modest cost uplift in 2014 over BR (at 2011 the CO_2 savings are the same as BR 2006). It can be surmised therefore that Policies 1 and 2 will require little or no capital cost increase over BR for this type of development.

Policies 3 and 4 however show cost uplifts of approximately £6,000 and £13,000 respectively in 2010 and approximately £6,000 each in 2014.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Policy 5 has not been tested for this case study.

DOMESTIC Case Study2	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	PV - medium installation + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2014	PV - medium installation + EE1	PV - medium installation + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	36%	36%	36%	50%	85%
	2014	50%	50%	68%	85%	85%
	2017	85%	85%	85%	85%	85%
£/dwelling uplift over BR Baseline	2011	0	0	0	6,361	12,635
	2014	0	0	402	6,275	6,275
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	20,510	11,760
	2014	0	0	1,022	8,209	8,209
	2017	0	0	0	0	0

Table 9.3 - Case Study 2 Results Summary

9.6 Case Study 3

- Development type: Housing – small city infill
- Development size: 10 flats
- Source: Local authority

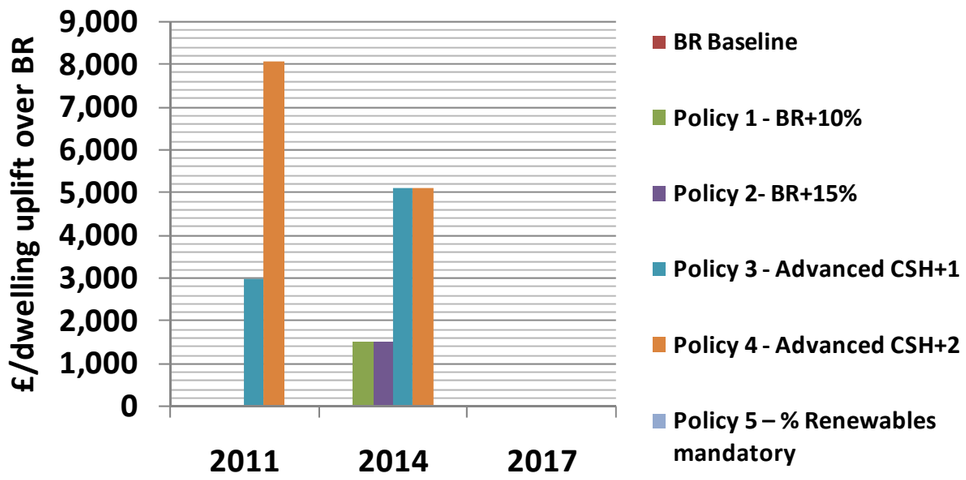

Figure 9.4a capital cost uplift of Policy Options above BR baseline (Case Study 3)

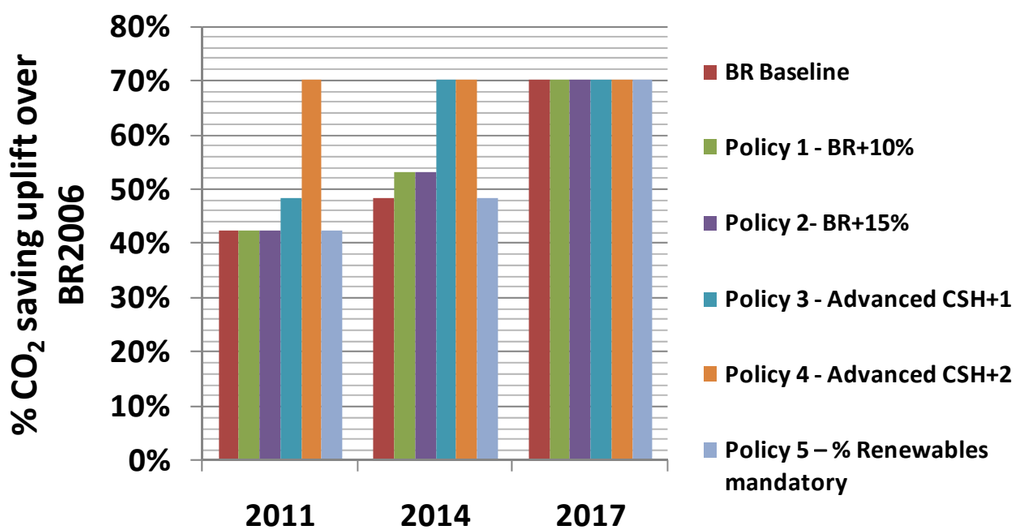

Figure 9.4b %CO_2 saving above BR 2006

Discussion

Policies 1 and 2 have no cost uplift over BR in 2011(since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement), but show a modest cost uplift of £1,500 per dwelling in 2014. Policy 3 shows a cost uplift of £3,000 in 2011 and an uplift of £5,000 in 2014. Policy 4 shows a capital cost uplift of £8,000 per dwelling in 2011 and an uplift of £5,000 in 2014.

Policy 5 costs the same and saves the same amount of CO_2 as BR. This is because a renewable technology makes a significant contribution to meeting BR in the years up to 2017.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study3	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	PV - maximum installation + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Solar Water Heating + EE1
	2014	PV - maximum installation + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	PV - maximum installation + EE1
	2017	Biomass heating + PV (medium) + EE1 + Allowable Solutions	Biomass heating + PV (medium) + EE1 + Allowable Solutions	Biomass heating + PV (medium) + EE1 + Allowable Solutions	Biomass heating + PV (medium) + EE1 + Allowable Solutions	Biomass heating + PV (medium) + EE1 + Allowable Solutions	Biomass heating + PV (medium) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	42%	42%	42%	48%	70%	42%
	2014	48%	53%	53%	70%	70%	48%
	2017	70%	70%	70%	70%	70%	70%
£/dwelling uplift over BR Baseline	2011	0	0	0	2,970	8,073	0
	2014	0	1,518	1,518	5,103	5,103	0
	2017	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	37,421	22,647	0
	2014	0	25,911	25,911	18,415	18,415	0
	2017	0	0	0	0	0	0

Table 9.4 - Case Study3 Results Summary

9.7 Case Study 4

- Development type: Housing – small rural
- Development size: 10 flats
- Source: Local authority

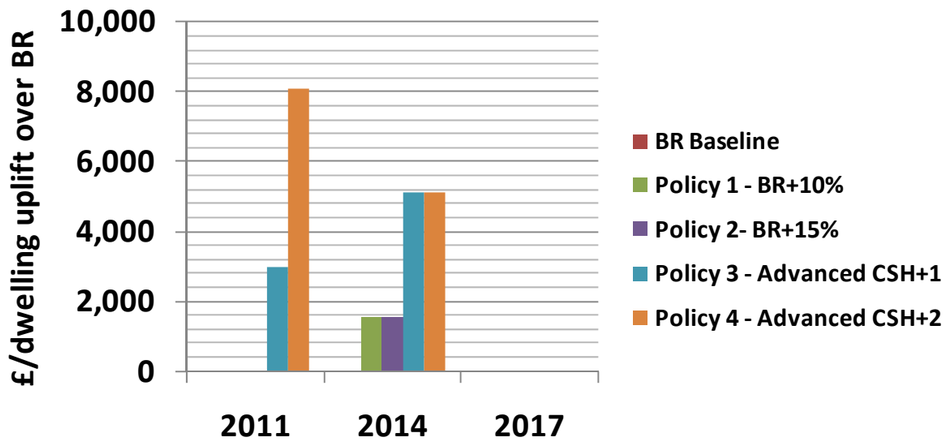

Figure 9.5a capital cost uplift of Policy Options above BR baseline (Case Study 4)

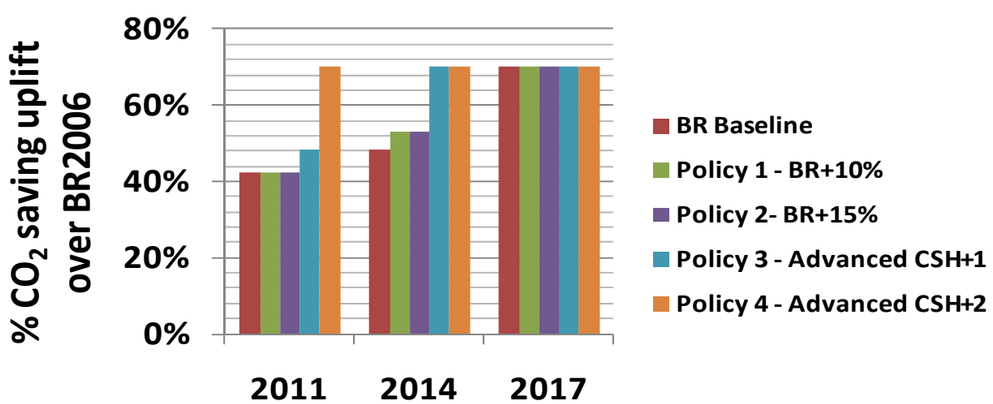

Figure 9.5b %CO_2 saving above BR 2006

Discussion

Policies 1 and 2 show a relatively small cost uplift of about £1,500 in 2014, otherwise the costs of these policies are the same as the BR baseline.

Policies 3 and 4 however show cost uplifts of approximately £3,000 and £8,000 respectively in 2011 and approximately £5,000 for both in 2013.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR. The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

Policy 5 has not been tested for this case study.

DOMESTIC Case Study 4	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	PV - maximum installation + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution
	2014	PV - maximum installation + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	42%	42%	42%	48%	70%
	2014	48%	53%	53%	70%	70%
	2017	70%	70%	70%	70%	70%
£/dwelling uplift over BR Baseline	2011	0	0	0	2,970	8,073
	2014	0	1,518	1,518	5,103	5,103
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	37,421	22,645
	2014	0	25,911	25,911	18,413	18,413
	2017	0	0	0	0	0

Table 9.5 - Case Study4 Results Summary

9.8 Case Study 5

- Development type: Housing – small rural
- Development size: 10 houses
- Source: Local authority

Discussion

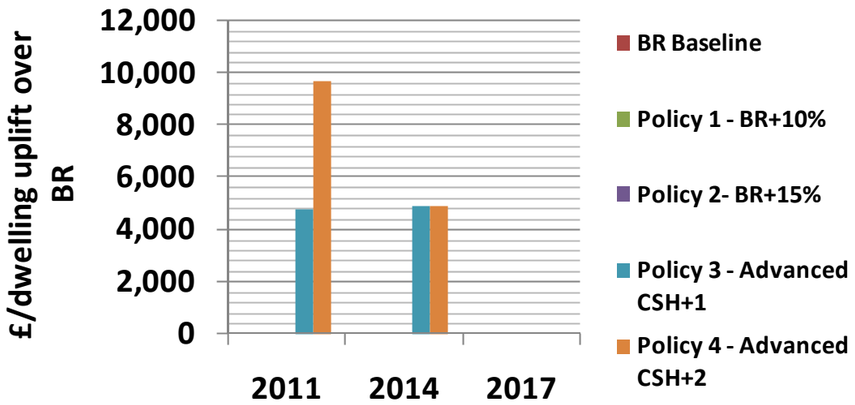

Figure 9.6a capital cost uplift of Policy Options above BR baseline (Case Study 5)

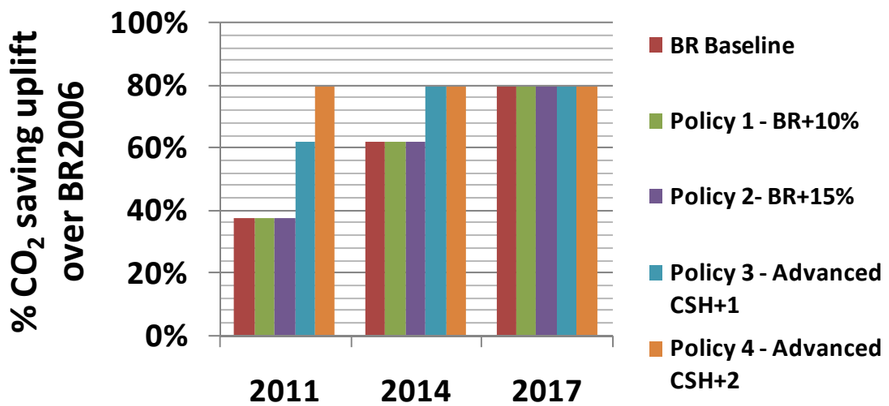

Figure 9.6b %CO_2 saving above BR 2006

Policies 1 and 2 show no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 3 shows a cost uplift over BR of approximately £5,000 per dwelling in 2014 and 2014. Although there is no cost uplift over BR for Policies 1 and 2, there is also no additional benefit in terms of CO_2 reduction.

Policy 4 shows a cost uplift of approximately £9,000 and £5,000 respectively in 2011 and 2014.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

Policy 5 has not been tested for this case study.

DOMESTIC Case Study5	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	38%	38%	38%	62%	80%
	2014	62%	62%	62%	80%	80%
	2017	80%	80%	80%	80%	80%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,793	9,725
	2014	0	0	0	4,931	4,931
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	11,761	13,800
	2014	0	0	0	16,596	16,596
	2017	0	0	0	0	0

Table 9.6 - Case Study5 Results Summary

9.9 Case Study 6

- Development type: Housing – small city infill
- Development size: 10 houses
- Source: Local authority

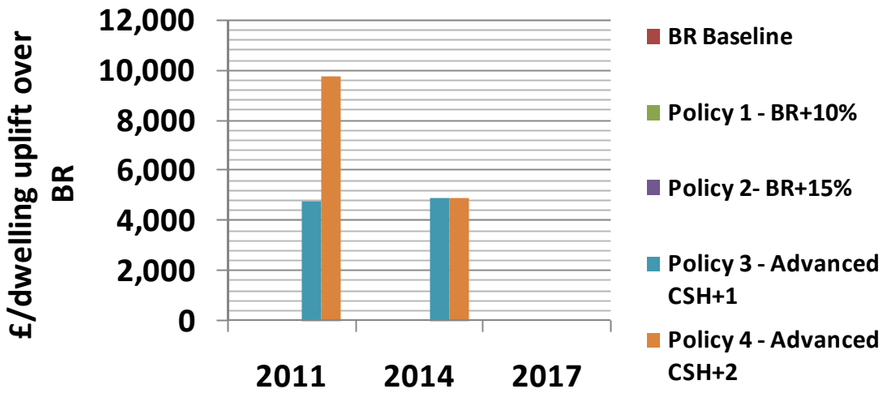

Figure 9.7a -capital cost uplift of Policy Options above BR baseline (Case Study 6)

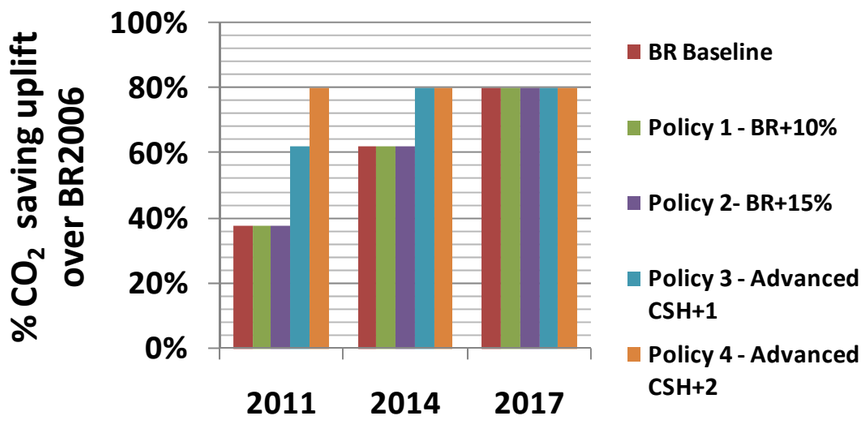

Figure 9.7b-%CO_2 saving above BR 2006

Discussion

Policies 1 and 2 show no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 3 shows a cost uplift over BR of approximately £5,000 per dwelling in 2014 and 2014. Although there is no cost uplift over BR for Policies 1 and 2, there is also no additional benefit in terms of CO_2 reduction.

Policy 4 shows a cost uplift of approximately £9,000 and £5,000 respectively in 2011 and 2014. Policy 5 has not been tested for this case study.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study6	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	PV - maximum installation + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Solar Water Heating + EE1
	2014	PV - maximum installation + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	PV - maximum installation + EE1
	2017	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (medium) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	42%	42%	42%	48%	70%	42%
	2014	48%	53%	53%	70%	70%	48%
	2017	70%	70%	70%	70%	70%	70%
£/dwelling uplift over BR Baseline	2011	0	0	0	2,970	7,133	0
	2014	0	1,518	1,518	4,163	4,163	0
	2017	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	37,421	20,008	0
	2014	0	25,911	25,911	15,022	15,022	0
	2017	0	0	0	0	0	0

Table 9.7 - Case Study6 Results Summary

Case Study 7

- Development type: Housing – medium mixed rural
- Development size: 50 flats and houses (25 flats and 25 houses)
- Source: Local authority

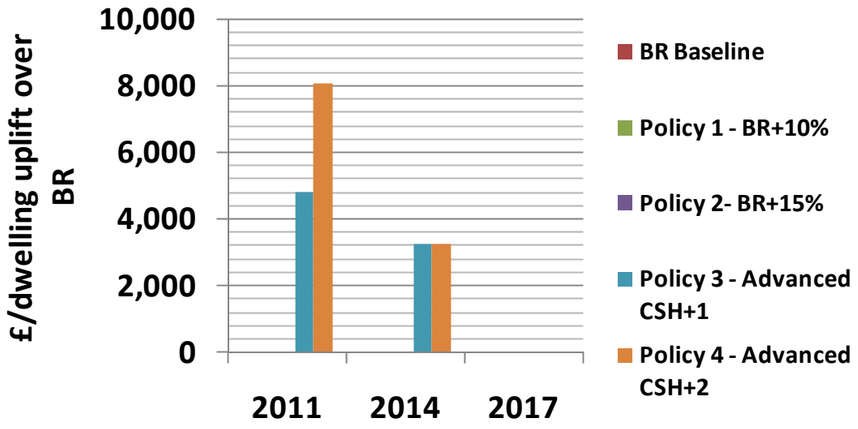

Figure 9.8a- capital cost uplift of Policy Options above BR baseline (Case Study 7)

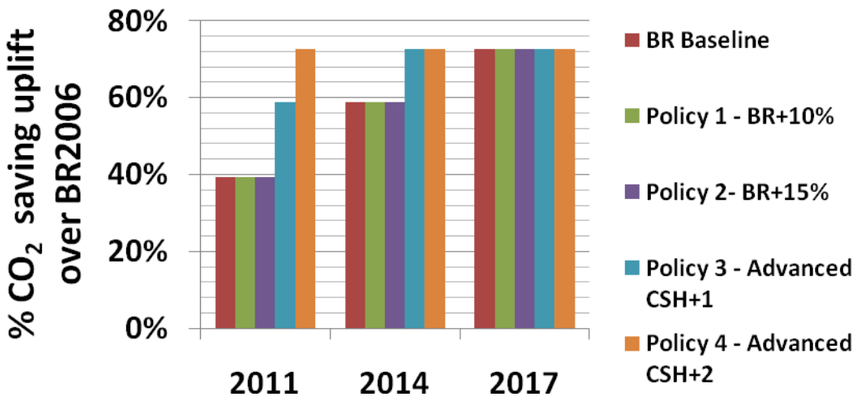

Figure 9.8b %CO_2 saving above BR 2006

Discussion

Policies 1 and 2 show no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 3 shows a cost uplift over BR of approximately £5,000 per dwelling in 2011 and £3,000 per dwelling in 2014. Although there is no cost uplift over BR for Policies 1&2, there is likely to be no significant benefit in terms of CO_2 reduction.

Policy 4 shows a cost uplift of approximately £8,000 and £3,000 respectively in 2011 and 2014. Policy 5 has not been tested for this case study.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study7	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%
	2014	59%	59%	59%	73%	73%
	2017	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063
	2014	0	0	0	3,254	3,254
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,225	15,970
	2014	0	0	0	15,607	15,607
	2017	0	0	0	0	0

Table 9.8 - Case Study7 Results Summary

9.10 Case Study 8

- Development type: Housing – medium urban
- Development size: 50 flats and houses (25 flats and 25 houses)
- Source: Local authority

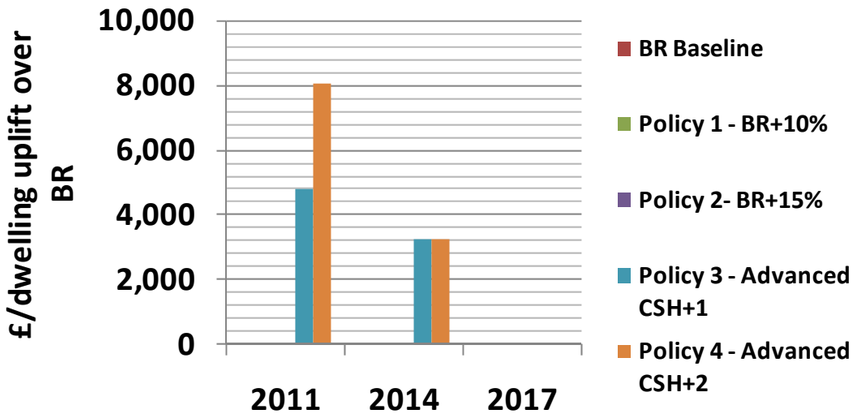

Figure 9.9a- capital cost uplift of Policy Options above BR baseline (Case Study 8)

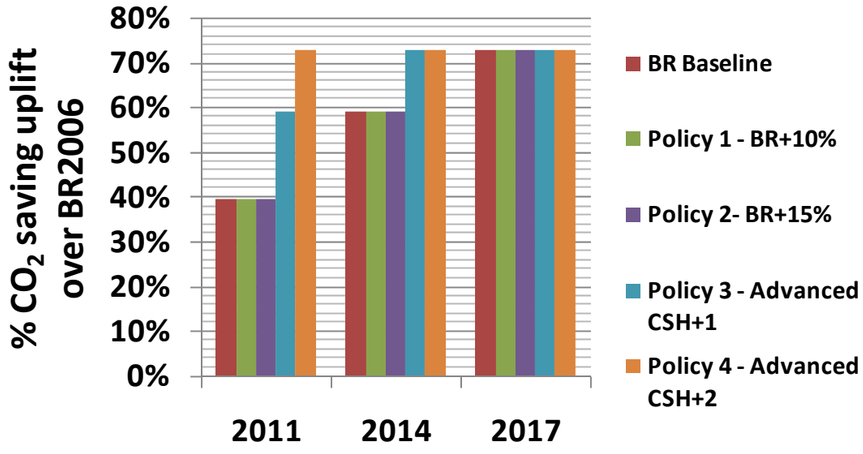

Figure 9.9b- %CO_2 saving above BR 2006

Discussion

Policies 1 and 2 show no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 3 shows a cost uplift over BR of approximately £5,000 per dwelling in 2011 and £3,000 per dwelling in 2014. Although there is no cost uplift over BR for Policies 1 and 2, there is also likely to be no significant additional benefit in terms of CO_2 reduction.

Policy 4 shows a cost uplift of approximately £8,000 and £3,000 respectively in 2011 and 2014. Policy 5 has not been tested for this case study.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR

DOMESTIC Case Study8	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%
	2014	59%	59%	59%	73%	73%
	2017	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063
	2014	0	0	0	3,254	3,254
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,225	15,970
	2014	0	0	0	15,607	15,607
	2017	0	0	0	0	0

Table 9.9 - Case Study8 Results Summary

9.11 Case Study 9

- Development type: Housing – medium mixed urban
- Development size: 350 flats and houses
- Source: Local authority

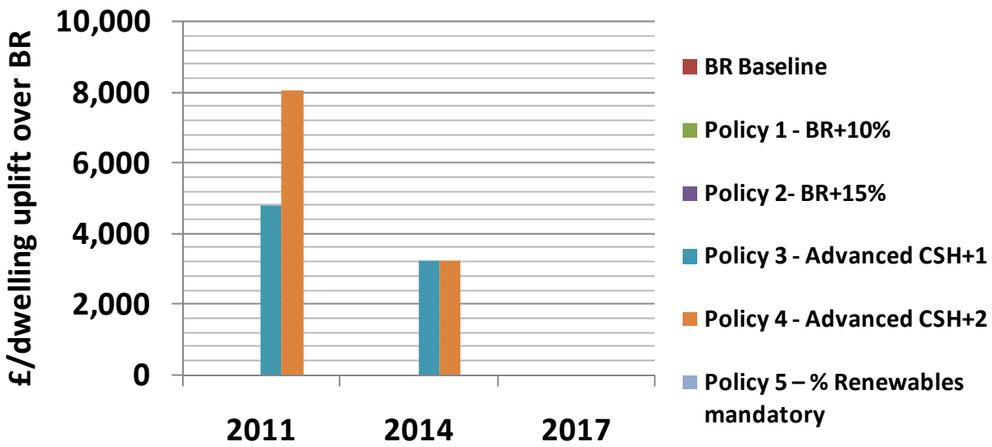

Figure 9.10a- capital cost uplift of Policy Options above BR baseline (Case Study 9)

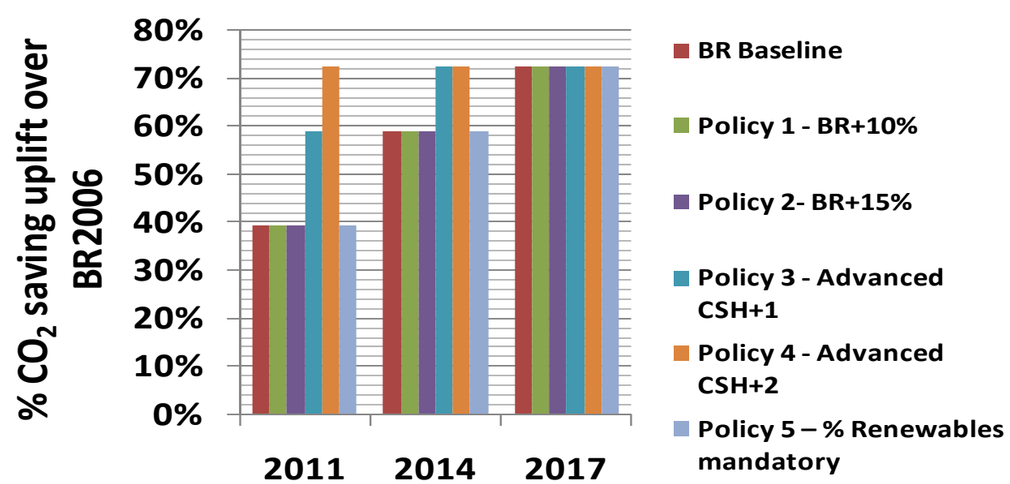

Figure 9.10b- %CO_2 saving above BR 2006

Discussion

Policies 1 and 2 show no cost uplift over BR for all years modelled (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 3 shows a cost uplift over BR of approximately £5,000 per dwelling in 2011 and £3,000 per dwelling in 2014. Although there is no cost uplift over BR for Policies 1 and 2, there is also likely to be no significant additional benefit in terms of CO_2 reduction.

Policy 4 shows a cost uplift of approximately £8,000 and £3,000 respectively in 2011 and 2014.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR

DOMESTIC Case Study9	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Solar Water Heating + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + EE1
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%	39%
	2014	59%	59%	59%	73%	73%	59%
	2017	73%	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063	0
	2014	0	0	0	3,254	3,254	0
	2017	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,225	15,970	0
	2014	0	0	0	15,607	15,607	0
	2017	0	0	0	0	0	0

Table 9.10 - Case Study9 Results Summary

9.12 Case Study 10

- Development type: Urban office development
- Development size: 100 sqm
- Source: Notional

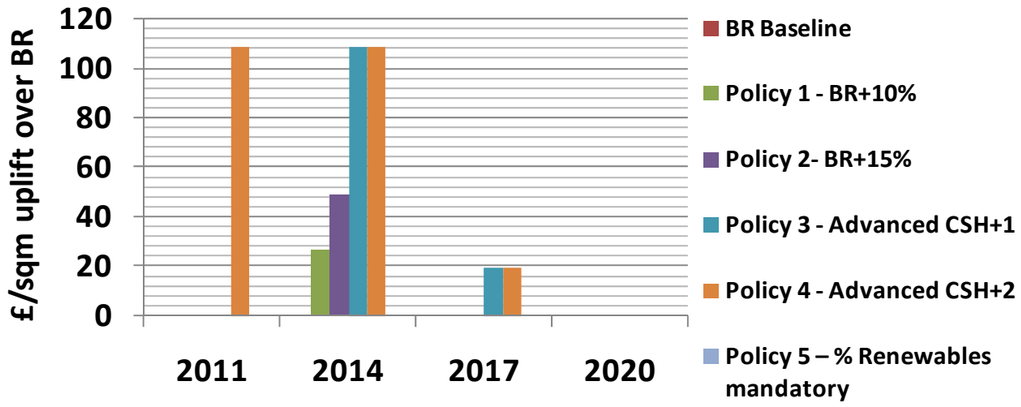

Figure 9.11a capital cost uplift of Policy Options above BR baseline (Case Study 10)

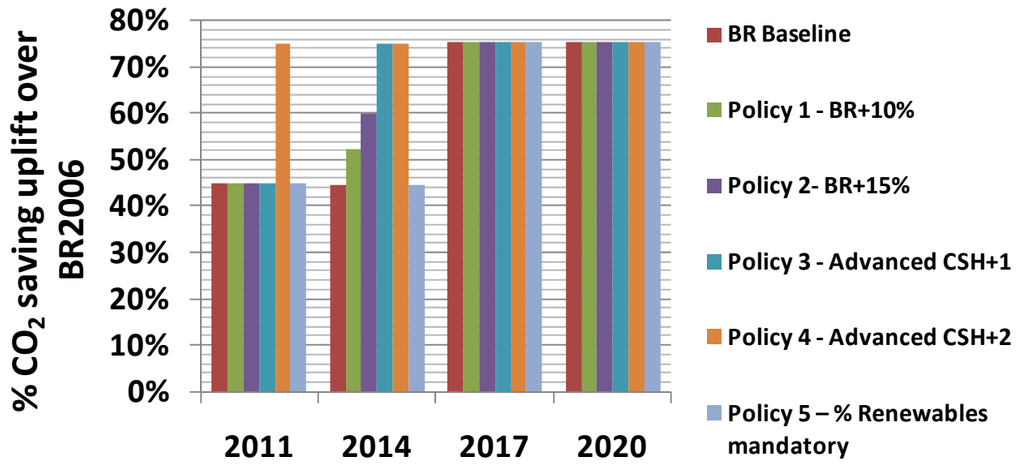

Figure 9.11b %CO_2 saving above BR 2006

Discussion

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £110 per sqm.

In 2014, the cost uplift increases as the required CO_2 reduction increases, up to a cost uplift of £110 per sqm for Policies 3 and 4. Policy 5 shows no cost uplift over BR for any of the years modelled. This is because a renewable or low carbon technology makes a significant contribution to meeting BR in the years up to 2020.

In 2017 only Policies 3 and 4 show a cost uplift over BR (£20 per sqm). The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements. From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study10	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + EE1
	2014	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1	Biomass heating + PV (medium) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + EE1
	2017	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1
	2020	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	45%	45%	45%	45%	75%	45%
	2014	45%	52%	60%	75%	75%	45%
	2017	75%	75%	75%	75%	75%	75%
	2020	75%	75%	75%	75%	75%	75%
£/sqm uplift over BR Baseline	2011	0	0	0	0	109	0
	2014	0	27	49	109	109	0
	2017	0	0	0	20	20	0
	2020	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	13,416	0
	2014	0	13,204	12,104	13,416	13,416	0
	2017	0	0	0	0	0	0
	2020	0	0	0	0	0	0

Table 9.11 - Case Study10 Results Summary

9.13 Case Study 11

- Development type: Urban office development
- Development size: 1,000 sqm
- Source: Notional

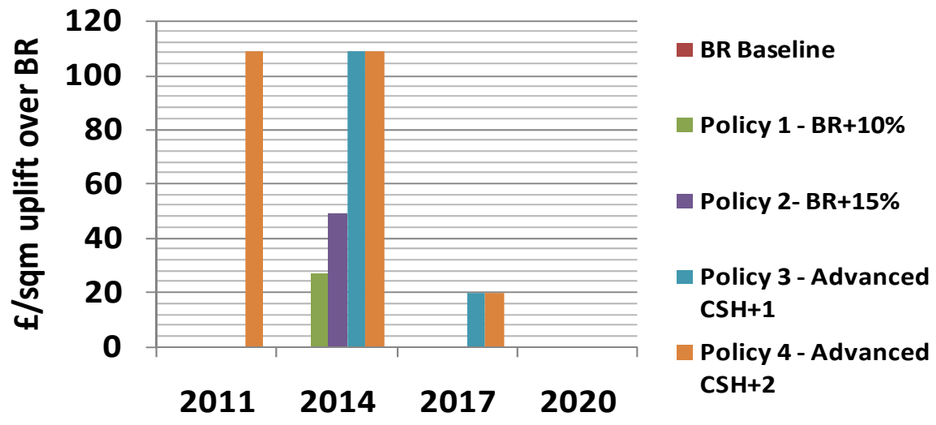

Figure 9.12a capital cost uplift of Policy Options above BR baseline (Case Study 11)

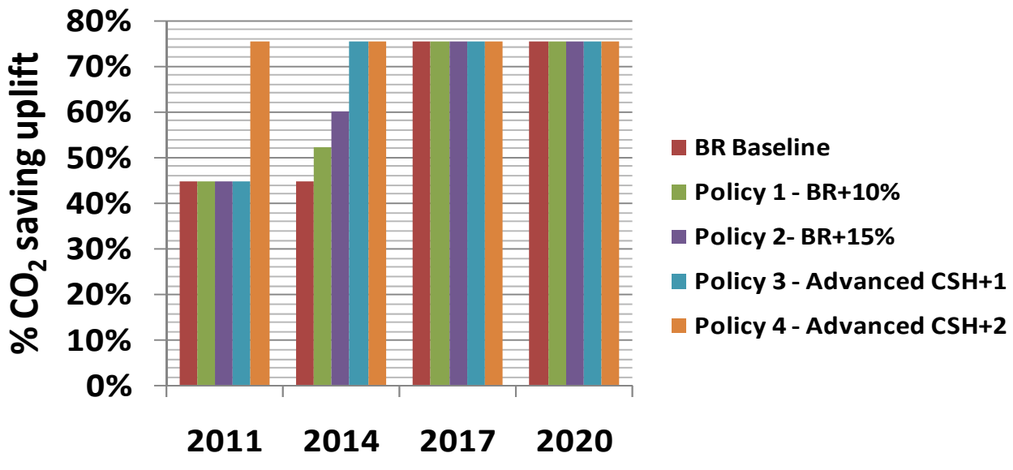

Figure 9.12b %CO_2 saving above BR 2006

Discussion

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £110 per sqm.

In 2014, the cost uplift increases as the required CO_2 reduction increases, up to a cost uplift of £110 per sqm for Policies 3 and 4. Policy 5 shows no cost uplift over BR for any of the years modelled. This is because a renewable or low carbon technology makes a significant contribution to meeting BR in the years up to 2020.

In 2017 only Policies 3 and 4 show a cost uplift over BR (£20 per sqm). Policy 5 has not been tested for this case study.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study11	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1	Biomass heating + PV (medium) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
	2017	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
	2020	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	45%	45%	45%	45%	75%
	2014	45%	52%	60%	75%	75%
	2017	75%	75%	75%	75%	75%
	2020	75%	75%	75%	75%	75%
£/sqm uplift over BR Baseline	2011	0	0	0	0	109
	2014	0	27	49	109	109
	2017	0	0	0	20	20
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	13,418
	2014	0	13,204	12,104	13,418	13,418
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.12 - Case Study11 Results Summary

9.14 Case Study 12

- Development type: Urban office development
- Development size: 8,000 sqm
- Source: Local authority

Discussion

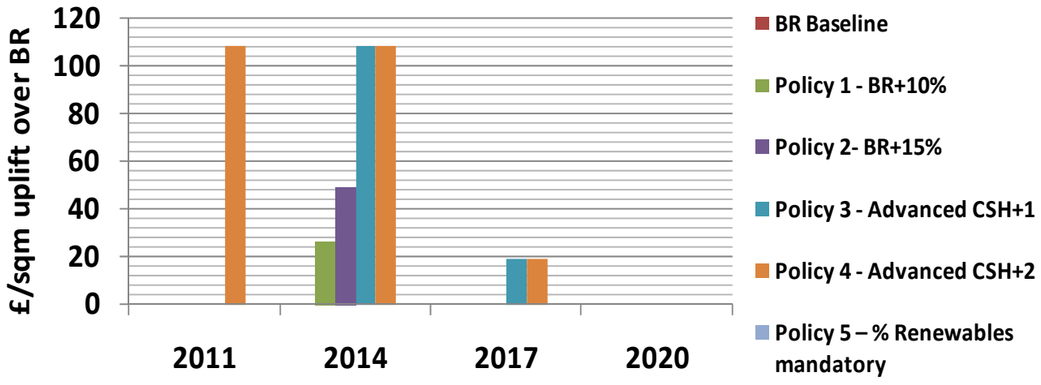

Figure 9.13a capital cost uplift of Policy Options above BR baseline (Case Study 12)

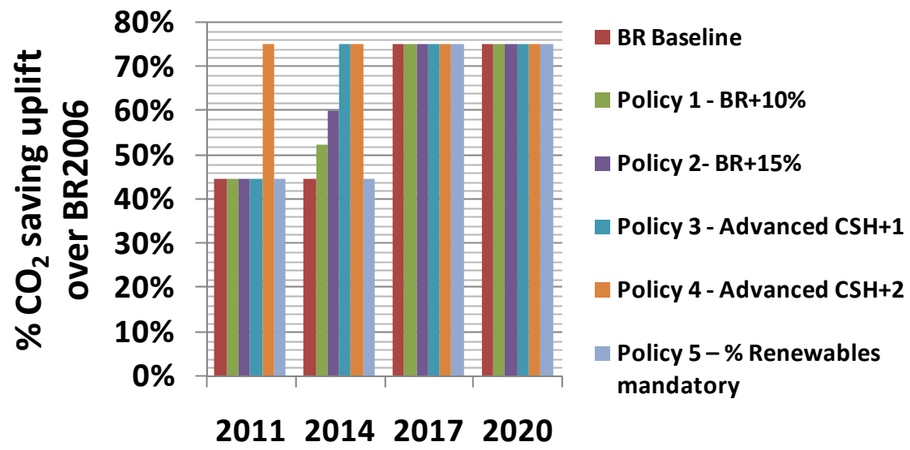

Figure 9.13b %CO_2 saving above BR 2006

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £90 per sqm.

In 2014, the cost uplift increases as the required CO_2 reduction increases, up to a cost uplift of £110 per sqm for Policies 3 and 4. Policy 5 shows no cost uplift over BR for any of the years modelled. This is because a renewable or low carbon technology makes a significant contribution to meeting BR in the years up to 2020.

In 2017 only Policies 3 and 4 show a cost uplift over BR (£20 per sqm).

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study12	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + EE1
	2014	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1	Biomass heating + PV (medium) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + EE1
	2017	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1
	2020	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions	Biomass heating + PV (maximum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	45%	45%	45%	45%	75%	45%
	2014	45%	52%	60%	75%	75%	45%
	2017	75%	75%	75%	75%	75%	75%
	2020	75%	75%	75%	75%	75%	75%
£/sqm uplift over BR Baseline	2011	0	0	0	0	109	0
	2014	0	27	49	109	109	0
	2017	0	0	0	20	20	0
	2020	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	13,418	0
	2014	0	13,204	12,104	13,418	13,418	0
	2017	0	0	0	0	0	0
	2020	0	0	0	0	0	0

Table 9.13 - Case Study12 Results Summary

9.15 Case Study 13

- Development type: Medium Mixed commercial development
- Development size: 4,000 sqm of B1,B2 and B8 uses
- Source: Local authority

Discussion

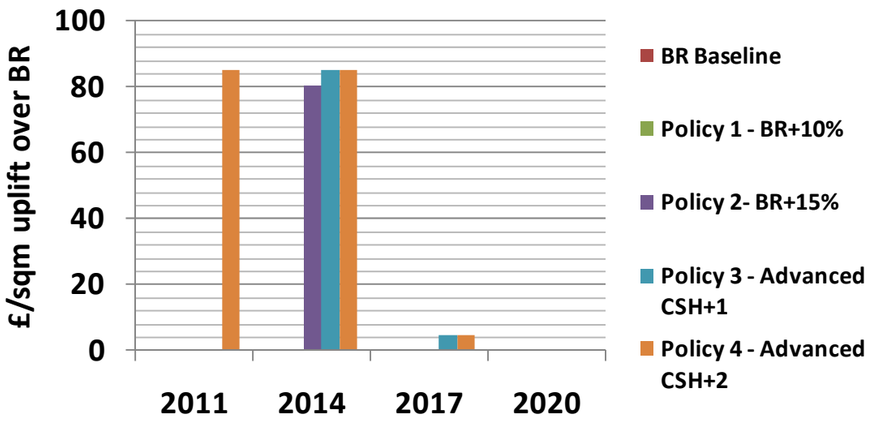

Figure 9.14a capital cost uplift of Policy Options above BR baseline (Case Study 13)

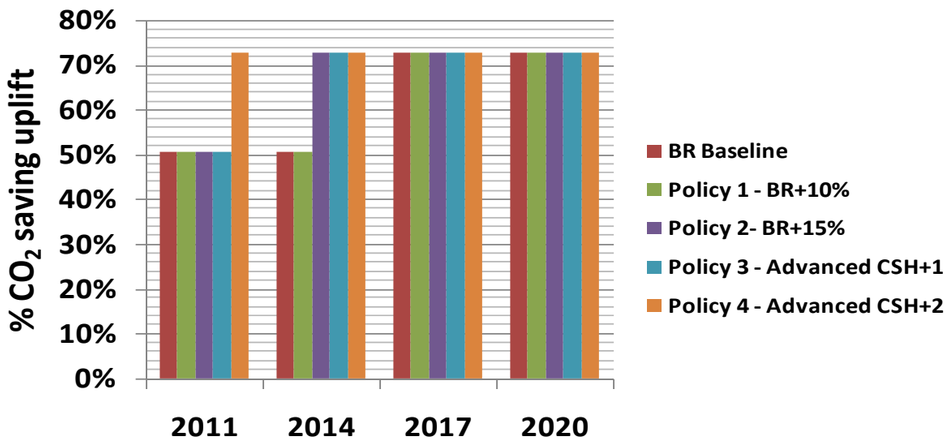

Figure 9.14b- %CO_2 saving above BR 2006

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £90 per sqm.

In 2014, Policy 1 has no cost uplift, while Policies 2, 3 and 4 have a similar cost uplift (approx. £90 per sqm).

In 2017 only Policies 3 and 4 show a cost uplift over BR (£5 per sqm).

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2020 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study13	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2017	Biomass + PV (min)	Biomass + PV (min)	Biomass + PV (min)	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2020	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	51%	51%	51%	51%	73%
	2014	51%	51%	73%	73%	73%
	2017	73%	73%	73%	73%	73%
	2020	73%	73%	73%	73%	73%
£/sqm uplift over BR Baseline	2011	0	0	0	0	85
	2014	0	0	80	85	85
	2017	0	0	0	5	5
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	14,025
	2014	0	0	13,204	14,025	14,025
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.14 - Case Study13 Results Summary

9.16 Case Study 14

- Development type: Large Mixed commercial development
- Development size: 35,000 sqm of retail, leisure, catering
- Source: Local authority

Discussion

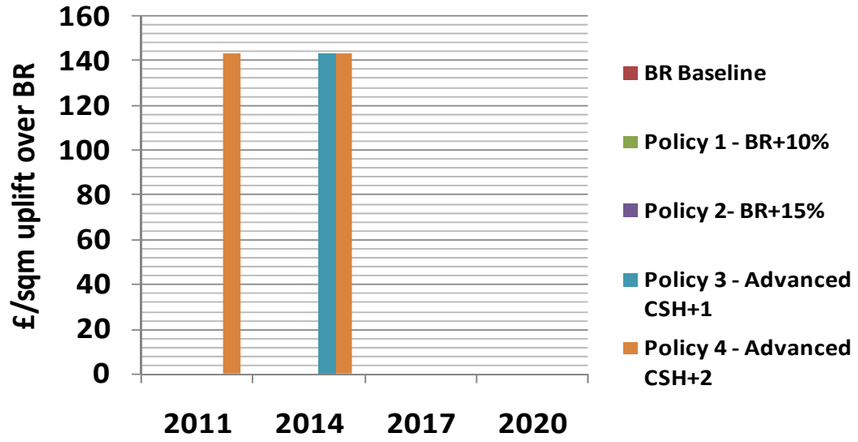

Figure 9.15a capital cost uplift of Policy Options above BR baseline (Case Study 14)

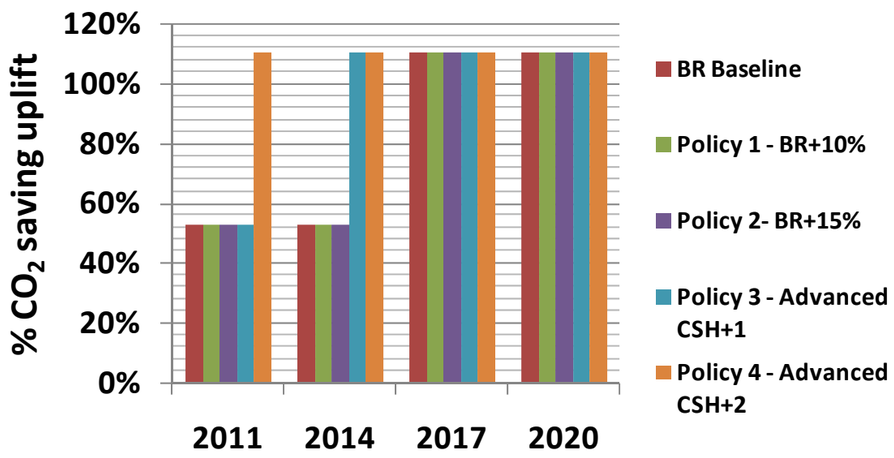

Figure 9.15b %CO_2 saving above BR 2006

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £140 per sqm.

In 2014, Policies 1 and 2 have no cost uplift, while Policies 3 and 4 have a similar cost uplift (approx. £140 per sqm).

In 2017 all Policies cost the same to achieve as the BR baseline.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2020 onwards, a mixture of energy efficiency, gas CHP with biomass backup, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study14	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2017	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions Contribution	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions Contribution	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions Contribution	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions Contribution	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions Contribution
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	52%	52%	52%	52%	110%
	2014	52%	52%	52%	110%	110%
	2017	110%	110%	110%	110%	110%
	2020	110%	110%	110%	110%	110%
£/sqm uplift over BR Baseline	2011	0	0	0	0	143
	2014	0	0	0	143	143
	2017	0	0	0	0	0
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	4,110
	2014	0	0	0	4,110	4,110
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.15 - Case Study14 Results Summary

9.17 Case Study 15

- Development type: Large Industrial development
- Development size: 100,000 sqm
- Source: Local authority

Discussion

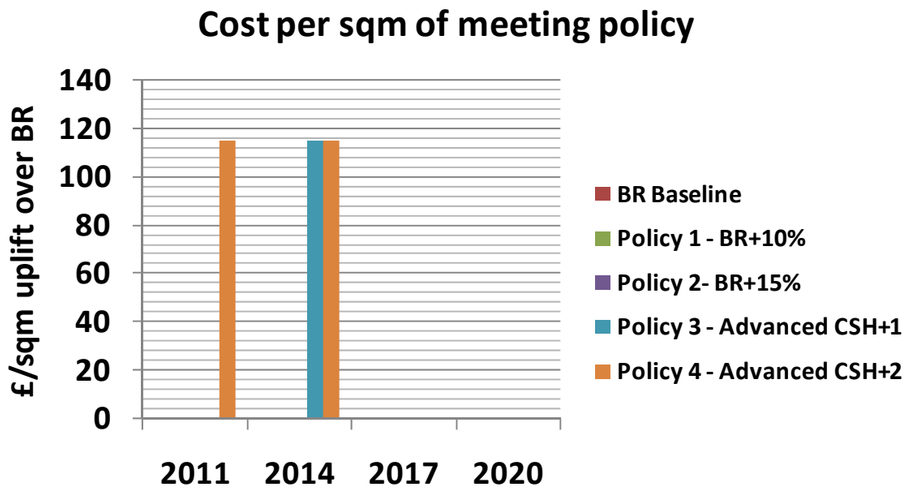

Figure 9.16a- capital cost uplift of Policy Options above BR baseline (Case Study 15)

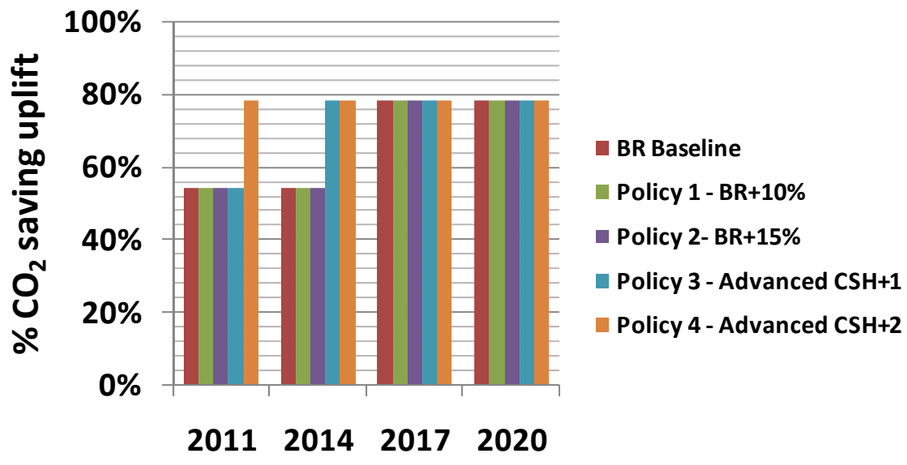

Figure 9.16b %CO_2 saving above BR 2006

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of £115 per sqm.

In 2014, Policies 1 and 2 have no cost uplift, while Policies 3 and 4 have a similar cost uplift (approx. £115 per sqm).

In 2017 all Policies cost the same to achieve as the BR baseline.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2020 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study15	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution	Biomass heating + PV (minimum) + EE1 + Allowable Solutions Contribution
	2020	Biomass + PV (min) + Al.Sol.	Biomass + PV (min) + Al.Sol.	Biomass + PV (min) + Al.Sol.	Biomass + PV (min) + Al.Sol.	Biomass + PV (min) + Al.Sol.
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	54%	54%	54%	54%	78%
	2014	54%	54%	54%	78%	78%
	2017	78%	78%	78%	78%	78%
	2020	78%	78%	78%	78%	78%
£/sqm uplift over BR Baseline	2011	0	0	0	0	115
	2014	0	0	0	115	115
	2017	0	0	0	0	0
	2020	0	0	0	0	0
%/tonne CO_2 uplift	2011	0	0	0	0	14,215
	2014	0	0	0	14,215	14,215
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.16 - Case Study15 Results Summary

9.18 Case Study 16

- Development type: Urban Retail development
- Development size: 11,000 sqm
- Source: Local authority

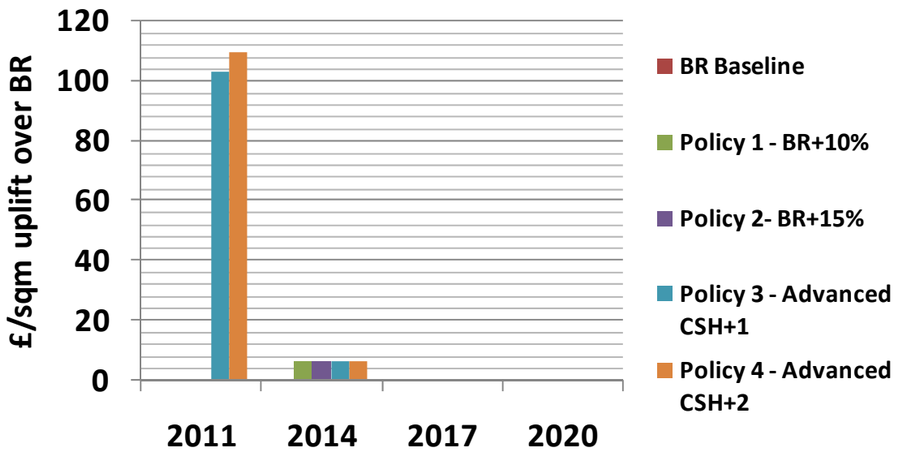

Figure 9.17a- capital cost uplift of Policy Options above BR baseline (Case Study 16)

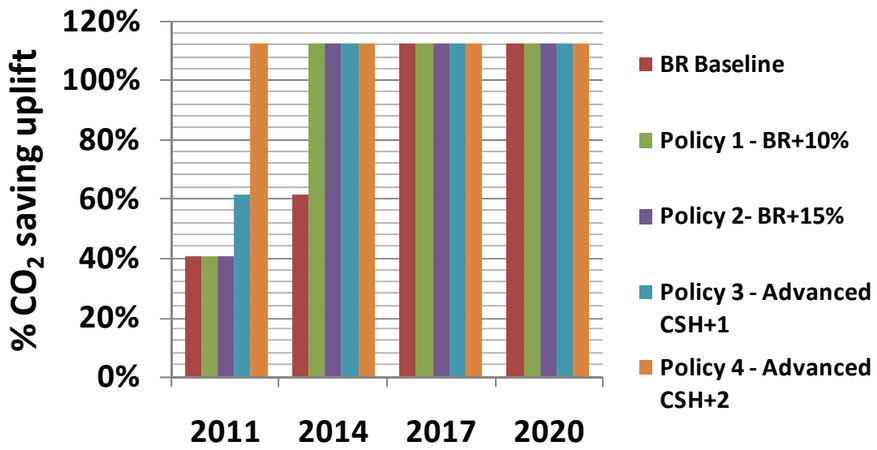

Figure 9.17b- %CO_2 saving above BR 2006

Discussion

In 2011, Policies 1 and 2 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policies 3 and 4 have a similar cost uplift of approximately £105 per sqm.

In 2014, all Policies have a cost uplift of £5 per sqm over the BR baseline.

From 2017, all Policies cost the same to achieve as the BR baseline.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2020 onwards, a mixture of energy efficiency, gas CHP with biomass backup, PV and allowable solutions would be needed to comply with BR.

Non Domestic Case Study 16	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass + PV (min)	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2014	Biomass + PV (min)	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2017	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	41%	41%	41%	62%	112%
	2014	62%	112%	112%	112%	112%
	2017	112%	112%	112%	112%	112%
	2020	112%	112%	112%	112%	112%
£/sqm uplift over BR Baseline	2011	0	0	0	103	109
	2014	0	6	6	6	6
	2017	0	0	0	0	0
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	12,214	3,773
	2014	0	309	309	309	309
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.17 - Case Study16 Results Summary

9.19 Case Study 17

- Development type: Small mixed use development
- Development size: 400 houses, 500 sqm retail, 2,000 sqm office, 2,500 school
- Source: Local authority

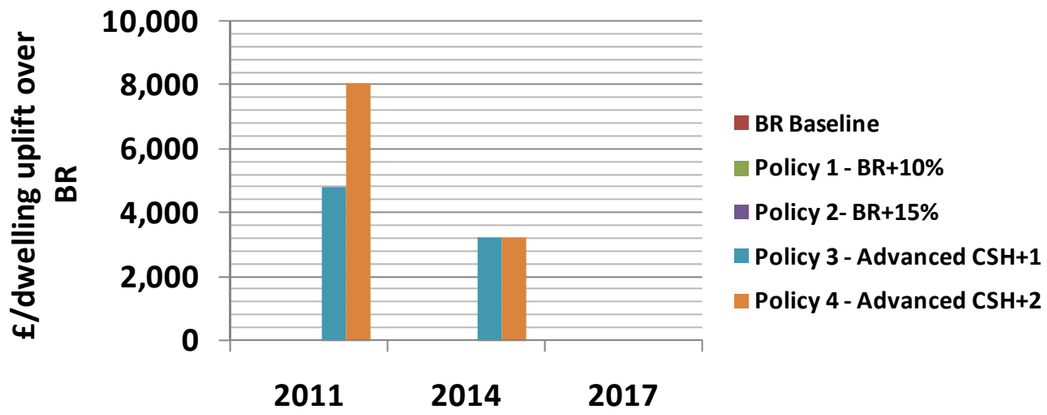

Figure 9.18a- capital cost uplift of Policy Options above BR baseline (Case Study 17)

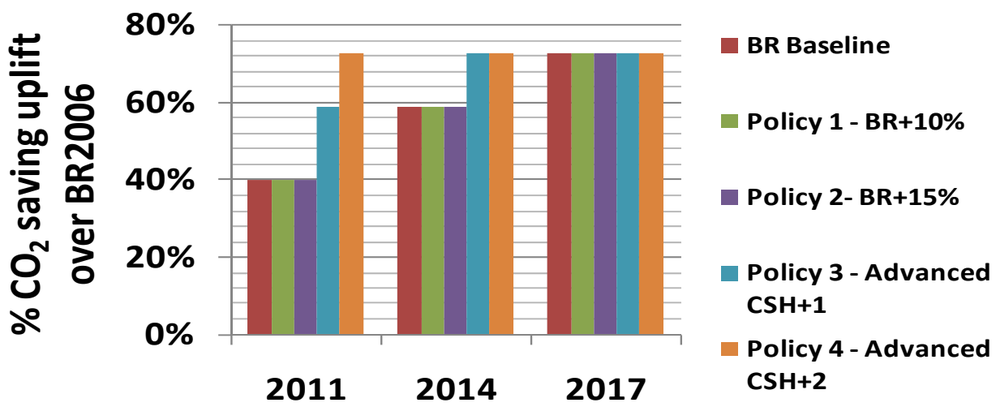

Figure 9.18b- %CO_2 saving above BR 2006

Discussion (Part 1 – Domestic)

In 2011, Policies 1 and 2 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policies 3 and 4 have a cost uplift of approximately £5,000 and £8,000 respectively per dwelling.

In 2014, only Policies 3 and 4 have a cost uplift of £3,000 per dwelling over the BR baseline.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study17	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	40%	40%	40%	59%	73%
	2014	59%	59%	59%	73%	73%
	2017	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063
	2014	0	0	0	3,254	3,254
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,225	15,970
	2014	0	0	0	15,607	15,607
	2017	0	0	0	0	0

Table 9.18a - Case Study17 Results Summary (Domestic)

9.20 Case Study 17

- Development type: Small mixed use development
- Development size: 400 houses, 500 sqm retail, 2,000 sqm office, 2,500 school
- Source: Local authority

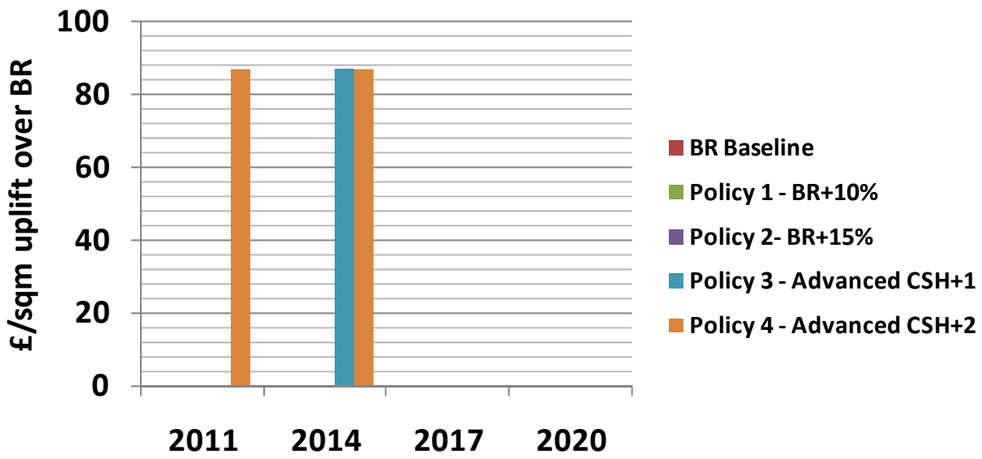

Figure 9.18c- capital cost uplift of Policy Options above BR baseline (Case Study 17)

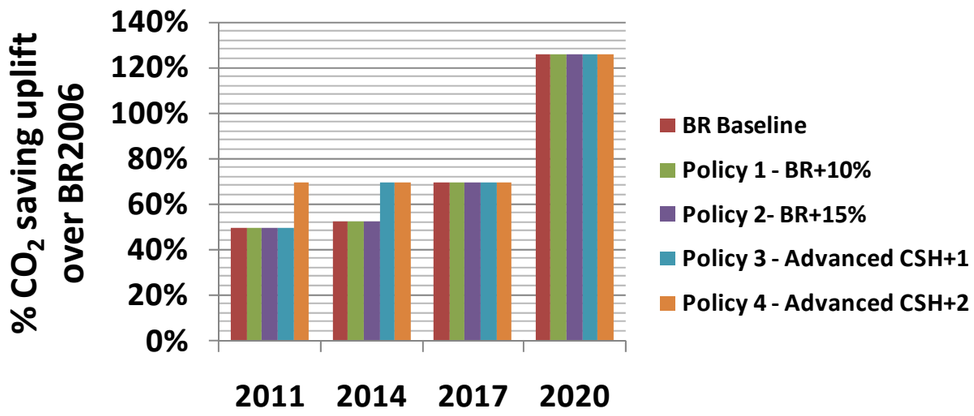

Figure 9.18d- %CO_2 saving above BR 2006

Discussion (Part 2 – Commercial)

In 2011, Policies 1, 2 and3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of approximately £90 per sqm.

In 2014, Policies 3 and 4 have a cost uplift of £90 per sqm over the BR baseline. The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, gas CHP and/ biomass heating, PV and allowable solutions would be needed to comply with BR.

Summary

Although different technology options have been chosen for the residential and non-residential parts of this development, the same technology choice could in practice be chosen to take advantage of economies of scale and/or simplicity of implementation.

Non Domestic Case Study17	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	50%	50%	50%	50%	70%
	2014	52%	52%	52%	70%	70%
	2017	70%	70%	70%	70%	70%
	2020	126%	126%	126%	126%	126%
£/sqm uplift over BR Baseline	2011	0	0	0	0	87
	2014	0	0	0	87	87
	2017	0	0	0	0	0
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	14,884
	2014	0	0	0	14,884	14,884
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.18b - Case Study17 Results Summary (Commercial)

9.21 Case Study 18

- Development type: Medium mixed use development
- Development size: 1,000 houses, 1,000 sqm retail, 2,000 sqm primary school, 400 sqm community facility
- Source: Local authority

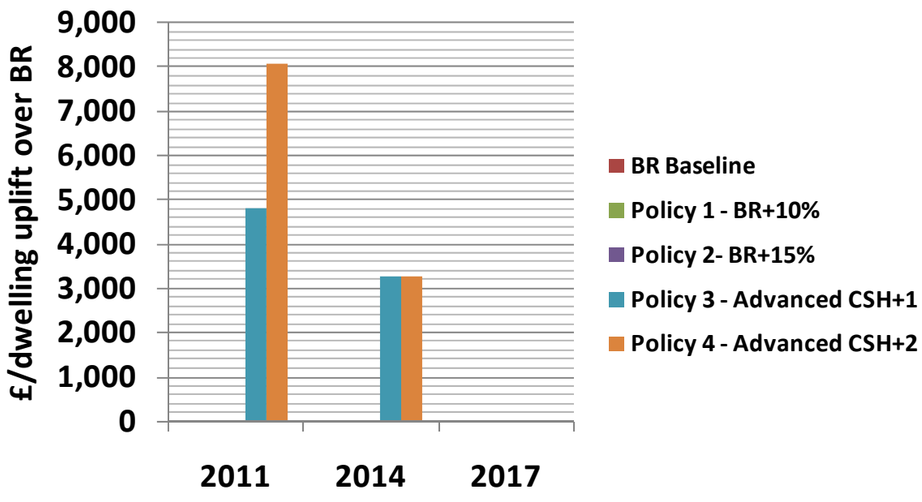

Figure 9.19a- capital cost uplift of Policy Options above BR baseline (Case Study 18)

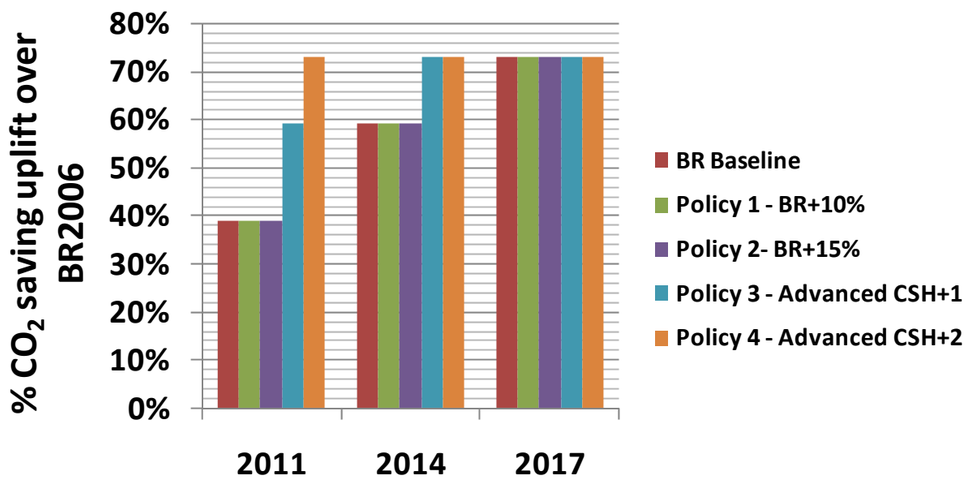

Figure 9.19b- %CO_2 saving above BR 2006

Discussion (Part 1 – Domestic)

In 2011, Policies 1 and 2 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policies 3 and 4 have a cost uplift of approximately £5,000 and £8,000 respectively per dwelling.

In 2014, only Policies 3 and 4 have a cost uplift of £3,000 per dwelling over the BR baseline.

The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.

From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study18	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%
	2014	59%	59%	59%	73%	73%
	2017	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,810	8,065
	2014	0	0	0	3,255	3,255
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,224	15,970
	2014	0	0	0	15,608	15,608
	2017	0	0	0	0	0

Table 9.19a - Case Study18 Results Summary (Domestic)

9.22 Case Study 18

- Development type: Medium mixed use development
- Development size: 1,000 houses, 1,000 sqm retail, 2,000 sqm primary school, 400 sqm community facility
- Source: Local authority

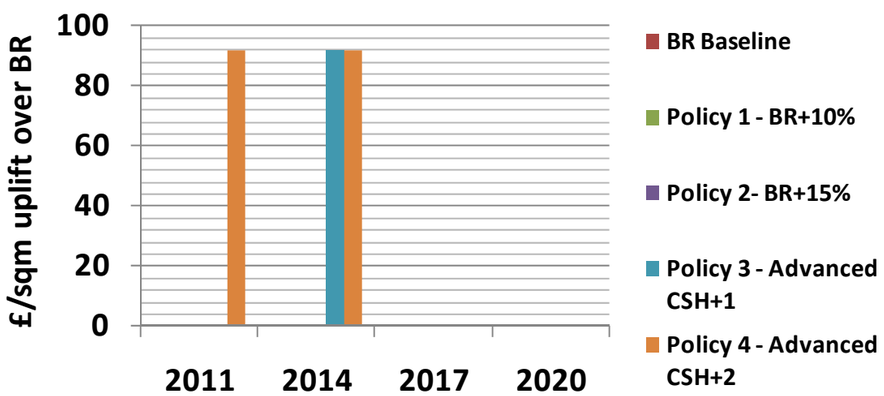

Figure 9.19c capital cost uplift of Policy Options above BR baseline (Case Study 18)

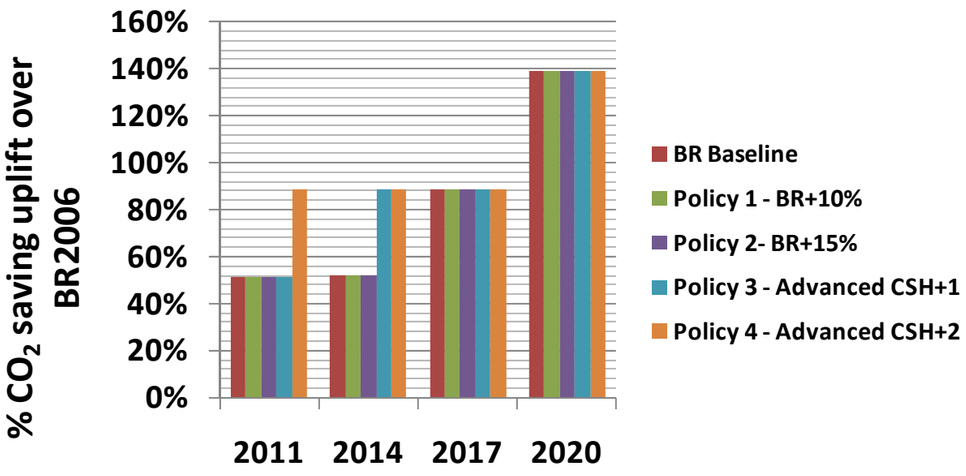

Figure 9.19d- %CO_2 saving above BR 2006

Discussion (Part 2 – Commercial)

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of approximately £90 per sqm.
In 2014, Policies 3 and 4 have a cost uplift of £90 per sqm over the BR baseline. The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements. From 2017 onwards, a mixture of energy efficiency, gas/biomass CHP and/ biomass heating, PV and allowable solutions would be needed to comply with BR.

Summary
Although different technology options have been chosen for the residential and non-residential parts of this development, the same technology choice could in practice be chosen to take advantage of economies of scale and/or simplicity of implementation.

Non Domestic Case Study18	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass Fired CHP + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1
	2017	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	52%	52%	52%	52%	89%
	2014	52%	52%	52%	89%	89%
	2017	89%	89%	89%	89%	89%
	2020	139%	139%	139%	139%	139%
£/sqm uplift over BR Baseline	2011	0	0	0	0	92
	2014	0	0	0	92	92
	2017	0	0	0	0	0
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	5,766
	2014	0	0	0	5,766	5,766
	2017	0	0	0	0	0
	2020	0	0	0	0	0

Table 9.19b - Case Study18 Results Summary (Commercial)

9.23 Case Study 19

- Development type: Medium/Large mixed use development
- Development size: 2,700 houses, 10,000 sqm retail, 20,000 sqm office 20,000 B2/B8 uses, 7,500 sqm primary school, 1,000 sqm community facility
- Source: Local authority

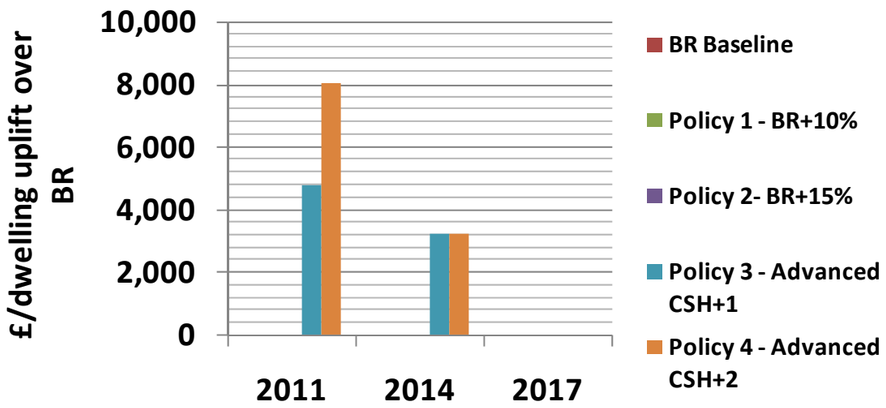

Figure 9.20a- capital cost uplift of Policy Options above BR baseline (Case Study 19)

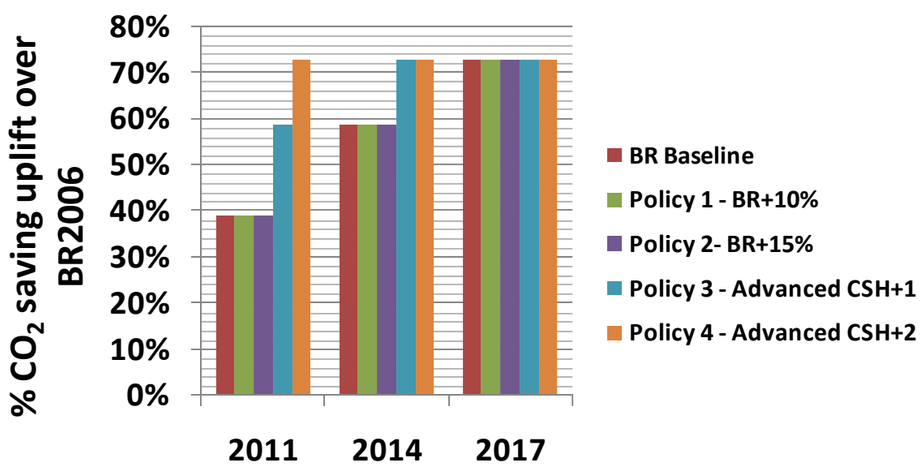

Figure 9.20b- %CO_2 saving above BR 2006

Discussion (Part 1 – Domestic)

In 2011, Policies 1 and 2 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policies 3 and 4 have a cost uplift of approximately £5,000 and £8,000 respectively per dwelling.
In 2014, only Policies 3 and 4 have a cost uplift of £3,000 per dwelling over the BR baseline.
The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.
From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study19	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%
	2014	59%	59%	59%	73%	73%
	2017	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063
	2014	0	0	0	3,254	3,254
	2017	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,224	15,970
	2014	0	0	0	15,608	15,608
	2017	0	0	0	0	0

Table 9.20a - Case Study19 Results Summary (Domestic)

9.24 Case Study 19

- Development type: Medium/Large mixed use development
- Development size: 2,700 houses, 10,000 sqm retail, 20,000 sqm office 20,000 B2/B8 uses, 7,500 sqm primary school, 1,000 sqm community facility
- Source: Local authority

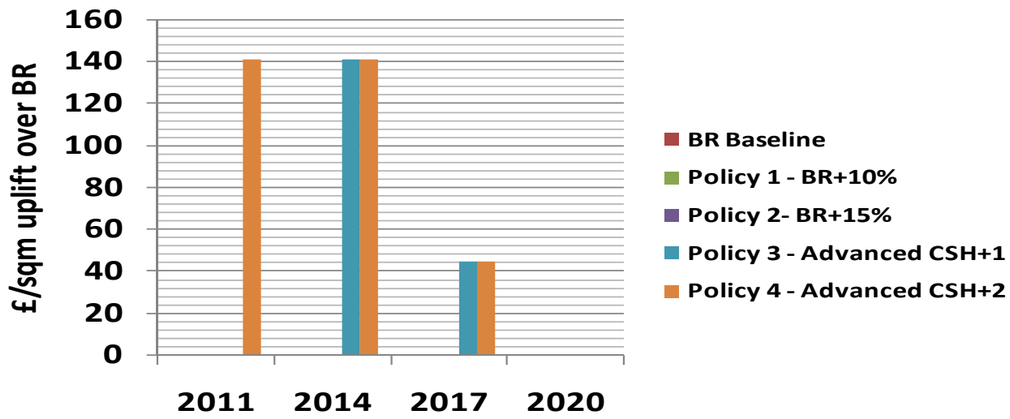

Figure 9.20c- capital cost uplift of Policy Options above BR baseline (Case Study 19)

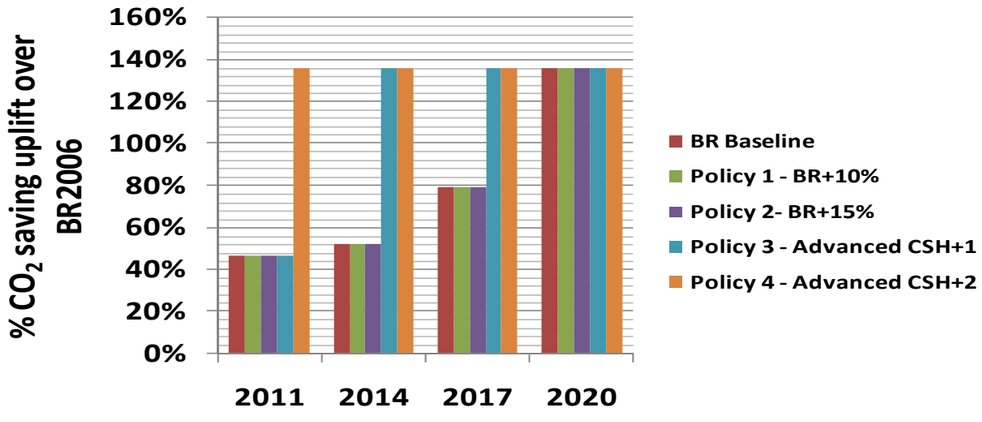

Figure 9.20d- %CO_2 saving above BR 2006

Discussion (Part 2 – Commercial)

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of approximately £140 per sqm.
In 2014, Policies 3 and 4 have a cost uplift of £140 per sqm over the BR baseline.
The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.
From 2017 onwards, a mixture of energy efficiency, gas CHP and/or biomass heating, and PV would be needed to comply with BR.
Depending on the specific building type, there may be a need for an allowable solutions pathway to achieve "Zero Carbon".

Summary

Although different technology options have been chosen for the residential and non-residential parts of this development, the same technology choice could in practice be chosen to take advantage of economies of scale and/or simplicity of implementation.

Non Domestic Case Study19	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2017	Biomass CHP	Biomass CHP	Biomass CHP	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1
Technically Viable?		Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	47%	47%	47%	47%	136%
	2014	52%	52%	52%	136%	136%
	2017	80%	80%	80%	136%	136%
	2020	136%	136%	136%	136%	136%
£/sqm uplift over BR Baseline	2011	0	0	0	0	141
	2014	0	0	0	141	141
	2017	0	0	0	45	45
	2020	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	5,301
	2014	0	0	0	5,301	5,301
	2017	0	0	0	2,651	2,651
	2020	0	0	0	0	0

Table 9.20b - Case Study19 Results Summary (Commercial)

9.25 Case Study 20

- Development type: Large mixed use development
- Development size: 12,000 houses, 165,000 sqm office, 20,000 B2/B8 uses, 9,500 sqm hotel
- Source: Local authority

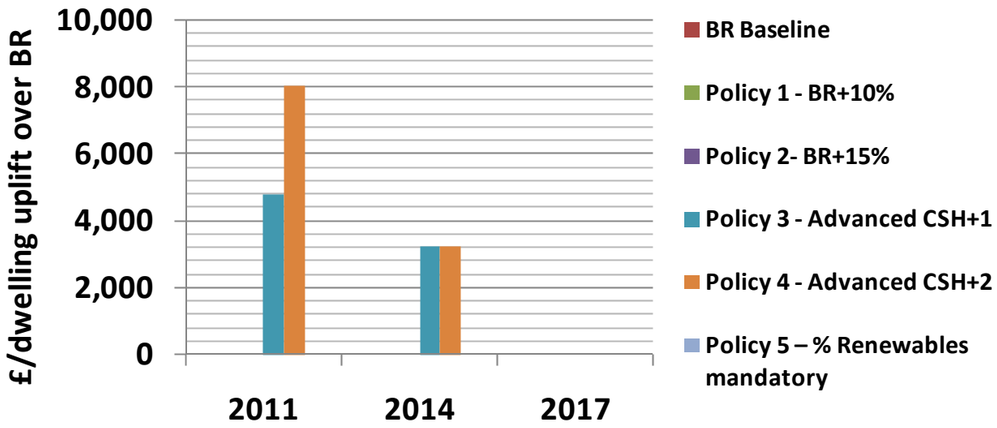

Figure 9.21a capital cost uplift of Policy Options above BR baseline (Case Study 20)

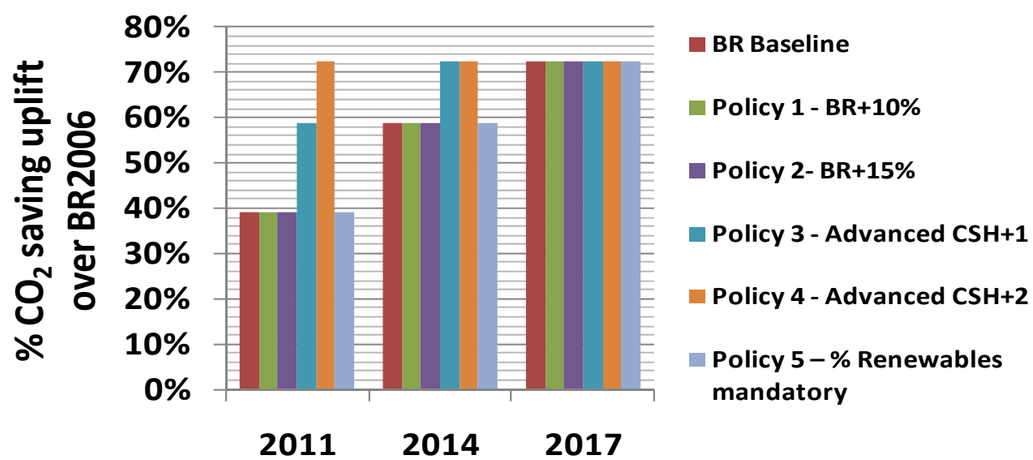

Figure 9.21b %CO_2 saving above BR 2006

Discussion (Part 1 – Domestic)

In 2011, Policies 1, 2 and 5 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policies 3 and 4 have a cost uplift of approximately £5,000 and £8,000 respectively per dwelling.
In 2014, only Policies 3 and 4 have a cost uplift of £3,000 per dwelling over the BR baseline.
The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.
From 2017 onwards, a mixture of energy efficiency, biomass heating, PV and allowable solutions would be needed to comply with BR.

DOMESTIC Case Study20	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Solar Water Heating + EE1	Solar Water Heating + EE1	Solar Water Heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Solar Water Heating + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + EE1
	2017	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions	Biomass heating + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	39%	39%	39%	59%	73%	39%
	2014	59%	59%	59%	73%	73%	59%
	2017	73%	73%	73%	73%	73%	73%
£/dwelling uplift over BR Baseline	2011	0	0	0	4,809	8,063	0
	2014	0	0	0	3,254	3,254	0
	2017	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	16,225	15,970	0
	2014	0	0	0	15,607	15,607	0
	2017	0	0	0	0	0	0

Table 9.21a - Case Study20 Results Summary (Domestic)

9.26 Case Study 20

- Development type: Large mixed use development
- Development size: 12,000 houses, 165,000 sqm office, 20,000 B2/B8 uses, 9,500 sqm hotel
- Source: Local authority

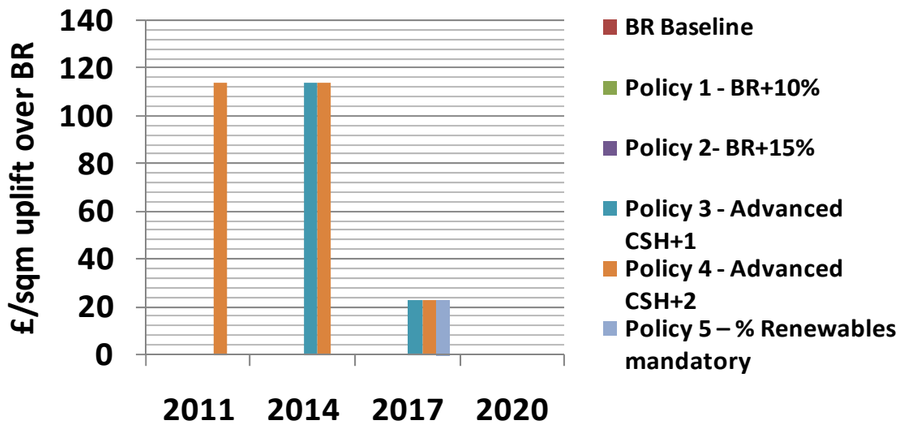

Figure 9.21c- capital cost uplift of Policy Options above BR baseline (Case Study 20)

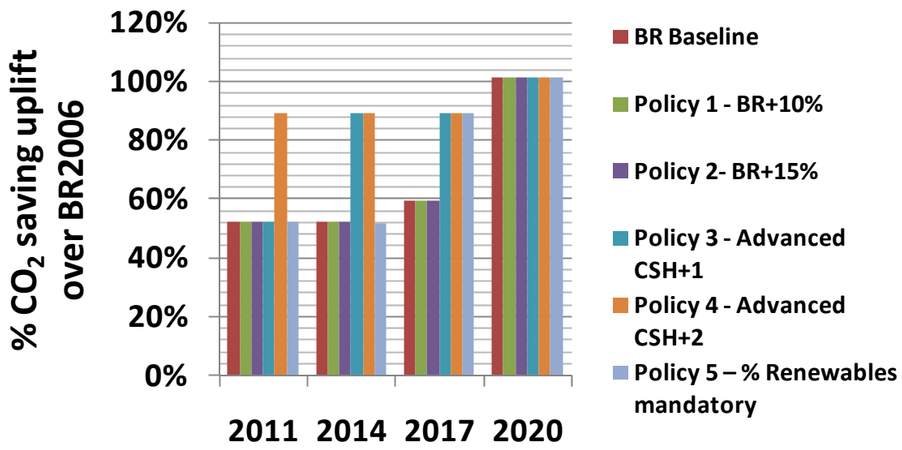

Figure 9.21d- %CO_2 saving above BR 2006

Discussion (Part 2 – Commercial)

In 2011, Policies 1, 2 and 3 have no cost uplift over the BR baseline (since the CO_2 savings are the same as BR 2006 which is a legal minimum requirement) whereas Policy 4 has a cost uplift of approximately £110 per sqm.
In 2014, Policies 3 and 4 have a cost uplift of £110 per sqm over the BR baseline. In 2017, Policies 3, 4 and 5 show a cost uplift of approximately £20 per sqm over the BR baseline. The selection of biomass heating for this type of development is based on an assumption that there is no limitation imposed by air quality requirements.
From 2017 onwards, a mixture of energy efficiency, gas/biomass CHP and/or biomass heating, and PV would be needed to comply with BR. Depending on the specific building type, there may be a need for an allowable solutions pathway to achieve "Zero Carbon".

Summary

Although different technology options have been chosen for the residential and non-residential parts of this development, the same technology choice could in practice be chosen to take advantage of economies of scale and/or simplicity of implementation.

Non Domestic Case Study20	Year*	BR Baseline	Policy 1 – BR+10%	Policy 2 – BR+15%	Policy 3 – Code+1	Policy 4 – Code+2	Policy 5 – % Renewables mandatory
Technology Option	2011	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass Fired CHP + EE1	Biomass heating + EE1
	2014	Biomass heating + EE1	Biomass heating + EE1	Biomass heating + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1	Biomass heating + EE1
	2017	Gas Fired CHP (Biomass Back Up) + EE1	Gas Fired CHP (Biomass Back Up) + EE1	Gas Fired CHP (Biomass Back Up) + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1	Biomass Fired CHP + EE1
	2020	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions	Gas Fired CHP (Biomass Back Up) + PV (minimum) + EE1 + Allowable Solutions
Technically Viable?		Yes	Yes	Yes	Yes	Yes	Yes
% CO_2 saving uplift (regulated emissions, over PtL2006)	2011	52%	52%	52%	52%	89%	52%
	2014	52%	52%	52%	89%	89%	52%
	2017	59%	59%	59%	89%	89%	89%
	2020	101%	101%	101%	101%	101%	101%
£/sqm uplift over BR Baseline	2011	0	0	0	0	114	0
	2014	0	0	0	114	114	0
	2017	0	0	0	23	23	23
	2020	0	0	0	0	0	0
£/tonne CO_2 uplift	2011	0	0	0	0	9,576	0
	2014	0	0	0	9,576	9,576	0
	2017	0	0	0	2,730	2,730	2,730
	2020	0	0	0	0	0	0

Table 9.21b - Case Study20 Results Summary (Commercial)

9.27 Summary of Model Findings

9.27.1 Residential Development

For the case studies looking at 1 house, the city infill house has a higher cost uplift than the rural house for Policies 3 and 4 as the urban house is assumed to be constrained so that it will not be practically possible to receive biomass deliveries. The city infill house therefore has a more expensive technology option chosen (PV) to comply with Policies 3 and 4.

For housing developments between ranging from 10 to 12,000 dwellings, the modelling suggests that the costs of meeting Policies 3 and 4 would be broadly similar, whether in a rural or urban location. This is estimated at £3,000 per dwelling for Policy 3 and £8,000 per dwelling for Policy 4. This is based on an assumption that biomass heating is a practical technology option for all these sites as it is calculated to have the cheapest capital cost.

However, if biomass heating were not possible for a given development (e.g. if there are significant air quality issues), the costs of achieving Policies 3 and 4 would vary. For example, if the next cheapest capital cost option for meeting these Policies was gas-fired CHP this may not be suitable for smaller development, therefore developments of 50 dwellings or less may require a more expensive technology option to achieve compliance. This point raises the question of setting threshold targets for new development.

Compliance with Policies 1 and 2 often costs the same and saves as much CO_2 as simply complying with BR. In reality, it may be possible to scale a given technology to produce CO_2 savings to exactly comply with a given policy. However, where the same technology option is shown to comply with BR and Policies 1 and 2, it is assumed that a standard sized module (e.g. solar hot water panel) available on the market is used: this may result in CO_2 savings that exceed BR to the point where the energy generating capacity of the technology option chosen to meet BR could also comply with Policy 1 and maybe even Policy 2.

Overall the residential modelling suggests that there would only be a modest cost uplift (if any) in meeting Policies 1 and 2.

In 2010, for Policies 1 and 2, solar water heating is often the technology option chosen, usually in line with the BR compliance option. Solar PV is typically chosen for Policy 3 and biomass heating with allowable solutions for Policy 4.

In 2014, technology options chosen range from PV to biomass heating for BR and Policies 1 and 2. For Policy 3, the technology choice is usually PV and/or biomass heating. To comply with Policy 4, a combination of PV, biomass and allowable solutions is usually chosen.

For all developments, the modelling suggests that some form of allowable solutions pathway would be needed to meet Zero Carbon requirements in 2017.

9.27.2 Office Development

For the three office development sizes modelled (100, 1,000 and 8,000 sqm), there was no difference shown by the modelling in terms of the capital cost uplift over BR to meet all Policy targets. In 2010, Policies 1, 2 and 3 show no cost uplift, whereas in 2014 the cost uplift was approximately £30 per sqm for Policy 1, £50 per sqm for Policy 2 and £110 per sqm for Policy 3. Policy 4 has a cost uplift of £110 per sqm in 2010 and 2014. In 2017, only Policies 3 and 4 have cost uplifts over BR of £20 per sqm.

As with residential development, if the use of biomass heating was not possible for a given development, the costs of achieving Policies 3 and 4 would vary between the offices. In particular, if biomass were not available, the next cheapest cost option of gas CHP may not be viable for a smaller 100 sqm office (and perhaps the 1,000 sqm office).

9.27.3 Non-residential Development

Modelling suggests that there would be no cost uplift in the years modelled to comply with Policies 1 and 2. Policy 3 only shows a cost uplift in 2014 (apart from urban retail development where an uplift is shown in 2011). Policy 3 shows a cost uplift ranging from £90 to £140 per sqm in 2014 for most of the non-residential developments, whereas Policy 4 shows a cost uplift of between £90 to £140 in both 2011 and 2014.

9.27.4 Mixed (residential and non-residential development)

Although separate and sometimes different technology options are chosen for the residential and non-residential parts, in reality there may be a one technology option chosen on a development for both parts regardless of whether this results in a cheaper capital cost options compared to two technology options. This could be for reasons of simplicity of installation/management of the renewable or low carbon technology.

9.27.5 Site constraints

If a rural site is not on the gas grid, the use of gas-fired CHP is unlikely to be a feasible. The use of solar thermal and PV will be site specific. In urban areas in particular, overshading issues and the orientation of panels will have to be given serious consideration.

9.28 Target Recommendations

The analysis and discussion in this section allows recommendations to be made on the type and extent of policy which can be applied to new development across Hertfordshire. In doing so it is important to recognise that the proposed changes to Building Regulations leading to zero carbon are very challenging in themselves and are based on extensive at technical and financial viability analysis. Alongside this, the rapid changes in proposed regulations means that any locally implemented policies will only impact on the shorter term (the next 6 years for homes) and then be overtaken by national regulation. Therefore, the recommended policy options should provide greater CO_2 reductions where possible but in a way which does not significantly impact on development viability.

When interpreting the model findings it is important to note that the cost uplifts above business as usual reflect constructions costs only and do not themselves constitute a viability assessment. To make a judgement on the viability or otherwise of particular targets these numbers should be included in a full viability assessment, perhaps undertaken alongside an assessment of affordable housing viability. The recommendations set out here will need to be considered again following such an assessment.

The two policy options based around percentage improvements on Building Regulations provide small CO_2 savings. Policy 1 (BR+10%) often shows the same capital cost uplift savings as Policy 2 (BR + 15%) but can often be met with the same or similar measures required for Building Regulations. Therefore, Policy 2 is considered preferable to Policy 1.

The Advanced Code +2 Policy (Policy option 4) has been shown to be significantly more expensive than the Advanced Code +1 Policy (Policy option 3) and it is considered that the technology and allowable solutions costs required to meet the 100% reduction in regulated emissions in 2011 could be too financially demanding for developers. Therefore Policy option 3 is considered further in preference over Policy option 4.

The Advanced Code +1 Policy (Policy option 3) shows a capital cost of between zero and £6,000 per dwelling before 2017 and zero and £140 per sqm for non-domestic buildings before 2020. This may be challenging but is considered achievable for most sites, and is currently required for all publicly funded social housing by the Homes and Communities Agency. The higher CO_2 reduction requirements of Policy option 3 (Advanced Code+1) could promote earlier adoption of district heating networks as a means to achieving compliance before 2017. This has the advantage of building capacity and helping develop a supply chain for the construction of zero carbon homes prior to 2017. Furthermore, the use of allowable solutions before 2017can provide a potential route for reducing CO_2 emissions in the existing building sector.

Policy option 5, which promotes renewable energy in meeting Building Regulations targets, does not result in higher CO_2 savings, but can increase construction costs. The nature of this policy is also against the aims of PPS1 by stipulating the technologies should be renewable and not simply low or zero carbon, and it is therefore not justifiable. The requirement to deliver the target CO_2 reduction via specific technologies also makes demonstrating compliance more complicated since it involved calculating the proportion that has come from the renewable technologies.

In summary, a policy requiring CO_2 standards one step ahead of the Building Regulations based on the Code for Sustainable Homes mandatory CO_2 standards (Policy option 3) is considered to be the most suitable type of policy for large developments in district heating and wind opportunity areas. This provides relatively large CO_2 reductions beyond national standards in the period up to 2016 (and 2019 for non domestic), and helps to promote measures which support future improvements in CO_2 reduction, but with relatively small additional costs. For development in energy constrained areas, it is considered more appropriate to apply either the Code for residential or Building Regulations Part L for non-residential at the equivalent level to Building Regulations current at that time. This conclusion is based on guidance emerging through the draft PPS. These standards are reflected in the proposed policy wording in section 9.29 below.

9.29 Proposed Policy Wording

A suite of planning policies is recommended to assist in delivering the Energy Opportunities Plan. The policies have been developed based on the outcomes of the policy testing and in terms of feasibility and impact on development cost.

In identifying and appraising policy options we have started from the basis that meeting the challenges of climate change and increasing renewable and low carbon energy capacity cannot and should not be delivered through planning alone. Understanding the role of planning as part of a wider set of national, regional and local delivery mechanisms is crucial. That said, planning is unique in being the only activity that is able to build up a comprehensive spatial

understanding of the opportunities and constraints for decentralised renewable and low carbon energy.

Using the Energy Opportunities Plan as the starting point, potential policy and delivery mechanisms have been assessed for their impact on both existing and new development (Chapter . The evidence demonstrates that the energy technologies available and the CO_2 reductions that may be achieved differ according to the type of development and its location in the district. Three different character areas have been identified to reflect this local variation.

This approach allows us to take advantage of the distinct merits of the planning system in promoting decentralised renewable and low carbon energy without unnecessarily stretching its remit where other regulatory or support regimes may be better placed to take a lead. Importantly, the focus on delivery mechanisms also allows us to address the difficult issue of developer viability by potentially shifting much of the additional cost burden away from developers and onto third parties.

Policy recommendations and predicted CO_2 savings are based on the assumption that the trajectory to zero carbon continues as proposed and that as-built development matches design. Changes to national policy, including future proposals for the Building Regulations, would alter the relative impact of the policies described here. In this event, the policy recommendations described here should be reviewed.

The following policy recommendations are made either for incorporation into Core Strategies or other local development documents or guidance.

9.30 The Energy Opportunities Plan

The district or borough specific Energy Opportunities Plan should be incorporated into Core Strategies and should be reviewed regularly to ensure they remain up-to-date.

Core Strategy Recommendation 1: The Energy Opportunities Plan

Planning applications for new development will need to demonstrate how they contribute to delivery of the opportunities identified in the current Energy Opportunities Plan. Different energy technologies and CO_2 reduction strategies will suit different parts of the district/borough and different types of development. To reflect this we have identified three character areas: as shown in the Energy Policy Map (*LPA to insert reference to the EOP*):

- Energy constrained – Areas where district heating or energy from wind is either not feasible or viable. Due to the constrained nature of the site, developers will be required to achieve CO_2 emissions reductions in line with Building Regulation Part L (non domestic buildings) and the Code for Sustainable Homes (Domestic Buildings). However, developments would still be expected to explore the feasibility of other opportunities for renewable or low carbon energy generation, from microgeneration or biomass for example. Larger development sites that come forward within energy constrained areas may be suitable to support renewable and low carbon technologies that would allow higher carbon reduction targets to be met. This will be assessed on a site-by-site basis.
- District heating – the Council's ambition is to develop networks across each district heating priority area. New development in these areas should, where possible, contribute to this objective by considering district heating as their first option for the heat supply to the site.
- Wind – wind priority areas have been identified to encourage consideration of wind turbines as stand-alone projects or turbines linked to new and existing development.

A district/borough-wide Supplementary Planning Document will be prepared for each character area to help developers understand what is expected of them for the different development types set out in these Character Areas.

Policy Justification

The Energy Opportunities Plan acts as the key spatial map for energy projects in Hertfordshire. It underpins the policies described here and sets out where money raised through mechanisms such as the Community Infrastructure Levy (CIL) could be spent. It should be used to inform the Sustainable Community Strategy and other corporate strategies, and investment decisions taken by the local authority and local strategic partnership (see Appendix D for further detail on delivery mechanisms).

The energy opportunities include commercial and community scale wind; district heating using waste heat from local sources or from community scale CHP, particularly if development is led by the Council; biomass boilers and other microgeneration technologies. However, the policy does not seek to rule out any other technology if it is in-line with council objectives to deliver reductions in CO_2 or increase the supply of decentralised renewable and low carbon energy.

The character area approach is designed to help applicants determine which technologies are likely to be most suited to a given area. It also seeks to encourage energy installations that will contribute to delivering all opportunities identified in the current Energy Opportunities Plan in the most effective way. The policy recognises, however, that the pace of change is rapid in this field and new technologies are likely to become viable and feasible within the lifetime of this plan and that the applicability of existing technologies to different development types is also likely to change. This could mean the technologies not currently considered suitable to particular areas may become so. It is not the intention to restrict this kind of innovation and LPAs should be prepared to discuss proposals that deviate from the Energy Opportunities Plan and character areas with applicants at the pre-application stage. The SPD will provide information to inform pre-application discussions, including which technologies work well together and which do not.

The policy recognises that different character areas and development types will have different opportunities for achieving CO_2 reductions. For example, developments in energy constrained areas will have fewer opportunities for delivering CO_2 reductions cost effectively than those in the other two character areas. Similarly, small developments are also likely to have fewer opportunities than major development (i.e. applications for development over 10 residential units, 1,000 sqm of commercial).

Core Strategy Policy Recommendation 2: Energy and CO_2 Reductions for New Developments in Energy Constrained Areas

All new residential developments in **Energy Constrained Areas** will be required to achieve the following levels of the Code for Sustainable Homes (Code) as a minimum. This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 –Code level 3 as a minimum will be required for all new homes once updates to Part L come into effect (currently scheduled for October 2010).
- 2013 - Code level 4 as a minimum will be required for all new homes once updates to Part L come into effect.
- 2016 - Code level 6 will be required for all new homes once updates to Part L and the national Zero Carbon Homes policy come into effect.

All new non domestic buildings in Energy Constrained Areas will be expected as a minimum to achieve CO_2 emissions reductions in-line with the Building Regulations Part L. This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 – 25% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations (currently scheduled for October 2010).
- 2013 – 44% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations (reductions above 70% can be delivered using allowable solutions).
- 2019 Zero Carbon – no additional requirement.

Where the proposed new development is located within an Energy Constrained Area, the local authority expects the Energy Opportunities Plan to be used to explore other opportunities for renewable and low carbon energy generation (other than wind or district heating) in order to help meet Building Regulation minimum levels and / or Code for Sustainable Homes. Other opportunities could include microgeneration or heat from biomass for example.

Core Strategy Policy Recommendation 3: Energy and CO_2 Reductions for New Developments in District Heating Opportunity Areas

All new residential developments of 10 dwellings or more in **District Heating Opportunity Areas as a minimum** will be required to achieve the following levels of the Code for Sustainable Homes (Code). This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 –Code level 4 as a minimum will be required for all new homes once updates to Part L come into effect (currently scheduled for October 2010).
- 2013 - Code level 5 as a minimum will be required for all new homes once updates to Part L come into effect.
- 2016 - Code level 6 will be required for all new homes once updates to Part L and the national Zero Carbon Homes policy come into effect.

All new non domestic buildings of 1000 sqm ore more in **District Heating Opportunity Areas** as a minimum will be expected to achieve the following CO_2 emissions reductions in advance of the Building Regulations Part L. This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 – 44% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations.
- 2013 – 100% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations (reductions above 70% should be delivered using allowable solutions).
- 2019 - Zero Carbon – no additional requirement.

New development in District Heating Opportunity Areas should, where possible, contribute to this objective by considering district heating as their first option for meeting the target. It is important to recognise that different development types will have different opportunities, therefore:

- All developments should seek to make use of available heat from district heating networks, including those supplied by heat from waste management sites or power stations.
- Larger developments should consider installing a district heating network to serve the site. The ambition should be to develop strategic area wide networks and so the design and layout of site-wide networks should consider the future potential for expansion into surrounding communities. Where appropriate, applicants may be required to provide land, buildings and/or equipment for an energy centre to serve existing or new development.
- New development should be designed to maximise the opportunities to accommodate a district heating solution, considering: density, mix of use, layout, phasing and specification of heating, cooling and hot water systems.

An SPD will be prepared and will set out the approaches that developers might adopt to deliver the target.

These requirements will apply to a development in or adjacent to a District Heating Opportunity Area or located close to potential sources of waste heat unless the applicant can demonstrate that compliance with these requirements on a particular site is either not feasible or not viable.

(Note for LPAs: If a Carbon Buyout Fund is to be created then the following text is recommended)

If an applicant can demonstrate that compliance with the target or the specific requirements is not feasible on site, a payment into the Carbon Buyout or 'Allowable Solutions' Fund will be required.

Small Developments

Small developments (under 10 residential units or 1,000 sqm of commercial) should consider connection to available district heating networks. Where a district heating network does not yet exist, applicants should consider installing heating and cooling equipment that is capable of connection at a later date.

Core Strategy Policy Recommendation 4: Energy and CO_2 Reductions for New Developments in Wind Opportunity Areas

All new residential developments of 10 dwellings or more in **Wind Opportunity Areas** as a minimum will be required to achieve the following levels of the Code for Sustainable Homes (Code). This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 –Code level 4 as a minimum will be required for all new homes once updates to Part L come into effect (currently scheduled for October 2010).
- 2013 - Code level 5 as a minimum will be required for all new homes once updates to Part L come into effect.
- 2016 - Code level 6 will be required for all new homes once updates to Part L and the national Zero Carbon Homes policy come into effect.

All new non domestic buildings of 1000 sqm or more in **Wind Opportunity Areas** as a minimum will be expected to achieve the following CO_2 emissions reductions in advance of the Building Regulations Part L. This requirement will not come into effect until successive updates to Part L of the Building Regulations become mandatory:

- 2010 – 44% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations.
- 2013 – 100% reduction in the Building Emission Rate compared to the Target Emission Rate defined by the Building Regulations (reductions above 70% should be delivered using allowable solutions).
- 2019 - Zero Carbon – no additional requirement.

New development in wind opportunity areas should consider wind as their first option for meeting the requirements of Policy 4. Wind Opportunity Areas have been designated to encourage applications for all scales of wind turbines, particularly but not exclusively:

- From community groups, co-operatives and individuals
- Related to new domestic and non-domestic developments. Large and mixed-use developments in appropriate locations should consider installing a wind turbine or turbines to serve the site's energy needs.

These requirements will apply to a development in a Wind Opportunity Area unless the applicant can demonstrate that compliance with these requirements on a particular site is either not feasible or not viable.

(Note for LPAs: If a Carbon Buyout Fund is to be created then the following text is recommended)

If an applicant can demonstrate that compliance with the target or the specific requirements is not feasible on site, a payment into the Carbon Buyout or 'Allowable Solutions' Fund will be required.

Wind power will play an important role in reducing CO_2 emissions and increasing installed renewable and low carbon energy capacity. Criteria policies should be prepared to guide applicants and development management decisions.

Policy justification – targets

Changes to the Building Regulations in 2010, 2013, 2016 and 2019 are expected to bring in tighter standards for CO_2 emissions. After 2016 it will be necessary for all new residential buildings to be delivered as zero carbon homes, with the equivalent standard for non-residential buildings due to be introduced in 2019. The role of planning in requiring new development to incorporate such technologies should therefore be limited to a supporting one.

The intention is to encourage applicants to reduce CO_2 emissions from proposed development beyond the Building Regulations requirements, where feasible and viable, and to obtain financial contributions towards community scale renewable and low carbon energy infrastructure. Three target options are recommended for a combination of targets and/or payments into a Carbon Fund, represented by the policy options above.

The targets proposed seek to accelerate the move towards zero carbon ahead of Building Regulations. All new buildings over a set threshold - both residential and non-residential - would be expected to achieve CO_2 emissions reductions one step ahead of the Building Regulations Code Level equivalent with the exception of developments in Energy Constrained Areas. This should be met through a combination of passive energy efficiency measures, incorporation of active energy efficiency, on-site renewable and low carbon energy technologies and direct connection to heat or power (not necessarily on-site).

The proposed policy provides flexibility in proposing renewable and low carbon solutions. The policy recognises that different opportunity areas and development types will have different opportunities for achieving CO_2 reductions. For example, new residential development in energy constrained areas will have fewer opportunities for delivering CO_2 reductions cost effectively than those in the other two opportunity areas.

The proposed policy should be simple to operate for both development managers and developers. Development managers can assess compliance with the targets by asking for design stage and as-built Building Control Compliance documentation.

The evidence base produced in support of this policy demonstrates that the targets should be achievable with minimal impact on overall development costs compared to the Building Regulations base case. It is up to the applicant to demonstrate this to the contrary on a case-by-case basis. However, it is recognised that there may be circumstances when it is not possible or desirable. An example might be in an energy constrained conservation area, where microgeneration technologies may be considered unacceptably intrusive. For such cases there is the option of introducing a Carbon Buyout or 'Allowable Solutions' Fund, with contributions based on the residual carbon emissions after any energy efficiency or on-site generation measures. The Carbon Buyout Fund would act as a 'stop-gap' before 'Allowable Solutions' are brought in through the Building Regulations (note – the Allowable Solutions mechanism is still out to consultation).

Policy justification – district heating

The PPS1 Supplement and the draft PPS actively encourage seeking opportunities to set higher standards on specific sites where it can be justified on viability and feasibility grounds. The purpose of this policy is to prioritise district heating in areas where opportunities are the greatest.

The long-term ambition should be to deliver a strategic district heating network across the district heating opportunity areas. Developments will need to show in a design and access statement or energy statement their assessment of the potential to deliver a reduction in the development's CO_2 emissions to the target level using a district heating network. It is recognised that the opportunities for installing such a network across existing communities are, for the most part, beyond the scope of planning. Therefore, the policy requires development to be able to connect once such a network is in place and to be designed to be

compatible with future networks, in terms of layout, density and so on. The policy requires larger more strategic new developments to install their own network, which can later be connected up to a larger network or incorporate existing nearby buildings. This has the benefit of reducing CO_2 emissions in new development and contributing to the longer term objective.

Where appropriate, applicants may be required to provide land, buildings and/or equipment for an energy centre to serve proposed or multiple developments. Such a requirement will be important for ensuring availability of the necessary space in the right location for an energy centre designed to serve more than one development. It is expected that requirements will be discussed in pre-application discussions and will be included as part of a planning condition. In order to provide additional certainty to the installation of district heating networks it is recommended that a Local Development Order be considered for the district heating opportunity areas.

This policy supports the approach of building up large scale networks over time. This barriers and challenges associated with developing large scale networks can hinder their development. Therefore by using policy to support smaller scale schemes in different developments and areas, opportunities are provided for combining these into larger scale networks at a later date.

Criteria that have been used to define the district heating opportunity areas are set out below.

- New development:
    - Large scale mixed use development – enables good anchor load and diversity of heat demand
    - Proximity to high heat density areas of existing buildings – enables extension into existing development
    - Proximity to existing heat sources
- Existing development:
    - Heat demand density of at least 3,000kW/km^2. These areas generally have higher density residential or commercial buildings. The presence of large public sector buildings can assist with acting as a catalyst for schemes.
    - Proximity to sources of heat (e.g. industrial processes) – enables zero carbon energy source

The final wording of this policy and its justification will need to be based on decisions taken about the wider role of the local authority and its partners. Options and their implications for planning policy are discussed in more detail in Chapter 10.

Policy justification – wind

The planning policy approach represents the application of national policy to the Hertfordshire context. The PPS1 Supplement on Planning and Climate Change and PPS22 (Renewable Energy) are both supportive of wind power and this policy has been worded accordingly. The primary driver for such a strongly worded supportive policy for wind are the twin challenges of achieving the national legally binding 34% reduction in CO_2 emissions over 1990 levels by 2020 and the equally binding requirement for the UK to generate 15% of its total energy from renewable sources, also by 2020. The Government's Renewable Energy Strategy expects a significant proportion of this to be delivered from onshore wind. It is evident therefore that every available opportunity for wind power needs to be taken advantage of.

The Energy Opportunities Plan is likely to be more directed at opportunities for community scale wind turbines since commercial developers looking to install large scale wind turbines are likely to develop their own constraints maps. Therefore policies should be prepared to guide applicants and development management decisions for community scale turbines.

The wind opportunity areas seek to promote community scale turbines. As such, the designation is based on the following criteria:

- Good local wind resource, consider hilltops, avoid forested areas.
- Close to electricity infrastructure (e.g. 10-30kV power lines, substations) to connect to grid.
- Close to roads, railways for easier transport of components to site.
- Close to the community involved (but not close enough to cause noise issues).
- Consideration of environmentally and archaeologically sensitive areas.
- Consideration of areas of high landscape quality (e.g. AONBs).
- Consideration of local airports and defence structures (e.g. radars and flight paths).
- Consideration of local residential areas.

Clearly some of these criteria are the same as those used by commercial wind developers. An important distinction is the proximity to the community involved. Here we have assumed that communities investing in their own wind turbine would be keen to be able to see it, but equally these locations are less likely to be of interest to commercial developers.

Developers within wind opportunity areas will need to show in a design and access statement that they have fully considered the potential to deliver the required targets using a wind turbine or turbines on site. Where no opportunities exist on-site applicants should demonstrate that they have considered off-site opportunities.

The final wording of this policy and its justification will need to be based on decisions taken about the wider role of the local authority and its partners. Options and their implications for planning policy are discussed in more detail in Chapter 10.

9.31 Carbon Buyout / Allowable Solutions Fund

The planning policy wording recommendations above include allowance for a 'Carbon Buyout / Allowable Solutions Fund' where applicants can demonstrate that compliance with the proposed target or the specific requirements is not technically feasible using 'on-site' energy efficiency or low/zero carbon energy solutions alone. Payment into the fund would be made per tonne of carbon emitted by the development, depending on the predicted carbon emissions for each building (based on the Building Regulations energy model).

The intention of the Carbon Buyout fund would be to act as a 'stop-gap' before the expected 'Allowable Solutions' mechanism is introduced through Building Regulations. The proceeds of the fund could be spent on low carbon infrastructure and energy efficiency initiatives across the district/borough or the County, as identified within the Energy Opportunities Plan (EOP). Potential investment opportunities from the proceeds of the fund could follow those identified in the Consultation on the Definition of Zero Carbon Homes and Non-Domestic Buildings[50]. The final list has yet to be confirmed but may include:

- Energy efficient appliances
- Advanced forms of building control systems which reduce the level of energy use in the home
- Exports of low carbon or renewable heat from the development to other developments
- Investments in Renewable and Low Carbon community heat infrastructure

Other 'allowable solutions' remain under consideration. A final Government announcement is expected towards the end of 2010.

Whilst this study has not tested the potential impact on viability of different levy contributions, the Impact Assessment that accompanied the definition of Zero Carbon Homes[51] suggested a cap of £100 per tonne of CO_2 emitted. The levy would be charged on any residual CO_2 emissions remaining after taking into account reductions from energy efficiency and 'on-site' low and zero carbon energy generation. The £100 contribution level would need to be reviewed following further publication of any consultation documents or approved regulations in relation to 'Allowable Solutions'.

Milton Keynes Council has pioneered the introduction of Carbon Buyout Funds in the UK (see case study below). Similar schemes are also planned for Ashford in Kent, Reigate and Banstead in Surrey, and Brighton.

Case Study: Milton Keynes – Carbon Offset Fund

Milton Keynes Council introduced a 'Carbon Offset Fund' in 2007 which raises money by taxing new development which emits carbon dioxide. The money raised is spent on upgrading the energy efficiency of existing homes.

Under the initiative, developers pay into a fund according to the carbon emissions generated by their buildings in return for planning permission. Developers pay a one-off tax at a rate of £200 per tonne of carbon dioxide generated by the scheme each year. This works out at £400 for a typical new home but if a scheme is carbon neutral, developers do not pay anything. The money is collected using a section 106 agreement and is payable on completion of the scheme.

The scheme was introduced in April 2007 with payment required when the development is completed. The council has set up a not-for-profit company to administer the scheme, which offers cavity wall and loft insulation at the subsidised price of £95 per item.

[50] Definition of Zero Carbon Homes and Non Domestic Buildings, Dec 2008, DCLG
[51] Definition of Zero Carbon Homes – Impact Assessment, Dec 2008, DCLG

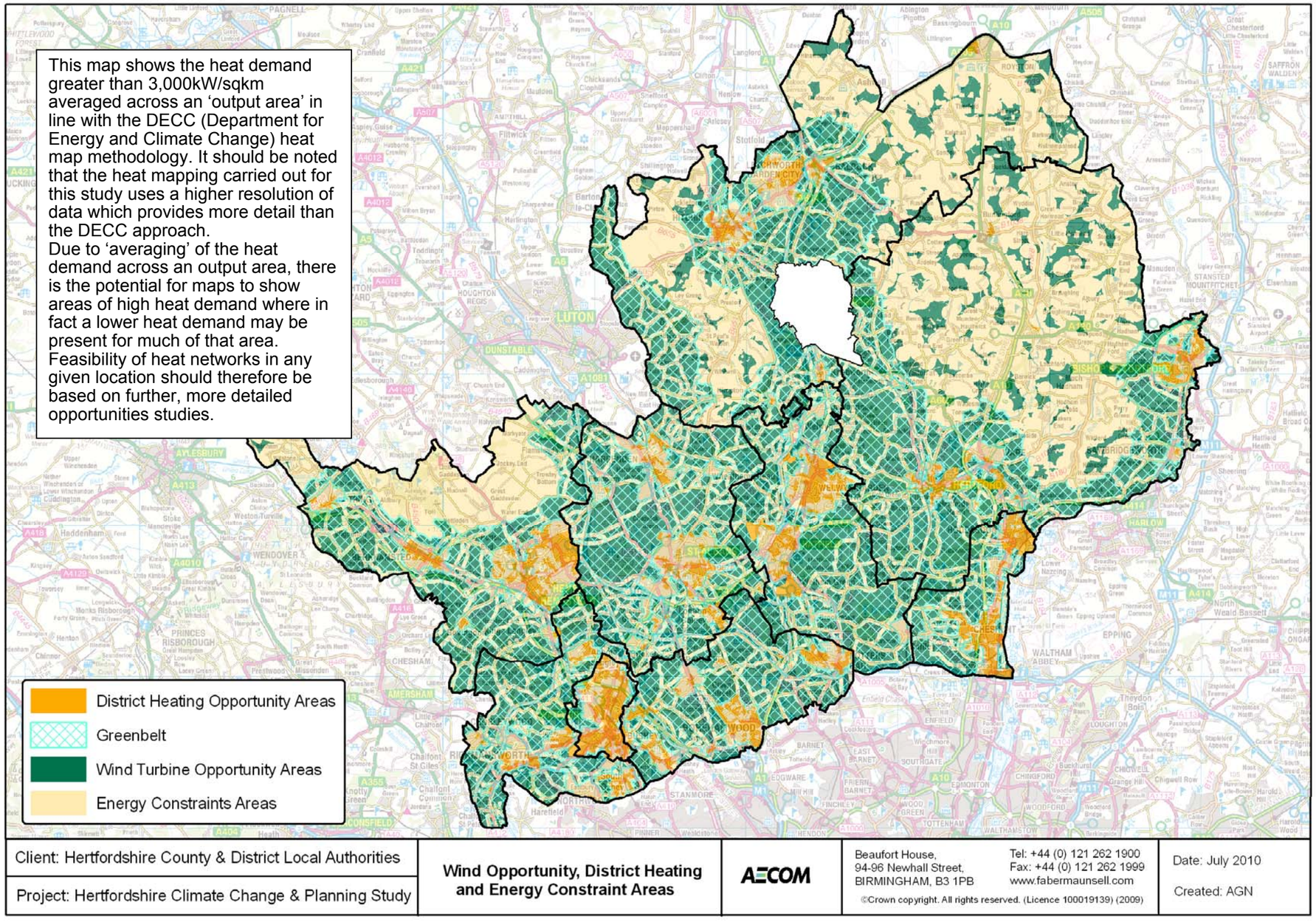

Figure 9.22 – Map showing large scale wind opportunity, district heating opportunity and "energy constrained" areas